miniDF manual.

V1.1 2015-02-22

NEVER CONNECT A MOTOR WHILE THE DRIVER IS POWERED.

NEVER DISCONENCT A MOTOR WHILE THE DRIVER IS POWERED.

IT WILL DAMAGE THE STEPPER DRIVER.

Contents

1.0 The Stepout miniDF system.

      The Stepout miniDF is a motion control system for Dragonframe stop motion software. The miniDf is a motor interface capable of addressing four independent motor drivers. The StepSlice is a motor driver capable of operating one single stepper motor from any of the miniDFs four control outputs. The LensMotor is a compact, low cost lensgear motor. It can be used to manipulate zoom, focus or aperture on any lens with manual ring style controls. Due to its built in gearbox, it is capable of moving large or sticky lenses.

MiniDF system

The miniDF system is open source. Any firmware modification that might be offered in the future will be provided free of charge.
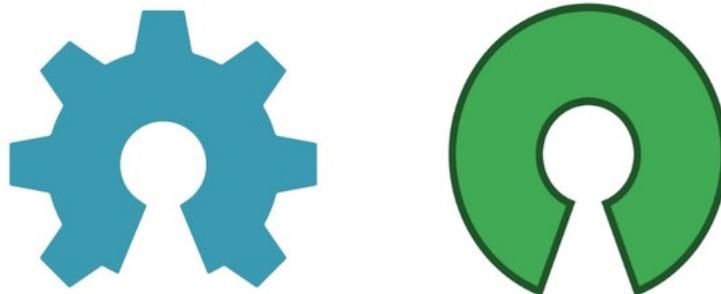
Open source

2.0 The miniDF.

      The miniDF device is based on the Arduino nano v3.0 and designed to interface with Dragonframe software. Each device comes preloaded with the DFmoco Dragonframe script for motion control. It is capable of commanding up to four independent motors simultaneously. A total of 4 miniDFs can be run simultaneously providing up to 16 independent stepper motors. The miniDF design is open source and it is based on the Arduino nano v3. And it can be loaded witf DFmoco or with the DFremote Dragonframe (See Appendix DFremote).

miniDF Rev 3.0

Front of unit:

1) Push button: kill switch. It has to be activated by editing the DFmoco script
2) Micro USB port: port for USB signal and power
3) Power port: optional power port. Voltage range 7-14 volts.

MiniDF: Front view

Regarding the power port:

The miniDF can be powered via USB. This is the preferred way to power the unit. The user can also choose to power it via the power plug in the front of the unit. This plug can use any power source from 7-14 V dc. The unit will automatically switch to the power barrel if this one is energized. There are circumstances were it might be advantageous to use the power barrel. If the Dragongframe system is run from a battery powered laptop, connecting the minDF to the battery powering the motor by using the power barrel connector, will cause the battery life of the laptop to be extended.

Regarding the kill switch:

In the front of the unit there is a push button designed to operate as a kill switch. It is connected to pin 2 on the Arduino, interrupt 0. If the user wants to enable the kill switch, the DFmoco script has to be edited and the following line has to be uncommented:

```
#define KILL_SWITCH_INTERRUPT 0
```

If the user wishes to use an external trigger for the kill switch it can connect a pushbutton or a limit switch. There is no need to provide any additional components.
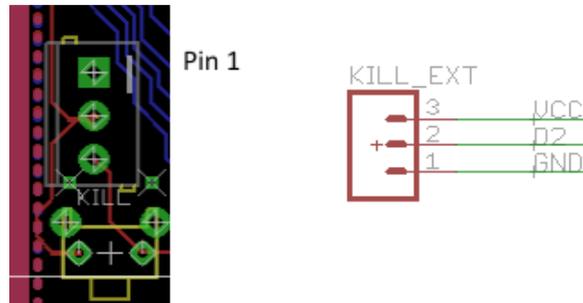
The internal kill switch

Back of the MiniDF

The back of the unit has four motor outputs. Each output has a 2.5mm stereo jack that provides step, direction and ground. Outputs are numbered 1 to 4, with 1 being the rightmost one behind the power connector. Each output can control an independent stepper

motor driver. Each miniDF can run four simultaneous stepper motor drivers to control four independent motorized axes.

If you use the miniDF with our StepSlice (the motor driver designed for the miniDF), a stereo cable 2.5" is required to connect the miniDF to the StepSlice. If you use any other stepper, you can buy our universal stepper cable or use one of the 2.5" jack to thumbscrew adapter.

2.5mm jack to thumb screw adapter

Universal signal cable.

miniDF 3.0 Specs	
Microprocessor	Arduino Nano 3.0
Output	X4 2.5mm stereo jack, (step and direction)
Max. power consumption	200 mA
Max amp output	13 mA per output, 26 mA per connector, 5V
Voltage Rating, input	7-14 volts via power barrel
USB data connector	Micro USB 2.0

3.0 StepSlice.

StepSlice Silver edition

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The StepSlice is a stepper motor driver designed to work with the miniDF. It can power a single stepper motor with up To 2.5 Amps. The unit can be set to full steps or micro stepping. Microstepping increases the total number of steps available. Up to 32x micro stepping can be engaged. Higher micro stepping settings produce quieter and smother operation at the cost of reduced torque. The recommended setting for the Bracket Lensgear motor is 4x micro stepping. Three dip switches on the back of the unit allows the user to adjust micro stepping.

As an example, our Lensgear motor has a 3800 steps per revolution at 4x micro stepping (200 steps/sec x 4.75:1 gear reduction x 4x mico stepping).

Connect the motor to the stepper driver while the driver is not powered. After that, power the driver. Disconnect the power from the driver before removing the motor. If you don't follow this sequence, you will damage your stepper driver.

The Stepslice has a four prong motor connector. All our motors can plug directly into the Stepslice. Also, inside the board there is a feature connector, jp1, that is not populated. It can be used to provide step and direction directly or to daisy chain multiple step slices (from top to bottom, direction, gnd, step)

In order to adjust the power to your the motor, turn the thumbscrew on the stepper driver until it the motor moves fine. This procedure is not required for the Silver edition as they came pre-adjusted and do not require any additional adjustment.
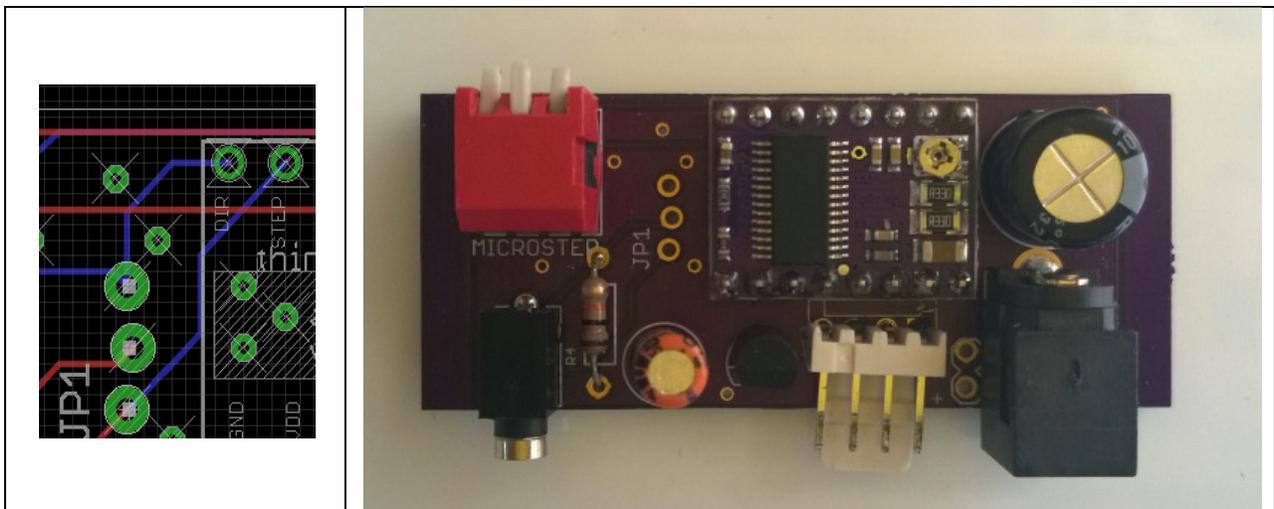
jp1 feature connector and Silver edition board

There are two different versions of the StepSlice: Silver and Black.

StpepSlice Black Edition

The silver edition is designed to interface with our Lens Bracket motors. The driver chip, DRV8824, is specially designed for improved micro stepping performance at low current. Its specification and power rating makes it a perfect match for the Lensgear and Vertical motor.

The Black Edition is designed to interface with bigger motors requiring higher drive currents. The driver chip, DRV8825, is specially designed for improved power handling and it is capable to provide up to 2.5 Amps of current.   It is actively cooled and the driver is user replaceable. It shares the same connection as the Silver Edition, and it can run any of our motors.

Micro stepping stepping Chart
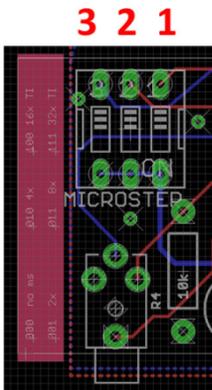
	1	2	3	Microstep
	Low	Low	Low	Full step
	High	Low	Low	Half step
	Low	High	Low	1/4 step
	High	High	Low	1/8 step
	Low	Low	High	1/16 step
	High	Low	High	1/32 step
	Low	High	High	1/32 step
	High	High	High	1/32 step

Stepslice Specs	
Voltage input	9-30 Volts
Input	1 2.5 mm mini jack
Max. power consumption, silver edition	Less than 1.2 A
Max. power consumption, black edition	Less than 2.8 A
Stepper Driver, silver edition	Stepstick Ti DRV8824, max. .75 Amps
Stepper Driver, black edition	Stepstick Ti DRV8825, max. 2.5 Amps
Cooling fan, black edition only	20 x 20 mm 12 Volts
Micro steps	Up to 32x user adjustable

For the black edition: https://www.pololu.com/product/2982

For the silver edition: https://www.pololu.com/product/2131

4.0 Lens Motors.

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The Lensmotor is a small high torque stepper motor capable adjusting focus, zoom or aperture. Depending on the size and design of the lens up to three can be used simultaneously. It can be used directly with cinema lenses with molded-in teeth for follow focus devices. It can be used with most other lenses by using a lens gear like the recommended Jag 35 D-gears. The motor cable is terminated with a four prong adapter compatible with all our steper drivers and other motion systems like emotimo TB3 and Dynamic Perception NMX.
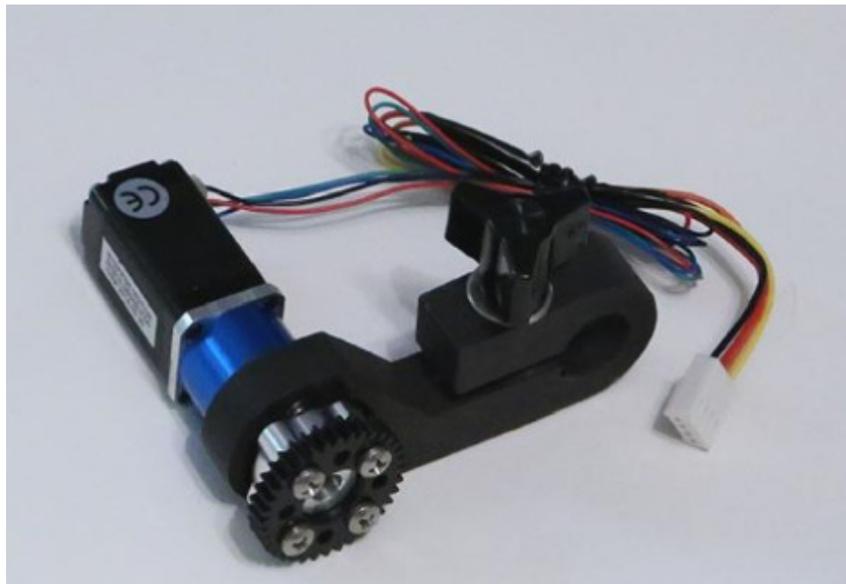
Bracket Lensgear motor

Connect the motor to the stepper driver while the driver is not powered. After that, power the driver. Disconnect the power from the driver before removing the motor. If you don't follow this sequence, you will damage your stepper driver.

Cine style lenses have gear teeth molded into the focus (and zoom when present) adjusting ring. These gear teeth mesh with other gears having teeth of a size called 32p, or

MOD.8 in metric units. Follow focus devices and focus motors have teeth of this size to mesh with the gear teeth on the lens.

If your lens does not have gear teeth on it already, you can use a follow focus gear like JAG35 D-gears. The D-gears come with several sets of little "feet" that snap into slots on the inside of the gear ring at one end, and rest on the lens focus ring at the other end. You adjust the D-gear to fit your lens in a coarse way by finding the the set of feet with the right length and installing them on the D-gear. You then fine-tune the D-gears fit by adjusting a screw that closes a small gap in the "C" shaped D-gear. If the adjustment is not enough to get a good fit, switch to the next size feet.

Do not to over-tighten the fine adjustment screw. Over-tightening has been known to distort plastic lens barrels slightly causing the lens' focus system to bind, causing too much friction for the motor to turn it. If this happens, loosening the D-gear will usually cause the lens barrel to spring back into its correct shape.

Bracket Lensmotors, Lensgears and 15 mm rod system.

Using a Baseplate To Attach Focus Device To Camera.

A 15mm rail system is used to attach focus motors and other devices such as matteboxes and filter holders to the lens. The rail system consists of a baseplate unit that attaches to the camera using the cameras tripod screw socket. The baseplate also has a threaded hole that allows you to attach it to the tripod or pan-tilt head. The baseplate has clamps which hold two 15mm diameter rods which serve as a framework for attaching lens accessories. You can adjust the position of the rods forward and back in the direction parallel to the lens by loosening the wing nut like screw on the clamp holding each rod.

The Lensmotor focus motor has a clamp with a 15mm hole that can be tightened around one of the 15mm rods of the rail system. A knob on the clamp is used to tighten it around the rod. To attach the focus motor, loosen the knob on the clamp and gently pull the gap by the round hole in the clamp open with your fingers. The clamp part of the focus motor should slide onto the 15mm rod now. Slide the motor along the rod until it aligns with the gear teeth on the lens. Rotate the motor on the rod to bring the teeth of the gear on the motor into mesh with the gear teeth on the lens. While holding the gear teeth tightly in mesh, tighten the knob of the clamp on the focus motor to lock it in place. Try moving the lens to make sure the teeth remain in mesh and re-tighten if necessary.

Using Different Gears Boxes in the Motor Output To Adjust Speed, Torque And Reach.

Replaceable Lensgear motor

Available Motors:

Gear Box	Max. Permissible torque	Length	Code
4.75:1	17.1 Ncm	59 mm	Gear805
19:1	61.56 Ncm	68 mm	Gear819
64:1	90 Ncm	68 mm	Gear864
90:1	90 Ncm	68 mm	Gear890

   The bracket lensgear motor is supplied with a 42 tooth output gear. The motor works well with this gear. If you are using the motor to adjust aperture or focus a very short lens, the motor may bump into the camera body before the gear teeth can be brought into mesh. In this case, it is possible to get a larger diameter gear which has more teeth. This will give you more

reach so the gears can reach each other and mesh. Changing the number of teeth on the output gear has the additional effects of increasing the speed it turns the lens while reducing the torque (strength) of the motor/gear system. (it will either turn faster or not turn at all.) It is also possible to increase torque slightly by using a smaller gear which will turn the lens slower, but with slightly more force. As a special order, we can supply gears with even numbers of teeth anywhere between 36 and 100 teeth. Contact us with your diameter requirements.

Appendix A: miniDF v3 schematic and board.
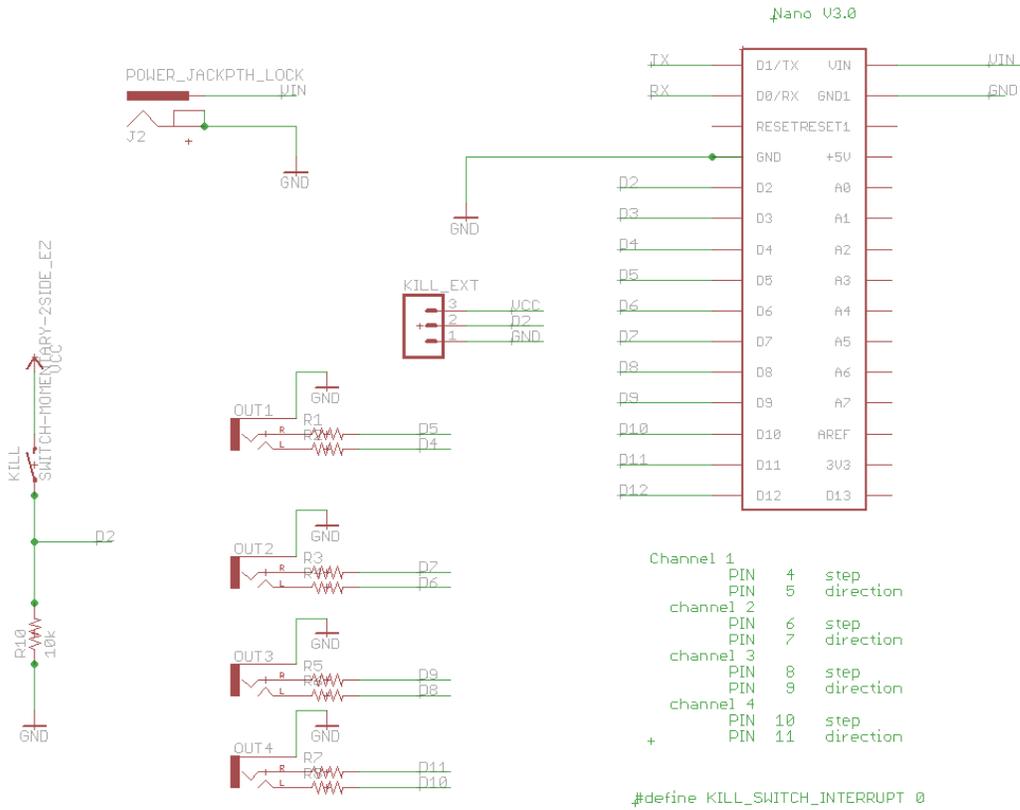
Schematic of the miniDF
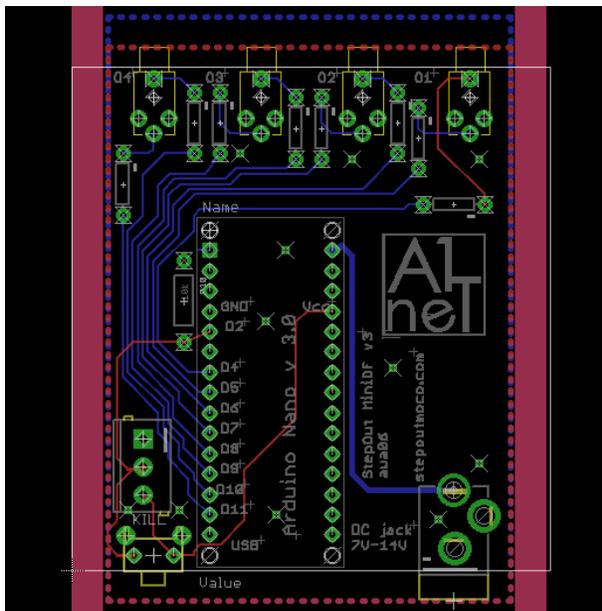
Minidf v.3 board layout

Appendix B: Arduino nano v3 and Arduino software.

In order to get more information about the arduino nano
General info: http://arduino.cc/en/Guide/ArduinoNano
Manufacturer page http://www.gravitech.us/arna30wiatp.html
Manual: http://site.gravitech.us/Arduino/NANO30/Arduino_Nano3_0.pdf

Arduino software (1.06 is the recommended release)

http://arduino.cc/en/Main/OldSoftwareReleases

Installation for the Mac OS

http://blog.iteadstudio.com/iteaduino-nano-driver-installation-manual-mac-os-x/

Installation for Windows

http://blog.rastating.com/installing-drivers-for-an-arduino-nano-in-windows/

Windows Drivers

http://www.ftdichip.com/Drivers/CDM/CDM%20v2.12.00%20WHQL%20Certified.zip

Appendix C: Installing DFmoco and DFremote.

The miniDF cames preinstalled with the DFmoco script revision 1.28, the latest available. In order to install or upgrade DFRemote (remote control) or DFMoco (motion control), you need the Arduino IDE installed (see appendix b). Also, yoy will need to install the drivers for the Nano V3. Start the Arduino IDE and select the location of the software. Make sure that the Arduino is connected via USB. Select the board Arduino nano v3 and upload the code.
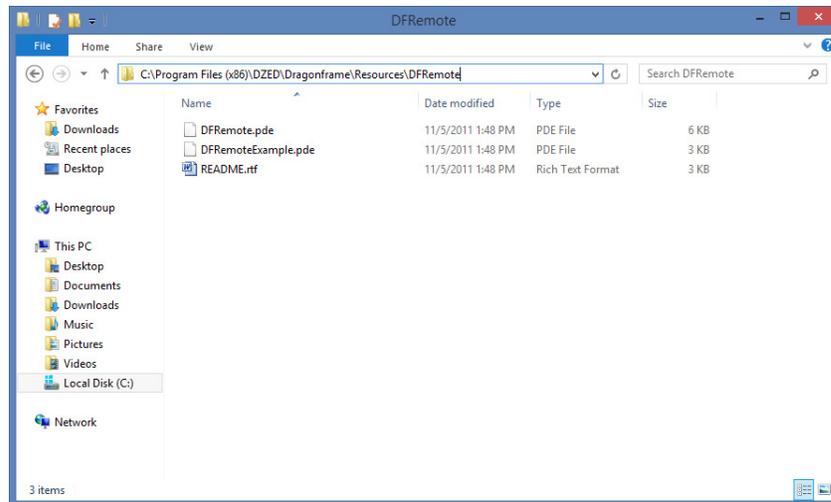
Location of DFremote
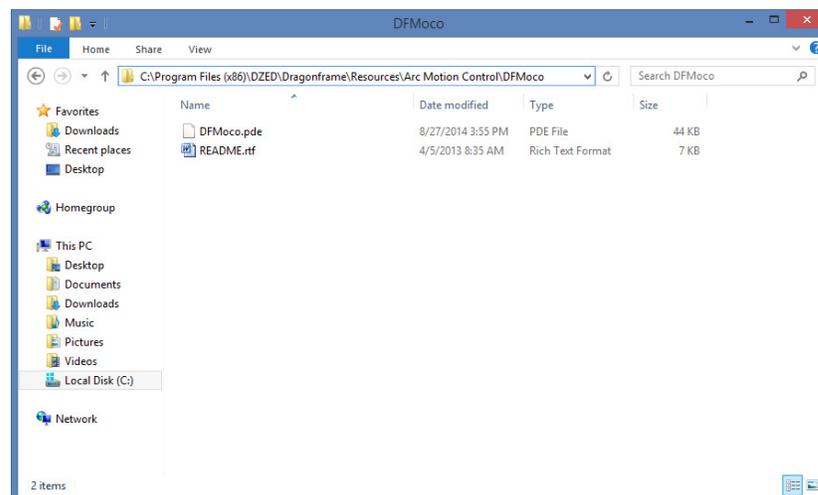
Location of DFmoco

Appendix D: Dragonframe serial interface.

Information from: http://www.dragonframe.com/arduino/serial.php

Serial Port Settings
Baud Rate   56000 kbps
Data Bits   8
Stop Bits   1
Parity   None

Messages to Control Dragonframe
Send these messages to Dragonframe to perform the specified actions.

Shoot   S [frame count][\r\n]
Delete D[\r\n]
Play/Stop   P[\r\n]
Go to Live   L[\r\n]

Messages from Dragonframe
Dragonframe sends these messages over the serial port.

Shooting Frame   SH [FRAME] [EXPOSURE] [EXPOSURE NAME] [STEREO INDEX][\r\n]
Deleting Frame   DE[\r\n]
Position Frame (Move to Frame)   PF [FRAME] [EXPOSURE] [EXPOSURE NAME]
[STEREO INDEX][\r\n]
Capture Complete   CC [FRAME] [EXPOSURE] [EXPOSURE NAME] [STEREO INDEX][\r\n]

Appendix E: DFRemote.

The dfRemote script can be loaded into the miniDF. Below is the example of the dfRemote code adapted to the miniDF. Each output of the miniDF has a current limiting resistor that provides 13 mA. All outputs can be high simultaneously without damaging the micro.

More information: http://www.dragonframe.com/moco-3d.php#arduino

```
/*
 * DFRemote example. Demonstrates DFRemote library.
 * In this specific example, pins 2 was wired as pushbuttons (active low).
 * Pins 5 is wired to Sainsmart 2 channel Relay board
   And wired to be trigger on high */

/* Modified to fir the miniDF */
/* v 1.0 20150117 */

// Create global object to communicate with Dragonframe
DFRemote df_remote = DFRemote();

/*
 * Arduino calls this function once, at the start of your program.
 */

void setup()
{
  // set up serial port to 57600 kbps
  Serial.begin(57600);

  /*
   * Activate one or more input pins, associating them with Dragonframe commands.
   */

  /*
    pins avaliable: (only for output)
    01: 4,5
    02: 6,7
    03 8,9
    04 10,11

      Kill switch: pin2 This is the only input pin available
*/

    // When input pin 2 goes LOW, send Dragonframe a SHOOT 1 frame command
  df_remote.activatePin(2, LOW, DF_SHOOT_CMD, 1);


  /*
   * Other commands are:
   *  DF_PLAY_CMD - toggles playback
```

```
 *   DF_LIVE_CMD - goes to live (also re-engages live view)
 */


 /*
* Configure output pins. This is optional, if you want to control
* another device (or just turn on an LED).
*
* The choice of output pins below was purely optional, but it corresponds
* to how they are used in the loop() function in response to DragonFrame messages.
*
* any pinn from 4 to 11 cab be used
 */

 pinMode(5, OUTPUT); // SHOOT SIGNAL
 digitalWrite(5, LOW);


}

//* Arduino calls this function repeatedly as the main program loop.
 */
void loop()
{
 // tell df to check for inputs and send messages to Dragonframe if needed
 df_remote.processPins();

 // read serial messages from Dragonframe
 int cmd = df_remote.processSerial();

 /**
  * The following examples take messages from Dragonframe
  * and turn a digital I/O pin high for 0.5 seconds.
  * You can take any action (or no action).
  */
 if (cmd == DF_SHOOT_MSG)
 { // Turn Relay on
  digitalWrite(5, HIGH);

 }
 if (cmd == DF_DELETE_MSG)
 {// Turn7 relay off
  digitalWrite(5, LOW);

 }


}
```

Appendix F: Dragonframe Arduino serial protocol.

Serial Port Settings
Baud Rate   56000 kbps
Data Bits   8
Stop Bits   1
Parity   None

Messages to Control Dragonframe
Send these messages to Dragonframe to perform the specified actions.

Shoot   S [frame count][\r\n]

Delete D[\r\n]

Play/Stop   P[\r\n]
Go to Live   L[\r\n]

Messages from Dragonframe
Dragonframe sends these messages over the serial port.

Shooting Frame   SH [FRAME] [EXPOSURE] [EXPOSURE NAME] [STEREO INDEX][\r\n]
Deleting Frame   DE[\r\n]
Position Frame (Move to Frame)   PF [FRAME] [EXPOSURE] [EXPOSURE NAME]
[STEREO INDEX][\r\n]
Capture Complete   CC [FRAME] [EXPOSURE] [EXPOSURE NAME] [STEREO INDEX][\r\n]

Appendix G: StepSlice schematic and board.
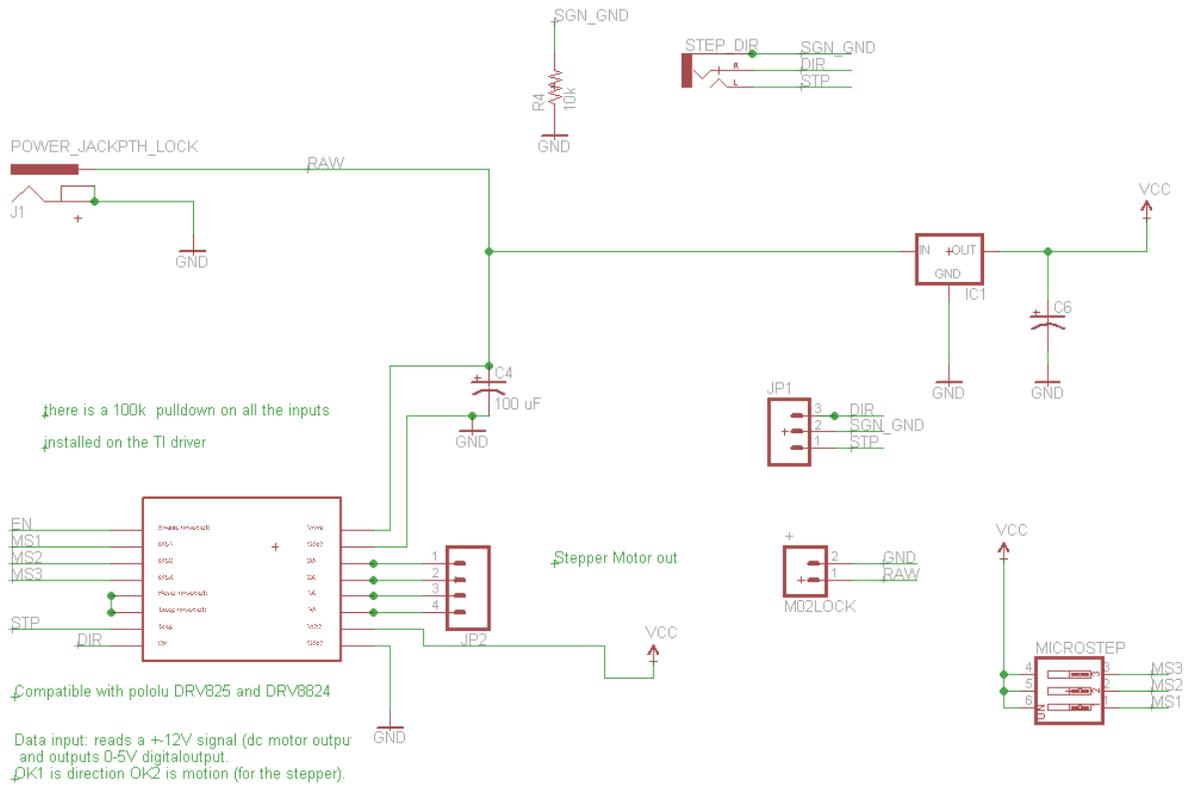
StepSlice awa09 schematic

StepSlice awa09 board