

De Slinger van Foucault

Foucault's Pendulum.

Partial translation of the original Dutch document by Jan Breemer.



Twents Carmel College

De Thij Oldenzaal

**Instruction manual
February 2008**

Partial translation: December 2017, Jan Breemer.

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Pendulum of the Thij College

On this beautiful school in Oldenzaal a pendulum has been built. Unfortunately there was no height of 67 meters available as in the Paris' Panthéon.

Manually giving the pendulum a push every hour or so is a bit cumbersome. Without affecting the principle an electromagnet has been placed exactly under the ball when it is hanging still. If the ball is moving it is attracted to the center, so no forces to the left or right are exhibited. The force should not be too large because the glass window might break, and not too small because the ball won't move very much.

In 1931 French Professor Charron wrote an article about pendulums.
[follows an explication of the ellipse problem and the Charron Ring]

Somewhat below the mounting point of the wire sits a stainless steel ring, such that the wire touches it, but not too hard. When the pendulum is started manually an elliptical path is mostly noticeable, but that is gone after some 20 periods.

Because the Charron ring must be there anyhow it also functions as an electrical contact for the timing of the electromagnet.

The latitude of the Thij College is 52,316 degrees North. Sine of this is 0,791, which gives a Foucault precession of 30,253 hours.

On the Thij College the Earth rotates once every **30,253 hour** under the pendulum !

Technical Description

At a height of 5.5 meter a plane of 40 x 40 cm was available. On this a thick-walled tube with a flange is mounted. In the top of the tube an adjustable mounting is made which holds the wire. The mounting sits at 5.865 meter and is electrically insulated from the tube by plastic parts. At the lower end of the tube the Charron ring is mounted. Electrical wires go from these parts to the electrical unit below the pendulum.

The center of the ball (18 kg) is at 0.315 meter above the floor. The total length of the pendulum is 5,55 meter, so a full period takes 4.70 seconds.

Below the pendulum is a wooden construction with a plate of polished stainless steel. After opening a small door the electrical parts are accessible. Installed is a Moeller Easy 512 PLC and for the actual switching of the electromagnet a Solid State Relais is used.

Top mount and Charron ring.

The wire is clamped in a M16 threaded rod in a hole of 2 mm. To prevent breaking of the wire the diameter of the hole increases gradually. On top of the threaded rod sits a piece of steel with two holes of 2 mm. The wire goes through one hole and is bended into the other to prevent slipping out. The wire was glow-heated before bending. The wire is Chrome-Silicon, 2mm. thick.

The threaded rod is adjustable in another piece of stainless steel which rests on plastic rings.

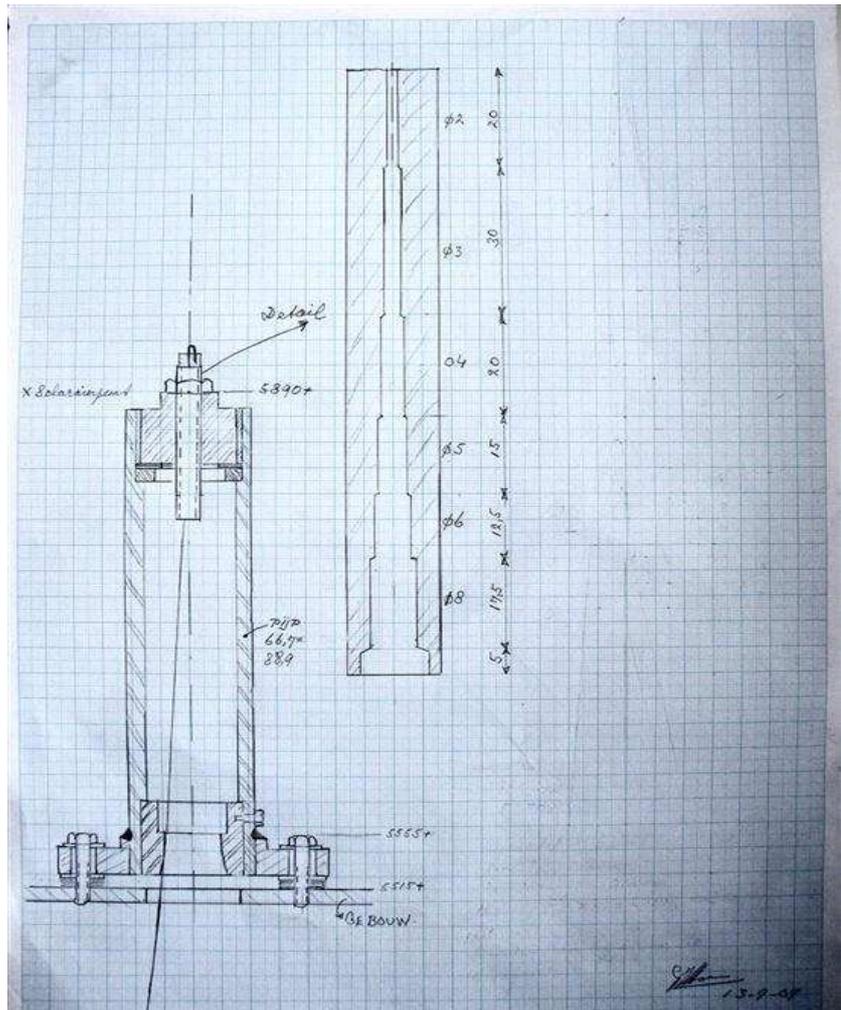
Electrical wires are connected to the metal mounting and the tube so we can detect the wire touching the Charron ring.

The Charron ring has a tapered hole with a diameter of 37mm on top and 45 mm on the bottom.

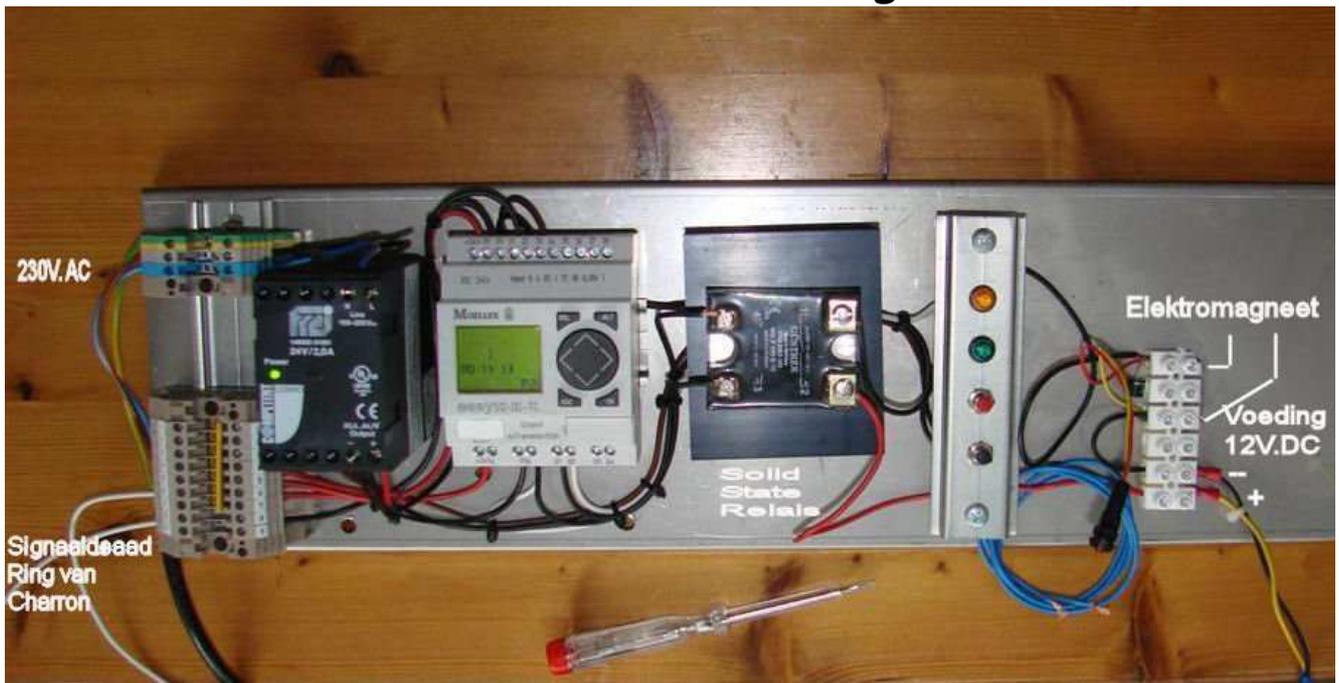
Below the flange we have thin fillers to adjust the wire centrally in the Charron ring.

The height of the pendulum can be adjusted by rotating the threaded rod.

Photo shows the adjustment of the top mounting >>>>>.



Control of Electromagnet



Below the bottom plate we have a floor-pit with a 230 VAC supply and the signal wires coming from the topmount. Connections are visible on the left side. On the right side a 12 Volts DC supply (unit not on the photo) enters for the electromagnet.

The PLC Moeller Easy is easy to program, however only by experts. When the wire touches the Charron ring the "timerelay" in the PLC is started. A moment later the ball goes to the center again and the contact is broken. Now the electromagnet is powered until "timerelay" is finished. "timerelay" lasts 1,1 second. The electromagnet is on for about 0.25 seconds.

When two times in succession the activation time of the electromagnet is longer than 0.45 sec. the PLC will shut down to prevent damage to the glass cage. The red button is RESET for the PLC, with the black button the electromagnet can be activated for test purposes.

General.

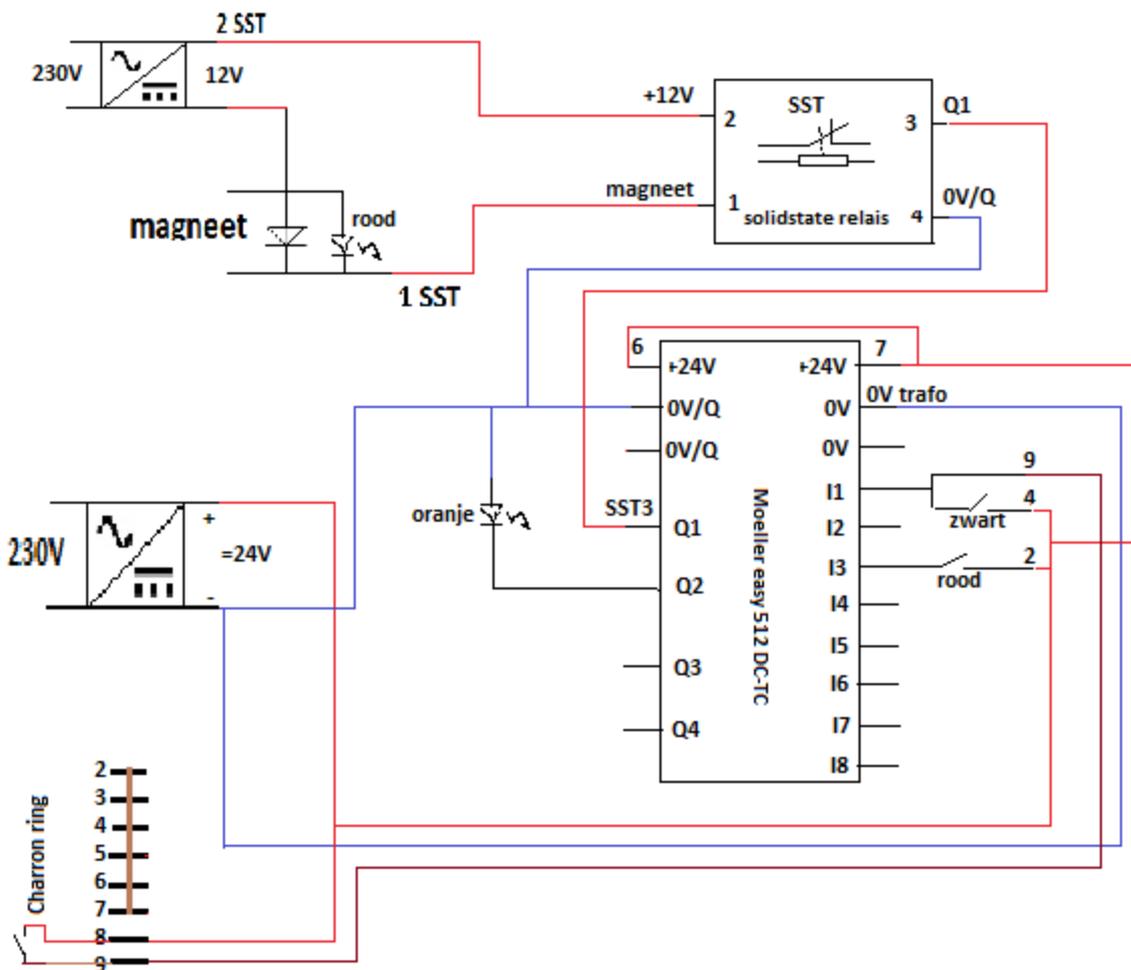
Realising this Foucault Pendulum has been made possible by H.Hammink, T. Sanders, H.Meek and M.Olderiekerink.

Several of my colleagues, B.Kamphuis, T.Nijhuis, G.R.Eisner, T.Bornebroek, M.Pot and K. Ekkelboom have contributed to the practical realisation.

For me it was a great pleasure to realise this project on such a beautiful school.

Piet van der Hoeven

Elektrical schema



2.3.4.5.6 and 7 are connected to the +24V from the transformer.
 PLC is Moeller easy 512 DC-TC