

SpecWare 9 Pro and Basic Software

PRODUCT MANUAL

Item #'s

3654P9, 3654P9U, 3654P9X,

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Spectrum[®] **Technologies, Inc.**

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1.1 SOFTWARE LICENSE AGREEMENT

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No liability for consequential damages To the maximum extent permitted by applicable law, in no event shall Spectrum Technologies or its suppliers be liable for any direct or indirect damages whatsoever, arising out of the use or inability to use this product. In any case, Spectrum and its supplier's entire liability is limited to the amount actually paid by you for the SOFTWARE.

IMPORTANT: The disease and insect models used by SpecWare have been validated by state university plant pathologists for the regions of the United States in which they were developed. To determine the validity and appropriate use of a particular disease model for your specific growing region, please consult with your State Agricultural Extension Service.

1.2 SOFTWARE INSTALLATION

System Requirements

SpecWare requires a 486 (or better) processor with at least 8 megabytes of RAM running Windows 95 or better. Windows 2000 or later is required for operations that require auto-scheduling (Autodownload, Frost alerts, and web publishing). You will also need a mouse and a free serial port to connect the logger to the computer. SpecWare requires a screen resolution of at least 640x480. If the screen resolution is only 640x480, then the Windows Taskbar Properties must be set to "Auto hide" so SpecWare can use the bottom 1/2" of the screen. To change the Taskbar Properties, right-mouse click on any empty area of the Taskbar (the gray bar at the bottom of the screen). Click on "Properties." Ensure that "Auto hide" has a check mark next to it. When "Auto hide" is checked, it is generally recommended that "Always on top" also be checked. Click "OK" to save any changes.



Installing SpecWare on a Hard Drive

To install SpecWare software onto your hard drive, insert the SpecWare CD into the appropriate drive of your computer and follow the on-screen instructions. If auto-start is not enabled on your computer, select **Run** from the **Start** menu and type **D:\setup** (Substitute the appropriate drive letter for your CD or floppy drive.) The default location for program installation is C:\Specware, but you can specify a different location if desired.

Connecting to Your IBM Compatible

The logger is connected to your computer with an interface cable. The PC-3.5 cable is designed to connect directly between the IBM compatible's DB-9 (9-pin) serial port and the data logger. A USB-Serial adapter (available from Spectrum or at your local computer store) may be needed if your computer does not have an available DB-9 port.

Upgrading from Prior SpecWare Versions

If you have SpecWare version 6 or earlier already installed on a given computer, it is recommended that SpecWare 9 be installed in the same directory as the existing version. Multiple versions of SpecWare can co-exist without interfering with one another. Data files from earlier versions must be imported into SpecWare 9 before they can be viewed and manipulated. SpecWare cannot convert SpecWare 9 data files to a format compatible with earlier versions.

1.3 TESTING THE COM PORT

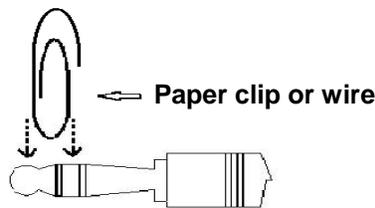
USB-Connection

With newer personal computers, an RS-232 serial port may not be available. If you cannot establish communication with the serial port, a USB-RS232 serial port adapter (item # 3661USB) is the best option. The adapter requires a driver to be installed on your machine and will work out of a different Com Port than the RS-232 port.

Identifying the Correct Com Port

The computer Communications Port to which the PC interface cable is connected can be identified by using a paper clip. This test is performed with the cable disconnected from the logger.

1. Go to the **Communications** tab of the **Preferences** screen (see p. 8).
2. Select the com port to be tested and click on the **Test Port** button. If the message "Connection OK" is displayed, another device (such as a modem) is probably connected to that port. If the message "No Connection" is displayed, this port may be the one connected to your serial cable and you can proceed to the next step.
3. Place the smallest side of a standard size paperclip (about 1 3/8" long) on the end of the serial pin so that it touches **BOTH** the tip of the pin and the metal area between the two black rings. Again click on the **Test Port** button. If the message "Connection OK" now appears, this is the com port connected to your serial cable.



NOTE: The original data loggers do not short-circuit the serial pin. Therefore, when the **Test Port** button is clicked while the logger is connected, a "Bad Data Returned" message will be displayed.

Testing a Connection to a 1000 or 2000-Series Logger or Station

In addition to testing the PC interface cable, the connection to a 1000 or 2000-Series logger or station can easily be checked by plugging the cable into the station's data port and hitting the **2000** button in the Preferences screen. Refer to the **Communications** tab of **Preferences** screen p. 8).

2.1 PREFERENCES

Preferences must be specified when the software is first installed to allow the computer, the software and the data logger to work together harmoniously. The **Preferences** screen can be accessed from the **File Menu** option (See p. 13). The **Preferences** screen is divided into 5 separate tabs: **General**, **Communications**, **Data Storage**, **Graph** and **Monitor**. Features not available in SpecWare Basic appear grayed out.

General

Units

Allows you to choose whether data output is in English or Metric units.

Degree Day Calculations

The degree day calculation method specified here will be used in the reports and the insect and disease models. The **Actual Degree Day Method** calculates degree days using the temperatures from each logged interval. The **Single Sine Method** applies a smooth sine curve to estimate degree days using the daily high and low temperatures. The **Growing Degree Day Method** considers only the high and low temperatures for the day to compute the total number of degree days acquired (See **Degree Days**, p. 39).

Location (for ET Calculation)

The evapotranspiration algorithm incorporates specific information on weather station location. Enter latitude and altitude information in the appropriate boxes. Integer values of latitude and longitude will give sufficient accuracy.

Growing Season Begins in Month

SpecWare allows you to produce graphs and reports at the user-defined beginning of the growing season. To correctly compute reports for an entire growing season, it must also know whether or not the season spans 2 calendar years. This is relevant mainly for growers in the southern hemisphere. Entering the month when the growing season begins allows SpecWare to make any necessary adjustments.

Dew Point

Dew point will automatically be selected and its data will be saved along with the Temp and RH.

Device Support

All of the devices supported by SpecWare by default will be selected, unless otherwise directed by Spectrum support.

The screenshot shows the 'Preferences' dialog box with the 'General' tab selected. The dialog has five tabs: 'General', 'Communication', 'Data Storage', 'Graph', and 'Monitor'. The 'General' tab contains the following settings:

- Units:** Radio buttons for 'Metric (Celsius, mm, km/h)' and 'English (Fahrenheit, in, mph)'. 'English' is selected.
- Degree Day Calculations:** Radio buttons for 'Use Actual Degree Days', 'Compute Degree Days using the Single Sine Method', and 'Compute Degree Days using the Growing Degree Day Method'. 'Use Actual Degree Days' is selected.
- Date and Time Display:** 'Date' is set to 'ISO 8601 (Y-M-D)', 'Time' is '12 Hour (AM/PM)', and 'Report' is 'Standard'. A preview shows '2010-03-19 08:12AM (03/19)'.
- Language:** Set to 'English'.
- Location (for ET calculation):** 'Latitude (degrees)' is '40' and 'Altitude (feet)' is '200'. A note says 'Use negative degrees for the Southern Hemisphere'.
- Growing Season Begins in Month:** Set to 'January(1)'.
- Dew Point:** A checked checkbox 'Save as data with Temp and RH'.
- Device Support:** Checked checkboxes for 'A-Series Loggers', 'B-Series (Button) Loggers', 'C-Series (Original) Loggers/Stations', and '1000/2000 Series Loggers/Stations'.

At the bottom right are 'OK' and 'Cancel' buttons.

Date and Time Display

The date/time displayed on graphs can be in U.S. or international format. 24- and 12-hour clock format must be selected as well as whether the date will be shown in standard format or as a Julian Date.

Language

If the Spanish-language version has been activated, the language option to be used is selected here.

Communication

Direct Connection

Allows you to select the port that SpecWare will use to communicate with the logger. It also allows you to test the connection to a 2000-Series station. You must select the communications port connected to your serial cable (See **Testing the Com Port**, p. 6)

A-Series Loggers

Allows you to select the port that SpecWare will use to communicate with A-Series logger. It does not use the standard gray PC interface cable that accompanies SpecWare Software. Instead, use the A-Series PC Connection Cable. This cables is a serial USB cable and requires that you install its USB driver prior to use.

Wireless

Allows you to select the port that SpecWare will use to communicate with a WatchDog Weather Station connected via a wireless connection. In most cases, this will be the same port that connects to the gray direct connection cable.

Modem Dial-Out

If you are connecting to the weather station via telephone, the **Port** field is used to select the Com Port associated with your computer's internal modem. The **Modem Initialization String** field is set to a common default string. Two of the more complete sites on the internet for modem information (including initialization strings) are www.modemhelp.org or www.modemhelp.net. Please reference these for other brands if the default string does not help.

Specify whether dialing is via touch-tone or pulse. Touch-tone is generally the correct option, though some phone systems use pulse dialing to minimize costs. If you hear a long series of clicks after dialing, you will need to specify "pulse" dialing.

The **Wait after Connect** time should generally be left as zero (the default). If the modem seems to connect, but the weather station connection fails, try setting the delay to 1 (second) to allow the modems time to finish handshaking before they are asked to transmit data.

The screenshot shows the 'Preferences' dialog box with the 'Communication' tab selected. The 'Direct Connection (Gray Cable)' section has 'COM1 Communications Port' selected in the 'Port' dropdown and 'All' in the 'Test Port' dropdown. The 'A-Series Loggers' section has 'None' selected in the 'Port' dropdown. The 'Wireless' section has 'None' selected in the 'Port' dropdown. The 'Modem Dial-Out' section has 'None' selected in the 'Port' dropdown. Below this, the 'Modem Initialization String' section shows 'Original' as 'ATZ0Q0V1X4+MS=V22.0,1200,1200,1:' and '2000-Series' as 'ATZ0Q0V1X4'. There are radio buttons for 'Touch Tone Dialing' (selected) and 'Pulse (Rotary) Dialing'. The 'Wait after Connect (seconds)' field is set to '0'. At the bottom right, there are 'OK' and 'Cancel' buttons, and an 'Advanced Options' button above them.

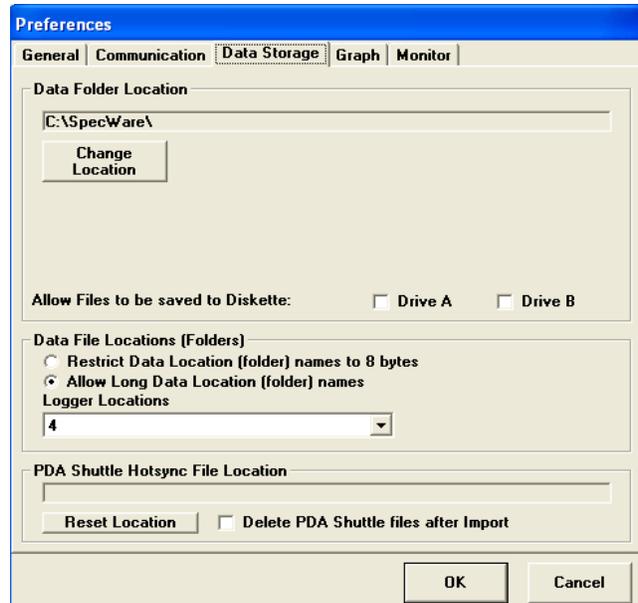
Data Storage

Data Folder Location

Initially displays the directory where SpecWare was installed and where **Logger Location** directories are being saved. The default storage location is in the SpecWare directory. This screen also allows you to specify whether or not data can be saved to diskettes (See **Saving Data**, p. 29).

Data File Locations

In this section, you can decide whether or not to limit the length of Logger Location names.



Palm Shuttle Hotsync File Location

When a Palm Pilot is used to download loggers in the field, SpecWare will remember the first location where Hotsync files are stored. If you want to change the Hotsync file storage location, press the **Reset Location** button and enter the new location in the field. Check the box if you want these files automatically deleted after they have been imported. Deletion will prevent files from being imported multiple times to SpecWare.

Graph

Initially Display

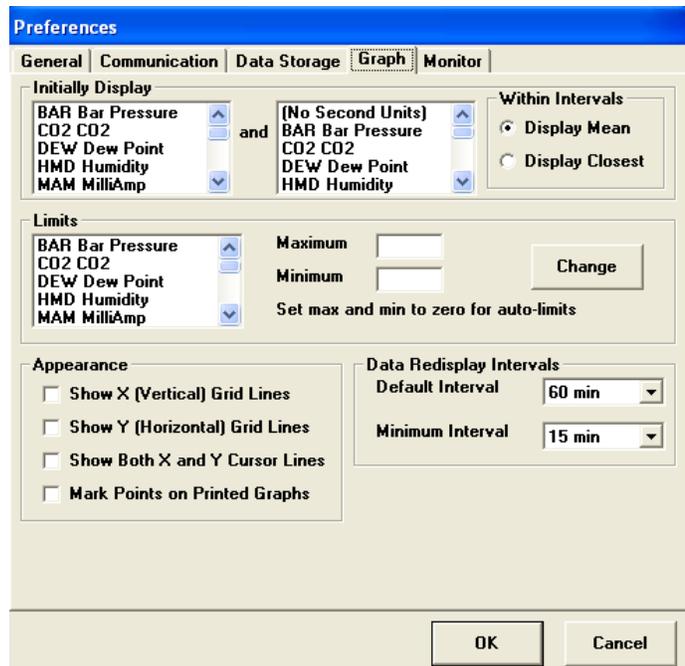
In this section, the user can select the 2 default parameters that are automatically graphed. If nothing is checked then the user must select the parameters to be graphed every time a file is opened.

Within Intervals

If the redisplay interval is longer than the measurement interval, SpecWare can display the mean value of all included data points (**Display Mean**) or the actual data point closest to each of the given time points (**Display Closest**).

Limits

For each graphed parameter, the user can specify the data range for the vertical axis. By default, the software will set the range based on the maximum and minimum values in the data set. But, for example, it may be desirable to have the horizontal axis pass through zero rather than the minimum data value. To set a maximum or minimum, select parameter of interest from the menu, enter the desired values and click the **Change** button.



Appearance

Show X (Vertical) grid lines

This will cause vertical lines to appear on the graph at regular intervals.

Show Y (Horizontal) grid lines

This will cause horizontal lines to appear on the graph at regular intervals.

Show Both X and Y Cursor Lines

Checking the box will add a horizontal tracker bar to the graph when it is displayed (See **View, Print, and Edit Menus**, p. 32).

Mark Points on Printed Graphs

If this box is checked, SpecWare will put individual data points onto the graphed line.

Data Redisplay Intervals

A **Default Interval** can be specified when displaying a graph from saved data files (the initial default is 60 minutes). SpecWare can graph a maximum of 8000 points, and the interval between data points depends on the time period displayed. A **Minimum Interval** can also be specified (the initial default is 15 minutes). This should be set to match your normal logger recording interval. Setting the **Minimum Interval** to the interval at which data was recorded prevents SpecWare from graphing more data points than you actually measured. This should be set to match your normal logger recording interval. For example, using data that was recorded every 30 minutes to create a graph that has a 15 minute **Minimum Interval** will cause SpecWare to display two points on the graph, 15 minutes apart, to represent the single recorded data point. In this case, specifying a 30 minute **Minimum Interval** will make the graph and text data display match your recorded data. (See **View, Print, and Edit Menus**, p. 32). **Change** button.

Monitor

This screen is used to configure your computer to automatically read and process a weather station's current conditions. This feature uses the Windows AutoScheduler and requires Windows 2000 or greater to run.

Weather Station Real Time Monitor

Weather stations with continuous direct connections have the ability to create a separate log file using the Weather Monitor Program. This file is separate from the data recorded in the data logger. This program will only log while the Weather Monitor Program is running (See **Advanced Features** manual for more details).

Monitor Log and Web Output

SpecWare can regularly update the current weather conditions on a user's web serve (See

The screenshot shows the 'Preferences' dialog box with the 'Monitor' tab selected. The 'Weather Station Real-Time Monitor' section has a 'Log Interval (in minutes - minimum 15)' field set to '0'. The 'Monitor Log and Web Output' section has a 'Log File' section with radio buttons for 'Text File, Real-Time Monitor Format', 'Text File, Standard Format', 'XML File, Standard Format', 'SpecWare 7+ Standard Data File Format', and 'None' (which is selected). There is an 'FTP' section with radio buttons for 'FTP' and 'None' (which is selected). Below this are input fields for 'FTP URL', 'FTP Path', 'FTP Logon', 'FTP Password', and a 'Repeat' checkbox.

2.2 TOOLBAR

After starting SpecWare, the menu bar will initially offer **File**, **Logger View** and **Help** menu options. The quick-buttons, from left to right, are **Exit SpecWare**, **Open File**, **Save Logger Data**, **WatchDog Manager**, **Launch/Set Properties for WatchDog 1000 or 2000**, **Get data from WatchDog 1000 or 2000 Series**, **Launch a WatchDog A-Series Logger**, **Get data from a WatchDog A-Series Logger**, **Launch Original WatchDog Logger**, **Get data from Original WatchDog Logger**, **Shuttle (Original) Weather Station Monitor**, **View Logger Data as Text**, **Reset Zoom**, **Zoom Out**, **Change Graph Parameters** and specify **Large/Small Toolbar Buttons**.



After a file is opened or a logger is downloaded, the **Edit**, **Print**, and **Tools** menu options will appear and the **View Data as Text** and **Change Graph Parameters** quick-buttons will be activated.



Two additional quick-buttons, **Reset Zoom** and **Zoom Out**, will be activated if the graph zoom feature is used (see pp. 33-34).



2.3 FILE MENU

Open File: Allows the user to open previously saved data files.

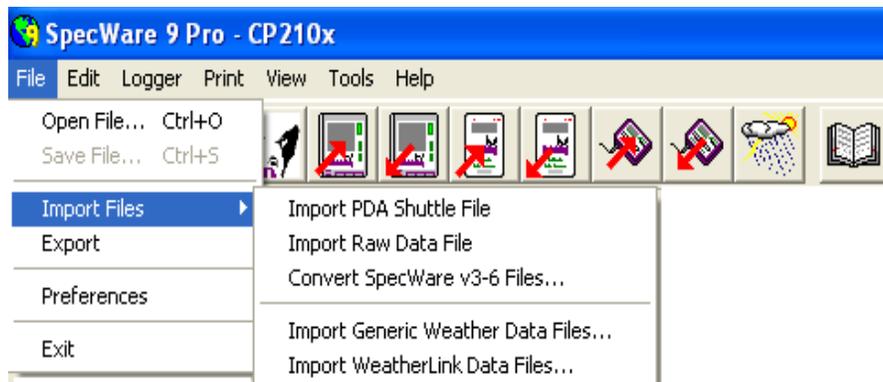
Save File: Allows the user to save data to a **Logger Location** if one is not chosen immediately after downloading a data logger.

Import Files:

- ◆ **Importing PDA Shuttle File:** Allows the user to import data files collected remotely by a portable, handheld computer. Contact Spectrum Technologies for information obtaining the software required for this option.
- ◆ **Importing Raw Data File:** Imports and interprets data files collected using SpecWare diagnostic tools.
- ◆ **Convert SpecWare v 3-6:** Converts data from SpecWare versions 3 through 6 to a format usable in SpecWare (See **Converting Archived Data into the current SpecWare Format** pg. 30).
- ◆ **Import Generic Weather Data Files:** This option allows you to import data files created by other weather collecting systems.
- ◆ **Import WeatherLink Data Files:** This option imports data collected using WeatherLink Software.

Preferences: Allows the user to select various graph, communication, data storage, and general configuration options (see **Preferences** p. 7)

Exit: This terminates the SpecWare session.



3.1 WATCHDOG MANAGER

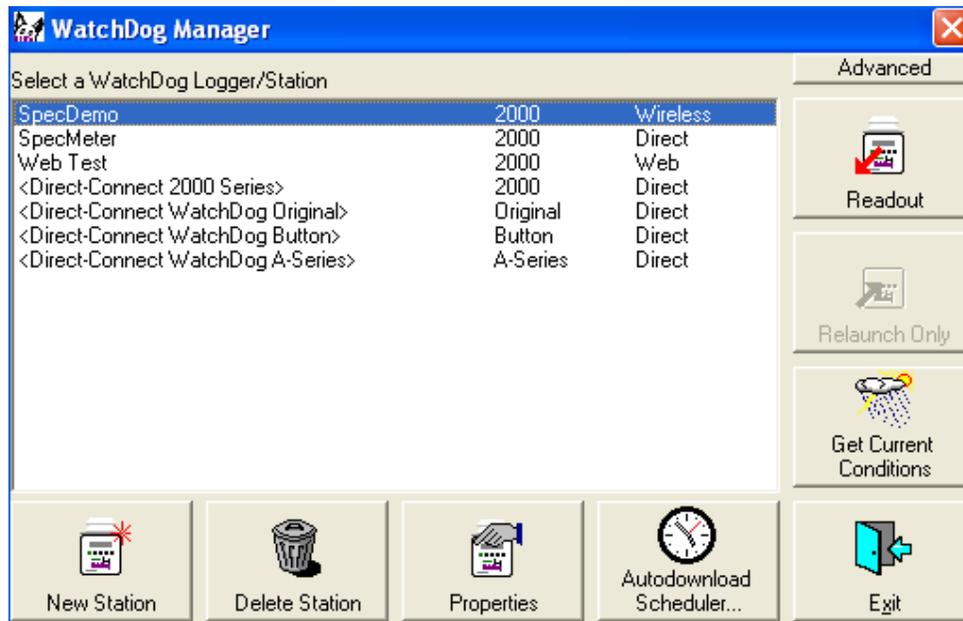


Figure 1

Introduction

The **WatchDog Manager** screen is brought up with the quick button on the SpecWare toolbar (see **Toolbar**, p. 12) or from the **Logger** menu (p. 21). SpecWare software divides the WatchDog family of data loggers into 4 categories; 1.) 1000 or 2000-Series Logger or Stations, 2.) Original WatchDog loggers (100/200/400 series mini data loggers and 525 - 900ET weather stations), 3.) Button loggers, and 4.) A-Series Loggers (WatchDog Model A110/125/130/150 Data Logger). For the sake of brevity, in this section, the term “station” will refer to all types of WatchDog products unless a specific type of WatchDog data logger is being referred to explicitly. The **WatchDog Manager** screen can be used with all 4 types of loggers but it must be used for all communications with a remote weather station via a telephone modem or with multiple stations connected via a wireless multi-point setup. This screen allows you to download and relaunch a specific station as well as add and delete a station to your network.

It is possible that you will have **Logger Locations** available in SpecWare that do not appear in the **WatchDog Manager** screen. The **WatchDog Manager** screen is only used to communicate with stations. It is not used for viewing existing data files (See **Opening Files**, p. 28). Deleting a station will have no effect on data that has already been downloaded and saved from that station. Likewise, establishing a new station will not automatically create a **Logger Location**. A **Logger Location** will be created when that station is first downloaded.

Generic Station Options

The last 4 options in the **WatchDog Manager** screen’s list of stations are generic options. The generic options are shown in parentheses. They do not refer to a specific station but rather to

each of the 4 logger categories (1000 or 2000-Series, Original, Button and A-Series). The generic option allows you to establish contact with a station even if you don't know its name. After selecting a generic option, you can then perform any operation available for that logger type. SpecWare is able to read the name of the station from its electronic header and carry out readout, relaunch and reconfiguration operations as if that station had been selected explicitly from the list of available stations in the **WatchDog Manager** screen (see Fig. 1). If you are downloading a station whose name is not on the list of stations, SpecWare will ask if you want to add that station to the list.

WatchDog Manager Toolbar Buttons

New Station

The **New Station** button is used to add stations to the list of available stations. After clicking this button, a blank **WatchDog Properties** screen will appear (see *Properties* section below for details).

Delete Station

This button allows you to delete an existing station from the list of available stations. Even after a station has been deleted, data downloaded from that station will be available from the SpecWare **Logger Location** directory.

Autodownload Scheduler

This button allows you to bypass the **WatchDog Properties** screen and go directly to the **AutoDownload Scheduler** screen (see **Advanced Features** manual).

Get Current Conditions

This option will bring up the WatchDog Real-Time monitor (see **Real-Time Monitor**, p. 25). This option is only available for WatchDog weather stations and 1000 or 2000-Series weather or mini stations that are in contact with the PC via a direct-connection, radio- or telephone connection. This option is grayed out for WatchDog button loggers and A-Series loggers.

Relaunch Only

Click this option if you want to launch a station without first downloading the data. This option may be desirable if the station is being put back into service after a period of being idle. The station will be launched with the same configuration it had the last time it read data. This option is grayed out for the 1000 or 2000-Series logger or stations because their data logging function is not interrupted by a download so the station never needs to be relaunched.

Readout or Readout and Relaunch

This button is used to download data from a station. For Original, Button-style and A-Series WatchDog data loggers, this option will appear as **Readout and Relaunch**. For the 1000 or 2000-Series logger or station, this option will appear as **Readout**. The data is saved to the **Logger Location** that matches the logger name. If this location does not exist, SpecWare will prompt you before creating it. Original, Button-style and A-Series loggers are relaunched with the same configuration they had when they were downloaded. With the **WatchDog Manager**, it is not possible, during the download process itself, to create a new location where data

should be saved. Data will always be saved to the location defined by the station name.

Exit

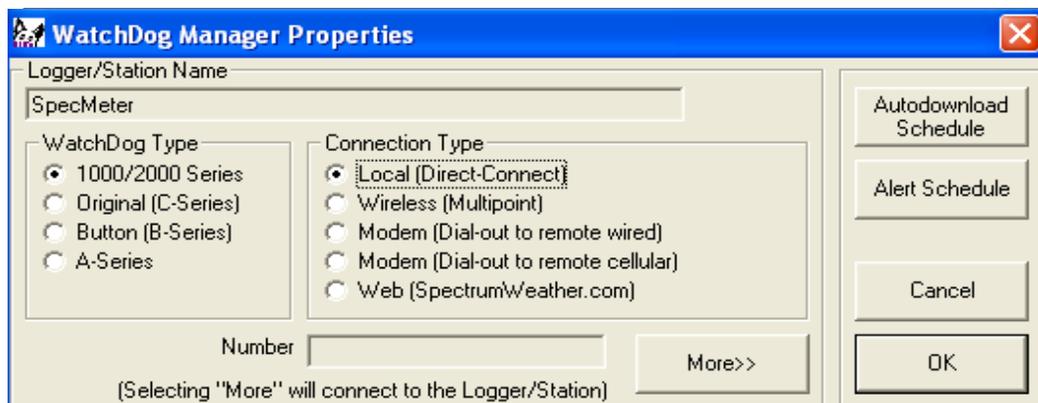
Exits the WatchDog Manager screen.

Properties

The **Properties** button brings up the **WatchDog Properties** screen. This screen is the gateway to all the **WatchDog Manager** configuration functions. It is used to configure a new station or to edit the configuration of an existing station. No configuration changes on this partial screen will be transferred to the station until the fully expanded **WatchDog Properties** screen (see **More** button, p. 19) has been brought up and the **OK** button has been pressed. The options for this screen are described below.

Logger/Station Name

Enter the name of the **Logger Location** where data will be saved. When creating a new station, this field will initially be blank. A name can only be entered for new stations. The name of an existing station cannot be changed. To change the name of an existing weather station or logger, a new station must be created with the new name. This name will then be transferred to the logger header. Caution must be exercised when changing the name of an existing station because all subsequent downloads of the station will be saved to a new **Logger Location** and it is possible all data will be erased (see **Clearing Data from a 2000-Series Station**, p. 18). The old station name will still be visible in the list of available stations. If the name change is permanent, this old station (not the **Logger Location**) can be deleted from the list of stations.



WatchDog Type and Connection Type

Select the appropriate options on this screen. For the 1000 Series, Original, Button and A-Series loggers, changes in logger configuration can only be performed with loggers that are directly connected. 2000-Series stations can be reconfigured through phone or radio connections as well. Configuration of remote stations can be most easily handled by directly connecting them to the PC and using the Generic Direct-Connect options (See **Generic Station Options**, p. 14) That way the existing connection info is not changed.

Number

If you are using a *dial-out modem*, enter the phone number in the text box. When entering a telephone number, be sure to include any additional, preceding digits required by your phone system. When using the *wireless transceivers*, enter the radio address in the **Number** text box. For 2000-Series weather or mini stations, the radio address is the same as the serial number of the station. If sending data to SpectrumWeather.com enter the 9 digit model and serial number of your station.

AutoDownload Schedule button

Brings up the **AutoDownload Scheduler** screen (see **Advanced Features** manual).

Alert Schedule button

Brings up the **Weather Station Alert Configuration** screen (see the **Advanced Features** manual).

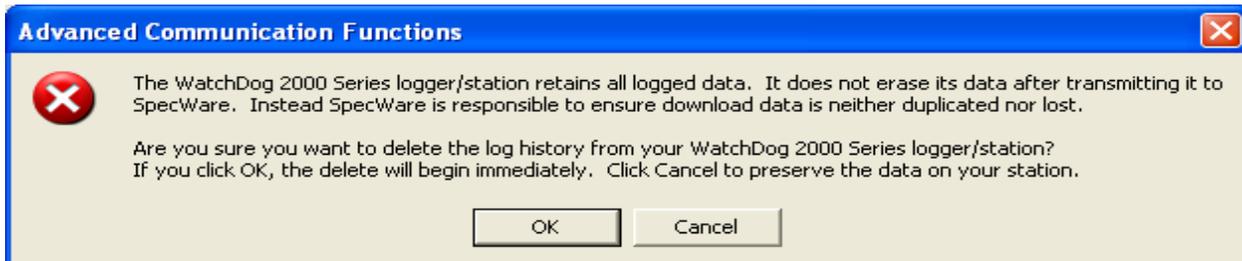
More button

Clicking the **More** button causes SpecWare to initiate communication with the station. The **WatchDog Properties** screen is then expanded to display specific details about the station's logging configuration (see **Launching/Configuring Stations with the WatchDog Manager**, p. 19). The expanded screen can only be brought up when a station is connected to a PC. A 1000 Series, Original, Button or A-Series logger cannot be configured or launched with a radio or telephone connection.

3.2 CLEARING DATA FROM A 2000-SERIES STATION

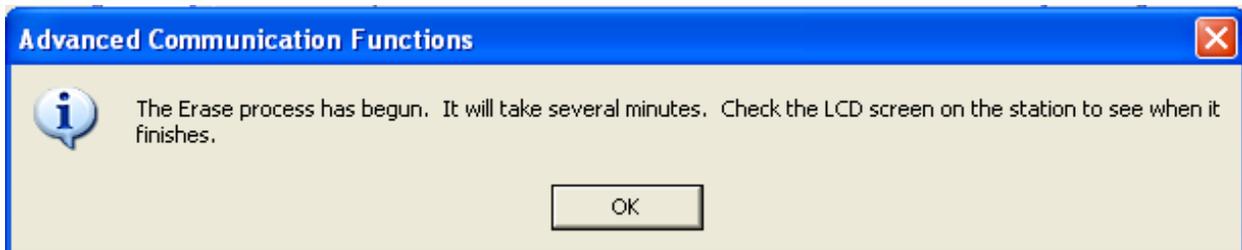
Data is *not* routinely erased from the memory of a 2000-Series station. If you are moving the logger from one location to another and want to delete the station history without deleting the station, you can do so by going to **WatchDog Manager** and highlighting the appropriate station.

Click on the Advanced button, then on the Clear button. The following screen will appear:



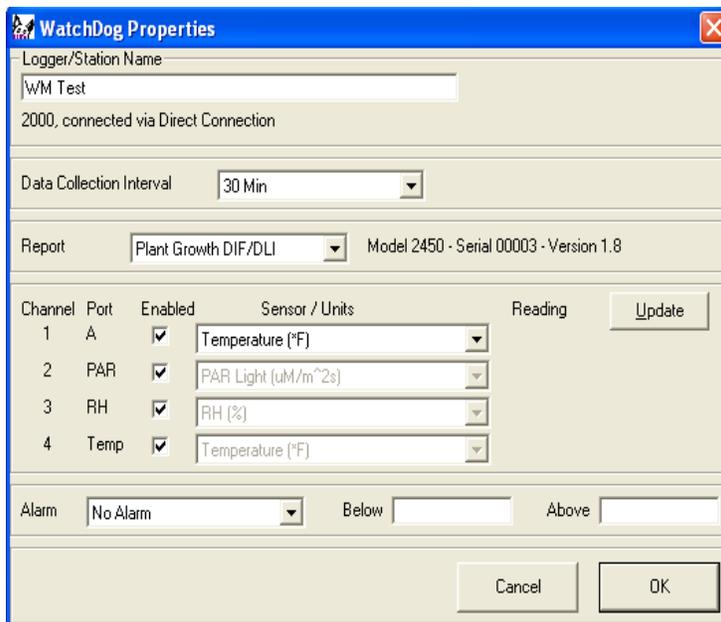
Click the **OK** button.

SpecWare will begin erasing data. The process will take several minutes and, at this point, cannot be reversed. It is not necessary for the station to be connected to the computer once the erasure process has begun



Click **OK**, exit out of the Advanced Communications feature by clicking on the **Exit** button. SpecWare will return to the **WatchDog Properties** screen.

3.3 LAUNCHING/CONFIGURING STATIONS WITH THE WATCHDOG MANAGER



Sample WatchDog Properties screen (fully expanded) for a 2000-Series logger

WatchDog 1000 or 2000-Series and A-Series loggers, can be re-configured through the **WatchDog Properties** screen of the **WatchDog Manager**, or the Launch/Properties toolbar button. These stations are not launched and relaunched like the original WatchDog data loggers. Original WatchDog data loggers and weather stations can be launched through the **WatchDog Manager** as well as through the **Logger** menu or toolbar quick buttons (see **Launching Original WatchDogLoggers**, p. 23). The **WatchDog Manager** screen is brought up with the quick button on the SpecWare toolbar (see **Toolbar**, p. 12) or from the **Logger** menu (p. 21).

Note: This screen is dynamically created and its appearance will depend on the type of logger connected.

Configuring/Launching a Station

The 1000-Series, Original, Button and A-Series stations can only be reconfigured when the station is connected to the PC via a direct-connect cable. The **WatchDog Manager** uses the old launch process to change the logger's properties. 2000-Series stations can be configured with any connection type. Bring up the **WatchDog Manager** screen, select the station of interest (or the appropriate generic option), and click the **Properties** button. This will bring up the **WatchDog Properties** screen which will display the entire configuration of the station. The various fields are described on the following pages.

Data Collection Interval

The data collection interval is the amount of time that elapses between measurements.

Report (2000-Series only)

The LCD can be programmed to display additional calculated parameters by selecting that parameter from the dropdown menu of the **WatchDog Properties** screen. The Plant Growth report requires PAR light and air temperature sensors. The Heating Degree Day report requires an air temperature sensor or an external temperature sensor on channel D (model 2400 only). If you have purchased optional disease models for SpecWare, the dropdown menu in the Report section will show these options as well. For 1000 Series, Original and A-Series data loggers, this feature will be grayed out. The model, serial and firmware number for the logger appear to the right of the dropdown menu field.

Sensor/Units

These boxes allow you to select which parameter each external channel will measure. Click on the arrow to display the list of possible parameters. Rain gauges connected to external channels of the data loggers and 2000-Series mini stations must be assigned to Port A.

NOTE: There are several different soil moisture sensors that can be connected to WatchDog data loggers. Ensure that the appropriate type of soil moisture sensor has been selected.

Update

While connected to the computer, the **Update** button will instruct the logger to take a reading. It will take about 2 seconds for the reading to appear. If no sensor is connected to a particular port, "N/A" will appear for that port. With the exception of the Button and A-Series loggers, the battery status will also be displayed. The battery should be replaced when battery power drops to 25%. If a sensor type is changed for a 2000-Series station, it will be marked "Pending" and cannot be read by **Update** until the change is completed (by clicking "OK")

Wrap Around

In the **Wrap around when full** box, you can determine how data will be handled if the logger is not downloaded before it reaches its data holding capacity. (The A-Series logger is the only one without this capability) Click in this box if you want the logger to write over the oldest data and continue reading new data. For example, if you launch for a 30 day duration, but do not recover the logger until much later, the data will reflect the most recent 30 days. If **Wrap around when full** is not checked, the logger will turn itself off when it is full and await recovery and readout. Wrap Around is always enabled for the 2000-Series stations and is optional for the 1000-Series loggers.

Delayed Start

This option is available for all of the data loggers. It allows the logger to begin logging at a later, pre-specified time (up to 45 days after launching your logger). Insert the date in the first box. Insert the starting time in the next box. The date/time formats should match the format selected in **Preferences**.

Alarm

This option is only available for Weather Stations and 2000-Series weather or mini stations. The Alarm feature works with the Alarm Output Module. Select the desired channel or parameter in the first field. A target value is entered into one or both of the other 2 fields to indicate whether an alarm is triggered if the measured value goes **Above** or **Below** the target value. Original weather stations allow only one target value. 2000-Series stations allow upper and lower alarm thresholds.

3.4 LOGGER MENU

WatchDog Manager

This option brings up the **WatchDog Manager** screen (see **WatchDog Manager** p. 14). This screen can be used for communicating with 1000 or 2000-Series weather or mini stations and A-Series loggers. It can also be used to readout and relaunch Original and Button loggers.

Launch/Set WatchDog 1000/2000 Properties

This establishes a connection with the 1000/2000 Series and displays the **Launch Options** screen. This option is equivalent to clicking on the **Launch/Set WatchDog 1000/2000 Properties** quick buttons.

Get WatchDog 1000/2000 Data

This established a connection with the logger and downloads data accumulated. This option is equivalent to clicking the **Get WatchDog 1000/2000 Data** quick button on the toolbars.

Launch WatchDog A Series

This establishes a connection with the WatchDog A-Series Data Logger and displays the **Launch Options** screen. This option is equivalent to clicking on the **Launch WatchDog A-Series** quick button on the toolbar.

Get WatchDog A-Series Data

This establishes a connection with the WatchDog A-Series logger and downloads data accumulated since the logger was launched. This option is equivalent to clicking the **Get WatchDog A-Series Data** quick-button on the toolbars.

Launch Original WatchDog

This establishes a connection with a WatchDog Original or Button logger and displays the **Launch Options** screen. This option is equivalent to clicking on the **Launch WatchDog Logger** quick-button on the toolbar (See **Launching Original WatchDog Data Loggers**, p. 23).

Get Original WatchDog Data

This establishes a connection with the logger and downloads the data accumulated since the logger was last launched. This option is equivalent to clicking the **Get WatchDog Data** quick-button on the toolbar (See **Downloading Original WatchDog Data Loggers**, p. 22).

Original Weather Station Real-Time Monitor

This launches the **Weather Monitor** screen (see p. 25). This is equivalent to the **Original Weather Station Monitor** toolbar button.



3.5 DOWNLOADING DATA

WatchDog data loggers and weather stations can be downloaded with the **WatchDog Manager** (see p. 14) or with the Quick Button on the SpecWare toolbar (see p. 12). The Quick Button download procedure is described below.

Before downloading data, you must establish a connection between the data logger and your computer. For 1000-Series, data loggers and data shuttles, this is done with a direct connect cable. For the WatchDog button loggers, use the docking station. For weather stations, a connection can be made with the connection cable, a 75-ft direct connect cable, a short-range modem pair, a remote wireless connection or with a landline or cellular telephone connection. For the A-Series logger a connection can only be made using the WatchDog A-Series USB cable connection to PC .

Click the **Get WatchDog 1000/2000, A-Series, or Original WatchDog Data** quick-button or use the **Logger** menu to contact the WatchDog and initiate the download sequence.

As the logger is downloading, a **SpecWare Progress** dialog box will be visible. When the data transfer is complete, a dialog box will appear indicating that readout and translation is complete. You may then disconnect the logger from the connection cable.

SpecWare will automatically prompt you to save the logger data (See **Saving Data**, p. 29). All new dataloggers require that you create a new **Logger Location** the first time the logger is read out. Once this **Logger Location** is established, subsequent logger data readouts can be appended to this **Logger Location**. For weather stations connected via telephone modem or a multi-point wireless system, the data will automatically be downloaded into the **Logger Location** with the same name entered in the **ID/Location Name** field of the logger header (See **Launching Original WatchDog Data Loggers**, p. 23) or the name given to it when it was created in the **WatchDog Manager** screen (see **WatchDog Manager**, p. 14).

After downloading WatchDog loggers, SpecWare will display a screen (see **Opening Files**, p. 28) that allows you to select which parameters will be graphed as well as on which vertical axis the data scale for a given parameter will be displayed. Up to 2 parameter types can be selected and all data files of that type will be displayed. The data will be displayed in a graph with the logger reading on the vertical scale and time on the horizontal scale.

IMPORTANT: Until the logger is relaunched, the data remains on the logger and can be downloaded again. Once you have retrieved data, you must relaunch the logger to continue making measurements. Clicking **Start** to relaunch the logger erases the previously recorded data from the logger.

3.6 LAUNCHING ORIGINAL WATCHDOG DATA LOGGERS

Original WatchDog Loggers can be launched with the Quick Button on the SpecWare toolbar (see p. 12). The Quick Button launch procedure is described below.

Initiating Contact

With the logger connected to the interface cable, initiate the launch process by using the **Logger** menu or by selecting the appropriate logger type and clicking the **Launch Original WatchDog** quick-button (See p. 12). The **Launch Options** screen will appear. Initially, the screen will display the current launch configuration. Any of the launch configuration parameters can be changed except whether the data is output in English or metric units (See **Preferences**, p. 7).

To launch the logger, click on the **Start** button. When the logger is actively reading, the LCD will indicate the logger status. On loggers lacking an LCD, a red LED will flash. (It will flash only dimly every four seconds during the delay period of a delayed launch.) Click the **Cancel** button to exit the **Launch Options** screen without launching the logger.

CAUTION: Clicking the **Start** button erases previously recorded data from the logger. Until **Start** is clicked, that data is available for download.

NOTE: **Do not** unplug the logger from the interface cable until SpecWare has indicated that the launch has been completed.

Launch Options Screen

Header

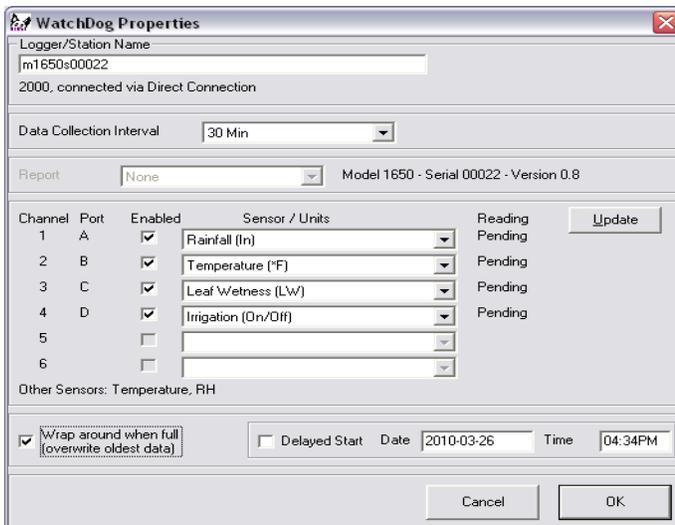
The top field of the dialog box gives a description of the logger and its serial number. Neither the description nor the serial number can be changed. The header will also show the current date and time on your computer. This information will be transferred to the logger when it is launched.

ID/Location Name

The text in this box can be used to identify the **Logger Location**. Up to 40 characters can be written in this area. The logger location entered will become the default location for saving the data.

Measurement Interval and Maximum Duration

The interval is the amount of time that elapses between measurements. After selecting the interval, the maximum duration (time it will take to completely fill the logger) is calculated and displayed by SpecWare, this feature is only available on the Original Data Loggers.



The screenshot shows the 'WatchDog Properties' dialog box. It contains the following fields and controls:

- Logger/Station Name:** m1650s00022
- Connection:** 2000, connected via Direct Connection
- Data Collection Interval:** 30 Min
- Report:** None
- Model:** Model 1650 - Serial 00022 - Version 0.8
- Sensor Configuration Table:**

Channel	Port	Enabled	Sensor / Units	Reading
1	A	<input checked="" type="checkbox"/>	Rainfall (In)	Pending
2	B	<input checked="" type="checkbox"/>	Temperature (°F)	Pending
3	C	<input checked="" type="checkbox"/>	Leaf Wetness (LW)	Pending
4	D	<input checked="" type="checkbox"/>	Irrigation (On/Off)	Pending
5		<input type="checkbox"/>		
6		<input type="checkbox"/>		

Other Sensors: Temperature, RH

Wrap around when full (overwrite oldest data)

Delayed Start Date: 2010-03-26 Time: 04:34PM

Buttons: Cancel, OK, Update

Sample Launch Options screen

Port Enabled

On the WatchDog data loggers you can enable or disable the ports by checking or unchecking the appropriate boxes of their external ports. The sensors that come standard (including the solar radiation sensor on the 900ET station) are always enabled.

Sensor/Units

These boxes allow you to select which parameter each logger channel will measure. Click on the arrow to display the list of possible parameters. Rain gauges connected to external channels of the 1000/2000 Series or mini data loggers must be assigned to Port A.

NOTE: There are four different soil moisture sensors that can be connected to WatchDog data loggers. Ensure that the appropriate type of soil moisture sensor has been selected.

Update

While connected to the computer, the **Update** button will cause the logger to take a reading. It will take about 2 seconds for the reading to appear. If no sensor is connected to a particular port, "N/A" will appear for that port. For the WatchDog (except model 100), the battery status will also be displayed. The battery should be replaced when battery power drops to 25%.

Alarm

The **Alarm** feature is only active with Weather Stations connected to an Alarm Output Module. Select the desired channel or parameter in the first field. Indicate in the second field whether the alarm module is triggered when the measured parameter **Goes Above** or **Goes Below** the target value entered in field 3. See the **Alarm Output Module User's Guide** for more details.

Wrap Around

In the **Wrap around when full** box, you can determine how data will be handled if the logger is not downloaded before it reaches its dataholding capacity. Click in this box if you want the logger to write over the oldest data and continue reading new data. For example, if you launch for a 30 day duration, but do not recover the logger until much later, the data will reflect the most recent 30 days. If **Wrap around when full** is not checked, the logger will turn itself off when it is full and await recovery and readout.

Delayed Start

The **Delayed Start** box will appear for those loggers that are capable of using this option. It allows the logger to begin logging at a later, pre-specified time (up to 45 days after launching your logger). Insert the date in the first 3 boxes in the format mm/dd/yyyy. Insert the starting time in the next 3 boxes. The time uses a 12-hour format; you must enter "am" or "pm".

3.7 REAL-TIME WEATHER MONITOR

WatchDog Original Weather Stations

The first launch of a station will enable the **Original Weather Station Real-Time Monitor** option in the **Logger** menu and the **Original Weather Station Monitor** quick-button on the SpecWare **Toolbar** screen (see p. 12). Clicking either the menu option or the quick-button will display one of the first two monitor screens shown on p. 26. (Note: once the **Original Weather Station Real-Time Monitor** is initialized, SpecWare does not have to remain open to display the monitor screen.) The monitor screen displays the current weather conditions including readings from the sensors that are plugged into the external ports of the weather station.

IMPORTANT: *For the Real-Time Weather Station Monitor to work correctly, the weather station must be connected to the computer using the optional hardwire or remote PC connections.*

The data on the monitor screen is updated by clicking on the **Refresh** button on the lower left part of the screen. Clicking the **Repeat Refresh** button will cause the monitor screen to update every five minutes.

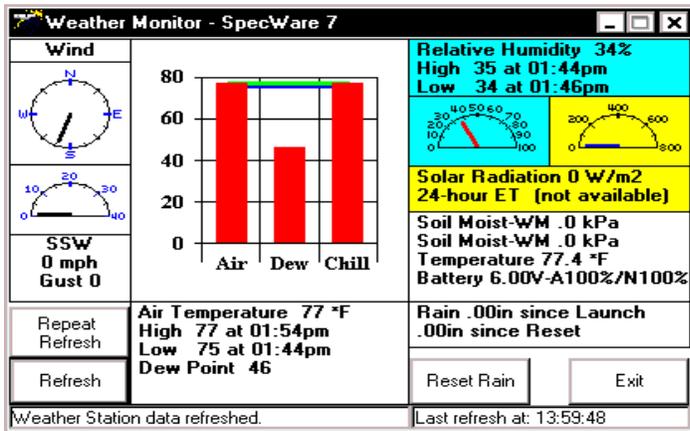
The amount of **Rain** since the last download/launch and current **Rain** amount since the last **Reset** are displayed on the lower right corner of the monitor screen. There may be several rainfall events between the times that data is downloaded to the computer (see **Downloading Original WatchDog Data Loggers**, p. 22). Click the **Reset Rain** button to zero the currently accumulated **Rain** amount.

The bar graph is composed of **Air** temperature, **Dew** point and wind **Chill**. The green and blue horizontal lines on the bar graph are the daily high and low temperatures.

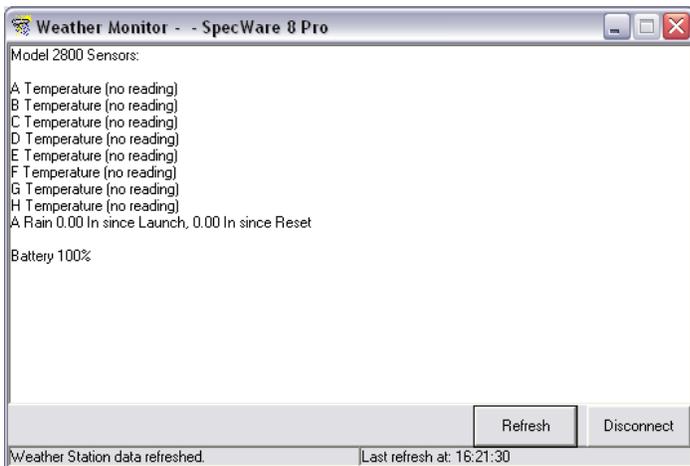
NOTE: If SpecWare cannot make a connection when trying to bring up the Real Time Monitor, the user may need to end the task (SpecWSM8) in the Task Manager. You can bring up the Task Manager by simultaneously clicking the Cntrl-Alt-Delete buttons on the keyboard.

1000 or 2000-Series Data Stations

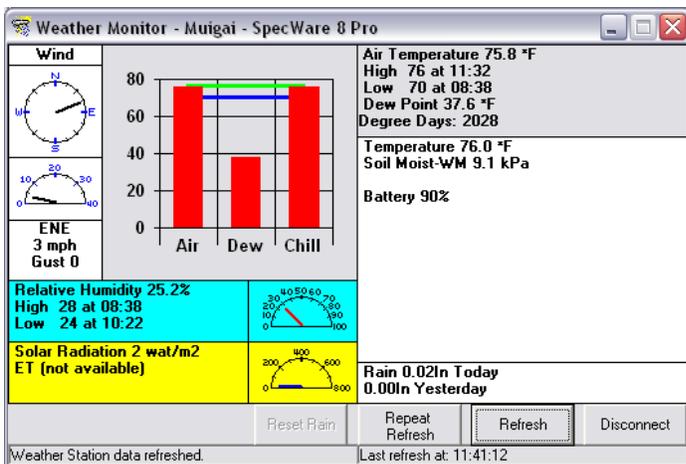
The monitor screen for the 1000 or 2000-Series stations can only be activated by clicking the **Get Current Conditions** option in the **WatchDog Manager**. A sample screen is shown on p. 26.



Monitor screen generated by toolbar quick-button for all Original stations (except the model 800).



Monitor screen generated by toolbar quick-button for a Model 800 station.



Monitor Screen generated by WatchDog Manager screen. Note: This is the only option available for the 1000 or 2000-series mini- and the weather station.

4.1 DATA MANAGEMENT

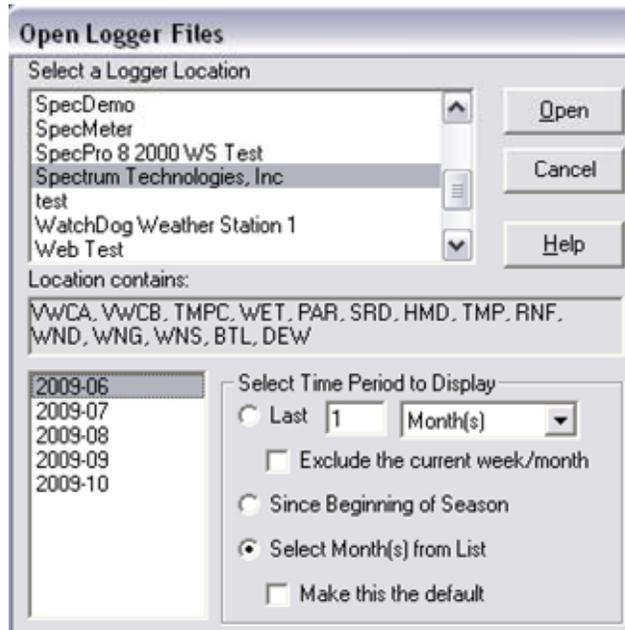
SpecWare offers significant advantages in data information management and decision-making tools. SpecWare simplifies your database with **Logger Location** directories. This permits easier analysis of trends and historical data.

The database is the permanent record of data stored on your hard drive. When you download the logger, SpecWare transfers all information in the logger memory to the computer and you have the option of saving to an existing **Logger Location**. For Original WatchDog data loggers and weather stations, it is also possible to create a new location to save the logger data. Suggestion: Use the "ID/Location Name" box that appears in the logger "Launch Options" screen as your **Logger Location** (e.g. North Orchard). Each **Logger Location** in SpecWare is a subdirectory in C:\Specware. If you choose to save your downloaded logger data to a floppy diskette, it is important to use a separate floppy diskette for each location because of the way data files are built by SpecWare.

The software stores data to disk in monthly files. All parameters are recorded in the same file in a subdirectory named for the **Logger Location**. As new data is downloaded from the logger, it is appended to the appropriate month for the location you have specified. The name of the data file indicates the year and the month of the data. For example, SD201002.swd is the data for February 2010. Each **Logger Location** directory must contain an index file (index.swd). This index file is used by SpecWare to identify which parameter is associated with each column in the data files. For this reason, care must be exercised when transferring or copying data files from one **Logger Location** to another.

CAUTION: The files in each **Logger Location** are given the same names as those in other **Logger Locations**. Therefore, it is important to carefully choose the **Logger Location** when adding new data to existing locations or to floppy diskette to avoid mixing the data from separate locations.

4.2 OPENING FILES



Open File

Click the **Open Logger File(s)** toolbar button or the **Open File** option from the **File** menu to bring up the **Open Logger Files** screen. From the upper box, select the **Logger Location** where the file is located. Data files saved on a floppy disk can also be retrieved (A: drive).

Data Redisplay Options

SpecWare offers 3 data redisplay options. These options are shown in the **Select Time Period to Display** field in the lower right corner of the **Open Logger Files** screen.

The first option allows you to view only the most recent data in the selected **Logger Location**. Enter the time interval of interest in the two text fields. The dropdown menu allows for time increments of days, weeks, or months. It is possible to exclude the current week or month of data. This may be desirable if the data has just been downloaded or if you want to look at data from the last complete time interval.

The second option instructs SpecWare to display all data from the beginning of the growing season defined in the **General** tab of the **Preferences** screen (see p. 7).

The third option allows you to select a specific range of months. The months are selected from the list in the lower left corner of the **Open Logger Files** screen. Multiple months can be selected by holding down the left mouse button and dragging the cursor or by selecting the first month and, while holding the shift key, selecting the other months with the arrow keys.

The third option is SpecWare's default mode. One of the other options can be set as the default by clicking the box at the bottom of the screen. The newly selected default setting will not be universal but will only apply to the specific **Logger Location** for which it has been selected.

After selecting the Logger Location and data redisplay interval options, clicking the **Open** button will bring up the **Change Graph Parameters** screen (shown to the right). This screen allows you to select which parameters will be graphed as well as the vertical axis that will be used. Only 1 parameter can be plotted on the Y1 axis, but multiple parameters can be plotted on the Y2 axis. The data on the graph will also be visible under the horizontal axis. This is especially useful when multiple parameters are plotted on the Y2 axis (See *View, Print and Edit Menus*, p. 32).

Y1	Y2	Select Data to Graph
<input type="checkbox"/>	<input type="checkbox"/>	BAR Bar Pressure
<input type="checkbox"/>	<input type="checkbox"/>	CO2 Carbon Dioxide
<input type="checkbox"/>	<input type="checkbox"/>	DEW Dew Point
<input type="checkbox"/>	<input type="checkbox"/>	HMD Humidity
<input type="checkbox"/>	<input type="checkbox"/>	MAM MilliAmp
<input type="checkbox"/>	<input type="checkbox"/>	PAR PAR Light
<input type="checkbox"/>	<input type="checkbox"/>	RNF Rainfall
<input type="checkbox"/>	<input type="checkbox"/>	SMS Soil Moisture
<input type="checkbox"/>	<input type="checkbox"/>	SRD Solar Radiation
<input type="checkbox"/>	<input type="checkbox"/>	STA State/Irrigation
<input checked="" type="checkbox"/>	<input type="checkbox"/>	TMP Temperature
<input type="checkbox"/>	<input type="checkbox"/>	VLT Voltage
<input type="checkbox"/>	<input type="checkbox"/>	VWC Vol Water Cont
<input type="checkbox"/>	<input type="checkbox"/>	WET Leaf Wetness
<input type="checkbox"/>	<input type="checkbox"/>	WND Wind Direction
<input type="checkbox"/>	<input type="checkbox"/>	WNS Wind Speed

4.3 SAVING DATA

Data downloaded from 1000 or 2000-Series weather or mini station is automatically saved to a **Logger Location** with the same name as the **Logger/Station Name** assigned in the **Properties** screen (see *WatchDog Manager*, p. 14).

Saving Files Downloaded from Original Watch-Dog Stations

When you download the data from an original logger, the **Save Logger Data** box will appear. Choose the directory where you want to save the file. You may append the data files into an existing **Logger Location**, save them to a newly created **Logger Location**, or save to a floppy disk. If you decide to create a new location, you will be prompted to name this location. Generally, the data will be saved to a logger location in the SpecWare directory on the drive where the software was installed. Files can also be saved to the floppy disk drive (A: or B: drive) if this option is selected in the **Data Storage** tab of the **Preferences** screen (see pg. 9). If you choose to not save your data at this time, click on the **Cancel** button to go directly to the graph screen. You can save the data later by selecting the **Save File** option from the **File** menu. Otherwise, you will be reminded to save the file if you attempt to open another file or exit from the program.

Save Logger Data

Select a Logger Data Location

SPECDEMO

[A:]

[B:]

Logger model 450 header:
Orlando

Using Your Data in Other Applications

SpecWare creates an ASCII file for use in other applications as soon as a downloaded file is saved. The file is tab-delimited for use in spreadsheets, word processors and other applications. These raw data files are located in the SpecWare directory in a folder named for the **Logger Location**.

NOTE: If a data file is changed is changed by a different application (i.e. Excel), do not save to this application with the original file name. By default, the format will be changed and SpecWare will be unable to read the modified file.

IMPORTANT: All new data loggers require that you create a new **Logger Location**. Once this **Logger Location** is established, subsequent logger data readouts can be appended to this **Logger Location**.

4.4 CONVERTING ARCHIVED DATA INTO THE CURRENT SPECWARE FORMAT

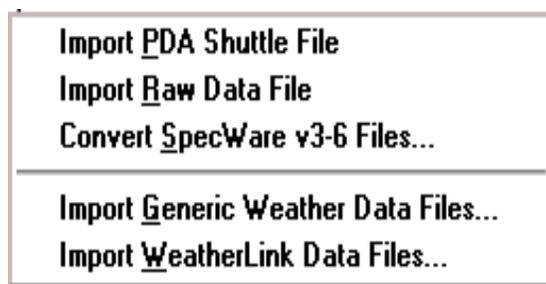


Figure 5

by SpecWare. Select **Convert SpecWare v3-6 Files** from the **Import Files** menu within the **File** menu (Fig. 5). This will bring up the file conversion screen (Fig. 6). All **Logger Locations** from the SpecWare directory will be visible. Select the location that contains the data you wish to convert. By default, every month of data will be converted. If you wish to only convert certain months of data, check the **Convert Specific Month(s)** box and use the mouse to select the desired months.

Click the **Convert** button to initiate the conversion. SpecWare will create the new data files and the index.swd file. The new data files are added to the directory and the old data files are left intact.

NOTE: If the index.swd file is removed, SpecWare will automatically recreate it the next time that Logger Location is opened.

The data file format for SpecWare versions 6 and earlier is different than the current format. Instead of having a unique monthly data file for each parameter, all data collected in a given month is included in one master data file. This file has a .swd extension associated with it. An index.swd file is also included in the **Logger Location** folder to allow SpecWare to process these data files into reports and graphs.

Data files created in earlier versions of SpecWare can be converted into the current file format used

by SpecWare. Select **Convert SpecWare v3-6 Files** from the **Import Files** menu within the **File** menu (Fig. 5). This will bring up the file conversion screen (Fig. 6). All **Logger Locations** from the SpecWare directory will be visible. Select the location that contains the data you wish to convert. By default, every month of data will be converted. If you wish to only convert certain months of data, check the **Convert Specific Month(s)** box and use the mouse to select the desired months.

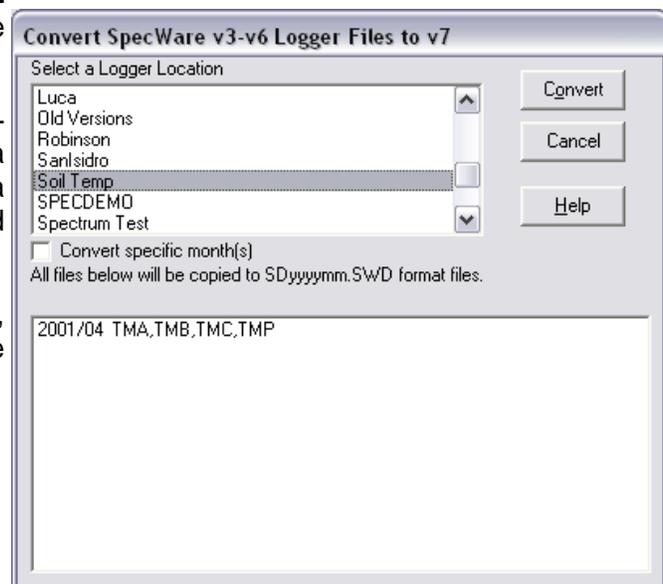


Figure 6

4.5 IMPORTING DATA

There are several instances when it may be necessary to import data files into SpecWare. All import functions are accessed from the **Import Files** option in the **File** menu (see p. 13). After the files to be imported have been selected, the **Save Logger Data** box will appear. If more than one file has been selected, each file will be imported in succession. You may append the data files into an existing **Logger Location**, save them to a newly created **Logger Location** or onto a floppy disk (see **Saving Data** p. 29). The various input options are listed below.

Importing .wdr Files

Palm/PDA Files

Files that have been transferred to a PC from a Palm Pilot or other PDA device must be imported into SpecWare. Select **Import PDA Shuttle File** from the **Import Files** dropdown menu. This will bring up a screen that allows you to browse to the location of the saved data files.

Raw Data Files

Some files that have been created by using WDTTest to extract raw data from a data logger or weather station may be imported directly into SpecWare. This will not be possible if the files need to be repaired by Spectrum Technologies before they can be imported. Select **Import Raw Data File** from the **Import Files** dropdown menu. This will bring up a screen that allows you to browse to the location of the saved data files.

Importing Weather Data Files

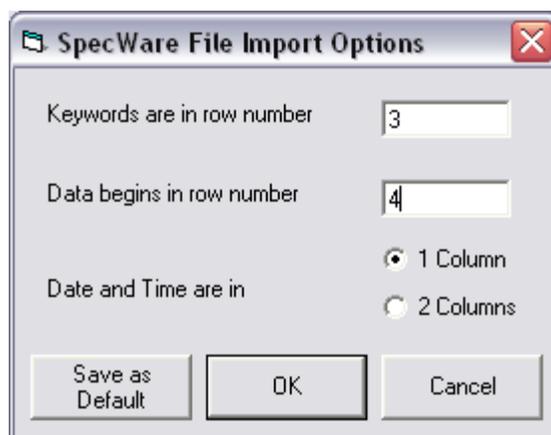
WeatherLink Data Files

SpecWare is able to import and process files that were initially downloaded with WeatherLink software. These files will have a suffix of .wlk. Select **Import WeatherLink Data Files** from the **Import Files** dropdown menu. This will bring up a screen that allows you to browse to the location of the saved WeatherLink data files.

Note: WeatherLink considers midnight to be the last data point of the day. SpecWare considers midnight to be the first data point of the day. Therefore, if a WeatherLink file has a data point for midnight, SpecWare will create a SpecWare file for the same month, plus a file for the following month containing only the last midnight record.

Generic Weather Data Files

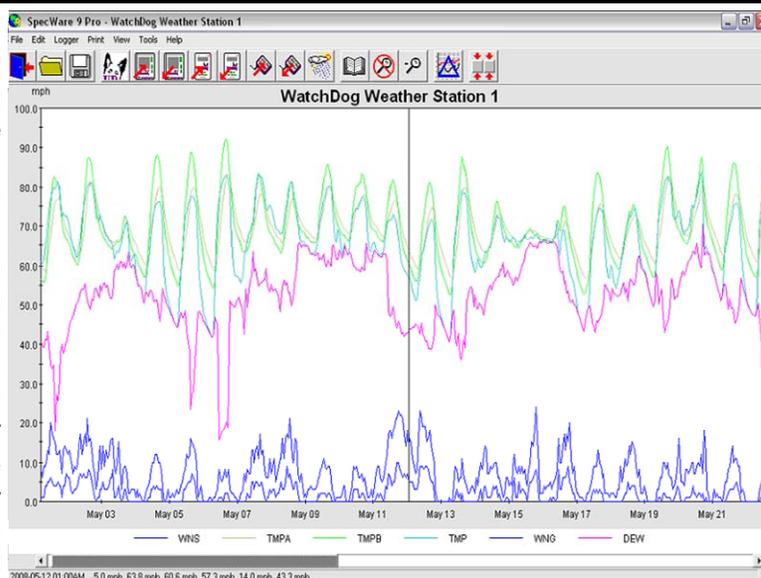
SpecWare is able to import and process weather data files that were initially created with other data logging software. The data must be text files in tab-delimited format. One line in the file must contain SpecWare-specific keywords that identify which weather parameter is contained in each column of data. The date and time information must be in the first one or two columns. Select the **Import Generic Weather Data Files** option from the **Import Files** dropdown menu. This will bring up a screen that allows you to browse to the location of the saved weather data files. Select one or more files and click **Open**. In the **SpecWare File Import Options** screen, specify how the data file is configured. This configuration can be stored as the default by clicking the **Save as Default** button. Otherwise, click the **OK** button and proceed with saving the data in SpecWare. Refer to **Appendix 1**, (p. 50) for details on creating generic data files.



4.6 VIEW, PRINT, AND EDIT MENUS

Viewing Your Data as a Graph

Upon downloading data or opening an existing file, you must select the parameters to view. SpecWare will display the **Change Graph Parameters** screen (see p. 34). This screen will also appear when opening new files (see **Opening Files**, p. 28). Select which parameters will be graphed and on which vertical axis (Y1 or Y2) the data scale for a given parameter will be displayed. The data will be displayed in a graph with the logger reading on a vertical scale, time on the horizontal scale and the legend shown underneath the graph. As the cursor is moved across the graph, the time and data values are displayed at the bottom of the screen.



Sample SpecWare Graph Screen.

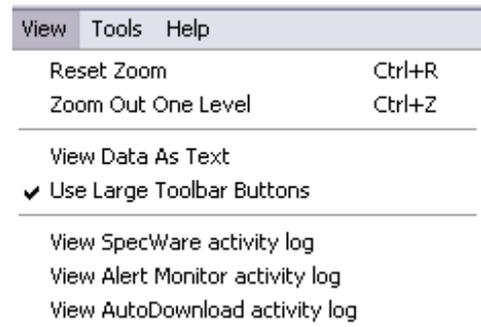
Only 1 parameter can be plotted on the Y1 axis. The data scale on the Y1 axis will be in the units of the parameter being displayed. The Y2 axis, however, can be used to plot multiple parameters. If only one parameter is being plotted using the Y2 axis, the data scale will be in the units of that parameter. However, if the Y2 axis is being used to plot more than 1 parameter, the data scale will range from 0 to 100. All data plotted with Y2 as its vertical

reference axis will, therefore, be normalized to a scale of 0 to 100. Each parameter has a default range that is used to do the normalization. The default ranges encompass most data values that will be seen in the field. This range can be modified in the **Graph** tab of the **Preferences** screen (p. 10). When more than 1 parameter is plotted on the Y2 axis, the actual numerical values of each plotted point can still be seen beneath the graph. The following example is given for illustration:

Example: The default range for solar radiation is 0 to 1,250 W/m². Assume, during a given month, the peak solar radiation was 550 W/m². If solar radiation is plotted on the Y2 axis along with one or more other variables, its maximum normalized value will be 44 [because 100 x (550/1250) = 44]. However, if in the **Preferences** screen, the default range is changed to 0 to 600 W/m², the normalized graph of solar radiation will then have a peak of 92 [because 100 x (550/600) = 92]. In both cases, “550 W/m² will be displayed as the value beneath the graph.

Viewing Your Data as Text

Click on the **View Data as Text** quick-button or on the **View Data as Text** command in the **View** menu. A WordPad or Notepad window (depending on what is available on your computer) will overlay the graph and display the numerical data for that graph.



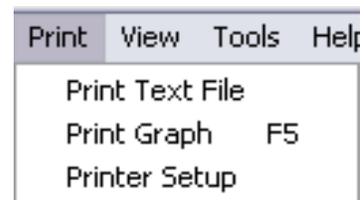
Printing Your Graph

Click on the **Print Graph** command under the **Print** menu to print the graph displayed on the screen.

Printing Your Data as Text

Click on the **Print Text File** command under the **Print** menu on the Graph/Data Screen to print the numerical data for the graph displayed on the screen.

NOTE: The data displayed using the **View Data as Text** or **Print Text File** commands may not always be the raw data as recorded by the data logger. The data displayed has been adjusted to fit uniform time periods for the purpose of graphing (See **Data Redisplay Intervals**, p. 10 and **Using Your Data in Other Applications**, p. 29).



Zooming in on any Plot Selection

You can zoom in on any section of the plot. This function is particularly useful when the plot encompasses a large data set. Note that when the cursor is within the graph box, a Tracker Bar appears. A vertical Tracker Bar is always present. It is also possible to display a horizontal Tracker Bar by setting this option in the **Graph** tab in the **Preferences** screen (see **Graph** p. 10). As the Tracker Bar is repositioned on the graph, the corresponding date, time, and associated data values appear in the status bar below the graph. To zoom in on a particular section of a graph, position the cursor at one end of the time interval of interest. While holding down the left mouse button, drag the Tracker Bar to the other end of the time interval. After releasing the mouse button, the software will display a graph of the chosen region.

Zooming Out One Level

To return to a previous graph after zooming in on your graph, click on the **Zoom Out** quick-button (magnifying glass without the red circle) or the **Zoom Out One Level** command in the **View** menu. Each time this button is clicked, the screen will return to the previous screen developed during the zooming-in process.

Returning to the Original Plot View

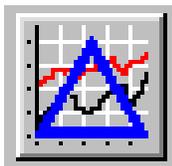
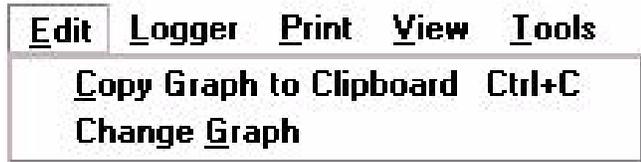
After zooming in on the data displayed in the graph screen, click on the **Reset Zoom** quick-button (magnifying glass with red circle) or the **Reset Zoom** command in the **View** menu to return to the original graph.

Copying Graph

To copy the graph as a bitmap for use in other applications, select **Copy Graph** from the **Edit** menu.

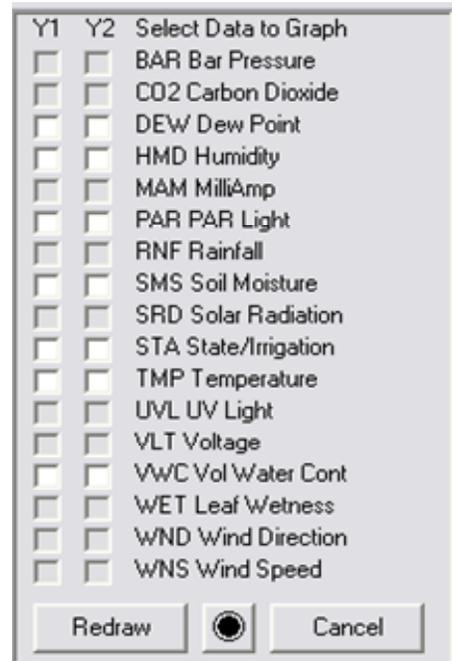
Change Graph

Selecting this option from the **Edit** menu will bring up the **Change Graph Parameters** screen. This screen can also be accessed from the **Change Graph Parameters** quick-button on the SpecWare toolbar. When this option is selected, the **Change Graph Parameters** screen will appear. Select the parameter(s) of interest and click the **Redraw** button to produce the new chart.



Change Graph Parameters
quick-button

 Adds points to the graph



Change Graph Parameters screen

5.1 TOOLS MENU

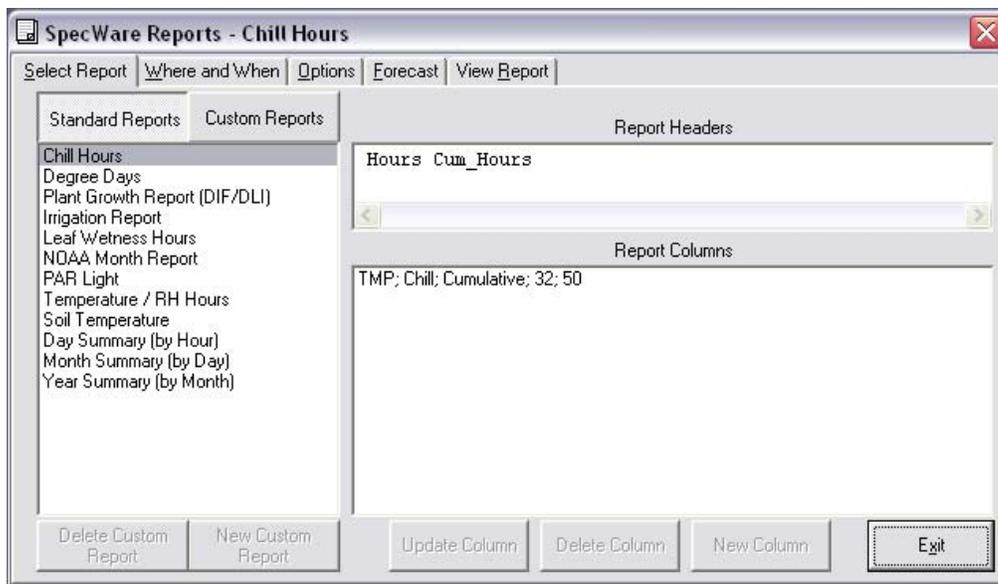
The **Reports** screen is available in the **Tools** menu on the SpecWare toolbar (see **Toolbar**, p 12). The **Reports** screen has 5 tabs; **Select Report**, **Where and When**, **Options**, **Forecast**, and **View Report**.



5.2 REPORTS

5.2.1 SELECT REPORT

This screen allows the user to select the report of interest. There are two Report Categories: Standard Reports (pp. 39-43), and Custom Reports (p. 44). The Standard Reports are predefined reports for each of the sensor types. Custom Reports allow you to create your own report in which you choose which parameters are displayed. SpecWare Basic cannot create Custom Reports .



5.2.2 WHERE AND WHEN

This screen allows you to produce reports for **Logger Locations** other than the one currently open. Initially, the default values for the location and process dates are from the file that is currently open. To generate a report for another location or date, select a new **Logger Location** and enter the desired time period in the **Process Dates** boxes. The calculations can begin and end on any date within a single year. SpecWare will not use data outside the chosen time period. To generate a report that begins in one year and ends in the next (e.g. Chill Hours) you must calculate each year separately and manually sum the results.

IMPORTANT: For your chosen **Location**, make sure the **Process Dates** are included in the **Available Months** and that the **Available Data** include the appropriate parameters needed for the chosen **Report** or that are needed to drive the chosen disease or insect model.

SpecWare Reports - Degree Days

Select Report | **Where and When** | Options | Forecast | View Report

Process Dates From: 08/10/1999 To: 08/14/1999

Locations: Luca, Old Versions, Robinson, Santidro, Soil Temp, **SPECDEMO**, Spectrum Test, wireless

Available Months: 1999/05 - 2002/09

Available Data: TMP

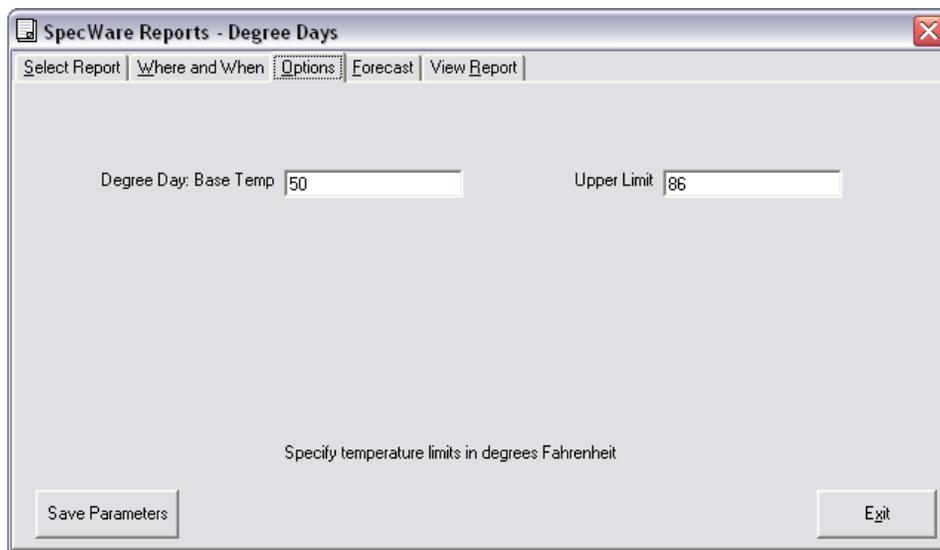
The Degree Days report uses Temperature

Exit

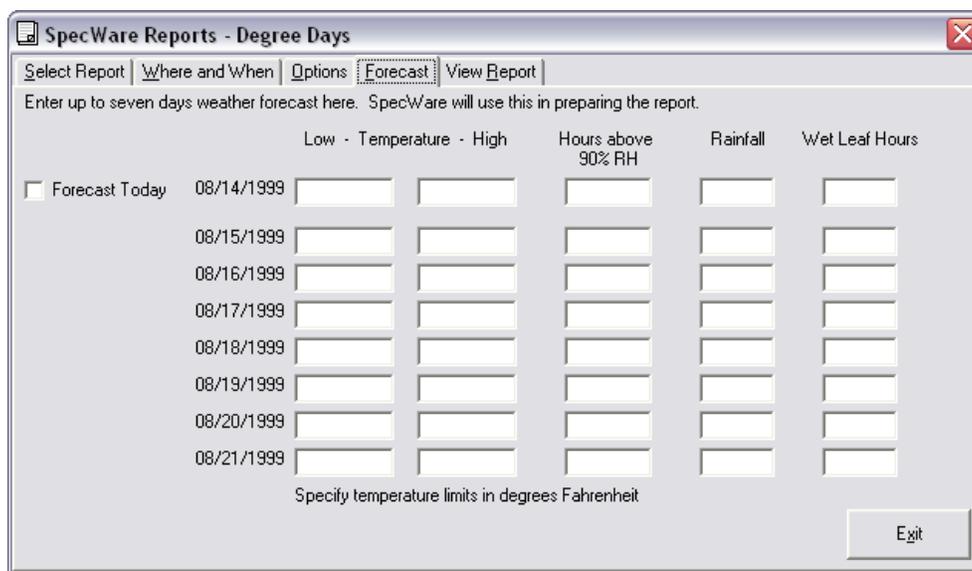
5.2.3 OPTIONS

This screen allows modification of parameter ranges and boundary conditions specific to the Report, Disease, or Insect Model of interest. Environmental inputs may include temperature, humidity, and leaf wetness limits. It may also be necessary to enter relevant biofix dates to indicate some visible stage of plant, disease, or insect development. A spray date may be required to update infection potential calculations from that point on. If a generally accepted value for a parameter exists, it is shown as the default. Consult your State Agricultural Extension Service for assistance in determining the appropriate values for your area. Once an appropriate value for each

of the parameters is determined, click on **Save Parameters** to avoid having to re-enter the values the next time the model is used.



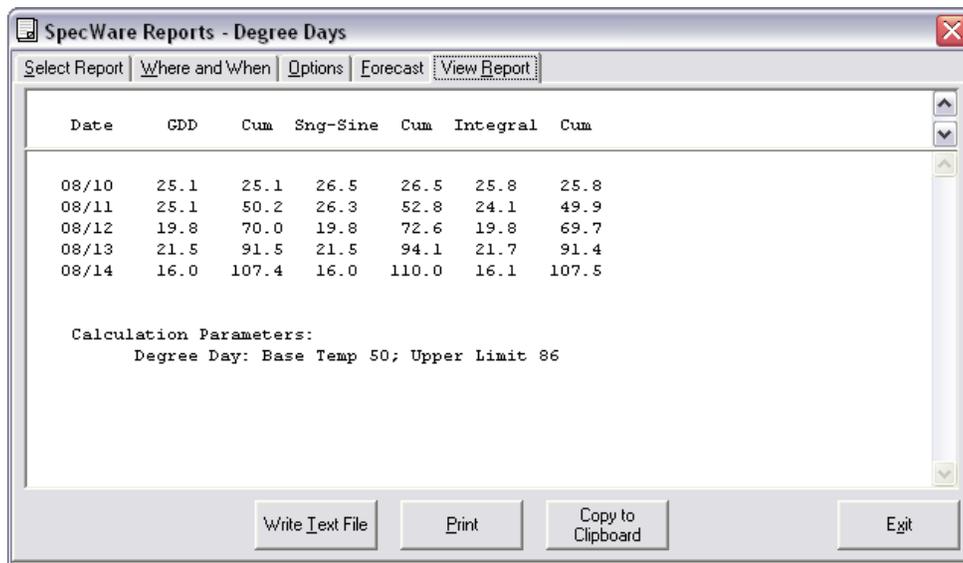
5.2.4 FORECAST



Forecast data can be entered for some disease and insect models. It is possible to include forecast data for some other reports and predict environmental conditions up to one week in the future. It is also possible to enter forecast data for the present date if data for the entire day was not logged. Check the **Forecast Today** box and enter the expected values for today's **Low** and **High** temperature, **Hours above 90% RH**, **Rainfall** amount and **Wet Leaf Hours**. Likewise, enter a forecast for the next seven full days by entering values for these parameters on the line next to the appropriate

date. When the report is viewed, an asterisk (*) will appear next to the forecasted dates to distinguish predictions based on forecasts from those based on actual measured data.

5.2.5 VIEW REPORT



The screenshot shows a software window titled "SpecWare Reports - Degree Days". It has a menu bar with "Select Report", "Where and When", "Options", "Forecast", and "View Report". The "View Report" menu item is active. Below the menu bar is a table with the following data:

Date	GDD	Cum	Sng-Sine	Cum	Integral	Cum
08/10	25.1	25.1	26.5	26.5	25.8	25.8
08/11	25.1	50.2	26.3	52.8	24.1	49.9
08/12	19.8	70.0	19.8	72.6	19.8	69.7
08/13	21.5	91.5	21.5	94.1	21.7	91.4
08/14	16.0	107.4	16.0	110.0	16.1	107.5

Below the table, the "Calculation Parameters:" are listed as "Degree Day: Base Temp 50; Upper Limit 86". At the bottom of the window, there are four buttons: "Write Text File", "Print", "Copy to Clipboard", and "Exit".

On this screen, Report parameters or the results from disease or insect models are displayed. If several different university models exist for a disease, they are shown in separate columns on the same report.

You can save the current report by clicking the **Write Text File** button. In the **Save As** screen, type a filename and select the directory where it will be saved.

Clicking **Print** will cause the report to be sent directly to the printer.

The **Copy to Clipboard** button allows the report to be copied and pasted into another document that has, for example, been created in a word processing or spreadsheet program.

NOTE: If the report is saved directly to a spreadsheet with **Copy to Clipboard**, it will not be separated into separate columns. To parse the information into separate columns, use **Write Text File** to create a separate file. Then open that text file in spreadsheet software (such as Microsoft[™] Excel) as a space-delimited file. Alternately, with Excel, if the text file is copied directly into the spreadsheet, the "Text to Columns" option from Excel's Data menu will also bring up the Text Import Wizard.

5.3 STANDARD REPORTS

5.3.1 DEGREE DAYS

Degree Days are computed for the Standard Degree Day Report (see figure below), Custom Reports, and for the Insect Models. SpecWare calculates the total degree days accumulated and requires temperature data measured by the thermistor inside the WatchDog. External temperature sensors cannot be used to generate these reports. (See **Soil Temperature Hours**, p. 42). Three methods are used to calculate degree days; Growing Degree Day, Single Sine, and Actual Degree Day.

The Growing Degree Day Method (GDD) considers only the high and low temperatures (T_{high} and T_{low}) for the day along with user-selected values for the base and upper limit temperatures to compute the total number of degree days acquired. The formula is:

$$\frac{1}{2}(T_{high} + T_{low}) - \text{Base}$$

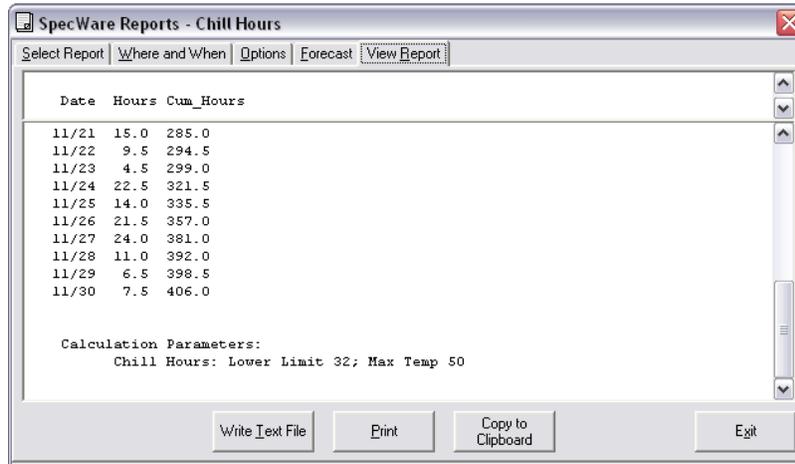
If T_{high} is above the upper limit, the upper limit is used for T_{high} . If T_{low} is below the base temperature, the base temperature is used for T_{low} . In addition to the GDD, both the Single Sine and Actual (Integral) Degree Days are also displayed in the GDD report. The Single Sine method uses the day's maximum and minimum temperatures to generate a sine curve. The area between this curve and the lower threshold temperature is the GDD. The Actual Degree Days (ADD) method employs a calculation similar to the GDD but is done at each measurement interval rather than on daily values. The ADD method is the most accurate.

Date	GDD	Cum	Sng-Sine	Cum	Integral	Cum
08/22	18.8	461.8	18.8	472.0	18.0	465.7
08/23	24.0	485.7	24.0	496.0	21.4	487.1
08/24	20.5	506.2	20.5	516.4	18.0	505.1
08/25	20.1	526.3	20.1	536.5	18.9	524.0
08/26	23.0	549.3	23.0	559.5	22.1	546.1
08/27	23.4	572.7	24.4	583.9	24.6	570.7
08/28	26.2	598.8	28.0	611.9	27.1	597.8
08/29	18.8	617.6	18.8	630.7	21.0	618.8
08/30	13.9	631.4	13.9	644.5	13.7	632.6
08/31	17.0	648.4	17.0	661.5	16.7	649.3

Calculation Parameters:
Degree Day: Base Temp 50; Upper Limit 86

5.3.2 CHILL HOURS

SpecWare calculates the total chill hours. Chill hours are calculated as the amount of time spent below a base temperature and above the lower limit.



The screenshot shows a window titled "SpecWare Reports - Chill Hours". It has a menu bar with "Select Report", "Where and When", "Options", "Forecast", and "View Report". The main area contains a table with the following data:

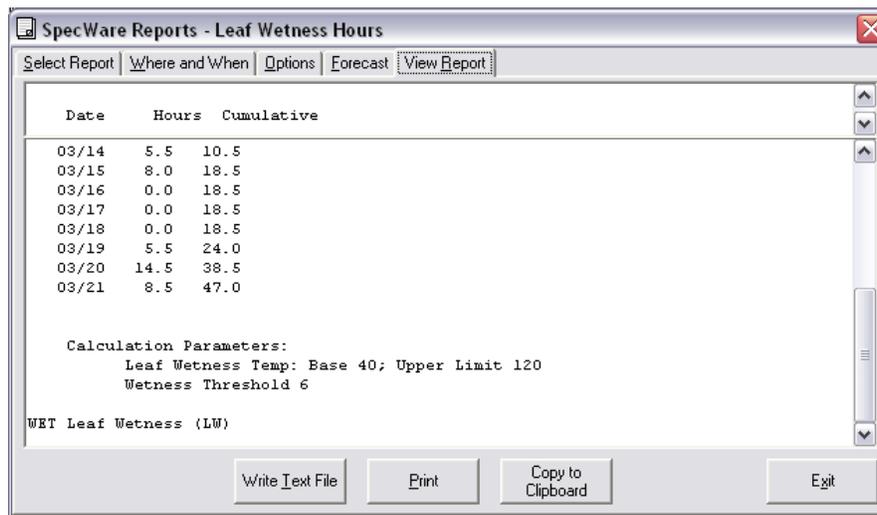
Date	Hours	Cum_Hours
11/21	15.0	285.0
11/22	9.5	294.5
11/23	4.5	299.0
11/24	22.5	321.5
11/25	14.0	335.5
11/26	21.5	357.0
11/27	24.0	381.0
11/28	11.0	392.0
11/29	6.5	398.5
11/30	7.5	406.0

Below the table, the "Calculation Parameters:" are listed as "Chill Hours: Lower Limit 32; Max Temp 50". At the bottom of the window are four buttons: "Write Text File", "Print", "Copy to Clipboard", and "Exit".

5.3.3 LEAF WETNESS HOURS

Leaf Wetness Hours

SpecWare calculates the total leaf wetness hours accumulated between an upper and lower temperature limit. This report requires leaf wetness and temperature data.



The screenshot shows a window titled "SpecWare Reports - Leaf Wetness Hours". It has a menu bar with "Select Report", "Where and When", "Options", "Forecast", and "View Report". The main area contains a table with the following data:

Date	Hours	Cumulative
03/14	5.5	10.5
03/15	8.0	18.5
03/16	0.0	18.5
03/17	0.0	18.5
03/18	0.0	18.5
03/19	5.5	24.0
03/20	14.5	38.5
03/21	8.5	47.0

Below the table, the "Calculation Parameters:" are listed as "Leaf Wetness Temp: Base 40; Upper Limit 120" and "Wetness Threshold 6". At the bottom of the window are four buttons: "Write Text File", "Print", "Copy to Clipboard", and "Exit".

5.3.4 PAR LIGHT, DIF/DLI

SpecWare calculates photosynthetically active radiation (PAR) received. The PAR Light report shows total hours of accumulated PAR above a user-determined minimum light intensity and total moles meter⁻² day⁻¹ of photons. The PAR sensor may be plugged into any port on the WatchDog. If multiple PAR sensors are connected to the same WatchDog, a separate column is established for each PAR sensor. SpecWare also calculates DIF and Daily Light Integral (DLI). DIF is the average day temperature minus the average night temperature. This value is used to determine stem elongation. When day temperature is warmer than night temperature (positive DIF value) plants will become taller. When day temperature is cooler than night temperature (negative DIF value) less stem elongation will occur. DLI is the sum of all recorded PAR light throughout an entire day. DLI influences root and shoot growth as well as flowering.

Date	A-Hrs	M/m2d	B-Hrs	M/m2d	C-Hrs	M/m2d	D-Hrs	M/m2d
03/07	8.8	23						
03/08	6.0	13						
03/09	1.3	4						
03/10	6.3	17						
03/11	7.5	13						
03/12	7.8	19						
03/13	7.3	12						
03/14	7.0	24						
03/15	4.3	12						
		303.5	699.5					

Calculation Parameters:
PAR Hrs Minimum Intensity Level 200

PAR PAR Light (uM/m²s)

PAR Light Report

Date	Light Hours	DLI M/m2d	Temperature				
			DIF Day	DIF Night	High	Low	
03/07	8.8	22.7	5.9	37.9	32.0	42.3	20.1
03/08	6.0	13.4	2.6	47.0	44.5	55.2	38.4
03/09	1.3	4.2	6.7	55.2	48.5	57.6	38.2
03/10	6.3	17.2	6.8	49.7	42.8	54.6	38.0
03/11	7.5	13.4	6.8	59.2	52.4	65.7	44.6
03/12	7.8	18.8	1.8	49.4	47.6	56.0	40.6
03/13	7.3	12.2	7.4	50.4	43.1	62.9	27.8
03/14	7.0	24.1	5.9	36.7	30.8	42.1	24.2
03/15	4.3	11.8	-15.9	32.5	48.4	76.1	22.7
		303.5	699.5				

Calculation Parameters:
PAR Hrs Minimum Intensity Level 200

PAR PAR Light (uM/m²s)

DIF/DLI Light Report

5.3.5 TEMPERATURE/RH HOURS

SpecWare calculates the hours of relative humidity that occur above an optional minimum percent RH and between a user-specified base and upper temperature limit. The report shows the sum of hours in which both the temperature and relative humidity conditions were satisfied.

Date	Hours	Cumulative
03/08	2.5	2.5
03/09	16.8	19.3
03/10	0.0	19.3
03/11	4.5	23.8
03/12	4.3	28.0
03/13	6.5	34.5
03/14	0.0	34.5
03/15	0.0	34.5

Calculation Parameters:
RH Temperature: Base 50; Upper Limit 120
Relative Humidity Threshold 80

HMD RH (%)

5.3.6 SOIL TEMPERATURE HOURS

SpecWare reports the high, low, and mean soil temperature for each day. Integrated hourly degree days are calculated for each day using the user-specified lower and upper temperature limits.

Date	Temp High	Temp Low	Temp Mean	DegDay DD50	Temp High	Temp Low	Temp Mean	DegDay DD50	Temp High	Temp Low	Temp Mean	DegDay DD50
04/27	64.2	59.4	61.9	11.9	78.8	77.4	77.6	27.6	78.8	77.4	77.6	27.6
04/28	64.9	60.8	62.6	12.6	77.4	76.7	77.1	27.1	77.4	76.7	77.1	27.1
04/29	64.2	60.1	62.3	12.3	76.7	75.3	75.9	25.9	76.7	75.3	75.9	25.9
04/30	66.3	60.8	63.2	13.2	76.0	73.9	74.8	24.8	76.0	73.9	74.8	24.8
				289.4				664.2				765.0

Calculation Parameters:
Degree Day: Base Temp 50; Upper Limit 86

Degree Days are 'Actual' - based on individual temperature readings throughout the day.

TMPA Temperature (*F)
TMPB Temperature (*F)
TMPC Temperature (*F)

5.3.7 DAY, MONTH, OR YEAR SUMMARY

Day, Month, or Year Summary

SpecWare summarizes the available data by hour for any single day, by day for any single month, or by month for any single year selected in the **Where and When** screen. For each summary, the temperature limits for calculating degree days and chill hours can be specified in the **Options** screen. The lower leaf wetness threshold and temperature range for calculating the hours of leaf wetness can also be specified.

Date	Temperature High	Temperature Time	Temperature Low	Temperature Time	Degree Days Mean	Chill Hours	RH Hi	RH Lo	Wet Hours	Rain-Fall	
09/13	66.3	13:30	45.9	00:00	57.3	7.7	1.5	100	49	9.5	0.01
09/14	71.8	16:30	42.3	07:00	57.2	9.2	8.0	100	27	7.0	0.00
09/15	59.4	09:00	40.8	06:00	46.0	0.3	7.5	98	68	4.5	0.00
					902.1	34.5			150.5	4.34	

Calculation Parameters:
Degree Day: Base Temp 50; Upper Limit 86
Chill Hours: Lower Limit 32; Max Temp 50
Leaf Wetness Temp: Base 50; Upper Limit 120
Wetness Threshold 6

Degree Days are 'Actual' - based on individual temperature readings throughout the day.

WET Leaf Wetness (LW)

Day Summary (by Hour) reports mean hourly values of temperature, relative humidity and PAR light, hourly accumulation of degree days, chill hours, rainfall and the length of time the leaves were wet during the hour. High and low temperatures for the time period of interest, as well as the time they occurred, are given at the bottom of the report. Only one day's data can be displayed.

Month Summary (by Day) reports the daily mean temperature, high and low RH, high and low temperatures and the time they occurred, daily accumulation of degree days, chill hours, rainfall and the length of time the leaves were wet during the day. Only one month's data can be displayed.

Year Summary (by Month) reports the monthly mean temperature, high and low temperatures and the day they occurred, monthly accumulation of degree days, chill hours, leaf wetness hours, rainfall, the length of time the leaves were wet during the month and the number of days that rain fell during the month. High and low temperatures for the year and the day they occurred are given at the bottom of the report.

5.3.8 NOAA/IRRIGATION REPORT

NOAA Report

SpecWare summarizes weather station data in a format approved by the National Oceanic and Atmospheric Association. The NOAA report includes the daily mean temperature, high and low temperatures and the time they occurred, daily accumulation of integrated-hourly degree days, daily solar radiation in average watts meter⁻² day⁻¹, daily mean RH, daily rainfall, and the daily mean wind speed and maximum wind gust. The **Options** screen is used to specify the temperature limits for calculating degree days. Only one month's data can be displayed.

Date	Temperature		Time	Low Time	Degree Days	Solar Rad	RH Mean	Rain-Fall	Wind		
	Mean	High							Speed	Gust	
07/25	72.7	85.2	17:00	62.2	05:30	22.7	141.8	81	0.01	0.0	4.0
07/26	77.0	88.1	15:30	68.4	05:30	27.1	170.2	87	0.00	0.5	10.0
07/27	78.7	91.0	17:00	70.4	07:30	28.0	145.6	88	0.46	0.3	15.0
07/28	78.7	87.4	11:30	71.8	23:30	28.8	122.0	86	0.01	0.0	10.0
07/29	75.4	84.5	16:00	67.7	00:00	25.5	145.4	90	0.20	1.0	12.0
07/30	78.2	91.8	17:00	64.2	05:30	26.9	291.6	81	0.00	0.1	4.0
07/31	79.3	93.3	14:30	64.2	05:30	27.5	299.0	79	0.00	0.0	3.0
						776.8		1.99			

Calculation Parameters:
Degree Day: Base Temp 50; Upper Limit 86
Degree Days are 'Actual' - based on individual temperature readings throughout the day.

Irrigation Report

A summary of the daily mean soil moisture readings as well as the amount of time the soil moisture tension was above or below the user-specified soil moisture range. If data from a state sensor (item# 6451) is available, the last 2 columns will report the length of time the irrigation system was pressurized and how many gallons of water were applied to the field. The soil moisture range and irrigation flow rate are set in the **Options** tab (see **Options** p. 43).

Date	SI	SI	SI	SI	SI	SI	Irgtn Hours	Irgtn Gal
	Mean	Above	Below	Mean	Above	Below		
09/15	26.0	0.0	0.0	77.2	24.0	0.0		
09/16	28.5	0.0	0.0	85.0	24.0	0.0		
09/17	30.8	0.0	0.0	89.6	12.5	0.0		
09/18	0.0	0.0	0.0	0.0	0.0	0.0		
09/19	0.0	0.0	0.0	0.0	0.0	0.0		
09/20	0.0	0.0	0.0	0.0	0.0	0.0		
		923.5	641.5	1274.5	637.5			

Calculation Parameters:
Soil Moisture: Upper 60
Soil Moisture: Lower 25
Flow Rate: Gal/Hr 1

SMSA Soil Moist (kPa)
SMSB Soil Moist (kPa)

5.4 CUSTOM REPORTS

SpecWare Pro gives users the ability to create customized, daily summary reports. Any parameter measured by the WatchDog data logger or weather station can be included in these reports. After entering the **Custom Reports** module (see Fig. 7) in the SpecWare **Reports** screen (see **Select Report**, pg. 35), you have the option of adding a new report or modifying or deleting an existing report. To delete a report, highlight the name and click the **Delete Custom Report** button in the lower left corner. To add a report, click the **Add New Custom Report** button and give a name for the new report in the **Create New Custom Report Screen** (see Fig. 8).

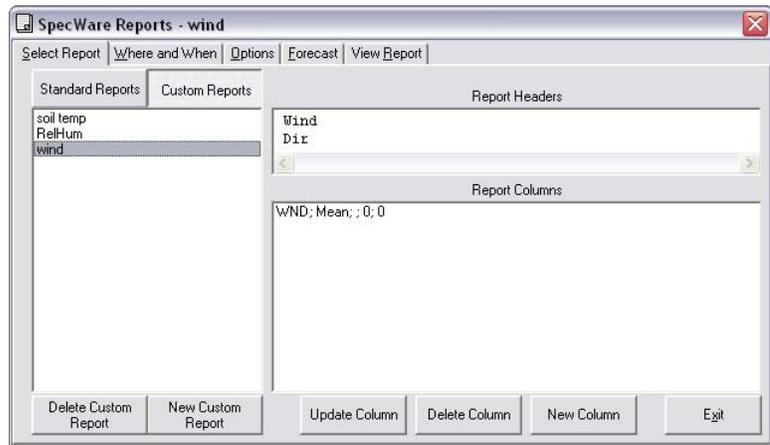


Figure 7



Figure 8

To modify an existing report, simply highlight that report. The details about this report will then appear in the **Report Columns** field on the right-hand side of the screen. Columns in a report are added, modified and deleted with the appropriate button in the lower right-hand side of the **Custom Reports** module.

Adding/Modifying a Custom Report Column

To modify an existing column, highlight that column from the **Report Columns** field. This will bring up the **Report Columns Options** screen (Fig. 9). This same screen will also appear if a new column is being added. From this screen, there are four options that must be selected. They are as follows:

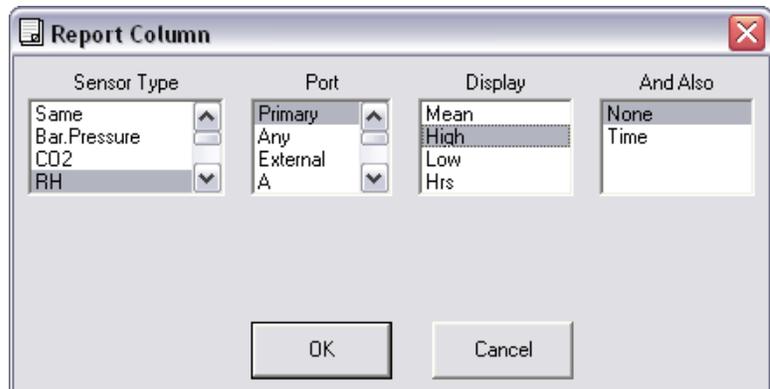


Figure 9

Sensor Type

The sensor type selected in the first field will determine what options are available in the other three fields. If the *Same* option is selected, the sensor used in the previous column will be also be used in the column being added. The column headings for each report column appear in the **Report Headers** field above the **Report Columns** field.

Port

After a sensor type has been selected, this option identifies the channel to which the sensor of interest is connected. The default option for this category is *Primary*. If *Primary* is selected, SpecWare will initially look for an internal sensor of that sensor type. If none is found, it will look for the data file of the first external sensor (in alphabetic order) of that sensor type. This option should be selected if there are no duplicate sensors connected to the WatchDog. If more than one of the same sensor type is connected to the data logger, select the location of the specific sensor that should be used in the report.

If a letter (*A - H*) is selected, data from the sensor connected to this port will be used in the report. The *External* option is similar to *Primary* except SpecWare will only look for external sensors (currently, the only sensor type that can be either an internal or external sensor is temperature). The *Any* option is used for reports that contain data from several sensors of the same sensor type but, for which, the port the sensors are connected to may change or vary from logger to logger. When *Any* is selected, SpecWare will look for the first data file of that sensor type that has not already been used in the report.

Note: If a sensor type/location combination does not exist (for example, the Custom Report requires a solar radiation on channel B but no such data file exists because a temperature sensor is actually connected to that port), that report column will be blank when the report is displayed or printed out.

Display

The **Custom Reports** module presents information gleaned from an entire day of data. The option selected here determines what information for the chosen sensor will be displayed. The options are summarized on the following pages:

Mean, High, and Low-SpecWare will display the mean, high or low value measured by the selected sensor.

Sensor Type	Port	Display	And Also
Irrigation	Primary	Low	None
Temperature	Any	DD	Cumulative
Voltage	External	ADD	Total
Leaf Wetness	A	GDD	

Degree Day: Base Temp Upper Limit

OK Cancel

Figure 10

Hrs-SpecWare will display the amount of time that the selected sensor was measuring values above a user-selected threshold value. The field for entering this information will be in the same part of the screen where base temperature and upper limit are entered for degree day reports (see fig. 10).

DD, ADD, GDD and DDSine-This option is only available for temperature data. SpecWare will display the number of degree days accumulated for the day based on a user-defined base temperature and upper limit (see fig. 10). The definitions of the different degree day options are:

DD:	Degree Days
ADD:	Actual Degree Days
GDD:	Growing Degree Days
DDSine:	Single Sine Method.

See **Degree Days** (p. 39) for more details on degree day computation.

Flow-This option is only available for data from the Irrigation On/Off sensor. Based on a user entered irrigation system flow-rate, SpecWare will display the total amount of irrigation water that was applied during the day.

HiHrs and LoHrs- This option is only available for soil moisture data. SpecWare will display the amount of time the selected soil moisture sensor was above (*HiHrs*) or below (*LoHrs*) a user-defined threshold value.

And Also

With some options, the **Custom Reports** module gives the user the option of adding additional information that supplements the *Display* column. This can be in the form of an additional column or an additional line of information at the end of the report. The options are summarized below:

None-This is the default option. If it is selected, no supplementary information will appear in the report.

Time-This option is available with the High and Low Display options. It creates an additional column that indicates when the respective high or low value occurred.

Cumulative-This option is available with the Sum, Flow, Hrs, HiHrs, LoHrs and Degree Day display options. It creates an additional column that shows a running total of the accumulation of the desired parameter up to, and including, the day for which it is displayed.

Total-This option is available with the Sum, Flow, Hrs, HiHrs, LoHrs and Degree Day display options. It creates an additional line at the end of the report that shows the sum of the desired parameter over the entire time range under consideration.

5.5 DISEASE AND INSECT MODELS

Optional Disease and Insect Models

SpecWare software includes models to predict infection events for the following diseases and for insects. These models are provided FREE for a 30 day evaluation. If the user desires continued use of any of the disease or insect models after the evaluation period, or if any model was purchased initially with SpecWare, the user must contact Spectrum Technologies, Inc. for a registration number.

Before calling Spectrum, click on the **Help** button on the main toolbar. Then click on "About SpecWare" A dialog box will appear with **both** the Serial Number and Registration Number. Call, fax, or e-mail Spectrum with this information. Currently, the optional disease and insect models are as follows:

	Catalog #
<u>Grape Alert</u>	3656GA
Black Rot (<i>Guignardia bidwellii</i>)	3656 BR
Botrytis (<i>Botrytis cinerea</i>)	3656 BT
Downey Mildew (<i>Plasmopara viticola</i>)	3656 DM
Phomopsis Cane Leaf Spot (<i>Phomopsis viticola</i>)	3656 PC
Powdery Mildew (<i>Uncinula necator</i>)	3656 PD
<u>Apple/Pear Alert</u>	3656AP
Apple Scab (<i>Venturia inaequalis</i>)	3656 AS
Fire Blight (<i>Erwinia amylovora</i>)	3656 FB
Sooty Blotch/ Flyspeck (<i>Peltaster fruticola</i> and <i>Leptodotium elatius</i> <i>Zygiophiala jamiacacensis</i>)	3656 SB
<u>Turf Alert</u>	3656TU
Brown Patch (<i>Rhizoctonia solani</i>)	3656 BP
Dollar Spot (<i>Sclerotinia homoeocarpa</i>)	3656 DS
Pythium Blight (<i>Pythium aphanidermatum</i> and <i>P. graminicola</i>)	3656 PT
<u>Potato Alert</u>	3656PO
Early Blight (<i>Alternaria solani</i>)	3656 EB
Late Blight (<i>Phytophthora infestans</i>)	3656 LB
<u>Tomato Alert</u>	3656TO
Tom-Cast (<i>Alternaria solani</i> , <i>Spetoria Lycopersici</i>)	3656 TC
<u>Cherry Alert</u>	3656CH
Cherry Leaf Spot (<i>Blumeriella jaapii</i>)	3656 LS
<u>Insects</u>	3656 IN

For detailed descriptions of each model, refer to the **SpecWare Disease and Insect Guide**.

5.6 EVAPOTRANSPIRATION



The first launch of a 900ET Weather Station will enable the **Evapotranspiration (ET)** report option in the **Tools** menu on the SpecWare Toolbar.

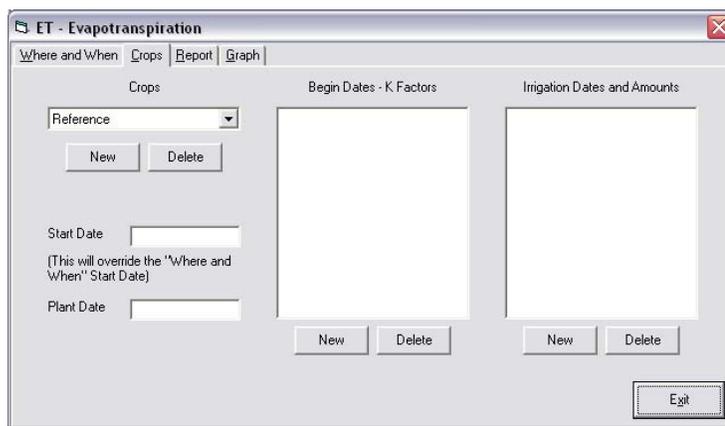
Note: The station **Latitude** and **Altitude** must be set in the **Preferences** screen (see p. 7).

Where and When

This screen allows you to produce reports for **Logger Locations** other than the one currently open (see p. 36).

Crops

The evapotranspiration (ET) value computed by SpecWare is the potential ET of a grass crop. Actual ET for a specific crop at a specific growth stage can be computed with a crop coefficient (k). The default k -value is 1.0. Crop coefficients are generally available from local extension services. This screen allows you to build reports for multiple crops. To see what crops are already entered, click the arrow to expand the **Crops** field. After choosing a crop, the data that has been entered for that crop can be seen in the **Begin Dates - K Factors** field. To add a crop, left-click the **Add** button under the **Crops** field, enter the crop name, and click **OK**. Enter the k factor and first date that factor is to be used by clicking the **Add** button under the **Begin Dates - K Factors** field. Multiple k factors and begin dates can be entered for each crop, allowing the user to track crop water status as plant water requirements change. The ET report can display the results of applied irrigation for each crop. Click the **Add** button under the **Irrigation Dates and Amounts** field and enter the irrigation date and amount of water applied. To change or delete data entered for any crop, highlight the data to be changed and click **Delete**. Re-enter new or updated data as needed by using the **Add** button.



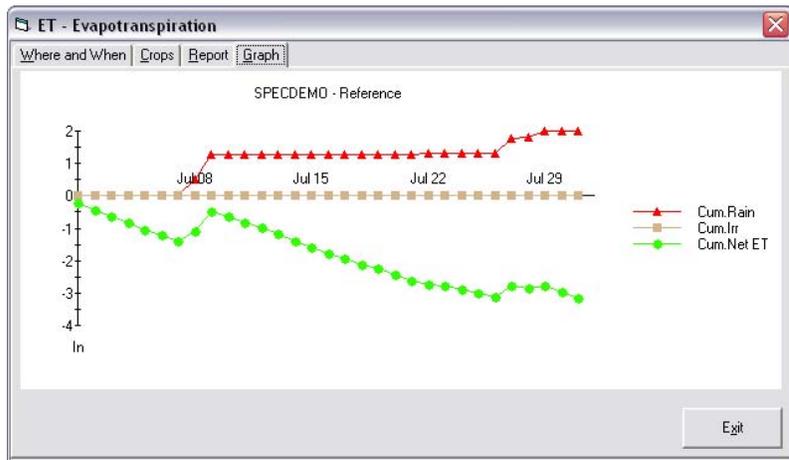
Report

The **Report** screen lists the daily values for the parameters used to calculate ET. Daily **Reference ET** is displayed and the **Crop ET** is calculated using the *k* values entered on the **Crops** screen. Irrigation events are displayed as entered on the **Crops** screen and from the values for **Irrigation**. **Crop ET**, **Rainfall**, the daily **Net Water** increase or decrease, and the **Cumulative Net** water increase or decrease are also displayed.

Date	Temperature			RH Mean	Solar W/m2	Wind Speed	Rain-Fall	ET Ref	ET Crop	Irrig ation	Net Water	Cum Net
	Mean	High	Low									
07/01	81.9	93.3	70.4	71	273	2.7	0.00	0.21	0.21	0.00	-0.21	-0.21
07/02	80.6	94.1	67.0	69	314	2.2	0.00	0.23	0.23	0.00	-0.23	-0.44
07/03	82.0	95.6	68.4	73	274	0.2	0.00	0.20	0.20	0.00	-0.20	-0.64
07/04	82.6	95.6	69.7	74	248	1.8	0.00	0.19	0.19	0.00	-0.19	-0.83
07/05	78.7	91.0	66.3	61	297	1.7	0.00	0.21	0.21	0.00	-0.21	-1.04
07/06	77.2	88.1	66.3	66	227	0.9	0.00	0.16	0.16	0.00	-0.16	-1.20
07/07	78.8	93.3	64.2	69	291	0.3	0.00	0.20	0.20	0.00	-0.20	-1.40
07/08	81.6	94.8	68.4	70	284	2.9	0.51	0.22	0.22	0.00	0.29	-1.11
07/09	78.9	88.1	69.7	86	193	2.9	0.77	0.15	0.15	0.00	0.62	-0.49
07/10	74.3	81.6	67.0	75	215	2.2	0.00	0.15	0.15	0.00	-0.15	-0.65
07/11	71.2	78.8	63.5	58	256	3.1	0.00	0.18	0.18	0.00	-0.18	-0.83
07/12	68.4	82.3	54.5	65	287	1.0	0.00	0.17	0.17	0.00	-0.17	-1.00
07/13	68.5	85.2	51.7	68	325	0.8	0.00	0.19	0.19	0.00	-0.19	-1.19
07/14	69.6	88.1	51.0	68	325	0.0	0.00	0.19	0.19	0.00	-0.19	-1.38
07/15	73.8	91.0	56.6	73	302	0.0	0.00	0.19	0.19	0.00	-0.19	-1.58

Graph

The **Graph** screen is a pictorial display of pertinent information using the values from the **Report** screen.



APPENDIX 1: GENERIC DATA FILES

There are some conventions that must be followed when creating a generic weather data file to be imported into SpecWare. There must be one row that has keywords that identify the type of data in each field of the subsequent rows of data. The list of SpecWare 3-letter keywords, along with the units for each parameter, are shown in table 1. Note that some parameters can be in English or metric units. It is important that the unit system selected in the **Preferences** screen (see p. 7) correspond to the units in the generic data file. The RAW option can be used for any sensor that does not correspond to any of the default categories recognized by SpecWare. For any parameter that is present multiple times in the data file (because multiple sensors of the same type were deployed), an additional letter (A - P) should be added to the end of the 3-letter keyword to distinguish one field from another. The date and time must occupy the first field or the first two fields. The keyword(s) associated with date/time fields are not critical, but SpecWare assumes the date precedes the time. Again, the date and time should follow the format selected in **Preferences**. The rows of data must also be tab-delimited and in the same sequence as the keywords. It is not necessary that the row of keywords be the first row in the text file. A sample data file is shown in Figure A1.

Note: Growing Degree Days will only be computed with temperature data in the column with keyword TMP.

Date	Time	TMP	TMPA	HMD	SMSA	SMSB
5/1/2006	13:42	78	93	45	30	63
5/1/2006	13:57	77	91	46	30	63
5/1/2006	14:12	77	91	46	30	63
5/1/2006	14:27	79	89	44	30	64
5/1/2006	14:42	80	90	44	31	64

Figure A1. Example of a generic data file that can be imported into SpecWare.

Spectrum key word	Parameter	Units
BAR	Barometric Pressure	In-Hg or mm-Hg
CO2	Concentration of CO ₂	ppm
HMD	Relative Humidity	%
MAM	Amperage	mA
PAR	PAR Light	μMole/m ² s
RAW	Raw Sensor	none
RNF	Rainfall	Inches or mm
SMS	Soil Moisture Tension	kPa
SRD	Solar Radiation	wat/m ₂
STA	State Sensor	On/Off (1 or 0)
TMP	Temperature	*F or *C
VLT	Voltage	V
VWC	Volumetric Water Content	%VWC
WET	Leaf Wetness	LW
WND	Wind Direction	Degrees
WNG	Wind Gust	mph or km/h
WNS	Wind Speed	mph or km/h

Table A1. SpecWare keywords for use with generic data files

Commonly Asked Question



- Q.** *When selecting Launch or Readout, the software gives the message “Can’t connect to data logger” or “WatchDog Logger Timeout”. What’s wrong?*
- A.** Try changing the battery. Otherwise, this is probably a serial port problem:
1. Make sure that the interface cable is pressed all the way into the jack on the logger.
 2. The interface cable must be connected to a working serial port. If the serial port was recently used for a network mouse, the port may still be configured as such. When removing a mouse, reboot your system.
 3. If the logger still fails to connect, the battery could be low. Replace the battery and try to connect again.
 4. Set and/or test the communications port settings through the **Preferences** screen in the **File Menu**.
 5. Check if software for any external devices (such as a palm pilot) has been installed on your hard drive.

Help is available under
Help Topics or the Knowledge Base at
www.specmeters.com

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