Advanced Line Finder Kit

INTRODUCTION AND OVERVIEW

Advanced line finder kit consists of 5 IR transmitter and IR receiver pairs. This line finder is the typically used for embedded system or robots in line following task. It can be used for either dark or bright line following. Any color with distinct brightness difference is suitable for This line finder.

The IR transmitters are pulsed to allow the transmitter to off at certain idle period of sensor. This is to minimize the current consumption of the line finder to at least half of the current consumption compared to a normal unregulated IR line sensor. Power polarity protection is available on the line finder in case the user accidentally applies a reverse voltage.

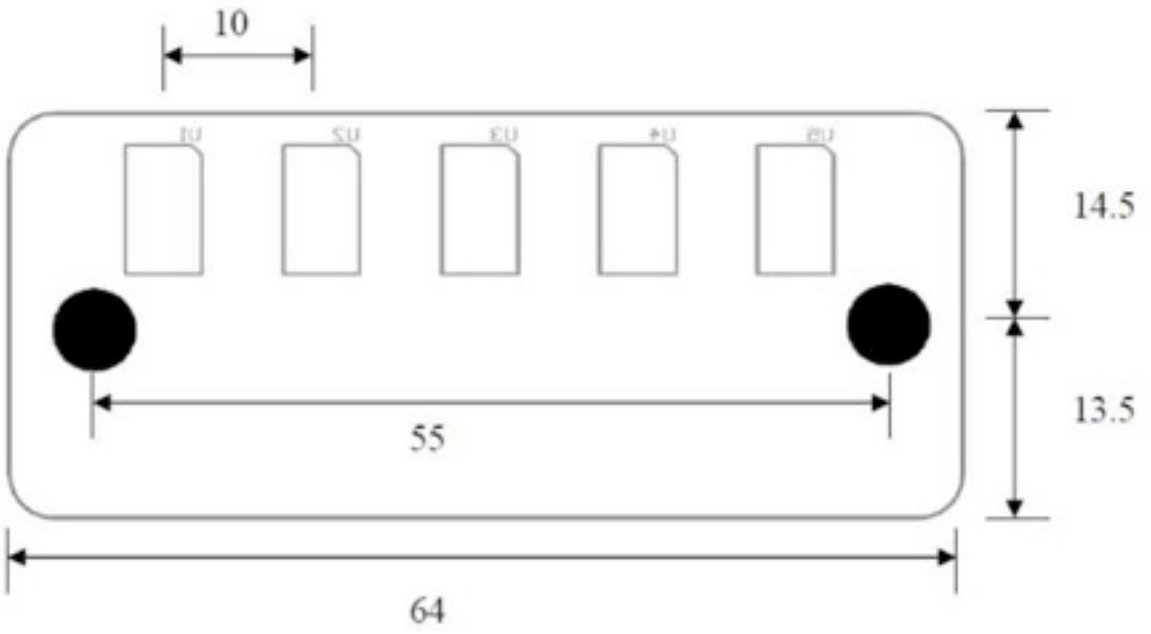
The line finder have 5 digital outputs to user indicating the existence of the line. The threshold to the brightness of line existence will be set when the user calibrate the sensor to the surface that it will recognize.

One digital input of calibration signal is available to user for automated calibration function by the user system. User can pull down this signal line with microcontroller to calibrate the sensors. This signal line also can be use to enter different mode of the line finder. Each sensor of the 5 sensors on the line finder is independent of each other. The refreshing rate of the sensors is more than 100Hz. Every sensor is provided with its own LEDs as indication of line detection.

This line finder has a manual calibration button. The calibration button is multifunctional. User can enter different mode of functions using calibration button too as the alternative to the calibration signal.

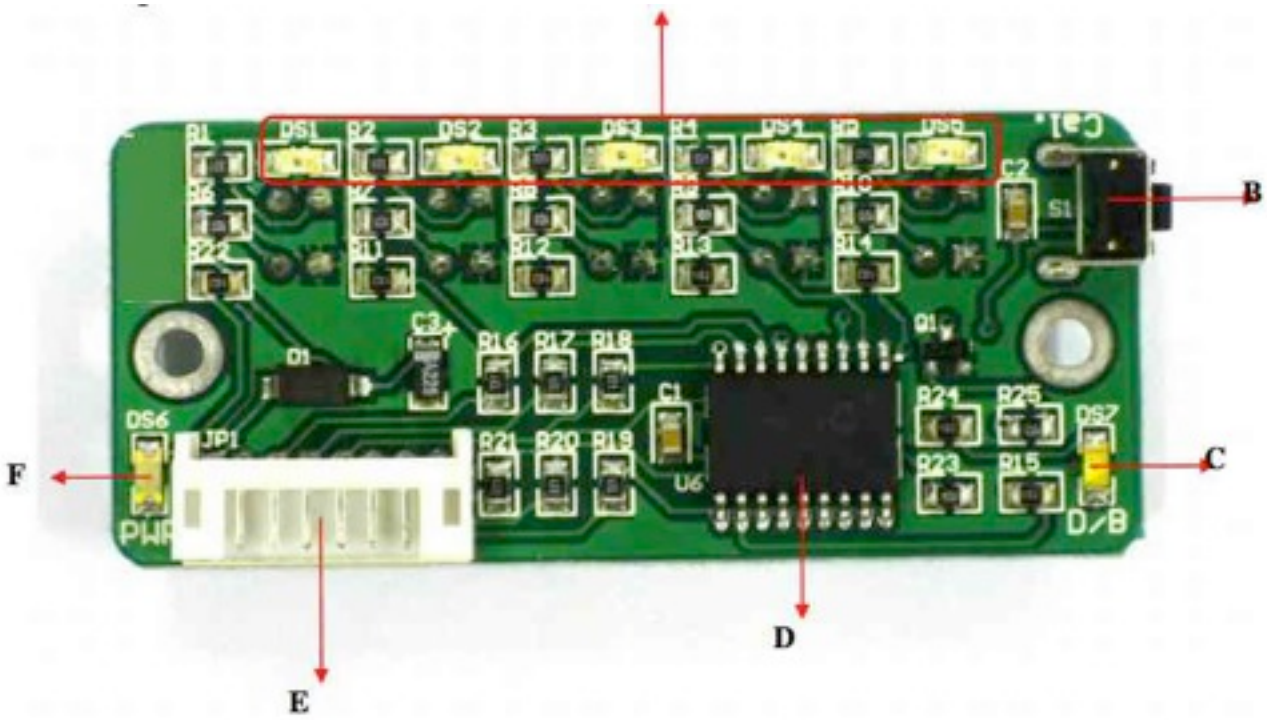
PRODUCT SPECIFICATION AND LIMITATIONS

Dimensions



Operating voltage : 5 V
Sensing distance: 1: 4 cm

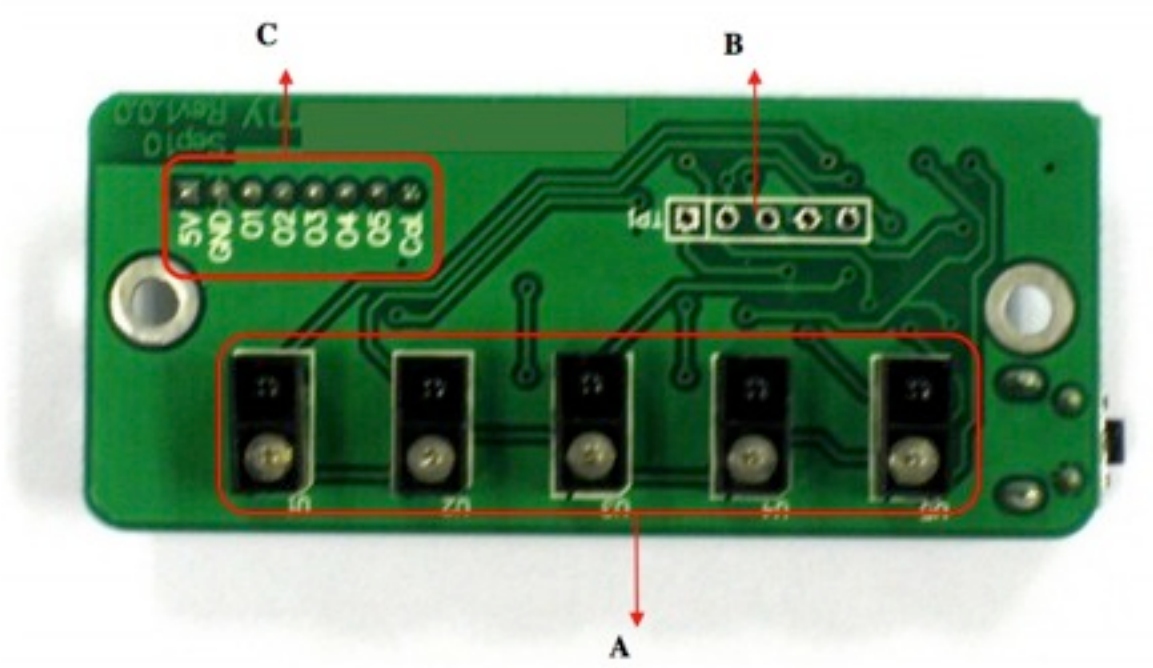
BOARD OR PRODUCT LAYOUT



Label	Function	Label	Function
A	Sensor indicator LEDs	D	PIC16F819
B	Calibration button	E	Power and output signal connector
C	Mode indicator LED	F	Power indicator LED

A – Sensor indicator LEDs (red) will light up showing that it detects line.
B – Calibration button is used to enter different modes. Press once to enter the calibration mode. Press twice to set the line sensor bar into dark line following mode and press 3 times to set the line sensor bar into bright line mode.
C – Mode indicator LED (orange) is for indication of the mode. LED will light up if line finder is in bright line detection mode. Otherwise, it is off.
D – PIC16F819 PIC microcontroller for data processing. **E** – Power and output signal connector
F – Power indicator LED (green) showing the board is supplied with power. Maximum input power is 5V.

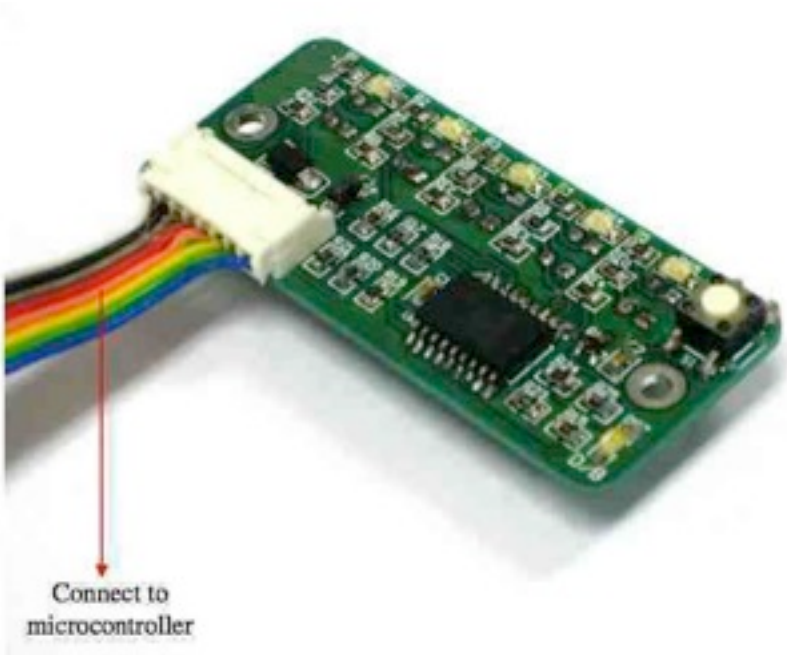
Bottom

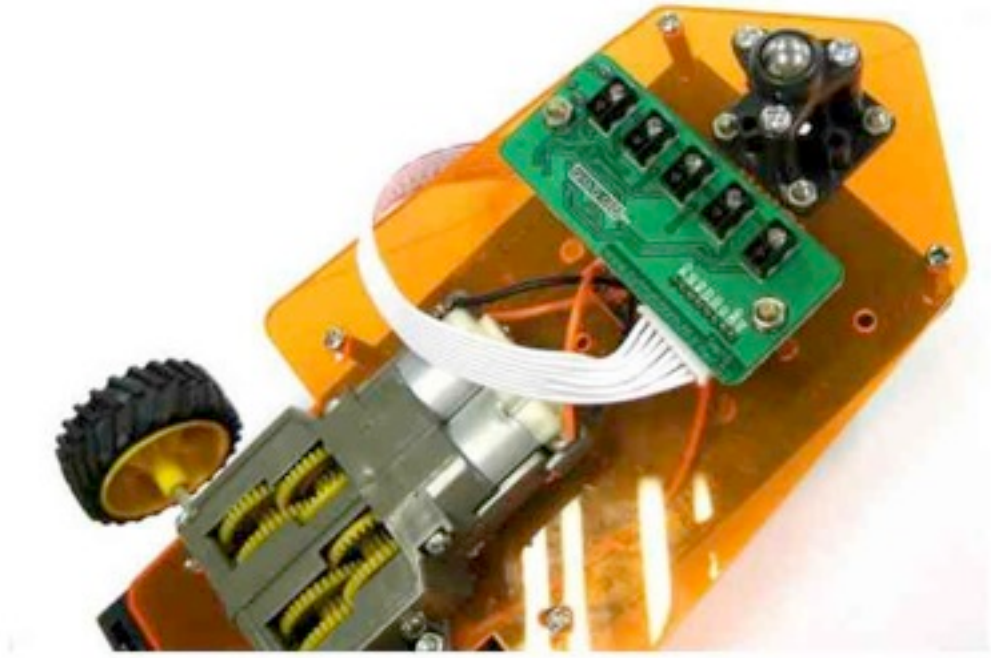


Label	Function
A	Pairs of IR sensor
B	Manufacturing Test Points
C	Input/output signal label

A – Pairs of IR sensor which consist IR transmitter and IR receiver. **B** – It is reserved for Manufacturing Test Point. Please **DO NOT** short or connect wire to any
of these pins.
C –Input/output signal label showing the Power (5V, GND), output signal pins (O1-O5) and calibration signal (Cal.).

INSTALLATION (HARDWARE)



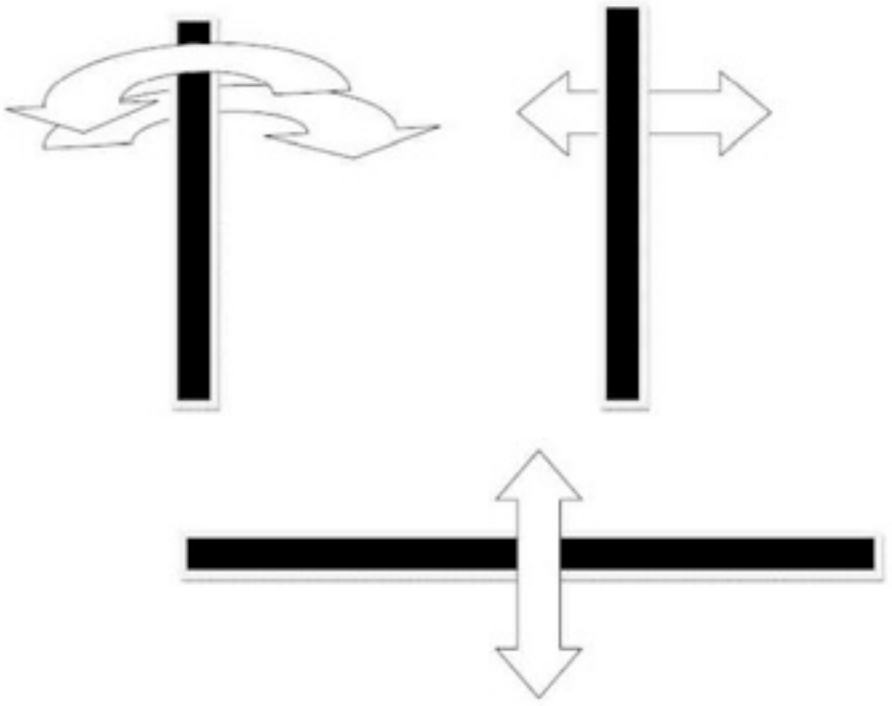


GETTING STARTED

Advanced line finder need to be calibrated to retrieve the dark and bright value of the surface that it will do the line follow.Every one of the IR sensor pairs need to be exposed to the dark and bright surface for it to read the value and save it. The line finder will save the value in EEPROM, it will retrieve back the data from the EEPROM every time its switch on.

Hence, only one time calibration is needed for the same surface and line. To calibrate the line finder, simply press the calibration push button once or pulling down the Cal. for few milliseconds. Calibration will be start by exposing the sensor to the bright surface and then to the dark surface as indicated by the LEDs. 3 LEDs blinking means the bright calibration (2.5 seconds) and 2 LED blinking means the dark calibration (2.5 seconds).

Calibration is normally done by crossing every sensor across the line that it will follow as shown in the figure below. Sensors will save the brightest value in the bright calibration process and darkest value in dark calibration. User can calibrate by simply swinging the sensors across the dark and bright surface in order to expose every sensor to the dark and bright surface. Calibration of every sensor is independent and value of each sensor will be saved.



Example motions of calibration by crossing the sensor between the lines.

Calibration button and signal

The calibration button or the calibration signal (Cal.) has 2 functions. The 1st function is to call for calibration of the line sensor and the 2nd function is to set whether the sensor bar will operate for dark line following or bright line following.

Using the calibration push button

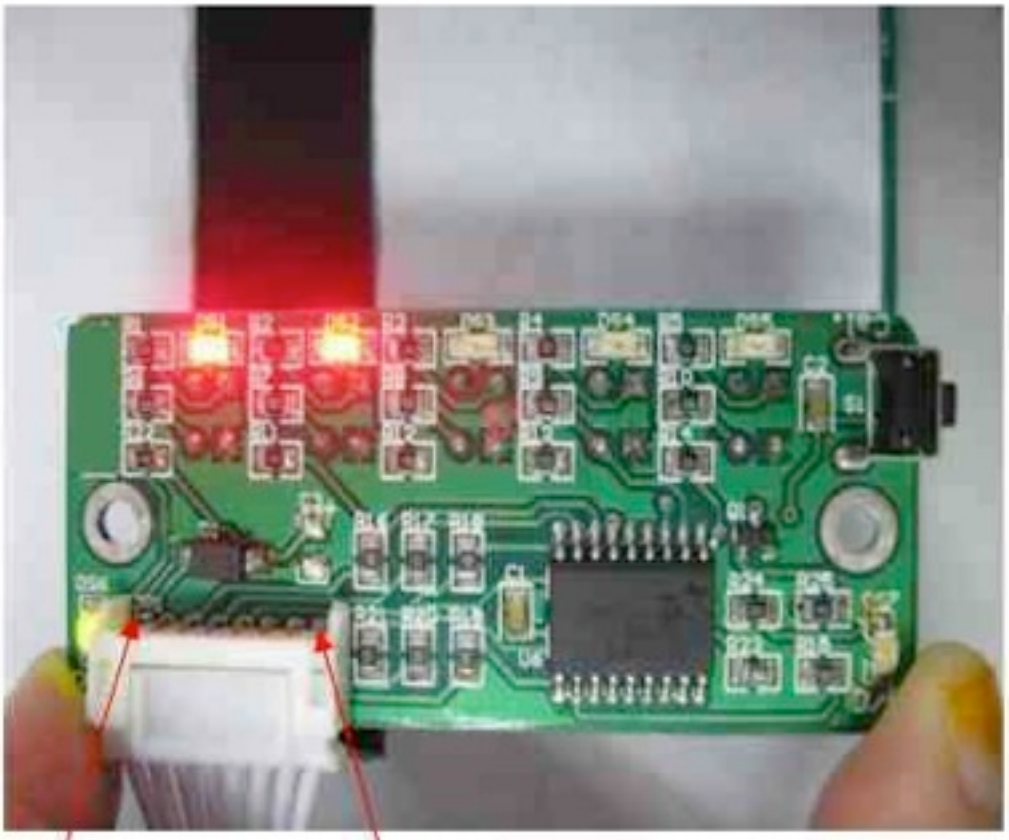
Press the push button **once** to set the sensor bar into calibration mode. Line finder will go into calibration mode and the red LEDs will start blinking accordingly to indicate whether it is calibrating for dark color or bright color.

Press the push button twice will set the line sensor into dark line following mode which line finder will detect dark line. Sensor indicator LEDs will light up if it detects dark surface (the line is dark) and the output is high. When no dark line is detect, the output will be low.

Press the push button 3 times will set the line sensor bar into bright line following mode which line finder will detect bright line; sensor indicator LEDs will light up if it detects bright surface (the line is bright) and the output is high. When no bright line is detect, the output will be low. Dark/Bright indicator (D/B) indicator LED will light up in orange color for this mode.

Below are examples of line finder output when it detects dark and bright line. Output 1 is for DS1, output 2 for DS2 and output 3,4, and 5 for DS3,DS4 and DS5 respectively. LED ON means that the sensor detected the line. For example, when sensor1(U1) and sensor2(U2) detected the dark line, DS1 and DS2 will turn ON. The output for sensor1(U1) and sensor2(U2) is high while it is low for sensor which do not detect the line (sensor3(U3), sensor 4(U4) and sensor 5(U5)).

LED					Output				
DS1/U1	DS2/U2	DS3/U3	DS4/U4	DS5/U5	1	2	3	4	5
ON	ON	OFF	OFF	OFF	1	1	0	0	0
OFF	ON	ON	ON	OFF	0	1	1	1	0
OFF	OFF	OFF	ON	ON	0	0	0	1	1
OFF	OFF	OFF	OFF	OFF	0	0	0	0	0



Using the calibration signal

The calibration signal from the sensor connector can be used to perform exactly the same function as the calibration push button. The calibration signal line requires user to generate falling edges to set for appropriate mode. line finder detect how many falling edges to set to appropriate mode.

- One falling edge pulse for calibration mode as shown in figure below. After the falling edge pulse the sensor will start calibration.

- Two falling edges for setting the line finder into dark line mode. The 2 falling edges need to be in range of 1.5 seconds.