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**EOS Technologies, Inc.**

**Generic Telescope**

## **Telescope Interface User Manual**

**SUM-13982-1**

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Prepared:	Aaron Evers	Date:	12/18/2009
Checked:	Elwood Downey	Date:	12/18/2009
Approved:	Andrew Lowman	Date:	12/18/2009
Configured:	Rose Tharp	Date:	12/18/2009

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# EOS Technologies, Inc. Generic Telescope Telescope Interface User Manual

## Chapter 1 Introduction

### 1.1 Overview

This document provides an overview of the TelescopeInterface application implemented by EOST. The TelescopeInterface is an extensible graphical user interface for telescope engineering and basic telescope operations. The TelescopeInterface is an EOS Framework Client application and can be configured to connect to any compliant EOS Framework Server application.

The TelescopeInterface is typically configured to display a variety of telescope status fields and provide graphical control interfaces for user interaction with the telescope. The graphical configuration is determined by the contents of a configuration file, known as the *RC* file. An example RC file appears as an appendix to this document. The TelescopeInterface fields shown as figures in this document are representative of the example RC file.

### 1.2 Document Configuration

This document has been configured as SUM-13982-1 and is a designated controlled document under the EOST Quality System.

### 1.3 Acronyms

The following acronyms are used throughout this document:

<i>DLL</i>	Dynamically Linked Library
<i>FK5</i>	Fifth Fundamental Catalog of Stars
<i>GUI</i>	Graphical User Interface
<i>RC</i>	Run-time Configuration
<i>UTC</i>	Coordinated Universal Time

### 1.4 Application Version Information

This document may refer to features of the TelescopeInterface that are only available in the latest version of the application. The following table lists the relevant latest version numbers at time of document authorship:

Executable*	2.3.1.21	3.3.1.21
EOS Framework	2.0.13	2.1.3

\*Due to incompatibilities between framework versions, two concurrent server versions are supported.

See Appendix A for a description of TelescopeInterface version changes coinciding with revisions of this document.



## Chapter 2 Installation and Startup

### 2.1 Installation

EOST currently provides binary TelescopeInterface packages compiled to run on the following operating systems: Windows XP, Suse Linux 9.2, and Ubuntu Linux 9.04. All supported operating systems are the 32 bit, x86 variants. The provided versions may operate on a variety of systems not included in this list.

EOST provides the release package in the form of a binary zip archive under Windows, or a tar.gz archive under Linux. The contents of the archive should be unzipped before use. EOSt typically installs the TelescopeInterface files to the C:\EOST\Clients folder under Windows and /EOST/Clients under Linux.

#### 2.1.1 Framework Configuration Prerequisite

This document does not cover the configuration of the basic EOS Framework system; however, TelescopeInterface will not operate if it cannot connect to the framework system servers. Minimally, the computer targeted for installation must have a CommonLocalConfig.dmx file that indicates the IP address of the system's dispatcher server.

**Note:** If the dispatcher server is installed on a computer whose IP address is privately assigned (i.e. begins with 10, 172.16 through 172.31, or 192.168), the TelescopeInterface will only be able to connect to the dispatcher if it is run from a computer that is also assigned an IP address within the private network.

#### 2.1.2 Common Data Files

The following data files are provided by EOSt with the TelescopeInterface release package. These files should reside in the same directory as the executables. These files are required for the star plot and planet display features of TelescopeInterface:

- bin2000.bin - a binary file containing DE200 format planetary ephemeris
- eop.dat - a fixed-width text file containing Earth Orientation Predictions based on the Ser7.dat file published by the USNO IERS Bulletin service, but with the header and footer sections removed. This file should be updated regularly from the USNO ftp site.
- StarCatalog.dat - a fixed-width text file containing a catalog of known star magnitudes and celestial positions. EOSt typically supplies the FK5 star database in this format.

#### 2.1.3 Windows Specific files

In addition to the common files, under Windows XP, EOSt provides the following files, which are part of the Microsoft Development Redistribution package:

- msvcp71.dll
- msucr71.dll

These are required by TelescopeInterface applications and may already exist on the host computer. EOSt provides them as part of the release package for convenience. Similarly, the

following required DLLs are part of the Qt redistribution package and are provided by EOST for convenience:

- QtCore4.dll
- QtGui4.dll
- QtNetwork4.dll

The included binary executable under windows is named:

- TelescopeInterface.exe

#### **2.1.4 Windows installation procedure**

The release package should be unzipped such that the files listed above exist in the same directory. EOST typically installs these files to C:\EOST\Clients\TelescopeInterface\_v142, where v142 is an example representing the current version number. EOST also typically creates a TelescopeInterface shortcut on the user's desktop to make launching the application convenient. To create a desktop shortcut, right click on the desktop and select new, then shortcut. In the 'Create Shortcut' dialog window that appears, use the browse button to select the TelescopeInterface executable.

Click next and give the shortcut an appropriate name. After clicking Finish, the shortcut can be used to launch the application.

#### **2.1.5 Linux Specific files**

The Linux version of TelescopeInterface is statically linked to the Qt libraries. This allows it to work on more Linux versions at a cost of larger executable files.

The binary TelescopeInterface executable file under Linux is named:

- TelescopeInterface

#### **2.1.6 Linux installation procedure**

The release package should be unzipped such that all included files remain in the same directory. EOST typically installs these files to \EOST\Clients\TelescopeInterface\_v142, where v142 is an example representing the current version number. EOST typically creates a symbolic link, such that \EOST\Clients\TelescopeInterface refers to the latest installed version and this directory path is added to the user's path environment variable. The executable should be given appropriate execute permissions for all user accounts that will need to run TelescopeInterface. Additionally, all data files and configuration files will need to be readable by this same set of users.

#### **2.1.7 Configuration Files**

TelescopeInterface uses the following configuration files:

- TelescopeInterface.rc
- TelescopeInterface.ini

TelescopeInterface.rc determines what telescope and observatory fields and commands to display. This file is typically edited by system administrators. See Appendix B for additional details regarding this file.

Upon shutdown, TelescopeInterface will attempt to write to a configuration file, called TelescopeInterface.ini under Windows and .TelescopeInterface.ini under Linux. This file stores the window size and position as well as various application states. Under Windows, TelescopeInterface expects the file to reside in the working directory. Under Linux TelescopeInterface expects the file to reside in the user's home directory. If the file does not exist and the application has 'write' access to the appropriate directory, one will be created. The TelescopeInterface will use default values if the file does not exist at startup.

## 2.2 Startup

If the installation procedure above is followed the TelescopeInterface can be started under Windows XP simply by double clicking the desktop icon, and under Linux, by typing TelescopeInterface from the command line.

### 2.2.1 Command Line Parameters

TelescopeInterface does not utilize any command line parameters.

### 2.2.2 Framework Credentials Login Dialog

Once connected to the EOS Framework system, the following dialog will prompt the user for credentials:

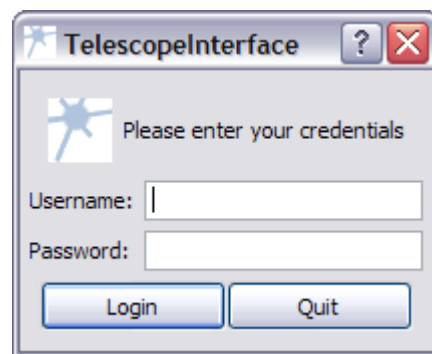


Figure 2-1: Framework Credentials Login Dialog

This dialog asks the user to provide login credentials for the EOS Framework system. Ask your system administrator for the appropriate credentials to login to the system.

## 2.3 Shutdown

To shutdown TelescopeInterface simply click on the close button in the upper right corner of the application's window.

## Chapter 3 Telescope Operations

This chapter describes operation of the telescope system using TelescopeInterface and utilizing the example RC file indicated in Appendix B.

Upon successful initialization and login, TelescopeInterface will resemble the following figure:

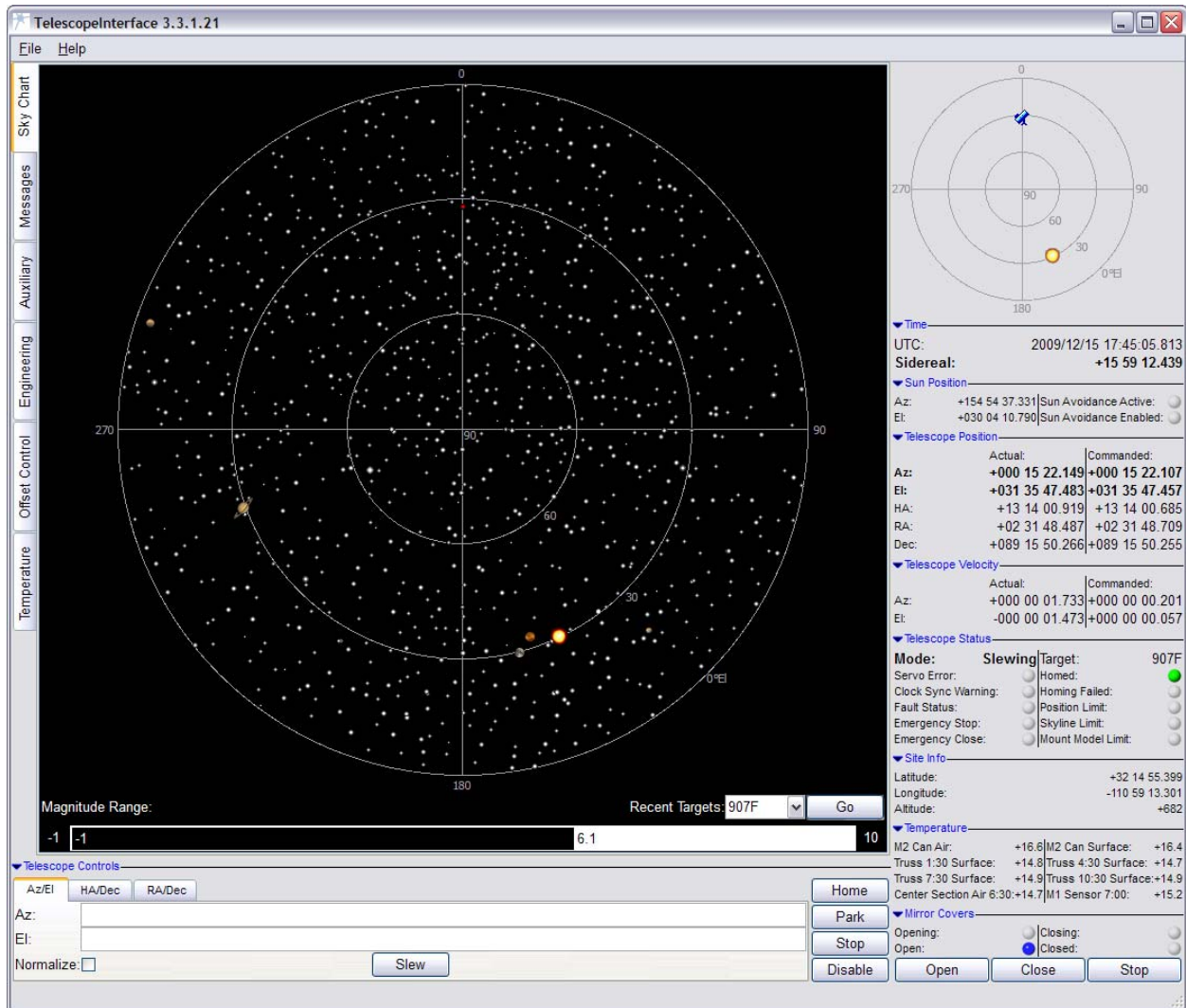


Figure 3-1: TelescopeInterface Main Window

The TelescopeInterface main window is divided into three main sections. The first is the tabbed pane interface that shows the Sky Chart Pane in the preceding figure and allows selection of several other tab panes that each provides access to specific groups of telescope functions. The second main section is the Basic Telescope Controls panel, which is immediately below the tabbed pane. The third main section is the Telescope Status Panel on the right. These three sections are described in detail below.

### 3.1 General Usage Details

#### 3.1.1 Data Organization and Hiding Strategies

The TelescopeInterface contains control and status displays for a large number of TCS sub-systems. It would be very difficult to present all of these displays at one time in a logical way to users. The TelescopeInterface therefore groups similar TCS functions and provides two mechanisms for users to optimize the view for their task at hand.

The first strategy is the tabbed pane interface. Figure 3-1 shows two examples of the tabbed pane interface. The main tabbed panel that currently shows a Sky Chart, as indicated by the highlighted tab, is an example. Other panes may be selected by clicking one of the labeled tabs. The main tabbed panel contains the following panes: Sky Chart pane, Messages pane, Auxiliary tab pane, Engineering pane, Offset Control pane, and Temperature pane. Upon shutdown the TelescopeInterface will remember which tab panes are visible.

The other strategy the TelescopeInterface uses is grouping. Groups are identified by the blue arrow next to the group description. Clicking the arrow reveals or hides the group contents. Figure 3-2 and Figure 3-3 demonstrate the Telescope Position group in its hidden and visible states.

▼ Telescope Position		
	Actual:	Commanded:
Az:	+252 07 53.355	+252 07 53.399
El:	+001 01 02.915	+001 01 02.855
HA:	+05 17 27.236	+05 17 27.241
RA:	+08 46 11.653	+08 46 11.648
Dec:	-014 26 25.205	-014 26 25.201
▼ Telescope Velocity		
	Actual:	Commanded:
Az:	+000 00 01.523	+000 00 00.000
El:	+000 00 02.251	+000 00 00.000

Figure 3-2: Telescope Position and Velocity Visible

▶ Telescope Position
▶ Telescope Velocity

Figure 3-3: Telescope Position and Velocity Hidden

The hidden versus visible status of each group is remembered by the TelescopeInterface upon shutdown.

#### 3.1.2 Cut and Paste

For convenience many of the read-only status fields are selectable by highlighting with the mouse. This allows users to copy the text to the system clipboard.

To copy a field, highlight it by clicking down and dragging across the field with the mouse, then click the Ctrl-c key combination. To paste, use the key combination Ctrl-v in an editable field of the UI or in another application that uses the system clipboard.

**Note:** The field will stop being updated while it is highlighted. If the field is not copied within several seconds, the highlighting will expire and the field will resume being updated.

### 3.1.3 Unit Convention and Binary Flags

The TelescopeInterface always displays angles in Degrees, Minutes, and Seconds and hour-angles in Hours, Minutes, and Seconds. All other units use the Metric base unit, unless the field description indicates the unit in parenthesis. If the unit is indicated in parenthesis the corresponding entry field will also use this unit. Angle and hour-angle entry fields will accept decimal notation (e.g. "-33.333"), space separated whole number degrees/hours and decimal minutes (e.g. "-33 19.98"), or space separated whole number degrees/hours, minutes, and decimal seconds (e.g. "-33 19 58.8").

Status flags use an icon resembling a colored lamp. Colors, such as red or yellow indicate a true status value. False values are indicated by a grey color resembling an unlit lamp icon.

## 3.2 Telescope Status Panel

The Telescope Status Panel is the section on the right side of the window that shows the telescope position on a polar plot, various telescope statuses, and has some often-used command entry buttons, such as mirror cover operation buttons. Figure 3-4 shows the Telescope Status Panel with all groups visible.

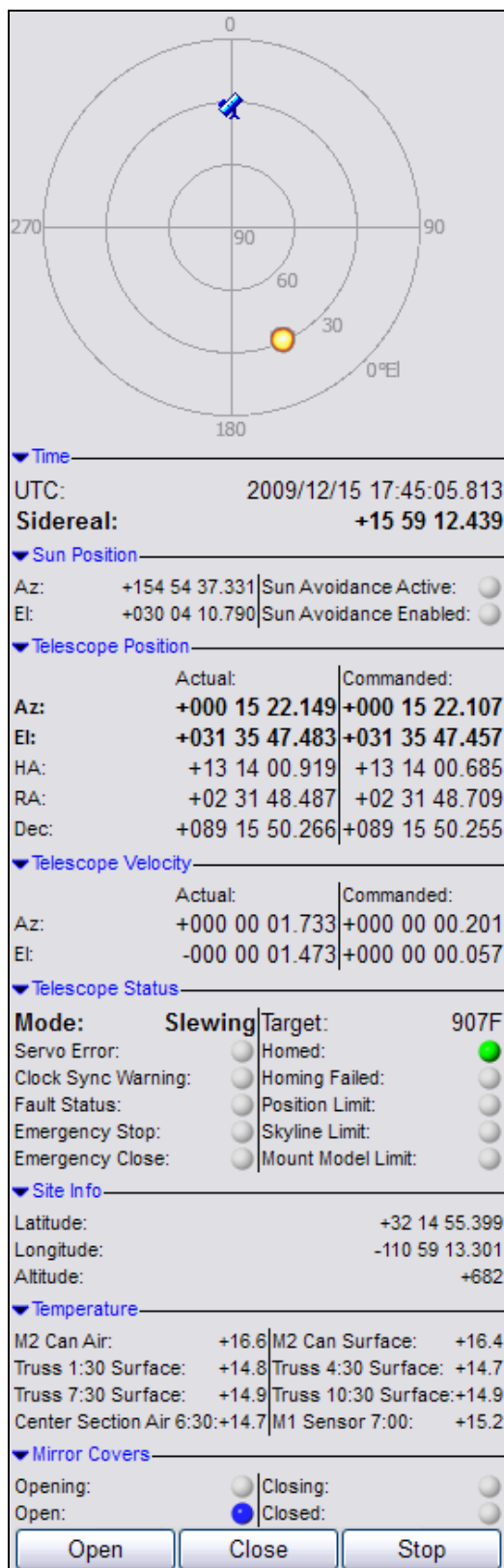


Figure 3-4: Telescope Status Panel



The Telescope Status Panel contains the following status and control indicators:

### 3.2.1 Polar Plot

The Polar Plot shows the position of the telescope and the Sun on an altitude/azimuth polar plot. The Telescope is represented by a blue telescope icon. The Sun is represented by an abstract icon that resembles the Sun. If the Sun's elevation is below horizon a grey sphere icon will be plotted at 0 degrees elevation and the correct azimuth. Telescope and Sun positions are based on the Azimuth and Elevation positions reported by the Telescope Position and Sun Position fields described below.

### 3.2.2 Time

This group shows the UTC time and date and the current local Sidereal time in a human-readable manner as determined by the Telescope Control System.

### 3.2.3 Sun Position

This group shows the current Azimuth and Elevation of the Sun as reported by the TCS. This position is calculated from the current time and the telescope site coordinates. If there is a problem with the telescope clock or the telescope site coordinates, then the calculated Sun position may be incorrect.

The Sun Avoidance Enabled flag indicates if the automated Sun avoidance system is enabled. If enabled, the telescope will be disabled if the system detects that the telescope is considered to be pointing too close to the sun. The Sun Avoidance Active flag indicates that the system has disabled the telescope because it has determined that the telescope is pointing too close to the sun.

Both the telescope position and the calculated position of the Sun are used to determine whether the telescope is pointing too close to the Sun. If the telescope position is not currently known (that is, it has not been homed successfully) then only the Sun position is considered by checking to see whether it is above a certain elevation angle, known as the solar horizon. If there is a problem with the telescope clock or the telescope site coordinates, then the calculated Sun position is considered to be unreliable, and the telescope is considered to be at risk regardless of where it is pointing.

### 3.2.4 Telescope Position

This group shows the current actual and commanded positions of the telescope in several coordinate systems. Azimuth, Elevation, and Hour Angle fields report apparent epoch. Right Ascension and Declination fields report epoch J2000.

The Command position fields reports the current commanded position for the telescope gimbal. If the telescope is currently moving (homing, slewing or tracking) in response to a track command, this field will be taken from the currently loaded track. If the telescope is currently parking or stopping, this field will be taken from the park position or stop position for the telescope. If the telescope is disabled, the fields in the structure will be set to zero.

The Actual position field reports the current actual position of the telescope gimbal. The position is read from the encoders and converted back to the equivalent position on the sky by reversing various transformations such as atmospheric refraction and the mount model correction. Any position offset applied by an operator using offset commands or by the autoguider is not removed from the Actual Position values. If the telescope is currently moving



into position then the values in this field may differ substantially from the corresponding values in the Command Position field. Otherwise, subtracting Actual Position values from the corresponding Command Position values gives an estimate of the following error of the telescope, provided that no position offset has been applied. If a position offset has been applied, then the position offset should be added to the Command Position values using spherical geometry algorithms before comparing with the Actual Position values. The actual position is reported regardless of the current mode of the telescope, even if it is disabled. If the telescope has not been homed then this position information is likely to be incorrect.

### 3.2.5 Telescope Velocity

This group shows the current actual and commanded velocities of the main telescope axis in degrees per second.

The command velocity fields report the current commanded velocity for the telescope gimbal. If the telescope is currently moving (homing, slewing or tracking) in response to a track command, this field will be taken from the currently loaded track. If the telescope is currently parking or stopping, the fields in the structure will be zero. If the telescope is disabled, the fields in the structure will be set to zero.

The actual velocity field reports the current actual velocity of the telescope gimbal. The velocity is read from the encoders and converted back to the equivalent velocity on the sky by reversing various transformations such as atmospheric refraction and the mount model correction. If the telescope is currently moving into position then the values in this field may differ substantially from the corresponding values in the Command Velocity field. Otherwise, subtracting Actual Velocity values from the corresponding Command Velocity values gives an estimate of the speed stability of the telescope. The actual velocity is reported regardless of the current mode of the telescope, even if it is disabled. If the telescope has not been homed then this velocity information may contain slight inaccuracies due to the effect of the mount model and atmospheric refraction.

### 3.2.6 Telescope Status

This group shows several important telescope status flags as well as the current telescope mode and target. The following fields are reported:

#### 3.2.6.1 Mode

This field reports the current mode that the telescope is in. The possible values of this field are:

- “Disabled” — The servo control system is disabled and the gimbal brakes (if equipped) are applied to lock the azimuth and elevation axes in place. The telescope starts in disabled mode when the telescope control system is started, and may be placed in disabled mode at any later time by sending the Disable command. The telescope also enters disabled mode if it encounters certain types of tracking errors, such as triggering Sun avoidance.
- “Homing” — One or more telescope axes are seeking an absolute position reference so that the encoder counts reported from their incremental encoders represent a true position of each axis.
- “Slewing” — The telescope is currently moving at maximum speed to reach the target position of the current track loaded by an operator using one of the telescope tracking commands. Some of the telescope axes may already be in position, but at least one is still moving into position. The telescope may also switch to this mode if the operator adjusts the

secondary focus, the instrument rotator, the tertiary mirror, or selects a different instrument port.

- “Tracking” — The telescope is currently following the current track loaded by an operator using one of the telescope tracking commands. All of the telescope axes are in position.
- “Parking” — The telescope is currently moving at maximum speed to reach the park position for each axis. An operator commands the telescope to move to its park position by clicking the Park button. Some of the telescope axes may already be in their park position, but at least one is still moving into position.
- “Parked” — The telescope has reached its park position and is currently stationary at this position under servo control.
- “Stopping” — The telescope axes are currently slowing down to stop at a position other than the telescope park position. An operator commands the telescope to stop by clicking the Stop button. The telescope may also stop if the client loses or the operator releases control during tracking or parking. Some of the telescope axes may already be stopped, but at least one is still moving.
- “Stopped” — All telescope axes are stationary and holding position under servo control, but the telescope is not in its park position. An operator commands the telescope to stop by clicking the Stop button. The telescope may also stop if the client loses or the operator releases control during tracking or parking. This state should not be confused with tracking a stationary target; in this case the Telescope Mode field will be set to “Tracking”.

#### 3.2.6.2 Servo Error

This field is set to true if a problem is detected in the telescope servo control system. The telescope will be disabled and the gimbal brakes will be applied to prevent possible damage. Telescope servo control system errors include various faults that may affect individual telescope axes and are described in the fields below. This field is set to false if no problems with the telescope servo control system have been detected.

#### 3.2.6.3 Clock Sync Warning (Clock Error)

This field is set to true if a problem with the telescope clock is detected. The telescope clock is checked periodically against the time reported by the GPS receiver, as well as the clock on the telescope control computer. If a discrepancy is found, this field will be set to true. A problem may also occur if the telescope clock can not be reset. In this case, the telescope will be disabled. This field is set to false if no problems with the telescope clock have been detected.

#### 3.2.6.4 Fault Status

This field is set to true if a failsafe limit switch has been activated and has not been overridden or if the Emergency Stop signal has been engaged. This will disable the servo system and apply the gimbal brakes (if equipped), preventing movement of the telescope axes. This field is set to false if the Emergency Stop signal is not engaged, and either the failsafe limit switches are not currently activated or the failsafe fault has been overridden using the failsafe override key-switch.

#### 3.2.6.5 Emergency Stop

This field is set to true if the emergency stop button is pressed. Power will be removed from all servo axes and the mirror cover, preventing movement. In addition, the gimbal brakes (if

equipped) will be applied. This field is set to false whenever the emergency stop button is released.

### **3.2.6.6 Emergency Close**

This field is set to true if the emergency close button is pressed. If true and no telescope faults have been detected, the mirror covers will close automatically.

### **3.2.6.7 Target**

This field reports the name of the target being tracked, if any. The target name is specified by an operator when the track is loaded using one of the track commands. The string preserves the case of the target name originally specified in the track command. The field may be empty. If the telescope is not currently moving (homing, slewing or tracking) in response to a track command, this field will be empty.

### **3.2.6.8 Homed**

This field is set to true if the last homing operation completed successfully. The telescope must be homed successfully before it can be used to track a target or moved to its park position. This field is set to false if the last homing operation was not successful (the Telescope Homing Failed field will be true), if homing is currently in progress (the Telescope Homing Failed field will be false and the Telescope Mode field will be set to "Homing"), or if the telescope has not been homed since it was started (the Telescope Homing Failed field will be false and the Telescope Mode field will be set to "Disabled").

### **3.2.6.9 Homing Failed**

This field is set to true if the last homing operation failed to complete successfully. This field is set to false if the last homing operation was successful (the Telescope Homed Okay field will be true), if homing is currently in progress (the Telescope Homed Okay field will be false and the Telescope Mode field will be set to "Homing"), or if the telescope has not been homed since it was started (the Telescope Homed Okay field will be false and the Telescope Mode field will be set to "Disabled").

### **3.2.6.10 Position Limit**

This field is set to true if the telescope is given a command while tracking that would have moved any of the telescope axes past their normal range of motion. This may occur if the currently loaded track exceeds an axis position limit after some time (for example, the telescope reaches an azimuth limit after tracking a constant RA/Dec position for several hours), or if an operator issues a command such as an offset command that moves the telescope into an axis position limit (typically this can only happen if the telescope is already operating very close to the axis position limit). If a position limit is reached, the telescope will stop tracking and this field will be set to true. This field is set to false if the telescope is operating in its normal range of motion, or if the telescope has not been homed.

### **3.2.6.11 Skyline Limit**

This field is set to true if the telescope is given a command while tracking that would move the telescope below the allowable skyline limit. The skyline limit is a minimum allowable elevation angle for each azimuth angle of the telescope, intended to prevent the telescope from colliding

with fixed obstacles in the dome. This field may be set to true if the currently loaded track exceeds the skyline limit after some time (for example, the telescope reaches the skyline limit after tracking a constant RA/Dec position for several hours), or if an operator issues a command such as an offset command that moves the telescope position into the skyline limit (typically this can only happen if the telescope is already operating very close to the skyline limit). If the skyline limit is reached, the telescope will stop tracking and this field will be set to true. This field is set to false if the telescope is operating above the skyline limit, or if the telescope is not currently tracking. The skyline limit is defined in a configuration file and can be set by the system administrator.

### **3.2.6.12 Mount Model Limit**

This field will be set to true if the position offset due to the mount model for the current telescope position has reached a maximum positive or negative value for either the azimuth or elevation axis. The telescope can be operated safely if this flag is set to true, but the pointing accuracy of the telescope may be degraded at this position.

### **3.2.7 Site Info**

This group shows the geodetic latitude, longitude and altitude of the telescope site. These values are used by the telescope control system to convert celestial coordinates into accurate azimuth and elevation positions. The value is loaded from a system configuration file when the telescope control system is started.

### **3.2.8 Temperature Sensors**

This group shows the name and temperature value in degrees Celsius of the first eight temperature sensors reported by the system. Additional sensors, if available, can be displayed by editing the TelescopelInterface.rc file.

### **3.2.9 Mirror Covers**

This group shows the current status of the Mirror Cover subsystem.

The Opening lamp lights blue to indicate that the mirror covers are being commanded to open. The Closing lamp lights yellow to indicate that the mirror covers are being commanded to close.

If the Open lamp is blue, the mirror covers are completely open. If the Close lamp is yellow, the mirror covers are closed. If both lamps are grey, the mirror covers are partway opened.

If both Open and Close lamps are lit simultaneously or similarly, both Opening and Closing lamps are lit simultaneously, this indicates a digital status fault or that the cable connecting the mirror cover subsystem has become disconnected.

The mirror cover group also provides buttons for operating the mirror covers. Details regarding the status of each individual mirror cover leaf are shown on the Auxiliary tab pane.

## **3.3 Basic Telescope Control Panel**

The basic telescope control panel provides a convenient method for manually commanding telescope slews. The following figure illustrates the Basic Telescope Control panel:

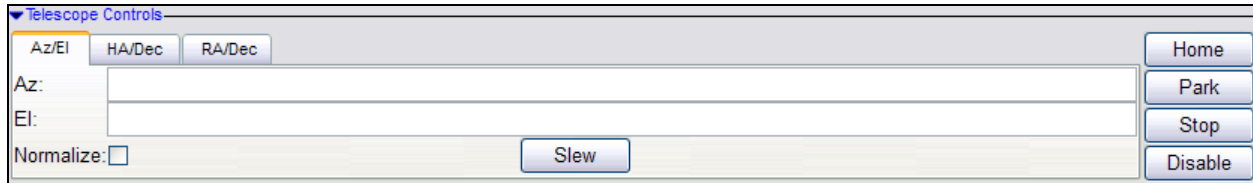


Figure 3-5: Basic Telescope Control Panel Showing Azimuth/Elevation Slew Command

The following commands may be issued using the panel:

### 3.3.1 Azimuth/Elevation Slew

To slew the telescope to an Azimuth/Elevation coordinate, select the Az/EI tab and enter the coordinates in the appropriate entry field and click the 'Slew' button. Any value is valid, including values outside the range of motion of the telescope. However, this may cause the telescope to report a position limit and stop tracking. Checking the 'Normalize' flag instructs the Telescope Server that the azimuth/elevation positions in the track are treated as normalized values, which means the Telescope Server is free to select the best equivalent azimuth/elevation values to use to track the object. E.g. if you specify an azimuth of  $90^\circ$ , then the Telescope Server may change this to  $-270^\circ$  if the telescope actually happens to be closer to  $-270^\circ$  at the time. Also, normalized azimuth/elevation tracks have cycle discontinuities removed, so that if the track points progress from  $359^\circ$  to  $0^\circ$  the Telescope Server will recognize that this is a smooth transition of  $1^\circ$  and change the  $0^\circ$  to  $360^\circ$ , not treat it as really meaning that you want the azimuth to swing counter-clockwise by a full revolution. The telescope will begin the homing sequence if it has not already been homed.

### 3.3.2 Hour Angle/Declination Track

To track an hour angle/declination position, select the HA/Dec tab and enter the coordinates in the appropriate entry field and click the 'Track' button. Any value is valid, including values outside the range of motion of the telescope. However, this may cause the telescope to report a position limit and stop tracking. Hour angle and declination fields expect coordinates to be in the apparent epoch. The telescope will begin the homing sequence if it has not already been homed.

### 3.3.3 Right Ascension/Declination Track

To track an hour angle/declination position, select the RA/Dec tab and enter the coordinates in the appropriate entry field and click the 'Track' button. Any value is valid, including values outside the range of motion of the telescope. However, this may cause the telescope to report a position limit and stop tracking. Right ascension and declination fields expect coordinates to be in the J2000 epoch. The telescope will begin the homing sequence if it has not already been homed.

### 3.3.4 Home

This button commands the telescope to begin the homing sequence. This command is useful for preparing the telescope for operation before issuing a tracking command. In order to start a homing operation, the telescope must be disabled. If the telescope is tracking, parking or stopping when this command is issued, the command will be rejected. If the telescope is already homing, this command will have no effect. All telescope axes are affected, including the gimbal, secondary focus, instrument rotator, and tertiary mirror. It may take some time for the

telescope to complete homing. The Telescope Mode field can be used to determine when all the telescope axes have finished homing. This command does not home the autoguider servo axes, which are controlled by the autoguider subsystem.

### 3.3.5 Park

This button commands the telescope to slew to the park position. The park position is defined in a system configuration file in terms of encoder counts for each telescope axis, and is not affected by truss temperature, atmospheric refraction, mount model or other phenomena that normally influence telescope motion. The telescope will slew from its current position (after homing, if necessary) to the park position. This command is similar to loading a single point track, but all telescope axes are parked, including the gimbal, secondary focus, instrument rotator, and tertiary mirror.

It may take some time for the telescope to reach its park position. The Telescope Mode field can be used to determine when all the telescope axes have reached their park position.

### 3.3.6 Stop

This button stops the telescope from tracking any active track loaded using one of the track commands. It also cancels any homing or parking operations. If the telescope is tracking or parking when this command is issued, the telescope will slow down at the maximum controlled deceleration rate from its current speed and stop, holding the position. The servo and drive systems for each axis remains enabled in order to hold the stopped position. If the telescope is homing when this command is issued, the telescope will be stopped immediately and all axis drive systems are disabled, as if the Disable button was pushed. If the telescope is already stopped or disabled, this command will have no effect. All telescope axes are affected, including the gimbal, secondary focus, instrument rotator, and tertiary mirror. It may take some time for the telescope to slow to a halt. The Telescope Mode field can be used to determine when all the telescope axes have stopped moving.

### 3.3.7 Disable

This button stops the telescope from tracking any active track loaded using one of the track commands. It also cancels any homing or parking operations and stops the telescope from actively holding a stopped position. The telescope motors will immediately be turned off. All telescope axes are affected, including the gimbal, secondary focus, instrument rotator, and tertiary mirror. Movement of the telescope can be restarted by issuing a home, park or track command.

## 3.4 Sky Chart Tab Pane

The Sky Chart pane shows a plot of stars and planets and provides a convenient input method for commanding the telescope to track such objects. The star plot resembles the following figure:



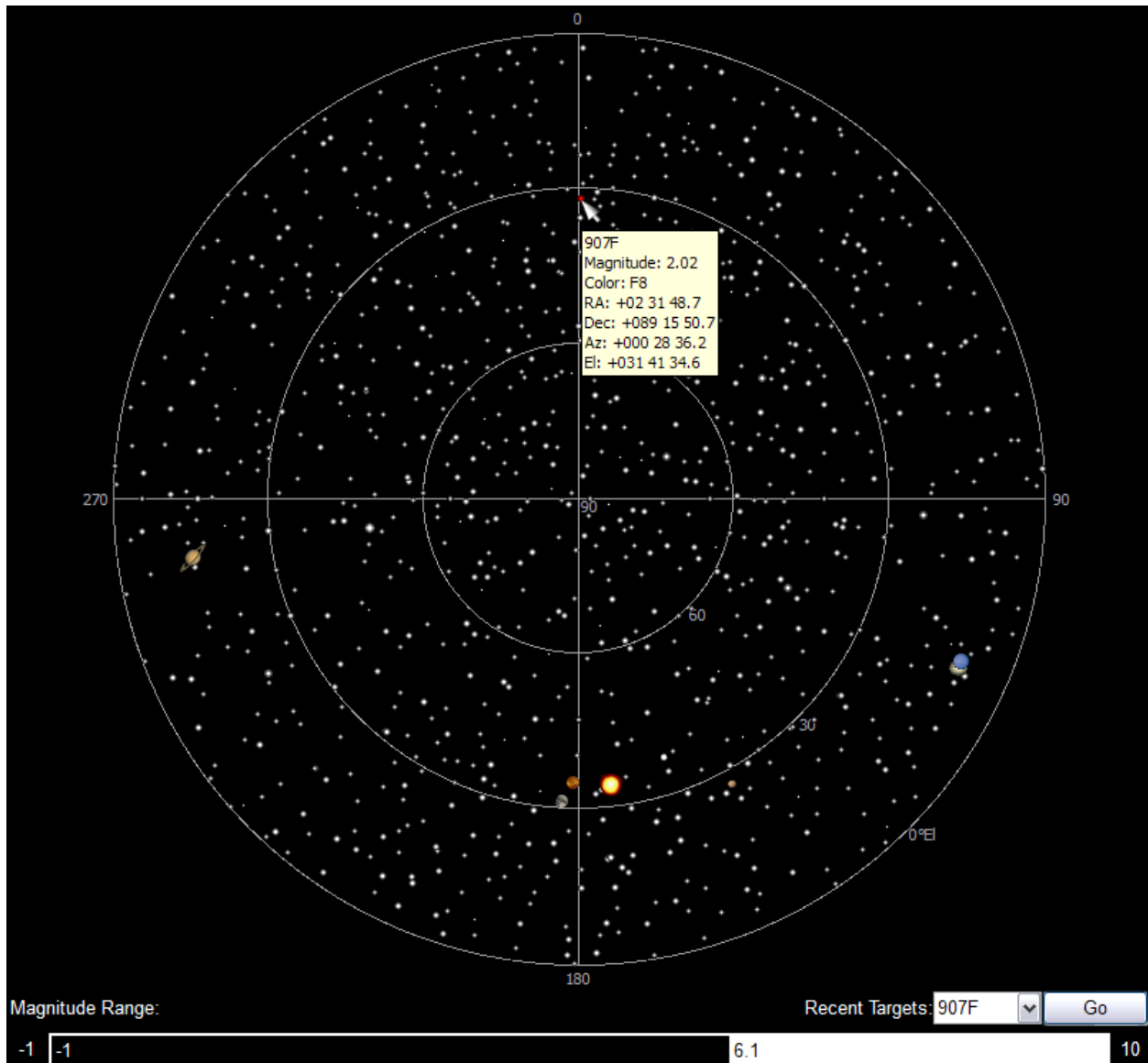


Figure 3-6: Sky Chart Polar Plot

The star catalog that is plotted comes from the StarCatalog.dat file, described in the installation section. This typically contains the FK5 database. This database is useful for testing telescope operation and performing the observations needed for mount modeling. The planet positions come from a DE200 data file, described in the installation section as bin2000.200.

Information about each object can be obtained by positioning the mouse over the desired object and allowing a pop-up tool-tip style description of the object. Figure 3-6 shows the pop-up description of Polaris (907F).

This figure also indicates that the telescope has been commanded to track Polaris. This is indicated by the red shading of the icon representing Polaris.

### 3.4.1 Tracking an Object

To command the telescope to track an object using the plot, simply double click the item. If the object is a star, the star will be drawn red to indicate that it is the target object. The client must be in control to issue a tracking command. Any object is valid, including objects outside the range of motion of the telescope. However, this may cause the telescope to report a position limit and stop tracking. The telescope will first execute the homing sequence if it has not already been homed.

### 3.4.2 Sky Chart Context Menu

The sky chart pane provides a pop-up context menu for changing several of the plot's visual parameters. The context menu is reached by right-clicking with the mouse anywhere on the star plot. The plot type can be changed to display a cylindrical plot by de-selecting the Polar Plot menu item. To disable plotting of planets, right click and de-select the Show Planets option. To disable plotting of stars, right click and de-select the Show Stars option. One is typically disabled if, for example, a planet is drawn over a star of interest. The gridlines can also be disabled by de-selecting the Show Grid option. The context menu settings are remembered by the TelescopeInterface on exit. The context menu resembles the following figure:



*Figure 3-7: Sky Chart Context Menu*

The sky chart will resemble the following figure if the polar plot and grid lines are turned off:



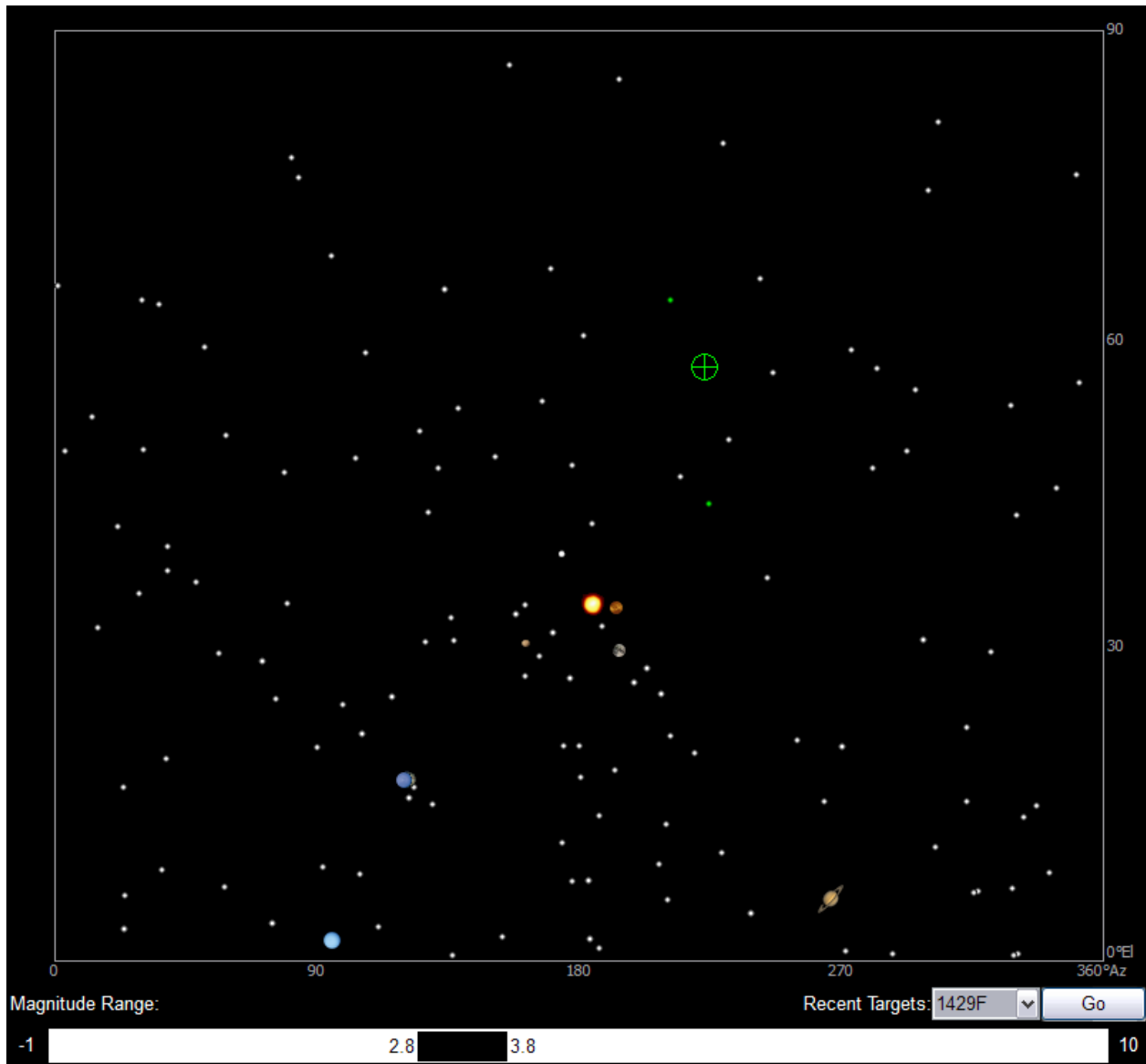


Figure 3-8: Sky Chart Cylindrical Plot

### 3.4.3 Magnitude Range Slider

The Magnitude Range Slider at the bottom of the pane, allows operators to adjust the range of magnitude values that will be plotted. This is useful for telescope operations that may require a specific star magnitude. To adjust the Magnitude Range, hold the mouse over the edge of the black bar of the slider. The cursor will change to a double-horizontal arrow, indicating that the range can be adjusted. If the bar is clicked while the cursor shows this icon, the range may be adjusted by moving the mouse. Both the upper and lower limit can be adjusted separately. If the middle of the bar is clicked, the upper and lower range will be adjusted simultaneously, such that span of the range will stay the same. The magnitude range is remembered by the TelescopeInterface on exit. Note that the currently tracked star, indicated with red highlighting,

may be hidden if it is outside the displayed magnitude range. Planets appearing on the plot are not affected by the magnitude range selection.

#### **3.4.4 Recent Target Selection**

The drop-down selection box, labeled Recent Targets, indicates the most recent objects that have been tracked from the current instance of the TelescopeInterface. The icon representing any star that is listed in the selection box will also be shown on the plot with green highlighting. As Figure 3-8 illustrates, objects selected in the drop-down box will also be highlighted in the plot with a circular crosshair. The crosshair will be removed when the selection box loses focus. Clicking on the Go button causes TelescopeInterface to issue a command to re-track the selected object.

### **3.5 Messages Tab Pane**

Responses from commands sent from the TelescopeInterface are written to the status bar at the bottom of the window. However, these are only visible for a limited time and can be quickly overwritten by subsequent command responses. The messages tab pane provides a log of these responses.

```

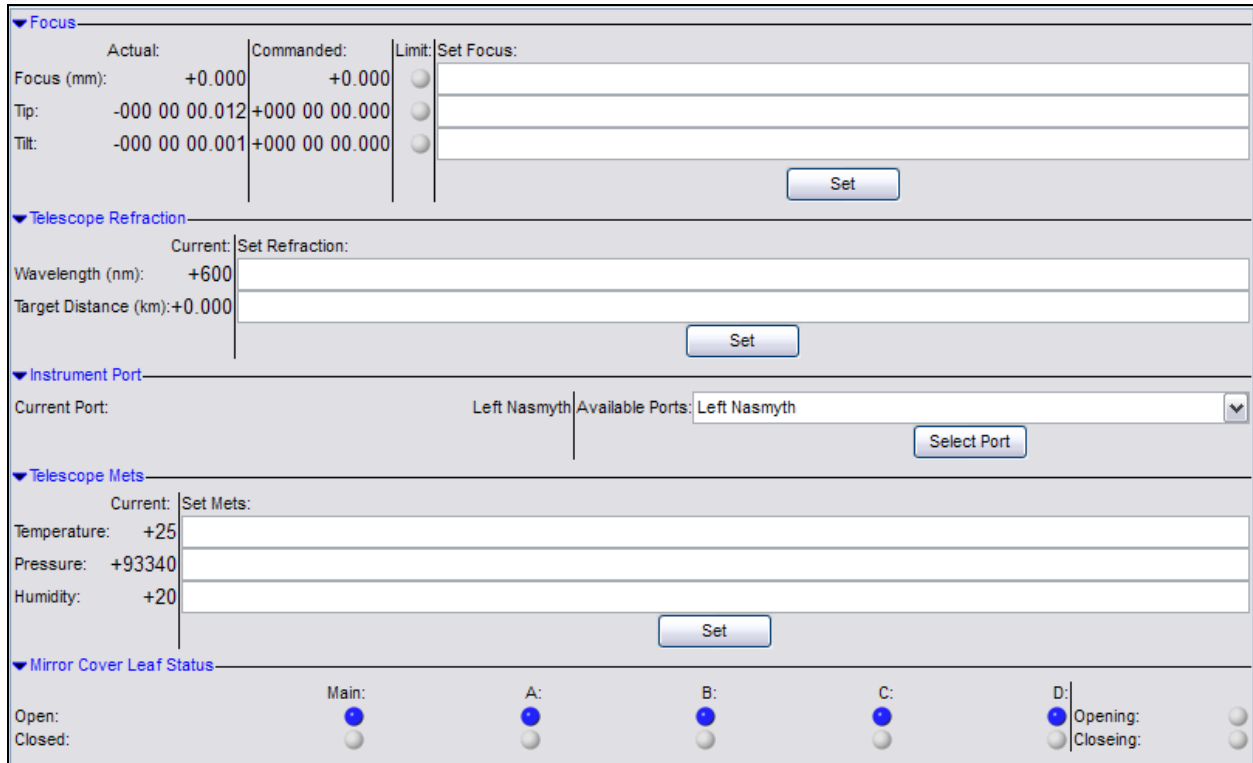
Subscribed
Command Successful: DeviceServer { Devices { Telescope { Commands { GetOffset {} }}} } }
Command Successful: DeviceServer { Devices { Telescope { Commands { GetSiteInfo {} }}} }
DeviceServer.Devices.Telescope.Commands.SetSlew failed: Telescope has not been homed: DeviceServer { Devices { Telescope {
Commands { SetSlew { Parameters { Data { Parallax 1.4544400000000000e-008 Pos1 0.6624040000000000 Pos2 1.5579500000000000
ProperMotionDec -2.3351500000000001e-015 ProperMotionRA 4.5804999999999995e-013 Target "907F" TrackType "RA/Dec" }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { HomeAll {} }}} }
DeviceServer.Devices.Telescope.Commands.SetSlew failed: Telescope has not been homed: DeviceServer { Devices { Telescope {
Commands { SetSlew { Parameters { Data { Parallax 0.0000000000000000 Pos1 0.4094820000000000 Pos2 1.5536200000000000
ProperMotionDec -4.19405000000000004e-015 ProperMotionRA 5.60735000000000003e-013 Target "4141F" TrackType "RA/Dec" }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetSlew { Parameters { Data { Parallax
1.4544400000000000e-008 Pos1 0.6624040000000000 Pos2 1.5579500000000000 ProperMotionDec -2.3351500000000001e-015
ProperMotionRA 4.5804999999999995e-013 Target "907F" TrackType "RA/Dec" }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetSlew { Parameters { Data { Parallax
4.8481399999999998e-009 Pos1 4.1435000000000000 Pos2 -0.0598687000000000 ProperMotionDec -3.6870800000000000e-015
ProperMotionRA -1.32274000000000000e-014 Target "585F" TrackType "RA/Dec" }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetSlew { Parameters { Data { Parallax
1.4059600000000000e-007 Pos1 4.2513900000000000 Pos2 -0.0644780000000000 ProperMotionDec -2.1968800000000002e-014
ProperMotionRA -6.774999999999998e-015 Target "603F" TrackType "RA/Dec" }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetSlew { Parameters { Data { Parallax 0.0000000000000000
Pos1 4.2943000000000000 Pos2 0.1212690000000000 ProperMotionDec 2.1661600000000001e-015 ProperMotionRA
4.3783999999999998e-016 Target "1429F" TrackType "RA/Dec" }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetSlew { Parameters { Data { Parallax
1.2605200000000000e-007 Pos1 4.4404200000000000 Pos2 0.1636250000000000 ProperMotionDec -1.6130999999999999e-015
ProperMotionRA -4.5374100000000000e-014 Target "633F" TrackType "RA/Dec" }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetSlew { Parameters { Data { Parallax 0.0000000000000000
Pos1 4.9538300000000000 Pos2 0.7670040000000000 ProperMotionDec 1.2674300000000000e-014 ProperMotionRA
4.9314599999999999e-015 Target "711F" TrackType "RA/Dec" }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetSlew { Parameters { Data { Parallax
1.2605200000000000e-007 Pos1 4.6145900000000000 Pos2 -0.2687550000000000 ProperMotionDec -8.9411600000000003e-015
ProperMotionRA -6.6597800000000003e-015 Target "658F" TrackType "RA/Dec" }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetOffset { Parameters { New { Across 0.0000000000000000
Along 0.0000000000000000 Az 0.0000000000000000 Dec 0.0000000000000000 El 4.8481406896048085e-006 InstX 0.0000000000000000
InstY 0.0000000000000000 RA 0.0000000000000000 }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetOffset { Parameters { New { Across 0.0000000000000000
Along 0.0000000000000000 Az 4.8481406896048085e-006 Dec 0.0000000000000000 El 4.8481406896048085e-006 InstX
0.0000000000000000 InstY 0.0000000000000000 RA 0.0000000000000000 }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetOffset { Parameters { New { Across 0.0000000000000000
Along 0.0000000000000000 Az 4.8481406896048085e-006 Dec 0.0000000000000000 El 0.0000000000000000 InstX 0.0000000000000000
InstY 0.0000000000000000 RA 0.0000000000000000 }}} } } } }
Command Successful: DeviceServer { Devices { Telescope { Commands { SetOffset { Parameters { New { Across 0.0000000000000000
Along 0.0000000000000000 Az 0.0000000000000000 Dec 0.0000000000000000 El 0.0000000000000000 InstX 0.0000000000000000 InstY
0.0000000000000000 RA 0.0000000000000000 }}} } } } }

```

Figure 3-9: Messages Tab Pane

### 3.6 Auxiliary Tab Pane

The auxiliary pane provides an interface for operating many of the telescope's sub-systems, including focus and instrument port selection. The following figure shows an example auxiliary pane with all groups expanded:



The screenshot displays the Auxiliary Tab Pane with the following sections:

- Focus:** A table with columns 'Actual', 'Commanded', and 'Limit'. Rows include 'Focus (mm)', 'Tip', and 'Tilt'. A 'Set Focus' field and a 'Set' button are present.
- Telescope Refraction:** Fields for 'Wavelength (nm)' and 'Target Distance (km)'. A 'Set Refraction' field and a 'Set' button are present.
- Instrument Port:** 'Current Port' and 'Available Ports' dropdown menus, both set to 'Left Nasmyth'. A 'Select Port' button is present.
- Telescope Mets:** Fields for 'Temperature', 'Pressure', and 'Humidity'. A 'Set Mets' field and a 'Set' button are present.
- Mirror Cover Leaf Status:** Five status indicators labeled 'Main', 'A', 'B', 'C', and 'D'. Each has 'Open' and 'Closed' radio buttons. 'Main' is 'Open', 'A', 'B', and 'C' are 'Closed', and 'D' is 'Opening'.

Figure 3-10: Auxiliary Tab Pane

### 3.6.1 Focus

The focus control section provides a table of adjustment parameters operators may use for manually adjusting the secondary mirror position.

The actual position is read from the encoders and converted back to the equivalent offset with respect to the collimated mirror position by reversing various transformations such as thermal compensation and gravity flexure. If the secondary mirror is currently moving into position then the values in this field may differ substantially from the corresponding values in the Command Focus field. Otherwise, subtracting Actual Focus values from the corresponding Command Focus values gives an estimate of the following error of the secondary mirror axes. The actual position is reported regardless of the current mode of the telescope, even if it is disabled. If the telescope has not been homed then this position information is likely to be incorrect.

The commanded position is the current commanded position for the secondary mirror. If the telescope is currently parking, this field will be taken from the park position for the secondary mirror. If the telescope is disabled, the fields in the structure will be set to zero.

**Note:** Focus values may be specified to compensate for any errors in focus due to instrument position, thermal compensation, or other factors.

**Note:** If a secondary mirror position is set that would cause the telescope to exceed a position limit, tracking is stopped and the Telescope Position Limit field is set to true. This is only likely to occur if the telescope is currently tracking very close to a limit.

**Note:** Commanded focus settings are independent of any corrections to secondary mirror position due to thermal expansion of the telescope truss, gravity-induced sag of the optical support structure, or configured focus offset of the currently selected instrument.

**Note:** The telescope gimbal position is automatically adjusted to compensate for commanded changes to tip, and tilt of the secondary mirror.

**Note:** Focus settings are remembered but have no effect while the telescope is homing, stopped, parked or disabled.

To set a new focus position, enter the desired position parameters in the Set Focus column using the same unit as specified for the row. Only the parameters that need changing should be entered. Parameters that do not need changing should be left blank. Once all desired parameters are entered, click the 'Set' button. The Commanded column should immediately be updated to reflect the changes.

The following adjustment parameters are provided:

### 3.6.1.1 Focus

This represents the focus or piston position of the secondary mirror. To be precise, this is the offset from the nominal collimated position of the secondary mirror measured as a distance from the primary mirror to the secondary mirror. This value is independent of the other three focus values. The units are millimeters. The valid range of values depends on the range of the secondary focus mechanism, which is a configured limit. Ask your system administrator for the valid range.

### 3.6.1.2 Tip

This represents the amount of tip of the secondary mirror. To be precise, this is the offset from the nominal collimated position of the secondary mirror measured as an angle tilting around a line through the secondary mirror parallel to the elevation axis, such that a positive value represents the top of the secondary mirror moving away from the primary mirror when the telescope is pointing at zero degrees elevation. The angle is corrected for optical magnification effects, and corresponds to an equivalent apparent shift of an object on the sky. This value is independent of the other three focus values. The units are degrees. The valid range of values depends on the range of the secondary focus mechanism, which is a configured limit. Ask your system administrator for the valid range.

### 3.6.1.3 Tilt

This represents the amount of tilt of the secondary mirror. To be precise, this is the offset from the nominal collimated position of the secondary mirror measured as an angle tilting around a line through the secondary mirror perpendicular to the elevation axis and perpendicular to the telescope optical axis, such that a positive value represents the right side of the secondary mirror moving away from the primary mirror as viewed from behind the primary mirror when the telescope is pointing at zero degrees elevation. The angle is corrected for optical magnification effects, and corresponds to an equivalent apparent shift of an object on the sky. This value is independent of the other three focus values. The units are degrees. The valid range of values depends on the range of the secondary focus mechanism, which is a configured limit. Ask your system administrator for the valid range.

### 3.6.1.4 Decenter X and Decenter Y

Telescopes equipped with a secondary mirror actuator that allows five degrees of freedom will also have the following two additional axes in the focus adjustment table:

#### 3.6.1.4.1 Decenter X

This represents the decenter offset of the secondary mirror in the horizontal (X) direction. To be precise, this is the offset from the nominal collimated position of the secondary mirror measured along a line through the secondary mirror parallel to the elevation axis, such that a positive value represents the secondary mirror moving to the right as viewed from behind the primary mirror when the telescope is pointing at zero degrees elevation. This value is independent of the other five focus values. The units are millimeters. The valid range of values depends on the range of the secondary focus mechanism, which is a configured limit. Ask your system administrator for the valid range.

#### 3.6.1.4.2 Decenter Y

This represents the decenter offset of the secondary mirror in the vertical (Y) direction. To be precise, this is the offset from the nominal collimated position of the secondary mirror measured along a line through the secondary mirror perpendicular to the elevation axis and perpendicular to the telescope optical axis, such that a positive value represents the secondary mirror moving up as viewed from behind the primary mirror when the telescope is pointing at zero degrees elevation. This value is independent of the other five focus values. The units are millimeters. The valid range of values depends on the range of the secondary focus mechanism, which is a configured limit. Ask your system administrator for the valid range.

### 3.6.2 Telescope Refraction and Target Distance

This section reports and allows operators to adjust the current telescope refraction wavelength setting and target distance setting.

The refraction wavelength reported is the current commanded value in nanometers, normally taken from the last Set Refraction command. When the telescope control system is started, a default value from a system configuration file is used until the first Set Refraction command is sent.

**Note:** The telescope gimbal position is automatically adjusted to compensate for atmospheric refraction during tracking, based on the specified wavelength value as well as the current meteorological settings. Accurate telescope pointing is dependent on the veracity and precision of these values.

The valid range of refraction wavelengths is 1.0 nm to 5000.0 nm. The wavelength setting is remembered but has no effect while the telescope is homing, stopped, parked or disabled.

The Target Distance field defines the distance of a target from the telescope. A value of zero represents infinity, and is the setting that should be used for celestial observations. The focus position of the secondary mirror is adjusted to account for near targets. The units are kilometers. The valid range of values is a configured limit. Ask your system administrator for the valid range. The target distance value is converted internally into a focus offsets.



To set a new refraction wavelength or target distance, enter the desired values in the Set Refraction column. Once entered, click the 'Set' button. The Commanded column should immediately be updated to reflect the changes.

### 3.6.3 Instrument Port

This section allows operators to see the current port selection and to select the desired instrument port.

The Current Port indicates the name of the currently selected instrument port.

**Note:** The telescope may not be currently set up to point to the instrument port because it is homing, stopped, parked or disabled.

The instrument ports are defined in a system configuration file. Each port represents a certain configuration of port selectors (e.g. tertiary mirror), instrument rotator, and focus offset that allows an instrument attached to the telescope to view stars through the main optics.

**Note:** Selection of a new instrument port is remembered but has no effect while the telescope is homing, stopped, parked or disabled. *The selection only takes effect when one of the track commands is issued, whereupon the designated port selector and/or instrument rotator will be moved into position.* The Telescope Mode can be used to determine when selection of the instrument port is complete.

The Available Ports drop-down list shows the configured ports available. To change the instrument port selection, select the desired port using the drop-down list and click the Select Port button.

### 3.6.4 Telescope Mets

This section displays and allows operators to update the current meteorological settings of the telescope.

When the telescope control system is started, default meteorological values from a system configuration file are used until the first Set Mets command is sent. The telescope gimbal position is automatically adjusted to compensate for atmospheric refraction during tracking, based on these meteorological values as well as the current refraction settings set by Set Refraction.

**Note:** Accurate telescope pointing is dependent on the veracity and precision of these values.

Meteorological settings are remembered but have no effect while the telescope is homing, stopped, parked or disabled.

Secondary focus compensation for thermal expansion of the truss uses the truss temperature, not the outside air temperature.

To set the parameters, enter the desired value in the Set Mets column using the same unit as specified for the row. Only the parameters that need changing should be entered. Parameters that do not need changing should be left blank. Once all desired parameters are entered, click

the 'Set' button. The Commanded column should immediately be updated to reflect the changes.

The following meteorological parameters are provided:

#### **3.6.4.1 Temperature**

This field represents the current outside air temperature being used to calculate telescope position corrections for atmospheric refraction. The units are degrees Celsius. The valid entry range is -100 to +100 °C.

#### **3.6.4.2 Pressure**

This field represents the current outside air pressure being used to calculate telescope position corrections for atmospheric refraction. The units are Pascals. The valid entry range is 10000 to 150000 Pascals.

#### **3.6.4.3 Humidity**

This field represents the current outside air relative humidity being used to calculate telescope position corrections for atmospheric refraction. The units are percentage relative humidity. The valid range is 0 to 100% RH.

### **3.6.5 Mirror Cover Leaf Status**

This group shows the current status of the mirror cover subsystem, with additional details regarding the status of each leaf of the Mirror Cover subsystem.

If the Open lamp is blue, the indicated mirror cover leaf is open. If the Close lamp is yellow, the indicated mirror cover leaf is closed. If both lamps are grey, the indicated mirror cover leaf is partway opened.

If both Open and Close lamps for a particular leaf are lit simultaneously, this may indicate a digital status fault or that the cable connecting the mirror cover subsystem has become disconnected.

The Opening lamp lights blue to indicate that the mirror covers are being commanded to open. The Closing lamp lights yellow to indicate that the mirror covers are being commanded to close.

### **3.7 Engineering Tab Pane**

The Engineering tab pane provides additional telescope status information suitable for engineering purposes, including commands for homing individual axes and diagnosing low level axis faults. The Engineering tab resembles the following figure:



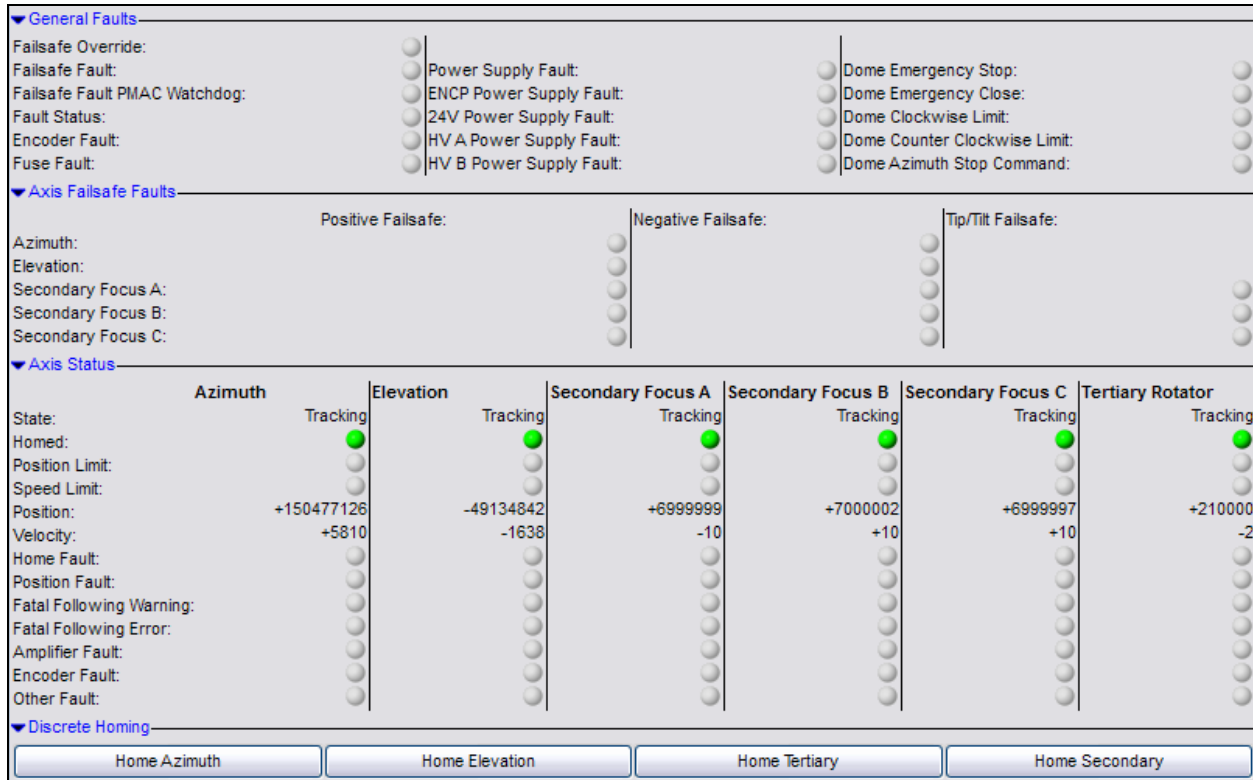


Figure 3-11: Engineering Tab Pane

### 3.7.1 General Faults

The General Faults group indicates the status of general telescope digital faults monitored by the TCS digital I/O subsystem. Faults will light red if a fault is indicated. The following fault indicators are provided:

#### 3.7.1.1 Failsafe Override

This field is set to true if the failsafe override switch on the telescope control cabinet has been turned on. This allows the servo system to continue operating if a failsafe limit switch is activated (the Failsafe Fault field is true). If a failsafe limit switch is also activated (the Failsafe Fault field is true), the servo system will not be disabled and the gimbal brakes will be engaged. This field is set to false whenever the failsafe override switch on the telescope control cabinet is turned off.

**CAUTION:** Moving the telescope axes with the Failsafe Override enabled requires extreme care, as damage to telescope may occur if an axis is moved beyond the failsafe limit.

#### 3.7.1.2 Failsafe Fault

This field is set to true if a failsafe limit switch has been activated. In normal use this will disable the servo system and apply the gimbal brakes, preventing movement of the telescope axes. However, if the failsafe override switch has been turned on (the Failsafe Override field is true)

then the failsafe fault will be ignored, and the servo system will not be disabled and the gimbal brakes will not be applied. This field is set to false if no failsafe limit switches are currently activated. If Failsafe Fault is true, a corresponding axis failsafe limit switch will also be activated.

### **3.7.1.3 Failsafe Fault PMAC Watchdog**

This field is set to true if the PMAC indicates that a watchdog fault has been triggered. The TCS treats this signal as a failsafe fault, and as such, power will be removed from all servo axes and the mirror cover, preventing movement. In addition, the gimbal brakes (if equipped) will be applied. This field is set to false when the PMAC is operating normally.

### **3.7.1.4 Fault Status**

This field is set to true if a failsafe limit switch has been activated and has not been overridden or if the Emergency Stop signal has been engaged. This will disable the servo system and apply the gimbal brakes (if equipped), preventing movement of the telescope axes. This field is set to false if the Emergency Stop signal is not engaged, and either the failsafe limit switches are not currently activated or the failsafe fault has been overridden using the failsafe override key-switch.

### **3.7.1.5 Encoder Fault**

This field is set to true if the digital I/O system detects a fault with the encoding system of any telescope axis. This is a warning indicator only and has no direct effect on the servo system, although it is likely that the servo system will not be able to operate or accurately report axis positions. This field is set to false if all encoders are operating normally.

### **3.7.1.6 Fuse Fault**

This field is set to true if the digital I/O system detects a fault with a fuse in the electronics. This is a warning indicator only and has no direct effect on the servo system, although it is likely that the servo system will not be able to operate. This field is set to false if the fuses in the electronics are operating normally.

### **3.7.1.7 Power Supply Fault**

This field is set to true if the digital I/O system detects a fault with any TCS power supply. This is a warning indicator only and has no direct effect on the servo system, although it is likely that the servo system will not be able to operate. This field is set to false if the power supply is operating normally.

### **3.7.1.8 ENCP Power Supply Fault**

This field is set to true if the digital I/O system detects a fault with an encoder planar power supply. This is a warning indicator only and has no direct effect on the servo system, although it is likely that the servo system will not be able to operate. This field is set to false if the servo power supply is operating normally.

### **3.7.1.9 24V Power Supply Fault**

This field is set to true if the digital I/O system detects a fault with the 24V power supply. This is a warning indicator only and has no direct effect on the servo system, although it is likely that

the servo system will not be able to operate. Several ancillary devices such as the temperature controller may fail to operate without 24V power. This field is set to false if the 24V power supply is operating normally.

#### **3.7.1.10 HV A Power Supply Fault**

This field is set to true if the digital I/O system detects a fault with the high voltage A power supply. This is a warning indicator only and has no direct effect on the servo system, although it is likely that the servo system will not be able to operate. This field is set to false if the servo power supply is operating normally.

#### **3.7.1.11 HV B Power Supply Fault**

This field is set to true if the digital I/O system detects a fault with the high voltage B power supply. This is a warning indicator only and has no direct effect on the servo system, although it is likely that the servo system will not be able to operate. This field is set to false if the servo power supply is operating normally.

### **3.7.2 Dome Signals**

The following flags, displayed in the rightmost column of the General Faults group, indicate the status of digital signals originating from the Dome Control System.

#### **3.7.2.1 Dome Emergency Stop**

This field is set to true if the Dome Control System indicates that an emergency stop button is pressed. Power will be removed from all servo axes and the mirror cover, preventing movement. In addition, the gimbal brakes (if equipped) will be applied. This field is set to false whenever the emergency stop button is released and reset.

#### **3.7.2.2 Dome Emergency Close**

This field is set to true if the Dome Control System indicates that the emergency close button was pressed. If true and no telescope faults have been detected, the mirror covers will close automatically.

#### **3.7.2.3 Dome Clockwise Limit**

This field is set to true if the Dome Control System indicates that the dome clockwise failsafe limit has been triggered. The TCS treats this signal as a fault, and as such, power will be removed from all servo axes and the mirror cover, preventing movement. In addition, the gimbal brakes (if equipped) will be applied. This field is set to false whenever the limit switch is in the nominal operating position.

#### **3.7.2.4 Dome Counter Clockwise Limit**

This field is set to true if the Dome Control System indicates that the dome counter-clockwise failsafe limit has been triggered. The TCS treats this signal as a fault, and as such, power will be removed from all servo axes and the mirror cover, preventing movement. In addition, the gimbal brakes (if equipped) will be applied. This field is set to false whenever the limit switch is in the nominal operating position.

### 3.7.2.5 Dome Azimuth Stop Command

This field is set to true if the Dome Control System indicates that dome azimuth motion has been disabled. The TCS treats this signal as a fault, and as such, power will be removed from all servo axes and the mirror cover, preventing movement. In addition, the gimbal brakes (if equipped) will be applied. This field is set to false whenever the dome azimuth motion is enabled.

### 3.7.3 Axis Failsafe Faults

The Axis Failsafe Faults group indicates the status of digital faults monitored by the TCS digital I/O subsystem, which relate to specific telescope axes. If any axis failsafe fault is detected, power will be removed from all servo axes and the mirror cover, preventing movement. In addition, the gimbal brakes (if equipped) will be applied.

Positive and negative failsafe limits are indicated for azimuth, elevation, and secondary A through C axes. Tip/Tilt failsafe limits are also indicated for secondary axes.

### 3.7.4 Axis Status Table

The axis status table displays troubleshooting information reported by the servo system for each displayed axis. Position and Velocity entries are reported in encoder counts. The state field reports one of the following states:

- “Disabled” — The servo control system is disabled for the indicated axis.
- “Homing” — The indicated telescope axis is seeking an absolute position reference so that the encoder counts reported from their incremental encoders represent a true position of the axis.
- “Slewing” — The indicated axis is currently moving at maximum speed to reach the target position.
- “Tracking” — The indicated axis is at the target position determined by the ideal momentary position of the currently commanded track.
- “Parking” — The indicated axis is currently moving at maximum speed to reach the configured park position for the axis.
- “Parked” — The indicated axis has reached its park position and is currently stationary at this position under servo control.
- “Stopping” — The indicated axis is currently slowing down to stop at a position other than the axis's park position under servo control.
- “Stopped” — The indicated axis is stationary and holding position under servo control, but the axis is not in its park position.

### 3.7.5 Discrete Homing

The discrete homing group provides buttons for homing individual axes. This may be useful for troubleshooting errors with telescope axes. The Home button on the main telescope control panel should be used for nominal operations.

### 3.8 Offset Control Tab Pane

The Offset Control tab pane provides operators an interface for commanding position offsets to the telescope. Position offsets are useful for manually correcting small pointing errors. The Offset pane is integral to gathering observational data for the mount modeling process.

Offsets may be entered by manipulating the controls provided below.

- Note:** More than one pair of offsets can be set simultaneously. Offsets larger than a degree or so may deviate slightly from the expected position if more than one pair of offsets are applied at the same time. Offsets should usually be applied strictly one pair at a time (Offset Az/Offset El, Offset RA/Offset Dec, Offset Along Track/Offset Across Track, or Offset Instrument X/Offset Instrument Y), with the other six offset fields set to zero.
- Note:** If an offset is set that would cause the telescope to exceed a position limit, tracking is stopped and the Telescope Position Limit field is set to true.
- Note:** Offsets are remembered but have no effect while the telescope is homing, stopped, parked or disabled.
- Note:** Commanded position offsets are independent of any adjustments to telescope position due to the mount model, secondary mirror position, tertiary mirror position, or atmospheric refraction.

The offset pane resembles the figure below:

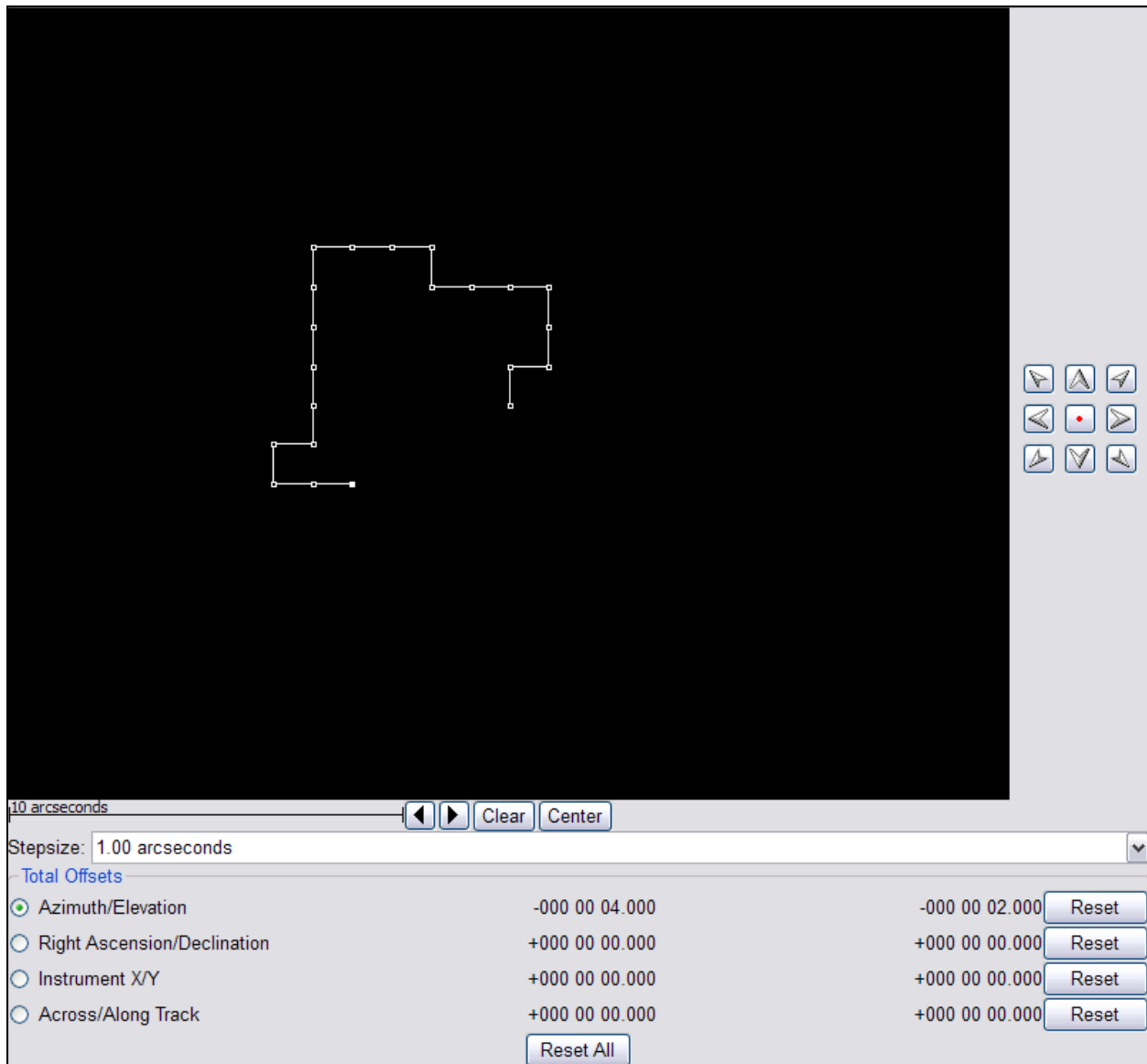


Figure 3-12: Offset Control Pane

### 3.8.1.1 Offset Coordinates

The telescope provides four types of offset pairs, yielding eight offset coordinates:

#### 3.8.1.1.1 Offset Az

This is the commanded position offset of the telescope in the azimuth coordinate. To be precise, this is an on-the-sky offset that scales with the cosine of the current telescope elevation, and is along a great-circle arc 90 degrees clockwise from the up-elevation direction, as viewed from the telescope. This offset is independent of the other seven offset coordinates. The valid range is -90 to 90 degrees.

#### **3.8.1.1.2 Offset El**

This is the commanded position offset of the telescope in the elevation coordinate, corresponding to the up-elevation direction as viewed from the telescope. This offset is independent of the other seven offset coordinates. The valid range is -90 to 90 degrees.

#### **3.8.1.1.3 Offset RA**

This is the commanded position offset of the telescope in the Right Ascension coordinate. To be precise, this is an on-the-sky offset that scales with the cosine of the current telescope declination, and is along a great-circle arc 90 degrees counter-clockwise from the positive declination direction, as viewed from the telescope. The coordinate system is epoch of current date. This offset is independent of the other seven offset coordinates. The valid range is -90 to 90 degrees.

#### **3.8.1.1.4 Offset Dec**

This is the commanded position offset of the telescope in the Declination coordinate, corresponding to the positive declination direction as viewed from the telescope. The coordinate system is epoch of current date. This offset is independent of the other seven offset coordinates. The valid range is -90 to 90 degrees.

#### **3.8.1.1.5 Offset Along Track**

This is the commanded position offset of the telescope in the along-track coordinate. To be precise, this is an on-the-sky offset that lies along a great-circle arc in the direction of travel of the currently active track, as viewed from the telescope. If the telescope is tracking at sidereal rate, this offset is equivalent and opposite in sign to Offset RA. If the telescope is stationary, this offset is ignored. This offset is independent of the other seven offset coordinates. The valid range is -90 to 90 degrees.

#### **3.8.1.1.6 Offset Across Track**

This is the commanded position offset of the telescope in the across-track coordinate. To be precise, this is an on-the-sky offset that lies along a great-circle arc 90 degrees clockwise from the direction of travel of the currently active track, as viewed from the telescope. If the telescope is tracking at sidereal rate, this offset is equivalent and opposite in sign to Offset Dec. If the telescope is stationary, this offset is ignored. This offset is independent of the other seven offset coordinates. The valid range is -90 to 90 degrees.

#### **3.8.1.1.7 Offset Instrument X**

This is the commanded position offset of the telescope in the instrument's horizontal (X) coordinate. To be precise, this is an on-the-sky offset that lies along a great-circle arc 90 degrees counter-clockwise from the up-image direction of the currently selected instrument, as viewed from the telescope. A positive value in this field should move an object to the right in the instrument view. This offset is independent of the other seven offset coordinates. The valid range is -90 to 90 degrees.



### 3.8.1.1.8 Offset Instrument Y

This is the commanded position offset of the telescope in the instrument's vertical (Y) coordinate. To be precise, this is an on-the-sky offset that lies along a great-circle arc in the down-image direction of the currently selected instrument, as viewed from the telescope. A positive value in this field should move an object upwards in the instrument view. This offset is independent of the other seven offset coordinates. The valid range is -90 to 90 degrees.

### 3.8.1.2 Offset Graphic

The offset graphic provides operators with visual feedback. The graphic plots the last 1000 offsets of the currently displayed offset pair. Only one offset pair is displayed at a time. The last offset entered is shown as a white dot, while the previous offsets are white circles, connected by white lines. If a position has been marked, the graphic will show the offset as red instead of white.

### 3.8.1.3 Offset Graphic Toolbar

The toolbar below the graphic, shown in Figure 3-13, reveals the scale of the graphic and provides buttons for increasing, or decreasing the scale of the graphic and buttons to clear or center the graphic. These buttons do not affect the offsets sent to the telescope.



Figure 3-13: Offset Graphic Toolbar

### 3.8.1.4 Offset Button Group

The button group, to the right of the graphic, shown in Figure 3-14, provides an onscreen entry method for increasing or decreasing the current offset pair by a specific step size. The center button with a red dot is for marking position offsets on the offset graphic.



Figure 3-14: Offset Button Group

### 3.8.1.5 Offset Step-size Selection Box

The bottom section of the Offset pane provides a combo-box for entering the step-size for each offset increment and a table listing the total telescope offsets being applied as shown in Figure 3-15. The step-size determines how much to increase the total offset each time an offset button is clicked.

### 3.8.1.6 Total Offset Table

The total offset table shows the total position offset of each of the four offset pairs simultaneously. Offsets are shown in degrees. The radio button to the left of each row determines which type of offset pair is displayed by the offset graphic and which type will be

applied when an offset button is clicked. The Reset button to the right of the row resets the offset applied by the offset pair of the current row only to zero. The Reset All button below the table resets all offsets to zero.

Stepsize: 1.00 arcseconds			
- Total Offsets			
<input checked="" type="radio"/> Azimuth/Elevation	-000 00 04.000	-000 00 02.000	<input type="button" value="Reset"/>
<input type="radio"/> Right Ascension/Declination	+000 00 00.000	+000 00 00.000	<input type="button" value="Reset"/>
<input type="radio"/> Instrument X/Y	+000 00 00.000	+000 00 00.000	<input type="button" value="Reset"/>
<input type="radio"/> Across/Along Track	+000 00 00.000	+000 00 00.000	<input type="button" value="Reset"/>
<input type="button" value="Reset All"/>			

Figure 3-15: Offset Step-size and Total Offset Table

### 3.8.1.7 Keyboard Shortcuts

Several keyboard shortcuts provide quick access to commonly updated features of the offset pane. In order for the keyboard shortcuts to work the offset graphic must have keyboard focus. Click anywhere in the offset graphic to give it focus. The following shortcuts are provided (directions refer to the keyboard arrow keys):

- Up, Down, Right, or Left - Enters an offset in the direction indicated by the arrow direction.
- Ctrl+Left - Decreases the scale of the offset graphic, effectively zooming in.
- Ctrl+Right - Increases the scale of the offset graphic, effectively zooming out.
- Ctrl+Up - Increases the step size of subsequent offset entries.
- Ctrl+Down - Decreases the step size of subsequent offset entries.

## 3.9 Temperature Tab Pane

The temperature tab pane provides a graph of recent TCS monitored temperatures. The first eight sensors are currently configured to be plotted by the graph. Up to sixteen temperatures can be plotted by editing the TelescopeInterface.rc file.

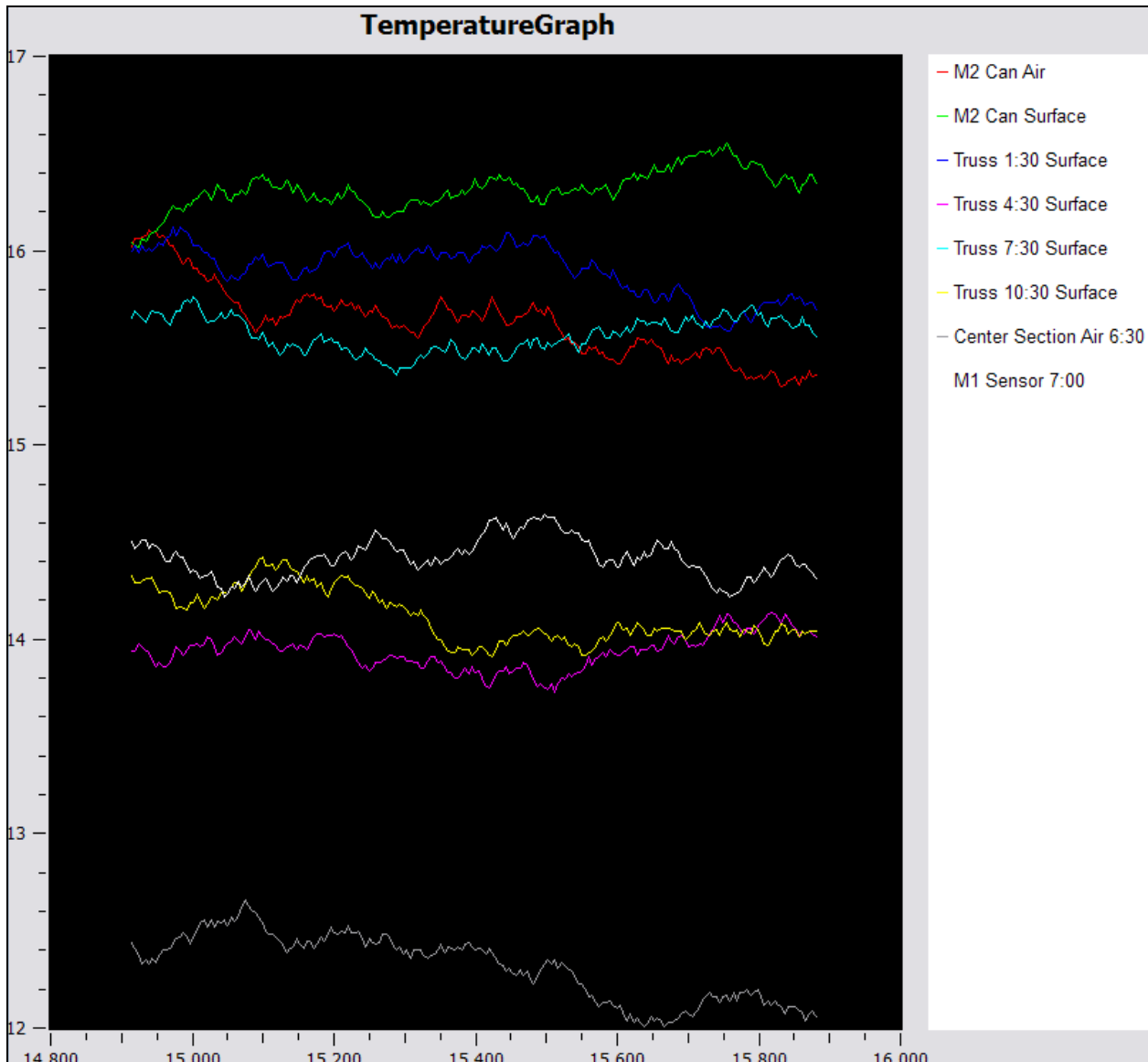


Figure 3-16: Temperature Pane

Clicking on the sensor's label on legend to the right of the graph toggles the sensor's plot line.

## Appendix A: Application Revision History

This section lists changes made to the application since the previous release of this document.

### A.1 Issue 1

Initial version of this document describes TelescopeInterface version 2.3.1.21 and version 3.3.1.21 depending on Framework revisions.

## Appendix B: TelescopeInterface.rc File Description

The TelescopeInterface.rc file resides in the working directory of the TelescopeInterface executable. The file determines the telescope and observatory fields and commands to display. The RC syntax can display virtually any published base DML attribute from any compliant EOS Framework server in a general-purpose fashion. The RC syntax also specifies several parameters required for specialized display widgets, such as the Sky Chart. The TelescopeInterface.rc file should only be edited by system administrators. However, modification should not typically be required since EOST endeavors to provide a comprehensive TelescopeInterface.rc file that is customized for the feature set of each telescope project.

### B.1 Example TelescopeInterface.rc

The following text illustrates the complete text of the graphical configuration file for an example telescope project. This example file is the basis for all of the descriptions and screen shots used throughout this manual.

```
#####  
#  
# TelescopeInterface.rc  
#  
# Configuration file for the EOST Telescope Interface Application  
#  
#  
# The application can be used to display members of data structures  
# published by Observatory servers. The application can also send  
# discrete commands to the Observatory servers. In this context  
# 'Observatory servers' describes any server that is a member of the  
# EOS Framework system version 2  
#  
# This configuration file defines the behavior of the graphical  
# components displayed by the application. This file should be  
# edited only under the direction of EOST.  
#  
#####  
  
#####  
# Constants  
#  
# These are specific keywords that may only be defined once  
#  
  
.catalog EOS_FK5.dat  
.eop EOP.dat  
.de200 bin2000.200  
.telescope TelescopeServer@Telescope  
.track DeviceServer.Devices.Telescope.Commands.SetSlew  
.target DeviceServer.Devices.Telescope.Attributes.Status.Target  
.setoffset DeviceServer.Devices.Telescope.Commands.SetOffset  
.getoffset DeviceServer.Devices.Telescope.Commands.GetOffset  
.getsiteinfo DeviceServer.Devices.Telescope.Commands.GetSiteInfo  
.getinstrumentports DeviceServer.Devices.Telescope.Commands.GetInstrumentPortList  
.offset_history 1000  
.recent_history 100  
  
#####  
# Subscriptions  
#
```

```
# The .subscription keyword is used by the application to subscribe
# to Observatory servers' attribute structures at a defined interval.
# A subscription is required to display all server data.
# Subscriptions are not required for command indicators.
#
# Syntax:
# .subscription <subscription_alias> <0 or interval (ms)> \
#     <device_server_id> <attribute_field_name>
#
.subscription GpsServ          0    GPSServer@Telescope \
    DeviceServer.Devices.TimeData.Attributes
.subscription TeleServ        250  TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Attributes
.subscription AxisServ        250  TelescopeServer@Telescope \
    DeviceServer.Devices.Servo.Attributes
.subscription TempServ        500  i8000TemperatureServer@Telescope \
    DeviceServer.Devices.i8000Temperature.Attributes
.subscription TeleStatusServ  0    DIOServer@Telescope \
    DeviceServer.Devices.TelescopeStatus.Attributes
.subscription TeleFaultServ   0    DIOServer@Telescope \
    DeviceServer.Devices.TelescopeFaults.Attributes
.subscription MirrorCoverServ 0    DIOServer@Telescope \
    DeviceServer.Devices.MirrorCover.Attributes

#####
# Font definitions
#
# These are the fonts the app will use to render text.  Font sizes
# also determine the size of some graphical components.
#
# Default values will be used for 'large' and 'small' fonts if not
# specified here.
#
# Syntax:
# .font <font_alias> <style> <size> [bold] [italic]
#
.font large  Helvetica 10
.font largeb Helvetica 10 bold
.font largei Helvetica 10 italic
.font small  Helvetica 8
.font smallb Helvetica 8 bold
.font smalli Helvetica 8 italic

#####
# Indicators
#
# The application is divided into 'grids' composed of a variable
# number of cells.  Each cell can contain a variable number of \
# 'indicators.' Most Indicators are graphical representations of
# basic Framework schema data types.  Some are designed to coorespond
# to specific structures published by an Observatory server.  A few
# indicators are only for structuring the display of data by the
# application.
#
# Grid Indicator Syntax:
#
```

```

# <grid_name> <number_of_rows> <number_of_columns>
#
# To add a new indicator to a grid use:
#
# <grid_name> <row> <column> <indicator syntax>
#
# A group indicator can be used to logically group and minimize
# associated data.
#
# Group Indicator Syntax:
#
# group <font_alias> <group_name>
#
# To add a new indicator to a group use:
#
# <group_name> <indicator syntax>
#
# A Tab view can be placed inside of a grid cell, so that additional
# indicators can be viewed by toggling tabs.
#
# Tab indicator Syntax:
#
# tab <tab name> <indicator syntax>
#
# Add each new indicator using the same syntax.
#
# A Graph indicator plots float data on an autoscaling qwt plot:
#
# graph <font_alias> <graph_alias> <interval> <initial_value>
#
# Add float indicators to plot data in a graph:
#
# <graph_alias> <float_indicator_syntax>
#
# The following indicators and their syntax are used for formatting
# or displaying static information:
#
# null <font_alias>
# label <font_alias> <label text>
# stretch
# fixedw
# fixed
# horizontal
# vertical
#
# The following indicators and their syntax are used to display basic
# server attributes:
#
# text <font_alias> <subscription_alias> <attribute_member> \
# <caption>|[active <caption type> <caption_subscription_alias> \
# <caption attribute_member>]
#
# left <font_alias> <subscription_alias> <attribute_member> \
# <caption>|[active <caption type> <caption_subscription_alias> \
# <caption attribute_member>]
#
# integer <font_alias> <subscription_alias> <attribute_member> \
# <caption>|[active <caption type> <caption_subscription_alias> \
# <caption attribute_member>] [width.precision] [red \
# <upper_limit> <lower_limit>] [yellow <upper_limit> \
# <lower_limit>] [multiply <multiplier>]
#
# float <font_alias> <subscription_alias> <attribute_member> \
# <caption>|[active <caption type> <caption_subscription_alias> \
# <caption attribute_member>] [width.precision] [red \

```



```

#   <upper_limit> <lower_limit>] [yellow <upper_limit> \
#   <lower_limit>] [multiply <multiplier>]
#
#   boolean <font_alias> <subscription_alias> <attribute_member> \
#   <caption>|[active <caption type> <caption subscription_alias> \
#   <caption attribute_member>]
#
#   angle <font_alias> <subscription_alias> <attribute_member> \
#   <caption>|[active <caption type> <caption subscription_alias> \
#   <caption attribute_member>] [width.precision] [red \
#   <upper_limit> <lower_limit>] [yellow <upper_limit> \
#   <lower_limit>] [multiply <multiplier>]
#
#   hourangle <font_alias> <subscription_alias> <attribute_member> \
#   <caption>|[active <caption type> <caption subscription_alias> \
#   <caption attribute_member>] [width.precision] [red \
#   <upper_limit> <lower_limit>] [yellow <upper_limit> \
#   <lower_limit>] [multiply <multiplier>]
#
#   flag <font_alias> <subscription_alias> <attribute_member> \
#   <caption>|[active <caption type> <caption subscription_alias> \
#   <caption attribute_member>] <>true_pixmap> [false_pixmap]
#
# The time indicator indicator cooresponds to a TimeDate dml structure
#
#   time <font_alias> <subscription_alias> <time_member> \
#   <caption>|[active <caption type> <caption subscription_alias> \
#   <caption attribute_member>] [width.precision]
#
# The bmp indicator indicator cooresponds to a binary data type with
# X and Y dimensions.
#
#   bmp <font_alias> <subscription_alias> <attribute_member.X> \
#   <attribute_member.Y> <attribute_member.Data> [palette_code] \
#
# The command indicator is used to send discrete commands to servers:
#
#   command <font_alias> <device_server_id> <command_field_name> \
#   <button_text> [<parameter_0> ... <parameter_n>]
#
# Command parameters may have the following syntax:
#
#   set <type> <field_name> <constant_value>
#   <field_name> <field_label> [multiply <multiplier>] \
#   [grid|gridl <row> <column>] [nbr] [please]
#   list <field_name> <field_label> <list_length> <item_0> ... \
#   <item_n> [multiply <multiplier>] \
#   [grid|gridl <row> <column>] [nbr] [please] \
#   tooltip <tooltip text>
#
# The following indicators coorespond to components of specific
# servers:
#
#   offsets <font_alias>
#   messages <font_alias>
#   starplot <font_alias> <refresh_interval> <subscription_alias> \
#   <time_member>
#   polarplot <font_alias> <plot_alias> <refresh_interval> \
#   [fixed|variable] <size>
#
# Add plot items to a polar plot using this syntax:
#
#   <plot_alias> azel <subscription_alias.az> <attribute_member.az> \
#   <subscription_alias.el> <attribute_member.el> <pixmap>
#

```

```

#
# \ delimits a newline
# <> indicates required fields
# [] indicates optional fields
# Spaces are not permitted within any of the fields, although some
# fields will automatically replace underscore (_) with space when
# displayed
#
MainGrid 1 2

MainGrid 0 0 grid TabGrid 2 1

TabGrid 0 0 tab Sky_Chart starplot large 30 TeleServ Position.Time.Time

TabGrid 0 0 tab Messages messages large
TabGrid 0 0 tab Auxiliary grid AuxiliaryTabGrid 1 1
TabGrid 0 0 tab Engineering grid EngineeringTabGrid 1 1
TabGrid 0 0 tab Offset_Control offsets large

AuxiliaryTabGrid 0 0 group small Focus
Focus grid FocusGrid 7 8
FocusGrid 1 0 label small Focus_(mm):
FocusGrid 2 0 label small Tip:
FocusGrid 3 0 label small Tilt:
FocusGrid 0 1 label small Actual:
FocusGrid 1 1 float large TeleServ Position.Focus.ActAbsPos.Focus \
_ 6.3 multiply 1000
FocusGrid 2 1 angle large TeleServ Position.Focus.ActAbsPos.Tip \
_ 3.3
FocusGrid 3 1 angle large TeleServ Position.Focus.ActAbsPos.Tilt \
_ 3.3
FocusGrid 0 2 vertical small
FocusGrid 1 2 vertical small
FocusGrid 2 2 vertical small
FocusGrid 3 2 vertical small
FocusGrid 4 2 vertical small
FocusGrid 5 2 vertical small
FocusGrid 6 2 vertical small
FocusGrid 0 3 label small Commanded:
FocusGrid 1 3 float large TeleServ Position.Focus.CmdAbsPos.Focus \
_ 6.3 multiply 1000
FocusGrid 2 3 angle large TeleServ Position.Focus.CmdAbsPos.Tip \
_ 3.3
FocusGrid 3 3 angle large TeleServ Position.Focus.CmdAbsPos.Tilt \
_ 3.3
FocusGrid 0 4 vertical small
FocusGrid 1 4 vertical small
FocusGrid 2 4 vertical small
FocusGrid 3 4 vertical small
FocusGrid 4 4 vertical small
FocusGrid 5 4 vertical small
FocusGrid 6 4 vertical small
FocusGrid 0 5 label small Limit:
FocusGrid 1 5 flag small TeleServ Status.FocusPositionLimit.Focus \
_ red
FocusGrid 2 5 flag small TeleServ Status.FocusPositionLimit.Tip \
_ red
FocusGrid 3 5 flag small TeleServ Status.FocusPositionLimit.Tilt \
_ red
FocusGrid 0 6 vertical small
FocusGrid 1 6 vertical small
FocusGrid 2 6 vertical small
FocusGrid 3 6 vertical small

```

```

FocusGrid 4 6 vertical small
FocusGrid 5 6 vertical small
FocusGrid 6 6 vertical small
FocusGrid 0 7 label small Set_Focus:
FocusGrid 6 7 command small TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.SetFocus Set \
    float New.Focus _ multiply 0.001 grid 1 7 \
    angle New.Tip _ grid 2 7 \
    angle New.Tilt _ grid 3 7

AuxiliaryTabGrid 0 0 group small Telescope_Refraction
Telescope_Refraction grid TelescopeRefractionGrid 4 4
TelescopeRefractionGrid 1 0 label small Wavelength_(nm):
TelescopeRefractionGrid 2 0 label small Target_Distance_(km):
TelescopeRefractionGrid 0 1 label small Current:
TelescopeRefractionGrid 1 1 float large \
    TeleServ Refraction.Wavelength _ 0.0 multiply 1000000000
TelescopeRefractionGrid 2 1 float large \
    TeleServ Refraction.TargetDistance _ 6.3 multiply 0.001
TelescopeRefractionGrid 0 2 vertical small
TelescopeRefractionGrid 1 2 vertical small
TelescopeRefractionGrid 2 2 vertical small
TelescopeRefractionGrid 3 2 vertical small
TelescopeRefractionGrid 0 3 label small Set_Refraction:
TelescopeRefractionGrid 3 3 command small TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.SetRefraction Set \
    float New.Wavelength _ multiply 0.000000001 grid 1 3 \
    float New.TargetDistance _ multiply 1000 grid 2 3

AuxiliaryTabGrid 0 0 group small Instrument_Port
Instrument_Port grid InstrumentPortGrid 2 4
InstrumentPortGrid 0 0 text small TeleServ Status.InstrumentPort Current_Port:
InstrumentPortGrid 0 1 vertical small
InstrumentPortGrid 1 1 vertical small
InstrumentPortGrid 0 2 label small Available_Ports:
InstrumentPortGrid 0 2 fixed
InstrumentPortGrid 1 3 command small TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.SelectInstrumentPort Select_Port \
    instrumentports "Name" _ grid 0 3

AuxiliaryTabGrid 0 0 group small Telescope_Mets
Telescope_Mets grid MetsGrid 5 4
MetsGrid 0 1 label small Current:
MetsGrid 0 2 vertical small
MetsGrid 0 3 label small Set_Mets:
MetsGrid 1 0 label small Temperature:
MetsGrid 2 0 label small Pressure:
MetsGrid 3 0 label small Humidity:
MetsGrid 1 1 float large TeleServ Mets.Temperature _ 0
MetsGrid 2 1 float large TeleServ Mets.Pressure _ 0
MetsGrid 3 1 float large TeleServ Mets.Humidity _ 0
MetsGrid 1 2 vertical small
MetsGrid 2 2 vertical small
MetsGrid 3 2 vertical small
MetsGrid 4 2 vertical small
MetsGrid 4 3 command small TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.SetMets Set \
    float New.Temperature _ grid 1 3 \
    float New.Pressure _ grid 2 3 \
    float New.Humidity _ grid 3 3

AuxiliaryTabGrid 0 0 group small Mirror_Cover_Leaf_Status
Mirror_Cover_Leaf_Status grid MCLeafGrid 3 8
MCLeafGrid 0 0 null small

```

```

MCLeafGrid 0 1 label small Main: true
MCLeafGrid 0 2 label small A: true
MCLeafGrid 0 3 label small B: true
MCLeafGrid 0 4 label small C: true
MCLeafGrid 0 5 label small D: true
MCLeafGrid 1 0 label small Open:
MCLeafGrid 1 1 flag small MirrorCoverServ Status.MCOpenStatus _ blue
MCLeafGrid 1 2 flag small MirrorCoverServ Status.MCAOpenSwStatus _ blue
MCLeafGrid 1 3 flag small MirrorCoverServ Status.MCBOpenSwStatus _ blue
MCLeafGrid 1 4 flag small MirrorCoverServ Status.MCCOpenSwStatus _ blue
MCLeafGrid 1 5 flag small MirrorCoverServ Status.MCDOpenSwStatus _ blue
MCLeafGrid 2 0 label small Closed:
MCLeafGrid 2 1 flag small MirrorCoverServ Status.MCClosedStatus _ yellow
MCLeafGrid 2 2 flag small MirrorCoverServ Status.MCAClosedSwStatus _ yellow
MCLeafGrid 2 3 flag small MirrorCoverServ Status.MCBClosedSwStatus _ yellow
MCLeafGrid 2 4 flag small MirrorCoverServ Status.MCCClosedSwStatus _ yellow
MCLeafGrid 2 5 flag small MirrorCoverServ Status.MCDClosedSwStatus _ yellow
MCLeafGrid 0 6 vertical small
MCLeafGrid 1 6 vertical small
MCLeafGrid 2 6 vertical small
MCLeafGrid 1 7 flag small MirrorCoverServ Status.OpenMCEnableStatus Opening: blue
MCLeafGrid 2 7 flag small MirrorCoverServ Status.CloseMCEnableStatus Closing: yellow

EngineeringTabGrid 0 0 group small General_Faults
General_Faults grid DIOStatGrid 1 5
DIOStatGrid 0 1 vertical small
DIOStatGrid 0 3 vertical small

DIOStatGrid 0 0 flag small TeleFaultServ \
    Status.FailsafeOverrideStatus Failsafe_Override: amber
DIOStatGrid 0 0 flag small TeleFaultServ \
    Status.FailsafeFaultStatus Failsafe_Fault: red
DIOStatGrid 0 0 flag small TeleFaultServ \
    Status.FailsafeFaultPMACWatchdogStatus Failsafe_Fault_PMAC_Watchdog: red
DIOStatGrid 0 0 flag small TeleFaultServ \
    Status.FaultStatus Fault_Status: red
DIOStatGrid 0 0 flag small TeleFaultServ \
    Status.EncoderFaultStatus Encoder_Fault: red
DIOStatGrid 0 0 flag small TeleFaultServ \
    Status.FuseFaultStatus Fuse_Fault: red

DIOStatGrid 0 2 null small
DIOStatGrid 0 2 flag small TeleFaultServ \
    Status.PowerSupplyFaultStatus Power_Supply_Fault: red
DIOStatGrid 0 2 flag small TeleFaultServ \
    Status.PowerSupplyENCPFaultStatus ENCP_Power_Supply_Fault: red
DIOStatGrid 0 2 flag small TeleFaultServ \
    Status.PowerSupply24VFaultStatus 24V_Power_Supply_Fault: red
DIOStatGrid 0 2 flag small TeleFaultServ \
    Status.PowerSupplyHVAFaultStatus HV_A_Power_Supply_Fault: red
DIOStatGrid 0 2 flag small TeleFaultServ \
    Status.PowerSupplyHVBFaultStatus HV_B_Power_Supply_Fault: red

DIOStatGrid 0 4 null small
DIOStatGrid 0 4 flag small TeleFaultServ \
    Status.DomeEmergencyStopStatus Dome_Emergency_Stop: red
DIOStatGrid 0 4 flag small TeleFaultServ \
    Status.DomeEmergencyCloseStatus Dome_Emergency_Close: red
DIOStatGrid 0 4 flag small TeleFaultServ \
    Status.DomeCWLimitSwStatus Dome_Clockwise_Limit: red
DIOStatGrid 0 4 flag small TeleFaultServ \
    Status.DomeCCWLimitSwStatus Dome_Counter_Clockwise_Limit: red
DIOStatGrid 0 4 flag small TeleFaultServ \
    Status.DomeAzStopCmdStatus Dome_Azimuth_Stop_Command: red

```

```

EngineeringTabGrid 0 0 group small Axis_Failsafe_Faults
Axis_Failsafe_Faults grid FailsafeGrid 1 6
FailsafeGrid 0 0 null small
FailsafeGrid 0 0 label small Azimuth:
FailsafeGrid 0 0 label small Elevation:
FailsafeGrid 0 0 label small Secondary_Focus_A:
FailsafeGrid 0 0 label small Secondary_Focus_B:
FailsafeGrid 0 0 label small Secondary_Focus_C:

FailsafeGrid 0 1 label small Positive_Failsafe:
FailsafeGrid 0 1 flag small TeleFaultServ Status.FailsafeFaultAzPosStatus _ red
FailsafeGrid 0 1 flag small TeleFaultServ Status.FailsafeFaultElPosStatus _ red
FailsafeGrid 0 1 flag small TeleFaultServ Status.FailsafeFaultSecAPosStatus _ red
FailsafeGrid 0 1 flag small TeleFaultServ Status.FailsafeFaultSecBPosStatus _ red
FailsafeGrid 0 1 flag small TeleFaultServ Status.FailsafeFaultSecCPosStatus _ red

FailsafeGrid 0 2 vertical small
FailsafeGrid 0 3 label small Negative_Failsafe:
FailsafeGrid 0 3 flag small TeleFaultServ Status.FailsafeFaultAzNegStatus _ red
FailsafeGrid 0 3 flag small TeleFaultServ Status.FailsafeFaultElNegStatus _ red
FailsafeGrid 0 3 flag small TeleFaultServ Status.FailsafeFaultSecANegStatus _ red
FailsafeGrid 0 3 flag small TeleFaultServ Status.FailsafeFaultSecBNegStatus _ red
FailsafeGrid 0 3 flag small TeleFaultServ Status.FailsafeFaultSecCNegStatus _ red

FailsafeGrid 0 4 vertical small
FailsafeGrid 0 5 label small Tip/Tilt_Failsafe:
FailsafeGrid 0 5 null small
FailsafeGrid 0 5 null small
FailsafeGrid 0 5 flag small TeleFaultServ Status.FailsafeFaultSecATipTiltStatus _ red
FailsafeGrid 0 5 flag small TeleFaultServ Status.FailsafeFaultSecBTipTiltStatus _ red
FailsafeGrid 0 5 flag small TeleFaultServ Status.FailsafeFaultSecCTipTiltStatus _ red

EngineeringTabGrid 0 0 group small Axis_Status
Axis_Status grid AxisStatusGrid 1 12

AxisStatusGrid 0 2 vertical small
AxisStatusGrid 0 4 vertical small
AxisStatusGrid 0 6 vertical small
AxisStatusGrid 0 8 vertical small
AxisStatusGrid 0 10 vertical small

AxisStatusGrid 0 0 null large
AxisStatusGrid 0 0 label small State:
AxisStatusGrid 0 0 label small Homed:
AxisStatusGrid 0 0 label small Position_Limit:
AxisStatusGrid 0 0 label small Speed_Limit:
AxisStatusGrid 0 0 label small Position:
AxisStatusGrid 0 0 label small Velocity:
AxisStatusGrid 0 0 label small Home_Fault:
AxisStatusGrid 0 0 label small Position_Fault:
AxisStatusGrid 0 0 label small Fatal_Following_Warning:
AxisStatusGrid 0 0 label small Fatal_Following_Error:
AxisStatusGrid 0 0 label small Amplifier_Fault:
AxisStatusGrid 0 0 label small Encoder_Fault:
AxisStatusGrid 0 0 label small Other_Fault:

AxisStatusGrid 0 1 left smallb TeleServ Status.Axes[0].Name _
AxisStatusGrid 0 1 text small TeleServ Status.Axes[0].State _
AxisStatusGrid 0 1 flag small TeleServ Status.Axes[0].HomedOkay _ green
AxisStatusGrid 0 1 flag small TeleServ Status.Axes[0].PositionLimit _ red
AxisStatusGrid 0 1 flag small TeleServ Status.Axes[0].SpeedLimit _ yellow
AxisStatusGrid 0 1 float small AxisServ Position.Motors[0].Pos _ 0
AxisStatusGrid 0 1 float small AxisServ Position.Motors[0].Vel _ 0

```

```

AxisStatusGrid 0 1 flag small TeleServ Status.Axes[0].HomingFailed _ red
AxisStatusGrid 0 1 flag small TeleServ Status.Axes[0].PositionFault _ red
AxisStatusGrid 0 1 flag small TeleServ Status.Axes[0].FollowErrorWarning _ yellow
AxisStatusGrid 0 1 flag small TeleServ Status.Axes[0].FollowErrorFatal _ red
AxisStatusGrid 0 1 flag small TeleServ Status.Axes[0].AmplifierFault _ red
AxisStatusGrid 0 1 flag small TeleServ Status.Axes[0].EncoderError _ red
AxisStatusGrid 0 1 flag small TeleServ Status.Axes[0].OtherFault _ red

AxisStatusGrid 0 3 left smallb TeleServ Status.Axes[1].Name _
AxisStatusGrid 0 3 text small TeleServ Status.Axes[1].State _
AxisStatusGrid 0 3 flag small TeleServ Status.Axes[1].HomedOkay _ green
AxisStatusGrid 0 3 flag small TeleServ Status.Axes[1].PositionLimit _ red
AxisStatusGrid 0 3 flag small TeleServ Status.Axes[1].SpeedLimit _ yellow
AxisStatusGrid 0 3 float small AxisServ Position.Motors[1].Pos _ 0
AxisStatusGrid 0 3 float small AxisServ Position.Motors[1].Vel _ 0
AxisStatusGrid 0 3 flag small TeleServ Status.Axes[1].HomingFailed _ red
AxisStatusGrid 0 3 flag small TeleServ Status.Axes[1].PositionFault _ red
AxisStatusGrid 0 3 flag small TeleServ Status.Axes[1].FollowErrorWarning _ yellow
AxisStatusGrid 0 3 flag small TeleServ Status.Axes[1].FollowErrorFatal _ red
AxisStatusGrid 0 3 flag small TeleServ Status.Axes[1].AmplifierFault _ red
AxisStatusGrid 0 3 flag small TeleServ Status.Axes[1].EncoderError _ red
AxisStatusGrid 0 3 flag small TeleServ Status.Axes[1].OtherFault _ red

AxisStatusGrid 0 5 left smallb TeleServ Status.Axes[2].Name _
AxisStatusGrid 0 5 text small TeleServ Status.Axes[2].State _
AxisStatusGrid 0 5 flag small TeleServ Status.Axes[2].HomedOkay _ green
AxisStatusGrid 0 5 flag small TeleServ Status.Axes[2].PositionLimit _ red
AxisStatusGrid 0 5 flag small TeleServ Status.Axes[2].SpeedLimit _ yellow
AxisStatusGrid 0 5 float small AxisServ Position.Motors[2].Pos _ 0
AxisStatusGrid 0 5 float small AxisServ Position.Motors[2].Vel _ 0
AxisStatusGrid 0 5 flag small TeleServ Status.Axes[2].HomingFailed _ red
AxisStatusGrid 0 5 flag small TeleServ Status.Axes[2].PositionFault _ red
AxisStatusGrid 0 5 flag small TeleServ Status.Axes[2].FollowErrorWarning _ yellow
AxisStatusGrid 0 5 flag small TeleServ Status.Axes[2].FollowErrorFatal _ red
AxisStatusGrid 0 5 flag small TeleServ Status.Axes[2].AmplifierFault _ red
AxisStatusGrid 0 5 flag small TeleServ Status.Axes[2].EncoderError _ red
AxisStatusGrid 0 5 flag small TeleServ Status.Axes[2].OtherFault _ red

AxisStatusGrid 0 7 left smallb TeleServ Status.Axes[3].Name _
AxisStatusGrid 0 7 text small TeleServ Status.Axes[3].State _
AxisStatusGrid 0 7 flag small TeleServ Status.Axes[3].HomedOkay _ green
AxisStatusGrid 0 7 flag small TeleServ Status.Axes[3].PositionLimit _ red
AxisStatusGrid 0 7 flag small TeleServ Status.Axes[3].SpeedLimit _ yellow
AxisStatusGrid 0 7 float small AxisServ Position.Motors[3].Pos _ 0
AxisStatusGrid 0 7 float small AxisServ Position.Motors[3].Vel _ 0
AxisStatusGrid 0 7 flag small TeleServ Status.Axes[3].HomingFailed _ red
AxisStatusGrid 0 7 flag small TeleServ Status.Axes[3].PositionFault _ red
AxisStatusGrid 0 7 flag small TeleServ Status.Axes[3].FollowErrorWarning _ yellow
AxisStatusGrid 0 7 flag small TeleServ Status.Axes[3].FollowErrorFatal _ red
AxisStatusGrid 0 7 flag small TeleServ Status.Axes[3].AmplifierFault _ red
AxisStatusGrid 0 7 flag small TeleServ Status.Axes[3].EncoderError _ red
AxisStatusGrid 0 7 flag small TeleServ Status.Axes[3].OtherFault _ red

AxisStatusGrid 0 9 left smallb TeleServ Status.Axes[4].Name _
AxisStatusGrid 0 9 text small TeleServ Status.Axes[4].State _
AxisStatusGrid 0 9 flag small TeleServ Status.Axes[4].HomedOkay _ green
AxisStatusGrid 0 9 flag small TeleServ Status.Axes[4].PositionLimit _ red
AxisStatusGrid 0 9 flag small TeleServ Status.Axes[4].SpeedLimit _ yellow
AxisStatusGrid 0 9 float small AxisServ Position.Motors[4].Pos _ 0
AxisStatusGrid 0 9 float small AxisServ Position.Motors[4].Vel _ 0
AxisStatusGrid 0 9 flag small TeleServ Status.Axes[4].HomingFailed _ red
AxisStatusGrid 0 9 flag small TeleServ Status.Axes[4].PositionFault _ red
AxisStatusGrid 0 9 flag small TeleServ Status.Axes[4].FollowErrorWarning _ yellow
AxisStatusGrid 0 9 flag small TeleServ Status.Axes[4].FollowErrorFatal _ red
AxisStatusGrid 0 9 flag small TeleServ Status.Axes[4].AmplifierFault _ red

```



```

AxisStatusGrid 0 9 flag small TeleServ Status.Axes[4].EncoderError _ red
AxisStatusGrid 0 9 flag small TeleServ Status.Axes[4].OtherFault _ red

AxisStatusGrid 0 11 left smallb TeleServ Status.Axes[5].Name _
AxisStatusGrid 0 11 text small TeleServ Status.Axes[5].State _
AxisStatusGrid 0 11 flag small TeleServ Status.Axes[5].HomedOkay _ green
AxisStatusGrid 0 11 flag small TeleServ Status.Axes[5].PositionLimit _ red
AxisStatusGrid 0 11 flag small TeleServ Status.Axes[5].SpeedLimit _ yellow
AxisStatusGrid 0 11 float small AxisServ Position.Motors[5].Pos _ 0
AxisStatusGrid 0 11 float small AxisServ Position.Motors[5].Vel _ 0
AxisStatusGrid 0 11 flag small TeleServ Status.Axes[5].HomingFailed _ red
AxisStatusGrid 0 11 flag small TeleServ Status.Axes[5].PositionFault _ red
AxisStatusGrid 0 11 flag small TeleServ Status.Axes[5].FollowErrorWarning _ yellow
AxisStatusGrid 0 11 flag small TeleServ Status.Axes[5].FollowErrorFatal _ red
AxisStatusGrid 0 11 flag small TeleServ Status.Axes[5].AmplifierFault _ red
AxisStatusGrid 0 11 flag small TeleServ Status.Axes[5].EncoderError _ red
AxisStatusGrid 0 11 flag small TeleServ Status.Axes[5].OtherFault _ red

```

```

EngineeringTabGrid 0 0 group small Discrete_Homing
Discrete_Homing grid HomingGrid 1 4
HomingGrid 0 0 command small TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.Home Home_Azimuth \
    set text Axes "Azimuth" expanding
HomingGrid 0 1 command small TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.Home Home_Elevation \
    set text Axes "Elevation" expanding
HomingGrid 0 2 command small TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.Home Home_Tertiary \
    set text Axes "Tertiary" expanding
HomingGrid 0 3 command small TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.Home Home_Secondary \
    \
    set text Axes "Secondary Focus A" \
    set text Axes "Secondary Focus B" \
    set text Axes "Secondary Focus C" \
    expanding

```

```

AuxiliaryTabGrid 0 0 stretch
EngineeringTabGrid 0 0 stretch

```

```

TabGrid 1 0 group small Telescope_Controls
Telescope_Controls grid TelescopeQuickControlGrid 1 3

```

```

TelescopeQuickControlGrid 0 1 htab Az/El command large \
    TelescopeServer@Telescope DeviceServer.Devices.Telescope.Commands.SetSlew \
    Slew \
    angle Data.Pos1 Az: \
    angle Data.Pos2 El: \
    boolean Data.NormalizeAzEl Normalize: nbr \
    set text Data.TrackType Az/El \
    set text Data.Target UserSpecified \
    set boolean Data.AutoHome true
TelescopeQuickControlGrid 0 1 htab HA/Dec command large \
    TelescopeServer@Telescope DeviceServer.Devices.Telescope.Commands.SetSlew \
    Slew \
    hourangle Data.Pos1 HA: \
    angle Data.Pos2 Dec: \
    set text Data.TrackType HA/Dec \
    set text Data.Target UserSpecified \
    set boolean Data.AutoHome true
TelescopeQuickControlGrid 0 1 htab RA/Dec command large \
    TelescopeServer@Telescope DeviceServer.Devices.Telescope.Commands.SetSlew \
    Track \

```



```

    hourangle Data.Pos1 RA: \
    angle Data.Pos2 Dec: \
    set text Data.TrackType RA/Dec \
    set text Data.Target UserSpecified \
    set boolean Data.AutoHome true
TelescopeQuickControlGrid 0 2 command large TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.HomeAll Home \
    tooltip "Home all telescope axes"
TelescopeQuickControlGrid 0 2 command large TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.Park Park \
    tooltip "Slew the telescope to the configured park position"
TelescopeQuickControlGrid 0 2 command large TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.Stop Stop \
    tooltip "Perform a controlled stop of all servo controlled axes"
TelescopeQuickControlGrid 0 2 command large TelescopeServer@Telescope \
    DeviceServer.Devices.Telescope.Commands.Disable Disable \
    tooltip "Disable control of all servo controlled axes"

MainGrid 0 1 fixedw
MainGrid 0 1 polarplot small PolarPlot -1 fixed 210
PolarPlot azel TeleServ Position.ActPos.Az \
    TeleServ Position.ActPos.El telescope
PolarPlot azel TeleServ Position.DetPos.SunAz \
    TeleServ Position.DetPos.SunEl Sun grey

MainGrid 0 1 group small Time
Time time large TeleServ Position.Time.Time UTC: 2.3
Time hourangle largeb TeleServ Position.Time.Sidereal Sidereal: 2.3

MainGrid 0 1 group small Sun_Position
Sun_Position grid SunPosGrid 1 3
SunPosGrid 0 0 angle small TeleServ Position.DetPos.SunAz \
    Az: 3.3
SunPosGrid 0 0 angle small TeleServ Position.DetPos.SunEl \
    El: 3.3
SunPosGrid 0 1 vertical
SunPosGrid 0 2 flag small TeleServ Status.SunAvoidance \
    Sun_Avoidance_Active: red
SunPosGrid 0 2 flag small TeleServ Status.SunAvoidanceEnabled \
    Sun_Avoidance_Enabled: green

MainGrid 0 1 group small Telescope_Position
Telescope_Position grid TelePositionGrid 1 4
TelePositionGrid 0 0 null small
TelePositionGrid 0 1 label small Actual:
TelePositionGrid 0 2 vertical small
TelePositionGrid 0 3 label small Commanded:
TelePositionGrid 0 0 label smallb Az:
TelePositionGrid 0 0 label smallb El:
TelePositionGrid 0 0 label small HA:
TelePositionGrid 0 0 label small RA:
TelePositionGrid 0 0 label small Dec:
TelePositionGrid 0 1 angle largeb \
    TeleServ Position.ActPos.Az \ 3.3
TelePositionGrid 0 1 angle largeb \
    TeleServ Position.ActPos.El \ 3.3
TelePositionGrid 0 1 hourangle large \
    TeleServ Position.ActPos.HA \ 2.3
TelePositionGrid 0 1 hourangle large \
    TeleServ Position.ActPos.RAJ2000 \ 2.3
TelePositionGrid 0 1 angle large \
    TeleServ Position.ActPos.DecJ2000 \ 3.3
TelePositionGrid 0 3 angle largeb \
    TeleServ Position.CmdPos.Az \ 3.3
TelePositionGrid 0 3 angle largeb \

```

```

    TeleServ Position.CmdPos.El          -      3.3
TelePositionGrid 0 3 hourangle large \
    TeleServ Position.CmdPos.HA          -      2.3
TelePositionGrid 0 3 hourangle large \
    TeleServ Position.CmdPos.RAJ2000     -      2.3
TelePositionGrid 0 3 angle large \
    TeleServ Position.CmdPos.DecJ2000    -      3.3

MainGrid 0 1 group small Telescope_Velocity
Telescope_Velocity grid TeleVelocityGrid 1 4
TeleVelocityGrid 0 0 null small
TeleVelocityGrid 0 1 label small Actual:
TeleVelocityGrid 0 2 vertical small
TeleVelocityGrid 0 3 label small Commanded:
TeleVelocityGrid 0 0 label small Az:
TeleVelocityGrid 0 0 label small El:
TeleVelocityGrid 0 1 angle large \
    TeleServ Position.ActVel.Az          -      3.3
TeleVelocityGrid 0 1 angle large \
    TeleServ Position.ActVel.El          -      3.3
TeleVelocityGrid 0 3 angle large \
    TeleServ Position.CmdVel.Az         -      3.3
TeleVelocityGrid 0 3 angle large \
    TeleServ Position.CmdVel.El         -      3.3

MainGrid 0 1 group small Telescope_Status
Telescope_Status grid TeleStatusGrid 1 3
TeleStatusGrid 0 1 vertical small
TeleStatusGrid 0 0 text largeb TeleServ Status.State \
    Mode:
TeleStatusGrid 0 0 flag small TeleServ Status.ServoError \
    Servo_Error: red grey
TeleStatusGrid 0 0 flag small TeleServ Status.ClockError \
    Clock_Sync_Warning: amber grey
TeleStatusGrid 0 0 flag small TeleFaultServ Status.FaultStatus \
    Fault_Status: red grey
TeleStatusGrid 0 0 flag small TeleFaultServ Status.EmergencyStopStatus \
    Emergency_Stop: red grey
TeleStatusGrid 0 0 flag small TeleFaultServ Status.EmergencyCloseStatus \
    Emergency_Close: red grey
TeleStatusGrid 0 2 text large TeleServ Status.Target \
    Target:
TeleStatusGrid 0 2 flag small TeleServ Status.HomedOkay \
    Homed: green grey
TeleStatusGrid 0 2 flag small TeleServ Status.HomingFailed \
    Homing_Failed: red grey
TeleStatusGrid 0 2 flag small TeleServ Status.PositionLimit \
    Position_Limit: red grey
TeleStatusGrid 0 2 flag small TeleServ Status.SkylineLimit \
    Skyline_Limit: red grey
TeleStatusGrid 0 2 flag small TeleServ Status.MountModelLimit \
    Mount_Model_Limit: red grey

MainGrid 0 1 group small Site_Info
Site_Info latitude small Latitude: 2.3
Site_Info longitude small Longitude: 3.3
Site_Info altitude small Altitude:

MainGrid 0 1 group small Temperature
Temperature grid TemperatureGrid 1 3
TemperatureGrid 0 1 vertical small
TemperatureGrid 0 0 float small \
    TempServ SensorData[0].Temperature \
    active text TempServ SensorData[0].Label 5.1 red 35 -10 yellow 30 -5
TemperatureGrid 0 2 float small \

```

```

TempServ SensorData[1].Temperature \
active text TempServ SensorData[1].Label 5.1 red 35 -10 yellow 30 -5
TemperatureGrid 0 0 float small \
TempServ SensorData[2].Temperature \
active text TempServ SensorData[2].Label 5.1 red 35 -10 yellow 30 -5
TemperatureGrid 0 2 float small \
TempServ SensorData[3].Temperature \
active text TempServ SensorData[3].Label 5.1 red 35 -10 yellow 30 -5
TemperatureGrid 0 0 float small \
TempServ SensorData[4].Temperature \
active text TempServ SensorData[4].Label 5.1 red 35 -10 yellow 30 -5
TemperatureGrid 0 2 float small \
TempServ SensorData[5].Temperature \
active text TempServ SensorData[5].Label 5.1 red 35 -10 yellow 30 -5
TemperatureGrid 0 0 float small \
TempServ SensorData[6].Temperature \
active text TempServ SensorData[6].Label 5.1 red 35 -10 yellow 30 -5
TemperatureGrid 0 2 float small \
TempServ SensorData[7].Temperature \
active text TempServ SensorData[7].Label 5.1 red 35 -10 yellow 30 -5

TabGrid 0 0 tab Temperature grid TempGrid 1 1
TempGrid 0 0 graph large TemperatureGraph 200 0
TempGrid 0 0 grid tempgrid 1 2
TemperatureGraph float TempServ SensorData[0].Temperature \
active text TempServ SensorData[0].Label
TemperatureGraph float TempServ SensorData[1].Temperature \
active text TempServ SensorData[1].Label
TemperatureGraph float TempServ SensorData[2].Temperature \
active text TempServ SensorData[2].Label
TemperatureGraph float TempServ SensorData[3].Temperature \
active text TempServ SensorData[3].Label
TemperatureGraph float TempServ SensorData[4].Temperature \
active text TempServ SensorData[4].Label
TemperatureGraph float TempServ SensorData[5].Temperature \
active text TempServ SensorData[5].Label
TemperatureGraph float TempServ SensorData[6].Temperature \
active text TempServ SensorData[6].Label
TemperatureGraph float TempServ SensorData[7].Temperature \
active text TempServ SensorData[7].Label

MainGrid 0 1 group small Mirror_Covers
Mirror_Covers grid MCStatus 1 3
MCStatus 0 0 flag small MirrorCoverServ Status.OpenMCEnableStatus Opening: blue
MCStatus 0 0 flag small MirrorCoverServ Status.MCOpenStatus Open: blue
MCStatus 0 1 vertical small
MCStatus 0 2 flag small MirrorCoverServ Status.CloseMCEnableStatus Closing: yellow
MCStatus 0 2 flag small MirrorCoverServ Status.MCClosedStatus Closed: yellow

Mirror_Covers grid MCCommands 1 3
MCCommands 0 0 command large DIOserver@Telescope \
DeviceServer.Devices.MirrorCover.Commands.OpenMirrorCovers Open \
expanding
MCCommands 0 1 command large DIOserver@Telescope \
DeviceServer.Devices.MirrorCover.Commands.CloseMirrorCovers Close \
expanding
MCCommands 0 2 command large DIOserver@Telescope \
DeviceServer.Devices.MirrorCover.Commands.StopMirrorCovers Stop \
expanding

MainGrid 0 1 stretch

```

#####



```
# end of file  
#####
```