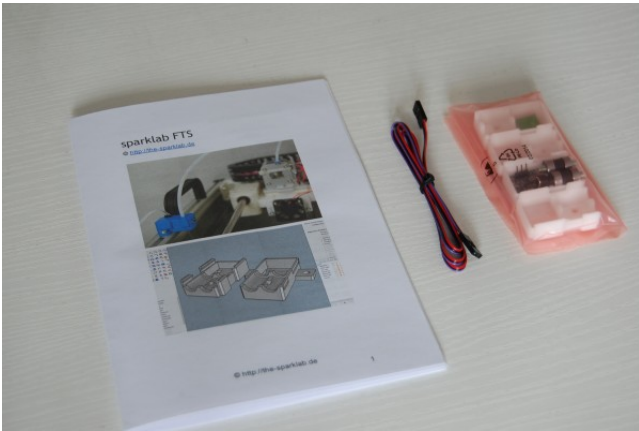# RADDS Electronics for 3D Printer

for a better printresult

FTS – Filament Tracking System

How to install and configure the sparklab **FTS** (**F**ilament **T**racking **S**ystem)

When using FTS the printer can be paused if you run out of filament, or reduce speed if a slip is detected to prevent a filament jam.

Included in the set:

- FTS housing for 1,75mm filament
- FTS housing for 3mm filament
- 4 Ball bearings
- 2 rubber wheels
- Magnet fixing
- Neodymium magnet
- electronics (Hal-E Endstop)
- 70cm connection cable
- Detailed instruction manual

The two ball bearing rubber wheels run smoothly and with enough grip on the filament to send the firmware reliable values about the filament feed.

The sensor electronics can be connected directly to a free end-stop port. It is compatible with all major electronics (3.3V and 5V compatible)
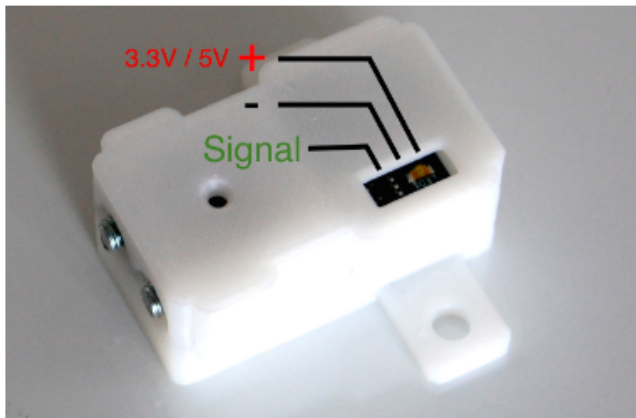
Repetier firmware from 0.92.3 supports "jam" and "out of filament" sensors.

http://sparklab-shop.de/parts/spareparts/28/fts-filament-tracking-system
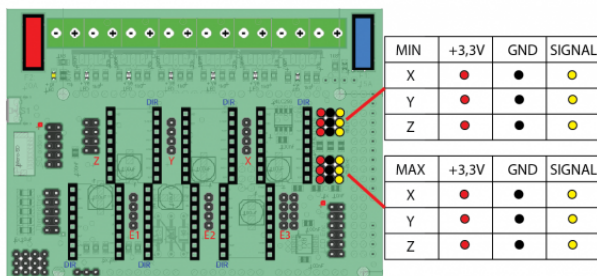
User guide (German):
https://www.dropbox.com/s/a81yqr75ei56xxe/sparklab%20FTS%20Bedienungsanleitung.pdf?dl=0

Connect the FTS to RADDS

Connect the FTS to the +, GND and Signal pins for a free end stop on the RADDS

IMPORTANT: Make sure that you connect to the correct pins.

MIN	+3,3V	GND	SIGNAL
X	●	●	○
Y	●	●	○
Z	●	●	○

MAX	+3,3V	GND	SIGNAL
X	●	●	○
Y	●	●	○
Z	●	●	○

sparklab FTS [#1] - Aufbau des Filament Tracking Systems

sparklab FTS [#3] - Konfiguration des Filament Tracking Systems

Configure Repetier firmware
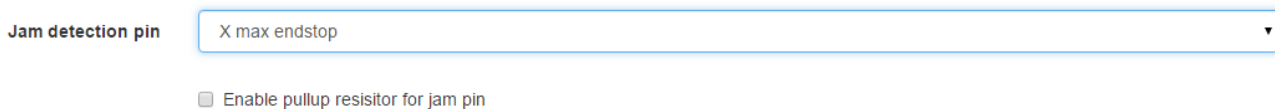
Using the Repetier Online Configuration tool

http://www.repetier.com/firmware/v092/

v 0.92.8 Screen captures used in this guide

Step 1

Select the endstop where you connected the fts (x max endstop used in this sample)

Tools -> Extruder -> Jam detection pin

Jam detection pin	X max endstop ▾
	☐ Enable pullup resisitor for jam pin

Let "Enable pull-up resistor for jam pin" remain deactivated.

The rest of the firmware settings must be set for your printer configuration. Download and install the firmware.

Step 2

Analyze the sensor values and find the correct settings

You have to do this step to get correct calibrations, there is too many factors, so "Plug ´n Play" is not possible.

However, doing the analyze is not difficult, and help you understand the system.

1. User "Repetier Server", "Repetier Host" or an other host application. Start the program and connect to the printer
2. Heat the nozzle
3. Insert filament by the fts into the extruder
4. Send the following command (manually): **M602 S1 P0**
5. Start a small print job. The M602 S1 P0 command activated debugging of the fts, and sends the readings

from the fts to the console.

The fts function is disabled while the debugging is enabled. After a short time of printing you should get values like this in the console:

```
14:17:26: Jam signal steps:5450 / 103% on 0
14:17:35: Jam signal steps:5687 / 107% on 0
14:17:43: Jam signal steps:5569 / 105% on 0
14:17:51: Jam signal steps:5589 / 106% on 0
14:17:58: Jam signal steps:5419 / 102% on 0
14:18:06: Jam signal steps:5332 / 101% on 0
14:18:14: Jam signal steps:5479 / 103% on 0
14:18:22: Jam signal steps:5543 / 105% on 0
14:18:30: Jam signal steps:5851 / 111% on 0
14:18:38: Jam signal steps:5603 / 106% on 0
14:18:46: Jam signal steps:5332 / 101% on 0
14:18:54: Jam signal steps:5468 / 103% on 0
14:19:02: Jam signal steps:5464 / 103% on 0
14:19:10: Jam signal steps:5329 / 101% on 0
14:19:17: Jam signal steps:5442 / 103% on 0
14:19:26: Jam signal steps:5691 / 107% on 0
14:19:33: Jam signal steps:5455 / 103% on 0
14:19:41: Jam signal steps:5530 / 104% on 0
14:19:49: Jam signal steps:5284 / 100% on 0
```

We are interested in the first value of the input, which in this sample fluctuates between **5284-5851**. We notate the average value as "**Regular steps for a cycle**"The value is a direct indicator of the extruder load. If you lower the nozzle temperature the value will increase because the extruder load rises.

Lower the temperature until the extuder starts to fail. You now find a higher value in the console. We notate the value as "**Slowdown Steps**"

There are several actions in the firmware which could reset this counter in some circumstances. So don't be afraid if there are some values in between which are way too small.

Later we use this value to reduce the printer speed when this value is detected

Step 3

Specifying the limit in the firmware

Mechanics -> Jam detection and out of filament detection

Jam detection and out of filament detection

You can compare filament moves with extruder moves to detect if the extruder is jamming, the spool is knotted or if you are running out of filament. You need a movement tracker, that changes a digital signal every x extrusion steps. There are three steps defined for signaling. Regular steps is what number of steps a complete on/off cycle of the signal should take. While debugging this is the reference for the percent output. Next stage is slowdown steps. When we measure this step amount, we will reduce speed multiplier to a lower factor. Then, when we exceed the steps for jam detection we take a defined action - preferrably a pause giving the user a chance to fix the jam and continue printing. See documentation for more informations.

Regular steps for a cycle JAM_STEPS	220	[steps]
Slowdown steps JAM_SLOWDOWN_STEPS	320	[steps]
Slowdown to JAM_SLOWDOWN_TO	70	[%]
Steps for jam detection JAM_ERROR_STEPS	500	[steps]
Min. steps for signal change JAM_MIN_STEPS	10	[steps]
Jam action JAM_ACTION	Show jam/out of filament dialog and block communication (requires LCD)	▼

Regular steps for a cycle – see step 2 This is the value at normal operation

Slowdown steps – see step 2, if his value is reached the print speed is reduced

Slowdown to – % of normal speed when slowdown steps is detected

Steps for jam detection – This value is above the slowdown steps value. If this value is reached it tells that you have a full blockage or you are out of filament. A good starting point = 1.5 x "Slowdown steps value"

If the value is to small you probably get false jam detect, if the value is to high it will take a bit longer to recognize the jam.

If jam detection is detected the print head is moved to the standby position and the nozzle turned off. Now you can insert new filament and continue the print job.

Save, and upload the firmware to the printer.

When the fts settings are tuned and active, you have a system that helps you prevent failed prints.