

was written originally by Gil Ninveh and Adi Zitrin for the PI CCD (as part of Adi's M.Sc. project). David Polishook has upgraded this DELPHI program so it can work with the "Remote Wise Commander" program that Yiftah Lipkin wrote.

Dead time between images:

When using the guider the MaximDL program adds 5 sec before the beginning of each exposure. We have not found a way (yet) in the software to get rid of these 5 sec and so the current option is just not to use the guider.

When taking a sequence of a full frame (2048x2048 binned pixels) through the "Remote Wise Commander" the overhead time of reading and displaying the image is about 10 sec (need to check this ●).

When guiding it adds to this 5 sec.

When taking a sequence and changing filters between exposures each 1 position filter move adds 3 sec to the dead time.

To shorten the overhead time one can observe with no guiding and save the 5 sec overhead on each frame due to it.

One can observe directly from the MaximDL and save about 1-2 sec of communication between the softwares/computers.

The main overhead shortening would come from taking a sub-frame of the STX CCD. The following table gives the overhead time of reading and displaying the image when not using an autoguider and when operating the CCD directly from MaximDL's "Camera Control" window in the "Expose" tab in its "AutoSave" mode. (sub-frames were taken about around the center of the CCD; the given average time is over about 100 images):

Sub-Frame	Overhead time (sec)
1340×1300	
750×750	
500×500	
250×250	
295×85	

3.3.2 STX-CAMERA Operation

A suggested procedure for operating the telescope with the CAMERA is outlined here. It is suggested to come to the observatory about an hour before sunset (if the CCD is warm you need to arrive 2 hours before sunset, so that you'll have enough time to cool it).

In the dome:

- On the way to the dome go to the electric box in the room below the telescope and lift the three circuit breakers (CB2, CB3, CB4).
- Turn on the STX CCD, the filter Wheel, and the ST7 CCD guider.

- Make sure the rotator is on the STX angle, which is 82.4 degrees. At this position, the guider ST7 should point south. Any other direction will mess up your work.
- Calibrate the dome position by moving the dome from the console so that the rails will be between the markers.
- Then go to the dome computer and in the “Dome Agent” write 90 in the “Set Az” and press Enter.
- On the dome-pc make sure the time of the clock gets updated with the Dimension4 program: put the cursor on the Dimension4 icon and check if the time was updated in the last 5 min.
- Also check that the “Telescope Agent” and “Focus Agent” programs are running. If not then start them from the desktop.
- Make sure the set/guide switch on the small gray hand paddle next to the dome-pc is pointing to the ”guide” position. Otherwise the guider will not work properly.
- Open a VNC from the dome-pc to the pi2006 (use the ”Remote” folder on the desktop) and make sure the “Filter Agent” program is running on it. If not, start it from the desktop icon - use the initialization process if needed (see section 3.2.1).
- Press once on “Look for Close Detent” to set the filter wheel correctly. Then make sure it is on the right filter position.
- Use the “Filter Agent” window to position the filter wheel on your desired filter in order to observe flat-fields at twilight. Make sure the program moves the filters correctly.
- In the pi2006 VNC window click twice on the STX icon that is on the desktop. The STX/PI interface will be opened, then the MaximDL’s windows will be opened and automatically will connect to the CCDs and will start the cooler on.

However, if this is the first time the STX is used after the eShel was used (or sometimes another instrument) you will need to setup the CCDs according to the following procedure:

- Close the STX program and the MaximDL.
- Open the MaximDL program by clicking twice the icon on the desktop.
- If the “Camera Control” sub-window will not appear toggle it from its icon that looks like a small CCD.
- Goto the “Setup” tab and set Camera 1 to “SBIG Universal” with the camera “STX-16803” and Camera 2 to “SBIG Univerasl” with the camera “Parallel 378”.
- In the “Setup” tab press “connect” and make sure there is connection to the cameras (“Camera idle”) will appear on the info window of each camera.
- Set Camera 1 cooler temperature to -30 and Camera 2 cooler to -10 , and press “On”

in the “Coller” section.

— In the “option” button of Camera1 make sure that the option “Rotate 90 CCW” is checked in the boxes next to it and the other options are not checked.

— In the “Expose” tab set the radio button of Camera 1, and set the “Exposure Preset” to “STX16803_camera”.

— In the “Guide” tab set the radio button of Camera 2.

– In the “Guide” tab Make sure that ”Pier Flip” is NOT checked and the “watch star” is checked, and that the “Aggressiveness” to is set to x=8 y=8. Click the “Settings” button and a “Guider Settings” Window will be opened. Set XSpeed to 0.9, Yspeed to -0.8 , and Angle to 1.

— Take an exposure with in the “Expose” and “Guide” tabs.

— In the “Setup” tab press “Coolers off” and “Disconnect”, and close the MaximDL window.

— Now click twice on the STX icon that is on the desktop. The STX/PI interface will be opened, then the MaximDL’s windows will be opened and automatically will connect to the CCDs and will start the cooler on.

— Close the VNC to the pi2006 from the dome-pc.

— Turn OFF the dome air condition using its remote control which is on the big blue console.

— Check the blue big console; if it is off, turn it on. When turning on the breakers (CB2, CB3, CB4) might jump so you will need to go down to the electric box in the room below the telescope to lift them up again.

— Take off the telescope cover.

— Lower the platform all the way down.

— Position the telescope to declination of $\sim 60^\circ$, so that when opening the dome shutter debris accumulated on top will not fall into the telescope.

— Make sure the Dec (or any other) button is not stuck by pressing only the slew button and making sure the telescope does not move.

— Turn on the relay box switche - behind the old console.

– Make sure the platform is all the way down.

— Turn off all light in the dome (including computer screens).

In the control room:

— On mizpe-cdr open VNC to dome-pc (from the remote folder on the desktop). In the “Focus Agent” tool put the secondary to a position close to STX camera focus used last

time (typically around 52600).

— On mizpe-cdr bring up the weather-pc VNC window (from the remote folder on the desk-top) to be able to check the weather.

— On weather-pc make sure that in the “Volume control ” Window the “Mute” and “Mute all” of the “Mic Volume” and “Volume Control” are not checked so that you’ll be able to hear the sounds from the dome, and also that the “Balance” in the “Volume Control” is on the left speaker.

— On mizpe-cdr open VNC to the cloudwatcher computer and check the sky clarity.

— On mizpe-cdr bring up the pi2006 VNC window.

— In the MaximDL’s “Camera Control” window go to the Guide tab. Make sure that “Pier Flip” is NOT checked and that the “Aggressiveness” to $x=8$ $y=8$. Click the “Settings” button and a “Guider Settings” Window will be opened. Set XSpeed to 0.9, Yspeed to -0.8 , and Angle to 1.

— On mizpe-cdr open the “Remote Wise Commander” program. In the “Camera” section set the instrument to “PI” and then choose the “Connect all” from the “Sockets” menu, which will initialize the connections to the different agents. Press the “FOV” button to reset a connection between the “Remote Wise Commander” and the “STX/PI Interface”. In the “Set CCD size” that will open just press “ok” - currently there is no meaning to the number in that window.

— Load the list/s you are going to use during the night from the List menu.

— Check the computers pi2006, mizpe-cdr, dome-pc, and weather-pc, that the Dimension4 program is running and updating the computer time and that it is correct.

— About 15 minutes before sunset, you should take a bias sequence by choosing the “bias” from the “Remote Commander”, entering the number 5, and pressing “ok”.

— NOTE: Take the bias only when the CCD temperature stabilized on -110 degrees and while the dome is in complete darkness, in order to prevent light leaks into the camera. The average bias level should be around 1200.

Taking Flat Field:

— On sunset open the dome from the “Remote Wise Commander” using the “shutter” button and the “open” option.

— Turn on the dome ventilation and open the dome’s openings around the dome using the “Dome Vent” button in the “Telescope Agent” window. Wait for two seconds to allow it to

respond.

— Start the tracking of the telescope and the dome by pressing the "RA Track" to "on" in the "Remote Wise Commander" window.

— Point the telescope to "Sky flat" position and start taking sky flats. Start with pressing the "Test" button in the "Remote Wise Commander" tool and taking 4 sec exposures until the counts in the image will get to below saturation. Then in the "STX/PI interface" press the "FlatField" button and put in the filter you are using. Using the green "observe button" to take about 3 to 5 flat field images.

Alternatively you can take images using the "Remote Wise Commander" tool By setting parameters in the "Camera" section and using the green "observe button" to take about 3 to 5 flat field images.

Move the telescope a bit between the flat-field exposures so that in case there will be a star in one flat-field it won't appear in the same position in the next flat-field (this enable to get a good median flat-field later in the reduction procedure). Hence, Enter "FF" as the object name and move the telescope a bit between exposures. Take 4-5 exposures of about 5 sec each with each filter you are about to use during the night. Check the number of counts, the maximum should be around 60000. Remember that the STX saturates at about 65000 counts and the bias level (of the 2×2 binned image is around 1200).

Calibration:

— After the flat field were done send the telescope to a bright star by choosing a star from the "_BrightStarsCatalog" list which is in the mizpe-cdr computer and sending the telescope by pressing "goto".

— Once the telescope reached the position take a 0.5 second "Test" exposure on the STX/PI interface. Since right in the middle of the STX CCD there is a raw which seems less sensitive to light than all the others it is best to position the object about 100 pixels above it, so if the star is not at [1024, 924] move it using the buttons of the "Telescope Agent" window on dome-pc.

— Once the star is at position you want it to be on the CCD, press the "calibration" button on the "Telescope Agent" window on dome-pc. A confirmation window will appear. Check that the suggested shifts of calibration are not too large (according to the movement you did and up to a few arcmin), and confirm the new shifts, or cancel if you did not moved the telescope.

Focusing:

- To focus the telescope you can point it to a field with stars of magnitude ~ 10 to 13. One option is to use the objects from the "spec_std" list in the "mizpe-cdr" computer.
 - Take a 2 second exposure and find a suitable star.
 - In the "Expose" tab in the "Camera Control" checkmark "Mouse" in the "Subframe" area, and also check mark "Continuous".
 - Mark a subframe with a suitable star for focusing on the image by clicking on the left mouse button in the upper-left corner of the subframe you want and dragging the mouse to the lower-right corner of the subframe you want. The subframe will be marked on screen and its parameters will appear in the "Subframe" section in the "Camera Control" window.
 - Choose about 3 seconds for an exposure and binning of 1. Then press the "start" button.
 - The tool will take continuous exposures of the subframe.
 - Enlarge the image using the "+" magnify mark and put the cursor on the star to see its FWHM in the information window.
 - On the "Camera Control" window choose from the "Options" menu the "Display large Statistics" option to see the parameters of the star.
 - Check the FWHM in a few images.
- Now move the secondary using the "Focus Agent" window until you'll get the narrowest image possible. You can use the "FocusAid" excel sheet in order to plot the V-curve of the focus and to choose the best focus place. When done stop the focus.
- In the "Expose" tab in the "Camera Control" check mark "Single", and in the "Subframe" area un-checkmark the "Mouse" and press the icon with the arrows to reset the subframe into the maximum dimension of the CCD.
 - Press the "object" button in the "STX/PI Interface" tool.
- The telescope is now ready for work. It is advised to observe when the Sun is more than 12 degrees below the horizon (or even 15 degrees for galaxies and faint objects).

Observations:

- Choose an object from your list.
- Point the telescope at the object using the "Remote Wise Commander" window.
- Press the "object" button in the "STX/PI Interface" tool.
- If you want to use the autoguider, then press the "start" from the guider section of the "Remote Wise Commander" tool. This will put the right declination the the guider and exposure time of 10 seconds. See if the guider is able to start automatically. If it will fail

then check the bullet next to “expose” in the “Guide” tab and obtain an image with the guider.

If the guider finds a guide star then start guiding by clicking the bullet next to “Track” and pressing “start”; if not, choose a guide star, put in its right coordinates and start guiding (see also section 3.4.3).

- Press the green “Observe” button in the “Remote Wise Commander” tool.

This will take the sequence of observations you want.

- Take another exposure of the same object, or stop the guiding and go to your next object.

- Alternatively to the above, You can use the AUTO mode of the “Remote Wise Commander” to automatically go over a list of objects and exposures. For details see section 2.4.1.

- It is recommended that the last exposure of the night should not continue beyond the time when the sun is 12 degrees below the horizon.

End of night:

- Stop the guiding by pressing “stop” in the “Guide” tab.

- If you have time, take a final bias sequence.

- If sky flats were not taken at the beginning of the night, take them at dawn as described above.

- In the “Camera Control” window on the “setup” tab, in the “coolers” area press “off” and “Disconnect”.

- Close the “ST/PI interface” window.

- Using the “Remote Wise Commander” tool position the dome to the east by pressing the “Sky Flat” button and “Go To” - the dome will move the east and the telescope to the zenith. Then disconnect the Dome Track by pressing its “off” button, and move the telescope to declination of 50 (this way when you’ll close the dome the hazard of things falling into the telescope is minimized).

- Close the dome using the “Shutter” button on the “Remote Wise Commander” tool.

- Turn OFF the RA tracking in the “Remote Wise Commander”.

- In the “Remote Wise Commander” disconnect all sockets.

- Exit the “Remote Wise Commander” program.

- Turn off the dome ventilation and close the dome’s openings around the dome using the “Dome Vent” button in the “Telescope Agent” window. Wait for two seconds to allow it to respond.

- Exit all VNC windows that are opened on mizpe-cdr.

- Backup the image files from the pi2006 computer to the mizpe-cdr computer and to the

mizpe-bck, using a simple "Total Commander" copy procedure on the mizpe-cdr computer. Verify that the files were copied correctly, i.e. check the image sizes in kb (see section 2.4.3).
— It is the responsibility of the principal investigator (PI) of the night to make sure that all files were backed up correctly.

- Go up to the dome and cover the telescope and position it to a DEC of about 50.
- Fill nitrogen into the CCD.
- Turn off the ST7, the STX CCD, and the filter Wheel.
- Switch off the relay box and the focus switch behind the blue console.
- Turn on the air conditioners.
- Make sure the platform is all the way down.
- Switch off all lights in the dome.
- On the way down switch off the three circuit breakers (CB2, CB3, CB4).
- Fill out the nightly log in: <http://wise-obs.tau.ac.il/observatory/log.html>
- Before leaving the site, please check that all the books are back at their place, the kitchen is clean and all lights are off.
- Lock the observatory up and go to sleep.

3.4 PI-CAMERA

3.4.1 The PI CCD

The PI (Princeton Instruments) CCD was purchased at the beginning of 2006. It is a 1300×1340 pixels CCD with squares pixels of 20×20 microns in size (model: VersArray:1300B). The pixel size is 0.580 ± 0.002 "/pixel (each 100 pixels are about 1 arcmin), which gives a very good sampling of the imaged objects. The overall field of view of the PI CCD is 12.57×12.95 arcmin.

The PI CCD is operated directly through a MaximDL software which is on the computer called pi2006. To integrate the PI CCD with the other facilities at the observatory the PI CCD is operated through a DELPHI program called "PI Interface" which was written originally by Gil Ninveh and Adi Zitrin (as part of Adi's M.Sc. project). David Polishook has upgraded this DELPHI program so it can work with the "Remote Wise Commander" program that Yiftah Lipkin wrote.

Dead time between images:

When using the guider the MaximDL program adds 5 sec before the beginning of each exposure. We have not found a way (yet) in the software to get rid of these 5 sec and so the current option is just not to use the guider.