



#### 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-84 Plus CE Program Editor
- 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

- When writing a new program or editing an existing program, TI-Innovator Rover commands are found when you select  $\frac{1}{4}$ , then the **Hub** menu, and then **7:Rover (RV)**....
- To quickly reach the Rover commands, select  $\frac{1}{4}$ , then select the left arrow to move to the **Hub** menu, and then select the number **7**.
- 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.
- Some Rover commands include the closing quotation mark and parenthesis and others do not, indicating that there's (possibly) more to enter within the command. In either case, all commands need to be ended with the closing quotation mark and closing parenthesis.



**Teacher Tip:** Remember that you are programming the calculator 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 Rover:

**Send("CONNECT RV")**

RV is the name of the Rover device.

To create this statement:

1. First, select the  $\frac{1}{4}$  key, and then select the **HUB** menu.
2. Then, select the **Rover (RV)**... submenu.
3. Finally, select **Send("CONNECT RV")**. The command is located 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.

```
NORMAL FLOAT AUTO REAL RADIAN MP
EDIT MENU: [Alpha] [F5]

PROGRAM: ROVER41
:Disp "ROVER UNIT4 SB1"
:Send("CONNECT RV")
:
:
:
:
:
:
:
```

# 10 Minutes of Code

## TI-84 PLUS CE WITH THE TI-INNOVATOR™ ROVER

Next we will add a **Pause** statement. This command pauses the calculator program and waits for the user to press the enter key.

- Press **↓** to move to a new line in the program.
- Press the **1/4** key and, in the **CTL** menu, select **Pause**.
- Add an appropriate message after the Pause command such as **"PRESS ENTER TO START"** using the Alpha keys.

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 **Pause** statement is used here 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. The Pause statement also allows you to have some time to place the Rover before the next command in the program is executed.

### Driving the Rover

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

Notice that the command that is pasted into the program is missing the closing quotation mark and the closing parenthesis. We still need to add some information.

- Add the number **1**, and then add the closing quotation mark and a closing parenthesis to the command. The quotation mark is **"** and the closing parenthesis key is above the **9** key.
- Quit the editor (**2nd > QUIT**), and run the program. Be sure that there is about one foot of free space in front of the Rover.

If all is well, then the Rover should move forward. But how far? Study the movement carefully and determine what **FORWARD 1** means.

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

## UNIT 4: SKILL BUILDER 1

### TEACHER NOTES

```
NORMAL FLOAT AUTO REAL RADIAN MP
EDIT MENU: [a1pha] [f5]

PROGRAM: ROVER41
:Disp "ROVER UNIT4 SB1"
:Send("CONNECT RV")
:Pause "PRESS ENTER TO STA
RT"
:
:
:
:
:
```

```
NORMAL FLOAT AUTO REAL DEGREE MP

Send("RV
1: FORWARD
2: BACKWARD
3: LEFT
4: RIGHT
5: STOP
6: RESUME
7: STAY
8: TO XY
9↓ TO POLAR
```

```
NORMAL FLOAT AUTO REAL RADIAN MP
EDIT MENU: [a1pha] [f5]

PROGRAM: ROVER41
:Disp "ROVER UNIT4 SB1"
:Send("CONNECT RV")
:Pause "PRESS ENTER TO STA
RT"
:Send("RV FORWARD ■
:
:
:
:
```

```
NORMAL FLOAT AUTO REAL RADIAN MP
EDIT MENU: [a1pha] [f5]

PROGRAM: ROVER41
:Disp "ROVER UNIT4 SB1"
:Send("CONNECT RV")
:Pause "PRESS ENTER TO STA
RT"
:Send("RV FORWARD 1")■
:
:
:
:
```



**Teacher Tip:** The default unit distance (**FORWARD 1**) is 10 cm. This unit distance can be changed by using the command **SET RV.GRID.M/UNIT** found in the **RV Setup...** menu.

**Teacher Tip:** In controlling the Rover, you are programming the TI-Innovator Hub. In the **Send** statements of this program, there are actually *two* commands: **Send(** and the instruction in quotes. **Send** is an instruction to the calculator 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.

In the new **alpha-F5** menu (accessed while writing or editing a program), there's an option to 'Execute Program' which switches to the home screen and pastes the program name onto the edit line and executes it.

### Driving Backwards

12. Edit the program, and add the statement **Send("RV BACKWARD 1")** by pressing **prgm > Hub > Rover (RV)... > Drive RV... > BACKWARD**.
13. Then add the number **1** and the closing quotation mark and closing parenthesis as you did in the **FORWARD** statement.

Quit the editor, and run the program again. 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:** If a program generates an **ERROR** message on the calculator screen, then there is something wrong in the calculator portion of the program (usually a 'Syntax Error'). There are two options under the error: **1:Quit** and **2:Goto**. **Quit** takes you to the home screen, and **Goto** takes you into the Program Editor to the place in the program where the error occurred. 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 it does not drive off the table.

```
NORMAL FLOAT AUTO REAL RADIAN MP
EDIT MENU: [alpha] [F5]

PROGRAM: ROVER41
:Pause "PRESS ENTER TO STA
RT"
:Send("RV FORWARD 1")
:Send("RV BACKWARD 1")
:
:
:
:
```

### Turning

The next two commands in the **Drive RV...** menu are **LEFT** and **RIGHT**. Add these two commands to your program, and run the program again. What do these instructions do?

```
NORMAL FLOAT AUTO REAL RADIAN MP

Send("RV
1: FORWARD
2: BACKWARD
3: LEFT
4: RIGHT
```

**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** commands will cause rover to move, pause, and then move again.



## 10 Minutes of Code

### TI-84 PLUS CE WITH THE TI-INNOVATOR™ ROVER

#### 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. Enter the commands into your calculator, 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?

**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.

#### Using the New Supplemental Program Editor Menu

Access the new supplemental Program Editor menu by pressing **alpha-F5**. Use this menu to copy a line (**5: Copy Line**) and paste the line (**6: Paste Line Below**) below the current cursor line. You can also undo and insert lines and run the program from this menu.

## UNIT 4: SKILL BUILDER 1

### TEACHER NOTES

```
NORMAL FLOAT AUTO REAL Radian HP
EDIT MENU: [alpha][F5]
PROGRAM: ROVER41
RT"
: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 ")
```

```
1:Execute Program
2:Undo Clear
3:Insert Line Above
4:Cut Line
5:Copy Line
6:Paste Line Below
7:Insert Comment Above
8:Quit Editor [2nd][quit]
```