

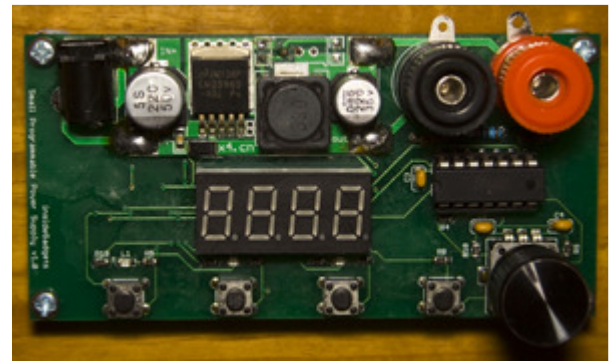
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Small Programmable Power Supply (SPPS) v1.0 Kit

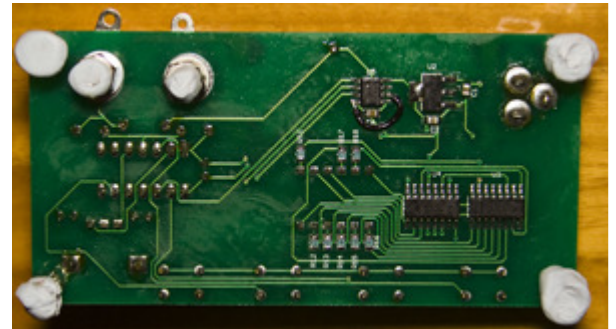
A small programmable power supply based on the LM2596 module found on Ebay.

An ATtiny44A controls the 4 digit LED segment display and features 3 programmable buttons with a rotary encoder with digital potentiometer to adjust the output voltage.

Auto calibration is supported in steps of 0.1-0.2V which means that one click of the rotary encoder equates to 0.1-0.2V change in output voltage (but higher steps occur due to design when you reach 5V and up).



* Colour of the LM2596 module may vary



Specifications

PCB Board: 100mm x 50mm

Input voltage: 12-15V

Output voltage: 1.8-12V



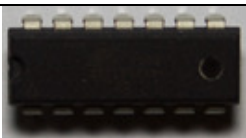
Ripple: under 70mVpp (no load), under 160mVpp to 4V (10 Ohms load), under 100mVpp (47 Ohm load)

Weight: 68 grams




Kit Contents

To assemble the kit you will require a soldering iron and solder.

To use the kit you will require a 12-15V power adapter such as those found on routers, network switches, etc.

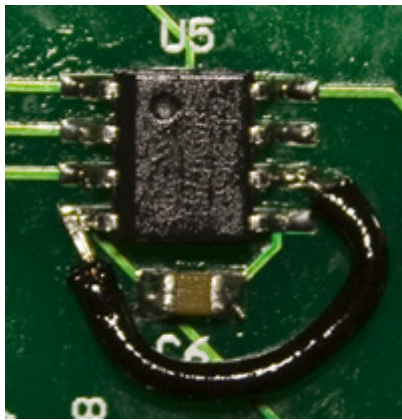
Picture	Name	Description	Qty
	PCB	SPPS v1.0 PCB	1
	LM2596	LM2596 Module (needs to be 4.2cm x 2cm and look as pictured otherwise it won't fit in place properly) *** Colour may vary between Blue/Green *** - (pre-soldered to PCB)	1
	U1	Atmel ATtiny44A 20MHz DIP - ATTINY44A-PU (Pre-programmed)	1

	U2	NCP LDO Regulator 3.3V 1% SOT223 (NCP1117ST33T3G)	1
	U3, U4	ST 74HC595 Shift Register SOP (M74HC595RM13TR)	2
	U5	Microchip Digital Potentiometer 10k 257-Position SOIC (MCP4152-103E/SN)	1
	R1	4.3K Resistor 1/4W 6.5mm (Yellow Orange Black Brown Brown)	1
	R2	1M Resistor 1/8W 3.6mm (Brown Black Green Gold)	1
	R3	39K Resistor 1/8W 3.6mm (Orange White Orange Gold)	1
	R4 – R10, R19 – R21	10K Resistor SMD 0805 (reads 1002)	10
	R11 - R18	1K Resistor SMD 0805 (reads 1001)	8
	C1, C2	4.7uF Capacitor SMD 0805 (thicker than the 0.1uF)	2
	C3 – C5	0.1uF Capacitor 2.54mm	3
	C6	0.1uF Capacitor SMD 0805	1
	DS	Four Hi-Red 0.36in CC 7-Segment LED Display (7FR3641AS)	1
	L1 – L3	Red LED SMD 0805	3
	S1 – S4	4.3mm Tactile switch	4
	S5	20mm Vertical encoder 24 Pulses 24 DET (EC12E24204A8)	1
	P1	2.0mm DC Power Male PC Mount 3P	1
	P2, P3	Red & Black Binding Posts	2
		14 Pin IC Socket	1

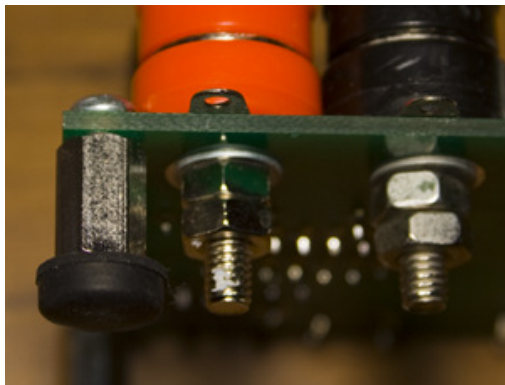
		Male header (pre-soldered to LM2596 module)	1
		Black Plastic Knob Round Control	1
		10mm M3 Hexagonal Standoff with screw	4

Build Instructions

1. Solder all the SMD packages first and then DIP packages.
2. Due to a design fault, please solder a wire on the digital potentiometer (U5) pin 4 to pin 6.



3. Attach the binding posts and the standoff posts to the PCB. For extra stability you can use small rubber feet or blu-tack on the stand offs.



Programming the ATtiny44 (optional)

This step is only necessary if you wish to update the firmware on the ATtiny44 or if you have replaced the chip. You will require a programmer such as the USBtinyISP and your programmer will need to be supported by the software called AVRDUDE -

<http://savannah.nongnu.org/projects/avrdude/>

Upload the \SPPS_v1.0\main.hex file to the ATtiny44 by running the following command:
 avrdude -p ATtiny44 -c usbtiny -U flash:w:main.hex

How to Use

Powering on

1. Unplug all devices from the outputs, this is because the LM2596 module can initially spike up to your power supply voltage.
2. Connect your power adapter and wait a second or two
3. Adjust the voltage by turning the knob

Using the programmable buttons

After powering on, select the programmable button you would like and the voltage will change to the previously stored value.

If you would like to program a new voltage to the selected button, once you reach your desired voltage, press the 4th button (closest to the knob) and the LED will blink a few times to confirm.

Resetting / disabling the calibration

When the power supply is used for the first time, the power supply will not be calibrated. This means that rotating the knob will directly increase or decrease the digital potentiometer's value which can be useful on the lower end of voltages, such as 1.8V to 3V.

To reset/disable the calibration:

1. Hold down the 4th button for a few seconds.
2. Press the second button and "RSET" will display on the screen.
3. Press the 4th button once more

Note: Your programmable buttons will be reset as well

Calibrating the power supply

By calibrating the power supply, this allows one step of the knob to equal a step of 0.1V. At the higher end (5V+), the steps will increase to 0.2V, 0.3V up to 0.8V.

1. Hold down the 4th button for a few seconds.
2. The text "CAL" will display on the screen, press the 4th button once more
3. The programmable button LEDs will light up and a few seconds later you will see them blink and the voltage start to increase
4. After 1 minute, you should see the text "DONE" appear on the display and the voltage will drop back down to the lowest setting

Note: Your programmable buttons will be reset as well

Example calibration information

Each step of the knob when turned would result in a change shown below.

Voltage	Change
1.74	
1.82	0.08
1.94	0.12
2.08	0.14

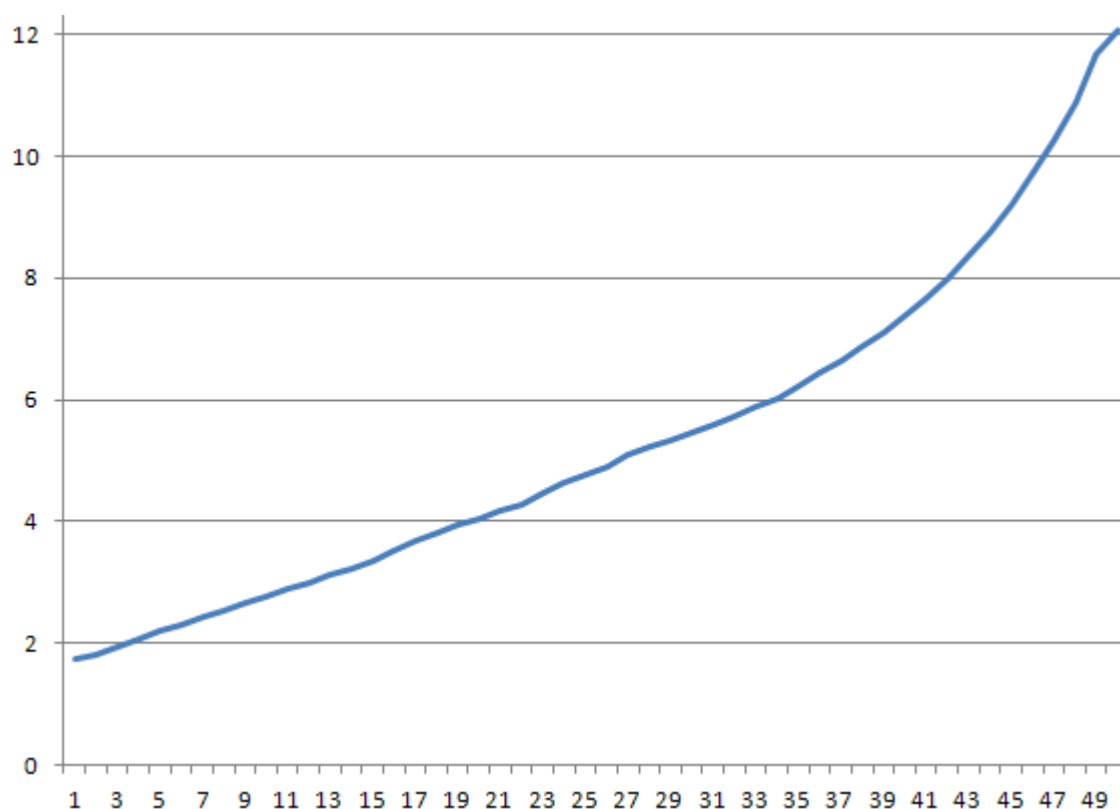
Voltage	Change
3.68	0.17
3.82	0.14
3.94	0.12
4.06	0.12

Voltage	Change
6.03	0.15
6.23	0.2
6.44	0.21
6.64	0.2

2.2	0.12
2.32	0.12
2.43	0.11
2.55	0.12
2.66	0.11
2.78	0.12
2.9	0.12
3.01	0.11
3.13	0.12
3.24	0.11
3.36	0.12
3.51	0.15

4.17	0.11
4.29	0.12
4.46	0.17
4.64	0.18
4.78	0.14
4.9	0.12
5.1	0.2
5.22	0.12
5.33	0.11
5.45	0.12
5.59	0.14
5.74	0.15
5.88	0.14

6.87	0.23
7.1	0.23
7.36	0.26
7.68	0.32
8	0.32
8.35	0.35
8.76	0.41
9.22	0.46
9.71	0.49
10.27	0.56
10.9	0.63
11.66	0.76
12.06	0.4



(Calibration steps when using a 12V supply)

Revision History

Rev. 1 – 11/05/2014

- Initial Revision

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