Specification

Nominal input voltage	12V	10-15vdc	24V nominal available
Maximum current	30A	Maximum 100mV insertion loss	
Temperature channels	3	Metering 1% accuracy Max 127.9ºC	
Voltage channels	1	Metering 1% accuracy	
Current channels	1	Metering 2% accuracy	
Smoke sensor	1	Proportional to ambient level 10x to 100x	

Power control functionality.

On initial power on the splash screen will be displayed then the home screen.

```
Hours    000:00:00

Printing      IDLE
```

Pushing the multifunction button will toggle to

```
Hours    000:00:00

Printing      WAIT
```

The SmartSwitch in now active. The control board output will be energised and the hotbed output will respond to the control signal supplied by the control board. When the bed sensor reaches the *Start Bed Temp* the hours counter will commence and the end of print sensing will become active if enabled (this ensures that preheat has completed)

```
Hours    123:45:59

Printing      RUN
```

End of print sensing is active and will shut the system down completely after the *End Time* followed by the *Warning Duration*. This is sensed from the time the printer bed is shut off. (send Gcode M140 S0 to the controller) Operating the multifunction button during the *Warming Duration* will restart the *End Time* timer this is a manual override to enable printer setup. The alarm buzzer will be sounding during the *Warning Duration*

```
Hours    123:45:59

Printing      END
```

System monitoring and shutdown

```
Hours    123:45:59

Printing      TRIP
```

There are seven sources of trip input that will shut the printer down (the bed and control supply will be turned off) These screens are accessed by spinning the rotary dial and the setting is accessed by pushing the control the value will then flash and can be adjusted.

1. PSU MIN V   11.0V   Under voltage from the power supply
2. PSU MAX I   22.0A   Over current from the power supply
3. Bed Max temp   80ºC   Over temperature of the hotbed
4. Head Max temp   100ºC   Over temperature of the hotend / cooler
5. Case Max temp   50ºC   Over temperature general environment
6. Smoke   10x   Smoke sensor proportional to ambient sensor
7. Timeout   10m   End of print sensing M140 S0

When the unit is operational any of seven conditions can force the unit off. This will be displayed as *Trip Source* for all conditions except the end of print sensing. For instance, if the hotend cooler fails and the top of the heatsink gets too hot the alarm will indicate *Trip Source Head*. The timer will stop after the *Warning Duration* time during which the buzzer will be active. These parameters can be dynamically adjusted *Save Settings* during operation. They are reloaded at power energise when the control board is powered up.

Issues that can potentially trigger the alarms

Bed over temperature could be an over voltage a fault in the bed itself or failure of the switching fet The sensor should be positioned in thermal contact with the hot bed.

Head over temperature could be failure of the head cooling fan the hot end switching fet this sensor should be positioned in thermal contact with the top of the heatsink above the hot end.

Case over temperature could be cause by either of the above conditions in a closed environment when printing ABS or other high temperature materials this will be automatically disabled if not fitted

Smoke sensing this will be able to monitor internal environment of a closed box and force a shutdown in event of (potentially) connector issues printer stopping with contact on an active print or failure of power supply / cabling this will be automatically disabled if not fitted

PSU sensing can see a dip in voltage caused by issues with over current an effect seen when cabling / connectors are failing this coupled with current sensing would shut the system down prior to catastrophic failure of the electronics and wiring

System Design features

Flexibility to operate with many printer types connecting between the power supply and the electronics package with a built in power switch for the heated bed to remove the current from marginally rated connectors on many control boards. A multi colour LED will indicate status and a 2x16 display will enable the following display screens

Power supply screen 1   Default values

```
PSU    12.25 V
Min    11.7  V              PSU  < 11.0 V
```

Power supply screen 2

```
PSU    18.50 A
Max    22.0  A              PSU  > 22.0 A
```

Temperature screen 3

```
Bed    99.9 °C
Max    120  °C              Max > 80 °C
```

Temperature screen 4

```
Head 120.9 °C
Max    122   °C             Max > 100 °C
```

Temperature screen 5

```
Case   44.2 °C
Max    55   °C              Max > 50 °C          (if fitted)
```

Smoke screen 6

```
Smoke   0 K
Max    10 K                10 K                 (if fitted)
```

Start Bed Temp 7

```
Start Bed Temp
        40.0 °C            40 °C
```

Stop timer screen 8

```
End Time
```

```
        10 m              10 m      Set to zero to disable
```
Warning timer 9
```
Warning Duration
        10 s              10 s
```

Trip Source 10
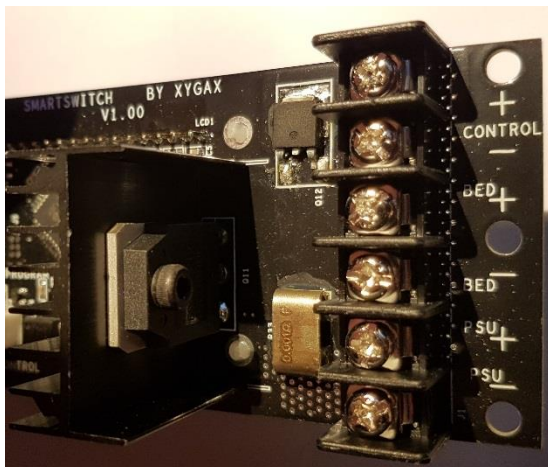```
Trip Source
        ---   The alarm source
```

Settings 11
```
Save Settings
        (Press 2S)   Saves the user settings
```

Default 12
```
Factory Defaults
        (Press 5S)   Restores the factory settings
```

# Connections to the system



1. PSU    The power supply. Observe the correct polarity reversal can damage the unit. This should be terminated with suitable cable rated adequately for the system 14AWG or 1.5mm with an M4 spade or ring crimp to ensure the best connection
2. Bed    The heated bed. Polarity isn't important unless there is an LED indicator on the hot bed itself in this case observe polarity or the led will not function. This should be terminated

with suitable cable rated adequately for the system into an M4 spade or ring crimp to ensure the best connection.

3. Control The connection to the main control board. Observe the correct polarity reversal can damage the control board. This should be terminated with suitable cable rated adequately for the system into an M4 spade or ring crimp to ensure the best connection.
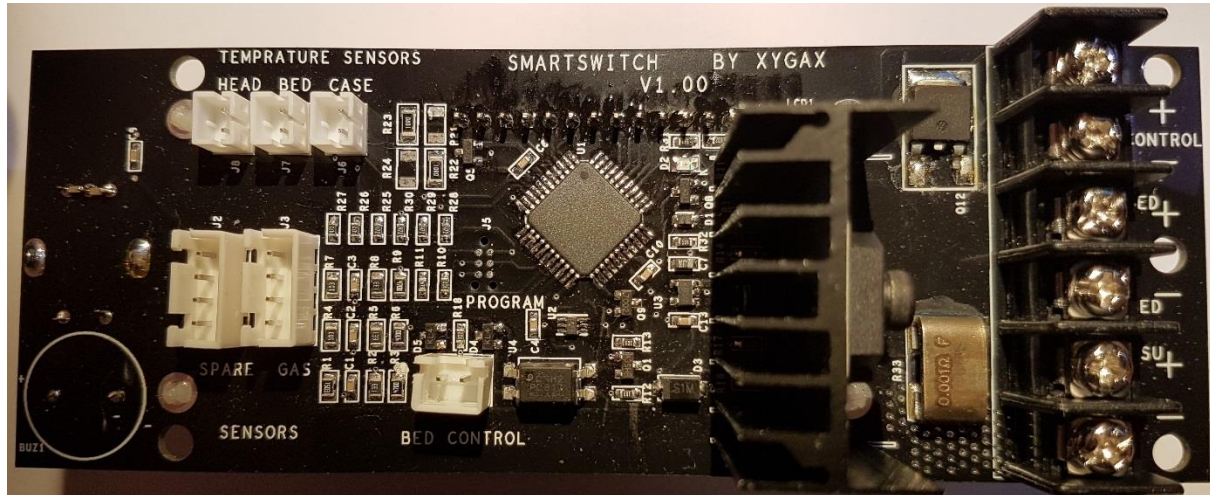


4. Head J8        Temperature sensor DS18B20 one wire bus for connection to the sensor positioned in thermal contact with the top of the extruder heatsink (cold side)
5. Bed J7         Temperature sensor DS18B20 one wire bus for connection to the sensor positioned in thermal contact with the bottom of the heated bed
6. Case J6        Optional Temperature sensor DS18B20 one wire bus for connection to the sensor positioned above the printer when an enclosure is required for  eg for ABS
7. Gas J3         Optional Smoke sensor analogue input from MQ-2 smoke sensor with signal conditioning.
8. Control J4     Input from control board this is not polarity conscious and is the control signal used to turn the hot bed on / off. The LED on the rear of the PCB will indicate when the signal isn't active (it will be off when the control board calls for heat)

There are five fixing holes provided in addition to the shaft of the multifunction control. These are 3.3mm diameter holes and the control has a 6.35 shaft.  The display requires a cutout of 24mm x 75mm this is on the centreline of the module offset 49mm from the multifunction switch centre.

The heatsink is expected to rise in temperature by 30 degs depending on the wattage of the hot bed. Please ensure its mounted in free air

Mechanical detail