INSTRUCTION MANUAL

HydroSense II (HS2) Support Software User Guide

11/11

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Section 1. Installation

1.1 System Requirements

HydroSense II Support Software is built on the .NET Framework 3.5, which has the minimum system requirements listed in *TABLE 1-1. NET Framework 3.5 Minimum Requirements* (p. 1-1).

TABLE 1-1. NET Framework 3.5 Minimum Requirements

Operating System	Windows XP SP2, Windows Vista, Windows 7, Windows Server 2003 Windows Server 2008
Processor	400 MHz Pentium processor or equivalent
RAM	96 MB
Hard Disk	Up to 500 MB of available space may be required
Display	800 x 600, 256 colors

The software also makes use of resource intensive drawing libraries to display charts and 2D plots. The recommended requirements to use these features are listed in *TABLE 1-2. HydroSense II Software Recommended Requirements* (p. 1-1).

TABLE 1-2. HydroSense II Software Recommended Requirements

Operating System	Windows XP SP3, Windows Vista SP2, Windows 7 SP1 Windows Server 2003 SP2, Windows Server 2008 SP2
Processor	1.6 GHz Pentium 4 processor or equivalent
RAM	512 MB
Hard Disk	500 MB for the .NET framework an additional 10 MB for the HydroSense II software
Display	800 x 600, 32 bit color

HydroSense II Support Software uses Bluetooth to communicate with the HydroSense II display. A Bluetooth stack is required on the local PC to handle traffic between software and Bluetooth hardware. Bluetooth hardware will be either a USB dongle or a built-in chip.

Supported Bluetooth Stacks

Microsoft (included with Windows XP SP2, Windows Vista, and Windows 7)

BlueSoleil (bundled in the form of BlueSoleil software with Bluetooth USB dongles)

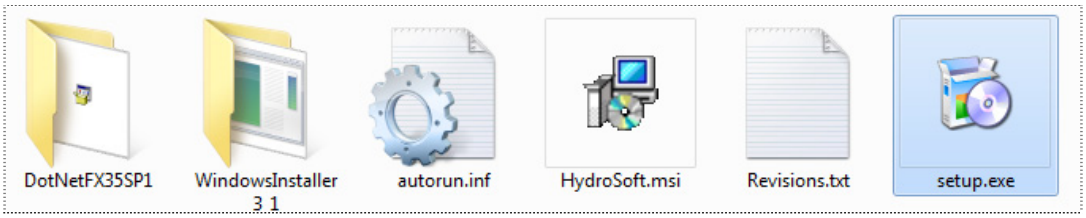
Toshiba (used by third parties, such as Dell and Sony, in laptops and USB dongles)

Broadcom / Widcomm (one of the older stacks, also licensed to third parties)

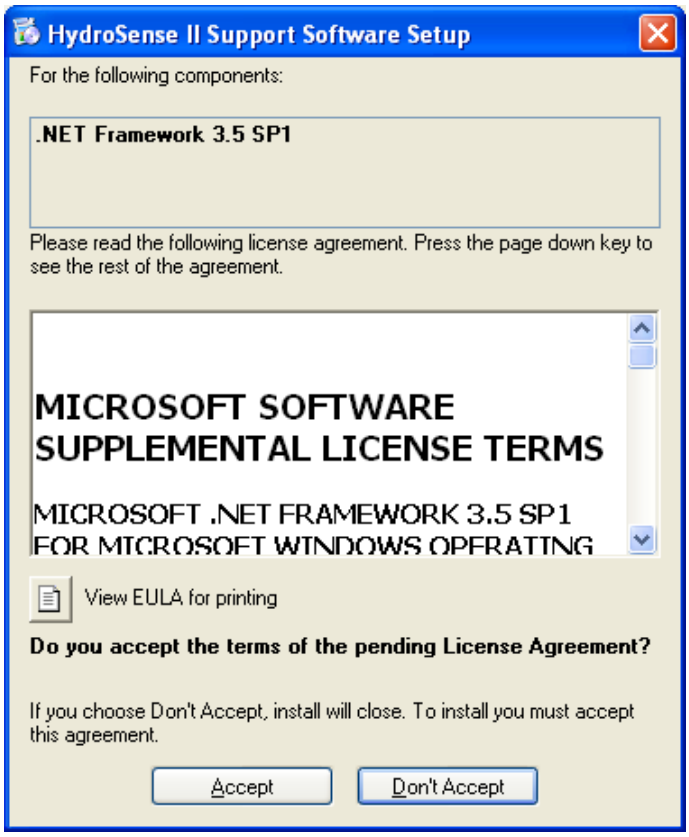
1.2 Installation CD

An installation CD is supplied with the HydroSense II unit. The CD contains the HydroSense II Support Software and the .NET Framework 3.5 for systems that do not have this already installed.

To install the software, insert the CD into the PC CD-ROM drive. The setup wizard should start automatically. If it does not, browse to the CD-ROM drive in Windows® Explorer® and run ***setup.exe***.



If the .NET Framework 3.5 SP1 is not already installed, the wizard will prompt to install it from the CD. Click Accept to continue.

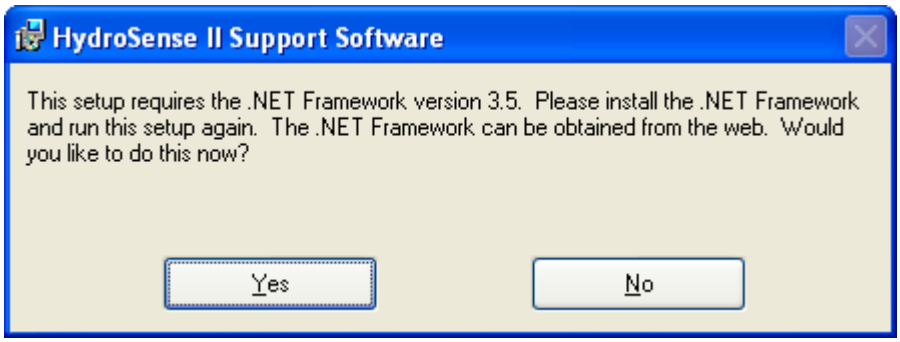


The installation of .NET Framework 3.5 will take a couple of minutes. Once the installation is complete, the install wizard will continue (*SECTION. Install Wizard* (p. 1-4)).

1.3 Web Setup File

Alternatively, HydroSense II Support Software can be downloaded from the Downloads menu at *www.campbellsci.com*. The download does not include the .NET Framework. To start the installation of the HydroSense II Support Software, double-click on HydroSoft.exe.

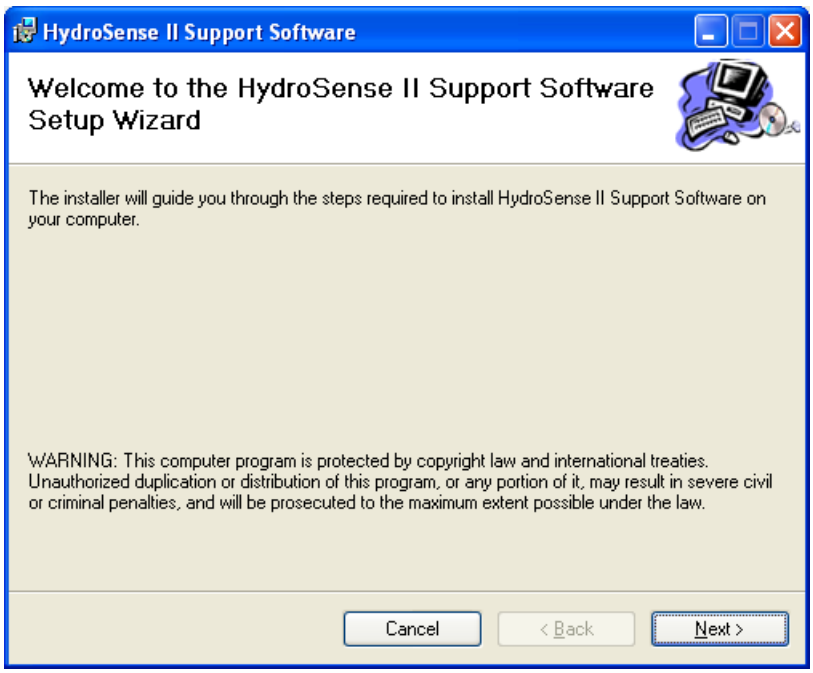
If the .NET Framework 3.5 is not installed, the wizard will prompt to download the framework from Microsoft's website.



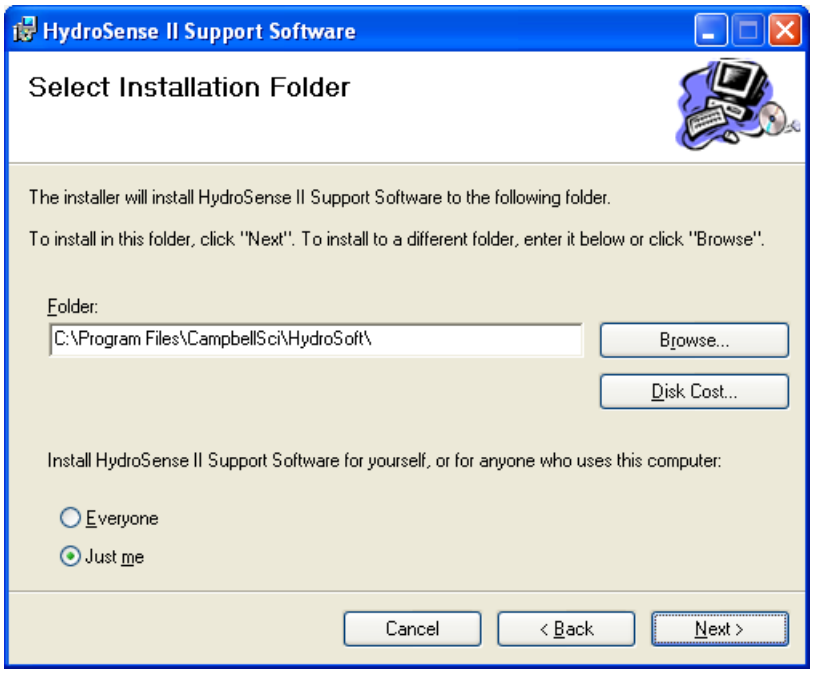
Click Yes to open a browser to download and install the .NET Framework, then run HydroSoft.exe again.

1.4 Install Wizard

The installation wizard begins with a welcome page:



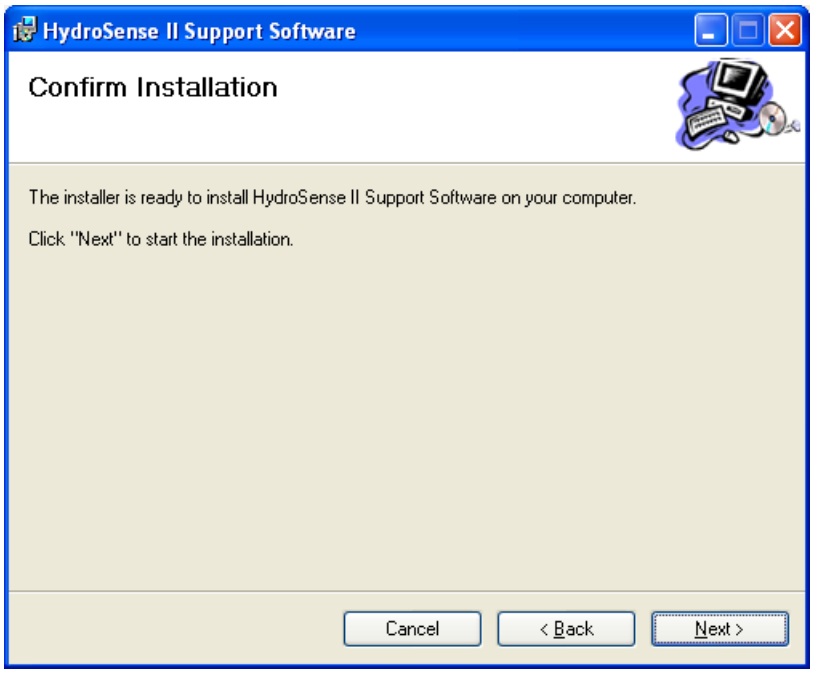
Click Next to continue. The next page shows the default installation directory for the software.



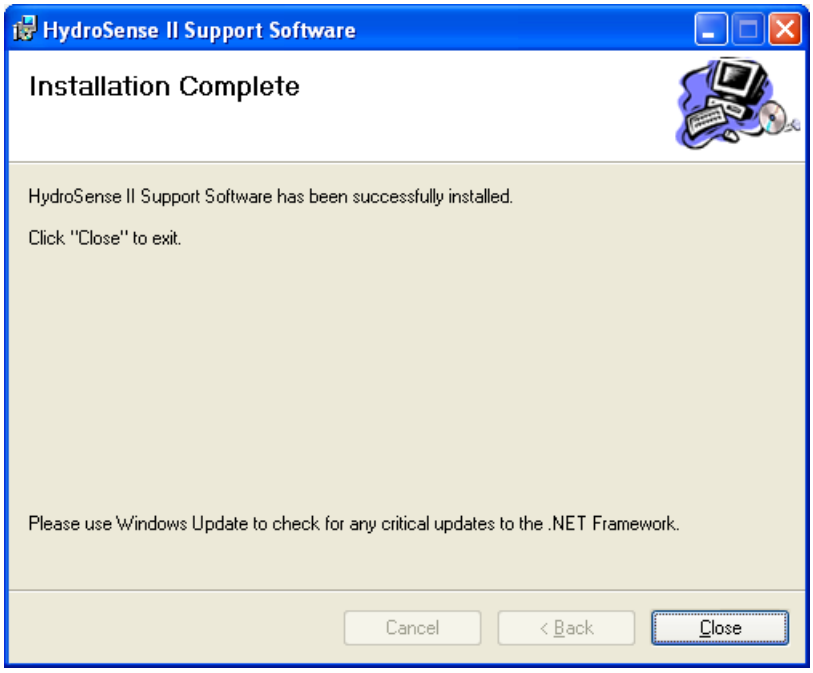
In most cases, the default directory should be used.

This page also asks whether to install the software for the current user or for all users on this PC. This decides whether the desktop shortcut and Start menu shortcut will be visible to just the current user or to all users. Click Next to continue.

Click Next on the next page to begin installing the software.



When installation is complete, close the wizard:



A shortcut to the software is placed on the desktop and in the Start menu under ***Programs > Campbell Scientific > HydroSense II***. This Start menu group contains two shortcuts.

HydroSense II Support Software

This shortcut will run the support software used to download and display data from the HydroSense II. See *SECTION 2. Quickstart* (p. 2-1) for more information.

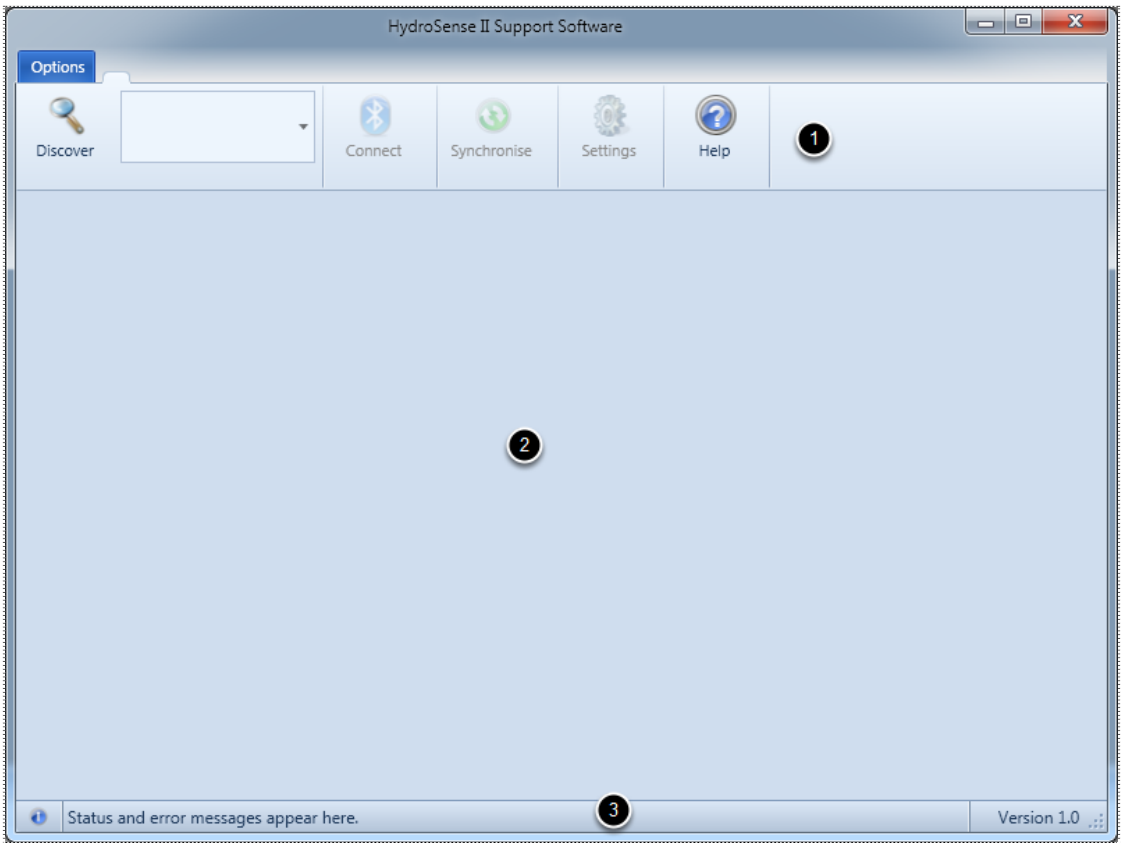
Operating System Updater

This shortcut will run the HydroSense II firmware update facility. This is used to send an updated operating system to the HydroSense II display unit. An OS update is required only if a new operating system has been released to add features or fix existing issues. See *SECTION 8. Operating System Updater* (p. 8-1) for more information.

Section 2. Quickstart

2.1 The Main Window

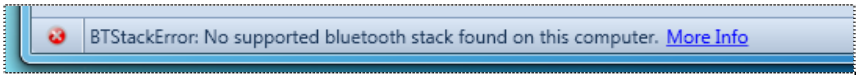
The main window has three areas.



1. Toolbar — used to connect to devices and download data.

2. Central area — contains the Data, Chart, and Map tabs. These tabs will become visible when data are downloaded from the HydroSense II. More information can be found in *SECTION 4. Viewing Data* (p. 4-1).

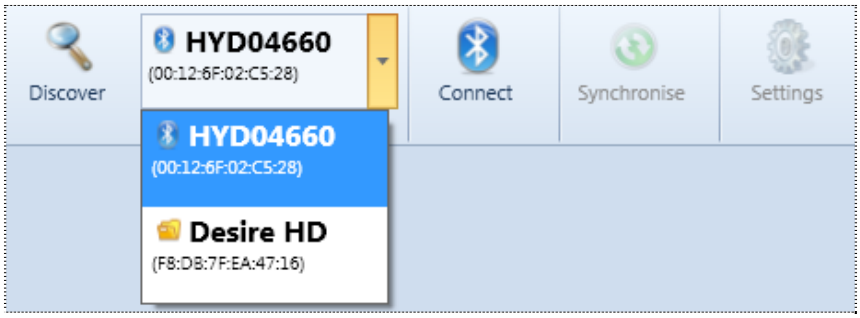
3. Status bar — displays errors that may occur while connecting to a device. On start up, the status bar in the lower portion of the window should not show any errors. It should show the information icon, . If the software does not detect any Bluetooth hardware on the local PC, an error will be shown. See *SECTION 7.3 (0x11) BTStackError* (p. 7-2) for more information.



2.2 Discover Devices

Press the Discover button in the toolbar to start searching for devices. Depending on your Bluetooth hardware, this search could take up to 30 seconds to complete and cannot be cancelled.

When discovery is complete, the first discovered device is displayed in the Device List to the right of the Discover button. To view all discovered devices, press the down arrow to the right of the device name.

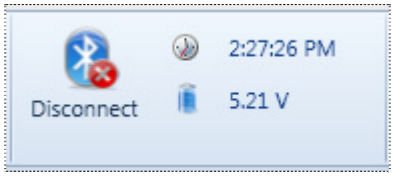


2.3 Connect to a Device

Select the device that corresponds to the HydroSense II. Device name will be "HYDxxxxx", where xxxxx is the serial number of the display. This will enable the Connect button. Press Connect to connect to the HydroSense II.

The first time the software connects to a specific HydroSense II, the user is required to enter a pairing code for the device. All HydroSense II displays have the pairing code **1234**.

When connection is successful, remote battery voltage and clock are displayed in the toolbar.

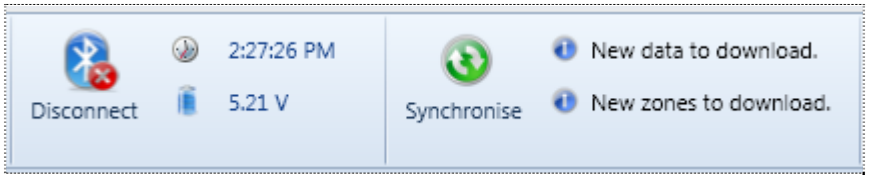


If the HydroSense II display clock needs updating, either wait for the first GPS time sync or see *SECTION 3.3 Setting Time* (p. 3-5) for instructions. The HydroSense II should have its battery replaced at 4.00 V; it will not power up when the battery voltage reaches 3.60 V.

More information on connecting to a device and possible connection errors can be found in *SECTION 3.2 Connecting to a Device* (p. 3-2).

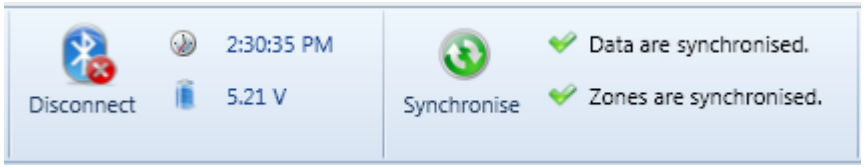
2.4 Download Data

If the HydroSense II has new measurement or zone data, notification will be posted in the status area to the right of the Synchronise button.



To download new data, press the Synchronise button.

After the download is complete, the status area indicates that the measurements and zones are now synchronized.



For more information on downloading data see *SECTION 3.4 Synchronizing with a Device* (p. 3-6).

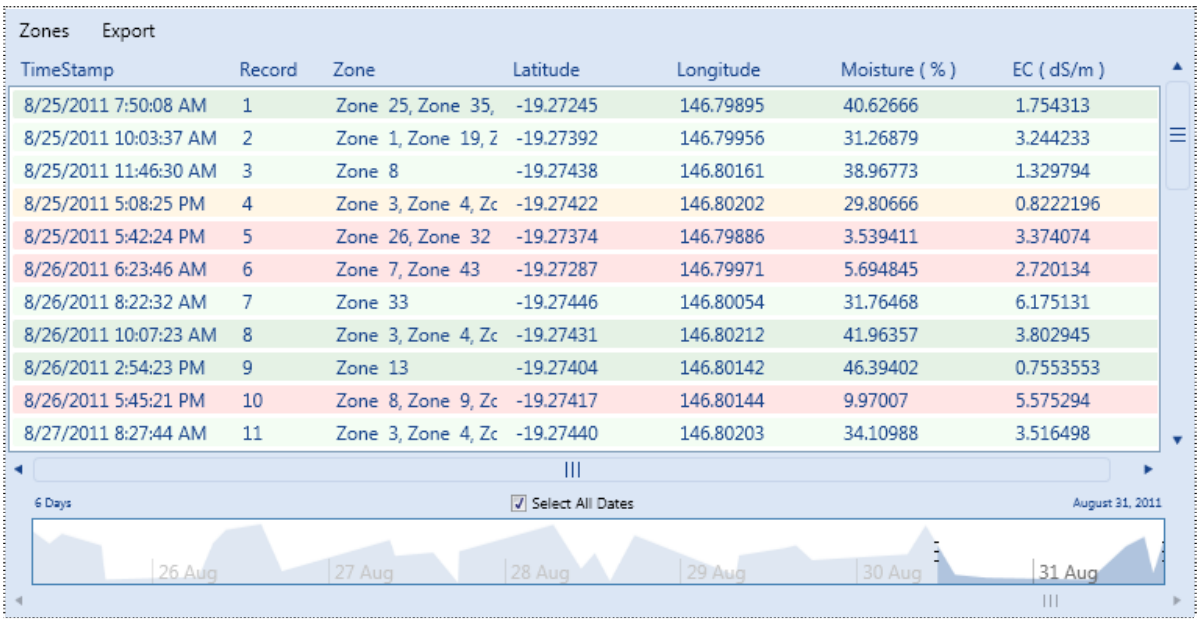
2.5 View Data

Downloading data from the HydroSense II will enable three tabs in the main window that enable viewing HydroSense II data.

2.5.1 Data Viewing Tab

The Data tab displays a list of all measurements sorted by time of measurement. Each row represents a single measurement and lists

- the zone a measurement is located within
- latitude and longitude of the measurement
- details of the parameters measured

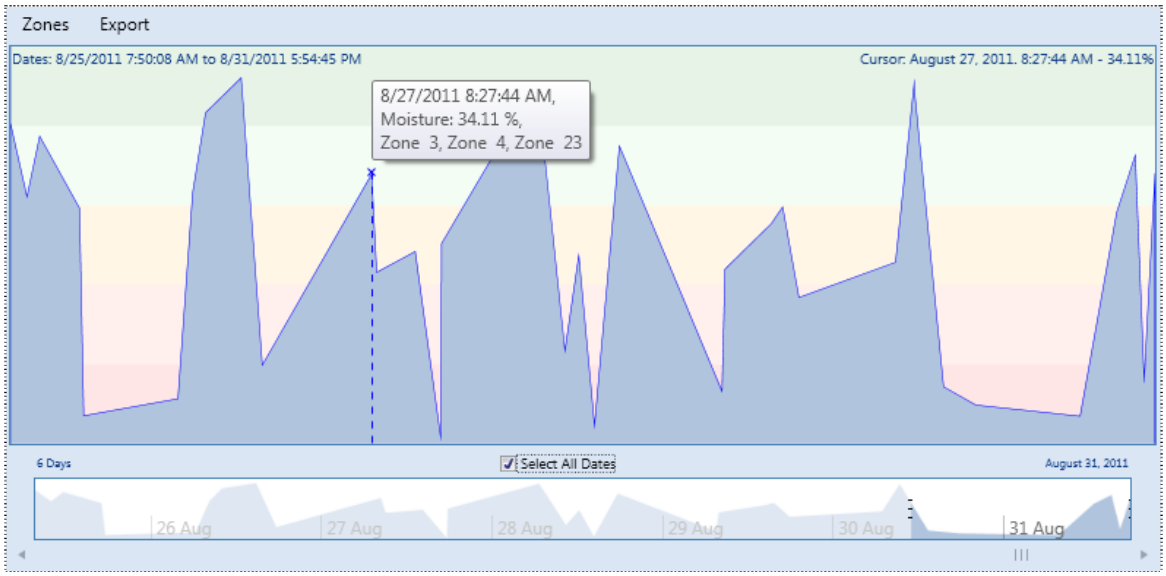


The timeline in the lower portion of the tab is used to filter the data by measurement time. The sliders on either side of the table are used to scroll through the measurements.

For more information on how to use the data tab viewing options, see *SECTION 4.3 Data Tab* (p. 4-5).

2.5.2 Chart Viewing Tab

The Chart tab plots measurements for a given zone (or group of zones) over time. As the pointer is moved over the chart, time and soil moisture at the pointer position are shown in the upper-right. If the pointer is moved close to a measurement, an infotip will display the measurement details.

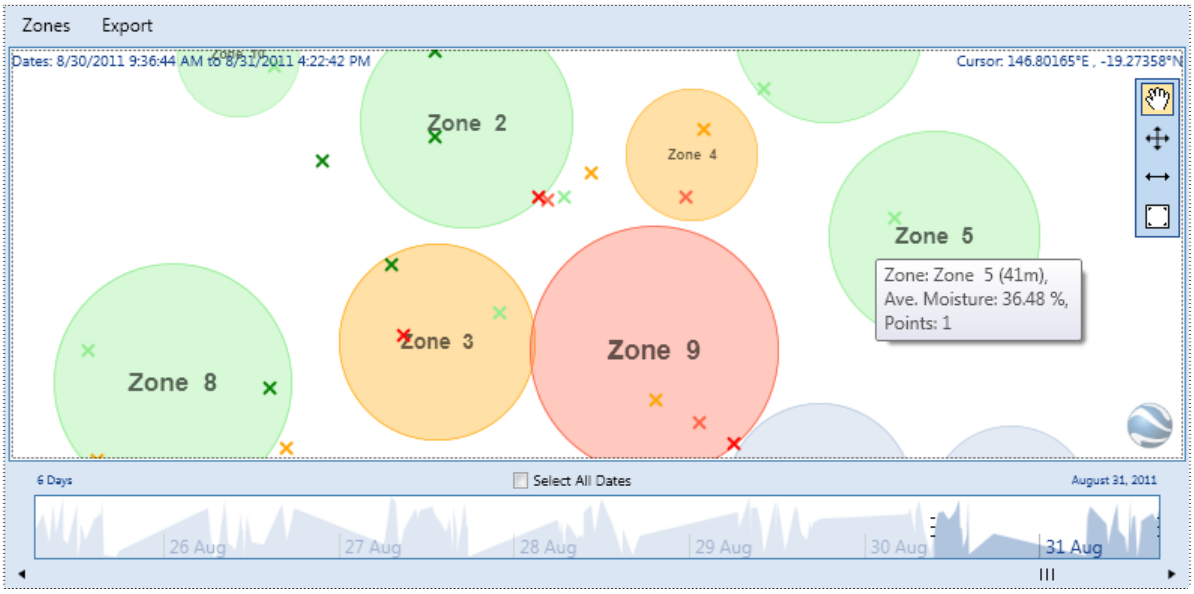


By default, the chart displays all measurements. To view a chart for a specific date range, clear the Select All Dates checkbox and use the timeline (timeline is below the chart) to highlight a range of dates to display.

For more information on using the Chart tab and the timeline, see *SECTION 4.4 Chart Tab* (p. 4-8).

2.5.3 Map Viewing Tab

The Map tab displays measurements and zones on a two-dimensional plot. Average moisture is calculated for each zone from the measurements within the zone; the zone is colored accordingly. Moving the pointer over any point or zone displays an infotip with more detailed information.



By default, all measured points are displayed in the map. The timeline (timeline is below the map) is used to filter the displayed points by a given date range.

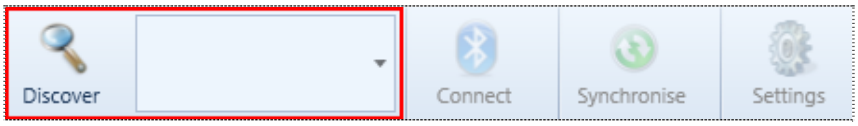
The toolbox at the right of the window can be used to move and resize zones. Double-click on a zone to set the zone radius or change the zone name.

For more information on using the Map tab, see *SECTION 4.5 Map Tab* (p. 4-11). For more information on moving and resizing zones, see *Zone Editing Tools* (p. 4-18).

Section 3. Downloading Data

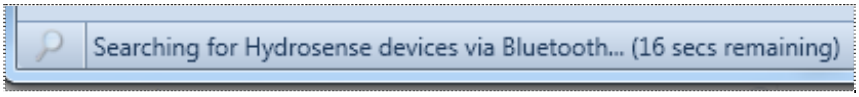
3.1 Discovering a Device

The main toolbar contains the Discover button and the list of known devices.



Press the Discover button in the toolbar to start searching for devices. The HydroSense II should be in range of the PC and turned on.

Depending on the Bluetooth hardware, this search takes up to 20 seconds and cannot be cancelled. During discovery, the status bar flashes a discovery symbol to indicate that discovery is in progress.

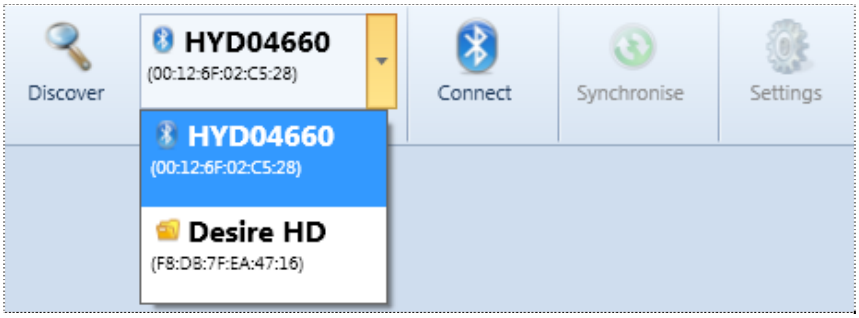


When discovery is complete, the first discovered device is displayed in the device list to the right of the Discover button.

3.1.1 The Device List

The device list contains all devices discovered in the current and previous sessions.

Each HydroSense II is listed with its device name (HYD followed by the serial number) in bold, and its Bluetooth address is printed in smaller font beneath. Devices discovered in the current session are shown with a Bluetooth icon, .



The software saves a list of devices previously discovered. They can be selected directly from the list without a discovery step. These devices are shown next to a folder icon, .

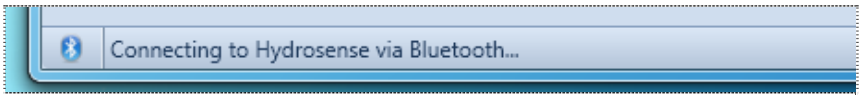
If data have been previously downloaded from a particular HydroSense II, selecting that device in the list will update the software data display area to show data for that unit. The device list controls which device has its data displayed in the software.

3.2 Connecting to a Device

3.2.1 Connecting

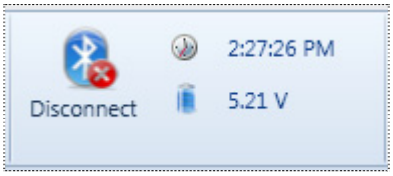
The Connect button controls connection to HydroSense II probes. If a device is selected in the device list, the Connect button will be enabled.

Press the Connect button to connect to the device. The connection process should take only a few seconds. The status bar will flash a Connect icon to indicate that the connection is in progress.



The first time the software connects to a particular HydroSense II, a pairing step is required. The pairing code is **1234**. See *SECTION 3.2.2 Pairing with a Device* (p. 3-3).

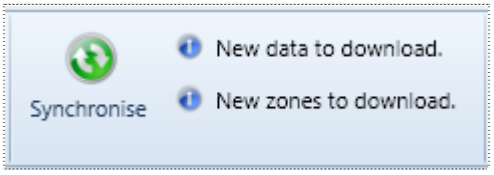
If the connection succeeds, an area next to the Connect button expands to show HydroSense II clock and battery voltage.



The clock icon may be pressed to set HydroSense II time. This will open a new window. For more information, see *SECTION 3.3 Setting Time* (p. 3-5).

If battery voltage is below 4.0 V, the batteries need replacing. The HydroSense II will turn off if voltage drops to 3.6 V.

During the connection process, the software asks the HydroSense II if it has any new data or zones. If the connection process is successful, this information is used to update the status area to the right of the Synchronise button.



Synchronizing data with the device is discussed in *SECTION 3.4 Synchronizing with a Device* (p. 3-6).

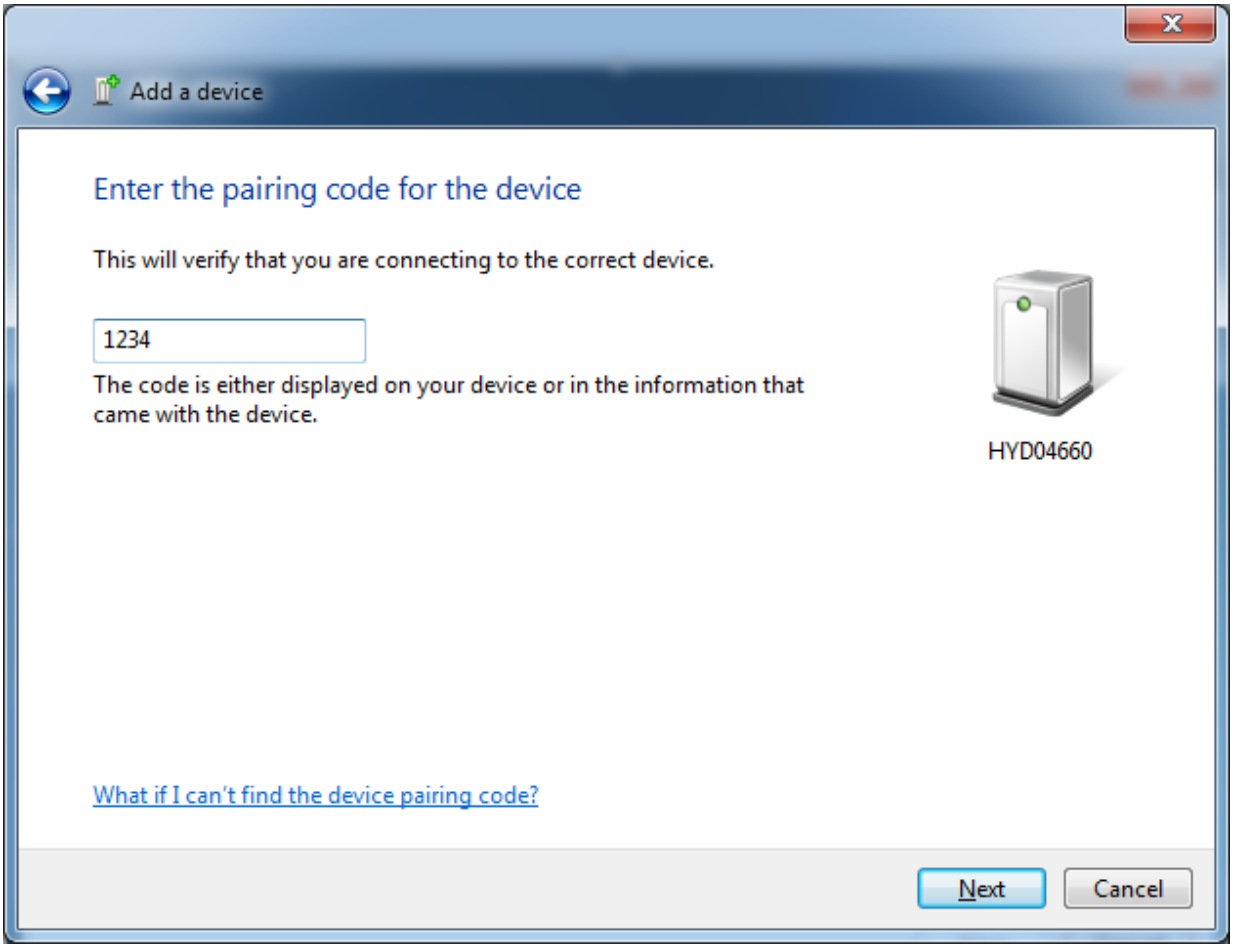
3.2.2 Pairing with a Device

The first time the software connects to a specific HydroSense II, the user is required to enter a pairing code for the device. For all HydroSense II displays, the pairing code is **1234**.

After pressing the Connect button, the Bluetooth stack on the local PC will ask for the pairing code. The method used to ask for this code varies between Bluetooth stacks. This page shows the procedure for the Microsoft stack running on Windows 7.

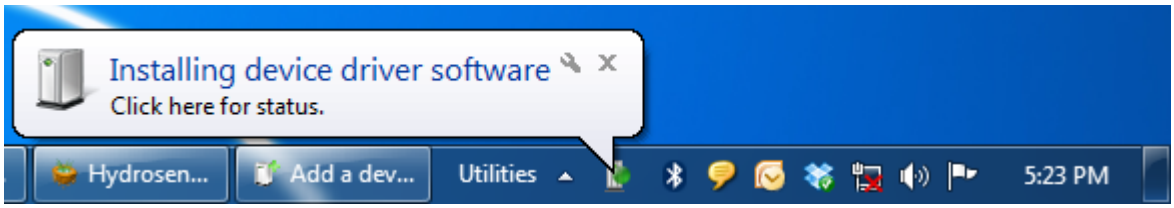
A notification will appear in the notification area of the Windows Desktop (lower-right).

Click the notification to open the "Add a device" window.



Enter the pairing code 1234, and then press Next.

Close the "Add a device" window by pressing the Close button. Windows will install the necessary drivers to communicate with the HydroSense II; the progress will be shown above the Windows task bar.



Once the installation is complete, the HydroSense software will connect to the HydroSense II.

3.2.3 Disconnecting

The software does not need to be connected to a device to view downloaded data.

The software does need to be connected to the HydroSense II display to perform the following.

- Download new measurements
- Download new zones
- Upload new or modified zones
- Change settings
- Set the HydroSense II display clock

Maintaining a Bluetooth connection consumes battery power. Disconnect and power down the HydroSense II after a data download to conserve battery life. All other software functions are available while disconnected.

3.2.4 Connect Errors

The following errors may occur when connecting to a device. Detailed information on each error can be found in *SECTION 7. Error Codes* (p. 7-1).

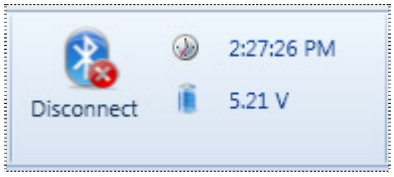
- BTUnkownError - an error has occurred during the connection and the local Bluetooth stack did not specify the reason.
- BTSocketError - there was an error creating a Bluetooth connection to the device.
- HydrocolNoResponse - a Bluetooth connection to the HydroSense II display was created, but the device is not responding to commands from the software.

3.3 Setting Time

Manually adjusting time and date is not normally necessary. GPS derived time will override time and date set with this menu. The time setting facility is generally used to set the clock when GPS synchronization is disabled or GPS power is turned off.

3.3.1 The Set Device Time Window

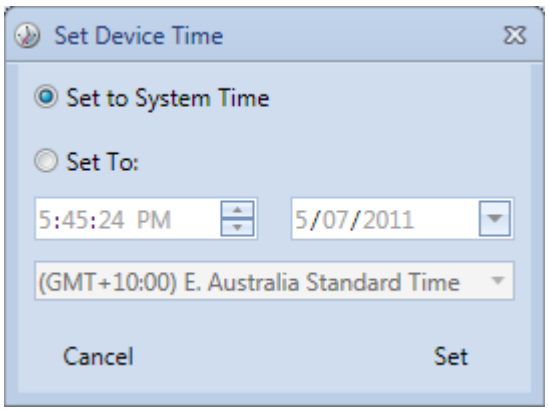
When connected (*SECTION 3.2.1 Connecting* (p. 3-2)), HydroSense II time appears next to the Connect button in the main toolbar.



Press the clock icon to open the Set Device Time window.

3.3.1.1 Set to System Time

By default, the window is configured to set the device time to the same time and time zone as the local PC (Set to System Time option is selected).

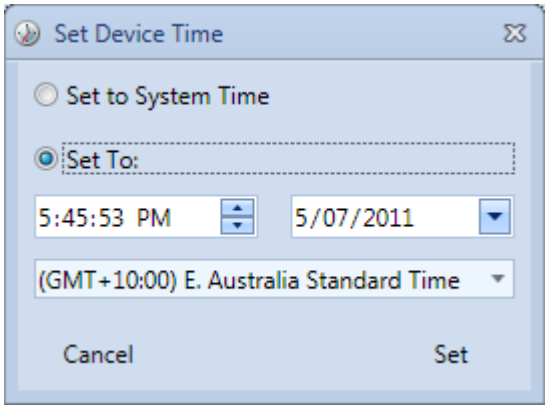


With this option selected, the time and time zone edit boxes are disabled, but will update once per second to the current system time.

Press the Set button to update the device with the current system time.

3.3.1.2 Set to Custom Time

To set HydroSense II time to a custom time or time zone, select the Set To: option.



This enables the time and time zone edit boxes. Enter the custom date and time into the edit boxes. To set the date using a calendar, press the drop down arrow on the date edit box.

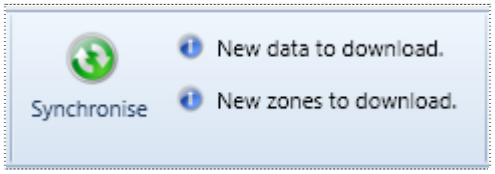
In the Item list, select the desired time zone.

Press the Set button to update the device with the custom time or time zone.

3.4 Synchronizing with a Device

The Synchronise and Settings buttons of the main toolbar are disabled until a Bluetooth connection is made.

After connection, synchronization status information is placed to the right of the Syncronise button. Status information shows whether data or zones need to be downloaded from the HydroSense II, or if zones need to be uploaded.



The following table shows the possible states that may be shown in the status area, and the action each performs.

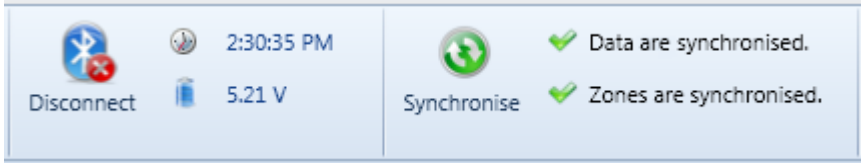
TABLE 3-1. Status Area States

State	Action Performed
New data to download.	The latest record stored on the device is newer than the latest record stored on the PC. *The PC will download the new records from the device.*
Data are synchronised.	The latest record stored on the device is the same as the latest record stored on the PC. *No action is needed.*
New zones to download.	The zones stored on the device have changed since the last synchronization. *The PC will overwrite its zones.* with those from the device.
New zones to upload.	The zones stored on the PC have changed since the last synchronization. *The device will overwrite its zones with those from the PC.*
Zones are synchronised.	The zones on the device match those stored on the PC. No action is needed.

3.4.1 Synchronizing

Press the Synchronise button to perform the download and upload actions indicated in the status fields. The status display will change to show the download and upload progress for each file on the device.

After synchronization is complete, the status display will show that data and zones are synchronized.



The connection with the HydroSense II can be disconnected after synchronization. Newly downloaded data can be viewed without an active connection.

Section 4. Viewing Data

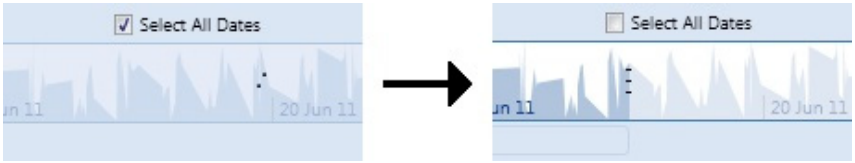
4.1 Using the Timeline

The timeline shows an overview of water content over time.

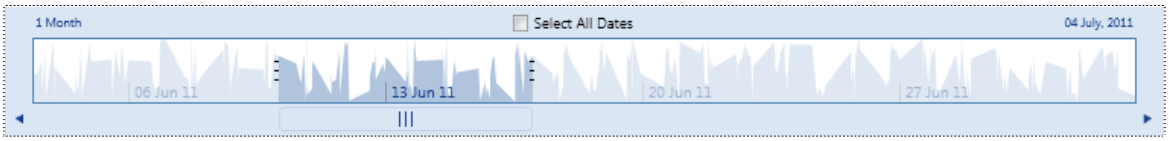
The Data, Chart, and Map tabs use a common timeline to filter measurements based on the time they were taken. The timeline is shown in the lower portion of each tab.

By default, the timeline has the Select All Dates checkbox selected. This means that all measurements will be displayed in the active tab.

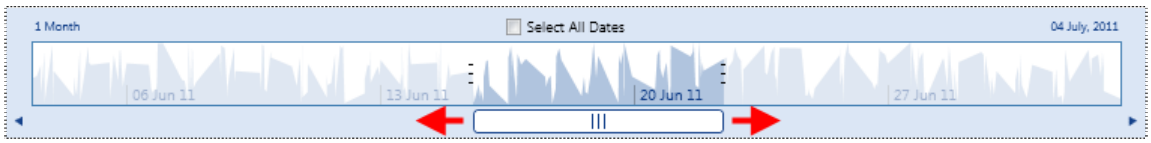
To start filtering measurements by timestamp, clear the Select All Dates checkbox. This will enable timeline control.



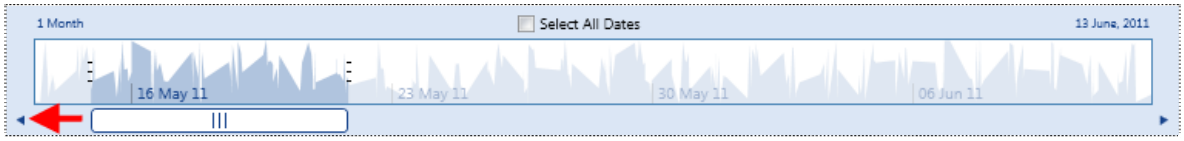
The following figure shows water content for the month before 4 July, 2011. The length of time shown in the timeline is displayed in the upper-left (1 Month), and the ending date shown in the timeline is displayed in the upper-right (04 July, 2011).



Part of the timeline around 13 June 2011 is highlighted to indicate points currently shown in the main view. This highlighted area can be moved to the left and right by clicking and dragging the scrollbar beneath the timeline.

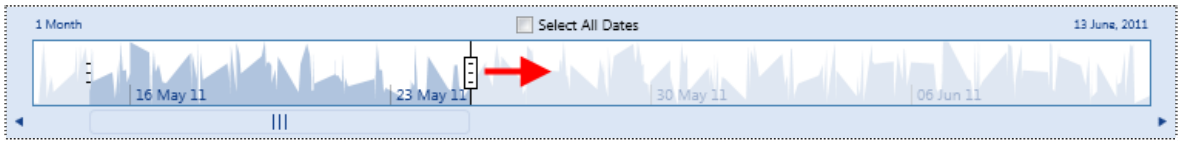


Dragging the scrollbar all the way to one edge of the timeline will scroll the timeline background to bring earlier (or later) points into view. Notice that the timeline is adjusted such that data for only one month are shown.

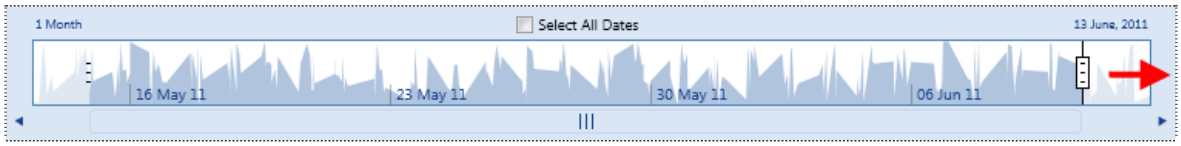


Dragging the scrollbar to the far left of the screen adjusts the timeline such that water content data for a month ending on 13 June are displayed.

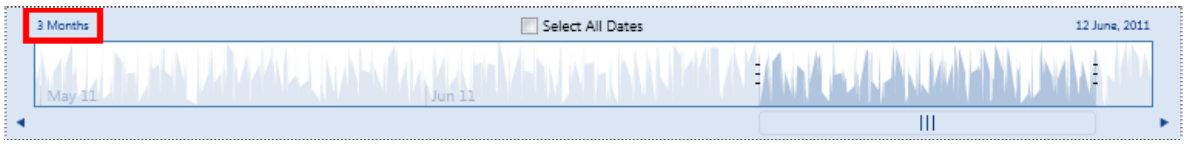
The length of the highlighted area are changed by clicking and dragging the sliders on either side of the selection.



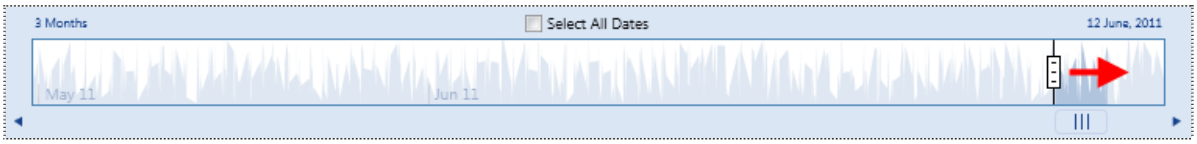
Extending the highlighted area to cover more than 80% of the timeline will cause the timeline to zoom out and a longer date range of data to be displayed.

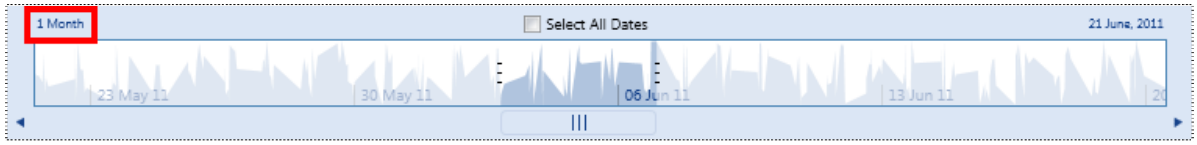


Notice that the timeline now shows 3 months of data.



Likewise, reducing the length of the highlighted area to cover less than 20% of the width of the timeline causes the timeline to zoom in and data from a smaller date range to be shown.



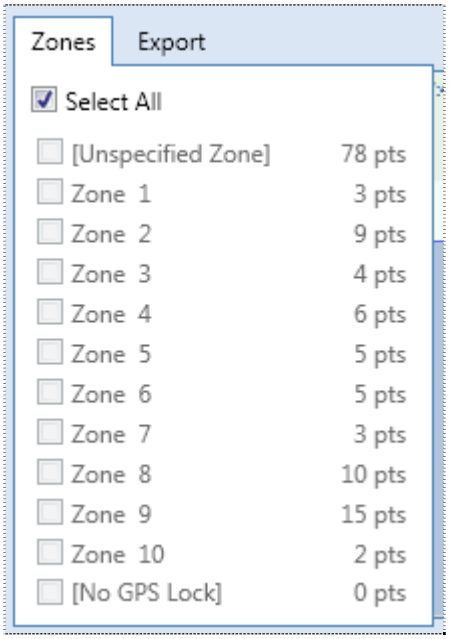


Notice that the timeline is now showing 1 month of data. To stop filtering by date and display all points, select the Select All Dates checkbox to disable timeline control.

When large numbers of measurements are updated, the process may take a few seconds. A loading icon will be displayed while the view is refreshed.

4.2 Showing / Hiding Zones

Zones menus in the Data and Chart tabs facilitate showing or hiding measurements by zone.



By default, all zones are shown; clear the Select All checkbox to enable individual zone checkboxes.

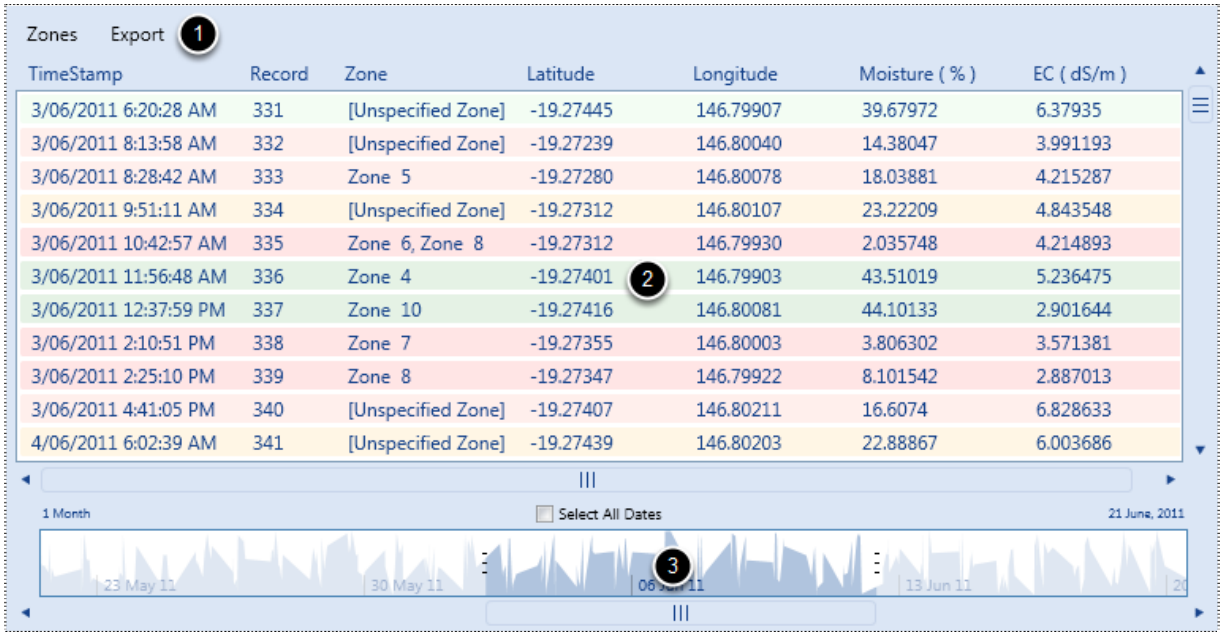
Clearing individual zone checkboxes will remove measurements from those zones. If the Select All checkbox is cleared and no individual zones are selected, no data are displayed.

The [Unspecified Zone] is a special zone that contains all the points that are not located in any of the other zones. The [No GPS Lock] zone is a special zone that contains all the points that were collected without positional information.

4.3 Data Tab

4.3.1 Records Display

The Data tab displays all records downloaded for the current device in detail. The tab has three sections.



1. Menu Bar

The menu bar has a Zones menu and an Export menu. The Zones menu allows the user to display or hide measurements by zone. See *SECTION 4.2 Showing / Hiding Zones* (p. 4-4) for more information.

The Export menu allows the user to output a .csv file containing the measurements currently in view. See *SECTION 4.3.3 Export Menu* (p. 4-7) for more information.

2. Data List

The data list contains measurements downloaded from the HydroSense II. Measurements shown in the list can be filtered using the Zones menu or the timeline.

Row color indicates a range of volumetric water contents. Colors default to red for low soil water, yellow for midrange soil water, and green for high soil water. For information on customizing colors, see *SECTION 5.3 Measurement Colors* (p. 5-7).

The following columns are in the data list:

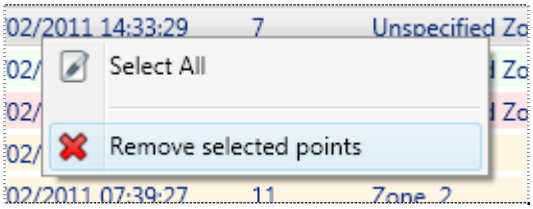
TABLE 4-1. Data List	
Element	**Description**
TimeStamp	HydroSense time when the measurement was made
Record Number	Record numbers range from 1 to 65535
Zone	Zone where this measurement is located
Latitude	Latitude (°N of the equator) where this measurement was made
Longitude	Longitude (°E of the prime meridian) where this measurement was made
Moisture (%)	Volumetric water content (VWC) reported in percent (%). Only water content is plotted on the Chart tab. Additional raw measurements with units are shown in the Data tab

3. Timeline

The timeline allows the user to filter the points in the data list based on when the measurements were taken. By default, the Select All Dates checkbox is selected and all measurements are displayed. For information using the timeline, see *SECTION 4.1 Using the Timeline* (p. 4-1).

4.3.2 Removing Records

Unwanted measurements are removed by right-clicking on the measurement row and selecting the "Remove selected points" command.

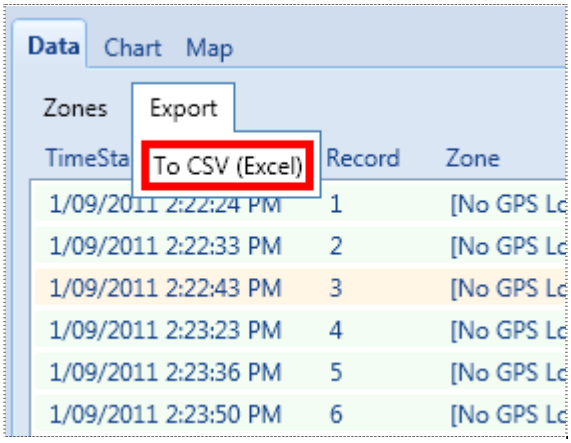


The software will prompt for confirmation of the removal. Once a measurement is removed from the list, it cannot be recovered.

Multiple measurements can be removed by holding the CTRL key and selecting the desired rows, and then right-clicking and choosing the “Remove selected points” command.

4.3.3 Export Menu

The Export menu can be found at upper-left of the Data tab



The menu contains a command to export the measurements listed in the Data tab to a .csv file. A .csv file can be opened in Excel® or similar spreadsheet applications.

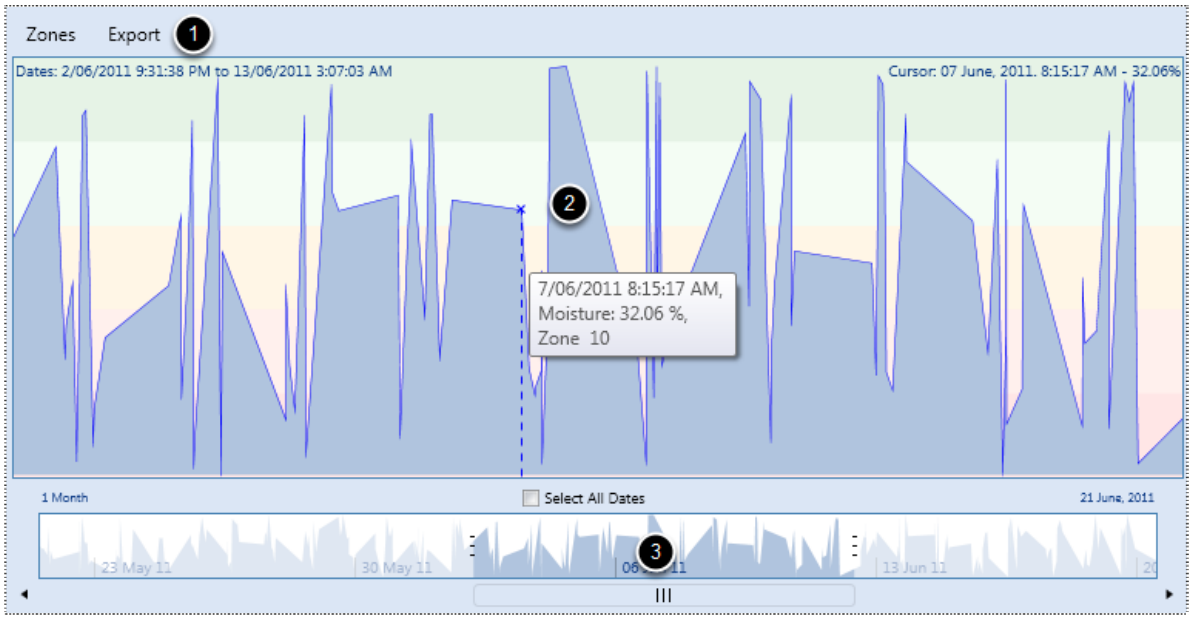
First, select the appropriate range of dates from the timeline in the Data tab. Click the "To CSV (Excel)" command from the Export menu. A Save As dialog box will prompt where to save the .csv file. Choose a location and press Save. All columns shown in the Data tab will be exported to the .csv file.

	A	B	C	D	E	F	G	H	I	J	K	L
1	TimeStamp	Record	Zone	Latitude	Longitude	Moisture (%)	EC (dS/m)	Period (us)	Attenuation	Temperature (°C)	Permittivity	Probe Model
2	1/09/2011 14:22	1	[No GPS Lock]	0	0	39.35	0.3073	0	2.6358	25.5241	24.3056	CD658 20cm rods
3	1/09/2011 14:22	2	[No GPS Lock]	0	0	38.73	0.3206	0	2.6234	25.5324	23.6966	CD658 20cm rods
4	1/09/2011 14:22	3	[No GPS Lock]	0	0	29.19	0.2785	0	2.3792	25.538	16.0595	CD658 20cm rods
5	1/09/2011 14:23	4	[No GPS Lock]	0	0	31.12	0.2956	0	2.429	25.6051	17.3976	CD658 20cm rods
6	1/09/2011 14:23	5	[No GPS Lock]	0	0	30.58	0.2965	0	2.4177	25.6386	17.0162	CD658 20cm rods
7	1/09/2011 14:23	6	[No GPS Lock]	0	0	32.34	0.3077	0	2.4618	25.6833	18.2942	CD658 20cm rods

4.4 Chart Tab

4.4.1 Chart Tab Sections

The Chart tab plots volumetric water content (VWC) from each measurement against time. The tab has three sections.



1. Menu Bar

The menu bar has a Zones menu and an Export menu. The Zones menu allows the user to display or hide measurements by zone. See *SECTION 4.2 Showing / Hiding Zones* (p. 4-4) for more information.

The Export menu allows the user to output a .csv file containing the measurements currently in view. See *SECTION 4.3.3 Export Menu* (p. 4-7) for more information.

2. Chart

The chart plots volumetric water content as a function of time. The plot can be scrolled using the timeline, and the measurements included in the plot can be filtered using the Zone menu. The chart plots volumetric water content as a function of time. The plot can be scrolled using the timeline, and the measurements included in the plot can be filtered using the Zone menu.

Moving the pointer over the chart displays a vertical line that will follow the pointer to indicate the volumetric water content at the pointer position. The text at the upper-right of the plot shows time of the point over which the pointer is currently paused, with the associated interpolated water content. Interpolated water content is the water content expected given the measurements directly before and after the pointer position. The text at upper-left of the plot shows the range of dates currently shown in the plot. If the pointer moves close to a measurement, the pointer changes to dark blue and an

infotip is displayed listing time the measurement was made, VWC in percent (%), and the zones to which the measurement belongs.

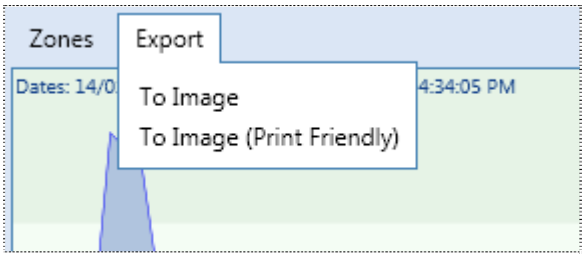
The background of the chart is a gradient of color defaults used in the HydroSense II software. This is the coloring scheme used as the background for rows in the Data tab and used to color measurements and zones in the Map tab. To change these colors, see *SECTION 5.3 Measurement Colors* (p. 5-7).

3. Timeline

The timeline is used to scroll the chart as well as zoom in and zoom out. For more information on how to use the timeline, see *SECTION 4.1 Using the Timeline* (p. 4-1).

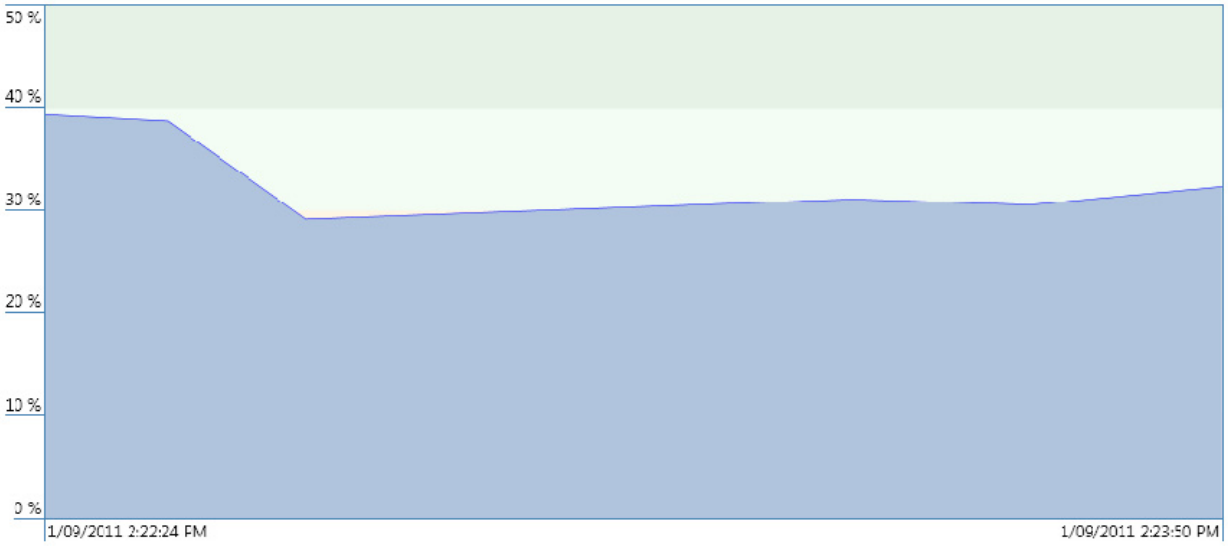
4.4.2 Export Menu

The Export menu can be found at the upper-left of the Chart tab.

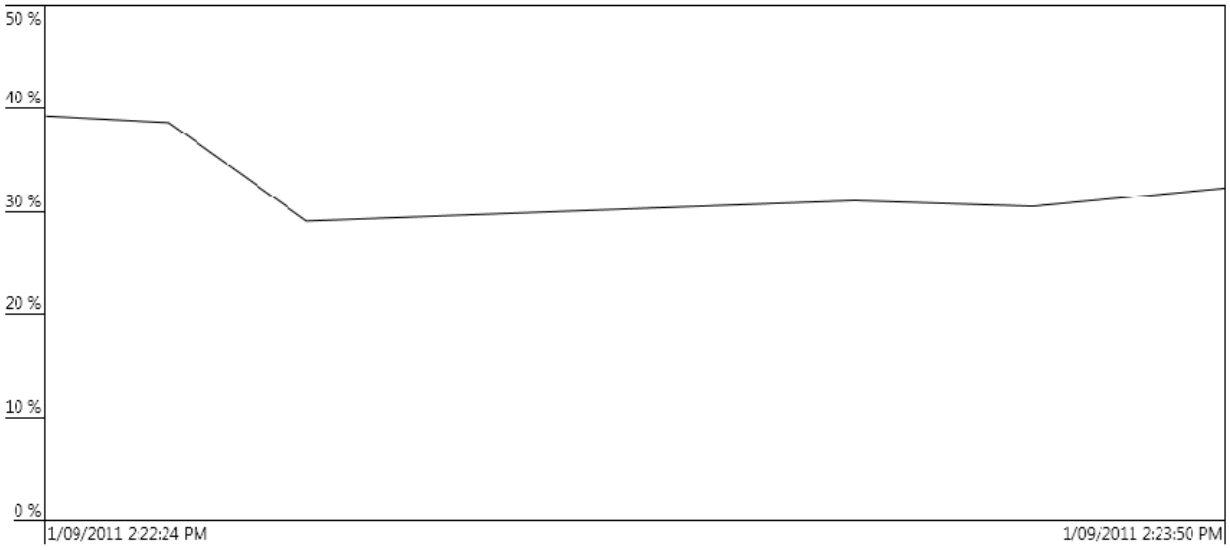


The Export menu facilitates exporting the current chart to a color or black and white image file. Clicking on either of the commands opens a Save As dialog box to choose the location to which to export the file. The file can be saved as .png, .jpg, or .bmp. Following are samples of the two image outputs.

Sample Chart Export (Color)

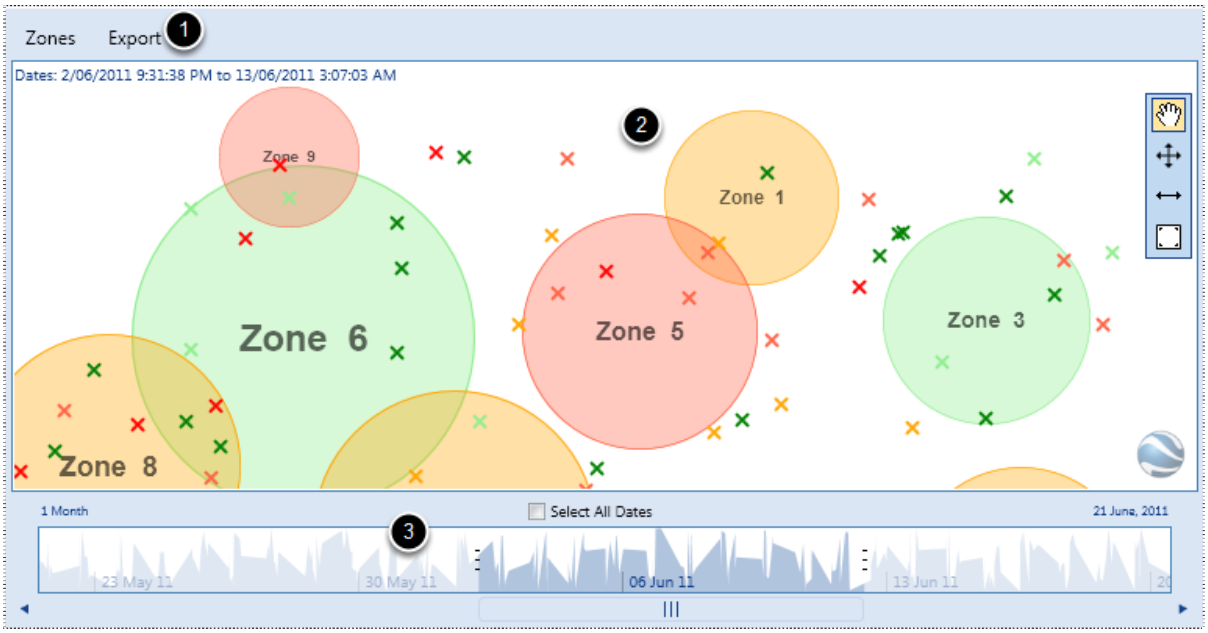


Sample Chart Export (Black and White)



4.5 Map Tab

The Map tab plots measurements and zones on a 2D map and colors them according to aggregate measurement values. The Map tab does not provide the option to import a background image on which to plot, but it can export the current map view to Google Earth for viewing against satellite imagery. The Map tab has three areas.



1. Menu Bar

The Zones menu lists all zones plotted in the main map and allows the user to zoom to a particular zone by double-clicking on its entry in the list. See *SECTION 4.5.1 Zones List* (4-13) for more information.

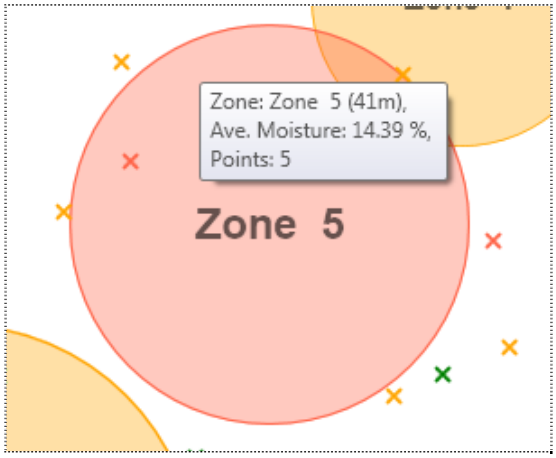
The Export menu allows the user to export the current view to either KML format to import into Google Earth, or GPX format, which supports many mapping applications. See *SECTION 4.5.2 Export Menu* (p. 4-14) for more information.

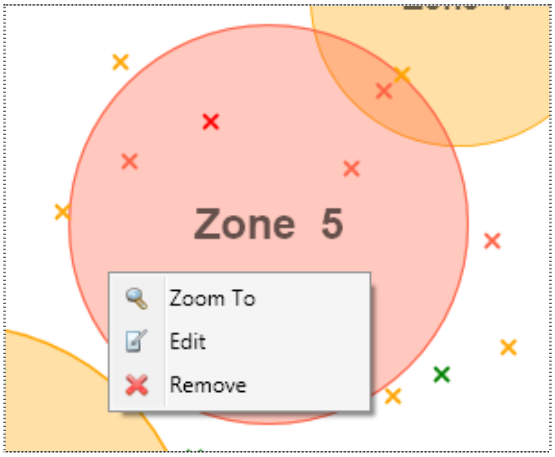
2. Map

The date range of the points displayed is shown at the upper-left of the main map. This is the date range which has been chosen with the timeline.

A toolbar is located on the right of the map. It contains tools to change zone sizes and positions. See *SECTION 4.5.4.1 Zone Editing Tools* (p. 4-18) for instructions on how to use this toolbar.

If Google Earth is installed on the local computer, clicking the button at the lower-right of the map will show the contents of the view in Google Earth. More information on this can be found in *SECTION 4.5.3 Show in Google Earth* (p. 4-15).



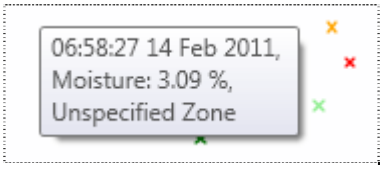


Zones are shown to scale on the map. The relative sizes of the zones match the diameters chosen on the HydroSense II. Each zone is colored according to the average VWC of all points contained in the zone. Colors used to represent different levels of VWC can be changed as described in *SECTION 5.3.4 Changing Measurement Colors* (p. 5-8).

Pausing the pointer over a zone will produce an infotip that lists the average VWC of this zone and the zone diameter and number of contained points. The diameter of the zone is shown in brackets next to the zone name.

Right-clicking on the zone shows the Zone Context menu, which has the following commands:

- Zoom To — zoom in to the current map view to show only the selected zone
- Edit — opens the Edit Zone window where the zone name and diameter can be changed. For more information, see *SECTION 4.5.4 Edit Zone Window* (p. 4-17).
- Remove — removes the zone from the software and from the HydroSense II device on the next synchronization. A dialog box will ask the user to confirm this action.



Measurements are shown on the map as small cross marks. These cross marks are not drawn to scale and do not change size during zooming. Each cross is colored according to the VWC for the measurement. The colors used to represent different levels of VWC can be changed as described in *SECTION 5.3.4 Changing Measurement Colors* (p. 5-8).

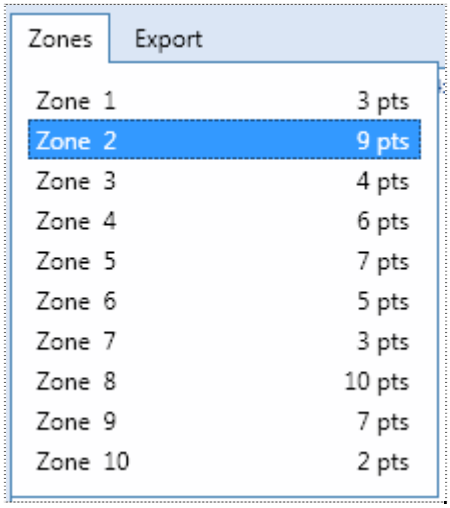
Pausing the pointer over a cross mark will produce an infotip listing the timestamp, VWC and zones containing the measurement.

3. Timeline

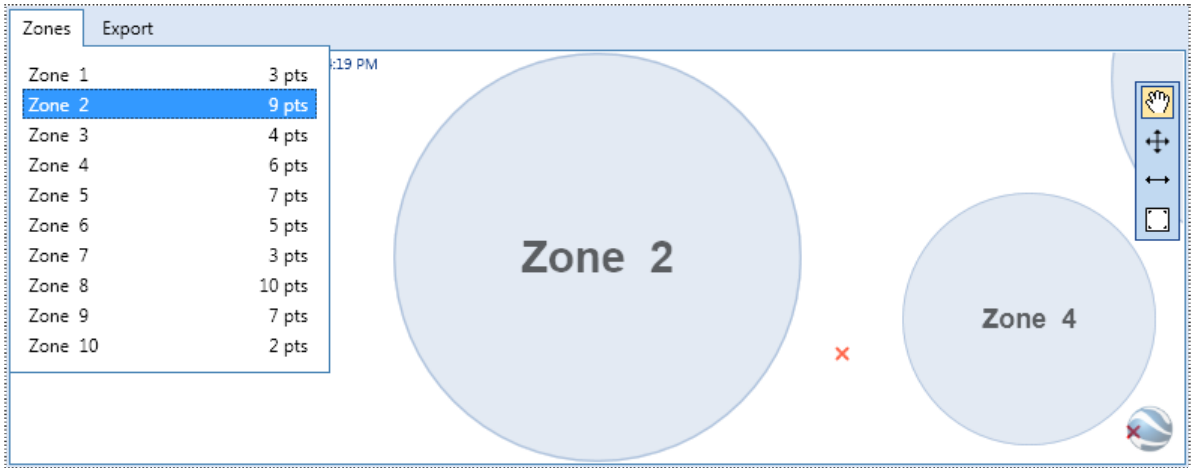
The timeline allows the user to filter the measurements shown in the map based on when measurements were taken. By default, the Select All Dates checkbox is selected, and all measurements are displayed. For more information on how to use the timeline, see *SECTION 4.1 Using the Timeline* (p. 4-1).

4.5.1 Zones List

The Zones list menu can be found at the upper-left of the Map tab.



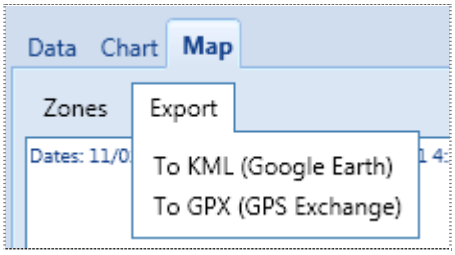
This menu lists the zones stored on the HydroSense II with the number of points in each zone. Double-click on a zone to zoom to that zone in the Map tab.



Zone editing commands are available by right-clicking on the zone in the Map tab. See *SECTION 4.5 Map Tab* (p. 4-11) for more information.

4.5.2 Export Menu

The Export menu can be found at the upper-left of the Map tab.



The menu facilitates exporting map data to one of two formats. Clicking on either of the commands will open a Save As dialog box to choose the location of the exported file. Only the points currently visible on the map will be exported. To export all points, select the Select All Dates checkbox in the timeline.

KML

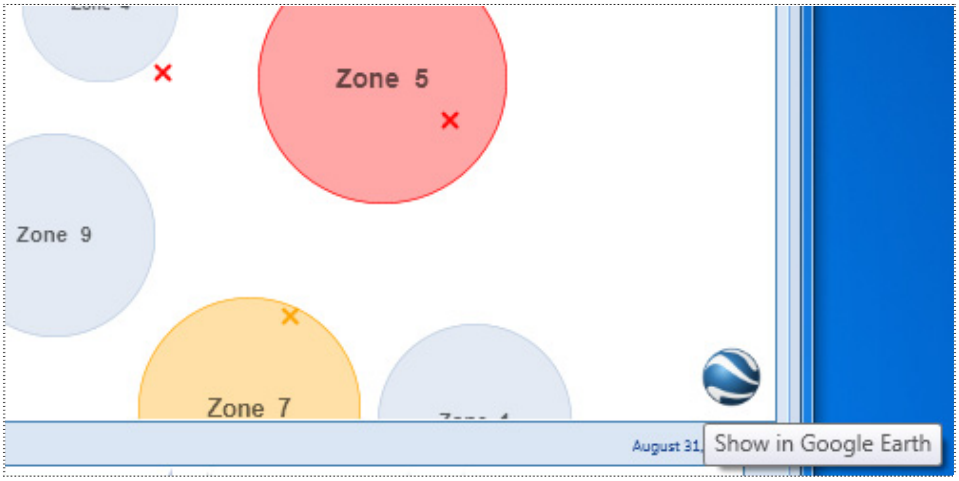
KML is the Google Earth file format. The .kml file contains both zone and measurement information. Zones are displayed as colored circles; measurements will be displayed as colored drawing pins. The color of the circles and drawing pins will be the same as the colors shown in HydroSense II Support Software.

GPX

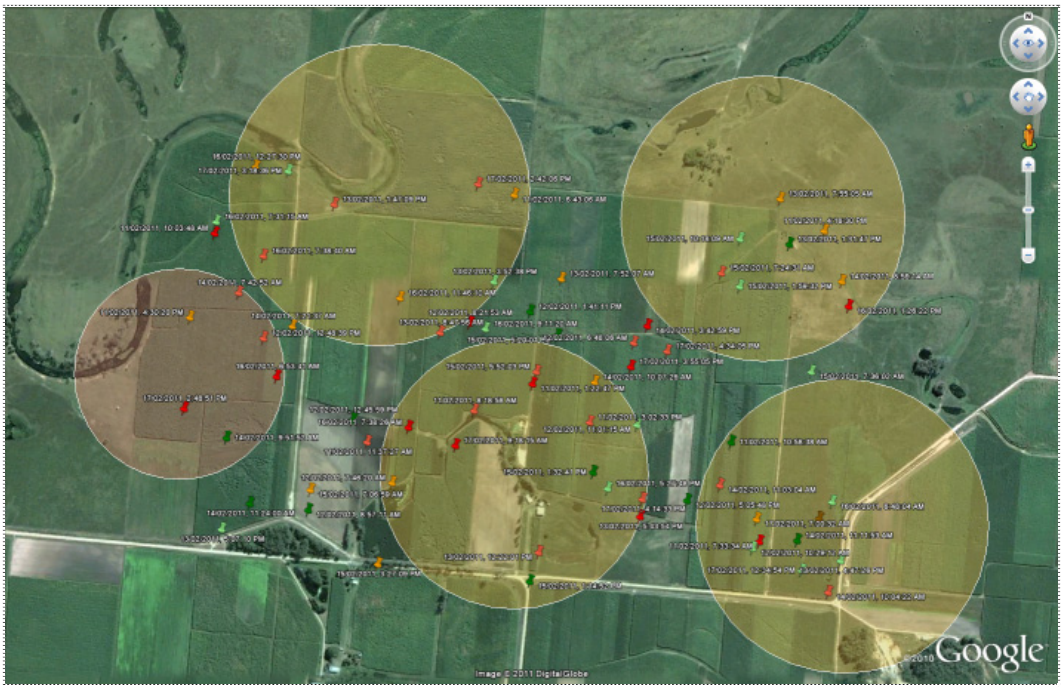
This is a standard GIS format used by many mapping packages. Google Earth supports GPX files, but the GPX format does not allow for drawing shapes, so only measurement information is stored in the exported GPX file. Each measurement is stored as a GPX waypoint with a timestamp. The VWC measurement is stored in the waypoint description.

4.5.3 Show in Google Earth

The Show in Google Earth button is located at the lower-right of the Map tab. This button is visible but disabled if Google Earth is not installed.

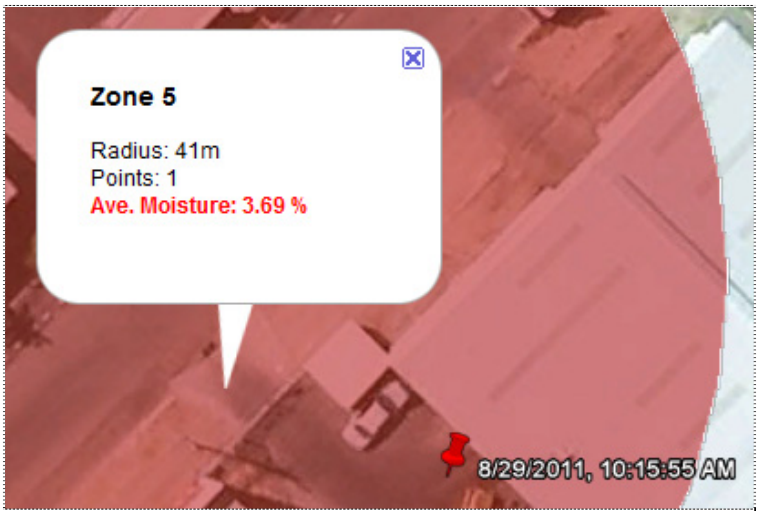


Clicking this button will open Google Earth and display the currently visible zones and measurements against Google Earth satellite imagery.



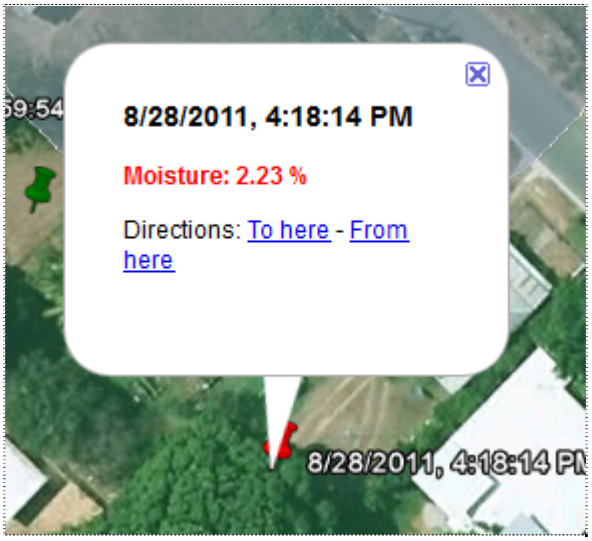
4.5.3.1 Zones

Zones are displayed to scale as colored circles. Circle color is determined by the average VWC of all points in a zone. Click the zone to view an infotip with more information about the zone.

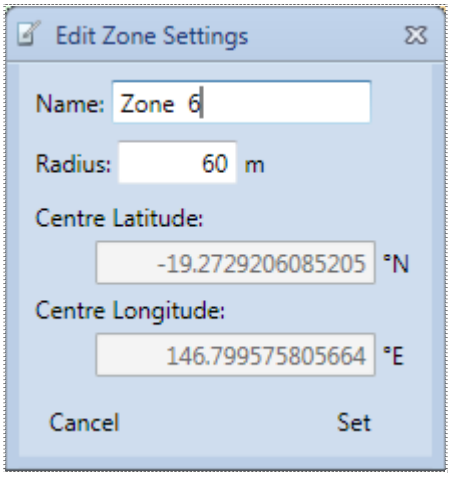


4.5.3.2 Measurements

Measurements are displayed as pin markers in Google Earth. Each marker will be colored according to the VWC measured at that point. Click on one of the markers to view an infotip with more information about the measurement.



4.5.4 Edit Zone Window



The Edit Zone window can be displayed by double-clicking a zone in the HydroSense Support Software map or right-clicking the zone and choosing the Edit command.

The following zone settings can be changed and saved by pressing the Set button. The Set button will be disabled until a change is made to the zone settings. Any changes made to zones on the local PC will be uploaded to the HydroSense II on the next synchronization.

Name

This field is used to name the zone in the software and on the HydroSense II handheld display. The maximum length of the name is 15 characters.

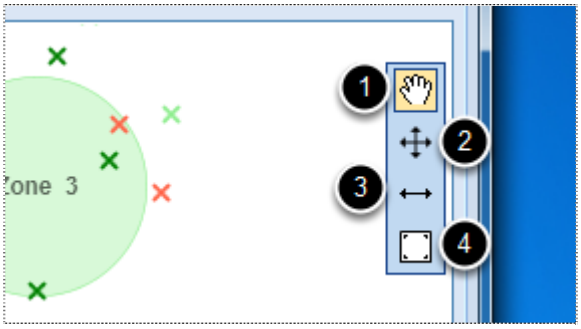
Radius

This field specifies the radius of the zone in meters. This field only accepts integers and a decimal. There is no maximum or minimum zone radius; however, the GPS of the HydroSense II is accurate to 5 m, so zones with sizes near this value may be difficult to locate using the handheld device.

Centre Latitude and **Centre Longitude** cannot be edited from the Edit Zone Settings window. To change the location of a zone, use the Move Zone tool in the map as described in *SECTION 4.5.4.1 Zone Editing Tools* (p. 4-18).

4.5.4.1 Zone Editing Tools

The toolbar at upper-right of the map contains tools to control map position and edit zones.

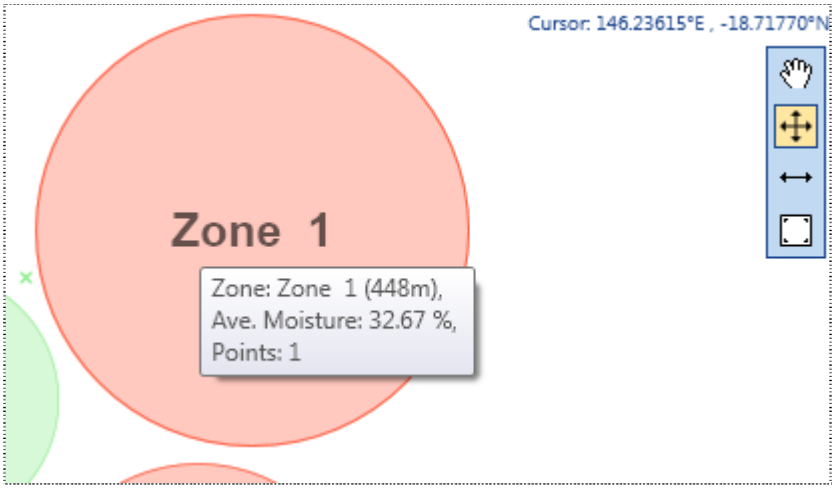


1. Drag Mode

By default, the hand icon is selected, so the map is in drag mode by default. Clicking and dragging anywhere on the map pans the view. Moving the mouse wheel while pausing over the map zooms the view in and out.

2. Move Mode

Clicking the move tool puts the map in Move Mode. Clicking and dragging on any zone makes the zone move with the pointer. This tool is used to reposition zones on the map.

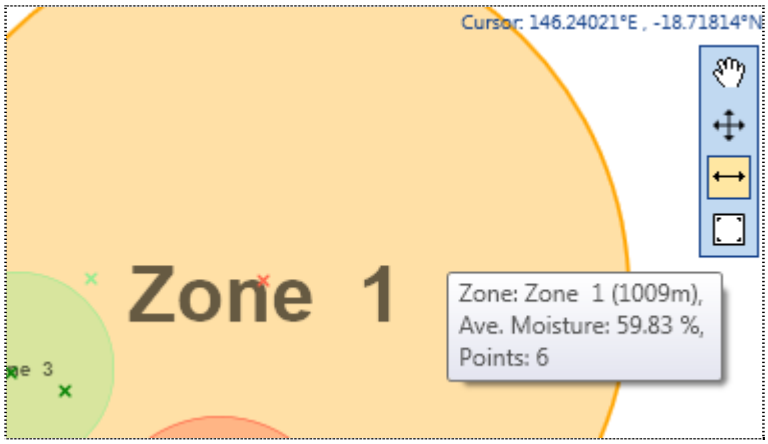


While dragging, the position of the pointer on the map is displayed in the upper-right of the map. An infotip is displayed to show the number of contained points and average moisture for the current zone position.

Right-clicking anywhere on the map, or selecting the hand tool from the toolbox, puts the map back into Drag Mode.

3. Resize Mode

Clicking the resize tool puts the map in Resize mode. Clicking and dragging on any zone will increase or decrease its radius with the position of the pointer. This tool can be used to resize zones on the map.



While dragging, an infotip will show the current radius of the zone in meters with the number of contained zones and the average moisture at this zone size. Right-clicking anywhere on the map or selecting the hand tool from the toolbox puts the map back into Drag Mode.

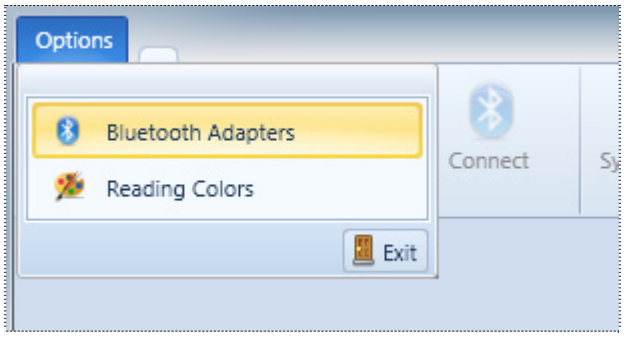
4. Zoom-to-Extents

Clicking the zoom-to-extents button will re-center the view so that all points for the selected date range are visible.

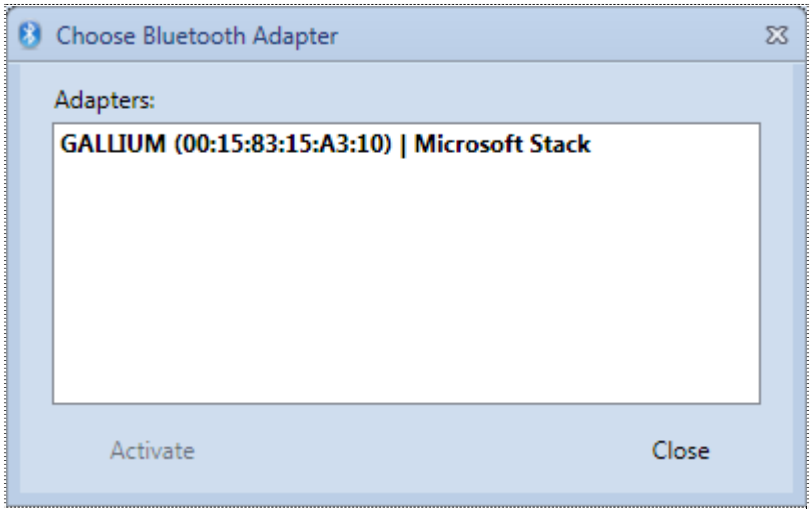
Section 5. Settings and Configuration

5.1 Bluetooth Settings

The Bluetooth Adapters window can be accessed from the Options menu in the main window.



The window shows a list of all available Bluetooth adapters on the local PC.



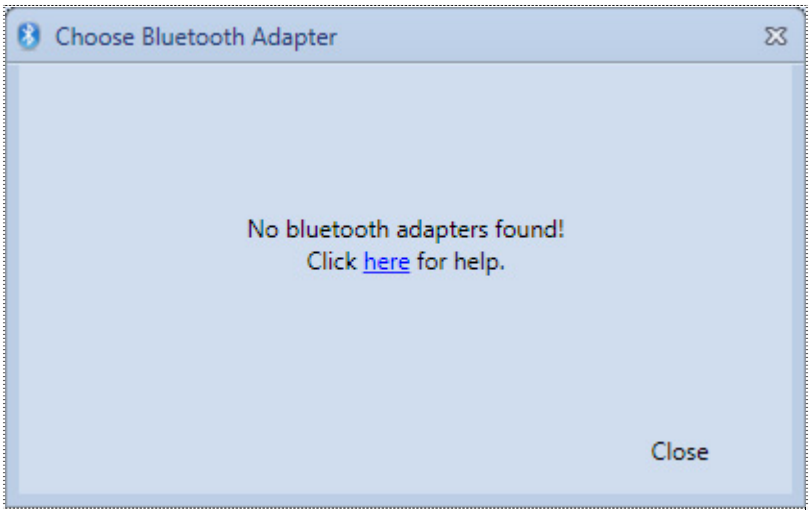
The Bluetooth adapter currently being used by the HydroSense II software is shown in bold. If there is more than one Bluetooth adapter on the local computer, the extra adapters are shown in normal font in the list.

Each adapter is listed in the following format:

Adapter Name (Adapter Bluetooth Address) | Bluetooth Stack Used

To use a different adapter, select the adapter in the list and press the Activate button. The new adapter is shown in bold. This setting is saved to disk so that this adapter will be used the next time the software is run.

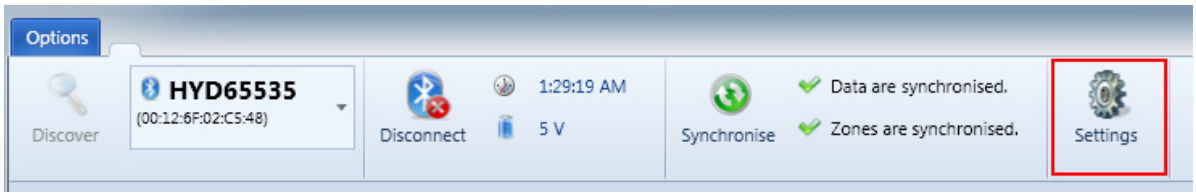
If the local PC does not have Bluetooth adapters connected, the following window will be displayed.



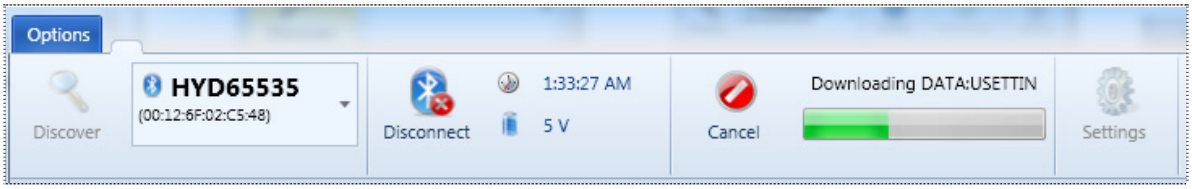
See *SECTION 7.3 (0x11) BTStackError* (p. 7-2) for more information.

5.2 Device Settings

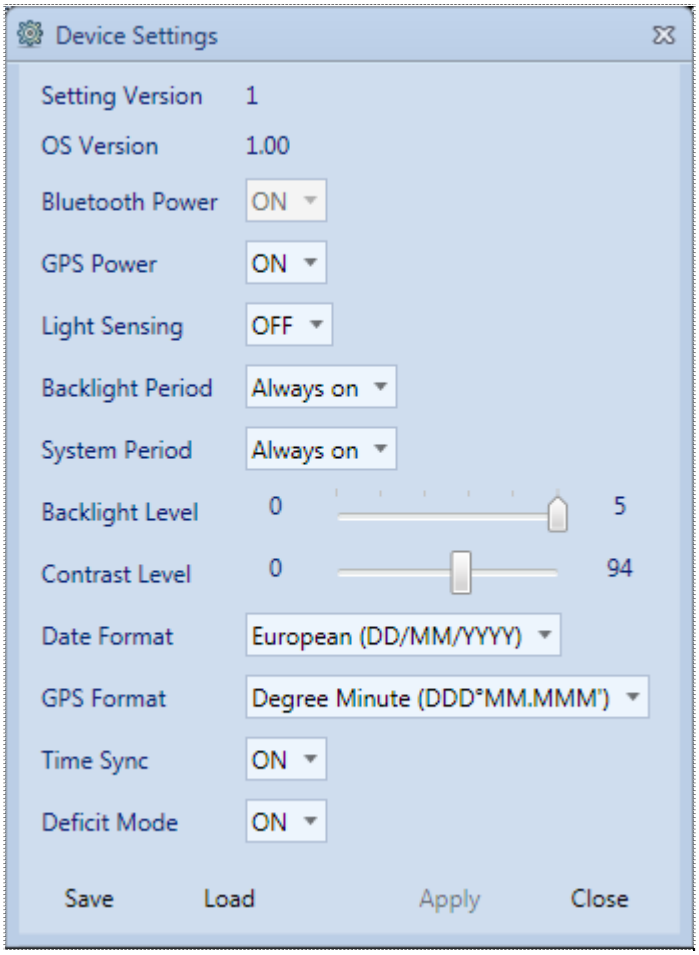
Settings for the HydroSense II can only be accessed when a Bluetooth connection has been established. Click the Settings button in the main toolbar.



The software will first download the settings from the device.

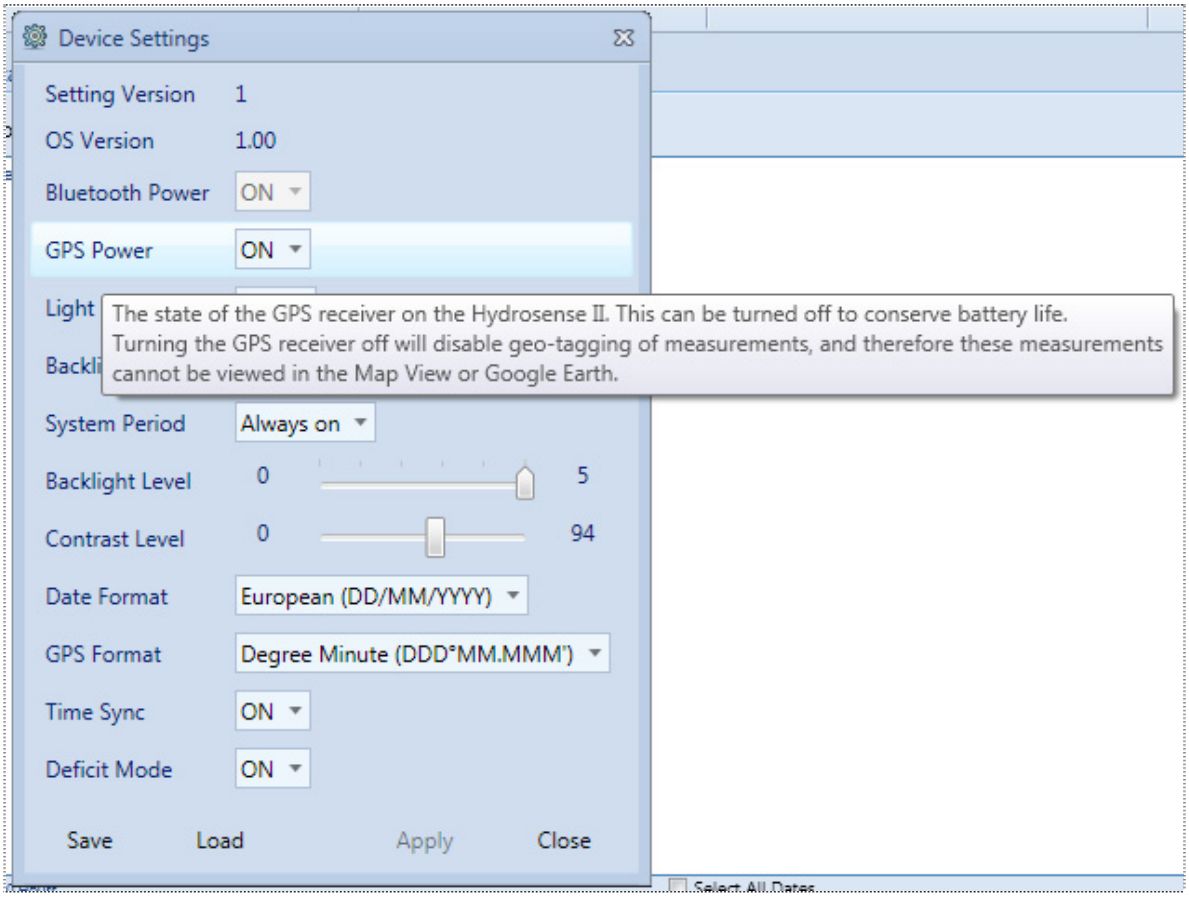


Then the Device Settings Window will be displayed.



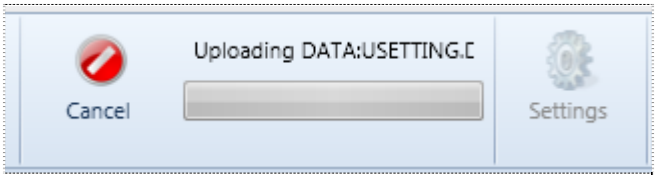
The device settings shown in the window will depend on the current version of the operating system. The settings in the preceding figure are for the first released version of the HydroSense II display operating system.

Move the pointer over the labels at the left of the screen to see more information about each setting.



Change settings using the list boxes and sliders. The Apply button will be disabled until a setting is changed. Press Apply to save the settings to the HydroSense II.

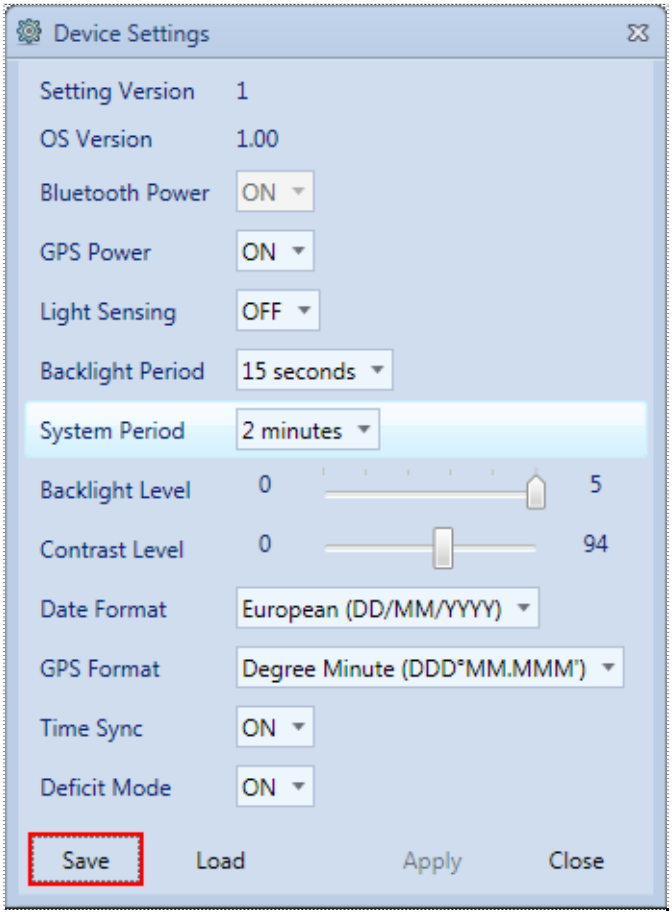
After pressing Apply, the main window will show the settings file being uploaded to the HydroSense II.



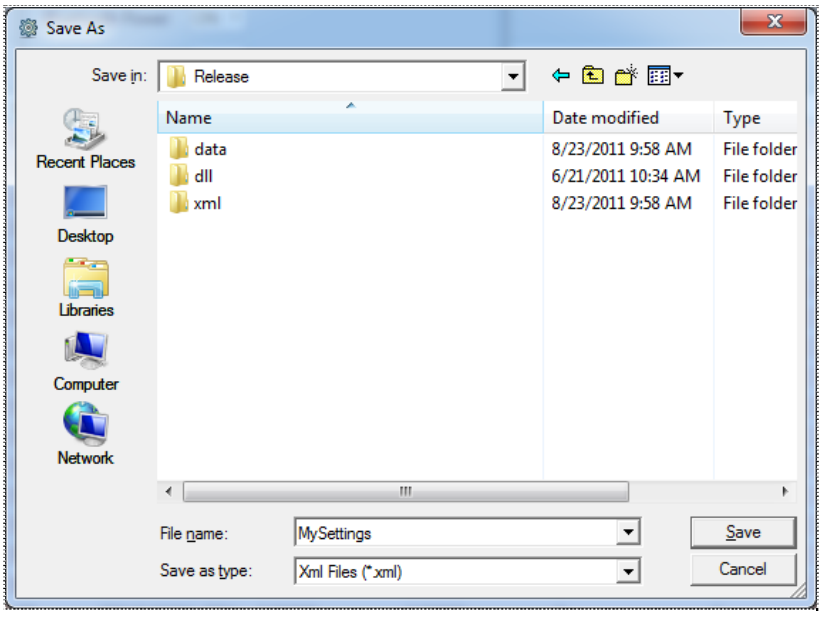
5.2.1 Saving Settings

During a firmware upgrade, the device settings of the HydroSense II will be lost. The Device Settings window can be used to save the settings before the upgrade.

Open the Device Settings window, then click the Save button.

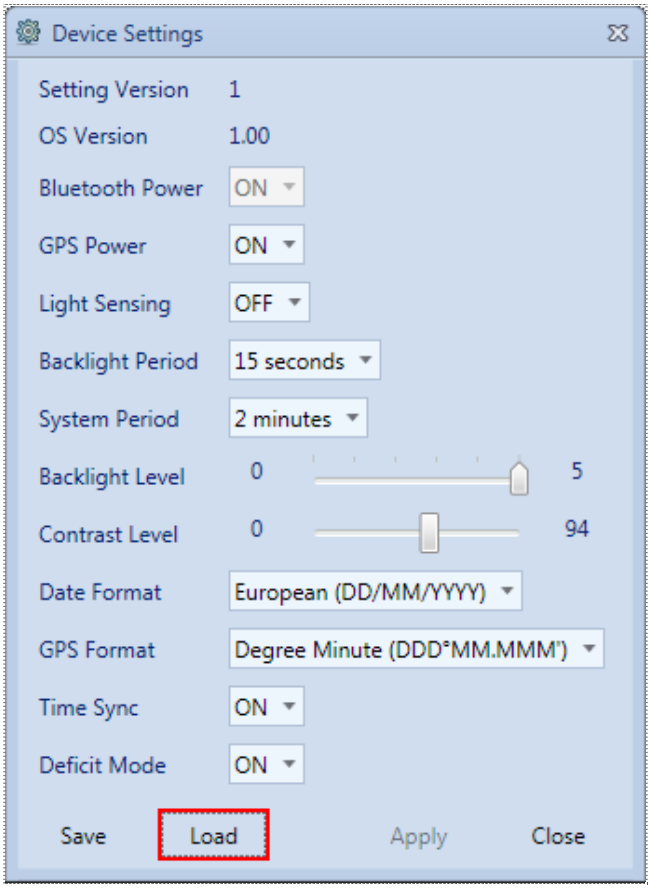


Choose a location on the local PC to save the settings in an .xml file, then click Save.

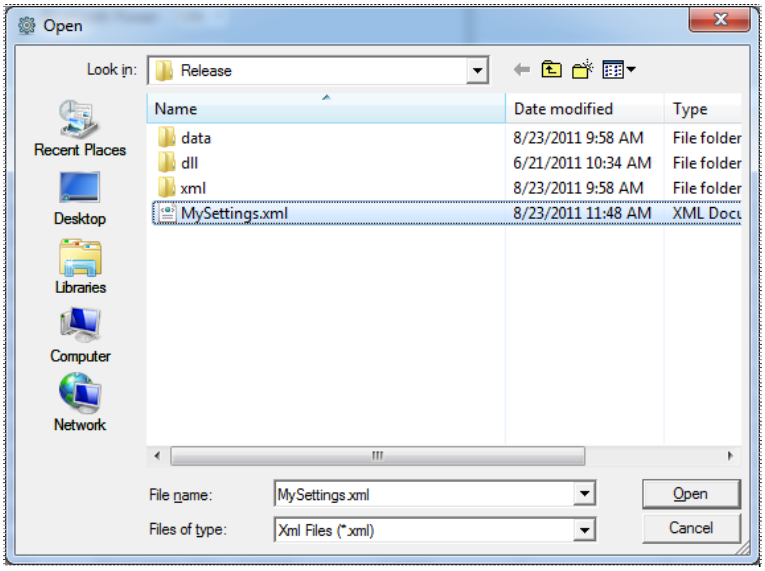


5.2.2 Loading Settings

Open the Device Settings window, then click the Load button.



Browse to the location of the settings .xml file on the local computer and click Open.



The window will be updated with the saved settings. Press the Apply button to update the HydroSense II display with these settings.

5.3 Measurement Colors

HydroSense II Support Software provides three ways to visualize data: Data tab, Chart tab and Map tab. In each tab, colors are used to represent the value of volumetric water content (VWC) from a measurement.

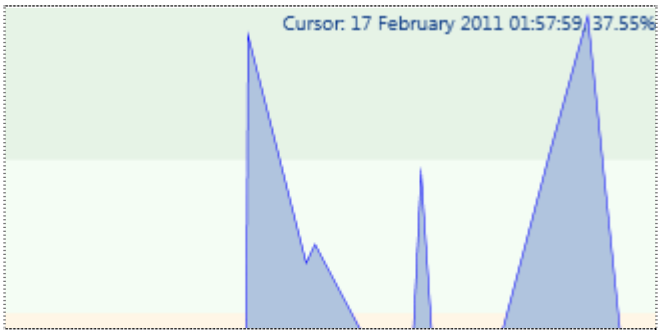
5.3.1 Data Tab

The background of each data record is colored based on the VWC measured at that point.

11/02/2011 06:37:02	1	Unspecified Zone	-19.27407	146.80171	36.58315
11/02/2011 07:36:20	2	Zone 5	-19.27285	146.80182	89.53485

5.3.2 Chart Tab

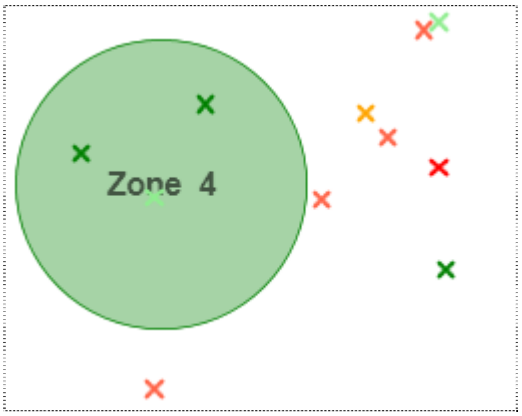
The background of the chart is colored with bands to show colors used for each level of VWC.



5.3.3 Map Tab

Zones in the map are colored based on the average VWC of all the measurements located within that zone.

Measurements are colored based on the VWC measured at that point.



5.3.4 Changing Measurement Colors

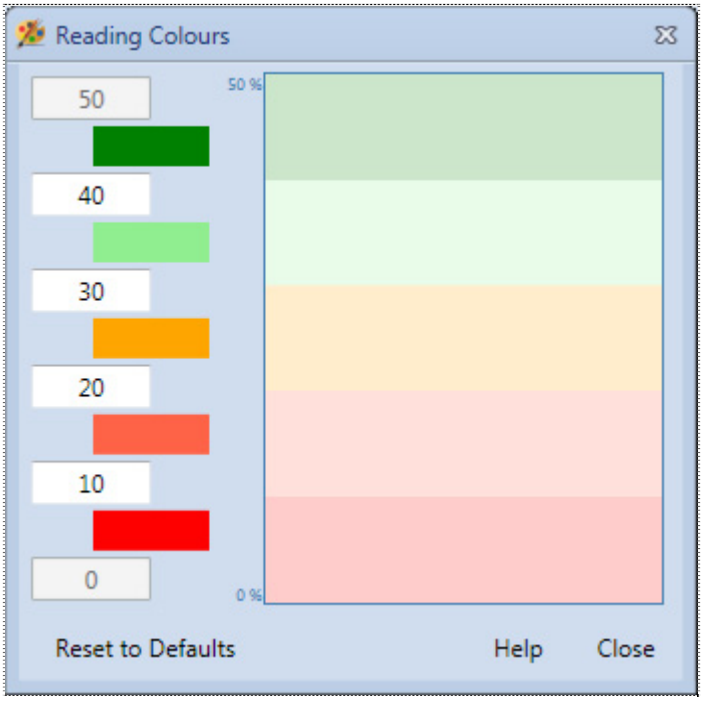
The default rules for deciding on the measurement color are shown in *TABLE 5-1. Default Measurement Colors*.

TABLE 5-1. Default Measurement Colors

Moisture Range	Color
0% < Moisture < 10%	Red
10% < Moisture < 20%	Light Red
20% < Moisture < 30%	Orange
30% < Moisture < 40%	Light Green
40% < Moisture < 50%	Green

These color levels can be customized. Click the Options menu in the main window, and choose Reading Colors.

The window contains six edit boxes and five color buttons.



Each color button is positioned between two edit boxes. The values in the edit boxes represent the upper and lower VWC limits for the reading color shown on the color button between them.

In the default configuration, the color RED is positioned between the values 0 and 10. This means that measurements between 0% and 10% VWC are assigned the color RED.

To change the levels at which colors begin and end, edit the values in the edit boxes. The preview at the right of the window will update automatically. The edit boxes will accept only numeric digits and will show a red outline when an invalid entry has been made.

The 0% and 50% edit boxes are disabled; these represent the minimum and maximum output from the sensor and cannot be edited.

To change the colors displayed, click the desired color button to open a selection dialog box.

Click one of the colors in the selection dialog box. The dialog box will close, and the selected color button will update its background to the selected color.

To close the dialog box without making a selection, click anywhere else in the Reading Colors window.

At the right of the Reading Colors window is a sample chart background.

This sample background updates automatically when changes are made to the values and colors on the left. It shows the background to be used for the Chart tab given the current selections.

Press the Reset to Defaults button to revert the reading colors to the factory default selections (shown in the preceding figures).

Press the Close button to save changes and return to the main window.

Section 6. Terms

6.1 Bluetooth Adapter

The Bluetooth adapter is a hardware device connected to the local PC that transmits and receives radio signals required for Bluetooth communications.

On desktop computers, the adapter is usually a USB device that connects to a USB port on the computer. If the HydroSense II Support Software is reporting a BTStackError, check that the USB device is firmly inserted into a USB port on the PC. The Bluetooth stack on the computer should recognize that the device is attached.

On laptop computers, the adapter is often built into the laptop hardware so that an extra USB adapter is not required. These laptop computers will have an option to enable/disable the internal adapter. Usually, this function is performed by a special key on the laptop keyboard or an extra sliding switch on the side of the laptop. If the software is reporting a BTStackError, check that the internal Bluetooth adapter is enabled using the hotkey or switch.

6.2 Bluetooth Stack

The term Bluetooth stack refers to the collection of code on a PC which handles Bluetooth traffic.

HydroSense II Support Software supports the four major Bluetooth stacks currently on the market: Microsoft, BlueSoleil, Toshiba and Broadcom.

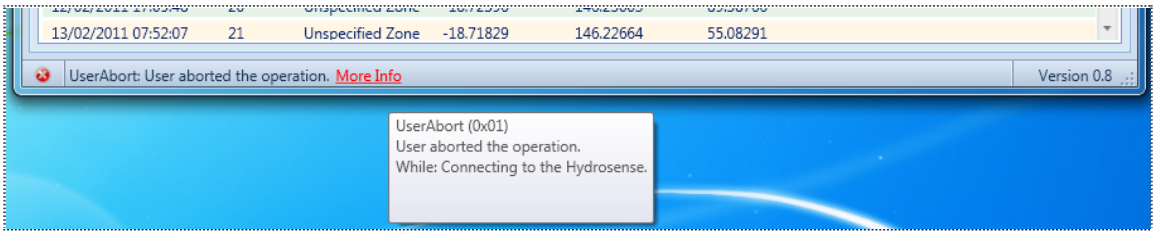
6.3 VWC

VWC is an acronym for volumetric water content. This is a measure of the volume of water present in soil expressed as a percentage of the total volume. A VWC of 20% indicates that the water fraction is 20% the soil by volume.

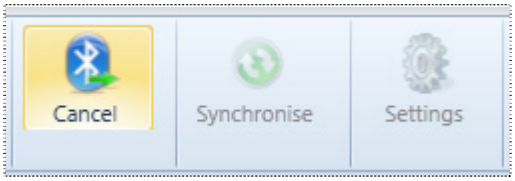
Section 7. Error Codes

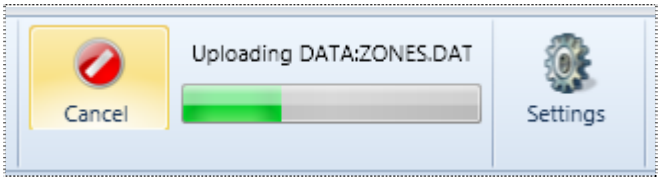
7.1 (0x01) UserAbort

User aborted the operation.



This error is shown when a connection or synchronization attempt is cancelled by clicking the Cancel button.

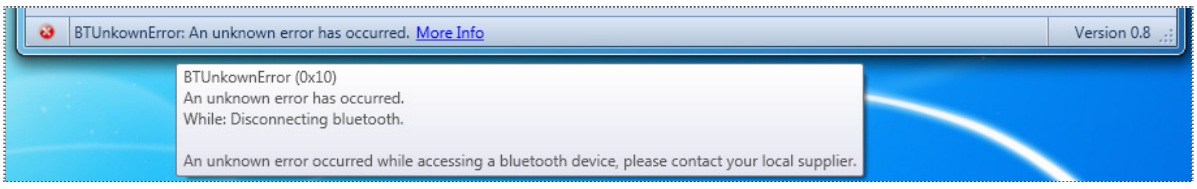




This error does not normally indicate a problem with communications; however, if it is displayed without the Cancel button being pressed, and it prevents normal operation of the software, please contact Campbell Scientific.

7.2 (0x10) BTUnkownError

An unknown error has occurred during Bluetooth communications.



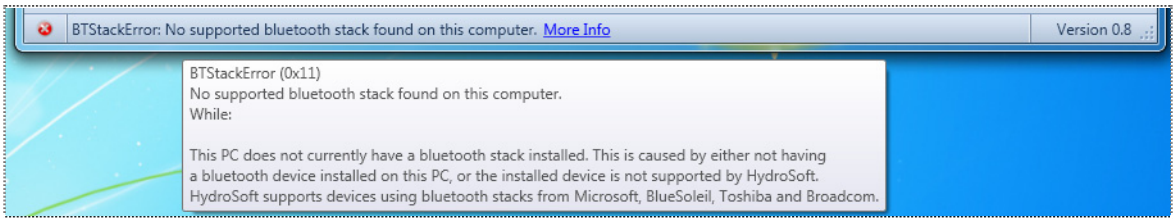
This error is shown when communication with the HydroSense II has failed and the Bluetooth driver on the local computer did not specify the cause of the failure.

If this error has occurred, attempt to reproduce the error a second time by following the same steps that resulted in the first error.

If the error is confirmed, please report the error to Campbell Scientific with the steps required to reproduce the error.

7.3 (0x11) BTStackError

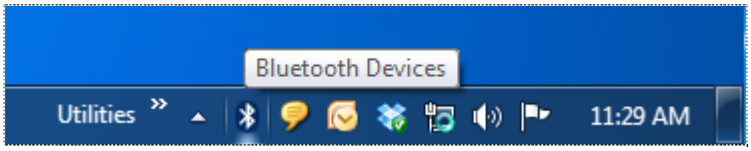
No supported Bluetooth stack found on this computer.



The software did not find a compatible Bluetooth stack on the local PC. This will usually occur on a desktop machine where the Bluetooth adapter has not been connected or on a laptop where Bluetooth has been disabled.

First, check that the Bluetooth adapter is connected via a USB port, or that Bluetooth has been enabled if using a laptop. Most new laptops have an external button or a keyboard key to toggle Bluetooth.

If the Bluetooth adapter is connected, and Bluetooth is turned on, check whether Windows has recognized the Bluetooth adapter. If Windows has recognized the Bluetooth adapter, a Bluetooth icon should be displayed in the Windows notification area.

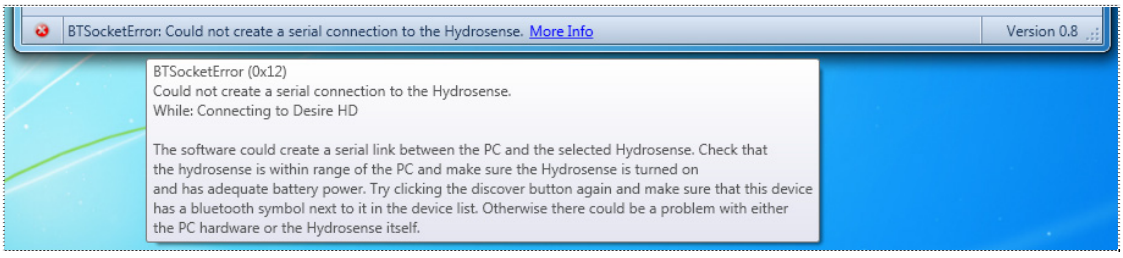


The Bluetooth icon should be shaded blue. If it is shaded grey or is missing, Windows has not recognized the Bluetooth hardware. Please contact the supplier of your Bluetooth hardware for assistance.

If the Bluetooth icon is present, then Windows has recognized the Bluetooth hardware, but HydroSense II Support Software has not. Please report the issue to Campbell Scientific.

7.4 (0x12) BTSocketError

Could not establish a connection to the HydroSense II.



This error occurs when the Bluetooth adapter on the local PC is not able to create a connection to the HydroSense II. This can be caused by the device being out of range, or not responding to Bluetooth requests.

Try the following steps to rectify the issue:

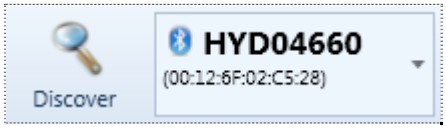
NOTE Make sure the HydroSense II is powered on. Check that the display is on and responsive.

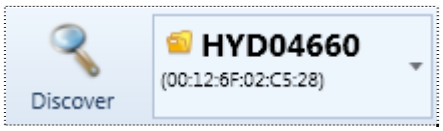
Make sure that the HydroSense II is within range of the PC. The maximum distance that the display can be situated away from the PC depends on the class of the Bluetooth adapter used by the PC, as shown in *TABLE 7-1. Bluetooth Transmission Distance* (p. 7-3).

TABLE 7-1. Bluetooth Transmission Distance

Bluetooth Class	Maximum Distance
Class 1	5 m
Class 2	10 m
Class 3	100 m

Press the Discover button in the software again and check that a Bluetooth symbol is shown next to the device serial number.



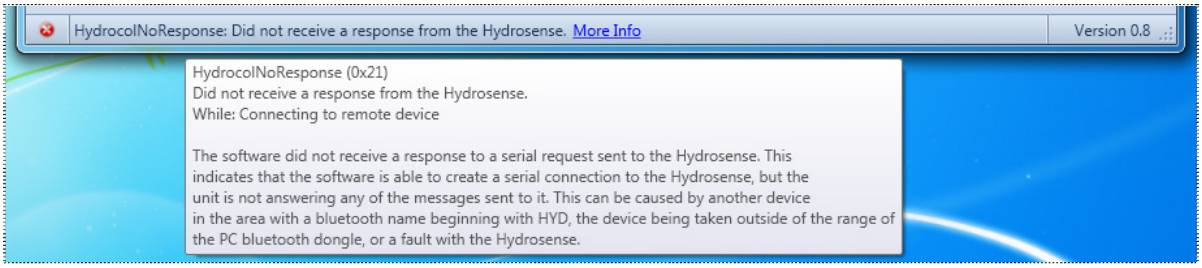


If a folder icon is shown instead, the software did not detect the device during the discovery process. Restart the PC software and the HydroSense II and then attempt another discovery.

If the device is still not discovered by the software, or if the device is being discovered but cannot establish a connection, please report the issue to Campbell Scientific.

7.5 (0x21) HydrocolNoResponse

Did not receive a response from the HydroSense II.



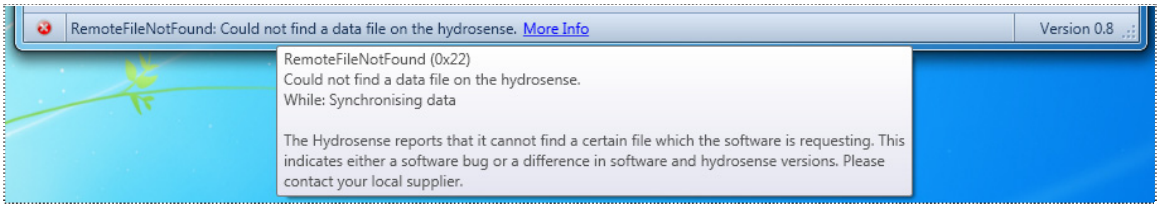
The software did not receive a response to a request sent via Bluetooth. This means that the Bluetooth connection was successfully connected, but communications after the initial connection failed.

Failure may be caused by:

- Another device in the area is accepting Bluetooth connections with a name beginning with the letters "HYD". Check that the serial number of the currently selected device in the software (the 5 digits after HYD) matches the serial number printed on the HydroSense II. If multiple HydroSense II units are within Bluetooth range, turn off all but one.
- The HydroSense II has been taken out of Bluetooth range after the initial connection. Ensure that the HydroSense II is well within the Bluetooth range specified by the Bluetooth adapter on the local PC.
- There is a fault with the HydroSense II or the PC software. If the No Response error can be reproduced a second time, and the preceding steps do not fix the issue, please report this to Campbell Scientific.

7.6 (0x22) RemoteFileNotFound

Remote file not found.



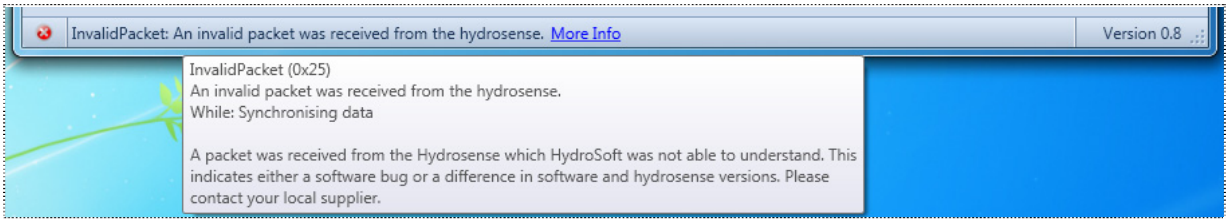
Data and zone information are stored in files on the HydroSense II. During synchronization, the software downloads these files from the device. If this error occurs, it means that the remote device does not recognize the file the software is asking for.

This can be caused by an older version of the software communicating with a device with new firmware. Please visit *www.campbellsci.com* to check whether an updated software version is available.

If the latest version of the software is being used, please report the issue to Campbell Scientific.

7.7 (0x25) InvalidPacket

Invalid packet received.



The software has received a response from the remote that is either the wrong length or has an incorrect format.

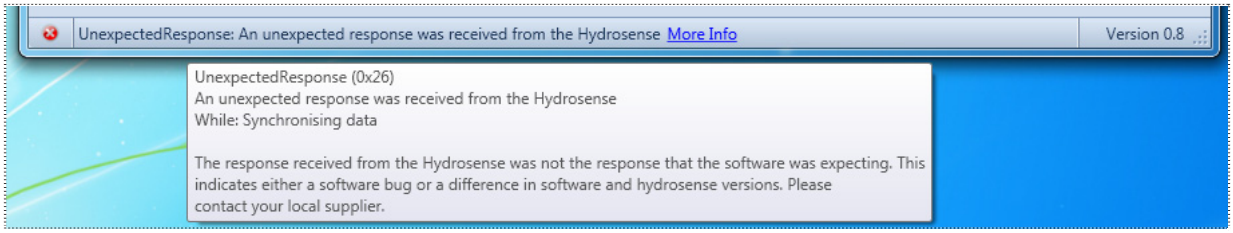
This can be caused by an older version of the software communicating with a device with new firmware. Please visit *www.campbellsci.com* to check whether an updated software version is available.

The error can also be caused by a weak Bluetooth connection with the remote device. Ensure that the device is well within the maximum distance quoted by the Bluetooth adapter on the local machine. The maximum communication distances for Bluetooth adapters are listed in *TABLE 7-1. Bluetooth Transmission Distance*.

If the error persists, please contact Campbell Scientific.

7.8 (0x26) UnexpectedResponse

Unexpected response received from the device.



The software has received a properly formatted response from the HydroSense II, but it is not the response that the software was expecting. This can be caused by an older version of the software communicating with a device with new firmware. Please visit *www.campbellsci.com* to check whether an updated software version is available.

If the latest version of the software is being used, please report the issue to Campbell Scientific.

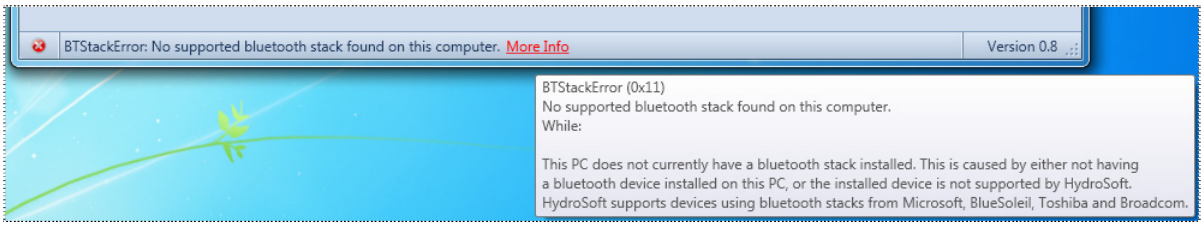
7.9 Reporting an Error

The following information is required when reporting an error code to Campbell Scientific.

1) Error Code

For example: BTStackError (0x11)

To find out more information on a particular error code, prompt an infotip by pausing the pointer over the error, or click More Info.



2) Steps to Reproduce the Error

For example:

1. Pressed the Discover button to discover the HydroSense II.

2. Selected the HydroSense II device from the list.

3. Pressed Connect.

4. Connection failed with the error BTUnkownError.

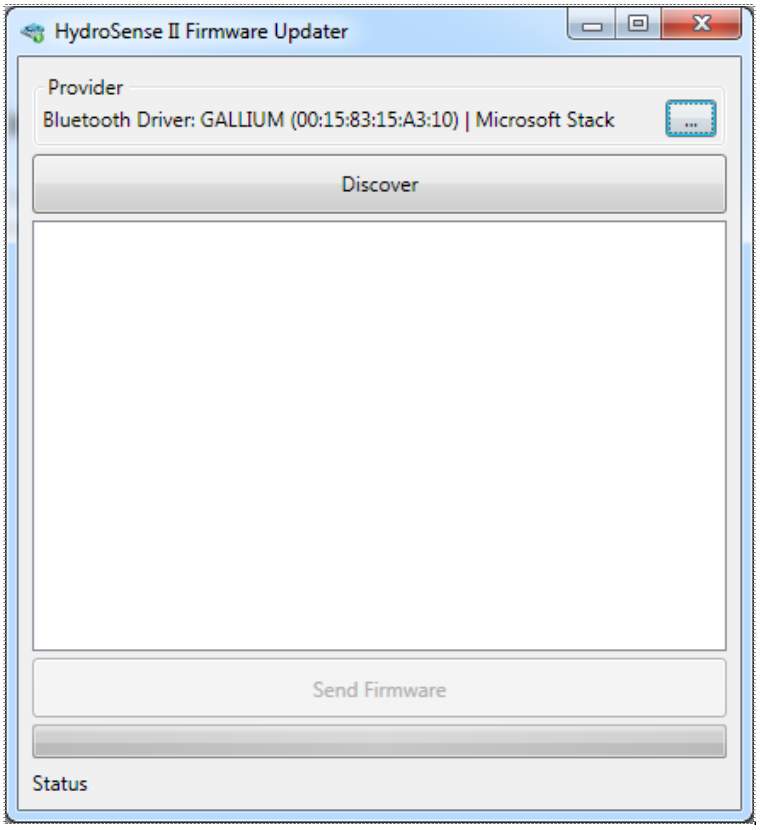
Please indicate whether these steps, prior to the error, had worked as expected.

3) Bluetooth Adapter Make and Model

Please supply the make and model number of the Bluetooth adapter if using a desktop computer. Supply the laptop make and model number if using a laptop computer.

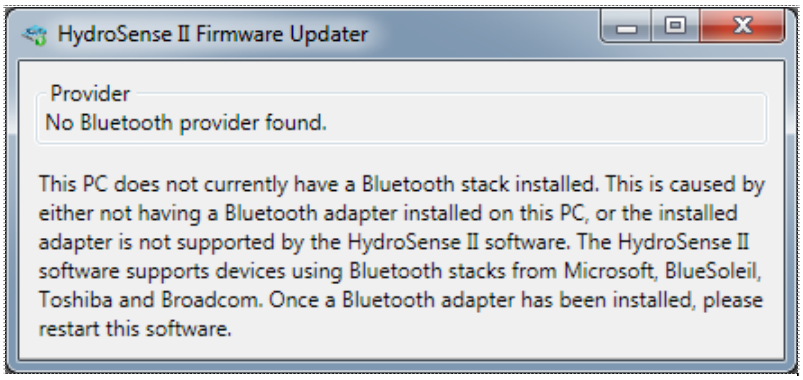
Section 8. Operating System Updater

The software includes a facility to update the operating system on the HydroSense II. This can be run from the Operating System Updater shortcut under the Campbell Scientific > HydroSense II group in the Windows Start menu.



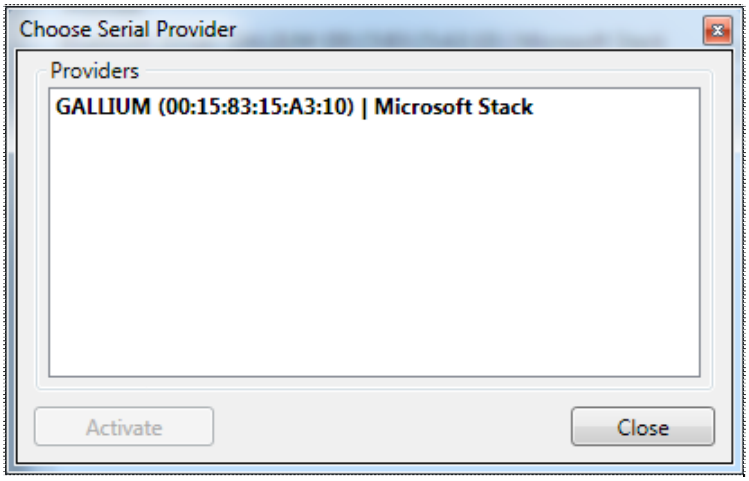
8.1 Bluetooth Provider

The facility uses Bluetooth to transfer a new operating system to a HydroSense II display. The Bluetooth provider used is shown in the upper portion of screen. A Bluetooth provider refers to either a USB dongle or a built-in USB chip in a laptop. If no Bluetooth provider is found, the following screen will be displayed.



Make sure that Bluetooth is enabled on the local PC. Bluetooth can be toggled using an external switch on a laptop or a special function key on the keyboard. Bluetooth can also be toggled using the Bluetooth icon in the Windows notification area. If Bluetooth is enabled and working with other devices and the error in the preceding figure is still displayed, please contact Campbell Scientific.

If multiple Bluetooth providers are available, click the browse button next to the current provider to select a different provider:



The currently selected provider will appear in bold in the list. To activate a different provider, double-click on its name, or select the provider and press the Activate button. Then close the window using the Close button.

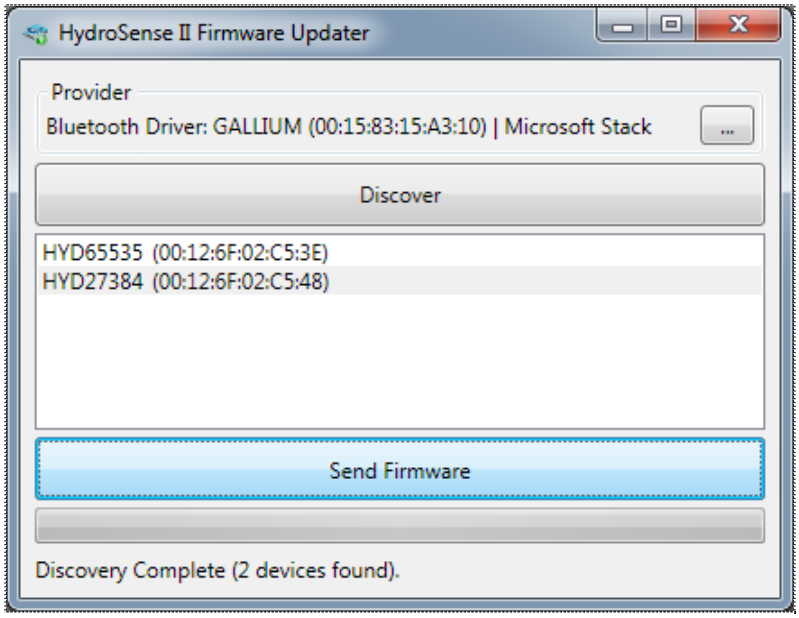
8.2 Discovering the Device

To send an operating system to the device, it must be powered on in "boot loader" mode. The procedure to do so is as follows:

- Make sure the HydroSense II is turned off
- Press and hold the up arrow button
- With the up arrow still depressed, press and hold the power button for two seconds

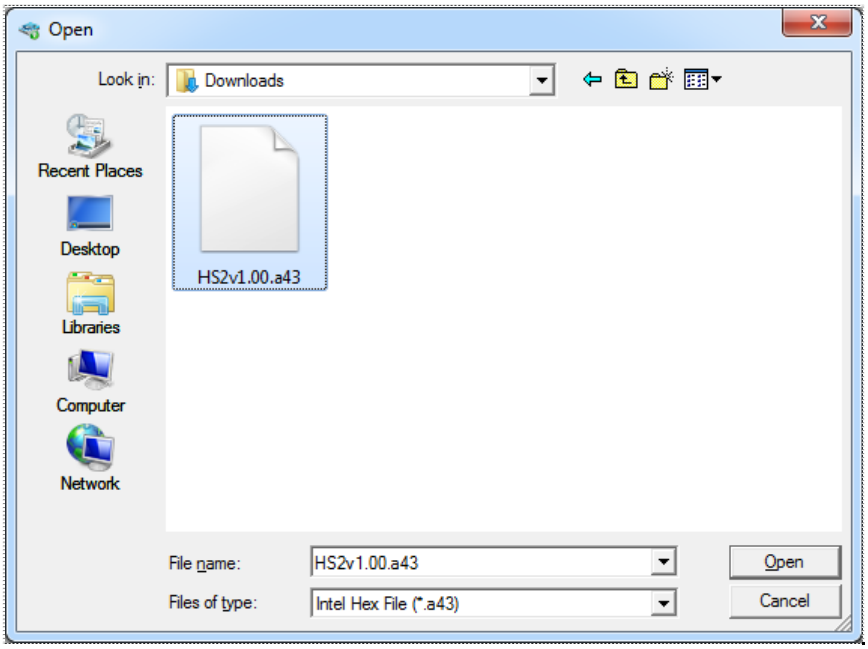
The HydroSense II will power on in "boot loader" mode and flash the LCD display.

The device will remain in this mode for two minutes. Return to the software and press the Discover button. The device should be displayed with its serial number.

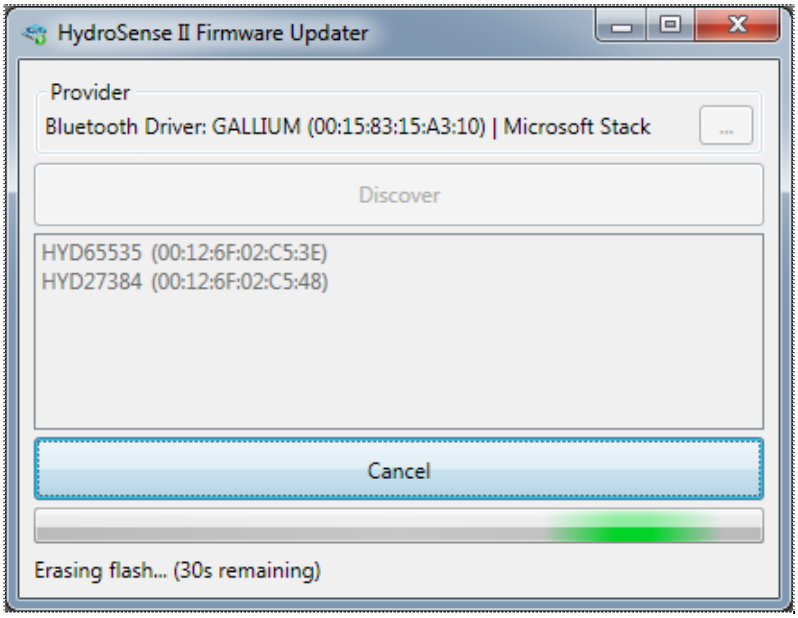


8.3 Sending an Operating System

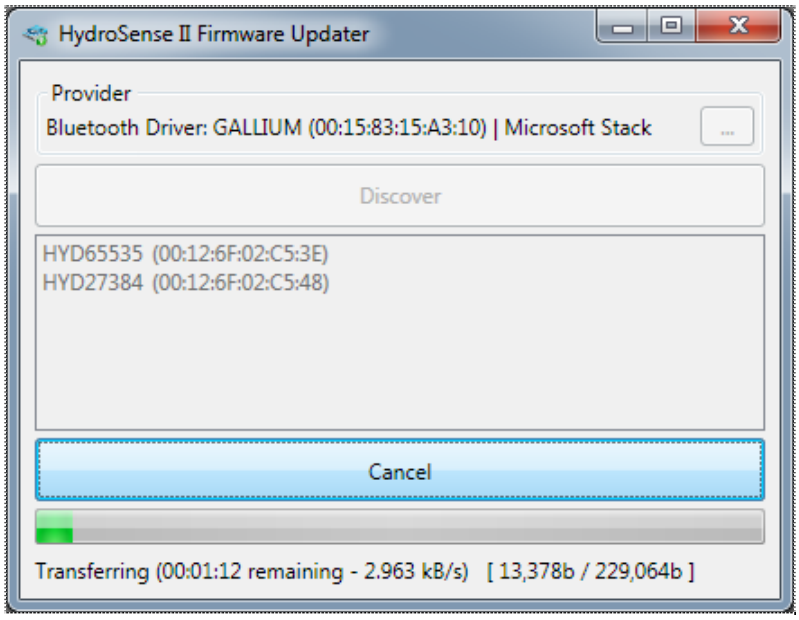
Select the device and press the Send Firmware button. This will open a file browser. Select the .a43 file for the new operating system. When a new operating system becomes available, it will be listed in the Downloads menu at *www.campbellsci.com* as an .a43 file. It is this file that should be selected in the file browser.



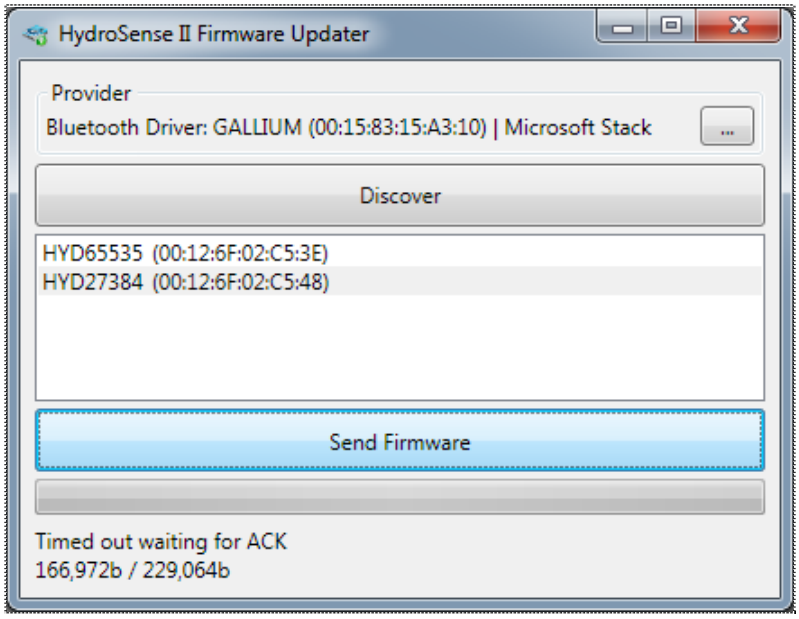
Click the Open button to begin the transfer. The HydroSense II will flash the LCD display rapidly to indicate a transfer is in progress.



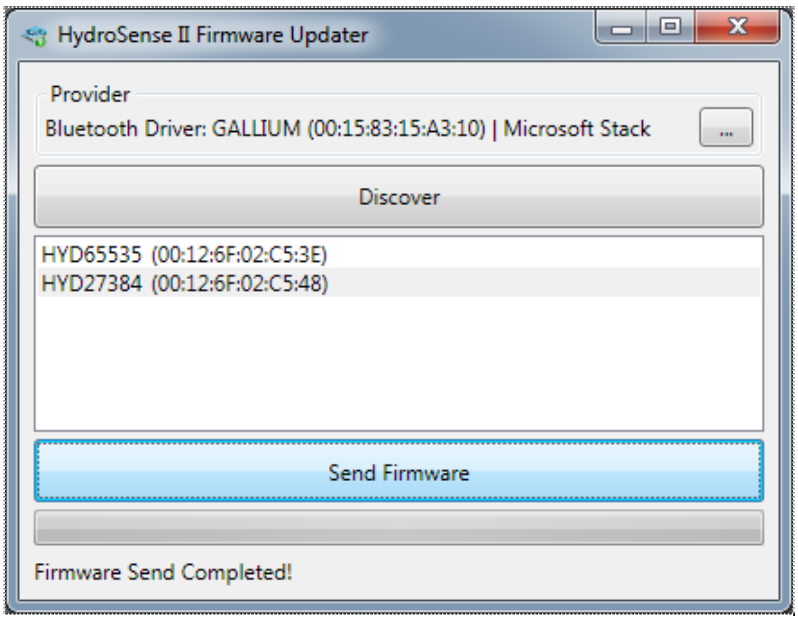
The device will first erase the old operating system. This process takes about 30 seconds to complete.



When the old operating system is erased, the facility will transfer the new operating system to the device. This process takes about 90 seconds to complete. A progress bar reports the transfer progress.



If there is a Bluetooth error while transferring the operating system, the error will be shown below the progress bar. The HydroSense II will turn off, and the operating system transfer will fail. At this point, the HydroSense II will not power normally on as it has an incomplete operating system. The device can still be powered on in "boot loader" mode. In event of an error, repeat the operating system transfer procedure. If the error continues, please contact Campbell Scientific.



Once the transfer is complete, the HydroSense II display will power off and the update facility will display a message indicating the transfer was successful. The HydroSense II display can now be powered normally.

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