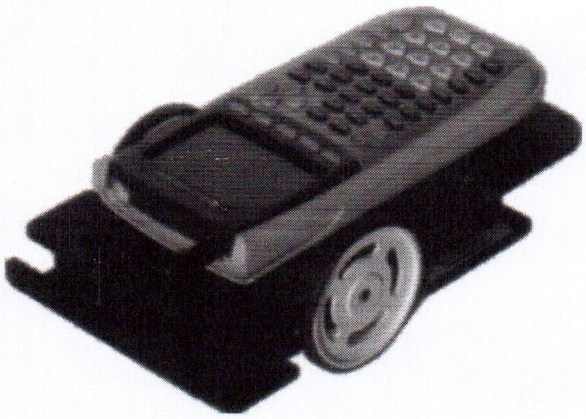
TI-Robot Calculator Controlled Kit Instructions

Congratulations on your purchase of your Calculator Robot from Norland Research! Please read all of these instructions before beginning. By accepting this kit, you will assume all responsibilities and damages that may occur. *If not, please return this kit for a full refund.*

This kit has been fully tested; however, as with any electronic product it may at times produce undesired effects. You will be adding motion to your calculator and this could result in loss of control and damage. We recommend that you secure any area that you will operate your robot in to be free of objects that could damage it. We also recommend adding barricades to prevent your kit from falling. Please do not operate your robot in a crowd, as it could be stepped on.



Always use tools as designed, wear eye protection, and secure loose clothing. Children should always have adult supervision when using tools and while operating moving devices. Moving items can become tangled in clothing or hair. Always use caution when soldering, using electricity, and connecting batteries and chargers. Since Norland Research does not control the final product, the kit owner/assembler will assume the safety considerations and responsibility of the final product. The kit owner/assembler will also be responsible for any damage to the products connected to the Norland Research robot kit. *Specifics subject to change without notice.*

Tools Needed (or recommended):

Tape measurer or ruler
Small Phillips screwdriver
Scissors
Sand paper or file
Texas Instruments graphing calculator (NOT INCLUDED IN KIT):
- **73, 82, 83, 83+, 83+ Silver, 84+, 84+ Silver, 84+ C, 85 CBL model, 86, 89, 89 Titanium (92 will not fit on base, but will operate the electronic components)**

Slide case
4 AA batteries

**** A Texas Instruments TI Connectivity Kit™ is useful, but not necessary.**

Getting Started:

Assembly Time: Allow approximately one hour to assemble your Calculator Robot. Be sure to understand the operation of your Calculator and the Graph Link procedures. These instructions are provided from the calculator manufacturer. Skills and techniques used in model building are useful. Some edges may require cleaning due to the cutting process. Care in measurement will improve the operation of this kit. E-mail us at **rick@smallrobot.com** if you have any questions.

Inspecting your kit: Look closely at the robot chassis. Inspect it for any shipping damage. Also look at all edges. If there are any sharp edges from the cutting process, please sand or file them until they are smooth.

Step 1: Route the link cable. Run the permanently attached link cable to the front hole if you have the 84 series calculator or run it out the side hole for all other models. Please take your time and do not dislodge any components or other wiring.

Step 2: Install the bumper. Remove the backing on the ½ inch double-sided tape and place on the two contact switches. Place the bumper on these; making sure it is level, square, and centered. If you plan on traveling with your robot, you can replace the foam tape with Velcro (which you can find easily at an art supply store). This will make the bumper removable for travel.

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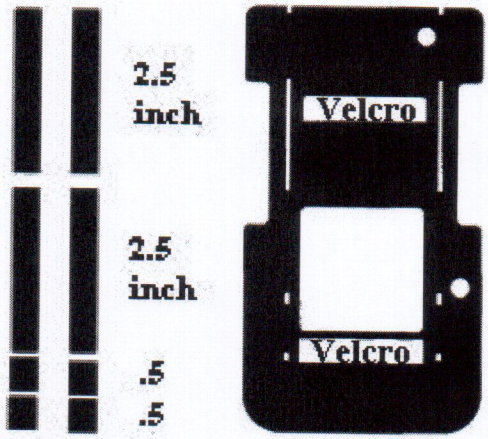
Step 3: Install the wheels. Remove the Phillips screw from the servomotor. Inspect the wheel to find the star-like pattern that fits over the same pattern on the motor. Push the wheel on and reinstall the screw. Sometimes these wheels require a lot of force, you may need to lay the wheel on a flat surface and push the robot down onto it. Repeat for other servomotor.

Step 4: Install the slide cover. You will find one 5/8 x 6 inch Velcro strip in your supply bag. If you have also ordered a Pen Holder, you will need to cut two .5-inch strips off of this in order to secure your pen holder to your robot. You will need to cut the remaining Velcro in 2.5" strips. We recommend placing the Velcro's soft side (loop side) on the slide cover. Remove the backing to expose the adhesive on the soft side. Place one strip on the top of the slide cover, and place one strip near the bottom of the slide cover. Then remove the adhesive on the hard (hook side) of the Velcro and place on the robot. Apply enough pressure for the slide cover to remain securely. If you have the 84 series, be sure to place your slide cover on the robot as far back as you can without hanging over the back edge. For all other models, place the slide cover as far forward as you can without hanging over the front edge. If this step is done correctly, you should be able to remove the slide cover to access the battery holder. You can place Velcro directly on your calculator temporarily if you have misplaced your slide cover.



Step 5: Install the Calculator. Slide your calculator into the slide cover with the display and keypad up until you hear a click. Plug in the link cable. Please make sure the cable is secured and will not tangle in a wheel or the caster.

Step 6: Install the batteries. Install 4 AA batteries into the battery holder as marked. We recommend using good quality brand-name batteries. Do not mix battery types. We do not recommend rechargeable batteries, as some only provide 1.2 volts each, which is not sufficient to run your Calculator Robot correctly. Please check the voltage on your batteries to ensure they are rated at 1.5 volts. If not, your robot may not follow through with the given commands correctly, as ***low batteries will cause unpredictable results***. Next, slide the switch on the bottom of your robot from off to on. The LED light at the front of your robot should come on. If not, check the battery installation, voltage, and connections. A small jump from the servomotors is normal. Now you are ready to run the software!

Step 7: Running the software. Directions shown are for the 83/84 Plus. If you are using a different device, please refer to our website www.TiRobot.com for directions. Before beginning any programming, please backup your installed software to your computer using the TI Connectivity Kit™, if you have one. Refer to the programming instructions on back: All you need to send commands to the robot processor is the Send(command which is built in to your Texas Instruments calculator basic programming. *See your guidebook that came with your calculator or go online at: http://education.ti.com/product/prselect.html

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Always follow the Send(command with a Get(command. Depending on the command sent, the Get variable might contain important data from the built-in touch sensors and timing.

To enter commands use "2ND" then "CATALOG" (see the 0 button). Be sure to select commands from the menu, as typing in the commands causes erratic behavior. If you are unsure how to program correctly, refer to your calculator's manual.

Command	**Left direction**	**Right direction**
1=timed movement only	0=backward	0=backward
2=move till switch is hit	1=no motion	1=no motion
3=time or until switch	2=forward	2=forward

The first number sent is the command. The movement commands format is CLR. Where C is the command, L is the direction of the left servomotor, and R is the direction of the right servomotor.

Format for CLR
C = command
L= left
R=Right

Format for C
1xx goes for certain time (requires second variable 1-65535)
2xx goes till switch is hit
3xx goes until switch or time (requires second variable 1-65535)
Format for L or R servo motor
0 = backwards
1 = stop
2 = forward

Examples:
Send({122,500})
Get(R)
(This will move the robot forward for approx 500 centiseconds)
Send({100,45})
Get(R)
(This will move the robot backward for approx 45 centisecond)
Send({221})
Get(R)
(This will allow the robot to rotate until the front contacts are hit)
Send({322,500})
Get(R)
(This will allow the robot to go forward approx 500 centiseconds or until a switch is hit)
(R will contain the time traveled)

The variable from the Get(R) command will contain the time the robot moved. To display this amount, just use the Disp R command

Switch status command

Command	**Switch**	**Action**
5=check switch	1=check for switch that stopped robot	2=check for switches as they are now

You have two contact switches on the robot.
If no switches are pressed, you will get the value of zero.
If the right switch is pressed, you will get a value of 1.
If the left switch is pressed, you will get a value of 2.
If both switches are pressed, you will get a value of 3.

Example:
Send({51})
Get(R)
(R will contain a 0, 1, 2, or 3, depending on the switch pressed)

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Other valid commands are:

Command	Action
4=calibrate	21=calibrate left forward pulse length
	01=calibrate left backward pulse length
	10=calibrate right backward pulse length
	12=calibrate right forward pulse length
	99=reset all settings to default

Examples:

421 - calibrate left forward
401 - calibrate left backward
410 - calibrate right backward
412 - calibrate right forward
499 - resets all settings to default

The following commands are for advanced use:

To control the servomotor, we just send a pulse of 1-2 milliseconds. Full speed one-way is 1 millisecond; full speed the other way is 2 milliseconds. This command gives you speed control on the servos. A 1.5 millisecond should be stop or very slow. Use this value(127) to calibrate the pot on the servomotor.

Right backwards is a 255 default
Right forward is a 0 default
Left backwards is a 0 default
Left forward is a 255 default
Valid values are 0-255

Example:

```
Send({421, 200})
Get(R)
(this will slow down the left forward speed)
Send({401, 75})
Get(R)
(this will slow down the left backwards speed)
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Note: These setting will be reset when the robot is shut off. Calculators will shut off after a period of time. Please allow for this in your application.

Where to Operate your Calculator Controlled Robot:

The best place to operate the robot is a table with barriers (to prevent it falling off). You can also use the robot on the floor. We recommend a hard surface. If you plan on using the robot on carpet, be sure to spray it with anti-static spray or a static charge could damage the electrical components in your robot.

Questions?? Concerns?? Comments??
Contact Us!

Norland Research
8475 S. Lisa Lane
Las Vegas, NV 89113
www.TiRobot.com

Office Phone: 702-263-7932
Cell Phones: 702-491-6449 (Rick)
702-498-5799 (Rebbecca)
Fax: 702-876-9231