Pro-Bot Robotics

Terrapin Software

Terrapin | 955 Massachusetts Ave, Suite 365 | Cambridge, MA 02139
800-774-LOGO (5646) | +1-508-487-8181 (*international*) | Fax 617-302-9778 YouTube Channel
TerrapinLogo.com | Facebook.com/BeeBot.us | Instagram.com/terrapin.tools.for.thinking

Pro-Bot Robotics

Contents

What is Pro-Bot and What Can You Do With It?

Pro-Bot is a sophisticated turtle robot with coding on board. Like a car, which it appears to be, Pro-Bot can move forward and back and turn left and right. Pro-Bot can also do much more. The built-in pen mechanism allows it to draw as it goes. Its ability to repeat and follow a series of commands, including a main program and sub-programs, makes Pro-Bot a hands-on responsive tool for teaching and learning programming. Built-in touch, light, and sound sensors give Pro-Bot the ability to respond to its environment, making it a great platform for teaching the basics of robotics. Whether you want to learn about programming, experience robotics, or just have fun, Pro-Bot is a great tool.

Pro-Bot can:

- Move according to a series of commands in specified distances and degrees
- Display its program, highlighting each command as it is followed
- Store and incorporate subprograms into a main program
- Draw as it moves with standard pens
- Respond to feedback from touch, sound, and light sensors

With Pro-Bot you can:

- Control a robot
- Write programs and watch them in action
- Teach a robot to navigate its environment
- Have fun!

Pro-Bot comes ready to go with no assembly required. Though Pro-Bot is a sophisticated robot, Pro-Bot is friendly and makes it easy to get started. Turn on the power switch (and the sound switch too if your environment allows) and get ready to have fun!

Getting Started with Pro-Bot

Batteries

Pro-Bot arrives with a lithium ion battery installed and is ready to go, though it is advisable to fully charge the robot before first use. In addition to the lithium ion battery that operates Pro-Bot motors, sounds, and sensors, older Pro-Bots also have a backup coin battery that powers its memory.

User Guide

The Pro-Bot *User Guide* that accompanies each Pro-Bot provides information on care and maintenance of the Pro-Bot and battery replacement.

Switches

Pro-Bot has two on/off switches, located in the bottom left corner on the underside of the robot. The right switch is the On/Off switch for Pro-Bot power. This power switch must be in the On position for Pro-Bot to operate. When the power switch is put in the On position, Pro-Bot's headlights blink once and the word "Main" appears at the top of the LCD display at the lower right of the top side of Pro-Bot.

Sound

The sound switch can optionally be set to Off or On. With the sound switch turned on, Pro-Bot clicks each time a button is pressed and honks its horn at the end of a series of commands. When the switch is Off, Pro-Bot makes no sounds.

Teaching Pro-Bot to Move

Using the Arrow Keys

Pro-Bot is controlled by the buttons on the back left side of the car. Once Pro-Bot's power switch is turned on, you can begin to command the robot using just arrow keys and the GO button. Simply press the Forward or Back, Left or Right arrow keys to enter commands that tell Pro-Bot to move in the direction you want.

When using arrow keys alone, Pro-Bot moves forward and back in 15 centimeter increments (approximately 6 inches). Pro-Bot turns left and right 90 degrees at a time. Using just arrow keys, you can tell Pro-Bot to move just like Bee-Bot.

Using the Screen

As you press the buttons, watch the screen on right of the keypad, where the first line displays Main (for Main procedure). You will see that the command represented by the arrow key you press appears on the screen as you press the key: Fd for Forward, Bk for Backward, Lt for Left, and Rt for Right. When you have entered all the movements you want Pro-Bot to follow, just press the GO button and watch Pro-Bot execute your series of commands. As each command is executed, it is highlighted on the Main command screen so you can watch as Pro-Bot follows your program.

Scrolling through Code

Pro-Bot can remember up to 128 commands at a time so you can develop quite an extensive route for the robot to follow. The Pro-Bot screen can display up to 16 lines. This includes the title **Main** indicating this is the main program and up to 15 lines of commands. If you enter more than 15 commands, the first command in the list "scrolls up" and disappears and the new command appears at the bottom of the list. This process continues as you enter more commands, with the first command displayed in the list disappearing when the last command entered appears at the bottom of the list.

Although some of the commands in the Main program may not appear on the display, they are still in Pro-Bot's memory. When you press the GO button, Pro-Bot follows the entire Main program, beginning with the first command, whether or not it is displayed when GO is pressed. If the first command(s) is not

displayed when GO is pressed, Pro-Bot changes the display to highlight the first line of the program. The highlight then moves through each line of the program as Pro-Bot executes it. If the Main program has more than 15 lines of commands, the top line scrolls off the screen when the last visible command is executed. The next line appears at the bottom of the screen and is highlighted while Pro-Bot executes that command.

That process repeats until all commands in the Main program have been executed. When the Main program has concluded, the screen displays the first 15 lines of the program and the highlight returns to the first line in the list. Pro-Bot is ready to GO again.

Try It!

Send Pro-Bot along a square or rectangular route. What commands would you enter?

Changing the Commands

Navigating the Program

Pro-Bot's Main screen not only displays the commands you have entered and highlights them as they are executed, but also makes it simple to change a series of commands after they have been entered to refine a route. When the commands are displayed on the Main screen, you can use the up and down arrow keys at the top right of the screen to the right of Menu to move the highlight up and down through the series of commands.

Insert or Delete Commands

To remove a command from the list, highlight that command and press the Clear button on the bottom right of the keypad below the 3 key to delete the command. To insert a command in the program, highlight the command before where you want to enter a new command. Press the key for the new command and it is inserted in the list ***below*** the highlighted command.

Try It!

Send Pro-Bot along a square route.
Then insert commands to change the route from a square to a rectangle.

Clearing the Program

You can delete your program one line at a time by using the Clear key and pressing it once for each command line. You may also delete the entire program at once by holding the Clear key down for 3 seconds and then using the down arrow key to the right of Menu to select Clr Main from the list of commands that appears. Then press Menu to clear the Main program. The Main screen and the Pro-Bot's Main program memory are now empty and ready for a new series of commands to be entered.

Stop Pro-Bot

If you need to stop Pro-Bot while it is following a program, press the GO key and Pro-Bot stops. Press GO again and the Main program starts from the beginning.

Preserving Memory
When you turn Pro-Bot off, the current Main program is preserved and appears when the power switch is turned on again. Each time you turn on Pro-Bot, it is ready to go with the last Main program that was entered.

Specifying Distance and Turns

Using the Numeric Keypad
You can explore a great deal with Pro-Bot using the default movements of 15 centimeters and turns of 90 degrees. Pro-Bot is capable of following more detailed routes since it also allows you to specify the distance it moves with each Forward (Fd) or Backward (Bk) command and the number of degrees it turns with each Left (Lt) or Right (Rt) command.

To give Pro-Bot more information, use its numeric keypad to enter the distance or degrees you want after pressing the arrow key. After you press the Forward or Back arrow, the number you enter tells Pro-Bot how many centimeters to move. After you press the Left or Right arrow, the number you enter tells Pro-Bot how many degrees to turn.

Try It!

Press the following sequence of keys to tell Pro-Bot to go forward 10 cm. and turn right 45º.

F 1 0 R 4 5

The following appears in the Main program window:

Fd10
Rt45

Press GO and watch Pro-Bot do as you commanded. Add to that program or try another.

Program Capacity
Pro-Bot can remember up to 128 commands so you can plan quite a long route. (Note: The Main display shows 15 commands at a time, but you can scroll through to see the entire program.)

Repeating

It can be tedious to enter a long series of commands, especially if you want Pro-Bot to repeat a set of moves and turns as part of its route. Pro-Bot's repeat function makes it easy to do series of commands multiple times without entering them individually.

Creating a Repeat Loop

There are four steps to tell Pro-Bot to repeat a series of commands:

1. Tell Pro-Bot to repeat by pressing the Rpt[key.
2. Tell Pro-Bot the number of times to repeat by pressing the appropriate number key.
3. Tell Pro-Bot what to repeat by entering a series of commands.
4. Tell Pro-Bot you are finished with the sequence of commands to be repeated by pressing the] key.

Try It!

Think of a series of commands you would like Pro-Bot to repeat. For example, you can use the repeat function to command Pro-Bot to follow the square route you did earlier, but with many fewer commands.

Start by pressing the Rpt[key. The command appears on the Main screen as

```
Rpt[
```

Then press the number of times you would like Pro-Bot to repeat the commands you plan to enter. In the case of a square route, press the 4 key. The Main screen displays

```
Rpt4[
```

For Pro-Bot to follow a square route, it must move either forward or back and turn left or right four times. Enter the combination of movement command (Fd or Bk) and turn command (Lt or Rt) you prefer. If you choose Fd and Rt, the screen displays

```
Rpt4[
Fd
Rt
```

To confirm that you have completed the repeat sequence, press the] key. The screen will display

```
Rpt4[
Fd
Rt
]
```

This YouTube video explains how to construct REPEAT loops with Pro-Bot.

Highlighting a Repeat Loop

Press GO and Pro-Bot will move in a square route. The command that Pro-Bot is currently following is highlighted on the Pro-Bot screen. In a repeat command the highlight moves through the series of commands starting with the first after the [. When it finishes with the last command in the list, just before], the highlight jumps back to the first command in the list. This process repeats the number of times specified in the repeat command.

Concluding a Repeat Loop

End the series of commands that you want Pro-Bot to repeat by pressing the] key. If you forget to press the] key after entering commands you want to repeat and then press GO, Pro-Bot executes the series of commands only once and then stops because Pro-Bot needs the closing] to know to repeat the commands. In this case, use the arrow keys to move the cursor to the last command in the repeating sequence and press the] key. The closing] is inserted after the last command. Then, when you press GO, the series of commands between [and] are repeated the specified number of times.

Developing Programs

Translating a Program into Pro-Bot Commands

Programming Pro-Bot is as simple as pressing keys on the Pro-Bot keypad. Getting Pro-Bot to do exactly what you want requires deciding the route you want Pro-Bot to follow, breaking it down into specific Pro-Bot commands, measuring the distances and turns, and finally entering this information into Pro-Bot by pressing the corresponding keys.

For example, if you want Pro-Bot to move in a square, you need to analyze the structure of the square and translate that into commands Pro-Bot can understand. A square has four sides of equal length, so Pro-Bot must make four forward (or back) movements of equal distance. The distance you decide on determines the size of the square.

A square has four corners so Pro-Bot must turn left (or right) four times. Since each corner of a square is a right or 90-degree angle, Pro-Bot must turn 90 degrees each time.

Try It!

To command Pro-Bot to follow a square route of 25 steps on a side, you would enter the same movement and turn commands four times and then press GO.

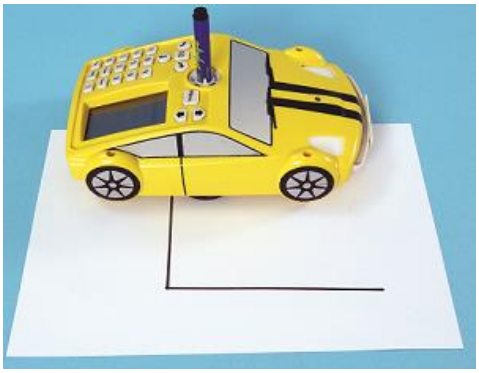
```
F 25 R 90 F 25 R 90 F 25 R 90 F 25 R 90
```

Since a square requires the same two commands to be executed four times in a row, you could enter the commands once using the repeat function and then press GO:

```
Rpt[ 4 F 25 R 90 ]
```

Programming Sequence

Follow the same process for any route you want Pro-Bot to follow. Decide on the route you want and the length of Pro-Bot's forward and back movements and the number of degrees for Pro-Bot to turn. Then enter this information in the Main program by entering it on Pro-Bot's keypad. Press GO to watch Pro-Bot carry out your commands.



Pen Mechanism
Pro-Bot's pen mechanism holds a standard felt-tip pen that allows Pro-Bot to draw as it moves. Pro-Bot can leave a written record of its route as it moves, making it easy to analyze the program and decide on changes and refinements. The pen mechanism also allows Pro-Bot to draw interesting shapes and pictures.

Raising and Lowering Pen
Pro-Bot's pen mechanism is in the middle of Pro-Bot and is marked Down and Up with two small handles that allow it to be turned. The pen is in the middle of Pro-Bot's wheels, which means Pro-bot pivots around the pen when it turns. Pro-Bot draws when it moves forward or back, but does not draw when it turns.

Preparing to Draw
To draw with Pro-Bot, first prepare the drawing area by placing a large sheet or roll of paper on a hard surface and locate a felt tip marker of the color you prefer. Raise the Pro-Bot pen mechanism to the up position by turning it counter-clockwise so that the handles are aligned with the direction of Pro-Bot. Remove the cap from the marker and gently insert the pen. Lower the pen mechanism by turning it clockwise until the pen drops into place, so that the point is touching the paper.

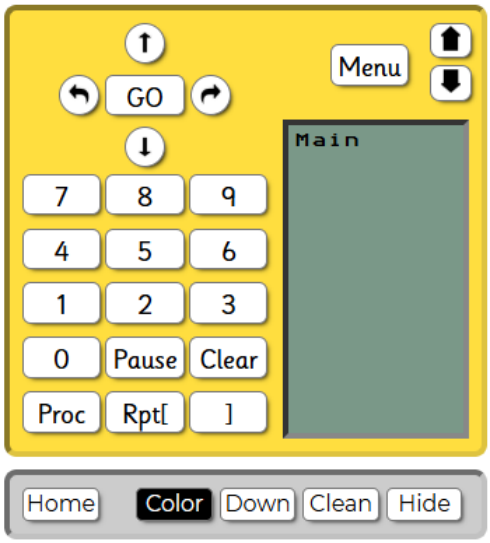
With the pen in place, Pro-Bot draws as it follows the Main program you have entered.

Remove or Change Pen
To remove the pen or exchange a pen of one color for another, raise the pen mechanism to the Up position by turning it counter clockwise and gently remove the pen by pulling it up. Insert another pen if desired, and lower the pen mechanism.

Operating without a Pen
If no pen is inserted, the pen mechanism can be in the Up or Down position and does not affect how Pro-Bot operates.

The Pro-Bot Online Emulator

The Pro-Bot Online Emulator allows you to experiment and even draw with Pro-Bot on your computer screen. You can find the emulator here: probot.terrapinlogo.com



The Pro-Bot in the emulator looks and acts just like Pro-Bot. There are only a few things you cannot do with the "virtual" Pro-Bot. You can control the touch sensors, but the online Pro-Bot can't respond to changes in light or sound.

You can write and edit procedures, just as you can with the actual Pro-Bot. Using the emulator can help you debug your code before using Pro-Bot on the floor.

There are many mats to choose from in the online emulator. Give them a try!

Pro-Bot's Menu

So far, you have entered commands directly into Pro-Bot's Main program by using the Pro-Bot keypad. Pro-Bot has many additional functions that are accessible through its Menu system. Like a restaurant menu, the Pro-Bot Menu offers choices for you to pick, depending on what you want.

Access the Menus

Access the Pro-Bot menu by pressing the key labeled Menu to the right of the pen mechanism. The up and down arrow keys to the right of Menu are used to choose the menu option you want. Press the up arrow to move the highlight cursor up one item in the current menu display. Press the down arrow to move the highlight cursor to the next item in the current menu display. Once the desired item is highlighted, press Menu to select it.

Menu Levels

As you move through the menu system, the Pro-Bot display shows the options for that level in the menu. In each case, the first line displayed is the title of the current menu section. The second line displayed is Back. Select Back and then press Menu to move up one level in the menu system, back to the screen from which the current option was selected.

Toplevel Menu

When the Main program displays and you press Menu, the following options are available.

Menu	–	indicates the Toplevel Menu
Back	–	go up one menu level; from the Toplevel Menu returns to the Main program
New Proc	–	enters the New procedure menu
Edt Proc	–	enters the Edit procedure menu

Config – enters the Configuration menu
Sensors – enters the Sensors menu
Clear – enters the Clear menu

Special Commands Menu

Access Special Commands Menu

Commands to control Pro-Bot's lights and sounds are available through the Special Commands Menu. To access the Special Commands Menu, press and hold Menu for two seconds. The Special Commands Menu appears.

Insert Special Commands

There are Special commands that you can include in either the Main program or a subprocedure. To insert a special command in your program or subprocedure, access the Special Commands Menu from the line where you would like the command. To do so press Menu for two seconds, then use the arrow keys next to Menu to scroll through the Special Commands list. Position the highlight on the command you want to insert. Press Menu and the command will be inserted in the Main program or the subprocedure. The screen then displays the program with the command inserted.

Special Commands Available

The commands available in the Special Commands Menu are:

Light On – turns the headlights on
Light Off – turns the headlights off
Sound 1 – plays the "switch on" sound
Sound 2 – plays the "button click" sound
Sound 3 – plays the "car horn" sound
Sound 4 – plays the "data transfer" sound
Sound 5 – plays the "transfer complete" sound
Sound 6 – plays the "error" sound
Sound 7 – plays the "go to standby" sound
Pen Up – has no effect
Pen Down – has no effect

Customizing Pro-Bot

Pro-Bot is highly adaptable and may be customized for different environments and situations.

Subprocedures

Pro-Bot offers up to 32 subprocedures that you can develop. Each subprocedure can hold a set of commands that are executed when the Main program calls that subprocedure. A set of commonly used tools in Pro-Bot programs can be developed and stored in Pro-Bot's memory so that they are available whenever Pro-Bot is in use. This lets you develop your own customized toolbox for Pro-Bot that is available whenever you need it. Read more in the Subprocedures section below.

Decals

Pro-Bot comes with a set of decals that you can use to decorate the robot. From numbers to wheel designs, the decals give Pro-Bot a customized look.

Attaching K'NEX Constructions

Pro-Bot comes with hexagonal slots to which you can attach standard K'NEX building set parts. This allows Pro-Bot to become a mobile platform for constructions made with K'NEX parts. There are four K'NEX connecting slots on Pro-Bot, one each above each wheel well. For more information about K'NEX construction kits, visit www.basicfun.com/knex.

Developing Subprocedures

The Main Pro-Bot program is the series of commands Pro-Bot follows when you press GO. Each time you turn Pro-Bot on, the most recent Main program appears. Add to or change the Main program by following the steps to edit or delete a Main program and change what Pro-Bot does when you press GO.

Create and Store Subprocedures

It is often useful to have Pro-Bot remember a series of commands you would like to use in different Main programs. This can be done by creating subprocedures or programs that are stored in Pro-Bot's memory. The commands in a subprocedure are executed by Pro-Bot when the subprocedure is called by the Main program.

Expand the Main Program

You can expand your Main program by including subprocedures. A Main program can have up to 128 commands. A subprocedure itself can also have up to 128 commands. Calling a subprocedure from the Main program is only one command in the Main program but Pro-Bot follows all the commands in the subprocedure before returning to the next line in the Main program. Including subprocedures allows you to greatly expand the number of commands in a Pro-Bot program.

Subprocedure Names

Pro-Bot can remember up to 32 subprocedures that you can define. Each of these subprocedures is identified by the word Proc (for procedure) followed by its number.

For example, Proc1 is the first procedure in the Menu list, Proc2 is the second procedure in the Menu list, and so forth to Proc32. To show the available subprocedures, press Menu, use the down arrow to highlight New Proc, and press Menu again.

There are also 5 procedures for sensors (33–37). Read more about these procedures below.
Three demo procedures are available, although they are not visible in the list of procedures. You can still enter the procedures in your Main program using their names: Proc38, Proc39, and Proc40. Proc40 uses Proc39 as a subprocedure.

```
38 HEXAGON: Draws a hexagon
   RPT6 [
   FD10
   RT60
   ]

39 DIAMOND: Draws a diamond
   FD10
   LT45
   FD10
   LT135
   FD10
   LT45
   FD10

40 FLOWER: Draws eight diamonds using PROC39 as a subprocedure
```

Scrolling through Subprocedures

The list of subprocedure names appears. The first line in the list is New Proc, indicating that Pro-Bot is ready for you to enter a new subprocedure. The second line in the list is Back. Selecting Back and pressing Menu takes you back one level in the menu system.

The Pro-Bot screen displays up to 16 lines at one time. There are more subprocedures than can be displayed at once. You can scroll the highlight through the list of subprocedures by pressing the up and down arrow keys next to Menu. When the last line in the list is highlighted and you press the down arrow, the next line appears and the first line in the list scrolls off the top of the screen. When Back is highlighted and you use the up arrow to move to the previous line, it appears below Back and the last line in the list scrolls off.

The title New Proc and Back are fixed on the screen and are always present when you scroll up and down through the entire list of subprocedures. If you highlight Back and press the up arrow key, the previous line in the list appears and the last line in the list scrolls off the screen. If you highlight Back and press Menu, you will move up one level in the Pro-Bot menu structure.

Try It!

Create a subprocedure that causes Pro-Bot to move in a square route. First, clear the Main program. Then from the Main display, press Menu. Press the down arrow key to select New Proc. Press Menu to enter the new subprocedure menu section. Press the down arrow key to select Proc1 and then press Menu to select that subprocedure.

Enter the commands for Pro-Bot to follow a square route. You can enter

```
Rpt[
4
F
R
]
```

When you have entered the commands for Pro-Bot to follow a square route, press Menu to define Proc1. This returns you to the Main program. Test your new procedure by using it as a command in the Main program. To do so, press Proc followed by 1, which is the number of the subprocedure that you defined. The screen displays

Main
Proc1

Since the commands to direct Pro-Bot along a square route are contained in Proc1, this is a sufficient Main program to make Pro-Bot trace a square. Try it out by pressing GO.

For an additional project, try entering these procedures and watch Pro-Bot draw a flower.

Main	Proc 1	Proc 2
Rpt 6 [	Proc 2	Rpt 10 [
Proc 1	Lt 120	Fd 1
]	Proc 2	Lt 6
	Lt 60	]

From Main Program to Subprocedure

When Pro-Bot encounters a subprocedure command, it moves from the commands in the Main program to the commands in the subprocedure. When that happens, the display changes from the Main program to show the commands in the subprocedure. The title of the display changes from Main to the name of the subprocedure. As Pro-Bot executes the subprocedure commands, the display highlights each command as it is executed. When the subprocedure concludes, control returns to the Main program which the display once again displays, highlighting the command in the Main program currently being executed.

Mixing Subprocedures and Direct Commands

In the Main program, you can mix subprocedures with direct commands. For example, to make Pro-Bot trace a flag shape, you can tell Pro-Bot to move forward and then follow a square route. Do so by editing the Main program and inserting a forward instruction prior to the subprocedure that tells Pro-Bot to follow a square route. Use the up arrow key to locate the highlight on Main. Press F. Fd is inserted after Main and prior Proc1. Press GO. Pro-Bot moves forward and then follows the commands in Proc1.

Try It!

Try making the flagpole section of the route longer by editing the Main program and extending the forward distance that Pro-Bot travels before following the square route specified by Proc1.

Editing Subprocedures

Selecting the Subprocedure
Like the Main program, Pro-Bot subprocedures may be edited. The editing process is similar to that for the Main program, but first you must enter Edit mode and choose the subprocedure you would like to edit. To do so, press Menu and press the down arrow key to highlight EdtProc. Then press Menu to select edit procedure mode.

A list of subprocedure names appears. Use the arrow keys to highlight the name of the subprocedure you would like to edit. Then press Menu to edit the selected subprocedure.

Try It!

Most flags are rectangular in shape rather than square. You can change the program in Proc1 by editing the commands so that they instruct Pro-Bot to follow a rectangular route rather than a square one.

"Edt Proc" vs. "New Proc"
When you choose Edt Proc and choose the subprocedure you want to edit, the current contents of the subprocedure appear. When you choose New Proc, indicating that you want to create a new subprocedure, any content of the subprocedure you choose is erased so that you can write a new subprocedure for that procedure number. Be sure to choose Edt Proc when you want to edit the contents of a subprocedure and New Proc only when you want to erase the contents of a particular subprocedure and create a new one.

Example Programs To Try

Can you draw these two stars and a complex flower?

6-Pointed Star

```
Rt30
Rpt6[
Fd20
Rt120
Fd20
Lt60]
```

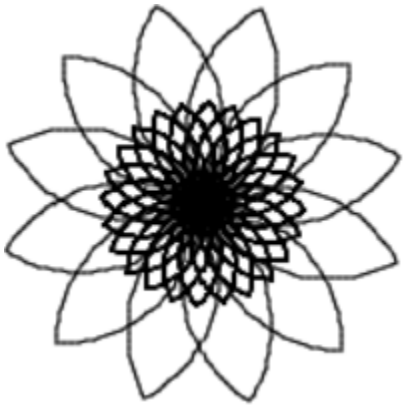
5-Pointed Star

```
Rpt 6[
Fd20
Rt132
Fd20
Lt60]
```

Complex Flower

The Main procedure repeats Proc1 12 times, and then Proc2 24 times, with some turns in between. Proc1 draws a large petal. Proc2 draws a smaller one. If you try this code in the Pro-Bot Online Emulator, it takes a very long time to draw!

```
Main
Rpt12[
Proc1
Lt30]
Rpt24[
Proc2
Lt15]
```



```
Proc1
Rpt30[
Fd1
Lt3]
Lt90
Rpt30[
Fd1
Lt3]
Lt90
```

```
Proc2
Rpt15[
Fd1
Lt6]
Lt90
Rpt15[
Fd1
Lt6]
Lt90
```

Specialized Sensor Subprocedures

The Pro-Bot has five specialized subprocedures, which correspond to inputs from its sensors. These are

```
33 FRONT
34 REAR
35 DARK
36 LIGHT
37 SOUND
```

Executing Sensor Commands
The commands in each of these subprocedures are executed when the condition of the corresponding sensor condition is met. When the sensor condition is met, the Main program is interrupted so that the commands in the corresponding subprocedure are run. If there are no commands in the subprocedure corresponding to the sensor, then the Pro-Bot does not respond to changes in the sensor condition.

Storing Sensor Commands

- Subprocedures 33 FRONT and 34 REAR correspond to the front and rear bumpers of Pro-Bot.
- Subprocedures 35 DARK and 36 LIGHT correspond to light conditions perceived by the light sensor located in the middle of Pro-Bot's hood.
- Subprocedure 37 SOUND corresponds to the sound sensor on the underside of Pro-Bot.

You can create and edit sensor subprocedures in the same way as any subprocedure.

Turning Sensors On and Off

Pro-Bot sensors may be turned off and on but must be turned on for Pro-Bot to respond to them. Turning sensors off when they are not in use conserves battery power. Sensors are turned off by default but maintain their state once it is set.

Toggling the Sensors
To turn the sensors on or off, press Menu. From the Toplevel menu, use the down arrow key to choose Sensors and press Menu to see the Sensor menu which shows each sensor state. The default Sensor menu is:

```
Sensors
Back
TouchOff
SoundOff
LightOff
```

Each of the three types of sensors can be toggled between On and Off. Use the down arrow key to select the sensor whose state you would like to change. Press Menu to change the sensor's state. Pro-Bot toggles the sensor from Off to On or from On to Off and returns you to the Main program.

Confirming Sensor State
To confirm that the sensor state has changed, press Menu, choose Sensors and note that the state of the sensor you selected has been toggled. Select Back to return to the Toplevel menu and select Back from there to return to the Main program.

Try It!

If TouchOff displays in the Sensor menu, Pro-Bot does not recognize either of its bumpers being triggered and will not run subprocedure 33 FRONT or subprocedure 34 REAR when the bumper is pressed.

To activate the bumpers so that subprocedure 33 FRONT or 34 REAR is run when the corresponding bumper is pressed, press Menu from the Main pr ogram. Use the down arrow key to choose Sensors. In the Sensor menu, use the down arrow key to highlight TouchOff and press Menu. The bumpers are activated and you return to the Main program

To verify that the Touch sensors are active, press Menu, choose Sensors, and press Menu. Touch On displays and the touch sensors are activated. Select Back and press Menu to return to the Toplevel menu where Back is highlighted. Press Menu again to return to the Main program.

Touch Sensors

Pro-Bot contains touch sensors that are activated when the front or rear bumper is pressed. When the touch sensors are turned on and one of the bumpers is pressed, Pro-Bot interrupts the Main program to run the commands in the subprocedure corresponding to the front or rear bumper.

Try It!

Make Pro-Bot back up and turn when it encounters an object that presses the front bumper while it is moving forward. You need to send Pro-Bot forward in the Main program and then define "back up and turn" code by entering commands in subprocedure 33 FRONT.

Setting Up
First, be sure that the touch sensors are turned on. Then enter the commands you would like Pro-Bot to follow when the front bumper is triggered. Press Menu, choose New Proc, press Menu, choose subprocedure 33 FRONT, and press Menu. 33 FRONT displays on the screen and you are ready to enter commands.

Entering Commands
For Pro-Bot to go back 20 steps and turn right 90 degrees when it encounters an obstacle that presses the front bumper, press the back arrow and 2 0 followed by the right arrow and 9 0.

Starting a Main Program
Press Menu to return to the Main program. Use the Main program to tell Pro-Bot to move forward. For example, you can send Pro-Bot forward 100 steps by pressing the forward arrow followed by 1 0 0. Press GO to start the Main program.

Responding to a Bumper Press
Pro-Bot moves forward until it has completed 100 steps or encounters an object that presses the front bumper. When the front bumper is pressed, Pro-Bot suspends the Main program and follows the commands in subprocedure 33 FRONT. The screen switches from displaying the commands in the Main program to displaying the commands in subprocedure 33 FRONT. You can see each command is highlighted as it is executed. When Pro-Bot finishes all the commands in subprocedure 33 FRONT, it returns to the Main program and begins executing the Main program **from the beginning**.

Programming the Back Bumper
Pro-Bot may be programmed to respond to the back bumper being pressed in a manner similar to that for the front bumper. Simply enter the commands you want Pro-Bot to follow when the back bumper is pressed in subprocedure 34 REAR rather than 33 FRONT.

When Pro-Bot's bumper touch sensors are turned on, Pro-Bot responds to either the front or back bumper being pressed. You can enter the same or different commands in subprocedures 33 FRONT and 34 REAR to define what Pro-Bot does in either case.

Watch It: This YouTube video shows you how to program Pro-Bot's front sensor.
Watch It: This YouTube video shows you how to program Pro-Bot's back sensor.

Sound Sensor

Pro-Bot contains a sound sensor that detects short sharp sounds such as a hand clap, a short yell, or other loud sound. Pro-Bot only listens for sounds when the motors are not running so that the sound of the motors does not trigger the sound sensor. Pro-Bot can be programmed to respond to sounds when a Main program is running but the motors are not activated. This may be achieved by inserting pauses in a Main program.

Activating the Sound Sensor
Pro-Bot's sound sensor must be activated for Pro-Bot to respond to sounds it detects. To activate the sound sensor, press Menu, use the arrow key to select Sensors, and press Menu to display the Sensors menu. If SoundOff appears in the Sensors menu, then use the arrow key to select it and press Menu. The sound sensor is turned on and the Main program appears. If Sound On appears in the Sensors menu display, then simply press Menu twice to return to the Main program screen.

Try It!

Decide what you would like Pro-Bot to do when it detects a loud sharp sound. Enter the commands you would like Pro-Bot to follow in subprocedure 37 SOUND.

To turn Pro-Bot 90 degrees when you clap your hands loudly, add that command to subprocedure 37 SOUND. Press Menu and select New Proc. (If you choose Edt Proc, the current contents of subprocedure 37 SOUND appear, which you can change. If you choose New Proc, the current contents of subprocedure 37 SOUND are erased and 37 SOUND appears blank. You can then add commands.) Use the arrow keys to select subprocedure 37 SOUND and press Menu.

Enter commands to turn Pro-Bot 90 degrees by pressing the right arrow and then 9 0. When you are finished, press Menu to return to the Main program. Enter commands in the Main program to move Pro-Bot about. Be sure to enter pauses after the movement commands so Pro-Bot can listen for a sound.

For example, you can tell Pro-Bot to move forward 20 steps and then back 20 steps four times, pausing after each move. To do so enter:

```
Rpt[ 4 F 2 0 Pause B 2 0 Pause ]
```

Press GO so Pro-Bot executes the program. During a pause, clap your hands loudly. On hearing the sound, Pro-Bot executes subprocedure 37 SOUND and turns right 90 degrees. After completing subprocedure 37 SOUND, Pro-Bot returns to complete the Main program at the point at which the sound occurred.

Light Sensor

Pro-Bot contains a light sensor located in the middle of the hood that can sense when the ambient light changes. This allows Pro-Bot to be programmed to respond when going through a dark tunnel or when the lights in the room are turned off and then on again.

Activate the Light Sensor

Pro-Bot's light sensor must be activated for Pro-Bot to respond to changes between light and dark. To activate the light sensor, press Menu, use the arrow keys to select Sensors, and press Menu to display the Sensors menu. If LightOff appears in the Sensors menu, use the arrow key to select it and press Menu. The light sensor is turned on and the Main program appears. If Light On appears in the Sensors menu, then simply press Menu twice to return to the Main program.

Light and Dark Subprocedures

Two subprocedures are reserved for defining how Pro-Bot responds to changes between light and darkness. Subprocedure 35 DARK holds commands that Pro-Bot executes when its environment becomes dark. Subprocedure 36 LIGHT holds commands that Pro-Bot executes when its environment changes from dark to light.

Try It!

If you want Pro-Bot to pause the Main program when the lights go out, you can enter one or more pauses in subprocedure 35 DARK. To do so, press Menu and use the arrow keys to select New Proc. Then use the arrow keys to select 35 DARK. Enter one or more pauses in the subprocedure by pressing Pause one or more times. Then press Menu to return to the Main program. If you have not yet entered a Main program, do so now.

Press GO to begin execution of the Main program. Turn the lights out. Pro-Bot pauses by following the commands in 35 DARK. Pro-Bot returns to the Main program when the lights are turned on or all the pauses in 35 DARK have been completed, whichever comes first.

If all you want is for Pro-Bot to return to the Main program when it emerges from darkness, there is no need to enter commands in subprocedure 36 LIGHT. If you want Pro-Bot to do something after it emerges from the dark and before it returns to the Main program, those commands may be entered in 36 LIGHT. They are executed after Pro-Bot emerges from darkness before returning control to the Main program.

This YouTube video explains how to program Pro-Bot's light sensor.

Troubleshooting

Pro-Bot Beeps
When the Pro-Bot power switch is turned on, but Pro-Bot has not moved and no keys have been pressed for 3 minutes, Pro-Bot makes a distinctive sound and the Pro-Bot screen goes blank. This is a reminder that Pro-Bot is turned on and helps preserve battery life. If you no longer want to use Pro-Bot at the time, then turn off the power switch. If you want to continue using Pro-Bot, simply press any key and Pro-Bot comes back to life and is ready to go.

Recharging Pro-Bot
Pro-Bot's internal, rechargeable battery powers its motors, lights, and sound. Sluggish Pro-Bot movement indicates the battery may be weak. Here are tips and techniques for recharging Pro-Bot.

- Insert the USB cable into the charging socket on the rear of your Pro-Bot.
- Connect the other end to a spare USB port on a PC or laptop. Alternatively, connect to a USB charging plug.
- If you have the Pro-Bot docking station, then place the Pro-Bot into the docking station and connect the power cable.
- The green LED in the left eye will turn on to show that the Pro-Bot battery is charging.
- The green LED in the left eye switches off when the Pro-Bot is fully charged.
- It may take up to 2 hours to fully charge the Pro-Bot if the battery has been fully discharged.
- Once fully charged your Pro-Bot will have approx. 8 hours of normal usage, approx. 2 hours when in continuous use.
- Battery life will be extended if the battery is recharged when power is low rather than allowing battery to become completely exhausted.
- Always fully charge your Pro-Bot before storing for long periods. It is strongly reccomended that the Pro-Bot is recharged every six months.

Changing the CR2032 Battery (older Pro-Bots only)
In older Pro-Bots, memory is powered by a CR2032 "watch" battery. This battery keeps Pro-Bot's memory active even when the power switch is turned off to maintain the contents of the Main program and all subprocedures between Pro-Bot sessions. The CR2032 battery should last a year or longer. When the battery requires replacement, a message appears on the Pro-Bot screen when Pro-Bot is turned on.

To replace the CR2032 battery, turn Pro-Bot over and locate the battery compartment at the back of Pro-Bot's underside. The battery compartment has a small square door held in place by a metal screw. Use a screwdriver to loosen the screw and remove the door. Gently dislodge the battery with your finger or the

flat edge of a small screwdriver. Insert the new battery by slipping it under the lip of the battery holder and pressing it into place. Replace the battery compartment door and screw it shut.

Care and Maintenance

- To clean, wipe Pro-Bot gently with a clean, damp cloth.
- Keep Pro-Bot away from direct sunlight and heat.
- Do not allow Pro-Bot to come into contact with water or other liquids

Pro-Bot is Non-Responsive

When turned on, nothing displays on the screen of a non-responsive Pro-Bot and Pro-Bot does not respond to button presses. This indicates that Pro-Bot needs to be reset. Turn Pro-Bot over and find the small hole labeled Reset at the bottom left of the underside of Pro-Bot near the switches. Bend a paper clip so that one end sticks out or obtain a toothpick which fits in the hole. Be sure batteries with power are installed with the correct polarity. Turn Pro-Bot on. Gently push the end of the paperclip or the toothpick in the Reset hole. Pro-Bot beeps and springs back to life.