



# SensorDisc™

Analysis Software for the SensorDisc dataloggers

## Quick start guide



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# 1. SensorDisc™ Hardware Overview

## 1.1 Whats in the pack

- ① SensorDisc™ data logger
- ② SensorDisc™ AC charger
- ③ USB cable
- ④ Software flyer
- ⑤ Banana cables
- ⑥ Temperature probe
- ⑦ Air pressure tube
- ⑧ pH electrode



## 1.2 Ports and Controls

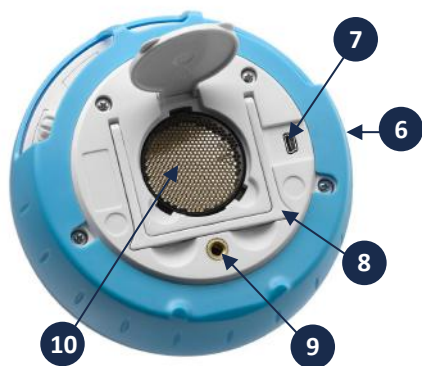
The picture below reviews the **SensorDisc™** ports, sensors, keypad and display:

- ① On/Off and Escape key
- ② Scroll key
- ③ Select key
- ④ Sensor selection keys
- ⑤ Graphical display 128 x 64 pixels



- ⑥ Rotating ring
- ⑦ USB port

- ⑧ Plastic leg
- ⑨ M5 screw insert
- ⑩ Distance sensor
- ⑪ Microphone, sound level sensors












- ⑫ Relative humidity sensor
- ⑬ External temperature input
- ⑭ pH input
- ⑮ Light sensor, universal input

- ⑯ Current and voltage sensor
- ⑰ Air pressure sensor
- ⑱ GPS sensor



### 1.3 Built-in Sensors

<i>Icon</i>	<i>Type</i>	<i>Range</i>	<i>Description</i>	<i>Max. Sample Rate</i>	<i>External Accessories (supplied with SensorDisc™)</i>
	Air pressure	10 to 300 kPa	Measuring air pressure	10/s	 Plastic tube
	Ambient temp.	-10 °C to 50 °C	Measuring ambient temperature	1/s	Not required
	Current	-1 to +1 A	Measuring electric current	100,000/s	 Banana cable
	Distance	0.4 to 10 m	Measuring distance	25/s	Not required
	External temp.	-25 °C to 125 °C	General purpose stainless steel temperature probe	100/s	 Temp. probe
	GPS	N/A	Measuring 6 different parameters: Longitude, latitude, course, speed, date and time	1/s	Not required
	Light	0 to 55,000 lux	Measuring light level	1000/s	Not required

	Sound	Sound level 56 to 95 dB	Measuring sound level	10/s sound level	Not required
	Microphone	Sound wave 0 to 5 V	Measuring sound waves	100,000/s	Not required
	pH	0 to 14 pH	Measuring pH level	10/s	 pH electrode
	Relative humidity	0 to 100% RH	Measuring relative humidity	1/s	Not required
	Universal input	0 to 5 V	Connecting Fourier or Vernier analog sensors	100,000/s	Universal input adapter cable
	Voltage	-30 to +30 V	Measuring electric voltage	100,000/s	 Banana cable

## 1.4 Using the SensorDisc™

### CHARGE THE SENSORDISC™ BATTERY BEFORE STARTING

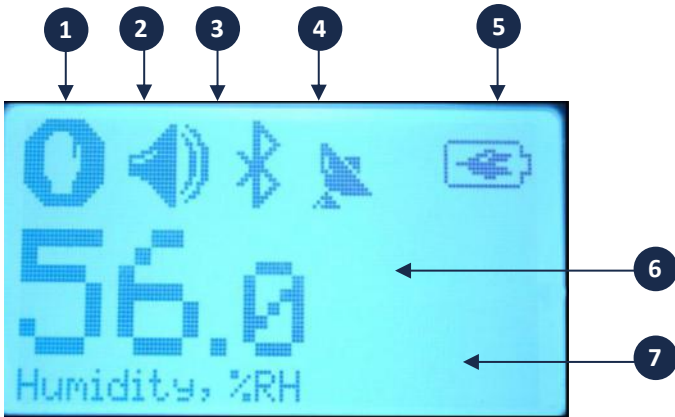
Before working with the **SensorDisc™** for the first time, the unit should be charged for six hours with the supplied 6V charger. The **SensorDisc™** charging input is located to the left of the **On/Off** key. Simply rotate the blue ring until the charging input on the **SensorDisc™** is exposed and then connect the charger plug to the charging input.











The **SensorDisc™** charger will accept any input voltage ranging from 100 to 240 VAC 50/60 Hz, making it functional worldwide.





### 1.4.1 SensorDisc™ display

The SensorDisc™ LCD display allows users to see the different sensor readings and to setup or re-configure the SensorDisc™ parameters.



- ① **Run/Stop icon** – shows  when the SensorDisc™ is logging data, or  when the SensorDisc™ is not logging sensor data.
- ② **Sound Status** – shows  active sound beep when the key is pressed and  when the sound beep is disabled.
- ③ **Communication Status** – shows  when Bluetooth communication is enabled, or  when the USB cable is connected from the host computer to the SensorDisc™.

④ **GPS Status** – shows  when the GPS is enabled,  when locked to GPS satellites and provides valid positioning parameters.

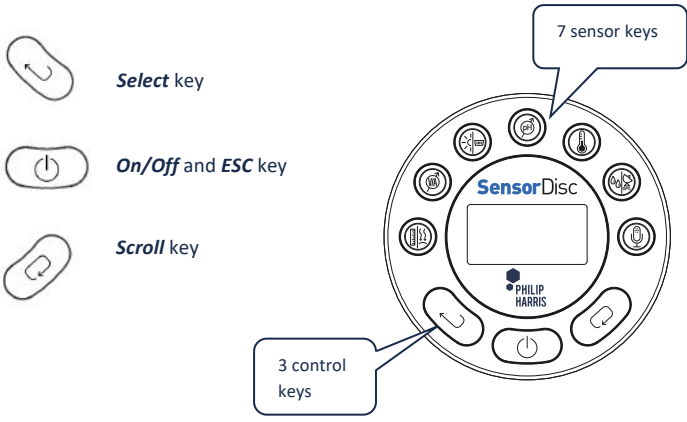
⑤ **Battery Level** – shows battery capacity at 3 levels    , or  when the **SensorDisc™** is connected to the external charger.

⑥ **Sensor Value** – shows the selected sensor value.

⑦ **Sensor Name and Unit** - shows the selected sensor name and unit.

### 1.4.2 SensorDisc™ keys

The **SensorDisc™** 10 keys are divided into 7 sensor keys and 3 control keys. Using the sensor keys users can select and view different sensor readings. The control keys are used to turn on/off the **SensorDisc™**, setup the device for the next logging session and configure all its parameters. The 3 control keys are:

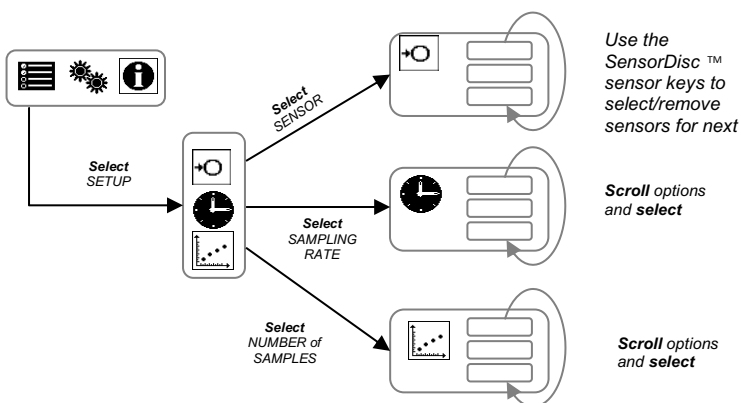




### 1.4.3 SensorDisc™ menu

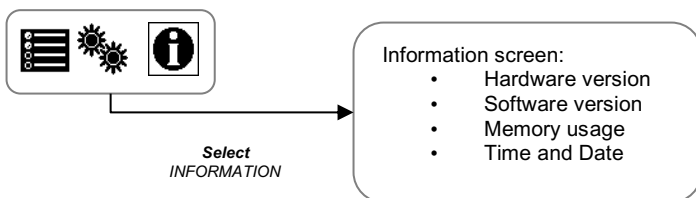
Press the **Scroll** key to enter the SensorDisc™ menu. Then use the **Scroll** key to scan menu options, the select key to choose a menu option and the **ESC** key to go one level up in the menu.

#### 1.4.3.1 Setup the SensorDisc™ for the next logging session

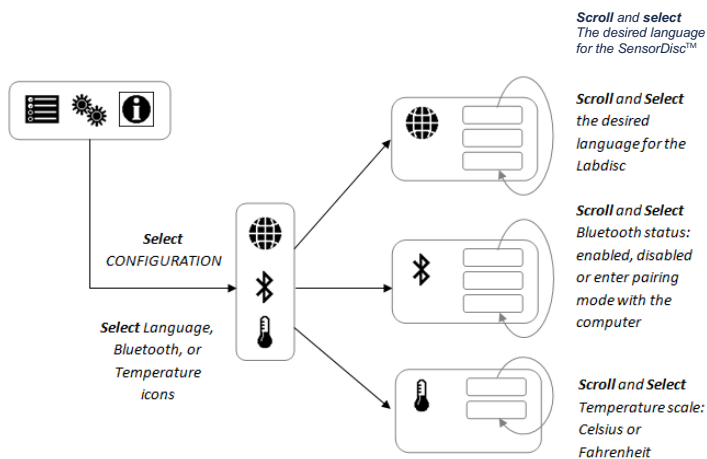


To start recording sensors - leave the menu and press the **Select** key.  
To stop recording, press and hold the **Select** key.

#### 1.4.3.2 SensorDisc™ information



### 1.4.3.3 Configuration of the SensorDisc™



### Calibrating the pH Sensor

The pH sensor is factory calibrated and under normal conditions does not require any calibration. Please follow the steps below should you wish to calibrate this sensor:

- Insert the SensorDisc™ pH electrode into a 7.0pH buffer
- Wait for the SensorDisc™ pH reading to stabilize
- Press and hold the pH key for 3 seconds, until you hear a long beep sound
- The SensorDisc™ pH sensor is calibrated and will show a reading between 6.95pH to 7.05pH
- pH calibration is not saved after the SensorDisc™ is turned off

### Calibrating the ambient temperature

The SensorDisc™ software allows the calibration of ambient temperature. Please follow the steps below for ambient temperature calibration:

Make sure the ambient temperature is stable (the SensorDisc™ should be located in a constant temperature environment for at least 20 minutes)

- Connect the SensorDisc™ to the computer and open the SensorDisc™ software
- Click the Configuration icon. SensorDisc™ will open the Configuration dialog box.
- Click on the Calibration tab, type in the actual ambient temperature and press send.

## 2. SensorDisc™ Analysis Software

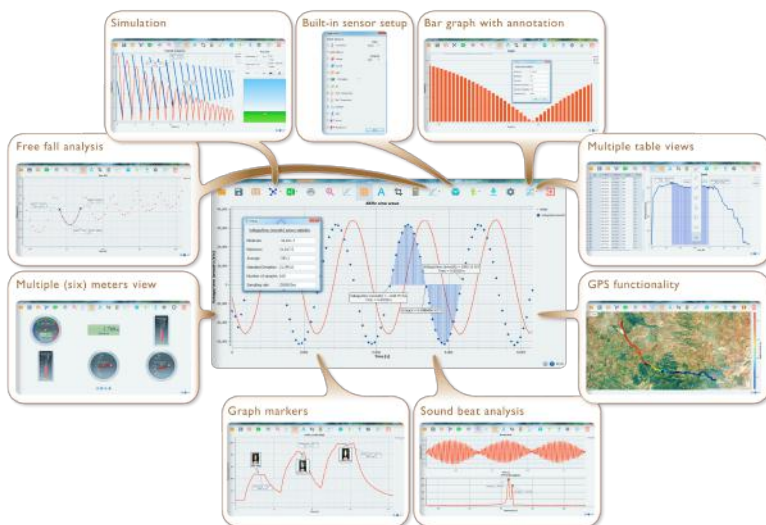
### 2.1 Software Installation

Our **SensorDisc™** software is available on our WEB for free download. Simply go to: <https://www.philipharris.co.uk/SensorDisc> and choose the software version you would like to download.






- For PC: SensorDisc™ MSI installation 3.X for PC
- For Mac: SensorDisc™ version 2.X


Then follow the simple installation instructions. These instructions take the user through the installation of the **SensorDisc™** software.


### 2.2 Software Functions





## 2.3 Software Popular Icons and their Functions


	<p>Selecting the <b>Open-project</b> icon opens the stored activity *.XML files and displays all its graphs and graphical attributes.</p>
	<p>Select the <b>Open-plus</b> in order to compare two or more different activities. First open a stored activity with the <b>Open-project</b>. Then use the <b>Open-plus</b> to open another stored activity (having the same sampling rate) in order to view and compare both activities on same graphic/table window.</p>
	<p>Selecting the <b>Workbook</b> icon opens the activities folder, where users can choose from a variety of PDF activities.</p>
	<p>Clicking the <b>Display-options</b> small triangle icon allows the user to select one of the following six display options:</p> <ol style="list-style-type: none"><li> <b>Line graph</b> – showing a line graph for each of the sensors. If there is more than one active sensor, you can set the scale on the left for different active sensors by <i>left</i> clicking on the sensor name in the legend in the upper right hand corner of the screen. A single <i>right</i> click on the sensor name will change the line to individual data points. A second <i>right</i> click will hide the sensor data from the graph. A third <i>right</i> click will return the sensor graph to a line. To change the color of a line, <i>left</i> click on the line and select a new color.</li></ol>

2.  **Bar graph** – showing bar graph data from only one sensor at a time. To change which data is displayed, left click the sensor name in the upper left hand corner of the screen.

3.  **Data table** – shows sensors data in a chart format. This can be used to view exact measurements for all sensors. You may use the table display to edit data points of the sensors.

4.  **Line graph and Data Table** – shows both a line graph and a data table simultaneously.

5.  **Meter view** - shows changes in all sensors data values as are they are happening. There are several different






options for meters including: 













Right click on each Meter will allow you to change the Meter type or choose different sensor for this Meter.



Using the blue dots at the bottom of the screen allows you to set the number of Meters displayed on the screen: 1,2,4 and 6.

	<p>6.  <b>Google Map</b> – this allows you to overlay a Google Map of the area where your experiment was conducted with the data from all sensors in that experiment. You must have an Internet connection for this display mode to work properly.</p>
<p style="text-align: center; font-size: 2em; color: #0070C0;">A</p>	<p>Selecting the <b>Annotation</b> icon activates the <b>Annotation mode</b>. Left mouse click opens a dialog box where users can enter text and images. Pressing the <b>Annotation</b> icon again exits the <b>Annotation mode</b>.</p>
	<p>Pressing the <b>Function-options</b> small triangle icon allows the user to apply the mathematical functions listed below between the graph markers:</p> <ol style="list-style-type: none"> <li data-bbox="373 695 886 860"> <p>1.  Selecting the <b>Slope</b> will display a slope-line on the active sensor graph. Moving the mouse pointer will move the slope line along the graph. A small text box will show the slope value.</p> </li> <li data-bbox="373 888 886 1087"> <p>2.  Selecting the <b>Linear regression</b> will display the best linear line that fits the graph between the locations of two markers. Next to the line the software will open a small text box displaying the linear line equation: <math>Y= aX+b</math>.</p> </li> <li data-bbox="373 1115 886 1339"> <p>3.  Selecting the <b>Quadratic regression</b> will display the best parabolic line (2<sup>nd</sup> degree) that fits the graph between the locations of two markers. Next to the line the software will open a small text box displaying the parabolic line equation: <math>Y= aX^2+bX+c</math>.</p> </li> </ol>

	<p>4.  Selecting the <b>FFT</b> will split the graphic display and show the original measurement on a time scale in the top graphic window, and its harmonics, on a frequency scale in the bottom graphic window.</p> <p>5.  Selecting <b>Smooth</b> will make an average all data points on the graph. Every sample is an average of the 2 readings before and 2 readings after. This function is useful in case the graph is very noisy.</p> <p>6.  Selecting <b>Derivative</b> will create a derivative graph on the active sensor data.</p> <p>7.  Selecting <b>Integral</b> will calculate the area under the sensor graph (Sensor value x Time).</p>
	<p>Selecting the <b>Run</b> icon launches a new data collection session.</p>
	<p>Selecting the <b>Stop</b> icon ends the current data collection session.</p>
	<p>Selecting the <b>Selective download</b> icon opens a table listing all stored recordings. Selecting one of the lines on the table and pressing download will download this specific recording to the computer.</p>



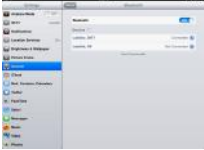




	<p>Setting up the <b>SensorDisc™</b> is done by selecting the <b>Setup</b> icon. The software will open a dialog box, where users can select/remove sensors, set the sampling rate and the amount of samples for the next data recording.</p>
	<p>Selecting the <b>EXCEL</b> icon saves the file in a *.CSV format, prompts the user for a file name and then automatically opens EXCEL and exports the experiment data into the spreadsheet.</p>
	<p><b>SensorDisc™ status bar</b>, is located at the bottom right corner of the software. It includes 3 icons:</p> <ol style="list-style-type: none"> <li>1. <b>USB indicator</b> – where blue indicates a USB communication between the computer and the <b>SensorDisc™</b>.</li> <li>2. <b>Bluetooth indicator</b> – where blue indicates a Bluetooth wireless communication between the computer and the <b>SensorDisc™</b>. A right mouse click on this icon will open a list of recognized <b>SensorDiscs</b>, click on one to connect.</li> <li>1. <b>Memory info</b> – shows how many experiments are stored in the <b>SensorDisc™</b> memory, out of a maximum of 127. In the example above there are 7 stored experiments out of 127. A right mouse click on this section will allow users to erase all stored data or just the last recording.</li> </ol>



## 2.4 SensorDisc™ Software for iPad






The **SensorDisc™** software for iPad (iPad, iPad 2 and 3rd generation iPad models) is available in the App Store and makes K-12 science experiments mobile, convenient and immediate. **SensorDisc™** wirelessly integrates between the **SensorDisc™** data logger and the iPad. Allowing full **SensorDisc™** management (setup of all data logging parameters, online display of current measurements and download of the **SensorDisc™** sample memory), together with graph manipulations (markers, zoom, crop, text and image annotation) and data analysis (statistics and curve fitting etc.).

**SensorDisc™** software for iPad was specifically designed to engage students and help visualize complex science concepts by harnessing the iPad built-in accelerometer sensor, data display, multimedia and multi-touch features. The following steps provide a guide on the installation and implementation of the **SensorDisc™** App for iPad.

	<p><b>Download and install of the SensorDisc™ application</b></p> <ul style="list-style-type: none"><li>• Tap the iPad App Store icon </li><li>• Search for “<b>SensorDisc™</b>”</li><li>• Press the FREE green key to install the application</li></ul>
	<p><b>Set wireless communication between the SensorDisc™ and the iPad</b></p> <ul style="list-style-type: none"><li>• Go to <i>iPad Setting - Bluetooth</i> and select your <b>SensorDisc™</b> from the Devices list</li><li>• The iPad should immediately connect to your <b>SensorDisc™</b> and change its status to “connected”</li><li>• Close the setting and open the <b>SensorDisc™</b> software</li></ul>
	<p><b>Meter view</b></p> <ul style="list-style-type: none"><li>• Tap Meter view  to see the current values of the <b>SensorDisc</b> sensors</li><li>• Tap one of the Meters and scroll the sensor wheel to select a different sensor type for an existing Meter</li><li>• Select a different Meter type   from the horizontal line of icons</li></ul>



### Data collection

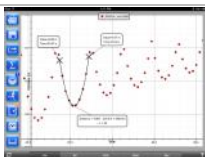
- Tap the SETUP icon  and enter the SETUP screen. This dialog box allows you to select the Sensors, Sampling rate and amount of samples for the next data recording.
- Tap the RUN icon  to start recording and observe the graph build up on the screen
- You may switch the display to a Bar Graph view by tapping the Bar Graph key 
- You may switch the display to a Table view by tapping the Table key 
- To stop recording tap the STOP icon 




### Download SensorDisc™ stored measurements to the iPad

The SensorDisc™ can store up to 127 different experiments. This is very useful when conducting outdoor data collection or long measurements.




- Tap the Download icon 
- The iPad will list all SensorDisc™ stored experiments Each line on this list shows what sensors were recorded, at what sampling rates and for how many samples. In addition it indicates the date and time of the recording.
- Click on one of the lines in the list. The SensorDisc™ transfers the data to the iPad.
- After all data is transferred, the iPad will show a graph of the collected measurement



### Data analysis (markers, curve fitting)

- Tap the open icon  and select "Free fall". This graph describes a real recording of a ping-pong ball bouncing on a table, as recorded by the SensorDisc™ distance sensor.
- Long touch on the graph to add a Marker














	<ul style="list-style-type: none"> <li>• Touch the Marker to cross and drag it with your finger. View the Marker text box data changing while the marker follows the graph line.</li> <li>• Tap the graph twice to view the actual sampling points</li> <li>• Long touch the graph to add a 2<sup>nd</sup> Marker</li> <li>• Place both the Markers on the beginning and end of a single ball jump</li> <li>• Tap the Curve Fitting icon  and select a Quadric Regression to get the mathematical equation representing the ping-pong ball jump. From this equation we can calculate earth gravitation.</li> </ul>
	<p><b>Graph Annotation</b></p> <ul style="list-style-type: none"> <li>• Use a long touch anywhere on the background (not on a graph), create an empty annotation. The edit annotation box opens automatically. From here: <ul style="list-style-type: none"> <li>○ Edit or write an annotation</li> <li>○ Add an image using the camera or the image gallery</li> <li>○ Remove the annotation</li> </ul> </li> </ul>
	<p><b>Use of Map view in field trip (Environment)</b></p> <p>Recording GPS together with other <b>SensorDisc™</b> sensors, enables the <b>SensorDisc™</b> software to plot these sensors over the Apple maps.</p> <ul style="list-style-type: none"> <li>• Make sure the iPad is connected to the Internet</li> <li>• Tap the Open icon  and select the “Walk in the park”. In this experiment we measured the different climate in a city park compared to a nearby cross road.</li> <li>• Tap the color scale on the left and select Amb. Temperature. Observe the dramatic temperature change while walking from the city cross-road to the park.</li> <li>• Tap the colored samples on the map to get a marker with the temperature value.</li> <li>• Pinch to zoom in/out the map</li> </ul>



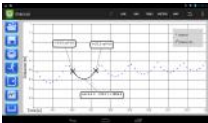


	<ul style="list-style-type: none"> <li>• See the experiment data in a table, by tapping the Table View  and observe the GPS longitude and latitude values.</li> </ul>
	<p><b>Online help</b></p> <p><b>SensorDisc™</b> offers an online help for each of the 5 views: Line, Bar, Table, Meter and Map.</p> <ul style="list-style-type: none"> <li>• Open the relevant View</li> <li>• Tap on the HELP icon  and observe a list of functions and controls</li> </ul>






## 2.5 SensorDisc™ Software for Android



The **SensorDisc™** software for Android 4 and above is available for download from the Philip Harris web site: [http://www.Philip\\_Harris.co.uk/SensorDisc](http://www.Philip_Harris.co.uk/SensorDisc) and from Google Play.

The software makes K-12 science experiments mobile, convenient and immediate. **SensorDisc™** wirelessly integrates between the **SensorDisc™** data logger and the Android tablet, allowing full **SensorDisc™** management (setup of all data logging parameters, online display of current measurements and download of the **SensorDisc™** sample memory), together with graph manipulations (markers, zoom, crop and text annotation) and data analysis (statistics and curve fitting etc.).

	<p><b>Set wireless communication between the SensorDisc™ and the Android tablet</b></p> <ul style="list-style-type: none"> <li>• Make sure the SensorDisc™ is paired to the Android tablet (see section 3.2.4)</li> <li>• Turn on the SensorDisc™</li> <li>• Launch the application </li> <li>• Tap the options icon in the top action bar  (rightmost, three vertical dots)</li> <li>• Tap <b>“Connect SensorDisc™”</b> and select the name of the SensorDisc™ you would like to connect with (e.g. SensorDisc_6588)</li> <li>• The App name (top right) will change to SensorDisc_6588, indicating that the connection is established</li> </ul>
	<p><b>Meter view</b></p> <ul style="list-style-type: none"> <li>• Tap the Meter view  to see the current values of the <b>SensorDisc™</b> sensors</li> <li>• Tap one of the meters and scroll the sensor wheel to select a different sensor type for an existing meter</li> <li>• Select a different meter type   from the horizontal line of icons</li> </ul>
	<p><b>Data collection</b></p> <ul style="list-style-type: none"> <li>• Tap the SETUP icon  and enter the SETUP screen. This dialog box allows you to select the Sensors, Sampling rate and amount of samples for the next data recording.</li> <li>• Tap the RUN icon  to start recording and observe the graph build up on the screen</li> <li>• You may switch the display to a Bar Graph view by tapping the Bar Graph key </li> <li>• You may switch the display to a Table view by tapping the Table key </li> <li>• To stop recording tap the STOP icon </li> </ul>

	<p><b>Download SensorDisc™ stored measurements to the tablet</b></p> <p>The <b>SensorDisc™</b> can store up to 127 different experiments. This is very useful when conducting outdoor data collection or long measurements.</p> <ul style="list-style-type: none"> <li>• Tap the Download icon </li> <li>• The application will list all <b>SensorDisc™</b> stored experiments. Each line on this list shows what sensors were recorded, at what sampling rate and for how many samples. In addition it indicates the date and time of the recording.</li> <li>• Click on one of the lines in the list. The <b>SensorDisc™</b> transfers the data to the tablet.</li> <li>• After all the data is transferred, SensorDisc™ will show a graph of the collected measurement</li> </ul>
	<p><b>Data analysis (markers, curve fitting)</b></p> <ul style="list-style-type: none"> <li>• Tap the open icon  and select “Free Fall”. This graph describes a real recording of a ping-pong ball bouncing on a table, as recorded by the <b>SensorDisc™</b> distance sensor</li> <li>• Long touch on the graph to add a marker</li> <li>• Touch the marker to cross and drag it with your finger. View the marker text box data changing while the marker follows the graph line.</li> <li>• Tap the graph legend and select “Dots” to view the actual sampling points</li> <li>• Long touch the graph to add a second marker</li> <li>• Place both the markers at the beginning and end of a single ball jump</li> <li>• Tap the Curve Fitting icon , select a Quadric Regression to get the mathematical equation representing the ping-pong ball jump. From this equation we can calculate earth’s gravitation.</li> </ul>

	<p><b>Graph Annotation</b></p> <ul style="list-style-type: none"> <li>• Use a long touch anywhere on the background (not on a graph), create an empty annotation. The edit annotation box opens automatically. From here: <ul style="list-style-type: none"> <li>○ Edit or write an annotation</li> <li>○ Remove the annotation</li> </ul> </li> </ul>
	<p><b>Use of Map view in a field trip (Environment)</b></p> <p>Recording GPS together with other <b>SensorDisc™</b> sensors enables the <b>SensorDisc™</b> software to plot these sensors over the Apple maps.</p> <ul style="list-style-type: none"> <li>• Make sure the tablet is connected to the Internet</li> <li>• Tap the Open icon  and select “Walk in the Park”. In this experiment the different climate in a city park compared to a nearby cross road was measured.</li> <li>• Tap the color scale on the left and select Amb. Temperature. Observe the dramatic temperature change while walking from the city cross-road to the park.</li> <li>• Tap the colored samples on the map to get a marker with the temperature value</li> <li>• Pinch to zoom in/out the map</li> <li>• See the experiment data in a table, by tapping the <b>TABLE</b> and observe the GPS longitude and latitude values</li> </ul>
	<p><b>Workbook section</b></p> <ul style="list-style-type: none"> <li>• Tap the Workbook icon  to view <b>SensorDisc™</b> experiment guides</li> <li>• Tap on one of the experiments on the list and view a comprehensive PDF guide of that experiment.</li> </ul>

	<p><b>Online help</b></p> <p>SensorDisc™ offers a PDF quick start guide. To open the quick start guide, tap on the HELP icon .</p>
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## 3 SensorDisc™ – SensorDisc™ Communication

### 3.1 USB Communication

Upon USB cable connection between the computer and the **SensorDisc™**, the **SensorDisc™** software automatically detects the USB connection and begins communicating with the **SensorDisc™**.



### 3.2 Bluetooth Wireless Communication

Before wireless communication with a **SensorDisc™** for the first time, the **SensorDisc™** should be added as a device to the computer in a process called pairing. Pairing need be done only once for each **SensorDisc™**, after which the computer stores the connection information, including a unique name for each **SensorDisc™**. When no **SensorDisc™** is connected via USB, the computer will automatically try to wirelessly connect to the last connected **SensorDisc™**. To connect to a different or a new **SensorDisc™**, right click on the Bluetooth icon in the **SensorDisc™ status bar**,



located at the bottom right corner of the screen, then click on the **SensorDisc™** you want to connect to.

#### 3.2.1 Pairing with a PC running Windows OS

1. Turn on the **SensorDisc™**. Make sure the **SensorDisc™** is not showing the sleep icon . If it does, please press any button to leave the sleep mode.
2. Start the **SensorDisc™** software.
3. Right click the Bluetooth icon located on the status bar at the bottom right corner of the screen 



- From the new pop-up menu select **"Find more SensorDiscs and sensors"**. The computer opens the **"add a device"** dialog box and starts searching for the Bluetooth device.
- Your SensorDisc™ will be displayed as **"SensorDisc-xxxx"**, where "xxxx" are the last four digits of the SensorDisc serial number sticker.
- Select this device and press **"Next"**







On the SensorDisc™: Press and hold the SCROLL key to put the SensorDisc™ in Pairing mode. The SensorDisc™ will produce a long "beep" while its screen shows **"BT pairing"**.

- On the computer dialog box select the 2nd option: **"Enter the device pairing code"** and click **"Next"**.
- In the next dialog box enter "1234" as the pairing code, click **"Next"**
- Wait for the computer to finish the process and announce **"Your device is ready to use"**.
- Right click the Bluetooth icon on the status bar. Choose the SensorDisc™ you've just paired and click on it.
- The computer will connect to the SensorDisc™ and turn the


Bluetooth icon blue 

### 3.2.2 Pairing with a Mac OS






- Turn on the SensorDisc™. Make sure the SensorDisc™ is not showing the sleep icon . If it does, please press any button to leave the sleep mode.
- Open the Bluetooth menu from the Mac menu and select **"Set Up Bluetooth Device..."**
- A dialog box opens. Your SensorDisc™ will be displayed as **"SensorDisc-xxxx"** where "xxxx" are the last four digits of the SensorDisc serial number sticker.
- Select this device and press **"Continue"**.
- Mac will try a quick default attempt to pair. This attempt will not succeed as SensorDisc™ requires a pairing code.
- Press the **"Passcode options..."** button and select the option **"Use a specific passcode"**. Enter the passcode "1234", and don't press "OK" yet.

7. On the **SensorDisc™**: Press and hold the **SCROLL**  key to put the SensorDisc™ in Pairing mode. The SensorDisc™ will produce a long "beep" while its screen shows **"BT pairing"**.
8. Press the **"OK"** button in the Mac dialog box.
9. Open the **SensorDisc™** software.
10. Right click the **Bluetooth** icon  located at the bottom right corner of the software.
11. Choose the **SensorDisc™** you've just paired and click on it. The computer will connect to the **SensorDisc™** and turn the **Bluetooth** icon blue .

### 3.2.3 Pairing with an iPad


1. Turn on the **SensorDisc™**. Make sure the **SensorDisc™** is not showing the sleep icon . If it does, please press any button to leave the sleep mode.
2. Launch the iPad Setting .
3. Open Bluetooth. Make sure the iPad Bluetooth is on.
4. From the devices list click the **"SensorDisc-xxxx"**, where the xxxx digits match the last 4 digits of your **SensorDisc™** S/N sticker on the **SensorDisc™** back cover.
5. On the **SensorDisc™**: Press and hold the **SCROLL**  key to put the SensorDisc™ in Pairing mode. The SensorDisc™ will produce a long "beep" while its screen shows **"BT pairing"**.
6. The iPad will ask for a PIN code. Enter **"1234"** and click Pair.
7. The iPad will show **SensorDisc-xxxx** connected.
8. Start the iOS **SensorDisc™** application . The application will automatically connect to the SensorDisc™ you have paired.

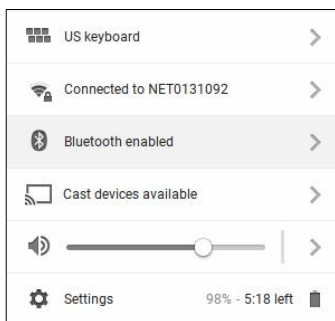
### 3.2.4 Pairing with Android OS

1. Turn on the **SensorDisc™**. Make sure the **SensorDisc™** is not showing the sleep icon . If it does, please press any button to leave the sleep mode.
2. On the tablet go to setting  and select **"Bluetooth"**
3. Make sure the Bluetooth radio is "ON", then turn on **"Search for Devices"**
4. On the **SensorDisc™**: Press and hold the **SCROLL**  key to put the **SensorDisc™** in pairing mode. The **SensorDisc™** will produce a long "beep" while its screen shows **"BT pairing"**.
5. From the devices list on the tablet tap the **"SensorDisc-xxxx"**, where the xxxx digits match the last 4 digits of your **SensorDisc™** S/N sticker on the **SensorDisc™** back cover.
6. The tablet will open the **"Bluetooth pairing request"** dialog box and display **"Type the device's required PIN"**
7. Enter the pairing code "1234" and tap **"OK"**
8. Pairing process is complete and the **SensorDisc™** will appear on the tablet **"paired devices"** list.
9. Open the **SensorDisc™** application on the tablet .
10. Tap on the options icon at the top Action Bar  (rightmost, 3 vertical dots)
11. Tap on **"Connect SensorDisc"**, and select the name of the **SensorDisc™** you'd like to connect (e.g. **SensorDisc\_1052**).
12. The App name will change to **"SensorDisc™ (SensorDisc\_xxxx)"** to indicate connection.


### 3.2.5 Pairing with Chromebook OS

1. Turn on your SensorDisc™.

2. Click on the Chromebook bottom right menu bar . The below dialog box opens:



3. Click on the Bluetooth icon. Make sure that Bluetooth is enabled on your Chromebook. Click on **Manage Devices...** then click **Add Device**. The Chromebook start searching for new SensorDisc™ devices.
4. Your SensorDisc™ with its last 4 serial number digit will appear on the Chromebook screen as: **SensorDisc-XXXX** - where the XXXX represent the SensorDisc™ last four S/N digits.
5. From the Chromebook's list of devices, select your SensorDisc™. Make sure that the four digit code on the back of the SensorDisc™ matches the one you have selected on your Chromebook. Click **Connect**.

- 
6. On the **SensorDisc™**: Press and hold the SCROLL key to put the SensorDisc™ in pairing mode. The SensorDisc™ will produce a long "beep" while its screen shows "**BT pairing**".
  7. On the Chromebook use the PIN code "1234" to pair your SensorDisc™ to your Chromebook.
  8. Your SensorDisc™ should be added to the Chromebook list of paired devices. On some Chromebooks you might see an error message. You may ignore it, as long as you see the SensorDisc™ on the Paired devices list.

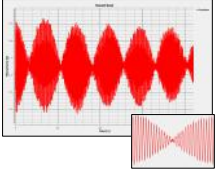

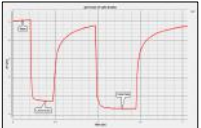
#### Connect the SensorDisc™ to a Chromebook Laptop Using a Bluetooth Connection:

1. Open the SensorDisc™ software and turn on the SensorDisc™.
2. Make sure that your SensorDisc™ has been paired with your computer. (see above) You will only have to pair the SensorDisc™ at the first time you use your SensorDisc™ with the Chromebook.
3. From the SensorDisc™ menu select "Connect SensorDisc™".
4. Select the SensorDisc™ that you want to connect to from the pop up menu. Make sure the 4 digit code matches the one on the back of the SensorDisc™.

## 4 Experiment Samples

The SensorDisc™ software includes experiment samples, for teachers and students to view, analyze, modify or repeat. This section reviews some interesting recorded experiments found in the SensorDisc™ application. To open a recorded experiment, simply press the **Open** icon in the SensorDisc™ software and select the files below:

	<p style="text-align: center;"><u><a href="#">Day and Night Temperature Changes</a></u></p> <p>A long 48-hour recording of temperature and light levels, with the SensorDisc™ located on the window shelf:</p> <ul style="list-style-type: none"><li>• <b>Sensors selected:</b> Light, ambient temperature</li><li>• <b>Sampling rate:</b> 1/min</li><li>• <b>Amount of samples:</b> 1000</li><li>• <b>Experiment duration:</b> 48 hours</li><li>• <b>Communication:</b> Offline, data downloaded at recording's end</li><li>• <b>Data Analysis:</b> Use the <b>Markers</b> to show min/max. values</li></ul>
	<p style="text-align: center;"><u><a href="#">Walk in the Park</a></u></p> <p>Micro climate activity. Comparing temperature and Relative humidity at a city cross-road and park:</p> <ul style="list-style-type: none"><li>• <b>Sensors selected:</b> External temperature, relative humidity, GPS</li><li>• <b>Sampling rate:</b> 1/sec</li><li>• <b>Amount of samples:</b> 1000</li><li>• <b>Experiment duration:</b> 15 minutes</li><li>• <b>Communication:</b> Offline, data downloaded at recording's end</li><li>• <b>Data Analysis:</b> Temp./humidity changes in SensorDisc™ map view</li></ul>
	<p style="text-align: center;"><u><a href="#">Free Fall</a></u></p> <p>A classic activity for Newton's 2nd Law. Measuring the free fall acceleration of a ping pong ball bouncing on a wooden surface, with the distance sensor located 1.5 m above it:</p> <ul style="list-style-type: none"><li>• <b>Sensors selected:</b> Distance</li><li>• <b>Sampling rate:</b> 25/sec</li><li>• <b>Amount of samples:</b> 1000</li><li>• <b>Experiment duration:</b> Seconds</li><li>• <b>Communication:</b> Online, preferably via wireless Bluetooth</li><li>• <b>Data Analysis:</b> Use <b>Markers</b> and <b>Crop</b> functions to focus on the ball bounces. Then use <b>quadratic regression</b> on a single bounce, to get the bounce equation and extract the free fall acceleration.</li></ul>

	<p style="text-align: center;"><b><u>Sound Beat</u></b></p> <p>Sound wave recording of 2 tuning forks, producing slightly different harmonics, of 440 Hz and 435 Hz.</p> <ul style="list-style-type: none"> <li>• <b>Sensors selected:</b> Microphone</li> <li>• <b>Sampling rate:</b> 25,000/sec</li> <li>• <b>Amount of samples:</b> 10,000</li> <li>• <b>Experiment duration:</b> &lt; 1 second</li> <li>• <b>Communication:</b> Offline, data downloaded at recording's end</li> <li>• <b>Data Analysis:</b> Use <b>Zoom</b> to see the sound sine wave and <b>Markers</b> to measure amplitude and frequency.</li> </ul>
	<p style="text-align: center;"><b><u>Boyle's Law</u></b></p> <p>Verifying the ideal gas law: <math>P \times V = \text{CONSTANT}</math>. Using a 100ml syringe connected to the air pressure sensor. Manually recording air pressure while decreasing the syringe volume by 10ml at a time.</p> <ul style="list-style-type: none"> <li>• <b>Sensors selected:</b> Air pressure</li> <li>• <b>Sampling rate:</b> Manual</li> <li>• <b>Amount of samples:</b> 10</li> <li>• <b>Communication:</b> Online, preferably via wireless Bluetooth</li> <li>• <b>Data Analysis:</b> Use <b>Bar-Graph</b> view to see air pressure values. Use <b>Annotation</b> to add the volume for each bar and <b>Export to Excel</b> to calculate <math>P \times V</math> multiplication.</li> </ul>
	<p style="text-align: center;"><b><u>pH level of Soft Drinks</u></b></p> <p>A fun and interesting activity, comparing the acidity of water, lemon juice and Coca-Cola.</p> <ul style="list-style-type: none"> <li>• <b>Sensors selected:</b> pH</li> <li>• <b>Sampling rate:</b> 10/sec</li> <li>• <b>Amount of samples:</b> 1000</li> <li>• <b>Experiment duration:</b> 2 minutes approx.</li> <li>• <b>Communication:</b> Online, preferably via wireless Bluetooth</li> <li>• <b>Data Analysis:</b> Using the <b>Markers</b> to measure the acidity level of the different liquids</li> </ul>

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[www.philipharris.co.uk](http://www.philipharris.co.uk)

SensorDisc™ supports Android versions 4.0 and up.

Made for  
iPad (3rd generation)  
iPad 2  
iPad

iPad is a trademark of Apple Inc., registered in the U.S. and other countries.

“Made for iPad” means that an electronic accessory has been designed to connect specifically to iPod, iPhone, or iPad, respectively, and has been certified by the developer to meet Apple performance standards. Apple is not responsible for the operation of this device or its compliance with safety and regulatory standards. Please note that the use of this accessory with iPod, iPhone, or iPad may affect wireless performance.

### **Cleaning**

To Clean, use a soft damp cloth. Under no circumstances use solvents or abrasives to clean the product

### **Warranty**

The SensorDisc™ is guaranteed for a period of one year from the date of delivery to the customer. This warranty does not apply to defects resulting from the action of a user such as misuse, improper maintenance or repair, or unauthorized modification.

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