

## Using ECH2O Utility Software

ECH2O Utility is a free software product from Decagon Devices, Inc. (Pullman, WA) that can be used to configure the Em50 series data loggers. It is compatible with Decagon's line of ECH2O sensors, data loggers and radio telemetry (Decagon Devices, Inc. 2013). Before field/greenhouse installation data loggers need to have certain parameters set - such as name, date and time, measurement interval, etc. - for proper functioning. In addition, the communication mode for the radio-enabled Em50R and the cellular Em50G data loggers has to be properly configured. ECH2O Utility provides a simple way to connect to and carry out these tasks for the Em50 series data loggers.

An example of the ECH2O Utility software screen is given in Figure 1. In the following sections, the steps involved in the configuration of data loggers using the ECH2O Utility software, various features/functionalities of the software and some tips for use are provided.

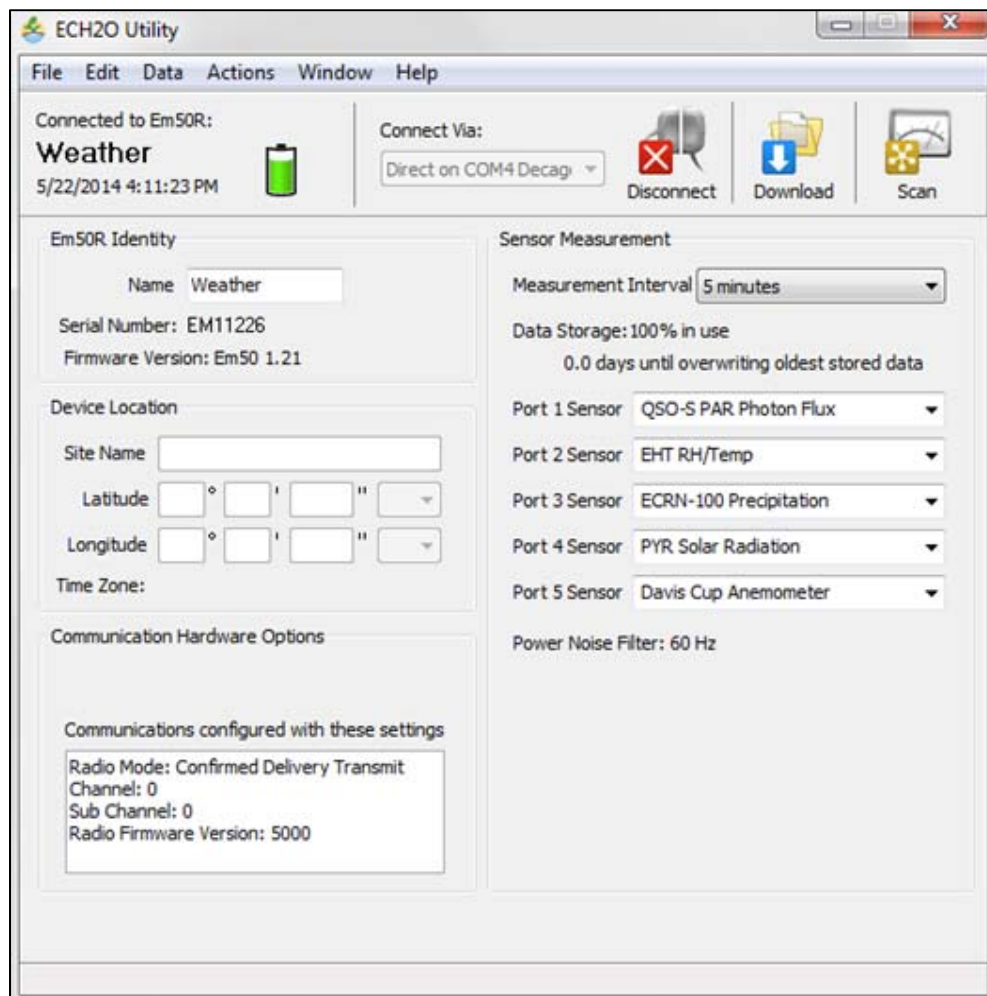


Figure 1. The ECH2O Utility screen showing configured data logger.

## 1. Configuring data loggers using ECH2O Utility

Although the Em50 series data loggers do not require programming, several parameters have to be set to control the identity of the loggers and how they function (Decagon Devices, Inc. 2014). The steps involved in configuring the data loggers using ECH2O Utility are outlined below.

### 1.1. Connecting to the data logger

Direct connection to the data loggers is achieved through the USB Cable Adapter (UCA) provided in the package with the logger. A driver for the UCA must be installed on a computer/laptop before it can be used to communicate with the Em50 logger. The driver installer can be found on the ECH2O System Software CD or from Decagon's website at <http://www.decagon.com/support/decagon-usb-cable-adapter-driver/>. After the driver is installed properly, the steps below can be followed to connect to the logger.

- Open the ECH2O Utility program on a computer/laptop
- Plug the 3.5 mm stereo end of the USB cable adapter into the logger's 'COM' port and the USB side into the USB port of the computer
- At the top of the ECH2O utility screen, select the appropriate COM port from the 'Connect via' drop down menu and click on 'Connect'. When using the USB cable, look for the 'Connect via' option that includes 'Decagon UCA' in the port name (Figure 2).

After successful connection, all menus and icons on the ECH2O Utility screen become active. The existing settings of the logger - sensor name, communication mode, measurement interval and sensors selection for the various ports will be displayed. The data logger in Figure 1, for example, is properly connected and the various settings are displayed. Once connection is established, the desired new settings in the configuration of the data logger can be made. Changes in configuration can also be made for data loggers that have been configured before.

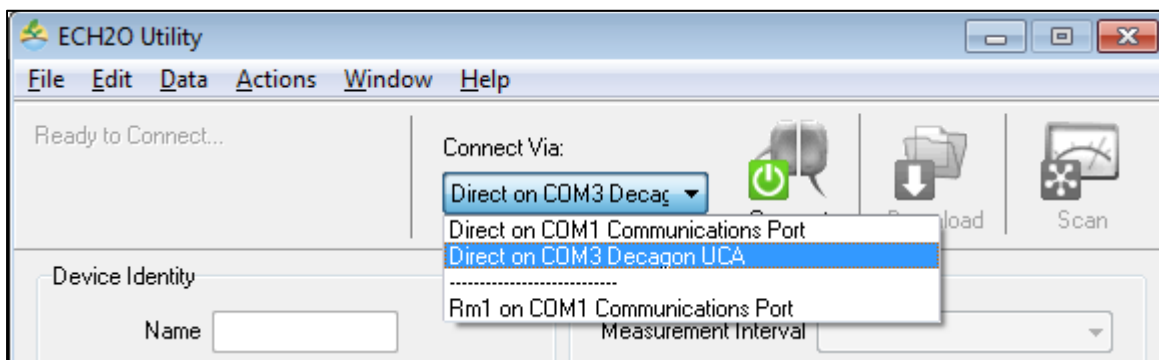


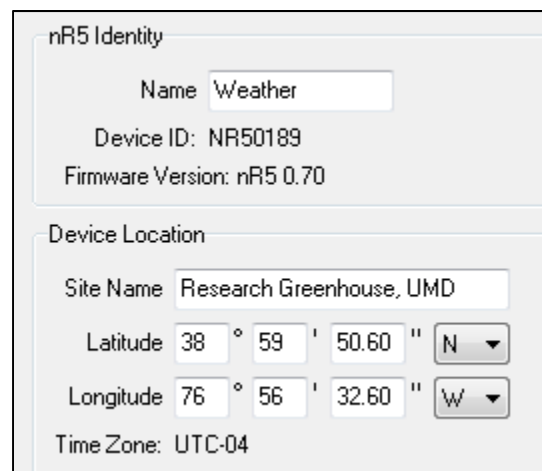
Figure 2. The communication port for showing 'Decagon UCA' with the port name is selected.

## 1.2. Naming the device and site

Each data logger installed in a field/greenhouse operation should have a unique name/identifier. This logger name can represent the name of the operation, crop, production block, treatment etc. ECH2O Utility allows a maximum of eight characters (including letters, numbers and most symbols) for naming data loggers. By default, data loggers have the serial number as their name. This serial number (Device ID) and the version of the current firmware installed on the data logger are displayed.

The site name field, available on some data loggers, can be used to identify the general location of the area where the data logger is installed. In addition, the latitudinal and longitudinal position of the area can be entered and saved in these data loggers. Both of the above are optional parameters and do not affect how data loggers function. However, they are useful for organizing the data logger when used in the DataTrac software (Decagon Devices, Inc., Pullman, WA) and to keep record of where the data logger is geographically located, respectively (Decagon Devices, Inc. 2013). The time zone of the location of the data logger is displayed. An example of data logger containing such optional information is given in Figure 3.

- Assign device name, site name and location to the data logger.



nR5 Identity

Name: Weather

Device ID: NR50189

Firmware Version: nR5 0.70

Device Location

Site Name: Research Greenhouse, UMD

Latitude: 38 ° 59 ' 50.60 " N

Longitude: 76 ° 56 ' 32.60 " W

Time Zone: UTC-04

Figure 3. ECH2O Utility screen showing device name, site name and geographic location.

## 1.3. Setting communication mode

Proper communication between data loggers installed in production zones and a BaseStation (usually placed in an office) is imperative for the continuous transmission of data. In the case of the cellular

Em50G data loggers, communication with Decagon’s internet server is a must for their proper use. Using ECH2O Utility, the data loggers can be configured with appropriate communication modes.

For the radio enabled Em50R data logger, the desired radio communication mode, channel and sub channel must be selected. Of the available options, the “Confirmed Delivery Transmit” radio mode ensures the most complete data transfer and the best battery life (Decagon Devices, Inc. 2014). However, there may be instances when other radio modes are preferred depending on the existing situation. Please refer to the [Em50-Em50R-Em50G Operator’s Manual](#) for detailed information on the radio modes available and their use. The channel and sub channel settings on data loggers and BaseStation has to be the same to enable their proper communication. The radio enabled nodes (such as Em50R) has a default channel and sub channel setting of 0, 0 (Figure 4). These settings can be changed in ECH2O Utility. If two or more BaseStations are going to be installed at one location, it is imperative that the BaseStations and nodes have differing channel and sub channel settings to avoid interference between them.

- Click on ‘Configure’ and select the communication mode, channel and sub channel desired

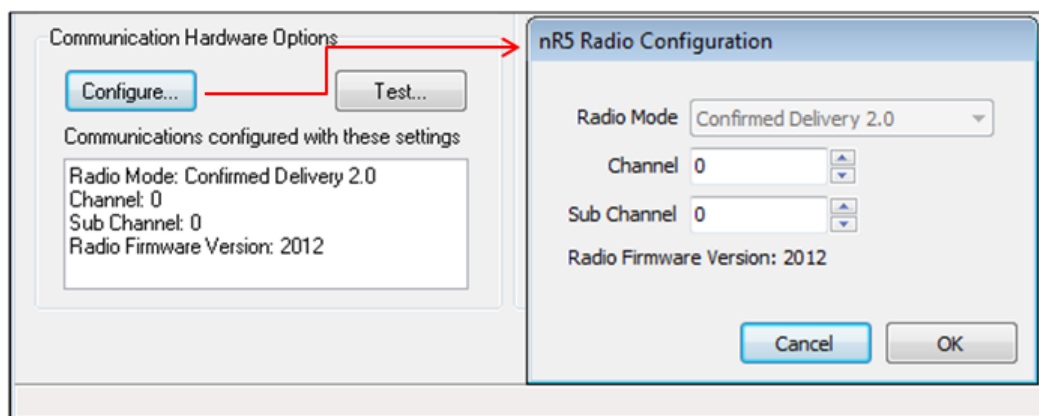


Figure 4. Communication mode, channel and sub channel are set for the node indicated.

Cellular communication for the Em50G data loggers is enabled using an activated subscriber identity module (SIM) card from a cellular network provider. Once communication with Decagon’s internet server is established, upload times can be selected to send data collected to the internet server at intervals. Upload times selected should be limited to reduce battery consumption.

- Click on “Configure” and check the “Upload data to ECH2OData.com” box
- Select the data upload times desired.

The ECH2O Utility software also allows testing the telemetry/communication quality (Figure 5) between a data logger and BaseStation (Decagon's internet server for Em50G nodes). This function is essential as it ensures data loggers deployed at a certain location in an operation are properly communicating with the BaseStation that may be sitting far away. Communication between Em50G nodes and Decagon's internet server can also be tested in the same way.

- Click on the "Test" button to check telemetry between data logger and base station/internet server.

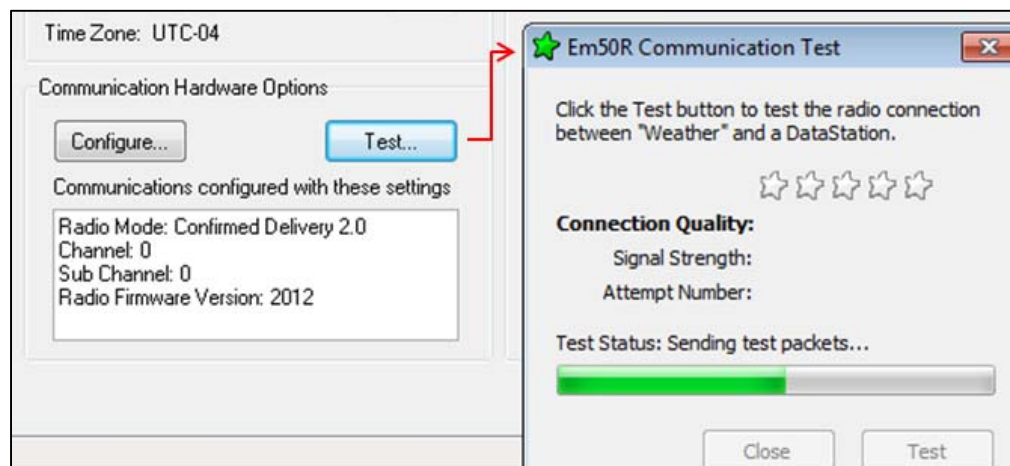


Figure 5. A communication test underway in ECH2O Utility.

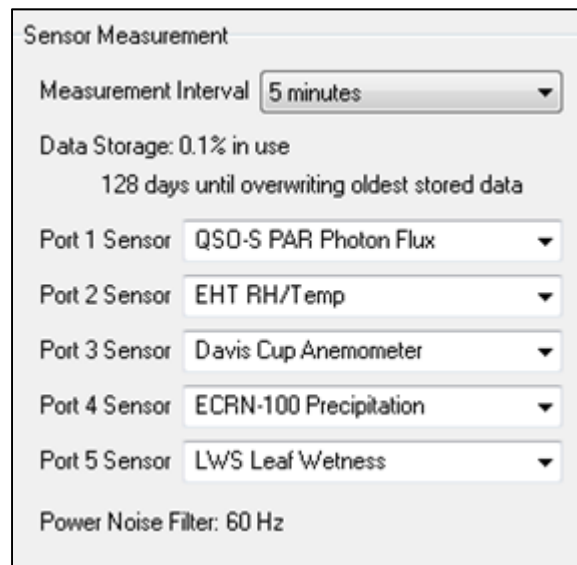
#### 1.4. Selecting measurement interval and sensors

Data recording in the Em50 series data loggers starts when a measurement interval is selected. Measurement interval can range from 1 min (5 min for Em50G data loggers) to 1440 min (1 day). No data will be logged when the measurement interval is set to 'Off (not logging)'. For most sensor types, regardless of the measurement interval selected, the Em50 series data loggers take sensor readings every minute. The 1-minute readings are then averaged and logged when the Em50's internal clock reaches the user-selected measurement interval. The data logger stores the average of all 1-min sensor readings taken since the last data stored (Decagon Devices, Inc. 2014). Readings are taken and recorded for all sensors attached to the five sensor ports.

ECH2O Utility also allows the selection of sensors that will be plugged to each of the five sensor ports in the Em50 series data loggers. A wide range of sensors, including soil moisture and electrical conductivity sensors, sensors for measuring environmental/weather variables, flow meters etc. are compatible with

the Em50 series data loggers. A weather node showing a range of environmental sensors is given as an example in Figure 6.

- Select the measurement interval of choice
- Select the sensors types from the drop down menu for each of the five ports. Leave empty ports as “None Selected”.



The screenshot shows a window titled "Sensor Measurement". It contains the following elements:

- A "Measurement Interval" dropdown menu set to "5 minutes".
- Data storage information: "Data Storage: 0.1% in use" and "128 days until overwriting oldest stored data".
- Five sensor selection rows, each with a label and a dropdown menu:
  - Port 1 Sensor: QSO-S PAR Photon Flux
  - Port 2 Sensor: EHT RH/Temp
  - Port 3 Sensor: Davis Cup Anemometer
  - Port 4 Sensor: ECRN-100 Precipitation
  - Port 5 Sensor: LWS Leaf Wetness
- A "Power Noise Filter: 60 Hz" label at the bottom.

Figure 6. A weather station node equipped with various sensors for environmental variables.

All new settings/changes that are made to the node configurations are sent to the device by clicking on the “Apply” button. These configurations will be saved by the node until further configuration changes are made.

- Click ‘Apply’ to save all new settings/configuration changes made
- Click the ‘Disconnect’ button (or press F2 on the key board).

The data logger can now be disconnected from the computer. The configuration process is completed and the data logger is ready to be deployed at the desired location.

## 2. ECH2O Utility functions

In addition to data logger configuration, the ECH2O Utility software can be used to perform a number of related functions. These important functions are described in the following sections.

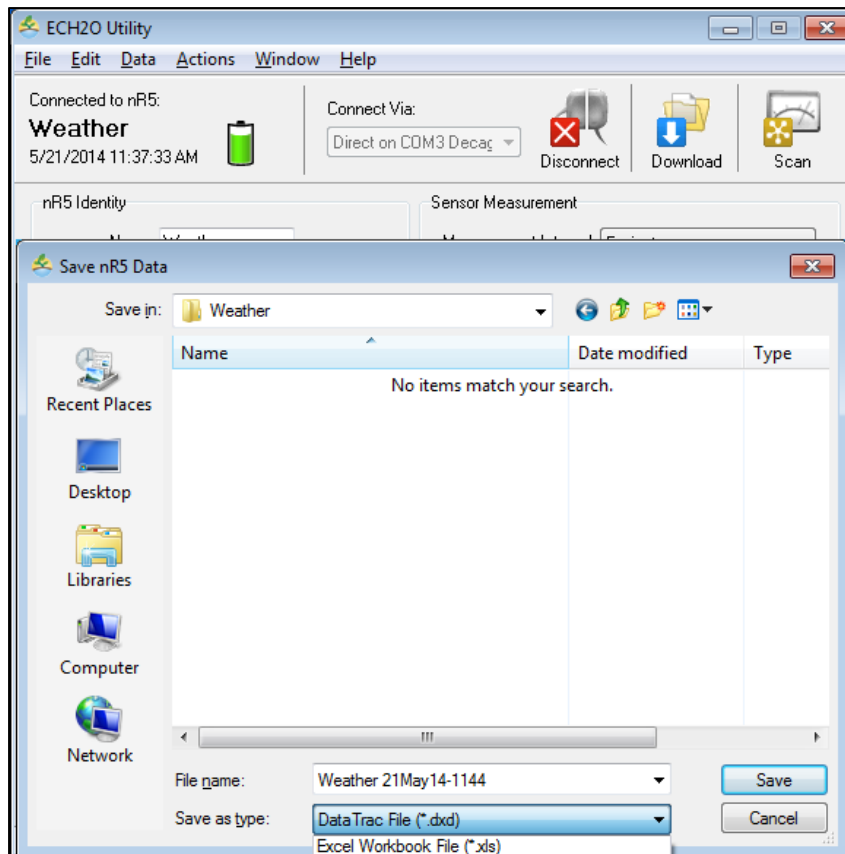
### 2.1. Downloading and erasing data

Using ECH2O Utility, both processed/calibrated and unprocessed data can be downloaded from the Em50 series data loggers in different file formats. The file formats available are excel workbook file (\*.xls), Datatrak file (\*.dxd), processed data text file (\*.txt) and raw file (\*.csv). Brief explanation of the file formats is given below (Decagon Devices, Inc. 2013).

- i) **Excel Workbook File (.xls):** converts the raw downloaded measurement data into processed values appropriate for each sensor type. The converted data are saved to sheet 1 of the workbook. Raw data are saved to sheet 2. You can use the raw measurement data to apply custom calibration to your sensor data.
- ii) **DataTrac Data File (.dxd):** saves the file in a format that DataTrac can import. Each dxd file contains information about the ECH2O logger's settings, identity, and status along with the raw data for each sensor.
- iii) **Processed Data Text File (.txt):** converts the raw downloaded data into processed values appropriate for each sensor type. Data are saved as a tab delimited text file.
- iv) **Raw Data (.csv):** saves the raw data in comma delimited file format.

ECH2O Utility uses the default conversion equation for each sensor when converting raw data to processed data (Decagon Devices, Inc. 2013). Information about the default conversion equations can be found in the data logger or sensor manual. To download stored data from Em50 series data loggers, follow these steps.

- Connect to the device directly through ECH2O Utility
- Click "Download New Data" or "Download All Data" in the "Data" menu depending on what is desired. The "Download" button on the tool bar or the keyboard short cut combination "Ctrl+D" can alternatively be used to download new data only. All new data download options collect data that is stored since the last download.
- Choose the folder to save the file in, file name, and the file format desired (Figure 7). The default file name has the name of the logger followed by the date and time of download. The file name can be changed if desired.



- Figure 7. A \*.dxd file format is being saved for the node named Weather.

Data can be permanently erased from the Em50 series data logger memory. **This process is not reversible and deleted data cannot be retrieved. So, it is advisable to download and back up data before erasing.** The ECH20 Utility software by default will ask for confirmation to make sure data is not erased by mistake. When starting new experiments or when changes in sensor configurations are made, it is advisable to download and erase old data. Similarly, firmware updates for the Em50 series data loggers erase data. Data should be downloaded and backed up before updating firmware. To erase/delete data permanently, follow the two steps below.

- Click the “Erase Stored Data” option in the Data menu
- Click “Erase Data” in the following pop-up window.

The “Report Stored Data” option in the Data menu gives the number of data scans stored in the logger and whether they have been downloaded or not.



## 2.2. Calculating memory storage and monitoring battery life

ECH2O Utility also shows the percentage of the storage memory that has been used and how many days of storage space remain on the Em50 series data logger (Figure 8). This is a function of the measurement interval selected. The number of day available for data storage can be determined by dividing the size of the data logger memory (36,864 scans) by the number of data scans stored per day. For example, a measurement interval of 1 h stores 24 data scans per day. At this rate, the Em50 logger will store  $36,864/24 = 1,536$  days (about 4.2 years) worth of data.

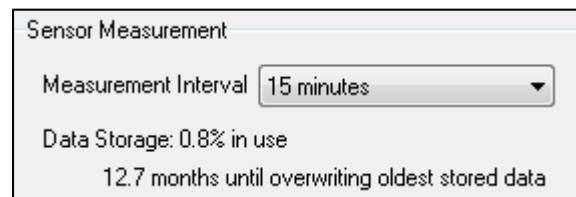


Figure 8. A measurement interval of 15 min will hold 12.7 month worth of data.

In ECH2O Utility, the battery level for the data logger is indicated in green at the top left hand side of the screen. Clicking on the battery symbol gives the remaining battery level (%) at the bottom of the screen.

## 2.3. Making real-time measurements

Real time measurements for all sensors connected to an Em50 data logger can be obtained by clicking on the “Scan” button in ECH2O Utility (or F7 on a computer keyboard). This is an important feature that can be used in a number of situations. For example, it can be used to test if a sensor is reading properly. By repeatedly clicking on the “Scan” button, changes in a variable of interest can be monitored using a sensor. The pop up window that opens when scans are taken can show both processed and raw real-time sensor readings (Figure 9). Scans taken this way are not stored by the logger.



Figure 9. Scan window showing real-time sensor measurements.

## 2.4. Changing measurement units

ECH2O Utility has a feature that allows changing the measurement units for various parameters. This capability allows data to be downloaded and displayed in the measurement unit of choice for these parameters (Figure 10). To change measurement intervals in ECH2O Utility, follow the steps below.

- Click on the "Preferences" tab in the Edit menu.
- Select the units desired for the parameter in question from the options available.

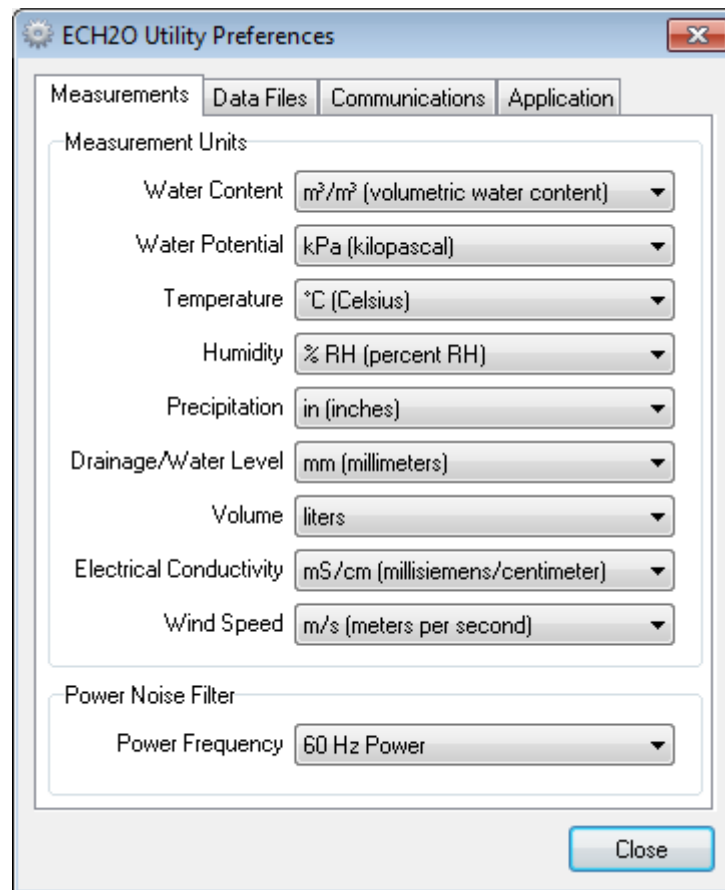


Figure 10. The preference tab in ECH2O Utility showing parameters with more than one unit.

## 2.5. Synchronizing time

When the Em50 series data loggers are connected to a computer via ECH2O Utility, they automatically acquire the computer's date and time. This is a default (and recommended) setting in ECH2O Utility (Figure 11) but can be disabled using the following steps.

- Click on "Preferences" in the Edit menu
- Click on the "Application" tab
- Uncheck the "Keep ECH2O device's clock synchronized to PC clock" to disable automatic clock synchronization.

If time synchronization is disabled, the data logger's time can be updated by going to the Actions menu in ECH2O Utility and clicking on "Set Date/time". The data logger will acquire the attached devices' date and time.

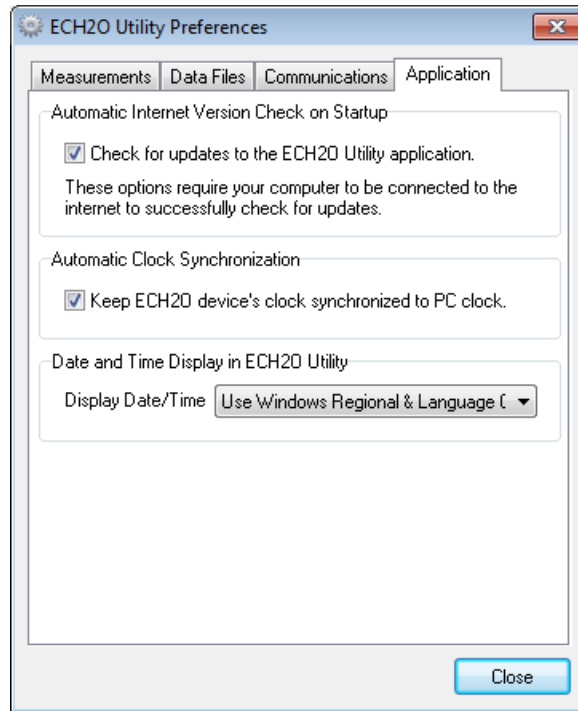


Figure 11. The ECH20 Utility preferences window has options to disable automatic clock synchronization.

## 2.6. Updating software and firmware

ECH20 Utility can also be used to check for and download updates device firmware when internet is available on the computer being used. To check for a newer version of the ECH20 Utility, choose "Check for ECH20 Utility Updates" from the Help menu. To check for updates to the firmware in your logger or Data Station, choose "Check for Device Firmware Updates" from the Help menu. Most of the ECH20 devices support user-updateable firmware (Decagon Devices, Inc. 2013). You can also view the latest information about the ECH20 software and firmware updates by visiting <http://www.decagon.com/support>.

### 3. Tips for using ECH2O Utility and installing data loggers

1. A driver for the USB Cable Adapter (UCA) must be installed on a device (computer or laptop) before it is used to communicate with the EM50 logger. If this is not done, the appropriate communication port containing “Decagon UCA” will not be available. The driver installer can be found on the ECH2O System Software CD or from Decagon's website at <http://www.decagon.com/support/decagon-usb-cable-adapter-driver/>.
2. It is important to have the correct date and local time on a computer that is being used for configuration. When moving across time zones, make sure to update the time zone on your device (if this is not automatically done).
3. When replacing batteries, it is essential to immediately connect to the data logger directly via ECH2O Utility to synchronize the time and avoid an incorrect date /time stamp on the measurements being stored.
4. Small measurement intervals consume data logger battery and memory fast. As the Em50 loggers collect data every minute for most sensor types and average and store that data. The measurement interval chosen should consider these facts and the resolution required for the data to be collected.
5. The Em50 stores “raw” data for each sensor. The stored values are not in millivolt units. The raw value has to be converted to a meaningful measurement depending on the sensor type and calibration.
6. Firmware updates to data loggers erase data. So, make sure to download and backup data first. When re-deploying data loggers for a new study or if changes are made on sensor configuration at any point, download and erase old data and start new.
7. The Em50 stores 36,864 data scans. When the logger has filled its data memory, it begins overwriting the oldest data in the memory.
8. Do not install Em50R or Em50G wireless loggers near large metallic objects, as these can attenuate the radio signal. If the loggers are mounted on a metallic post, be sure to use an antenna extension cable to mount the antenna to the top of the post. This will maximize the transmit range of the data logger.
9. Plug the sensor’s stereo jack firmly and all the way into the Em50 sensor ports. A slightly pulled out sensor does not take any measurement.
10. In field installations, make sure to install the Em50 upright to avoid water entering the data loggers’ enclosure. Check the thin rubber seal around the Em50 casing to ensure that it is firmly seated and not crimped.

## References

Decagon Devices, Inc. 2013. ECH2O Utility Help.

Decagon Devices, Inc. 2014. Em50/Em50R/Em50G Em50 Series Data Collection System: Operator's Manual. Accessed May 20, 2014. [http://manuals.decagon.com/Manuals/13453\\_Em50\\_Web.pdf](http://manuals.decagon.com/Manuals/13453_Em50_Web.pdf).

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