

XOX-TRAK Controller

(Automatic Controller for Satellite Stations)

User Manual

Version 1.0

By

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(Nov /2011)

1. Introduction

To install a complete satellite communications station, there are several technical points to take care of. A station like this usually has the following equipments:

- Transceiver V/U- ICOM IC-910 or FUNCUBE dongle for Receiving only
- Antenna Rotator- YAESU G-5500 or other brand controller
- Antennas for U/V frequency bands - ARROW antenna
- Computer for satellite tracking: - Orbitron , WX track, SATPC.

Of course, one can always use a satellite station in manual mode. The operator is then responsible for all the adjustments to be made during a satellite communication. However, when one is talking through a LEO satellite, in a polar or elliptic orbit, a typical satellite found for amateur satellite service, it is quite difficult to take care of everything, without losing performance on the communication. Typically one needs to adjust the antenna position, Frequencies for uplink and downlink, at regular intervals (every 10 sec at the most).

In order to free the operator of this job, so he can focus on the communication itself, one needs a way to make this job accomplished, automatically.

XOX Trak Controller is a interface controller for satellite communication tracking stations.

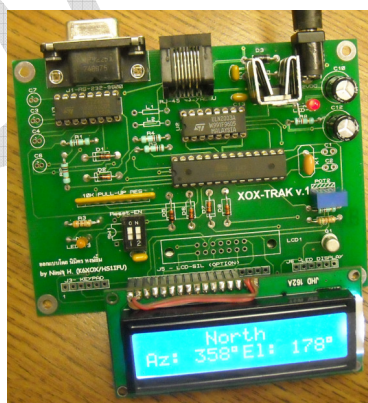


Fig. 1– XOX-TRAK V1.0 with 2x16 displays

2. How it works

XOX TRAK Controller uses an Arduino Bootloader ATMEGA328 microcontroller capable of dealing with all the signals, digital and analogue. Work is done in real time, depending on the received information, from the equipment it is connected to.

The most popular antenna rotator on the market, Yaesu G5400/5600 and G5500 are compatible with this system. In the package is included a cable that connects the *XOX TRAK Controller* to the antenna rotator. See later will shows the pin out of the connectors available on the rear panel of the equipment that you can modify as you need to fit with AC motor or DC motor with H-Bridge controller.

The rotator positions, azimuth and elevation, are collected from PC by using serial data in GS232 format and converted to digital signals. All the decisions and movements/actions are made according to these signals.

Connecting the controller to the personal computer is done through the Serial port or COM port which you can use Virtual com port by using USB – serial (Universal Serial Bus) port. Most PC's sold today, don't carry a RS232 COM port. The USB connection will enable the use of the *XOX TRAK Controller* in future computers.

Through this connection, all the information is sent from the computer to the *XOX TRAK Controller* (frequencies, modulations, azimuth, elevation and other control parameters).

The interface software is used to configure parameters needed for a normal system operation. All configurations can be changed anytime. After saving, the new configuration takes effect immediately. Read more learn more about software usage

3. Hardware install

XOX TRAK Controller has 3 connectors in the rear panel:

- Rotator –RJ45 connector for antenna rotator
- DB-9 serial port –for personal computer
- Ext DC-Jack 12V DC (In case of using other Rotor Controller)



The following picture suggests how equipments are present in a satellite Communication station and how they connect to the *XOX TRAK Controller*.

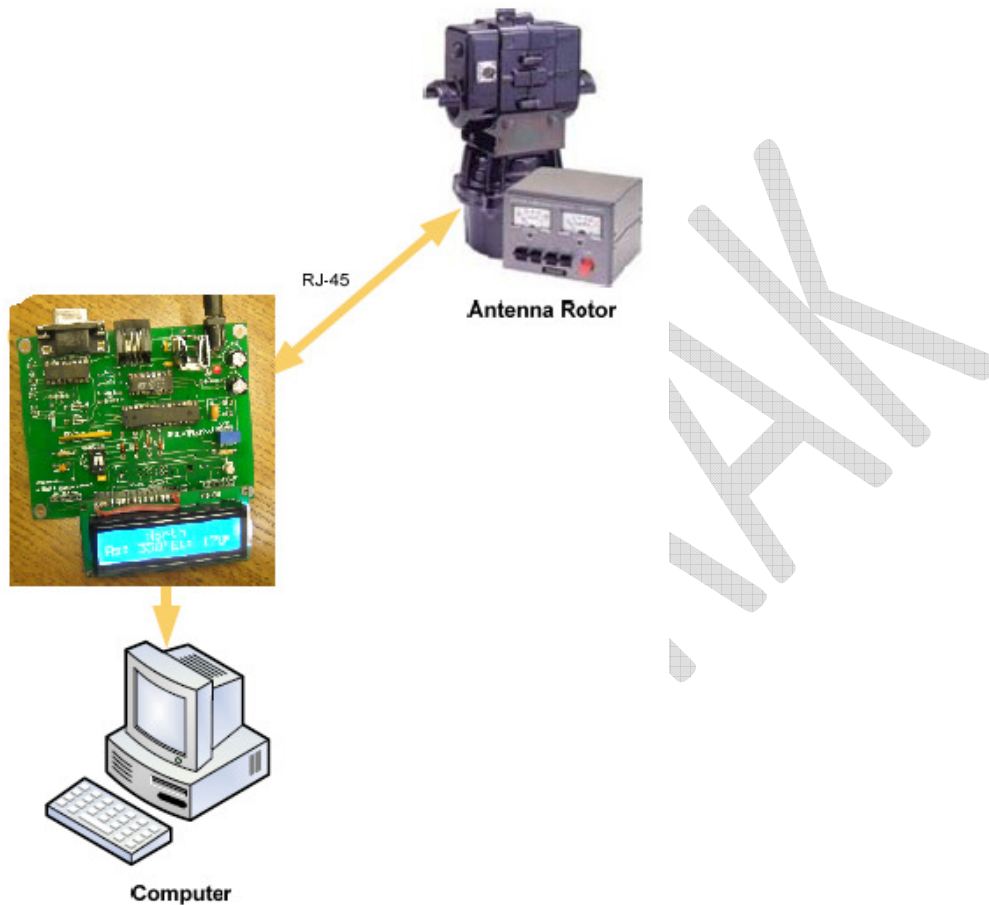


Fig. 3 – Connecting *XOX TRAK Controller* to the peripherals



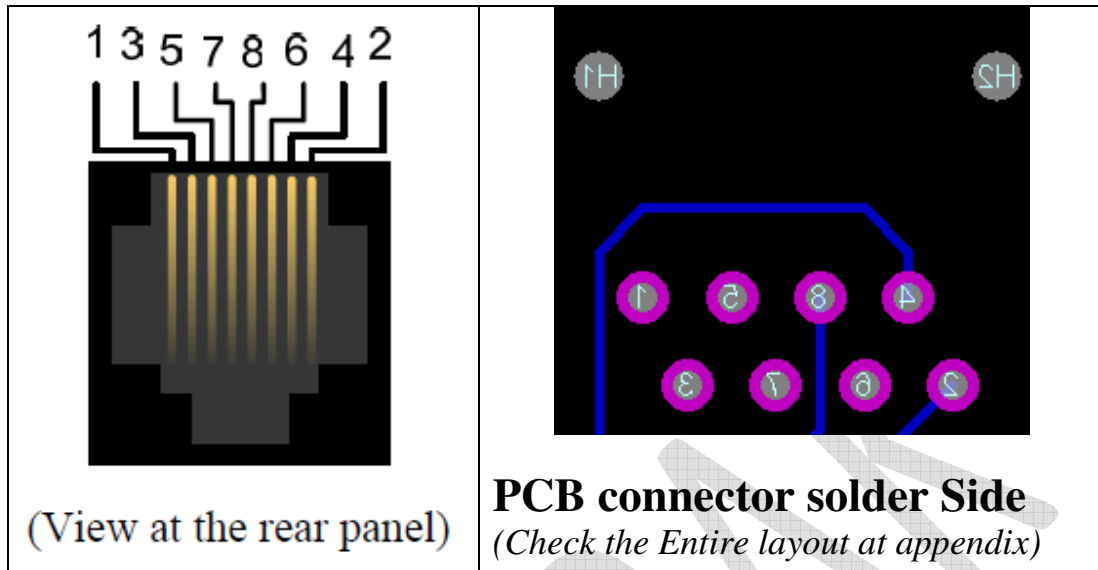
Fig. 4 – Connecting *XOX TRAK Controller* to YAESU G-5500 Rotor Controller

3.1 Antenna rotator connection

To connect the antenna rotator, use the supplied cable, and connect it to the respective connector, on the rear panel. The other end, with an 8 pin DIN plug must be connected to the antenna rotator, models G5400, G5600 or G5500 from Yaesu.

The RJ-45 connector present on the rear panel of *XOX TRAK Controller* has the following pin out:

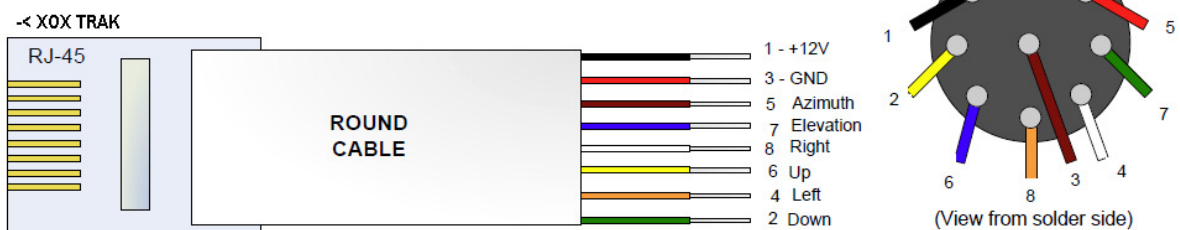
I used the RJ-45 Pin number which not in order from 1-8 but they will line up the same way.

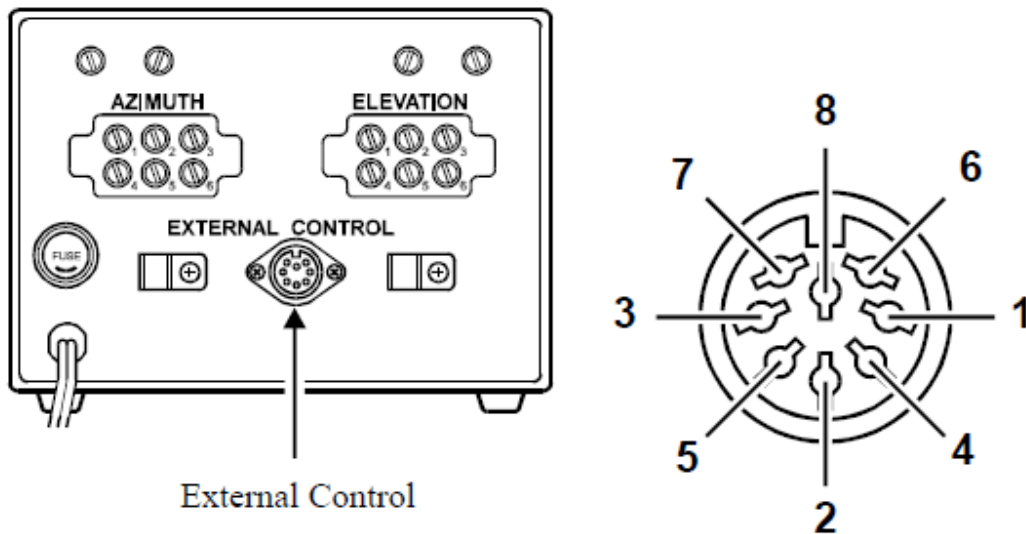


1	+ 12 V from Yaesu Rotor control Box
3	GND
5	Azimuth (Input from Rotor POT) 0-5 VDC
7	Elevation (input from Rotor POT) 0-5 VDC
8	Right (CW) output logic "LOW"
6	Up output Logic "LOW"
4	Left (CCW) Output logic "LOW"
2	Down output Logic "LOW"

Cable from RJ-45 XOX track to the DIN 8 Connector

Rotator cable description





Pin	Function
6	Provides 2 to 4.5VDC corresponding to 0 to 450°
1	Provides 2 to 4.5VDC corresponding to 0 to 180°
4	Connect to Pin 8 to rotate left (counterclockwise)
2	Connect to Pin 8 to rotate right (clockwise)
5	Connect to Pin 8 to rotate UP
3	Connect to Pin 8 to rotate DOWN
7	Provides DC13V to 6V at up to 200mA
8	Common ground

YAESU Rotor G-5500 External Control Pin-out



USB Virtual COM Port installation

Connecting the *USB-Serial Cable* to the personal computer is done through the USB port which is the same as in the Picture below as price range around \$9-\$20 on EBAY. This requires the user to install a small driver that emulates a virtual COM port.



To install this driver execute the following steps. Plug-in the USB cable on the computer. *Windows* will recognize the new peripheral automatically. When you are asked to give an install source directory, point to the “*FTDI VCP Driver*” directory on the CD and follow the steps until the installation is finished.

After installation, please open the *Windows control panel* to check which COM port corresponds to the *virtual COM port from FTDI USB chip*. The following picture shows the typical peripherals list from *Windows*, where the available COM ports are also present. The recently installed USB Serial Port (COMx) can be selected.

LED 13 will flash every time when receive the serial data input to the **XOX TRAK**

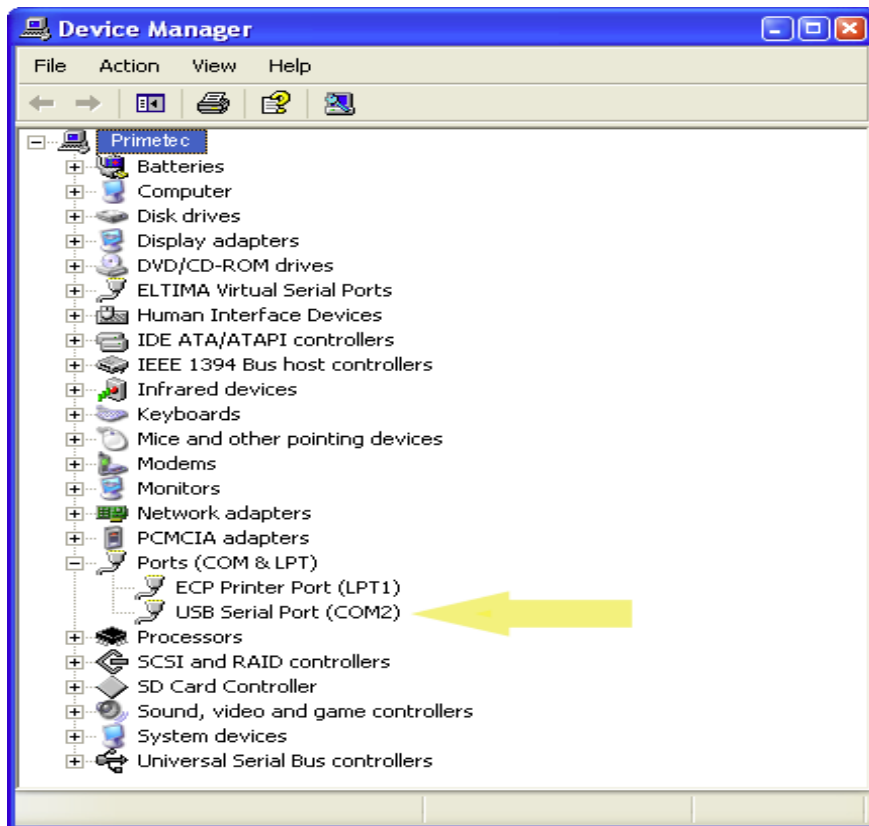


Fig. 5 –USB Virtual COM Port

How to setup Output of GS-232 with Orbitron DDE driver (WIN XP only)

1. Download and Install ORBITRON software
2. Download fcd_dde.exe copy to C:\program Files\Orbitron\Config\
3. In the Folder C:\program Files\Orbitron\Config\setup.cfg
Use Notepad or text editor to open setup.cfg to edit

Check if it already has:-

DDEdriver=Wisp.dde

Change to

DDEdriver=FCD-GS232

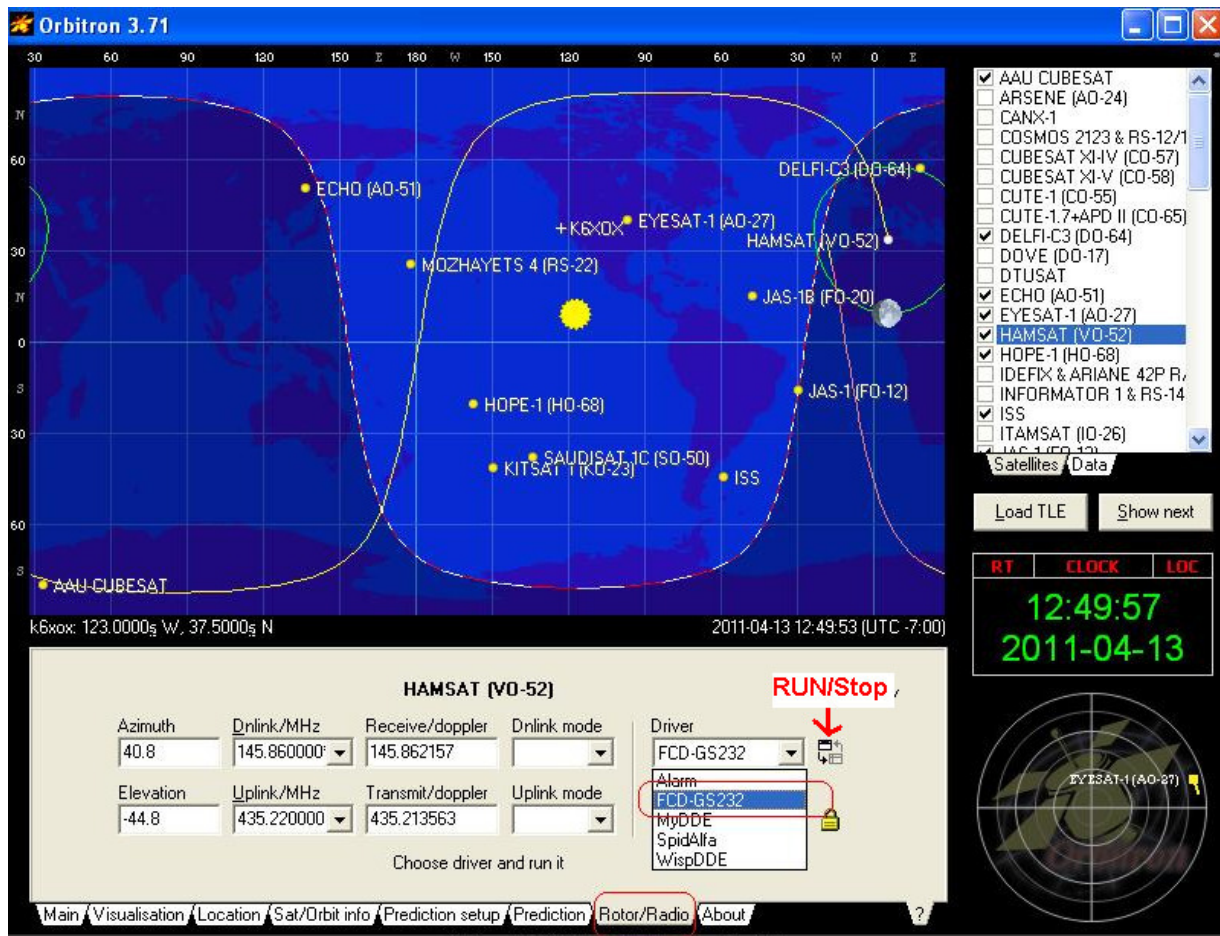
Search for the [Driver] of adding as below:-

[Drivers]

FCD-GS232=C:\program Files\Orbitron\Config\fcd_dde.exe

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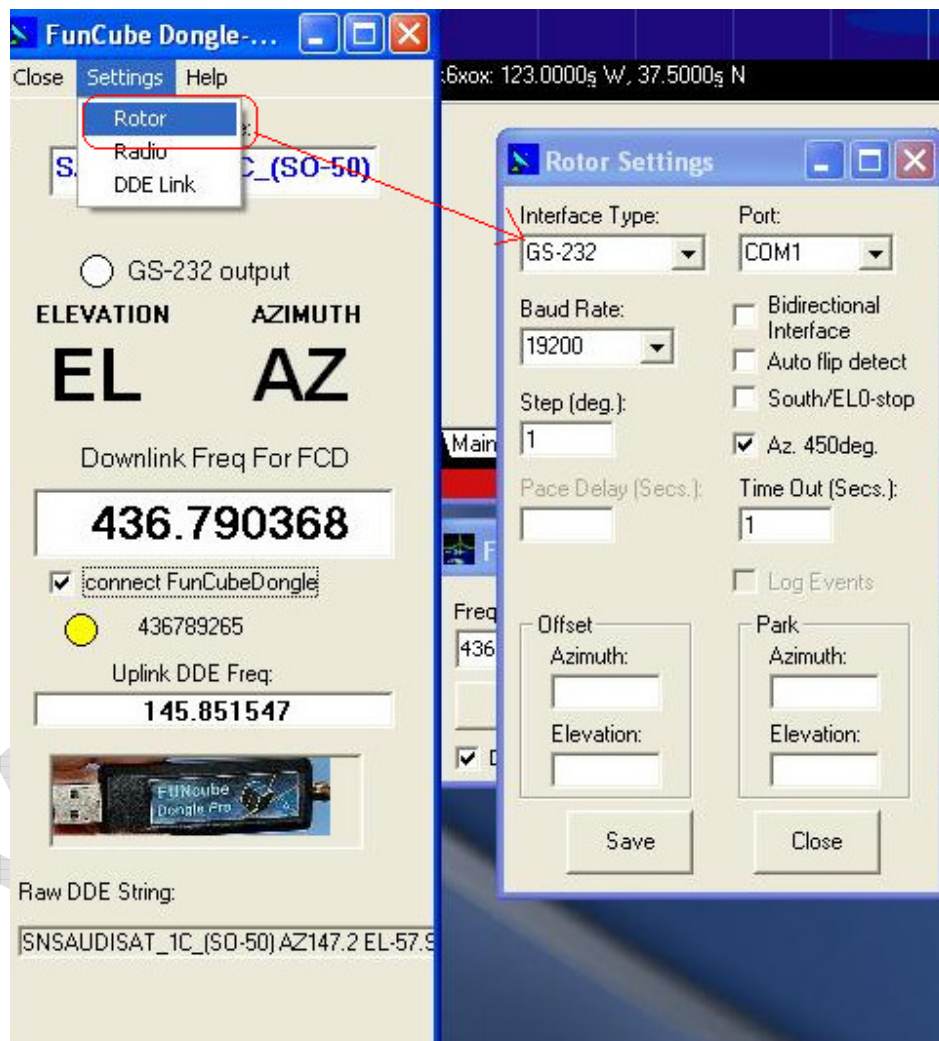
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pop up menu pop down and need to select the DDE source from setting menu tab
select DDE link to select data from “**ORBITRON**”

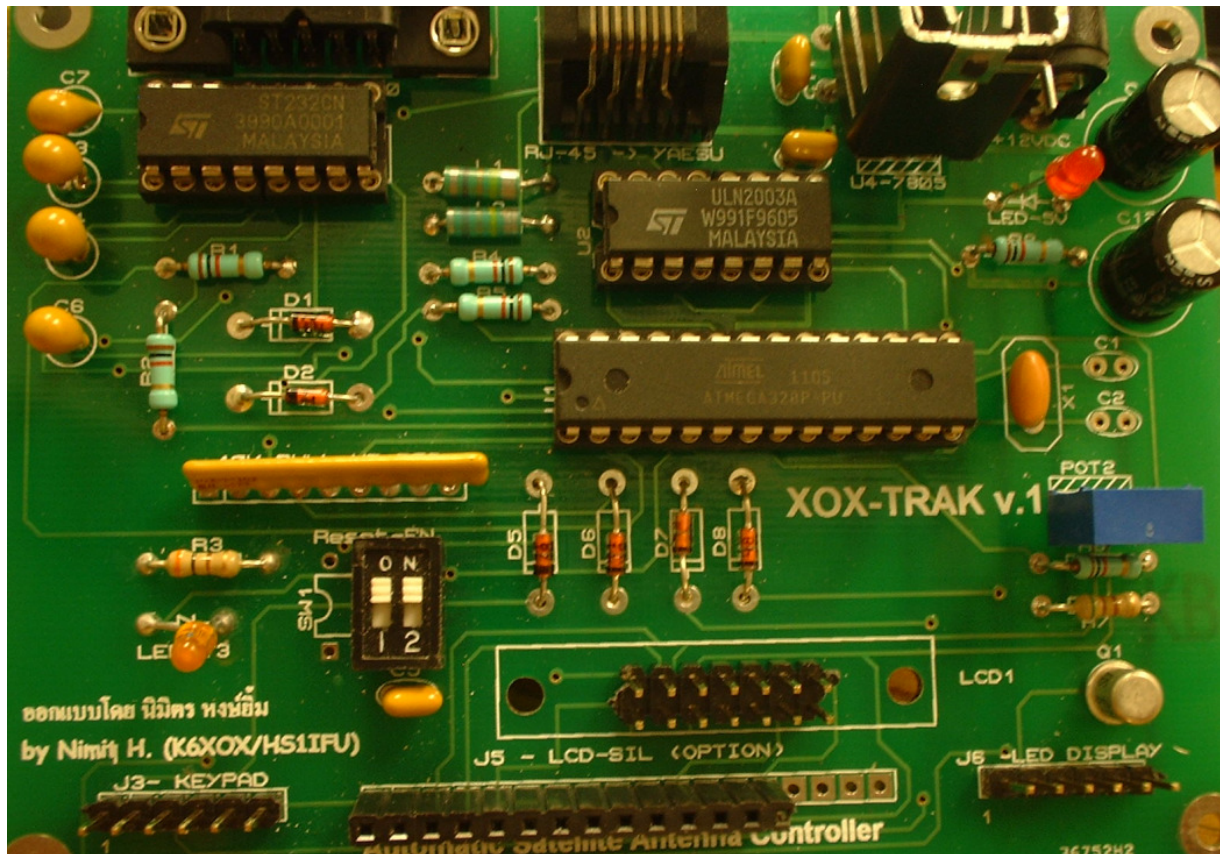


To set up for the GS-232 rotor you will need to go to Menu tab of FCD_DDE select Rotor and select GS-232 and Port then LED on DDE will go Green and AZ_EL data will appear (Change the Baud to **9600** and Com port that set for USB-Serial cable.)



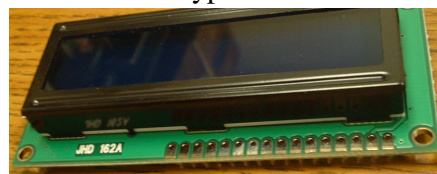
*Change the Baud to **9600** and Com port that set for USB-Serial cable.*

The detail of setting and Connector :-



1. **DIP SW 1** for LED 13 Enable, LED 13 will flash every time that serial data input from P.C and some user might want to connect to the front panel or Turn it off
2. **DIP SW 2** – ON Position will enable to reset CPU every time when data in-put to Serial port it will use for reprogram the new firmware. Normal operation might need to turn it off-
3. **J3-** For the Key Pad that can be used to control UP – DOWN – LEFT – RIGHT

DN	UP	Left	Right	NC	Gnd
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4. **J5** . LCD connection both SIL and DIL parallel for both type of LCD connection.



5. **J6** LED connection

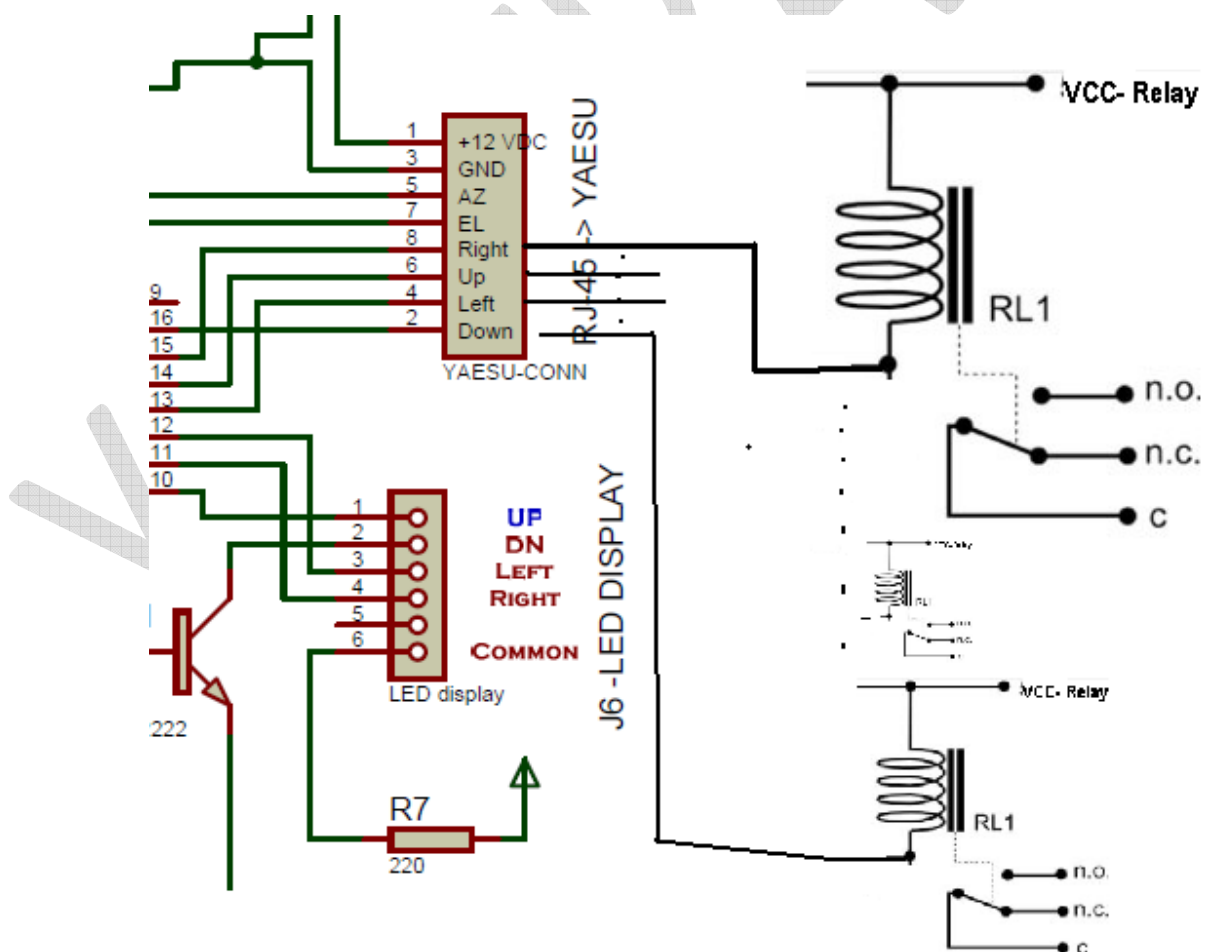
Up	Right	DN	Left	NC	Common R-220 OHM
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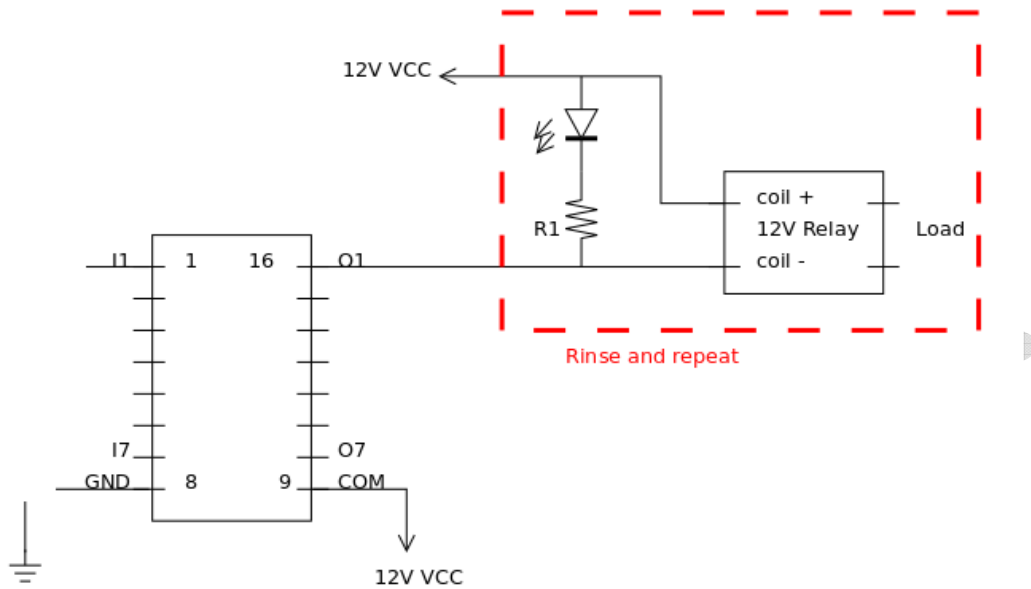
Advance application:-

For the Detail of the Output to the Other Rotor Controller box that can be modify to match the Rotor Controller.

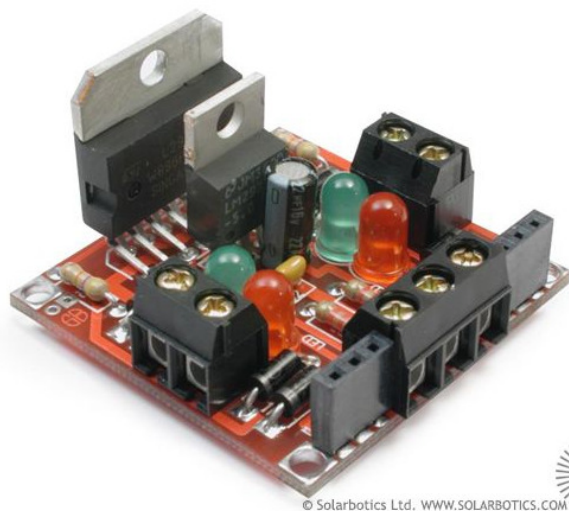
The output is open Collector which will enable as Active Logic ‘LOW’

If you wish to use for drive Relay that would be only connect one of the Relay pin end to +VCC and the other pin to this open collector output because we used ULN2003 that already have Diode then please jump Pin 9 of ULN2003 to Relay VCC. Or if you want to controller the Rotor that has AC-Motor can use Solid state relay of Mechanic relay as below:

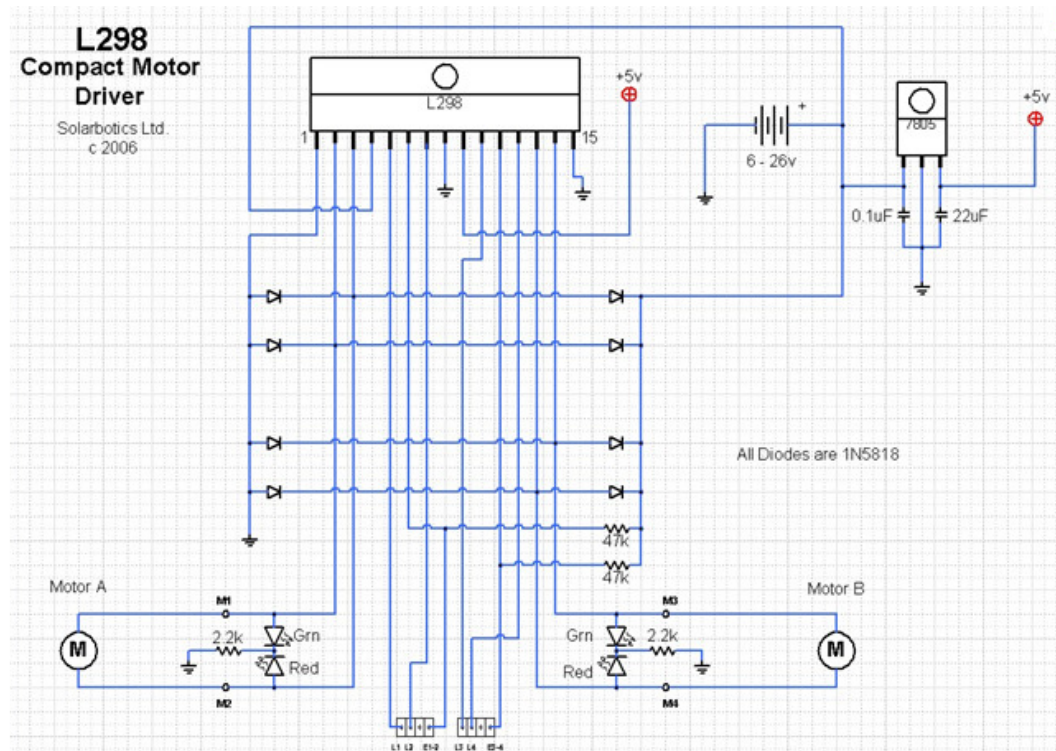




The other application that you can use the H-BRIDGE to Homebrew Rotor like I have by using H-BRIDGE L298 KIT from Solarbotics.com or you can buy from Hobby engineering in San Mateo, CA

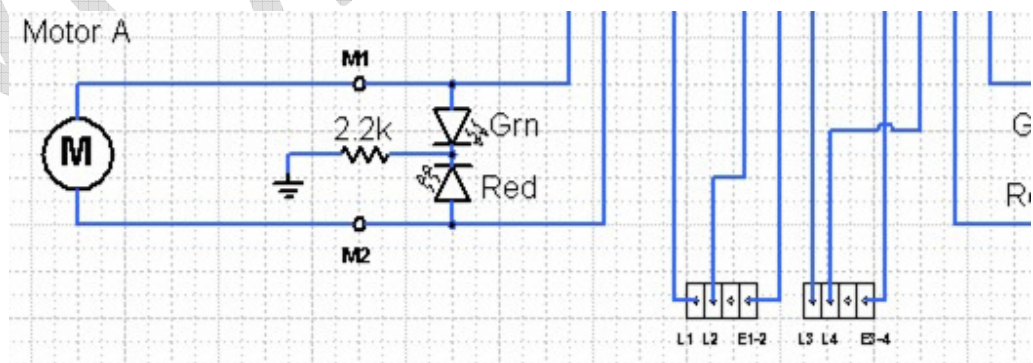


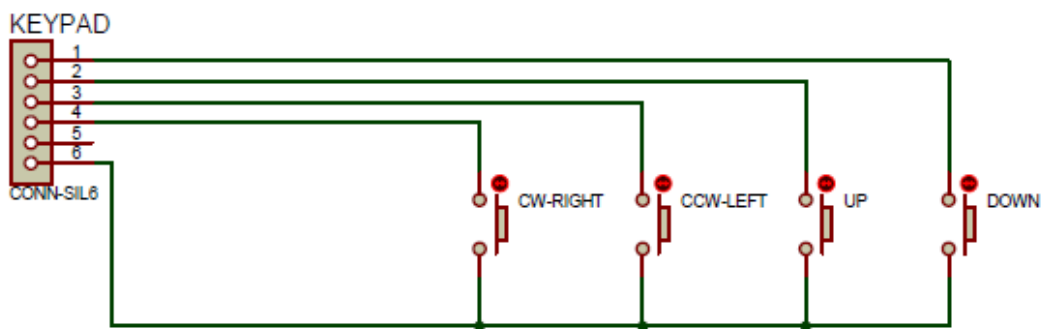
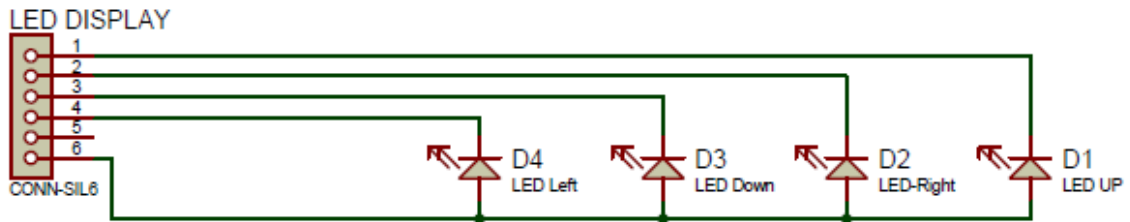
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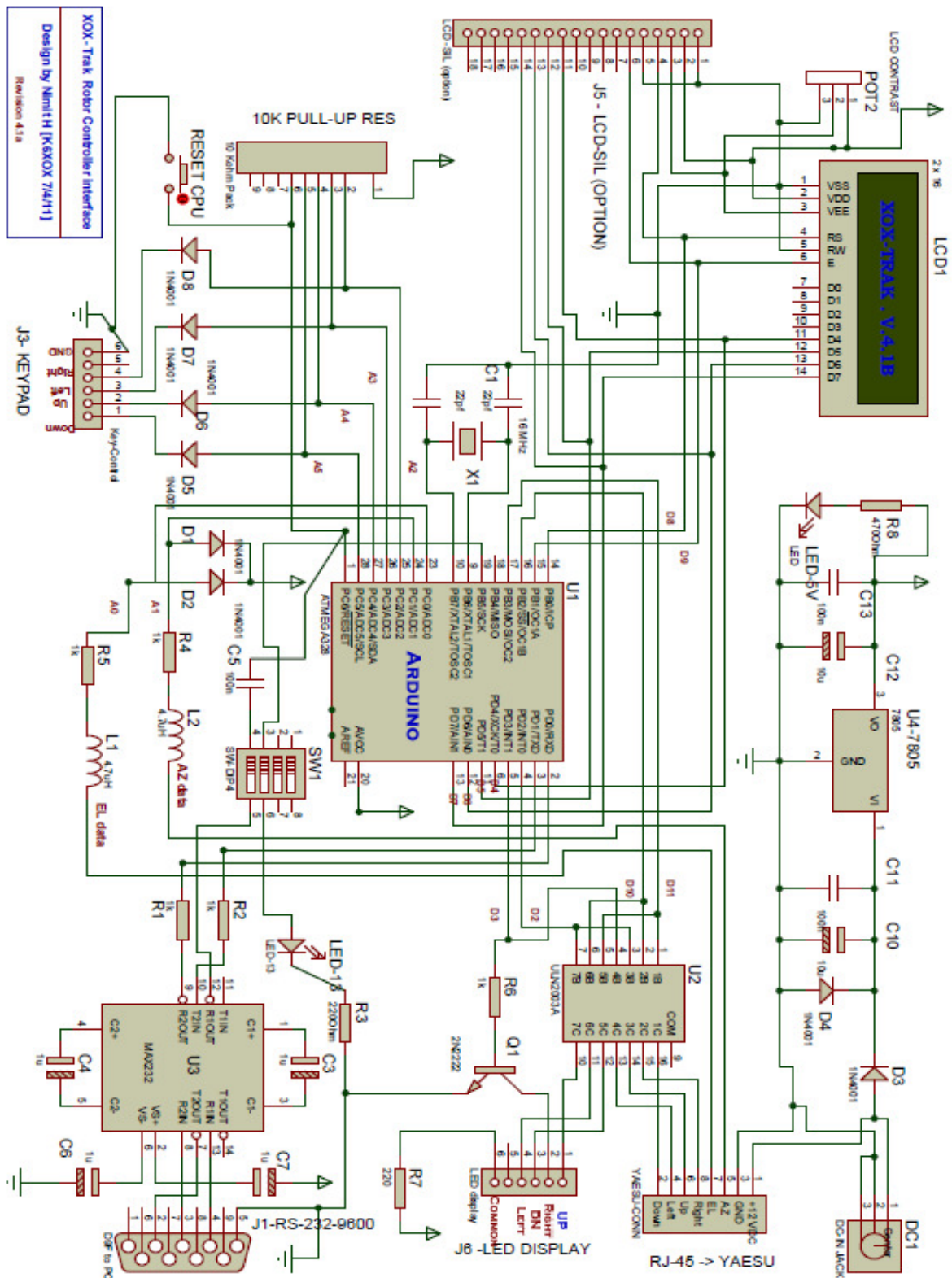
(Schematic Credit: - Hobby Engineering & Solarbotics)

By Connect the output from Rj-45 cable and connect Control AZ (CW/CCW) to the L1, L2 and EL (Up/DN) to L3, L4



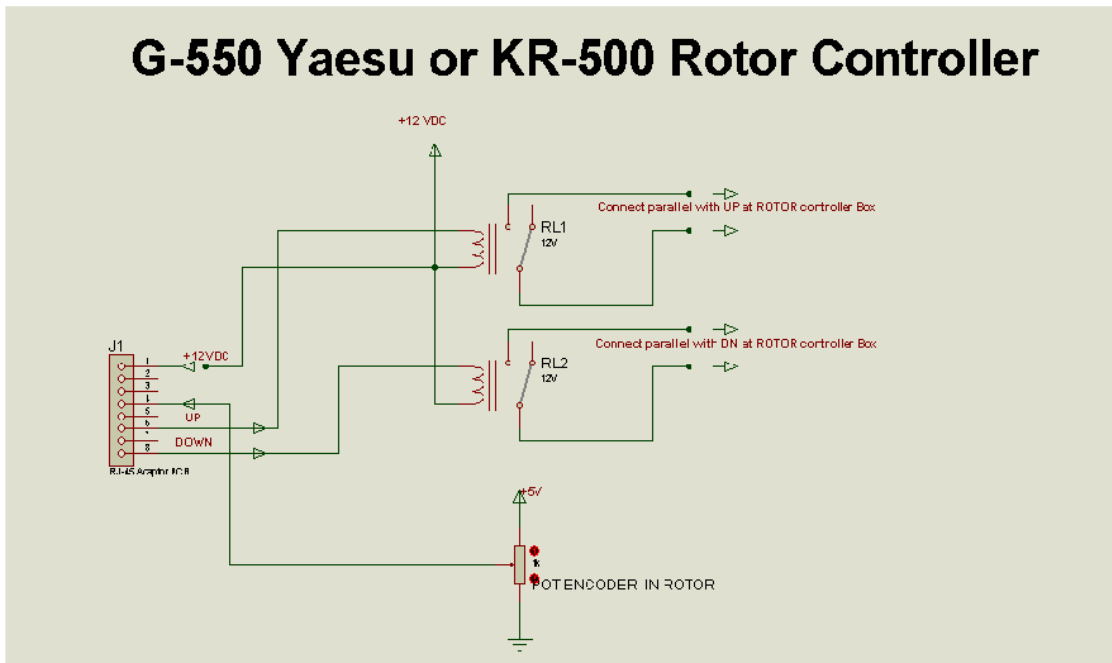


KEYPAD and LED Schematic (Option)

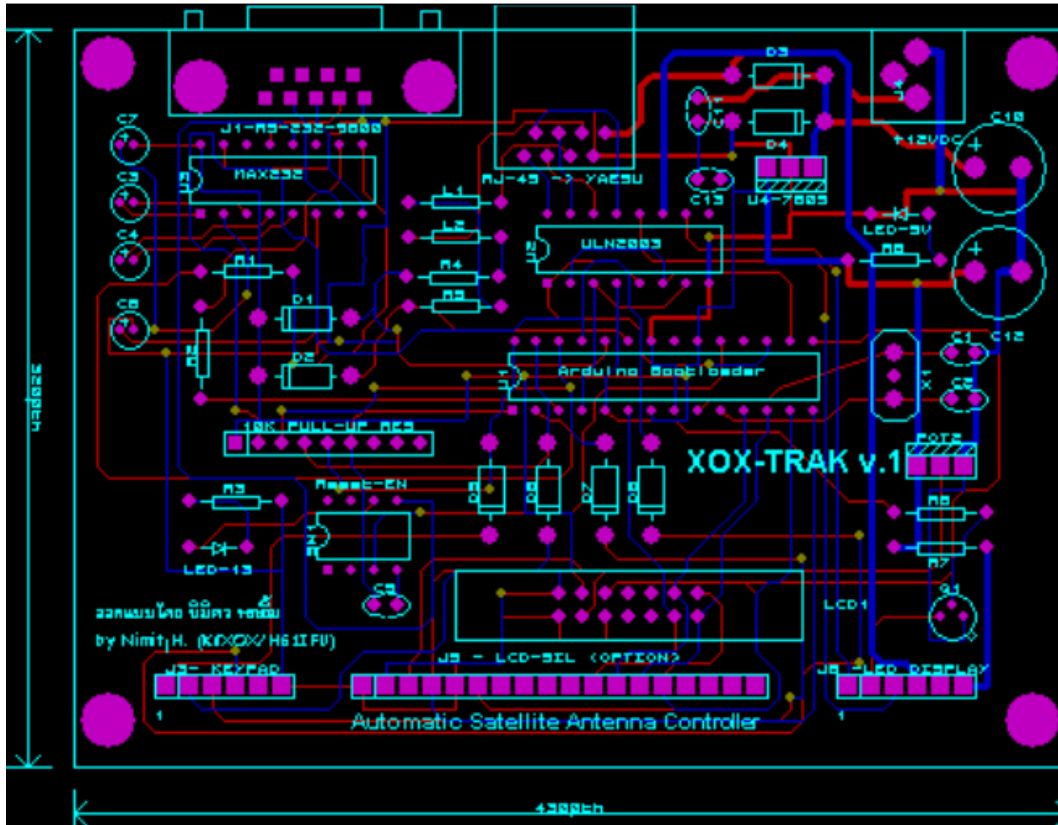


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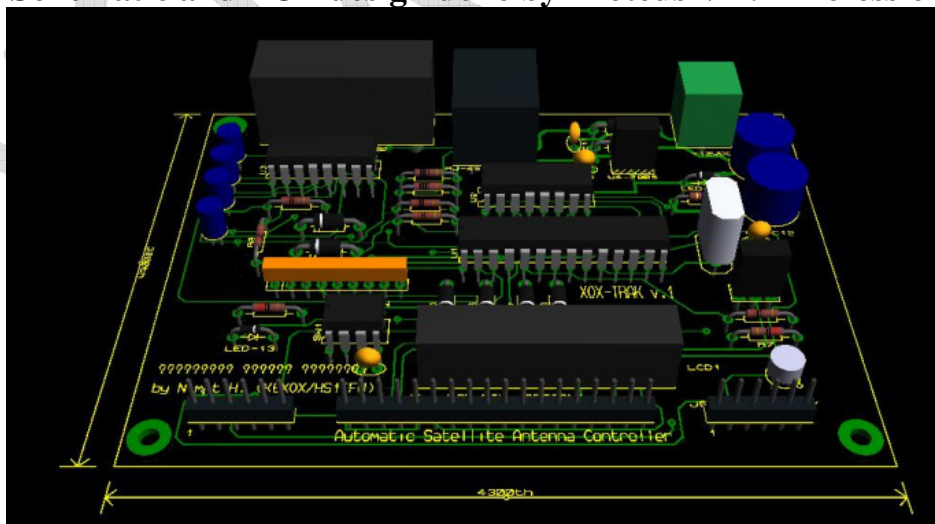
G-550 Yaesu or KR-500 Rotor Controller



Appendix:-



Schematic and PCB design done by Proteus V 7.1 Professional



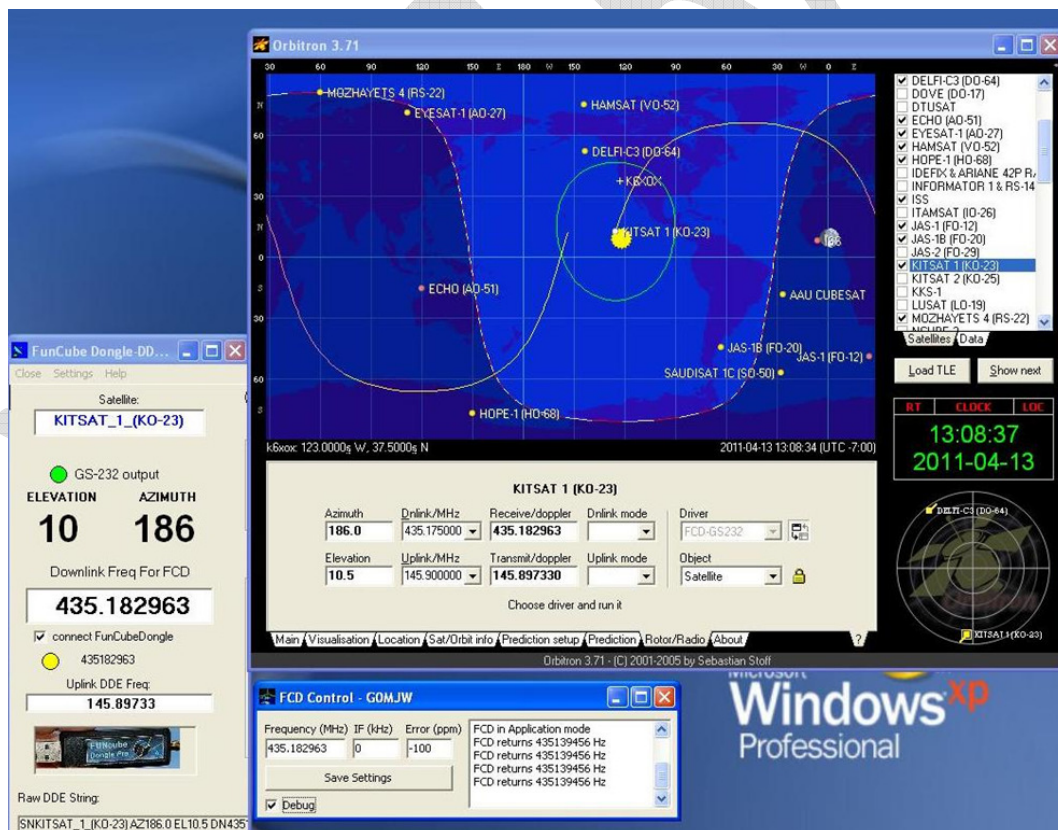
G-800 (Azimuth) and G500 (Elevation)



Auto-Doppler correction by Orbitron → DDE → CI-V interface → IC910



Can be modified to use with KR-400 (Kenpro) & KR-500 (Kenpro) controller



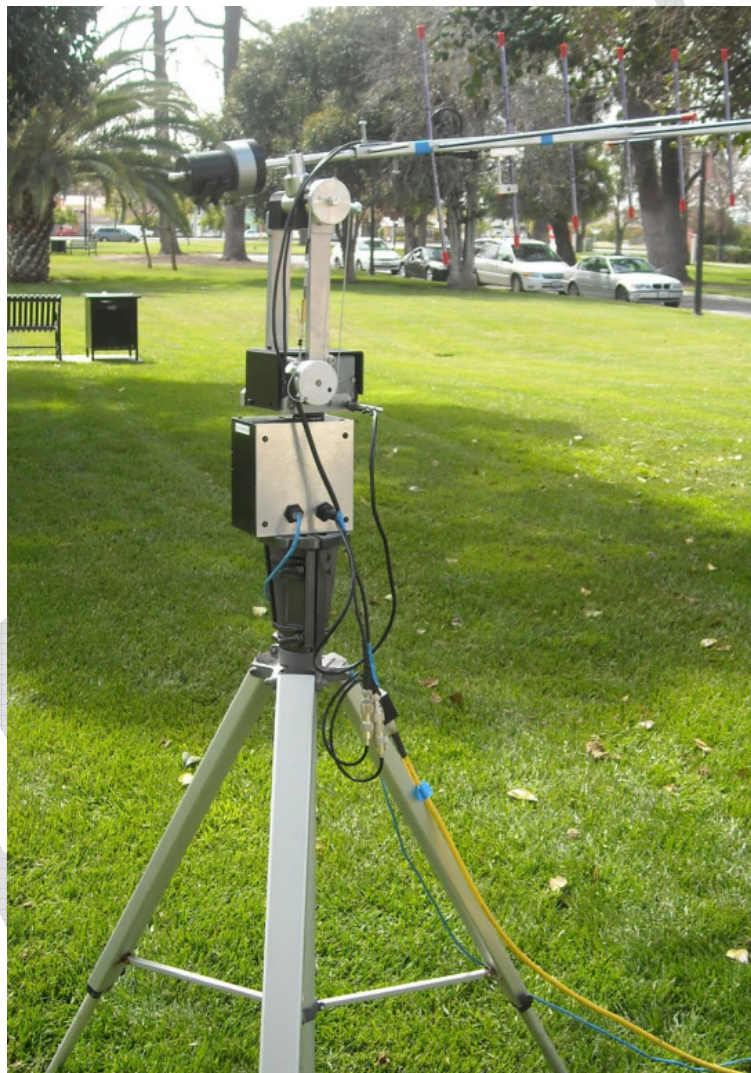
Screenshot that I modified DDE to work with Funcude Dongle SDR radio for auto Doppler

Question Email me at : K6XOX@arrl.net

<http://qrz.com/db/k6xox>

More Picture from my rotor project in my blog:-

<http://siamsg.blogspot.com>



I build Rotor from piece of Aluminum with milling and lathe machine and decoder with MA-3 magnetic rotary encoder 1024 bit resolution, you can find out more in my blog.