

# **Product Manual**

1130 - pH/ORP Adapter



Phidgets 1130 - Product Manual For Board Revision 0 © Phidgets Inc. 2009

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# **Product Features**

- Interfaces to a glass electrode through a common BNC connection
- Measures the pH or ORP level of a substance

#### Connections

Designed to connect to a:

- 1018 PhidgetInterfaceKit 8/8/8
- 1019 PhidgetInterfaceKit 8/8/8 w/6 Port Hub
- 1070 PhidgetSBC
- 1202 PhidgetTextLCD

### **Type of Measurement**

The sensor uses non-ratiometric measurement.

### **Checking the Contents**

#### You should have received:

- An pH/ORP Adapter Board
- A Sensor Cable

# In order to test your new Phidget you will also need:

- A PhidgetInterfaceKit 8/8/8
- A USB Cable
- A pH or ORP electrode

#### Connecting all the pieces

- 1. Connect the pH/ORP Adapter Board to the Analog Input #6 on the PhidgetInterfaceKit 8/8/8 board using the sensor cable. In this example, we are using a pH electrode.
- 2. Connect the electrode to the adapter board using the BNC connector.
- 3. Use the DIP switch to select pH or ORP to correspond to the type of electrode you are using.
- 4. Connect the InterfaceKit 8/8/8 to your PC using the USB cable.



### Testing Using Windows 2000/XP/Vista

#### **Downloading the Phidgets drivers**

Make sure that you have the current version of the Phidget library installed on your PC. If you don't, do the following:

Go to www.phidgets.com >> Drivers

Download and run Phidget21 Installer (32-bit, or 64-bit, depending on your PC)

You should see the  $mathba{m}$  icon on the right hand corner of the Task Bar.

#### **Running Phidgets Sample Program**

Double clicking on the million loads the Phidget Control Panel; we will use this program to make sure that your new Phidget works properly. Since the sensor is connected to a 1018, the computer will see only the 1018. The sensor is providing data through the Analog input it is connected to.

The source code for the InterfaceKit-full sample program can be found under C# by clicking on www.phidgets.com >> Programming.

Double Click on the **Phidget** Control Panel and make sure that the **Phidget InterfaceKit 8/8/8** is properly attached to your PC.

Phidget Control Panel		<u> </u>
General WebService		
Library Information: Phidget21 - Version 2.1.6 - Built Apr 30 2009 Phidget21.NET - Version 2.1.6.105	9 13:23:49	
Locally Attached Devices: (Double click to launc	h UI)	
Device 🗠	Serial Number	Version
Phidget InterfaceKit 8/8/8	76667	826
✓ Start Phidget Control Panel with Windows?		

- 1. Double Click on Phidget InterfaceKit 8/8/8 in the Phidget Control Panel to bring up InterfaceKit-full and check that the box labelled Attached contains the word True.
- 2. Make sure that the Ratiometric box is NOT Ticked.
- 3. View the unconverted pH value inside the Analog In boxes. At a pH level of 7 or with a neutral ORP, the SensorValue will be 500.
- 4. You can adjust the input sensitivity by moving the slider pointer.
- 5. Click on the Sensors button to bring up the Advanced Sensor Form.

- In the Sensor 6 box, select the 1130 pH Adapter (pH) from the drop down menu. Alternatively, if you are using an ORP electrode, choose 1130 - pH Adapter (ORP).
- 2. The pH level measured by the sensor is shown here.
- 3. Formula used to convert the analog input SensorValue into pH (or ORP).

🚧 InterfaceKit-fi	ull	
InterfaceKit Info		Digital In
Attached:	True	
Name:	Phidget InterfaceKit 8/8/8	0 1 2 3 4 5 6 7
Serial No.:	76667	
Version:	826	Analog In 5
Digital Inputs:	8 (2)	
Digital Outputs:	8	Ratiometric 4 Sensors
Analog Inputs:	8	Input Sensitivity:

🔜 Advanced Sensor Form	×
Sensor 0 Base Value	Sensor 1 Base Value
Value: 1	Value: 2
Sensor 2 Base Value	Sensor 3 Base Value
Value: 2	Value: 2
Sensor 4 Base Value	Sensor 5 Base Value
Value: 2	Value: 0
Sensor 6 - 1130 - pH Adapter Board (pH)	Sensor 7 Base Value
pH: 5.605 <b>~ 2</b>	Value: 0
(pH) = 0.0178 * SensorValue - 1.889	

## **Testing Using Mac OS X**

- Click on System Preferences >> Phidgets (under Other) to activate the Preference Pane
- Make sure that the Phidget InterfaceKit 8/8/8 is properly attached.
- Double Click on Phidget InterfaceKit 8/8/8 in the Phidget Preference Pane to bring up the InterfaceKit-Full example. This example will function in a similar way as the Windows version, but note that it does not include an Advanced Sensor Display.

# **Programming a Phidget**

Phidgets' philosophy is that you do not have to be an electrical engineer in order to do projects that use devices like sensors, motors, motor controllers, and interface boards. All you need to know is how to program. We have developed a complete set of Application Programming Interfaces (API) that are supported for Windows, Mac OS X, and Linux. When it comes to languages, we support VB6, VB.NET, C#.NET, C, C++, Flash 9, Flex, Java, LabVIEW, Python, Max/MSP, and Cocoa.

#### **Code Samples**

We have written sample programs to illustrate how the APIs are used.

Due to the large number of languages and devices we support, we cannot provide examples in every language for every Phidget. Some of the examples are very minimal, and other examples will have a full-featured GUI allowing all the functionality of the device to be explored. Most developers start by modifying existing examples until they have an understanding of the architecture.

Go to www.phidgets.com >> Programming to see if there are code samples written for your device. Find the language you want to use and click on the magnifying glass besides "Code Sample". You will get a list of all the devices for which we wrote code samples in that language.

If this is your first time writing a program to control a Phidget, you should read the Getting Started Guide for the language you are planning to use.

#### **Coding for your Sensor**

Phidget analog sensors do not have their own API, but instead their output is a voltage that is converted to a digital value and accessed through the SensorValue properties and events on a PhidgetInterfaceKit. It is not possible to programmatically identify which sensor is attached to the Analog Input. Your application will need to apply any formulas from this manual to the SensorValue to translate it into usable data.

See the PhidgetInterfaceKit product manual for an overview of its API and a description of our architecture.

# **Technical Information**

#### Measuring the pH

To determine the pH of a solution, make sure the DIP switch on the board is flipped to the pH side. Given the SensorValue from the Phidget InterfaceKit, the following formula can be applied:

pH = 0.0178 \* SensorValue - 1.889

This formula assumes that the solution is at 25 degrees Celsius. Depending on the temperature of the solution and on the actual pH level, the SensorValue can change dramatically. To incorporate temperature (in degrees Celsius) for added accuracy, the following formula can be used:

pH = 7 - (2.5 - SensorValue / 200) / (0.257179 + 0.000941468 \* Temperature)

The following example is to give an idea of how the temperature affects the SensorValue. A solution with a pH of 2 at a temperature of 25 degrees Celsius yields a SensorValue of 219. At 100 degrees Celsius, the SensorValue decreases to 148, and at 0 degrees celsius, the SensorValue reports 242. A solution with a pH of 8 with a temperature of 0, 25 and 100 degrees Celsius gives a SensorValue of 551, 556 and 570, respectively. It can be seen that the temperature has a greater affect on solutions that have a pH further away from the reference pH of 7. Additionally, temperature affects the impedance of the glass electrode, and can result in increased errors if not properly calibrated.

## Measuring Oxidation/Reduction Potential (ORP)

To determine the ORP of a solution, make sure the DIP switch on the board is flipped to the ORP side. Given the SensorValue from the PhidgetInterfaceKit, the following formula can be applied:

ORP (V) = (2.5 - SensorValue / 200) / 1.037

ORP electrodes give a typical range of -2V to 2V, where the positive values are for oxidizers and the negative values are for reducers.

#### **Words of Caution**

#### The pH Adapter Board should be used to measure solutions that are 'electrically quiet'.

Measuring pH in electrically noisy environments such as tanks with mixing pumps, and even other measuring devices, is not recommended.

### **Choosing Electrodes**

Review the data sheet for the electrode you have selected for your application to ensure that it complies with the device specifications of the pH Adapter Board. The important specification is the output voltage of the electrode. Many electrodes will work but it is important to verify compliance before connecting an electrode to the Adapter Board. We have reviewed the following electrodes, and found that they can be used with the pH Adapter Board. This is by no means a comprehensive list, but can be used as a comparison with other electrodes if necessary.

Manufacturer	Web Page	Part Number
Omega	www.omega.com	PHE13XX, PHE14XX, ORE1311, ORE1411
Cole - Parmer	www.coleparmer.com	EW-59001,
		EW-27003
Mettler - Toledo	www.mt.com	InLab (BNC) Series

#### **Other Interfacing Alternatives**

If you want maximum accuracy, you can use the RawSensorValue property from the PhidgetInterfaceKit. To adjust a formula, substitute (SensorValue) with (RawSensorValue / 4.095)

If the sensor is being interfaced to your own Analog to Digital Converter and not a Phidget device, our formulas can be modified by replacing (SensorValue) with (Vin \* 200). It is important to consider the voltage reference and input voltage range of your ADC for full accuracy and range.

#### **Analog Input Cable Connectors**

Each Analog Input uses a 3-pin, 0.100 inch pitch locking connector. Pictured here is a plug with the connections labeled. The connectors are commonly available - refer to the Table below for manufacturer part numbers.



Cable Connectors		
Manufacturer	Part Number	Description
Molex	50-57-9403	3 Position Cable Connector
Molex	16-02-0102	Wire Crimp Insert for Cable Connector
Molex	70543-0002	3 Position Vertical PCB Connector
Molex	70553-0002	3 Position Right-Angle PCB Connector (Gold)
Molex	70553-0037	3 Position Right-Angle PCB Connector (Tin)
Molex	15-91-2035	3 Position Right-Angle PCB Connector - Surface Mount

Note: Most of the above components can be bought at www.digikey.com

#### **Mechanical Drawing**



### **Device Specifications**

Characteristic	Value
Current Consumption	3.0 mA
Input Impedance	>1 TeraOhm
Input Voltage	4.5 V to 5.25 V
pH Specifications	
Input Range	-400 mV to +400 mV
Input Resolution	1 pH / 54.4 SensorValue
Min/Max Error	±0.09 pH
Typical error	±0.02 pH
<b>ORP Specifications</b>	
Input Range	-2000 mV to +2000 mV
Input Resolution	100 mV / 20 SensorValue
Min/Max Error	±8 mV
Typical Error	±3 mV

## **Product History**

Date	<b>Board Revision</b>	Comment
March 2010	0	Product Release

# Support

Call the support desk at 1.403.282.7335 8:00 AM to 5:00 PM Mountain Time (US & Canada) - GMT-07:00

or

E-mail us at: support@phidgets.com