

Vintage Avionics Controls Emulator

March 2014

Demonstrating vintage avionics requires a lot of resources, which are often difficult to find. One is the control panel, with an unusual connector and very specific coded switches to select the frequency and other settings.

Therefore, I decided to make a universal control panel, consisting of a USB-to-relay interface board and PC based software to emulate transceivers from the fifties and sixties. The supported transceivers are the AN/ ARC-27, ARC-44, ARC-51, ARC-52, ARC-54, ARC-73 and ARC-131.

The ARC-34 is not supported, its frequency is set with potmeters, not with digital contacts.

USB interface

An USB sub-board was used from http://electronics-diy.com/USB_IO_Board.php

They have a set of drivers (free) which makes the interface show up as a serial port. I wrote a VisualBasic exe which shows a live picture of any supported control panel, and drives the relays. Both the sourcecode and the exe will be free.

Relay interface

The 15x10 cm board has 24 single-pole relays, and two variable resistors for squelch-, and volume if required. All relays are controlled via an USB interface by special PC software. Each relay has a single change-over contact, rated 8A at 30Vdc, the coil rating is 24Vdc / 17 mA = 1400 Ω

- 20 relays are pre-wired with the make-contact connected to ground,
- 4 relays are pre-wired with the mother-contact connected to ground.

The relay contacts are pre-wired on the circuit board, only small additions must be added by hand, depending on the avionics set to be controlled.

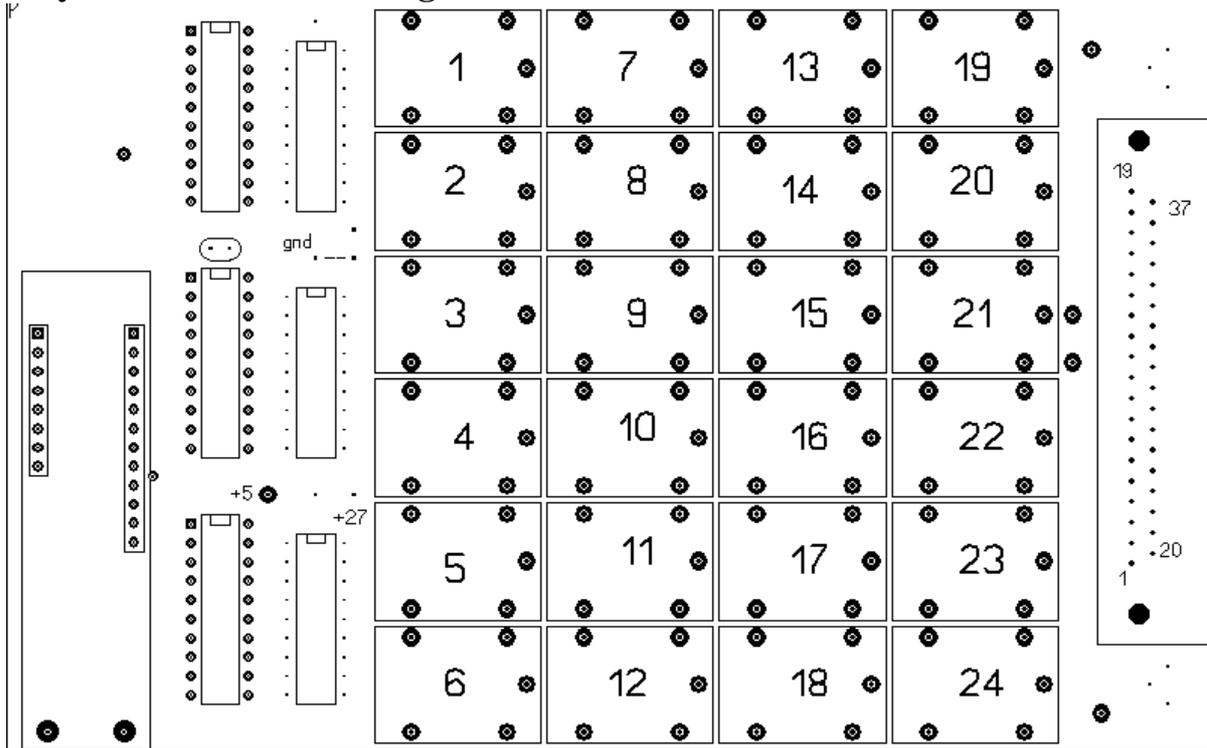
In addition, the interface board has two analog inputs. One analog input measures the 27V line, the other a signal from the transceiver, like the AGC voltage.

Power supply and connectors

The interface is powered by +5V via the USB link, and by +27V, either from the avionics set when relay-common and PC-ground can be interconnected, or otherwise you need a separate 24V/ 0.4A supply or ac adapter. The 27V supply shall be present AFTER the USB link is established and the program runs, but before the avionics set can be turned on, as it is needed for the "ON" relay. The connection to the avionics set is by a 37-pole sub-D connector, on the left side of the picture below.



Relay interface - numbering



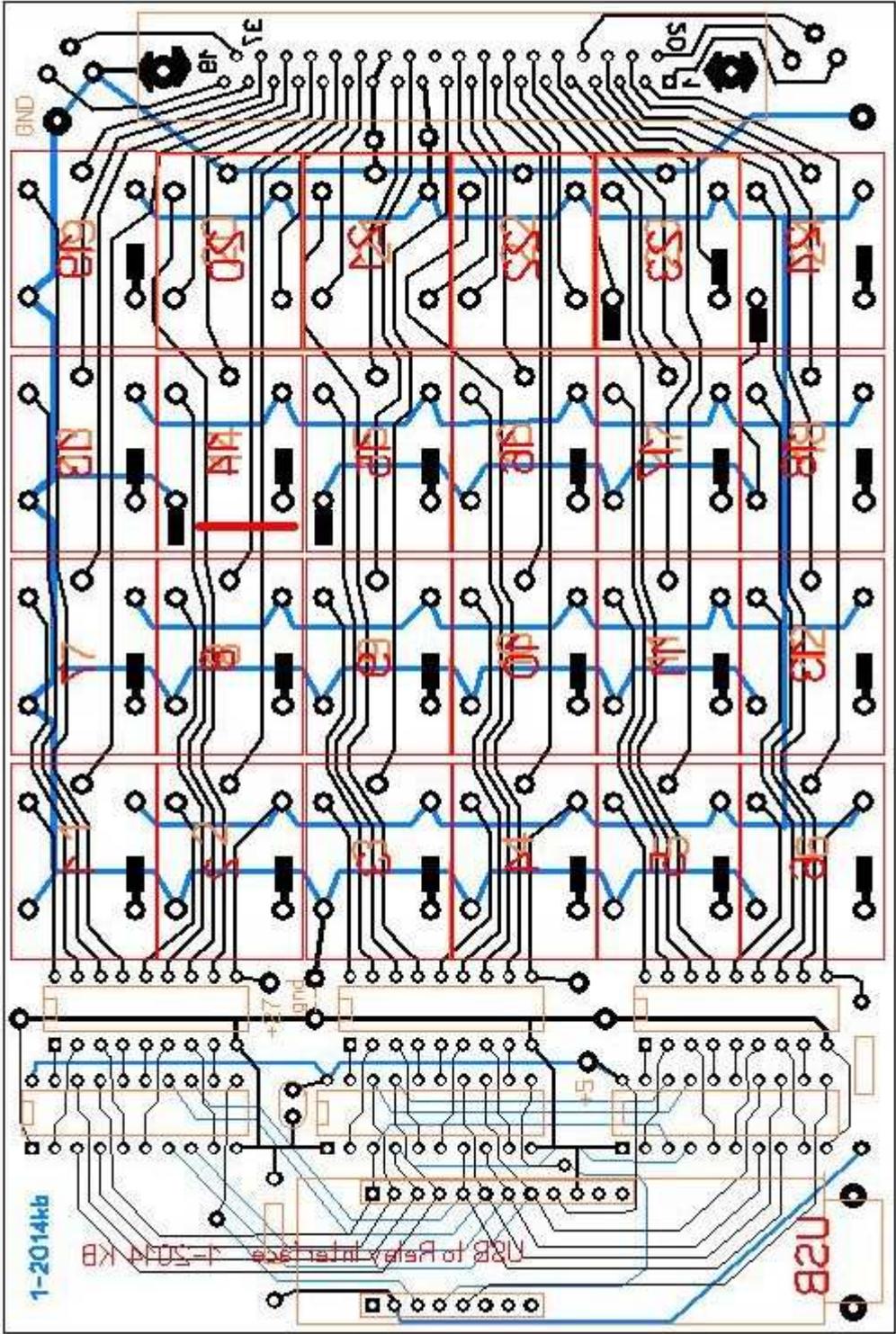
relay	Coil at	mc	idle	make	arc27	arc52	arc51	arc44	arc54/131	arc73
1	a5	35	pad	X	-	KC-low	-	-	Sq=Carr	Tx-KC-E
2	a2	33	pad	X	KC - l	KC-A	KC-A	ANT-A	ANT-A	Tx-KC-F
3	b6	10	pad	X	KC- m	KC-B	KC-B	ANT-B	ANT-B	Rx-KC-E
4	b2	26	pad	X	KC- n	KC-C	KC-C	ANT-C	ANT-C	Rx-KC-F
5	c4	5	pad	X	KC- o	KC-E	KC-D	ANT-D	ANT-D	Rx-KC-G
6	c0	2	pad	X	-	KC-F	KC-E	-	ANT-E	Rx-KC-H
7	a4	17	pad	X	tone	MC-low	-	-	Sq=Tone	Tx-KC-G
8	a0	15	pad	X	MC- g	MC-A	tensMCA	KC-A	KC-A	Tx-KC-H
9	b7	30	pad	X	MC -h	MC-B	tensMCB	KC-B	KC-B	Rx MC-A
10	b3	8	pad	X	MC- i	MC-C	tensMCC	KC-C	KC-C	Rx MC-B
11	c7	24	pad	X	MC- j	MC-D	tensMCD	KC-D	KC-D	Rx MC-C
12	c1	22	pad	X	MC- k	MC-D	tensMCE	KC-E	KC-E	Rx MC-D
13	a6	36	pad	X	MC a	tensMClo	-	-	-	Tx-N
14	a1	34	pad	X	MC b	tensMCA	MC-A	MC-A	MC-A	Rx-N
15	b5	12	pad	Xx	MC c	tensMCB	MC-B	MC-B	MC-B	Tx MC-A
16	b1	27	pad	Xx	MC d	tensMCC	MC-C	MC-C	MC-C	Tx MC-B
17	c5	6	pad	Xx	MC e	tensMCD	MC-D	MC-D	MC-D	Tx MC-C
18	c3	3	pad	Xx	MC f	tensMCE	MC-E	MC-E	MC-E	Tx MC-D
19	a7	18	pad	X	On	On	On	On	On	On
20	a3	X	14	16	Guard	Guard	Guard	-	Retran	Tx MCodd*
21	b4	X	28	32	ADF	ADF	ADF	Home	Home	Rx MCodd*
22	b0	X	7	9	-	-	2/300 MC	Squelch	Band A-B*	Tx 50kc*
23	c6	X	4	25	-	300or MC	0/50kc*	-	MC Odd*	Rx 50kc*
24	c2	21	pad	Xx	>370	2/300 MC	squelch	-	H.Filter	SCS-DCD

X= connected to ground, Xx can be disconnected from ground as a group

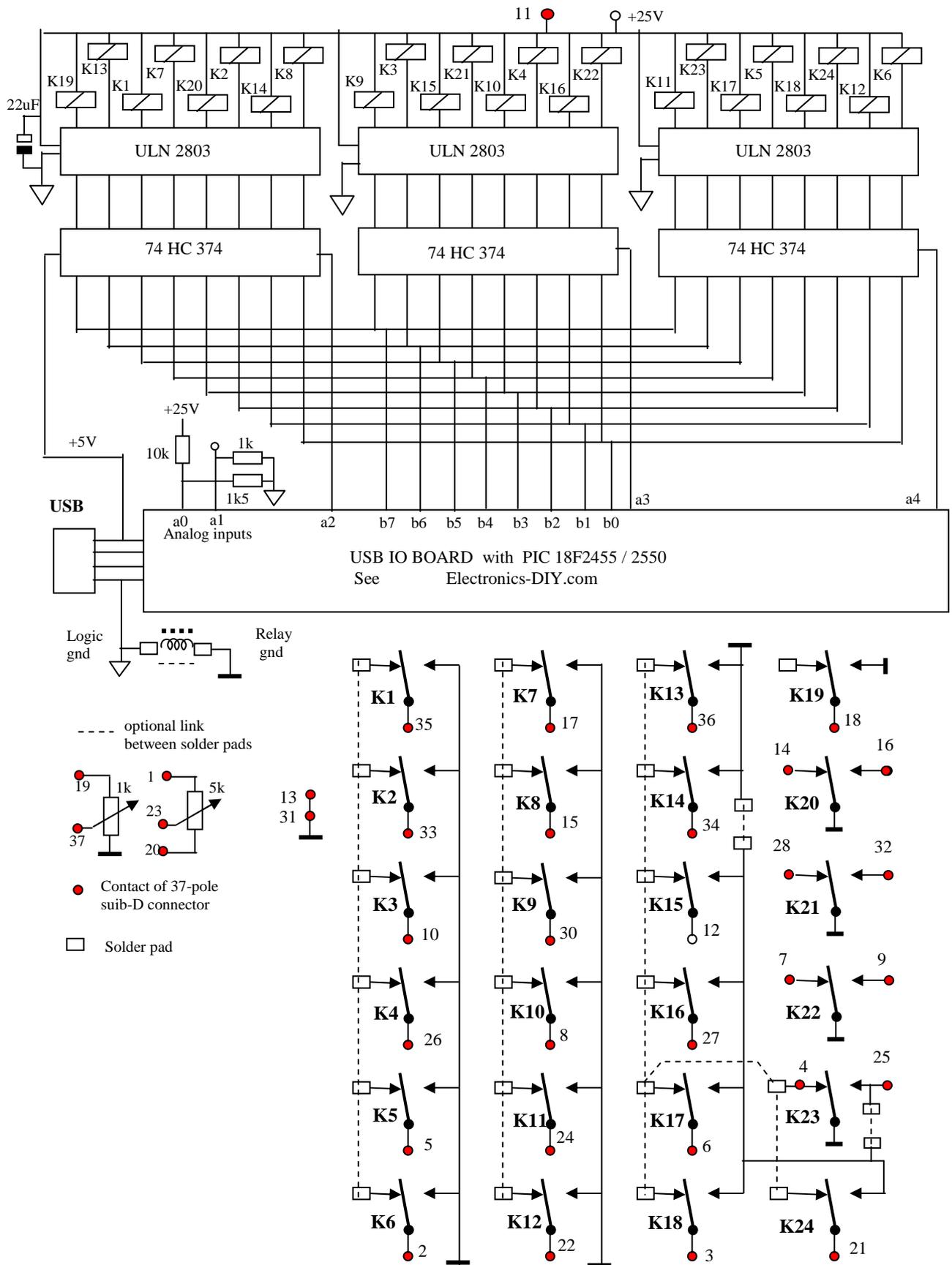
Connector-to-connector info for each set will follow soon.

*) Determine empirical whether the make or idle contact has the odd or even function

Relay interface board



Relay Interface Board, *component side*
A few (empty) boards are available - dual side, thru plated, with on both side solder masks and silk screen



The control panels as shown on your PC :



Each red field can be changed by clicking left or right of the adjustment knob.

The same goes for the rotary knob(s) and the tumbler switches.



Remarks

1. Start-up sequence

This sequence is critical both for the PC and the Receiver/Transmitter (RT).

a) With disconnected 27Vdc, connect the USB cable, check on your PC : configuration -> system -> hardware -> ports (COM & LPT). When OK you see a new COM port higher than the obvious COM1 port, note the number. If not, try again to establish a valid USB connection.

b) Start ControlPanel.exe, the dedicated visual basic program to control your RT.

Enter the COM port number, and Select Connect ->USB. A red ball indicates connection.

As an extra check, click the More... button, and send V to the USB controller.

The response is the version, something like V > UBV FW D Version 1.4.3

d) Select your RT set from the Radio menu. Select a frequency.

e) Now connect the 27Vdc. Relays on the USB board turn on, and when you switch ON or when the ON function is bypassed, the motor tuning of the RT starts to find the right channel.

2. EMC

The relay contacts in the USB board drive directly the clutch coils in the mechanical tuning unit of the connected RT. These coils take approx. 1A at 27Vdc, and produce over 500V surges when disconnected. There is enough coupling to the USB circuitry to disrupt the USB data handling.

The USB IO board driver creates a COM port, usually COM5. The (automatic) link from USB driver to serial port control is quite sensitive for disturbances caused by these spikes. Symptoms are a hanging visual basic 5 program, or even loss of the USB driver. Disconnecting and reconnecting the USB plug may restore the correct driver in most cases.

Capacitors of approx. 0.1 uF/200V should be placed across each clutch coil. These may be present as in the ARC73 receiver but not in others like in the ARC73 transmitter and should be added.

3. The 27V connection

The relays in the USB interface board can be supplied from the main 27V supply as used for the RT. To reduce EMI, at least some filtering is needed, both in the USB interface board, and in the mechanical tuning unit of the RT.

