



Unit 4: Make Rover Move!

Skill Builder 1: Your First Rover Program

In this first lesson for Unit 4, you will learn about working in the Program Editor to write a program that makes the TI-Innovator Rover move.

Objectives:

- Use the TI-Nspire CX Program Editor
- Access the Rover (RV) submenus
- Use the **Send** command to **CONNECT** the TI-Innovator Rover to the TI-Innovator™ Hub
- Make the TI-Innovator Rover move **FORWARD**, **BACKWARD**, **LEFT**, and **RIGHT**

Getting Started

- The Rover commands are found by pressing **menu > Hub > Rover (RV)**.
- Some portions of the final instruction, such as numeric values and optional parameters, are entered as normal keypad characters or selected from another Rover menu.
- Most Rover commands leave the cursor inside the quotation marks. This indicates that there are more options to enter within the command. The TI-Nspire CX requires that quotation marks come in pairs.



Teacher Tip: Remember that you are programming the handheld to program the TI-Innovator Hub to *control* the TI-Innovator Rover. You are not programming the Rover directly.

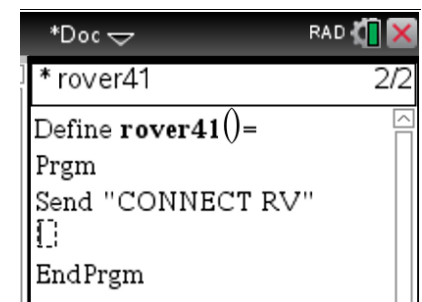
Your first Rover command tells the TI-Innovator Hub to connect to the Rover:

Send "CONNECT RV"

RV is the name of the Rover device.

To create this statement:

1. Press the **menu** key, and select the **HUB** menu.
2. Then, select the **Rover (RV)** submenu.
3. Select the **Send "CONNECT RV"** command near the bottom of the submenu.



Teacher Tip: The **CONNECT RV** command is required in all programs that utilize the TI-Innovator Rover. It connects the Rover to the TI-Innovator Hub just like other external devices. It also initializes the Rover's state (position and direction) and clears other Rover related data, such as distance travelled and headings.

10 Minutes of Code

TI-NSPIRE™ CX WITH THE TI-INNOVATOR™ ROVER

The next command is the **Text** statement found in the **menu > I/O** menu. This command pauses the program and waits for the user to press the **enter** key.

4. Press the **menu** key, and select the **I/O** menu.
5. Select **Text**.
6. Add an appropriate message after the Text command:
Text "Press enter to start."

When running the program, if you hear a beep from the TI-Innovator Hub before (or while) you see "Press enter to start" it means that the **CONNECT RV** command was unsuccessful. Make sure the Rover is turned on.

Teacher Tip: The **Text** statement is used here as a pause instruction to ensure that the **CONNECT RV** command was successful. If you hear a beep from the TI-Innovator Hub, it is an indicator that the command was not accepted. Most often, this is because the Rover is not turned on.

Driving the Rover

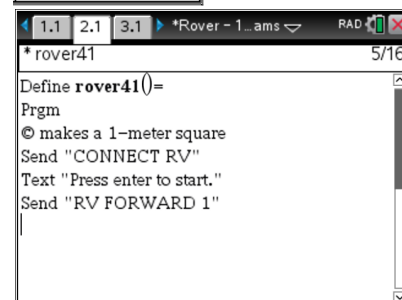
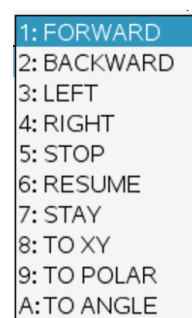
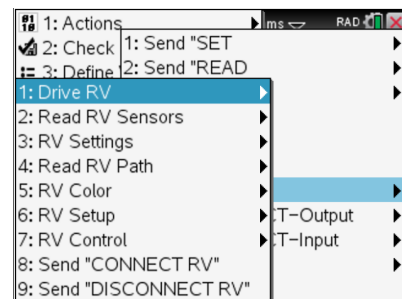
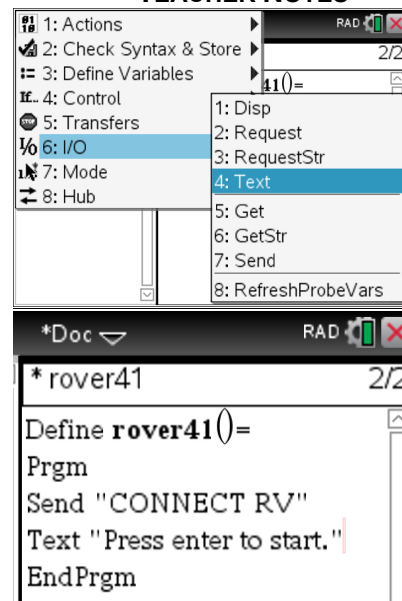
7. Press **enter** at the end of the **Text** statement in order to add the next command which will cause the Rover to move forward.
8. Press **menu > Hub > Rover (RV)**, and then select the **Drive RV** menu as shown to the right.
9. Select **FORWARD** from the **Drive RV** menu.

Notice that the **FORWARD** command that is pasted into the program has the insertion cursor inside the quotation marks preceded by a space character. This is for adding optional parameters to the command.

10. We add the number **1** here:
Send "RV FORWARD 1"

UNIT 4: SKILL BUILDER 1

TEACHER NOTES





11. In the Program Editor, press **ctrl+R** to 'Run' the program. This command (in the 'Check Syntax & Store submenu) performs the 'Check Syntax & Store' operation and switches to a Calculator application and pastes the program name on the entry line. Supply any needed arguments to the program and press **enter** to run it. Be sure that there is about one foot of free space in front of the Rover.

The **Text** command displays a message and, when **enter** is pressed again, the Rover should move forward. But how far? Study the movement carefully and determine what **FORWARD 1** means.

The Calculator application displays 'Done' when the program ends. Notice that the program actually ends before the Rover finishes moving. The handheld and the TI-Innovator Hub work at different rates.

Teacher Tip: **FORWARD 1** moves the Rover forward 10 cm. This unit value can be customized.

Teacher Tip: In controlling the Rover, you are actually programming the TI-Innovator Hub. In the **Send** statements of this program, there are *two* commands: **Send** and the instruction in quotes. **Send** is an instruction to the handheld to send an item (the string in quotes) out the USB port. The string is an instruction to the TI-Innovator Hub to - in this case - control the Rover.

Driving Backwards

12. Edit the program, and add the statement **Send "RV BACKWARD 1"** below the **FORWARD** command by pressing **menu > Hub > Rover > Drive RV > BACKWARD**.
13. Add the number **1** to the string.
14. Run the program again (**ctrl+R**).

```

1.1 Define rover41()=
2.1 Prgm
3.1 © makes a 1-meter square
Send "CONNECT RV"
Text "Press enter to start."
Send "RV FORWARD 1"
Send "RV BACKWARD 1"

```

This time, the Rover should move forward a bit and then back to its original position. If it does, congratulations! You made the Rover move.

Teacher Tip: Syntax errors are caught by the 'Check Syntax and Store' process. If a program generates a runtime **ERROR**, then the dialog box gives you the option of quitting to the Calculator application or Editing the program. This might or might not be the actual place that caused the error.

If there's an error in the TI-Innovator Hub code, then the TI-Innovator Hub will beep unexpectedly. (The color LED also blinks but it's hidden from view when installed in the Rover.)

The third error that can occur is with the Rover itself; incorrect instructions will result in unexpected behavior. Be careful that the Rover does not drive off the table.



10 Minutes of Code

TI-NSPIRE™ CX WITH THE TI-INNOVATOR™ ROVER

UNIT 4: SKILL BUILDER 1

TEACHER NOTES

Turning

The next two commands in the **Drive RV** menu are **LEFT** and **RIGHT**.

15. Add these two commands to your program, and run the program again.

Send "RV LEFT "

Send "RV RIGHT "

What do these instructions do?

1: FORWARD

2: BACKWARD

3: LEFT

4: RIGHT

5: STOP

6: RESUME

7: STAY

8: TO XY

9: TO POLAR

A: TO ANGLE

Teacher Tip: **LEFT** and **RIGHT** cause the Rover to turn 90 degrees left or right, respectively, from its current heading. Note that distance and turning angles are heavily dependent on the type of surface on which the Rover is travelling. The center of the turn angle is halfway between the bases of the wheels.

Teacher Tip: There's also a **TO ANGLE** command which behaves quite differently. We discuss this command in Unit 4, Skill Builder 3.

Two consecutive **FORWARD 1** commands will cause rover to move, pause, and then move again.

Making it Travel

Study the program to the right, and predict what the Rover will do and where it will end up when the program ends.

16. Enter these commands into your handheld, and run the program.

Did your program do what you expected? Can you make a program *with only these commands* that causes the Rover to make a *rectangular* pattern?

```
*rover41
Text "Press enter to start."
Send "RV FORWARD 1"
Send "RV RIGHT "
Send "RV FORWARD 1"
Send "RV LEFT "
Send "RV BACKWARD 1"
Send "RV LEFT "
Send "RV FORWARD 1"
Send "RV RIGHT "
EndPrgm
```

Teacher Tip: The last program in this lesson causes the Rover to move in a square pattern and return to its original position and heading. But, on one side of the square, the Rover is moving backwards. Optional parameters to the commands in this lesson are covered in the next lesson, Unit 4, Skill Builder 2.