Congratulations for buying your EASY-ROTOR-CONTROL (shortly **ERC**). This document will guide you through the needed steps for assembly, configuration and installation of the **ERC**. You will reach the best result by following these instructions step by step.

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Safety-Instructions

- Don’t continue using the product if fit is damaged.
- Keep electronic assemblies and components away from children!
- Products that carry electric voltages must be handled by taking care about the valid instructions and regulations.
- If the product must be repaired, only use original spare parts! Using different parts may cause property damage and personal injury! The repair has only to be done by an expert!
- Before applying main-voltage the product must be securely build into a housing to provide protection against accidental contact!
- The installation has to be done by a skilled expert.
- Cables that carry dangerous voltages (e.g. main-voltage) must be installed according to the valid instructions and regulations. The needed safety-distances have to be maintained.
- Connection-cables have to be chosen according to the needed diameter.
- Before working on the product all supply-voltages have to be securely cut of.
- The product is designed to work in clean and dry areas inside buildings.
- Prevent the product of humidity, water and heat.
- Don’t use the product in areas where explosive gases, vapour or dust are or may occur.
- Don’t let the product fall or apply mechanical stress as the product may be damaged.

1. Bill of Material (BOM)

The Bom is in the order how you should use the parts.

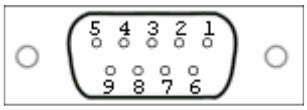
ERC V3.2 Bill Of Material					
QTY	**Type**	**Value**	**Pitch**	**Reference**	**Comments**
RS232-Cable					
0,5	Cabel with Phonejack	3.5mm Stereo 2.5m			for RS232 Adapter
1	DSUB-Connector	9 pol. Female			for RS232 Adapter
1	DSUB-Case	for 9 pol.			for RS232 Adapter
PCB Assembly					
1	PCB	2-layer 79x54mm V3.2			
1	Crystal	4,9152 MHz HC49U		Q1	
1	IC-Socket	16 pol. DIL16		IC2*	for IC2
1	IC-Socket	28 pol. DIL28		IC1*	for IC1
2	Capacitor ceramic	22p 16V 5%	2.5	C1,C2	alt.: 27p 16V 5%
1	Phone-Jack	3.5mm Stereo		X2	RS232
8	Capacitor ceramic	100n 50V 20%	2.5	C3,C5,C12-C17	
6	Capacitor Tantal	1u 35V 20%	2.5	C6-C11	
1	Mini-Fuse	1.0A	5	F1	alt.: 0.5A
3	Resistor	4K7 5%	2.5	R2,R3,R4	
1	Resistor	10K 5%	2.5	R1	
2	Resistor	20K 5%	2.5	R7,R8	
1	Resistor	39K 5%	2.5	R6	
1	Resistor	220K 5%	2.5	R5	
3	Transistor	BC547B TO92		T1,T2,T3	alt.: BC546-BC549
1	Voltage-Regulator	78L05 TO92		IC3	
2	Diode	BAT48	2.5	D6,D7	alt.: BAT42
4	Diode	1N4004	2.5	D1,D2,D3,D4	alt.: 1N4005-4007
1	Diode	P6KE33CA	3.81	D5	
2	Coil	10u 10% SMCC	2.5	L1,L2	
8	Terminal-block	2 pol. 5mm	5	X3-X8	
1	DC-Jack	2.1/5.5mm		X1	DC
1	Capacitor Al	100u 16V 20%	2.5	C4	
1	Relay	G6D-1A-ASI12VDC		K3	
2	Relais	FTR F1CA012V		K1,K2	alt.: RT424012 alt.: LMR2-12D
Mechanical Assembly and ICs on socket					
1	IC	MAX232CPE	DIL16	IC2	with socket alt.: MAX232N
1	IC	MEGA168(P)-20PU	DIL28	IC1	with socket alt.: ATMEGA168A-PU
4	Distance-Bolt	M3x8mm			
8	Spring-Wascher	3.2mm			
4	Nuts	M3			
4	Screw	M3x6mm			
1	DC-Connector	2.1/5.5/9mm			alt.: 14mm for DC
3	Cable-Ties	150mm			
1	Cable	blue 1m 0.75sqmm			for installation
1	Cable	black 1m 0.75sqmm			for installation

2. Assembly of RS232 cable

Materials needed:

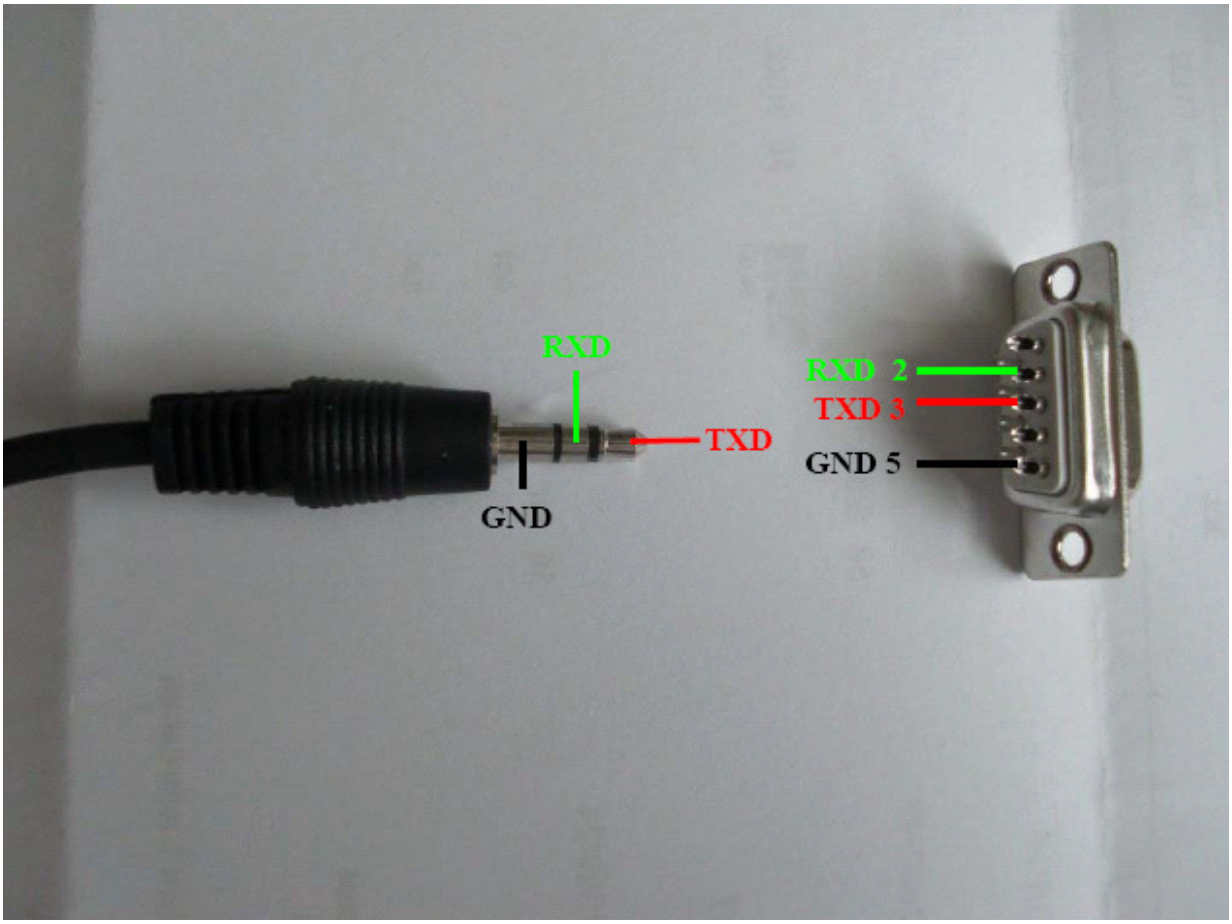
- Cable with 3.5mm Stereo phone-jack
- DSUB-connector 9 pole female
- DSUB-case for 9 pole

Pinning of DSUB seen from the connector-frontside



As the delivered cables differ with their colours, it has to be measured which of the inner cables is connected to what contact of the phone-jack. Alternatively to the 3-wire cable a 2-wire cable with shielding can be delivered. For this kind of cables the both shielding have to be twisted together. The shielding is representing GND.

GND: inner contact of the phone-jack : to PIN 5 of the D-SUB
RXD: middle contact of the phone-jack : to PIN 2 of the DSUB
TXD: tip-contact of the phone-jack : to PIN 3 of the DSUB



3. Assembly of PCB

Assemble and solder the components according to the following drawings.

Please read the following points before you start :

1. The vertical assembled Diodes should have a distance (1-2mm) to the PCB while soldering. Otherwise there is the risk of overheating these components while soldering.

2. Take care of polarization of the following components :
   - Diodes D1,D2,D3,D4,D6,D7 (D5 is bidirectional, no polarization)
   - Transistors T1,T2,T3
   - AL-Capacitor C4
   - Tantal-Capacitors C6,C7,C8,C9,C10,C11
   - Voltage Regulator IC3
   - IC-Sockets IC1*,IC2*
   - Connectors X3,X4,X5,X6,X7,X8 (cable entry to the outside)

Those components are marked red in the following drawing.

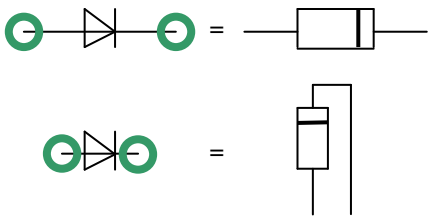
Components :

Colour-code of Resistors:

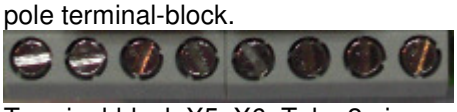
4K7 5%	yellow-violett-red-gold
alt.: 4K7 1%	yellow-violett-black-brown-brown
10K 5%	brown-black-orange-gold
alt.: 10K 1%	brown-black-black-red-brown
20K 5%	red-black-orange-gold
alt.: 20K 1%	red - black-black-red- brown
39K 5%	orange-white-orange-gold
alt.: 33K 1%	orange-white- black-red-brown
220K 5%	rot-rot-yellow-gold
alt.: 220K 1%	rot-rot- black-orange-brown

Colour-code of Coils:
10uH 10% brown-black-black-silver (they look also like resistors)

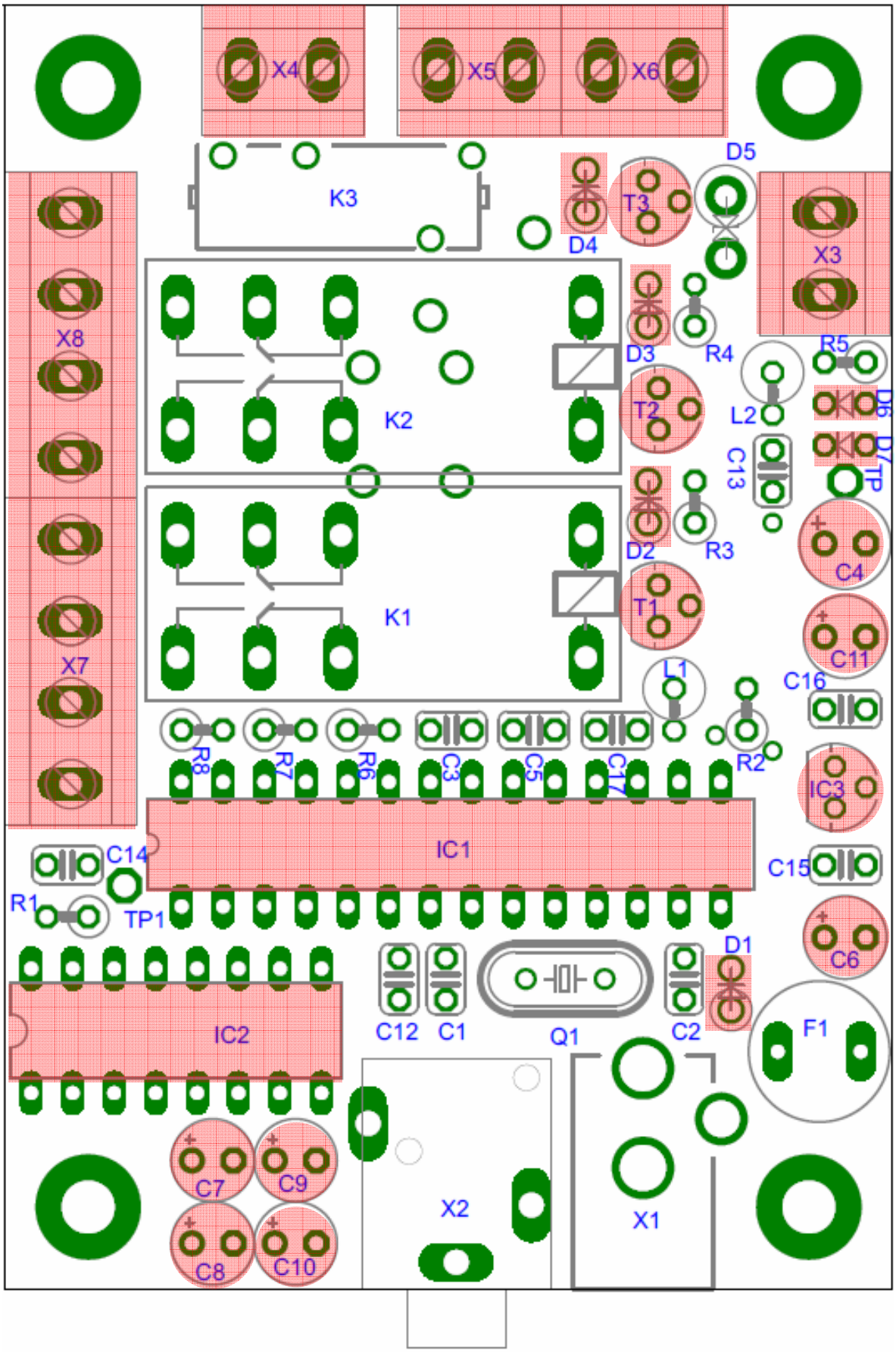
Diodes :

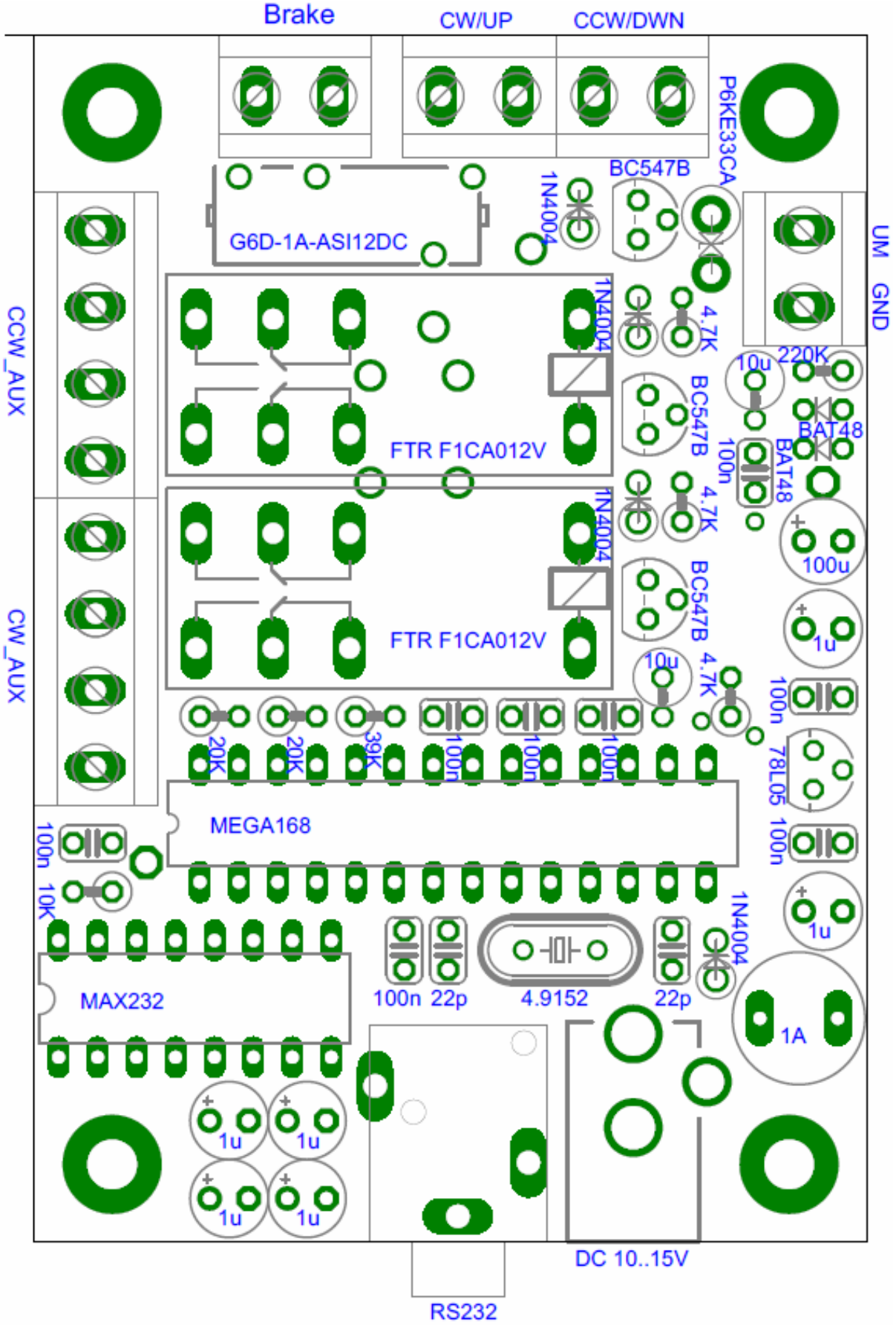


Terminal-block X7, X8: Take 4 pieces of 2-pole terminal-bocks and slide them together to form an 8-pole terminal-block.



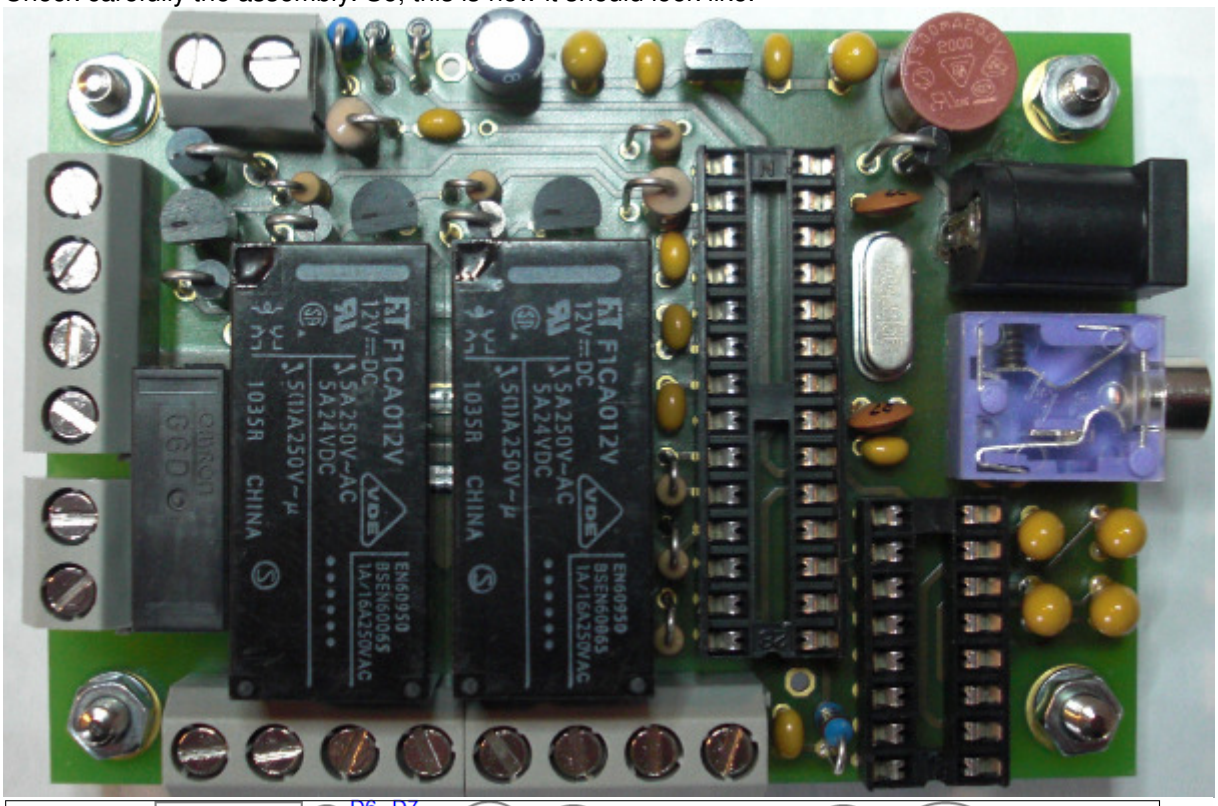
Terminal-block X5, X6: Take 2 pieces of 2-pole terminal-bocks and slide them together to form an 4-pole terminal-block.

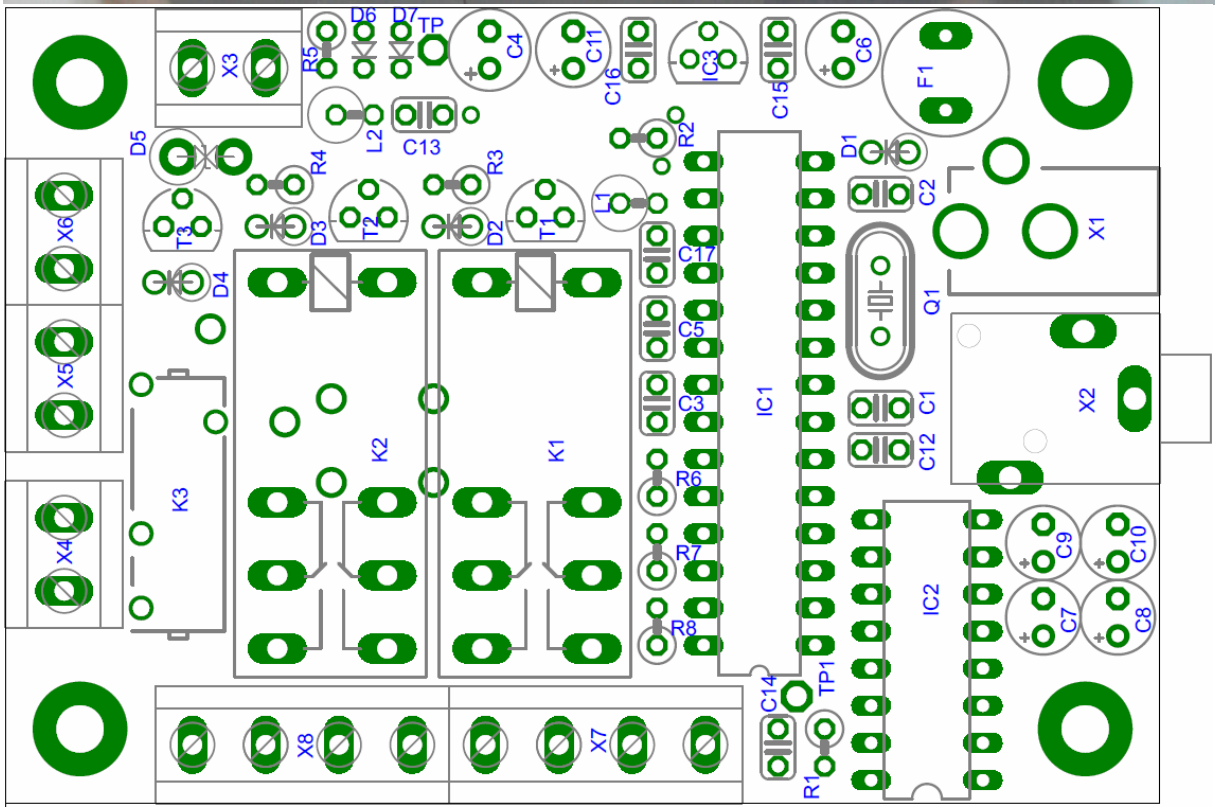




After assembly, attach the 4 bolts with nuts for mounting. Use spring-washers below the nuts.

Check carefully the assembly. So, this is how it should look like.





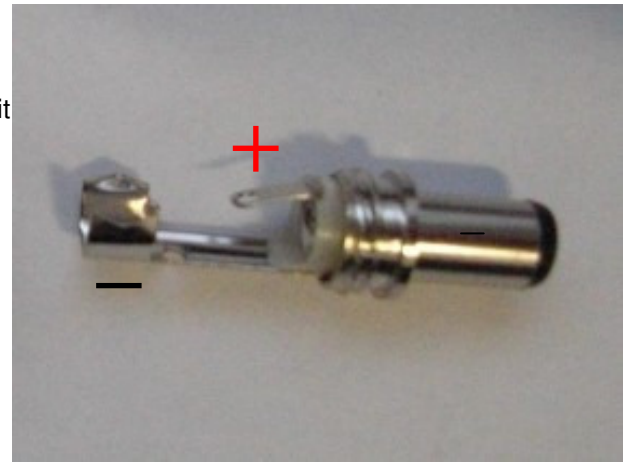
So fare, don´t put the ICs (MEGA168 and MAX232) into their sockets. First a little electrical test should be performed:

4. Connection of the DC-supply and check of the voltage-regulator

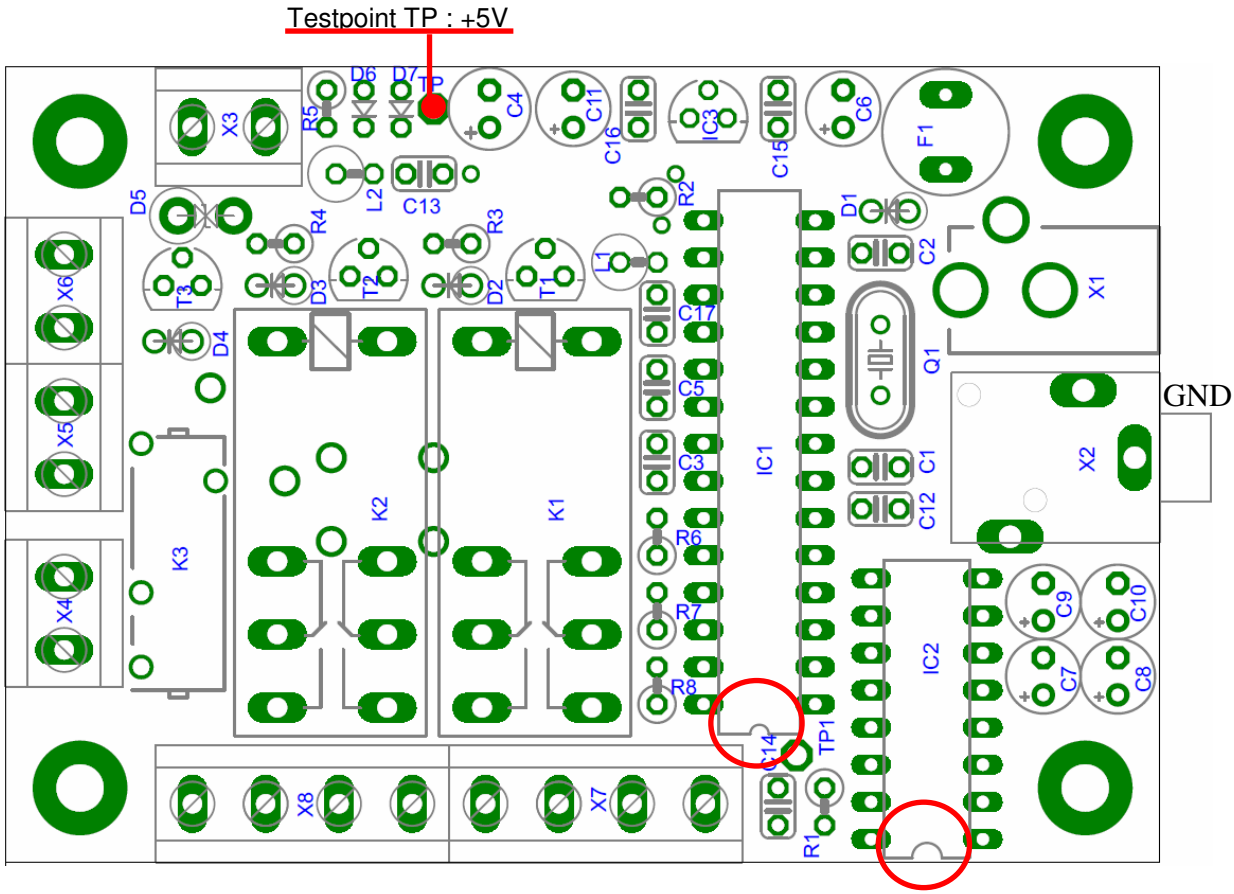
After checking all assembled components for identity, polarization and solder-bridges, connect 10 to 15VDC to connector X1. This can be done by using the DC-Connector supplied with the kit or any other DC-Source with a appropriate DC-Connector of 2.1/5.5mm and **Plus(+)** on the center-pin.

Connect the **Plus(+)-pole** to the center contact and the **Minus(-)-pole** to the outer contact.

If DC is reversed, nothing will happen as the circuit is proven against wrong polarization.



After connecting DC correctly, you should measure +5VDC +/-0.2V at the test-point TP against GND. GND is available at the outer contact of X2.



Disconnect the supply and put the ICs into their sockets. Take care of the direction of the components and not to bend any pins while inserting the components into the sockets.

5. Installation of the Service Tool

The Service Tool is on the CD supplied with the kit.

Start the Setup-File **SETUP.EXE** directly on the CD and follow the instructions.

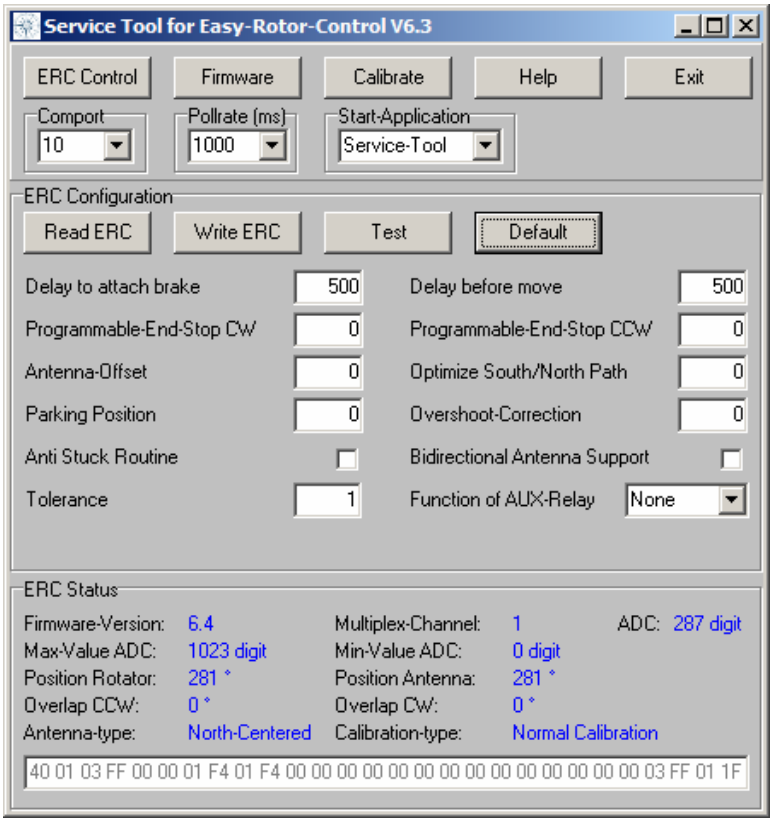
The installation wizard will automatically install the Service Tool in the program directory (or any other if you choose a different one) and put an icon on your desktop.

6. Connect the Easy-Rotor-Control

Connect the ERC to one of the COM-Ports using the RS232-cable from the kit. If you don´t have a (free) COM-Port on your computer you may use an additional USB-serial-converter to connect to the USB-Port of your computer. Now connect the ERC to a DC-Source of 10 to 15 VDC.

7. Configuration of the Service Tool

Start the Service Tool by double-clicking the Icon on the desktop.



On shipment, the Service Tool is configured to comport COM1:, hence after Start-Up the program may bring up an error-message because of the wrong COM-Port.

7.1 Configuration of the COM-Port

Choose the right COM-Port. The Service Tool will check the availability of the ERC at the choosen COM-Port. If successfull, the Service Tool will read the configuration-parameters of the ERC and populate the ERC-configuration-window.

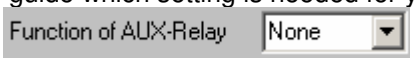
7.2 Read the ERC-configuration-parameters

The parameters of the ERC can be read by clicking the 

button

7.3 Configuration of the AUX-relay

Depending on the rotator used, you need to configure the function of the 3rd relay. Otherwise the rotator may not move.
Please check in the installation-guide which setting is needed for your type of rotator.

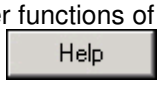
Choose the desired function in 

and store the new value into the ERC by pressing the 

buttons.

7.4 Other functions of the Service Tool

The other functions of the Service Tool are well described in the help-function of the Service Tool.

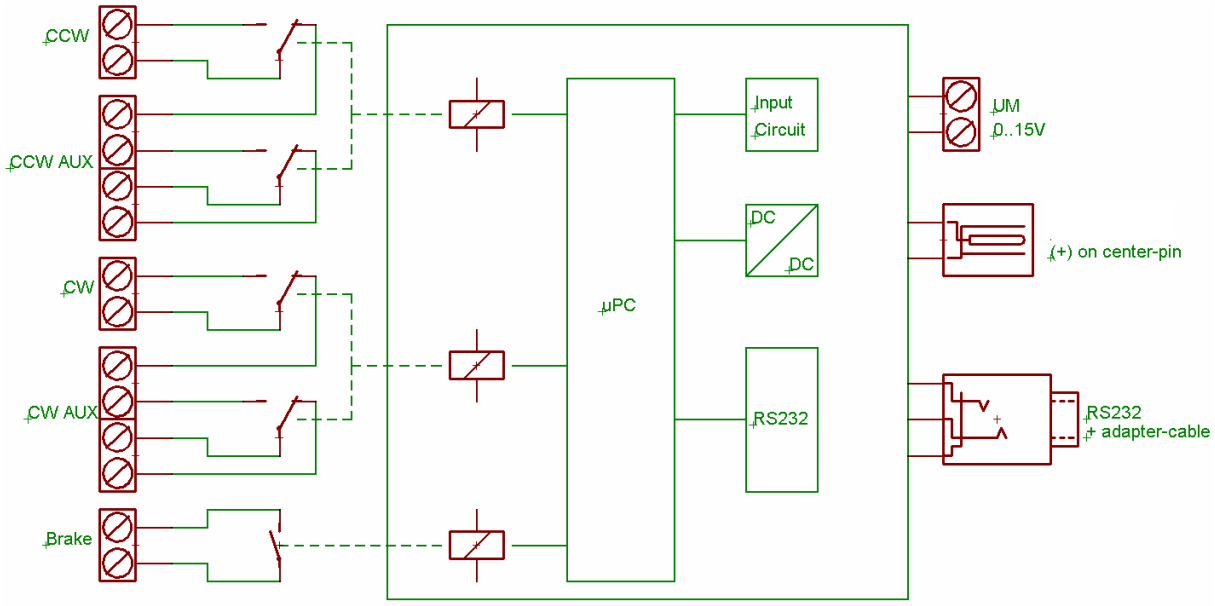
Click the 

button.

8. Installation of the ERC

Easy-Rotor-Control can either be installed in the rotor-controllers housing or in certain cases it can be connected completey from the ouside to the rotor-controller. The installation is specific for every typ of rotor/controller. Therefore you received an specific instruction, how to install the ERC in your setup.

8.1 Theory of operation



A Microcontroller receives commands via the RS232-interface in different protocols from the programs that support controlling rotators. These commands include the target-position for the rotator (0..360°) or a rotor-stop-command or the request to report the current position of the antenna.

The ERC takes the task to move the rotor to the desired position or, to stop the rotor while it is already moving. Also changes of the direction are possible while the rotor is moving. The current position of the rotor is calculated by the ERC from the measured rotor-feedback-voltage UM. To achieve accurate function, the ERC has to be calibrated to the specific value of the rotor-feedback-voltage. (ref. To the next chapter)

Depending on the direction to move, the relay at contacts CW and CW AUX (ClockWise = right) or the relay at contacts CCW abd CCW AUX (CounterClockWise = left) is closed. With a programmable delay the relay at contacts BRAKE will be activated to release a brake prior to movement or to attach the brake after the rotor has stopped..

The RS232-connector ist a 3.5mm phonejack which will provide a standard 9-pin DSUB connector together with the adapter-cable made in chapter 2.

The power supply connector is a standard DC-jack with an inner contact with diameter 2.1mm and an outer diameter of 5.5mm.

9. Calibration

After the ERC is connected to the rotor-controller it has to be calibrated. This calibration is needed, because different kind of rotors deliver different kind of feedback-voltages. Also variations between rotors of the same model would lead to inaccuracy. To calibrate the ERC, it has to meassure the rotor-feedback-voltage at 180° clockwise-position and 180° counterclockwise-position. For rotors that have their center to south direction (south-centered-antennas), the calibration has to be done at 0° CCW and 0° CW. The calibration is a software-guided procedure, which will be started by pressing the

Calibrate button of the service tool.. Just follow the instructions given.

10. First check of calibration with ERC-Control

Together with the service tool you will receive a program to control your rotor. It is called ERC Control and is available through the ERC Control button.

This tool sends commands in the Hygain-DCU-1 protocol to the ERC.

The compass in the middle and the green value above are always showing the current position of the antenna which is reported from the ERC to the program.

You can click any point on the compass rose and the rotor will move to the direction indicated above the compass rose or put a target-direction in the upper left field 0 and start moving the rotor with the GO button. If you press the Stop button, the rotor will stop.

If you press the << button, the rotor will move to the left (CCW) until you release the button.

If you press the >> button, the rotor will move to the right (CW) until you release the button.

If you press the |<< button, the rotor will move to the left (CCW) until you press the Stop button.

If you press the >>| button, the rotor will move to the right (CW) until you press the Stop button.

If you press the Park button, the rotor will move to its programmed parking position.

11. Connect the ERC to other programs

Please take care about the following points, if you want to control your ERC with other programs :

- Choose the right COM-port
- Adjust the comport in the program to : 4800N81
  - 4800 Baud
  - No Parity
  - 8 databits
  - 1 stopbit
- More information is available in the software-wiki at our homepage: www.easy-rotor-control.com

Appendix A: Schematics