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QTI Line Follower AppKit for the Small Robot (#28108)

Line Following with QTIs

The QTI sensor is a close-proximity infrared emitter and receiver pair mounted on a tiny PCB. It can be used as an analog sensor to differentiate between different levels of infrared reflectivity. It can also be used as a purely digital device that returns a 1 when it detects a black line or a 0 if it detects a white background. An array of four QTI sensors used as digital devices makes an effective and flexible line-follower for your small robot.

The QTI positions are adjustable for different sizes and types of lines. This activity demonstrates how the QTIs can be used for digital line following on a simple 3/4-inch wide electrical tape course with a white background. See the "Downloads and Documentation" section of the #28108 product page for QTI Line Follower source code in PBASIC, C, and Arduino.
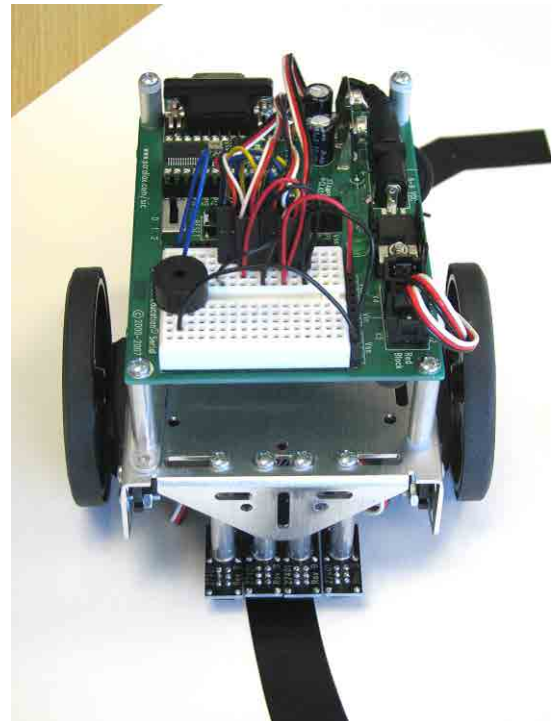
For this activity, you will need to supply your own:

- Built and tested Boe-Bot, ActivityBot or Arduino Shield-Bot robot
- #2 Philips-head screwdriver
- Black ¾-inch electrical tape
- White poster board

Kit Contents

Part #	Description	Qty
800-00120	3-wire Extension cable, 12"	4
800-00016	3-inch jumper wires (bag of 10)	2
150-01030	Resistor - 10 kΩ	4
555-27401	QTI sensor	4
451-00303	3-pin male-male header	4
710-00007	7/8-inch screw, pan head, 4-40	4
700-00060	Standoff, round, 1-inch, 4-40	4
713-00007	Spacer, round, 1/2 inch	4
700-00002	3/8-inch screw, pan head, 4-40	4
700-00015	Washer, nylon, #4	4

Mounting the QTIs

1. Match the components in your kit to the Kit Contents listed above to make sure all pieces are present. If anything is missing, contact Parallax Tech Support.
2. Referring to Figure 1, insert the 7/8-inch screws through the top of the small robot chassis, at the three slots near the front. Two screws will go through the center slot, and one screw each in the right and left slots.
3. On the underside of the chassis, slip a 1/2-inch unthreaded spacer on each screw, followed by a 1-inch threaded standoff.
4. Attach a QTI sensor to the other end of each threaded standoff, using a 3/8-inch screw. The sensors should be facing downwards, and the 3-pin headers on each sensor should be pointing towards the back of the chassis.
5. If necessary, slightly loosen the 7/8-inch screws and adjust the position of the QTI sensors so that they are closely positioned edge to edge.
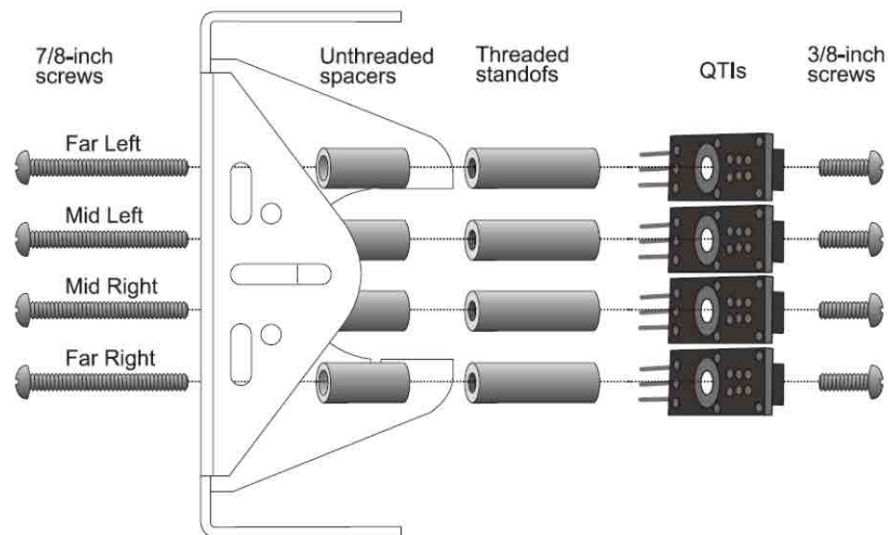6. Tighten all connections securely.

Figure 1 – Mechanical Assembly

Building the Sensing Circuits

Each QTI B pin is tied to Vss (Ground/GND) and each W pin is connected to Vdd (5V). R pin connects to an I/O pin:

- Far right to P4
- Mid right to P5
- Mid left to P6
- Mid right to P7

√ Use the schematic (Figure 2) and the wiring diagrams (Figure 3) on the next page to build the circuits for the three-pin headers. Be sure to use the correct breadboard setup for your specific robot (Boe-Bot, ActivityBot, or Arduino Shield-Bot). Although there are many ways this circuit can be built, these setups are simple and thrifty with breadboard real-estate. If you are using a Boe-Bot with a HomeWork Board (instead of a Board of Education), it won't interfere with the servo connections.
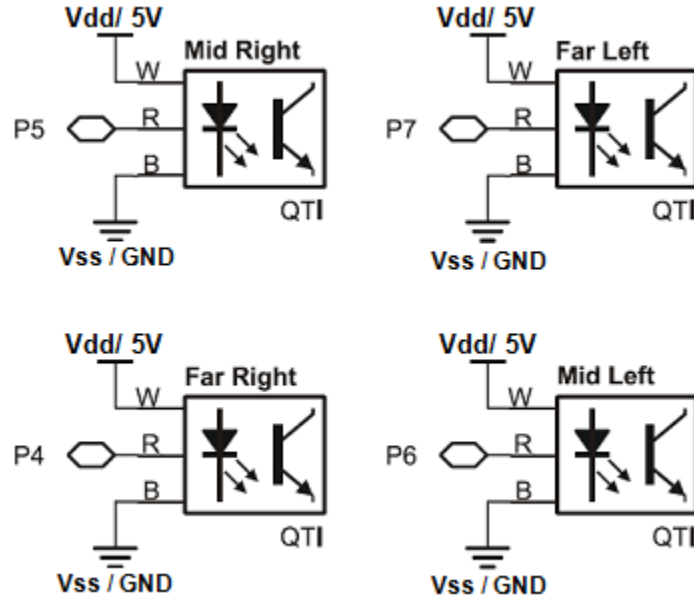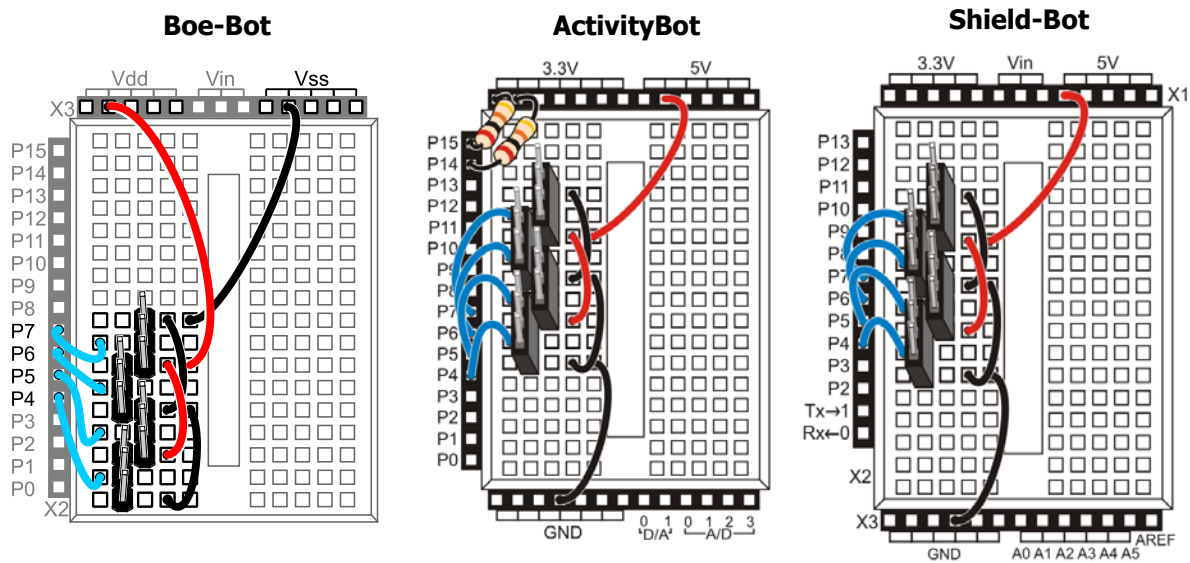
Figure 2 – Schematic

Figure 3 – Wiring Diagrams

Use the Figure 4 to connect the servo extension cables to the male-male headers that are plugged into the breadboard. The other end of each cable is plugged into a QTI. Be careful when you make these connections, and pay close attention to the wire colors listed in the figure. Notice that the far left and mid left cables have white wires that plug onto header pins in the same breadboard row. The same applies to the mid right and far right QTI cables. Instead of common white wires, the mid left and mid right QTI cables share a pair of black wires.

> ⚠ **Use Figure 4 for Boe-Bot, ActivityBot, or Shield-Bot robots.** If you set up your robot's breadboard according to Figure 2, the servo extension cables will always be connected in the configuration shown below, regardless of which robot you are using.
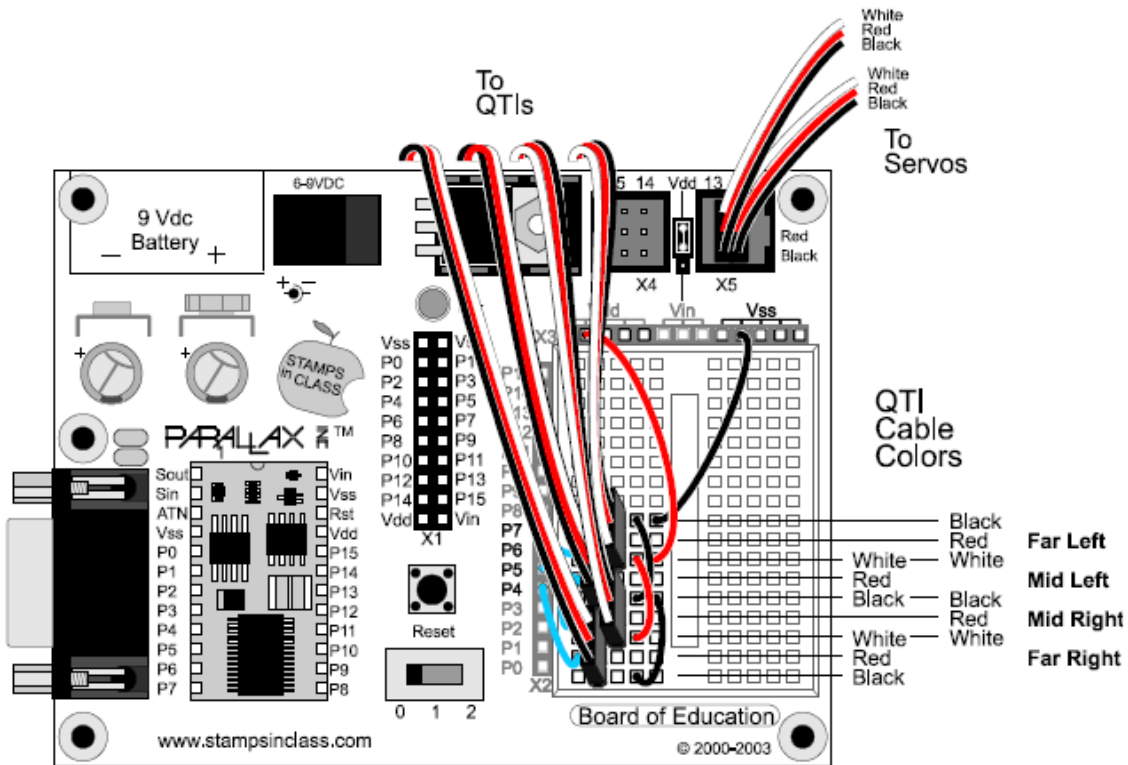

Figure 4 – Servo Extension Cable Connections

> ❓ **What are the 10 kΩ resistors for?** A 10 kΩ resistor can be added across each QTI W and R terminal to make the sensor supply an analog output voltage. This can be useful for systems with analog to digital (A/D) inputs.

> ⚠ **IMPORTANT**: **DO NOT** try to use 10 kΩ resistors with Parallax line-following example code; the code will not work.

Revision History

3.0 – PBASIC code removed (archived on #28108 product page); name and images updated to reflect kit's compatibility with ActivityBot and Arduino Shield-Bot robots.

2.1 – New information boxes explain the purpose of the (4) 10 kΩ resistors included in the QTI Line Follower AppKit.