DRIACS-G2

Antenna Control System Generation II

by Alex Artieda, HB9DRI

Tracking the moon and celestial bodies without PC

Agenda

- Tracking the Moon – dilemma: PC or not PC
- The first ACS by OE5JFL
- The DRIACS-G2
- The Microcontroller
- The Control Interface
- Encoders
- The DRIACS-G3 (prototype)
- Diagrams, PCB templates and firmware availability

Tracking the Moon
Dilemma: PC or not PC?

- Tracking calculations for EME don‘t need high computational power
- Excess of processing capabilites at the shack.
- Relatively easy to implement tracking systems with PC
- Initially most run under BASIC, MS-DOS, later Windows, Linux and MAC
- Interfacing via the LPT or COM ports, few via USB
- Most systems do come from Ham Satellite communications, adapted for slow movements but with poor resolution
- Implementation cost moderate to expensive, +/- 400.00 USD but don‘t forget to add the PC cost

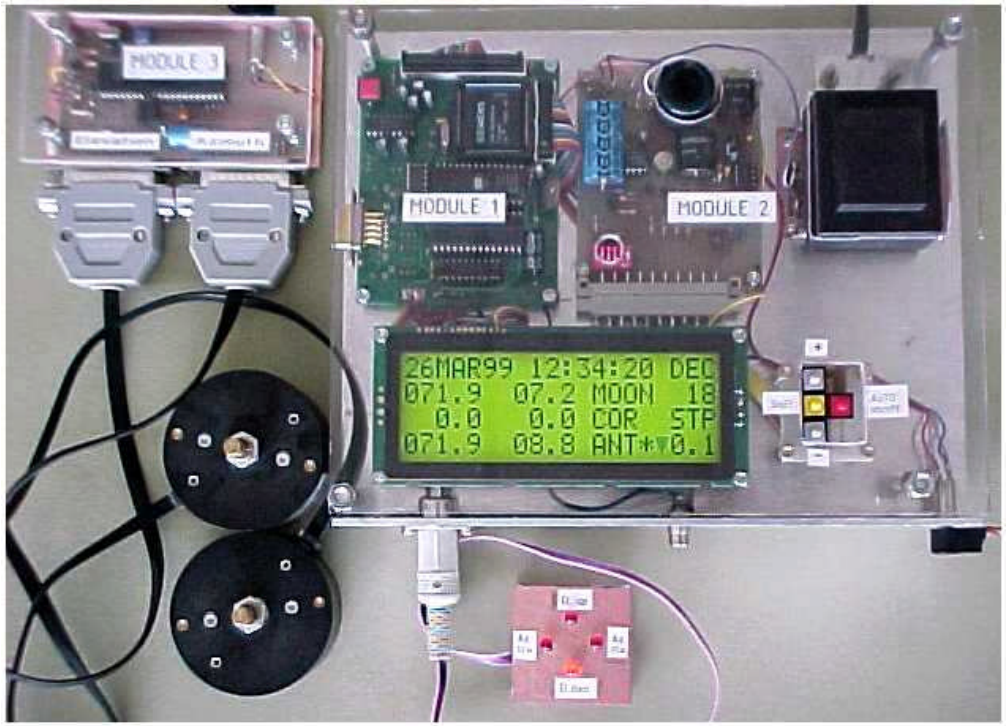
Tracking the Moon
Dilemma: PC or not PC?

more PC‘s = more NOISE and birdies in your BW

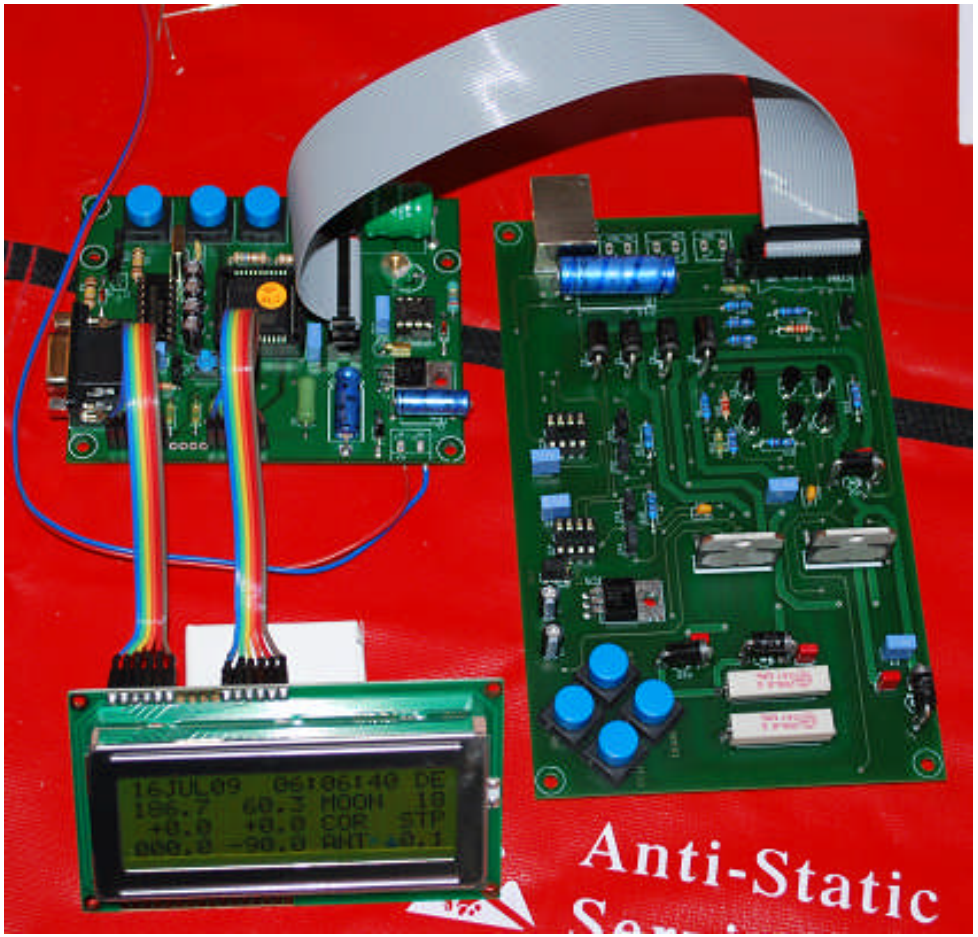
.....less QSO‘s

The first ACS by OE5JFL

- Hannes Faching, OE5JFL, designed and implemented the first ACS 14 years ago, idea was tracking the moon without PC



The DRIACS-G2



The DRIACS-G2

- HW and SW designed by OE5JFL, implementation done by HB9DRI.
- In 2009, Hannes and I agreed to build few controllers with the condition to keep the entire information such as diagrams, PCB templates, firmware and applications notes available to the EME community for free.
- Until today, 30 DRIACS-G2 were produced by HB9DRI, 10 additional units are under production and an unknown number reproduced from the information available on internet.

The DRIACS-G2

- Characteristics

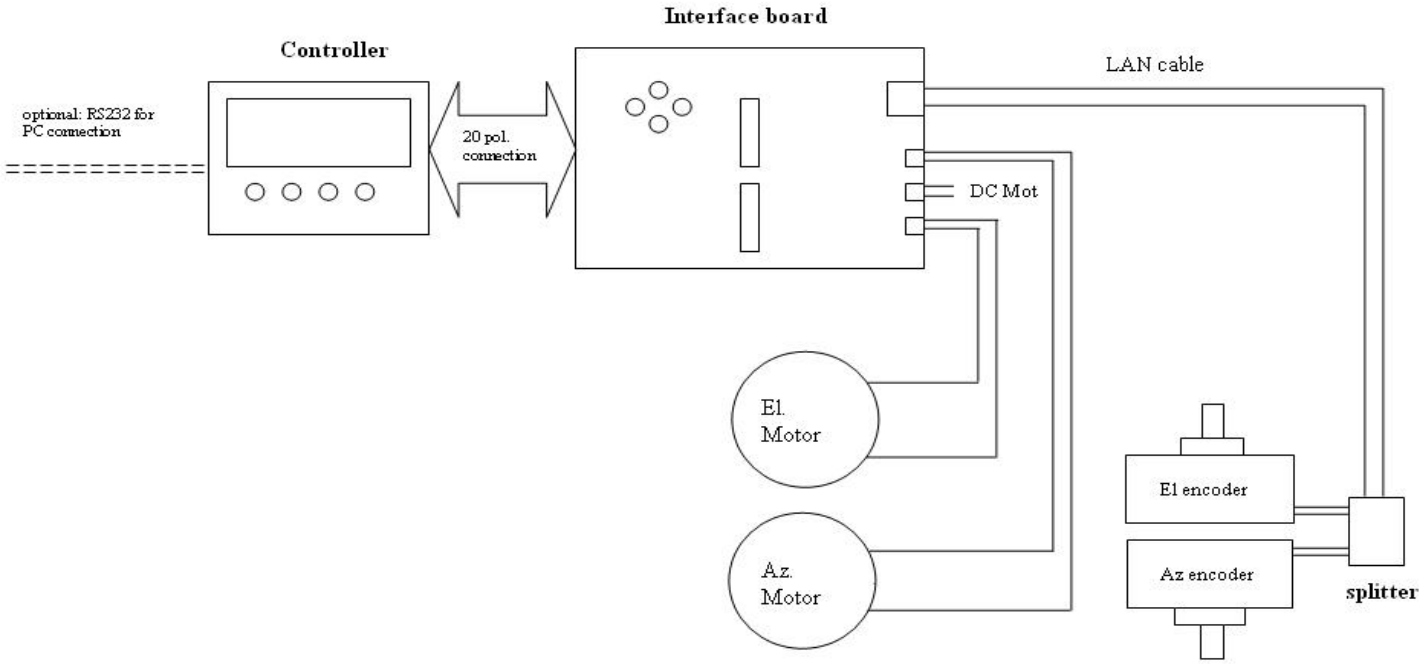
  - PC not required, no patching, no viruses, less energy, less noise.
  - Computation position for Moon, Sun, Cassiopeia, Cygnus, Sagittarius, Taurus, Leo, Aquarius and a RA/DEC value of free choice
  - AZ and EL motor controlling (with soft start and soft stop, PWM)
  - Interfacing with different absolute encoders with 10, 11, 12 bit like MAB25, MAB28 and US digital A2-S-S

The DRIACS-G2

- Characteristics
  - Selectable step size for tracking with 0.5 , 0.2 and 0.1deg
  - Selectable offset for AZ and EL +/- 9.9deg
  - Operation with only 4 buttons.
  - Nonvolatile storage of all parameters
  - Real time clock (RTC)
  - 4 x 20 character LCD display
  - RS-232 interface for uploading firmware updates and remote controlling.

The DRIACS-G2

- Block diagram

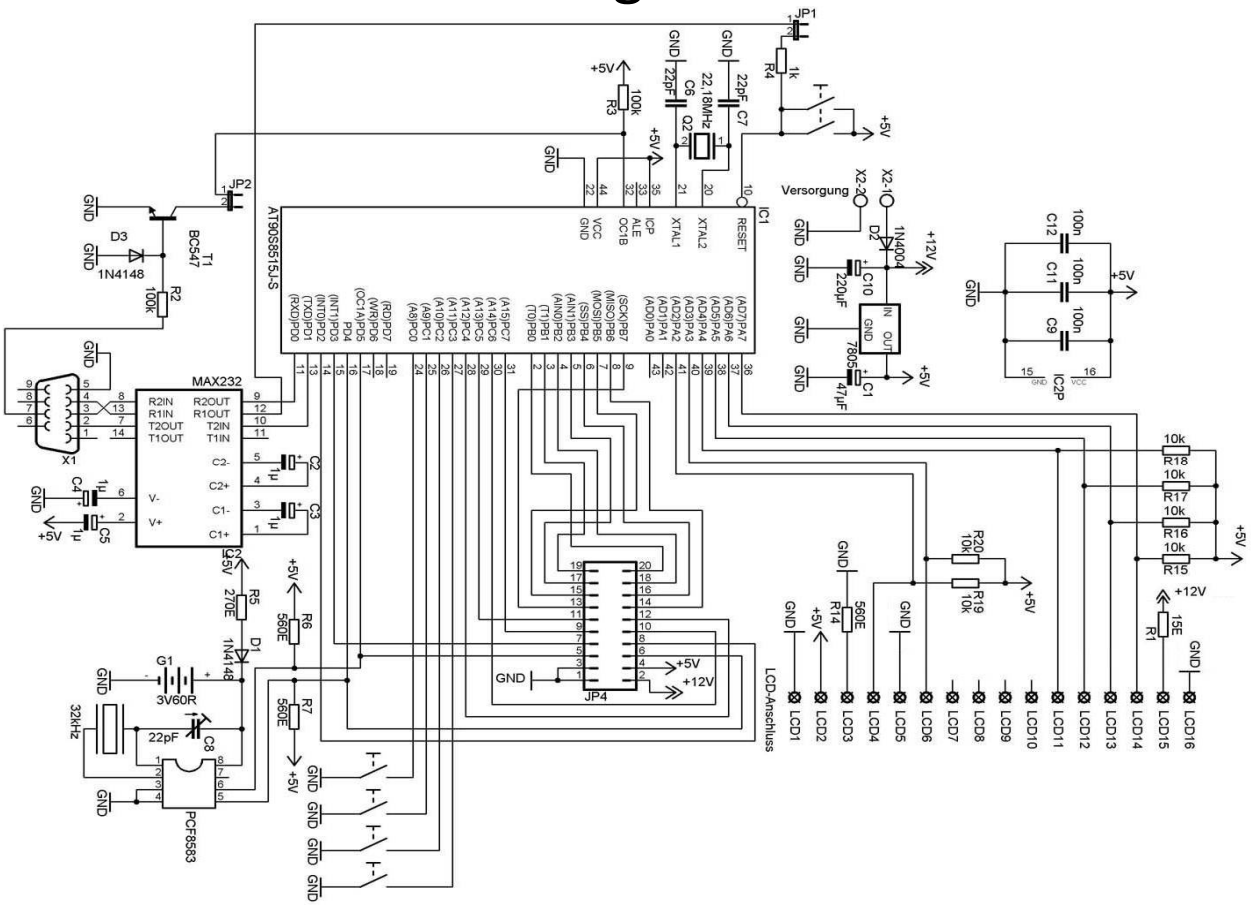


The DRIACS-G2

- CPU Atmel AT89C51ED2
  - 64K program memory
  - 256 bytes Internal RAM
  - 1768 bytes so called external RAM but on the same chip
  - Clock speed 22.118 MHz
- RS-232 interface for programming and remote control
- Real time Clock PCF8583 IIC with RAM embeded to store system parameters
- 3.6v NiCd battery (life 5 years)
- LC6203 Mosfets H-bridges to controlling AZ /EL up to 36 vdc / 4 amps

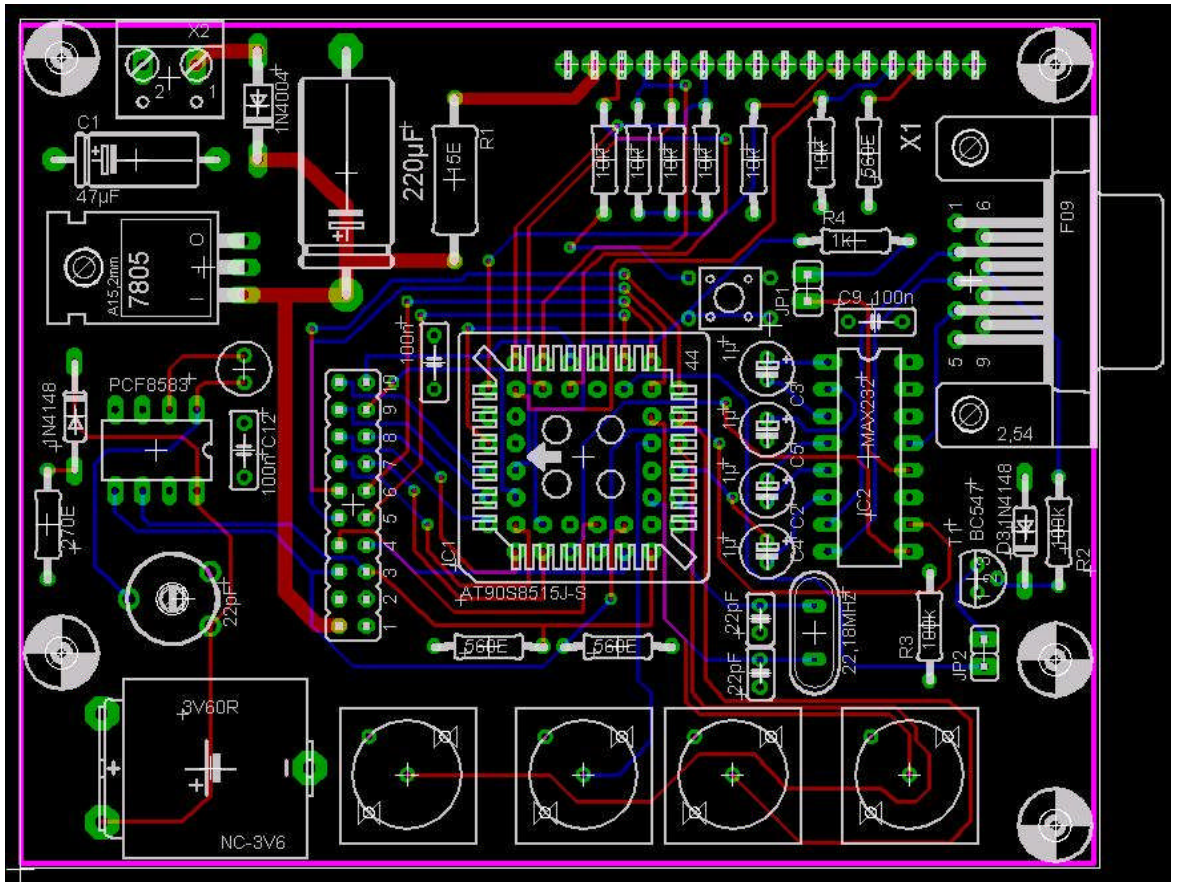
The DRIACS-G2

- The Controller board diagram



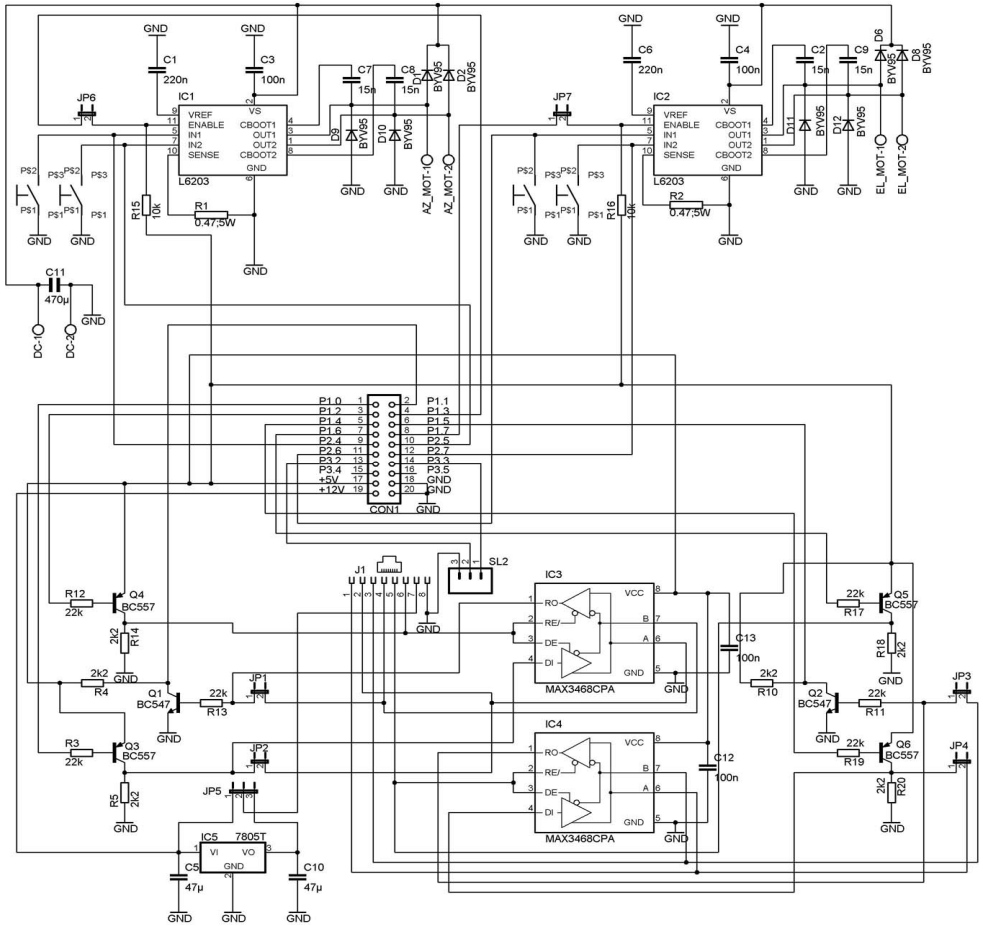
The DRIACS-G2

- The Controller board



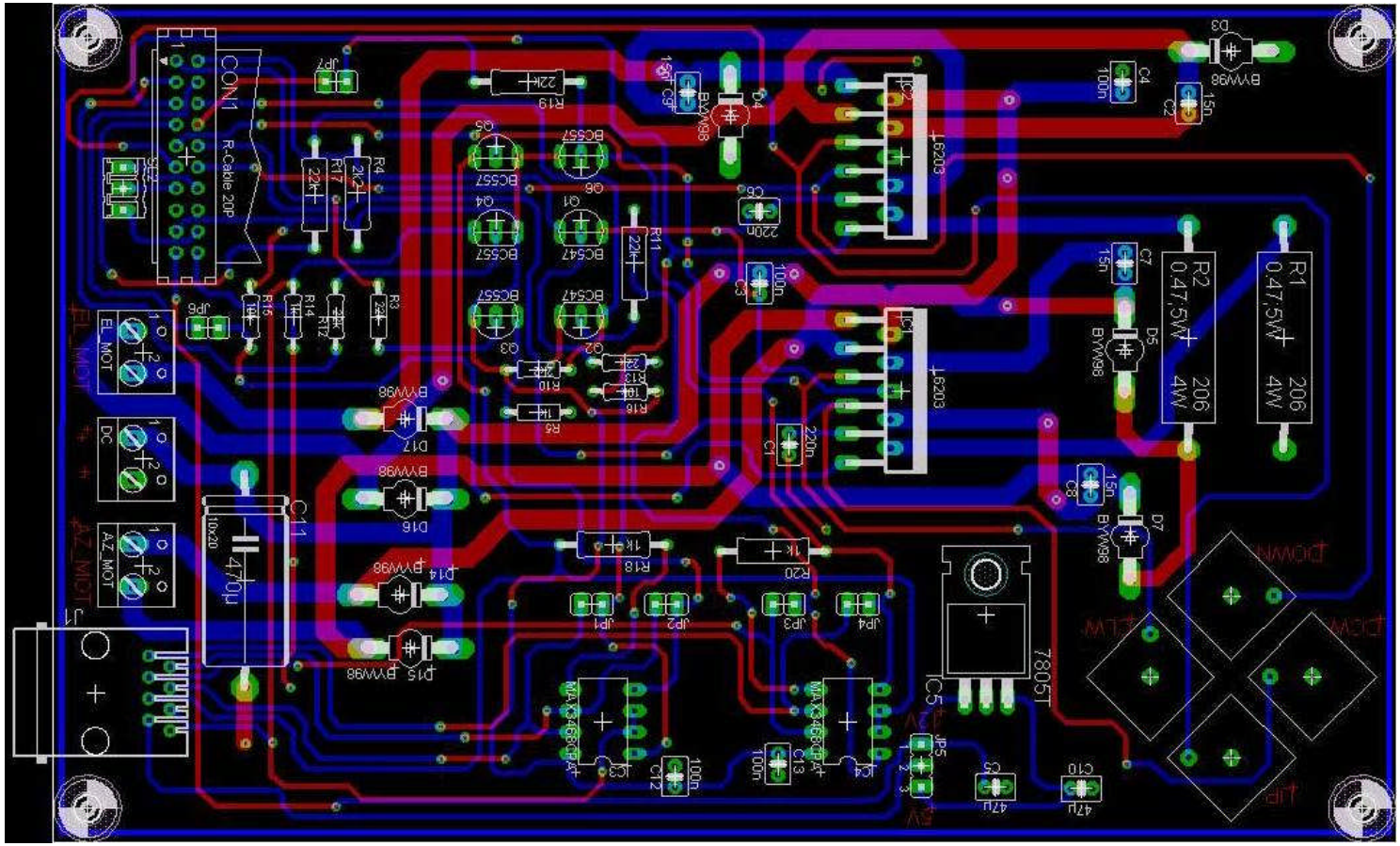
The DRIACS-G2

- The Interface board diagram



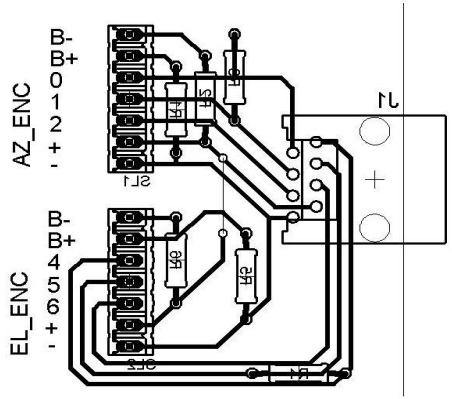
The DRIACS-G2

- The Interface board



The DRIACS-G2

- The splitter diagram and board



A2-S-S connection

Splitter		Encoder
0(4)		6: DATA- (blue)
1(5)		5: DATA+ (yellow)
GND		1: GND (red)

MAB25 connection

Splitter	Encoder
+5V	VDD
2(6)	CS
0(4)	CLK
1(5)	DATA
GND	GND

At the splitter the pin numbers 0,1,2 for Az and 4,5,6 (in brackets) for El are connected via the LAN cable and the switching transistors to P1.0,..,P1.6 of the 20pin connector.

The DRIACS-G2

Encoders

- The DRIACS-G2 works with Incremental and Absolute encoders. However, we don‘t recommend incremental encoders.

  - **Incremental encoders**: The current position is calculated by incrementing/decrementing a counter, whenever the system ´forgets´ a pulse (too fast movement, not perfect tracks...) or the power supply is switched off, the position indication is wrong from that moment on.

  - **Absolute encoders**: Each position is assigned to an unique bit combination. Therefore the **correct position is indicated immediately** after switching on the power supply and is not lost if you switch it off. Most popular encoders use the Serial Synchronous Interface (SSI), such as the MAB25 and US digital A2-S-S encoders.

The DRIACS-G2

Encoders, the MAB25

- The DRIACS-G2 works with the US Digital A2-S-S or with the MEGATRON MAB25 Absolute encoders.
- Experiences show that the MAB25 encoder is a serious option capable to run up to 0.1deg resolution (12bit)

- The mechanical installation of a MAB25 encoder demands more precision than a A2-S-S, otherwise additional +/- 0.2 deg error is added. (axial mov.). Better MAB28 with 2 ball bearings
- The DRIACS-G2 selects via software resolutions with 10, 11 and 12bits (0.5, 0.2 and 0.1 deg) with the MAB25

- MAB25 encoder costs aprox: 60.00 USD
- US digital A2-S-S costs aprox: 250.00 USD

The DRIACS-G2

Encoders, interconnection

- via a network cable CAT5

- Simple plug in a network cable in to the interface and the other side into the splitter board.

- Encoders are connected to the splitter board as short as possible.

- Quality of the CAT5 cable is critical, certain bad cables show erratic lectures with only 7 meter, good cables work up to 80 meters.

The DRIACS-G2

Encoders, interconnection, AN01

- AN01 is available for free and explains how to fix erractic lectures.

- The problem was detected by Gerad PA0BAT and he proposes dumping to ground the CAT5 lines 0,1 and 2 via a 560 ohms resistor on the splitter side.

- The solution was tested with several „bad cables „ and the problem was solved by 99%.

The DRIACS-G3 (protoype)

- 2 new options are under development:

  - Interface with a GPS receiver (time, date and position)
  - AFP = Automatic Fine Pointing system

- Implemented as an extra PCB easy to interface with the DRIAC-G2
- It is at the moment a protoype

The DRIACS-G3 (protoype)

GPS interface

- Will work based on a PIC, maybe 16F678, not yet defined
- The system reads the GPRMC sentece from the NMEA protocol

$GPRMC,225446,A,4916.45,N,12311.12,W,000.5,054.7,191194,020.3,E*68

225446 Time of fix 22:54:46 UTC
A Navigation receiver warning A = OK, V = warning
4916.45,N Latitude 49 deg. 16.45 min North
12311.12,W Longitude 123 deg. 11.12 min West
000.5 Speed over ground, Knots
054.7 Course Made Good, True
191194 Date of fix 19 November 1994
020.3,E Magnetic variation 20.3 deg East
*68 mandatory checksum

- Upload time, date and LAT/LON to DRIACS-G2 via ASCii chr.
- Andy Talbot, G4JNT is modifing his GPLOCDIS PIC project to interface with the DRIACS-G2, diagrams, Firmwares and templates will be available for free soon.

The DRIACS-G3 (protoype)

Automatic Fine Pointing , AFP

- Based on moon noise level
- Will work only on 23cm and up, at least 2.5m dish
- Design based on the VK3NX moon noise meter
- The DRIACS-G2 will point the antenna to the moon and then the AFP system will „fine point“ the antenna to the „hot spot“ reading the moon noise level and combined with the micro processor information will use the PWM mov.
- No more manually OFFSET insertion (OFFSET varies depending of the weight of your feed)
- Especially for high microwave bands and/or medium to big dishes (23cm and up)
- Needs very good mechanical design for AZ/EL
- AFP will exploit the soft-start /soft-stop capability of DRIACS based on PWM
- Capable to work with at least 0.5dB moon noise levels
- It is a prototype and not yet finished, stay tuned.....

Diagrams, PCB templates and firmware availability

- Download for free from :

http://www.qsl.net/oe5jfl/ant_cont.htm

Updates and Application Notes are available

Assembled systems please contact
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