

USER MANUAL

10 Key - Stackmatch/Universal Controller v2

By S56WIX & S57TS & S550

SMCTL V2.0 Program v2.7– EN Version 1.1 • January 27, 2016

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0. INTRO

After finishing the SMCTL v1 with 3-6 keys we got into thinking what about the gadgets that needs more as 6 keys. So we changed some little things and we got to this 10 keys controller SMCTL v2. It's ideal for 1x10 antenna switches, k9ay look controller and it retains all other programs that were made in the SMCTL v1. (1x10, 12V switch, sj2w and 4o3a stackmatches). The controllers were not problematic even in heavy RFI environment and they worked well so far with every user. Special thanks to Tomaž S57TS for the programming, Matej S56WIX for the PCB and all the support and to my great crew @ S51A who always help me out.

Hope you enjoy this controller as it was made for!

Boštjan - Ian S55O

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2. CIRCUIT SPECIFICATIONS

The circuit contains 10 power outputs (6 unused) for controlling 12 volt relays with one common point. Outputs can be controlled positively by using a UDN2981A (or TD62783) with a common ground, or with a negative control, using a ULN2803A with common +12 V. The circuit lets you connect 10 push button switches and a PTT interlock (active when grounded). Pressing one of the push buttons will select the active outputs. When the PTT is grounded an interlock circuit prevents the user from switching between outputs when in transmit mode (PTT interlock / hot switch protection).

The circuit logic is controlled by an ATMEGA88 AVR microcontroller. The circuitry and software are designed to control the SJ2W and 403A stackmatches, however the microcontroller contains additional programs which enables the controller to be used for other switching purposes, such as a 10x1 antenna switch, 12V switch and K9AY receiving loop switching.

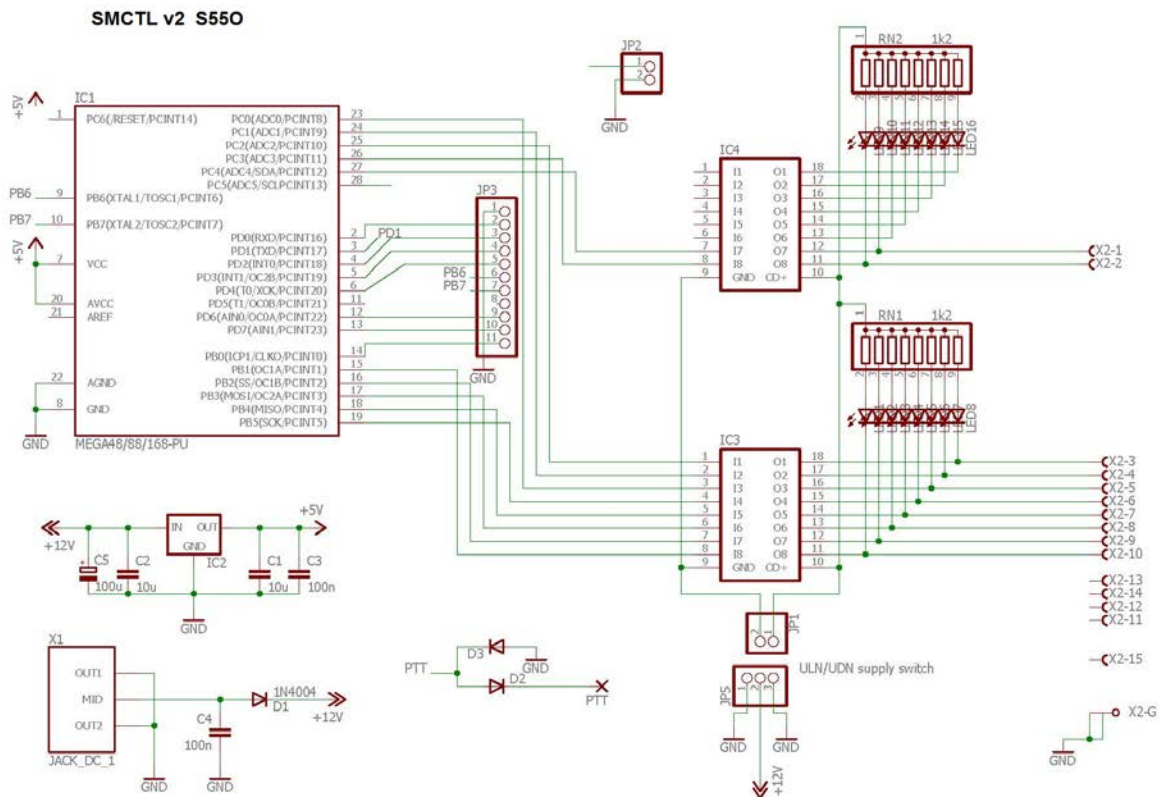
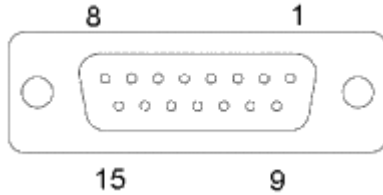


Figure 1: SMCTL v2 Schematic

3. OUTPUTS – DB15 PINOUT

DB15 Female:



DB15	General	Stackmatch SJ2W (prog 1)	Switch 1x10 (prog 2)	Switch on/off 12V (prog 3)	Stackmatch 4o3a (Prog 4)	K9AY 1 (Prog 5)	K9AY 2 (Prog 6)
1		K1	K1	K1	K1	LED1	LED1
2		K2	K2	K2	K2	LED2	LED2
3		K3	K3	K3	K3	LED3	LED3
4		K4	K4	K4	K4	LED4	LED4
5		LED1	K5	K5	LED1	K1	K1
6		LED2	K6	K6	LED2	K2	K2
7		LED3	K7	K7	LED3	R1	R1
8		STACK LED*	K8	K8	STACK LED*	R2	R2
9		-	K9	K9		R3	R3
10		-	K10	K10		PREAMP	PREAMP
11	-	-	-	-	-	-	-
12	GND	GND	GND	GND	GND	GND	GND
13	GND	GND	GND	GND	GND	GND	GND
14	GND	GND	GND	GND	GND	GND	GND
15	GND	GND	GND	GND	GND	GND	GND

* Optional

4. ULN/UDN

The UDN2981 is an 8 buffer LED/Relay driver with a Common Ground. The ULN2803 is an 8 Channel Darlington Driver. It is worth mentioning that the 2981 is not a pin for pin replacement for the 2803. The 0V and V+ at the bottom pins either side are reversed. Because of this difference it is necessary to correctly solder two jumpers (2 lines marked ULN/UDN on PCB) depending on the selected IC. The jumpers determine the potential of the common point (pins 12-15 on the DB15), and the orientation of LED diodes.

*ULN2803 is a SINKING Driver (Open Collector) - provides GND path to load

*UDN2981 is a SOURCING Driver - provides V supply path to load

5. PTT – HOT SWITCHING PROTECTION

There are two possible ways to configure PTT circuit for hot switching protection:

1. With a Diode 1N4148 on position D2, the D3 remains empty
2. With the appropriate resistor values (e.g. 10k) at D2 and 4V7 Zener diode on the position D3.

*Chose the best solution for your station PTT switching requirements.

6. PROGRAM – HOW TO CHANGE THE PROGRAM

The Microcontroller contains six programs, which can be selected by holding certain push button combinations during initial power up of the controller. The last program selected is stored in the EEPROM and is maintained even after the switching off of the controller.

The keys to be pressed are key **8 + PROGRAM KEY (1-6)**, that have to be **pressed during the initial power up**.

7. PROGRAM 1 - SJ2W STACKMATCH CONTROL

Program 1 (key 1+8)

Default position at startup is antenna A (or 1) is active.

SJ2W stackmatch control is the default program of the controller. This program can also be selected by holding down buttons 1 and 6 during initial power up of the controller. This control needs 3 push button switches (1, 2 and 3). Briefly pressing these buttons switches on/off all 3 antennas. Pressing a button for a longer time (more than 250ms) activates only the chosen antenna, other antennas are off.

Four LED diodes are soldered to the unused outputs (O5, O6, O7, O8) of the chip. The first 3 LEDs show the status of the individual antennas, whilst the fourth switches on when the UNUN is selected (ie, when more than one

antenna is selected). The fourth LED is optional; it is advisable to use a different colour to differentiate it from selected antennas (Caution: The LEDs do not show the actual switching of the relays, but only that an output is activated).

Keys connected to input 1-4, LED diodes have to be wired (output 5 to key 1, output 6 to key 2, output 7 to key 3 and output 8 for the stack LED (optional)). Other keys are not used (4-10) in this program.

[SJ2W](#) stackmatch and similar switching matrix:

SJ2W Stackmatch Ant combination	Relay				LED			
	A (K2)	B (K3)	C (K1)	K4/K5	A	B	C	STACK*
1	1	0	0	1	1			
2	0	1	0	1		1		
3	0	0	1	1			1	
1+2	0	0	1	0	1	1		1
1+3	0	1	0	0	1		1	1
2+3	1	0	0	0		1	1	1
1+2+3	0	0	0	0	1	1	1	1

* optional

8. PROGRAM 2 - ANTENNA SWITCH (1 TO 10 OUTPUTS)

Program 2 (key 2 + 8)

Default position at startup is antenna A (or 1) is active.

Up to 10 push button switches can be used. Pressing the appropriate button, switches on an individual antenna, the other antennas are off. Only one output is selected at any time

Up to 10 LED diodes are soldered to the same outputs as the antenna (O1, O2..... O6).

9. PROGRAM 3 - INDEPENDENT ON/OFF CONTROL SWITCH FOR 10 OUTPUTS

Program 3 (key 3 + 8)

Default position at startup is NO LED active.

This is actually a program that uses the controller as up to ten individual on/off switch for the appropriate output, where channels do not affect, one another.

Up to 10 LED diodes are soldered to the same outputs as the antenna (O1, O2..... O6).

10. PROGRAM 4 - 4O3A STACKMATCH CONTROL

Program 4 (key 4 + 8)

Default position at startup is antenna A (or 1) is active.

This control needs three keys (1, 2 and 3). Briefly pressing each button switches the antennas on/off. Holding a button for a longer period of time (more than 250ms) activates only the antenna chosen, other antennas are off.

Four LED diodes can be soldered to the IC's unused outputs (O5, O6, O7, O8). The first 3 LEDs show the status of the individual antennas, while the fourth shows when the UNUN is selected (i.e., when more than one antenna is selected). The fourth LED is optional; it is advisable to use a different colour to differentiate it from selected antennas. (Caution: The LED's do not show the actual switching of the relays, only that an output is activated.)

Keys connected to input 1-4, LED diodes have can be wired to the same outputs as the keys (1-4) or to the unused outputs (output 5 to key 1, output 6 to key 2, output 7 to key 3 and output 8 for the stack LED (optional)). Other keys are not used (4-10) in this program.

[4O3A](#) stackmatch (power splitters) switching matrix:

4O3A Stackmatch	Relay				LED			
	Ant combination	A (K1)	B (K2)	C (K3)	K4/K5	A	B	C
1	1	0	0	0	1			
2	0	1	0	0		1		
3	0	0	1	0			1	
1+2	1	1	0	1	1	1		1
1+3	1	0	1	1	1		1	1
2+3	0	1	1	1		1	1	1
1+2+3	1	1	1	1	1	1	1	1

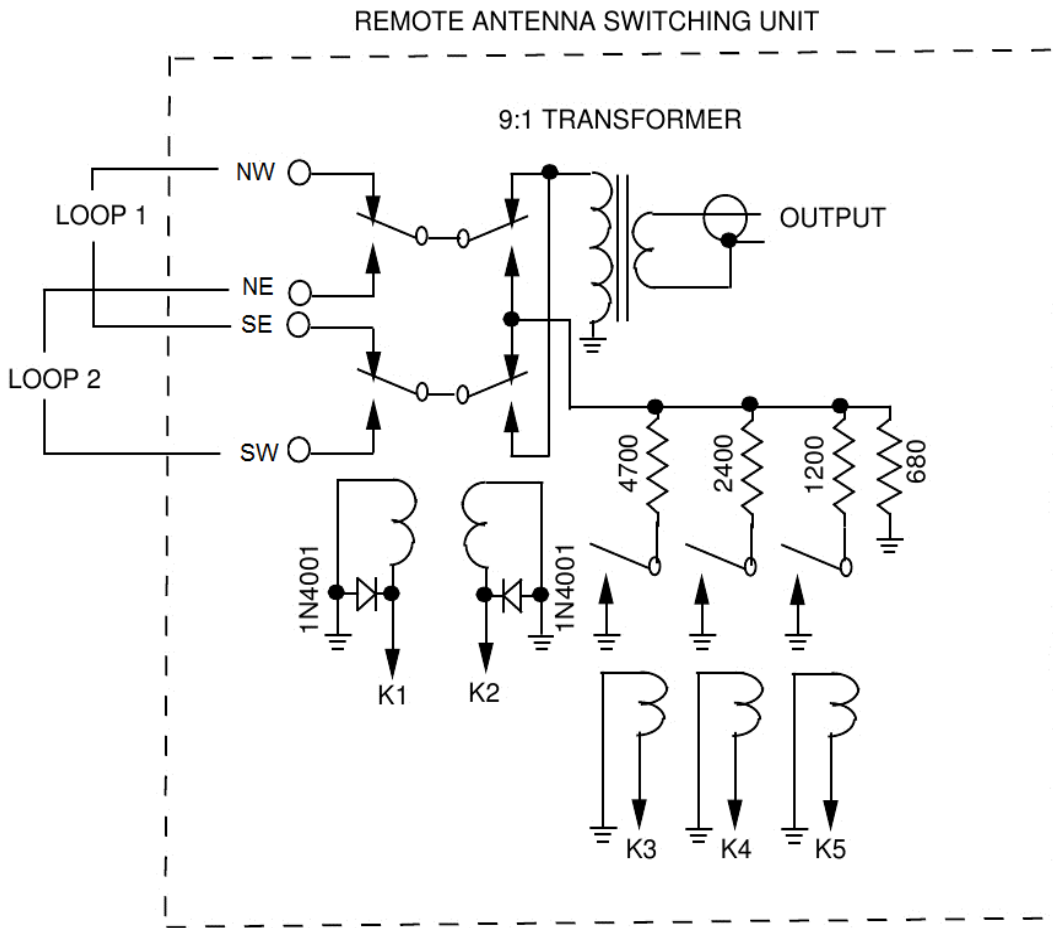
* optional

11. PROGRAM 5 - K9AY 1 – ORIGINAL ON4UN/OK1RR/FAR CIRCUITS

Program 5 (key 5 + 8)

Default position at startup is key 1 active.

This program is made for the original Far Circuits remake of the ON4UN K9AY controller.



(Pic from <http://www.ok1rr.com/index.php/antennas/32-a-control-box-for-the-k9ay-loop-antenna>)

This control needs all 10 keys.

First 4 outputs (1-4) are for LED showing the direction of the K9AY loop.

Outputs 5 and 6 are for the driving of the direction relay (DPDT relays)

Keys 1-4 are for choosing different direction (combinations of the outputs 5 and 6 of the k9ay relays)

Keys 5-9 are for **different combinations of the 4 resistors** (5 being the lowest 341 Ohm, to 9 being the highest 680 Ohm). When you press one of the keys 5-9 the others are turned off.

Key 10 is an on/off switch intended for preamp on/off.

LEDS 1-4 shows the direction used (combination of outputs 5 and 6).

LEDS 5-6 shows the combination of outputs of the relays (you can leave these unconnected).

LEDS 7-9 shows the combination of the R (keys 5-9).

		LED SMER				dpdt	dpdt		R 1 4700 Ohm	R 2 2400 Ohm	R 3 1200 Ohm		Preamp
	Relay	NW	SE	NE	SW	K1 Relay	K2 Relay		K3	K4	K5		12V+
	Output Db15 (pin)	1	2	3	4	5	6		7	8	9		10
Key	Direction												
1	NW	1				0	0	loop1					
2	SE		1			0	1	loop1 - reverse					
3	NE			1		1	0	loop 2					
4	SW				1	1	1	loop 2 - reverse					
5	R1 comb								1	1	1	341 ohm	
6	R2 comb								1	0	1	397 ohm	
7	R3 comb								1	1	0	476 ohm	
8	R4 comb								1	0	0	594 ohm	
9	R5 comb								0	0	0	680 ohm	
10	Preamp												1

12. PROGRAM 5 - K9AY 2 – SINGLE SWITCHES FOR RESISTOR RELAYS

Program 6 (key 6 + 8)

Default position at startup is key 1 active.

This program has a different application for the resistor relays as the K9AY program 1.

This control needs all 10 keys.

First 4 outputs (1-4) are for LED showing the direction of the K9AY loop.

Outputs 5 and 6 are for the driving of the direction relay (DPDT relays)

Keys 1-4 are for choosing direction of the antenna (but they use outputs 5 and 6 only – outputs 1-4 are for the LEDs)

Keys 5-9 are **individual on/off switch** for the appropriate output, where channels do not affect, one another for the resistor relays.

Key 10 is an on/off switch intended for preamp on/off.

LEDS 1-4 shows the direction used (combination of outputs 5 and 6).

LEDS 5-6 shows the combination of outputs of the relays (you can leave these unconnected).

LEDS 7-9 shows the combination of the R (keys 5-9).

		LED DIRECTION				dpdt	dpdt		R1 4700 Ohm	R2 2400 Ohm	R3 1200 Ohm	Preamp
		Relay	NW	SE	NE	SW	K1 Relay		K2 Relay	K3	K4	K5
	Output Db15 (pin)	1	2	3	4	5	6		7	8	9	10
Key	Direction											
1	NW	1				0	0	loop1				
2	SE		1			0	1	loop1 - reverse				
3	NE			1		1	0	loop 2				
4	SW				1	1	1	loop 2 - reverse				
5	R1								1			
6	R2									1		
7	R3										1	
8									0	0	0	
9	Same as key 8								0	0	0	
10	PREAMP											1

13. CONSTRUCTION

Warning, construction differs (LED wiring) if you want to use it for different programs and different chips UDN or ULN!!!

COMMON TO ALL:

- Solder all 4 of the SMD capacitors on to the underside of the PCB. Be careful to correctly orientate the tantalum capacitor (dark smd). The silver bar on the tantalum is oriented to the + on the PCB
- Solder the non-SMD parts and two jumpers (e.g. cut off legs of the 1N4148). When soldering the resistor network makes sure it is correctly positioned (dot indicates pin 1).
- Position the 78L05 so the flat part of the 78L05 is in line with the bold line on the PCB.
- The holes for D2 (1N4148) are less than optimally spaced for the diode. The diode will sit a few mm off the surface of the PCB.
- Mount the Microcontroller on a 20 pin DIL socket.
- The UDN2981A (or TD62783) or ULN2803A can be mounted on an 18pin DIL socket or alternatively solder directly to the PCB.
- Finally solder the push buttons, LED's, PTT interlock components (optional) and the power connector, all of which are connected to the circuit via wires. Proper placement of LED's is marked on the circuit - see Figure 3. PTT is marked on the circuit, adjacent to the GND holes bottom right of the PCB.

STACKMATCH SJ2W:

- Wire LED 1, LED 2, LED 3 to the output positions 5, 6, 7, since the matrix for the relays is not the same as the matrix for the LED display

STACKMATCH 403A:

- Wire LED 1, LED 2, LED 3 to the output positions 1,2,3 OR 5, 6, 7, since the matrix for the relays is the same as the matrix for the LED display

1X10 ANTENNA SWITCH OR 1X10 12V SWITCH:

- Wire LED 1, LED 2, LED 3,... LED10 to the output positions corresponding the same output

K9AY 1 PROGRAM:

- Wire LED 1, LED 2, LED 3 and LED4 to the output positions corresponding the same output (1-4)
- LED 5 and 6 if wired show the combinations of the relays K1 and K2 (not recommended to wire)

- LEDS 7-9 show the different combinations as described in the program of the R relays (combinations changes when pressing different R keys (5-9).
- LED 10 shows the status of the output 10 (PREAMP)

K9AY 2 PROGRAM:

- Wire LED 1, LED 2, LED 3 and LED4 to the output positions corresponding the same output (1-4)
- LED 5 and 6 if wired show the combinations of the relays K1 and K2 (not recommended to wire)
- LEDS 7-9 show the status of R relays independently (combinations changes when pressing different R keys (5-7). Keys 8 and 9 make all the R relays go OFF (outputs 5-7 are 0).
- LED 10 shows the status of the output 10 (PREAMP)

14. FINISHED CONTROLLER

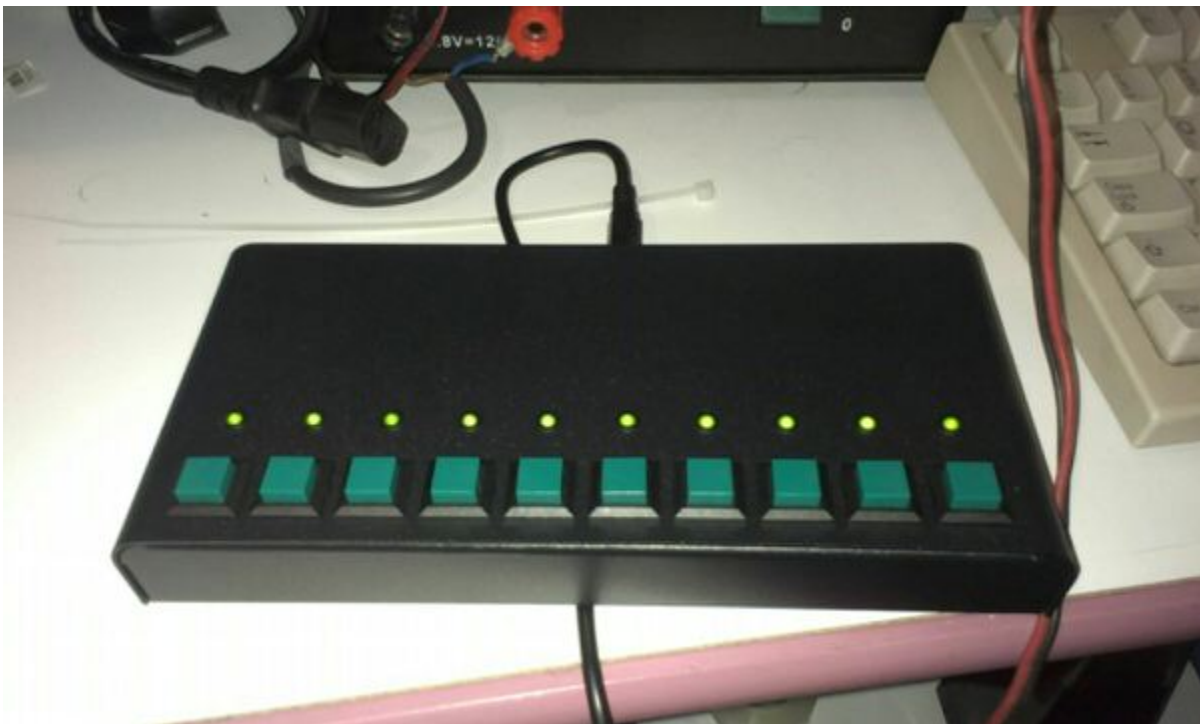
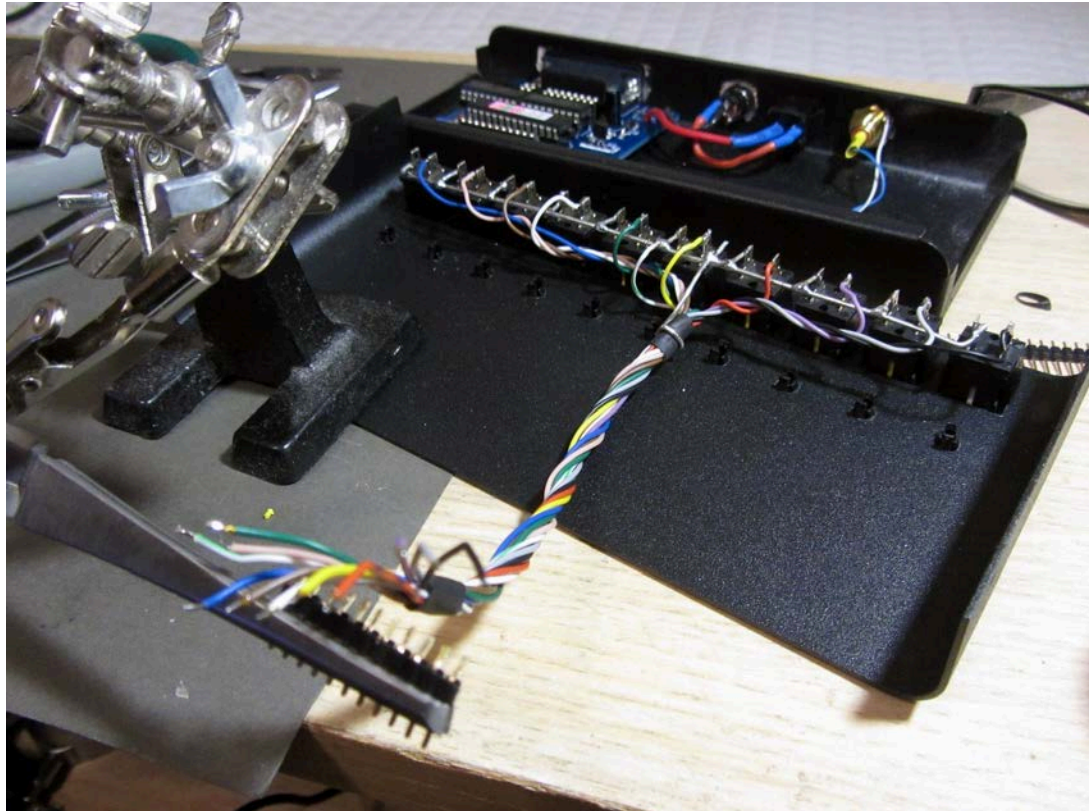
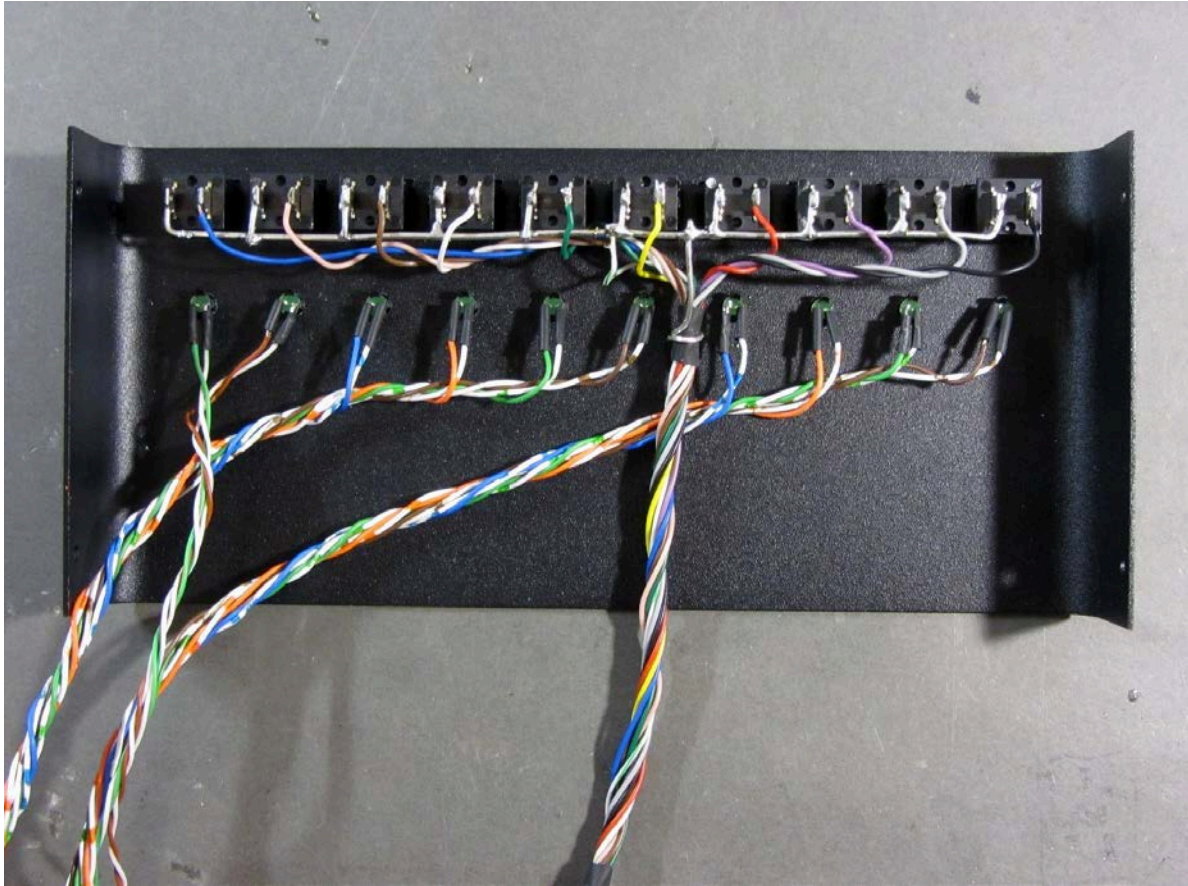
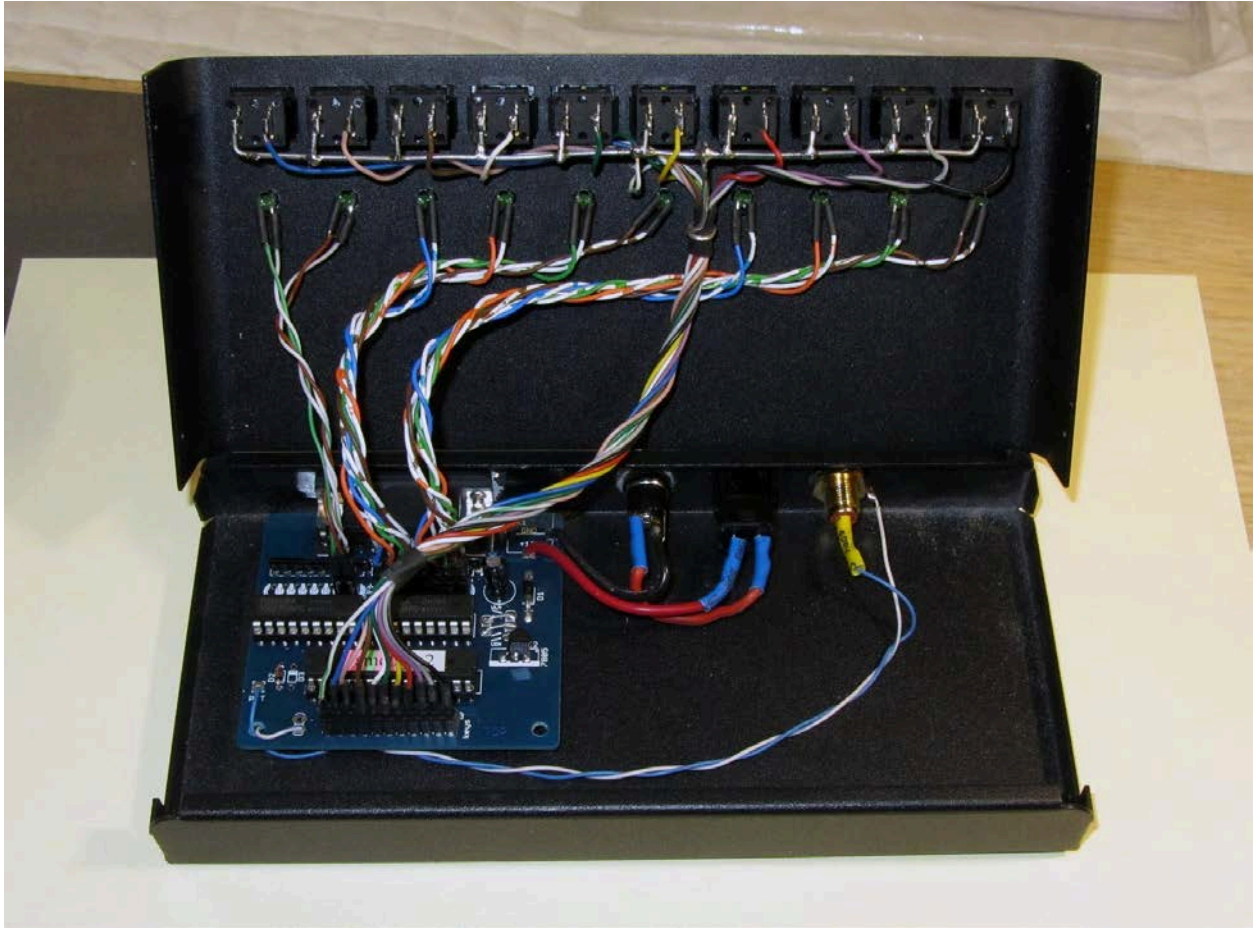


Figure 2: Finished controller







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