

## Instructions to make an OnTrack Dyno Speed Sensor

The OnTrack Digital dyno software uses the soundcard in a PC or laptop to capture data signals from an inertia dyno speed sensor and convert the signals from analogue to digital data.

A soundcard can capture up to 48,000 data samples per second, so it can accurately capture and process the signals from an inertia dyno speed sensor.

### Data Input Ports on PCs and Laptops

OnTrack can use either a Line-In or Microphone (MIC) port on a soundcard for data input. The maximum voltage that these ports will accept is 5V for the Line-In and 0.5V for the Microphone port.

### These Build Instructions are for a Dyno Speed Sensor that uses the PC Microphone port

Some PCs and laptops only have one sound input port, usually marked as Microphone. The single port in these PCs can be set in the Windows Sound Settings as either a Microphone or Line-In port. We use the Microphone setting.

The advantage of using the Microphone port for input is that one of the lines in the Microphone port has a voltage, in the range of 3 to 5 volts, that can be used to generate a data signal for the Speed Sensor.

Some laptops do not have a Microphone port in which case you can use a Sound Port adapter that includes a Microphone input and plugs into a USB-B or USB-C port on the laptop. These adapters are small and inexpensive.

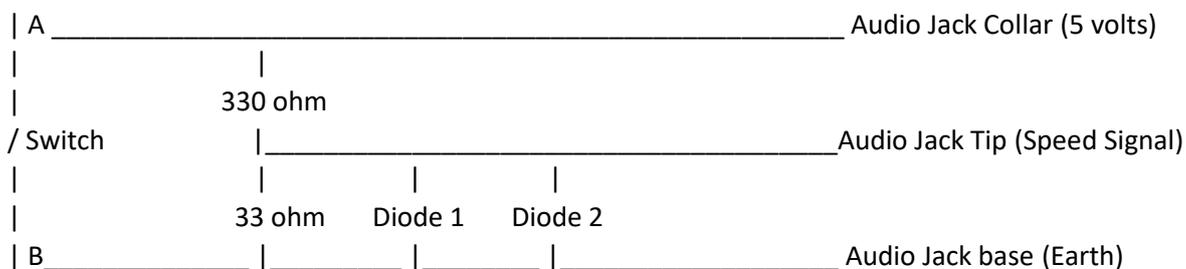
The following are examples of USB-B audio adapters for PCs and laptops without a Microphone port.



## Speed Sensor Circuit Diagram

Proximity Reed Switch

Stereo Audio Jack



The Speed Sensor uses a Proximity Reed Switch that is triggered by a passing magnet which turns the switch off and on and generates the speed signal pulses that are captured at the Microphone port of the PC.

The signal is filtered by the resistors (33 Ohm and 330 Ohm) that act as a voltage divider to reduce the 3-5 volts from the Audio Jack Collar down to 0.3-0.5 volts for the Speed Signal line.

Diodes 1 and 2 are connected in opposite directions with the negative side of Diode 1 connected to the Earth line and the negative side of Diode 2 connected to the Signal line. The diodes are used to limit the maximum voltage across the Signal and Earth lines and filter out any stray voltage peaks. PC Microphone ports include their own voltage limiting protective circuits, but we have included these diodes just to be safe. The maximum voltage allowed by the diodes across the Signal and Earth lines is 0.7 volts, with any higher voltages filtered out.

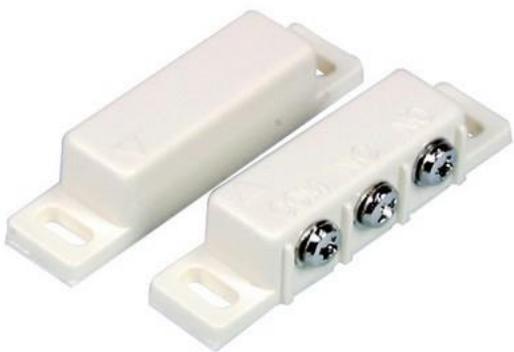
## Parts required for the Speed Sensor

**1 Magnet triggered Proximity Reed Switch;** Normally Closed (NC) type. (Tip: Purchase 2 so you have one as a spare).

With the Normally Closed type, the switch within the Proximity Sensor is closed when there is no magnet close to it, and the switch is open when a magnet is close (0-5mm) to the switch. Examples of magnet triggered proximity switches are door security reed switches which can be purchased from most electrical stores.

**Note: It is VERY important that the switch be a Normally Closed (NC) type.** There can be some confusion about whether a switched is normally Open or Closed and some switches are labelled the opposite way. You can easily test this with a multi-meter. The switch should be **closed (on)** when there is no magnetic close to it and **Open (off)** when a magnet is close to the switch. Some reed switches have both Normally Closed and Normally Open connections, like the switch in the photo below.

Proximity Reed Switches often come with a magnet which you can use, but you can also use a rare earth magnet which is stronger and can trigger a reed switch from a greater distance, 5 -10mm. This can make it easier to mount the Proximity Switch and triggering magnet on a dyno.



This type of Proximity Reed Switch, and magnet, has both Normally Open (NO) and Normally Closed (NC) circuits. They include a mounting flange and can be purchased from electronic stores and many hardware stores. These switches are inexpensive and work well as a dyno speed sensor.



Proximity Reed Switches are available in many forms, such as this type with the threaded body. It is **VERY** important that the switch is normally closed when a magnet is not near the switch.

You should test that the switch is the correct type before installing it.

**1 Rare earth magnet:** This is optional if the Proximity Reed Switch comes with a trigger magnet. Rare earth magnets are strong magnets, so they have a strong triggering magnet field, and you can mount them further from the Proximity switch (5-15mm) if required. A small button magnet that can be glued to the dyno shaft works well.

**1 Stereo 3.5mm Audio Cable:** A good quality, shielded cable that is long enough to run from the PC microphone port to the speed sensor on the dyno. It is important that it be shielded to prevent interference. If needed, you can use audio extension cables to get the length required.

**Resistors:** 1 x 33 Ohm, 1 x 330 Ohm. Note: The exact value of the resistors is not important, just that the ratio between the two resistor values is 1 to 10. For example: 1 x 100 Ohm and 1 x 1000 Ohm (1k Ohm).

**Diodes:** 2 Silicon Diodes. The exact diodes is not so important, just that they are Silicon Diodes, for example: type 1N4001, 1N4004, and 1N4007, and that they have a maximum voltage of 12V or greater.

**Circuit Enclosure Box:** This is optional. The resistors and diodes can be located at the Proximity Switch or at any point along the audio cable. To locate them along the audio cable you can cut the cable, feed the cable through a hole drilled in each end of the Circuit Enclosure Box and solder the resistors and diodes across the cable wires inside the box. Fasten or glue the cables so that they cannot be pulled out of the box.



Circuit Enclosure Boxes are available in a variety of sizes, plastic or metal, and some include mounting flanges. The box can be any size and as small as 50mm x 75mm (2in x 3in) which is large enough for the few components required.

**1 Small Circuit Board.** This is optional. For a neat job you can mount the resistors, diodes and cable ends on a small circuit board which fits inside a Circuit Enclosure Box.

### **Wiring up the Proximity Switch (Sensor)**

Referring to the Speed Sensor Circuit Diagram above, the audio cable wires from the audio jack collar and the audio jack tip are both connected to one end the Proximity Switch A and the wire from the audio jack base (earth) is connected to the other end of the switch B. The diodes and resistors can be placed at the Proximity Switch or anywhere along the cable. See the Circuit Enclosure Box above.

### **How it works**

When the magnet is NOT near to the Proximity Switch the Switch circuit is CLOSED and the voltage at A is connected to the base (earth) at B and there is no signal voltage at the Audio Jack Tip.

When a magnet IS near to the Proximity Switch the switch is OPEN, the voltage on A is not connected to the base at B and there is a signal voltage at the Audio Jack Tip.

Each time the magnet passes near the Proximity Switch there is a voltage pulse at the Audio Jack Tip which is processed by the PC Sound Card and the OnTrack Dyno software.

### **Mounting the Speed Sensor on the dyno**

The trigger magnet can be mounted on any moving part that is rotating at the same speed as the dyno flywheel or rollers. A good place is on the dyno flywheel or roller shaft. You can glue the magnet to the shaft with epoxy or similar glue. It does not affect the signal if you cover the magnet with glue. The Proximity Switch needs to be mounted so that the magnet passes the switch with a 2-5mm gap. With a strong magnet the gap can be up to 10mm.

When routing the audio cable keep it away from engines, electric motors and equipment that may cause interference.

## Testing the Speed Sensor

When testing the Speed Sensor, it helps to think of it as an external microphone on the PC or laptop.

PCs and laptops may also have an internal microphone or other external microphone, for example on a webcam.

It is important to set the Speed Sensor as the active Input Device / Microphone in the **Windows Sound Settings**.

In Windows 10, this can be found at **Settings – System – Sound – Input, Chose Your Input Device** (drop down list). After you chose the Input Device there is an Option to **Test Your Microphone**.

After setting up the Speed Sensor as an external microphone in Windows you can test it in either the Windows Sound Settings, using the **Test Your Microphone** feature above, or using the standard **Voice Recorder** application in Windows.

To test using the Voice Recorder:

- Open the Voice Recorder app from the Windows Start menu, or search for it in Windows Taskbar Search.
- Click on record and wave a magnet close to the Proximity Switch.
- Stop recording and play the recorded sound. You should hear a clear click – click – click sound from the magnet passing the Proximity Switch.

You can also do a test playback of the recorded data within the OnTrack Dyno software as follows:

- Start the OnTrack software and go to the Dyno Run screen
- Start a Sensor Data Input dyno run as normal, which processes and records data from the Proximity Switch.
- While the dyno run is inputting data, wave a magnet close to the Proximity Switch.
- Stop the dyno run and click on Playback data. You should hear a clear click – click – click sound through your PC speakers.

## Any Questions?

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