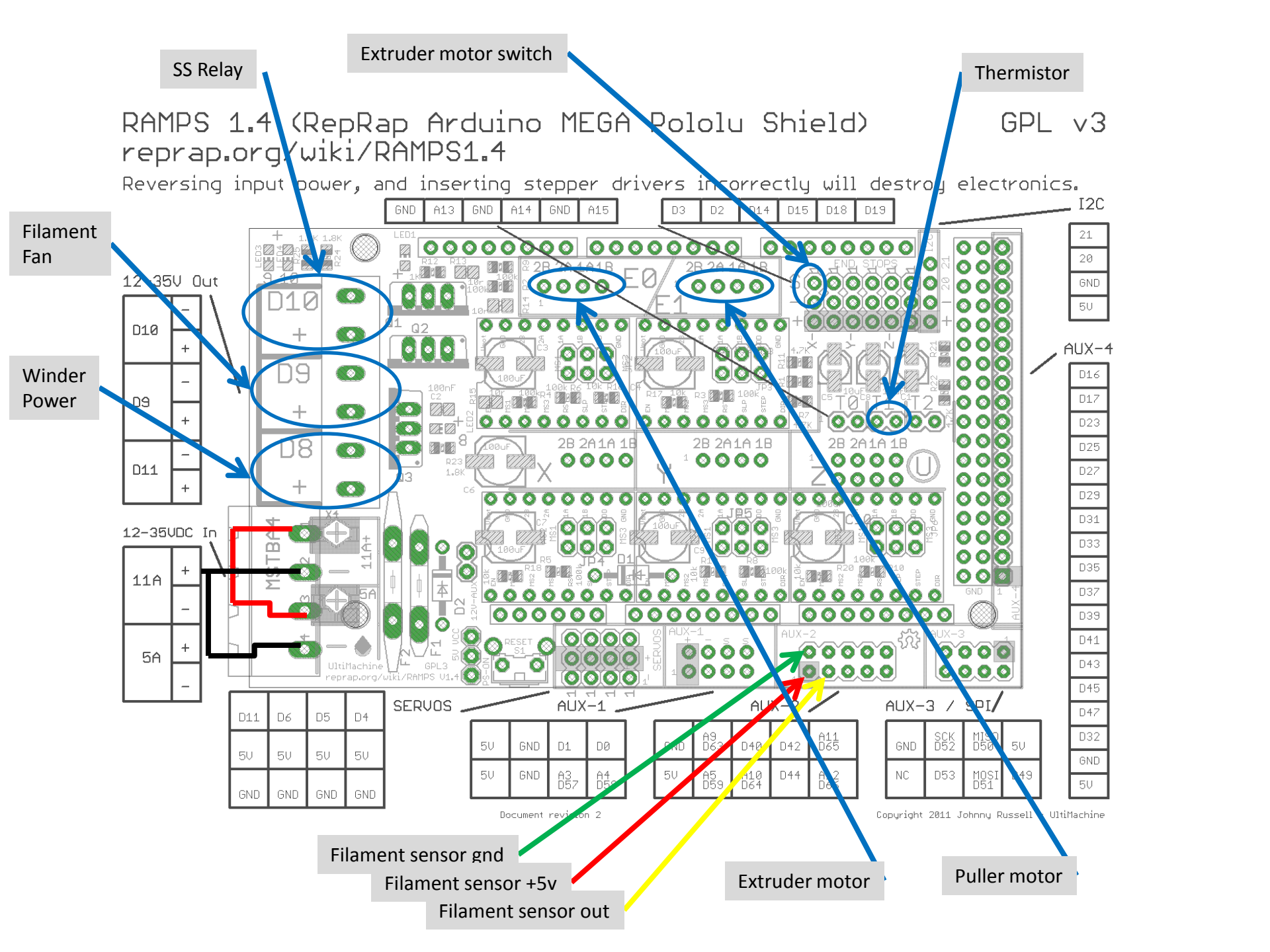
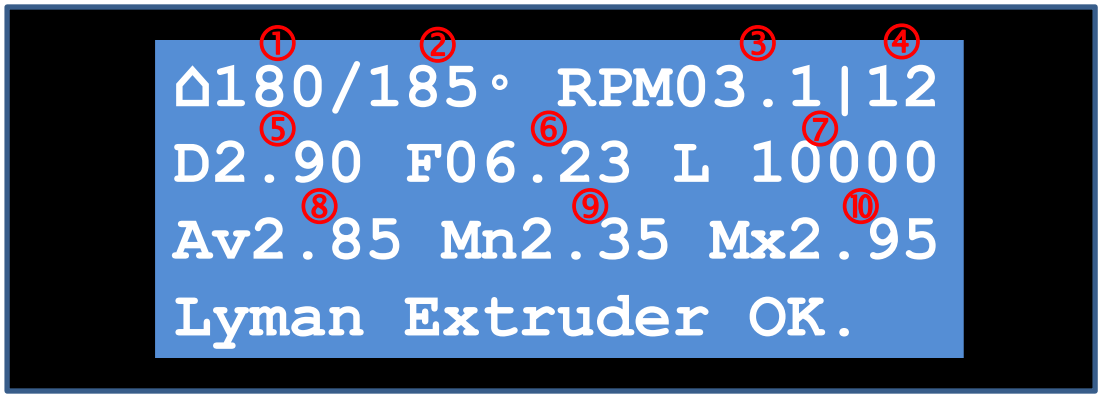

SS Relay
Extruder motor switch
Thermistor
Filament Fan
Winder Power
RAMPS 1.4 (RepRap Arduino MEGA Pololu Shield)
reprap.org/wiki/RAMPS1.4
GPL v3
Reversing input power, and inserting stepper drivers incorrectly will destroy electronics.
I2C
AUX-4
12-35V Out
12-35VDC In
SERVOS
AUX-1
AUX-2
AUX-3 / SPI
Filament sensor gnd
Filament sensor +5v
Filament sensor out
Extruder motor
Puller motor

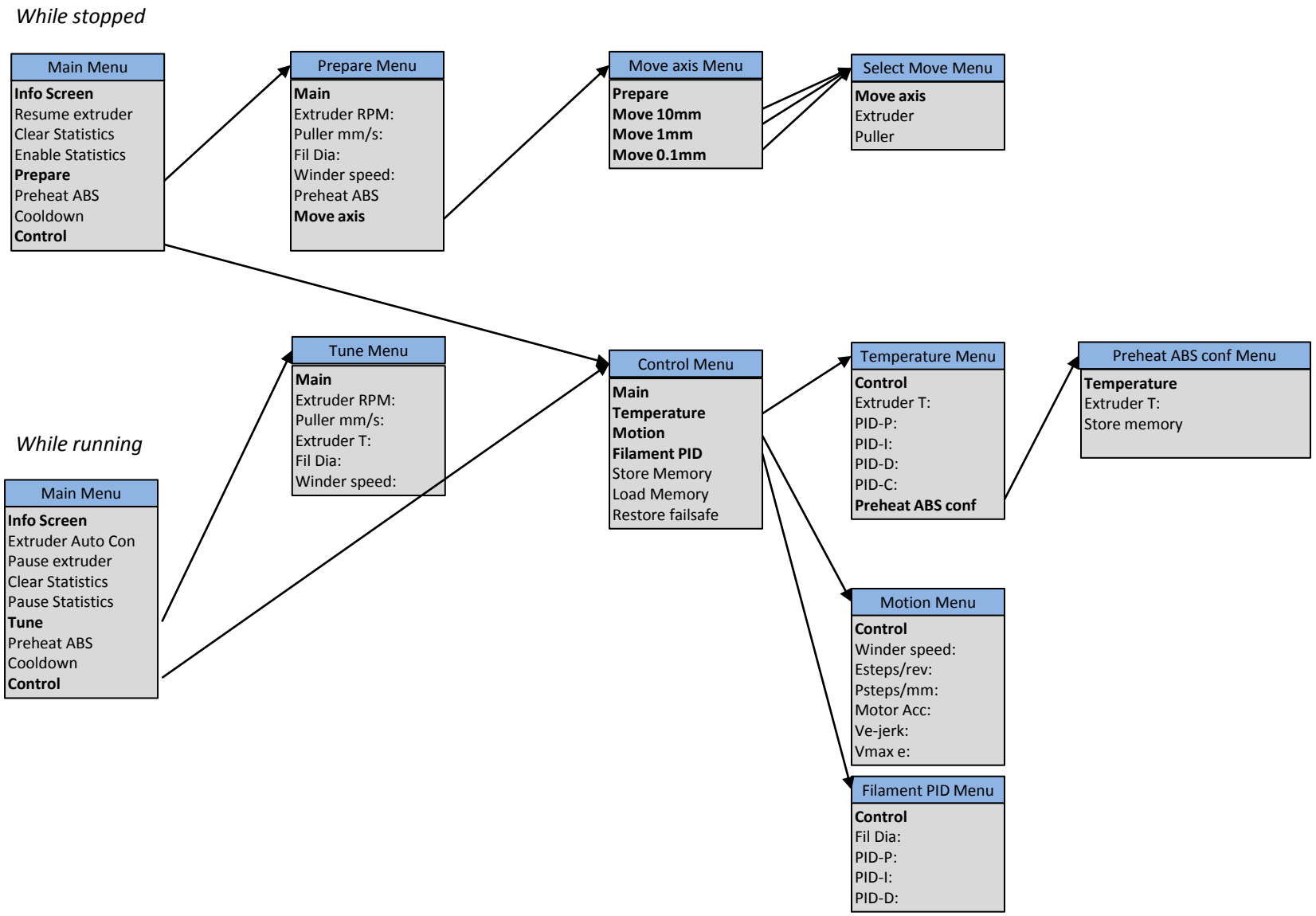
LCD Info Screen



① Actual Extruder barrel temp in deg C
② Setpoint Extruder barrel temp in deg C
③ RPM of the Puller motor
④ RPM of the Extruder motor (also displays 'CO' for cold extruder and 'OF' when external extruder switch is off)
⑤ Measured diameter of filament in mm
⑥ Filament Feed rate at Puller in mm/sec
⑦ Length of filament produced in mm
⑧ Average measured filament diameter
⑨ Minimum measured filament diameter
⑩ Maximum measured filament diameter

Last row – status or warning message

LCD Menus


While stopped
Main Menu
Info Screen
Resume extruder
Clear Statistics
Enable Statistics
Prepare
Preheat ABS
Cooldown
Control
Prepare Menu
Main
Extruder RPM:
Puller mm/s:
Fil Dia:
Winder speed:
Preheat ABS
Move axis
Move axis Menu
Prepare
Move 10mm
Move 1mm
Move 0.1mm
Select Move Menu
Move axis
Extruder
Puller
While running
Main Menu
Info Screen
Extruder Auto Con
Pause extruder
Clear Statistics
Pause Statistics
Tune
Preheat ABS
Cooldown
Control
Tune Menu
Main
Extruder RPM:
Puller mm/s:
Extruder T:
Fil Dia:
Winder speed:
Control Menu
Main
Temperature
Motion
Filament PID
Store Memory
Load Memory
Restore failsafe
Temperature Menu
Control
Extruder T:
PID-P:
PID-I:
PID-D:
PID-C:
Preheat ABS conf
Preheat ABS conf Menu
Temperature
Extruder T:
Store memory
Motion Menu
Control
Winder speed:
Esteps/rev:
Psteps/mm:
Motor Acc:
Ve-jerk:
Vmax e:
Filament PID Menu
Control
Fil Dia:
PID-P:
PID-I:
PID-D:

Menu Explanations 1

Main Menu – While motors are Idle
Info Screen – Returns to the info screen. Resume extruder – Will turn on the Puller motor, extruder motor (if warmed up), Winder motor, and fan (if warmed up) Clear Statistics – Clears the Filament average, minimum, maximum, and length. Enable Statistics – turns on gathering of statistics while extruder is not running. **Prepare – Go to the Prepare menu. Used to get ready for the run.** Preheat ABS – Turn on the heater to the setting for ABS. System will beep when at temperature. Can press the knob to stop the beep. Cooldown – Turn off the heater **Control – Go to the Control menu, which is used to set parameters for motion, temperature, and filament control.**

Main Menu – While motors are running
Info Screen – Returns to the info screen. Extruder Auto Con – Turns on the PID loop that controls the puller motor speed to hold filament diameter to a fixed setting. Pause extruder – Turns off all motors. Clear Statistics – Restarts collection of statistics, including zeroing of extruded length. Pause Statistics – Pauses collection of statistics, but keeps info in memory. **Tune – Goes to menu used to tune settings such as motor speeds during extrusion** Preheat ABS - Turn on the heater to the setting for ABS. System will beep when at temperature. Can press the knob to stop the beep. Cooldown – Turns off the heater to allow extruder to cool. **Control– Go to the Control menu, which is used to set parameters for motion, temperature, and filament control.**

Prepare Menu
Main – Returns to the Main Menu Extruder RPM: - Enter the desired extruder RPM. Default is 12. Puller mm/s: - Enter the desired default puller mm/second. Default is 6 mm/sec Fil Dia: - Enter the desired filament diameter when using filament PID control. Default is 2.8mm Winder speed: - Enter the desired winder speed (0-255). Default is 128. Preheat ABS - Turn on the heater to the setting for ABS. System will beep when at temperature. Can press the knob to stop the beep. **Move axis – Goes to the menu allowing user to move the extruder or puller a set distance.**

Menu Explanations 2

Tune Menu
Main – Returns to the Main Menu Extruder RPM: - Enter the desired extruder RPM. Default is 12. Puller mm/s: - Enter the desired default puller mm/second. Default is 6 mm/sec Extruder T: - Enter the desired extruder temperature in deg C. Default is 185 deg. Fil Dia:- Enter the desired filament diameter when using filament PID control. Default is 2.8mm Winder speed:- Enter the desired winder speed (0-255). Default is 128.

Move axis Menu
Prepare – Returns to the Prepare Menu **Move 10mm – Will move an axis (extruder or puller) in 10 unit increments** **Move 1mm – Will move an axis (extruder or puller) in 1 unit increments** **Move 0.1mm – Will move an axis (extruder or puller) in 0.1 unit increments**

Select Move Menu
Move axis – Returns to the Move axis Menu Extruder – Select extruder to move. There are 100 units in one revolution. Puller – Select the puller motor to move. The units are mm.

Menu Explanations 3

Control Menu

Main – Return the Main Menu
Temperature – Select the Temperature control menu (Heater settings)
Motion – Select the Motion control menu (Motor settings)
Filament PID – Select the Filament PID control menu (Filament PID settings)
Store Memory – Save settings in EEPROM
Load Memory – Load EEPROM settings
Restore failsafe – Go back to default settings

Temperature Menu

Control – Return back to the Control Menu
Extruder T: - Enter the desired extruder temperature in deg C. Default is 185 deg.
PID-P: - Enter the desired P value for the heater PID loop. Default is 12.66. Can use Autotune to tune this just like Marlin.
PID-I: - Enter the desired I value for the heater PID loop. Default is 0.27. Can use Autotune to tune this just like Marlin.
PID-D: - Enter the desired D value for the heater PID loop. Default is 146.24. Can use Autotune to tune this just like Marlin.
PID-C: - Enter the desired C value for the heater PID loop. Default is 1. This is usually not adjusted.
Preheat ABS conf – Menu to configure settings for the standard ABS preheat.

Motion Menu

Control– Return back to the Control Menu
Winder speed:- Enter the desired winder speed (0-255). Default is 128.
Esteps/rev: Enter the number of steps per 1/100th of a revolution of the extruder, taking into account the gearbox and fractional steps. Default is 489.6. for stepper with 15.3:1 gears.
Psteps/mm: Enter the number of steps per 1mm of motion of the puller motor, taking into account the gearbox and fractional steps. Default is 2653.6 for stepper with 100:1 gears.
Motor Acc: Enter the acceleration for the steppers in mm/sec^2. Default is 200.
Ve-jerk: Default is 1.0.
Vmax e: Default is 40 1/100ths revolutions per second, or 24RPM.

Filament PID Menu

Control– Return back to the Control Menu
Fil Dia: - Enter the desired filament diameter when using filament PID control. Default is 2.8mm
PID-P: - Enter the desired P value for the filament diameter PID loop. Default is 0.020.
PID-I:- Enter the desired I value for the filament diameter PID loop. Default is 0.060.
PID-D:- Enter the desired D value for the filament diameter PID loop. Default is 0.250.

Preheat ABS conf Menu

Temperature
Extruder T: - Enter the desired extruder temperature in deg C that will be used when 'Preheat ABS' is selected in the Main Menu or Prepare Menu . Default is 185 deg.
Store memory – Save the settings in EEPROM

Configuring the stepping units

- Extruder

  200 steps/rev motor, 15.3:1 reduction gearbox
  Jumpers set for 1/16 stepping.
  Esteps/rev = 200 steps/rev * 15.3 * 16*1/100
  Esteps/rev = 489.6

- Puller motor

  200 steps/rev motor, 99 1044/2057 : 1 reduction
  Urethane wheel is 120 mm circumference
  Jumpers set for 1/16 stepping.
  Psteps/mm = 200 steps/rev * 99 1044/2057 * 16 /120
  Psteps/mm = 2653.6

Using the Extruder

1. Turn on the heater – select Preheat ABS from the Main Menu.
2. Wait until temp hits setpoint (185 deg). Beeper will go. Can press knob to shut off.
3. Turn on the motors – select Resume Extruder from the Main Menu.
4. Adjust the Puller motor speed via the knob to achieve close to the filament diameter desired (2.8mm). Can use the Tune menu or Control menu to make adjustments to motor speeds, etc.
5. Switch to Extruder Auto Con from the Main Menu to go to automatic control of the puller motor.
6. Can Clear Statistics on the Main Menu to start collecting data now that filament is under control.
7. Select Pause Extruder on the Main Menu when finished with run.
8. Select Cooldown on the Main Menu to shut off heater.