

Marlin Filament Monitoring

October 2014

Why is Filament Monitoring Useful?

There are a number of filament monitors and filament break detectors available which will generate an alarm if the filament runs out. Some will also detect when the filament tangles to the point where it won't feed properly.

However the standard Marlin firmware does not have the built in capability to recognise the filament monitor alarm and to automatically pause the print and resume when the filament problem is cleared.

The aim of this note is to explain how to add the filament alarm function in Marlin so the print pause and resume can be handled automatically. The notes assume that a RAMPS 1.4 board is used as the printer driver, interface and connections board.

The Filament Change function in standard Marlin also assumes that an LCD controller display is connected to the printer.

Marlin Software Modifications

The mod to add the pause and resume uses the "filament Change" function built into standard Erik/Zalm Marlin on GitHub. The same modification can also be made to the Marlin firmware adapted for the Robo3d

The Marlin mods are intended to be simple and robust and use existing Marlin functionality where possible.

The code changes required in the file marlin_main.cpp are highlighted :

```
lcd_init();
_delay_ms(1000); // wait 1sec to display the splash screen

#if defined(CONTROLLERFAN_PIN) && CONTROLLERFAN_PIN > -1
  SET_OUTPUT(CONTROLLERFAN_PIN); //Set pin used for driver cooling fan
#endif

#ifdef DIGIPOT_I2C
  digipot_i2c_init();
#endif
}

// Filament monitor mod - Ziggy 14/10/2014
boolean FC_Flag = false; // initialise flag to enqueue M600 command once per alarm

void loop()
{
  if(buflen < (BUFSIZE-1))
    get_command();
#ifdef SDSUPPORT
  card.checkautostart(false);
#endif
  if(buflen)
  {
    #ifdef SDSUPPORT
```

And in the loop() code

```
    {
        process_commands();
    }
    #else
        process_commands();
    #endif //SDSUPPORT
    buflen = (buflen-1);
    bufindr = (bufindr + 1)%BUFSIZE;

// filament monitor mod - Ziggy 14/10/2014
//
// note FC_Flag variable must be global
//
if (digitalRead(44) == LOW) {           // check filament monitor alarm pin
    if (FC_Flag == false) {             // not already triggered ?
        enqueuecommand_P(PSTR("M600")); // trigger a filament change
        FC_Flag = true;                 //
    }
} else FC_Flag = false;                 // reset for next alarm

}
//check heater every n milliseconds
manage_heater();
manage_inactivity();
checkHitEndstops();
lcd_update();
}

void get_command()
{
    while( MYSERIAL.available() > 0 && buflen < BUFSIZE) {
        serial_char = MYSERIAL.read();
    }
}
```

Note that the alarm is expected to be a LOW signal on Pin 44. The Marlin modification assumes that alarms (ie Pin 44 going LOW) will only ever be received when the printer is actually in operation and printing (ie using filament). Typically Filament Monitors are reset manually before printing and do not generate alarms until after the filament has started moving.

In addition to the code modifications, the following standard "Filament Change" parameters need to be set in the configuration_adv.h file.

```
//adds support for experimental filament exchange support M600; requires display
#ifdef ULTIPANEL
  #define FILAMENTCHANGEENABLE
  #ifdef FILAMENTCHANGEENABLE
    #define FILAMENTCHANGE_XPOS 100
    #define FILAMENTCHANGE_YPOS 10
    #define FILAMENTCHANGE_ZADD 10
    #define FILAMENTCHANGE_FIRSTRETRACT -1
    #define FILAMENTCHANGE_FINALRETRACT -0
  #endif
#endif
#endif
```

You can, of course, modify these X, Y and Z parameters to suit where you want the extruder to move to so you can change or untangle the filament. The Z value is relative to where the Z was when the print was paused.

Note that with the choice of X position you need to remember not to pull any further on a filament that may be tangled.

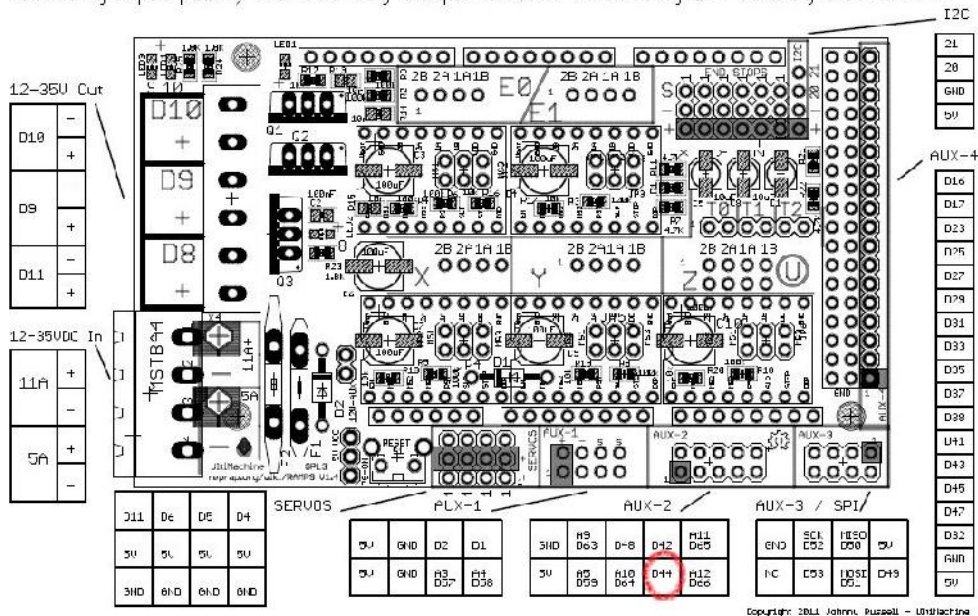
Finally save the modified marlin_main.cpp and configuration_adv.h files, recompile and upload the firmware to the printer.

Filament Monitor Alarm Signal

The Filament Monitor alarm signal needs to be connected to Pin 44 on the RAMPS 1.4 circuit board. This pin is located on the RAMPS 1.4 AUX-2 connector. There are also +5v power and ground pins on the same AUX-2 connector.

RAMPS 1.4 (RepRap Arduino MEGA Pololu Shield) GP_ v3
reprap.org/wiki/RAMPS1.4

Reversing input power, and inserting stepper drivers incorrectly will destroy electronics.



Handling Filament Monitor Alarms

When a filament alarm is received, the modified Marlin will handle the alarm as follows

- The printer completes the current gcode command
- An “M600” change filament gcode command is generated which causes the printer to stop printing then move the extruder to the X, Y and relative Z position specified by the configuration_adv.h file Filament Change parameters.
- The alarm buzzer on the LCD Controller sounds to bring some attention to the alarm. A “Filament Change” message appears on the LCD display.
- A “M600” log message is sent to the host PC (if connected)
- The extruder and bed remain heated to their current temperature settings during the pause.
- While the alarm buzzer is operating there is an opportunity to change or untangle the filament. The alarm buzzer can be annoying when operating for a long time, but that’s the way standard Marlin handles a Filament Change.
- Note : Do not move the extruder by hand (or using any gcode command) during the filament change. The reason is that Marlin needs to know how to move the extruder back to the correct position to resume printing.
- When the filament is changed and you are ready to resume printing, press the encoder button on the LCD Controller. The alarm buzzer is then cancelled and the extruder moves back and resumes printing exactly from the position where it paused.

Note: In a situation where the LCD Controller is defined but there is no LCD Controller actually connected, it is also possible to use the host software to “pause” the print when the “M600” log message is received and then manually resume printing by host command. But in this case there is no audible alarm and the process is not as simple as using the LCD Controller button.

Code Text for copy/paste

```
// filament monitor mod - Ziggy 14/10/2014
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once per alarm

// filament monitor mod - Ziggy 14/10/2014
//
// note FC_Flag variable must be global
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  if (digitalRead(44) == LOW) {           // check filament monitor
alarm pin
    if (FC_Flag == false) {             // not already triggered ?
      enqueuecommand_P(PSTR("M600"));   // trigger a filament change
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    }
  } else FC_Flag = false;               // reset for next alarm
```