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HC-SR04 User Guide

1. Ultrasonic Distance Measurement Principles

The transmitter emits a 8 bursts of an directional 40KHz ultrasonic wave when triggered and starts a timer. Ultrasonic pulses travel outward until they encounter an object, The object causes the the wave to be reflected back towards the unit. The ultrasonic receiver would detect the reflected wave and stop the stop timer. The velocity of the ultrasonic burst is 340m/sec. in air. Based on the number of counts by the timer, the distance can be calculated between the object and transmitter The TRD Measurement formula is expressed as: $D = C \times T$ which is know as the time/rate/distance measurement formula where D is the measured distance, and R is the propagation velocity (Rate) in air (speed of sound) and T represents time. In this application T is devided by 2 as T is double the time value from transmitter to object back to receiver.

2. Product Features

Features

- Stable performance (Xtal.)
- Accurate distance measurement
- High-density SMD Board
- Close Range (2cm)

Uses

- Robotics barrier
- Object distance measurement
- Level detection
- Security systems
- Vehicle detection/avoidance

3. Product Views



4. Module Pin Asignments

	Pin Symbol	Pin Function Description
1	VCC	5V power supply
2	Trig	Trigger Input pin
3	Echo	Receiver Output pin
4	GND	Power ground

5. Electrical Specifications

WARARNING

Do Not connect Module with Power Applied! Always apply power after connecting Connect "GND" Terminal first

Electrical Parameters	HC-SR04 Ultrasonic Module
Operating Voltage	5VDC
Operating Current	15mA
Operating Frequency	40KHz
Max. Range	4m
Nearest Range	2cm
Measuring Angle	15 Degrees
Input Trigger Signal	10us min. TTL pulse
Output Echo Signal	TTL level signal, proportional to
	distance
Board Dimensions	1-13/16" X 13/16" X 5/8"
Board Connections	4 X 0.1" Pitch Right Angle Header Pins

6. Module Operation

Set Trig and Echo Low to initalize module. Place a minimum 10us High level pulse to "Trigger" (module will automatically send eight 40KHz acoustic bursts). At the same time, Gate the microcontroller timer to start timing.

Wait to capture the rising edge output of ECHO port to stop the timer. Now read the time of the counter, which is the ultrasonic propagation time in the air. According to the formula: Distance = (ECHO high level time X ultrasonic velocity (Speed of Sound in air 340m/sec) / 2, you can calculate the distance to the obstacle.

For best results and maximum range, the Object should be larger than 0.5M² the nearer the target object, the smaller it may be



7. ModuleTiming



HC-SR04 ULTRASONIC MODULE

Trigger 10us min. start measurement from microcontroller. Max Rep. Rate: 50us
ECHO Output pulse to microcontroller, width is the time from last of 8 40KHz bursts to detected reflected signal (microcontroller Timer gate signal) Distance in cm = echo pulse width in uS/58 Distance in inch = echo pulse width in uS/148

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Wiring the E18-D80NK Infrared Distance Ranging Sensor

In this illustration we will going to wire the Infrared distance switch, a high-sensitive photo reflector to detect distance function, ranging from 3cm to 80cm. When the infrared emitted by the emitter it will get reflected on a surface blocked it then the phototransistor will pick up the signal for a distance calculation. This device has integrated with potentiometer to adjust the range for easy and clear to use. Best usage on this device is for robotics, interactive media, industrial and automotive, etc.





As you can see the diagram above the technology behind this effective distance sensor is the modulation from the infrared light, the receiver functionality is sense only if infrared light and only when it receives the correct signal. Therefore it is not very sensitive to ambient light compared to normal infrared detectors. Below are the wiring diagram for testing and how to use this device with Arduino MCU.

Device Characteristics

- Power Supply: 5VDC
- Supply current DC <25mA
- Maximum load current 100mA (Open-collector NPN pulldown output)
- Response time <2ms
- Diameter: 17MM
- Pointing angle: ≤ 15 °, effective from 3-80CM Adjustable
- Detection of objects: transparent or opaque
- Working environment temperature: -25°C+55°C
- Case Material: Plastic
- Lead Length: 45CM

Wiring Diagram Schematics Emitter-Receiver Sensitivity Adjustment E18 D80NK) SIDE FRONT **10K Pullup Resistor** -GND D12 D11 D10 D7 D6 D4 D2 RXO 60 80 03 RST TX1 0 0 0 0 0 0 0 0 00 0 5 ICSP TX m RX Micro Power USB RST L 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 • O GND D13 3V3 **SIN** REF RST A4 AJ AO A A3 A5 A6 A2 Two types of wires color coding used on this device TYPE - 1 TYPE - 2 Gnd +5 Vcc Vcc Gnd Signal Signal Placing a 4.7k to 10k Pullup Resistor to +5v /* E18-D80NK Infrared Distance Ranging Sensor */ void setup() { Serial.begin(9600); //Start serial communication boud rate at 9600 pinMode(5,INPUT); //Pin 5 as signal input } void loop() { while(1) { delay(500); if(digitalRead(5)==LOW) { // If no signal print collision detected Serial.println("Collision Detected."); } else { // If signal detected print collision detected Serial.println("No Collision Detected."); } } }