



C.A. Muller Radio Astronomy Station

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Basic Operator Training

Radio Telescope Dwingeloo



Document version 1.6

The purpose of this manual is to train operators who operate the Dwingeloo radio telescope and then help them to perform this operation in a careful and safe manner.

The manual provides step-by-step actions that the operator must take to start the operation, operate the dish for a public demonstration and switch off the radio telescope in a safe position after the demonstration.



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Reading Guide

This manual is divided into 5 chapters with 4 appendices.

- Chapter 1 is a general introductory part.
- Chapter 2 provides instructions for commissioning the movement mechanism.
- Chapter 3 indicates what you need to pay attention to to ensure that the receiver(s) work correctly.
- Chapter 4 provides instructions for operating the dish using the operating console Chapter
- 5 instructs you to decommission the entire installation after the demo session(s).

to take.

The appendices include a description of the protections, an operator checklist, an instruction for installing the wheel clamps and a brief emergency procedure.

Historical document

Version	Date	Mutation/status	Author(s)
1.0	You in 2016	First off-the-shelf meter operating device	W. de Morné
1.1	Nov. 2017	Processing curatorial comments	W. de Morné
1.2	Juni 2019	Adapted to new hard and stare alre sisie	W. de Morné
1.3	Juli 2019	New layout comments students we werk	W. de Morné
1.4	Aug 2021	Minor maintenance, long lasting	W. de Morné
1.5	Okt 2021	Major commercial update werk	W. de Morné
1.6	Apr 2024 Geovangers	n hoofdstuk 3	W. de Morné



1 Introduction

1.1 General points of attention regarding safety

A telescope operator operates an unusual instrument, often in the presence of an audience. The operator is primarily responsible for acting safely to protect the people present (public and volunteers) and the telescope. The operator, as ultimately responsible, determines whether or not something is possible or responsible. For example, the operator may refuse a request to move the dish if he/she believes there is a reason to do so. You can seek redress about this (if deemed necessary) from third parties from the board.

Only at larger events (for example Open Monument Day) is one often used designated safety coordinator who is in close contact with the telescope operator to ensure outdoor safety keeps an eye on the DT.

Points of attention regarding the safety:

- There is a fire extinguisher at the entrance to the cabin.
- There is a central fire alarm with direct alarms from the local fire brigade. There is a first aid kit at the entrance with a list of important telephone numbers taped to it.
- There is running water in the pantry (note: do not dispose of dirt in the sink).
- There is a flashlight in the engine room on the workbench under the window.
- There is a landline telephone in the measuring room (0521 595 623) with a list of important ones phone numbers.
- therein. Consult the schedule for the summer openings the purposes described emergency procedure in the event of an emergency in or around the dish.
- There are TWO emergency stop push buttons (large mushroom-shaped red buttons). on the measuring room in the middle of the niche of the operating console. in the engine room on the magnetic brake (above the timing belt).
- The steel door of the engine room must remain closed during operation so that the escape route from the measuring room is not blocked in the event of a fire in the engine room.
- A telescope operator is not allowed to work alone. A second operator must always be present to assist and take over in case of emergency.

The names of the rooms in the cabin, as used here, are calculated from the entrance. First door on :

- the left: Pantry (kitchen, output stage 70 cm transmitter and storage of small equipment)
- Second door on the left: Machine room, not freely accessible to guests.
- End of the corridor: Measuring room (consoles and instrumentation)

1.2 Starting position

- The dish is in the rest position ("show" position or in the "storm" position).
- The cabin is not closed and all areas are accessible..
- The drive is in manual operation and is mechanically blocked.
- All dish control equipment is turned off.

1.3 Stormprotocol

- At wind gusts of 50 km/h or wind force 6, the telescope's motors are not turned on.
- If the KNMI gives a yellow code, the telescope is placed in storm position. The storm position is elevation 85 degrees, azimuth 30 degrees from south.
- If in code yellow the expected wind gusts for the province of Drenthe are harder than 80 km/h or with code orange or red, the wheel clamps are also placed.
- Consult <https://www.knmi.nl/nederland-nu/weer/kleding/drenthe> for the current status



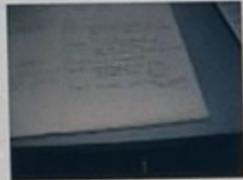
2 Operating instructions "commissioning"

Use the operator checklist. See appendix 2 of this training document.

Adhere to the order of the actions described in this document!

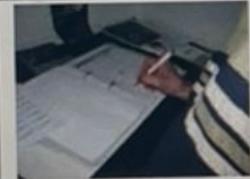
2.1 Inspection and preparation inside

- Check the messages in the logbook



Check the logbook in the measuring room to see if there has been a recent report about a problem with the controls that has not yet been resolved. Assess whether a reported problem affects the implementation of the intended activity.
If in doubt, consult an expert

- Register in the attendance register



Also register in the attendance register that is located next to the logbook on the gray document cabinet to the right after entry.

2.2 Outdoor inspection and preparation

- Inspect the rail track.



Make sure that there is nothing on the track and also check the spaces between the wheels and the brushes

- Check that the wheel clamps are not installed?



Check that the wheels are not blocked with the (red) wheel clamps that should prevent the dish from moving uncontrollably during very heavy storms.

Remove the clamps if installed. See Appendix 3 for details.

- Other checks.

- Check that there are no persons or objects within the turning circle of the stairs to the cabin and warn people in the area that keeping a distance is required. If possible, instruct the tour guides present to ensure this.
- Check that the space under the cabin within the track circle is clear.
- Check that there is no one on the roof of the cabin or on the upper platforms and that the stair gate is locked.
- Check whether the storm protocol measures should be declared applicable.



2.3 Starting up the engine room

- Collect the key for the main controls.



Get the key for the main control box in the engine room. The key is on a bunch of 3 keys with a green label that says "Drive".

- Check engine room in general.



Look around the engine room to make sure everything looks normal.

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There is a red button in the middle of the engine room behind the drive motor. This is the emergency button. Only if a real disaster threatens should you press it.

If the emergency button has been activated, this must be noted in the logbook, together with the reason.

- Check the elevation lock.



The long red handle on the wall at the back must be "free" (slanting upwards), secured with a padlock.

In the down position, an electrical blockage is active that prevents the dish from being operated.

This is a safeguard for working on the focus box with the elevator.

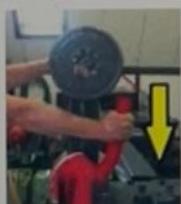
- Release the drive train lock (azimuth lock).



Do not touch the red handle, but pull the handle with the black handle all the way towards you so that the locking pin is withdrawn from the gear on the main shaft.

At this stage the azimuth movement is only blocked by the drum brake on the main shaft.

- Disconnect the manual control



Then push the red handle all the way back in a clockwise direction to disconnect the hand control.

Now the electrical controls for the motors are also released so that they can be operated as soon as the mains voltage of the main control box is also switched on (see next page).



➤ Switch on the control computer in the engine room.



First switch on the control computer on top of the black switch box by briefly pressing the "on/off" button.

Wait 20 seconds for the boot to complete.

The control computer is then ready to execute commands from the control console in the measuring room.

➤ Switch on the mains voltage of the main control box.



1. Insert the smallest of the 3 keys on the bunch you brought with you into the leftmost key switch in the left green panel of the cabinet and turn it clockwise.
2. The "Emergency Stop" light will continue to flash and flash for approximately 30 seconds turns off automatically.
3. You now hear the oil pump running between the gearboxes and after a while the 2 rightmost lights in the "TROUBLES" group go out.

In this step the motors and their controllers for the azimuth and elevation are turned on. Because no steering commands can yet be given (see section 2.4), they maintain the current position and thus actively counteract any movement.



Shortly afterwards you will hear a loud bang indicating that the drum brake on the main shaft is being released by the lifting magnet.

At this stage, the blocking of the azimuth movement has been completely taken over by the motor.

➤ Check the oil pressure



Look through the window on top of the gearbox to see if you see the oil flowing.

Check on the oil pressure manometer whether there is sufficient (2 to 3 bar) oil pressure is.

The pressure gauge is located next to the oil pump on the front gearbox. If the oil pressure remains far too low, something is wrong and you should not operate the installation any further and consult an expert. Please report this in the logbook.

➤ Leave the engine room and close it to unauthorized persons



When leaving the engine room, do not forget to wear the red/white chain to close the entrance to unauthorized persons.

Close the door. Remember that this is a fire door that prevents the only escape route from the measuring room to the outside from being blocked by smoke and fire in the event of a fire in the engine room.



2.4 Starting up the operating console in the measuring room

In the measuring room, there are 2 monitors and a sound box on the control table in the niche next to the instrument racks.

The left monitor, with associated keyboard and mouse, is connected to a computer that forms the control console with which you control the azimuth and elevation movement of the dish and with which you position the antennas in the focal point of the dish.

This control console is connected to the control computer in the engine room. The right monitor with associated keyboard, mouse and sound box belongs to the signal processing computer that will be discussed in the next chapter.



There is a large red button in the middle of the wall of the niche. This is the emergency button that releases the entire installation. Only if a real disaster threatens should you press it. If the emergency button has been activated, this must be noted in the logbook, together with the reason. See section 4.2 for an alternative, less violent stop.

- Switch on the control console in the measuring room.



Now start the control console by switching on the ("Supermicro" CONSOLE) computer in the instrument rack to the left of the control table in the space just above the panel with wall sockets. Switch it on with the "on/off" button.

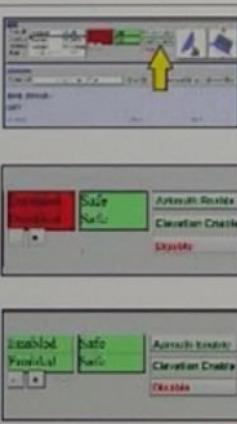
The green lights flashing on the console are for the internet connection, not a fault indication.

- Log in and activate the controls.



Wait until the PC has completely started up.

Then enter your username and password to log in. The username and password will be provided to you separately. When a message appears that a Firefox session is already running, this is the result of a previous user not being careful in the shutdown procedure. You can click that away.



After a while, the screen will appear on which you can click on the operating instructions with the mouse.

In the top half, the "Status" block, 2 areas are colored red with the text "Disabled".

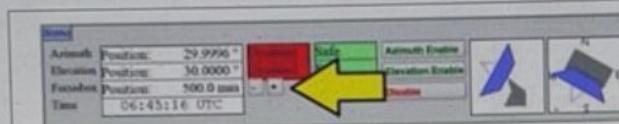
To the right of this are 2 green areas that should read "Safe" to indicate that there is no fault in the controls. If there is not, there is a fault in the machinery that prevents the controls from being released. Consult an expert to resolve the fault lift.

Click on the "Azimuth Enable" and "Elevation Enable" boxes to activate the controls.



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- Check the positioning of the antennas in the focus box



To listen to an object in space, in this case a pulsar, the antenna for receiving the signals must be at the focus of the dish.

The focus box setting must be 450 ± 10 mm for this.

Adjust if necessary with the "+" or "-" buttons.

You are now almost ready to start an observation or give a demonstration.

Now just make sure that you and your audience do not suffer from bad air in the limited space. With large groups, the temperature can also rise sharply and you cannot just open a window.

2.5 Check the condition of the indoor climate

- Check the air quality in the measuring room based on the CO₂ value



A carbon dioxide (CO₂) monitor is available to determine the air quality in the measuring room. The monitor is on the table near the window on the dish side.

Experience has shown that the CO₂ content remains below 800 ppm when the fan in the observation room is switched on and the outside door and the door of the observation room is open. At a CO₂ level of 1000 ppm everyone should use a radio telescope. must be ventilated until the CO₂ level has dropped to 800 ppm.

- Operation of the mechanical ventilation in the measuring room



Forced ventilation has been installed to control the temperature and air quality in the measuring room. This must be switched on manually (and switched off again when leaving the dish). The switch is located to the right of the entrance to the measuring room above the thermostat.



3 Preparation for an observation or demonstration

3.1 Check whether the required equipment is ready for operation

For an observation or a demonstration we need the receivers and "Mercury", the computer for signal processing. This "Mercurius" computer is located in the rack under the narrow panel with the 4 earthed mains connections. It should always be scaled. Check that.

In 2023, the configuration of the receivers used in the demo sessions will be drastically changed.

The receivers in the new situation have been reduced to an interplay of small SDR units that are controlled entirely via the control console.

Make sure that the three left cables from the antenna panel are properly connected to the B210 unit below.



3.2 Switching on "MERCURIUS" signal processing computer and peripheral equipment

The computer is located in the instrument rack to the left of the control table in the space just below the panel with wall sockets. The screen, keyboard and mouse are located on the right in the recess on the control table. The sound box is located between the two monitors.

Normally you will only have to move the mouse or press a key on the keyboard. If there is

no image, it may be that the monitor has been turned off with the on/off switch.

Check that before you start pressing all kinds of buttons. The on/off switch is located at the bottom right of the screen and has a blue signal LED that lights up when the monitor is ready for use.



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- Verify the status of the "Mercury" Computer.



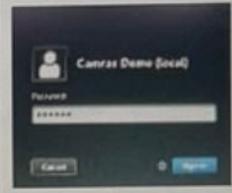
This computer should always remain switched on due to a number of continuous measuring processes.
If by chance it is not turned on, you can bring the signal processing computer to life with a short press of the on/off button.

Only carry out the next step if you had to switch on the "Mercury" yourself!

- "Mercury" session login



Select username
(camrasdemo) from
the list and log in with
the password that you
receive separately.



- Start of Pulsar demo



Double-click on the pulsardemo icon at the top left of the screen to start the pulsardemo software.
In the top left plane the progress of the program processing and in the middle plane the screen will show the graphical representation later of pulsarsignalen.



- And finally: Turn on the sound box...



After the last command, also turn on the speaker box by turning the volume knob clockwise to hear the pulses later. Now all you hear is noise....



4 Operate the dish with the control console.

Now the big work can begin: send the dish to the position of pulsar PSR B0329+54. You do this with the control console that you started according to section 2.4.

4.1 Positioning dish for astronomical observation or demonstration

- Choose the coordinate system of "Year 2000"

Click on <J2000>.

- Choose the source you want to hear

Click on <PSR B0329+54>.

FYI: this pulsar is almost 3,500 light years away from us.

The machinery is now on full alert.

Note that the position display in the status block is different than in the J2000 tracker block. In the Status block the viewing direction of the dish in the terrestrial compass coordinate system is shown.

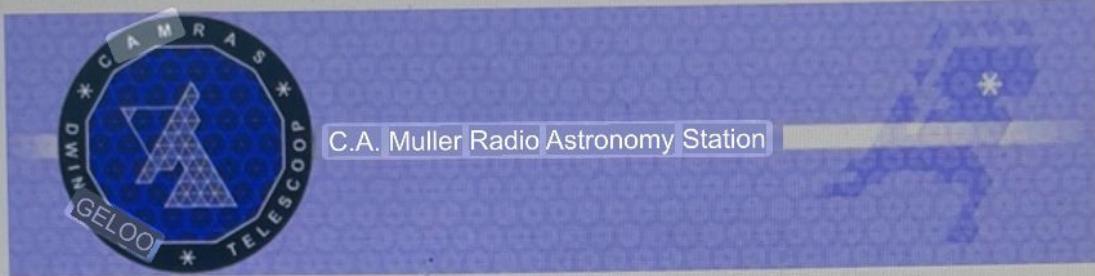
The J2000 tracker block reports the orientation of the pulsar relative to the Earth in the astronomical coordinate system according to the internationally recorded data in 2000. The J2000 coordinates are in a database and are controlled by the operating software converted to the viewing direction of the dish.

- Start the movement.

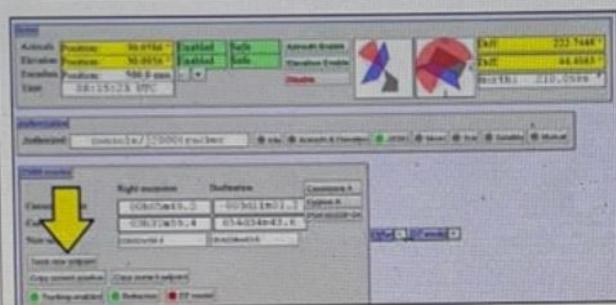


Free turning range?

Before you continue, first check whether the turning area is clear, that there is nothing and no one in the danger zone and that there is nothing on the rail.



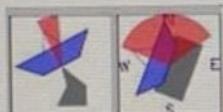
- Allow the dish to rotate to the selected position



Click on <Track new setpoint>

The "New setpoint" is copied to the "current rent setpoint". Clicking this command automatically activates <Tracking enabled> and starts the motors.

The dish will immediately rotate to the selected position,

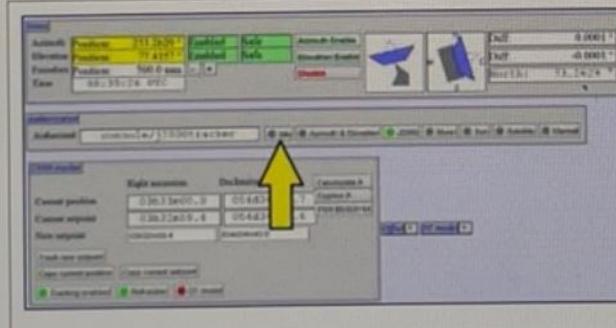


Progress is indicated on screen in the top row of the screen. The red shaded areas indicate how far we are from the desired position

4.2 Temporarily interrupting the movement

You can also temporarily stop the movement of the dish with a "soft landing", without there being an (imminent) emergency.

- Allow the saucer to stop temporarily with a "soft landing".



• Click <Idle>

• The speed of the movement then decreases very gradually. So be patient, he will definitely stop.

- Resume the movement.

A

Free swivel range?

Before you continue, first check whether the turning area is clear, that there is nothing and no one in the danger zone and that there is nothing on the rail.

To continue to the pulsar you must click again on area <J2000>, on <PSR B0329+54> and then check For details, the track is free Fri and click on <Track new setpoint>. see paragraph 4.1. whether



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4.3 Temporarily turn the dish away

If you have pointed the dish at the pulsar, you can also adjust the elevation of the dish a bit degrees away.

You do this to show that you are really focused on the pulsar. If you turn away 2 degrees, the pulsar falls outside the reception beam of the dish. In this reception configuration it is approximately $\pm 1\%$ degree.

Preferably only choose an offset from the Elevation of 3 degrees.

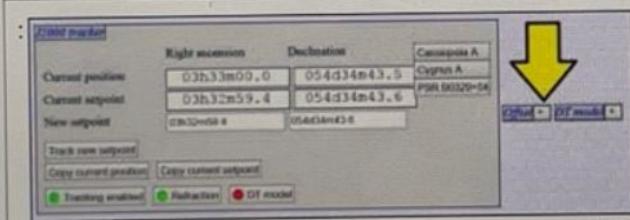
That's faster and you don't have to worry about whether the turning range is clear.

A

If you also use an Azimuth offset, you must always first check whether the turning range is free before activating the <Set> or <Reset>.

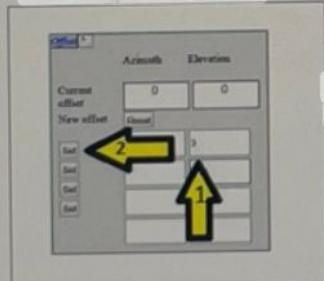
You do not have to enter an offset via "Idle", but do so directly in the current screen.

- Choose an offset for the current position...



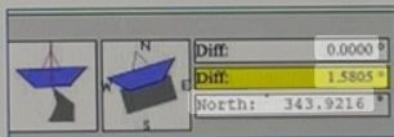
Expand the offset menu by clicking on the <+> box.

- Set the offset value

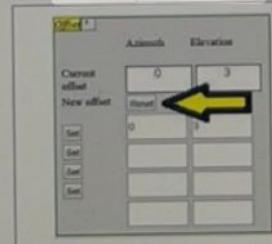


Enter the value "3" for the elevation offset. And click <Set>.

The dish starts rotating immediately with the <Set> and <Reset> commands.



- Undo the offset



click <Reset>.

The dish starts rotating immediately with the <Set> and <Reset> commands.



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5 Operating instruction "Decommissioning"

Once you've done everything you wanted to do, the time has come to turn off all receiver equipment, put the dish back in the "show" mode and then turn off the controls in the correct order.

5.1 End the Pulsar session on the "MERCURIUS" computer.



Click on the cross in the Terminal area at the top left where the program progress is shown to end the session. The Gnuplot window at the bottom right will then close automatically.

No further action is now required on this terminal.

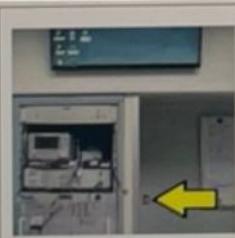
Be careful not to turn off the "Mercurius" computer. The computer is also used for other measuring processes that must run continuously. The monitor  automatically falls to sleep after a short time, and does not switch it off manually.

- Turn off the loudspeaker.



Turn off the speaker box. Turn volume knob counterclockwise.

- Switch off the additional monitor above the instrument racks.



Turn off large extra monitor.
The switch is located on the left in the back wall of the niche.

The receivers and further electronic peripherals can be installed in any order be turned off. To see which peripherals are enabled, see section 3.1.

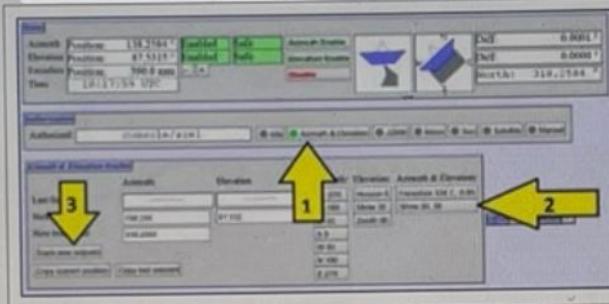
Be careful not to switch off the control computer (CONSOLE) at this stage.



5.2 Place the dish in the "show" position

The "show" position is also the safe position.
If wind force >8 Beaufort is expected, place the wheel clamps. See Appendix 3 for this.

- Select the commands to put the dish in "show" mode.



1. Select the <Azimuth and Elevation> selection field
2. Click on the <Show 30,30> preset

- Check that the turning range is clear.



Free turning range?

Before you start "turning", first check that the turning area is clear, that there is nothing and no one in the danger zone and that there is nothing on the rail.

- Give the start command.



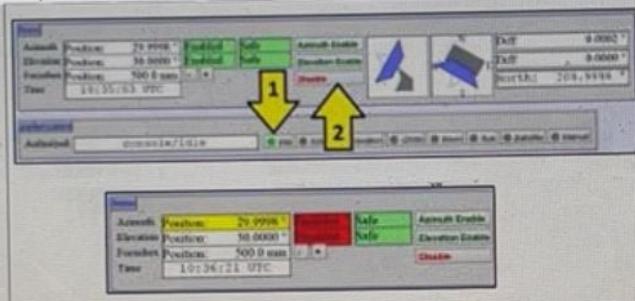
NB! The dish will start rotating immediately when the <Track new setpoint> command is given.

3. To start the movement click on <Track new setpoint> and wait until the dish is in the desired position. You can see this if the two "Diff" fields at the top right of the screen are zero.



5.3 Disabling the controls and locking

- Complete the console operating session.



1. Click on <Idle>

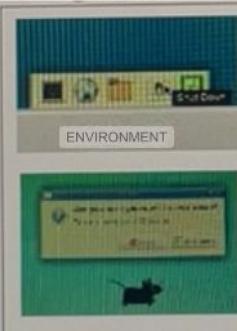
2. Click on <Disable>
Both status areas for Azimuth and Elevation now turn red to indicate that the console is in standby.

- Close the Firefox browser session on the console.



Close the Firefox browser session by clicking on the cross at the top right of the browser area.

- End the CAMRAS (Linux) session on the console.



1. Logout CAMRAS session

2. Shut-down

The "Supermicro" CONSOLE control computer is then switched off by the software,

Do not manually switch off the computer because then the next operator will have a problem starting up. Two Firefox browser sessions will then be started.

- Switch off the control computer in the engine room



Now switch off the control computer on the black main control box in the engine room by briefly pressing the on/off button.



➤ Lock the Drive Train - Step 1.



Connect the manual control to the main shaft of the drive. Pull the red handle counterclockwise all the way towards you.

This way you connect the manual control to the main shaft and you also operate the switch that disconnects the motor/drive drum brake control. This will also activate it.



Sometimes the handle gets stuck halfway because the teeth of the main shaft gear (on the green "motor") are not aligned properly with the bottom gear of the manual column.

Do not try to pull the handle further by force!

You can turn the gray handwheel at the top of the manual control column a little so that the teeth of the gear at the bottom are pulled into the correct position. **Do not** turn the red handwheel all the way forward!

➤ Lock the Drive Train - Step 2.



Block the drive.

Push the handle with the black handle all the way to the left. Do not use brute force!



This allows you to slide a steel locking pin between the teeth of the gear on the main shaft (on the green "motor"). This way, the rotation of the DT Tom and the spill is permanently blocked.



If the locking pin does not fit smoothly between the teeth, it may be necessary to slightly adjust the gear on the main shaft. Do not touch the timing belt of the servo drive

cost your fingers. Ask a colleague to manually release the drum brake a little. The drum brake is released by gently lifting the red weight slightly with your hand until you see the drum brake release.

slipping You can then also turn the gray handwheel at the top of the manual control column a little by hand so that the teeth are in the right position to press the locking pin between them. This is difficult because you then drive the entire azimuth movement. ...

➤ Turn off the main control.



Turn off the main control and put the key ring back where it belongs.



- Close the engine room to unauthorized persons and close the door



When leaving the engine room, do not forget to close the entrance to unauthorized persons with the rod/white chain. Close the door. Remember that this is a fire door that prevents the only escape route outside from being blocked by smoke and fire in the event of a fire in the engine room.

- Turn off the ventilation in the measuring room.



This must be disabled manually.

The switch is located to the right of the entrance to the measuring room above the thermostat.

5.4 Final matters when leaving the cabin

- Check that the gate on the stairs to the upper landings is locked. When a heavy storm is expected, install the wheel clamps. In that case, do not forget to report this in the logbook. See appendix 3 for this.
- Clean up used coffee cups. remove any spilled coffee (stains) and leave the measuring room and pantry tidy. Those who come after you will thank you for it.
- Check that all keys are in place in the key box. Close the key box and store its key in the appropriate place. Check that all visitors have been registered and deregistered in the attendance book.
- Check that you have checked all relevant boxes on the operator checklist and indicate any comments.
- Check that all individual appliances (and CERTAINLY the coffee closed. Kettle in the pantry) maker) are switched off and that all interior doors are locked.
- Lock the cabin or arrange who locks it and check that this has happened.
- Make sure that the door locks properly!! If that does not work, the electric lock may not be active.



In the pantry there is a red push button on a yellow/gray cabinet on the wall on the left. This is the button with which the electric lock can be activated and deactivated.

The electric lock is active when this button is pressed.



6 Appendix 1 - Protections in the control of the telescope

This description is very brief and is for illustrative purposes only.

6.1 Emergency stop (Red button).

Activation causes the dish control to be abruptly switched off electrically.

Solution: A restart must be performed by switching off and on again the mains voltage with the key switch on the main control box in the engine room.

6.2 Azimuth eindstops.

The extreme position for the azimuth is limited to + or -270 degrees. This prevents the power and communication cables in the spindle from being damaged.

- At the extreme positions + or -270 degrees of rotation, the console software stops the movement. Solution: You can simply turn back to 0.
- If you turn through + or - 270 degrees, the first microswitch is activated and the console software stops the movement. Solution: You can simply turn back to 0.
- If the telescope rotates through + or -270.5 degrees, the second microswitch activates and the "RUN" contact of the servo controller is broken and the telescope stops moving. Solution: The computer-controlled operation is now blocked and the telescope must be turned back by hand to the relevant extreme position. If this blockage is lifted after the power has already been switched on, a restart must be made by switching off the mains voltage with the key switch on the main control box in the engine room and switching it on again.

6.3 Elevation end stops.

The protection for elevation works in the same way as that of azimuth.

6.4 Dish blocking for working on the focus box.

Separate work instructions are available for working with the lift. Only qualified operators may perform these actions. The brief explanation below is for illustrative purposes only. The control

console has a command to enter the focus box mode. The dish is placed in the elevation position 0 degrees. This position must be manually operated mechanically be blocked with the red handle at the back of the engine room. This will remove the elevation servo controllers are disabled and the elevator is released. The position of the handle is indicated by locked with a padlock. The position of the lift is reported back to the control console. Only when the lift is in the lowest position can the blockage be released by unlocking the elevation blocker in the machine room. While working with the elevator, the dish control for the safety disabled.

6.5 Wheel clamps.

These clamps can be used to fix the wheels on the rail track. This is to prevent the dish from swinging uncontrollably due to strong gusts of wind, which could cause one or more wheels to come loose from the rail, resulting in serious damage to the movement. This also prevents excessive forces from being released on the transmission, which could damage the bearings and gears. For details, see Appendix 3.



7 Appendix 2 Operator checklist

Switch

Datum :
Time (local) :
Telescope operator :

- Log checked for comments and any follow-up
- No restrictions regarding weather conditions (see storm protocol)
- Inspection of rail track and immediate turning circle area
- Wheel clamps removed
- Neutral elevation lock checked
- Neutral azimuth lock checked
- Control computer in engine room switched on
- Electro-mechanical engine room voltage switched on
- Oil pressure checked
- Control console enabled
- Signal processing computer and receivers enabled

Comments:

Switch off

Datum :
Time (local) :
Telescope operator :

- Control console disabled
- Signal processing computer and receivers disabled
- Electro-mechanics engine room voltage switched off
- Control computer in engine room switched off
- Azimuth lock activated
- Engine room closed with red/white chain and door closed
- Wheel clamps fitted (if necessary)
- Log updated

Comments:



8 Appendix 3 - Installing and removing wheel clamps

The function of the clamps is to fix the wheels on the rail track. There are four wheel clamps, one for each wheel.

The clamps prevent the dish from swinging uncontrollably due to strong gusts of wind, where one or more wheels come loose from the rail, resulting in serious damage to the moving mechanism.



When the clamps are not in use, they are located in the pantry to the left of the door.

Please note! They are very heavy. When going up or down the stairs with it, keep one hand on the handrail and only take one hand at a time. Better to rest healthy in the cabin than with a broken leg in the hospital.

Make sure you store the clamps clean and dry after use.



The wheel clamp consists of three parts that are held together by a clamp bolt.

The center part is the wedge that blocks horizontal movement of the wheel. The wedge is secured between the two clamping elements with a clamping bolt. The clamping elements block vertical movement of the wheel. Each element contains a swivel that clamps the element to the rail track.



The wheel clamp can be placed on the right or left of the wheel, depending on the position of the wheel and its location on the rail.

Separate the parts by loosening the clamp bolt that holds the three parts together and remove one of the clamping elements. Apply the clamp as shown in the illustration and ensure that the wedge fits nicely on both the rail and the wheel.



Make sure you mount the clamps in the position shown in the illustration on the left. The swivels that fix the clamps to the rail track are then vertical. If you do this incorrectly, the swivels will be at an angle and will bend if a lot of force is applied to them. Then their effectiveness is not guaranteed and there is also a risk that you will not be able to loosen those swivels later. Not a good way to make friends.

Then place the second clamping element and tighten the nut on the connecting bolt hand-tight. Then tighten both swivels firmly by hand.

Install the clamps alternately on the wheels so that they do not all block the same direction of slip and that they can block the rotation of the dish in both directions. So the clamps are on 2 wheels to the right of the wheel and on 2 wheels to the left of the wheel.

Disassembly is done in reverse order.



9 Appendix 4 - Emergency stop procedure for the operator.

Two emergency buttons are placed in the cabin.



One emergency button in the engine room on top of the lifting magnet of the drum brake on the azimuth drive.

One emergency button in the measuring room in the niche of the control console.

In the event of an emergency or the detection of an impending emergency, the movement of the dish can be stopped immediately by pressing the emergency button. The drive is blocked and can no longer be operated from the console.

This means that the power supply in the cabin is not interrupted.

The lighting throughout the cabin and all equipment in the measuring room continue to function as usual.

9.1 Mechanical effect of the emergency stop.

In normal operation, the motors for the elevation and azimuth movement are sufficiently powerful to suppress any disturbing movement, for example in strong winds.

The emergency stop intervenes in the control of those motors. They are abruptly switched off electrically. The result corresponds to the condition before the control is switched on with the key (see section 2.3). However, the drive train is now not mechanically locked with the locking pin on the main shaft!

- The elevation movement will immediately stop abruptly. The drive is configured in such a way that the brakes installed there automatically intervene immediately when both engines are switched off.
- The azimuth movement takes a little longer to stop. When the drive motor is switched off, it takes a few seconds before the drum brake engages because the braking movement is hydraulically damped. This is somewhat comparable to the ABS of a car. The mass that has to be brought to a standstill is much larger here (more than 120 tons) than with the elevation movement of the dish (35 tons).

9.2 Next steps after the emergency stop.

Try to instruct the guests and colleagues in the cabin in such a way that panic does not break out. Do this together with your fellow operator and agree who will interfere with the guests so that the other person has his/her hands free for the concrete follow-up. After activating the emergency stop, first check what the cause of the intervention was and assess the situation with regard to possible calling of emergency services. If necessary, use the landline telephone to alert the emergency services according to the existing procedure.

If the emergency or threat thereof is within the dish, ensure an orderly evacuation.

If the emergency or threat thereof is outside the dish, you decide whether to evacuate the cabin or not. Make your guests aware of your decision.

For further details of the emergency procedure, please consult the most recent version of the manual for the CAMRAS summer openings. This describes the official emergency procedure in the event of a disaster described.

When the signal "safe" has been given, you can restart as described in paragraph 2.3.