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**Inficon Hapsite
Sensor Interface Manual
Revision 07.08.23**

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About NexSens Technology, Inc.

NexSens software and real-time data logging systems are designed to simplify the setup and operation of environmental monitoring networks. NexSens products automate much of the tedious programming, data collection, and manual data processing common with other systems.

iChart is an easy-to-learn, easy-to-use Windows-based software program designed to interface with the industry's most popular environmental monitoring sensors and systems. A large multi-vendor instrument library makes setup quick and easy. iChart automates much of the tedious programming, data collection and manual data processing common with other environmental data collection systems.

The NexSens iSIC (Intelligent Sensor Interface and Control) is a state-of-the-art line of data loggers that simplify the collection of real-time data from environmental sensors and monitoring instruments. The iSIC data logger supports multi-vendor sensor connections and is designed for environmental data monitoring with NexSens communication equipment and software.

How to Use This Manual

This manual is designed to provide you with detailed instructions for interfacing specific sensors to the NexSens iSIC data logger.

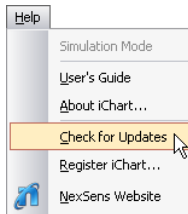
This manual provides you with all the information needed to interface your sensor with the iSIC data logger. For advanced system and sensor reference material:

- Review the material in the iSIC operations manual:
 - <http://www.nexsens.com/support/manuals.htm>
- Review the sensor manufacturer's operations manual. This information should have been provided with the purchase of the sensor. This material can also typically be found at the instrument manufacturer's website. If you are still having difficulty, email your technical support question to:

support@nexsens.com

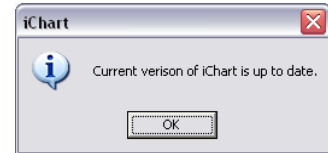
Keeping iChart Up to Date

NexSens periodically releases new versions of iChart software and iSIC firmware to be downloaded free of charge. The updated versions typically add new features, improve existing features, and/or add more reliability to the system. It is important that iChart is updated to the latest version before connecting a new sensor to your iSIC data logger. Your computer will require internet access to update automatically.

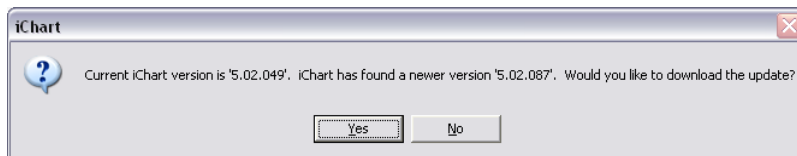


To obtain the latest version of iChart software, open the program on your computer. In the **Help** menu, select **Check for Updates**.

If your software is up to date, iChart will confirm that your computer is running the current software release.

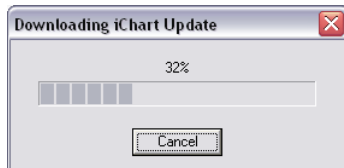


If a newer version of iChart is available, a dialog box will appear asking if you would like to upgrade to download the update.



Click **Yes**. iChart will begin downloading the update.

Note: Depending on your connection speed, this update may take a few minutes. You can continue running other applications on your computer while the download is progressing.



When the update has finished the downloading process, click **OK** and close iChart.


Reopen iChart. When the program opens, iChart will automatically begin the installation process. Follow the step-by-step installation windows to complete the iChart software update.

Note: If an internet connection is unavailable on the computer, iChart can be downloaded onto another computer and then moved to the computer where it needs installed. The latest version of iChart can be downloaded here:

<http://www.nexsens.com/support/downloads.htm>

Technical


The Inficon Hapsite comes with a display running Inficon software. To interface to an NexSens iSIC, the display will also be running iChart Hapsite Modbus Server software which requires one free COM port* on the display to connect to an RS232 port on an iSIC data logger.

 **Note** A USB to RS232 converter can be used if a free COM port is not available.

At a fixed interval, the iChart Hapsite Modbus Server software running on the display checks for a new rql_sum file that has been generated by the Inficon software. If a file is available, it is processed. If there is error in the file, it is moved to the folder <hapsitefolder><prefix>_bad. If the file is successfully processed, it is moved to the folder <hapsitefolder><prefix>_archive. In either case, if the destination file (during the move) already exists, the file is renamed with current time/date embedded in the name, i.e. <filename>_yymmddhhmmss.rqlsum.

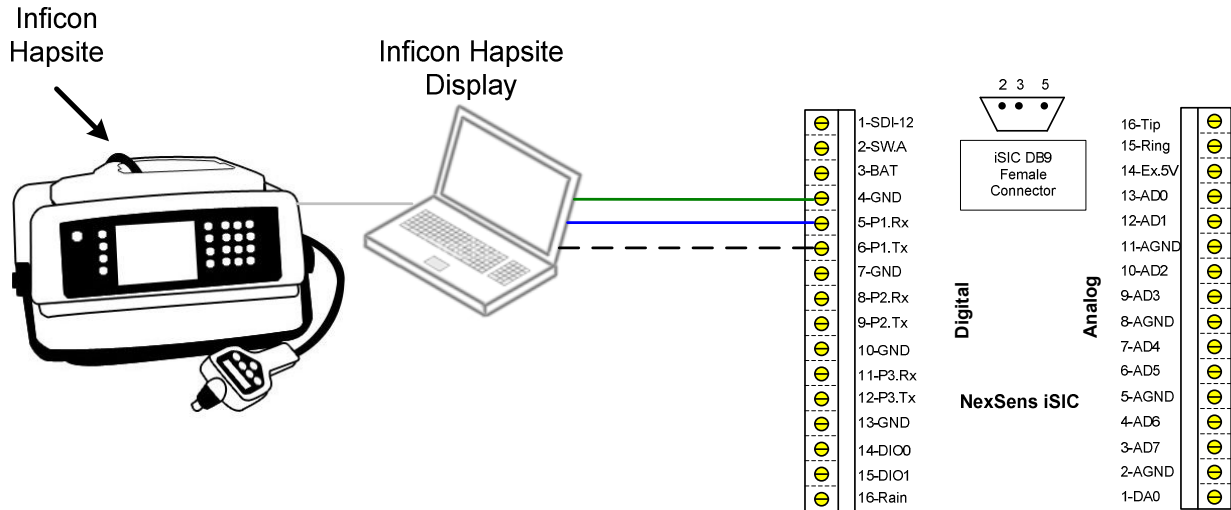
When a compound is found in an rql_sum file, it is checked against the 20 watched compounds for an exact name match to that stored in the iChart Hapsite Modbus Server. If one is found, the corresponding compound value is updated. For those compounds that are not detected, the corresponding values are marked as empty and transmitted as -1 during a modbus read from the iSIC. iChart checks for the -1 value and mark it as empty when it uploads data from the iSIC.

When the iSIC cannot communicate with the iChart Hapsite Modbus Server, it stores the value of -100000 in that time slot. iChart checks these values and marks them as deleted when it uploads data from the iSIC.

 **Note** The Inficon software must be configured to automatically generate rql_sum files and the iChart Hapsite Modbus Server must always be running for data to be updated in the iSIC.

Wiring

<u>Inficon Display COM DB9</u>	<u>iSIC</u>	<u>Color</u>
DB9 Pin 2	P1.Tx	White
DB9 Pin 3	P1.Rx	Blue
DB9 Pin 5	GND	Green



The diagram above shows an Inficon Hapsite connected to Port 1 of the iSIC using an iSIC-Hapsite interface cable.

Up to three RS232 sensors can be connected to the digital terminal of the iSIC at one time. This number can increase two more by adding a factory installed Digital Expansion connector.

It is necessary that both the blue and white wires be connected to the Rx and Tx pins on the same port. For example, if you are adding second RS232 sensor to the iSIC, connect the blue and white wires to P2.Rx and P2.Tx respectively as shown in the diagram above.

When adding a third RS232 sensor, connect the blue and white wires to P3.Rx and P3.Tx respectively. Follow this wiring pattern for every RS232 sensor you interface with the iSIC.

After connecting the flying lead wires, power the iSIC by connecting the red and black battery terminals.

Configuring Hapsite iChart on Laptop

Step 1 – Configure Inficon Software

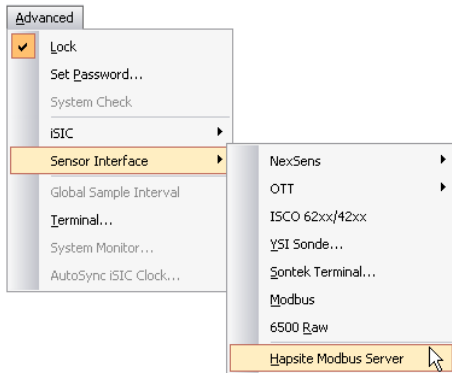
First install configure the Inficon software to automatically generate new .rql_sum files at a predefined interval.

Step 2 – Install iChart

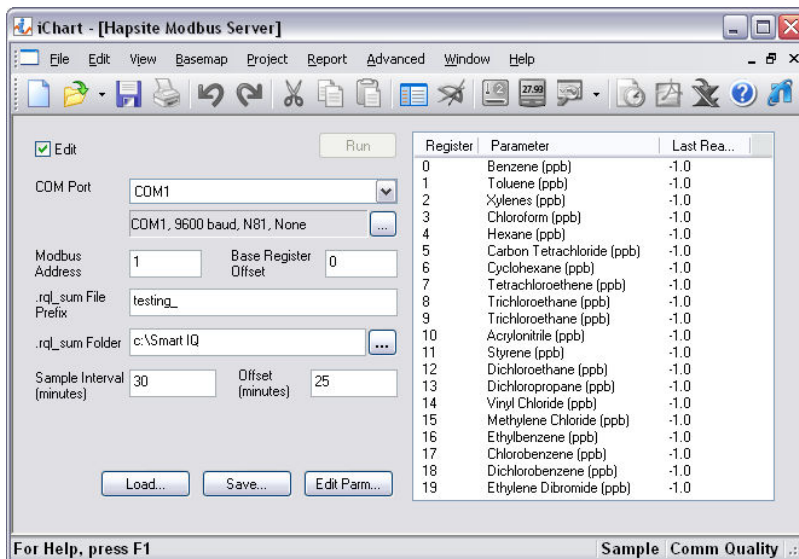
First install iChart software onto the laptop running the Inficon software.

Step 3 – Configure Hapsite driver

Run iChart and select “Advanced | Sensor Interface | Hapsite Modbus Server”.



This will create a Hapsite project file.



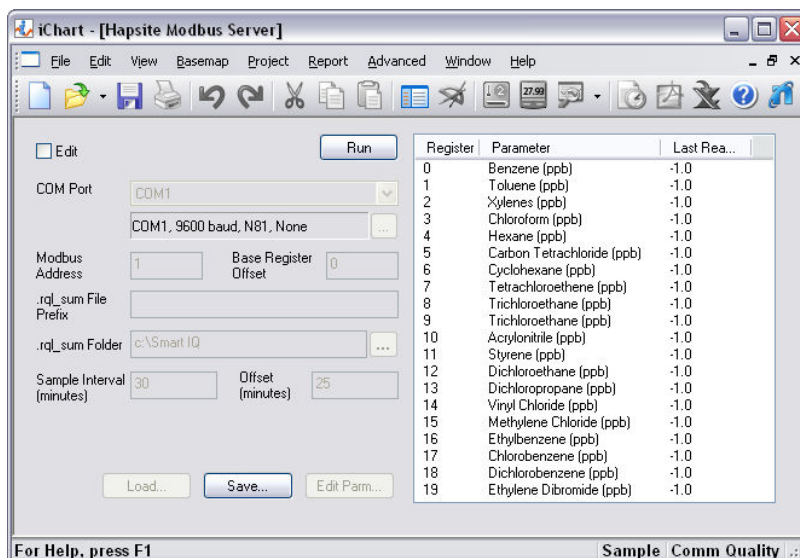
Put a check in the **Edit** box and fill in the following information:

- **COM Port** – Select the COM port that the iSIC Hapsite cable is connected to.
- **Modbus Address** – This is the address the iSIC will use to retrieve data from the laptop. Unless the iSIC is connected to other Modbus sensors that use the same address, this can be left at '1'.
- **Base Register Offset** – This is the base Modbus register offset the iSIC will use to retrieve data from the laptop. This can be left at the default '0'.
- **.rql_sum File Prefix** – Enter the file prefix used by the Inficon software.
- **rql_sum Folder** – Click on the "..." and navigate to the folder where the Inficon software saves the .rql_sum project files.
- **Sample Interval** – This is the interval iChart Hapsite Modbus Server will retrieve a new .rql_sum file. It is recommended to leave this value at '30', or whatever interval the Inficon software automatic rql_sum file generation interval is set to, to ensure that the latest rql_sum file is always used.
- **Offset** – This is the the iChart Hapsite Modbus Server software will wait after each sample interval before retrieving a new rql_sum file. This offsite is so the Inficon software has time to generate a new rql_sum file for the given interval. It is recommended to leave this value at '25', or a value that is significantly longer than the time it takes for the Inficon software to generate a new rql_sum file.

Buttons:

- Load: Loads a saved parameter configuration from a parameter XML file.
- Save: Saves the current parameter configuration into an XML file.
- Edit Parm: opens the Edit Parameter dialog box to edit parameter names and units of measurement. Note: these parameter names must match the parameter names in the rql_sum files exactly.

Then uncheck the **Edit** box and click the **Run** button. The "Run" will change to "Stop".

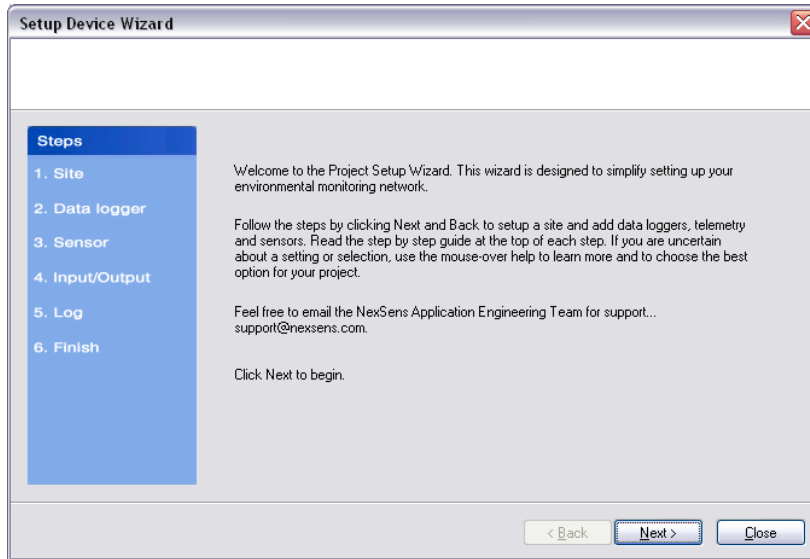


Configuring an iSIC Data Logger

Once all wiring is completed, the device is ready to be added to an iChart database. To add the device to an existing database, select **Instrument | Add Device**. To create a new database, select **File | New Project**.

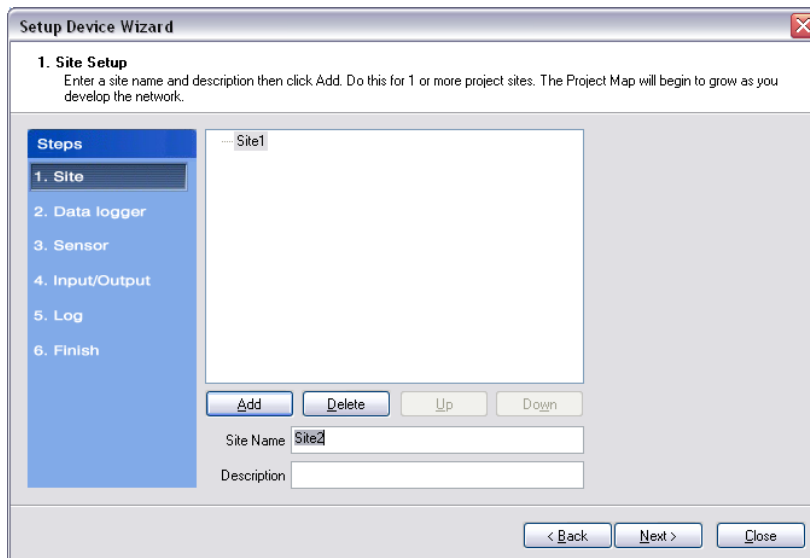
Setup Device Wizard

The Setup Device Wizard will begin. Click **Next** to continue.



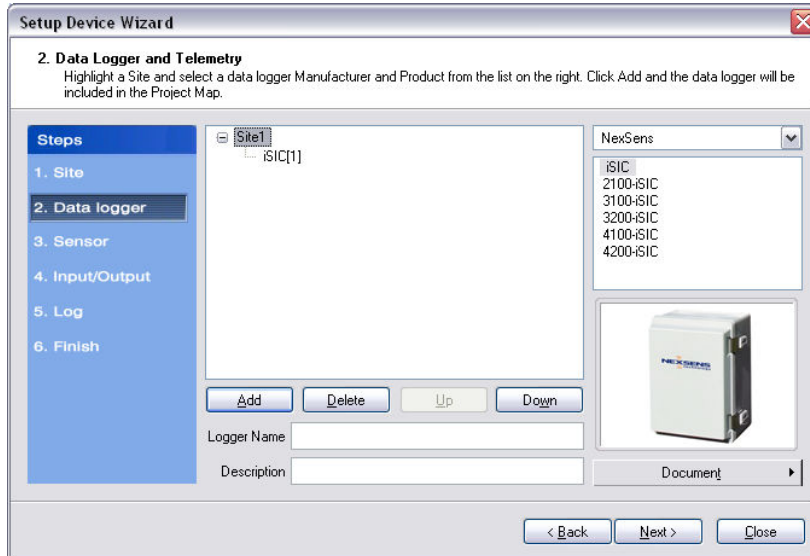
Step 1 – Site Setup

The first step is to create a site for data loggers and sensors to be located in. If this is an existing project, sites may already exist. Enter a **Site Name** and click **Add** or simply select a site that has already been added from the navigation list.



Step 2 – Data Logger & Telemetry

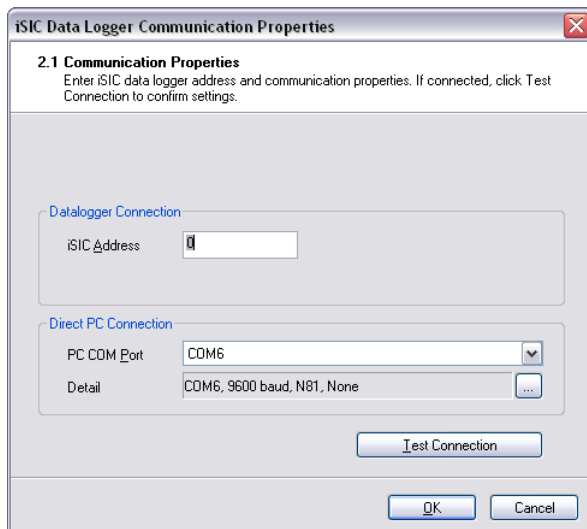
The next step is to add the data logger(s) to the sites created in the previous step. Select a site to add a data logger to. Then select the data logger model number from the list at right and click **Add** or select a data logger that has already been added from the navigation list, if simply adding the sensor to a data logger that has already been setup.



The **iSIC Data Logger Communication Properties** dialog box will appear. Enter the required iSIC data logger connection information (see below for model-specific instructions) to finish adding the data logger to the selected site. When complete, click **OK**.

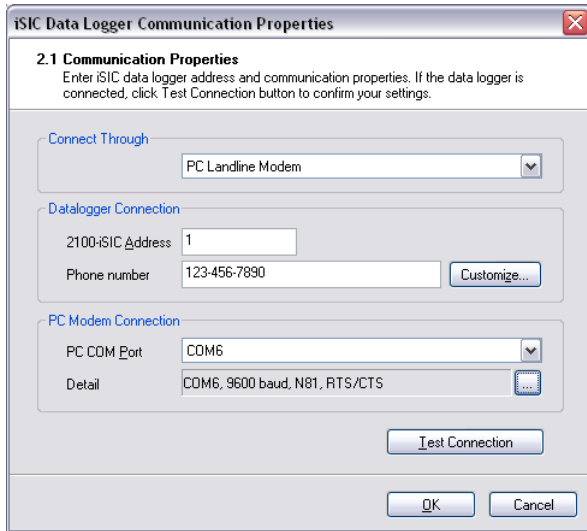
For an **iSIC** data logger, enter the iSIC address and select the PC COM Port that the data logger is connected to.

- The iSIC address is typically '1'. If unknown, enter '0' and click **Test Connection** to determine the address.
- The PC COM Port drop-down menu is the list of available COM ports iChart detected on the computer.



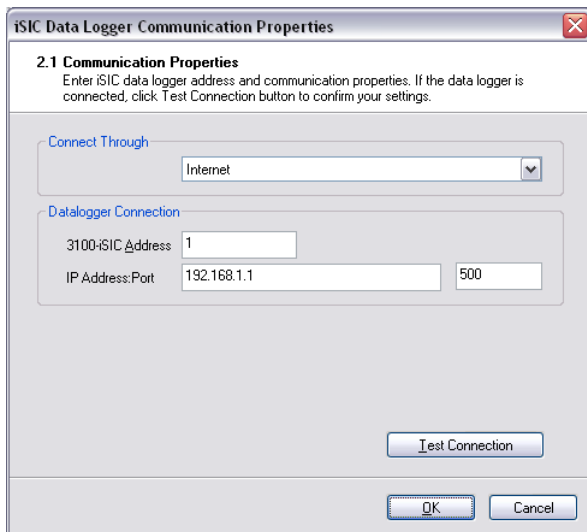
For a **2100-iSIC**, enter the 2100-iSIC address, phone number, and PC COM Port that the computer phone modem is connected to.

- The 2100-iSIC address is typically '1'. If unknown, enter '0' and click **Test Connection** to determine the address.
- The PC COM Port drop-down menu is the list of available COM ports iChart detected on the computer. Internal PC phone modems are typically set to COM3.



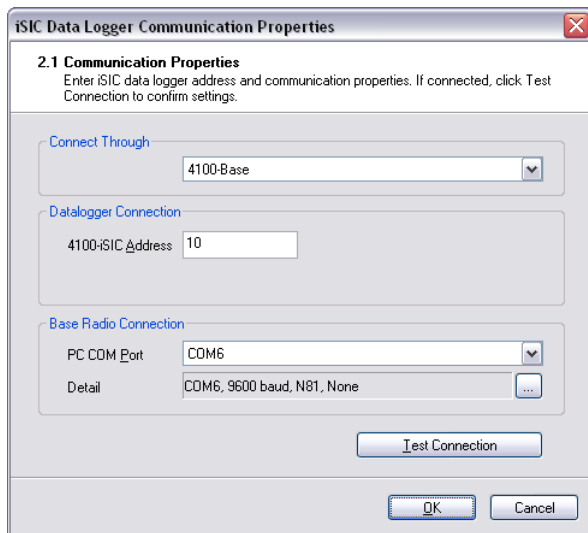
For a **3100-iSIC**, enter the 3100-iSIC address and the IP address of the data logger.

- The 3100-iSIC address is typically '1'. If unknown, enter '0' and click **Test Connection** to determine the address.
- The IP address is provided by the cellular service provider in which your cellular data account is setup. The port is set to 500 by default.



For a **4100-iSIC**, select the method in which the 4100-iSIC is connected to your PC and enter the 4100-iSIC address.

- A 4100-iSIC can connect to a PC through a 4100-BASE or a 4200-iSIC.
 - A 4100-BASE system connects to a PC via RS-232 cable.
 - A 4200-iSIC connects to a PC via landline telephone.
- The 4100-iSIC address is '1' by default.
 - If there is more than one 4100-iSIC in use, each 4100-iSIC should be programmed with different addresses (See the *4100-iSIC | iSIC Addressing* section in the iSIC manual).

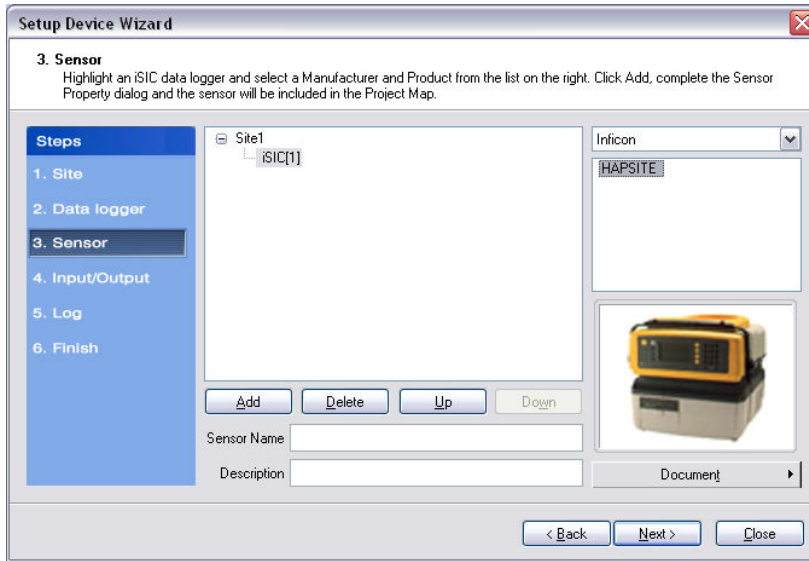


For a **4200-iSIC**, enter the iSIC address and PC COM port the data logger is connected to.

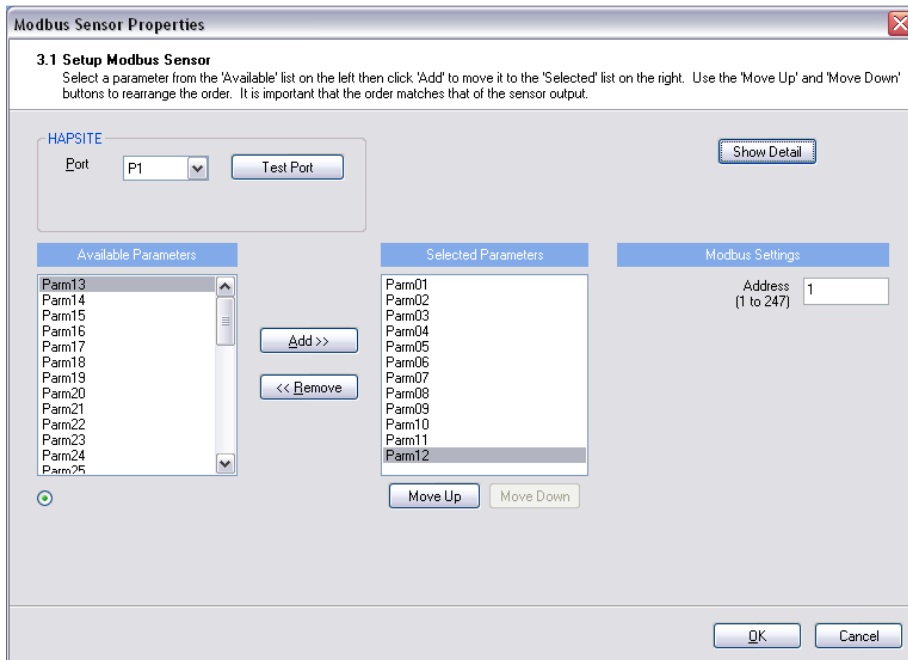
- The 4200-iSIC address is typically 250. When communicating with a 4200-iSIC, any communication using the 4200-iSIC address will be sent to the 4200-iSIC data logger.
 - Communications using any other address will be broadcast to any 4100-iSIC(s) in your radio network.
- **Note:** Do not use address '0' when communicating to a 4200-iSIC.
- The drop down menu of PC COM Port's is the list of available COM ports iChart detected on the computer. Internal phone modems are typically set to COM3.

Step 3 – Sensor

After selecting a data logger, click **Next** and select **Inficon** from the drop-down list of manufacturers. Then select the **Hapsite** model number associated with your device and click **Add**.

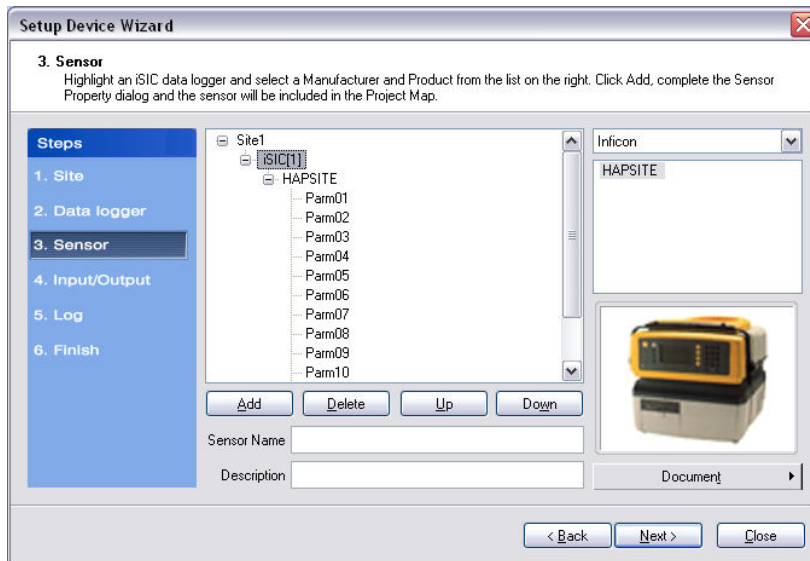


The **Sensor Properties** dialog box will come on the screen. From the **Available Parameters** column, move over as many parameters to the **Selected Parameter** list as setup on the Modbus server. If a certain parameter is not available in the list, add a generic parameter name, as the parameter name can be edited later.



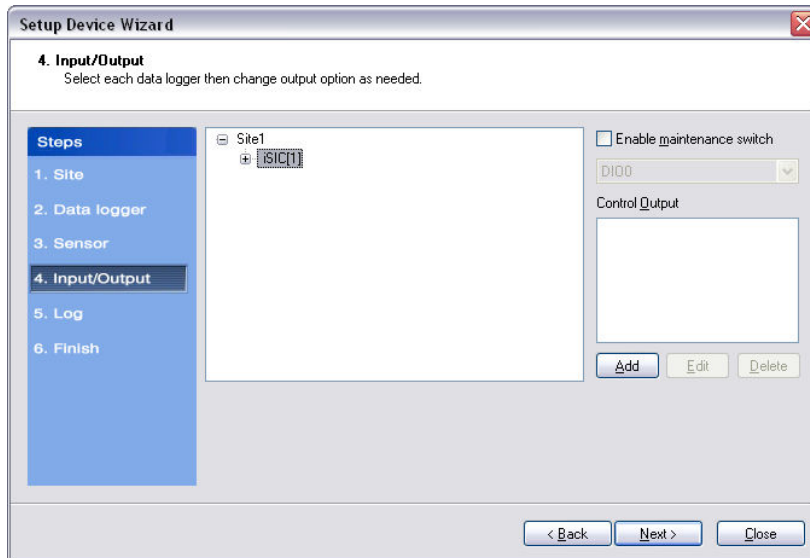
Be sure to select the right port the Hapsite is connected to. P1 was used in the beginning of this manual.

Click **OK** and the sensor will be added to the selected data logger. More sensors can be added at this time by selecting the sensor manufacturer and then sensor model number from the drop down menu on the right. Click **Next** when finished adding sensors.



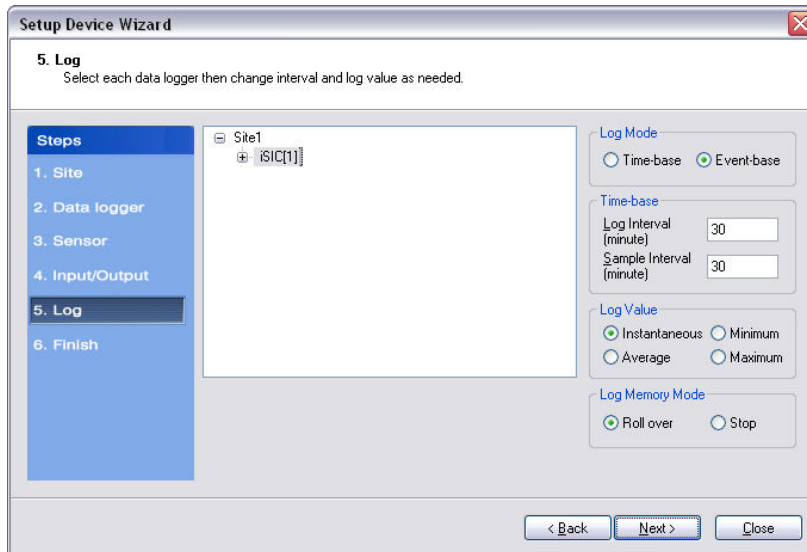
Step 4 – Input/Output

Enable any output and control features of the data logger. See the iSIC manual, section **4.4.2 iSIC Controls** for more information on this functionality.



Step 5 – Log

Select each data logger from the site list and enter the desired **Log Interval** and **Sample Interval** for the data logger in the **Interval** section. In the **Log Value** section, select how the data logger should log data points.



Log Mode

The Log Mode controls when data is logged by an iSIC. In **Time-base** (the default and most common), data is logged at a specified interval, controlled in the **Time-base** section. In **Event-base** log mode, data is only logged when a ground pulse is sent to the Rain input pin on the iSIC digital terminal strip (such as from the contact closure of a tipping bucket rain gauge).

Log Value

By default, the **Sample Interval** and **Log Interval** are equal. When a sampling interval is different than the log interval, all the sampled measurements for the iSIC are used to calculate the average, minimum, or maximum of that logging interval (based on the log type selected, only one can be selected at a time). The individual data points that comprise the samples are not saved; only the final, average, minimum or maximum data point is saved at the specified log interval.

Log Memory Mode

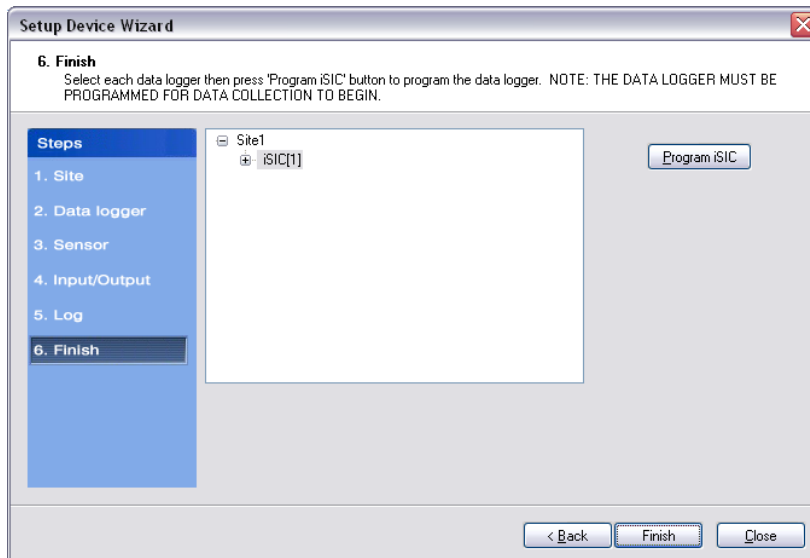
The default memory mode is **Roll over**, and is the recommended operating mode. In this mode, the last ~150K readings (when using 512K flash) will be stored in iSIC memory. When the iSIC memory has filled with readings it will “roll over” the original readings and keep logging. This is ideal for real time applications, where data is being uploaded to a PC as

In **Stop** memory mode, the first ~150K readings (when using 512K flash) will be stored in the iSIC memory. When the iSIC memory has filled with readings, it will stop logging until memory is cleared. When operating in this mode, it is recommended that memory is cleared every time data is uploaded.

Step 6 – Finish

All data loggers and sensors must be programmed before data collection can begin.

- Select an iSIC data logger and click the '**Program iSIC**' button. Before programming an iSIC:
 - The iSIC must be powered and connected to the computer.
 - The 2100-iSIC must be powered and connected to a phone line.
 - The 3100-iSIC must be powered and have a cellular data account.
 - The 4100-iSIC must be powered and be able to communicate to the computer through a 4100-base or 4200-iSIC
 - The 5100-iSIC must be powered and be able to communicate to the computer over Ethernet.
- Click **Finish** when programming is complete.



This wizard can always be revisited by selecting **Project | Setup Device Wizard** if you would like to program an iSIC at a later time or need to setup other sites, data loggers, and sensors.

Step 7 – Retrieve an Initial Data Set and Use the Instrument Within iChart

After your sensor has been added to the database, the main instrument control screen will appear.

Important: All parameters are initially displayed with blank values until after the first log interval has passed and data has been interrogated. Once data has been retrieved from the iSIC, these fields will show the most recent data set recorded by the instrument. By default, iChart will automatically interrogate devices five minutes after every hour.

RQL SUM FORMAT

The modbus server expects the rql_sum files generated by the Inficon software to be in the following format:

Compound line format:

Format: <runno>\t<name>

. <runno> format: "#n"

. There may be more tokens following the <name> token but they will be ignored

i.e.

#2 Ethene, methoxy-

#37 Benzene, 1,3,5-trimethyl-

Data line format:

Format: RT=\t<time>\t<Fit=|Net=>\t<percent>\t<value> <unit>

. <time> format: m:ss.ff where m is minute, and ss.ff is second with 2 decimal digit (0 prefilled)

. <unit> must be either "ppm" or "ppb" and must match what the user selected

i.e.

RT= 1:48.82 Fit= 99.9 1.101 ppm

RT= 3:09.00 Net= 81.0*

Possible Error Values

The Hapsite may return the following values:

DS_NOCOMM: **-100,000**

Communication between the iSIC and iChart server fail:

- Cable problem
- iChart server not running
- iChart computer crash

Note: the value -100000 returns from the iSIC is not exactly 100,000. Thus, to compare to this value, use greater than AND less than logic.

DS_INVALID: **-3**

When any of the following condition is TRUE:

- The specified .rql_sum File Prefix does not match the Inficon output
- The specified .rql_sum Folder does not match the Inficon output
- Fail to open .rqlsum file
- .rqlsum file name does not contain appropriate datecode
- The embedded datecode is older than or the same as the last one processed
- iChart cannot copy .rqlsum file to a temp folder for processing
- .rqlsum file does not contain "Data Info:" section

DS_EMPTY: **-1**

- No chemical detected
- Fail to parse compound line (see format below)

DS_ERR: **-5**

Chemical name detected but fail parsing the data line (see format below):

- "RT=" fail
- "Fit=" fail
- Unit (ppm/ppb) is wrong (note: no unit check for generic parameters parm1 to 32 and 33 to 82).