

Interface for Yaesu G-5400 and G-5600 Antenna-rotators



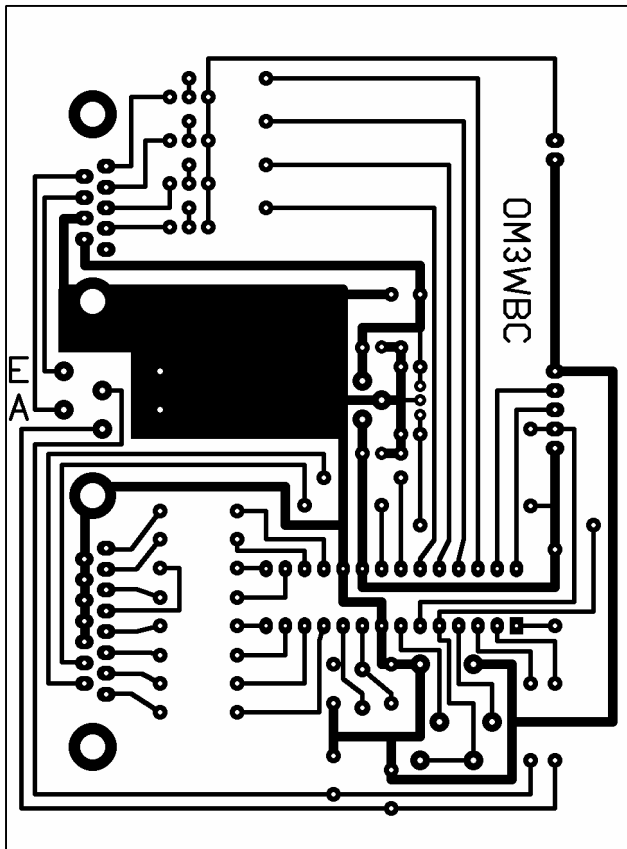
I started to deal with Earth-Moon-Earth communications in the middle of 2005. I had to realize, that my two-bay DJ9BV (2.1 wavelength boom length each) antenna array is not enough for this mode of communications. It seemed to be an obvious solution to improve the boom length of the existing antennas which are otherwise consisting of modules. Unfortunately, after modifying the antennas it became evident, the original display solution using Deprez meters can not meet the new requirements. To solve this problem this interface was born, which beside the exact display makes it possible to rotate the antenna by computer control, so it is a great help in providing satellite communications as well. Those who use shorter antenna for satellite tracking only, can build the interface without digital display. The interface was made in two versions. One of them makes use of a parallel port the other uses a serial port for communications with the rotator. Both solutions have advantages and disadvantages. The version making use of a parallel port has a great disadvantage because the port can handle eight bits only; hence the best possible definition is 1.4 degree. On the other hand, while the serial ports are generally in

use for different communication purposes, parallel ports are not utilized i.e. later printer models are made for USB ports. The base of both versions is a PIC16F870 microprocessor which includes a ten-bit A/D converter and a serial port driver too.

Interface for the parallel port

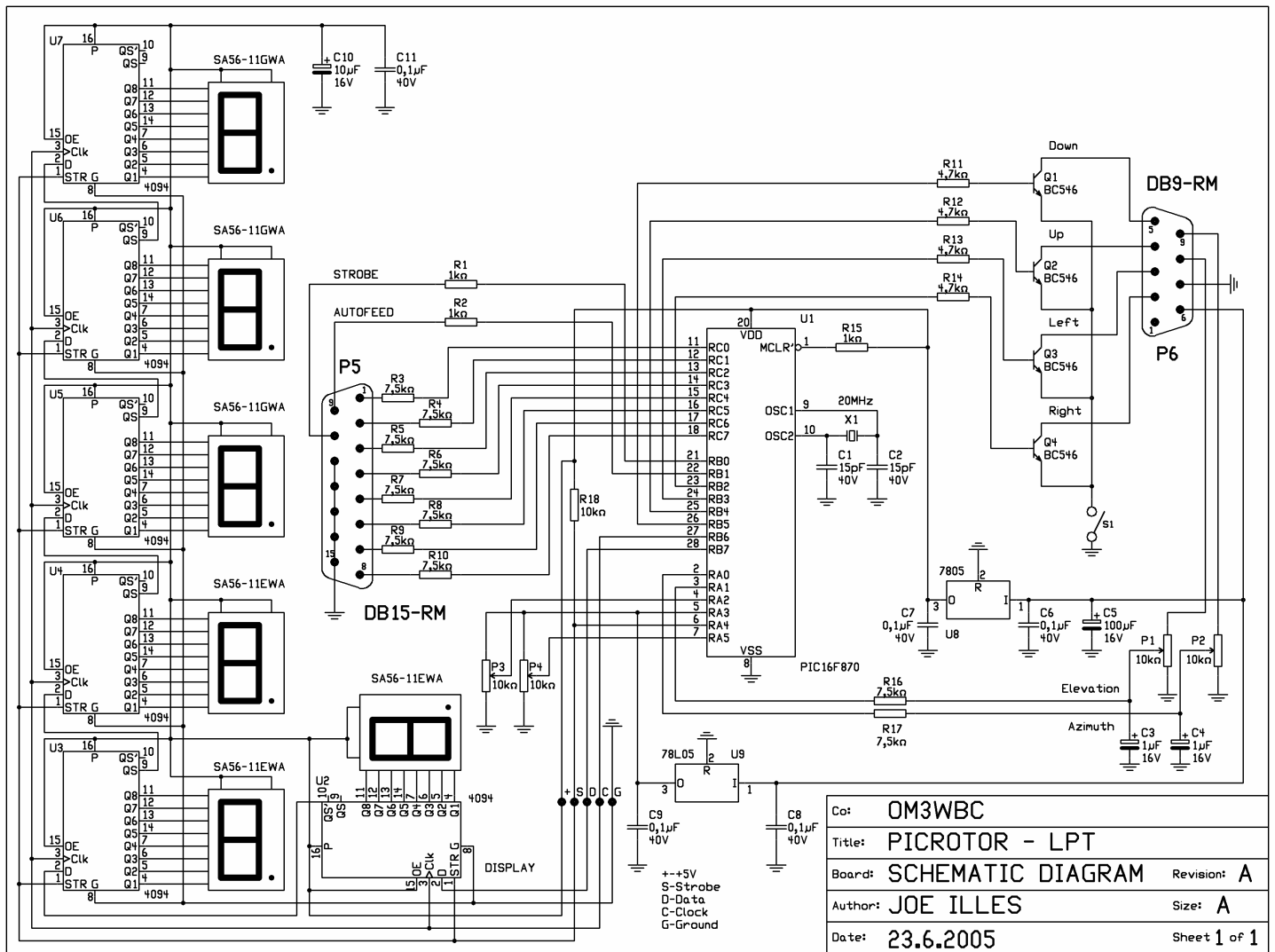
Operation

This interface uses the protocol of the FODTRACK program. This driver can be freely downloaded from the Internet. Latest software like WXTRACK is able to handle an interface like this, by default. The co-ordinates of azimuth and elevation are calculated in eight bit accuracy. AUTO-FEED output decides which data is active at a given time. The high level output of STROBE shows the validity of data. The processor continuously checks STROBE signal and in its active state it decides depending on the level of AUTOFEED signal, whether data is to be applied as azimuth or as elevation. According this, it puts data into a variable. In case the content of variables does not correspond with the momentary position of the antenna then it gives an instruction to turn the antenna until it reaches the required position. In this version the maximum elevation of the antenna can be 90 degrees. The FLIP function of satellite-tracking software is disabled. To turn the antenna into a position exactly without climbing the tower or mast, the interface is equipped with two variable resistors to make it possible to correct the difference between the displayed values and the real position of the antenna. These adjustments can be done by connecting STROBE and AUTO-FEED inputs to low logic level before the interface is



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switched on. Then variable resistors P3 and P4 can be adjusted to the required shift in both horizontal and vertical plane.



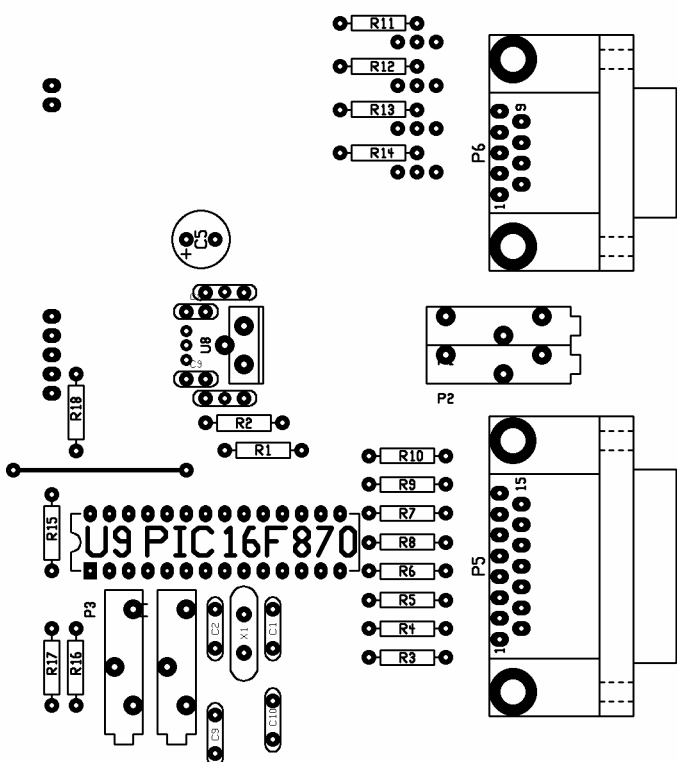
Construction

Make ready the single sided PCB which is not too complex so it can be done in your home workshop. After placing and soldering components check whether voltage regulators are functioning properly. If yes, then adjust all variable resistors into middle position and start with final adjustments.

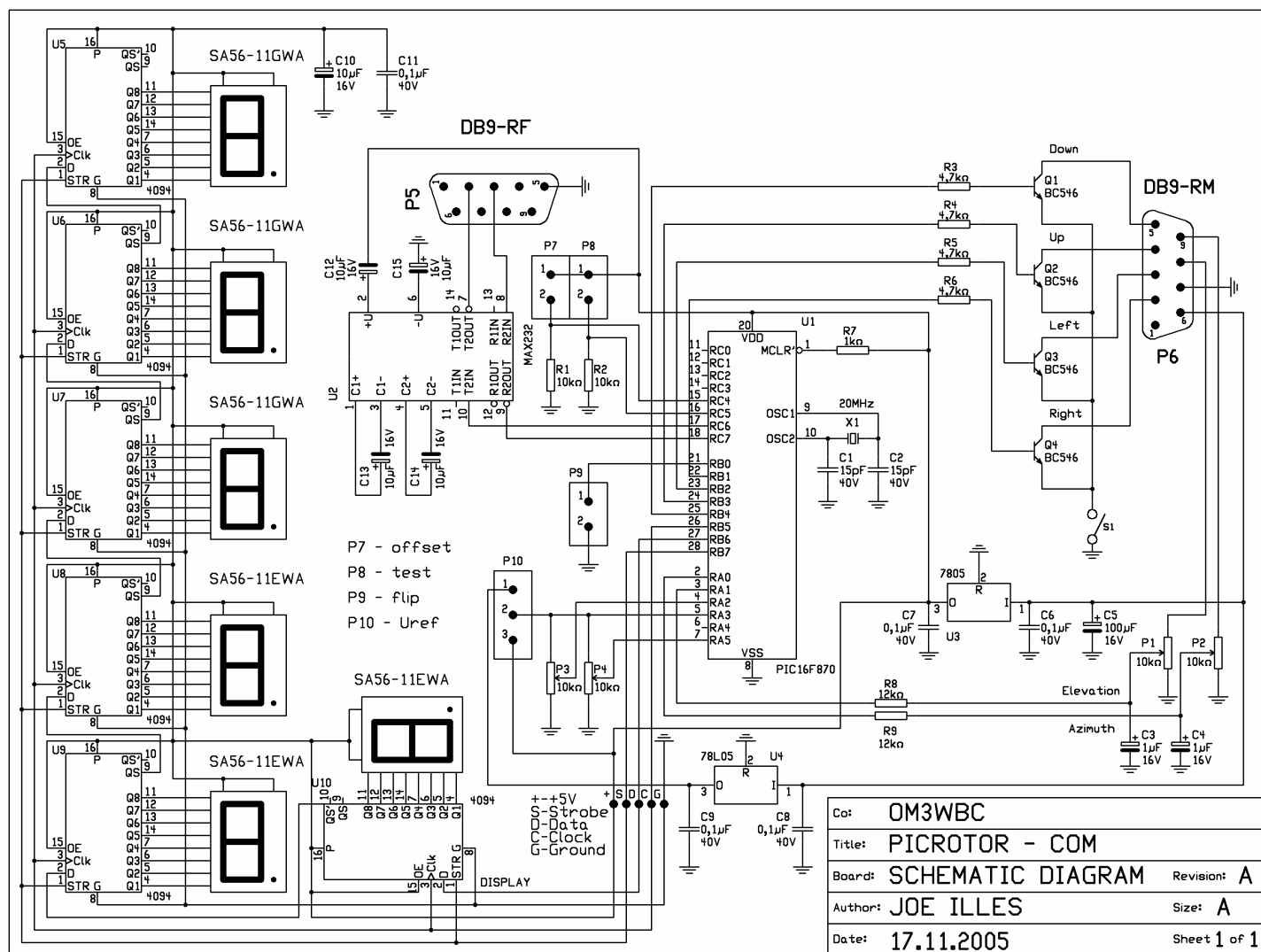
Interface for serial ports

Operation

In case we are intended to use a serial port instead of a parallel port we have to adjust voltage levels properly. For this task a well known circuit MAX232 can be used. Since the change to a serial port we can save some connections on the microprocessor. In this case we can decide ourselves whether to utilize FLIP function (PORTB, 0-P9) and for adjusting the necessary shift it is enough to take a short circuit to the right place (PORTC, 4-P7). Beside these, we can test communications between PC and interface if we put the



the short circuit into P8 position. In this case we do not turn the antenna. The value on the display is that voltage which is calculated by the computer. The processor needs this value from the antenna-rotator. For full scale deflection 3.6 Volts are necessary on both inputs. Use the CX6DD.COM (GS232) driver for communication. The necessary parameters are 9600 Bd, 8N1.



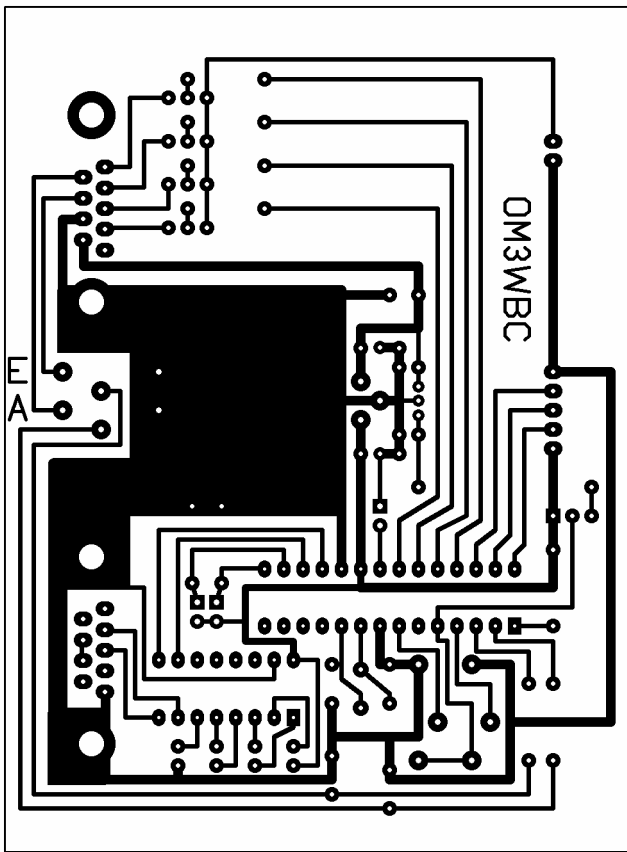
Construction

The PCB is similar to the previous one. It's not too complicated to produce. For providing the necessary supply and reference voltages, we use two voltage regulators but for the sake of simplicity, the reference voltage regulator can be omitted and the voltage source of the main regulator can be used for this purpose. Depending on the factory of MAX232 it can happen that the inverter inside of the circuit does not work properly. In this case we have to use tantalum capacitors – or depending on the production technology smaller capacitor values can be chosen which may be as low as 100 nF for a CMOS product. In case of appropriate operation on pin 2 of MAX232 +9.4 V, while on pin 6 -9.4 V must be measured. If the voltages are equal to these values adjust the variable resistors into middle position.

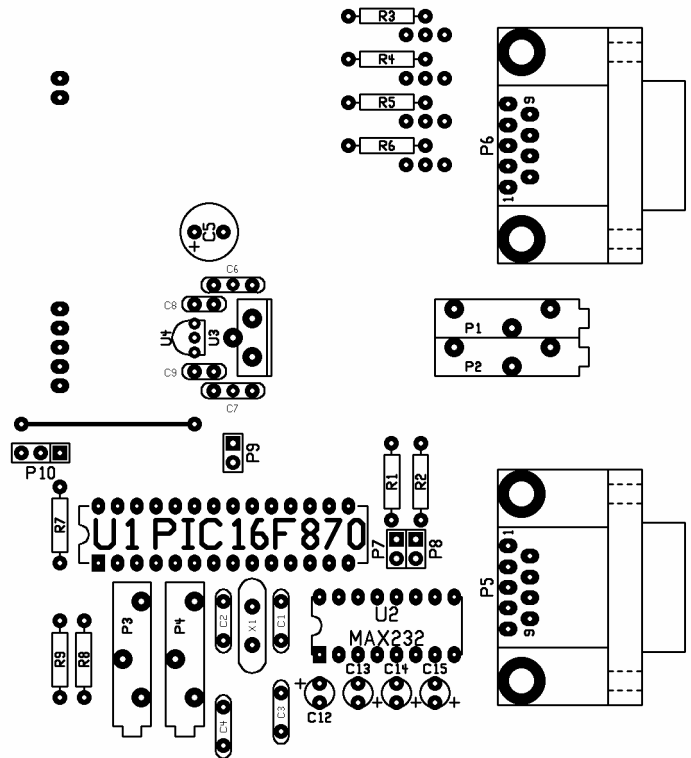
Display

Operation

It is connected to the processor by three data lines using serial data transfer. The circuit contains six shift registers which convert serial data coming from the processor to parallel data for the LED displays. Operation is as follows: Data arriving to the input is shifted by the clock signal continuously one place forward in the register. When all the 48 bits are on the right place the strobe signal copies data to the output of the register. The advantage of this method to the widely used multiplex method is that the light intensity of the displays is higher and they do not vibrate.

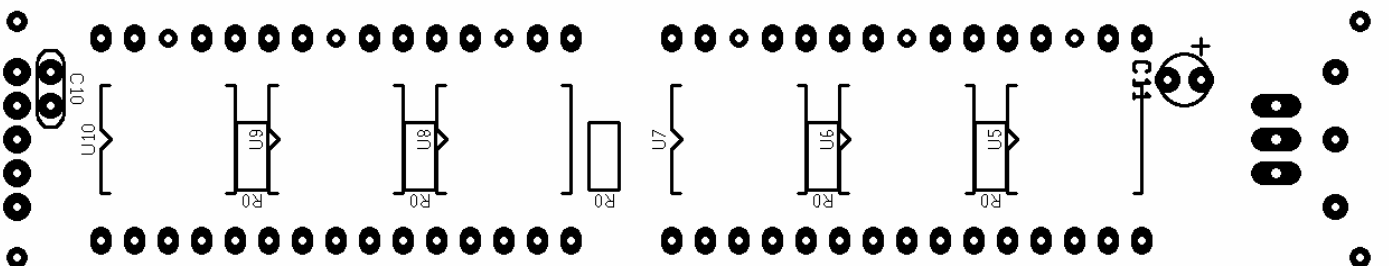
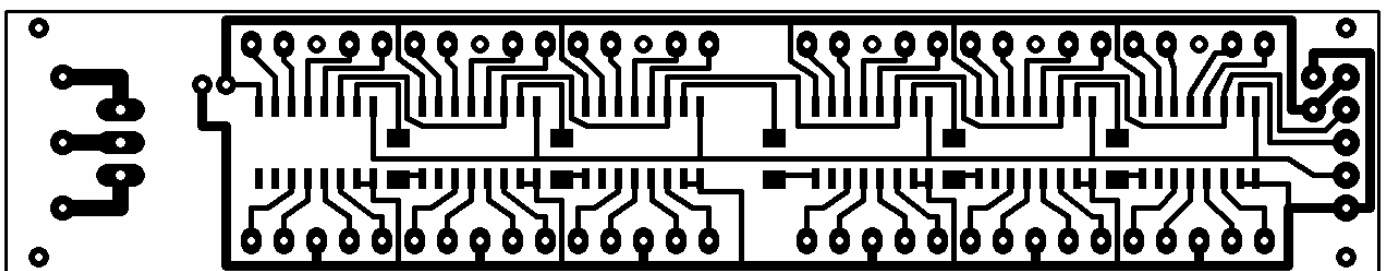


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Construction

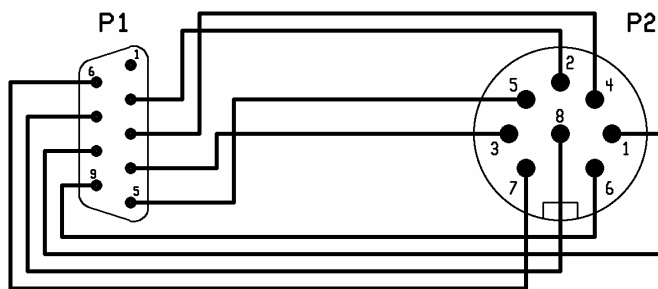
Production of the PCB is a greater challenge. The drawing of the panel is much more complex and denser than the previous ones. It was successful to produce this PCB using the so called “blue-foil” technology. Other photo-resistive sprays like Positiv-20 can also be used. Check the PCB thoroughly before placing components because it would not be possible to repair foil under integrated circuits. Shift registers are placed onto the foil side while LED displays are to be inserted onto the component side.



Final adjustments

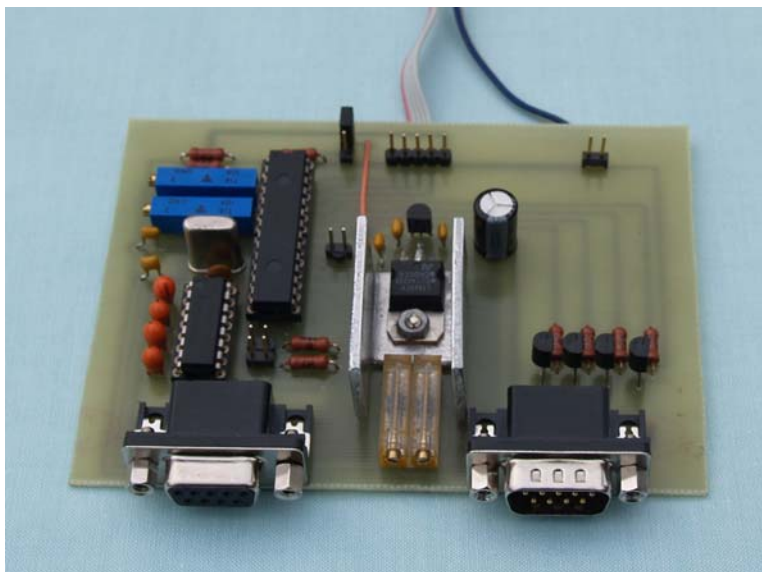
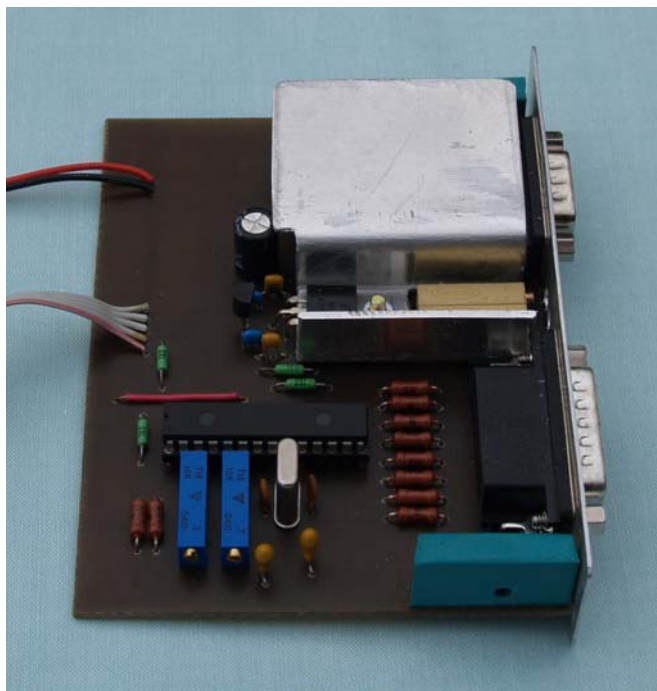
Final adjustments are similar in case of both versions. First step is to adjust the two variable resistors named „OUT VOLTAGE ADJUST” on the back side of the rotator to produce maximum voltage on the connector. Start with the adjustment of the shift. Connect the interface to the original controller of the rotator. The drawing

of the connecting cable can be seen below. Before switching the unit on connect together pin 9, 10, 11 in the PC-connector. In case of serial port put a short circuit to P7. When everything is all right, then a number will appear on the display which is between +16 and -16 both as azimuth and as elevation. If not, we must have done something wrong on the PCB of the display or we did not connect the main board and the display properly. Adjust zero value by P3 and P4 variable resistors. (Now we do not take into account the real position of the antenna.) Cut the short circuit. Then values will appear on the display according to the position of the antenna. Turn the antenna into default position. The display will show 0 and 180 respectively. Now check the direction of the antenna optically. Mark this direction as precisely as we can. Turn around the antenna to point into the same direction as in default position. Now adjust 180 degrees azimuth by P2 again. Then we will have finished horizontal adjustments. In the vertical plane the procedure is the same but the display must show 0 in default position and 180 in the end position (P1). We will then have basic adjustments finished. If the antenna does not point to the direction shown on the display we can correct shifts by variable resistors P3 and P4.



Final notes

This interface has been built for Yaesu rotators but there is no reason not to use it with rotators of other makes. The single condition is that there must not appear higher voltage than 5V on analog input and the relay used in the rotator must not consume more power than the transistors can withstand without failure. Of course their power rating can be properly chosen according to the requirements hence they can be different to those on the circuit diagrams. The aforementioned software can be obtained freely on the Internet.



WXTRACK <http://www.satsignal.net> , FODTRACK – <http://qsl.net/xq2fod>

The content of PIC16F870 can be found in ZIP-file