USER MANUAL

Stackmatch/Universal Controller

By S56WIX & S55O

SMCTL V1.0 Program v1.2– EN Version 1.4 ● June 16, 2014

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0. INTRO

Doesn't everyone hate it when, while using a turn-knob antenna switch you get the wrong antenna or wrong stack position? I did! So thanks to Matej S56WIX and Aleš S59MA we succeeded in finishing this simple controller project, which I hope will help some hams get rid of the same problem and improve the antenna switching process. Seldom hams improve their operating posts and IMHO most of the hams have a 10-20% margin of improvement there. This is a simple controller that was made to satisfy our needs at the S53APR or S51A station.

My thanks for the redaction of this manual and the layout goes to Collin GM0RLZ.

Best of luck and hope to hear you on the bands!

Boštjan – Ian S55O

1. CIRCUIT SPECIFICATIONS

The circuit contains 8 power outputs 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 6 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 ATtiny26 AVR microcontroller. The circuitry and software are designed to control the SJ2W stackmatch, however the microcontroller contains three additional programs which enables the controller to be used for other switching purposes, such as a 6x1 antenna switch.

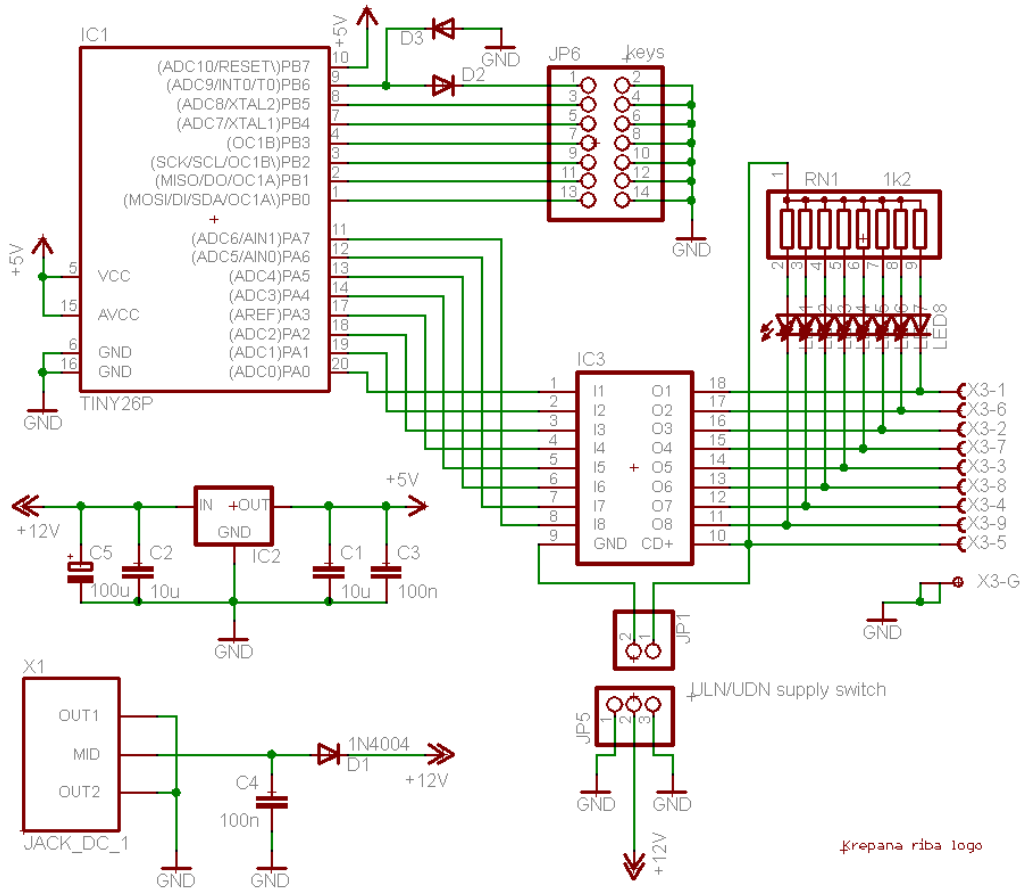


Figure 1: smctl Schematic

2. OUTPUTS

DB9	General	Stackmatch SJ2W (prog 1)	Switch 1 to 6 (prog 2)	on/off 12V (prog 3)	Stackmatch 4o3a (Prog 4)
1	Output 1	Relay 1	Relay 1	Relay 1	Relay 1
2	Output 3	Relay 3	Relay 3	Relay 3	Relay 3
3	Output 5	(LED ant A (K2))*	Relay 5	Relay 5	(LED ant A (K2))*
4	Output 7	(LED ant C (K1))*			(LED ant C (K1))*
5	Common Point	GND (UDN)	GND (UDN) or Vcc (ULN)	GND (UDN) or Vcc (ULN)	GND (UDN)
6	Output 2	Relay 2	Relay 2	Relay 2	Relay 2
7	Output 4	Relay 4	Relay 4	Relay 4	Relay 4
8	Output 6	(LED ant B (K3))*	Relay 6	Relay 6	(LED ant B (K3))*
9	Output 8	(LED UN-UN)*			(LED UN-UN)*

* Optional

3. 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 (pin 5 on the DB9), 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

4. 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.

5. PROGRAM

The Microcontroller contains four 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 source code is available at:

http://lea.hamradio.si/~s56wix/smctl/smctl_v1.1.zip

6. SJ2W STACKMATCH CONTROL

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 400ms) 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).

7. ANTENNA SWITCH (1 TO 6 OUTPUTS)

The antenna switch program is selected by holding down buttons 2 and 6 during power up of the controller. Up to 6 push button switches can be used. Pressing the appropriate button, switches on an individual antenna, the other antennas are off.

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

8. INDEPENDENT ON/OFF CONTROL FOR 6 OUTPUTS

The independent on/off control program is selected by holding down buttons 3 and 6 during power up of the controller

Electrically identical to the previous program, only the buttons function as an on/off switch for each output, where channels do not affect, one another.

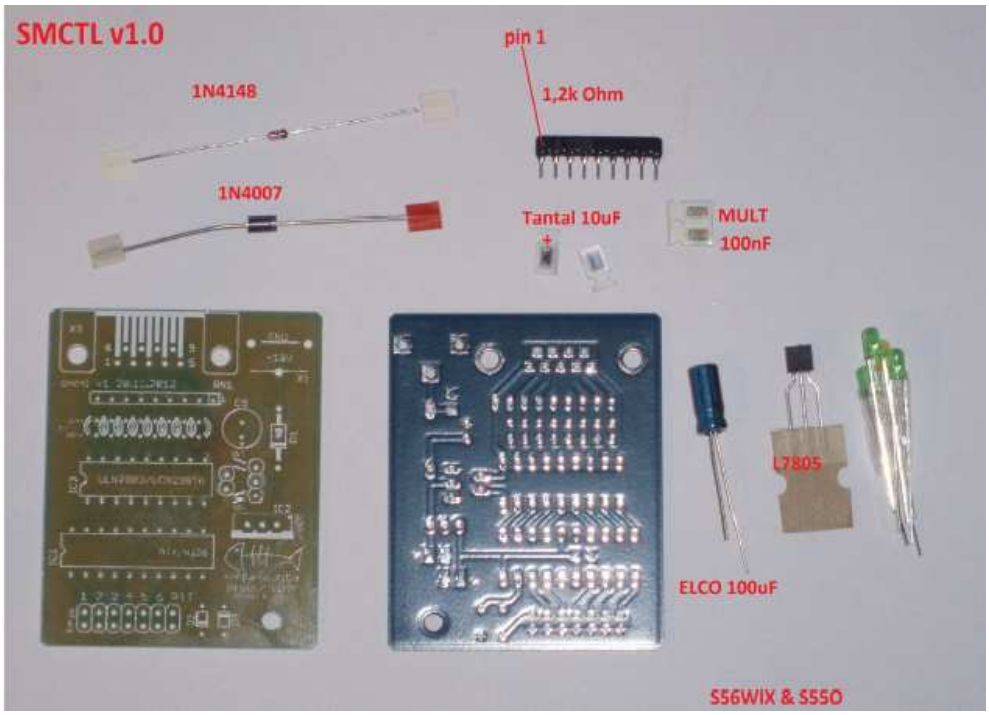
9. 4O3A STACKMATCH CONTROL

The 4O3A stackmatch control is activated by holding down buttons 4 and 6 during power up of the controller.

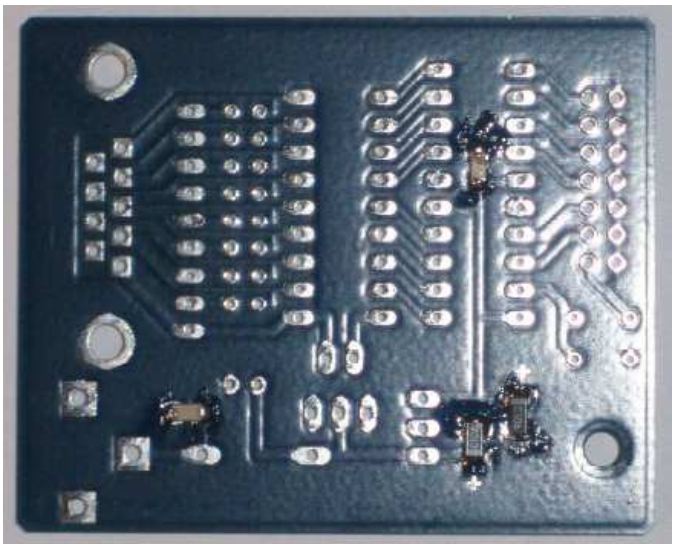
This control needs three buttons (1, 2 and 3). Briefly pressing each button switches the antennas on/off. Holding a button for a longer period of time (more than 400ms) activates only the antenna chosen, other antennas are off.

Four LED diodes are 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.)

10. CONSTRUCTION



- 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.
- 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.

11. FINISHED CONTROLLER

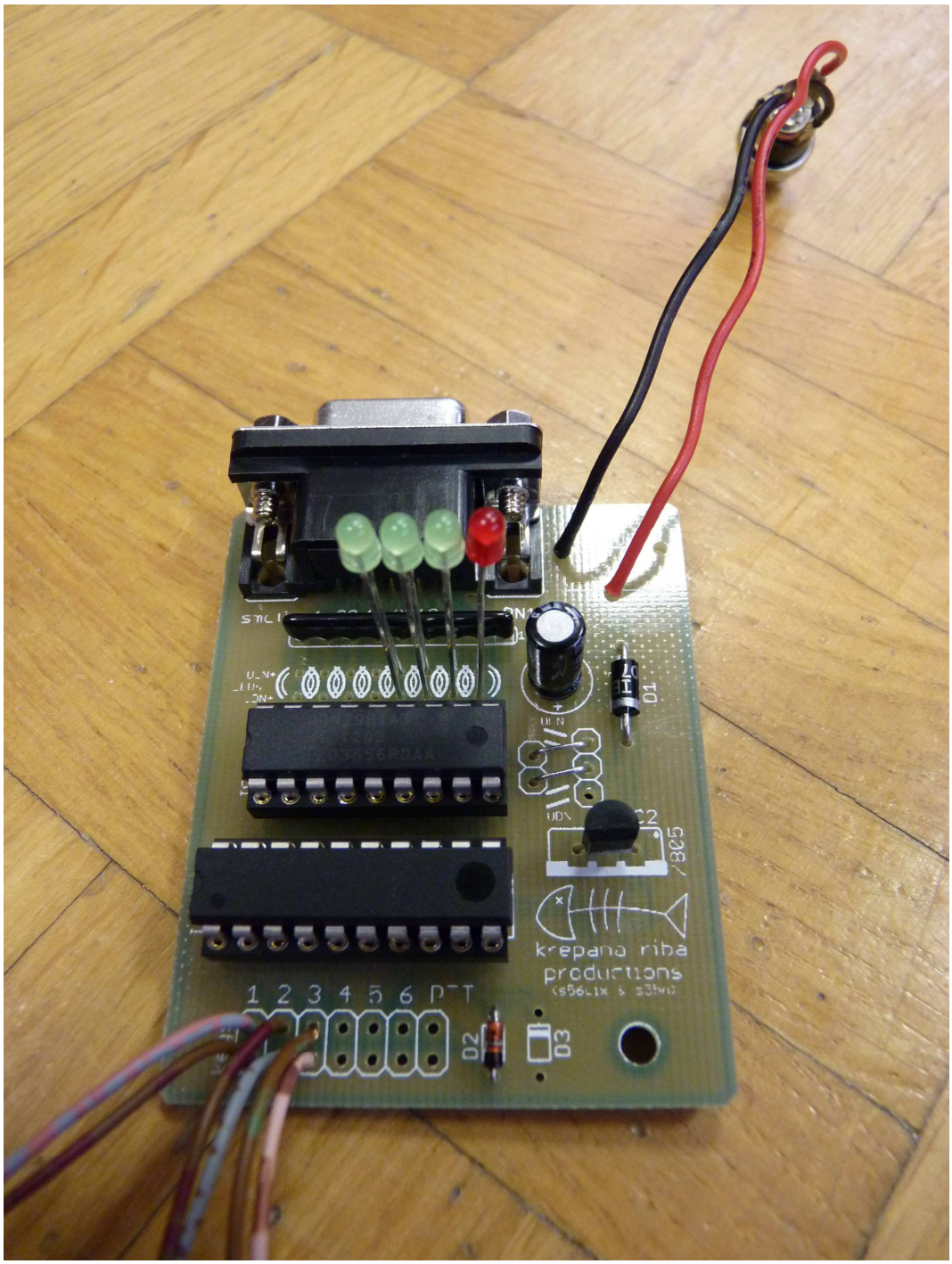


Figure 2: Finished controller

12. ARTWORK

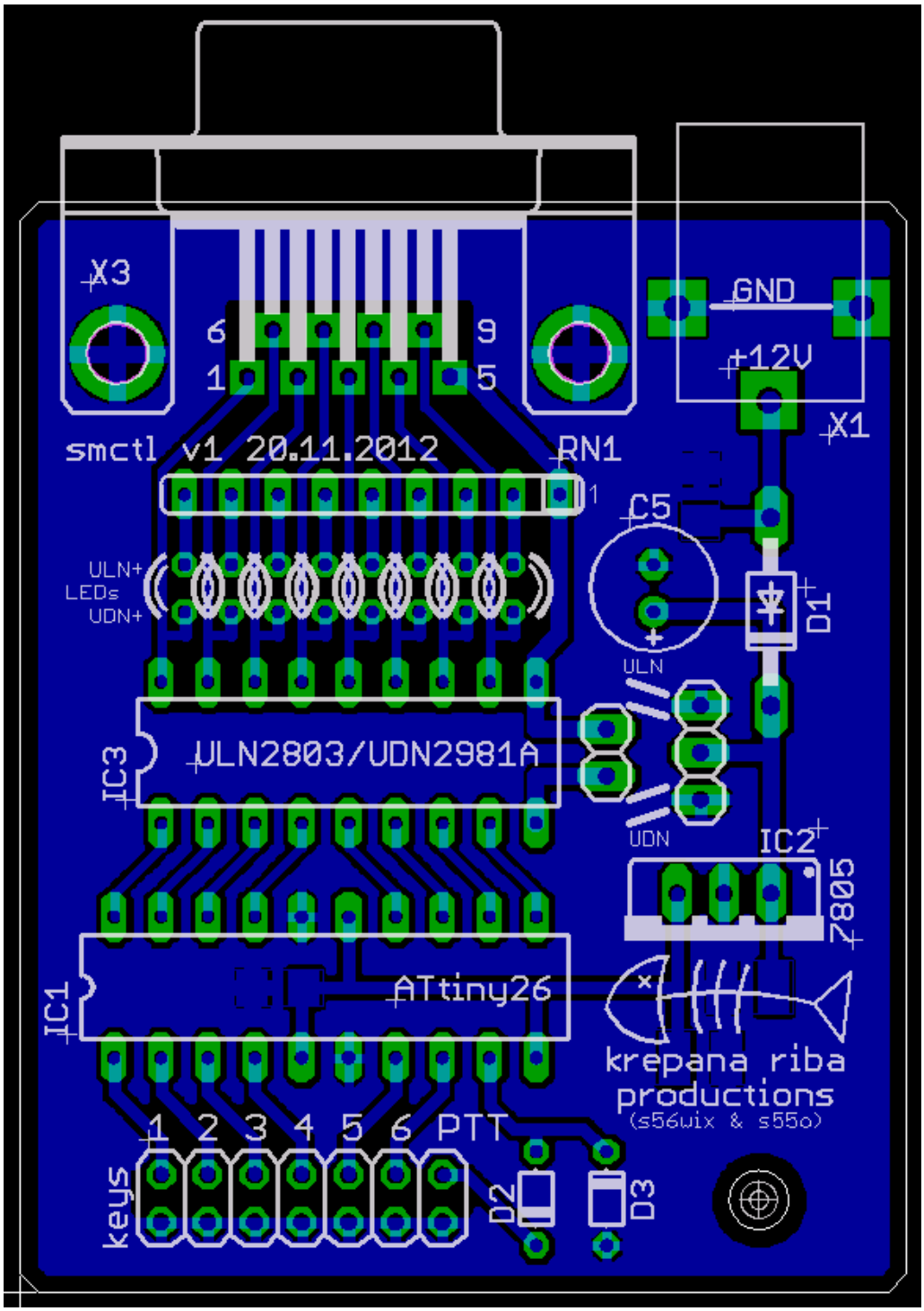


Figure 3: PCB artwork copper layer and silkscreen overlay

13. DB9 PINOUT

Cable link to Stackmatch SJ2W and SMTCL

SJ2W pinout to connect with relays

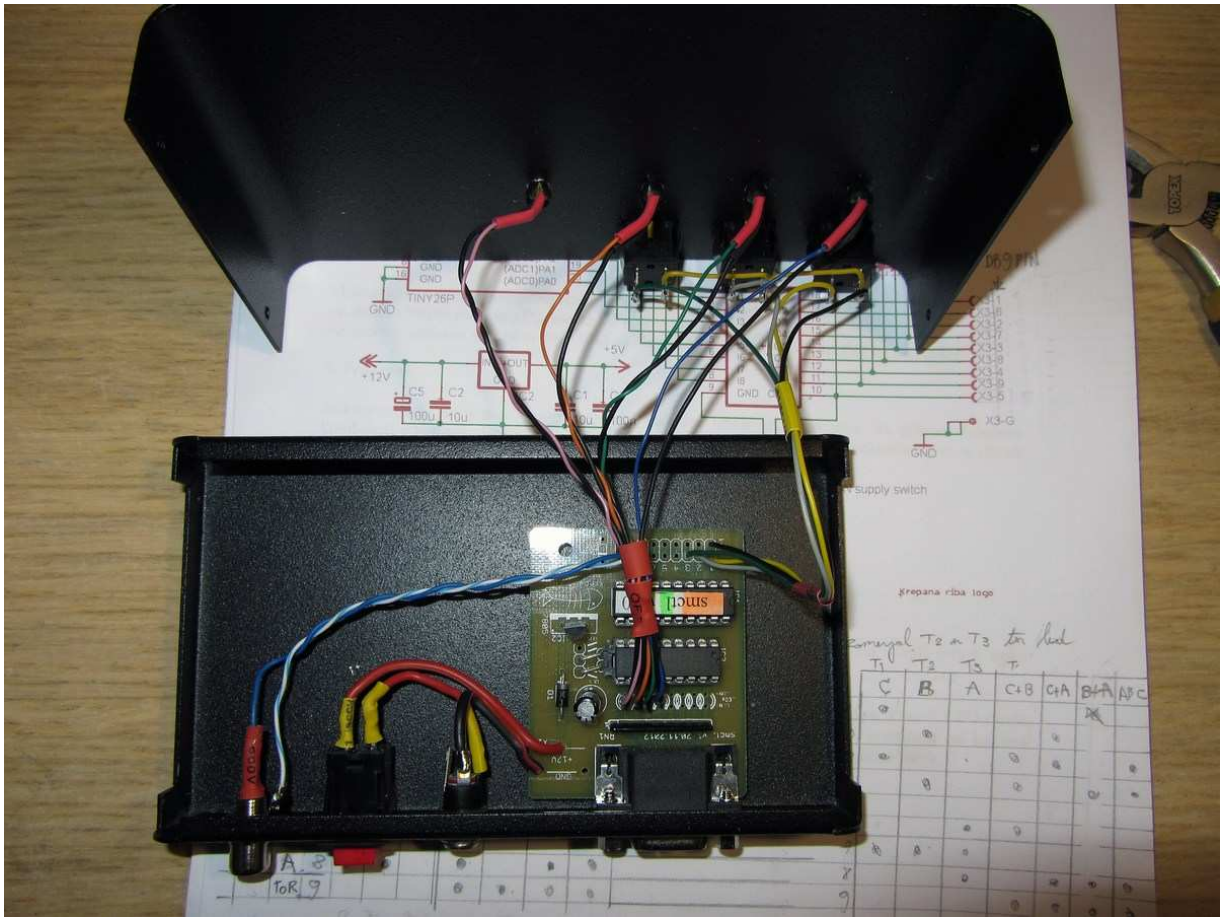


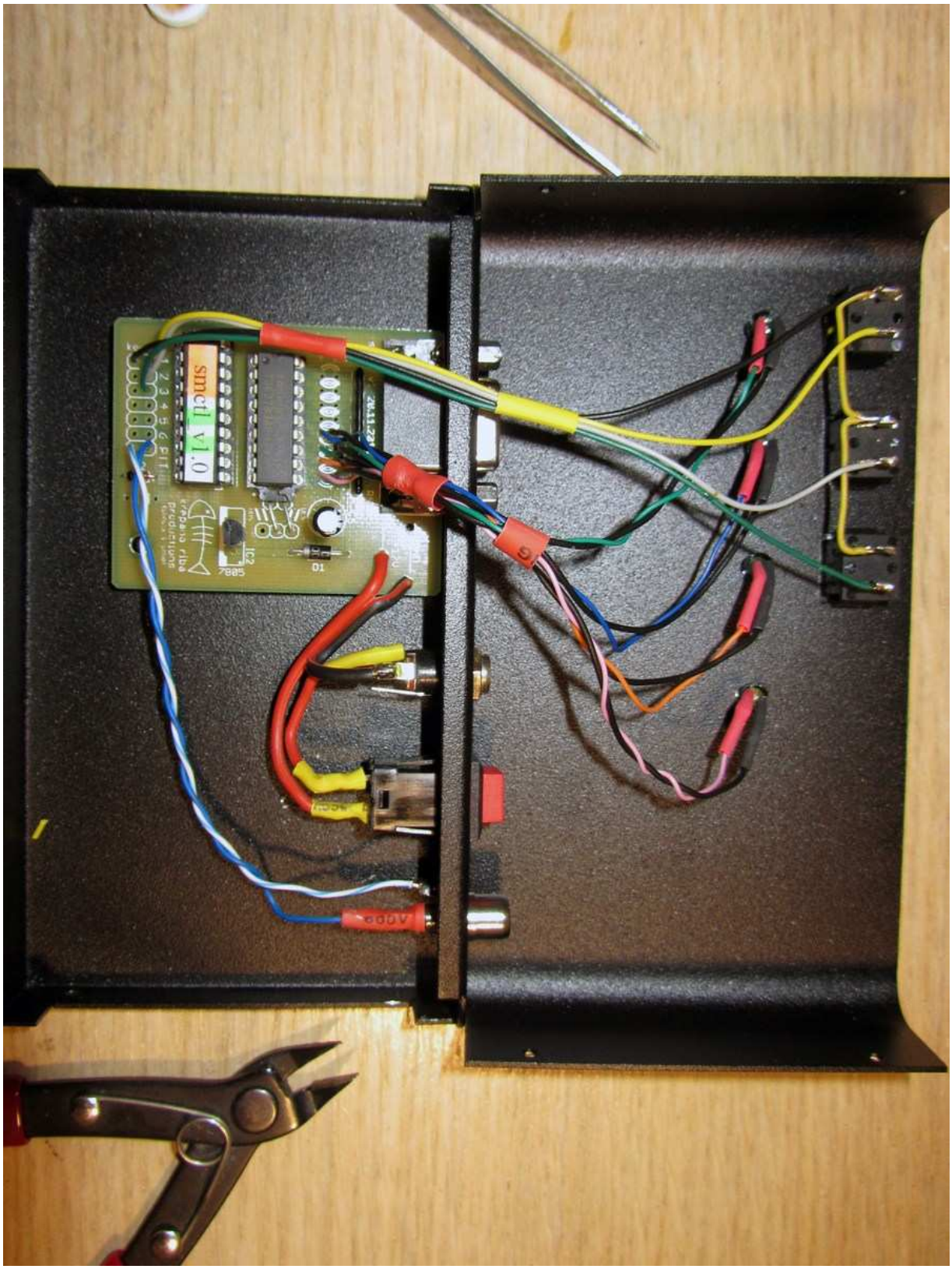
DB9	General.	Stackmatch SJ2W (prog 1)	Optional for Stackmatch-LED (3mm) + 1,2 k Ohm resistor inside the RF part of the Stackmatch
1	Output 1	Relay 1	
2	Output 3	Relay 3	
3	Output 5		LED – antenna A
4	Output 7		LED – antenna C
5	Common Point	GND (UDN)	
6	Output 2	Relay 2	
7	Output 4	Relay 4	
8	Output 6		LED – antenna B
9	Output 8		LED – toroid (UN-UN transformer)

- Optional LED's can be placed at the antenna sockets of the RF part to indicate that the stackmatch is working correctly. This will aid installation and any maintenance.
- When installing the LEDs in the stackmatch a 1.2 K Ohm resistor is required for each LED and is attached to ground (GND) common point 5, Db9 connector. The operation of the stackmatch is not affected.

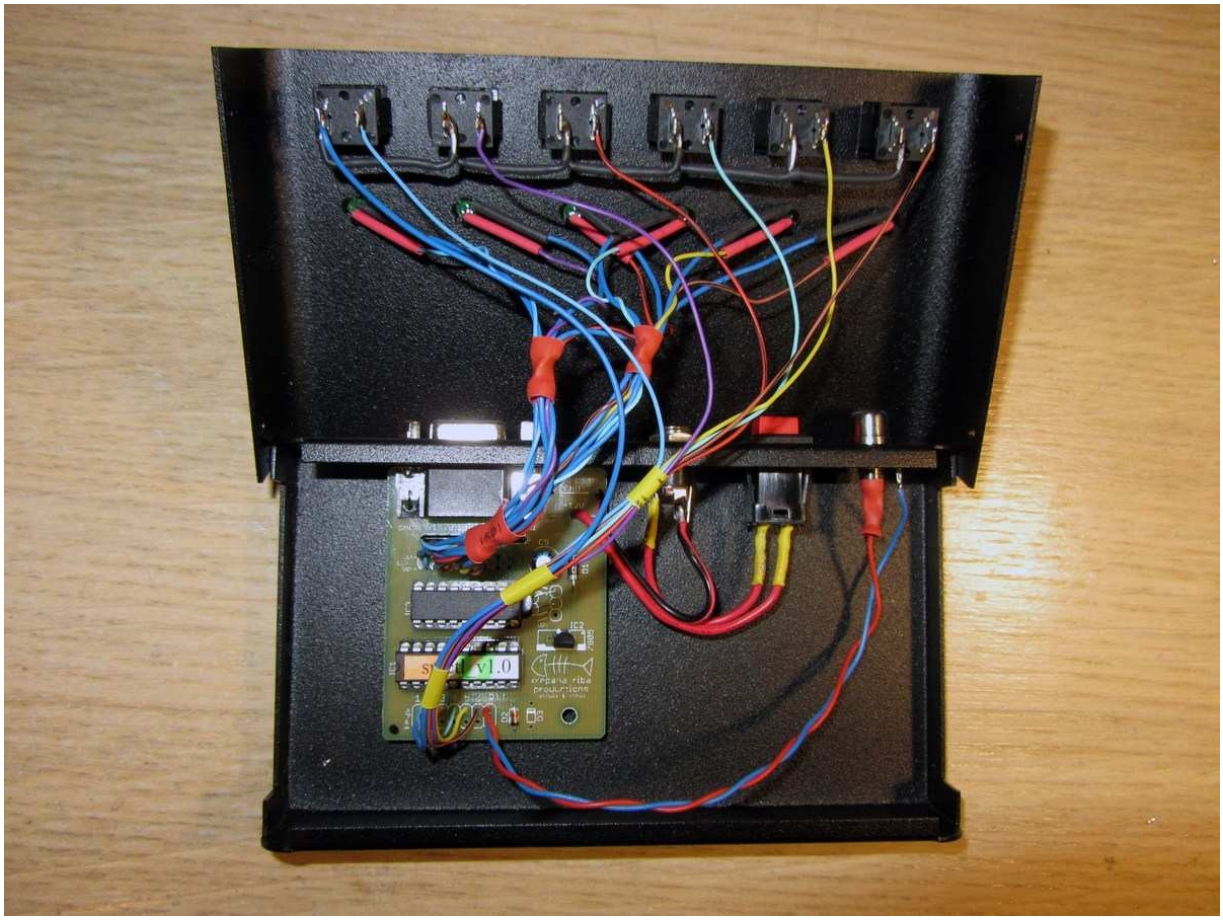
14. PICTURES OF WIRING

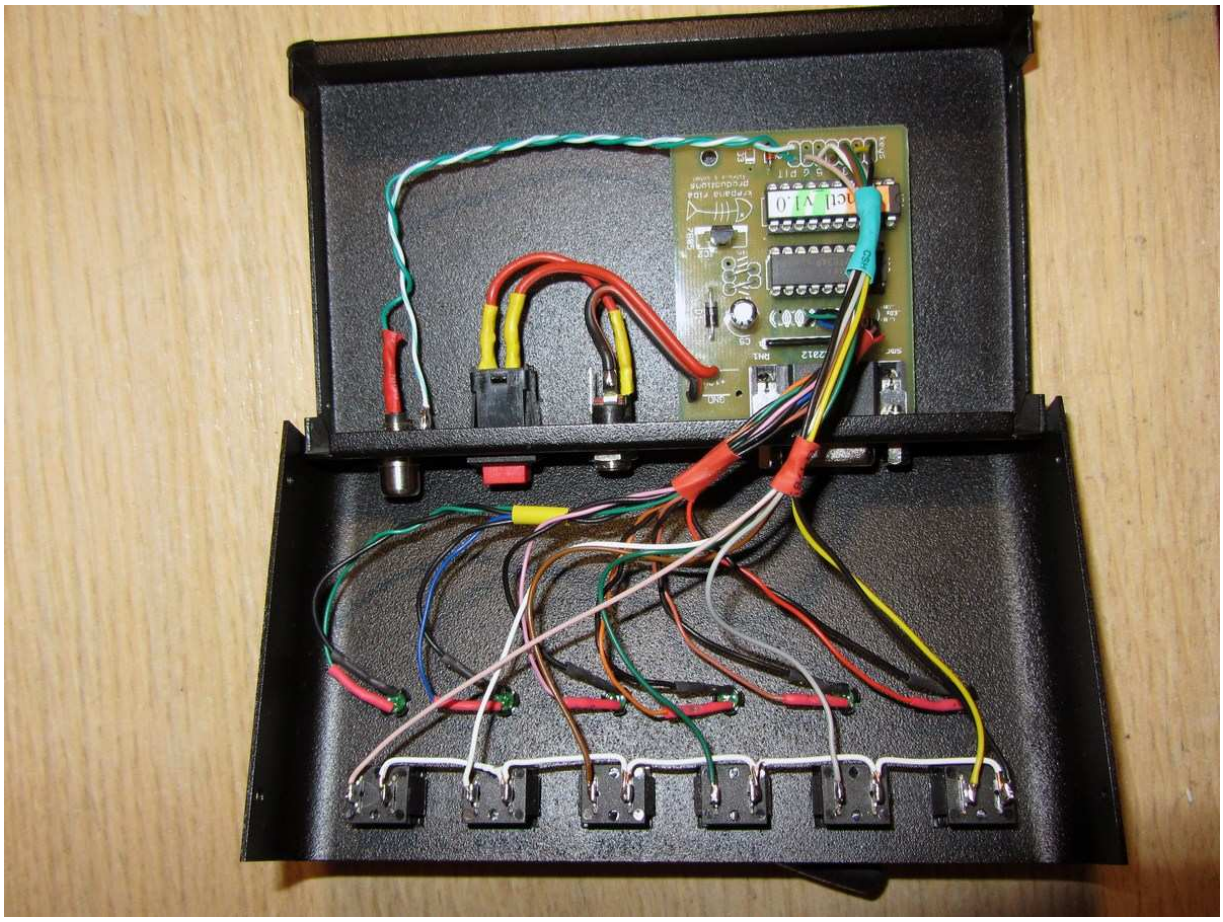
Wiring of the **smtcl with 3 keys** (sj2w and 4o3a stackmatch)




smctl v1.0

Wiring of the **smtcl with 6 keys** (1x6 switch, 12V on/off)





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