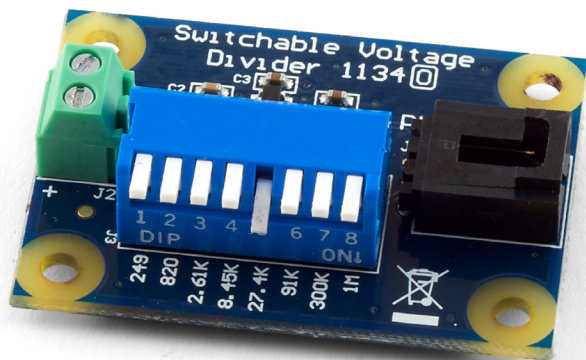


# Product Manual

## 1134 - Switchable Voltage Divider



**Phidgets 1134 - Product Manual**

**For Board Revision 0**

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# Product Features

## Applications

- Provides an interface to non-Phidgets variable resistance sensors such as: Force Sensing Resistors (FSR), light sensors, thermistors (heat sensors), and bend sensors.
- Precision resistors on the 1134 allows the application to precisely calculate the resistance of the attached sensor.
- Possible to use multiple resistors to select an equivalent resistance for the 'fixed' resistor
- The interface to the variable resistance sensor is a convenient terminal block.

## 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 ratiometric measurement.

# Getting Started

## Checking the Contents

### You should have received:

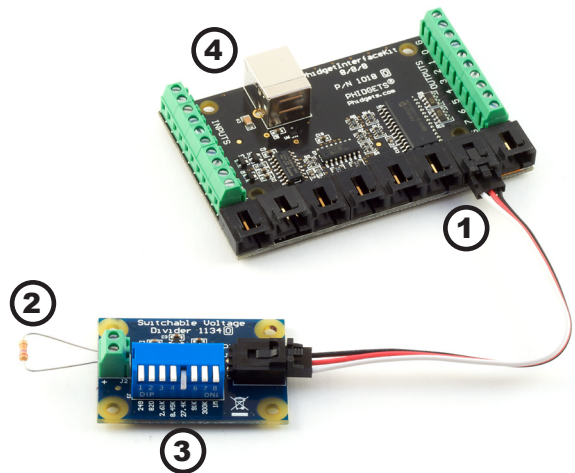
- A Switchable Voltage Divider board
- A Sensor Cable

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

- A PhidgetInterfaceKit 8/8/8
- A USB Cable
- A variable resistance sensor or any resistor ( we are using a 27K resistor)

## Connecting all the pieces

1. Connect the Switchable Voltage Divider to an Analog Input on the PhidgetInterfaceKit 8/8/8 board using the sensor cable.
2. Connect the variable resistance sensor to the terminal block on the Voltage Divider.
3. Select an appropriate measurement range for your application by toggling the desired DIP switch. We are toggling the 27.4K switch. When the switch is down, the associated measuring resistor is selected. It is possible to have more than one switch toggled and have the resistors in parallel. For our purpose only toggle one switch.
4. Connect the InterfaceKit board 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](http://www.phidgets.com) >> Drivers


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

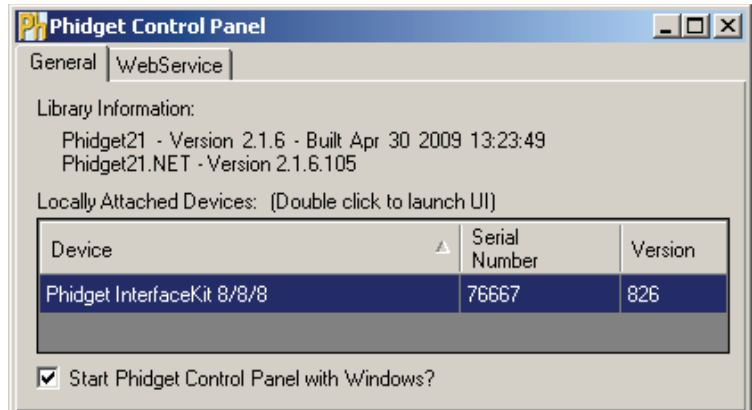
You should see the  icon on the right hand corner of the Task Bar.

### Running Phidgets Sample Program

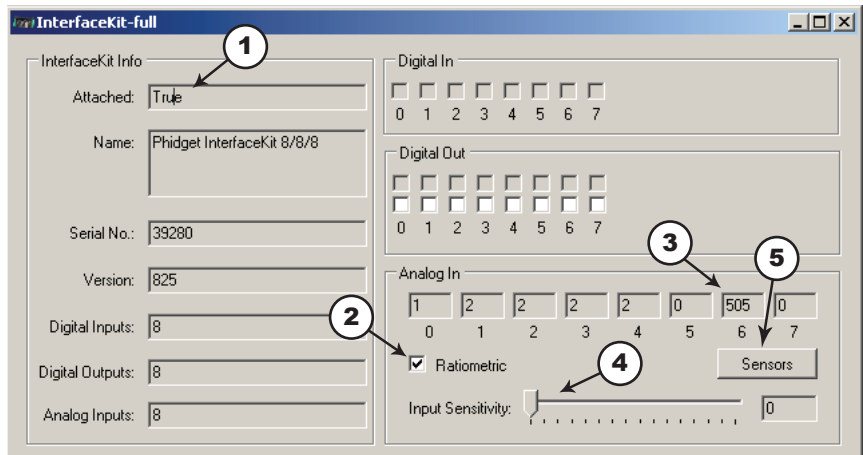
Double clicking on the  icon loads the Phidget Control Panel; we will use this program to make sure that your new Phidget works properly. Since the sensor is connected to a 1018, the computer will see only the 1018. The sensor is providing data through the Analog input it is connected to.

The source code for the InterfaceKit-full sample program can be found under C# by clicking on [www.phidgets.com](http://www.phidgets.com) >> Programming.

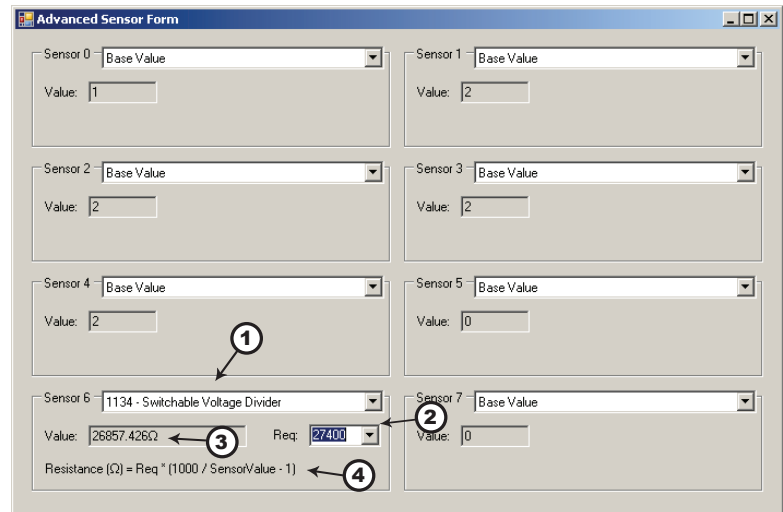
Double Click on the  icon to activate the Phidget Control Panel and make sure that the **Phidget InterfaceKit 8/8/8** is properly attached to your PC.



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 Ticked.
3. The Analog In box displays a number corresponding to the resistor value.
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.



1. In the Advanced Sensor Form, select the 1134 - Switchable Voltage Divider from the drop down menu.
2. Select the appropriate resistor from the drop-down menu that has been selected with the DIP switch on the board.
3. The resistance measured by the sensor is shown here.
4. Formula used to convert the analog input SensorValue into resistance.



## 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](http://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

The 1134 Switchable Voltage Divider is a voltage divider with switches. The switches can be used to control which resistors are used in the voltage divider. From left to right, the resistance values (in Ohms) are 249, 820, 2.61K, 8.45K, 27.4K, 91K, 300K and 1M. It is possible to have multiple switches flipped, putting the corresponding resistors in parallel.

## Formulas

The Formula to translate SensorValue into resistance is:

$$\text{Resistance (Ohms)} = \text{Req} * (1000 / \text{SensorValue} - 1)$$

Where Req is the equivalent resistance of the switches that are flipped on in Ohms.

The Switchable Voltage Divider has an internal buffer on the output. This allows the output to be read without distortion caused by the device reading the measurement, such as the PhidgetInterfaceKit.

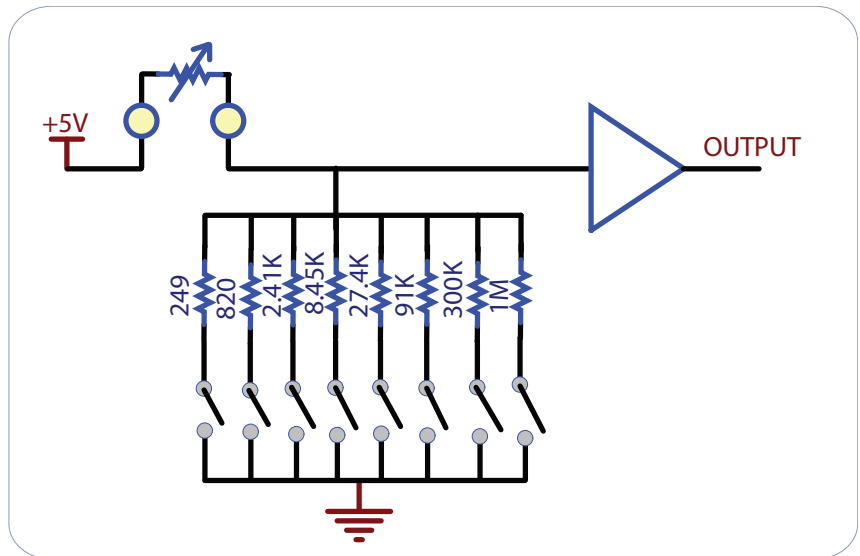
## Configuring the Voltage Divider

To optimize the voltage divider to meet your needs, you have to adjust the switchable resistance to match the characteristics of your chosen variable resistor. First, adjust the resistance for no stimuli on your sensor, then apply maximum stimuli and make sure that the Sensor Value stays within a range that gives you an acceptable resolution. The formula is most accurate at a SensorValue of 500, with an error of 0.4%. At 100 and 900, the error increases to approximately 1.1% and at 50 and 950, it increases to 2.1%.

As a general rule, if the SensorValue is over 900, a lower resistance should be switched in. If the SensorValue is below 100, a higher switch should be toggled. Continue adjusting the switches until you find an acceptable range.

**Warning:** It is possible for the 1134 to apply up to 5V to the variable resistor. If the resistor cannot handle this voltage, it can be damaged.

The 1134 is a very simple way of measure resistance. When interfacing to sensors with small resistances (like 100 ohm RTDs, for instance), large currents can flow - up to 30 mA. This level of current may cause substantial heating in the variable resistor, distorting the measurement or even possibly permanently damaging it.





## Variable resistance sensors

Here are some interesting variable resistance sensors that could be used with the Voltage Divider.

Sensor Type	Manufacturer	Example	Digikey search
Light Sensors	Advanced Photonics	PDV-P9003-1	photocell
Force Sensors	CUI Inc.	IESP-12	force sensor
Thermistors	US Sensor	615-1037-ND	thermistor radial
Bend Sensors	imagesco.com	FLX-01	n/a

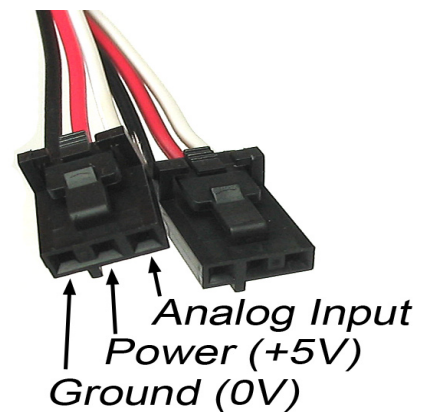
## Other Interfacing Alternatives

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

If the sensor is being interfaced to your own Analog to Digital Converter (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.

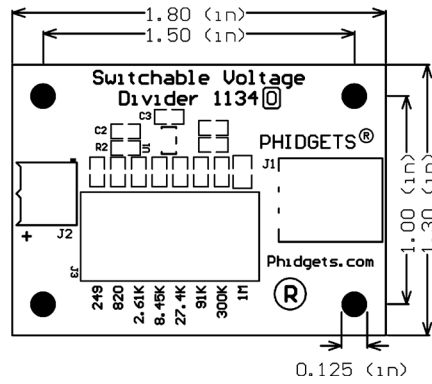


Cable Connectors		
Manufacturer	Part Number	Description
Molex	50-57-9403	3 Position Cable Connector
Molex	16-02-0102	Wire Crimp Insert for Cable Connector
Molex	70543-0002	3 Position Vertical PCB Connector
Molex	70553-0002	3 Position Right-Angle PCB Connector (Gold)
Molex	70553-0037	3 Position Right-Angle 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](http://www.digikey.com)

## Mechanical Drawing

1:1 scale



## Device Specifications

Characteristic	Value
Maximum Current Consumption	30 mA
Supply Voltage	3.0 to 5.25 VDC
Max Switchable Resistance	1M Ohms
Min Switchable Resistance	172 Ohms
Variable Resistor Range	Up to 50 MegaOhms
Resolution between SensorValue 100-900	Less than $\pm 1\%$ of variable resistor per SensorValue

## Product History

Date	Board Revision	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](mailto:support@phidgets.com)