**TEXAS INSTRUMENTS**

# TI-Innovator™ Rover
# Setup Guide

This guidebook applies to TI-Innovator™ Rover which requires TI-Innovator™ Sketch software version 1.2 or later. To obtain the latest version of the documentation, go to *education.ti.com/go/download*.

## *Important Information*

# *Contents*

## TI-Innovator™ Rover Overview

**TI-Innovator™ Rover** is a two-wheeled programmable robotic vehicle which works with the TI-Innovator™ Hub with TI LaunchPad™ Board. You communicate with the Hub and control the Rover through TI Basic programs on one of these TI products:

• TI CE Family of Graphing Calculators (TI-83 Premium CE, TI-84 Plus CE, and TI-84 Plus CE-T) with operating system version 5.3 or later installed. You also need to install or update the Hub App, which contains the Hub menu.

• TI-Nspire™ CX or TI-Nspire™ CX CAS handheld with operating system version 4.5 or later installed

• TI-Nspire™ computer software version 4.5 or later

Follow this guide to setup your TI-Innovator™ Rover with your TI CE Graphing Calculator or TI-Nspire™ CX Handheld.

**Learn More**

Refer to the TI-Innovator™ Technology eGuide for more details.

The eGuide is a web-based source of TI-Innovator™ information, including:

• Programming with the TI CE Family of Graphing Calculators and TI-Nspire™ Technology, including sample programs.

• Available I/O Modules and their commands.

• Available Breadboard components and their commands.

• TI-Innovator™ Rover and its commands.

• Link to update the TI-Innovator™ Sketch software.
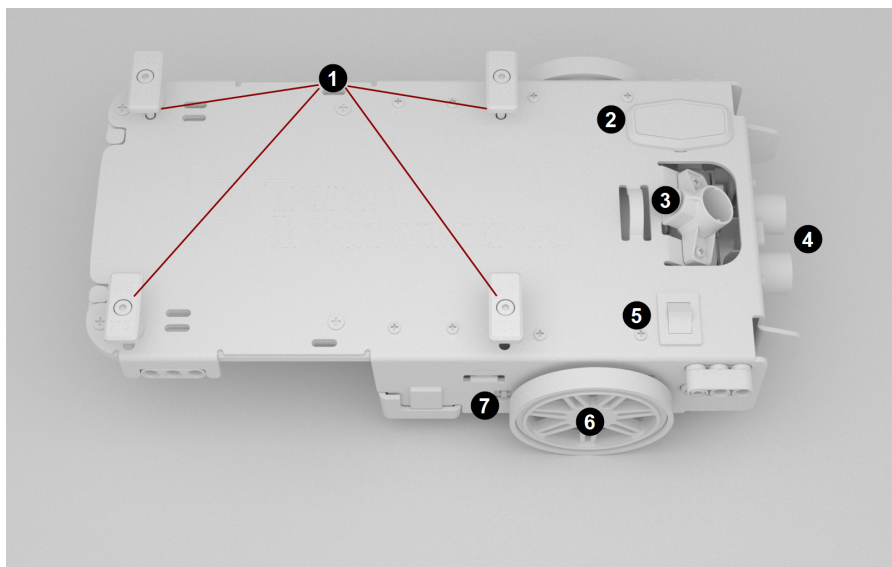
• Free classroom activities for Hub and Rover.

To access the eGuide, visit https://education.ti.com/go/eguide/hub/EN.

For a list of precautions to take while using the Rover and its components, refer to *General Precautions* (page 14).

## *What's in the Box*

The box includes the TI-Innovator™ Rover and two ribbon cables to connect the Rover to the TI-Innovator™ Hub.



**Rover On-Board Components**

**❶ Calculator Holder Pegs** - For securing a TI CE Graphing Calculator or a TI-Nspire™ CX Handheld to the calculator platform.

**❷ LED Panel (RGB LED/Battery Level Indicator)** - For displaying programmable feedback through the **Red-Green-Blue (RGB) LED**, and for displaying battery charge levels.

**❸ Marker Holder** - For inserting a marker to draw paths on paper.

**❹ Ultrasonic Ranger** - Front-mounted for measuring distance to obstacles.

**❺ ON/OFF (I/O) Switch** - For turning Rover on or off.

**❻ Wheels** - Each with electric motor and rotary encoder to track rotations.

**❼ PWR** port - For charging Rover's high-capacity, rechargeable battery.

**Other Features on the Rover**

- Bottom-mounted color sensor for measuring surface colors.
- Gyroscope for measuring or maintaining orientation.

## TI-Innovator™ Rover Setup Requirements

To set up your TI-Innovator™ Rover with your TI-Innovator™ Hub and graphing calculator you will need these materials.

| Component | Image | Description |
|---|---|---|
| TI-Innovator™ Rover | | A two-wheeled programmable robotic vehicle which works with the Hub. |
| Breadboard Ribbon Cable | | Connects the Rover to the Hub's Breadboard Connector. |
| $I^2C$ Cable | | Connects the Rover to the Hub's $I^2C$ port. |
| TI-Innovator™ Hub with TI LaunchPad™ Board | | Controls the Rover through TI Basic programming commands. |
| USB Unit-to-Unit (Mini-A to Mini-B) Cable | | Included with the Hub. Connects the Hub to a TI CE Graphing Calculator or a TI-Nspire™ CX Handheld. |
| USB Standard A to Micro Cable | | Included with the Hub. Connects the **PWR** port of the Rover to a TI approved power source. |
| TI CE Graphing Calculator or TI-Nspire™ CX Handheld | | Runs TI Basic programs to send commands to the Hub. |
| TI Wall Charger | | Included with the Hub. Power source for charging the Rover. |

## *Preparing TI-Innovator™ Rover*

Follow these steps to fully charge your TI-Innovator™ Rover.

1.  Identify the Micro connector on the USB Standard A to Micro cable.



2.  Insert the Micro connector into the **PWR** port on the side of the Rover.
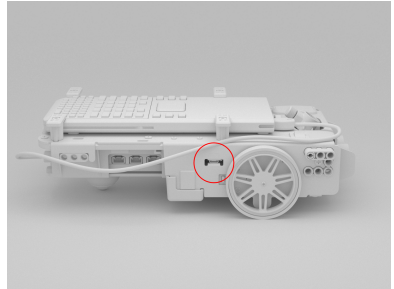


3.  Insert the free end of the cable (the "**A**" connector) into the USB port on your computer or TI Wall Charger.

    **Note:** The Battery Level Indicator shows solid green when the battery is fully charged.



Make sure the TI-Innovator™ Rover is switched **OFF** before connecting to the TI-Innovator™ Hub.

▶  Flip the **On/Off (I/O)** switch to the **Off (O)** position.

## *Connecting TI-Innovator™ Rover*

There are two sets of connection steps to use the TI-Innovator™ Rover.

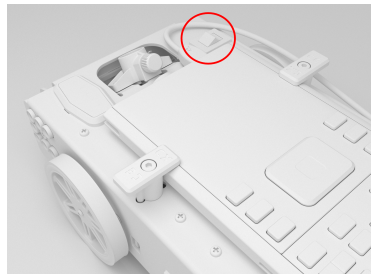- First, connect the Rover to the TI-Innovator™ Hub, using the two ribbon cables provided.
- Second, connect the Hub to a graphing calculator, using the USB Unit-to-Unit (Mini-A to Mini-B) cable included with the Hub.

**Connecting TI-Innovator™ Rover to TI-Innovator™ Hub**

1. Insert the **Breadboard Ribbon Cable** into the **Breadboard Connector** on the Hub.

   **Note:** It is critical that you insert the cable correctly. Make sure the red (dark) wire pin is inserted into the 5v hole on the Hub's **Breadboard Connector**.



2. Carefully guide the attached Ribbon Cable through the opening at the back of the Rover.
3. As the cable comes through, slide the Hub into place using the **Guide Rails**.

   You will hear a click when the Hub is properly inserted.
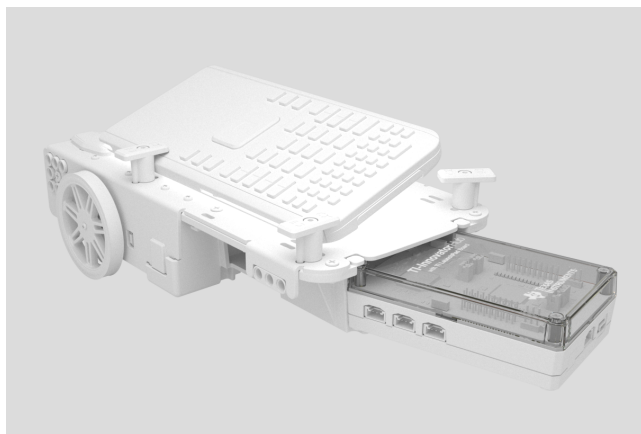
4. Open the two latches on the **Rover Circuit Board Ribbon Cable Connector**.

5. Align the notch in the ribbon cable with the slot on circuit board connector.

6. Insert the ribbon cable and close the latches.
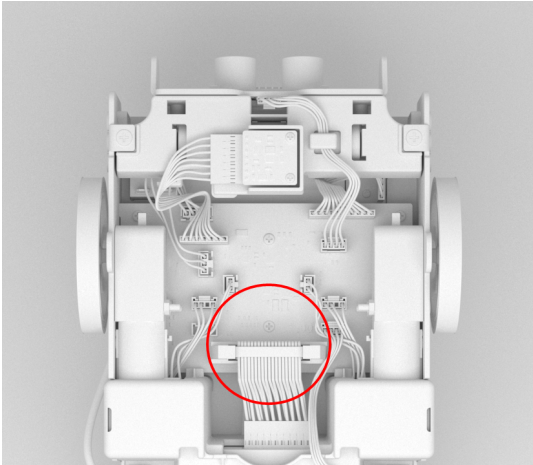


7. Insert one end of the **I$^2$C Cable** into the Rover circuit board.

   **Note:** There are two possible **I$^2$C ports**. Use **Port 1**.
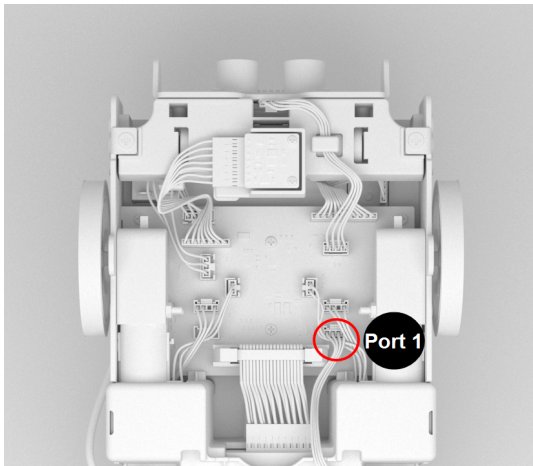
8. Insert the slack **I<sup>2</sup>C Cable** into the side rails.



9. Align the tab on the **I<sup>2</sup>C Cable** with the top of the **I<sup>2</sup>C port**.
10. Insert the free end of the **I<sup>2</sup>C Cable** connector into the **I<sup>2</sup>C port** at the back of the Hub.

**Connecting TI-Innovator™ Hub to a Graphing Calculator**

1. Turn the Rover right side up.

2. Lift and turn the **Calculator Holder Pegs** so that they are parallel with the side of the Rover.

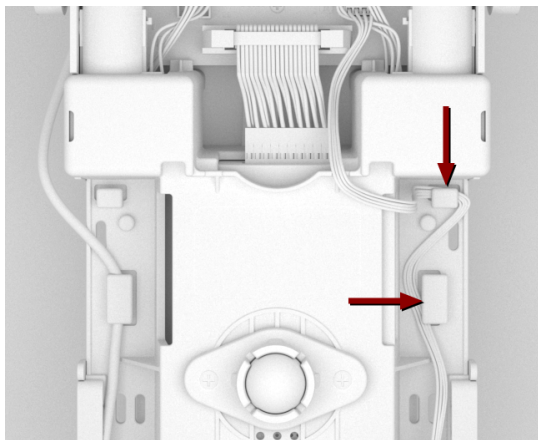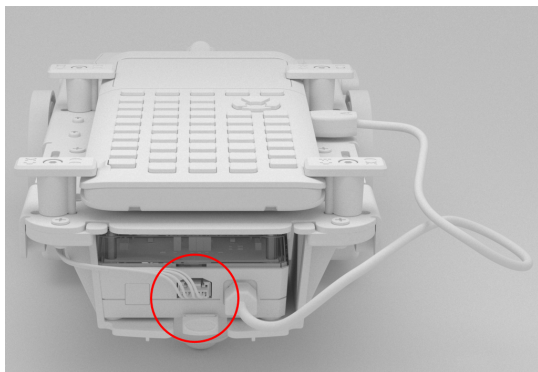3. Place the TI CE Graphing Calculator or TI-Nspire™ CX Handheld on the platform with the screen toward the **Marker Holder**.

4. Turn the pegs so that the CE or CX Label is positioned inward to match the graphing calculator.

   The pegs will snap into place when they are positioned correctly.

   **Caution:** Do not turn the **Calculator Holder Pegs** without lifting them first. They could break.
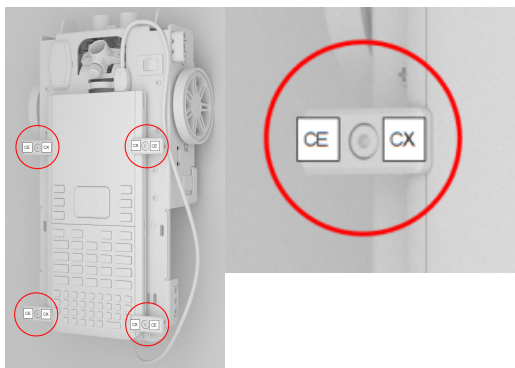


5. Identify the "**B**" connector on the **USB Unit-to-Unit (Mini-A to Mini-B) cable**. Each end of this cable is embossed with a letter.

6. Insert the "**B**" connector into the **DATA** port on the Hub.

7. Insert the free end of the cable (the "**A**" connector) into the USB port on the graphing calculator.
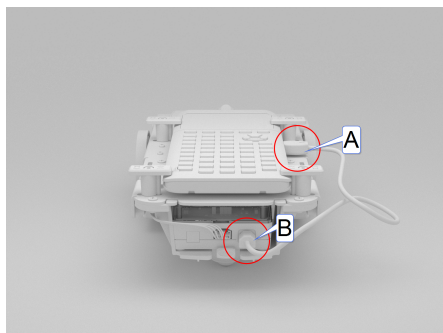
## *Exploring the Assembled TI-Innovator™ Rover*

Explore all sides of the TI-Innovator™ Rover when assembled with the TI-Innovator™ Hub and TI CE Graphing Calculator or TI-Nspire™ CX Handheld connected.

**Top Side of the Rover**
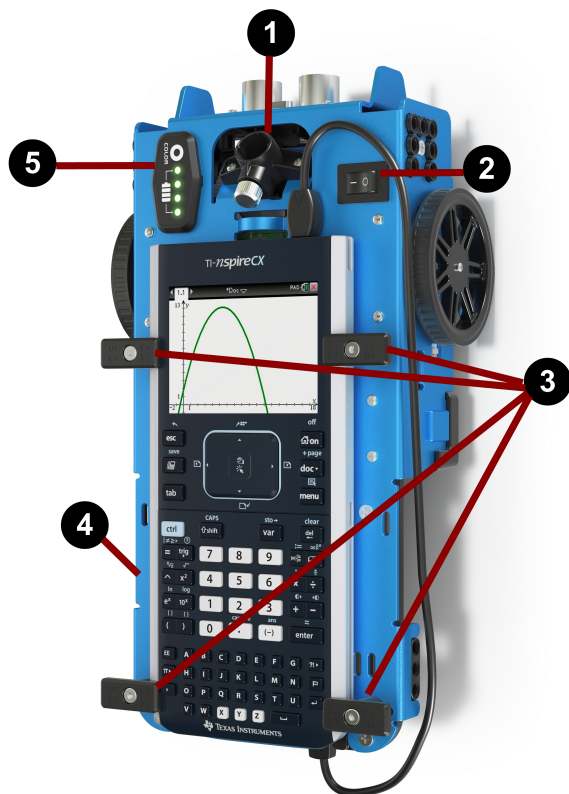


**①** **Marker Holder** - Holds a marker to draw paths.

**②** **ON/OFF (I/O) Switch** - Turns the Rover **ON (–)** or **OFF (O)**.

**③** **Calculator Holder Pegs** - Secures a graphing calculator to the calculator platform.

**④** **Calculator Platform** - Holds either a TI CE Graphing Calculator or TI-Nspire™ CX Handheld.

**⑤** **LED Panel (RGB LED/Battery Level Indicator)** - Displays programmable feedback through the **Red-Green-Blue (RGB) LED**, and displays battery charge level.

**Bottom Side of the Rover**
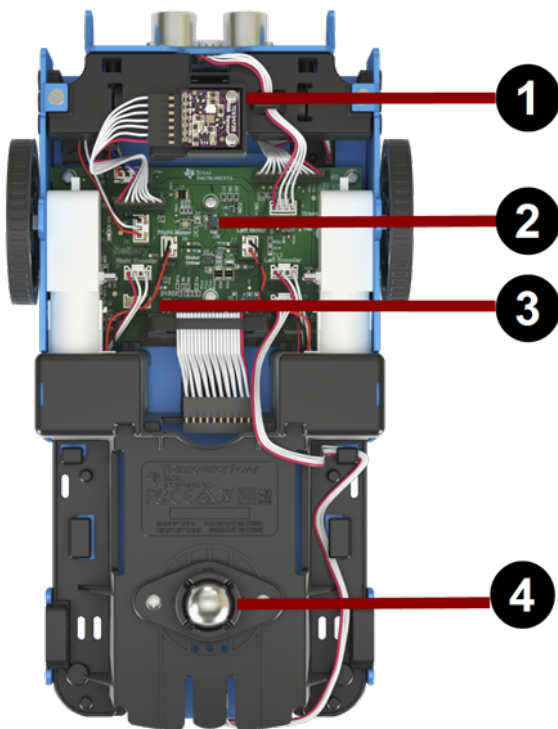


**①** **Color Sensor** - Bottom-mounted color sensor detects the color of the surface. Can also detect gray-level scale of black (0) to white (255).

**②** **Gyroscope** - Measures or maintains orientation.

**③** **I²C** expansion port.

**④** **Ball Caster** - Provides smooth movement on hard surface.
**Note:** Not recommended for use on carpet.

**Caution:** If you dislodge or disconnect any of the cables, use this image as a reference for correct hookups.

**Front Side of the Rover**

**Ultrasonic Ranger** - Measures distance to obstacles.



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**Back Side of the Rover**

**Guide Rails** - Allows the Hub to slide easily into the Rover and connect to the Rover circuit board.



**Note:** With the TI-Innovator™ Hub inserted, access a sensor and two ports.

- **Light Brightness Sensor** - Reads as "BRIGHTNESS" in Hub command strings.
- **$I^2C$ port** - Uses $I^2C$ cable to connect the Hub to the Rover circuit board.
- **DATA** Mini-B port - Uses USB Unit-to-Unit (Mini-A to Mini-B) Cable to connect the Hub to a Graphing Calculator.

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**Right Side of the Rover**

Access on the Rover:

- **PWR** port - Uses USB Standard A to Micro auxiliary power cable when charging the Rover's Rechargeable battery.

- **Front and Back Mounts** - For adding structures to the Rover using interlocking plastic blocks.



**Note:** With the Hub inserted, access three ports for controlling output modules.

- **OUT 1** and **OUT 2** provide 3.3V power.
- **OUT 3** provides 5V power.

**Left Side of the Rover**

Access on the Rover:

- **Front and Back Mounts** - For adding structures to the Rover using interlocking plastic blocks.



**Note:** With the Hub inserted, access three ports for collecting data or status from input modules.

- **IN 1** and **IN 2** provide 3.3V power.
- **IN 3** provides 5V power.

## *General Precautions*

**TI-Innovator™ Rover**

- Do not expose the Rover to temperatures above 140˚F (60˚C).

- Do not disassemble or mistreat the Rover.

- Do not put anything heavier than 1 Kg or 2.2 lbs on the Rover platform.

- Use only the USB cables provided with the TI-Innovator™ Hub.

- Use only the Ribbon cables provided with the Rover.

- Use only the TI provided wall charger included with the Hub.

- The front-mounted Ultrasonic Ranger will detect objects within 4 meters of the Rover. For best results make sure the object's surface is bigger than a folder. If used to detect small objects, such as a cup, place the Rover within 1 meter of the object.

- For best results, leave the Slide Case off of your graphing calculator.

- For best performance, use Rover on the floor, not on tables. Damage may occur from Rover falling off a table.

- For best performance, use Rover on a hard surface. Carpet may cause the Rover wheels to catch or drag.

- Do not turn the Holder pegs on the Calculator Platform without lifting them first. They could break.

- Do not use the marker as a lever to pull or push the Rover.

- Do not unscrew the case enclosure on the bottom of the Rover. Encoders have sharp edges that should not be exposed.

- Do not move Rover after executing a program. The internal gyroscope may unintentionally try to get the Rover back on track using the initial location.

- When inserting the Breadboard Ribbon Cable into the Hub Breadboard Connector, it is critical that you insert the cable correctly. Make sure the red (dark) wire pin is inserted into the 5v hole on the Hub's Breadboard Connector.

**Caution:** If you dislodge or disconnect any of the cables, use this image as a reference for correct hookups.

**Reference to Bottom View**
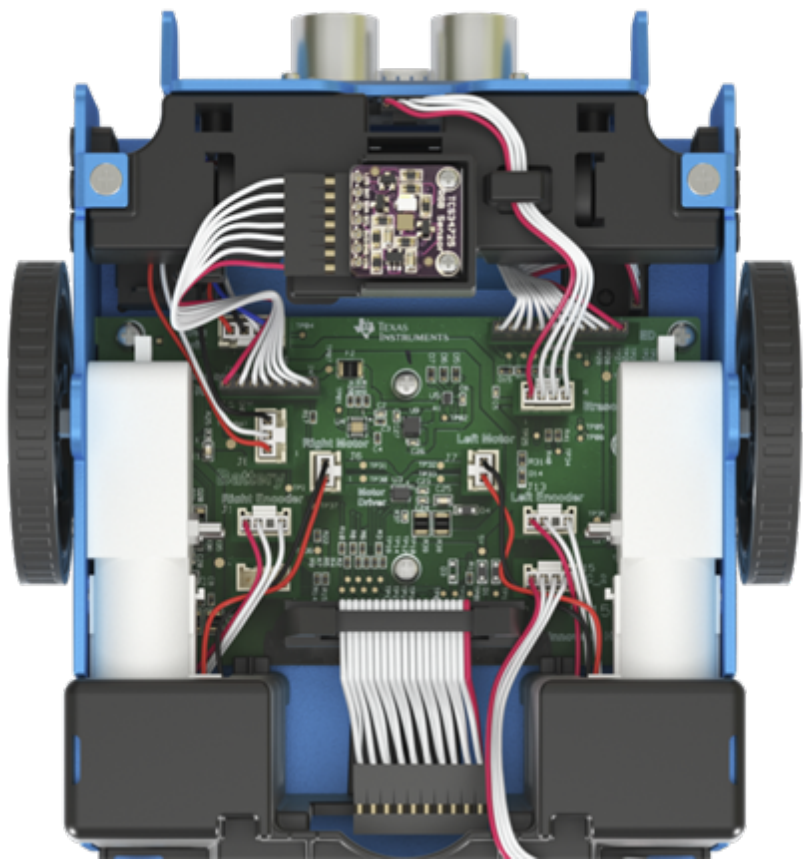
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For information about the length and terms of the warranty or about product service, refer to the warranty statement enclosed with this product or contact your local Texas Instruments retailer/distributor.

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