



# Grove - Optical Rotary Encoder(TCUT1600X01)

The Grove - Optical Rotary Encoder(TCUT1600X01) is a transmissive sensor that includes an infrared emitter and two phototransistor detectors. Usually, the infrared emitter emits infrared rays, the phototransistor detectors receives the infrared rays, then the phototransistor is turned on, both of the output is High, the on-board LED indicators light up. When there is an obstacle blocking, the phototransistor can not receive the infrared rays, so the phototransistor will be turned off and both of the output will be Low, the on-board LED indicators fade away.

You can use this sensor as a rotary encoder to detect the speed or rotation, and thanks to the two phototransistor detectors, you even can detect the rotation direction.

## **Features**

- Double phototransistor detectors, can determine the direction of rotation
- On-board LED indicators
- Grove Interface

# **Specification**

Item	Value
Operating voltage	3.3V / 5V
Operating temperature	-40°C to +105°C
Storage temperature Range	-40°C to +125°C
Emitter wavelength	950 nm
Gap	3 mm
Interface	Digital

# **Applications**

- Automotive optical sensors
- Accurate position sensor for encoder
- Sensor for motion, speed, and direction
- Sensor for "turn and push" encoding

## **Hardware Overview**

Pin Map



SIG2: default High, output of channel 2, which connect to phototransistor detector 2 O SIG1: default High, output of channel 1, which connect to phototransistor detector 1

### Schemaitc

### Power



The typical voltage of TCUT1600X01 is 5V, so we use the MP3120 current mode stepup converter to provide a stable 5V. The input of MP3120 ranges from 0.8V to 5V, so you can use this module with your Arduino both in 3.3V and 5V.



When the phototransistor detectors receive the infrared signal, the output should be High, and when the obstacle blocks the infrared, the OUT1 and OUIT2 should be Low. However due to the leakage current, it won't be 0V. The leakage voltage varies with the input voltage.

# **Mechanical Drawing**





**Directional Detection** 



Тір

Thanks to the two phototransistor detectors, we can detect the moving direction. If the obstacle moves from the left to right, The output states change should be  $11 \rightarrow 01 \rightarrow 00 \rightarrow 10$ ; in the same way, if the obstacle moves from the right to left, it should be  $11 \rightarrow 10 \rightarrow 00 \rightarrow 01$ .

# **Platforms Supported**

Arduino	Raspberry Pi	BeagleBone	Wio	LinkIt ONE
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### Caution

The platforms mentioned above as supported is/are an indication of the module's hardware or theoritical compatibility. We only provide software library or code examples for Arduino platform in most cases. It is not possible to provide software library / demo code for all possible MCU platforms. Hence, users have to write their own software library.

# Getting Started

# **Play With Arduino**

Hardware

## Materials required

Seeeduino V4.2	Base Shield	Grove - Optical Rotary Encoder
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### Note

**1** Please plug the USB cable gently, otherwise you may damage the port. Please use the USB cable with 4 wires inside, the 2 wires cable can't transfer data. If you are not sure about the wire you have, you can click here to buy

**2** Each Grove module comes with a Grove cable when you buy. In case you lose the Grove cable, you can click here to buy.

- Step 1. Connect the Grove Optical Rotary Encoder to the D5 port of the Base Shield.
- Step 2. Plug Grove Base Shield into Seeeduino.
- Step 3. Connect Seeeduino to PC via a USB cable.



#### Note

If we don't have Grove Base Shield, We also can directly connect this module to Seeeduino as below.

Seeeduino	Grove - Optical Rotary Encoder
5V	Red
GND	Black
D6	White
D5	Yellow

### Software

### Note

If this is the first time you work with Arduino, we strongly recommend you to see Getting Started with Arduinobefore the start.

• Step 1. Install the Encoder Library in the Arduino IDE. You can find this library by the following path: Sketch→Include Library→Manage Libraries

File Edit	Sketch Tools Help			
	Verify/Compile	Ctrl+R		
	Upload	Ctrl+U		
sketch	Upload Using Programmer	Ctrl+Shift+U		
void set // put	export complied binary	Ctrl+Alt+S		
// put	Show Sketch Folder	Ctrl+K		
}	Include Library	;	Δ	
	Add File		Manage Libraries	
<pre>void loop() {     // put your main code here, to run repeatedly:</pre>		epeatedly:	Add .ZIP Library	
			Arduino libraries	

Then search for the **encoder** in the pop-up window. Find the **Encoder by Paul Stoffregen**, choose the **Version1.4.1**, then click **Install**.

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Bas bas	e64 by Densauge e64 encoder/deco e64 characters are <u>e info</u>	oder for a		common web conventions - '+' for 62, '/' for 63, '=' for padding. Note that invalid
<b>Jse</b> liffe		lata on a d	lifferential drive	<b>robot to estimate position.</b> This library implements dead reckoning on a to estimate the position of the robot real time.
Cou	commonly availab	lses from		<b>position encoders.</b> Encoder counts pulses from quadrature encoded signals, which or or shaft sensors and other position sensors.
	<u>e info</u>			3
Mor				Version 1 Version 1.4.1
Mor	e info veEncoder by Dav	vid Antler		

When the library is installed you will see **INSTALLED**, click **Close** then.

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Gro	oveEncoder	by David A		ables the Gro	ove Rotary Encoder v1.2 to be controlled by a basic Arduino	_
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					Clos	se

Thanks for Paul for his splendid library.

- **Step 2.** Restart the Arduino IDE. Open the example, you can open it in the following three ways :
  - a. Open it directly in the Arduino IDE via the path: File  $\rightarrow$  Examples  $\rightarrow$  Encoder  $\rightarrow$  Basic.

New	Ctrl+N			
Open	Ctrl+O			
Open Recent	>			
Sketchbook	>			
Examples	;	*		
Close	Ctrl+W	Firmata	>	
Save	Ctrl+S	GSM	>	
Save As	Ctrl+Shift+S	LiquidCrystal	>	
		PN532	>	
Page Setup	Ctrl+Shift+P	Radio	>	
Print	Ctrl+P	Robot Control	>	
Preferences	Ctrl+Comma	Robot Motor	>	
		SD	>	
Quit	Ctrl+Q	Servo	>	

Encoder	>	Basic
Grove - LED Matrix Driver(HT16K3	3 wit	NoInterrupts
Grove Multiple Switch library	>	SpeedTest
Grove Temper Humidity TH02	2	TwoKnobs

b. Open it in your computer by click the Basic.pde which you can find in the xxxx\Arduino\libraries\Encoder\examples\Basic, XXXX is the location you installed the Arduino IDE.

	~			
•	Name	Date modified	Туре	Size
	💿 Basic.pde		PDE File	1 KB

c. Or, you can just click the icon in upper right corner of the code block to copy the following code into a new sketch in the Arduino IDE.

<pre>1/* Encoder Library - Basic Example 2 * http://www.pjrc.com/teensy/td_libs_Encoder.html 3 * 4 * This example code is in the public domain. 5 */ 6 7#include <encoder.h> 8 9// Change these two numbers to the pins connected to your 10encoder. 11//</encoder.h></pre>	r
<ul> <li>8</li> <li>9// Change these two numbers to the pins connected to your</li> <li>10encoder.</li> </ul>	r
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9// Change these two numbers to the pins connected to your 10 encoder.	/
10encoder.	7
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	/
11// Best Performance: both pins have interrupt capability	/
12// Good Performance: only the first pin has interrupt capability	
13// Low Performance: neither pin has interrupt capability	
14Encoder myEnc(5, 6);	
15// avoid using pins with LEDs attached	
16	
17void setup() {	
18 Serial.begin(9600);	
19 Serial.println("Basic Encoder Test:");	
20}	
21	
22 long oldPosition = -999;	
23	
24void loop() {	
<pre>25 long newPosition = myEnc.read();</pre>	
26 if (newPosition != oldPosition) {	
27 oldPosition = newPosition;	
28 Serial.println(newPosition);	
29 }	
}	

# Тір

You can change two numbers to the pins connected to your encoder, for the Best Performance: both pins have interrupt capability, so you can change the code line 13 into Encoder myEnc(2, 3);, meanwhile, you should connect this sensor to the **D2** of the baseshield.

- **Step 4.** Upload the demo. If you do not know how to upload the code, please check How to upload code.
- Step 5. Open the Serial Monitor of Arduino IDE by click Tool-> Serial Monitor. Or tap the Ctrl + Shift + M key at the same time. Set the baud rate to 9600.

### Success

If every thing goes well, you will get the result. When you move the obstacle from left to right, the count value will increase by 1; when you move the obstacle from right to left, the count value will be decremented by 1.

1Basic Encoder Test	
20	
31	
42	
5 <mark>3</mark>	
64	
73	
82	
91	
100	
11-1	
12-2 13-3	
14-4	