# SPECWARE™ 7.1
## PROFESSIONAL

## SOFTWARE USER'S GUIDE

# *Spectrum*
## *Technologies, Inc.*

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# 1.1 Software License Agreement

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**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
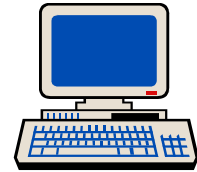
SpecWare requires a 486 (or better) processor with at least 8 megabytes of RAM running Windows 95 or better.  Windows 2000 or later is required for operations that require auto-scheduling (Autodownload, Frost alerts, and web datafile creation).  You will also need a mouse and a free serial port to connect the logger to the computer.  SpecWare 7 Pro 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 7 Pro 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 a prior version of SpecWare already installed on a given computer, it is recommended that SpecWare 7 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 7 before they can be viewed and manipulated.  SpecWare cannot convert SpecWare 7 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 <u>disconnected</u> 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 a paperclip 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.

paper clip
or wire ⟹
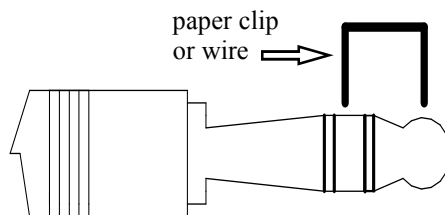
NOTE: The Original dataloggers do not short-circuit the serial pin. Therefore, when the **Test Port** button is clicked while the logger is connected, a "Bad Data Returned" message will be displayed.

**Testing a Connection to a 2000-Series Logger**

In addition to testing the PC interface cable, the connection to a 2000-Series logger can easily be checked by plugging the cable into the logger'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**.

## *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.

### 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 logger. You must select the communications port connected to your serial cable (See **Testing the Com Port**, p. 6).

### 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.

### Download Options

Allows you to specify how the software handles the data download from the WatchDog loggers or shuttle (See **Downloading Original WatchDog Data Loggers**, p. 22). The options are **Normal**, **Auto Download for Shuttles** only or **Auto Download for all**

loggers. The **Auto Download** options retrieve the data from the loggers or shuttle and automatically save that data to the appropriate, already-created **Logger Location(s)** (See pp. 27 and 29). By checking the **Auto Relaunch after Auto Download** box, the software will automatically relaunch your logger after the automatic download. The previously used name and recording interval are retained during an automatic launch. All **Auto** options proceed without user intervention.

NOTE: It is recommended that you choose **Normal** and confirm each step of the download, save, and relaunch process until you are familiar with how the software manages the data and the data logger. *This option does not apply to 2000-series loggers*.

**Com Port Open**

The power-saving features on some PCs (especially laptop computers) will power down the serial port until it is needed. The delay in the power-up can hinder SpecWare's ability to communicate through the Com Port. The **Always** option tells SpecWare to open the serial port and keep it open until the software is closed. This option, however renders the Com Port unavailable for Alert and AutoDownload functions until SpecWare is shut down. This situation is remedied by selecting the **Fast** or **Pause** options. For PCs that do not have energy-saving features, the **Fast** option tells SpecWare to immediately begin communication through the Com Port as soon as it is opened. The default option, **Pause** with a delay of 1 second, provides a compromise solution with minimal delay while still functioning properly on almost all PCs. The number of seconds to pause can be changed if necessary.

*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.
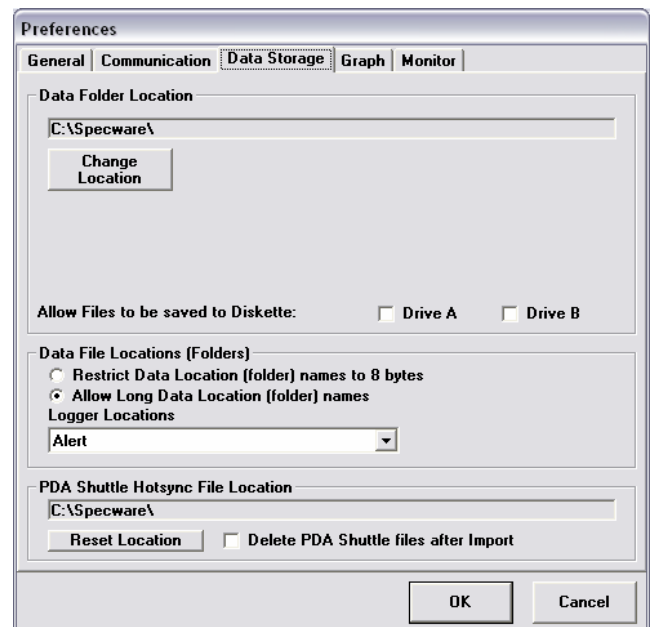
**Palm Shuttle Hotsync File Location**

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*

### 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.

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* and *Print* **Menus**, p. 32)

### 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.
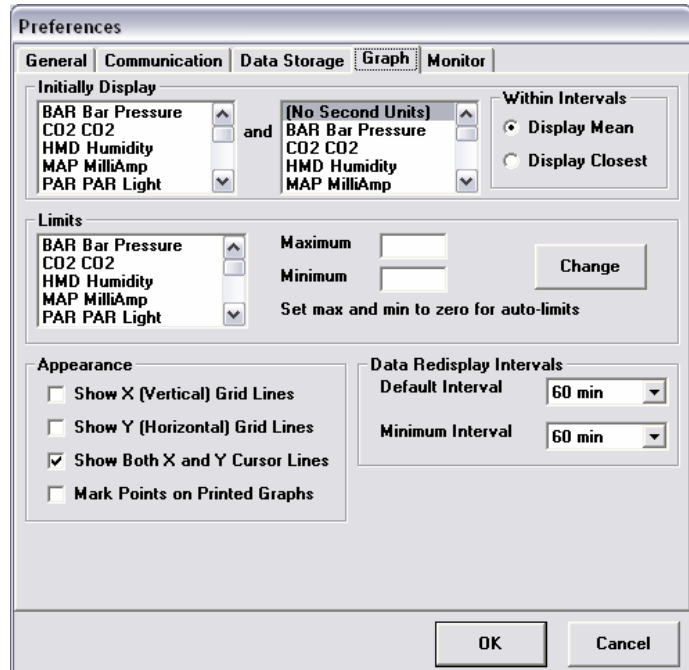
## Appearance

### 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* and *Print* Menus, p. 32).

### Mark Points on Printed Graphs
If this box is checked, SpecWare will put individual data points onto the graphed line.

### *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 **Scheduled Features** manual for more details)

### Monitor Log and Web output

SpecWare 7 can regularly update the current weather conditions on a user's web server.   (See **Scheduled Features** manual for more details)

# 2.2 TOOLBAR

After starting SpecWare, the menu bar will initially offer **File**, **Logger** and **Help** menu options. The quick-buttons, from left to right, are **Exit SpecWare, Open File, Save Logger Data, WatchDog Manager, Launch WatchDog Logger, Readout WatchDog,** and **Weather Station Monitor,** and specify **Large/Small Toolbar Buttons**.



After a file is opened or a logger is downloaded, the **Edit**, **Print**, **View** 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. 39-40).

# 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 datalogger.

**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 7. (See **Converting Archived Data into SpecWare 7 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 Weather-Link 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.
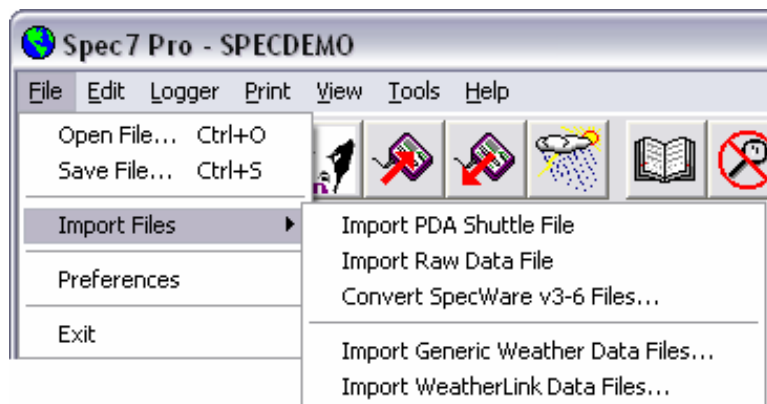
# 3.1 WatchDog Manager



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 7 Pro software divides the WatchDog family of data loggers into 3 categories; 1.) 2000-Series data loggers, 2.) Original WatchDog loggers (100/200/400 series mini data loggers and 525 - 900ET weather stations), and 3.) Button loggers. 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 3 types of logger but it <u>must</u> be used for all communications with the 2000-Series data loggers. It must also be used when communicating 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 re-launch 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 don't appear in the **WatchDog Manager** screen. The **WatchDog Manager** screen is <u>only</u> 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 3 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 3 logger categories (2000-Series, Original, and Button). 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 **Scheduled 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 2000-Series data loggers that are in contact with the PC via a direct-, radio- or telephone connection. This option is grayed out for WatchDog button 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 2000-Series data loggers 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 and Button-style WatchDog data loggers, this option will appear as **Readout and Relaunch**. For the 2000-Series data loggers, 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 and Button-style loggers are re-launched 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) has been brought up and the **OK** button has been pressed. The options for this screen are described below.
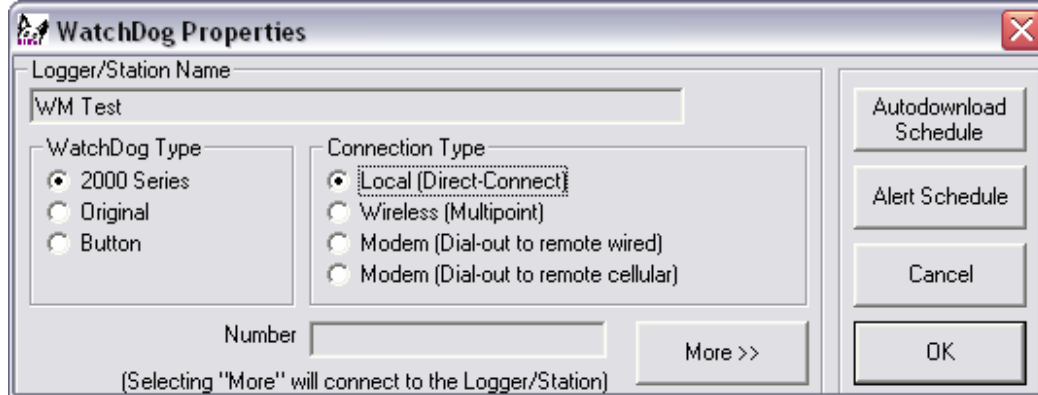


**Logger/Station Name**

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 station, 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 to erase all data on the logger (see **Clearing Data from a 2000-Series Data Logger**, p. 18). The **Logger Location** asso-

ciated with 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.

**WatchDog Type** and **Connection Type**

Select the appropriate options on this screen.  For Original and Button loggers, changes in logger configuration can only be performed with loggers that are directly connected.  2000-Series loggers 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. 15) 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.

**AutoDownload Schedule** button

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

**Alert Schedule** button

Brings up the **Weather Station Alert Configuration** screen (see the **Scheduled 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.  An Original or Button logger cannot be configured or launched with a radio or telephone connection.

# 3.2 Clearing Data from a 2000-Series Data Logger

Data is not routinely erased from the memory of a 2000-Series data logger. The only way to clear the data from memory is by changing the Station Name in the **Watch-Dog Properties** screen (See **WatchDog Manager**, p. 14). This is done by connecting the logger to the PC and creating a new station with a different name. Click on the "More" button. This will bring up a warning message (fig. 2).
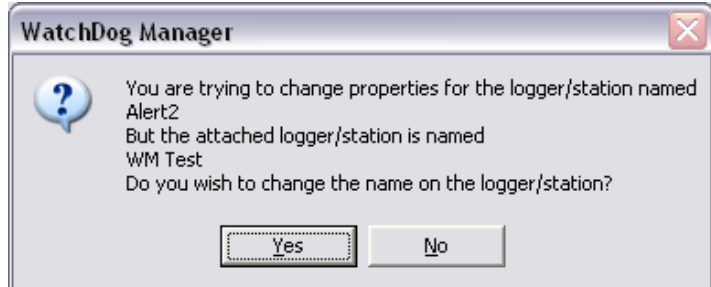


Figure 2

After clicking the **Yes** button, a warning message (fig. 3) will appear informing you that, if the data is not erased, future downloaded data will be saved to a different **Logger Location**. After clicking the **OK** button, a final warning message (fig. 4) appears that asks you whether you want to delete all data from memory or not. Clicking the **Yes** button will prepare SpecWare to send the "Clear Data" instruction to the data logger. After clicking the **Yes** button, SpecWare will return to the **WatchDog Properties** screen (see p. 15). Hitting the **Cancel** button on that screen will disallow the erasure process. Hitting the **OK** button will cause the logger to erase itself. The process will take several minutes and, at this point, cannot be reversed. It is not necessary for the logger to be connected to the computer once the erasure process has begun.



Figure 3



Figure 4

# 3.3 LAUNCHING/CONFIGURING STATIONS WITH THE WATCHDOG MANAGER



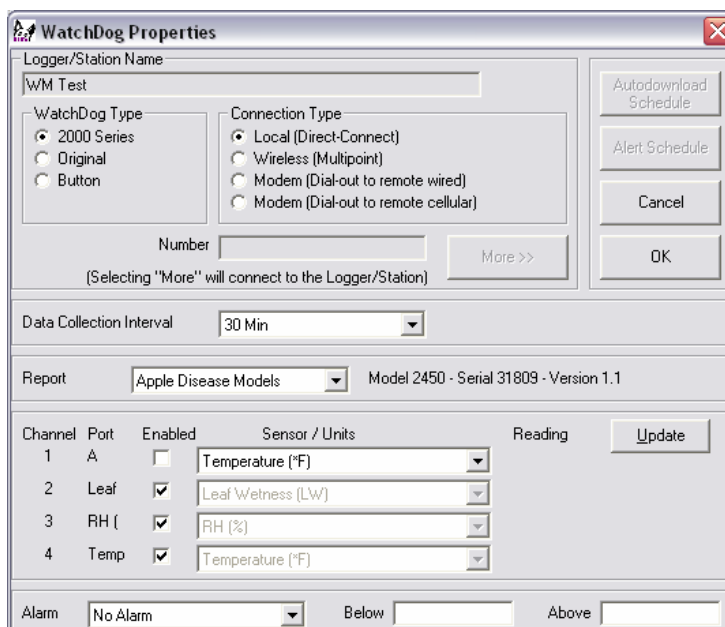Sample WatchDog Properties screen (fully expanded) for a 2000-Series logger

WatchDog 2000-Series data loggers can only be re-configured through the **WatchDog Properties** screen of the **WatchDog Manager**.  These loggers 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 Loggers**, 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 (see p. 21).

Note: *The appearance of this screen will depend on the type of logger connected.*

Configuring/Launching a Station

Original and Button stations can only be reconfigured when the station is connected to the PC with the gray PC interface cable, direct-connect cable or short-range modem pair.  The **WatchDog Manager** uses the old launch process to change the logger's properties. 2000-Series loggers 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.  Click the "More" button at the bottom of the screen.  This will expand the screen to 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 Original 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 mini- and 2000-Series data loggers 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 loggers, the battery status will also be displayed. The battery should be replaced when battery power drops to 25%.

*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. 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 data loggers.

*Delayed Start*

This option is only available for mini data loggers and Button 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**. For loggers with an LCD display, the letter "d" will appear followed by the number of minutes until launch. Loggers with an LED will flash dimly every four seconds until the delay has expired and the logger begins logging.

*Alarm*

This option is only available for Weather Stations and 2000-Series data loggers. 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 loggers allow upper and lower alarm thresholds. See the **Alarm Output Module User's Guide** for more details.

# 3.4 Logger Menu

**WatchDog Manager**
This option brings up the **WatchDog Manager** screen (see **WatchDog Manager** p. 14). This screen <u>must</u> be used for communicating with 2000-Series data loggers. It can also be used to readout and relaunch Original and Button loggers.

**Launch 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 Data Loggers**, p. 23).

**Get 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 Data Loggers**, p. 22).

**Weather Station Real-Time Monitor**
This launches the **Weather Monitor** screen (See p. 25). This is equivalent to the **Weather Station Monitor** toolbar button. This option will not activate the real-time monitor for a 2000-Series data logger.

# 3.5 Downloading Original WatchDog Data Loggers

WatchDog mini data loggers and weather stations can be downloaded with the **Watch-Dog Manager** (see p. 14) or with the Quick Button on the SpecWare toolbar (see p. 12). The Quick Button download procedure is described below. 2000-Series loggers can only be contacted via the WatchDog Manager.

Before downloading data, you must establish a connection between the data logger and your computer. For mini data loggers and data shuttles, this is done with the gray serial cable. For the WatchDog button loggers, use the docking station. For weather stations, a connection can be made with the gray cable, a 100- or 200-ft direct connect cable, a short-range modem pair, a remote wireless connection or with a landline or cellular telephone connection.

Click the **Get WatchDog Data** quick-button or **Get WatchDog Data** from 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 serial 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 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

WatchDog mini data loggers and weather stations can be launched with the Quick Button on the Specware toolbar (see p. 12). The Quick Button launch procedure is described below. 2000-Series loggers can only be contacted via the WatchDog Manager (see **WatchDog Manager** p. 14).



Sample Launch Options screen

**Initiating Contact**

With the logger connected to the interface cable, initiate the launch process by using the **Logger** menu or by clicking the **Launch WatchDog Logger** 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.

**Port Enabled**
On the WatchDog Data Loggers you can enable or disable the ports by checking or unchecking the appropriate boxes. For WatchDog weather stations, only the external channels can be disabled. 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 mini data loggers must be assigned to Port A.

NOTE: There are four different soil moisture sensors that can be connected to WatchDog dataloggers. 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 it's 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. For loggers with an LCD display, the letter "d" will appear followed by the number of minutes until launch. Loggers with an

LED will flash dimly every four seconds until the delay has expired and the logger begins logging.  The time uses a 12-hour format; you must enter "am" or "pm".

NOTE:  WatchDog Weather Stations are not capable of using the **Delayed Start** feature.

# 3.7 Real-Time Weather Monitor

**WatchDog Original Weather Stations**

The first launch of a station will enable the **Weather Station Real-Time Monitor** option in the **Logger** menu and the Weather Station quick-button on the SpecWare 7 Pro **Toolbar** screen (see p. 12).  Clicking either the menu option or the quick-button will display the one of the first two monitor screens shown on p. 26.  (Note: once the **Weather Station Real-Time Monitor** is initialized, SpecWare 7 Pro 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 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
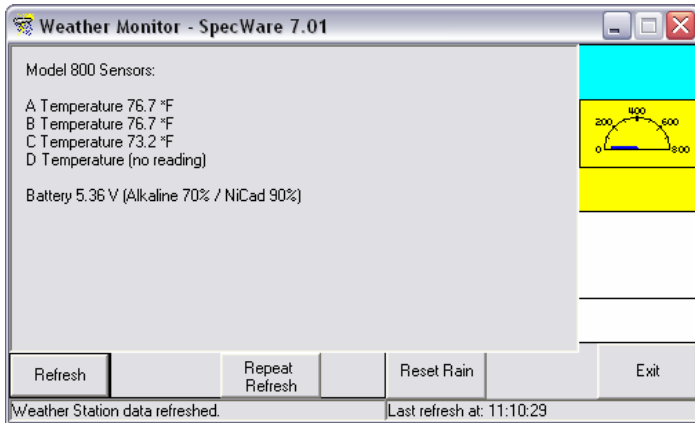
**2000-Series Data Loggers**

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

**Note:**  If SpecWare cannot make a connection when trying to bring up the Real Time Monitor, the user may need to end the task (SpecWSM7) in the Task Manager.  You can bring up the Task Manager by simultaneously clicking the Cntrl-Alt- Delete buttons on the keyboard.
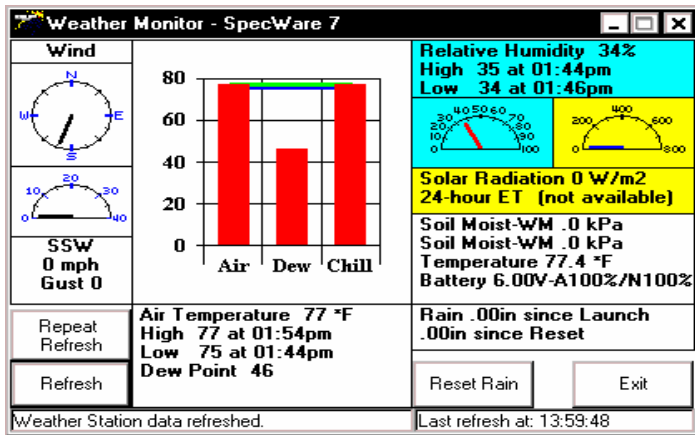
Monitor Screen for all Original stations ) except the model 800).



Monitor Screen for a Model 800 station. Current values for each of the 8 sensors, the battery strength, and the time are displayed.
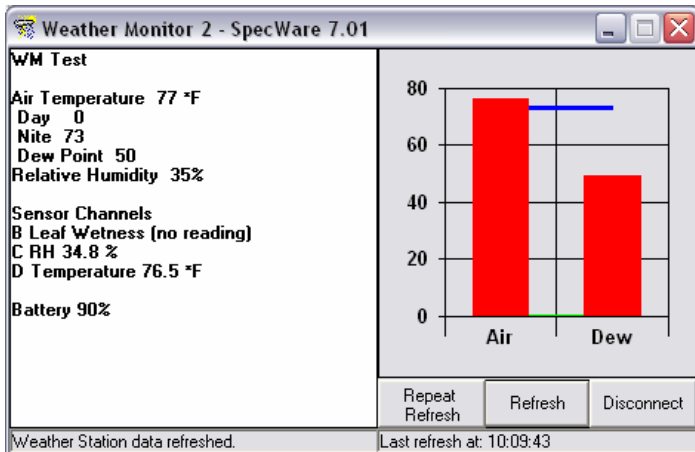


Monitor Screen for a 2000-series logger.

# 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, SD200602.swd is the data for February 2006. 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
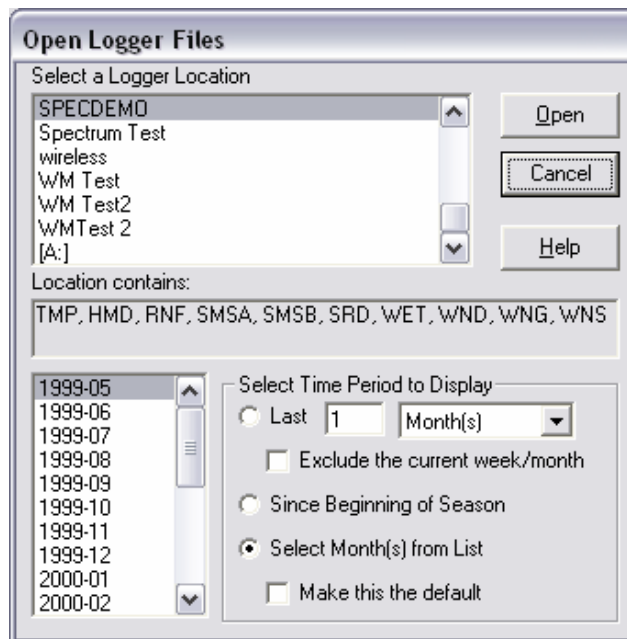


**Open File**

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 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.  (See *View* and *Print* **Menus**, p. 32).

| Y1 | Y2 | Select Data to Graph |
|----|----|----|
| ☐ | ☐ | BAR Bar Pressure |
| ☐ | ☐ | CO2 Carbon Dioxide |
| ☐ | ☐ | HMD Humidity |
| ☐ | ☐ | MAP MilliAmp |
| ☐ | ☐ | PAR PAR Light |
| ☐ | ☐ | RNF Rainfall |
| ☐ | ☐ | SMS Soil Moisture |
| ☐ | ☐ | SRD Solar Radiation |
| ☐ | ☐ | STA State/Irrigation |
| ☐ | ☐ | TMP Temperature |
| ☐ | ☐ | VLT Voltage |
| ☐ | ☐ | VWC Vol Water Cont |
| ☐ | ☐ | WET Leaf Wetness |
| ☐ | ☐ | WNS Wind Speed |

Redraw    Cancel

# 4.3 Saving Data

Data downloaded from 2000-Series loggers 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 WatchDog 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.

Save Logger Data

Select a Logger Data Location

Old Data

Save

Cancel

Create Location

Logger model 525 header:
Model 525

Help

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. 15).  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.

**Using Your Data in Other Applications**
SpecWare creates an ASCII file for use in other applications as soon as a download 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**.

IMPORTANT: All new dataloggers 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**.

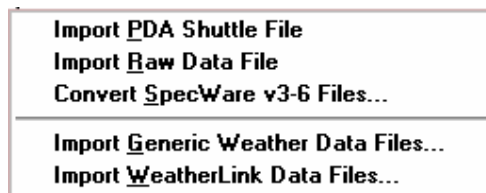# 4.4 Converting Archived Data into SpecWare 7 Format



Figure 5

The data files used in SpecWare 7 differ from those in earlier versions of the software. 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 file format used by SpecWare 7. 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.
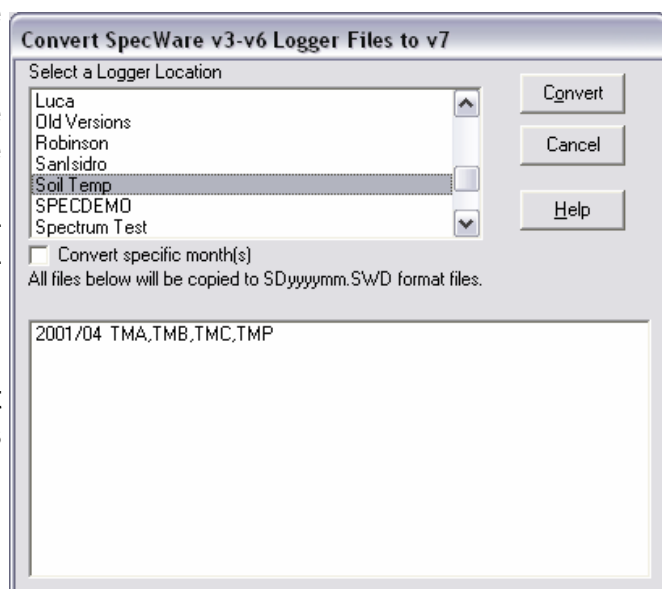


Figure 6

# 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 WDTest 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 Weather-Link 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 key words 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.
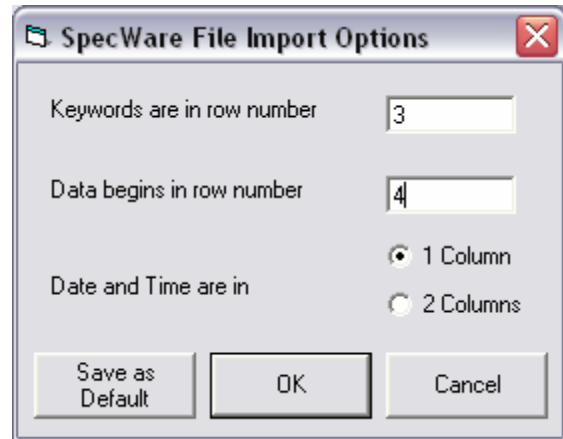
# 4.6 VIEW AND PRINT MENUS

**Viewing Your Data as a Graph**
Upon downloading data or opening an existing file, select the parameters you wish to view. SpecWare will display the **Change Graph Parameters** screen (see p. 29). Select which parameters will be graphed and 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 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.

**Viewing Your Data as Text**
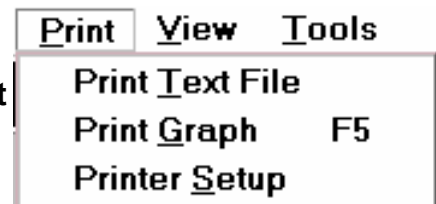Click on the **View Data as Text** quick-button or on the **View Data as Text** command in the **View** menu. A WordPad or Notepad window (depending on what is available on your computer) will overlay the graph and display the numerical data for that graph.
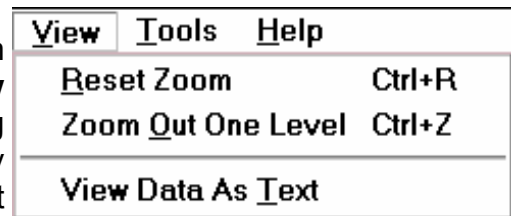
**Printing Your Graph**
Click on the **Print Graph** command under the **Print** menu to print the graph displayed on the screen.

32

**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
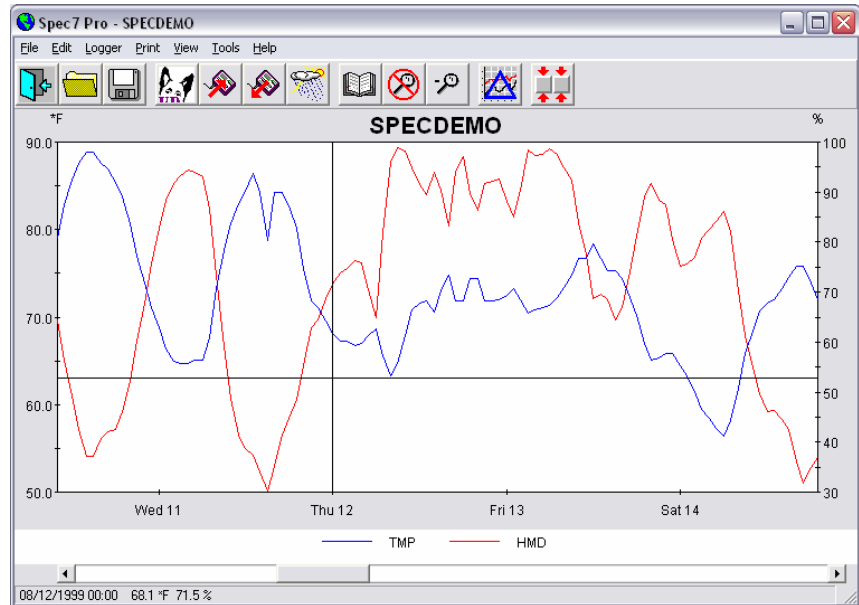


Sample SpecWare Graph Screen.

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 (below).
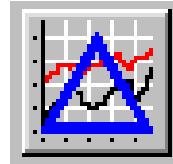


**Change Graph Parameters** quick-button

# 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**.
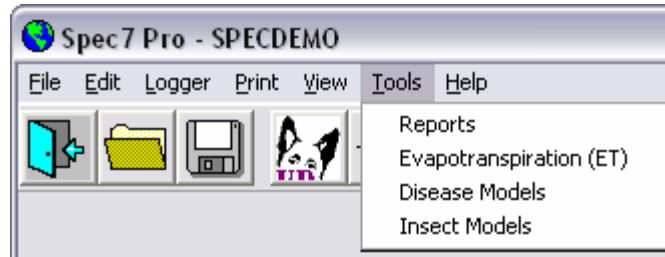


# 5.1.1 Select Report

This screen allows the user to select the report of interest. There are two Report Categories: Standard Reports (see pp. 39-43), and Custom Reports (see 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.
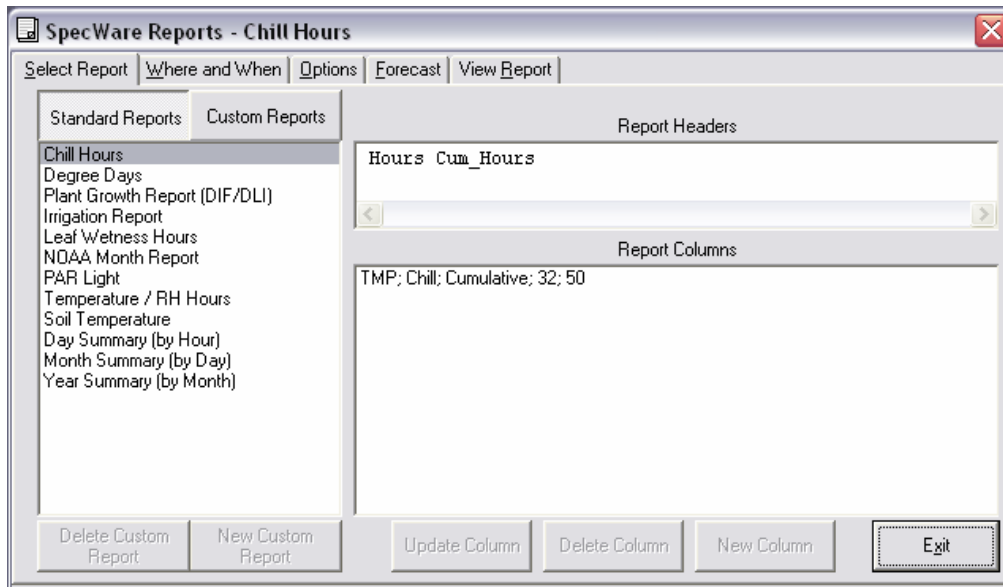
# 5.1.2 Where and When

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.



# 5.1.3 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.
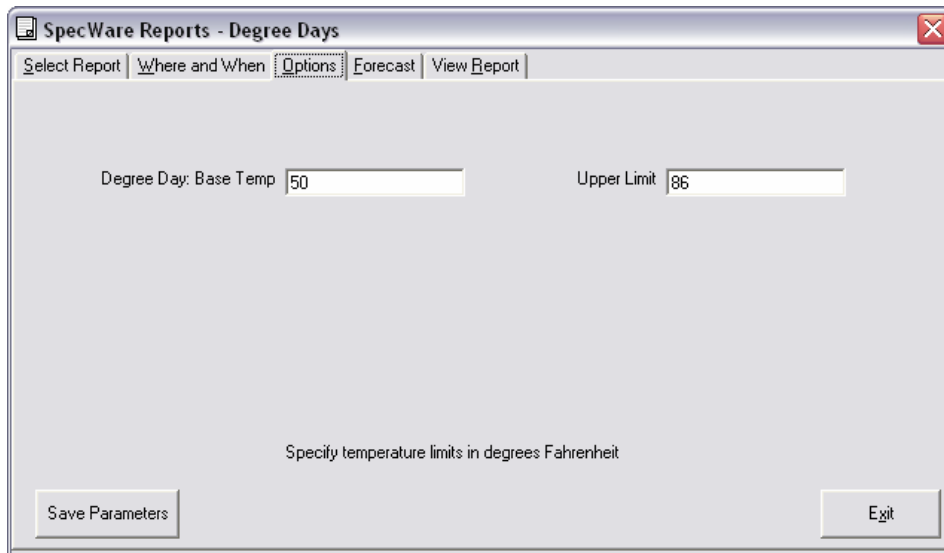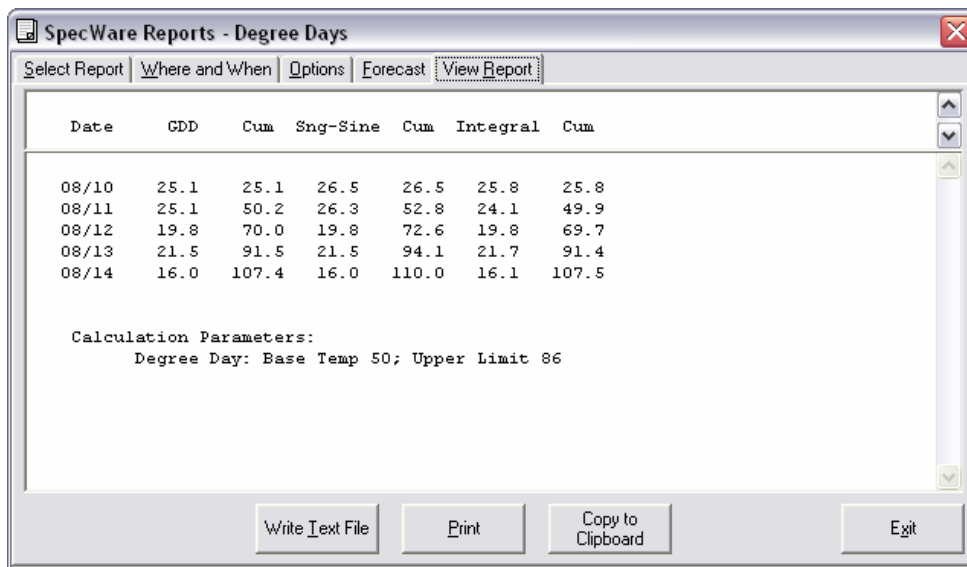


# 5.1.4 Forecast
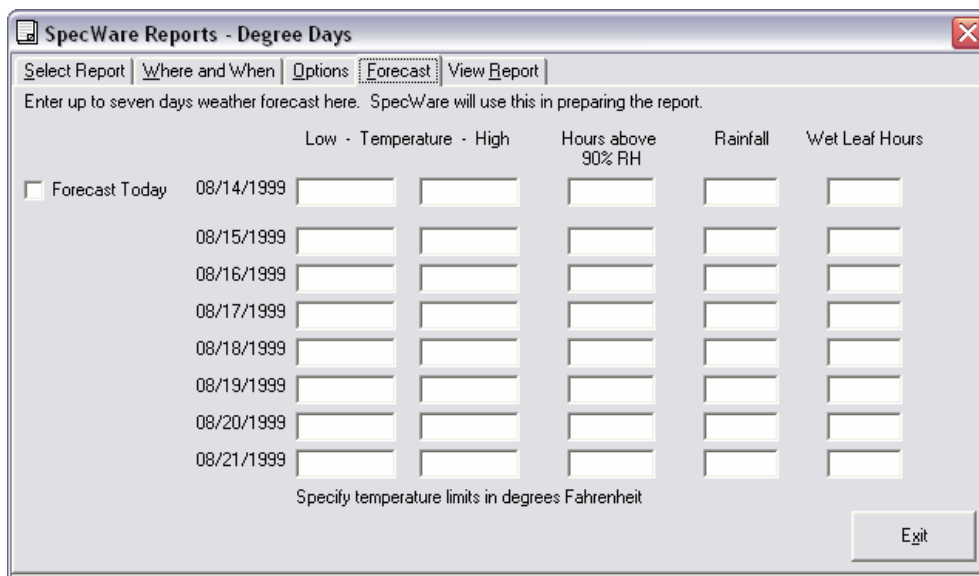


Forecast data is required for some disease and insect models.  It is possible to include forecast data for some other reports and predict environmental conditions up to one week in  the future.  It is also possible to enter forecast data for the present date if data for the entire day was not logged.   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.

# 5.1.5 VIEW REPORT

```
SpecWare Reports - Degree Days                                      ✕

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

    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


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




         Write Text File      Print      Copy to        Exit
                                         Clipboard
```

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 spread sheet 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 a spreadsheet as a space-delimited file.
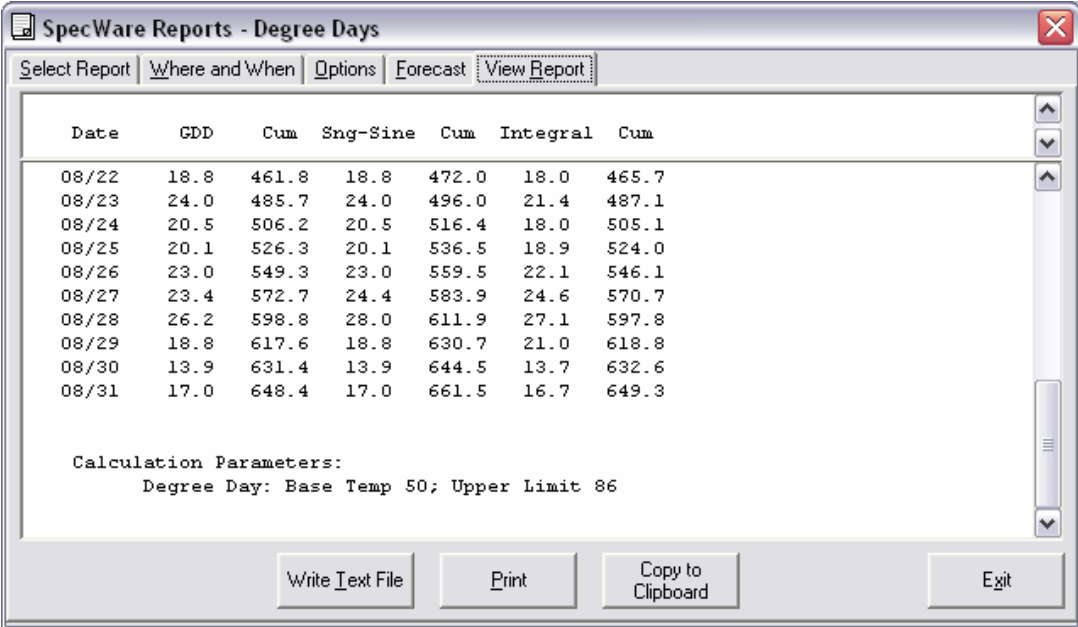
# 5.2 Standard Reports

# 5.2.1 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**, 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:

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

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 on the hourly values rather than on daily values. The ADD method is the most accurate.
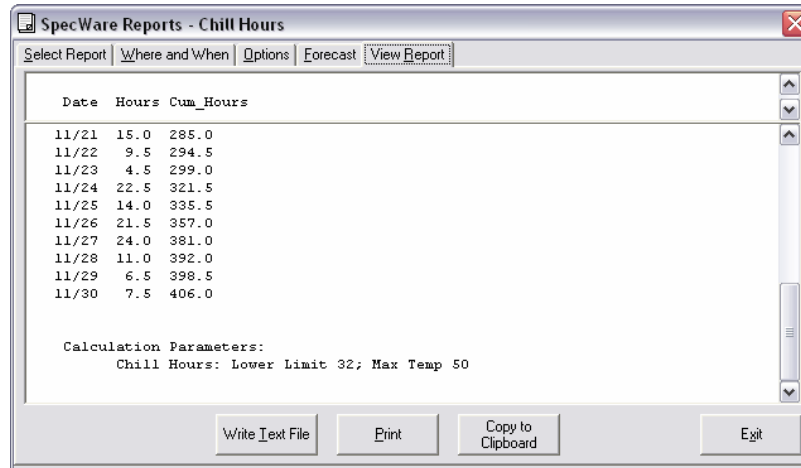


SpecWare Reports - Degree Days

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

| 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

Write Text File      Print      Copy to Clipboard      Exit

# 5.2.2 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.

```
SpecWare Reports - Chill Hours                                    ✕

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

    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


   Calculation Parameters:
          Chill Hours: Lower Limit 32; Max Temp 50


        Write Text File     Print      Copy to        Exit
                                      Clipboard
```
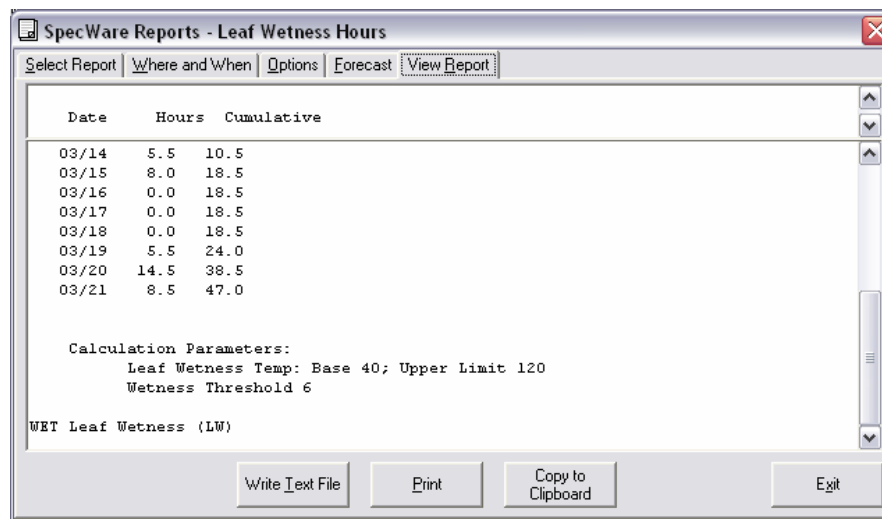
# 5.2.3 LEAF WETNESS HOURS

**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.

```
SpecWare Reports - Leaf Wetness Hours                             ✕

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

    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


   Calculation Parameters:
          Leaf Wetness Temp: Base 40; Upper Limit 120
          Wetness Threshold 6

WET Leaf Wetness (LW)

        Write Text File     Print      Copy to        Exit
                                      Clipboard
```

# 5.2.4 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.



PAR Light Report                                    DIF/DLI Light Report

# 5.2.5 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.

# 5.2.6 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.

```
SpecWare Reports - Soil Temperature                                    [X]
Select Report | Where and When | Options | Forecast | View Report |

         Temp  Temp  Temp DegDay  Temp  Temp  Temp DegDay  Temp  Temp  Temp DegDay  ^
   Date  High   Low  Mean  DD50   High   Low  Mean  DD50   High   Low  Mean  DD50    v

  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)                                                          v

         Write Text File      Print       Copy to              Exit
                                          Clipboard
```

# 5.2.7 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

```
SpecWare Reports - Month Summary (by Day)                     [X]
Select Report | Where and When | Options | Forecast | View Report |

              ___Temperature___       Degree Chill RH  RH  Wet  Rain-   ^
   Date  High  Time   Low  Time  Mean  Days  Hours Hi  Lo  Hours Fall   v

  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)                                             v

         Write Text File     Print       Copy to          Exit
                                         Clipboard
```

and temperature range for calculating the hours of leaf wetness can also be specified.

**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.

# 5.2.8 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.

SpecWare Reports - NOAA Month Report

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

| Date | Temperature Mean | High | Time | Low | Time | Degree Days | Solar Rad | RH Mean | Rain-Fall | Wind 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.
```

Write Text File | Print | Copy to Clipboard | Exit

## 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).

SpecWare Reports - Irrigation Report

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

| Date | S1Mst Mean | S1Mst Above | S1Mst Below | S1Mst Mean | S1Mst Above | S1Mst Below | Irgtn Hours | Irgtn Gal |
|---|---|---|---|---|---|---|---|---|
| 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 | | |
| 09/19 | | 0.0 | 0.0 | | 0.0 | 0.0 | | |
| 09/20 | | 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)
```

Write Text File | Print | Copy to Clipboard | Exit

# 5.2.9 Custom Reports

SpecWare 7 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 ex-



Figure 7

isting 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).
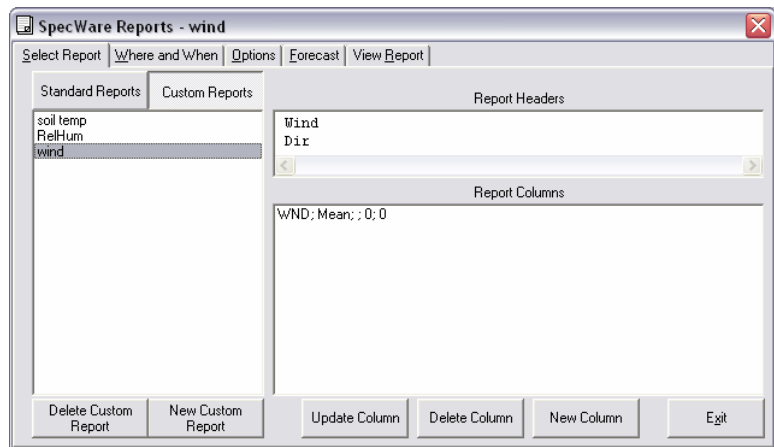


Figure 8

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:
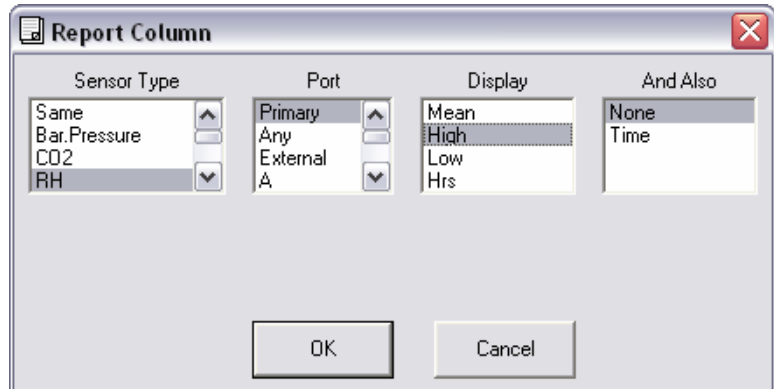


Figure 9

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.



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** (pg. 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.

<u>And Also</u>

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.

# 5.2.10 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 #** |
|---|---|
| Apple Scab (*Venturia inaequalis)* | 3656 AS |
| Black Rot (*Guignardia bidwellii)* | 3656 BR |
| Botrytis *(Botrytis cinerea)* | 3656 BT |
| Brown Patch (*Rhizoctonia solani)* | 3656 BP |
| Cherry Leaf Spot *(Blumeriella jaapii)* | 3656 LS |
| Dollar Spot *(Sclerotinia homoeocarpa)* | 3656 DS |
| Downey Mildew *(Plasmopara viticola)* | 3656 DM |
| Early Blight *(Alternaria solani)* | 3656 EB |
| Fire Blight *(Erwinia amylovora)* | 3656 FB |
| Late Blight *(Phytophthora infestans)* | 3656 LB |
| Powdery Mildew *(Uncinula necator)* | 3656 PD |
| Pythium Blight *(Pythium aphanidermatum and P. graminicola)* | 3656 PT |
| Sooty Blotch/ Flyspec (*Peltaster fruticola and Leptodotium elatius Zygiophiala jamiacacenis)* | 3656 SB |
| Tom-Cast *(Alternaria solani, Spetoria Lycopersici)* | 3656 TC |
| Insects | 3656 IN |

For detailed descriptions of each model, refer to the **SpecWare 7 Disease and Insect Guide**.

# 5.2.11 EVAPOTRANSPIRATION
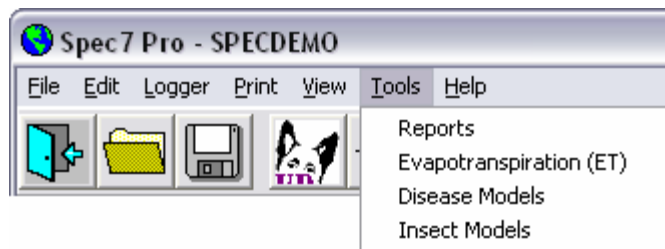


The first launch of a 900ET Weather Station will enable the **Evapotranspiration (ET)** report option in the **Tools** menu on the SpecWare Toolbar.

**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
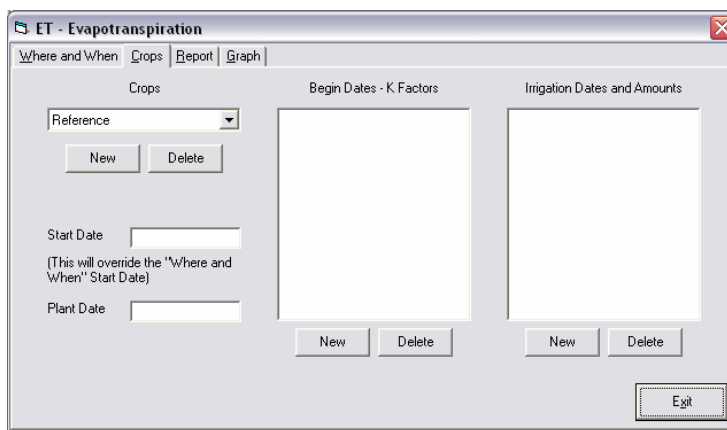


reports for multiple crops. To see what crops are already entered, click the arrow to expand the **Crops** field. After choosing a crop, the data that has been entered for that crop can be seen in the **Begin Dates - K Factors** field. To add a crop, left-click the **Add** button under the **Crops** 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.

**Graph**

The **Graph** screen is a pictorial display of pertinent information using the values from the **Report** screen.
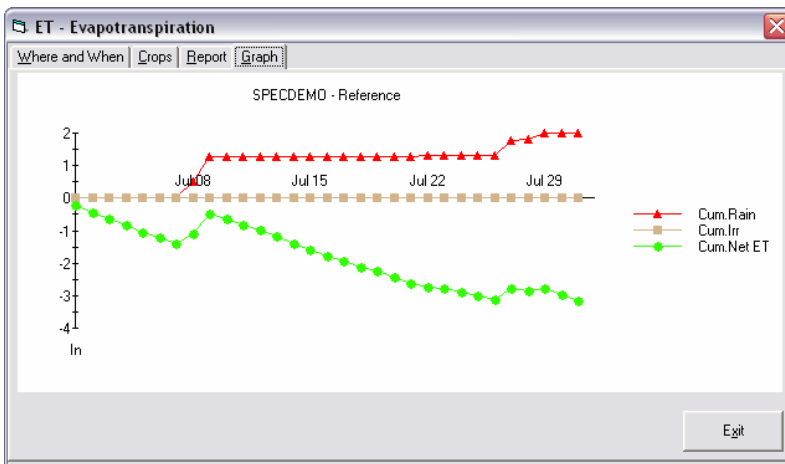
# Commonly Asked Question  ☆?☆

**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

# Spectrum
## Technologies, Inc.