

Motorization of a homemade fork mount and of a focuser



Revision 21.09.19

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This document describes the transformation of a 400 mm telescope belonging to François Monatte (Villebret, Auvergne, France), in order to be able to control it by computer to make astronomical photography. The Pleiades-3 Skypikit series cards were used in this project.

The original telescope was a Dobsonian (D = 400mm f = 1830mm) from the Meade brand. The previous owner had adapted it on a fork mount he had made.

This mount was powered in right ascension by two 12V motors, one for sidereal tracking with a gear mechanism; the other was for the Goto with a clutch release system allowing switching from one motor to the other.

It wasn't very convenient, plus tracking wasn't perfect, corrections were difficult, and GoTo and autoguiding not possible.



Motorization of a homemade fork mount and of a focuser



The new telescope is based on the structure of the old one: the same fork and the same tube retaining hoop. However, many things have changed. Two adjustment mechanisms for putting into operation have been added to the structure. The tube has been completely redone. It is a semi-open octagonal 9mm plywood tube. A 127mm refractor telescope has been added to the side. It will be used for eyepiece observations, and initially for autoguiding, while waiting for a second telescope specifically dedicated to this.

Motorization of a homemade fork mount and of a focuser

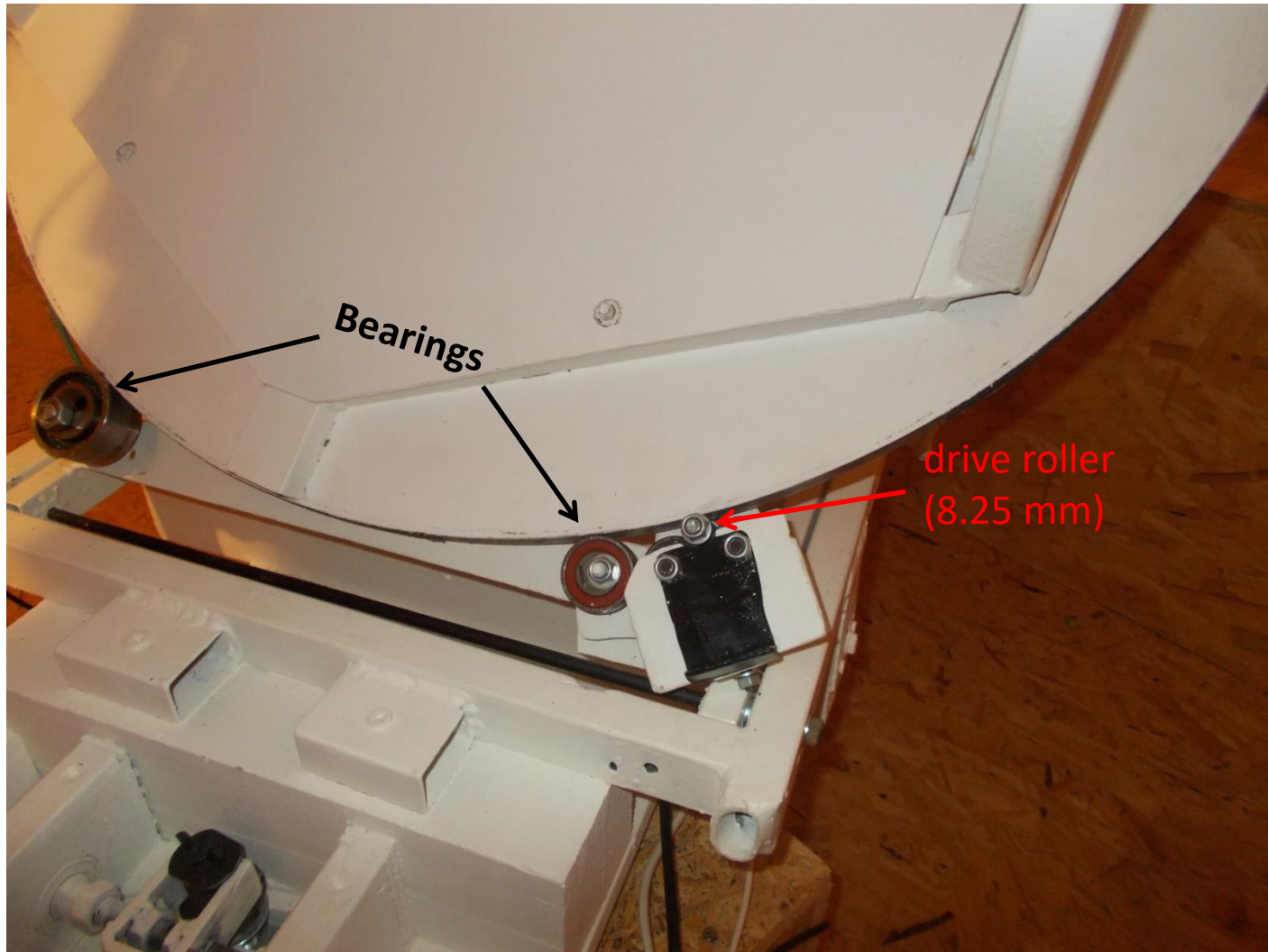


The new tube retrieves the spider and mirrors from the old tube.

The refracting telescope is mounted on a homemade adapter to perfectly align its optics with that of the telescope.

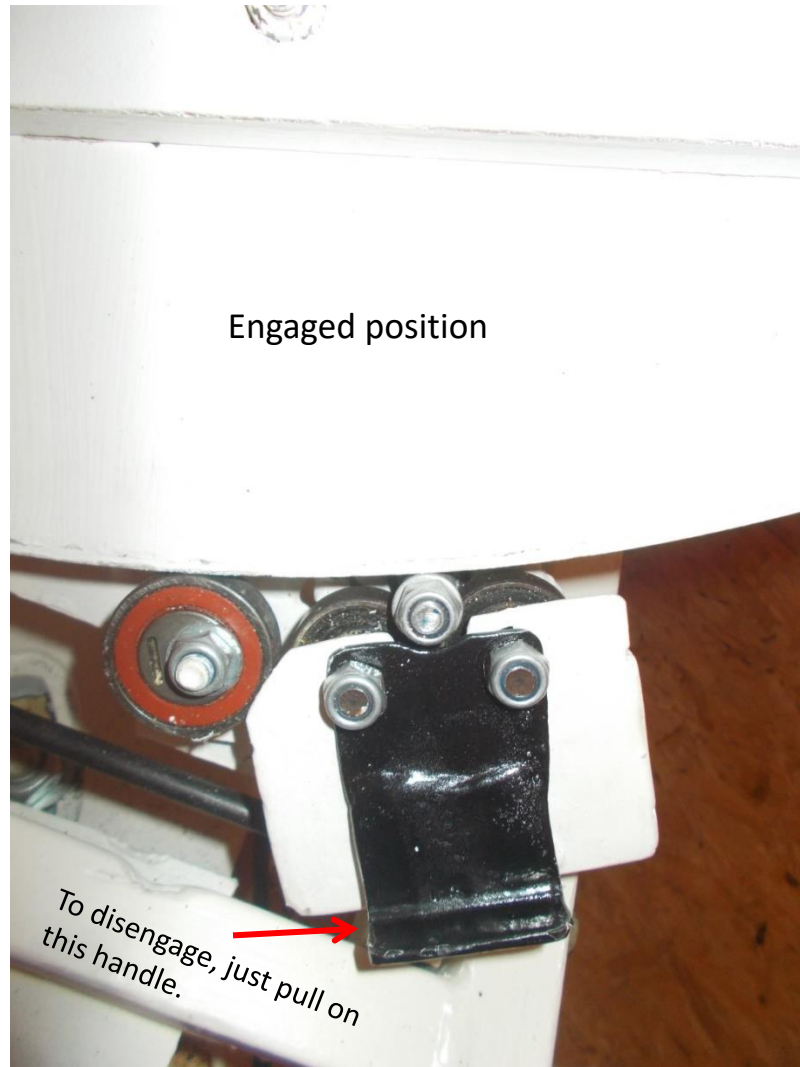
A counterweight of 11 kg made with old brake discs is placed on the other side, it allows the balancing.

Motorization of a homemade fork mount and of a focuser



View of the drive mechanism in right ascension: the large wheel (diameter 861 mm) on which the fork is placed is driven by an 8.25 mm diameter roller. The whole is placed on ball bearings. There is also a bearing at the rear of the wheel.

Motorization of a homemade fork mount and of a focuser



The large wheel's drive roller is disengageable so that the telescope can be operated by hand if necessary.

Motorization of a homemade fork mount and of a focuser



Behind the large wheel is the same right-ascension motor, which drives a worm gear coupled to a 72-tooth toothed wheel.

The compartment containing the electronic cards can be seen in the background.

Motorization of a homemade fork mount and of a focuser



Engaged position

To disengage, just pull on this handle.



Disengaged position

Close-up of the declination mechanism: the 13-tooth toothed wheel can be disengaged to be able to orient the telescope by hand if necessary. It drives a 49-tooth toothed wheel placed on the declination axis. The gears were salvaged from an old worn out grinder.

Motorization of a homemade fork mount and of a focuser



The declination motor is placed on the side of the fork.

Two 90° bevels also allow the movement to be multiplied by a factor of 1/8594, including the gears that are on the declination axis (previous page).

Motorization of a homemade fork mount and of a focuser



The need for GoTo and autoguiding justified the choice of two stepper motors powerful enough to move the whole. These are two identical motors with a torque of 0.5 N.m at 100 rpm and maintaining sufficient torque of 0.2 N.m at 1000 rpm. They require a current of 1.6 A.

The necessary electronic boards were placed in a compartment with a transparent cover. The right ascension motor is located in an adjacent compartment.

Motorization of a homemade fork mount and of a focuser



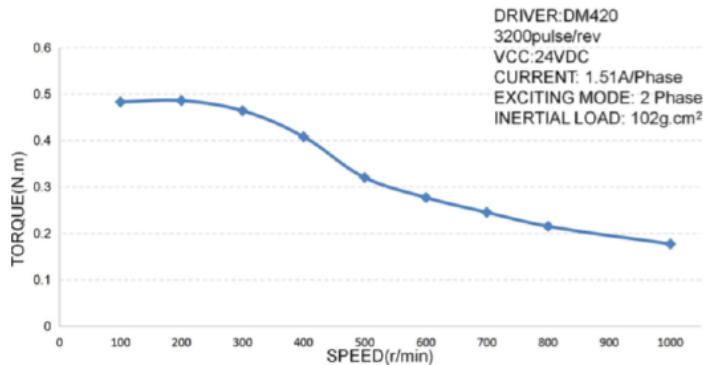
ACT Motor GmbH

17HS6416D6L22P5.5-12

Spezifikationen / Specifications

Phase	2 Phase
Step Angle / Schrittwinkel	1.8° ± 5% / Step
Voltage / Nennspannung	3.52 V
Current / Nennstrom	1.6 A/Phase
Resistance / Widerstand	2.2 ± 10% Ω/Phase
Inductance / Induktanz	6 ± 20% mH/Phase
Holding Torque / Haltemoment	70 N.cm Min
Detent Torque / Rastmoment	3.2 N.cm Max
Insulation Class / Isolierungs Klasse	B
Lead Style / Kabel Art	AWG26 UL1007
Rotor Torque / Rotorträgheit	102 g.cm ²

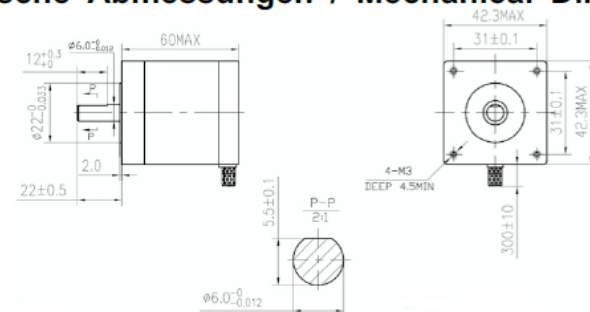
Haltemoment Kurve / Torque Curve



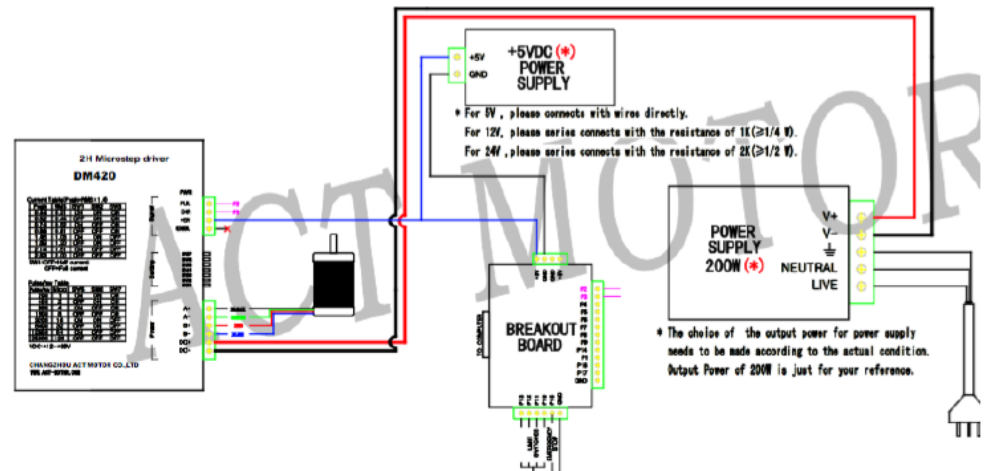
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Mechanische Abmessungen / Mechanical Dimensions

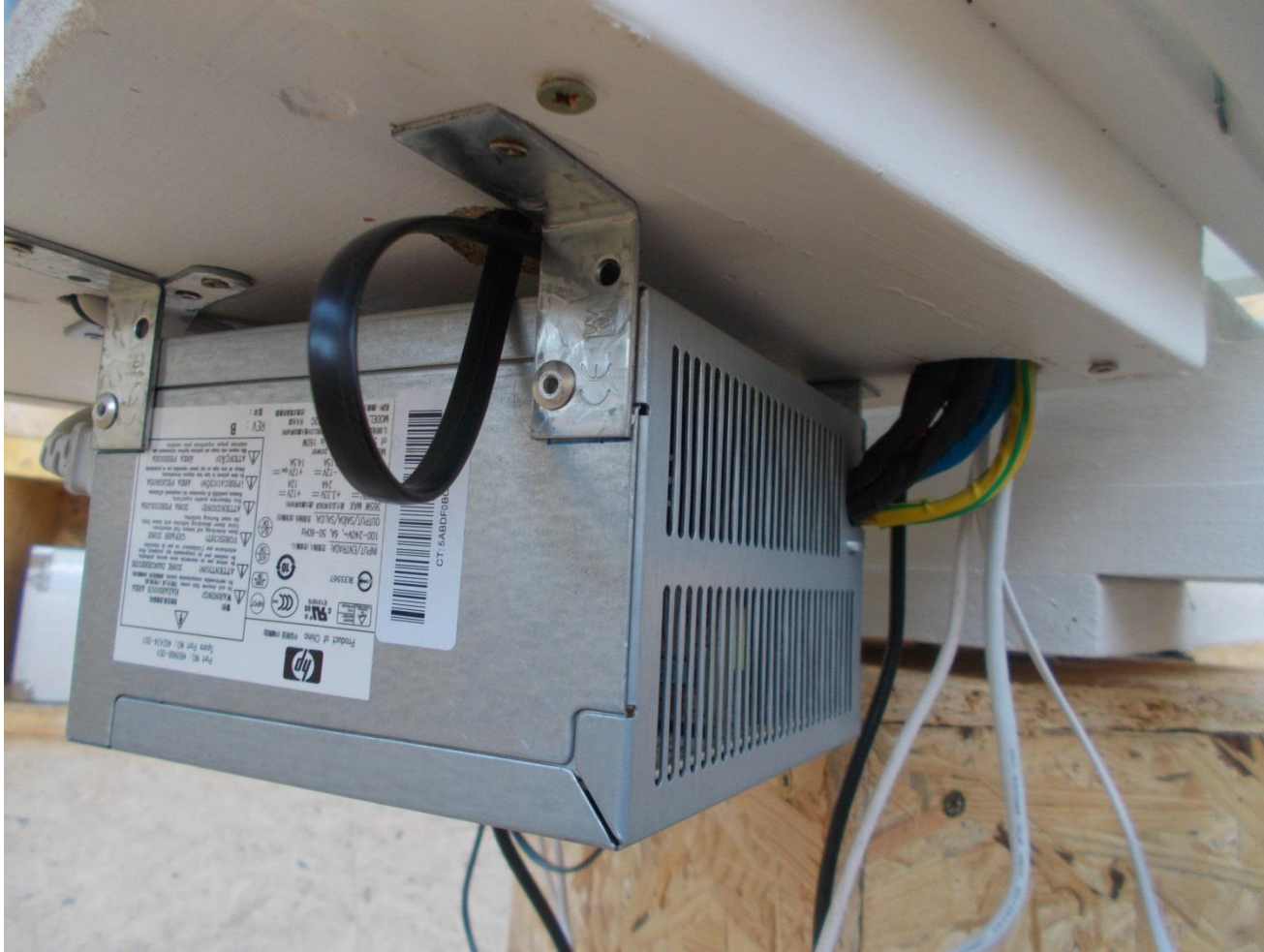


Verbindungen / Connections



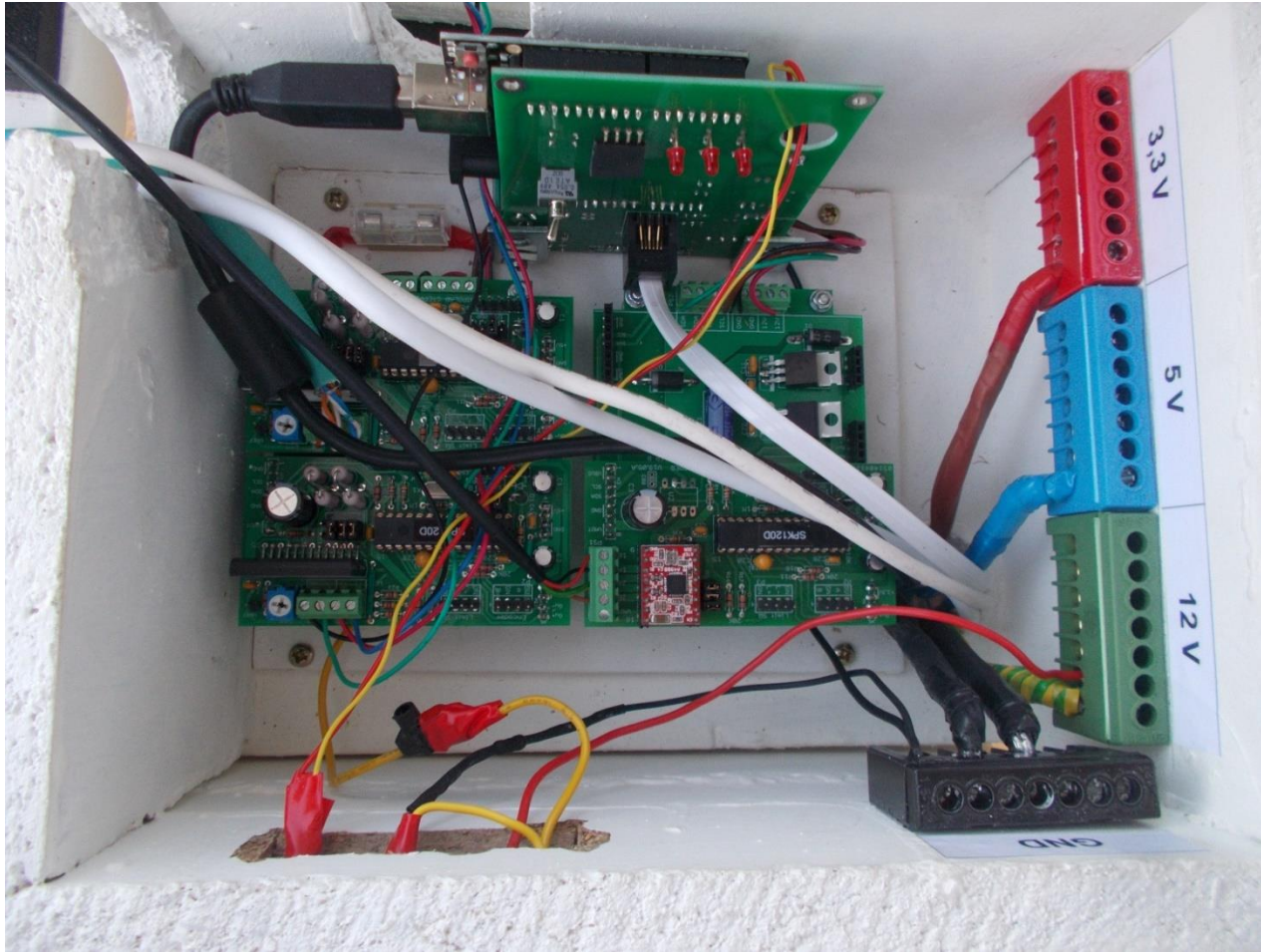
Bankverbindung:
Commerzbank AG Bremen
BIC: COBADEFFXXX
IBAN: DE56 2904 0090 0140 3658 00

Motorization of a homemade fork mount and of a focuser



The entire telescope is powered by an old computer power supply. This allows stabilized outputs in 12V, 5V and 3.3 V with sufficient amperage to supply all the electronic boards, a camera cooled by Peltier module (Project Cam86 under development) and possibly other devices. The power supply is attached under the box containing the electronic boards.

Motorization of a homemade fork mount and of a focuser

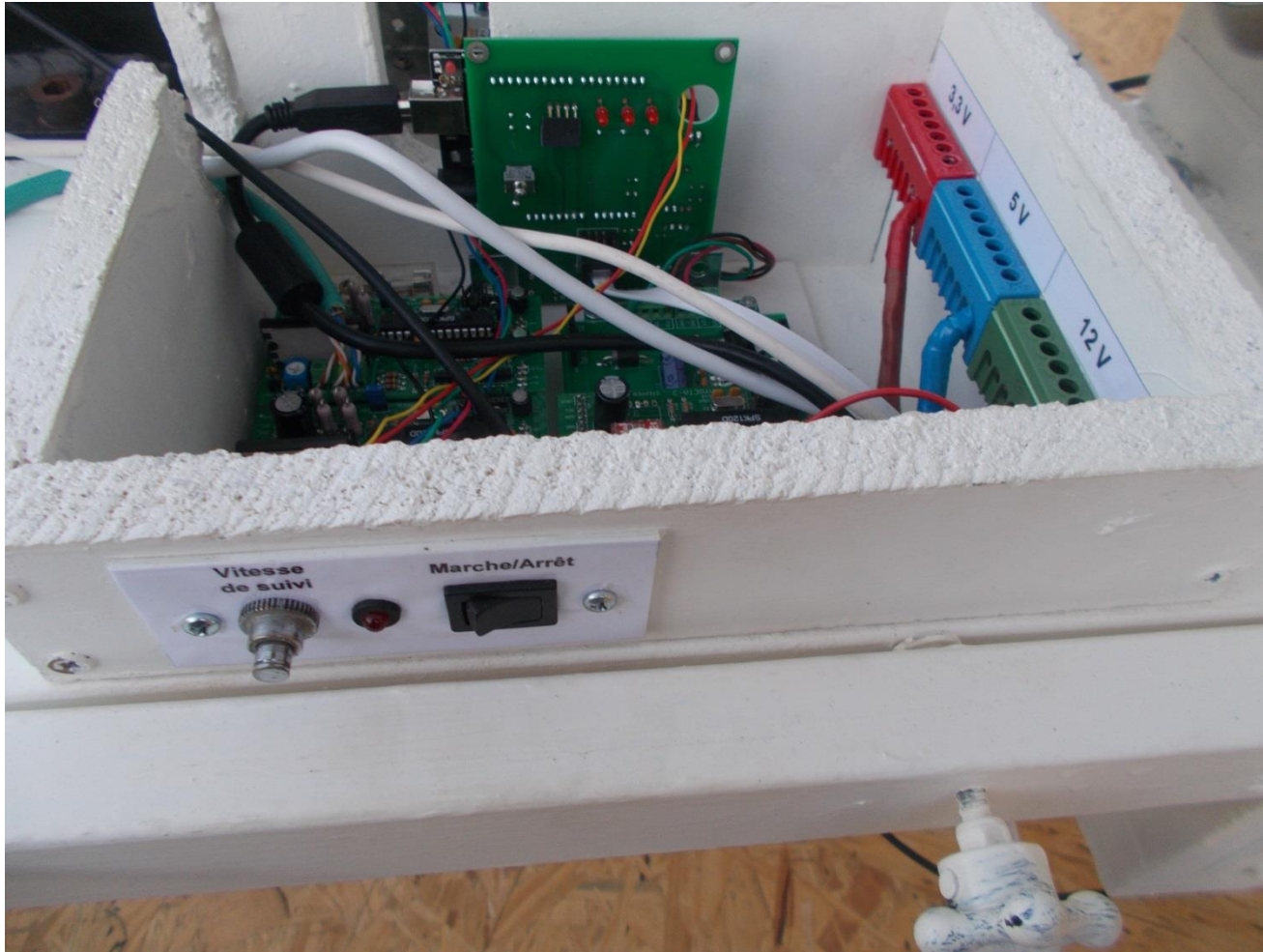


There are a total of 7 electronic boards: the Arduino board that contains the program, an ALCYONE-3 board, two ELECTRA-3 boards, one supporting two ATLAS-4 boards and the other a TAYGETA-3 board.

ATLAS-4 boards are dedicated to right ascension and declination motors. They allow currents of up to 2.4 A, which was necessary for both motors. The TAYGETA-3 card is dedicated to the focuser motor.

See the document [“The Pleiades Series of Boards”](#) for a detailed description of these boards.

Motorization of a homemade fork mount and of a focuser



On the outside of the box is the system switch, a small red LED and a push button to adjust the tracking speed (sidereal, solar, lunar) when the telescope is in manual mode. The USB cable connected to the Arduino board allows you to control the whole system from a computer located in a small room next to the telescope.

Motorization of a homemade fork mount and of a focuser



The control room located next to the telescope has a computer for controlling the telescope, do autoguiding and controlling the main camera.

Motorization of a homemade fork mount and of a focuser



The micrometric focuser is motorized from a stepping motor recovered from an HEQ5 mount. The reduction is carried out from the gears recovered on this same mount. This allows focusing accuracy of around 10 micrometers.

Motorization of a homemade fork mount and of a focuser



In manual mode, the hand control is used to aim the telescope and adjust the focuser. It was carried out by salvaging an old, worn out SynScan. Very ingenious.

The screen no longer lights up and only the useful buttons have been kept.

The electronic diagram and the connections of the handbox are described in the document on the boards of the Pleiades-3 series.

Conjonction Jupiter/Saturne - Photo prise le 18 décembre 2020



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Great Orion Nebula, M 42.

Canon EOS 450D camera; 50 exposures of 30 seconds at 1600 iso; 20 dark; 20 offset; 20 flatfield. No autoguiding, processing with IRIS software. There are no spikes around the stars because, just to test, the spider has been replaced with a glass window with a hole in it to hold the secondary diagonal mirror.

END