

Assembly and Installation of ScopeDome 3M Clamshell Observatory

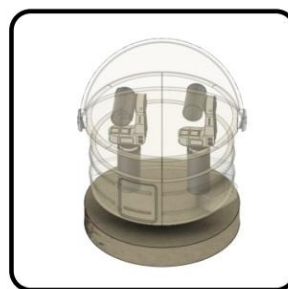
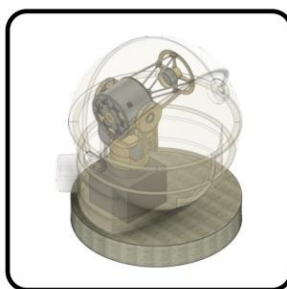


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ScopeDome Clamshell 3M observatory specification

Observatory components

- Observatory base – 2 segments
- Aluminium stiffening ring – 4 segments
- Observatory shutters – 3 pieces
- Sealings of observatory shutters – 4 pieces [3 types]

Observatory automation

- Shutter drive units integrated with the bases of the observatory
- ScopeDome Arduino 1.3 card observatory controller
- Clamshell observatory control relay module
- Limit switches module for observatory shutters
- Inverter control of the operation of drive motors
- Hygrometer with integrated thermometer
- Power cords for drive unit of the left side of the observatory

Clamshell 3M observatory installation site requirements

Due to the structural and technical parameters, the Clamshell observatory should be placed on a concrete slab with a load capacity being calculated inclusive of the weight of this observatory (approx. 300kg). The slab shall have a minimum diameter of more than 2800 mm (3000 mm recommended), which is the diameter of the observatory base. It is necessary to ensure that the base is adequately levelled and the smoothness of the surface made so that the maximum deviation does not exceed 3 mm in each of the points (in particular on the perimeter) of the slab. At the design stage of the observatory's foundation, it is also worth considering all necessary cable routes for power and communication, as this observatory does not provide such conduiting from outside to its inside. The slab should be sealed to prevent uprising of moisture, and at the least, with an appropriate concrete top sealer.

Before proceeding with the installation, we encourage you to familiarize yourself with the photo documentation of this manual. Through the associated text and the accompanying photos, please familiarize yourself with the details of the work carried out during each stage. Before the installation stage, you should also plan the different stages of work and prepare all necessary materials and tools for installation.

Packaging of a Clamshell 3M Observatory

The observatory is supplied in three vinyl wrapped, oversized pallets [length x width x height of 2800mm x 2100mm x 2280mm], with the equipment being in partially assembled state. The shipment contains the following:

- Pallet #1: Left observatory base with drives and their covers,
- Pallet #2: The observatory base with the drives, their covers and the control electronics, and
- Pallet #3: The 3 observatory shutters



Figure. 1 – Clamshell packed bases [x2 for Left and Right sides] and the shutter pallet



Figure. 2 – Clamshell parts boxes and safety covers

Inclusive within the consignment are the necessary Fixtures and Fittings for observatory installation, the Aluminium Stiffener Ring that mounts atop of the observatory base, and a set of Shutter Seals.



Figure. 3 – elements of the upper ring stiffening the base of the Clamshell observatory

List of necessary tools and materials for the installation of the observatory

Tools:

- Phillips Head, cross-size PH1 and PH2 screwdrivers
- Small screwdriver with flat tip for turning electrical fittings
- Allen wrenches 3.0 mm and 2.5 mm
- Electric tester (neon tube)
- Universal multi-meter
- Open or closed spanners for nuts associated with the M5, M6, M8 screws
- Impact drill and drill for concrete anchors, and metal drills of 5 and 6 mm sizes
- Plain and plastic hammers for setting of part positions
- A tape measure or laser distance meter
- Transport belts for lifting and moving observatory elements
- Wooden or plastic wedges/ coasters measuring 5x5 cm and a length of approx. 15 cm for leveraging elements apart during the sealing processes

Materials required separately:

- Concrete anchors for fixing observatory base to concrete foundation. Suggested: M8 with a length of at least 80mm, at least 10 pieces. Alternatively, your choice of preferred anchor with similar specification.
- Sealing silicone, and applicator gun – approximately 5 tubes with a capacity of about 300 ml
- fast-bonded adhesive in the tube – for the installation of brush seals [approximately x1 capacity of about 300 ml].



Figure. 4 – sample set of materials and tools for mounting the observatory

Note: Due to the weight (approx. 100 kg) and the dimensions of the individual components, we recommend using a gantry lift or a small crane for lifting and mounting components. The recommended minimum load capacity of the crane is 400 kg.



Figure. 4 – electric gantry used for observatory mounting

Assembling the Base Elements of the Observatory

Preparation for the installation of the Observatory



Due to the size, shapes and weight of the individual components, there is a risk of injury during the processes of disassembly, placing parts to storage, and that of the assembly. Always implement adequate safeguards and comply with local occupational health and safety requirements.

The installation of the observatory should be planned during a period of good, windless and rainless weather. The assembly time frame for this observatory will vary in accordance to the efficiency and size of the assembly team. Allow for approximately 16 hours for the unpacking through to assembly completion.

Preparation for installation begins with unpacking of the components from their packaging. The installation of the base can be done in two variants:

1. Separating the top and bottom of the observatory base for easier transportation of observatory elements to the assembly position. The disassembled components may in this case be transported and manually positioned with the participation of 4 persons [without the help of a lift or crane].
2. With no separation of the upper and lower parts: In this case, the gantry/ crane (Fig. 4) should be used for lifting and part transportation. The manual cartage of these awkward, oversized and heavy elements is very difficult when assembled, creating a risk of damage to the bases and that of injury to the team. In this case of implementing a gantry/crane, 3 people will be satisfactory for the assembly.



Figure. 5 – unpacked left part of the observatory base, with upper and lower segments defined

The illustrations below show the process of installing the observatory in accordance with Option 2 above, electing to separate the upper and lower segments of the Left and Right bases.

Moving of Individual Parts from Pallet to Assembly Location

To begin, the slab should be dry and clean. This will ensure the good adhesion of the sealing compound that goes between the slab and the observatory base. Four persons will be required to safely lift and transport the base elements from the pallet to the assembly position. You can still employ an overhead gantry for this purpose, using material lifting slings that will protect the observatory's surface during the lifts. The slings can be placed between the top and bottom of the observatory base as shown in Fig. 6 and 7.



Figure. 6 – putting the transport slings between the top and bottom part of the observatory base

The upper and lower elements of the base halves are joined by M6 bolts. Ensure to partially disassemble these to allow the slings to be safely passed through and then connected to the gantry. Otherwise, have your team of at least four people ready whilst these are removed.



Figure. 7 – dismantling of M6 screws connecting the top and bottom of the observatory base to be transported to the installation site

Marking out the Observatory Position upon the Slab

In the next stage of preparation, we place the bases on to the slab to mark out the contact area of the observatory to the slab. Connecting the two base halves without bolts and positioning these relative to the centre of the slab, you can define the rotation and position of the observatory. This is not a critical element of installation and can be carried out with a fairly high tolerance. At this stage, care must be taken to ensure that the base of the observatory is properly oriented at the geographical directions, if required.



Figure. 8 – positioning of the bases of the observatory



Figure. 9 – measurement of observatory position relative to the centre of the slab

In the next step, we mark the inner and outer edge of the observatory base on the slab with a carpentry pencil. This will provide an outline for applying the sealing compound that goes between the base and that of the slab.



Figure. 10 – inner outline of the observatory base



Figure. 11 – outer outline of the base of the observatory

Securing Observatory Base to Slab

The first step is to mark location and drill holes for the fixing bolts that will secure the observatory to the slab. Depending on the needs and quality of the concrete, a minimum of 10 holes should be provided. Drilling can be done directly through the laminate of the base halves however, care must be taken by gently applying pressure through the drill upon the observatory surface so not to damage or fracture the laminate.



Figure. 12 – drilling of base fixing holes



Figure. 13 – drilled holes in one of the bases of the observatory

In the next step, we raise the bases of the observatory on wooden or plastic spacers, making sure the slab and base of the observatory are clean and ready for the application of the foundation silicone sealant. When applying the sealant, ensure to apply between the previously marked inner and outer contours. Silicone should be applied in the form of two parallel strips from the outer and inside of the base. A good sealing of this element is crucial to protect the observatory from the inflow of water during rainfall.



Figure. 14 – applying seals under the base of the observatory



Figure. 15 – applying seals under the base of the observatory

In the same way, we apply sealant seals on both planes of the connecting halves of the Left and Right bases before connecting them with screws.



Figure. 16 – applying seals on the planes connecting the base

After applying the seals to the base connection surfaces, lower the base of the observatory to the slab by removing the spacers. If possible, apply additional sealant to the surfaces where the spacers once were. The entire base will be riding on a bed of sealant; glide entire base into position to align anchor holes positions to holes in the slab. Apply anchors, tighten these to specification.



Figure. 17 – mounting the base with anchors

Next, both halves of the base of the observatory are secured by the supplied M6x25 bolts and nuts, placing them in pre-prepared holes.



Figure. 18 – connecting the bases of the observatory with screws

Installation of the Upper Base Elements

Next, the upper Right and Left elements, together with their drives, are to be assembled upon the installed lower elements. Before placing the upper parts into position, the mating surfaces should be sealed with sealant, same way as with the lower parts to the slab.



Figure. 19 – preparation for installation of the top of the observatory base



Figure. 20 – sealing of the observatory base elements



Figure. 21 – sealing of the observatory base elements

After preparing the sealing layer, we can embed the upper element on the lower base, while helping with a wedge pad that allows the transport slings to be pulled out at the last moment of the operation.



Figure. 22 – Lowering the upper base element onto lower one

After the lowering the top elements into place, we secure these to the lower elements with the M6x25 bolts and nuts previously removed. If you can, please seal the spacers positions before completely the lowering upon the base. Before the final connection of the both elements, it is necessary to remember to make silicone seals on the vertical planes of the upper elements of the observatory base, which next should be screwed with the included M6x25 bolts and nuts.



Figure. 23 – Place of sealing of the upper elements of the observatory base



Figure. 24 – Place of sealing of the upper elements of the observatory base



Figure. 25 – Screw connections of the upper elements of the observatory base

After the initial combination of all the elements of the observatory base, confirm all bolts and nuts are tight and secure.



Figure. 25 – Final connection of the upper elements of the observatory base with screws

Installation of the Upper Aluminium Ring

In the next step, we proceed to the installation of an aluminium stiffening ring for the upper part of the base of the observatory. The ring consists of 4 numbered segments.

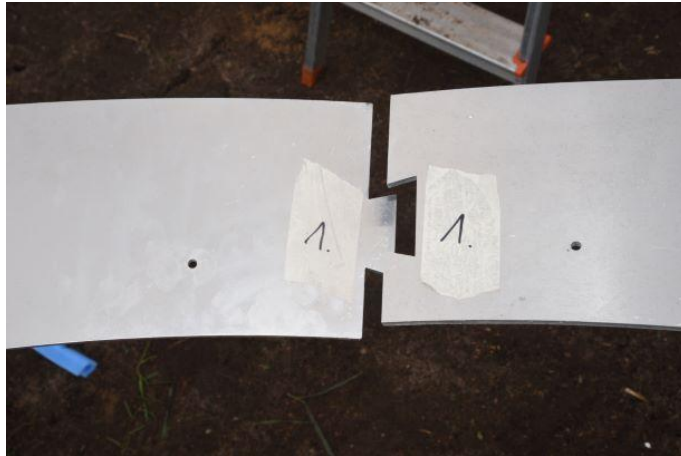


Figure. 26 –Ring element numbering

All segments have holes to attach it to the top of the observatory base with the included M6x25 bolts and nuts. The wider part of the ring must be oriented in a way that it is on the front of the observatory base.



Figure. 26 – Way of orientation of the wider part of the ring based on the observatory



Figure. 27 – Ring fixing holes to the base of the observatory



Before screwing the stiffening ring to the base of the observatory, make sure that the anchor holes of the ring match the holes in the base mating surface. Secondly, carefully apply sealant in a dual parallel paths to ensure the prevention of water infiltration and to reduce moisture condensation.



Figure. 28 – Sealing of the stiffening ring when connecting to the observatory base



Figure. 29 – Securing the ring with mounting screws

Ensure all stiffening ring elements are sealed, mounted and installed upon the base assembly the same way.



Figure. 30 – Mounting the side elements of the stiffening ring



Figure. 31 – Connecting the stiffening ring from the base of the observatory

Installation of Observatory Shutters

Preparation for the installation of shutters



VERY IMPORTANT: Before installing the observatory shutters, make sure that all components of the observatory base are properly connected to each other by bolt and nut, and that the base itself is firmly attached to the slab.

If the external, internal and upper drive covers are in place, please remove these first so you have clear access to the shutter mounting handles that are found on both Left and Right sides of the base.



In order to install individual shutters efficiently, it will be necessary to be able to drive the individual drive units responsible for opening and closing them to designated positions. In your parts box, there will be the Plug N Play wire loom, having corresponding numbers per plug to assist with correctly connecting these to the plugs within each drive area. Before connecting the controller to the power supply, connect the wire loom of the drive motors of the left side of the observatory first.

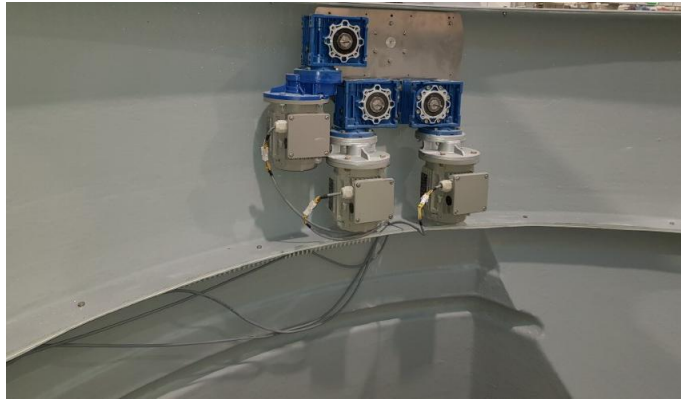


Figure. 32 – power connection wires for the left side of the observatory base

To do this, unscrew the top fixing screws and remove carefully the right cover of the drive unit. Be careful not to damage the controller connection wires to the buttons in the cover. The attached wires shall be placed and retained in a comb strip located under the upper part of the observatory base. The cables must be connected to the proper engine number marked on the cable plug and, on the other hand, to the corresponding plug in the observatory driver.



Note: Always connect cables according to their numbering. Make sure that the plugs are connected correctly on both sides of the plugs. Incorrect connections can damage the observatory shutters or their drives!



Figure. 33 – connecting the motor power wires on the left side of the observatory base to the controller

After the connections are made, the powered drive units must be tested for their correct operation before proceeding to installing the shutters. To do this, when the controller is connected to the power supply, start the individual shutter's drive units using the buttons on the inner cover of the right side of the observatory.

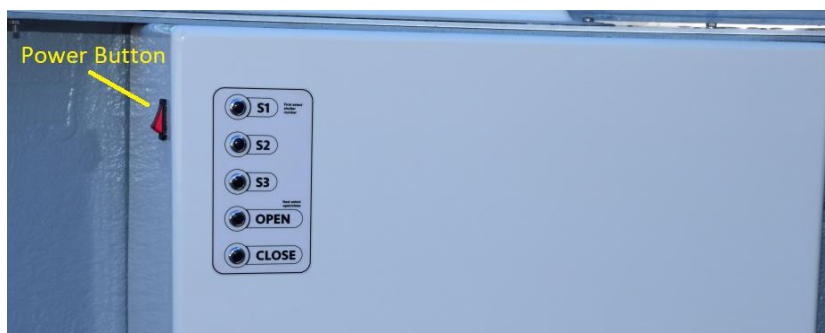


Figure. 34 – Control panel for manual opening of observatory shutters

To start the drive for a specific shutter, press the S1-S3 button and while holding it press the OPEN or CLOSE button, depending on the direction of operation of the drive. The engine drive unit has limit switches preventing the shutter from exceeding the rotation limit. The drive of the shutter will be stopped when the extreme position of the metal actuators of the switches are reached.



IMPORTANT DRIVE TESTS

Do not proceed until all drive movements are tested.

Tests:

1. **Before proceeding with further work, make sure that all actuators and end switches are working correctly by moving drives to fully open and then fully closed positions.**
2. **Verify that the drive handles do not lock in the end positions with the drive axles.**
3. **Verify the angular position of the handles of all shutters, and ensure symmetrical movements are occurring on both sides.**
4. **Do not proceed to shutter installation if shutter mounting handles move in opposing directions.**



Figure. 35 – view of limit switches and observatory shutters control mechanism

Installation of Observatory Shutter #1

We start the installation of observatory shutters from unit No. 1, with corresponding labels on both Left and Right-side mounting handles. Note that the side of the shutter labelled "Shutter Right" should be on the right side, and the side labelled "Shutter Left" on the left side of the observatory looking from the front door position on the base.



Figure. 36 – labels with numbering of observatory shutters

For trouble-free installation of the shutter, transport the shutter number 1 to the position directly in front of the observatory [Note: door is at the front position of the observatory, see below]. This will provide you the shortest path of lifting and transporting the shutter number 1 into the right assembly position and orientation.

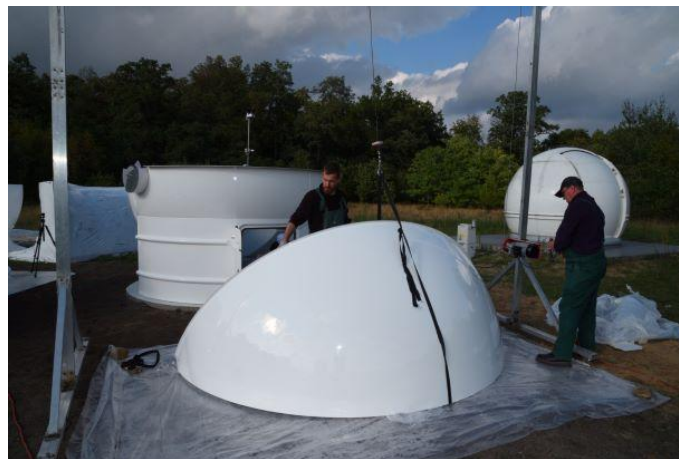


Figure. 37 – Shutter No. 1 – orientation before installation



NOTE: There will be bolts and nuts installed to the shutter mounting handles. Take note of their POSITION and ORIENTATION [that is the nut side versus the bolt side]. These will need to be re-installed in the same orientations to secure each shutter side. Figure 41 indicates the correct bolt orientations when viewed from within the observatory.

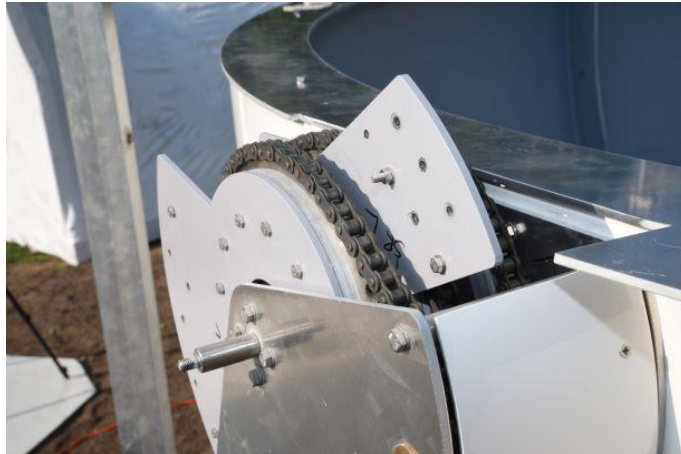


Figure. 38 – washer and fixing screws in the shutter mounting handles and handle position before its installation

Using the help of several people, or preferably the use of the overhead gantry, carefully place shutter No. 1 on the aluminium ring installed on the top of the observatory. It is necessary to protect the shutter on the ring so that it does not fall during its installation in the handles.

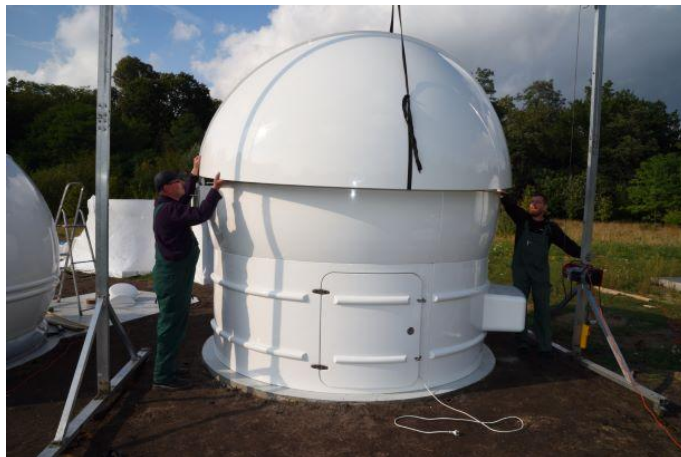


Figure. 39 – Shutter no. 1 placed on the ring of the base.

Note: Pay special attention when embedding the shutter connection flap that the mounting handle is on the outer side of the shutter, as shown below in Figure 40. This method of installation applies to all shutters.



Figure. 40 – Shutter no. 1 in the handles.

For the installation of the shutter onto the mounting handles, use previously unscrewed washer mounting bolts and the set of bolts and nuts found in the bags marked No. 1L and 1R for the left and

right handles respectively. Within these bags are also the main mounting washers [shaped aluminium plates].

The aluminium mounting washer is located on the inside of the flap as per figure. 41 below. Please note that the fixing screws should be placed only in those holes that are shown on fig no 41. Ensure the mounting washer is installed in the correct orientation as shown. M5 bolt heads must be located on the outer side of the cover. To match the holes in the shutter connection to the mounting handles, you can use the S1 button [pressed and held] and the OPEN or CLOSE button to manually drive the mounting handle to the best position. You can also use a Phillips Head screwdriver to fine align the bolt holes.

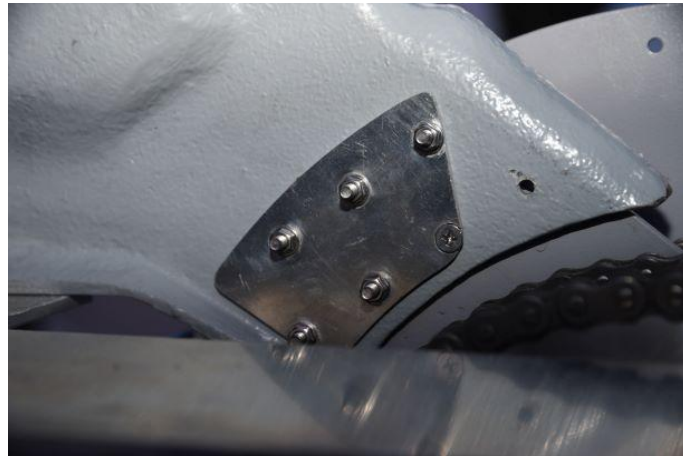


Figure. 41 – How screws and aluminium washer are attached on shutter #1 - view from the inside



Figure. 42 – screwing the shutter #1 to its mounting handle



Figure. 43 – Screw connections of shutter #1 upon its mounting handle

After tightening the screws of the shutter to its mounting handles, you can try to open and close it using the buttons on the manual control panel by pressing and holding the S1 button, and then the OPEN and CLOSE buttons. **Special care should be taken while verifying the operation of the limit switches and the synchronous operation of both drives.**

Installation of Observatory Shutter #2

The next stage of the work is the installation of shutter No. 2. Preparation for installation we begin with the correct positioning relative to the base of the observatory. Shutter #1 shall be in a closed position, rested on the front of the ring.



Figure. 44 – Orientation and preparation of Shutter No. 2 for installation

Unlike Shutter No. 1, its installation is made from the back of the observatory. As with shutter # 1, special care should be taken to ensure that the side of the flap marked "Shutter Right" is on the right side, and the side marked "Shutter Left" is on the left side of the observatory looking from the front door of the base.



Figure. 45 – Shutter #2 labels

Before lifting shutter #2 into the installation position, firstly install the parking handles to the top of the base, and within the stiffening ring. These parking handles must be screwed with M6x10 bolts to the notches made in the ring as indicated in the figure 46 below.



Figure. 46 – Attached Parking Handles for mounting shutter No. 2

The ring has 5 notches on its outside to install these handles, but only three are required for efficient installation: two near observatory drives and one at the top of the rear of the ring.

In the next step, we move shutter No. 2 onto the upper part of the base of the observatory and settle it on the parking handles. Make sure that the shutter is well seated in the handles and will not fall out during installation.

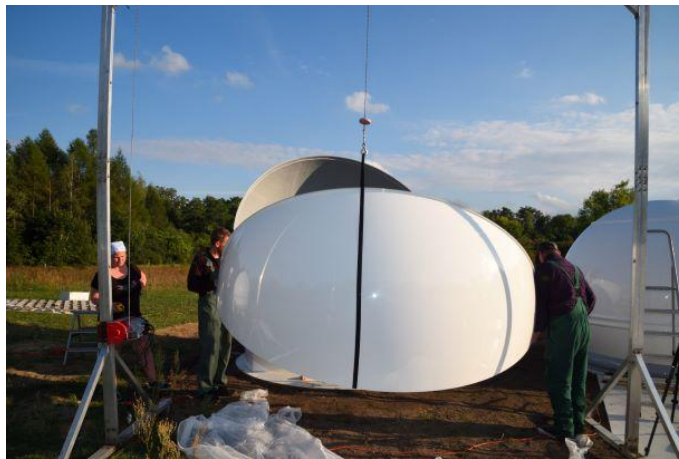


Figure. 47 – shutter No2 transport to top of base



As with the installation of shutter #1, special attention should be taken when setting the shutter so that its handle is on the outer side of the shutter, as shown in Figure 48 below.



Figure. 48 – Setting shutter No. 2 in the holder

The operation with the fixing of the shutter #2 to its mounting handles is like those described when mounting shutter #1. Special care should be taken for proper positioning of the aluminium washer on the inside of the shutter. Its holes should match the holes drilled in the shutter.



Figure. 49 – Inner washer for shutter No. 2

Make sure that the bottom edge of the shutter is below the aluminium ring. Only in this position will it be possible to operate the shutter properly.

Verify with Figure 50 below your bolt layout.



Figure. 48 – Screw connections of shutter No. 2

After tightening all bolts to shutter #2 whilst it laid in its parking handles, it is necessary to remove these three handles from the ring. After unscrewing the fixing screws, the handles can be pulled from the bottom, and through the gap between the shutter and the base wall by pulling out the shutter slightly. After disassembling and removing these handles, you can then try to OPEN and CLOSE shutter #2 using the buttons on the manual control panel by pressing and holding the S2 button and OPEN and CLOSE buttons. **Special care should be taken while verifying the operation of the limit switches and the synchronous operation of the drives on both sides of the observatory.**



Figure. 49 - Shutter #2 in a partially open position. Shutter No. 1 in closed position.

Installation of Observatory Shutter #3

The installation of shutter #3 is the last phase of the installation of the shutters, and at the same time is the most difficult to install due to the tight dimensions of access. It requires overlapping the edges of the shutter #3 over shutter #2, and their appropriate positioning and arrangement so that it can be installed to its dedicated mounting handles.

Shutter #3 is the heaviest of the installed observatory shutters. Installation of shutter #3 is only possible with shutters #1 and #2, and mounting handles for shutter #3 as shown in figure number 49 above.

As with shutters #1 and #2, attention shall be paid to the appropriate labels on the shutter, placing these so they are orientated towards the corresponding side of the base of the observatory.



Figure. 50 - Labels on shutter #3

The M5x30 bolts included with aluminium washers and nuts for set #3, Left and Right bags, should be used for the shutter installation. Due to the weight of the element and the method of its installation, it is HIGHLY recommended that an overhead gantry is used.

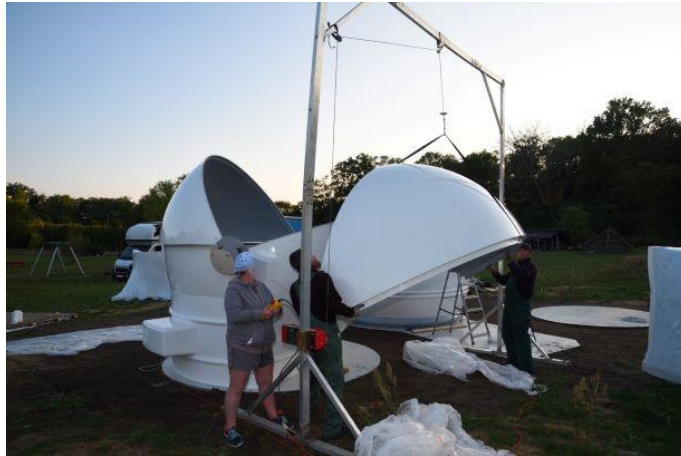


Figure. 51 - Shutter #3 before installation

The mounting of the shutter shall be carried out in such a way that the upper edge of shutter #2 is above the lower edge of shutter #3. The correct positioning of the edges of the shutters is shown in Figure 52.



Figure. 52 – position of the rear edge of shutter #3 relative to #2

Installation of the cover in a different way will prevent it from working properly and may damage the Shutter/s or drive units.



Figure. 53 - Shutter No. 3 mounting in the handles - left view



Figure. 54 – mounted shutter No. 3 mounting in its handles

When mounting the shutter, the washers in the 3L and 3R-marked bags, should be used as shown in Figure 55.



Figure. 55 – mounted shutter #3 in the handles, inside view on the left side

After tightening all the screws fixing shutter 3 in the handles, you can proceed to verify the correct operation of all installed observatory shutters.

Testing of Observatory Operation



Note: After installation of all shutters, it is ABSOLUTELY NECESSARY to open and close them in correct order using the manual control panel. An incorrect order of their opening and closing can damage the shutters or their drives units.

The correct order of opening the covers is:

- Shutter #3
- Shutter #2
- Shutter #1

The correct order of closing them is:

- Shutter #1
- Shutter #2
- Shutter #3



The first attempt to OPEN and CLOSE the observatory shall be carried out slowly and very carefully, verifying that the covers or their handles do not interfere with the drive shafts in the opening or closing positions.

DURING OPENING, it is also necessary to verify that the shutters do not touch each other's edges and *make appropriate adjustments to the mounting in the handles if necessary*. This applies in particular to the operation of opening Shutter #1, which in open position hides between the Shutter #3 and #2.

During the assembly of this observatory in the factory, all components have been verified and properly adjusted. However, during the reassembly process there may be minor differences that will require corrections at this testing stage.



Figure. 56 – observatory with shutters installed in closed position



Figure. 57 – position the shutters in the open position of the observatory. From top: shutter #2, shutter #1, shutter #3

Adjust Position of Limit Switches

While verifying the position of the observatory shutters, you can adjust the operation of the limit switches for each shutter if necessary. The operation and adjustment of the limit switch and its actuators is described in the chapter "Maintenance, adjustments of the Observatory"

Installation of Internal and External Observatory Covers

After successful testing of opening and closing the observatory, we can proceed to the installation of external and internal drive covers. The installation is done with closed observatory covers, although this is not an obligatory condition. We begin work by installing the inner gear cover, attaching it with the included M6 screws with cross head to the mounting holes located in the ring.



Figure. 58 – installation of the gear inner cover

Next, we install the inner covers of the drive units by embedding them as shown in Figure 59. In doing so, they shall be positioned so that the fixing holes in the cover match with the fixing holes in the aluminium ring. Screw the cover to the ring with the included M6 screws with cross head.



Figure. 58 – Mounted internal cover of drive units [optional Hygrometer shown].

The final stage of the installation of drive unit covers is the installation of the external cover. When installing it, the observatory should have all the shutters closed. The cover is fixed on the spacer with the bearing, terminated with M6 and M8 threads attached with the observatory equipment shown in Figure 59.



Figure. 59 – Spacer screw for fixing the covers of external drive units.

The end of the M6 thread spacer bolt shall be screwed into the hole in the main shaft of the drive shaft as shown with Figure 60.



Figure. 60 – Mounted spacer bolt in the main shaft hole.

To install the cover, remove the M8 cap from the spacer screw, unscrew it and embed the cover as shown in Figure 61 and 62. Special care should be taken to ensure that the notches in the cover are closely attached to the external profile of Shutter #3, as when opening and closing this shutter, the cover rotates with it.



Figure. 61 – Mounted drive unit cover – left side, view at the front of the observatory.



Figure. 62 – Mounted drive unit cover – right side, rear view of the observatory.

The drive cover must be screwed with the M8 nut with washer while not to damage the outer surface of the cover laminate. Secure the nut with a plastic cover.

Installation of Observatory Cover Seals

The seals included with the observatory equipment are designed to limit the inflow of rain and dust into the observatory through the gaps at the edges of the observatory shutters, and at the edge of shutter #1 with the observatory upper base ring. The seals are self-adhesive, but some of them require additional mounting adhesive for permanent attachment.

Three Seals are delivered in the following set:

- 20x15 mm EPDM seal mounted on the front edge of shutter #1
- 10x12 mm "D" seal mounted on the top edge of shutter #2
- Brush seal 20x7mm mounted on the back of the observatory, directly under the ring
- Brush seal 20x7 mm mounted on the inside, on the front of shutter #3

For the installation of brush seals, it is necessary to use fast-bonded adhesive applied at the installation site immediately before sticking them. All surfaces on which seals will be installed must be clean, dry and skimmed with an appropriate means, such as technical acetone.

The installation of the seals is carried out with partially or completely open observatory shutters depending on the location of their installation. Following photos show the course of their installation.

Installation of the seal on shutter #1

We start the installation of seals from the front edge of shutter #1. To do this, open the shutter #3 partially or open it completely, and then lift shutter #1, so you can access its inner edge, as shown in Figure 63.



Figure. 63 – Opened shutter #1 for the installation of the seal.

Starting from the beginning of the edge of shutter, stick the 20x15 EPDM seal as shown in Figures 64 and 65, on its entire edge.



Figure. 64 – Installation of the seal on the edge of shutter No. 1.



Figure. 65 – Installation of the gasket on the edge of shutter No. 1.

Installation of the seal on shutter #2

The installation of the seal on shutter #2 shall be started with the complete opening of shutter #3 and the partial opening of shutter #2 in such a way that you have a free access to its front edge on the rear of the observatory, as shown in Figure 66.



Figure. 66 – Opening of shutter #2 for seal mounting

After cleaning the mounting surface, stick the seal with a profile "D" 10x12 mm along the outer edge of the cover as shown in pictures 67 and 68



Figure. 67 – mounting the seal on shutter #2



Figure. 68 – mounting the seal on edge of shutter #2

Installation of the seal on back edge of shutter #1

Before mounting the seal on back edge of shutter #1 (see Figure 69) mounting the seal, the contact surface near edge of the cover, where a seal will be placed should be thoroughly cleaned and degreased.



Figure. 69 – Placement of the seal on back edge of shutter #1

After cleaning, apply the 20x7 mm brush seal along the line with a quick-binding adhesive on the edges of the seal base to prevent it from detaching during operation.



Figure. 70 – Placement of the seal on back edge of shutter #1

Installation of an external seal

For additional protection of the gap between shutter #2 and the rear of the observatory, a brush seal can also be installed directly below the edge of the ring as shown in Figure 71. As with other seals, the installation place should be clean, dry and degreased. Installation of the seal should be carried out with fully opened shutters of observatory #2 and #3. As with the installation of the seal on shutter #3, an additional quick-bonding flexible adhesive should be applied to the edges of the seal base.



Figure. 71 – How to install the seal under the upper ring

Maintenance, regulation of the observatory

Due to the design of the dome and the high force of mechanical components, periodic adjustments and inspections of key components are necessary. They will ensure safe and long-term operation of the dome.

Adjustment of the end switches of the dome covers

End switches are responsible for correct starting and stopping dome drive units that control the operation of the dome covers. Their proper operation and adjustment is crucial for the correct positioning of the covers in their opening and closing positions. The limit switches are activated mechanically by pushers coupled with the drive axles on the right side of the dome. The overview of the end switch assembly and the control mechanics of the switches is located in Fig. 72. Each of the covers has two independently acting limit switches, switching off the drive in its closing and opening positions, marked "LS Close" and "LS Open".



Figure. 72 – View of the limit switches assembly and drive units

Note: Incorrectly performed adjustment of the end switches can damage the drive units and/or dome covers!

The adjustment of limit switches operation should be carried out only if extreme positions (close/open) of individual covers are incorrect. Switch pushers are blocked on the axles of the gears with 3mm Allen head screws on its circumference. In order to change the angular position of the pusher, loosen all screws (Fig. 73) and then turn the pusher on the axle clock- or counterclockwise depending on whether sooner or later the stopping the movement of the cover is required. The most secure

adjustment can be done in the position of full open or close of the cover. The pusher in this position of the cover should press the tip switch roller, causing it to start. This is indicated by a characteristic "click" sound of the switch.



Figure. 73 – View of the end switch and its pusher

The adjustment should be made very carefully, as even a slight angular change on the axle results in large changes in the end position of the cover. The pusher should be locked firmly in a new position on the axle. The correct position of the pusher on axle is shown in Figure 74. After the adjustments have been made, check if in the extreme positions (open/close) cover or its handles it do not interfere with the drive axles or elements of the dome base. Testing the start and stop positions of dome covers is best done with manual control panel and with the help of a person who will be able to verify the operation of the dome from the outside.



Figure. 74 – View of the end switch and its pusher while acting with pusher

Periodic verification and maintenance of dome components

Regularly no less than every six months, or about 100 cycles of opening and closing the dome, check that all screws connecting the dome covers with its dome handles are tightened. The condition of the clearances on the drive chains should be monitored, cleaned and lubricated regularly (use lubricant dedicated to lubricate the drive chains) and replace the chains with new ones if necessary. Do not allow chains to rust or soil them with sand or dust which negatively affects the durability of the drive mechanism. Special attention should also be paid to the positioning of the drive axle tips in the sliding bearings of the outer mounting plates (Figure 75). They should be lubricated regularly and verified if there is an excessive clearance between the bearing and the axle tip.



Figure. 75 –Axle tip bearing lubrication points

If the dome is dirty, it should be washed with water with any detergent. Larger ones can be washed off with acetone.

The rubber seals should be cleaned and then maintained with silicone grease, which prevents water deposition and the aging of seal.

SPECIFICATIONS

Basic parameters

- diameter: 3.0 m
- heigh: 3.1 m
- weight: 300 kg
- number of shutters: 3
- opening time: 80s
- drive: six engines 250W
- automation: ScopeDome Arduino Card
- software: ScopeDome Arduino Driver, ASCOM, Windows 10
- equipment bay: 77 x 35 x39 cm
- door: 77 x 59 cm
- dedicated telescope: PlaneWave CDK 700 or smaller

