Using the MD01 Interface

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1. Initial Setup

Before the interface is launched, apparatus must be powered on in a particular order.

Boot the ETTUS2 PC, and launch Anaconda Navigator either by clicking the icon on the taskbar or entering `anaconda-navigator` into a terminal window. Launch 'Spyder' from the navigator. If the script is not present already, it can be opened using the Spyder menus at the top: `File → Open → /home/astro/Documents/LRT-Interface → interface2ccb.py`. **DO NOT OPEN THE FILE DIRECTLY FROM THE FILE MANAGER –** doing so will likely open it using Spyder 2.x which runs on a different python library and will not function.

Ensuring the power cable is switched on at the mains, switch on the PS-01 with the front-facing power switch, followed by the MD-01 in a similar fashion. If all is well, a loud fan should be heard from the PSU, with U1 & U2 lights turning green. A basic interface displaying azimuth-elevation coordinates should appear on the screen of the MD-01. The interface can now be started by clicking the green arrow 'Run File' at the top or pressing the F5 key. If done correctly, a small window with two buttons titled 'Telescope Interface' should appear. If another window, 'Error: No Driver' appears instead, go to the Troubleshooting section.

Note: The other buttons on the front of the MD-01 driver should not be pressed unless necessary for driver recalibration.

2. Making an Observation

Click 'Navigation Interface' to enter the main control panel for the drive. A number of options are presented here that enable different types of observation to be carried out. For reference, the mount has a mechanical tolerance of 0.1 degrees. The 'Chopping' procedure is detailed in subsection 2.3; do not enable this option before reading this section.

2.1. Coordinate Observation – 'Drive to Coordinates'

Slew to a set of coordinates in one of the following coordinate systems: Equatorial, Ecliptic, Galactic, or Horizontal. For any of the first three coordinate systems, tracking is also supported, with a refresh rate of 15s. When the coordinates to be observed have been entered, click the 'Drive' button to initiate a slew. A status window displaying the target coordinates will appear – in the case of a tracked observation, this may be paused and resumed in this window. A timer displays the current observation period.

When the observation is complete or no longer required to continue, click 'Pause' and close the status window. Then, click 'Stop' on the coordinate menu. The observation is complete.

2.2. Object Observation – 'Drive to Object'

Slew to one of the following objects: Sun, Moon, Cassiopeia A, Sagittarius A, Cygnus A, Crab Nebula. The rising and setting times of these objects can be produced by selecting an object in the drop-down list and clicking the 'Generate rise/set times' button. Tracking is supported, with a refresh rate of 15s. When the object has been chosen from the drop-down list, click the 'Drive' button to initiate a slew. If successful, a status window displaying the chosen object will appear – in the case of a tracked observation, this may be paused and resumed in this window. A timer displays the current observation period. If the object chosen is below the horizon at the time of slew, the attempt will fail and an error message will return instead.

When the observation is complete or no longer required to continue, click 'Pause' and close the status window. Then, click 'Stop' on the object menu. The observation is complete.

2.3. Chopping

Both provided observation methods may use this technique. When observing a radio source, calibration of the signal against the background is readily achievable by introducing a low-period, alternating movement of the detector towards and away from the source. The chopping parameters, such as the distance and period of this movement, can be changed in the Settings menu (see Section 5). Use of this technique requires the use of signal processing techniques to be used properly, however; this feature is included simply to enable the corrections required to be applied in any independent project using the telescope.

3. Observation Scheduling

This interface supports basic observation scheduling in single-hour increments. Currently, only observations of objects is supported. To begin, click the 'Observing Schedule' button.

3.1. The Observing Schedule Interface

The observing schedule displays the day represented by the date entered at the top of the window, in the format dd-mm-yyyy. A new date may be entered here, and the schedule refreshed by either pressing 'Enter' or clicking the 'Go' button. The numbers 0-23 represent the day's observing slots in 1-hour increments. This is colour-coded; green observing slots are free, while red slots represent booked telescope time.

To view more information about a booked slot, double click one of the numbers comprising the slot (which will turn yellow to signify it has been selected) to view additional information such as a booking author, the chosen object and any attached information.

3.2. Scheduling an Observation

An observation can be scheduled for the chosen day using the entry fields provided. 'Start hour' and 'End hour' refer to the beginning and end of the desired observation, with 'end hour' indicating the last full hour of observation to occur. 'Object' designates the object to be observed. 'Author' and 'Note' can be used to provide an annotation to the booking to provide other users with information about the observation taking place, including a contact email address. 'Track' and 'Chop' indicate whether the observation should track, or make use of the 'chopping' technique (See Section 2.3).

Once all fields have been completed, press 'Save' to record the observation on the datafile; if successful, the chosen observation should appear in red on the numberline.

3.3. Removing an Observation

To remove an observation, simply double-click the booked slot on the numberline. In the information window, click the 'Remove' button. The observation will be removed, and the slot will turn green. To verify the removal, click 'Go' to refresh the schedule.

4. Homing/Slewing the Telescope

The telescope may be homed to return it to a chosen position (usually 0,0). This can be achieved using the 'Home Telescope' button.

When use of the telescope is complete, it is recommended to store it in a particular position to minimise the danger of excessive winds damaging the system. This can either be performed using the 'Stow Telescope' button or by attempting to exit the interface; a dialogue will appear to check if the telescope should be stowed. Click 'yes' to stow the telescope.

The home/stow coordinates may both be changed in the 'Settings' menu (See Section 5).

5. Changing the Settings

The settings menu is accessed by clicking the 'Settings' button on the main navigation menu. Here, the home and stow coordinates of the telescope are displayed, and can be altered, in the entry boxes. In addition, the parameters of the 'chopping' functionality can be changed by clicking the 'Chop Setup' button.

When the desired changes have been made, click the 'Save' button. The menu may now be closed.

6. Troubleshooting

If you've come this far, something appears to have gone wrong. This section will look to address the most common issues; if none of the provided solutions are useful in solving the problem you're having, please contact Christian Chapman-Bird on 2191474C@student.gla.ac.uk; I'll be more than happy to look into it.

6.1. 'No Driver' Error on Launch.

This error is almost always fired when the USB from the MD-01 is not correctly attached to the PC. If this is the case, reattach the USB, restart the program and try again. If the issue is not fixed, restart the PC and go through the initial setup detailed in Section 1. When successful, the menu should appear as normal.

6.2. Interface appears as a single, frozen grey window on startup.

This issue is usually caused by forgetting to switch the driver on before launching the program. Unfortunately, powering on the driver will not fix this issue immediately, as the program has frozen – a hard restart of Spyder is required. If this is not possible for any reason, a restart of the PC may be carried out. The program should then start as normal. If not, check the Spyder iPython console; contact me with the error traceback.

6.3. The driver is making a loud clicking sound every half-second, help!

You may have left a 'chopping' checkbox pressed. This is just the chopping technique at work, don't worry! This can be remedied with a restart of the program if the offending checkbox remains elusive.

6.4. I tried to manually slew the telescope with the driver, and it won't pass a certain point. What's going on?

There is a mechanical safety feature in place on the telescope to prevent cables from winding too far and tearing. This safety has been taken into account in the interface, but directly inputting directions using the driver buttons bypasses this. Use the interface to control the telescope – it's much less of a headache.