Basic Kit Construction Guide

TI Robotics System Learning Kit (TI-RSLK): The Maze Edition
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Lab Tools

- Soldering Iron
- Wire Stripper and Cutter
- Heat Gun (optional)
- Precision Knife
- Pliers
- Screwdriver
Section 1: Soldering
Step 1: Gather Your Supplies

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Heat Shrink Tube</td>
<td>1</td>
<td>01M8939</td>
</tr>
<tr>
<td>b Chassis</td>
<td>1</td>
<td>55AC1156</td>
</tr>
<tr>
<td>c 6 Female to Male Wires</td>
<td>1</td>
<td>44AC9484</td>
</tr>
<tr>
<td>d 2 Female to Female Wires</td>
<td>4</td>
<td>44AC9484</td>
</tr>
<tr>
<td>e 11 Female to Female Wires</td>
<td>1</td>
<td>44AC9484</td>
</tr>
<tr>
<td>f 6 Female to Female Wires</td>
<td>1</td>
<td>44AC9484</td>
</tr>
<tr>
<td>g 6 Male to Male Wires</td>
<td>1</td>
<td>44AC9484</td>
</tr>
<tr>
<td>h 2 Male to Male Wires</td>
<td>1</td>
<td>44AC9484</td>
</tr>
<tr>
<td>i Battery Terminals</td>
<td>1</td>
<td>55AC1157</td>
</tr>
<tr>
<td>j Motor</td>
<td>2</td>
<td>55AC1157</td>
</tr>
<tr>
<td>k TI LaunchPad™ Kit</td>
<td>1</td>
<td>41Y9541</td>
</tr>
</tbody>
</table>
Step 2: Prepare Headers, Tubing, and Wires

Gather the following:
- Heat Shrink Tubing (a)
- 6 Female to Female Wires (f)
- 6 Male to Male Wires (g)
- 90° Bent Headers (v)
- 2x20 Header (u)
- 1x20 Header (r)
- 1x25 Header (s)

(optional step) Cut the heat shrink tubing (a) into 12.1 in (~2.5 cm)
Cut the following:
- 90° bent headers (v) into a 1x11
- 2x20 header (u) into a 2x19
- 1x20 header (r) into a 1x8, 1x6, and two 1x3
- 1x25 header (s) into a 1x3 and five 1x2

Cut and strip one end off of the 6 female to female wires (f) using the wire stripper.
Cut and strip one end off of the 6 male to male wires (g) using the wire stripper.
Make sure the wire stripping is relatively even, if you mess up you can trim to fit

Step 3: Prepare the Motor Board

Gather the following:
- Motor Board (m)
- 1x8 Header (Prepared earlier)
- 1x6 Header (Prepared earlier)
- 3 1x3 Headers (Prepared earlier)
- 5 1x2 Headers (Prepared earlier)
- 2 1x6 Female Socket Headers for encoders (t)
Cut Traces: Use a precision knife to cut the **VPU-VREG**, **VCCMD-VREG**, and **SLP L-R** traces. Make a deep solid cut through the small line connection between the square pads. No need to scratch out the pads or be excessive with the cuts.

Solder the following:
- two 1x6 female socket headers (t) to the **yellow** connections.
- a 1x2 header cut earlier to the **ELA** and **ELB** connections. **Note:** You will need to bend these to a 45° angle after soldering.
- a 1x2 header cut earlier to the **ERA** and **ERB** connections. **Note:** You will need to bend these to a 45° angle after soldering.
- a 1x2 header cut earlier to the **VPU** connection. **Note:** The white connection will never be used but helps with soldering.
- a 1x3 header cut earlier to the **VCCMD** connection. **Note:** The white connection will never be used but helps with soldering.
- a 1x6 header cut earlier to the **Left** and **Right** motor driver connections.
- a 1x3 and 1x2 header cut earlier to the **VREG** terminals.
- solder 1x8, 1x3, and 1x2 headers cut earlier to the **GND** terminals.
You will solder the four battery connections later on as part of the attachment to the chassis. You will secure the board with two support screws later.

You should use pliers to bend out the ELA and ELB & ERA and ERB connections so they can be connected by wires to the LaunchPad later. As long as the headers are properly soldered they should be strong enough to bend out slightly without issue or causing damage.
Step 4: Connect Battery Terminals and Chassis

Gather:
- Soldered Motor Board (m)
- Battery Terminals (i)
- Chassis (b)
- Screws for Motor Board (l)

Flip chassis (b) over.
Remove battery cover.

Insert the linking battery terminals (i) into the slots on the left.

Put battery cover back on and flip chassis (b) over.

Insert battery tabs into the slots on the left. **Note:** the order from top to bottom is spring, flat tab, spring, flat tab.
Attach to Chassis: Solder the motor board (m) onto the battery terminals and secure the motor board (m) with two screws (l).

(Optional) Using a voltage meter, verify that the earlier solder connections were made and traces were cut on the motor board (m).

Step 5: Solder LaunchPad Connections

Gather your LaunchPad (k) and the 2x19 header you cut earlier.

Solder the 2x19 header on the J5 pinout at the bottom of the LaunchPad (k) with long pins facing upwards.
Step 6: Ready the Motors

Gather:
- Motors (j)
- 2 Motor Encoders (u)

Solder the included encoder headers (u) to the encoders (u). **Note:** The bent portion of the headers should be towards the motor as pictured above.

Solder the prepared encoders (j) onto the motors (i). **Note:** The encoder adapter should be flush with the motor as pictured above.

Attach the magnets onto the motors (i).
Step 7: Solder the Line Sensor Connections

Gather the line sensor (n) and the 1x11 90° bent headers cut earlier.

Solder the 1x11 bent headers onto the line sensor (n). Connect the highlighted 3.3V bypass by either creating a solder bridge or soldering a short wire from your extra wire clippings.

Step 8: Prepare the Bump Switches

Gather the following:
- 6 Bump Switches (o)
- 12 Heat Shrink Tube pieces cut earlier (a)
- 6 Female wire with one end cut and stripped from earlier (f)
- 6 Male wire with one end cut and stripped from earlier (g)
- 12 Bump Switch wire spade connectors (v) *not included in kit

Note: You can solder the wires directly to the bump switches in the next step but using the spade connector is much better. If you have a crimper tool this will be easier task but you can manually crimp with pliers or a wire cutter.
Start with the 6 female wires (f).

Crimp a wire connector (v) on each wire.

Attach one female wire on the “1” or “C” connection on each bump switch (0).

Ready the 6 male wires (g).

Crimp a wire connector (v) on each wire.

Attach one male wire on the “3” or “NO” connection on each bump switch (0). Color coding each switch will help you later when wiring.

**Note:** you can separate each wire but for a cleaner look try to keep them together.
## Section 2: Assembly

### Step 1: Gather Supplies

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>a #2-56 Screw 1/2&quot;</td>
<td>12</td>
<td>55AC7011</td>
</tr>
<tr>
<td>b #2-56 Nut</td>
<td>12</td>
<td>18M5986</td>
</tr>
<tr>
<td>c #2-56 Screw 1/4&quot;</td>
<td>4</td>
<td>56AC1176</td>
</tr>
<tr>
<td>d #2-56 Metal Standoff 1/2&quot;</td>
<td>2</td>
<td>27T8693</td>
</tr>
<tr>
<td>e #4-40 Screw 1/2&quot;</td>
<td>4</td>
<td>55AC7009</td>
</tr>
<tr>
<td>f #4-40 Plastic Standoffs</td>
<td>4</td>
<td>16F1043</td>
</tr>
<tr>
<td>g #4-40 Nut</td>
<td>4</td>
<td>43AC8400</td>
</tr>
<tr>
<td>h Prepared Motor w/ Encoders</td>
<td>2</td>
<td>55AC1157</td>
</tr>
<tr>
<td>i Motor Clip</td>
<td>2</td>
<td>55AC1156</td>
</tr>
<tr>
<td>j Ball Caster</td>
<td>1</td>
<td>55AC1156</td>
</tr>
<tr>
<td>k Prepared Line Sensor</td>
<td>1</td>
<td>55AC1159</td>
</tr>
<tr>
<td>l Rubber Tire</td>
<td>2</td>
<td>55AC1156</td>
</tr>
<tr>
<td>m Wheel</td>
<td>2</td>
<td>55AC1156</td>
</tr>
<tr>
<td>n Prepared Chassis</td>
<td>1</td>
<td>55AC1156</td>
</tr>
<tr>
<td>o Prepared Bump Switch</td>
<td>1</td>
<td>55AC1159</td>
</tr>
</tbody>
</table>
Step 2: Attach Motors

Gather:
- Prepared Chassis and Motor Board (n)
- Motor Clips (i)
- Prepared Motors (h)

Insert the motor clips (i) into the motor board (n) as shown above.

Ensure the motor clips (i) are fully inserted.

Fully slide the motors (h) into the motor clips (i) with gentle pressure as shown above. Be careful not to over-stress the clips.

The pins from the encoders should plug into the motor board. Ensure they are not in contact with the bent pins.
Step 3: Attach Ball Caster

Gather your Chassis (n) and the Ball Caster parts (j).

Place the three small wheels in the groves on the short side as shown above.

Place the white ball in the grove as shown above.

Secure the assembly with the final piece.

Step 4: Attach Wheels

Gather:
- Prepared Chassis
- Wheels (m)
- Rubber Tires (l)

Attach rubber tires (l) to the wheels (m).

Attach the prepared wheel to the motor. Please be sure to align the flat portions of the wheel and motor.
Step 5: Attach Line Sensor

Gather:
- Prepared Chassis
- 11 Female to Female Wires (e from pg. 4)
- Screws #2-56 1/4” (e)
- Standoffs #2-56 (f)
- Line Sensor (n)

Attach the standoffs (f) to the bottom of the chassis with two screws (e) at the highlighted locations.

Run the wires (e from pg. 4) through the middle hole of the chassis. Attach the line sensor (n) using two screws (e) to the standoffs (f) you just attached.
Step 6: Attach Bump Switches

Gather:
- Prepared Chassis
- Bump Switches (u)
- Screws #2-56 1/2” (a)
- Nuts #2-56 (b)

**Note:** you may find it easier to fish the screw from the bottom and secure with the nut on the top of the bump switch. Both orientations when secure can work.

Attach the bump switches (u) to the Prepared Chassis via the holes above using the nuts (b) and screws (a).
Step 7: Attach LaunchPad Standoffs

Gather:
- Prepared Chassis
- Plastic Standoffs (h)
- Screws #4-40 1/2” (g)
- Nuts #4-40 (j)

Attach the standoffs (h) to the top of the chassis with screws (g) from the bottom via the highlighted areas above. Do not over tighten or screw them all the way in.

You will use four nuts (j) to attach the LaunchPad after the next section.

**Note:** the chassis holes may be slightly too small, but the screws will fit. Press the screws firmly through.
Section 3: Wiring

Step 1: Bump Switches

Connect the “1” or “C” output (female wire) from each bumper to GND on the motor board. Connect the “3” or “NO” output (male wire) from each bumper to the LaunchPad underside female inputs below.

<table>
<thead>
<tr>
<th></th>
<th>Bump 1</th>
<th>Bump 2</th>
<th>Bump 3</th>
<th>Bump 4</th>
<th>Bump 5</th>
<th>Bump 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>LaunchPad</td>
<td>P4.0</td>
<td>P4.2</td>
<td>P4.3</td>
<td>P4.5</td>
<td>P4.6</td>
<td>P4.7</td>
</tr>
</tbody>
</table>
Step 2: Motor Board Logic

Using the 6 female to male wires (c from pg. 4), connect the male motor driver connections to the LaunchPad underside female outputs below.

<table>
<thead>
<tr>
<th>Motor Board</th>
<th>Left SLP</th>
<th>Left DIR</th>
<th>Left PWM</th>
<th>Right SLP</th>
<th>Right DIR</th>
<th>Right PWM</th>
</tr>
</thead>
<tbody>
<tr>
<td>LaunchPad</td>
<td>P3.7</td>
<td>P1.7</td>
<td>P2.7</td>
<td>P3.6</td>
<td>P1.6</td>
<td>P2.6</td>
</tr>
</tbody>
</table>
Step 3: Motor Board Power

Using the 2 female to female wires (d from pg. 4), connect the VPU and VCCMD connections to the LaunchPad’s 3.3V outputs (3V3).

<table>
<thead>
<tr>
<th>Motor Board</th>
<th>VPU</th>
<th>VCCMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>LaunchPad</td>
<td>3V3</td>
<td>3V3</td>
</tr>
</tbody>
</table>
Step 4: LaunchPad Power

Using the 2 female to female wires (d from pg. 4), connect the VREG and GND connections to the LaunchPad 5V and GND connections respectively.

**Note:** You must disconnect these wires every time you connect your LaunchPad to your computer via USB. You do not want to have the robot batteries connected up while the LaunchPad is being programmed or powered by the PC!

<table>
<thead>
<tr>
<th>Motor Board</th>
<th>VREG</th>
<th>GND</th>
</tr>
</thead>
<tbody>
<tr>
<td>LaunchPad</td>
<td>5V</td>
<td>GND</td>
</tr>
</tbody>
</table>
Step 5: Line Follow Sensor

Using the 11 female to female wires (e from pg. 4) you fed through the chassis earlier (Step 5 on pg. 17) make the below connections between the line sensor and LaunchPad top side.

<table>
<thead>
<tr>
<th>Line Sensor</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>LED ON</th>
<th>VCC</th>
<th>GND</th>
</tr>
</thead>
<tbody>
<tr>
<td>LaunchPad</td>
<td>P7.7</td>
<td>P7.6</td>
<td>P7.5</td>
<td>P7.4</td>
<td>P7.3</td>
<td>P7.2</td>
<td>P7.1</td>
<td>P7.0</td>
<td>P5.3</td>
<td>3V3</td>
<td>GND</td>
</tr>
</tbody>
</table>
Step 6: Attach LaunchPad

Next, secure the LaunchPad to the LaunchPad standoffs using the nuts you set aside earlier. If wires are on the bottom you may need to gently and carefully maneuver the LaunchPad to align with the standoffs.

**Note:** You have the ability to add Booster Packs to the top of the RSLK for adding capabilities and more learning experiences.

**Congratulations; your TI-RSLK is built!**