Mechanical Endstop

From RepRapWiki

A **mechanical endstop** is the simplest type of endstop: a simple mechanical switch positioned to trigger when a RepRap's axis reaches the end of its motion.

Mechanical Endstop

Vitamin

no image available

Wikipedia	none

Contents

Overview

Mechanical switches are less complicated to implement and cheaper than optical endstops because they do not require a circuit board and only use 2 wires for connecting the switch. Pull up and down resistors can be put close to the main board. You can use contact switches and contact-less (usually magnetically actuated) mechanical switches. Contact-less magnetic switches are called reed switches. They are proximity switches that close (or switch over) if a magnet comes close enough (usually 1mm or less) and open if the magnet moves away. Reed switches are used as sensors in home alarm systems to detect open windows and doors.

How to wire a mechanical switch to replace an optical endstop.

Reasons to use a mechanical switch

- Switches are the cheapest endstops in most cases.
- No need for opto pcb.
- Simple switches can be used on x and y axis.
- You could even make your own contact switch from a few pieces of metal.
- You get to solder stuff.

Limitations of mechanical switches

- Switches have a limited number of on/off cycles. However, most purpose built micro-switches are rated for well over 1,000,000 cycles and will last years.
- Needs new way to mount switch, which will depend on the switch type.
- The repeatability of the switch is very important for the z axis, and not all switches will work.

Opto Endstop v1.0, v2.1 and Tech Zone Remix

How to replace Opto Endstop v1.0, Opto Endstop v2.1 and Tech Zone Remix Endstop which share the same basic design.

Note the Tech Zone Remix Endstops are working the opposite way (normally closed) as the insctructions below, so you need to change either your firmware or the wiring of the switch to compensate.

Interface

Copied from Opto Endstop v1.0#Interface

| Pin	Function
+5	This is the pin to supply +5 volts on.
S	This is the signal pin. It will output high (+5) if it is triggered, or low (0v) if it is clear
G	This is the ground pin.

Switch requirements

You want a normally closed (NC) switch. Meaning you need a switch which connects two poles when *not* triggered. (A single pole double throw (SPDT) switch will work, if you wire up to the NC side of the switch -- ignore the NO pin). Read more at wikipedia. (http://en.wikipedia.org/wiki/Switch#Contact_terminology)

"what happens if it's unplugged or my pet rabbit chews through the cable?" Design it such that when it's unplugged, it registers as "at the end" rather than "keep going". [1] (http://forums.reprap.org/read.php? 13,64189,64297#msg-64297)

For the z axis, high resolution (aka short trigger distance) and high repeatability is needed.

The x and y axis resolution is not that important, unless you home the machine during a print. But you are of course encouraged to use a high quality switch if you can, as it certainly won't hurt.

Switch wiring
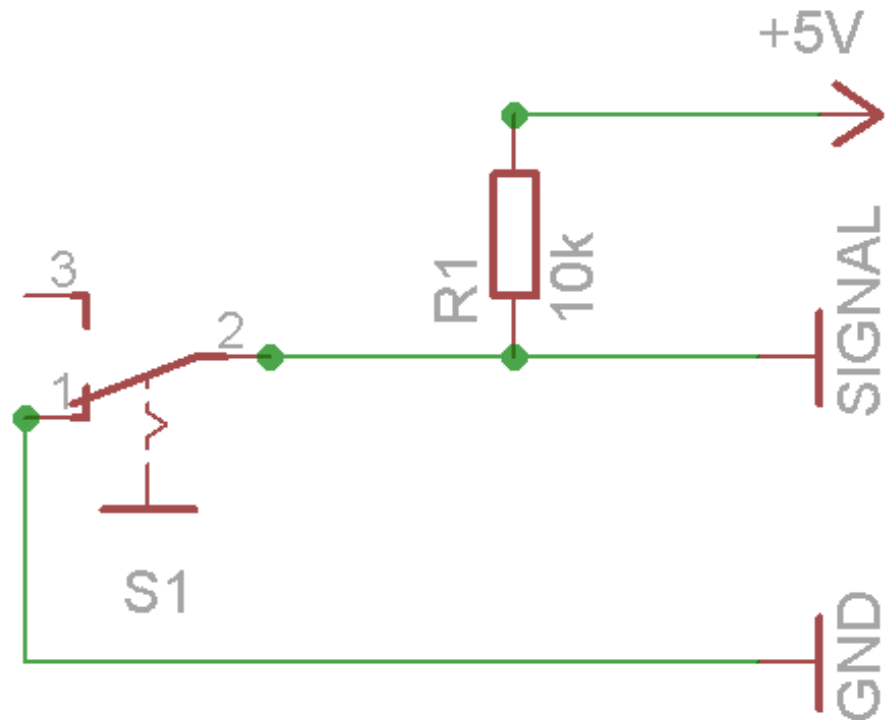
Eagle 5.10.0 light schematic: File:Mechanical endstop wiring schematic.sch

When the switch is off (like in the schematic above), it connects signal to ground. When the switch is triggered, the ground connection is cut and the signal is connected to 5v through the pull up resistor (http://en.wikipedia.org/wiki/Pull-up_resistor) .

Make sure you keep the wires away from the motor leads and / or used screened cable as it is easy to pick up enough noise to get false triggering. [2] (http://forums.reprap.org/read.php?13,64189,64731#msg-64731)

Note: if you use Teacup or Sprinter firmware, then resistor R1 and the connection to 5V are obsolete. The Arduino ATmega has internal pullup resistors which can be turned on in the firmware using the USE_INTERNAL_PULLUPS flag in config.h for Teacup firmware or ENDSTOPPULLUPS in configuration.h for Sprinter and Marlin firmware. Using the internal pullup resistors eliminates the need for external resistors, which simplifies the wiring. If internal pullup resistors are used the switch can simply be connected to the signal and ground pins. Reportedly sometimes the internal pullup resistors have a large tolerance which can in rare cases cause issues. If you are having problems first double check that your wiring is correct and confirm that your firmware is configured correctly before deciding you may have bad internal pullup resistors.

Optional LED

If you want an indicator, you can hook up a LED (and a matching resistor).

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Generation 6 endstops

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Switch mounting

You need a way to mount the switch on the printer. Feel free to share your solutions and designs here. Modular design encouraged to fit different switches.

Mendel

X axis

The endstop holder from Prusa Mendel works fine. Take care to solder the wires pointing up, to place the holder as far out as possible, and this maximize the build space.
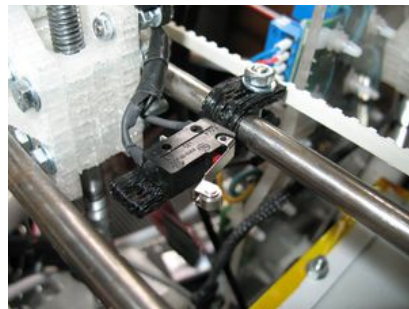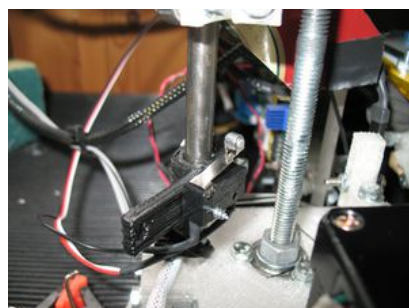

Y axis

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Z axis

Needs to sit very securely, but still be easy adjustable in small increments. The endstop holder from Prusa Mendel works fine. To simplify design, I suggest a very solid mount even if it is very hard to adjust. It is often easier to set the location of the endstop in firmware than it is to try and move the actual switch around .01 mm at a time!

External links

- Forum discussion (http://forums.reprap.org/read.php?13,64189)
- Mechanical Endstop v1.0 (http://www.thingiverse.com/thing:762)
- Reed-Sensors (http://www.meder.com/sensor-for-screw-mounting5.html)
- Think3dPrint3d's microswitches - ships worldwide (http://www.think3dprint3d.com/endstop-microswitches)
- General FAQ#wires and connectors

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