

Vertical Translation Unit for the Large Binocular Telescope

presented by

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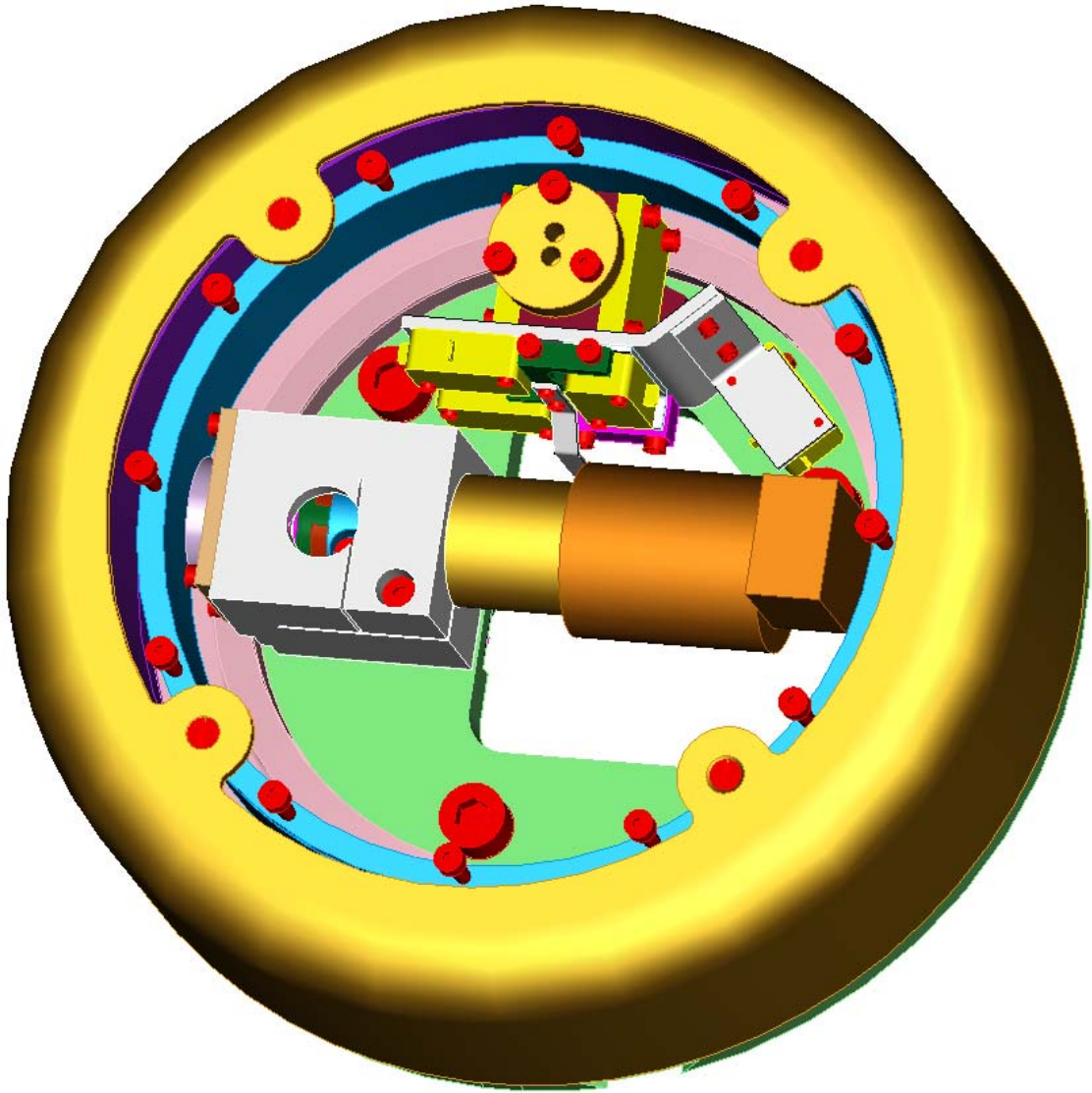
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Figure 1
View onto the underside of the breadboard
(the counterring is faded out)



Figure 2
Vertical Translation Unit
(without countererrng)



Vertical Translation Unit

Technical Description

The Vertical Translation Unit has to be mounted at the underside of the breadboard and has the function of a support for a piezo oscillation device with the pistonmirror. The adjustment range of the unit is ± 5 mm. The construction of the unit is designed for high stiffness because of the stringent accuracy requirements with reference to the rigidity at external oscillations.

The unit consists of:

- base ring
- drive unit
- guide unit with switching mechanism

Design and Interaction of the Different Components

Base Ring:

The base ring is the fundament of the unit. It is fastened by three hexagon socket head cap screws M10 x 40 at the underside of the breadboard (according to the bo- ring layout). This is possible without disassembling the unit: In the upper threaded ring there are bores at the positions of these screws.

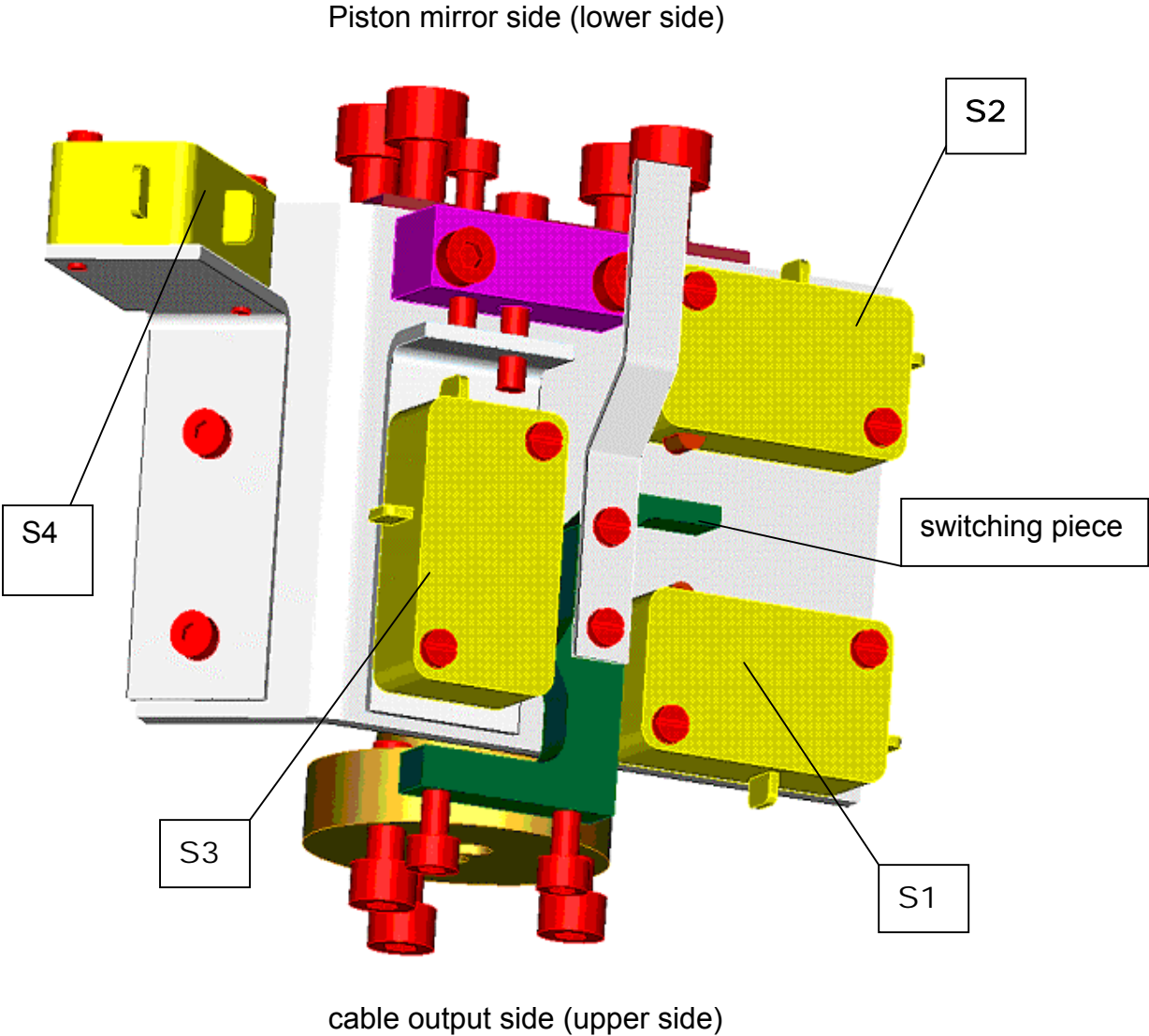
All wires for controlling and driving come out from within laterally of the base ring. In the base ring a threaded ring is beared precisely axially and radially. The counter- ring is screwed in the threaded ring. It is protected against rotation with reference to the base ring by a guide.

In that way the height adjustment is reached without any rotational movement of the counter- ring with all its parts.

Drive Unit:

The drive is positioned inside of the unit. A Phytron gear drive (ZSS 41.2.1,2 with gearbox PLG 32 $i=512:1$ and HEDL 5540) drives the threaded ring via a coupling and a bevel gear drive. In this way the treaded ring enables the height adjustment via the thread together with the counter- ring.

Switching Mechanismus:



At the guide unit there is fixed a plate which holds the limit switches S1 and S2 for the upper and lower boundary position. Furthermore on this plate there are two other microswitches S3 and S4. You can vary slightly the position of one from them (S3) with the help of 2 hexagon socket head cap screws M3 x 20 so to be sure that in the central position of the height adjustment unit the microswitch S3 is pushed. The microswitch S4 is pushed one time at each rotation by a cam positioned on the periphery of the threaded ring.

So at each 1 mm height adjustment one signal is generated. Additionally in the central position microswitch S3 is pushed. This central microswitch S3 cannot exactly define the height position. But in interaction with the microswitch S4 on the periphery of the threaded ring a signal is generated with an accuracy of $\pm 1^\circ$. This corresponds to a height error of $\pm 0,0028$ mm at a pitch of 1 mm.

S1 = limit switch for the upper limit position (cable output side)

S2 = limit switch for the lower limit position (Piston mirror side)

S3 = switch for the central position

S4 = switch on the periphery for finding the angle position

S3 is slightly variable with the help of two hexagon socket head cap screws M3 x 20. With the aid of the adjustment you have to secure that microswitch S3 is pushed when the Vertical Translation Unit is in its central position.

S4 is shortly pushed one time at each rotation by a cam positioned on the periphery of the threaded ring.

S1	S2	S3	S4	
●	○	○	● or ○	lower limit position
○	●	○	● or ○	upper limit position
○	○	●	●	central position, starting from lower position (S2)

The switches are to be programmed as follows:

Lower position: direction S2 = direction cable output side

Subroutine 1:
(is always done after each switching in)

Position is unknown
S1 open S2 open S3 open S4 ignored

Reaction:

Move drive unit down into direction cable output side until S2 is switching; S3 is to be ignored

S2 switches

Reaction:

Stop. Reverse direction of the motor.

Move drive unit upward into direction Piston mirror side until S3 and S4 are switching at the same time

Central position just is reached: as to zero setting software

Subroutine 2: Position is known and controlled by the software

Subroutine 3: In that case that there is reached S1 or S2 → emergency, interrupt

Emergency

a) alarm, manual break, stop motors

b) start subroutine 1

Demounting:

Before of each mounting and demounting all wires have to be disconnected.

If it is necessary to disassemble the height adjustment unit so first in this case the complete height adjustment unit has to be unscrewed. After that the protective cap can be removed.

Next the switching piece has to be dismounted – otherwise it would destroy the microswitches when you rotate the counterring. After that you have to unscrew three M4 x 12 screws beside it. Now the protection against twisting is ineffectual.

If one now cannot rotate the counterring, so you slightly may loose the M4 x 25 screws (at the periphery). To disconnect the cone below you have to tighten the existing stud bolts in the threads beside it. In this way the cone ring gets loose.

After removing the counterring you can see the functional elements. The guide with switching mechanism and the gear unit (with the gear drive) may be unscrewed now.

When the axial and radial sliding bearings are unscrewed now you can take out the thread ring.

Mounting:

The assembly has to be made in reverse order.

When fixing the sliding bearings again you should oil them with a fine film of acid-free special oil.

The backlash between the flanks of the thread is set up onto a minimum with the aid of the M4 x 25 screws positioned at the periphery.

The axial and radial sliding bearings are tightened, free from backlash. You will reach a smooth even motion if you put some special oil onto the slides of the threaded ring.

Colour Markings of the Switch Connecting Cords:

Central position:	white	switch S3
Maximum retracted position	yellow	switch S2
Maximum extended position	red	switch S1
Switch at the periphery	black	switch S4

Technical Data:

Diameter:	260 mm
Minimum height:	75 mm
Maximum height:	85 mm
Time for a stroke of 10 mm:	about 5 minutes
Weight:	12 kg