Computer controlled Sirius motor dome interface

This description cover the implementation of the electrical and mechanical interface to the Sirius motor dome control unit using the Velleman USA interface board (P8055) and the LesveDome driver program.

In order to understand the interface it is needed to understand the LesveDome software driver and the electrical interface which is used by this program. This interface can be found on the Lesvedome website.
So please study this interface before reading the Sirius motor dome control interface.
Since I was only interested in the electrical dome control, I used only a part of the LesveDome electrical interface.
Because the Sirius dome motor is a 12V DC motor I use the CD motor setup and the manual rotation part of the schematic.
The other parts will maybe build-in later on.
This document is written as a Microsoft word document and later on transferred to a PDF file. This means that the drawings and pictures are parts of this document.

The document contains 3 paragraphs which describes the electrical additions, the mechanical additions and the driver software changes.

- Electrical additions.

My Sirius 2.3m Dome observatory was build in November 2007 and is equipped with a manual controlled dome rotation motor. Since the observatory is still under warranty no modifications or changes were done on the existing parts when building in the computer controlled dome interface.

In figure 1 the connection diagram is shown of the various parts of the computer controlled Sirius motor dome interface.
At the left the Velleman USB interface is shown (K8055), the Sirius motor interface is shown in the middle and the Sirius motor control is shown left. Top right the Hall effect sensors (type 3141) for the dome home position and the azimuth information are shown. All 3 sensors are connected directly to the Sirius motor interface.
For the azimuth information 2 sensors are used. These are mounted at an angle of 45 degree inside the reducing gear assy. In this way a “Gray code” can be obtained. At the dome reducing gear, 2 magnets are mounted which are sensed by the 2 azimuth Hall sensors.
The home position sensor is attached near the small gear driving the dome rack (see figure 14). The home position magnet is attached on the rack. A more detailed description will be given later on.

The connections of the manual dome rotation switch for the CW and CCW dome rotation connected to the Sirius motor control is fed back to the Sirius motor interface. This information is needed by the LesveDome driver program in case a manual movement is carried out.

The Velleman USB interface outputs 2 signals, OUT1 and OUT2 for the CW and CCW dome movement. It receives 4 input signals Di-1 (first azimuth info), Di-2 (home info), Di-4 (manual CCW movement) and Di-5 (second azimuth info).

The 5 volt from the Velleman PCB is used to power the opto-couplers and the Hall sensors.
Since the Sirius motor control uses 12V to control the CW and CCW direction, also this voltage is returned to the Sirius motor interface board.

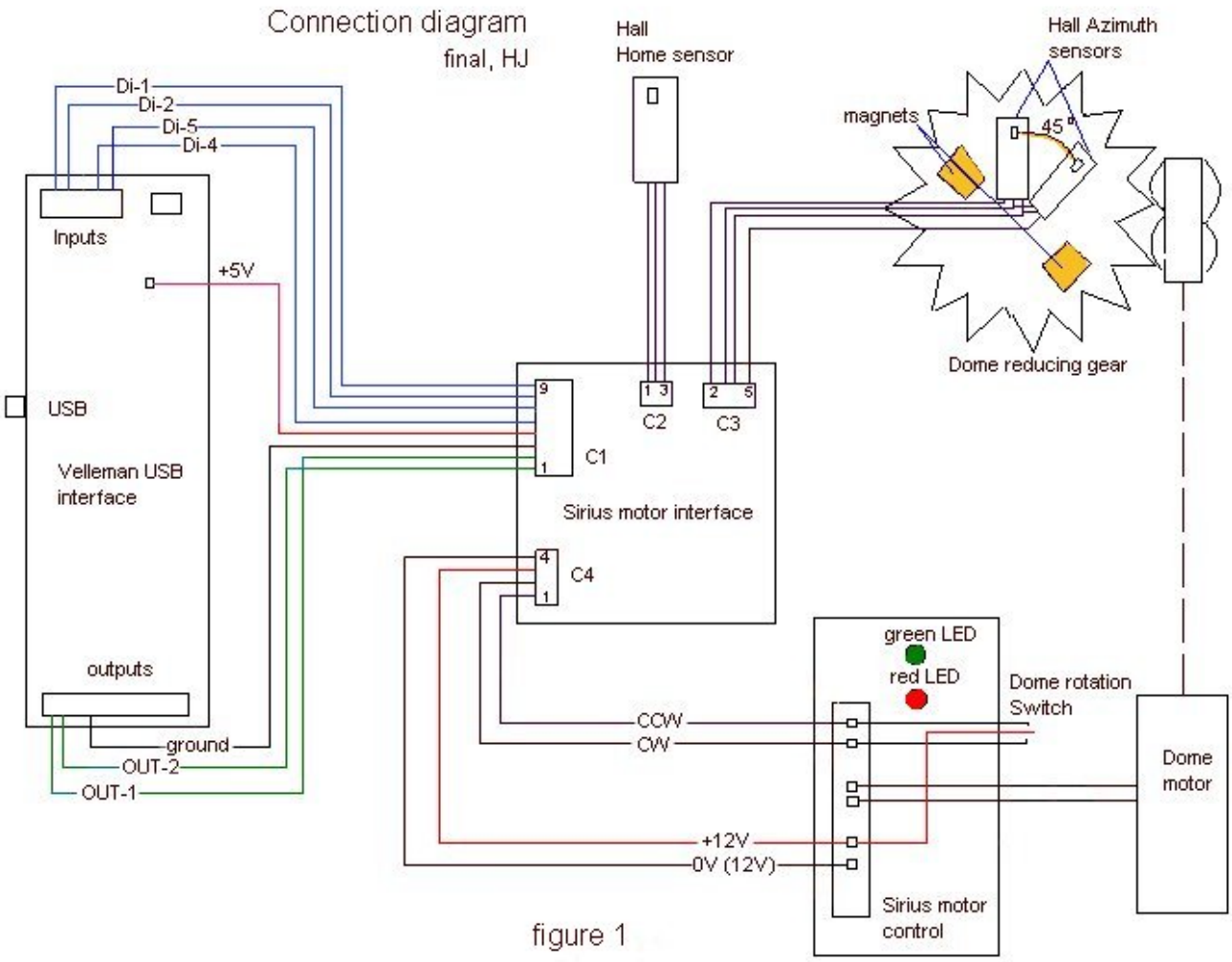


figure 1

In figure 2 the Sirius motor interface is shown.

This is a small pcb (Fig. 2, 3 and 4) which translates the LEsveDome (Velleman) in- and output signals in such a way that they can be understood by the Sirius motor control board. The Sirius motor control board needs 12V to activate the CW and CCW movement of the dome. Since we did not want to modify the Sirius motor control board, we use opto-couplers (IC1, 2 and 3) to get a galvanic separation between the Sirius motor control board and the Sirius motor interface board.

The lesveDome driver program outputs the following signals to control the dome movement:

Action:	**active signals (0V):**
CW, right-hand dome movement	OUT1
CCW, left-hand dome movement	OUT1 and OUT2

This means that if the OUT1 signal is active (0V), IC1/T2 causes the CW (right-hand) movement of the dome.

Also, if the OUT2 signal is active (0V) IC2/T3 causes the CCW (left-hand) movement of the dome. Since OUT1 and OUT2 are active the same time, the transistor T1 inhibits the IC1/T2 control.
The manual dome switch CCW action is returned back to the Velleman board via opto-coupler IC3.

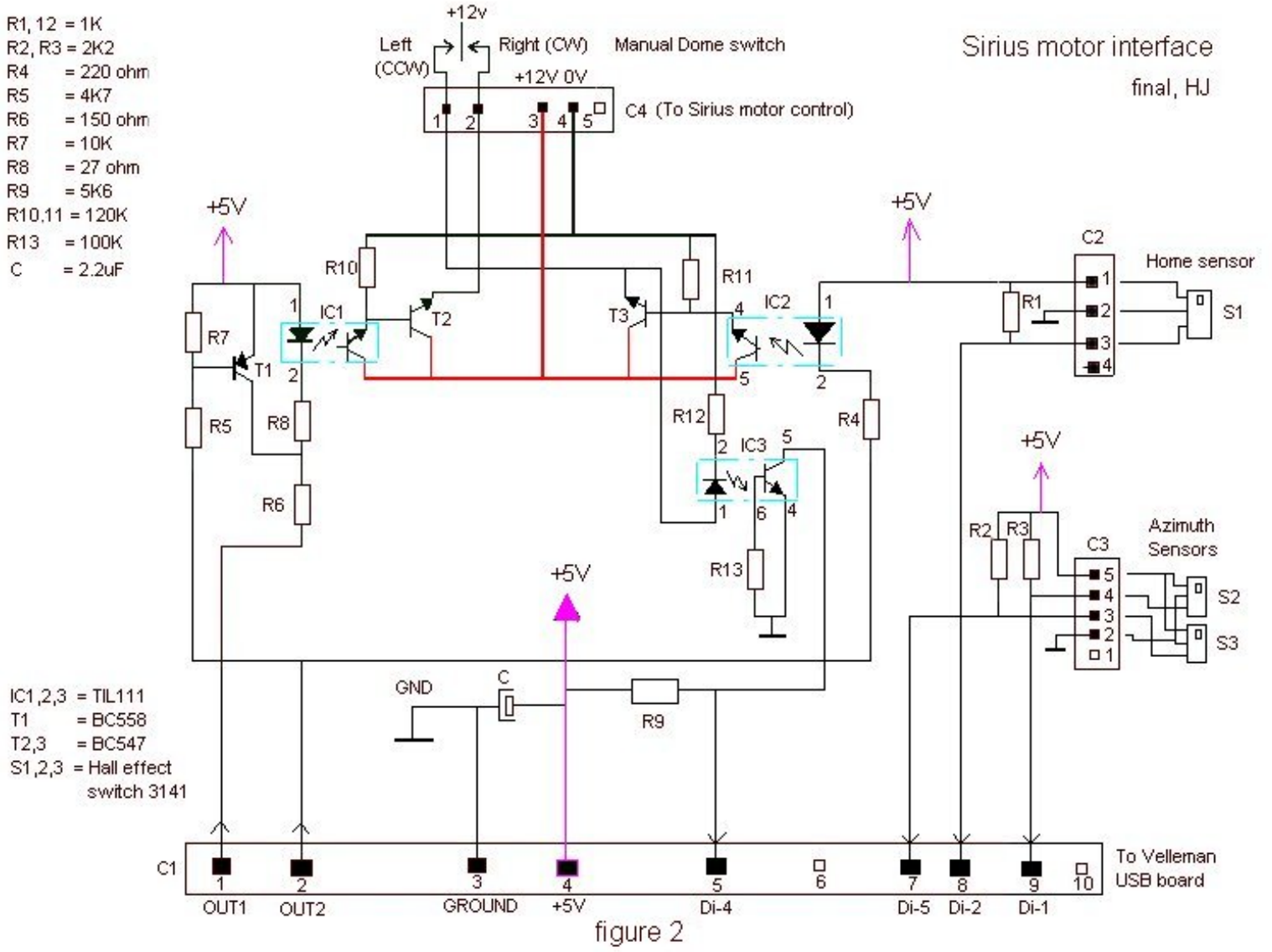


figure 2

In figure 3 and 4 pictures are shown of the Sirius motor interface board.

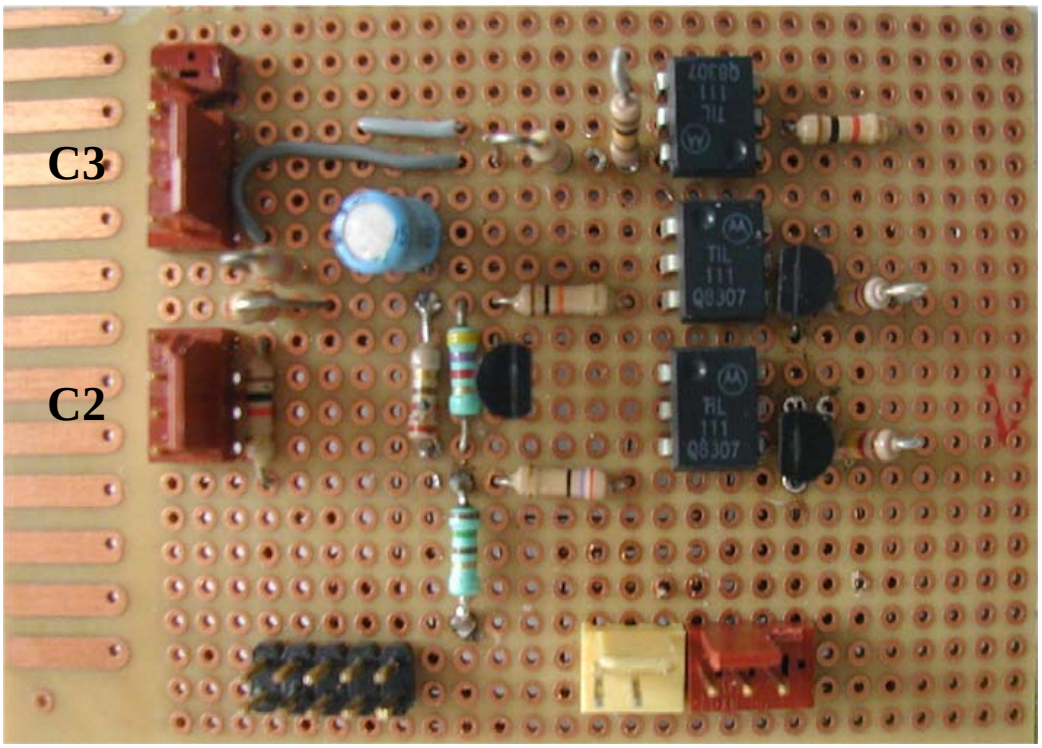


Figure 3, front view

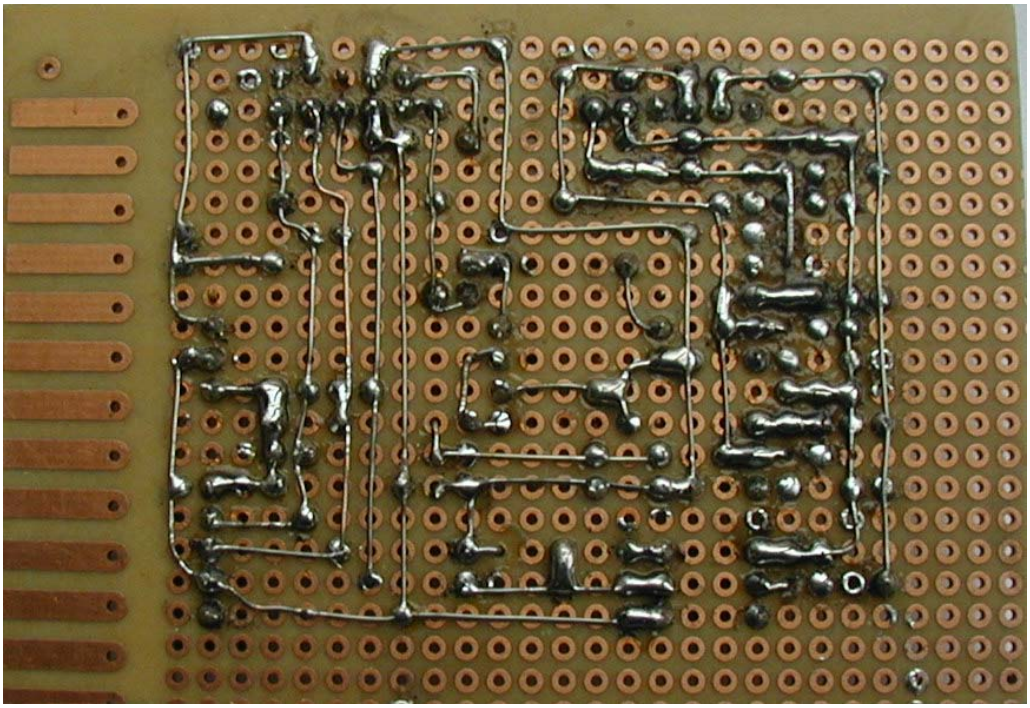


Figure 4, back view

Figure 5 below, shows the complete installation of the computer controlled Sirius motor interface inside the Sirius motor control box.

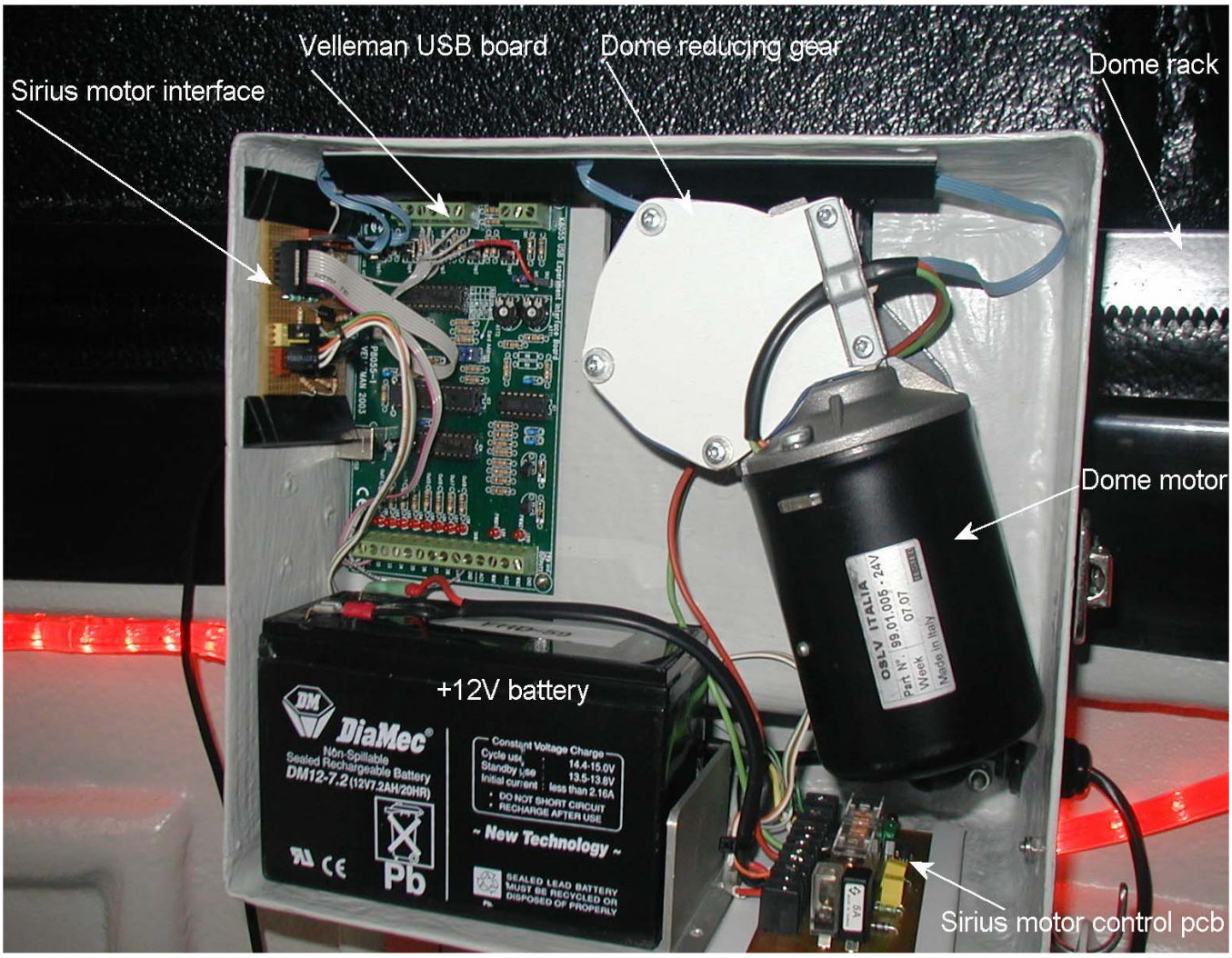


Figure 5, The complete installation

Figure 6 and 7 are showing the implementation of the Sirius motor interface inside the motor control box.

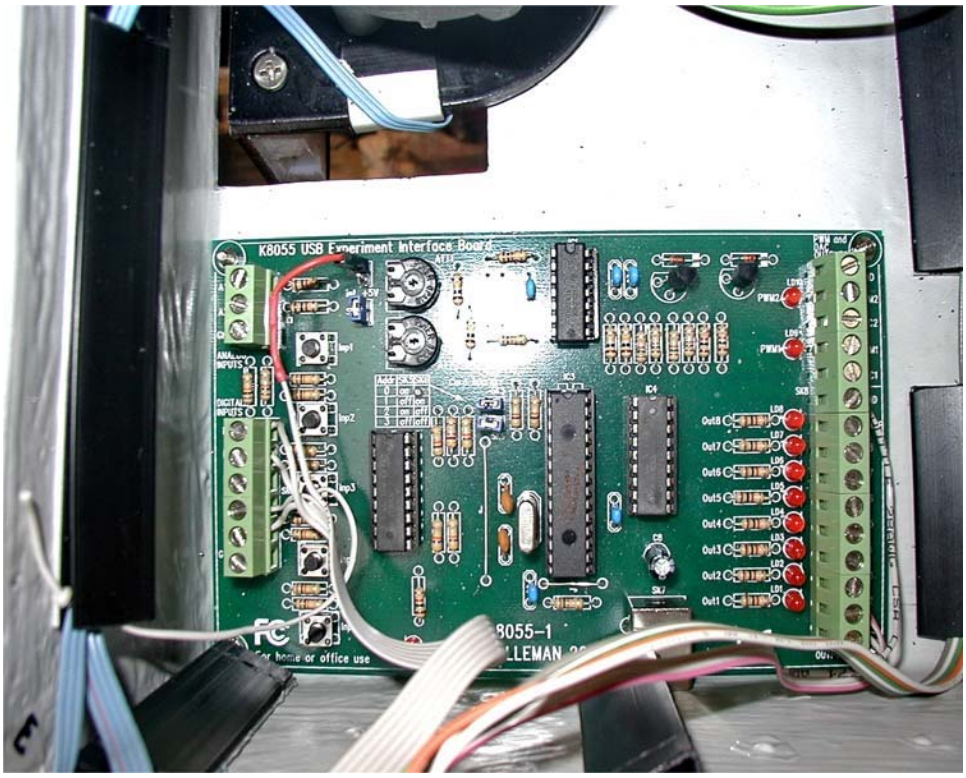


Figure 6

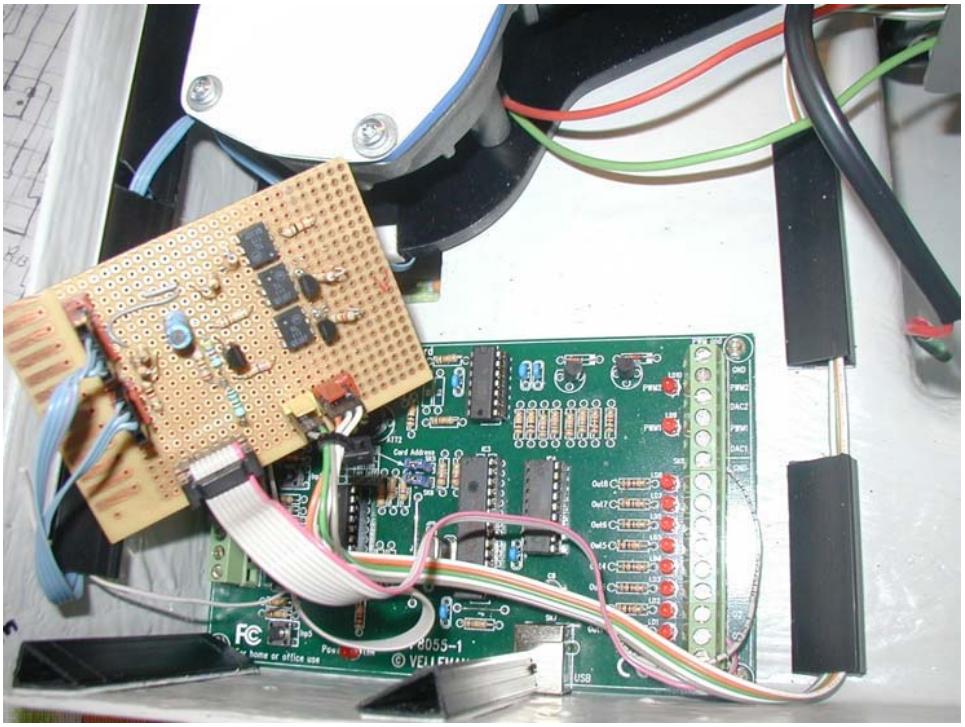


Figure 7

- Mechanical additions

The following mechanical additions are implemented.

Azimuth sensors

In figure 8 a drawing is made showing the home and azimuth magnets and home and azimuth sensors.
Inside the reducing gear box a plastic disk is mounted with 2 azimuth magnets. This disk is attached to the reducing gear by means of a fixation spring (see fig. 12). A second plastic disk with the 2 azimuth sensors is mounted next. In fact this disk is the cover of the gear box.
Figure 9 shows this.

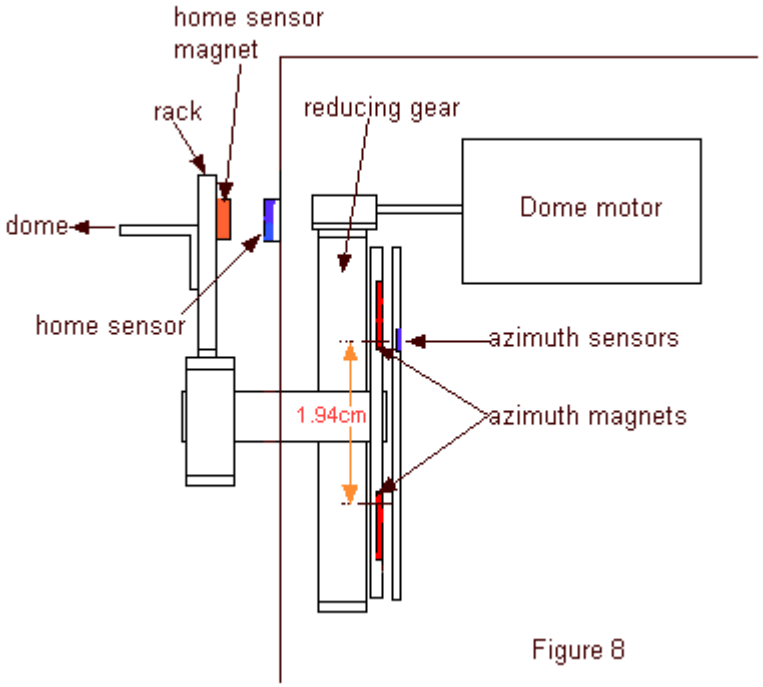


Figure 8

It is important that both sensors are mounted at an angle of 45 degree. The sensitive area of both sensors needs to see both magnets but 45 degree shifted. In this way a 'gray code' can be obtained.
The distance between both magnets at the sensitive area of the sensors is 1.94cm. This value is needed to calculate the number of pulses given by the LesveDome driver program.

Since we use 2 sensors with a distance of 1.94cm and a dome diameter of 220cm (diameter of dome rack), we obtain 227 pulses during one dome rotation.
Dome diameter is 220cm, azimuth wheel diameter is 1.94cm and azimuth sensor wheel – hole number is 2).

Figure 9 shows the 2 azimuth sensors at an angle of 45 degree.

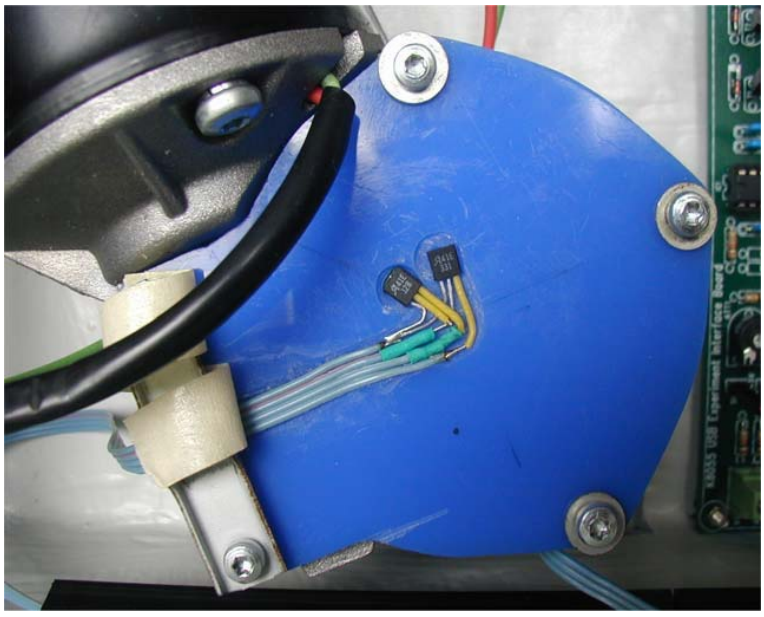


Figure 9

This page shows some more pictures of the plastic disk with the azimuth magnets and sensors.

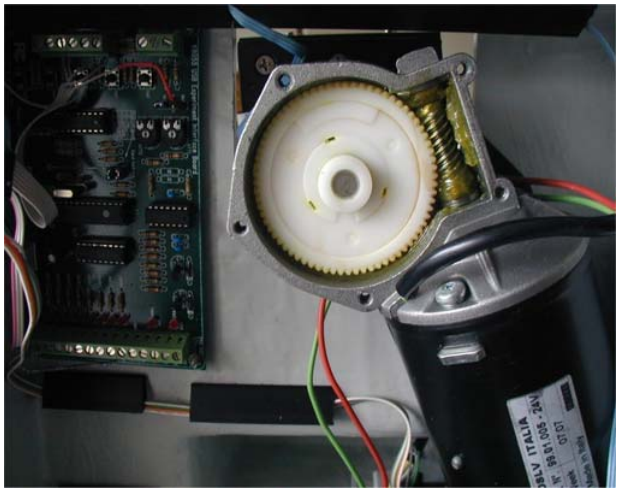


Figure 10, reducing gear

Figure 11, disk with azimuth magnets

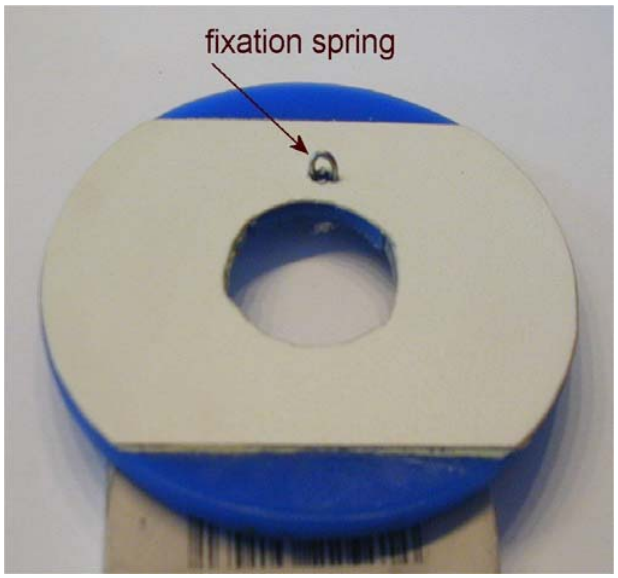


Figure 12, disk with magnets and fixation spring
Covered with glued paper.

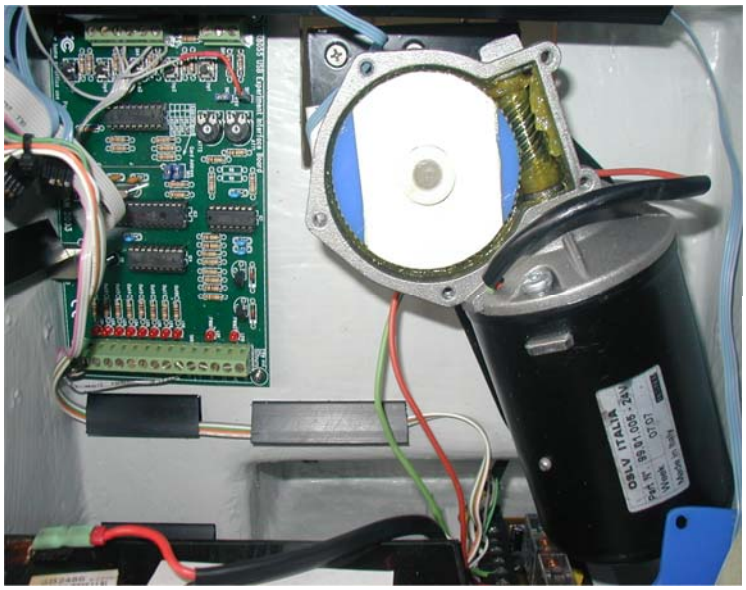


Figure 13, disk with magnets attached to the reducing gear.

Home sensor

The home sensor is attached to the outside Sirius motor box. In figure 14 this is shown. Since the distance between the sensor and the rack (and magnet) is too large, some additional spacers need to be placed at the backside of the sensor, this to reduce the distance between sensor and magnet.

The home sensor magnet is attached on the rack which is attached to the dome (see figure 9).

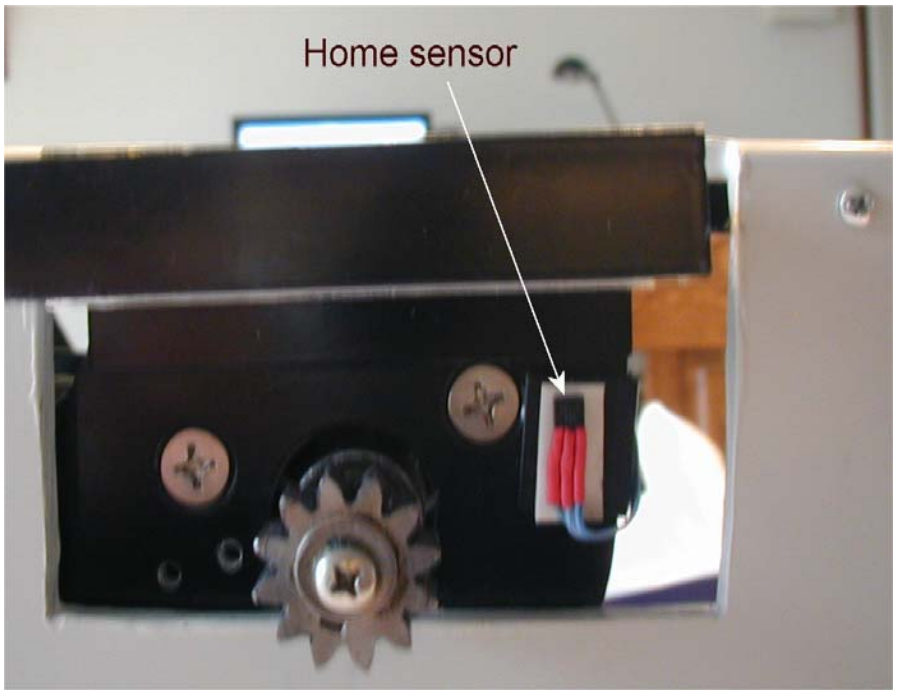


Figure 14

The used magnets are taken form a defect hard disk. They are 2mm thick see, figure 15.

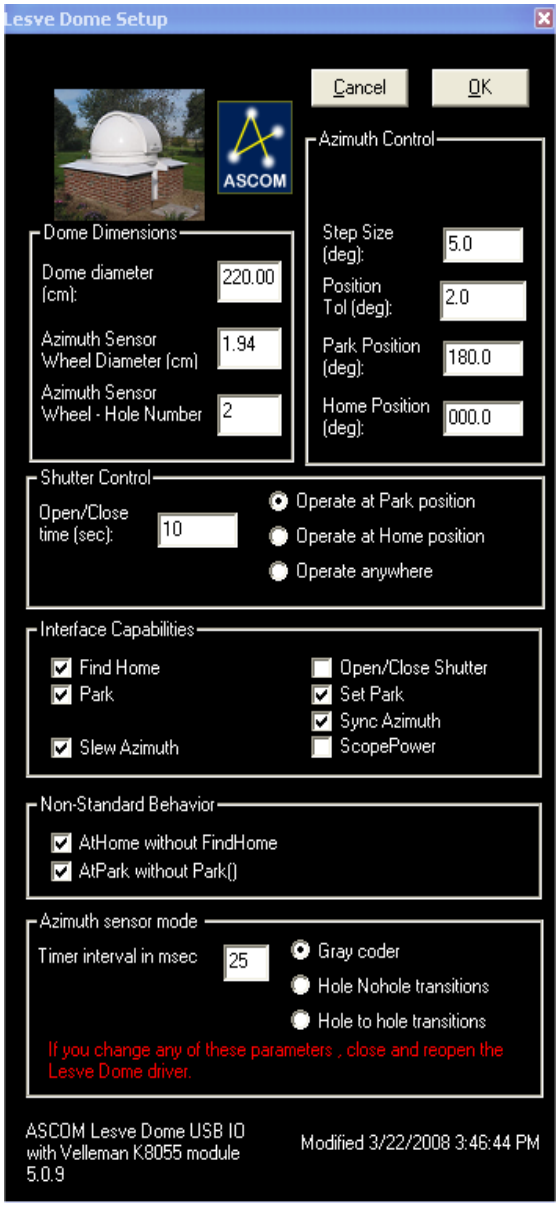
Figure 15

- Software driver setup.

As mentioned at the beginning, it is needed to use the LesveDome driver software to run the dome control program. This driver can be obtained at the LesveDome website.
(www.dppobservatory.net/dome/automation/domedriver.htm)
It is also needed to install the latest version ASCOM 5.0 software platform in order to run this driver.
This platform can be obtained at the ASCOM website.

When the driver is downloaded it can be used for a number of days to create the dome control application. After the driver is installed you can run it and it will start up with screen 1 as is shown below. To install the settings as made in the above description, enter the setup button which will open the setup screen (screen 2). Now enter the values as given on page 7, or as is shown in screen 2.

Screen 1



Screen 2