QUICK REFERENCE · TK50

Ultrasonic Distance Sensor

An RCWL-9616 and two 40 kHz transducers: distance by echo, four ways.

VCC sets the signal level

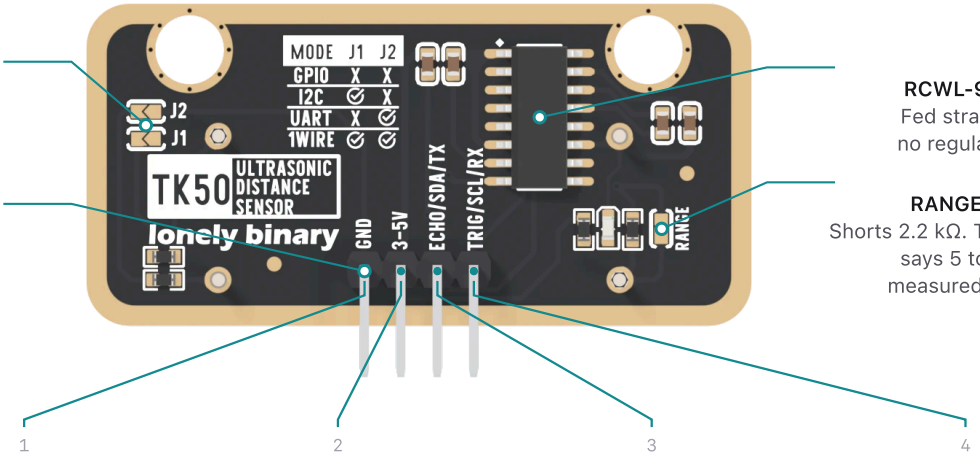
There is no regulator and no level shifter: ECHO and TRIG work at whatever feeds the hole printed **3-5V**. Beside a 3.3 V board use **3V3**, never 5V, and no divider is needed. On an Uno, 5V.

Pins, and which to wire

The chip side, header at the bottom. The names are printed on this side only; with the cans facing you the four pads read the other way round. **GND is the square pad.** The mode rows show what each pin does once J1 and J2 are set.

J2 above J1: the mode
Both open, as shipped, is GPIO; the table beside them gives the rest.

GND, the square pad
Count from it: GND, VCC, ECHO, TRIG.



RCWL-9616, one chip
Fed straight from VCC: no regulator, no shifter.

RANGE: leave it open
Shorts 2.2 kΩ. The chip maker says 5 to 6 m then; not measured on this board.

Front	GND	3–5V	ECHO/SDA/TX	TRIG/SCL/RX
GPIO	GND	3-5V	ECHO	TRIG
I²C, J1	GND	3-5V	SDA	SCL
UART, J2	GND	3-5V	TX	RX
1-Wire, both	GND	3-5V	•	I/O

In 1-Wire the wire is TRIG

Bridge both jumpers and the whole conversation moves to the pin printed TRIG/SCL/RX: the trigger goes out on it and the timed pulse comes back on it. ECHO is not used. Wired by its name, a working sensor says nothing.

What it can honestly see

Blind zone

2 cm and closer

The echo is back before the burst has finished. No reading, not a small one.

Accurate

±1 cm, 2 to 100 cm

Resolving about 0.3 cm. Where most projects live.

Usable

3 m, errors growing

4 m only off a large flat wall, square on, in still air.

Soft, angled, too far and nothing there all look the same: **no echo**. A sketch that turns that into 0 cm reports something touching the sensor. Treat a timeout as unknown, and take the median of three readings.

Range figures are Lonely Binary's for the earlier TK50 board, with RANGE open; beam 70 ± 5 degrees at −6 dB and -25 to 60 °C from Huayu's transducer datasheets. Bus numbers are the supported library's. Not re-measured on this board.

The first reading, GPIO mode

Arduino IDE · no library · any board · ESP32-S3: USB CDC On Boot: Enabled · Serial Monitor 115200

```
// Both jumpers open (as shipped): GPIO mode.
const int TRIG_PIN = 4, ECHO_PIN = 5;  // Uno: 9, 10
const unsigned long TIMEOUT_US = 25000UL;  // ~4 m
const float CM_PER_US = 0.0343;        // at 20 C

void setup() {
  Serial.begin(115200);
  pinMode(TRIG_PIN, OUTPUT);
  pinMode(ECHO_PIN, INPUT);
  digitalWrite(TRIG_PIN, LOW);
}

void loop() {
  digitalWrite(TRIG_PIN, HIGH);        // as the library:
  delayMicroseconds(500);              // 500 us high
  digitalWrite(TRIG_PIN, LOW);

  unsigned long us =
      pulseIn(ECHO_PIN, HIGH, TIMEOUT_US);
  if (us == 0) {
    Serial.println("no echo");         // not 0 cm
  } else {
    float cm = (us / 2.0) * CM_PER_US; // out and back
    Serial.print(cm, 1);
    Serial.println(" cm");
  }
  delay(100);                          // 50 ms a reading
}
```

```
52.3 cm
```

Ten lines a second. Pointed at a wall a metre off it reads about 100; at nothing, or at a curtain, it prints no echo.

Wiring

	FRONT	ESP32-S3	ARDUINO UNO
1	**GND**	GND	GND
2	**3–5V**	3V3	5V
3	**ECHO/SDA/TX**	GPIO 5	D10
4	**TRIG/SCL/RX**	GPIO 4	D9

GPIO mode, as shipped. In I²C mode ECHO goes to SDA and TRIG to SCL; in UART mode they cross, ECHO (the sensor's TX) to your RX. In 1-Wire mode only TRIG is wired.

Two jumpers set the mode

Solder with the power off; the chip reads J1 and J2 as it starts. **Both open**: GPIO, trigger and echo, 50 ms a reading. **J1**: I²C at 0x57. Write 0x01, wait 150 ms, read three bytes, most significant first: the distance in micrometres, so divide by 10 000 for cm. The address is fixed: one sensor per bus. **J2**: UART at 9600 baud; send 0xA0, wait, read the same three bytes. **Both**: 1-Wire, on TRIG alone. J2 is the upper pad.

When it does not work

No echo, every time

Point it at a flat wall a metre away first. Curtains, carpet and open air return nothing.

Readings ten times too big

The bus bytes are micrometres. Divide by 10 000 for cm, not by 1000.

1-Wire says nothing

The wire is TRIG, not ECHO. Both jumpers bridged, and ECHO left empty.

Distances are double

The divide-by-two is missing: the sound crosses the gap twice. Halve the microseconds.

A jumper changed nothing

Power off and on again, then check the joint spans the gap. J2 is the upper pad.

The sketch stalls a second

pulseIn has no timeout. Pass 25000 as its third argument.

Specifications

Chip	RCWL-9616, four modes	**Transducers**	16 mm, 40 kHz, send and receive
Supply	3 to 5 V, printed 3-5V	**Range**	2 cm to about 3 m
Accuracy	About ±1 cm under a metre	**I²C / UART**	0x57 fixed / 9600 baud
Temperature	-25 to 60 °C (transducers)	**Board**	46.4 × 22.4 mm, header fitted