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# **BIGTREETECH**

## **Smart Filament Sensor Module**

### **Operating instruction**

## **I . Product introduction**

Smart Filament Detection Module is a filament detection module aiming at the defects of the broken materials detection module in the market. It was launched by the 3D printing team of ShenZhen BigTree Technology CO.,LTD .

## **II .Module Features**

- 1) It can detect abnormal extrusion of filament caused by nozzle plugging, filament wrapping and extruder failure.
- 2) It works with open source firmware marlin 2.0.x. Marlin2.0 uses powerful development tools, Visual Studio Code integrated development environment: supports online debugging, which is more helpful for product development and performance optimization. Adopts C language development, so it has low development threshold.
- 3) Support motherboard with broken filament detection interface.
- 4) Support screen 2004,12864, TFT24 (12864 mode), tft35\_v3.0 (12864 mode).
- 5) The module is being optimized and will be compatible with touch screen in the future.
- 6) Compatible touch screen TFT24, TFT35-V3.0.
- 7) Support for input power 3.3v-5v.

- 8) Support long - range and short - range extrusion.
- 9) Support 1.75mm diameter filament (please install the flexible filament before installing the extruder).
- 10) Installation is optional.

### III. Item listing

#### 1) Smart Filament Sensor:



#### 2) Smart Filament Detection Module Cable:



#### 3) Smart Filament Detection Connector



#### 4) Spare set screws:



#### IV.Module parameters

Module size:75mmX30mmX29.55mm

Fixed hole spacing: 20.35mm

Filament detection diameter: 1.75mm

Detection length: 7mm

Voltage: 3.3V~5V

Adapter firmware: marlin 2.0.X

Support extrusion: long - range extrusion, short - range extrusion

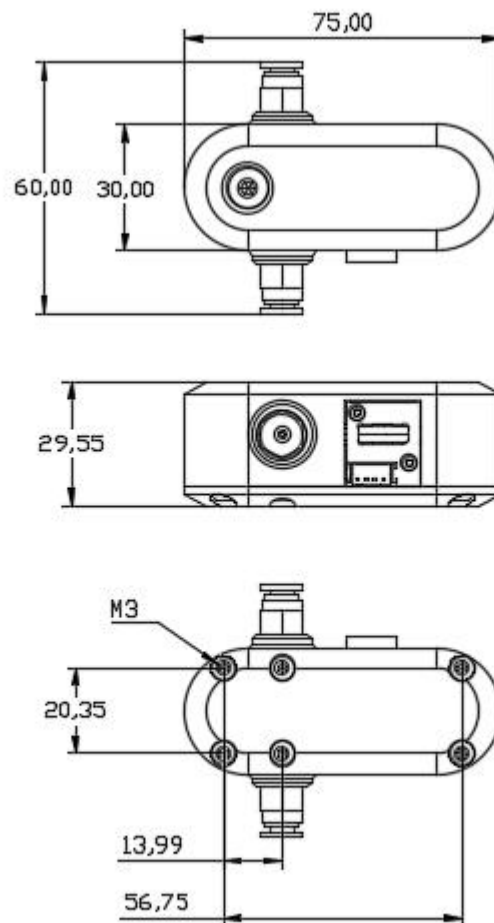


figure 1

## V . Firmware modification

1) The firmware of this product is marlin2.0.x. Screen 2004,12864, TFT24 (12864 mode), tft35\_v3.0 (12864 mode) can be used directly. The motherboard that can be used :SKR V1.3; SKR mini E3. SKR E3 DIP; MKS CEN L; MKS GEN V1.4. The modification method is shown in figure 2.

```

1084
1085 /**
1086  * Filament Runout Sensors
1087  * Mechanical or opto endstops are used to check for the presence of filament.
1088  *
1089  * RAMPS-based boards use SERVO3_PIN for the first runout sensor.
1090  * For other boards you may need to define FIL_RUNOUT_PIN, FIL_RUNOUT2_PIN, etc.
1091  * By default the firmware assumes HIGH=FILAMENT PRESENT.
1092  */
1093 #define FILAMENT_RUNOUT_SENSOR
1094 #if ENABLED(FILAMENT_RUNOUT_SENSOR)
1095   #define NUM_RUNOUT_SENSORS 1 // Number of sensors, up to one per extruder. Define a FIL_RUNOUT#_PIN for each.
1096   #define FIL_RUNOUT_INVERTING false // Set to true to invert the logic of the sensor.
1097   #define FIL_RUNOUT_PULLUP // Use internal pullup for filament runout pins.
1098   //#define FIL_RUNOUT_PULLDOWN // Use internal pulldown for filament runout pins.
1099
1100   // Set one or more commands to execute on filament runout.
1101   // (After 'M412 H' Marlin will ask the host to handle the process.)
1102   #define FILAMENT_RUNOUT_SCRIPT "M600"
1103
1104   // After a runout is detected, continue printing this length of filament
1105   // before executing the runout script. Useful for a sensor at the end of
1106   // a feed tube. Requires 4 bytes SRAM per sensor, plus 4 bytes overhead.
1107   #define FILAMENT_RUNOUT_DISTANCE_MM 7
1108
1109   #ifndef FILAMENT_RUNOUT_DISTANCE_MM
1110     // Enable this option to use an encoder disc that toggles the runout pin
1111     // as the filament moves. (Be sure to set FILAMENT_RUNOUT_DISTANCE_MM
1112     // large enough to avoid false positives.)
1113     #define FILAMENT_MOTION_SENSOR
1114   #endif
1115 #endif
1116
  
```

figure 2

The configuration to be modified is:

Uncomment `#define FILAMENT_RUNOUT_SENSOR` Turn on the consumables detection sensor

Uncomment `#define FILAMENT_RUNOUT_DISTANCE_MM 7` Sets the accuracy of the sensor to 7mm

Uncomment `#define FILAMENT_MOTION_SENSOR` Sets the sensor to the encoder type

2) When using the serial touch screen mode, you also need to enable "M114\_DETAIL" in marlin ,as shown in Figure 3

```

262 #define AUTOTEMP
263 #if ENABLED(AUTOTEMP)
264   #define AUTOTEMP_OLDWEIGHT 0.98
265 #endif
266
267 // Show extra position information with 'M114 D'
268 #define M114_DETAIL
269
270 // Show Temperature ADC value
271 // Enable for M105 to include ADC values read from temperature sensors.
272 //#define SHOW_TEMP_ADC_VALUES
  
```

Figure 3

3) Interface to modification

Modify the interface location as shown in figure 4. Change the interface to any extended interface.

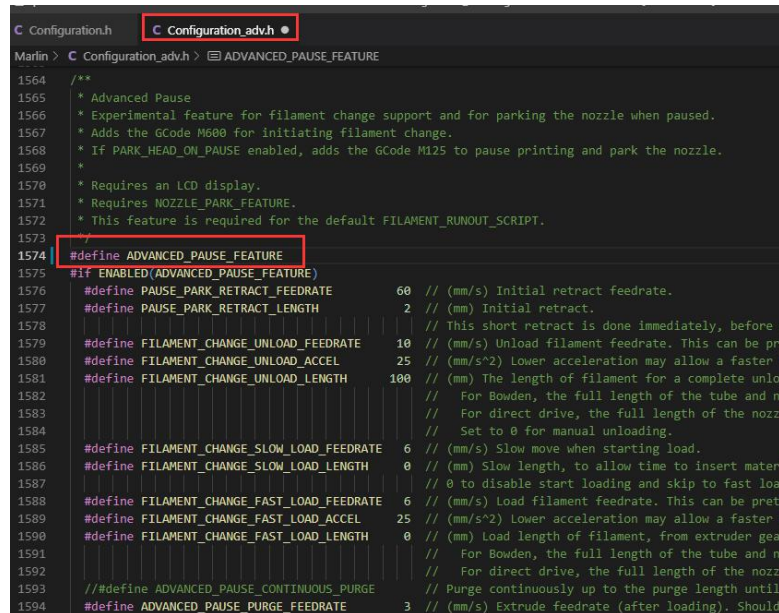
```

54 #define Z_MIN_PROBE_PIN P1_24
55 #endif
56
57 //
58 // Filament Runout Sensor
59 //
60 #ifndef FIL_RUNOUT_PIN
61   #define FIL_RUNOUT_PIN P1_28
62 #endif
63
64 //
65 // Steppers
66 //
67 #define X_STEP_PIN P2_02
68 #define X_DIR_PIN P2_06
69 #define X_ENABLE_PIN P2_01
70 #ifndef X_CS_PIN
71   #define X_CS_PIN P1_17
72 #endif
73
74 #define Y_STEP_PIN P0_19
75 #define Y_DIR_PIN P0_20
76 #define Y_ENABLE_PIN P2_08
77 #ifndef Y_CS_PIN
78   #define Y_CS_PIN P1_15
79 #endif
80
81 #define Z_STEP_PIN P0_22
82 #define Z_DIR_PIN P2_11
  
```

figure 4

#### 4) Relevant parameters after modification

The modified position is shown in figure 5, and parameters such as the backpull speed and backpull distance after suspension can be controlled.



```

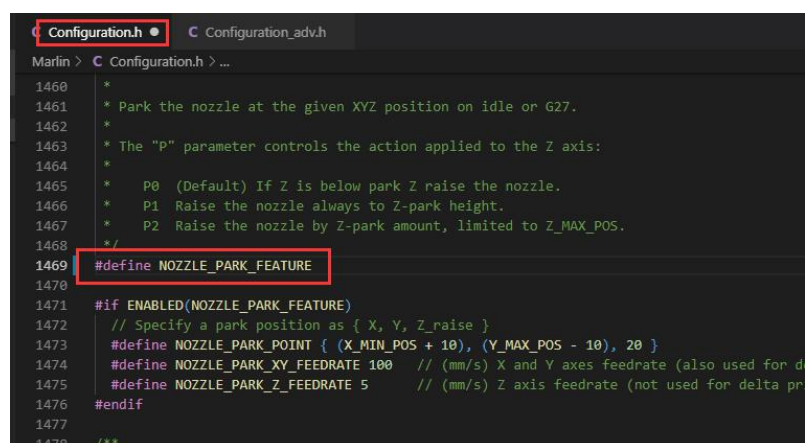
1564 /**
1565  * Advanced Pause
1566  * Experimental feature for filament change support and for parking the nozzle when paused.
1567  * Adds the GCode M600 for initiating filament change.
1568  * If PARK_HEAD_ON_PAUSE enabled, adds the GCode M125 to pause printing and park the nozzle.
1569  *
1570  * Requires an LCD display.
1571  * Requires NOZZLE_PARK_FEATURE.
1572  * This feature is required for the default FILAMENT_RUNOUT_SCRIPT.
1573  */
1574 #define ADVANCED_PAUSE_FEATURE
1575 #if ENABLED(ADVANCED_PAUSE_FEATURE)
1576   #define PAUSE_PARK_RETRACT_FEEDRATE 60 // (mm/s) Initial retract feedrate.
1577   #define PAUSE_PARK_RETRACT_LENGTH 2 // (mm) Initial retract.
1578   // This short retract is done immediately, before parking the nozzle.
1579   #define FILAMENT_CHANGE_UNLOAD_FEEDRATE 10 // (mm/s) Unload filament feedrate. This can be pretty high.
1580   #define FILAMENT_CHANGE_UNLOAD_ACCEL 25 // (mm/s^2) Lower acceleration may allow a faster feedrate.
1581   #define FILAMENT_CHANGE_UNLOAD_LENGTH 100 // (mm) The length of filament for a complete unload.
1582   // For Bowden, the full length of the tube and nozzle.
1583   // For direct drive, the full length of the nozzle.
1584   // Set to 0 for manual unloading.
1585   #define FILAMENT_CHANGE_SLOW_LOAD_FEEDRATE 6 // (mm/s) Slow move when starting load.
1586   #define FILAMENT_CHANGE_SLOW_LOAD_LENGTH 0 // (mm) Slow length, to allow time to insert material.
1587   // 0 to disable start loading and skip to fast load.
1588   #define FILAMENT_CHANGE_FAST_LOAD_FEEDRATE 6 // (mm/s) Load filament feedrate. This can be pretty high.
1589   #define FILAMENT_CHANGE_FAST_LOAD_ACCEL 25 // (mm/s^2) Lower acceleration may allow a faster feedrate.
1590   #define FILAMENT_CHANGE_FAST_LOAD_LENGTH 0 // (mm) Load length of filament, from extruder gear to nozzle.
1591   // For Bowden, the full length of the tube and nozzle.
1592   // For direct drive, the full length of the nozzle.
1593   // #define ADVANCED_PAUSE_CONTINUOUS_PURGE // Purge continuously up to the purge length until paused.
1594   #define ADVANCED_PAUSE_PURGE_FEEDRATE 3 // (mm/s) Extrude feedrate (after loading). Should be slower than load rate.

```

figure 5

#### 5) Modify the pause position

The position where the nozzle stops after suspension can be set. The modified position is shown in figure 6.



```

1460 *
1461 * Park the nozzle at the given XYZ position on idle or G27.
1462 *
1463 * The "p" parameter controls the action applied to the Z axis:
1464 *
1465 * P0 (Default) If Z is below park Z raise the nozzle.
1466 * P1 Raise the nozzle always to Z-park height.
1467 * P2 Raise the nozzle by Z-park amount, limited to Z_MAX_POS.
1468 */
1469 #define NOZZLE_PARK_FEATURE
1470 #if ENABLED(NOZZLE_PARK_FEATURE)
1471   // Specify a park position as { X, Y, Z_raise }
1472   #define NOZZLE_PARK_POINT { (X_MIN_POS + 10), (Y_MAX_POS - 10), 20 }
1473   #define NOZZLE_PARK_XY_FEEDRATE 100 // (mm/s) X and Y axes feedrate (also used for delta mode)
1474   #define NOZZLE_PARK_Z_FEEDRATE 5 // (mm/s) Z axis feedrate (not used for delta mode)
1475 #endif
1476 /**

```

figure 6



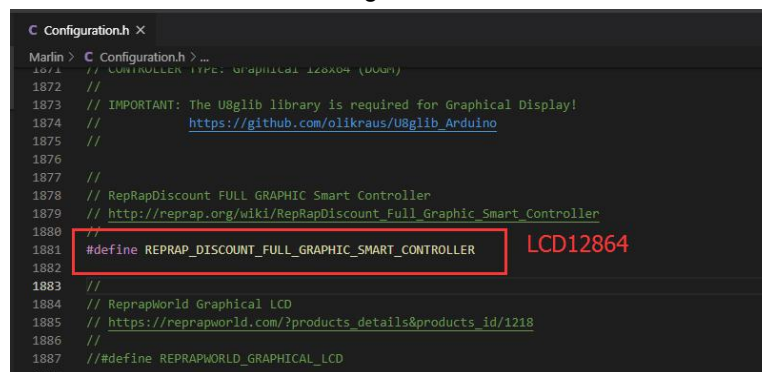
## 6) Modify the screen

Modify figure 7 and figure 8 to use LCD2004. 12864, TFT24-12864 mode, TFT35-v3.0-12864 mode.



```
C Configuration.h
Marlin > C Configuration.h > ...
1732 //===== (Character-based LCDs) =====
1733 //=====
1734
1735 //
1736 // RepRapDiscount Smart Controller.
1737 // http://reprap.org/wiki/RepRapDiscount\_Smart\_Controller
1738 //
1739 // Note: Usually sold with a white PCB.
1740 //
1741 #define REPRAP_DISCOUNT_SMART_CONTROLLER LCD2004
1742
1743 //
1744 // Original RADDs LCD Display+Encoder+SDCardReader
1745 // http://doku.radds.org/dokumentation/lcd-display/
1746 //
```

figure 7



```
C Configuration.h X
Marlin > C Configuration.h > ...
1871 // CONTROLLER TYPE: Graphical 128x64 (DUIN)
1872 //
1873 // IMPORTANT: The U8glib library is required for Graphical Display!
1874 // https://github.com/olikraus/U8glib\_Arduino
1875 //
1876
1877 //
1878 // RepRapDiscount FULL GRAPHIC Smart Controller
1879 // http://reprap.org/wiki/RepRapDiscount\_Full\_Graphic\_Smart\_Controller
1880 //
1881 #define REPRAP_DISCOUNT_FULL_GRAPHIC_SMART_CONTROLLER LCD12864
1882
1883 //
1884 // ReprapWorld Graphical LCD
1885 // https://reprapworld.com/?products\_details&products\_id/1218
1886 //
1887 // #define REPRAPWORLD_GRAPHICAL_LCD
1888
```

figure 8

## VI.Touch screen Settings

Note: at present, the touch screen only supports TFT 24 and TFT35 V3.0 produced by our company

- 1) Select Settings in the ready to print screen



figure 9

- 2) Select function settings in the Settings interface



figure 10

- 3) Click filament detection in the function setting interface until the smart detection is on (The default setting of filament detection function on the screen is off. Click the icon again after the filament detection function is on to open the smart filament detection mode).



figure 11



figure 12



figure 13

## VI. Wiring method

1) Take SKR V1.3 (figure 14) as an example

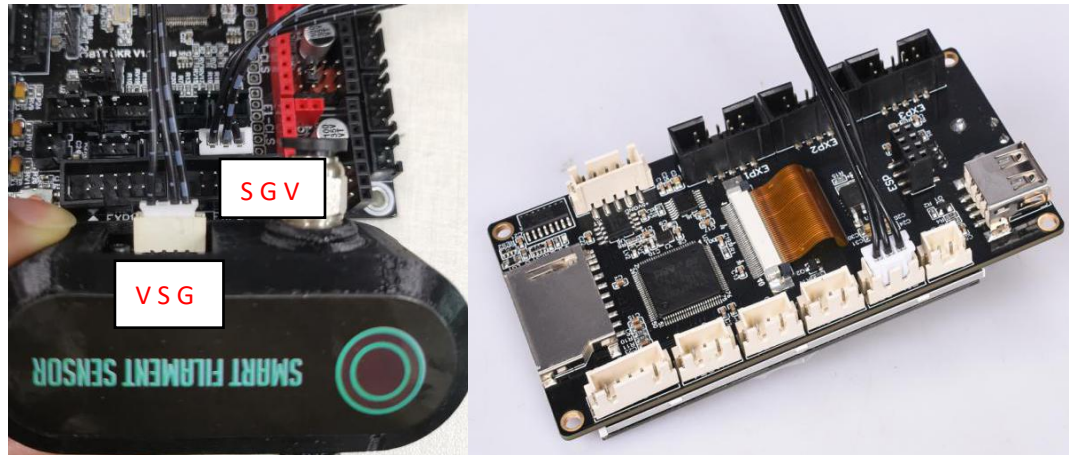


figure 14

The smart filament detection module uses a break detection interface (such as SKR V1.3 for E0DET). **Any motherboard with a break detection interface can be used.**

S for SIN

G for GND

V for VDD

## VIII.Installation method

Remove the pneumatic joint between the teflon tube and the extruder  
(as shown in figure 15-17)

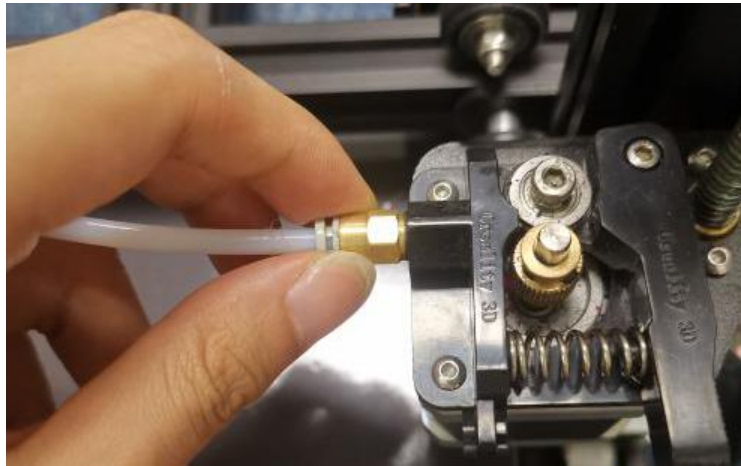


figure 15

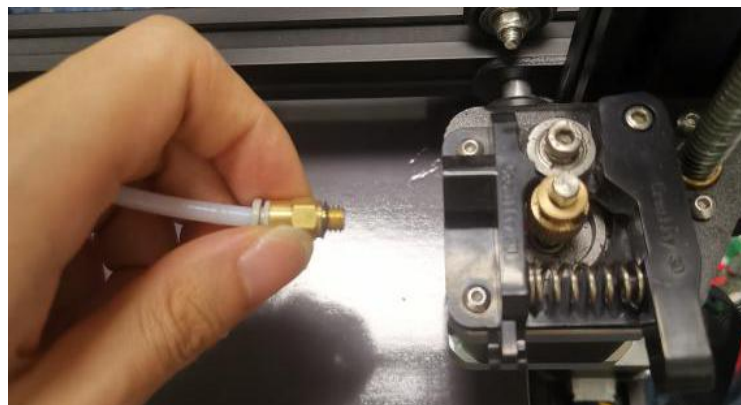


figure 16



figure 17

2) Insert the printer's teflon tube into the pneumatic joint (like Figure 18)

**Note:** The teflon tube needs to be fully inserted into the module in order to ensure that it will not affect the entry of filament.



figure 18

3) Screw the smart filament module connector into the extruder.(like figure 19)

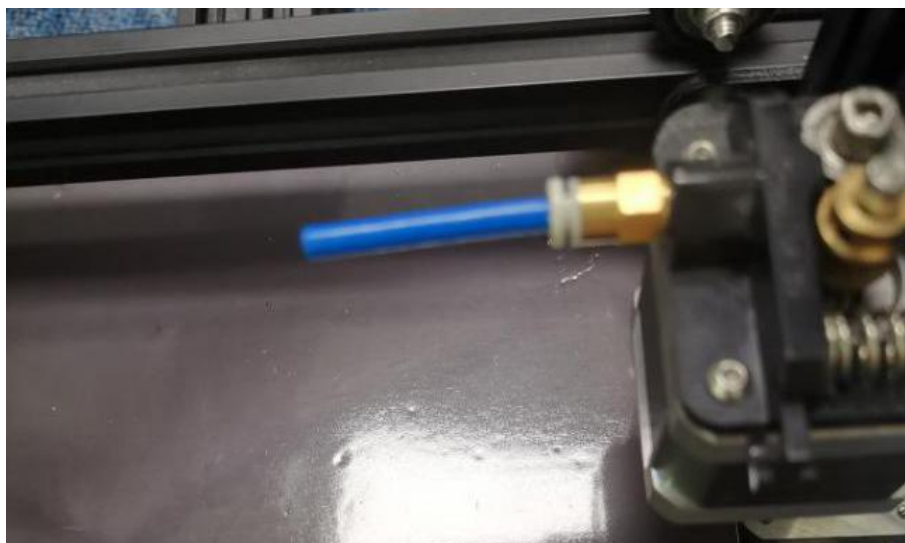


figure 19



4) Insert the smart filament module connector Teflon tube into the pneumatic joint (like Figure 20)

**Note: Teflon tube needs to be fully inserted into the module so that it does not affect the entry of filament.**



figure 20

5) Other fixed methods

The two screw holes shown in Figure 10 can be used for fixing, and the printed piece can be designed according to the fixed position. So this module can be applied to the proximity extruder.



figure 21

## IX. Notes

- 1) This module is powered by 3.3v or 5V, so high voltage will cause damage to the module.
- 2) The current shell material is printed with PLA, so the shell will be damaged if the screws and pneumatic joints are turned frequently and wrongly many times.
- 3) Scrap and dust may cause false alarms and you need to remove the module to clean.
- 4) Please consult technical support before using the motherboard with no broken filament detection module.