TI-SensorLink Adapter Setup Guide

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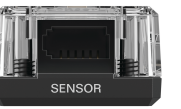
TI-SensorLink Adapter

What is TI-SensorLink Adapter?

TI-SensorLink Adapter is an accessory to TI-Innovator™ Hub to support the use of Vernier analog sensors with the Hub. TI-SensorLink expands STEM project possibilities by connecting select Vernier Sensors to TI-SensorLink, then to TI-Innovator™ Hub.

Note: TI-SensorLink is not a data collection solution. USB connected probes or TI-Nspire™ Lab Cradle are a superior solution for pure data collection and analysis.

TI-SensorLink – Industrial design and markings

Top view of TI-SensorLink Adapter.	
Front view - Port for connecting probes and sensors	
Back view - Port for connecting to the Hub	
Bottom view - identifying label.	

Supported Vernier Analog Sensors

We officially support these four Vernier analog sensors with TI-SensorLink.

Module	Ports	Image	Example code for TI-SensorLink

Stainless Steel Temperature Probe	TI-SensorLink 		Connect To:
			`Send "CONNECT VERNIER 1 TO IN1 AS TEMPERATURE"`
			`Send "READ VERNIER 1"`
			`Get T`

ph Sensor	TI-SensorLink 		Connect to:
			`Send "CONNECT VERNIER 2 TO IN2 AS PH"`
			`Send "READ VERNIER 2"`
			`Get P`

Gas Pressure Sensor	TI-SensorLink 		Connect To:
			`Send "CONNECT VERNIER 1 TO IN1 AS PRESSURE"`
			`Send "READ VERNIER 1"`
			`Get P`

Dual-Range Force Sensor	TI-SensorLink 		Connect To:
			`Send "CONNECT VERNIER 2 TO IN2 AS FORCE"`
			or
			`Send "CONNECT VERNIER 2 TO IN2 AS FORCE50"`
			`Send "READ VERNIER 2"`
			`Get F`

Low-g Accelerometer	TI-SensorLink 		Connect To:
			`Send "CONNECT VERNIER 1 TO IN 1 AS ACCEL"`
			`Send "READ VERNIER 1"`

Light Sensor	TI-SensorLink 		Connect To:
			`Send "CONNECT VERNIER 1 TO IN 1 AS LIGHT"`
			`Send "READ VERNIER 1"`

Module	Ports	Image	Example code for TI-SensorLink

Vernier Energy Sensor	TI-SensorLink 		Connect To:
			`Send "CONNECT VERNIER 1 TO IN 1 AS ENERGY"`
			`Send "READ VERNIER 1"`

Requirements for Vernier adapter:

Hardware:

- Add-on TI-SensorLink Adapter to TI-Innovator™ Hub
- Support a single Vernier analog sensor
- Will work on all three IN ports of Hub
  - Use with I2C port or the OUT ports is **NOT** supported - sketch will indicate an error
- The following sensors are supported
  - Stainless Steel Temperature Probe
  - pH Sensor
  - Gas Pressure Sensor
  - Dual-Range Force Sensor
  - Low-g Accelerometer Data Sheet
  - Light Sensor Data Sheet
  - Vernier Energy Sensor Data Sheet

Precautions for the TI-SensorLink Adapter and Vernier Sensors

TI-SensorLink Adapter

- TI-SensorLink is **not** a data collection solution. USB connected probes or Lab Cradle remains a superior solution for pure data collection and analysis.
- The Hub commands for the TI-SensorLink with the Vernier analog sensors are currently **not** part of the Hub App (CE family) or the Hub menu (TI-Nspire™ CX).
- The new commands and keywords will either need to be typed in OR copied from an existing program. Please note that any typographical errors in the keywords will result in an error indication in the sketch.

Vernier Sensors

- Gas Pressure Sensor - The Gas Pressure Sensor sensing element will be damaged with direct contact to liquid.

- pH Sensor - Place the electrode in pH 4 or pH 7 buffer solution. It should never be stored in distilled water. If the electrode is inadvertently stored dry for a short period of time, immerse the tip in the pH 4 buffer/KCl storage solution for a minimum of 8 hours prior to use.
- Stainless Steel Temperature Probe -
  - Twisting the cable. Sometimes students twist or crimp the wire near the handle of the sensor. Over time, this can cause the wires to come loose and make the sensor stop working.
  - Overheating the sensor. When used in chemistry labs, students will sometimes lay the sensor on a hot plate and effectively "cook" the unit.
  - The unit is not waterproof! Water can seep into the hilt of the sensor and damage the electronics. Only submerge the stainless steel portion the sensor into water when collecting data.

Connecting the TI-SensorLink Adapter

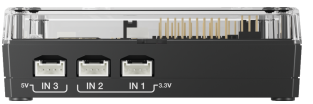
Follow these set of steps in this order to connect and use the TI-SensorLink Adapter.

Connect the TI-SensorLink Adapter to the TI-Innovator™ Hub

TI-Sensor Link Adapter

Provided Cable

TI-Innovator™ Hub



STEPS

1. Connect one end of the provided cable to the TI-SensorLink port labeled HUB.
2. Connect the other end of the provided cable to the port on the Hub labeled IN1.

   Note: may also insert cable into IN2 or IN3.

Connect the TI-Innovator™ Hub to a Graphing Calculator

The TI-Innovator™ Hub connects by a USB cable to a graphing calculator or computer. The connection lets the Hub receive power and exchange data with the host.

See complete details (here).

Connect TI-SensorLink Adapter to a Vernier Sensor

TI-SensorLink Adapter

Vernier Sensor

Connecting TI-Sensor Link to one of the four supported Vernier Analog Sensors, using the analog sensor's attached connector.

STEPS

1. Connect the Vernier sensor to the TI-SensorLink (This example uses the Stainless Steel Temperature Probe)
2. From the connected graphing calculator, enter the following code:

```
Send "CONNECT VERNIER 1 TO IN1 AS TEMPERATURE"

Send "READ VERNIER 1"

Get T
```

Note: The new commands and keywords will either need to be typed in OR copied from an existing program. Please note that any typographical errors in the keywords will result in an error indication in the sketch.

See Code Samples for:

- Dual-Range Force Sensor
- Gas Pressure Sensor
- pH Sensor
- Stainless Steel Temperature Probe

TI-SensorLink Adapter and Vernier Sensor Data Sheets

The TI-SensorLink Adapter Data Sheet and Vernier Sensor Data Sheets include the following; a product name and number, a brief description, a product image, specifications, how the component connects to the TI-Innovator™ Hub, and Hub commands with simple code samples.

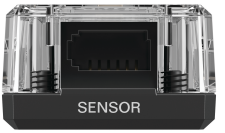
Topic Links

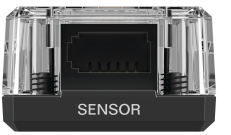
- TI-SensorLink Adapter Data Sheet
- **Vernier Sensor Data Sheets**
  - Stainless Steel Temperature Probe Data Sheet
  - pH Sensor Data Sheet
  - Dual-Range Force Sensor Data Sheet
  - Gas Pressure Sensor Data Sheet
  - Low-g Accelerometer Data Sheet
  - Light Sensor Data Sheet
  - Vernier Energy Sensor Data Sheet

Note:

- TI-SensorLink is **not** a data collection solution. USB connected probes or Lab Cradle remains a superior solution for pure data collection and analysis.
- The Hub commands for the TI-SensorLink with the Vernier analog sensors are currently **not** part of the Hub App (CE family) or the Hub menu (TI-Nspire™ CX).
- The new commands and keywords will either need to be typed in OR copied from an existing program. Please note that any typographical errors in the keywords will result in an error indication in the sketch.

TI-SensorLink Adapter Data Sheet



Title	**TI-SensorLink Adapter**
TI Item Name	STEMKT/AC/SL/A
Included in	TI-SensorLink Adapter
Quantity	1
Description	Accessory to TI-Innovator™ Hub to support use of Vernier analog sensors with Hub **Note:** Not a data collection solution – USB connected probes or Lab Cradle remains a superior solution for pure data collection and analysis
Category	Adapter
Hub Connection	 
Assembly Instructions	N/A
Precautions	.
Specifications	

Stainless Steel Temperature Probe Data Sheet

Title	**Vernier Stainless Steel Temperature Probe**
TI Item Name	n/a
Vernier Order Code	TMP-BTA
Included in	Stainless Steel Temperature Probe
Quantity	1
Description	The Stainless Steel Temperature Probe is a rugged, general-purpose temperature sensor that can be used in organic liquids, salt solutions, acids, and bases. Use it as you would use a thermometer for experiments in chemistry, physics, biology, Earth science, and environmental science. **See Also:** User Manual
Category	Environmental Sensor
Hub Connection	TI-SensorLink Adapter for TI-Innovator™ Hub
Assembly Instructions	N/A
Precautions	1. Twisting the cable. Sometimes students twist or crimp the wire near the handle of the sensor. Over time, this can cause the wires to come loose and make the sensor stop working. 2. Overheating the sensor. When used in chemistry labs, students will sometimes lay the sensor on a hot plate and effectively "cook" the unit. 3. The unit is not waterproof! Water can seep into the hilt of the sensor and damage the electronics. Only submerge the stainless steel portion the sensor into water when collecting data.
Specifications	Temperature range: –40 to 135°C (–40 to 275°F) Maximum temperature that the sensor can tolerate

Title	Vernier Stainless Steel Temperature Probe
	without damage: 150°C Typical Resolution: • 0.17°C (–40 to 0°C) • 0.03°C (0 to 40°C) • 0.1°C (40 to 100°C) • 0.25°C (100 to 135°C) **See Also:** Full Specifications here.

HUB Commands	
Sketch Object	VERNIER
Command Syntax	

Code Sample:

Desired Action	Code Sample

Read the temperature from the attached Vernier sensor	`Send "CONNECT VERNIER 1 TO IN1 AS TEMPERATURE"`
	`Send "READ VERNIER 1"`
	`Get T`

pH Sensor Data Sheet

Title	**Vernier pH Sensor**
TI Item Name	n/a
Vernier Order Code	PH-BTA
Included in	pH Sensor
Quantity	1
Description	Use the pH Sensor just as you would a traditional pH meter with the additional advantages of automated data collection, graphing, and data analysis **See Also:** User Manual
Category	Environmental Sensors
Hub Connection	TI-SensorLink Adapter for TI-Innovator™ Hub
Assembly Instructions	N/A
Precautions	Place the electrode in pH 4 or pH 7 buffer solution. It should never be stored in distilled water. If the electrode is inadvertently stored dry for a short period of time, immerse the tip in the pH 4 buffer/KCl storage solution for a minimum of 8 hours prior to use.
Specifications	• Type: Sealed, gel-filled, epoxy body, Ag/AgCl • Response time: 90% of final reading in 1 second • Temperature range: 5 to 80°C (readings not compensated) • Range: pH 0–14 • Accuracy: +/- 0.2 pH units • Isopotential pH: pH 7 (point at which temperature has no effect) • Default calibration values: slope: –3.838, intercept: 13.720 • Shaft Diameter: 12 mm OD **See Also:** Full Specifications here.

HUB Commands	
Sketch Object	VERNIER
Command Syntax	

Code Sample:

Desired Action	Code Sample

Read the pH from the attached Vernier sensor	`Send "CONNECT VERNIER 2 TO IN2 AS PH"`
	`Send "READ VERNIER 2"`
	`Get P`

Gas Pressure Sensor Data Sheet

Title	**Vernier Gas Pressure Sensor**
TI Item Name	n/a
Vernier Order Code	GPS-BTA
Included in	Gas Pressure Sensor
Quantity	1
Description	Used to monitor pressure changes in a gas. The range is wide enough to perform Boyle's law yet it is sensitive enough to conduct vapor-pressure or pressure-temperature experiments. Biology teachers can use the Gas Pressure Sensor to monitor transpiration or respiration in an enclosed environment. **See Also:** User Manual
Category	Environmental Sensor
Hub Connection	TI-SensorLink Adapter for TI-Innovator™ Hub
Assembly Instructions	N/A
Precautions	The Gas Pressure Sensor sensing element will be damaged with direct contact to liquid.
Specifications	• Pressure Range: 0 to 210 kPa (0 to 2.1 atm or 0 to 1600 mm Hg) • Accuracy: ±4 kPa • Maximum pressure that the sensor can tolerate without permanent damage: 4 atm • Sensing Element: Honeywell SSCMRNN030PAAA5 **Note**: There are two variants of the Gas Pressure Sensor. Version 1.3 of the sketch for TI-Innovator™ Hub includes the calibration constants for one of the two variants. The reference programs show how to use the CALIBRATE command to use the other type of Gas Pressure sensor. **See Also:** Full Specifications here.

HUB Commands	
Sketch Object	VERNIER
Command Syntax	

Code Sample:

Desired Action	Code Sample

Read the gas pressure from the attached Vernier sensor	`Send "CONNECT VERNIER 1 TO IN1 AS PRESSURE"`
	`Send "READ VERNIER 1"`
	`Get P`

New in Sketch v 1.4

There is an additional variant of the Vernier Gas Pressure sensor with different calibration constants.

New keyword: **PRESSURE2**

The calibration constants are: 51.71 -25.86

Code Sample:

```
Send "CONNECT VERNIER 1 TO IN 1 AS PRESSURE2"
Send "READ VERNIER 1"
Get P
```

Dual-Range Force Sensor Data Sheet

Title	**Vernier Dual-Range Force Sensor**
TI Item Name	n/a
Vernier Order Code	DFS-BTA
Included in	Vernier Dual-Range Force Sensor
Quantity	1
Description	General-purpose sensor for measuring pushing and pulling forces. Two ranges allow you to measure forces as small as 0.01 newtons and as large as 50 newtons. **See Also:** User Manual
Category	Environmental Sensor
Hub Connection	TI-SensorLink Adapter for TI-Innovator™ Hub
Assembly Instructions	Designed to be mounted on a ring stand, cart, track, or force table in several different ways. Use a 13 mm rod extended through the hole in the Dual-Range Force Sensor. Tighten the included thumb screw.
Precautions	N/A
Specifications	± 10 N Range Resolution: 0.01 N ± 50 N Range Resolution: 0.05 N **Note**: There is a switch on this sensor to allow measuring: – ± 10 N – ± 50 N **See Also:** Full Specifications here.

HUB Commands		
Sketch Object	VERNIER	
Command Syntax		
Code Sample:	**Desired Action**	**Code Sample**

	Read the force from the attached Vernier sensor in 10 N configuration	`Send "CONNECT VERNIER 2 TO IN2 AS FORCE"`
		`Send "READ VERNIER 2"`
		`Get F`

	Read the force from the attached Vernier sensor in 50 N configuration
	(Note that the CONNECT command includes FORCE50)
		`Send "CONNECT VERNIER 2 TO IN2 AS FORCE50"`
		`Send "READ VERNIER 2"`
		`Get F`

Low-g Accelerometer Data Sheet

(Order Code- LGS-BTA)

Title	**Low-g Accelerometer**
TI Item Name	n/a
Vernier Order Code	LGA-BTA
Included in	Low-g accelerometer
Quantity	1
Description	The Low-g Accelerometer can be used for a wide variety of experiments and demonstrations, both inside the lab and outside. **See Also:**User Manual
Category	Environmental Sensor
Hub Connection	TI-SensorLink Adapter for TI-Innovator™ Hub
Assembly Instructions	N/A
Precautions	
Specifications	**See:** Full Specifications here.

Light Sensor Data Sheet

(Order Code- LS-BTA)

Title	**Light Sensor**
TI Item Name	n/a
Vernier Order Code	LS-BTA
Included in	Light Sensor
Quantity	1
Description	The Light Sensor can be used for measurements of light intensity in a variety of situations. **See Also:**User Manual
Category	Environmental Sensor
Hub Connection	TI-SensorLink Adapter for TI-Innovator™ Hub
Assembly Instructions	N/A
Precautions	The Light Sensor is sensitive enough to pick up the 60 or 120 Hz flicker of overhead fluorescent lamps, which may interfere with light experiments. If you think such interference may be occurring, try the following: • First, eliminate all artificial light sources (except battery-powered flashlights) and try your experiment again. • Next, test the Light Sensor positioned as you plan to use it. Set the sampling at 1000 points/second for 0.1 second. If the flicker is the problem, you will see a drastic variation in the light intensity with a period of 60 or 120 Hz (50 or 100 Hz outside of North America). • If the overhead flicker is an issue, set the sampling rate to a number that is not a factor of 60. For example, using 30, 20, or 10 samples/s is worse than using 17, 23, 27 samples/s.
Specifications	**See:** Full Specifications here. Default calibration values 0–600 lux

Title	Light Sensor	
		slope: 154 lux/V intercept: 0 lux 0–6000 lux slope: 1692 lux/V intercept: 0 lux 0–150000 lux slope: 38424 lux/V intercept: 0 lux

Vernier Energy Sensor Data Sheet

(Order Code- VES-BTA)

Title	**Vernier Energy Sensor**
TI Item Name	n/a
Vernier Order Code	VES-BTA
Included in	Energy Sensor
Quantity	1
Description	The Vernier Energy Sensor allows students to easily measure current and voltage. Source terminals connect to energy output sources such as model wind turbines or solar panels, and Load terminals connect to loads such as LEDs, water pumps, resistors, or variable loads. **See Also:**User Manual
Category	Environmental Sensor
Hub Connection	TI-SensorLink Adapter for TI-Innovator™ Hub
Assembly Instructions	N/A
Precautions	
Specifications	**See:** Full Specifications here.

General Information

Online Help

education.ti.com/eguide

Select your country for more product information.

Contact TI Support

education.ti.com/ti-cares

Select your country for technical and other support resources.

Service and Warranty

education.ti.com/warranty

Select your country for information about the length and terms of the warranty or about product service.

Limited Warranty. This warranty does not affect your statutory rights.

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