

## Sensor Accessories

# Line Tracker

A line tracker consists of an infrared light sensor and an infrared LED. It works by illuminating a surface with infrared light; the sensor then picks up the reflected infrared radiation and, based on its intensity, determines the reflectivity of the surface in question. White surfaces will reflect more light than dark surfaces, resulting in their appearing brighter to the sensor. This allows the sensor to detect a dark line on a white background, or a white line on a dark background.

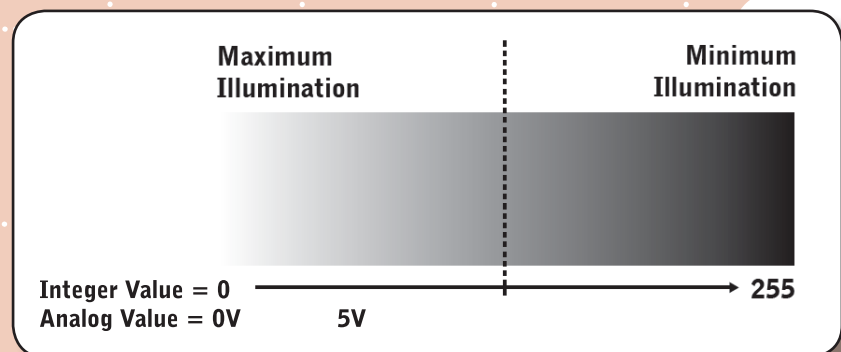
You can use a line follower to help your robot navigate along a marked path, or in any other application involving discerning the boundary between two high-contrast surfaces. A typical application uses three line tracking sensors, such that the middle sensor is over the line your robot is following.

### Technical Overview

This is an analog sensor, meaning that its output covers a range of values (in this case, from zero to five volts) rather than being only high (five volts) or low (zero volts), as is the case for a digital sensor. This varying range of outputs from zero to five volts is sent to the microcontroller.

The following example is based on values when using MPLAB software and the PIC Microcontroller. The zero to five volts value that is sent to the microcontroller will read as a range of integer values from 0 to 255.

For this particular sensor, sensor output will be low (around 0) when the infrared light bounces back to the detector - in other words, when the surface is pale or highly reflective - and high (around 255) when the light is absorbed and does not bounce back.



For other programming software and/or the Cortex Microcontroller, this range of outputs from 0-5V that is sent to the microcontroller translates it into a corresponding range of integer values from 0 to full scale. Full scale is 1023 for 10-bit Analog-to-Digital values such as with easyC or ROBOTC for PIC, 4095 for 12-bit values such as with ROBOTC for Cortex and 255 for 8-bit values such as with MPLAB. When using the Cortex Microcontroller, typical white/black/"away from everything values" will be 38/662/770 for easyC, 153/2650/3076 for ROBOTC and 9/166/192 for 8-bit values. When using the PIC Microcontroller, typical white/black/"away from everything values" will be 38/882/1012 for both easyC and ROBOTC and 9/220/253 for 8-bit values.

Limited 90-day Warranty

This product is warranted by VEX Robotics, Inc. against manufacturing defects in material and workmanship under normal use for ninety (90) days from the date of purchase from authorized VEX Robotics dealers. For complete warranty details and exclusions, check with your dealer.

For More Information, and additional Parts & Pieces refer to:  
[www.VEXrobotics.com](http://www.VEXrobotics.com)

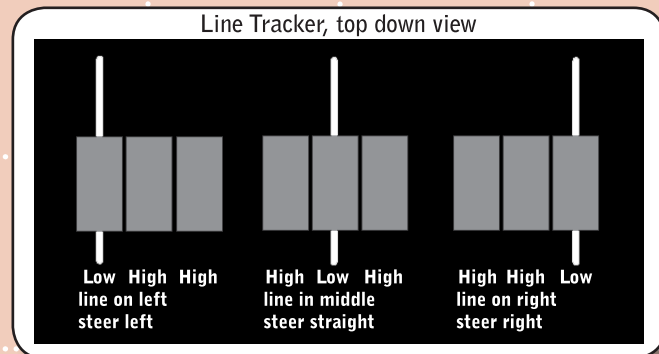
VEX Robotics, Inc.  
1519 IH 30 W  
Greenville, TX 75402

0312

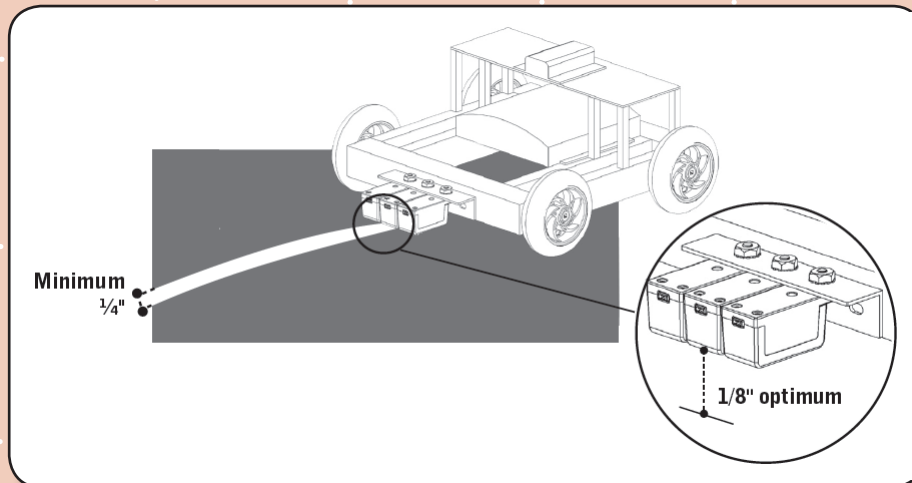
## Sensor Accessories

### Line Tracker, continued

From this basic premise, we can build more complicated behaviors. For example, if you have three line sensors on the front of your robot, then you can program your robot to follow a white line on a black surface. LineFollower\_Middle should always see white, and the other two - LineFollower\_Left and LineFollower\_Right – should always see black. If LineFollower\_Left starts seeing white, then your robot needs to steer back to the left. If LineFollower\_Right starts seeing white, then your robot needs to steer back to the right.



The optimal range for the line follower is approximately 3mm (about 1/8 inch). The minimum line width it can detect is 0.25", the optimal width is 0.50".



Sensor output will be low (0V) when the infrared light bounces back to the detector – in other words, when the surface is pale or highly reflective – and high (+5V) when the light is absorbed and does not bounce back.

#### HELPFUL HINT:

Because the Line Follower uses an infrared LED to illuminate its target and an infrared sensor to detect the reflected light, it will actually work in low-light conditions or even in the dark! However, **this also means that it can easily become saturated** – in other words, everything will look white to it, like an over-exposed photograph – in environments where there is a lot of infrared radiation. You'll find environments like this in competition settings where tungsten lights are used for illumination. **To avoid saturating the infrared sensor,** consider mounting it underneath the robot or adding a shield to block ambient radiation.

For more information on programming with the VEX Line Tracker, refer to the creator of your programming software, or your software help files.