ACE Control System
JKT 1.0-m Observatory
SARA ORM
User's Manual

Created for:

SARA Consortium

Created by:

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CHANGE RECORD

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1.0 INTRODUCTION

1.1 PURPOSE

This User's Manual gives details of the ACE Observatory Control System. The information contained herein is proprietary and the intellectual property of Astronomical Consultants & Equipment, Inc. (A.C.E.) and was produced entirely at private expense without public funding. Nothing in this manual is to be considered as "public domain".

This manual is a primer for the daily operating procedures of the telescope, instruments and dome. There is a separate manual on the operating details of the ACE Connector software. You should not use this facility without having personal training by an authorized SARA instructor.

Please do not use the facility in marginal conditions. The data you collect will be sub-standard and you will be putting the facility at risk. Thank you.

1.2 OVERVIEW

The SARA ORM facility is the re-birth of the JKT 1.0-m telescope located on the island of La Palma in the Canary Isles, Spain. It was built by Sir Howard Grubb-Parsons and commissioned in 1985 as part of the Isaac Newton Group of telescopes. The telescope fell into disuse at the turn of the century and is now operated by the SARA group. As part of the Agreement, the Instituto de Astrofísíca de Canarias (IAC) which operates the Observatorio del Roque de los Muchachos (ORM) became a full member of SARA.

The observatory is called the JKT (Jacobus Kapteyn Telescope), named after the famous Dutch astronomer. It used to be an f/13 system. The original f/8 system (which was almost never used) has been redesigned with a longer back focus distance to allow the same instrumentation that is used at SARA KPNO and SARA CTIO to be deployed here.

The current (initial) instrumentation is for direct imaging, using an Andor Ikon-L 2048 camera producing images 11.6 arc minutes square.

There is no "night assistant" available for this facility. It is intended to be run unattended by an experienced observational astronomer. It is not recommended to operate this facility on those nights that experience marginal weathers conditions, especially when rain or snow is predicted within the next 12 hours.

The JKT is the highest telescope on the sharp ridge of a volcano. The weather can change dramatically is a matter of a few minutes, from pristine observing to terrible. Do not doubt the weather sensors! Always ere on the side of caution.

1.3 ACRONYMS

A list of acronyms is presented in Table 1-1.

TABLE 1-1 ACRONYMS	
ACE	Astronomical Consultants & Equipment, Inc.
IAC	Instituto de Astrofísíca de Canarias
JKT	Jacobus Kapteyn Telescope
ORM	Observatorio del Roque de los Muchachos
SARA	Southeast Association for Research in Astronomy
NSF	National Science Foundation
PDU	Power Distribution Unit
VPN	Virtual Private Network

1.4 QUICK VIRTUAL TOUR

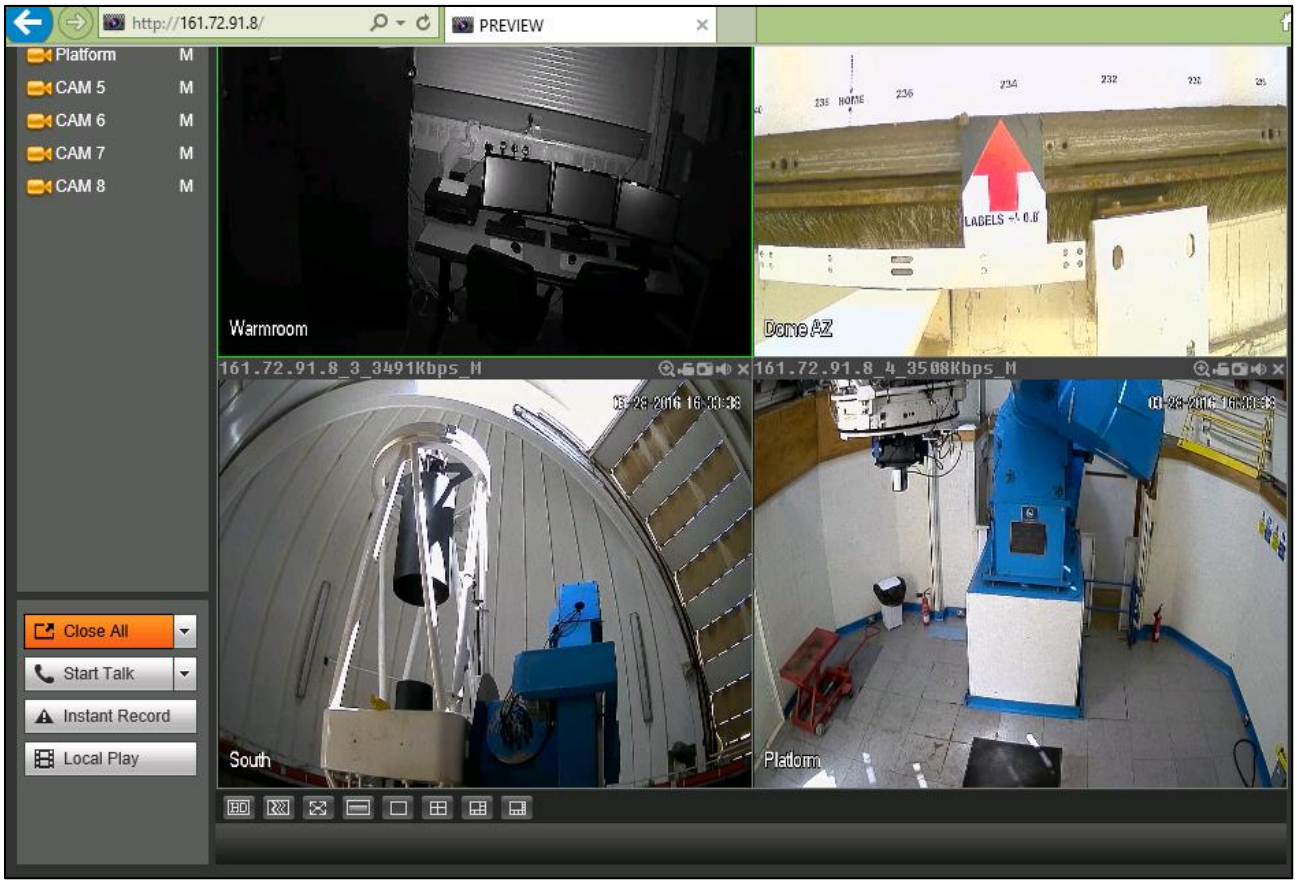


FIGURE 1-1 THE LOREX QUAD-VIDEO DISPLAY

The JKT is an equatorial torque tube mount. In theory the instrument can swing past the mount when pointing at the north celestial pole. However, the control system will not permit this.

The telescope tube sits on the EAST side of the mount. The eastern horizon is slightly limited due to the offset nature of the mount. The western horizon is not restricted. The telescope is driven by a worm and worm wheel (360:1) and backlash is taken up with preload motors. This is all done automatically and the observer does not have to be concerned with the operation.

A tilt sensor prevents the telescope from going below 15 degrees. If you are clever enough (?) to defeat the system and trigger the tilt sensor, then the telescope must be restored by the System Engineer.

The dome is a bi-parting slit that allows full access to the sky. A windscreen is also available. This is a very windy site (compared to CTIO and KPNO) and the intention is to run the windscreen in automatic mode. It will track with the telescope just like the dome azimuth tracking.

The dome has a real-time rain-snow sensor and a Boltwood cloud sensor. In addition, there is an all-sky camera.

A set of video cameras gives a remote observer key views of the facility. One of the cameras show the position of the dome, another the main telescope, and another the instrument.

The main observing floor can be raised. It should ALWAYS be down. If you see the platform is up do not operate the telescope. The appearance should be the same as that shown in the Platform camera in Figure 1.1.

FIGURE 1-2 THE INSTRUMENTATION

The JKT is equipped with a dual filter wheel (18 discrete filters), and X-Stage guider with a QSI 683 camera, and a direct imaging Andor Ikon-L 2048 camera.

The ACE Control System is housed in a 2-door control cabinet located in the warm room. The system uses three computers to manage the telescope, the science cameras, and the auxiliary equipment. The warm room has a window that must remain closed during observations (check the video system if you think there is an issue).

There is an APC remote power switch for recycling critical components.

The environmental sensors are housed on the roof of the dome.

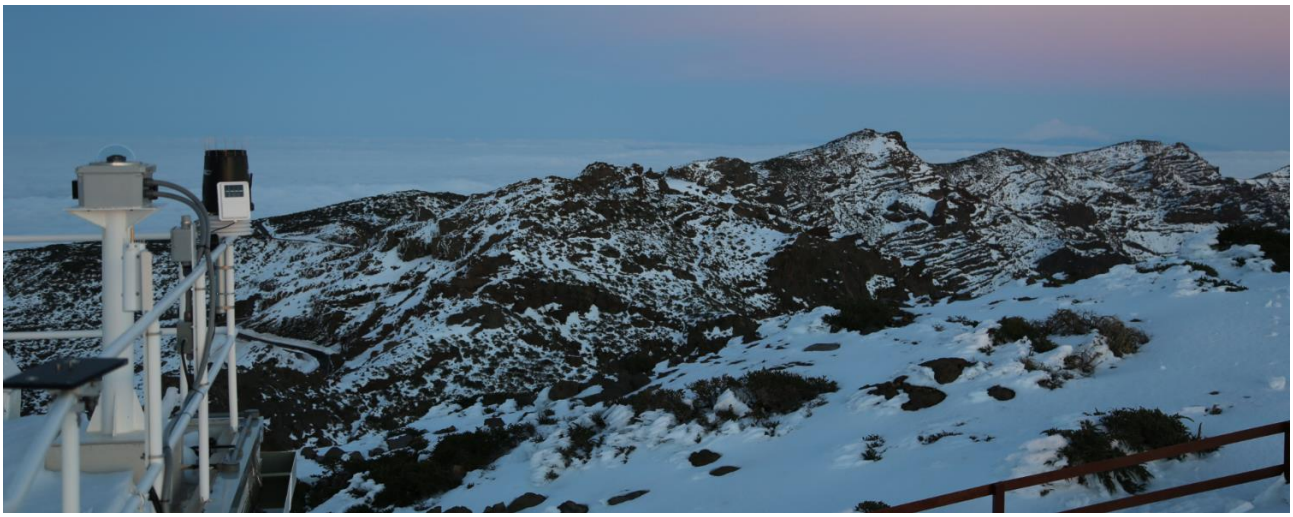


FIGURE 1-3 ENVIRONMENTAL SENSORS

FIGURE 1-4VIEW TO THE SOUTH

The JKT sits on the rim of a volcano and the clouds often gather in the caldera less than 100 meters below. The humidity can change rapidly if the clouds spill over the rim. The JKT is the first to see this.

FIGURE 1-5 ICE ON THE DOME

During winter storms (severe ones occur about every seven years) the dome can be completely covered in ice. The image above (courtesy Jorge Gmelch) shows the storm of February 2016. The ice took 5 days to melt off the dome.

SARA ORM has an automatic generator backup for coping with long power outages. The telescope is on a 240 VAC 3kw UPS. The dome is not on a UPS. Power glitches are rare and are not expected to be a problem.

FIGURE 1-6 ALL SKY CAMERA

The all-sky camera can be used to monitor the observing conditions.

1.5 PLANNING YOUR OBSERVATIONS

The SARA ORM observatory is located at La Palma in the Canary Isles. On site observers cannot just turn up un-announced! With the exception of IAC observers, permission must be granted for each visit to the observatory.

Anyway, the facility is not intended to be used by on-site observers other than local astronomers. Even they are expected to do most of the observing remotely.

The following information will help you when planning your observations:

Table 1-2 Observatory Parameters	
Time Zone	UTC -4
Longitude	WEST 17 DEG 52 MIN 41.15 SEC
Latitude	NORTH 28 DEG 45 MIN 40.4 SEC
Elevation	2438 METERS
Altitude Limit	15 DEG
North Limit	+89.8 DEG
South Limit	-40.0 DEG

The telescope will become out of bounds when one or more of the limits is reached. The software will not permit slews outside of the observing boundaries. If you need to observe between +89 degrees and the north celestial pole, please contact ACE so that this region can be opened up. It is normally closed to prevent accidental reversal of the telescope.

Please note that the longitude of the observatory is almost 19° and that the time zone is centered on 0°. This means that La Palma enjoy long hours of daylight in the evening compared to the morning. At civil noon the Sun is still almost two hours to the east of the meridian.

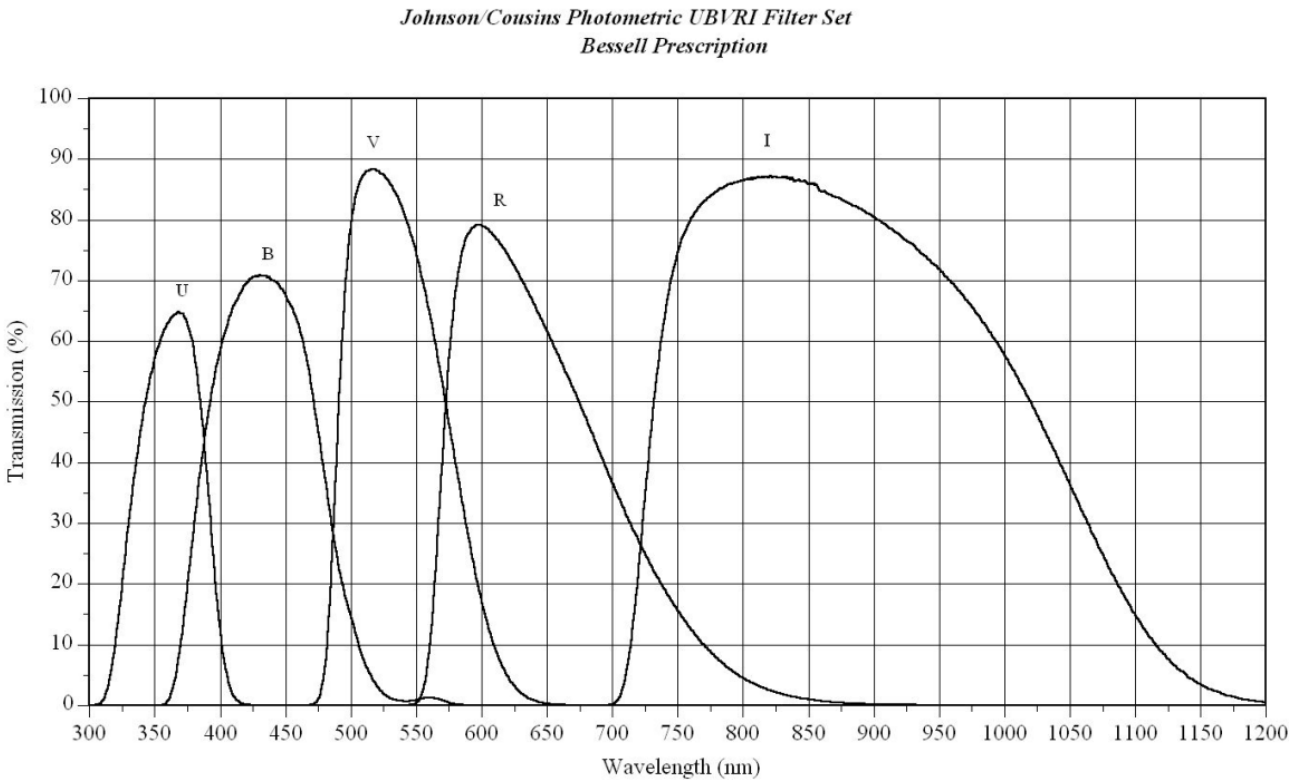
1.6 FILTERS

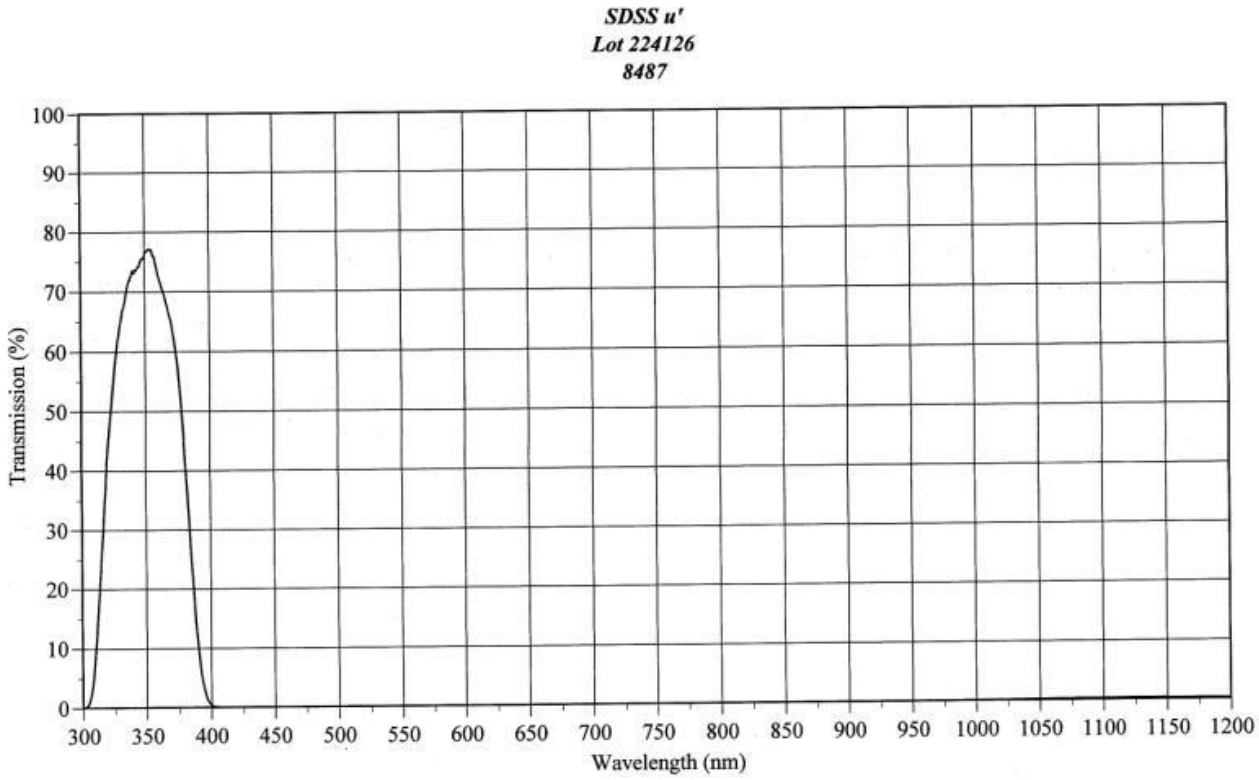
The following filters are normally available. If you plan on using additional filters, contact ACE at least 10 weeks beforehand to allow for jackets to be made and shipped to La Palma.

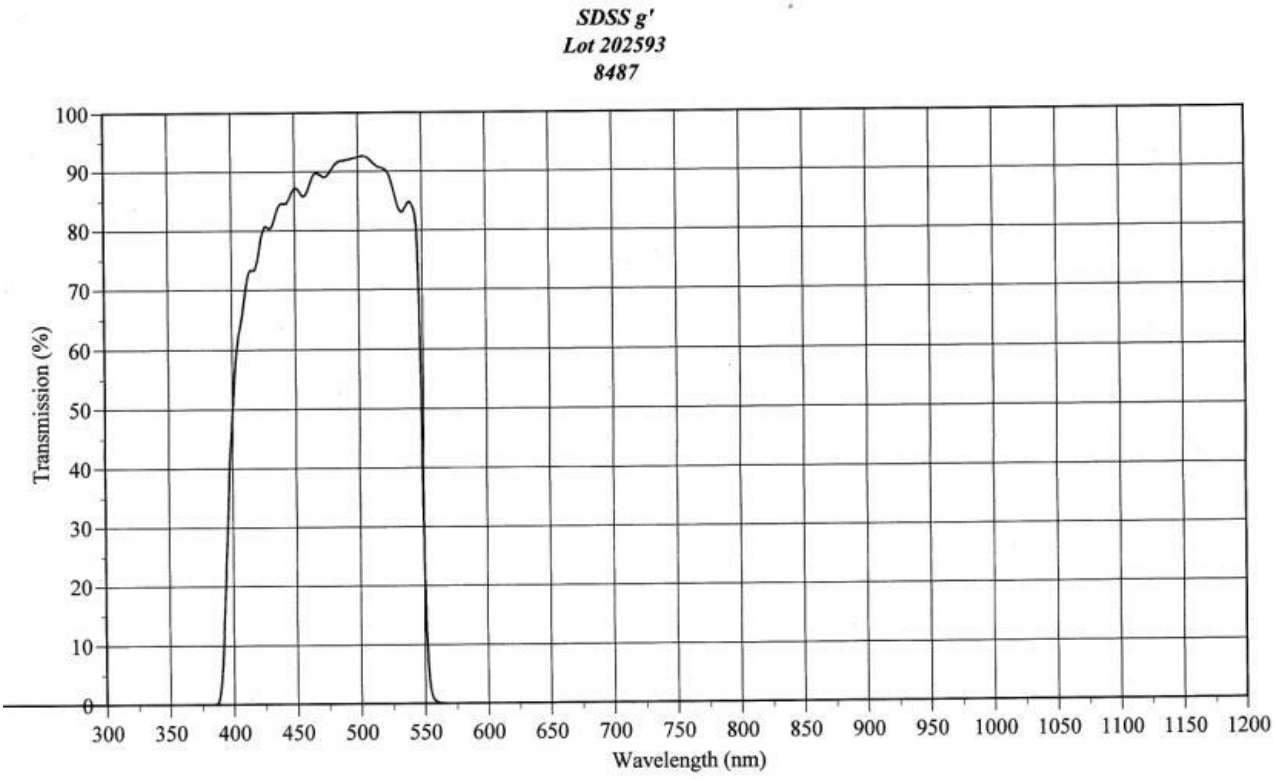
Table 1-3 Available Filters

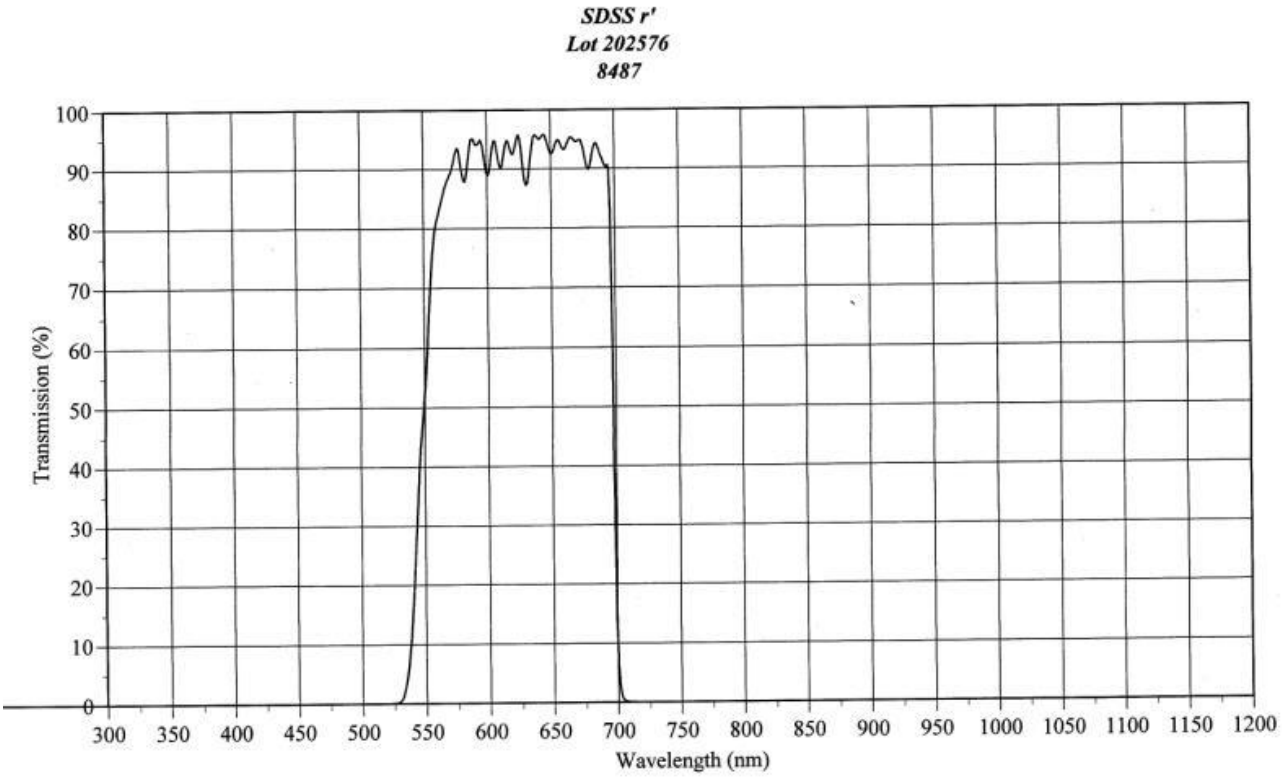
Wheel 1	Wheel 2
Empty	Empty
UV Block	UV Block
Johnson U	Sloan u'2
Johnson B	Sloan g'2
Johnson V	Sloan r'2
Cousins R	Sloan i'2
Cousins I	Sloan z'2
Empty	Sloan z_s2
Empty	Empty
Empty	Empty

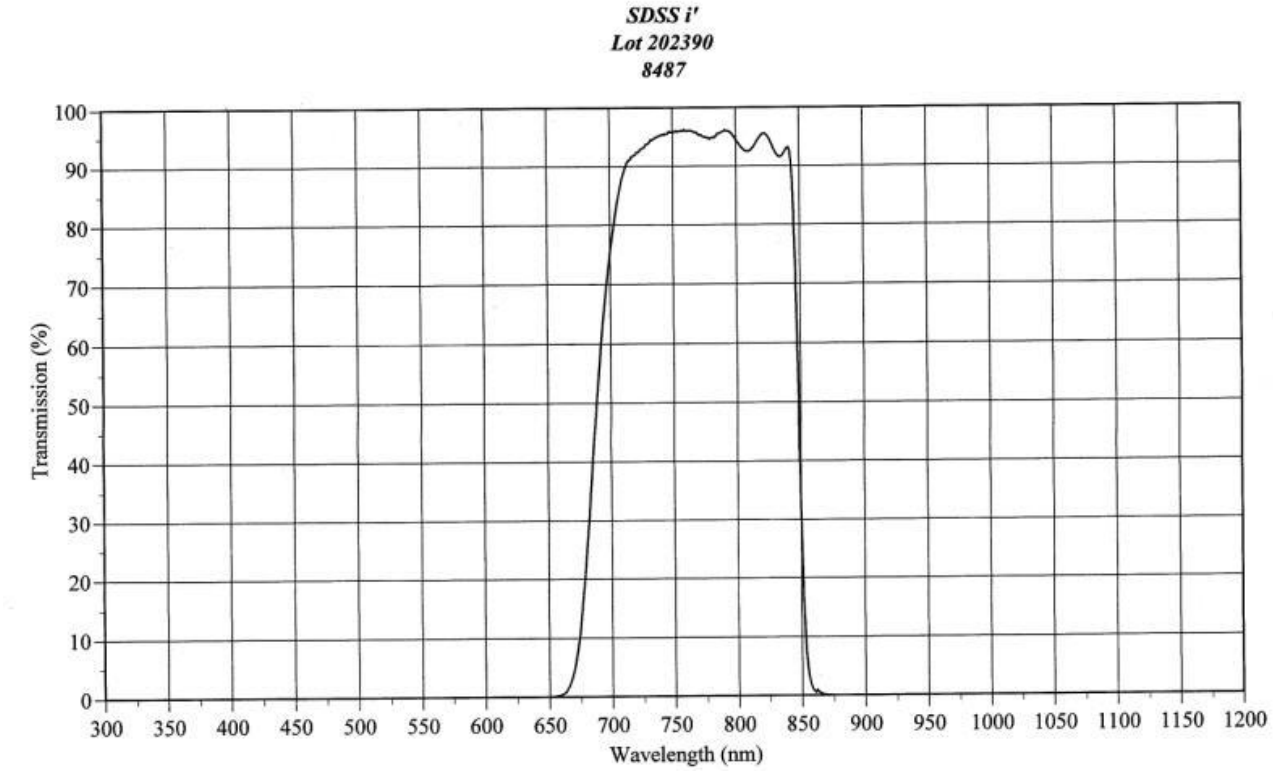
1.6.1 Transmission Curves for Bessel, SDSS and Luminance Filters



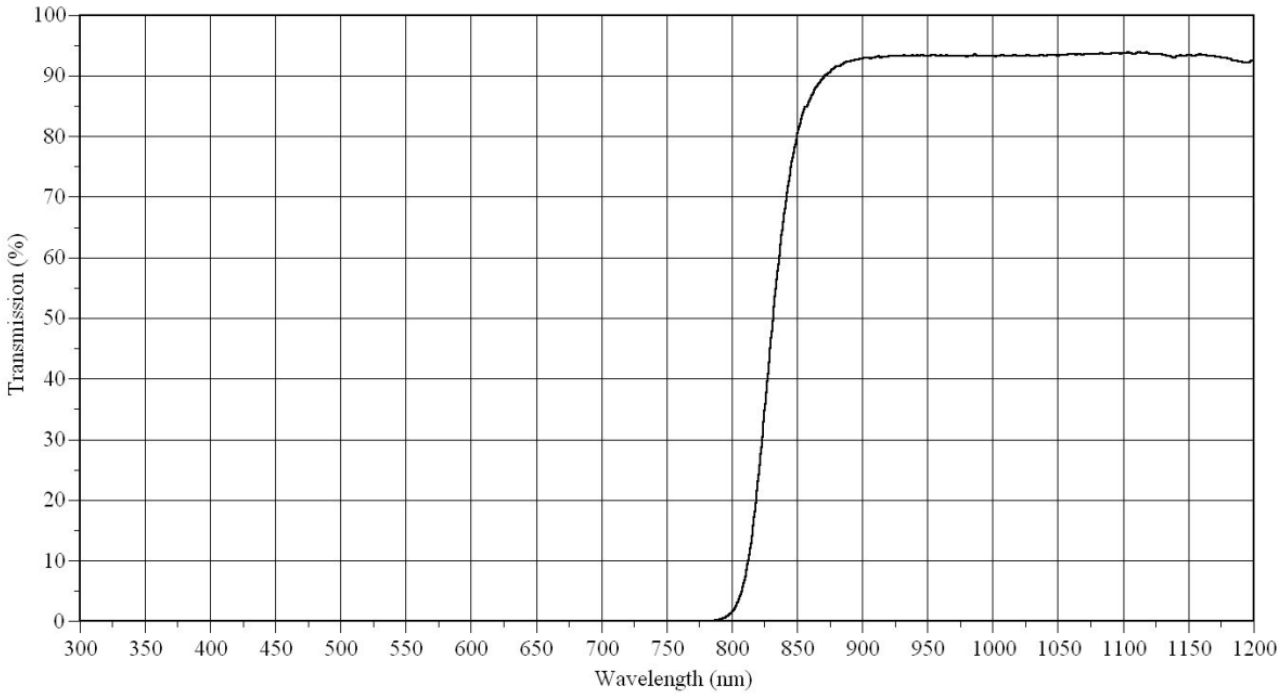

SDSS u'
Lot 224126
8487
Transmission (%)
100
90
80
70
60
50
40
30
20
10
0
300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200
Wavelength (nm)


SDSS g'
Lot 202593
8487
Transmission (%)
100
90
80
70
60
50
40
30
20
10
0
300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200
Wavelength (nm)

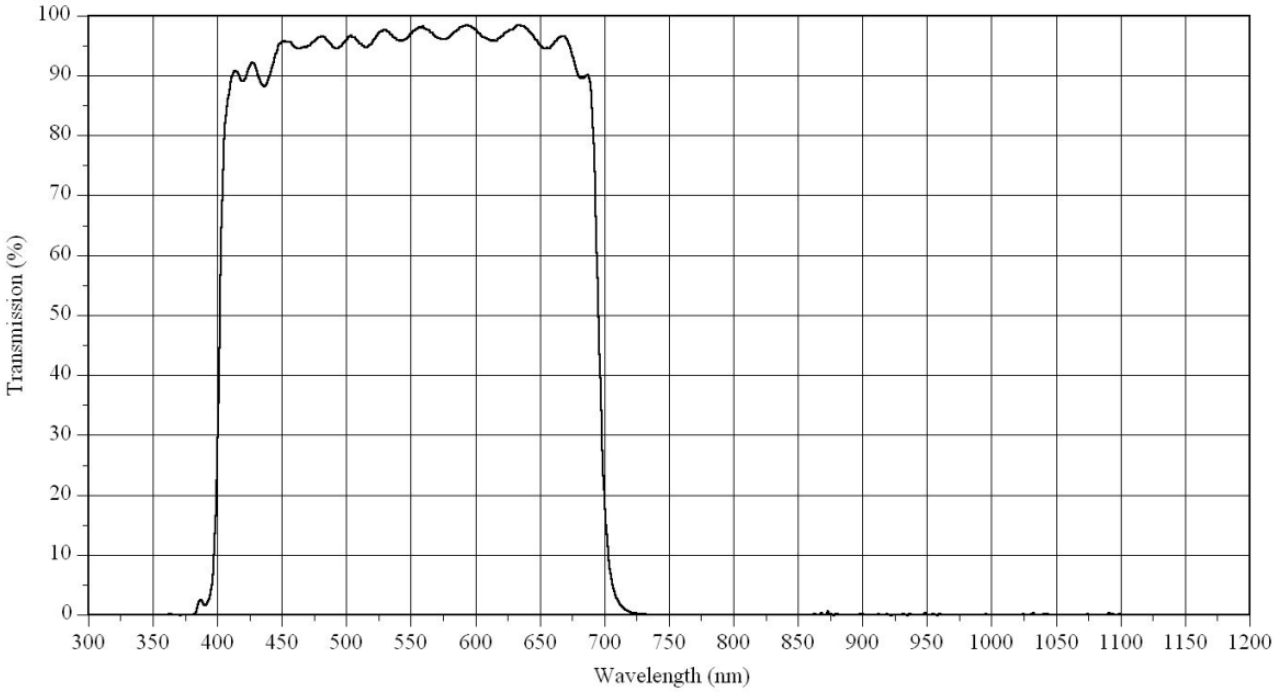

SDSS r'
Lot 202576
8487
Transmission (%)
100
90
80
70
60
50
40
30
20
10
0
300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200
Wavelength (nm)


SDSS i'
Lot 202390
8487
Transmission (%)
100
90
80
70
60
50
40
30
20
10
0
300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200
Wavelength (nm)

SDSS z'

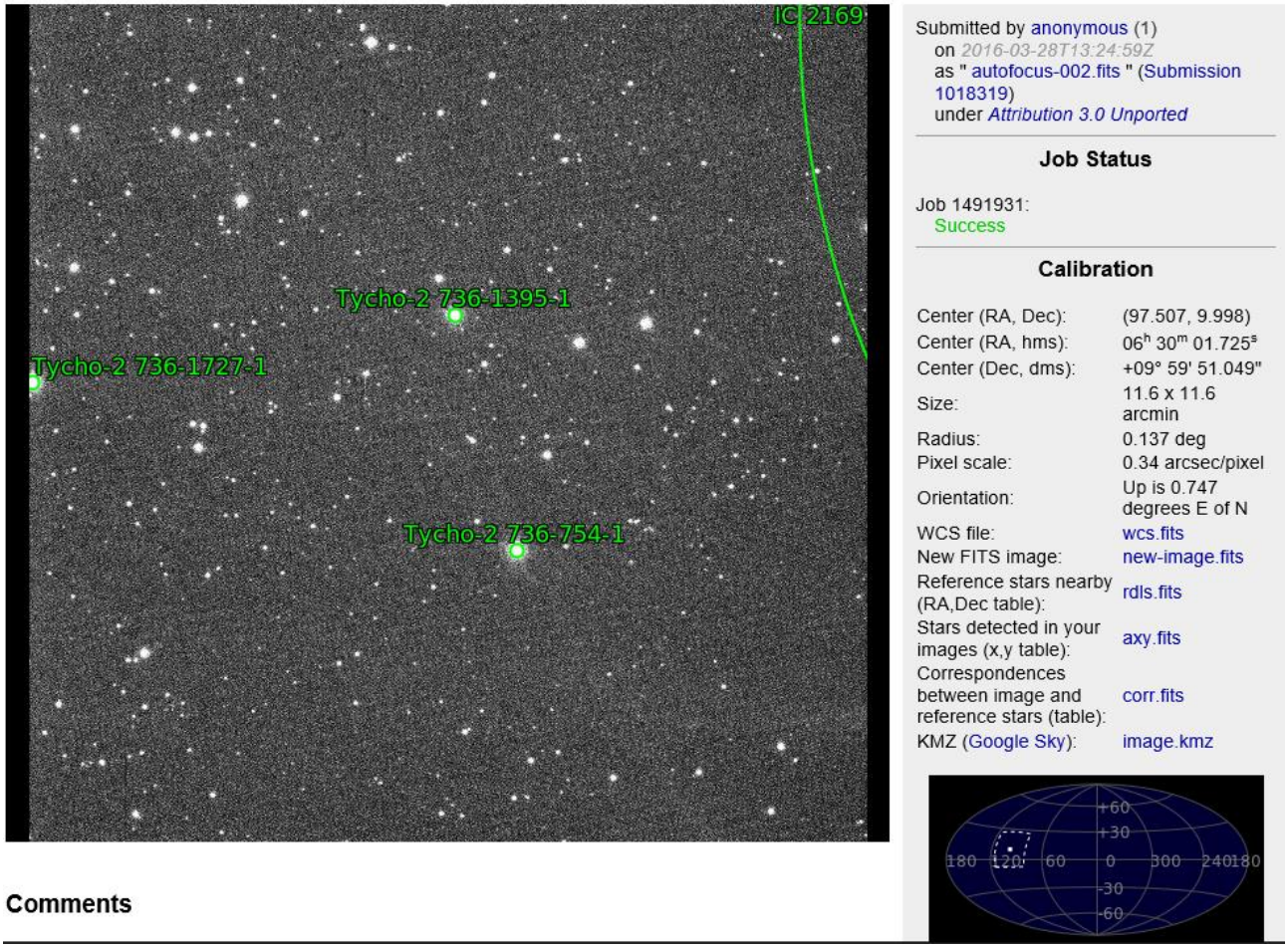


Luminance
IR-Blocked Clear



1.7 DETECTORS.

The science camera is an Andor Ikon-L detector.



1.8 FAILURES AND EMERGENCIES

There are no on-site staff available for you to contact. Do not use this facility when precipitation is predicted within 12 hours or if conditions are marginal. Internet failures are common and the outages have been known to last for half a day or more when cables are severed.

Emergencies are categorized as situations like the dome being unable to close after an earthquake, as opposed to a camera being inoperable. If a piece of equipment fails in the night, it will be at least the next day (or over the weekend the following Monday) before it can be seen to. The local staff work Mondays through Fridays from approximately 09:00 through 16:00 local time with essentially no staff available during the night. Observers should report non-critical equipment failures in the usual manner and a response team will see to getting things back to normal.

Fill out the nightly report log so that ACE can see to non-critical concerns during normal business hours if there is a non-critical equipment failure.

Please note that ACE staff do not provide training or observing assistance. They are only available for technical support. For non-technical issues contact the Observatory Director.

For emergencies contact Peter Mack on Skype at TCB142 or call 520 979 0101. (Don't leave messages on the cell phone; they are not monitored).

Send email to support@astronomical.com which is read by all technical staff.

2.0 COMPUTERS

2.1 ACCESS TO THE OBSERVATORY

The SARA ORM computer system is a part of the IAC network. Please bear in mind that the privilege to access the system comes with the responsibility to use it properly and keep the IAC network safe.

Also, you have one more responsibility. The computers at the observatory should not be treated simply as another desktop computer. Rather, think of them as dedicated control computers designed for a specific task, like moving the telescope. Therefore, do not download and install any software on these computers. The only files that should be created are your own CCD images and telescope catalog files.

> Do not update any system files, windows updates, etc.
> This will be done on a regular basis by the System Engineer.
> If update pop-ups appears say No Thanks or decline.

2.2 SARA PASSWORDS

There are only two usernames and passwords in use.

They are:

Username: SARA
Password: Kpn0Cti00RM

It's easy to remember!! It's the three observatories, KPNO, CTIO and ORM. We have just morphed it up a bit. Each of the three words starts with a capital letter or the number zero (since all letter O's are turned into zero's). Then capitalize the observatory you are using.

Use this username and password for radmin, realvnc and Windows login.

Exceptions:

The APC switch racks and the Lorex 4-port video cameras are slightly different as they don't allow as many characters. So it is:

Username: SARA
Password: 0RM (That's a zero of course!).

The D-Link steerable cameras are:

Username: admin
Password: Kpn0Cti00RM

2.3 NETWORK OVERVIEW

The control system utilizes three computers, one called "*TELSECOPE"*, one called "*CAMERA"* and one called "*OBSERVATORY*".

Various additional devices are controllable over the network including two switchable power outlet racks and an 8-channel video switcher

Under normal circumstances these devices are all left powered on all the time and protected from surges and power outage by a UPS system.

The IP addresses 139.229.14.226 through 238 are available for the SARA CTIO Observatory:

Address	Device	Notes
161.72.91.2	APC RACK	
161.72.91.3	TELESCOPE COMPUTER	
161.72.91.4	CAMERA COMPUTER	
161.72.91.5	OBSERVATORY COMPUTER	
161.72.91.6	ACE Motion Controller	
161.72.91.7	Reserved	
161.72.91.8	Quad Video	
161.72.91.9	SmartDome	
161.72.91.201	Steerable Camera	
161.72.91.207	Weather Station	Temporary.

The following parameters are recorded for maintenance staff:

- ☑ Mask: 255.255.255.00
- ☑ Gateway: 161.72.91.1
- ☑ DNS1: 161.72.7.3
- ☑ DNS2: 161.72.1.3

2.4 REMOTE CONNECTIONS

2.4.1 Remote Administrator

Remote Administrator viewer is available free of charge at www.radmin.com. It will only work on a windows platform but it is much faster than real vnc and is able to perform remote shutdown, file transfer, **chat tool** and remote access.

The port selection is as follows:

TABLE 2-1 RADMIN PORT ASSIGNMENTS

Computer	IP Address	Port Address
TELESCOPE	161.72.91.3	5003
CAMERA	161.72.91.4	5004
OBSERVATORY	161.72.91.5	5005

Note that you cannot use the default port assignment of 4899, you must use the port addresses shown above.

For the system to work efficiently the screen resolution of your computer must be equal or greater than the (1920 x 1080) setting of the remote computer otherwise the screen will pan and scroll all the time making the experience very slow and frustrating. To avoid this problem right mouse, click on the connection icon and select Properties from the pop-up menu (Figure 2-1). Select Fullscreen from the Video Mode. You can dramatically speed up the connection by reducing the amount of color. For normal use 16 bits is fine. It even works with 1 bit although the screen looks odd!

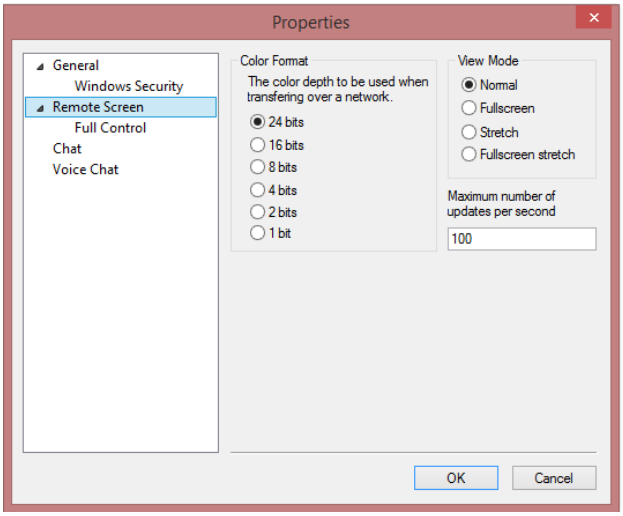


FIGURE 2-1RADMIN REMOTE SCREEN PROPERTIES

Radmin also has a CHAT tool. Much better than Notepad! Try it out if talking with ACE or you have multiple observers.

2.4.2 Real VNC

Real vnc can also be used to connect remotely. The viewer is available free of charge at www.realvnc.com. This works from any platform (choose the correct operating system for your remote computer). However, it does not allow for a chat tool and file transfer, and it is not as fast as Radmin.

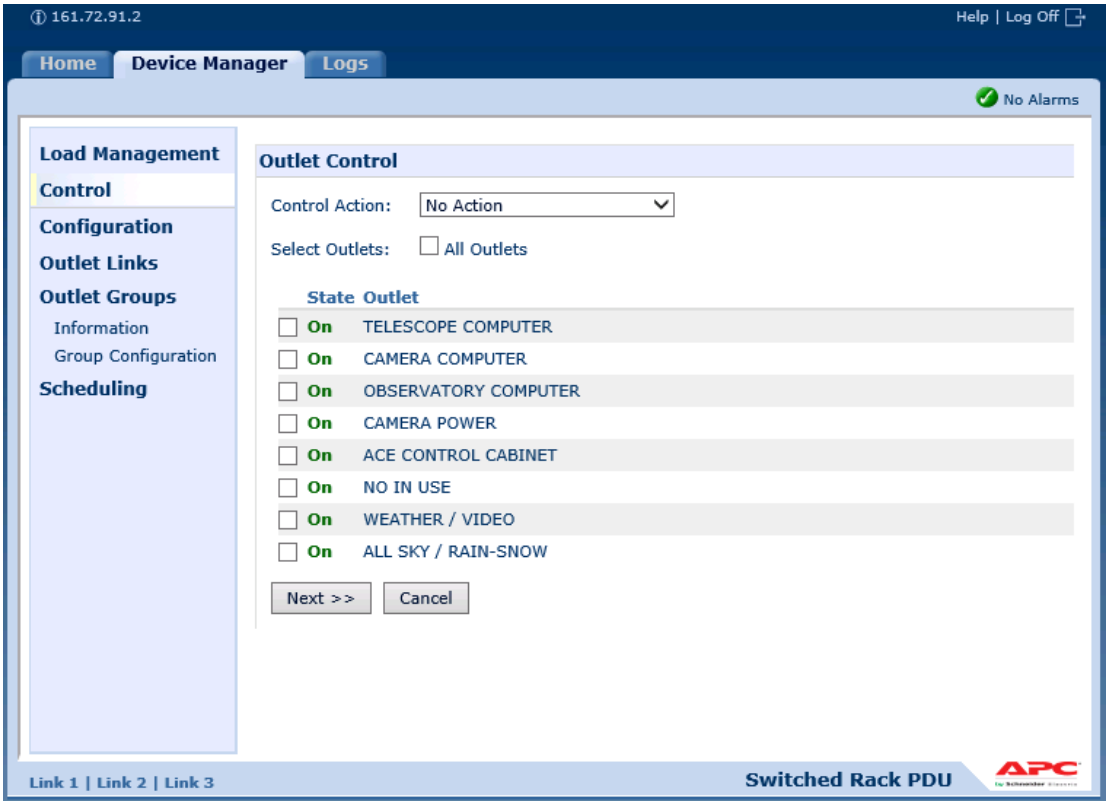
TABLE 2-2 REAL VNC PORT ASSIGNMENTS

Computer	IP Address	Port Address
TELESCOPE	161.72.91.3	6003
CAMERA	161.72.91.4	6004
OBSERVATORY	161.72.91.5	6005

2.5 APC SWITCHED RACK PDU

The Switch Rack PDU (Power Distribution Unit) is a networkable device with eight power outlets. It is possible to turn on/off and reboot each individual outlet or a set of outlets. The system has been setup so the choosing the control action "*Reboot Immediate*" will turn off a given device for a pre-determined number of seconds and then turn it back on again.

IMPORTANT!! The computers are equipped with 1kW power supplies. They take AT LEAST 75 seconds to die down. So wait at least that long before turning back on.



Although you can simply type in the IP address it is easier to go to favorites and select the rack. Please don't change the favorites in windows explorer!

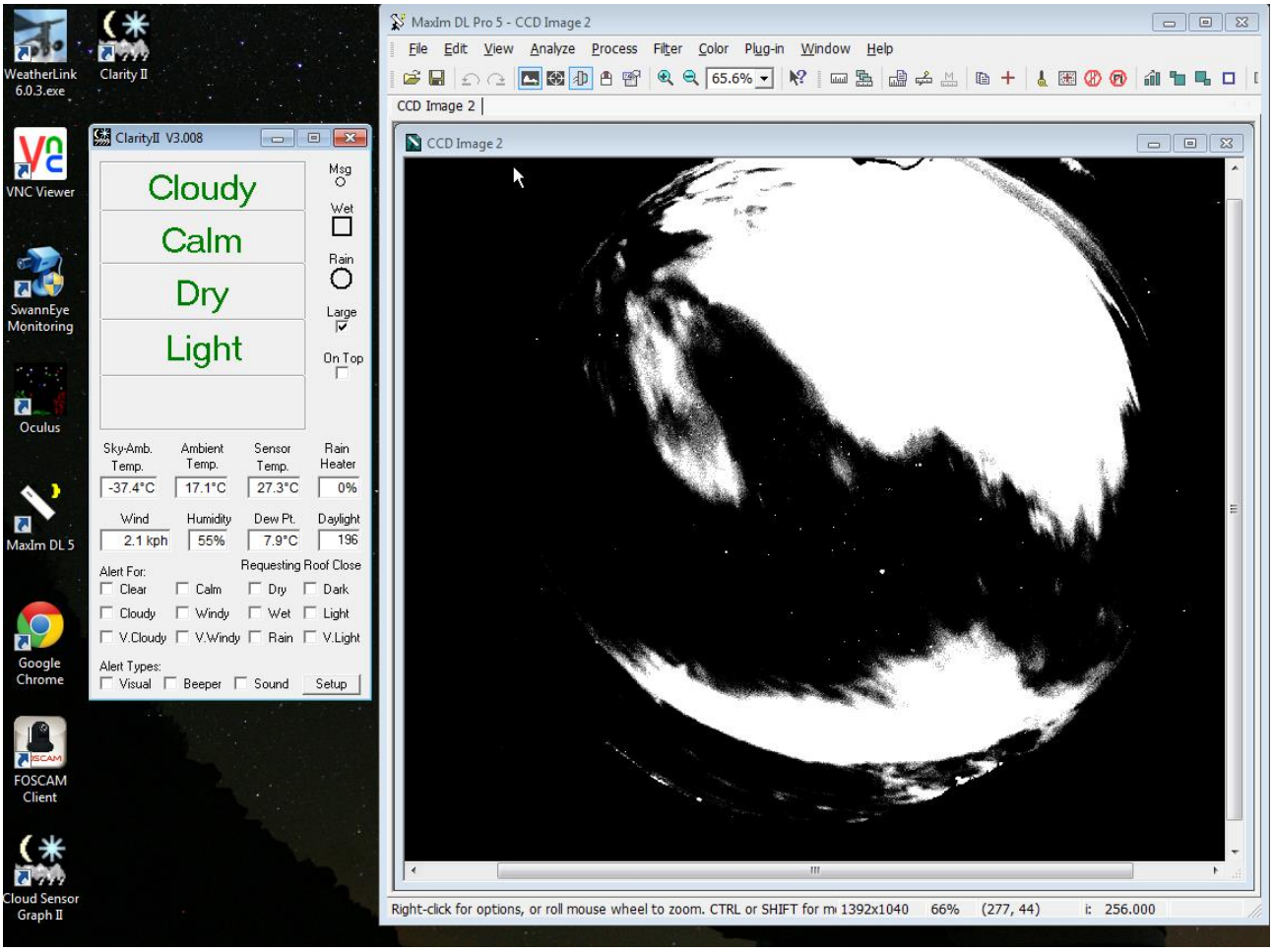
3.0 ENVIRONMENTAL MONITORING

3.1 INTRODUCTION

The observatory is equipped with three different environmental monitoring devices:

- An all-sky camera
- A cloud sensor
- A weather station

They can all be found on the OBSERVATORY computer:

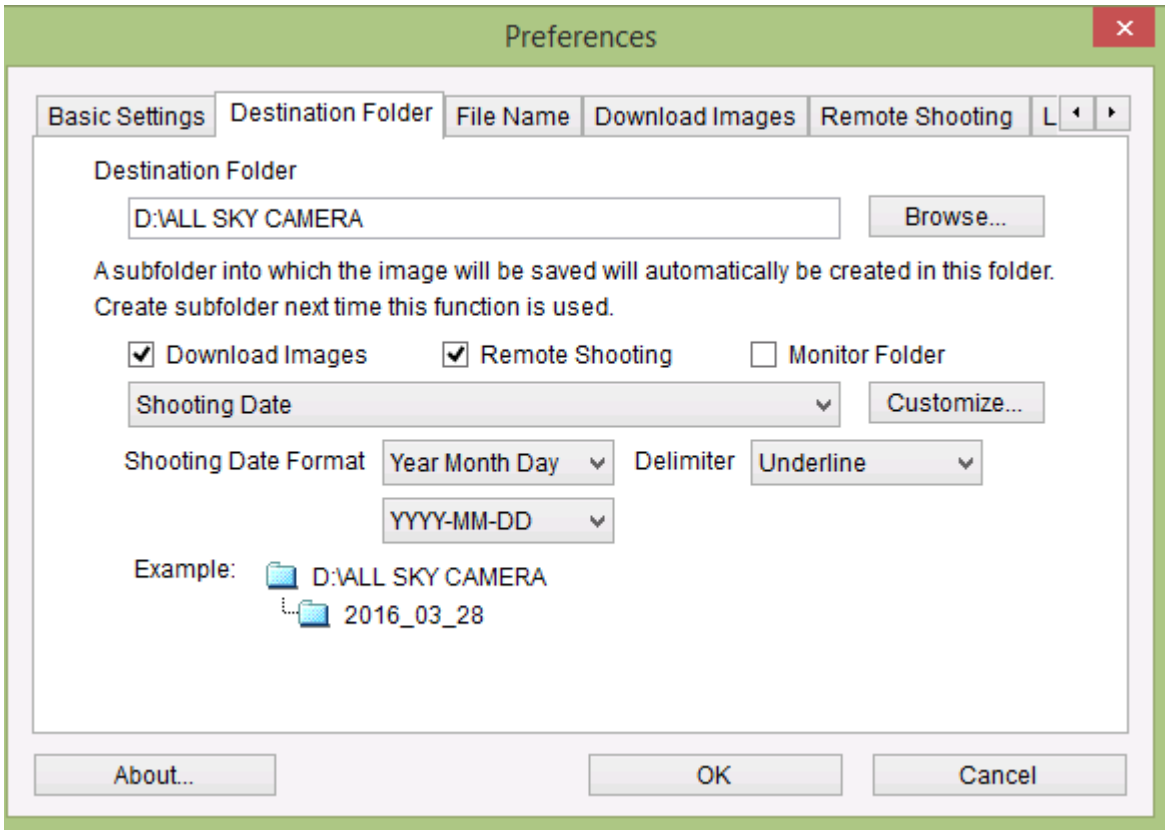


3.2 ALL SKY CAMERA

The all sky camera uses a Canon EOS 5D equipped with an 8mm fish-eye lens. To use the camera, start the EOS Utility. There is one small annoyance with the software. The fisheye lens only has manual focus but the software defaults to automatic focus. Slide the little bar at the top right from AF to MF to use the system.

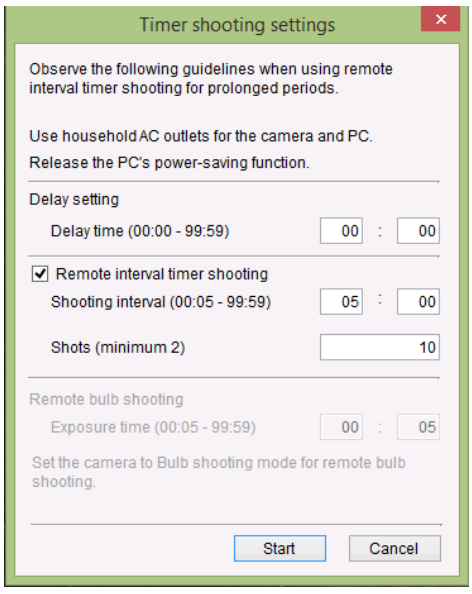
The correct settings for night-time exposures is shown above. For daylight the exposure time should be around 1/4000 and the ISO rating around 100.

The images are automatically saved in the ALL SKY CAMERA directory and a sub-folder with the current date. If the settings have been corrupted the correct values are shown below:



To take a single exposure click on the big circular button. If you hover to mouse over this button and it turns red with the message "busy" then an exposure or readout is taking place.

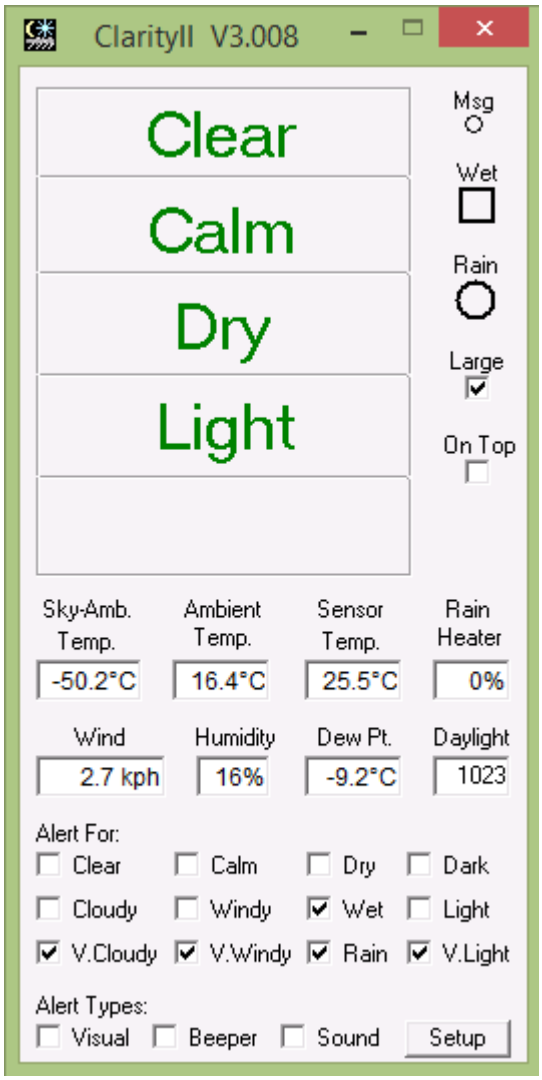
To collect data during the night, click on the little clock icon in the main window.



Set the number of exposures in the "Shots" field. Unless you have a good reason please don't take images more frequently than every 5 minutes.

3.3 BOLTWOOD CLOUD SENSOR

This sensor works with the ACE SmartDome. If a threshold is reached the dome closes. Close conditions include too cloudy, too bright (daylight), too windy and raining. Please do not alter the thresholds to extend your observing time in marginal conditions!! (The settings are monitored). The Boltwood is designed to close the dome in bad weather even if the Boltwood software is not running.



3.4 WEATHER STATION

The Davis Instruments Pro Vantage 2 wireless weather station is displayed on the Observatory computer, and also in ACE Connector. (It must be running on the observatory computer).

Currently, the wind speed and direction are not working. They were ripped off in an ice storm.