Quasonix

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Antenna Control Unit (ACU)

Graphical User Interface (GUI)

Software Instruction Manual

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1 Overview of User Interface and Operating Software

The system software for the Local and Remote Antenna Control Units (ACU) consists of the Windows based operating system (Windows 7.0 or greater) and the ACU control program, additional drivers necessary for the correct operation of the ACU's Single Board Computer (SBC), and add in cards for specific system functions (Figure 1).

All instructions in this document refer to the local and remote ACUs unless otherwise indicated.

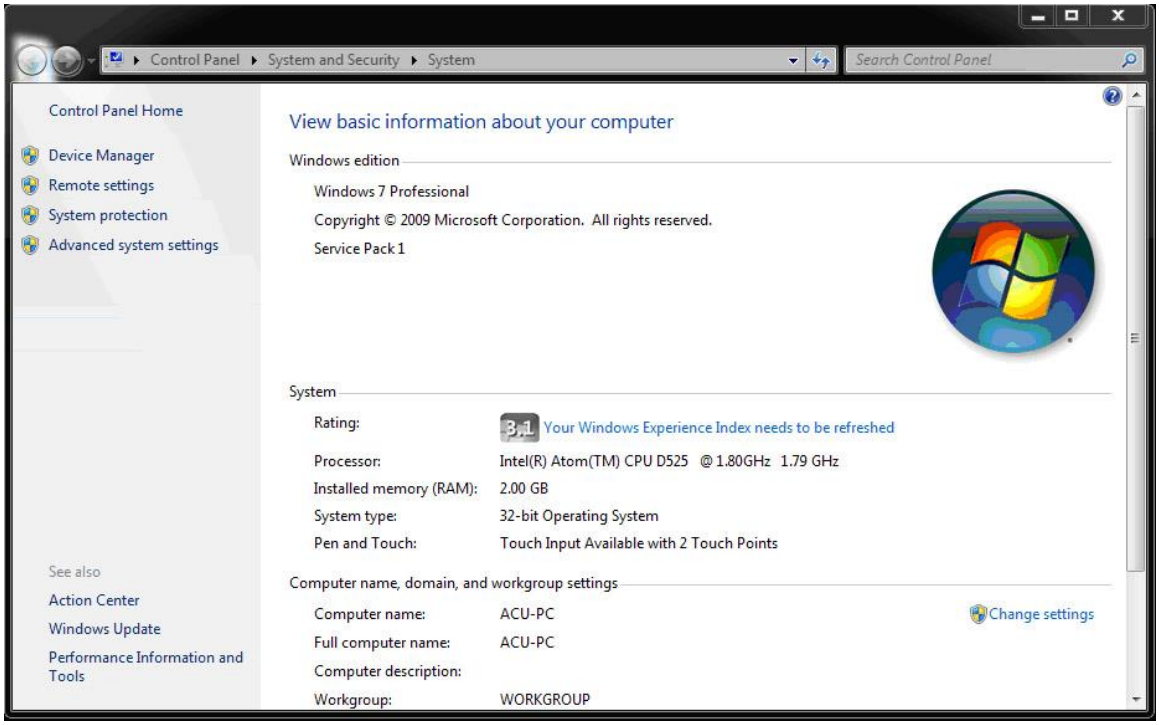

Figure 1: Windows 7 Professional Desktop System Information Screen

1.1 ACU Software

The ACU automatically starts the Graphical User Interface (GUI), however, it is also possible to start the GUI by clicking on the ACU icon (small antenna) located on the left-hand side of the Windows desktop (Figure 2). The Local ACU software version and the Remote version of the software are similar. The local ACU is the controller directly connected to the pedestal/antenna system, while the remote ACU is usually at a location removed from the local controller. The remote unit can be a portable PC running Windows 7 or greater, a laptop, tablet, or another Quasonix ACU.

Upon ACU power up, the Windows desktop is briefly displayed, then the ACU automatically starts the Quasonix ACU Front Panel GUI. The GUI display is composed of separate feedback and control widgets separated into specific operational areas on the touch screen display. The GUI provides the operator with all axis control, system axis angle feedback, receiver signal level displays, and tracking information. The local ACU GUI (the ACU that is connected directly to the antenna pedestal system) front panel screen is shown in Figure 3. The remote ACU screen is similar.

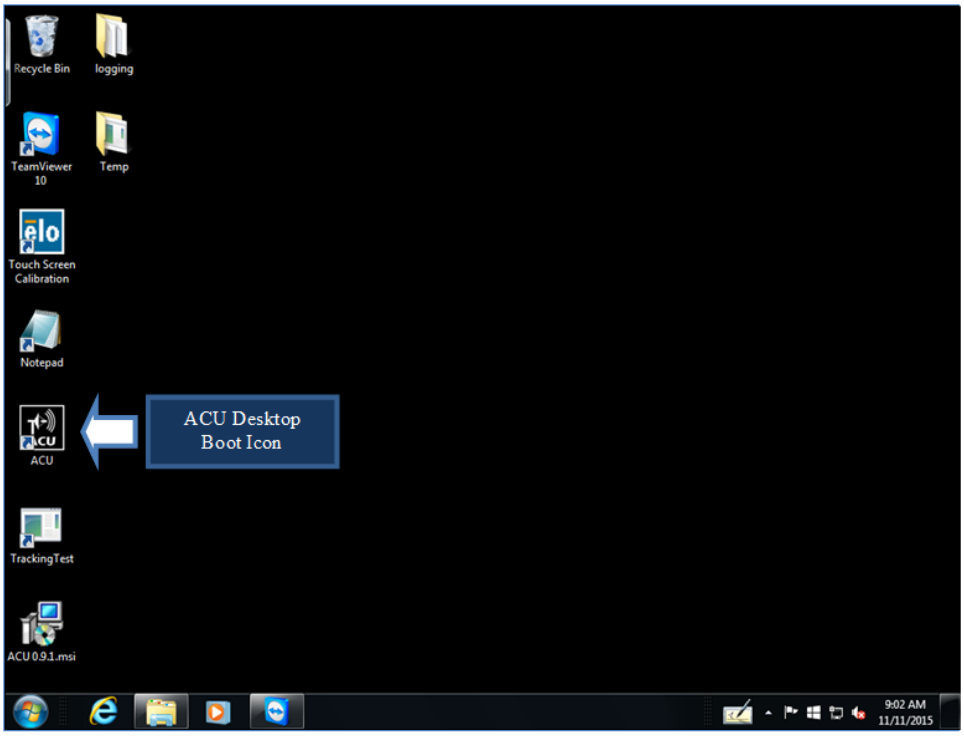

Figure 2: Windows Desktop ACU Boot Icon

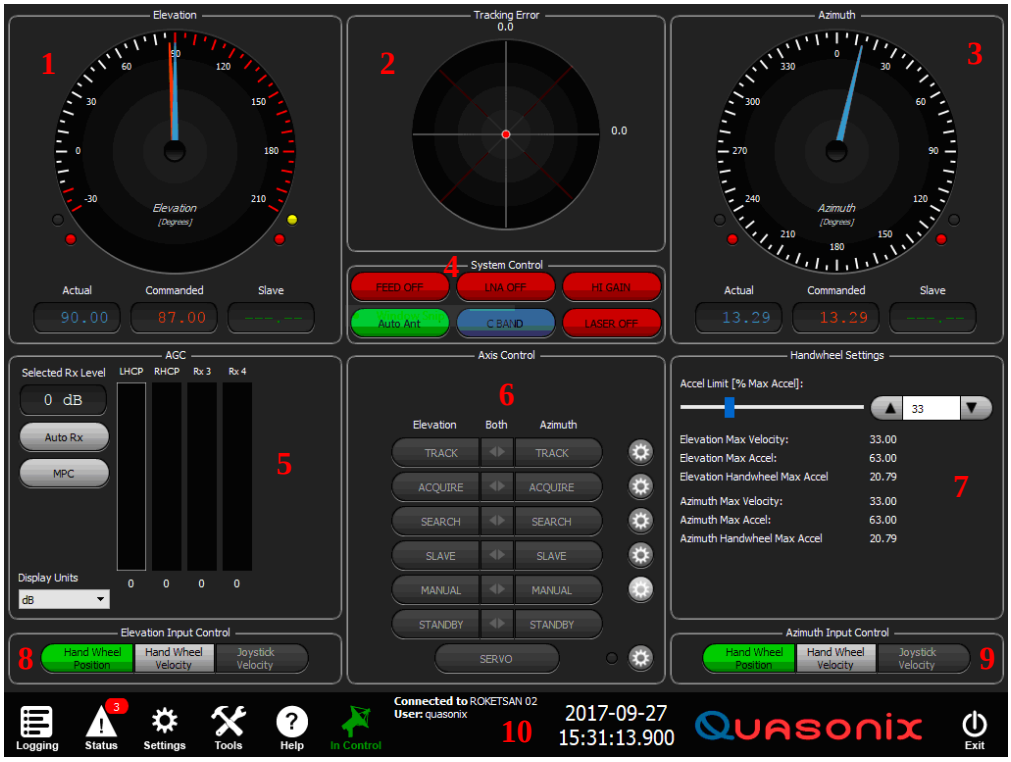

Figure 3: Quasonix ACU Front Panel Display with Numbered Components

The ACU Front Panel Display is separated into ten control areas, as shown in Figure 3. The functions of each control area are described below.

1. Elevation axis angle feedback display containing both analog and digital position display readouts, as well as, the up and down, soft and hard (electrical) Limit indicators (lower red LEDs). The orange pointer is the commanded position and the blue pointer is the actual pointing position of the EL axis.
2. Tracking Error meter display with AZ and EL track error numeric readouts and the target center "meatball"
3. Azimuth axis angle feedback display containing analog and digital position display readouts, the (optional) user selectable cable wrap meter (CWM) – slider and the CW and CCW Soft and hard (electrical) limit indicators (lower red LEDs)
4. System Control contains the user accessible buttons needed for system functions, such as Feed (On/Off) (scanner power) and LNA (On-Off). Additional buttons for various system functions may be added or removed, as required.
5. AGC signal meter display shows four receiver signal ribbon meters (LHCP, RHCP, RX3, and RX4), as well as the automatic receiver selection button (Auto Rx) and Multipath Clipping control button (MPC)
6. Axis Control with separate AZ and EL axis manual control buttons and their associated Multi-Display Window selection hot buttons (Gear icons); the last hot button (available with a stabilized system) activates a Stabilization Multi-Display Window
7. Handwheel Settings OR Multi-Display Window for hot button (Gear icon) user activated parameter/setting and information display options (window changes depending on the parameter selected)
8. Elevation (axis) Input Control for the three EL axis manual control input options: Hand Wheel Position, Hand Wheel Velocity, and Joystick Velocity
9. Azimuth (axis) Input Control for the three AZ axis manual control input options: Hand Wheel Position, Hand Wheel Velocity, and Joystick Velocity
10. ACU Tool Bar with imbedded, selectable icons (left), a date/time display, and an Exit icon (right)

1.2 ACU Software Configured for a Non-tracking (Pointing) System

The Quasonix software allows changes to the front panel control areas to configure the GUI for a non-tracking system. These changes are factory set in the Advanced Menu (accessed via the Settings icon on the Tool bar). However, the settings are password protected and cannot be accessed by the ACU operator.

The functions of the control areas in the non-tracking ACU are identical to the tracking ACU minus the devices (menus, parameters, and components) needed for an auto-tracking system, as shown in Figure 4. Components common to the tracking and non-tracking systems are unchanged, including operation of front panel buttons.

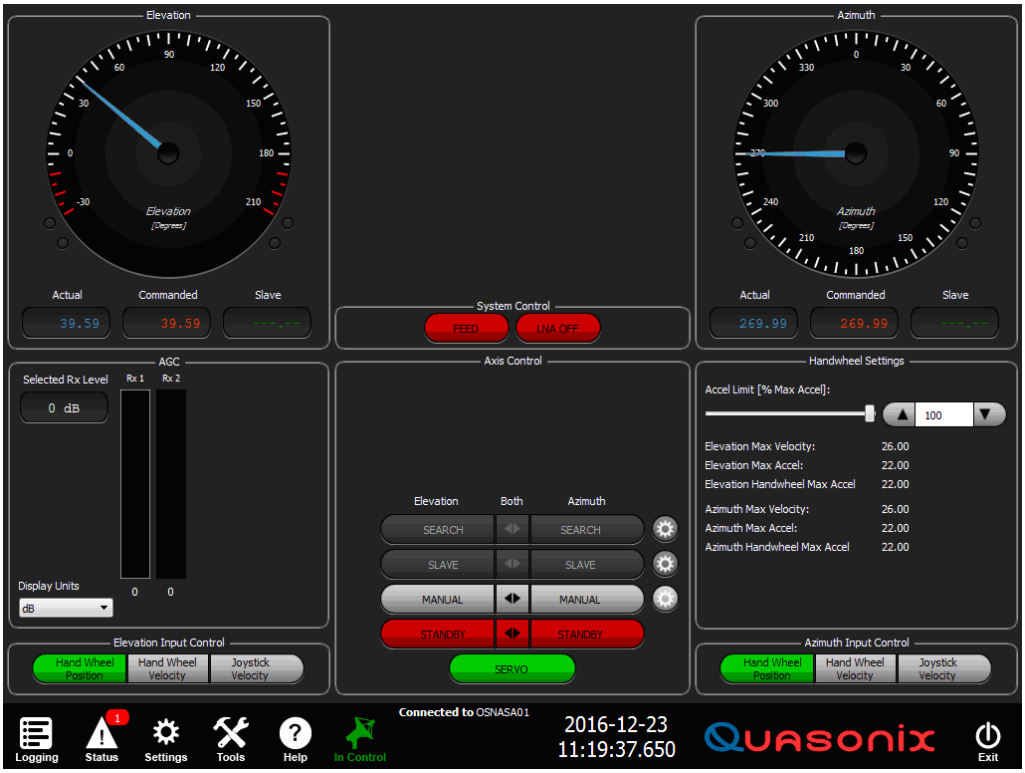

Figure 4: Quasonix ACU Front Panel Configured for Non-Tracking (Pointing) System

2 Graphical User Interface (GUI)

The Graphical User Interface Screen (ACU front panel touch screen display) presents the operator with the controls and feedback necessary to operate the Quasonix Auto-tracking Antenna System.

In addition, the GUI provides icon driven, selectable menu options—Logger, Settings, Tools, Help, and Remote Control—which allow the operator to update, change, and save all operational parameters controlling the antenna system, tracking, location, axis operation, and operator enhancement functions of the ACU. The GUI is subdivided into basic control and feedback on-screen windows. The Tool bar at the bottom of the screen contains all of the icon driven set up, testing, and control functions available to the operator. The front panel contains the operational selection buttons, as well as the display feedback readouts and indicators.

The GUI consists of the following basic elements located on screen or within selectable windows, accessed via hot button (Gear) icons. These items are common to both the Local and Remote GUI.

- AZ and EL axis position display dials with analog pointer and digital readout
- Feed Selection Controls, Hi Gain (Hi-G) and Omni/ACQAID selection control buttons, if present
- Feed polarization LHCP/RHCP control buttons, if present
- Feed Scanner and LNA control
- Servo, AZ, and EL axis control selection buttons with available hand wheel rate and position modes, as well as Joystick selection mode
- Status icon (on the Tool bar) for the notification of Interlock and Fault indicators and launching the faults/interlocks presentation menu
- Local/Remote icon (Antenna button on the Tool bar) for control selection and handoff
- Search menu and control
- Program Designates menu and selection control
- AZ and EL Immediate Designate windows and control
- Elevation limit indicators for software and electrical (hard) up and down limits
- Azimuth limit indicators for software and hardware CW and CCW limits, if present
- Date and time digital display
- Settings icon (Gear button) for ACU Test, Calibrate, and Control system parameters
- Tools icon (Crossed Hammer Wrench button) for system Test and Information routines
- Help icon (Question mark button) for system Help information
- Tracking control and Error Meter information display
- Receiver signal level display and signal parameter control

2.1 Analog Axis (AZ and EL) Position Display Dials

The Azimuth (AZ) and Elevation (EL) axis analog position feedback dial, shown in Figure 5, has two pointing devices: the red pointer (1) represents the pedestal axis commanded or desired angle and the orange pointer shows the current position of the axis. Upon initialization of the ACU GUI, both arrows should be collocated, with the red Pointer in the foreground. As the user commands the pedestal in AZ and/or EL, the orange arrow is visible until the pedestal has reached its commanded position goal where the orange arrow is covered by the red commanded

position pointer. To summarize, the orange pointer indicates the actual position of the axis, while the red pointer indicates the user commanded or desired position of the pedestal axes.

Figure 5: Elevation Axis Analog/Digital Position Feedback Display

1. Elevation Axis analog display dial shows the orange commanded position pointer (at 90°), the blue actual position pointer (at 34.2°), and the external green Slave position pointer (at 63°)
2. Elevation down soft limit indicator LED (yellow) and the down electrical limit indicator LED (red); Azimuth is similar with both soft and electrical (CW and CCW limits)—LEDs Off in this example
3. Actual axis position digital display readout (described in the next section)
4. Commanded axis position digital display readout (described in the next section)
5. Slave position pigtail display readout (described in the next section)
6. Elevation up soft limit indicator LED (yellow) and the up electrical limit indicator LED (red); LEDs Off in this example

2.2 Digital Axis (EL and AZ) Position Display

The three lower digital display readouts show the two digit accuracy of the Commanded (orange) (3), Actual (blue) (4), and Slave (green) (5) AZ and EL position of the pedestal axes. Irrespective of the axis mode of operation, the received (incoming) "raw" slave data is always displayed in the Slave position window. When there is no slave angle data available, the slave digit field displays dashes ("---.---"). When slave data is present, the axis slews to the indicated slave angle when the axis SLAVE button is selected. The operator should always visually check the slave angle readouts to determine whether the displayed angles make sense for the mission before selecting the axis SLAVE (button) function.

When the axis SLAVE button(s) are selected, the antenna immediately slews to the angles displayed in the digital Slave position readout box (green) in the lower right-hand corner of the AZ and/or EL axis angle display. In addition, the green pointer reports the present axis position (AZ and/or EL) of the received slave pointing data.

The Azimuth axis analog angle display dial with the digital readouts lined up below is shown in Figure 6. The orange pointer represents the commanded position, while the blue pointer shows the actual axis position.

Figure 6: Azimuth Axis Analog/Digital Position Feedback Display

1. Azimuth (AZ) axis analog display dial with the orange Commanded position pointer at (0.0°) and the blue Actual position pointer at (54.2°)
2. CCW AZ soft limit indicator LED (yellow) and the CCW Electrical limit indicator LED (red)—LEDs Off in this example
3. Actual axis position digital display readout (blue readout)
4. Note: With the Cable Wrap Meter selected, the digital readouts display + and – position from 0.0 (zero).
5. Commanded axis position digital display readout (orange readout)
6. Note: With the Cable Wrap Meter selected, the digital readouts display + and – position from 0.0 (zero).
7. Slave position digital display readout (green readout)
8. AZ CW soft limit indicator LED (yellow) and the CW Electrical limit indicator LED (red)—LEDs Off in this example
9. Azimuth (optional) Cable Wrap Meter (CWM) showing the pointer located at the CCW maximum position—near the CCW limits

   The CWM can be turned On and Off by selecting the **Settings > Advanced > Cable Wrap** Tab and checking the ENABLE box. The CWM is used when a system does not contain a slip ring but has cables running between the upper Elevation section and the lower Azimuth rotating section. Constant AZ motion would eventually twist the cables until they fail. The CWM lets the operator know where in the cable twist (wrap) the AZ axis is located and prevents the axis from moving past a selected maximum and minimum angular position (AZ limits). When the pointer is centered in the meter, that location indicates the middle of the cable twist (loose cables) and shows the operator full AZ cable wrap is available to both the CW and CCW directions.

2.3 Power Command Button-Servo On/Off

The SERVO (On/Off) or power command button is located at the center bottom of the Axis Control window, as shown in Figure 3, numbered item 6. Select the button to provide power to the AZ and EL axis servo control modules located within the servo power assembly. Depending on the state of the critical interlocks, the user may or may not turn the servos On. The system interlocks are:

- Run - Safe Switch
- Stow Pin
- Local Control
- Shorting Plug (located at the servo amplifier assembly box)

When an interlock or fault is present, the Status icon (located on the Tool bar at the bottom of the screen) displays a red ID number above the icon, indicating that an interlock or fault condition has occurred. The SERVO command button is disabled (and displays red) until the interlock or fault is cleared or is no longer present. The servo power to the pedestal is not available until the critical fault or interlock is removed and the Status Indicator is clear.

Figure 7: Servo Button Modes

- Red indicates the servos are in the Off state and may be disabled by an interlock or fault condition reported by the Status icon on the ACU Tool bar
- Yellow indicates the servo control is selected and is in alarm transition
- Green indicates the servo power is applied and there are no active faults or interlocks present

Figure 8 illustrates the ACU Tool bar, showing the six (6) control, settings, and information icons, with the Status icon reporting one (1) fault. The fault can be further diagnosed by selecting/touching the Status icon. The Status icon launches the Faults/Interlocks reporting page. The green antenna icon indicates that this ACU is in control of the antennal/pedestal system.

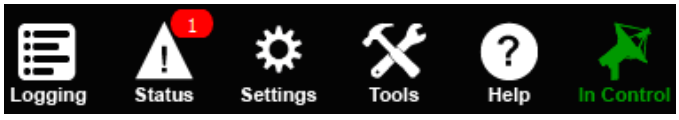

Figure 8: ACU Tool Bar Control Settings and Information Icons

When no interlocks are present, servos may be energized by selecting the red SERVO button. The servos are powered On only after a user pre-defined transition wait time is passed. During the transition time, an alarm at the pedestal sounds to alert any personnel working on or close to the pedestal of possible immediate motion.

On the ACU user interface, this transition time is indicated by a Yellow SERVO button and an alarm or warning horn which sounds at the pedestal to warn of imminent system movement.

After the transition time, the power is applied to the servos and the servo command button changes to green. Only at this moment does the user have access to the Azimuth and Elevation axis mode control buttons.

When the servo is in the Off state or the transition state, the axis mode control buttons are all disabled and display "greyed out." The transition time is selectable from 1 to a maximum of 65 seconds and is controlled by clicking on the Settings icon on the Tool bar and then selecting the Transition Alarm button.

Figure 9 illustrates the GUI with the system servos enabled (Servo buttons are green), each axis in manual, the motor brakes disengaged, and both axes servos enabled. The feed (scanner) and LNA (RF amplifiers) are On, as indicated by the green Feed and Sys LNA On buttons in the System Control window. In addition, the frequency switch has S-band selected. The AGC window, ribbon Signal Level meters indicate that received signals are present on both receiver channels (LHCP and RHCP show 48.0 dB). This system has stability hardware installed. Stability is enabled as indicated by the green Stability On button, as the illuminated green LED next to the STAB button. The Stability option is enabled via the Settings > Advanced menu.

Note: The user is the Administrator, indicating that operator/administrator (Quasonix), is logged into the ACU at this moment and is the System Administrator.

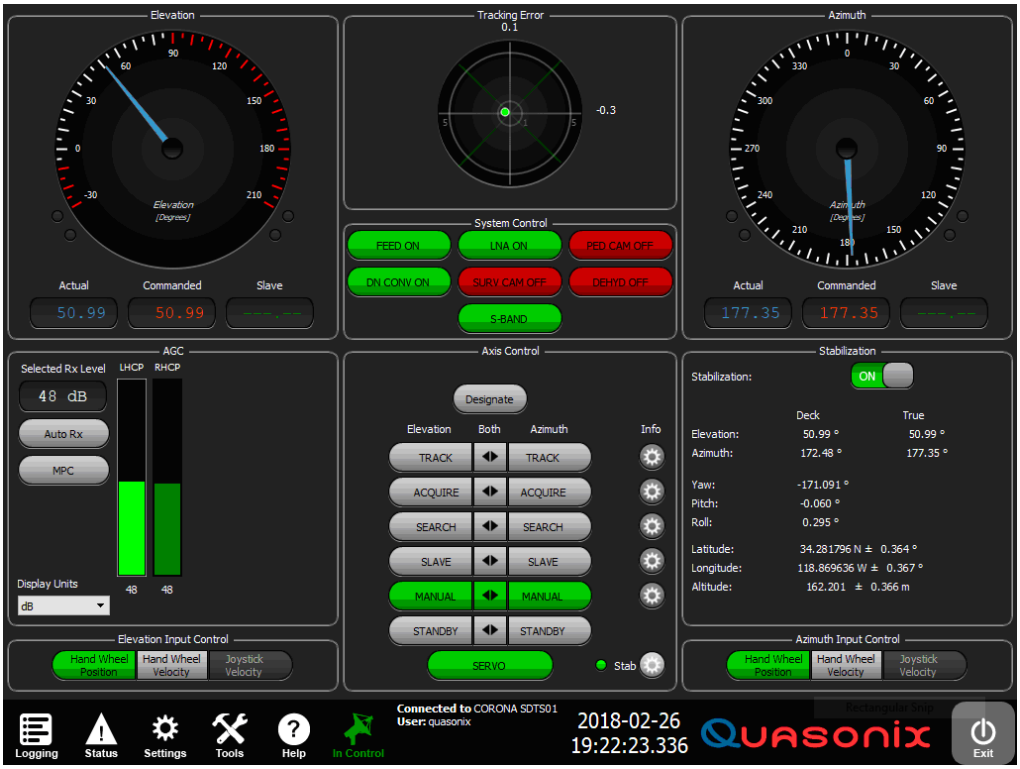

Figure 9: Quasonix ACU Front Panel Display, Stability Enabled

2.4 Modes of Operation

There are seven (7) possible modes of Azimuth and Elevation axis operations:

- Standby
- Manual
- Slave
- Search
- Acquire
- Track
- Stabilization Control (if system is equipped)

The system can be placed in these modes independently for each axis (for example, the Azimuth axis can be in Slave mode while the Elevation axis is in Search or Manual mode). The user has the option of changing the mode of operation for an axis basis or applying a mode change to both axes simultaneously by clicking on the center command buttons, denoted by the double arrows shown in the Both column in Figure 10.

The Axis Control section, shown in Figure 10, shows the available independent axis control modes, the servo On-Off button, and the (right hand side) Gear Icon (hot buttons) used for immediate display of the linked control and parameter input windows. When activated, those windows display directly to the right of Axis Control.

Figure 10: Axis Control Buttons

1. The SERVO button commands power to both the AZ and EL servo amplifiers located within the servo enclosure. Red indicates that servos are Off or are locked out. Yellow indicates the transition alarm period. Green indicates that servo power has been supplied to both servos.
2. Azimuth and Elevation independent axes STANDBY buttons: A red button indicates that the axis motor brakes are engaged and the axis servo amplifier is disabled. When the axis MANUAL button is selected

and green, the axis STANDBY button displays grey. The axis motor brakes are released and the axis servo is enabled and waiting for manual control input.

3. Azimuth and Elevation independent axis MANUAL enable buttons: When selected, the button displays green indicating that the axis is ready for manual input commands.
4. Azimuth and Elevation independent SLAVE enable buttons: When selected, (green), the axis responds to slave angle inputs from an outside source. The Slave angles are displayed in the digital Slave readout field below the AZ and EL analog position dials.
5. Azimuth and Elevation independent SEARCH buttons: When selected, (green) the axis responds to a pre-determined search sequence. The axis search parameters are accessed by selecting the Gear icon hot button located to the right of the Search buttons.
6. Azimuth and Elevation independent ACQUIRE buttons: When selected, (yellow) the axis automatically switches to TRACK when a pre-set signal level is reached. This threshold value setting is available for each receiver shown in the AGC display area. When the threshold level is reached, the Acquire button displays light green and auto track is enabled (Track turns solid green).
7. Azimuth and Elevation independent TRACK buttons: When selected, (green) the axis is forced to auto track the received signal without regard to quality or signal level.
8. Azimuth and Elevation dual selection (Both) arrow buttons: When the button is selected, both the Azimuth and Elevation axis control selection are enabled at the same time.
9. Gear icon (hot buttons): When selected, an independent window opens to the right of the Axis Control window. The new window contains additional user available control options, input parameter areas, and informational screens associated with the specific manual control button to the left of the Gear icon.
10. Stabilization button: When selected, an independent window (Stabilization) opens to the right of the Axis Control window. Stabilization provides an On/Off switch and displays stabilization parameters. When the switch is On, the LED at the bottom of the Axis Control window is green. This means stabilization is active, even when the Stabilization window is closed or a different function window displays.

    This option is only available if the system is equipped with the stabilization feature.

2.4.1 Standby Mode

In the active Standby mode (denoted by a red Standby manual command button), the servos are energized but disabled; also, the brakes are engaged. When released from Standby (servos enabled and motor brakes disengaged), the STANDBY button turns grey. When the servo power is Off, the AZ and EL STANDBY mode command buttons are both red and all other modes are inaccessible (denoted by grey manual control buttons). If a critical interlock is sensed, the ACU software automatically forces the mode of operation to the Standby mode until the interlock fault is cleared or removed. These options are active in both the Local and the Remote ACU GUI.

In Figure 11, the SERVO power button is selected and is green indicating that power has been successfully applied to both the AZ and EL axis servo amplifiers and that NO interlocks or faults have been detected (so far). Each axis is in Standby, indicating that the system motor brakes are applied and that each axis servo amplifier is disabled. The system is ready for operation and each axis can be moved when the AZ and/or EL axis manual buttons are selected (MANUAL is green).

Figure 11: Servo On with AZ and EL Axes in Standby

2.4.2 Manual Mode

In the Manual mode (denoted by a green AZ/EL MANUAL command button), the servos are energized and enabled with the motor brakes released. The servos "station keep" the pedestal at the present prescribed position until commanded to move by the operator, as shown in Figure 12. The user has the option of positioning the pedestal through the following manual input options:

- Hand Wheel Position mode and Hand Wheel Velocity (continuous) mode
- Joystick Velocity mode if a joystick is attached to the rear USB port(s)
- Command entry (Immediate Designate mode)
- Pre-Programmed coordinates (Programmed Designate including Sun Designate and Stow)

In Figure 12, the AZ and EL MANUAL buttons are selected within the Axis Control window. The Gear icon hot button located directly to the right of the MANUAL buttons is also selected. The Gear icon opens the Handwheel Settings window directly to the right of the Axis Control window. AZ and EL current hand wheel motion parameters display and the hand wheel acceleration control parameter (Accel Limit % Max Accel) can be adjusted via the slider bar or Up/Down arrows. The acceleration control input selection applies equally to both the Azimuth and Elevation axes.

The slider (or Up/Down arrow entry) limits the applied acceleration from 10 to 100 percent of the assigned maximum acceleration parameter for both the Azimuth and Elevation axes. By adjusting the slider, the operator can tone down or increase the applied hand wheel acceleration settings available to and stored on the local ACU. This setting helps to smooth out the manual hand wheel control for each axis, depending on the servo mechanical components of the system.

When under remote control, from a device such as a laptop or similar device, each pedestal axis (both AZ and EL) can be moved by selecting the keyboard Up and Down arrows (for Elevation motion) and the right and left arrows (for Azimuth motion).

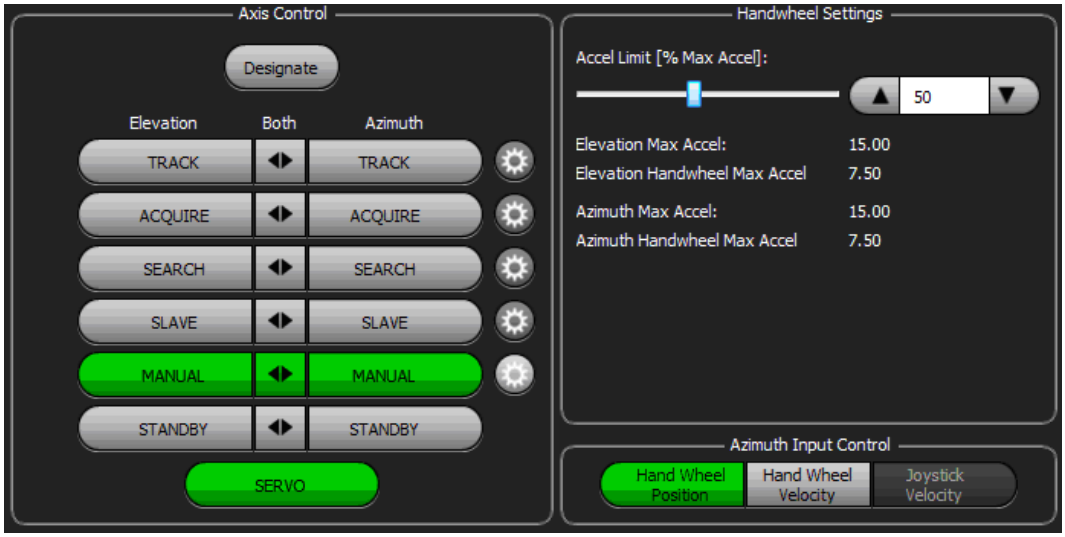

Figure 12: Manual Axis Control with Two Axis Manual Selected and Handwheel Settings Window Open

Figure 13 shows the manual input control buttons for the Azimuth and Elevation axes: Hand Wheel input mode buttons (Position and continuous or Velocity – rate mode) and the Joystick Velocity selection button. When no joystick is attached, the button remains greyed out.

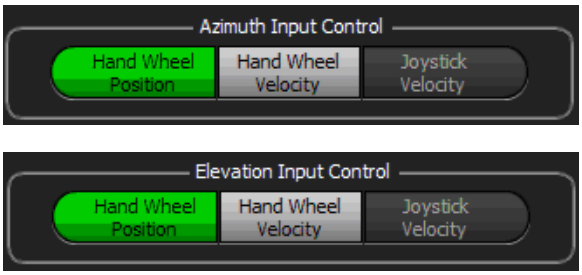

Figure 13: Azimuth and Elevation Input Control Hand Wheel and Joystick Selection Buttons

Hand wheel sensitivity may be adjusted by selecting the Settings icon on the Tool bar and then selecting the desired Hand Wheel button. Joystick motion polarity may be adjusted by selecting the Settings icon and then touching the Joystick button.

When using a Remote ACU, if a joystick is attached to the remote laptop or similar device, the Settings icon > JOYSTICK buttons must be selected and the Joystick Settings menu opened and enabled (check box checked). The Joystick type (Windows recognized) should be selected from the pull down (Name) menu. Additional joystick operational parameters are selected and saved in this menu.

While in manual mode, the user can select the DESIGNATE button (at the top of the Axis Control window) to enter an Azimuth or Elevation axis commanded angle (Immediate Designate) by clicking on or touching the AZ and/or EL command entry Up/Down arrows, located just above the program designates list, as shown in Figure 14. The software keypad displays enabling the operator to enter the desired angle, which displays in the AZ or EL commanded entry field. Selecting the GO button sends the axis to the desired (entered) position.

The DESIGNATE button is active only when the Azimuth and/or Elevation MANUAL buttons are selected and are green. The Immediate Designate window supersedes the Axis Control window when the DESIGNATE button is selected. The functions of immediate designate and program designate are co-located within this window.

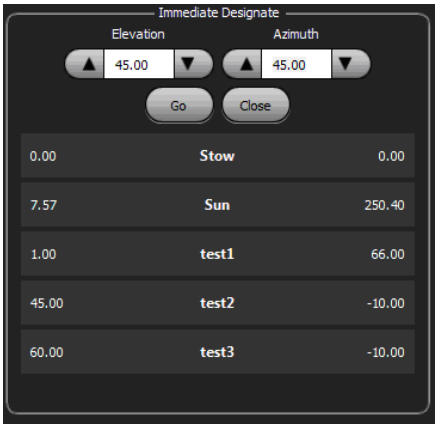

Figure 14: Immediate Designate Window

The antenna can also be positioned by selecting the user defined, pre-programmed coordinates available on the panel, just below the Immediate Designate scroll arrows. Highlighting the desired (saved) coordinates and then selecting the GO button slews the antenna to the highlighted saved location(s). The programmed designates also include the factory default SUN designate and STOW position headings. The programmed designates are user definable and can be updated by the operator by selecting the Settings icon on the Tool bar and then touching the DESIGNATES button to open the Immediate Designates window where the pre-programmed coordinates are added, edited, or removed.

The STOW position, on the first line of the designate list, is preset at the factory to keep the AZ and EL axes aligned to the stow pin receptacle (locking) position, which is not affected by Azimuth or Elevation axis offsets (such as the True North setting). With a stabilized system, selecting the STOW designate, when stability is enabled, generates a stow warning message, as shown in Figure 15. Stability must be turned Off before the system will move to the stow position.

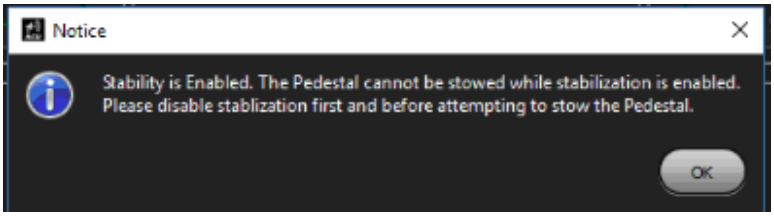

Figure 15: Stow Warning Message When Stability Enabled

The SUN designate is also a pre-programmed computed location, which is automatically updated based on the current system time and Earth location. When SUN is selected, the pedestal axes slews the antenna to point at the current sun position in the sky.

2.4.3 Slave Mode

In Slave mode, the pedestal is positioned by data received through an external Ethernet link, a Serial connection, or an internal, saved, preset burn file. Usually the received data is generated from a client processor, another tracking system, or GPS data. The Slave position data is visible in the AZ and/or EL Slave digital position readout field just below the analog position readout dial. When the operator selects the SLAVE button(s) within the Axis Control window, as shown in Figure 16, the selected axis slews to the displayed slave angles. The recommended received data updates should be at a minimum of 100 ms to ensure smooth AZ and EL axes operations and proper pointing accuracy. The ACU GUI continuously updates slave angle information in the AZ and EL digital position display fields as long as the slave data is available, regardless of the mode the system is in. When slave data is no longer available, the ACU front panel displays dashes ("---.---") in the individual axis Slave angle digital position display field.

In addition to the manual selection of the slave axis, via the Axis Control window, the user can open the Slave Settings window, by selecting the Gear icon hot button, located directly to the right of the axis SLAVE buttons. Selecting the icon opens the Slave Settings window to the right of the Axis Control window. Various slave parameters and protocols are displayed (if available) in the Slave Settings window for operator selection. The Slave Settings window also displays a drop down menu of all active slave sources available to the ACU, as well as START and STOP buttons to accept or stop the slave data.

Slave control is available in the Local and Remote modes of ACU control.

Note: The operator should always check the displayed AZ and EL Slave angles before selecting the AZ / EL axis SLAVE buttons to ensure that they are not out of bounds for the system limits.

In Figure 16, the AZ and EL SLAVE buttons are selected within the Axis Control window and the Gear icon hot button, located directly to the right of the SLAVE buttons, is selected. The Gear icon opened a Slave Settings window to the right of the Axis Control window. Active Slave sources can be selected from the Slave Settings Active Slave drop down menu and started or stopped by the operator.

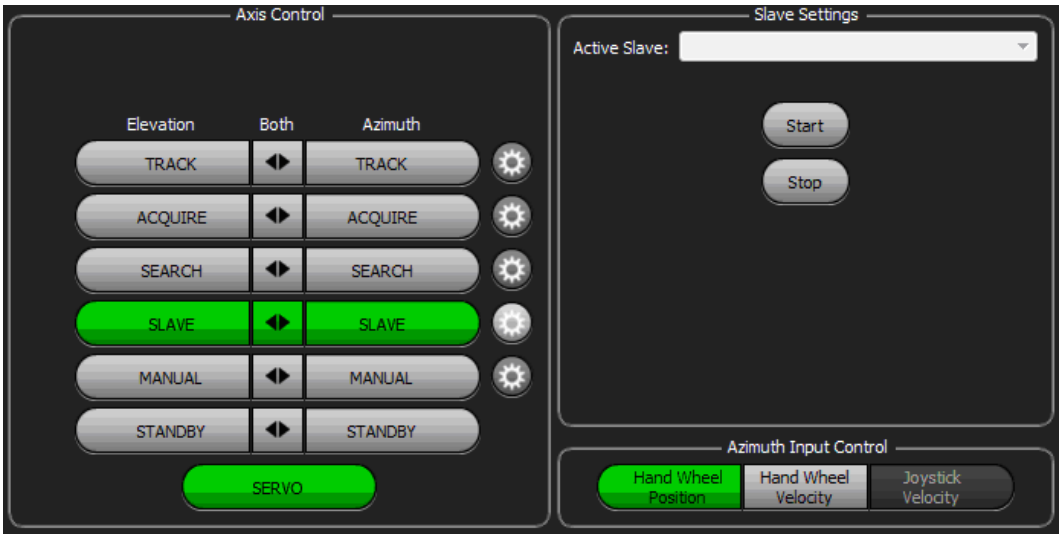

Figure 16: Axis Control and Slave Settings Windows

2.4.4 Search Mode

In Search mode the brakes are released and the ACU has axis control of the search width and search rate. Each axis can be selected to search independently or in unison. There are two ways to search in unison, either in a box spiral or a raster scan pre-programmed motion. The ACU can be set to search within a particular angular width and rate. The search operation is available in the Local and Remote ACU control modes.

The search width (in degrees) and search rate (in degrees per second) parameters can be updated from the Search Settings window, shown in Figure 17, which is accessed by selecting the Gear icon, located to the right of the Axis Control manual SEARCH buttons. All search parameters are located within the Search Settings window. All search parameters settings are entered into the desired field via the pop-up keypad or by selecting the Up and Down arrows for incremental numerical input.

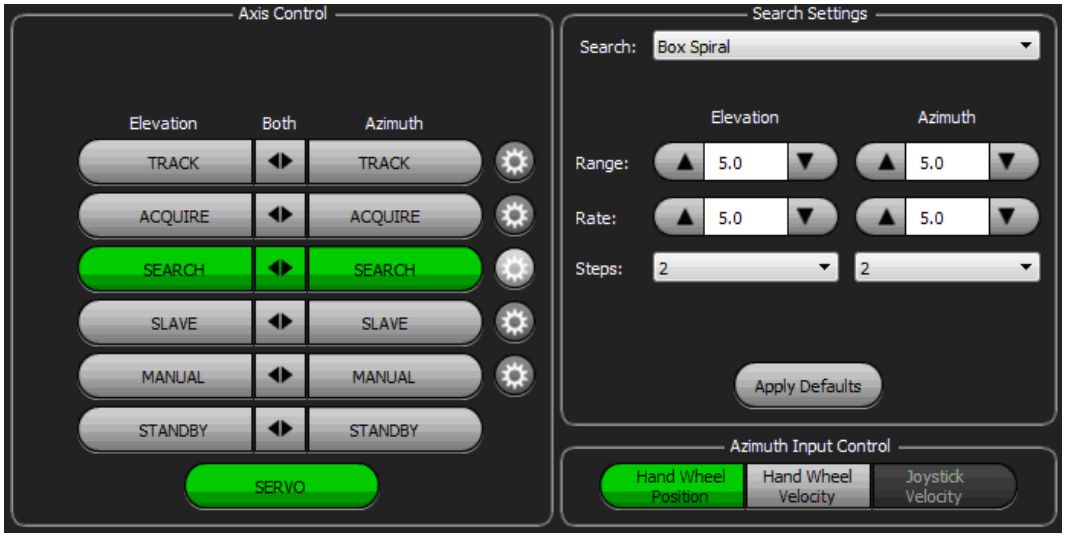

Figure 17: Axis Control and Search Settings Windows

In Figure 17, the AZ and EL SEARCH buttons and Gear icon are selected in the Axis Control window. When the Search Settings window opens, search parameters can be selected and entered using the Up/Down arrows in the associated fields. The operator can select and control the search width, the search speed per axis, the number of steps associated with the search, and the desired two axes, pre-programmed Search type (Raster and Box Spiral).

Operator inputs include:

- One/two axis RANGE - Width of the search window equidistant from a center position
- One/two axis RATE - Angular speed of the axis
- One/two axis STEP - Number of desired steps within the axis search window
- Two axis search TYPE - Box Spiral or Raster Scan; when a two axis search is selected (both manual Search buttons selected and active)

Care should be taken when searching in low elevation angles, as the system can reach the lower limits during a low search operation.

2.4.5 Acquire Mode

In Acquire mode, the brakes are released, the servos are enabled, the operator has selected the MANUAL mode buttons in each axis (MANUAL buttons are green) and has selected the ACQUIRE buttons. The operator may attempt to find the radiating source by slewing the antenna to point at different locations (or select a desired search pattern).

If the signal level of the selected receiver climbs above the set threshold of the selected receiver, the ACU automatically switches to Track mode (TRACK buttons display green) and begin to auto-track the signal source.

If the signal source falls below the set threshold, the ACU switches out of Track and back to Acquire until the signal source again exceeds the chosen threshold of the selected receiver. The ACQUIRE button(s) displays yellow when active, but not tracking the signal source. When the source is re-acquired and above the pre-set threshold level, the

Acquire buttons will stay yellow and the TRACK buttons turn green, however, the last MANUAL mode button that was previously selected turns light green, indicating that the original mode is now in Shadow mode.

By correctly setting the threshold above the antenna side lobe level, the system should acquire and auto-track on the antennas main beam and not on a side lobe, thus, eliminating the side lobe tracking errors which sometimes may occur.

In Figure 18, the selected active Acquire mode for both axes is displayed above (ACQUIRE buttons are yellow). The ACU waits until a received signal from the attached receiver is detected that meets the set threshold requirement, in this example 19 dB, entered into the Acquire Settings window. When the received signal surpasses the threshold setting, the ACU automatically switches to two axes Track (both TRACK buttons will turn green).

The selected receiver track parameters may be quickly accessed using the associated Gear icon. The Acquire/Track switching Saturation, Threshold, Hysteresis, Noise Floor, and Receiver Switch Over parameters (in dB) are immediately available to the operator in the Acquire Settings window. All Acquire Settings parameters are entered into the desired fields via the pop-up keypad or by selecting the Up/Down arrows for incremental numerical input. Changes to the Acquire-Track parameter settings take effect immediately and are reflected in the Signal Level display meters in the ACU AGC window.

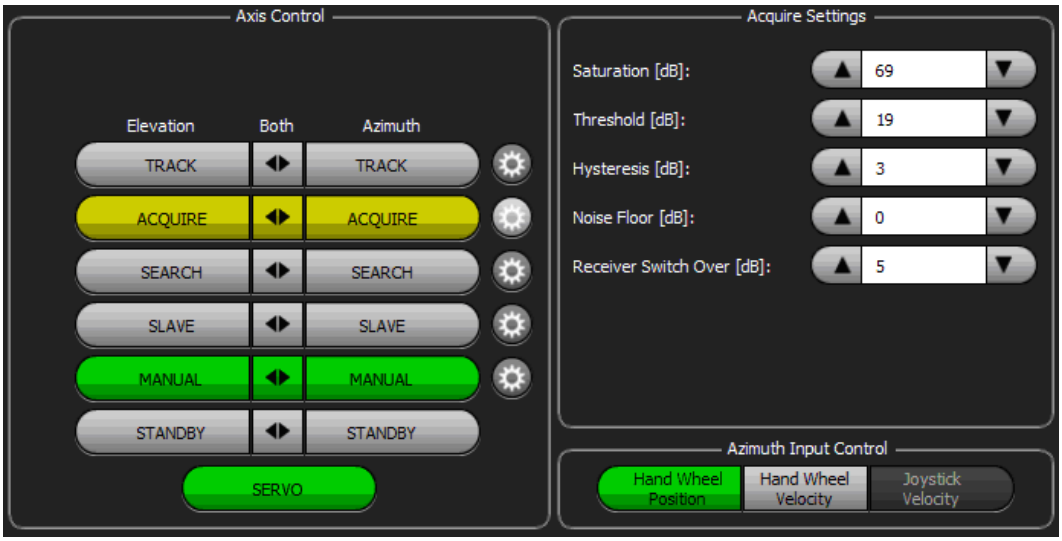

Figure 18: Axis Control and Acquire Settings Windows

2.4.6 Track Mode

In Track mode (forced auto-track), the pedestal's motor brakes are released and servos enabled. The ACU system tries to track any received signals without regard to the selected receiver's threshold level (operator forced auto-track). In this mode it is possible, when not within proper range of the desired signal source, to track unnecessary or undesired signals, for example, off of the ground or buildings and/or other objects (multi-path), or another stronger signal source within the desired RF band. In Track mode, the ACU auto-tracks in both the Azimuth and Elevation independently or in unison depending on the operator selection of the axis TRACK buttons.

In Figure 19, the Axis Control window shows two (2) axis TRACK selected for both axes and the AZ and EL buttons are green. The system is in forced track and attempts to auto-track on any received signal within band, regardless of its signal strength, desirability, or location.

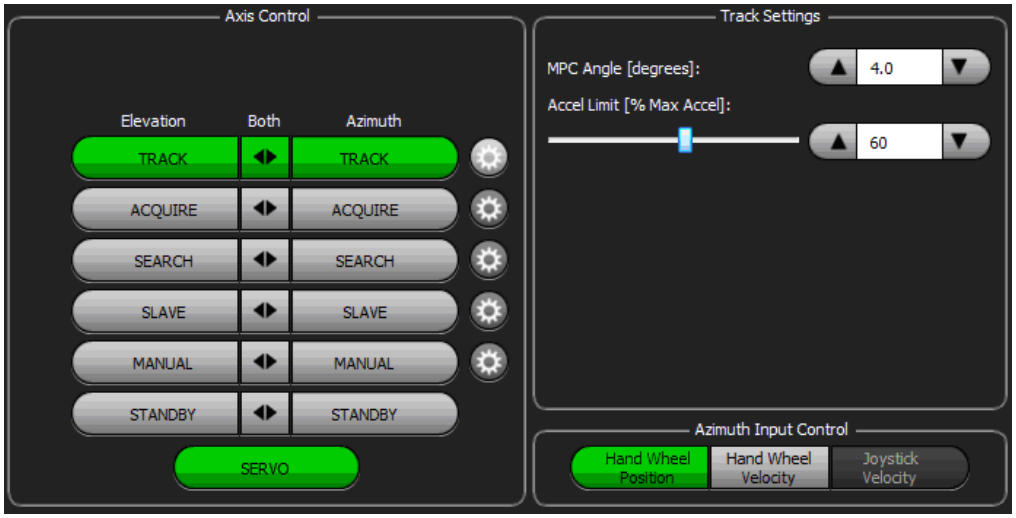

Figure 19: Axis Control and Track Settings Windows

Select the Gear icon to the right of the TRACK buttons to open the Track Settings window. By using the Up/Down arrows in the MPC Angle (degrees) field (or using the popup keypad), the MPC down limit position selection angle is available for immediate operator control. In addition, the Accel Limit % of Max Accel slide control is available to track acceleration and to increase or decrease the axis motion acceleration during Track mode. The slide control affects AZ and EL axes equally.

2.4.7 Stabilized Mode

A Stabilized Mode Control (Gear Icon) button is located next to the LED in the Axis Control window. This mode is associated with all pedestal axis motion control modes. When selected, an independent window (Stabilization) opens to the right of the Axis Control window. Stabilization provides an On/Off switch and displays stabilization parameters. When the switch is On, the LED at the bottom of the Axis Control window is green. This means stabilization is active, even when the Stabilization window is closed or a different function window displays.

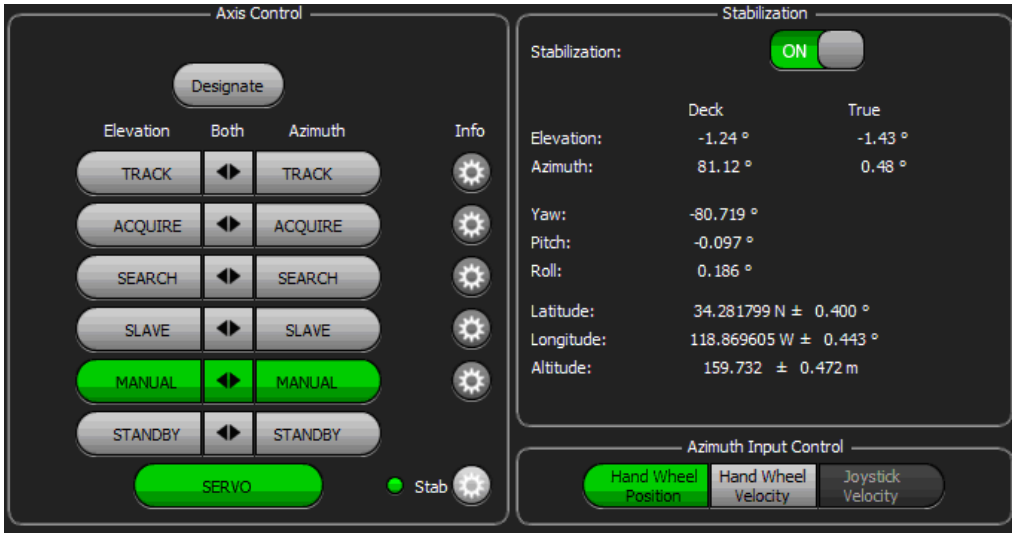

Figure 20: Axis Control and Stabilization Windows, Stabilization Option Enabled and Switched On

The Stabilization Window displays Deck and True elevation and azimuth pointing angles, the system's world position (latitude and longitude) and altitude, and the pitch, yaw, and roll feedback from any attached IMU or gyro device. When stabilized, the antenna's pointing position (AZ and EL pointing angles) are continuously updated to compensate for ship's (pitch and roll) motion. In addition, the true north heading (yaw) is updated via the attached differential GPS system.

Stability is turned On or Off using the Advanced menu. If the system is not stabilized, the Stability check box in the Advanced menu is unchecked.

2.5 Track Error Dial and Feed Control

Located between the Azimuth and Elevation analog position display dials are the Tracking Error dial and the Feed Control window. The Tracking Error dial provides the operator with visual feedback of the radiating target location within the antennas beam width. The Error dial's center dot, also called a meatball, shows the location (up, down, or side to side) of the radiating source, off from the antenna's RF or electrical boresight.

As the antenna is slewed towards the radiating target, the meatball moves toward the center (cross hair) position of the Error dial, in both Azimuth and Elevation, provided that the dial is calibrated correctly. Likewise, as the antenna is moved away from the target, the meatball moves away from the central cross hair position within the dial. The Tracking Error dial also provides the operator with digital readouts of the Azimuth and Elevation track errors in numeric format, as shown in Figure 21. When the system is auto-tracking a radiating target, in AZ and EL (both TRACK buttons are green), the meatball should be located at or near the center cross hair location within the Tracking Error dial. In addition, the center meatball turns green when the feed scanner is running and generating a Top Dead Center (TDC) signal. Typically, the feed scanner is rotating at about 1800 RPM generating a TDC signal of about 30 Hz. If this signal is not present, the center meatball displays red and the antenna system will not auto-track the radiating target.

Calibrating the system for correct auto-tracking capability may be accomplished by selecting the Settings icon from Tool bar and then selecting the TRACK SETTINGS button. All calibration parameters for each RF band and available receiver(s) are set and stored in the ACU's settings database. Refer to Appendix B - Required Tracking Calibrations-Adjusting TDC Offsets and Slopes for system auto track calibration details.

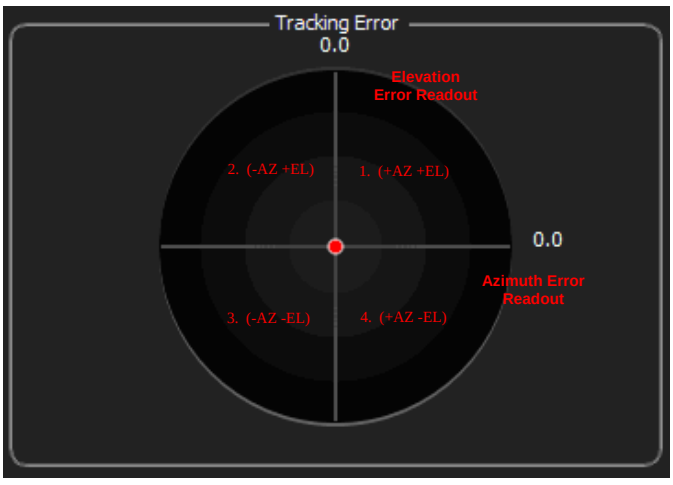

Figure 21: Tracking Error Dial

The Tracking Error dial is shown in Figure 21. The Error dial's center meatball is red, indicating that the feed's scanner is not running and not providing the required (tracking). Top Dead Center Signal (TDC) is necessary for correct auto-tracking capability. The Error dial's top and side EL and AZ digital numeric displays indicate that there are no track errors present at this time (both read 0.0). The target meatball (red ball) is at center of the Error dial when scanner/feed is Off. The four quadrants of the Error dial are also illustrated.

2.6 System Control Window

Directly below the Tracking Error dial is the Feed Control window, shown in Figure 22, where the common and optional system control buttons are located. Typically, in a tracking system, the FEED and SYS LNA buttons are always present.

However, other control buttons can be placed in this area as needed for system functions such as Pedestal Camera On/Off and External AC Power On/Off.

The FEED button activates and deactivates the feed's scanner and LNAs. The SYS LNA button turns the feed's low noise amplifiers On and Off. Selecting the FEED button to activate the scanner (button turns green) will also turn On the LNAs (the SYS LNA button turns green). The LNA(s) can be turned Off by selecting the LNA button only (it turns red) indicating that the LNAs are now Off. LNAs can also be turned On and Off when the FEED button is Off (red), if desired.

Figure 22: System Control Window

Some systems may include additional feed control buttons such as Antenna Pedestal, High/LO Gain antenna, and Auto Antenna, as described below.

- FEED ON/OFF – Controls manual switching of the feed's scanner motor and turns the system LNA's to On when activated
- LNA ON/OFF – Controls the manual switching of the feed's low noise amplifiers (LNAs) On or Off, as required
- HIGH/LO GAIN – Controls manual switching between the High Gain Feed and the reflectors' side mounted ACQ AID (Low Gain). This can be used to reduce signal strength at the receiver to prevent receiver saturation (when low gain detected), or the Lo Gain antenna can be used for a wider view of the target area for tracking or searching for the target.
- AUTO ANT – When manually selected, automatically switches between the High Gain (Reflector) and the LO Gain Omni antenna or an external ACQ AID antenna; bright green when enabled
- FREQUENCY BAND SWITCHING – When installed, switches between the L/S band feeds and the C band feeds; Switching to each band displays a new set of tracking parameters in the software Track Settings window for optimal tracking of the radiating target within each band.
- LASER – User selectable switching of the attached laser to the On (radiating) or the Off (non-radiating) position

The System Control button layout is specific to the customer tracking system. The feed buttons and control window are factory adjustable and are set to be compatible with the feed assembly hardware.

2.7 AGC Window

The AGC window is located just below the Elevation window. The AGC window contains the received signal level ribbon meters for up to four (4) connected receivers, the Auto Receiver button (AUTO RX) and the Multi Path Clipping activation button (MPC).

The signal level ribbon meters are each connected to an external receiver through the ACU back panel AGC input BNC connectors. Each meter displays the signal level received from the external radiating source as detected by the connected receiver. The selected receiver signal level for Auto-track is indicated by a white border around the outside edges of the meters, as shown in the RHCP meter in Figure 23.

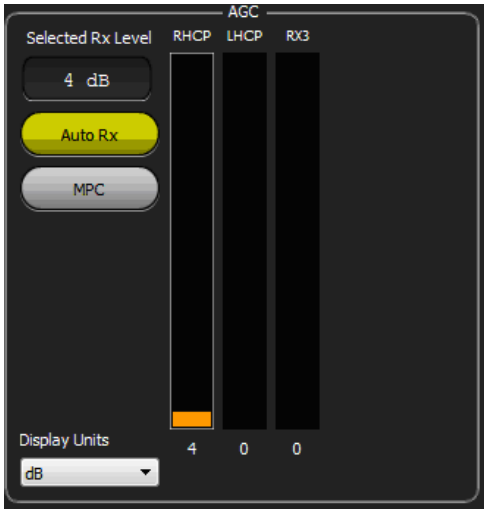

Figure 23: AGC Window, RHCP Meter Outlined in White

To manually select a receiver for tracking, select or touch the ribbon meter on the ACU front panel. That receiver's signal level and its associated AM signal from the external receiver are used for auto-tracking the desired target. By selecting the AUTO RX button (button will glow yellow), the signal level meter with the displayed level that exceeds the pre-set threshold conditions is automatically selected for tracking purposes along with the receiver's associated AM.

With multiple external receivers connected, the AGC signal level meter which meets the pre-set threshold settings is always automatically selected for auto-tracking the radiating target when the AUTO RX button is active. The receiver that is automatically selected (or manually selected by the operator) displays its signal level in the Selected Rx Level field (just above the AUTO RX button). Signal level meters can also be set to display their AGC level in dB or dBm by selecting the Display Units drop down menu, located at the bottom AGC window.

In Figure 23, the AGC received signal level meter display shows three signal meters—RHCP, LHCP, and RX3. The RHCP labeled meter is currently the auto-selected receiver to track on, as indicated by the white, highlighted border around the meter. Only one meter is reporting signal while the other two meters display no source signal level information from the connected external receiver(s). The automatically selected AGC meter (RHCP) is reporting a received signal strength of 4.0 dB. The AUTO RX button is yellow indicating that the automatic receiver selection function is active. The MPC button is grey indicating that the Multi-Path Clipping (MPC) feature is turned Off.

The MPC button, when active (yellow), enables a preset, Multi-Path Clipping, Elevation down limit position. This prevents the EL axis from moving below the preset down position (MPC) during auto-track. The MPC is used during auto-track (only) to keep the antenna from tracking ground reflections instead of the actual radiating target.

The MPC down limit settings can be accessed by selecting the Gear icon located to the immediate right of the AZ and EL TRACK buttons in the Axis Control window.

AGC signal level ribbon meters also react to the (Acquire) Noise Floor, Threshold, and Saturation settings by changing color. When a signal rises above the Noise Floor setting, it displays an orange ribbon. When the meter exceeds the Threshold setting (triggering the auto track mode if Acquire is active), it changes to green, and when the ribbon meter exceeds the Saturation level setting, it changes to red.

In Figure 24, the manually selected (AUTO RX button is Off) RHCP ribbon meter shows signal strength of 16 dB above the noise floor, with the ribbon meter orange in color. The selected receiver (RHCP) has a white border surrounding the meter, and its signal level is shown in the Selected Rx Level field. However, the threshold level for auto-track switch in has not been reached or exceeded yet.

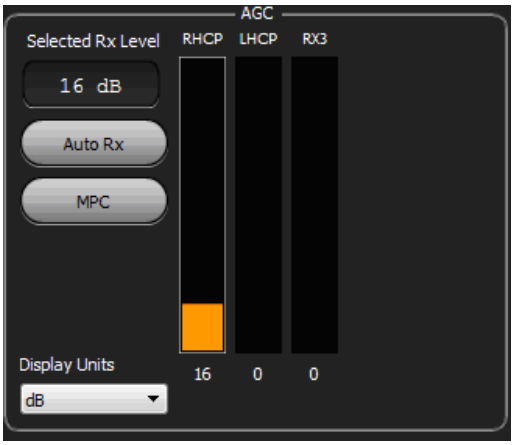

Figure 24: AGC Window, Manually Selected-RHCP Meter Outlined White, Threshold Not Reached

In Figure 25, the manually selected receiver (RHCP) has reached and exceeded the threshold level setting for automatic, auto track switch in, causing the signal level ribbon to turn green. The system begins to auto-track the radiating target on the RHCP receiver at this point (if the ACQUIRE buttons are selected and active).

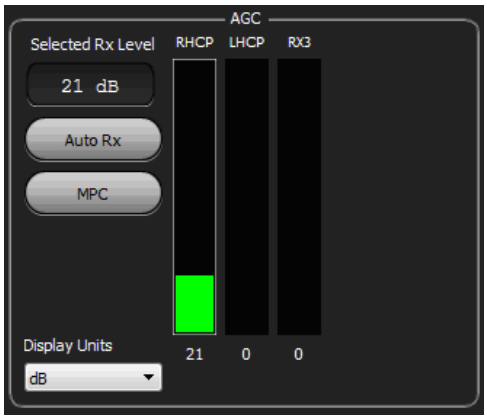

Figure 25: AGC Window, Manually Selected-RHCP Meter Outlined White, Threshold Exceeded

In Figure 26, the manually selected receiver (RHCP) signal level has reached and exceeded the Saturation setting, causing the signal level ribbon to change to red. This indicates a received signal that is too high and is causing receiver saturation. If the signal continues to increase, the feed's LNAs can be damaged.

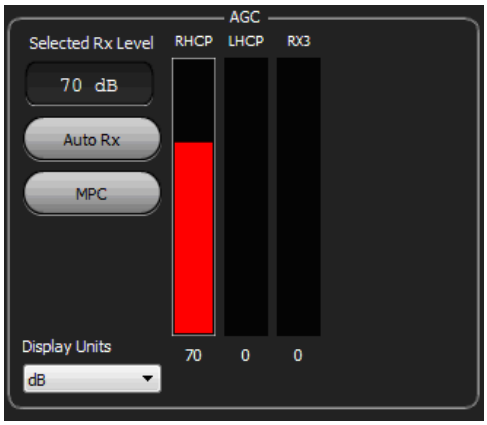

Figure 26: AGC Window, Manually Selected-RHCP Meter Outlined White, Saturation Exceeded

3 ACU Tool Bar

Along the bottom of the ACU GUI touch screen is the System Tool bar. Imbedded into the Tool bar are the six (6) quick access icons and control indicators, where all system access, control and set up functions are primarily located. In addition to the quick access icons, the Tool bar also contains the User identifier, the Date/Time indicators, and an Exit icon. By clicking or touching the icons, the (lower level) menus are launched.

The ACU Tool bar contains the eight (8) embedded icons and/or devices available to the operator. Each device or icon is touch screen and/or mouse activated to allow for easy access to the lower level, icon driven menus launched by selecting each Tool bar icon. The User identifier is read only—recording and displaying the current logged in user. In this example, the administrator is logged in.

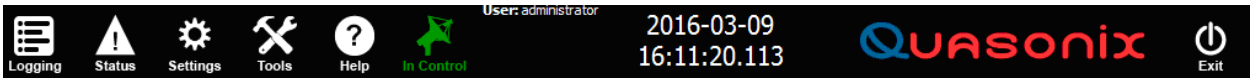

Figure 27: AGC Tool Bar

The icons located on the Tool bar (from left to right) are:

- Logging – Start and stop the Logging Applet
- Status – Access all system interlock and fault messages
- Settings – Access all system set up menus
- Tools – Access all system testing and special function menus
- Help – Access the help messages
- In Control – Enables or disables remote ACU access
- User – Identifies the current logged in user of the ACU
- Date/Time – Displays system date and time via the computer clock
- Exit – Shuts down ACU GUI and exits to the Windows Desktop

3.1 Tool Bar - Logging

When selected, the Logging icon, shown in Figure 28, allows the operator to start a user defined log file running/recording. The log file captures the selected parameters requested by the operator when the log file setting(s) were created. The log file is currently saved to a folder called LOGGING on the Windows Desktop. Each time the log file is started and stopped it is renamed and automatically saved into the logging folder. The log file is saved as a (xxx.csv) file for easy importing into Excel. However, to view the file from the Windows Desktop without importing into Excel the file must be renamed as a text file, (xxx.txt). After renaming, the file can be viewed in Word, WordPad, or by the Windows Notepad.

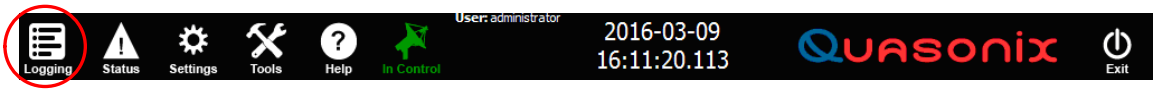

Figure 28: AGC Tool Bar, Logging

The Windows Logging folder shown in Figure 29. Six saved Logging Files are shown in the folder. The files are saved by the ACU as (date-name.csv) files for importing into Excel. One file has been renamed as an XXX.txt file for display in Word, WordPad, or the Windows Notepad. In this example, the logging folder is placed on the Windows desktop.

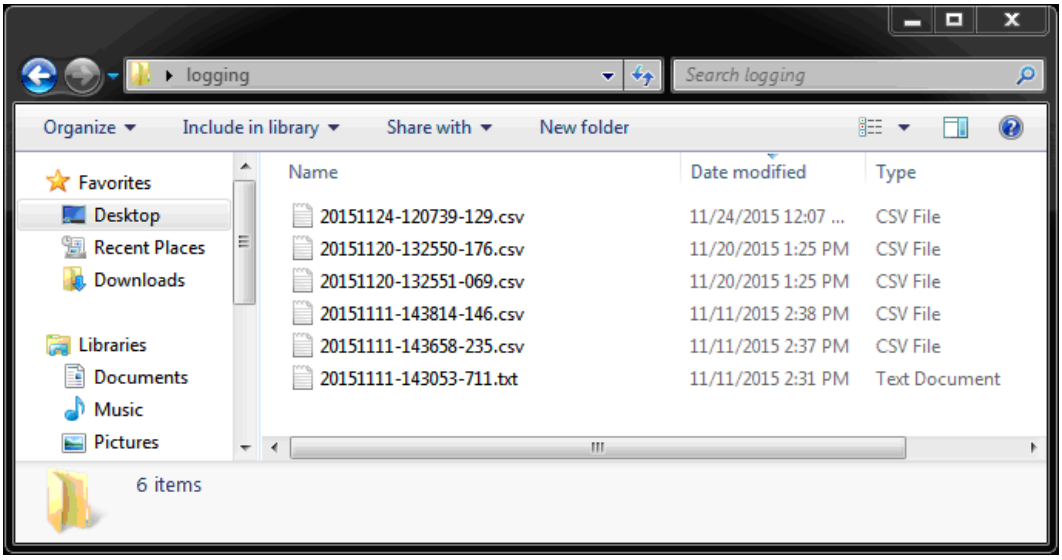

Figure 29: Windows Logging Folder

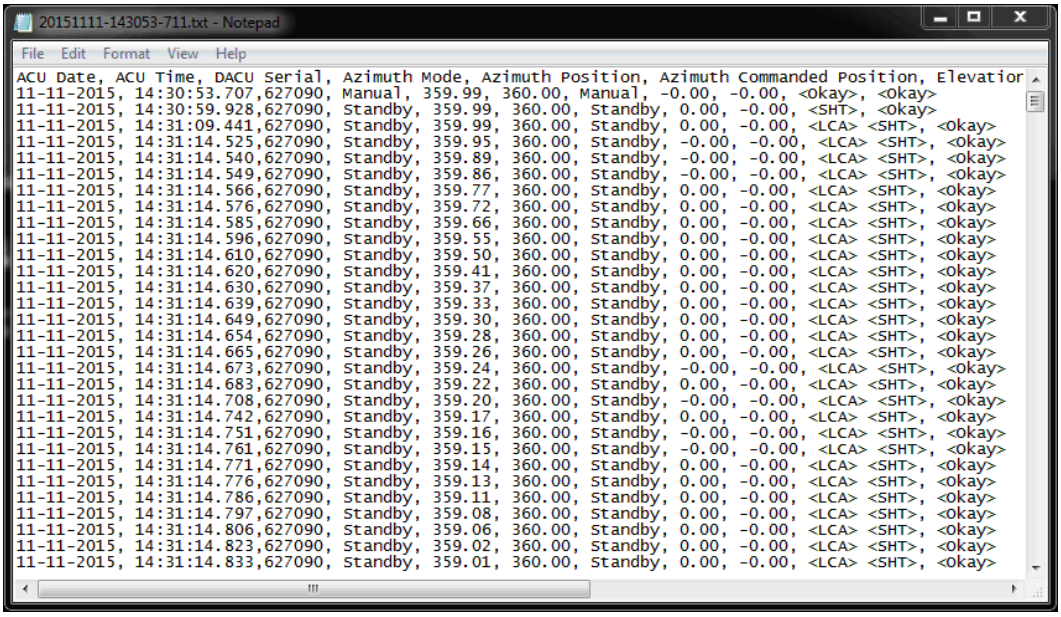

Figure 30: Example of a Logging Text File

When the logger is running, the Logging icon is highlighted in green. To stop the Logger, select or touch it again. To request a list of parameters to be recorded in the log file, select the Tools icon, then the LOGGING button to display the Logging Set Up window. Each parameter to be recorded is selected by choosing the On/Off slider next to the parameter's title. When finished, touch the OK button to save and exit.

There are 16 parameters which can be activated for recording by the log file. The first 14 parameters are ACU front panel operational modes, such as, current axis status or AGC signal levels. The last two parameters are the fault or interlock indicators. The fault/interlock indicators are saved in two banks of possible recorded values. The fault codes for each bank are outlined in Table 1, Table 2, and Table 3.

Table 1: Bank 1, Faults and Interlocks Logger Reporting Codes

Condition	Code	Description
Safe is Active	SFE	Safe switch is in the SAFE position (system in SAFE)
Stow is Active	STW	The stow pin is removed from its receptacle (in stow)
Local Control (Hand-Held) Active	LCA	The Hand-Held controller is attached
Shorting Plug	SHT	The Shorting Plug is removed
DACU Communications Error	DCU	Lost Comm. / link with the ACUs internal DACU PCB
Message Error	MSG	A Software message is erroneous / not received

Table 2: Bank 2, Faults and Interlocks Logger Reporting Codes

Condition	Code	Description
Azimuth Encoder Fault	AEF	AZ position encoder failure or encoder power has failed
Elevation Encoder Fault	EEF	EL position encoder failure or encoder power has failed
AZ Servo Fault	ASF	AZ axis servo amplifier reports and internal fault
EL Servo Fault	ESF	EL axis servo amplifier reports an internal fault
Dehydrator Fault	DYD	Dehydrator has reported a failure

Table 3: Bank 3, Status Bits Logger Reporting Codes

Condition	Code	Description
Auto Stow Pin Inserted	API	Indicates that the stow pin is in place and stowed
Auto Stow Pin Moving	APM	Indicates that the Auto Stow Pin is moving

All of the faults and indicators listed are fatal conditions (with the exception of the dehydrator fault). Each causes the immediate shut down of the servo controller and places the ACU in Standby with servo power in the Off state (SERVO button is red). The dehydrator fault is indicated in the status area, but does not stop the normal system operation.

3.2 Tool Bar - Status

The Status icon, shown in Figure 31, warns the operator when a fault or interlock has occurred by displaying a small, red, indicator containing an embedded number, in the upper right hand corner of the icon (Figure 32). The number identifies the number of faults/interlocks detected. On a remote ACU or device, the Status icon reports the status detected by the Local ACU and then transmits that to the remote device.

Figure 31: ACU Tool Bar, Status

Figure 32: ACU Tool Bar, Status with Fault Indicator of 1

Select the icon to open the Status window, shown in Figure 33. Status uses LEDs to indicate the system faults, interlocks, and operational status. The status faults and indicators are separated into several areas for easy analysis of the system. Typically, a green indicator reports a NO fault condition, while a red indicator reports a fault for the parameter listed. The exception is the Tracking Running LED (under the ACU heading) which oscillates, indicating that the ACU is in communication with the internal A/D PCB (within the ACU chassis). The CLEAR FAULTS button is used to refresh indicators which may be reporting an old status.

Figure 33: Status Window with LED Indicators

Table 4: System Status/Fault Indicators - Elevation

Indicator	LED Color	Description
Servo Enabled	Green Red	EL servo amplifier enabled EL servo amplifier is disabled
Offset Enabled	Green Red	Axis position offset On Axis position offset Off
Soft Down Limit	None Red	Axis is NOT in software Down limit Axis has reached the soft Down limit
Soft Up Limit	None Red	Axis is NOT in software Up limit Axis has reached the soft Up limit
Hard Down Limit	None Red	Axis is NOT in electrical (factory set) Down limit Axis has reached the electrical Down limit
Hard Up Limit	None Red	Axis is NOT in electrical (factory set) Up limit Axis has reached the electrical Up limit
Encoder Fault	None Red	EL position encoder is operating correctly EL position encoder failed or power/connection to encoder is faulty
Servo Fault	None Red	EL servo amplifier is operating correctly EL servo amplifier has indicated an internal fault

Table 5: System Status/Fault Indicators - Azimuth

Indicator	LED Color	Description
Servo Enabled	Green Red	AZ servo amplifier enabled AZ servo amplifier is disabled
Offset Enabled	Green Red	Axis position offset On Axis position offset Off
Soft CCW Limit	None Red	Axis is NOT in software CCW limit Axis has reached the soft CCW limit
Soft CW Limit	None Red	Axis is NOT in software CW limit Axis has reached the soft CW limit
Hard CCW Limit	None Red	Axis is NOT in electrical (factory set) CCW limit Axis has reached the electrical CCW limit
Hard CW Limit	None Red	Axis is NOT in electrical (factory set) CW limit Axis has reached the electrical CW limit

Indicator	LED Color	Description
Encoder Fault	None Red	AZ position encoder is operating correctly AZ position encoder failed or power/connection to encoder is faulty
Servo Fault	None Red	AZ servo amplifier is operating correctly AZ servo amplifier has indicated an internal fault

Table 6: System Status/Fault Indicators - General

Indicator	LED Color	Description
Servo Enabled	Green	Servo power relay is enabled and the axis servos have power applied
Servo Enabled	None	Servo power relay is Off and the axis servos have no power applied
Dehydrator Fault	Red None	Dehydrator has indicated an internal fault No dehydrator is attached or there are no detected dehydrator faults present

Table 7: System Status/Fault Indicators – Stow Safe

Indicator	LED Color	Description
Auto Stow Pin Moving (Optional)	Red None	Automatic stow pin is in motion Automatic stow pin is NOT moving or no available auto stow
Auto Stow Pin Inserted (Optional)	Red None	Automatic stow pin is inserted into the receptacle Automatic stow pin is NOT inserted or no available auto stow
Manual Stow Pin Inserted	None	Not available, no function
Safe Switch Fault	Red None	System is in Safe and ACU is locked out System is NOT in Safe and ACU is in control
Shorting Plug Fault	Red	Shorting plug has been removed from the connector and ACU is locked out
Shorting Plug Fault	None	Shorting Plug is in place
Stow Pin Fault	Red	Stow pin has been removed from its receptacle and ACU is locked out
Stow Pin Fault	None	Stow pin is in place in receptacle and ACU has control

Table 8: System Status/Fault Indicators – Controls

Indicator	LED Color	Description
Hand Wheels	Green	Hand Wheel (USB) connection to Arduino PCB is valid and data is correct
Hand Wheels	Red	Hand Wheel (USB) connection lost or data is not valid
Joystick	Green Red	Joystick is attached via USB and is valid Joystick is NOT attached to USB port or not valid

Table 9: System Status/Fault Indicators – DACU

Indicator	LED Color	Description
DACU Connected	Red Green	DACU has lost Ethernet communication link DACU Ethernet connection is good and active
DACU Status Valid	Red Green	DACU internal status check sum is not valid DACU internal status check sum is correct
DACU Internal Error	Red None	DACU check sum error DACU check sum is valid
DACU Communication Error	Red None	Internal DACU PCB communication error detected Internal DACU communication is valid
DACU Command Message Error	Red None	A specific DACU command message is invalid Command messages are valid
DACU Local Control Fault	Red None	Local hand-held controller attached and is in control No local control present; hand held is not attached

Table 10: System Status/Fault Indicators – ACU

Indicator	LED Color	Description
Connected	Green	Connection to server is present and ready for remote communications
Connected	Red	NO connection to server; a remote connection cannot be established
In Control	Green Red	ACU is in control of pedestal ACU does NOT have control of pedestal

Indicator	LED Color	Description
ADC Present	Green Red	Internal A/D PCB present and detected by the ACU Internal A/D PCB is NOT present in the ACU
TDC Present	Green	Top Dead Center (TDC) signal from feed is present and detected
TDC Present	Red	Top Dead Center (TDC) signal from feed is NOT present
Tracking Running	Blinking Green	Internal A/D PCB is being polled every 20 ms; All A/D functions OK
Tracking Running	Red	Internal A/D PCB is NOT being polled; auto-track function will be disabled

Table 11: System Status/Fault Indicators – Stabilization

Indicator	LED Color	Description
Stability Device Connected	Red	Stability device not detected or Stability device connected but not powered or detected
Stability Device Connected	None	No stability device connected or not used
Stability Device Connected	Green	Stability device connected and detected
Stability Data Valid	Red	No stability data available from connected gyro or data is not valid (optional)
Stability Data Valid	None	Stability data not available or not used
Stability Data Valid	Green	Stability data is present and valid
Stability Device Locked	Red	Stability device (gyro) not communicating and/or not GPS locked (optional)
Stability Device Locked	None	No stability device connected
Stability Device Locked	Green	Stability device connected and valid lock is present
UTC Time Valid	Red	No UTC time input present or detected
UTC Time Valid	None	UTC Time not used
UTC Time Valid	Green	UTC time is present and valid
IMU Clock Valid	Red	IMU clock signal from device is not present or not detected
IMU Clock Valid	None	IMU clock not used
IMU Clock Valid	Green	IMU clock pulse is present and valid

Indicator	LED Color	Description
IMU GPS Course Used	Red	IMU GPS course not valid or data not within range
IMU GPS Course Used	None	IMU GPS course not used
IMU GPS Course Used	Green	IMU GPS course data is available and within range
IMU GPS Heading Used	Red	GPS heading data is not available or out of range Satellites not visible
IMU GPS Heading Used	None	GPS heading data not used or not connected
IMU GPS Heading Used	Green	GPS heading data is available and within range Satellites are visible
IMU GPS Position Used	Red	GPS position not available or out of range Satellites not visible
IMU GPS Position Used	None	GPS position not connected or not used
IMU GPS Position	Green	GPS position is available and is within range
IMU GPS Velocity Used	Red	GPS velocity not available or out of range Satellites not visible
IMU GPS Velocity Used	None	GPS velocity not connected or not used
IMU GPS Velocity Used	Green	GPS velocity is available and within range
IMU GPS Altitude Reliable	Red	GPS altitude not within range Satellites not visible
IMU GPS Altitude Reliable	None	GPS altitude not connected or not used
IMU GPS Altitude Reliable	Green	GPS altitude is valid and within range Satellites are visible
IMU GPS Heading Reliable	Red	GPS heading not within range Satellites not visible
IMU GPS Heading Reliable	None	GPS heading not used or is not connected
IMU GPS Heading Reliable	Green	GPS heading is available and within range Satellites are visible
IMU GPS Position Reliable	Red	GPS position is not within range Satellites not visible

Indicator	LED Color	Description
IMU GPS Position Reliable	None	GPS position not used or is not connected
IMU GPS Position Reliable	Green	GPS position is available and within range Satellites are visible
IMU GPS Velocity Reliable	Red	GPS velocity is not within range Satellites not visible
IMU GPS Velocity Reliable	None	GPS velocity not used or not available
IMU GPS Velocity Reliable	Green	GPS velocity available and is within range Satellites visible

3.3 Tool Bar - Settings

The Settings icon, shown in Figure 34, allows access to the system set up and control parameters which affect the operation of the pedestal, antenna, and other associated systems and attached devices.

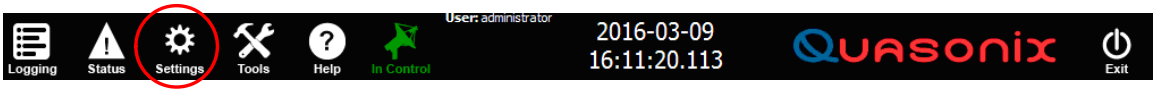

Figure 34: AGC Tool Bar, Settings

Selecting the Settings icon opens the Settings window, as shown in Figure 35, which contains buttons used to access sub-windows in three (3) areas of operator control input:

- This Computer – Set up buttons which affect the current computer that is running and launching this set of control options; Buttons launch dialog windows which affect the Local ACU and local remote devices—they do not control any externally connected computer remotes
- Local ACU – Set up buttons which launch dialog windows that control parameters stored on the local ACU or the ACU that is directly connected to the antenna pedestal/system. Access is available from a remote device or remote ACU for many of the button launched windows, or control dialog boxes. However, all parameter changes initiated from a remote device are SAVED ON THE LOCAL ACU ONLY. In addition, some parameters cannot be changed or modified from a remote device, such as the factory STOW settings.
- Calibration - Set up buttons that launch control dialog windows for certain system calibration functions that can be accessed from both the Local ACU and a remotely connected device or computer, such as a remote ACU

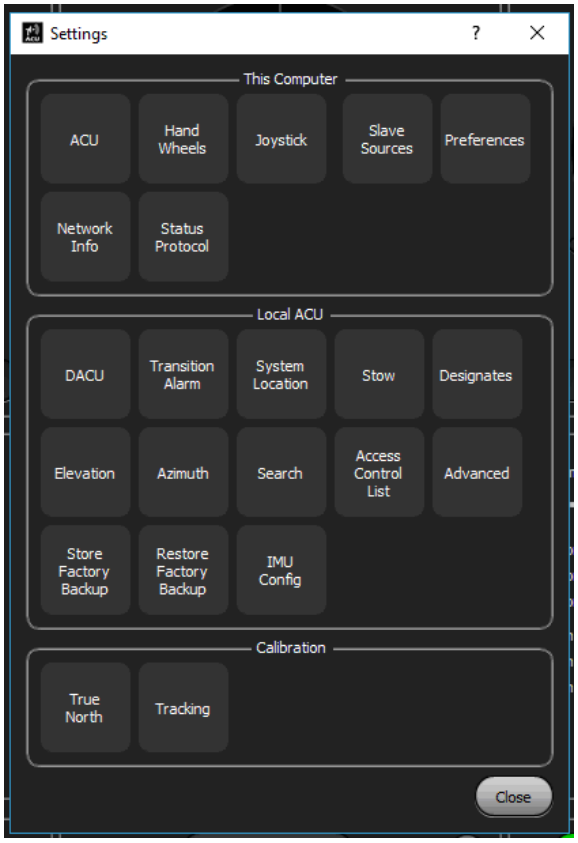

Figure 35: Settings Window

3.3.1 Settings - This Computer Window

The Settings, This Computer sub-window contains seven (7) access buttons: ACU, Hand Wheels, Joystick, Slave Sources, Preferences, Network Info, and Status Protocol, as shown in Figure 36. All parameters entered via this window, apply only to the local device or ACU. They do not affect any remoted ACUs or other devices accessing remotely.

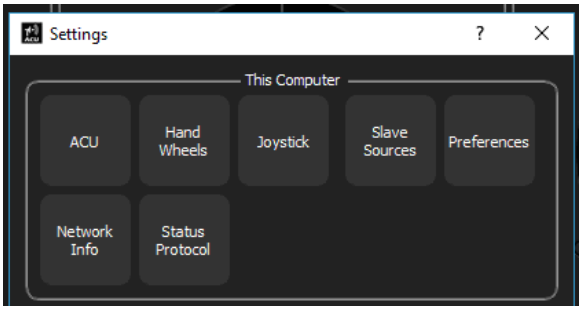

Figure 36: Settings Window, This Computer Sub-window

3.3.1.1 This Computer - ACU Settings

The ACU button opens the ACU Settings communication dialog box, shown in Figure 37. It allows the operator to set the Local ACU IP address, select the port, and give the ACU a unique name. This dialog box is active for the Local ACU and remote devices. In addition, the Fullscreen check box locks the GUI window to the display area. When unchecked, the GUI may be minimized and moved. These parameters only apply to the device/computer launching this dialog box.

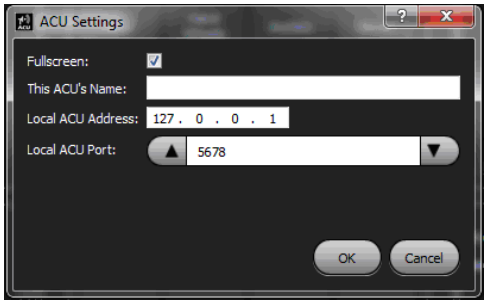

Figure 37: ACU Settings Dialog Box

3.3.1.2 This Computer - Hand Wheels

The HAND WHEELS button opens the Hand Wheel Settings dialog box, as shown in Figure 38, enabling access to the hand wheel control and communication parameters. This includes user definable hand wheel position, rate controls, serial port, and acceleration setting parameters.

The settings allow the operator to select the serial communications port where the AZ and EL hand wheel encoders are connected (in this example, the COM 8 Arduino PCB resolves the hand wheel encoder input). Operators may also set the position and rate feedback control per hand wheel turn, as well as, the acceleration limit for each axis. Though this dialog box is active on the Local and Remote ACUs, a device such as a laptop may not have hand wheels, so the Hand Wheels Enable Box should be unchecked. Most of the fields may be adjusted by using the Up/Down arrows at the beginning and end of each field.

Click on the OK button to save the hand wheel settings. Cancel closes the window without saving.

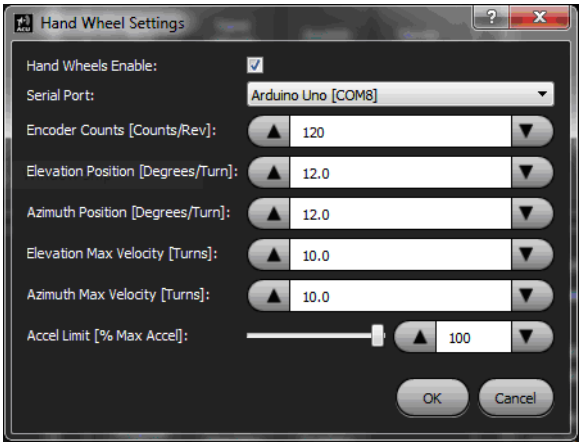

Figure 38: Hand Wheel Settings Dialog Box

3.3.1.3 This Computer - Joystick

The JOYSTICK button opens the Joystick Settings dialog box, as shown in Figure 39. Joysticks may be enabled or disabled by checking the Enable box.

The operator can see the ID or name of the attached Joystick or select a new joystick from the Name field drop down menu. In most cases, Windows recognizes the attached USB joystick, however, if the joystick is not displayed in the drop down menu, it may be necessary to reboot Windows with the joystick attached and/or use the Windows Control Panel to set up the new joystick device.

AZ and EL polarity for the particular joystick that is attached to the ACU may be selected by using the drop down menu for the respective axis. A dead zone area that applies to both axes may be set using the Up/Down arrows to select a percentage deflection.

Click on OK to save the joystick settings.

The joystick should now be available to the Remote device operator. The Axis Control window joystick button(s) should now be available for both axes (AZ and EL) manual control. If the ACU front panel, AZ and EL Input Control, and Joystick Velocity buttons are greyed out, then Windows does not recognize the attached joystick and new drivers may be needed for correct joystick operation.

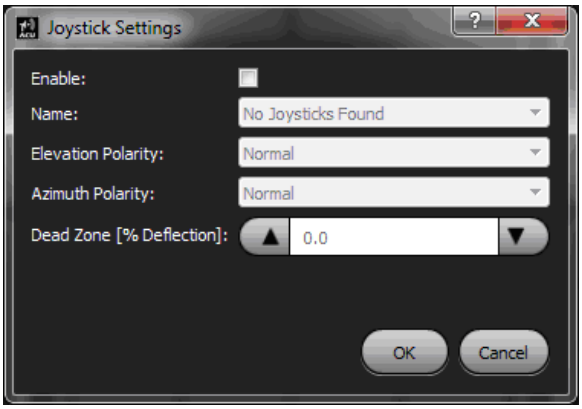

Figure 39: Joystick Settings Dialog Box

3.3.1.4 This Computer – Slaves – For Local ACU Use Only

The SLAVES button opens the Slaves dialog box, shown in Figure 40, when connected to a local ACU. This menu is not available to a remoted ACU or other device running the remote ACU software. Slaving files can only be configured at the local ACU (the ACU directly connected to the tracking system).

The operator can view the listed slave devices, both internal and external, and their individual parameters. ADD, EDIT, and DELETE buttons enable these activities for any internal and external slave devices.

- Add – Opens the Add Slave dialog box where a new slave file may be created (with its associated parameters) and saved (additional details follow)
- Edit – Provides the ability to change the location of a slave file/folder and rename it; the file to be edited must be highlighted in blue by touching/clicking on the file name before the Edit button is activated

- Delete – Deletes an existing slave file with its associated parameters; touching/clicking on a listed slave file highlights the field in blue
- Apply – When used with the Delete function, Apply causes the highlighted slave file to be completely and immediately removed. When used with the Edit function, Apply causes the highlighted, edited slave file to be saved.
- Close – When used with the Delete or Edit function, Close cancels the operation—the window closes without saving any changes.

3.3.1.4.1 Add Slaves

Figure 40 shows a Slaves dialog box with two (internal) burn files listed. Selecting the Add button allows the operator to set up the parameters for a new internal or external slave file/device and save it to the ACU database. The ACU can currently accept slave data from an external Ethernet or Serial attached source, through the ACU's back panel Ethernet or Serial (RS-232 or RS-422) ports.

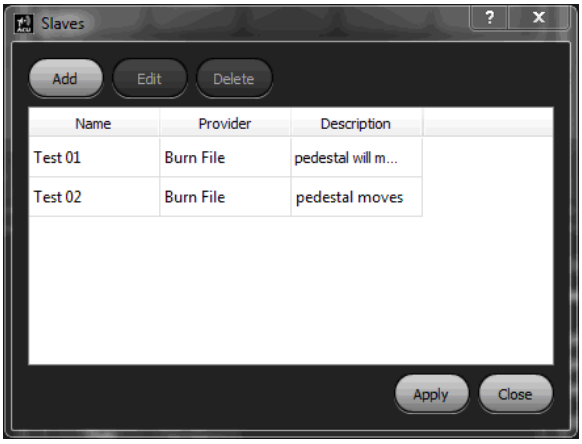

Figure 40: Slaves Dialog Box, Local ACUs Only

The Add Slave dialog box, shown in Figure 41, displays when the Add button is selected. When a new slave file is set up, the file parameters of Name, Description, and Provider (Burn File, Serial, or Ethernet) are entered in the Add Slave fields within the menu.

When Burn File is selected via the drop down menu in the Provider field, the Burn File Settings sub-window displays. The burn file is an internal text file stored in the Burn File Folder on the ACU's hard drive. The burn file contains AZ and EL axis, pre-programmed positions, in text format. The BROWSE button in the Burn File Settings window in the Add Slave dialog box is used to display or search for the stored location of the burn file in the Windows file system. Generally the location is: **C: > Users > ACU > Desktop > Burn Files (folder) > Burn File.txt**

The Up/Down arrows in the Start Delay field are used to add a delay (in seconds) to the start of any burn file. This delay time is saved to the selected burn file when the APPLY button is touched to exit the window.

The burn files stored on the ACU, as well as external slaves, are launched by selecting the ACU front panel GUI manual SLAVE buttons, then the associated Gear icon.

The drop down menu in the Slave Settings window contains all of the saved slave files (including burn files). The desired burn file can be chosen, by the user, from the drop down menu and started by selecting the START button in the same window. When started and running, the burn file's AZ and EL positions (angles) are running in the axis,

digital, slave angle display meter. Refer to section 2.4.3 for additional information about SLAVE button control of the saved slave files (burn files and other slave input protocols).

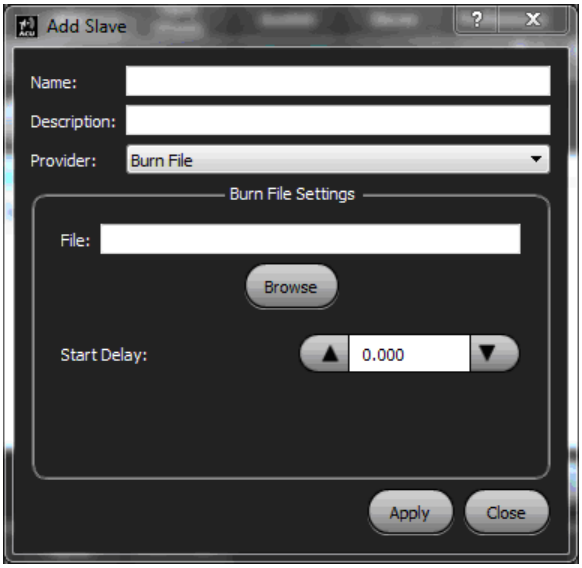

Figure 41: Add Slave, Burn File Settings Dialog Box

Slaving functions are NOT available to the remote ACU or any remoted devices running the ACU remote software. The SLAVE button, in the Settings window, is not present in the remote software. At the Local ACU, all slaving parameters are available to all operators and there is NO login required to access the slave menus and their parameters.

When Serial is selected via the drop down menu in the Provider field, the Serial Settings sub-window displays, as shown in Figure 42. The serial port slave parameters are selected (via the drop down menus in each field) and saved here. The available back panel communications port is selected (COM 1- 7) along with the parameters that apply to the selected COM port. Touch or click on the OK button to save the serial settings.

These operations are NOT AVAILABLE to a remote user.

Figure 42: Add Slave Serial Settings Dialog Box

When Ethernet is selected via the drop down menu in the Provider field, the Ethernet Settings sub-window displays, as shown in Figure 43. Ethernet configurations are set by typing the desired IP Address and using the Up/Down arrows to select the Port. Touch or click on the OK button to save the Ethernet settings and exit.

This operation is NOT AVAILABLE to a remote user.

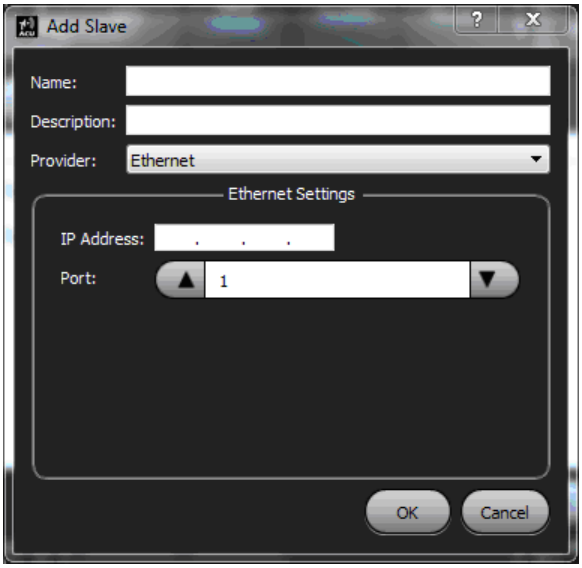

Figure 43: Add Slave Ethernet Settings Dialog Box

3.3.1.4.2 Edit Slave

The Settings > Slave > Edit Slave dialog box, shown in Figure 44, provides the ability to edit the slave settings for a highlighted slave file. In this example, the selected file is a burn file (provider of the slave data), where the operator can name, describe the function of the file, show its saved location, and add a start delay (time delay before the file starts).

After making desired changes, touch or click on the APPLY button. The changes are implemented immediately. To exit without saving changes, touch or click on the CLOSE button.

These operations are NOT AVAILABLE to a remote user.

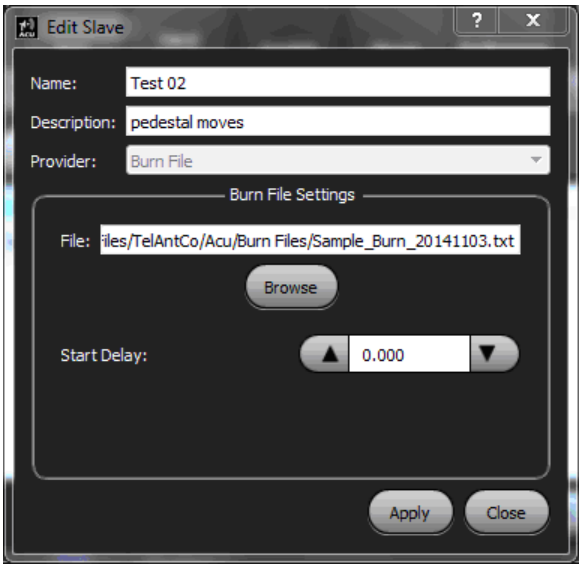

Figure 44: Edit Slave Dialog Box

3.3.1.4.3 Delete Slave

The Settings > Slave Sources dialog box, shown in Figure 45, provides the ability to delete a selected slave file. In this example, the selected file is a burn file (provider of the slave data) named Burn01.

Touch or click on the Delete button. The file is removed from the Slave Sources window immediately. Select the Save button to save the change. To exit without saving changes, touch or click on the CLOSE button.

These operations are NOT AVAILABLE to a remote user.

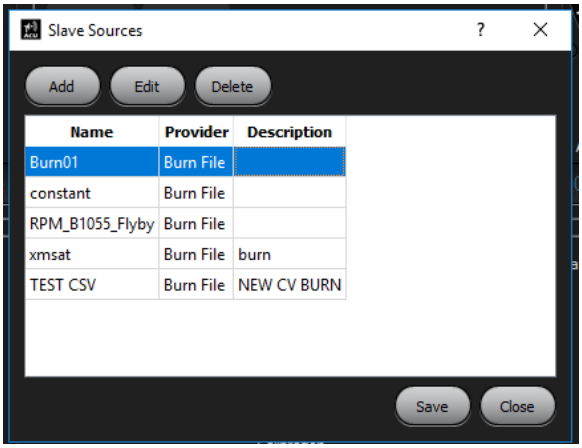

Figure 45: Slave Sources Dialog Box

3.3.1.5 This Computer - Preferences

The PREFERENCES button opens the Preferences dialog box, as shown in Figure 46, where various front panel GUI color themes are stored for user recall. Touch or click on the APPLY button to save preference changes.

The Fullscreen check box enables the ACU GUI to display on a full monitor screen. When enabled, the ACU GUI is locked to the screen. The display cannot be resized, dragged, or the size changed in any way while in full screen mode.

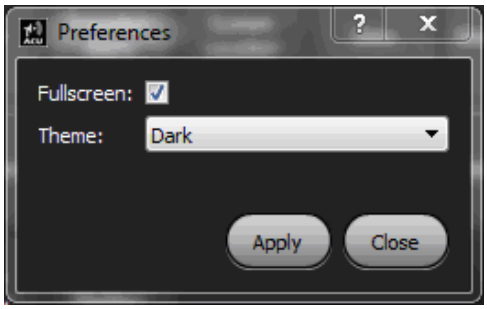

Figure 46: Preferences Dialog Box

3.3.1.6 This Computer - Network Info

The NETWORK INFO button opens the Network Info window, as shown in Figure 47. Network Interfaces—external network identifiers and IP addresses—the ACU is connected to display here.

This example shows the back panel Ethernet connection to the ACU (as Local Area 2) with the associated IP address of 10.100.42.219.

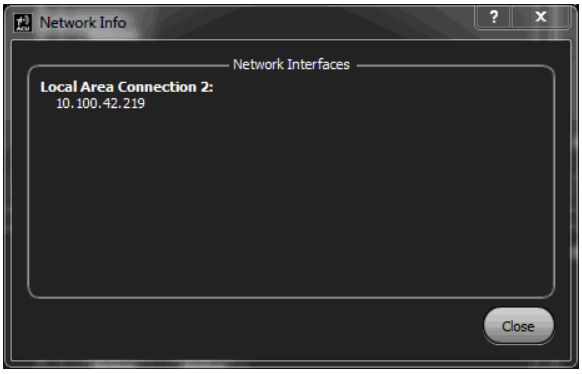

Figure 47: Network Info Window

3.3.2 This Computer – Status Protocol

The STATUS PROTOCOL button opens the Status Protocol window, as shown in Figure 48. Automatic status messaging may be enabled or disabled by checking the Enable Automatic Status Messages box. Outgoing status message parameters are also set up in this window.

The Destination Address is the direct IP address, broadcast address, or the multicast group address receiving the status message. Type the desired IP address into this field.

A Destination Port and Message Rate (in milliseconds) may be set by using the Up/Down arrows next to each field.

Other fields may not be changed by the user.

Touch or click on the Apply button to save the Automatic Status settings and exit, or click on the Close button to exit without making any changes.

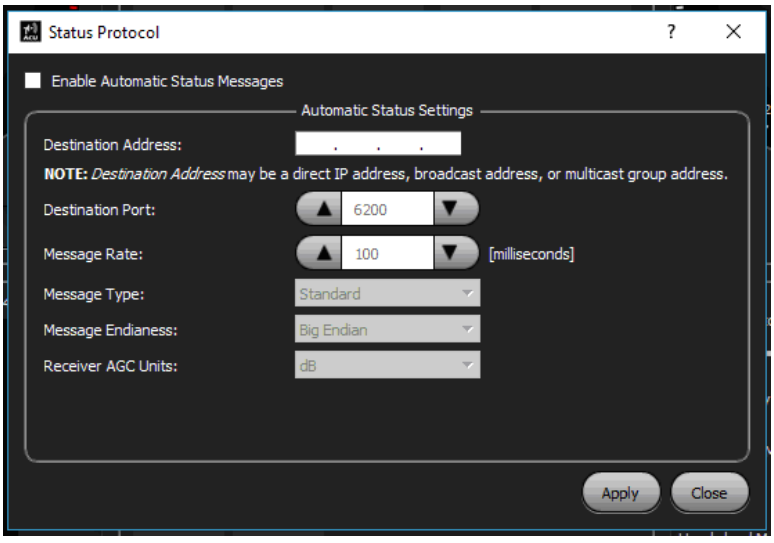

Figure 48: Status Protocol Window

3.3.3 Settings - Local ACU Window

The Settings, Local ACU sub-window contains thirteen access buttons: DACU, Transition Alarm, System Location, Stow, Designates, Elevation, Azimuth, Search, Access Control List, Advanced, Store Factory Backup, Restore Factory Backup, and IMU Config, as shown in Figure 49.

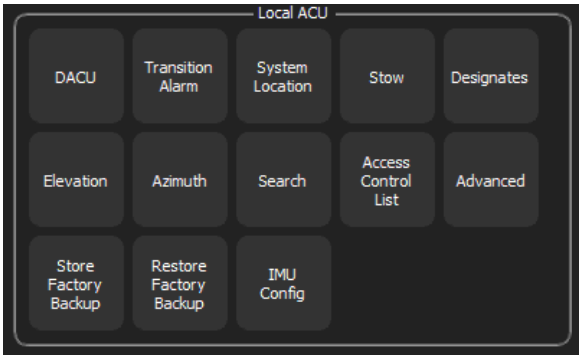

Figure 49: Settings Window, Local ACU Sub-window

3.3.3.1 Local ACU - DACU

The DACU (Digital Antenna Control Unit) button opens the DACU Settings dialog box, shown in Figure 50. Available communication ports, the UDP ports, and the network IP address of the internal DACU PCB are specified here.

Digital control includes the serial port (COM 8), where the internal CPU communicates with an Arduino PCB (through a USB connection), as well as the IP address of the internal DACU PCB (192.168.200.67). This resolves the AZ and EL hand wheel encoders providing hand wheel control of the pedestal.

The ACU's CPU card (single board computer) and the internal DACU IF PCB communicate via Ethernet and the parameters saved using this dialog box affect this communication. Other serial ports (COM) and the UDP ports are listed and selected from the dialog box drop down menu and Up/Down arrows.

Note: The DACU Settings box requires permission and a log in to make changes to the saved parameter settings.

To request permission:

1. Select the Tools icon from the ACU Tool bar.
2. In the Authentication window, select the LOGIN button.
3. Type the Username and Password.

   The DACU Settings dialog box can then be re-launched with the permission removed and all entry fields available for user access and modification.

Access to this dialog window is available to both the Local ACU and remoted devices and changes can be made from either, after the proper log in authentication is established. All changes to parameters affected by this dialog box are **saved on the Local ACU only**.

The DACU handles all of the real time transmission of information between the pedestal and the Local ACU. Changing these settings may stop the AZ and EL hand wheel operations of the ACU and may cut off communication with the external antenna pedestal system.

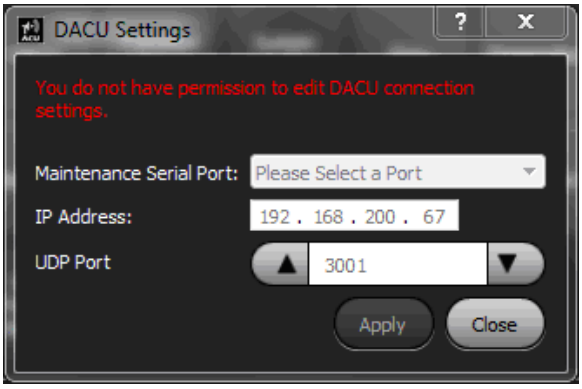

Figure 50: DACU Settings Dialog Box

Changing the DACU IP address and UDP port settings may stop communication between the ACU's CPU and the internal DACU PCB which will lead to a loss of feedback and control of the antenna pedestal system. After a proper login is achieved, these critical settings can be changed from a remote device!

3.3.3.2 Local ACU - Transition Alarm

The TRANSITION ALARM button opens the Alarm Settings dialog box, shown in Figure 51. It sets the duration of the Imminent System Motion Warning alarm from 1 to 65 seconds via the Up/Down arrows in the Duration field and allows the operator to enable or disable the alarm completely by checking/unchecking the Enable box.

Alarm Settings can be accessed from a remote or local ACU and no permissions are required. All settings are saved on the Local ACU.

In this example, the Imminent System Motion Warning Alarm is set for a one (1) second alarm duration.

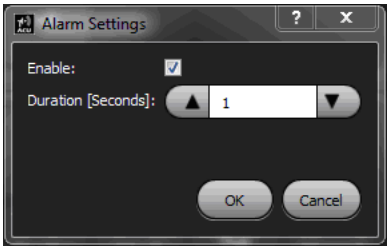

Figure 51: Alarm Settings Dialog Box

3.3.3.3 Local ACU - System Location

The SYSTEM LOCATION button opens the System Location dialog box, shown in Figure 52. The physical location on Earth (Latitude, Longitude, and Altitude) of the antenna pedestal system is entered and saved in this box, NOT the location of the Local ACU or any remoted ACUs or remote control devices, which may be at a location apart from the antenna pedestal system.

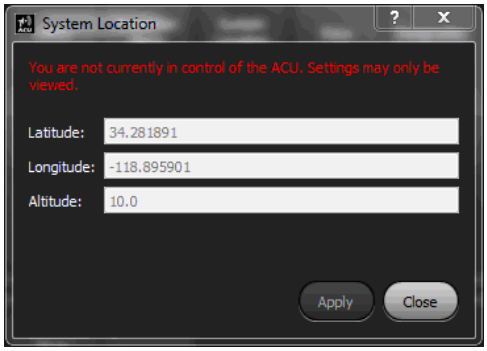

Figure 52: System Location Dialog Box

Note: The System Location box requires permission and a log in to make changes to the saved parameter settings. To access this dialog, you must be logged in as system administrator.

To request permission:

1. Select the Tools icon from the ACU Tool bar.
2. In the Authentication window, select the LOGIN button.
3. Type the Username and Password.

When permission is granted, the System Location dialog box can then be re-launched. Any Local or Remote user can modify and save (Apply) the parameters if they are logged in as system administrator.

3.3.3.4 Local ACU - Stow

The STOW button opens the Stow Position dialog box, shown in Figure 53. Authorized operators may set the stow position of the antenna pedestal system based on the raw angle positions from each axis encoder.

The AZ and EL axes are aligned to where the Stow Pin can easily be inserted (by hand) through the yoke arm into the stow receptacle. The user selects the SET STOW Button to record this AZ and EL position and APPLY to save it as the permanent system stow location in the Local ACU database.

The Stow Position dialog box shown in Figure 53, illustrates a stow position of EL (0.0°) and AZ (9.98°). These are the raw (unmodified) angles resolved directly from each axis encoder. The antenna may actually be located at 0° AZ and 90° EL due to AZ and EL offsets being enabled.

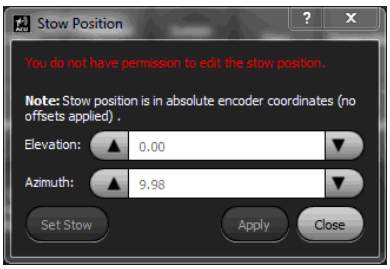

Figure 53: Stow Position Dialog Box

When Stow is selected from the Designates window (refer to section 2.4.2) the ACU drives the system to this recorded stow position. The system stow location, set by this dialog box, is not affected by AZ or EL system offsets, such as the True North settings or other offsets.

The stow pin alignments are typically factory set and saved and should not be changed. A Remote ACU can view the settings but cannot access the dialog box to modify them. Because the Stow Pin insertion position is critical to the safe operation of the antenna pedestal system and requires physical alignment by hand at the pedestal, it can only be modified from the Local ACU with log in permission.

The Stow Pin insertion position is critical to the proper operation of the Antenna Pedestal System. The Stow Position box is only available to a recognized user (with proper login) at the Local ACU and is NOT available to remote users, devices, or ACUs. Changing this setting can result in damage to a system that employs an AUTOSTOW unit.

Note: The Stow Position box requires permission and a log in to make changes to the saved parameter settings. To access this dialog, you must be logged in as system administrator.

To request permission:

1. Select the Tools icon from the ACU Tool bar.
2. In the Authentication window, select the LOGIN button.
3. Type the Username and Password.

When permission is granted, the Stow Position dialog box can then be re-launched. All entry fields available for the Local ACU user (only) access and change. This dialog box is not available to Remote user(s) who may only view the settings.

3.3.3.4.1 Special Case – Stowing a Stabilized System

If the tracking system is supplied with the Hemisphere/SPG IMU stabilization option, the system cannot be designated to the stow position with Stabilization active. Before selecting the stow position from the Designates menu, Stabilization must be turned Off. If Stow is selected with stabilization On, an error message displays on the screen, as shown in Figure 54.

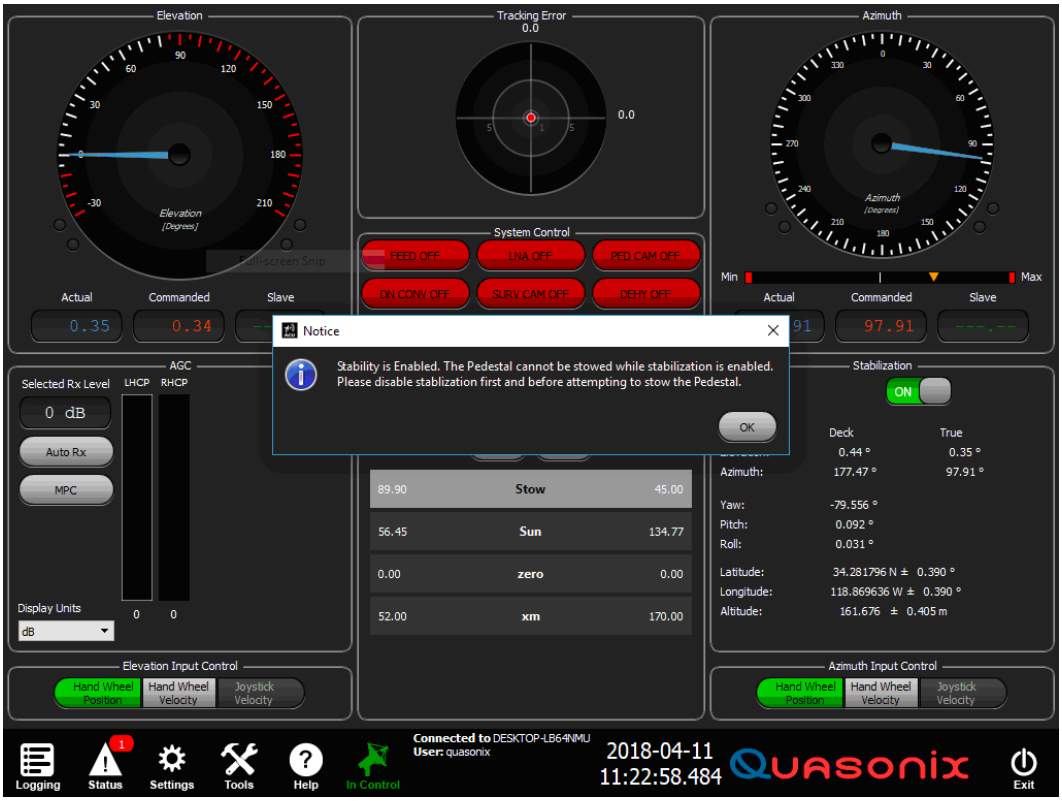

Figure 54: Stow Stabilization Warning

3.3.3.5 Local ACU - Designates

The DESIGNATES button opens the Designates dialog box, shown in Figure 55. Authorized operators may name and save multiple, user defined, designated locations in three possible formats, Azimuth/Elevation, GPS, and XYZ. The Designates dialog box is available to the Local ACU and all remoted devices. However, any new pointing or Edited pointing locations set up by a Remote ACU are saved to the Local ACU.

The saved antenna pointing positions are recalled by selecting the DESIGNATE button located on the ACU front panel Axis Control window. Selecting this button opens the Immediate Designate window showing the saved Designates pointing locations. Highlighting a saved designate and selecting the GO button slews the antenna to the saved pointing location.

The Designates dialog box shown in Figure 55 has four (4) entries in place. The first line shows an antenna pointing location for the West Runway at 37.55° AZ and 4.53° EL.

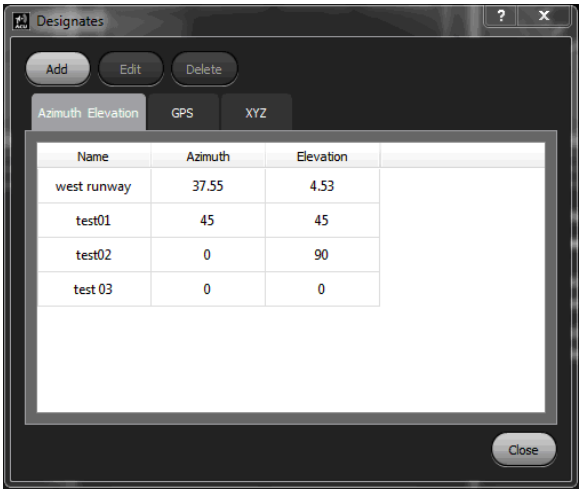

Figure 55: Designates Dialog Box

3.3.3.5.1 Designate Tabs

As previously mentioned, authorized operators may name and save multiple, user defined, designated locations in three possible formats, Azimuth/Elevation, GPS, and XYZ.

- Azimuth Elevation Format – The designated location is saved by a name, which is linked to an Azimuth axis pointing position in degrees and an Elevation axis pointing position in degrees (such as, West Runway 37.55° AZ 4.53° EL). When the Intermediate Designates window is opened (refer to section 2.4.2), via the front panel of the ACU, the antenna pointing position for the West Runway is shown. By highlighting the West Runway heading and selecting the GO button, the antenna will be aimed to the saved AZ and EL coordinates (37.55° AZ and 4.53° EL).
- GPS Format – Designated locations are defined by the location name and the GPS coordinates of latitude, longitude, and height above sea level (in meters).
- XYZ Format - Locations are defined by location name and XYZ position coordinates in degrees.

The operator can view the listed designates and their individual parameters. ADD, EDIT, and DELETE buttons enable these activities.

- Add – Opens the Add dialog box where a new designated location (antenna pointing positions) may be created (with its associated parameters) and saved (additional details follow)
- Edit – Provides the ability to change a Designate line; the file to be edited must be highlighted in blue by touching/clicking on the file name before the Edit button is activated
- Delete – Deletes an existing Designate line with its associated parameters; touching/clicking on a listed slave file highlights the field in blue before the Delete button is activated
- Apply – When used with the Delete function, Apply causes the highlighted Designate line to be completely and immediately removed. When used with the Edit function, Apply causes the highlighted, edited Designate line to be saved.
- Close – When used with the Delete or Edit function, Close cancels the operation—the window closes without saving any changes.

The user attempting to add, edit, or delete antenna pointing locations with the Designates dialog box must be in control of the Local ACU or the Remote ACU device that is currently controlling the antenna pedestal system. The “IN Control” (Antenna) icon located on the ACU GUI Tool bar must be green and indicate that the ACU is currently

in control of the antenna pedestal system. If the Antenna icon is red, you cannot access the Designates control buttons until control is requested and approved, which will change the Antenna icon to “In Control” (green). This is true for most dialog boxes where system parameters are added or updated.

The Designates dialog box displaying the “Not in Control” warning message is shown in Figure 56. This prevents changes to any saved pointing location, including updating or deleting the location.

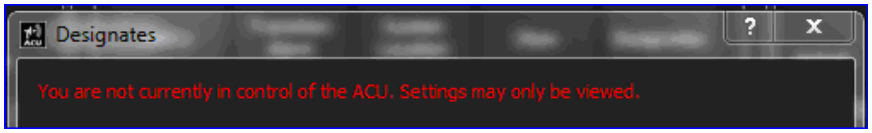

Figure 56: Designates Dialog Box with Not in Control of ACU Message

3.3.3.5.2 Add Designates

Selecting the ADD button, as shown in Figure 57, allows the operator to name an antenna pointing location and the Azimuth and Elevation pointing angles for that location.

Use the down arrow in the Type field to access and select the type of pointing parameter—AZEL, GPS, or XY. The Up/Down arrows in the Azimuth and Elevation fields are used to select the desired pointing angles in degrees.

This dialog box is available to the Local ACU and all remoted devices, however, all saved pointing positions are saved to the Local ACU and stored in the Local database.

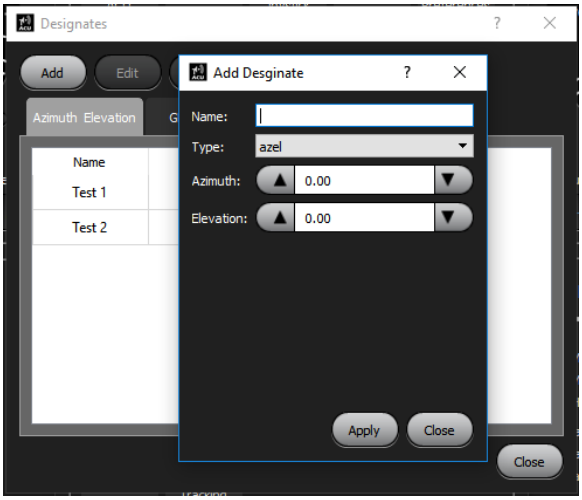

Figure 57: Designates with Add Designate Box

3.3.3.5.3 Edit Designates

The EDIT button launches a dialog window similar to Add to enable edits of any saved antenna pointing locations.

3.3.3.6 Local ACU - Elevation

The ELEVATION button opens the Elevation Settings dialog box, shown in Figure 58. It is used to set the Up and Down Elevation software limits, axis velocity, acceleration, and offsets which directly affect the Elevation axis operation for the pedestal.

This dialog box is available to the Local ACU and any Remote ACU devices. To change parameter settings in this dialog box, the ACU must be "In Control" of the Antenna Pedestal System. If the ACU is not in control, the settings can only be viewed until control is established. Any changes made by a Remote device or ACU is saved on the Local ACU.

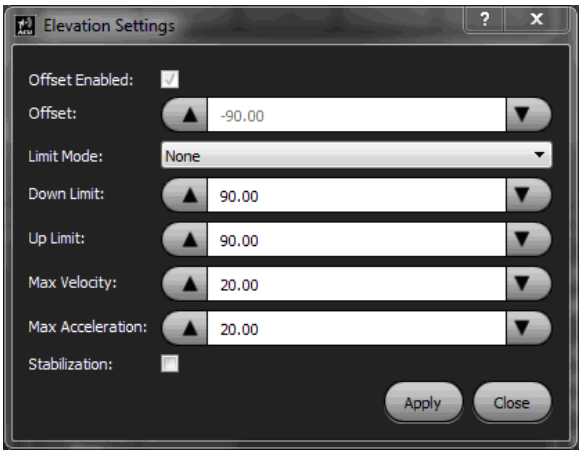

Figure 58: Elevation Settings Dialog Box

The present Elevation offset(s) is displayed in the Offset field (-90.0° offset in this example). The Offset Enabled check box indicates whether the present EL offset is enabled or disabled.

Limit Mode is enabled via the drop down arrow in the Limit Mode field. The limits indicated are the Elevation soft limits and are usually set in front of the electrical/hard limits. The soft limits, when activated by the Elevation axis motion, are displayed by a yellow LED, located on each side of the Elevation position analog dial.

The maximum available axis velocity and maximum acceleration are set via the Up/Down arrows in the associated fields.

The Stabilization check box is used to enable/disable stabilization of the Elevation axis. For stabilization to work, the pedestal must have a gyro or similar device installed.

The APPLY button saves parameter changes and the CLOSE button exits the dialog box without saving.

3.3.3.7 Local ACU - Azimuth

The AZIMUTH button opens the Azimuth Settings dialog box, shown in Figure 59. It controls the basic parameters for Azimuth axis system motion and control. The Clockwise (CW) and Counterclockwise (CCW) software limits are set and enabled within this dialog box.

This dialog box is available to the Local ACU and any Remote ACU devices. To change parameter settings in this dialog box, the ACU must be "In Control" of the Antenna Pedestal System. If the ACU is not in control, the settings can only be viewed until control is established. Any changes made by a Remote device or ACU is saved on the Local ACU.

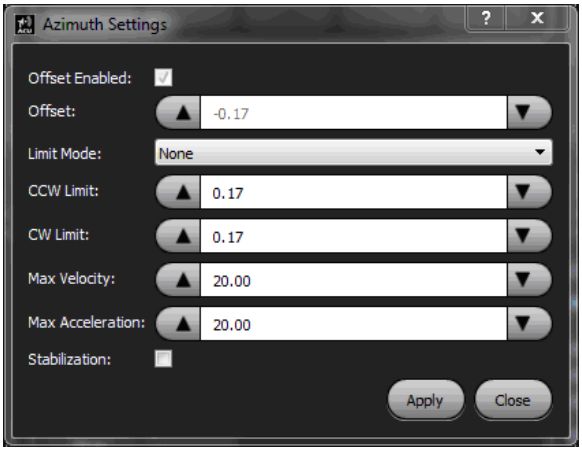

Figure 59: Azimuth Settings Dialog Box

The present Azimuth offset(s) is displayed in the Offset field (-0.17° offset in this example). The Offset Enabled check box indicates whether the present AZ offset is enabled or disabled.

Limit Mode is enabled via the drop down arrow in the Limit Mode field. It is used to display and enable the AZ limits or to turn them off completely.

The Counterclockwise (CCW) and Clockwise (CW) software limits are set via the Up/Down arrows in the associated fields.

The maximum available axis velocity and maximum acceleration are set via the Up/Down arrows in the associated fields.

The Stabilization check box is used to enable/disable stabilization of the Elevation axis. For stabilization to work, the pedestal must have a gyro or similar device installed.

The APPLY button saves parameter changes and the CLOSE button exits the dialog box without saving.

3.3.3.8 Local ACU - Search

The SEARCH button opens the Search Default dialog box, shown in Figure 60. It is used to set-up the two axis search parameters used by the Box Spiral and Raster pre-programmed two axis search patterns. These patterns are automatically activated when both the AZ and EL search buttons are selected together from the ACU front panel manual control box area. The Search Defaults dialog box controls the Range (width of search from a center point), the Rate (speed in degrees per second), and the number of steps for each axis to take when searching in the Box Spiral or Raster pattern.

Select the Box Spiral or Raster tab, then use the Up/Down arrows to change values in specific fields.

After the desired parameters are entered, select the APPLY button to save the settings. The CLOSE button exits the dialog box without saving.

This dialog box is available to both the Local ACU and any Remote ACU devices. To change parameter settings in this dialog box, the ACU must be “In Control” of the Antenna Pedestal System (Antenna icon on the Tool bar must be green). If the ACU is not in control, the settings can only be viewed until control is established. Any changes made by a Remote device or Remote ACU is saved on the Local ACU

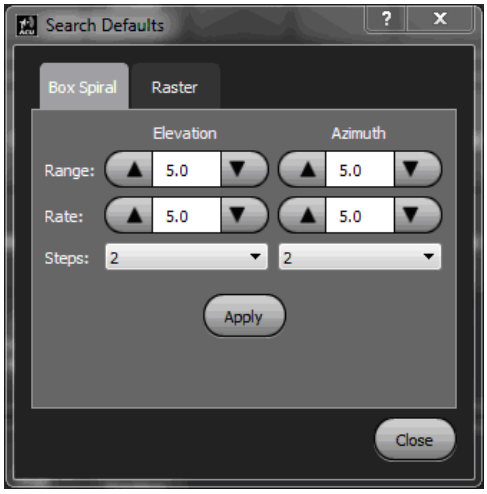

Figure 60: Search Defaults Dialog Box

3.3.3.9 Local ACU - Access Control List

The ACCESS CONTROL LIST button opens the Remote Access Control dialog box, shown in Figure 61. The Access Control List is a database of Remote users who have been granted access to (remotely) control the antenna pedestal system (through a remote device connected to the Local ACU via Ethernet). The Access Control List is usually maintained by the system administrator who must log in to change or update the list.

Generally, the Remote Access Control dialog box gives the system administrator control over who has access to the antenna pedestal system by setting up the access list control parameters. The parameters consist of a unique Name (for the remote user), the public IP address of the remote user, the type of permission granted (view and/or control), the assigned priority of the remote user (on a scale of 0 - 5), where a higher priority remote user automatically supersedes a lower priority user when asking for control of the antenna pedestal system, and whether the remote user is active or not (yes or no). All parameter changes are saved to the Local ACU.

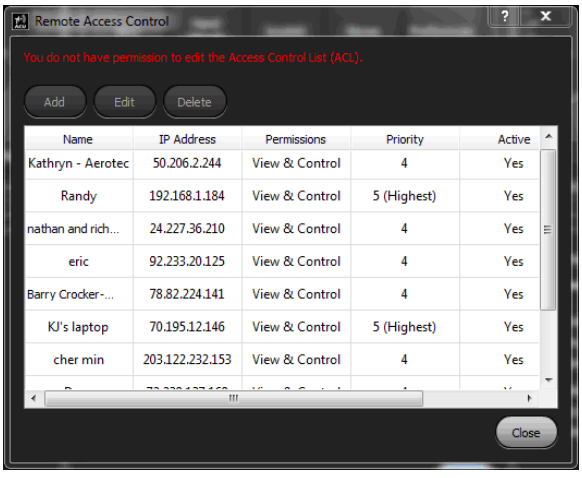

Figure 61: System Location Dialog Box

Note: The Remote Access Control box requires permission and a log in to make changes to the saved parameter settings. Generally, you must be the antenna pedestal administrator to access this dialog. It is available to remote user(s) with the proper log in credentials.

To request permission:

1. Select the Tools icon from the ACU Tool bar.
2. In the Authentication window, select the LOGIN button.
3. Type the Username and Password.

When permission is granted, the Remote Access Control dialog box can then be re-launched.

3.3.3.9.1 Overview of Access Control List (ASL) Priority Control System

The main components of the Access Control List (ASL) priority control system are:

- **Master ACU (Local) -** The Local ACU, when in control, has the highest priority. A user currently operating the antenna pedestal system from the Local ACU cannot automatically be removed from control of the antenna pedestal

  A remote user can request control from the Local ACU operator. A message pops up on the Local ACU screen notifying the administrator of the request. The Local operator has 30 seconds to allow or deny the request. If no response to the request is given by the Local ACU operator within the 30 second time frame, the remote takes control in order of priority access number, (only if multiple remote requests occur at the Local ACU the same time).

- **Priority Number -** The priority number system is a used to maintain orderly remote access to the antenna pedestal system. Each remote operator is assigned a priority number from 5 to 0 by the system administrator in the order of first use or priority access, with 5 being the highest priority access.

  Access to the antenna pedestal system is granted by the magnitude of the priority number, for example, an assigned priority number of 5 always achieves automatic access before any lower priority number. A remote user with a priority access number of 0 always loses control of the antenna pedestal system to a larger assigned priority number remote user. Also, the lower priority remote user immediately loses control of the antenna pedestal system without notification.

  If two remote users have the same priority access number (both are assigned access numbers of 3 for example) and one is currently in control, if the other remote user asks for control, since both are assigned the same priority, a message displays on the remote device screen of the user in control, asking for control. The user in control has 30 seconds to approve or deny the other remote user's request. After 30 seconds with no response from the remote in control, the requesting remote gains control.

- **Permissions -** The two permissions available are View (only) and View and Control.

  The remote assigned to View (only) can only look at the Local ACU's screen activity and is not allowed control of the antenna pedestal system.

  The View and Control assigned remotes, are given view and control of the antenna pedestal system when requested (depending on priority number).

- **Active -** The Active setting or heading allows the system administrator to assign a Remote ACU or device an inactive status with an Active setting of NO. The remote user access parameters are still saved in the access control list (ACL), but the remote in question, is not allowed access to the antenna pedestal system at all. Deleting a remote user from the list has the same effect, but the remote's parameters are lost.

- **Name and IP** - The system administrator assigns a unique name to each remote listed in the ACL and link the remote's IP address to the name the ACL. This process provides security by allowing only approved remote devices assigned by the administrator access to the antenna pedestal system.

The Remote Access Control dialog box with the ADD button selected is shown in Figure 62. The Add ACL Entry box is also displayed. A new remote device user or ACU is defined and added to the Access Control List here. Editing a current remote is similar.

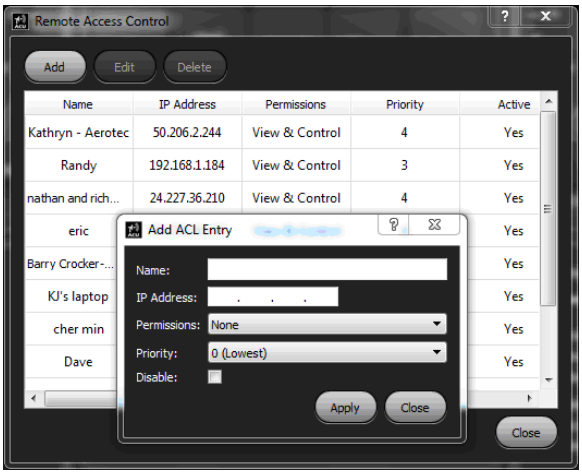

Figure 62: Remote Access Control Dialog Box with Add ACL Entry Box

3.3.3.10 Local ACU - Advanced

The ADVANCED button opens the Advanced dialog box, shown in Figure 63, which gives the system administrator access to pedestal performance controls and settings, plus control over any installed compass device, and the Azimuth cable wrap limits and indicator. Additional tabs provide access to Relays, Feed Buttons, Features, and Feed controls. The following sections explain the Advanced menu control tab parameters in detail.

The Advanced Window contains parameters which set and control various system wide functions, such as feed control, axis MAX velocities, and MAX accelerations. These parameters are factory pre-set, and may render the tracking system unusable if removed or modified.
The highest level login is required for access.

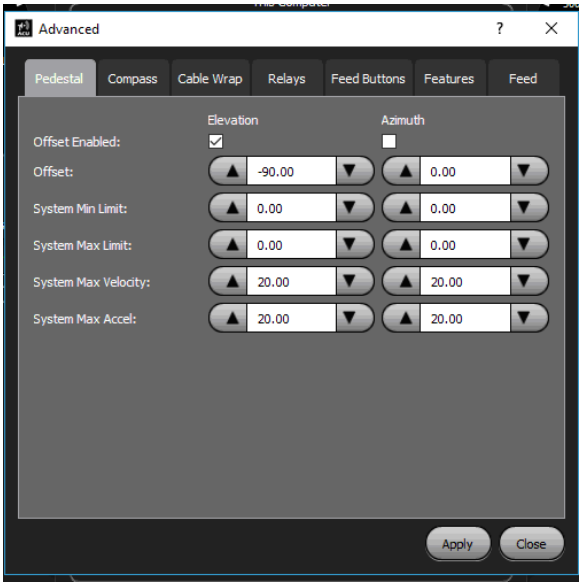

Figure 63: Advanced Dialog Box

Note: The Advanced dialog box requires permission and a log in to make changes to the saved parameter settings. Generally, you must be the antenna pedestal administrator to access this dialog. It is available to remote user(s) with the proper log in credentials. All parameter changes are saved to the Local ACU.

To request permission:

1. Select the Tools icon from the ACU Tool bar.
2. In the Authentication window, select the LOGIN button.
3. Type the Username and Password.

   When permission is granted, the Advanced dialog box can then be re-launched.

3.3.3.10.1 Pedestal Tab

Selecting the Pedestal tab causes the pedestal related parameters to display. The advanced pedestal settings control the system minimum and maximum AZ and EL axis limits, system maximum axis velocity, and maximum axis acceleration available to the pedestal operator. The parameters selected by use of the Up/Down arrows in the associated field and are factory set (default settings). They are normally not to be exceeded by the user. The Advanced dialog box, also displays the Azimuth and Elevation currently applied angle offsets to the system and indicates whether the offsets are enabled or disabled by checking or unchecking the Offset Enabled check box associated with each parameter.

The APPLY button saves any changes, and the CLOSE button exits the dialog box without saving.

The Advanced dialog box with the Pedestal tab selected is shown in Figure 64. It displays the current default pedestal minimum and maximum parameters. These parameters are typically set at the factory to protect the system operation.

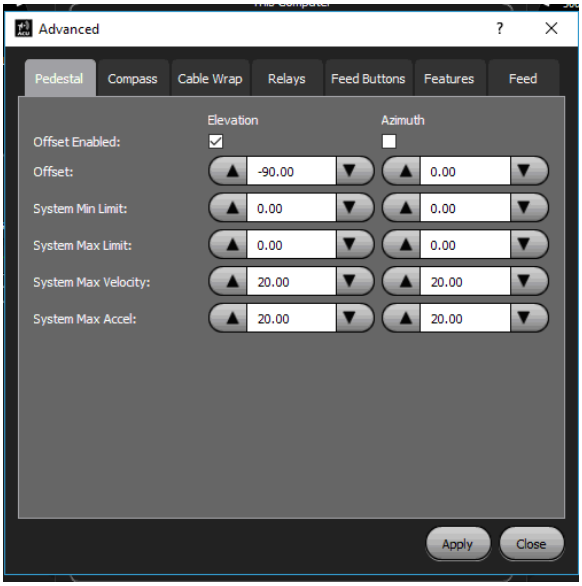

Figure 64: Advanced Dialog Box, Pedestal Tab Active

3.3.3.10.2 Compass Tab

Selecting the Compass tab causes the compass related parameters to display as shown in Figure 65. In this example, an attached compass (or North Seeker) is detected and enabled or disabled via the Enable check box. If the external compass is connected to one of the ACU's back panel serial ports (RS232 or 422) the Serial Port drop down menu, allows the selection of the correct communication port recognized by the operating system (Windows 7) so the ACU can communicate with the attached device. The Windows detected (visible) COM ports are listed in the Serial Port field.

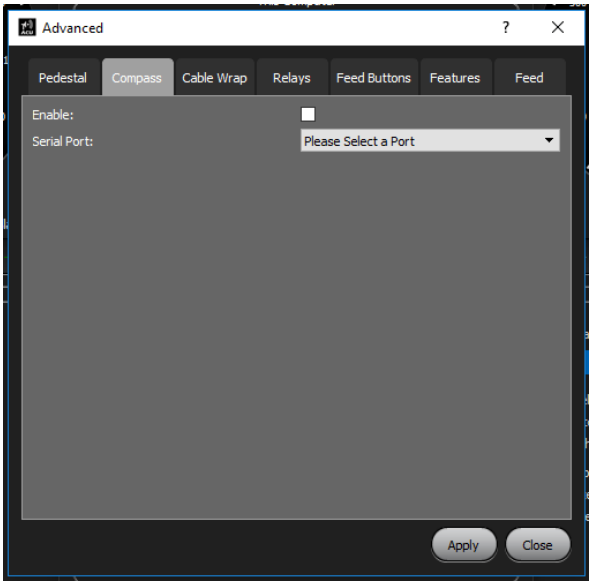

Figure 65: Advanced Dialog Box, Compass Tab Active

The antenna pedestal system shown in Figure 65 does not contain a compass, so the Enable check box is blank. No serial ports are available because the user is NOT LOGGED IN. After log in, the list of detected serial ports is available to the operator/administrator.

3.3.3.10.3 Cable Wrap Tab

Selecting the Cable Wrap tab causes the cable wrap related parameters to display as shown in Figure 66. The cable wrap meter indicates to the operator, exactly where the center of cable wrap is (where the internal EL system cabling is centered and loose). The meter also tells the operator where the AZ axis will be close to a CW or CCW limit. When tracking, the cable wrap meter visually warns if the tracking path or direction of track (if auto tracking a target) is getting near an Azimuth end point (CW or CCW limit).

If the system is tracking a target near an Azimuth limit, the axis stops when it reaches the limit and the target track may be lost. Before tracking a target, the cable wrap meter shows the operator approximately how far away the AZ axis is from a CW or CCW limit. This allows the operator to place the Azimuth axis in the best position (per the cable wrap meter) for the direction of the target track in the Azimuth axis.

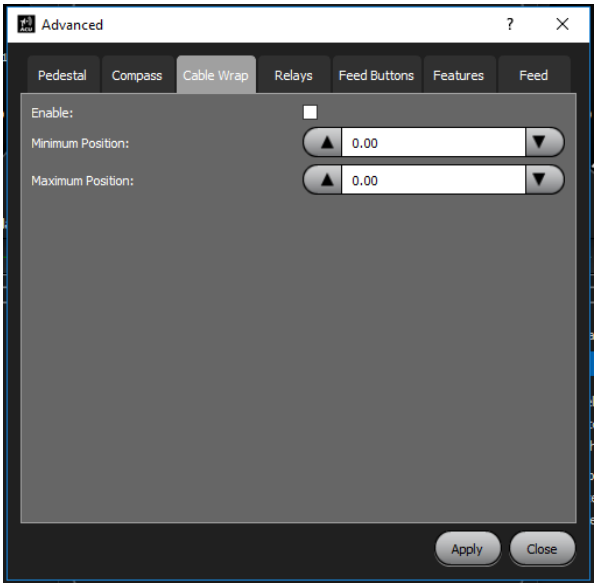

Figure 66: Advanced Dialog Box, Cable Wrap Tab Active

The Azimuth cable wrap meter (CWM) is enabled (displayed on the ACU front panel in the Azimuth position dial) or disabled (not displayed), by checking or unchecking the Enable check box. In a system which has an internal slip ring, the Azimuth travel is unlimited in both directions (CW and CCW) and normally does have AZ limits. In such a case, the cable wrap meter is not needed and the cable wrap Enable check box is left unchecked.

The Azimuth cable wrap minimum and maximum position end points are set, using the Up/Down arrows in the associated fields, which, in turn, defines the center of the cable wrap meter, located just below the Azimuth analog position dial. Normally, the CWM and its associated CW and CCW end points are factory set as a system default.

The APPLY button saves all parameter changes, and the CLOSE button exits the dialog box without saving.

In Figure 66, the cable wrap meter is not displayed due to the unchecked Enable box. The minimum and maximum AZ limit positions are greyed out and cannot be accessed because the operator has not logged in with the correct password. The last AZ limit positions were left set to + and - 400°.

The AZ axis position dial, shown in Figure 67, displays the Cable Wrap Meter Slider (CWM) enabled, the pointer at the MAX CW position, and the CW Soft Limit LED On (Yellow). Placing the small orange pointer in the center of the CWM locates the system center of cable wrap. The AZ axis has reached the soft limit at + 390.51° CW while the commanded position is at +406.38°.

Figure 67: Azimuth Axis Position Dial with Cable Wrap Meter Enabled

3.3.3.10.4 Relays Tab

Selecting the Relays tab causes the relays parameters to display, as shown in Figure 68. The screen contains a list of pre-set and operator selectable relays available for the On/Off control of various system components. These relays are associated with the front panel GUI system buttons, which are also user configurable. It allows the association of a system button with available Relay parameters between 5 and 16.

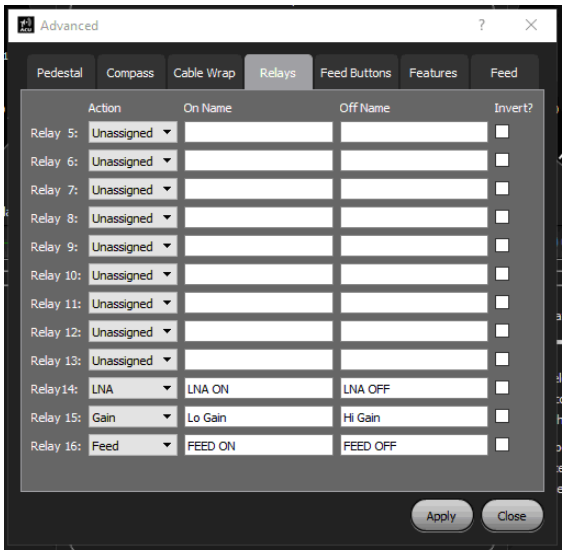

Figure 68: Advanced Dialog Box, Relays Tab Active

Some relays are preassigned to specific system functions, such as LNA On/Off control, Feed On/Off control, and Gain control. These functions are also associated with system buttons selected in the Feed Buttons tab. Relays that are not preassigned may be selected and assigned to any system operation requiring a front panel button control (On/Off) operation.

Each Relay is assigned an On Name and an Off Name. The condition of any relay may be inverted by checking the Invert box next to the desired relay.

The APPLY button saves all parameter changes, and the CLOSE button exits the dialog box without saving.

Note: Typically, all relays are assigned at the factory, and are pre-set for the required system function(s). Changing relay assignments can render the operation of a system component (such as the FEED) unusable.

Consult Quasonix before adding or modifying relay assignments.

3.3.3.10.5 Feed Buttons Tab

Selecting the Feed Buttons tab displays the feed button parameters, as shown in Figure 69. This screen enables the assignment of up to twelve (12) front panel buttons, which may be displayed in the System Control window on the ACU front panel, as shown in Figure 70.

Each button can be associated with a predetermined relay (such as Feed or LNA), or the button can be associated with a user defined relay. The Up/Down arrows next to each field are used to assign a relay name, or to specify button colors that correspond to an On or Off condition.

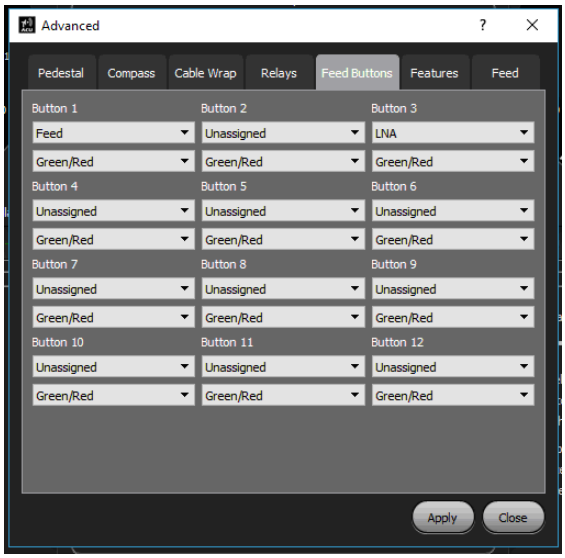

Figure 69: Advanced Dialog Box, Feed Buttons Tab Active

Figure 70: System Control Window, Button Assignment Example

Buttons in the System Control window display in the same order that they are shown in the Feed Buttons tab. In the example, FEED OFF is defined in Button 1. The LNA button is the second button and is shown as “Unassigned” in the Advanced dialog box. For button 2 to display, it would have to be assigned to “LNA” using the drop down selection. Buttons 1, 2, and 3 display in the top row, buttons 4, 5, and 6 in the second row, and so forth.

An unassigned button does not display on the ACU front panel in the System Control window.

Note: Typically, all button assignments are set at the factory. Changing button assignments can cause the device they are designated to control to operate differently than intended, rendering operation of a system component unusable.

Consult Quasonix before adding or modifying button assignments.

3.3.3.10.6 Features Tab

Selecting the Features tab causes the features parameters to display, as shown in Figure 71. The Elevation Display, Track Error Display, and Azimuth Display provide the ability to enable or disable these front panel windows by checking or unchecking the associated Enable box. For example, unchecking the Enable box under Elevation Display, then clicking on APPLY, removes the Elevation analog angle display meter from the ACU front panel. Conversely, checking the Enable box, then clicking on APPLY, redisplays the window on the front panel.

AGC and Axis Control check boxes are also used to add or remove items from the ACU front panel.

The APPLY button saves all parameter changes, and the CLOSE button exits the dialog box without saving.

Note: All front panel displays/features are set at the factory.

Contact Quasonix before modifying displays or control features.

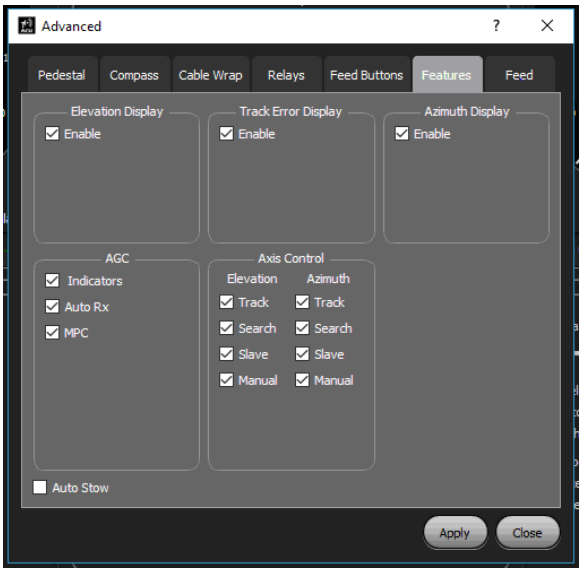

Figure 71: Advanced Dialog Box, Features Tab Active

3.3.3.10.7 Feed Tab

Selecting the Feed tab causes the feed parameters to display, as shown in Figure 72. This screen allows selection of the scanning order for the conical scan (Conscan) feed, and/or for a typical electronically scanned feed. A mechanically rotating Conscan feed usually requires a specific selection using the Up/Down arrows. However, changing the feed scan order can impact the tracking ability of the entire system.

Note: Scan order is factory set and tested. It should not be changed without consulting Quasonix.

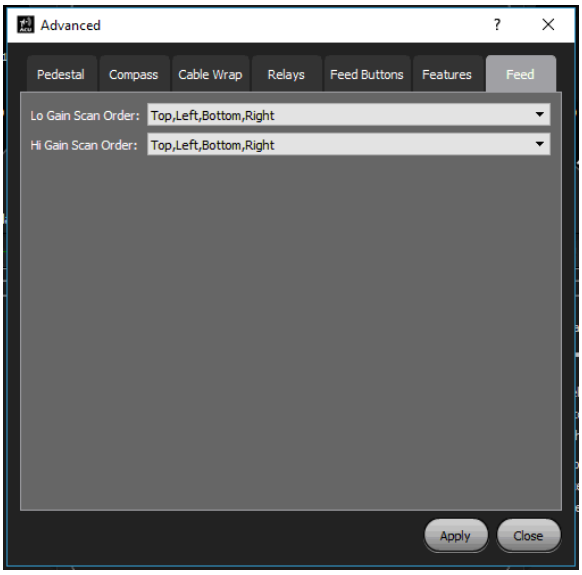

Figure 72: Advanced Dialog Box, Feed Tab Active

3.3.3.11 Local ACU - Store Factory Backup

The STORE FACTORY BACKUP button opens the Store Factory Backup dialog box, shown in Figure 73, which permits the operator (administrator) to save all of the current ACU settings to a ZIP file for archiving safety. The file may be recalled at a later time to restore the system, if necessary.

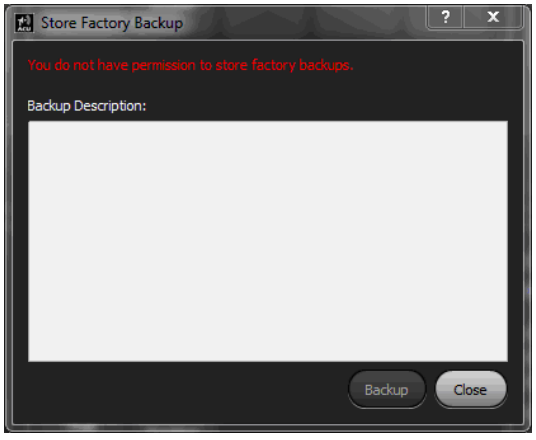

Figure 73: Store Factory Backup Dialog Box

Note: The Store Factory Backup dialog box requires permission and a log in to make changes to the saved parameter settings. Generally, you must be the antenna pedestal administrator to access this dialog. It is available to remote user(s) with the proper log in credentials. All parameter changes are saved to the Local ACU.

To request permission:

1. Select the Tools icon from the ACU Tool bar.
2. In the Authentication window, select the LOGIN button.
3. Type the Username and Password.

   When permission is granted, the Store Factory Backup dialog box can then be re-launched.

When the Store Factory Backup dialog box opens, the user is asked to give the file a specific description which is stored with the backup file. The ACU automatically date and time stamps the file. Selecting the BACKUP button saves all current ACU settings into a folder. If the operator is not logged in, the BACKUP button is not available. CLOSE exits the dialog box without saving.

3.3.3.12 Local ACU - Restore Factory Backup

The RESTORE FACTORY BACKUP button opens the Restore Factory Backup dialog box, as shown in Figure 74. The administrator can choose a previous backup from the displayed list of available saved Factory Backups in the associated drop down menu. The drop down menu provides the list of all available backups (by date) that can be chosen for restoration. The administrator can also choose to restore the ACU settings and/or the ACU's internal DACU PCB settings, as required. The Restore DACU Settings and/or Restore ACU Settings soft switches must be set to ON to restore the desired saved settings.

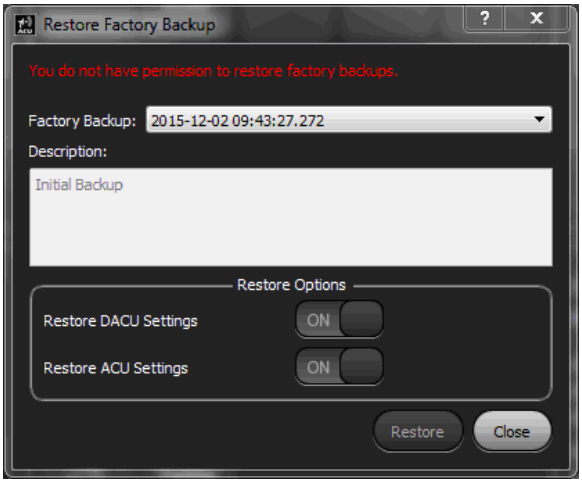

Figure 74: Restore Factory Backup Dialog Box

Note: The Restore Factory Backup dialog box requires permission and a log in to make changes to the saved parameter settings. Generally, you must be the antenna pedestal administrator to access this dialog. It is available to remote user(s) with the proper log in credentials. All parameter changes are saved to the Local ACU.

To request permission:

1. Select the Tools icon from the ACU Tool bar.
2. In the Authentication window, select the LOGIN button.
3. Type the Username and Password.

   When permission is granted, the Restore Factory Backup dialog box can then be re-launched.

If the operator is logged in, selecting the RESTORE button restores the selected backup file. If the operator is not logged in, the RESTORE button is not available. CLOSE exits the dialog box without saving.

3.3.3.13 Local ACU – IMU Config

The IMU CONFIG button opens the IMU Configuration window, as shown in Figure 75. These parameters are used with a Stabilized System using an SPG IMU module with an attached Hemisphere Differential GPS antenna system.

The Up/Down arrows enable scrolling through Lever Arm, Misalignment, and Other parameters to set the desired values. These parameters are critical for the correct stabilization function of the tracking system.

The Lever Arms represent the X, Y, and Z measured distance (in meters) between the SPG module and the Hemisphere GPS antenna unit. Refer to the SPG factory documentation, and Appendix D in this manual, for detailed lever arm measurement information.

The Misalignment parameters allow for the slight offset in pitch and yaw (in degrees) which may present itself after system install and lever arm measurements are complete.

The Inter Antenna Distance is pre-set at 0.50 meters and represents the distance from center to center of the two GPS antennas located within the Hemisphere differential GPS unit.

When stabilization is enabled, IMU/GPS output parameters are used by the ACU to correct AZ and EL antenna pointing. Incorrect, or inaccurate, lever arm measurements result in unreliable or jumping pitch, yaw, and roll IMU/GPS output data. This may cause the system motion to become unstable when Stability is enabled.

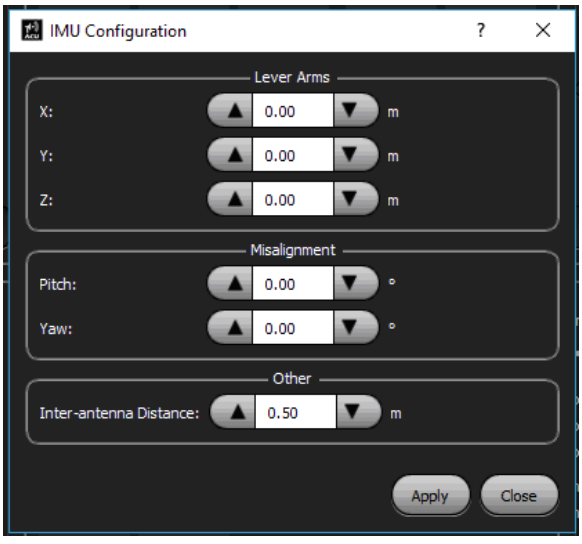

Figure 75: IMU Configuration Window

3.3.4 Settings - Calibration Window

The Settings, Calibration sub-window contains two (2) access buttons: True North and Tracking, as shown in Figure 76.

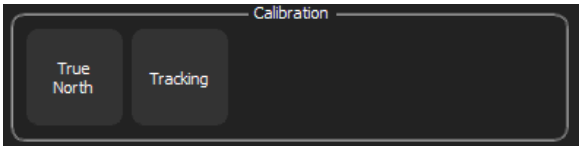

Figure 76: Settings Window, Calibration Sub-window

3.3.4.1 Calibration - True North

The TRUE NORTH button opens the True North dialog box, shown in Figure 77, which allows the operator to set the North pointing position (AZ 0.0°) of the antenna pedestal system where AZ 0.0° = North. There are three modes of calibrating the True North position: Manual, Sun, and Compass. The True North dialog box is available to remoted devices and ACUs, however, all parameters are saved to the Local ACU.

Figure 77: True North Dialog Box

- **Manual Mode** – The AZ zero (North) position is MANUALLY set by the operator. MANUAL is selected via the drop down arrow in the Calibration Mode field, then zero (0.0°) is selected by using the Up/Down arrows in the Azimuth Angle field.

When the APPLY button is selected, the new Azimuth position is set to zero degrees. The Effective Offset readout shows what offset is used to generate the new AZ (zero) North position. In most cases, the operator points the antenna to approximate North, and then manually enters zero (0.0°) into the Azimuth Angle field.

- **Sun Position** – The SUN location in the sky is used to set the AZ, North, zero (0.0°) position. SUN is selected via the drop down arrow in the Calibration Mode field. The operator manually points the antenna to the sun position in the sky (the feed's shadow will be in the center of the reflector).

  After the antenna is pointed directly at the sun, the user selects the APPLY button and the sun calibration is completed. The North (AZ 0.0°) position is now set by the sun position.

  For this calibration method to work correctly, the system's EARTH position (latitude and longitude) must be set in the Settings > System Location dialog box and the system current time must be correct for that Earth location.

- **Compass** – A COMPASS (North Seeker) is attached to the ACU's back panel COM (RS232) port to provide the zero North position. Compass is selected via the drop down arrow in the Calibration Mode field, then the provided North position is read into the ACU. It is used to calibrate the True North position when the APPLY button is selected.

  This method of calibration is available only when a compass is attached to the ACU and the position must be adjusted for the difference between magnetic and true north.

The North position currently stored in the ACU can be removed by selecting the CLEAR OFFSET button. After the previous North position is cleared, one of the three calibration methods can be used to reset the system's North position (if desired).

For a stabilized system using the SPG IMU unit and the Hemisphere differential GPS, the ACU true north pointing position should be set up to match the SPG/differential GPS unit's north pointing position.

3.3.4.2 Calibration - Tracking

The TRACKING button opens the Track Settings dialog box, shown in Figure 79. The window on the left displays the ACU Track Error Meter which is used to help align the TDC and AM signals by adjusting the phasing (TDC) parameter (located in the Receiver section). The display on the right contains tab selections, which contain the various menus for user applied calibration settings—essential for correct auto-track functionality. There are four tabs: General, AGC, Receiver, and Antenna Switch. In this section, each area is explained in detail.

Note: The Track Settings dialog box requires permission and a log in to make changes to the saved parameter settings. Generally, you must be the antenna pedestal administrator to access this dialog. It is available to remote user(s) with the proper log in credentials. All parameter changes are saved to the Local ACU.

To request permission:

1. Select the Tools icon from the ACU Tool bar.
2. In the Authentication window, select the LOGIN button.
3. Type the Username and Password.

   When permission is granted, the Track Settings dialog box can then be re-launched.

If the operator is logged in, selecting the APPLY button saves parameter changes. If the operator is not logged in, the APPLY button is greyed out and cannot be accessed. CLOSE exits the dialog box without saving.

If the operator is not logged in, and does not have permission to access this dialog box, a message displays in red text, as shown in Figure 78, and all parameter settings are greyed out.

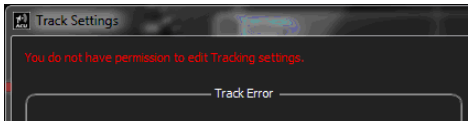

Figure 78: Track Settings, No Permission Message

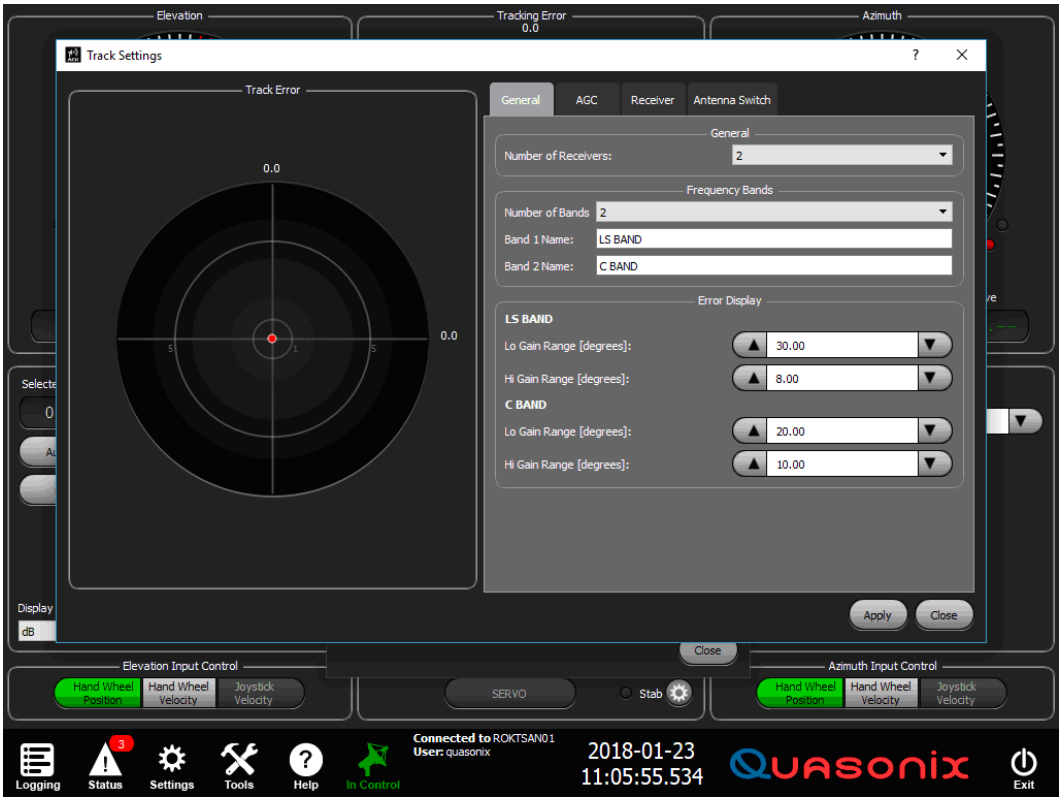

Figure 79: Track Settings Dialog Box, General Tab

3.3.4.2.1 General Tab

Selecting the General tab displays the General parameters menu, as shown in Figure 79, and provides the following signal level and receiver associated entry fields.

- **Number of Receivers** – Sets the number (1-4) of (selectable) receiver signal level meters (via the drop down menu) to be displayed in the AGC window of the ACU's GUI. Each meter is connected to the external receiver through the AGC input BNC connector (AGC1 - AGC4) located on the back panel of the ACU. If, for example, four (4) receivers are selected, then four (4) signal level meters display (RX1, RX2, RX3, RX4) in the AGC window on the ACU front panel.
- **Number of Bands** – Establishes the number of frequency bands available for tracking calibrations; In the example in Figure 79, two (2) bands are selected. Each band has its own tracking calibration parameters associated (saved) with it.
- **Band 1 Name and Band 2 Name** – Frequency band name is entered in each field (such as; L, S, and/or C band for example)

- **Lo Gain Range** (degrees) (for Band 1 and Band 2) – Sets the range or scale of the Track Error Meter by placing concentric circles every 5 degrees around the center 1 degree circle, based on operator input. The Error Meter range parameter applies only to an (optional) Lo Gain antenna or Acquisition Aid and would only be displayed if Lo Gain is selected from the front panel System Control button.

  The range setting is typically dependent on the antenna's beam width (for example, the larger the beam width the larger the range setting). This setting is intended to keep the center dot (meatball) within the confines of the Error dial when antennas of varying beam widths are installed. By increasing or decreasing the Lo Gain Range number, a ring is placed with the Error Meter every 5 degrees, after the first 1 degree ring is shown. If, for example, 30 is entered for the Lo Gain Antenna beam width, the following rings display: 1, 5, 10, 15, 20, and 25, and the Error Meter outer edge is the 30 degree position.

- **Hi Gain Range** (degrees) (for Band 1 and Band 2) - Sets the range or scale of the Track Error Meter; This user applied Error Meter range parameter is specifically for the High Gain antenna.

  The range is usually dependent on the antenna's beam width (for example, a smaller beam width sets a smaller range). This setting is intended to keep the center dot (meatball) within the confines of the Track Error dial when multiple antennas of varying beam widths are installed in the tracking system. If the system's Hi Gain Antenna has a beam width of 5 degrees, the Error Meter display can be set to 8 degrees (refer to Figure 79) so the antenna's beam width lies within the Error Meter display. Rings are shown within the Error Meter at the 1 degree and 5 degree positions, with the edge of the Error Meter now at the 8 degree position.

The range adjustment parameters are stored separately for each frequency band set and for each High Gain and Low Gain antenna available in the specific tracking system.

If the operator is logged in, selecting the APPLY button saves parameter changes. If the operator is not logged in, the APPLY button is greyed out and cannot be accessed. CLOSE exits the dialog box without saving.

3.3.4.2.2 AGC Tab

Selecting the AGC tab displays the AGC parameters, as shown in Figure 80. The AGC tab allows the operator to set the general AGC signal level settings and the system specific Acquire/Track parameter settings. It provides the following fields: Analog Voltage Range, Scale, (noise) Floor, Saturation, Threshold, Hysteresis, Noise Floor, and Receiver Switch Over.

The AGC Tab is password protected and the user must log in to change any parameters.

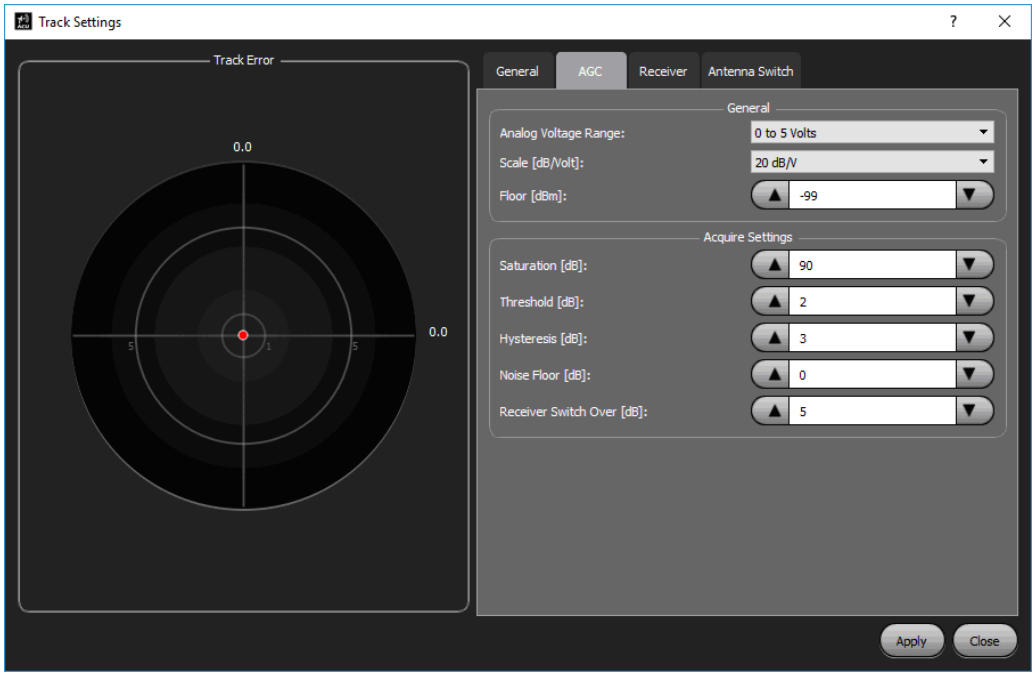

Figure 80: Track Settings Dialog Box, AGC Tab

AGC General Settings

- **Analog Voltage Range** – Sets analog voltage range using the drop down menu; Current selections are 0-5 volts or 0-10 volts; and should be adjusted to match the voltage of the RDMS receiver connected to the ACU (for the standard Quasonix RDMS receivers, 0-5 volts is selected); It is used in conjunction with the Scale parameter to set scaling sensitivity in dB per volt.
- **Scale (dB/V)** – Sets the scale of the AGC front panel meters to 10 dB per volt or 20 dB per volt

  The setting is usually selected to be compatible with the attached receiver's AGC output. The voltage is generated by the attached receiver's individual channel (AGC) outputs and is connected to the ACU through (AGC1 – AGC4) back panel AGC BNC connectors. The scale (dB/V) should be selected to match the connected receiver's AGC Scale (dB/V) setting output. For example, if the 20 dB per volt parameter is set in the Quasonix receiver's AGC menu, then the 20 dB per volt should be selected in the ACU drop down menu so the receiver and the ACU AGC scaling parameters match. This applies to all attached receivers.
- **Floor (dBm)** – Sets noise floor sensitivity of the attached receiver (in dBm)

  Use the Up/Down arrows to select the desired receiver noise floor value or type a number directly into the field. This setting should be selected to match the attached receiver's noise floor, then the dBm setting should be selected from the ACU's front panel (AGC window, Display Units drop down menu).

Acquire Settings

The Acquire Settings window contains the control parameters for automatic switching from Acquire to Auto Track and back, as well as other parameters needed for correct target tracking when the Acquire function is used.

- **Saturation (dB)** – User defined, highest signal level (dB), as reported by the ACU front panel's AGC signal level meters, causing saturation of the received signal; Use Up/Down arrows to change settings

  The AGC front panel meter bar changes to red (when saturated).

- **Threshold (dB)** – User defined signal level (dB) where the ACU switches from Acquire mode to Track mode; Use Up/Down arrows to change settings

  The threshold is typically set to a level above the antenna's highest side lobe level to prevent the system from tracking on the antenna's side lobe. When switchover takes place, or when the signal level reaches the set threshold, the AGC front panel meter's color bar changes from yellow to green.

- **Hysteresis (dB)** – Change in signal level (dB) necessary to induce the ACU's automatic switching between the Track and Acquire modes; Use Up/Down arrows to change settings; The automatic switching back from Track (falling out of track) to Acquire happens at the Acquire threshold level setting (the Hysteresis level setting).

  This setting keeps the Acquire and Track modes from constantly switching back and forth.

- **Noise Floor (dB)** – Lowest (user defined) signal level perceived by the system or the user defined setting that establishes the system's practical background noise level, below which, the desired tracking signal is no longer discernable (signal is in the noise or mud); Use Up/Down arrows to change settings

- **Receiver Switch Over (dB)** – User defined setting (level) where automatic switching between receivers takes place (typically from channel 1 LHCP and channel 2 RHCP)

  The AGC signal level meter that is selected is outlined in white (when the AUTO Rx button is On or yellow in color). The AM associated with that receiver (via ACU back panel AM input) is also auto selected for the tracking of the target. Automatic switchover will not occur if the AUTO Rx button is not selected and displays white or light grey in color.

If the operator is logged in, selecting the APPLY button saves parameter changes. If the operator is not logged in, the APPLY button is greyed out, and is not available. CLOSE exits the dialog box without saving.

AGC Target Track Settings Example:

An example setup of AGC target track settings is shown in Figure 81. The Track Settings dialog box has the AGC Tab selected with the AGC parameter settings displayed. In the General window, the Analog Voltage Range was set to 0 to 5 volts (VDC). The signal level scale for the front panel AGC meters is set to 20 dB per volt (set to match the attached receiver's AGC settings). The overall system noise floor is defined as minus 105 dBm (-105).

The Acquire Settings parameters include the receiver saturation indicator level setting. In the example (Figure 81), Saturation is set to 90, so the ACU front panel Signal level meters indicate saturation at 90 dB, and the signal level meter bar turns red.

The Threshold setting, where the system switches from Acquire to Auto Track, is set to 42 dB in the example.

The Hysteresis parameter is set to 3 dB. This means the change in signal level, where the system switches back to Acquire after the Auto Tracking threshold is surpassed, and the system is tracking the target, occurs at 3 dB. This setting prevents the constant switching between Auto Track and Acquire.

The Noise Floor parameter allows the operator to set the system noise floor, where system noise can be set as the zero (0) level specifically for the Acquire/Track functions, for tracking purposes only. In the example, the noise floor is set to 0 dB.

Lastly, the Receiver Switch Over parameter sets the signal level difference, where the ACU automatically switches between the attached receiver's RF input channels. With two RF input ports (usually LHCP and RHCP), based on the front panel AGC signal level meter reading of the highest displayed signal level, the system will select that channel for tracking. In the example, the switchover point is set to 4 dB. When the signal level of one channel (LHCP) rises 4 dB above the other channel (RHCP), the ACU automatically switches to the higher channel (LHCP) to auto track. For this action to take place, the AUTO RX button in the ACU's front panel AGC window must be selected and display in yellow.

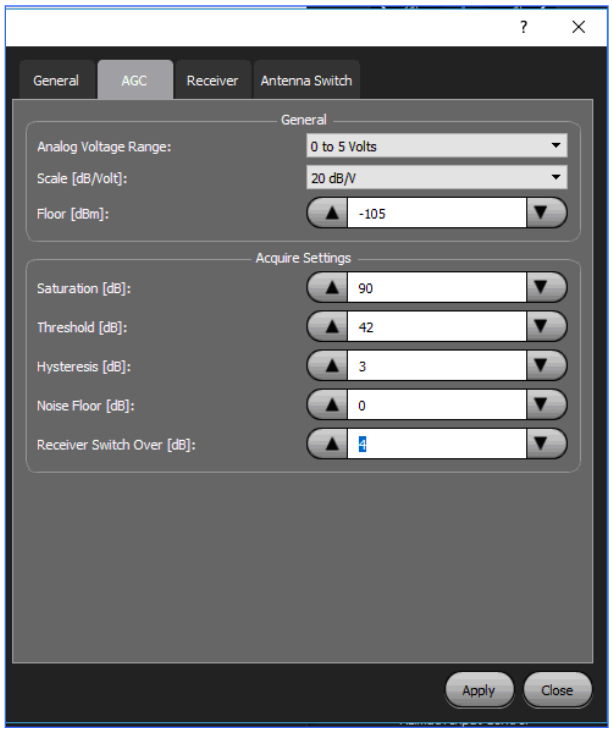

Figure 81: ACG Target Track Settings Example

3.3.4.2.3 Receiver Tab

Selecting the Receiver tab displays the Receiver parameters, as shown in Figure 82, and provides the following receiver (Track Calibration) parameter fields needed for correct target tracking: Receiver, Frequency, and Name, plus Beam Width, TDC Offset, Feed Rotation, Detector Gain, Tracking Slope, and Display Scale for High and Low Gain settings.

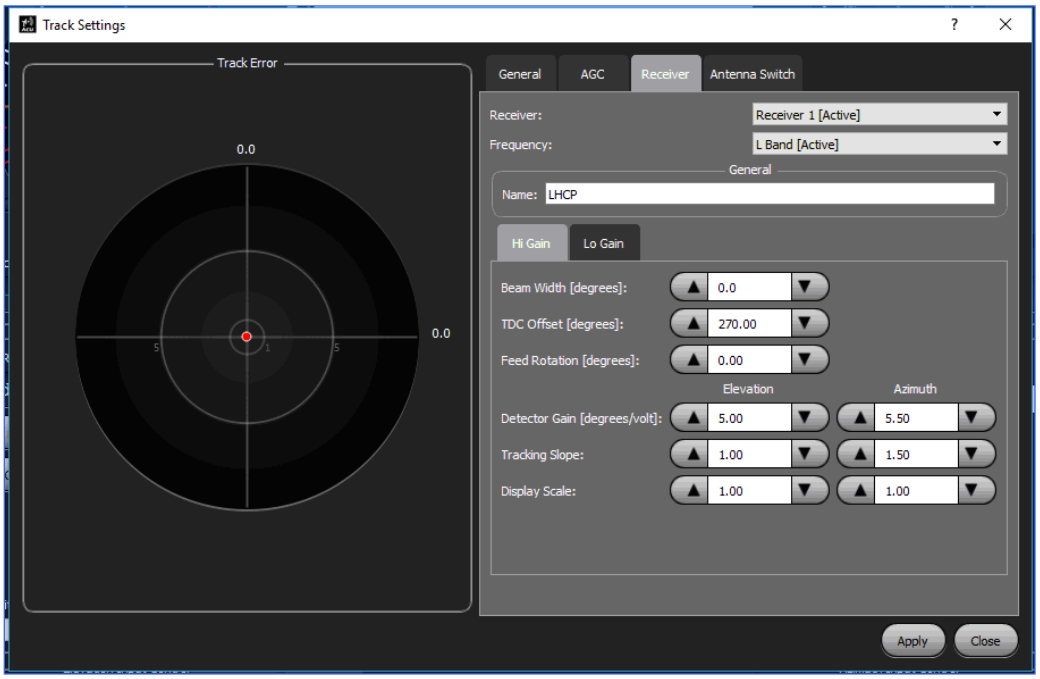

Figure 82: Track Settings Dialog Box, Receiver Tab

- **Receiver** – Selects the desired Receiver's (Rx1 – Rx4) settings to edit; [Active] indicates the receiver is already selected in the AGC window on the ACU's front panel, and is the selected receiver for target tracking; Any changes to the High and Low Gain parameters are applied only to the active receiver.
- **Frequency** – Selects the desired Frequency Band's settings to edit; Use the drop down arrow to select from available values; [Active] indicates the selected band is the one designated by the associated System Control button on the ACU front panel; Any changes to the High and Low Gain parameters are applied only to the active frequency band.
- **Name** – Used to enter a name for the [Active} Receiver selected in the Receiver field, such as LHCP or RHCP

  This name is displayed above the Receiver AGC Signal Level meter on the front panel of the ACU. In this example, Rx 1 was renamed to LHCP for the first signal meter.

High and Low Gain Tab Settings

- **Beam Width (degrees)** – Used to enter the beam width of the antenna, in degrees, for the High Gain reflector and feed combination, and the Low Gain ACQ Aid antenna

  In this version of the software, the parameter has no effect on any other setting. It should remain at the default setting of 0.0.
- **TDC Offset (degrees)** – To correctly track the radiating target, the system's (feed) generated Top Dead Center (TDC) square wave signal must be phased correctly with respect to the AM output of the tracking receiver. Adjusting the phase of the TDC, by entering an offset in degrees (0°-359°) aligns the TDC with the AM signal for the selected tracking receiver. Use the Up/Down arrows to select the desired value, or enter a value directly into the field. In Figure 82, the TDC Offset is set to 270 degrees to align the AM output of the receiver to the TDC square wave signal.

  To establish the correct system TDC offset:

The tracking system is peaked up on a transmitting boresight, such that the received signal is maximized and the error meter's green meatball is positioned in the center of the error meter. The system is then moved in Azimuth (only) a few degrees, and the position of the meatball is checked. Elevation is not moved and can be placed in standby.

If the deflection of the meatball is too small to see easily, an arbitrary number must be entered in the AZ Detector Gain parameter field (usually a small number in the 2 to 5 range) to make the AZ motion of the meatball within the error meter more visible. All other settings should be set to 1 (default), except for the Beam Width and Feed Rotation, which are kept at 0.0 (default).

If the meatball is deflecting up or down during the small AZ motion, the AZ axis is stopped while showing the meatball deflection. The Track Settings menu opens, and the Receiver tab is selected. The TDC Offset parameter is adjusted until the meatball is moved (up or down) to the center horizontal line of the error meter, and the setting is saved by selecting the APPLY button. With the meatball resting on the center line of the error meter, the AZ axis is again moved CW and CCW. The meatball should move along the horizontal center line of the error meter (with little up or down deflection) crossing the center point, as the AZ axis moves across the boresight.

AZ tracking can be checked here by moving the AZ axis a few degrees CW or CCW and stopping. The AZ axis Track button is now selected, and the meatball should pull back to the center position of the error meter. If the meatball pushes off from, and moves away from, the center position of the error meter, the TDC phasing is 180 degrees (approximately) out of phase. To adjust it, re-peak the system back on the boresight, so that the meatball is in the center of the error meter. Move the AZ axis (only) a few degrees again and stop. Open the Track Settings menu and the Receiver Tab, then adjust the TDC parameter 180° to flip the meatball over to the other side of the horizontal line of the error meter. After the TDC is set, select the APPLY button to save the settings.

Check the AZ tracking by selecting the AZ Track button, and force the system to track the boresight. With the correct TDC in place, the meatball should move back to the center of the error meter from all locations in AZ and EL, and the system should track the boresight. (No Elevation motion is necessary for the calibration process, except for the initial positioning of the system on the boresight and centering the Track Error meter).

Note 1 - When adjusting the TDC, changing the sign of the AZ Tracking Slope parameter from plus to minus has the same effect on the TDC phasing as flipping the meatball 180 degrees from one side of the Track Error meter to the other side of the meter.

Note 2 - The Detector Gain setting should be returned to 1 after the correct TDC is established, since the Detector Gain has not been correctly calibrated at this point. (Refer to Detector Gain below).

- **Feed Rotation (degrees)** – Compensates for any mechanical misalignment of the attached feed

  If the feed position is not set to exactly 0° TOP, but is mechanically, slightly rotated, this parameter compensates for this type of misalignment by entering a number, in degrees, which brings the 0° position back to TOP. Typically, this parameter is set to 0°. All Conscan feeds are aligned at the factory to the 0° TOP position when mounted on the system's feed attachment ring and (laser) aligned to the center of the reflector.

- **Detector Gain (degrees/volt)** – *Earlier versions of the ACU software combined the Detector Gain and Tracking Slope into the single Slope parameter. For more precise tracking adjustments, later versions of the ACU software split the single Slope parameter into the Detector Gain and Tracking Slope parameters.*

  The Detector Gain is a constant used to scale the sample AM error signal from Volts (VDC) to degrees of error used by the tracking loop. After the receiver has been configured and the TDC adjusted for correct AM to TDC phasing (for initial tracking), the Detector Gain parameters can be set.

  To establish the Detector Gain:

  The antenna is peaked up on a transmitting boresight until the received signal is maximized and the error meter's meatball is centered. The AZ axis is moved CW or CCW to a known number of degrees of error.

With the AZ and EL display scale parameters set to one (1), in the Display Scale fields, the detector gain can now be adjusted in value. Enter a number in the Detector Gain field until the Error Meter reads out the correct degrees of error per volt, matching the degrees of AZ movement, as described in the following example.

Example: A Tracking system with a 5° beam width is peaked up on a transmitting boresight, at the desired frequency, and moved to position the meatball in the center of the error meter (in both AZ and EL). At this peaked location, the received signal should be maximized.

The system is now moved in Azimuth only CW or CCW 2.5° from the peaked center position. The meatball moves horizontally along the center axis of the Error Meter until the system is stopped (after moving the 2.5 degrees in AZ). The AZ Error Meter voltage is checked (small digital readout at the right edge of the Error Meter) and should display 2.5 volts/degree. If the AZ error voltage is not equal to the degrees of AZ movement, the AZ Detector Gain parameter is adjusted until the AZ Error Meter readout displays approximately 2.5 volts/degree. If the system is moved another 2.5° in AZ, in the same direction, the Error Meter's AZ readout should be about 5.0 volts/degree. The process can be repeated for the EL axis, but in many cases, the EL axis Detector Gain setting can be set to match the AZ setting for good tracking results.

Typically, all initial TDC phasing adjustments and Detector Gain parameters are set up using the AZ axis to eliminate ground reflections, which may be calibrated into the system if the EL axis were used for the initial and final calibrations.

Note 1: Before the detector gain can be correctly set, the system's TDC phasing must be adjusted so that the center meatball moves horizontally across the center line of the Error Meter when the AZ axis is moved CW and/or CCW, across the boresight. It may be necessary to enter an arbitrary detector gain value to see the full deflection of the meatball across the horizontal axis of the Error Meter before the final detector gain number is established. (Refer to the TDC section described previously for the TDC phasing method).

Note 2: The Detector Gain, TDC, and Tracking Slope are subject to change if the receiver's AM Bandwidth and/or AM Gain are changed after the ACU tracking settings have been set.

- **Tracking Slope** –User applied value to set the Error dial sensitivity (gain) for the system High or Low Gain antennas

  The larger the number the "Hotter" the motion of the center dot (meatball) is and the quicker the antenna tracks back to the target. A setting that is too large leads to a "jumpy" or oscillating antenna (and center meatball) as it attempts to auto track the target. Refer to section 8, Appendix B for detailed slope and TDC track calibrations.

- **Display Scale** – User selected scale for the Track Error dial; Adjust scale with the Up/Down arrows in the associated Hi or Lo Gain Display Scale field; Typically, a scale factor of one (1) is enough for the best view of the Error Meter display functions. Use the Scale parameter to keep the Error Meter's center meatball within the Error Meter circle. Too large a scale and the meatball will "stick" to the edge of the meter during large movements of the system. If scale is set too small, the center meatball will appear to barely move during system motion.

If the operator is logged in, selecting the APPLY button saves parameter changes. If the operator is not logged in, the APPLY button is not greyed out. CLOSE exits the dialog box without saving.

3.3.4.2.4 Antenna Switch Tab

Selecting the Antenna Switch tab displays the antenna switching parameters, as shown in Figure 83, and provides the following parameters: High to Low, Low to High, and Dead Band. The operator can select the power level (in dB) at which the High Gain and Low Gain antennas will switch from one to the other. Use the Up/Down arrows next to each field to scroll to the desired power level

If the system is equipped with a separate low gain, ACQ AID antenna, the high gain level can be set, so the system will switch to the low gain antenna if too much power is received with the high gain feed, keeping the receiver from going into saturation. The high gain/low gain switching only applies to a system with an external low gain antenna

(ACQ AID), or another device (attenuator or amplifier) which can be switched into and out of the receive path at a predetermined received signal strength.

In Figure 83, the system switches from High Gain at 90dB to the low gain antenna to prevent saturation of the receiver. Likewise, when tracking with the Low Gain antenna, if the signal rises above 15 dB, the system switches to the High Gain antenna. A dead band can be provided to prevent the antennas from constantly switching back and forth.

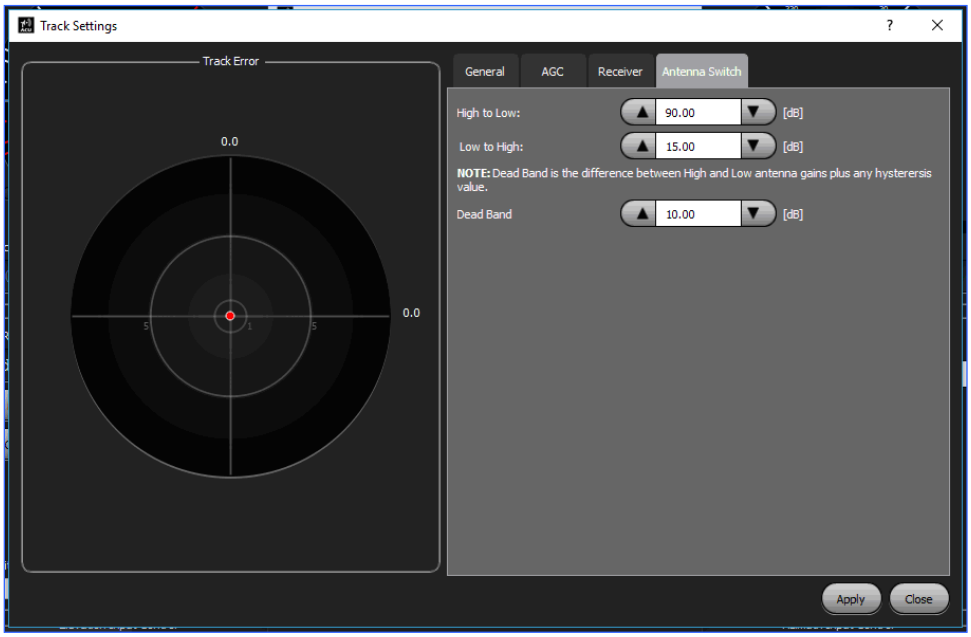

Figure 83: Track Settings Dialog Box, Antenna Switch Tab

3.4 Tool Bar - Tools

The Tools icon located on the ACU's Tool bar and shown in Figure 84, allows access to the system's pre-installed testing and general ACU control applets.

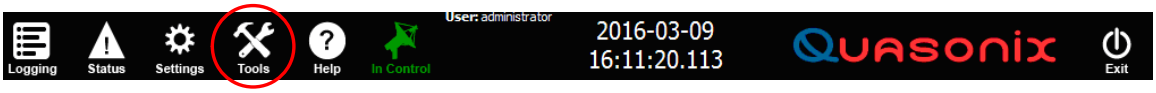

Figure 84: AGC Tool Bar, Tools

Selecting the Tools icon opens the Tools window, as shown in Figure 85, which contains buttons used to access sub-windows in three (3) areas of operator control input:

- General – Buttons which affect general ACU control including Reset DACU, Logging, Client List, Auto Stow (if the system has Auto Stow attached), and G/T Calculator

- Test – Provides access to test and evaluation routines via Velocity and Acceleration Test, Antenna Pattern, Hand Wheel Test, and Joystick Test buttons
- Authentication – Enables administrator access to facilitate log in and password validation and change

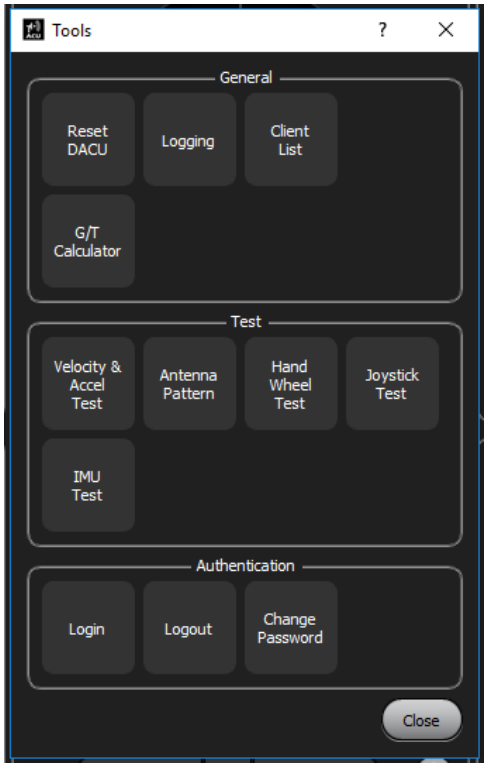

Figure 85: Tools Window

3.4.1 Tools - General Window

The Tools, General sub-window may contain five (5) access buttons: Reset DACU, Logging, Client List, Auto Stow (on a system with Auto Stow attached), and G/T Calculator, as shown in Figure 86.

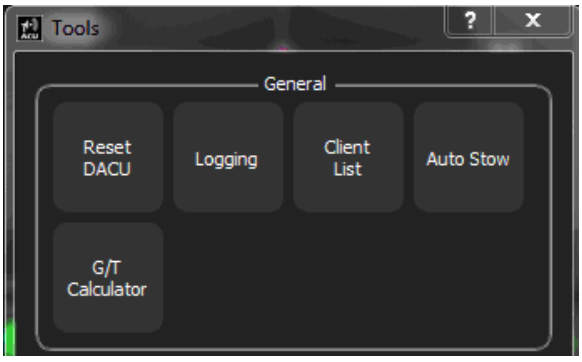

Figure 86: Tools Window, General Sub-window

3.4.1.1 General - Reset DACU

The RESET DACU button opens the Reset DACU dialog box, shown in Figure 87, which immediately resets the internal ACU's system Interface and control Digital Antenna Control Unit (DACU) PCB. The reset process takes about one (1) minute to complete and all communication between the Pedestal and ACU are lost for that period of time. During the reset process, the front panel Manual Control Buttons are greyed out and not available to the operator. In addition, control and feedback between the pedestal and ACU is suspended for the short reset duration.

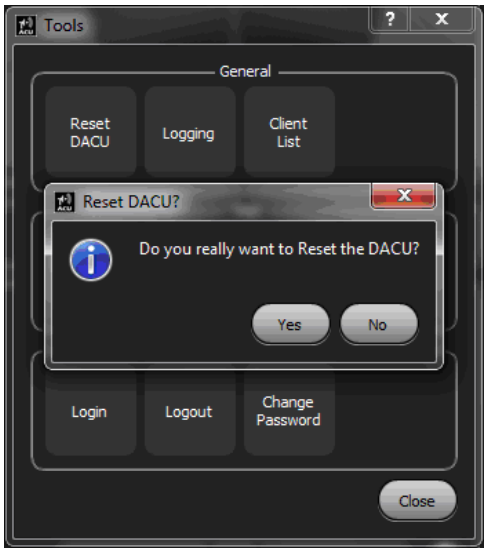

Figure 87: Reset DACU Dialog Box

The Reset tool should only be used to clear a persistent fault or interlock indication that has been detected by the System Status Indicator or a generated fault that pertains directly to the DACU PCB, such as an Ethernet communication link loss or intermittent connection. This operation resets the ACU's internal DACU board and typically is accessed as a last resort for the clearing of a system fault or interlock. If the fault or interlock will not clear with the DACU reset, then the antenna pedestal system/servo box must be further examined for fault diagnosis.

Note: The Reset DACU dialog box requires permission and a log in to make changes to the saved parameter settings. Generally, you must be the antenna pedestal administrator to access this dialog. It is available to remote user(s) with the proper log in credentials. Only the Local ACU is reset—no remotes.

To request permission:

1. Select the Tools icon from the ACU Tool bar.
2. In the Authentication window, select the LOGIN button.
3. Type the Username and Password.

   When permission is granted, the Reset DACU dialog box can then be re-launched.

To reset the DACU, select the YES button. The DACU PCB immediately resets.

Note: If the Reset DACU button is selected during a Tracking mission, *the Auto-tracking functions of the ACU will be suspended, and the Track is lost for the duration of the reset process.*

Note: The antenna pedestal can also be reset from a remote device or ACU, *which also causes loss of communication with the DACU PCB, and disturbs any ongoing tracking operation*.

3.4.1.2 General - Logging

The LOGGING button opens the Logging dialog box, shown in Figure 88. It allows control over the ACU's multiple logging file creation settings which are available to the Local ACU and all remote users.

Figure 88: Logging Dialog Box

The Logging Dialog Box contains the following parameters.

Logging Control

- **Directory** – Sets the folder and location for storing/viewing the saved logging files

  Currently the logging folder is located on the Windows desktop on the Local ACU. The created logging TXT files are stored in this folder. On a remote device or remoted ACU, the logging files are stored on the remote device in the logging folder set up by the remote operator. The Local and Remote ACU operators can place the logging folder anywhere in the Windows file system, as desired.

- **Log Changes Only** – The ON-OFF selection allows the choice of collecting all data parameters shown in the Log Data window (explained below) or collecting only those parameters that have changed during the time the logging tool was enabled. This allows the user to collect only the parameters that have changed during the log session, which can be useful for troubleshooting a pedestal or ACU issue.

- **Enable Logging** – Starts logging of the selected parameters from within this dialog box

  With the Enable Logging selector set to the ON position, the ACU starts logging data as soon as the OK button is selected by the operator and the dialog box is closed.

This has the same effect as selecting the Logging icon from the ACU Tool bar. When the Enable Logging slider is set to ON, the icon on the Tool bar turns green, indicating that the ACU is currently recording a log file. The Logging icon enables a log file creation from the Local ACU and Remoted Devices. Both display green during logging and white when not logging.

Log Data

Parameters shown in the Log Data window are described in Table 12. Changes are selected via the ON-OFF selector next to each parameter field. Changes are applied when the OK button is selected and the dialog box is closed.

Table 12: Log Data Window Available Parameters

Parameter	Option	Logging Record
Azimuth Axis Mode	ON-OFF	Record the mode of the Azimuth axis
Elevation Axis Mode	ON-OFF	Record the Mode of the Elevation Axis
Azimuth Position	ON-OFF	Record the Azimuth Angles feeding back to the ACU from the pedestal
Elevation Position	ON-OFF	Record the Elevation Angles feeding back to the ACU from the pedestal
Azimuth Position, True	ON-OFF	On a stabilized system, reports the AZ True Position based on IMU input Actual computed pointing position of the antenna when Stabilization is enabled
Elevation Position, True	ON-OFF	On a stabilized system, reports the EL True Position based on IMU input Actual computed pointing position of the antenna when Stabilization is enabled
Azimuth Commanded position	ON-OFF	Record the requested (user inputted) position for the Azimuth axis
Elevation Commanded Position	ON-OFF	Record the requested (user inputted) position for the Elevation axis
Azimuth Velocity	ON-OFF	Record the computed Azimuth axis velocity
Elevation Velocity	ON-OFF	Record the computed Elevation axis velocity
Azimuth Track Error	ON-OFF	Record the AZ Track Error as displayed by the Track Error dial
Elevation Track Error	ON-OFF	Record the EL Track Error as displayed by the Track Error dial
Rx 1 Signal	ON-OFF	Record the signal level displayed by AGC meter 1
Rx 2 Signal	ON-OFF	Record the signal level displayed by AGC meter 2
Rx 3 Signal	ON-OFF	Record the signal level displayed by AGC meter 3
Rx 4 Signal	ON-OFF	Record the signal level displayed by AGC meter 4
Rx Auto Select	ON-OFF	Record the Auto Receiver Select button (Auto Rx) position

Parameter	Option	Logging Record
Rx Selected	ON-OFF	Record the selected receiver (Rx 1, Rx 2, Rx 3, or Rx 4)
Fault Bits 1	ON-OFF	Record the faults selected in the fault bit 1 group*
Fault Bits 2	ON-OFF	Record the faults selected in the fault bit 2 group*
Status Bits 1	ON-OFF	Record Status Bit 1
IMU Yaw	ON-OFF	Record the displayed Yaw angles
IMU Pitch	ON-OFF	Record the displayed Pitch angles
IMU Roll	ON-OFF	Record the displayed Roll angles

*The faults / interlocks contained in BIT 1 and BIT 2 are outlined in section 3.1.

3.4.1.3 General - Client List

The CLIENT LIST button opens the Clients window, shown in Figure 89. The Clients list displays identifiers for the Local ACU and Remoted devices currently controlling the antenna pedestal system. The list includes the client Name, IP Address, Port, and Control status of the remoted devices that are currently in control of the Local antenna pedestal system.

The Client List is available to the Local ACU and all remote users to see who is currently linked to the Local ACU and who is currently in control of the Antenna Pedestal System.

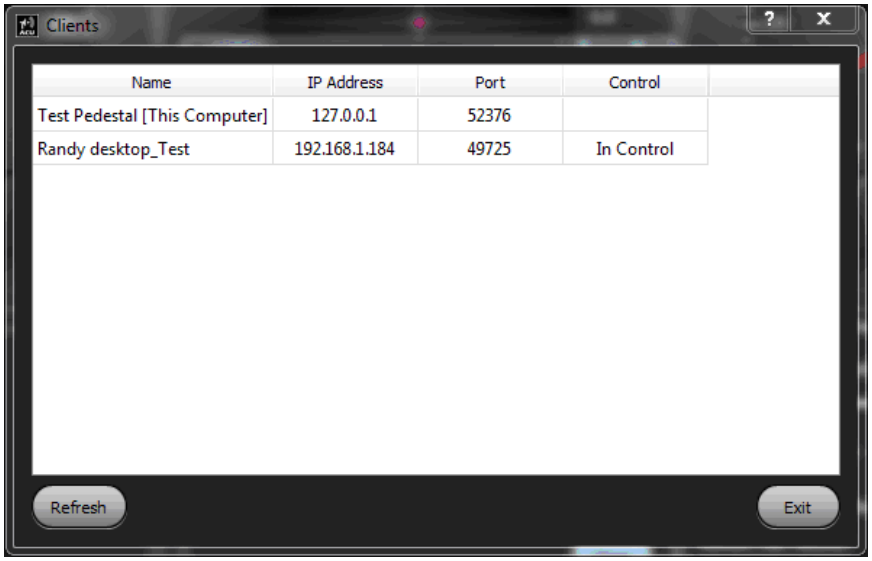

Figure 89: Clients Window

When a remote user ends control and exits the Remote ACU software, the client list line is also removed. The client list only displays the remote user when the Remoted ACU software is up and running on a remote device that has Ethernet access.

3.4.1.4 General - Auto Stow

The AUTO STOW button opens the Stow Pedestal dialog box, as shown in Figure 90. (*This button only displays on ACUs equipped with auto stowing antenna mechanisms.*) Selecting the YES button causes the pedestal to automatically slew to the stow position, wait for correct axis alignments (usually about 3 seconds), and then activate the electrically driven stow pin, which is pushed into the stow receptacle in the pedestal yoke arm.

The motion of the automatic stow pin triggers proximity sensors which feed back to the ACU the progress of the stow operation. The sensor (feedback) information is displayed in the Status reporting window (which can be accessed by selecting the Status icon from the Tool bar). After the stowing process is complete and the pin is fully inserted, the system's AZ and EL servos are turned Off.

Figure 90: Stow Pedestal Dialog Box

To un-stow the system, the SERVO button on the main ACU screen is selected. Turning on the servo power automatically withdraws the stow pin from the stow receptacle. At this point, manual control can be selected for each axis and the system responds to manual motion commands.

If the system fails to un-stow correctly, the stow pin sensors provide an indication that the stow pin has not been withdrawn from the stow receptacle. If this happens, the system must be manually inspected to determine the cause of the stow or un-stow failure.

3.4.1.5 General - G/T Calculator

The G/T CALCULATOR button opens the G/T Calculator dialog box, as shown in Figure 91. It is used to calculate the system Gain per Temperature number. The parameters necessary to calculate the G/T number are entered from a keyboard directly into the associated fields (or may be updated via the Up/Down arrows next to each field) and are calculated by selecting the CALCULATE button.

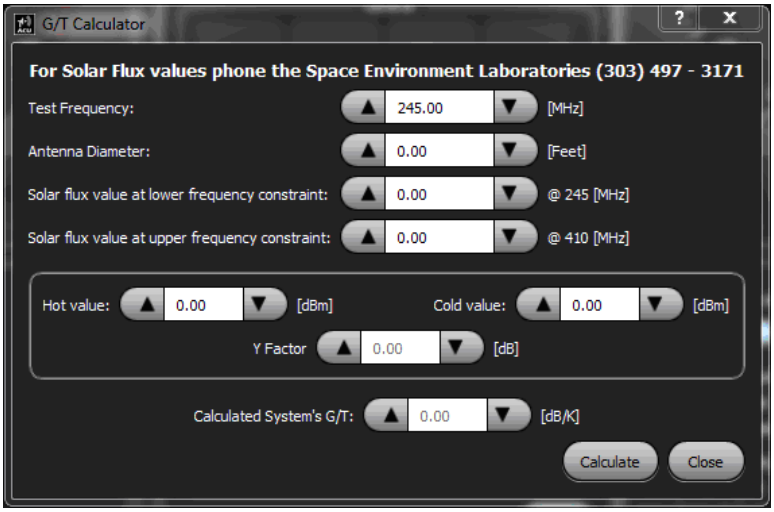

Figure 91: G/T Calculator Dialog Box

3.4.2 Tools - Test Window

The Tools, Test sub-window contains five (5) access buttons: Velocity and Acceleration Test, Antenna Pattern, Hand Wheel Test, Joystick Test, and IMU Test, as shown in Figure 92.

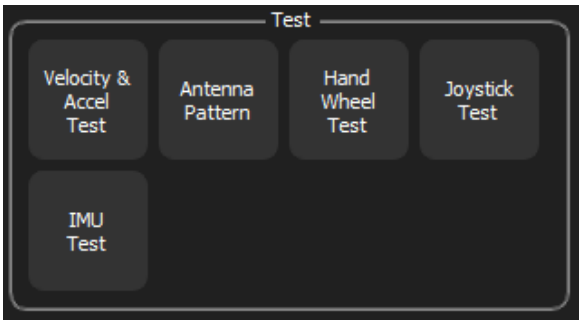

Figure 92: Tools Window, Test Sub-window

3.4.2.1 Test - Velocity and Acceleration Test

The VELOCITY AND ACCELERATION TEST button opens the Velocity & Acceleration Test dialog box, as shown in Figure 93. This built in test routine runs a pre-programmed test which checks the system's motion by verifying the Elevation and Azimuth axes velocity and acceleration ability.

The test determines the systems Azimuth and Elevation maximum motion capability by running the pedestal through a programmed series of AZ (CW and CCW) and EL (up and down) motions. The routine determines the maximum AZ and EL velocities and accelerations present in the system. The Velocity and Acceleration Test ascertains and keeps track of the pedestal's electro/mechanical health. The results of the test display in Elevation and Azimuth windows.

A graphical representation of the AZ and EL motion is shown below the calculated and reported values windows. The AZ and EL graphs overlap but can be displayed individually by selecting the AZIMUTH and ELEVATION buttons to the right of the graph.

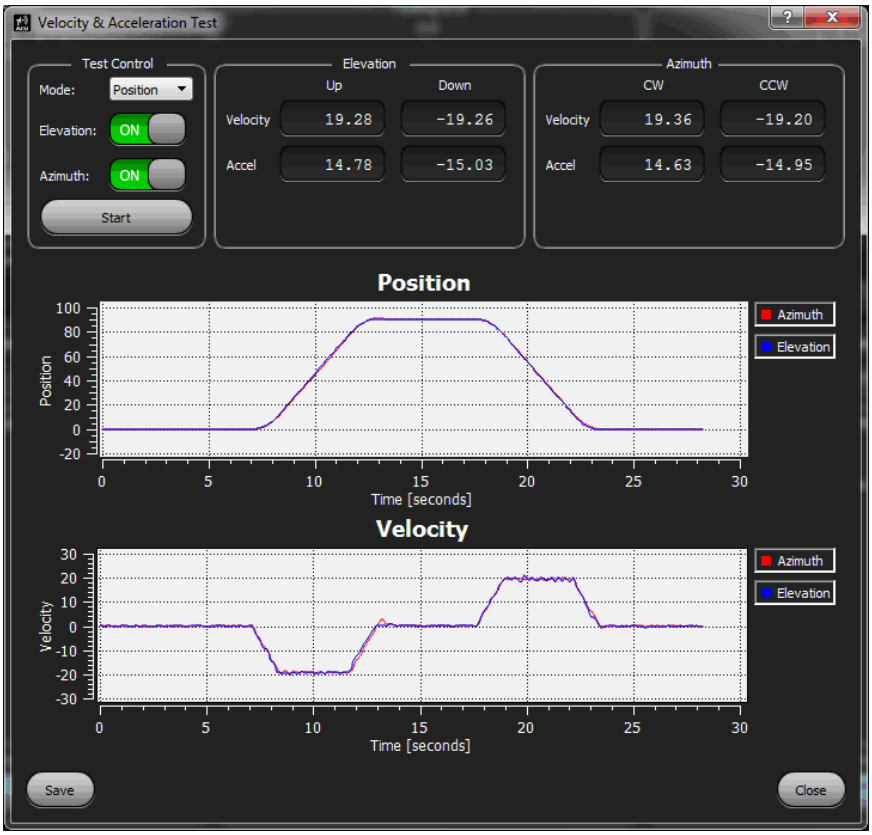

Figure 93: Velocity & Acceleration Test Dialog Box

Test Control Window

1. Start the Velocity and Acceleration test by choosing the acceleration and velocity test mode (Position/Tracking) with the Mode drop down arrow.
2. Select Elevation, Azimuth, or both by selecting the ON-OFF button in the Elevation and Azimuth fields.
3. Select the START button.

The ACU automatically turns on servo power and places both axes in operate (Manual) mode to run the test. After test completion, the AZ and EL motion graphs and their calculated values display.

Test Results

The velocity test results can be saved by selecting the SAVE button at the bottom of the dialog box. When the SAVE button is selected, the Windows location of the saved velocity and acceleration test files is opened. The files are saved into the Vel_Acc_Test folder for future reference. For example:

C > Users > ACU > Documents > Vel_Acc_Test (folder) > XXXXX.png file

The Velocity and Acceleration Test is available to the Local ACU and Remoted devices and ACUs, however, the test results are saved on the Local ACU (only) in the Vel_Acc_Test folder.

The CLOSE button exits the dialog box.

3.4.2.2 Test - Antenna Pattern Test

The ANTENNA PATTERN TEST button opens the Test Parameters dialog box, as shown in Figure 94. This test connects the ACU to a Quasonix receiver, takes the AGC output of the receiver, and connects it to one of the AGC inputs (AGC 1-4 available) on the back panel of the ACU. The AGC signal level input from the receiver is used to plot an antenna pattern as the antenna is swept across a suitable boresight in Azimuth or Elevation.

This test gives the local and remote operator the ability to check the system's reflector, feed, and focus mechanical locations. The test runs an Azimuth or an Elevation pattern and starts and stops the sweep of the antenna depending on the Start Angle and Stop Angle selections (in degrees). The sweep speed is adjustable (in degrees per second). A warning message, which displays during the test, gives the operator the ability to stop the test at any time.

Test Parameters

- Axis – Use the drop down arrow to select Azimuth or Elevation
- Receiver – Use the drop down arrow to select the connected receiver input channel
- Gain – Use the drop down arrow to select Lo or Hi gain
- Start Angle (AZ and EL) – Use the Up/Down arrows to select the start angle in degrees
- Stop Angle (AZ and EL) – Use the Up/Down arrows to select the stop angle in degrees
- Velocity (AZ and EL) – Use the Up/Down arrows to select the sweep speed in degrees per second

The pattern starts when the START button is selected and is saved when the SAVE button is selected.

The SAVE button saves the test results to the device in control of the Antenna Pedestal System at the time of the test. If the Local ACU is in control, the test is saved to the Local ACU documents folder. If a remoted device is in control, the test results are saved to the remoted device documents folder.

The EXIT button exits the test dialog without saving.

A completed antenna Pattern test is shown in Figure 94.

- Receiver 1 is selected to accept the receiver AGC signal input from back panel AGC 1 (receiver AGC output is connected to AGC 1 on the ACU back panel).
- The pattern is an Azimuth pattern swept across a boresight from 300° to 60°. The pattern is swept CW from 300° start to 60° stop.
- The LNA and Feed buttons were left in the Off position (the feed and LNAs can be turned On and Off from inside this test box).
- A second pattern ran in the same AZ sweep area. It graphed across the first pattern in a different color—in this example, red.

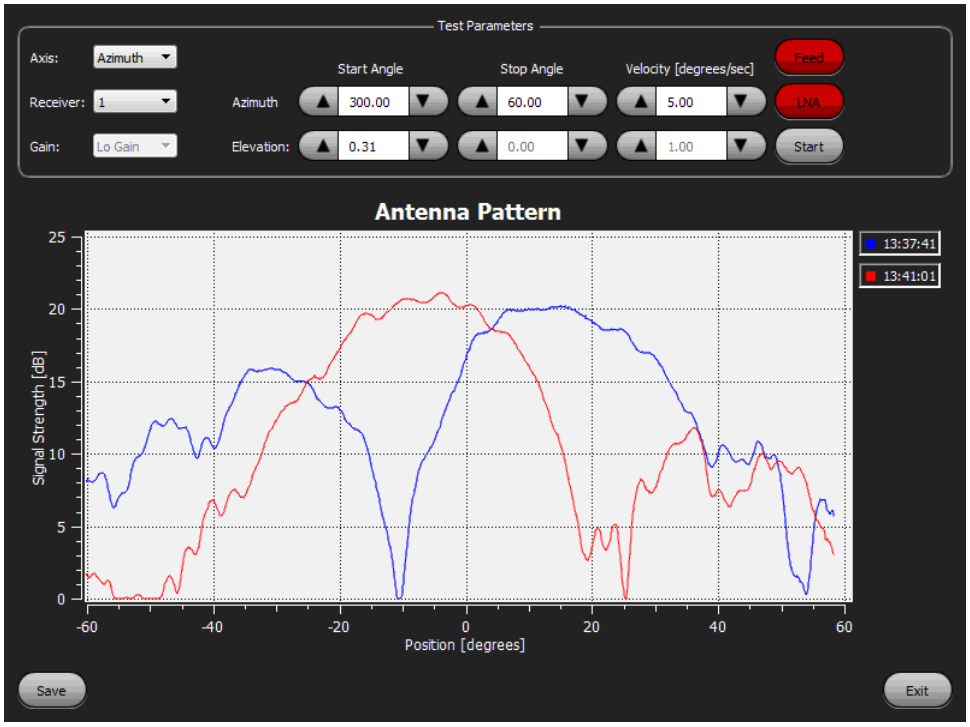

Figure 94: Test Parameters/Antenna Pattern Test Dialog Box

3.4.2.3 Test - Hand Wheel Test

The HAND WHEEL TEST button opens the Hand Wheel Test window, as shown in Figure 95. This test provides the ability to check the hand wheel encoders and their associated connections up to the internal resolver card (Arduino PCB) by displaying the action of each hand wheel on screen with a hand wheel test feedback dial. Rotating the ACU's AZ hand wheel moves the AZ dial's orange pointer CW and CCW in line with the motion of the hand wheel. The Elevation test is similar.

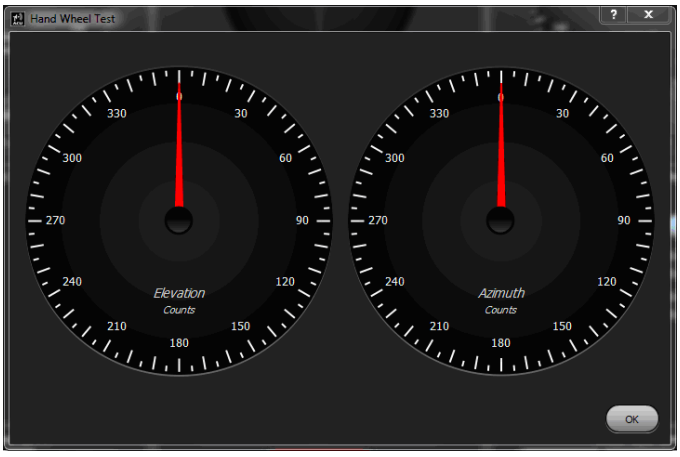

Figure 95: Hand Wheel Test Window

This test is available to the Local ACU and any Remoted Devices that have hand wheels. A remote laptop that is not equipped with the available hand wheels add on device cannot perform this test. Select OK when finished.

Troubleshooting

- If the on screen test dials do not respond to the ACU's hand wheel motion, there may be a problem with a cable connection between the hand wheel encoder and the internal interface board (located on the side of the CPU card cage).
- The Arduino PCB, which is used to resolve the AZ and EL hand wheel encoders may have failed, its USB interface cable may have become disconnected, or it has not been de-selected in the Settings > This Computer > Handwheel Settings dialog box > Serial Port (COM 8 Arduino for example).
- The ENABLE check box (Settings > This Computer > Handwheel Settings dialog box must be checked to allow hand wheel operation.
- Windows 7 Control Panel > Device Manager > PORTS (COM and LPT) should be opened to verify that the Arduino COM port is listed and is the same COM port that is selected in the Handwheels Settings dialog box.

3.4.2.4 Test - Joystick Test

The JOYSTICK TEST button opens the Joystick Test window, as shown in Figure 96. This test is used to check the connected joystick's feedback by moving the joystick from side to side while checking the on screen feedback motion of the red ball in the test area.

A joystick must be connected to the ACU through one of the back panel USB ports and configured correctly. Refer to section 3.3.1.3 for additional information about joystick settings. This test is available to the Local ACU and any remoted devices or remote ACUs with an attached USB joystick that Windows recognizes.

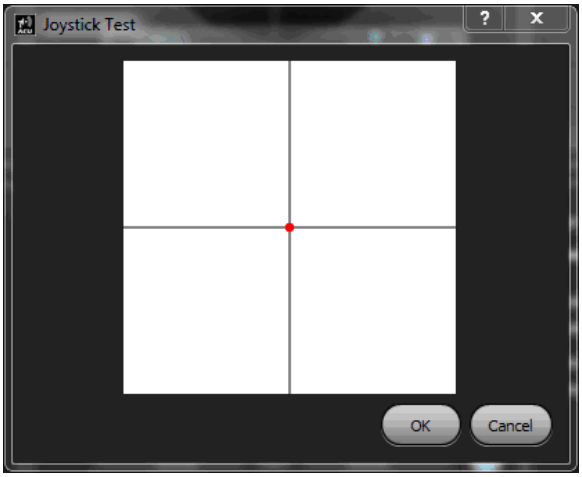

Figure 96: Joystick Test Window

3.4.2.5 Test - IMU Test

The IMU TEST button opens the IMU Test window, as shown in Figure 97. This test window only displays data. No operator input is required or available.

GPS position data is displayed. This includes the quality of data, depending on the interpretation of the available data, as indicated by checks in the check boxes. If the received data is determined to be good, the box next to the parameter is checked. If the data is poor, or not present, the box remains unchecked.

If the system is equipped with Stabilization, the pitch, yaw, and roll data from IMU is also displayed.

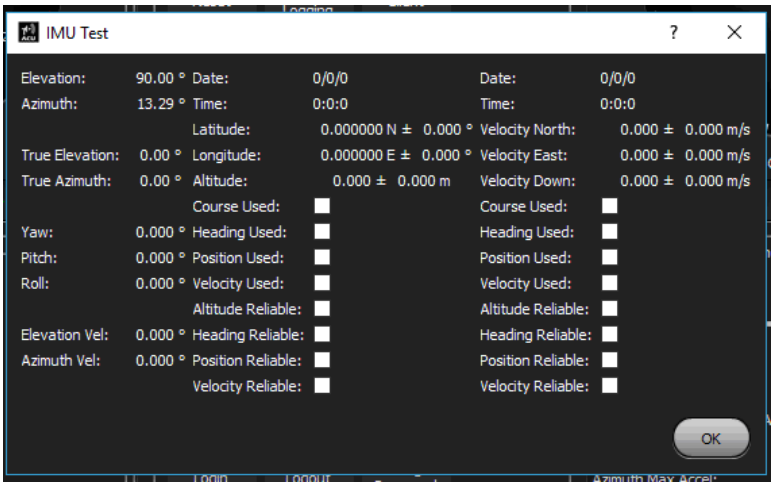

Figure 97: IMU Test Window

3.4.3 Tools- Authentication Window

The Tools, Authentication sub-window contains three (3) access buttons: Login, Logout, and Change Password, as shown in Figure 98.

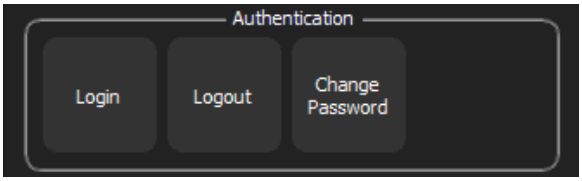

Figure 98: Tools Window, Authentication Sub-window

3.4.3.1 Authentication - Login

The LOGIN button opens the Login dialog box, shown in Figure 99. The system Administrator uses this dialog box to enter the correct user ID and password. When the login is accepted by the ACU, the Administrator has access to all sensitive (log in required) setting and control dialog boxes. The Login dialog box is available to the Local ACU and all remoted devices.

Figure 99: Login Dialog Box

The Login dialog box responds to two (2) username and password parameters. One allows the modification of basic system functions. The other allows full access to all system critical operational parameters and must be used with care, as some changes to the ACU control parameters can render the tracking system unusable.

Usernames

- Operator - Allows basic control changes that may be needed by the day to day operator
- Administrator - Allows access to all operator restricted settings, as well as, all critical system set up parameters

Passwords

The passwords are provided to the Designated Tracking System Administrator during system install or are available only by direct contact with Quasonix Antenna Systems Group.

Care must be taken when system critical parameters accessed by the ADMINISTRATOR login are changed or modified from their original factory tested settings. Changes to many system critical parameters can cause the loss of system control, or render the tracking system unstable, or completely unusable.

3.4.3.2 Authentication - Logout

The LOGOUT button opens the Logout dialog box, shown in Figure 100. This box requests confirmation of logout. By selecting the YES button, the Administrator is logged out of the ACU or remote device. By selecting the NO button the Administrator remains logged in. This window is available to the Local ACU and all remoted devices and ACUs.

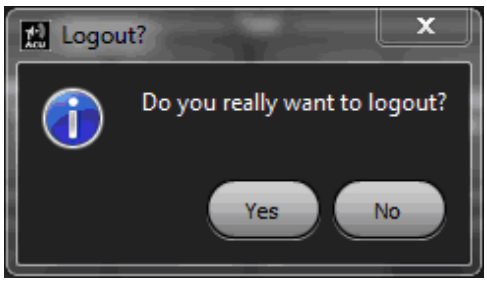

Figure 100: Logout Dialog Box

3.4.3.3 Authentication - Change Password

The CHANGE PASSWORD button opens the Change Password dialog box, shown in Figure 101, enabling an administrator to change the password associated with a particular username. The current Administrator username and current password must be entered and accepted for the Administrator password to be renamed and changed.

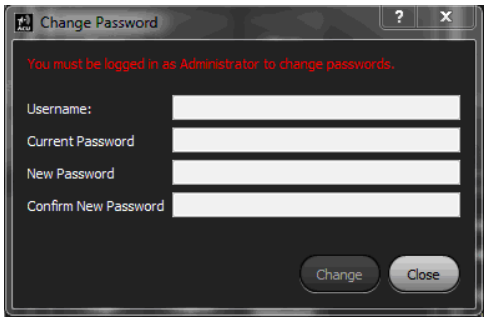

Figure 101: Change Password Dialog Box

Note: The Change Password dialog box requires permission and a log in to make changes to the saved parameter settings. Generally, you must be the antenna pedestal administrator to access this dialog. It is available to remote user(s) with the proper log in credentials. Only the Local ACU is reset—no remotes.

To request permission:

1. Select the Tools icon from the ACU Tool bar.
2. In the Authentication window, select the LOGIN button.
3. Type the Username and Password.

   When permission is granted, the Change Password dialog box can then be re-launched.

The Administrator must complete all four fields: Username, Current Password, New Password, and Confirm New Password. The CHANGE button saves the changes and exits the dialog.

The CLOSE button exits the dialog box without saving.

3.5 Tool Bar - Help

The Help icon located on the ACU's Tool bar and shown in Figure 102, provides information useful when contacting Quasonix customer service.

Figure 102: AGC Tool Bar, Help

Selecting the Help icon opens the Help window, as shown in Figure 103. The Help window contains four (4) tabbed sections: Contact, ACU Version, DACU, and Documents.

Figure 103: Help Window, Contact Tab

3.5.1 Contact Tab

The Contact tab, shown in Figure 103, provides the address and telephone numbers for the Quasonix California facility.

3.5.2 ACU Version Tab

The ACU Version tab, shown in Figure 104, provides the current software build information.

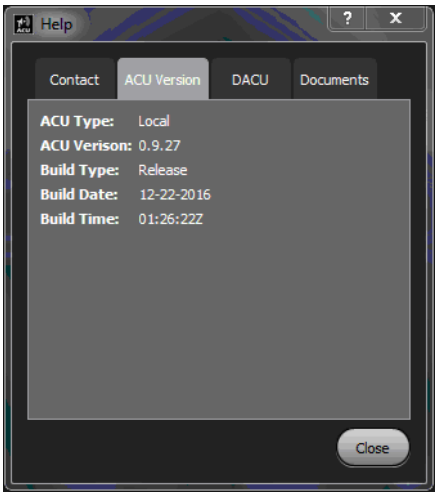

Figure 104: Help Window, ACU Version Tab

3.5.3 DACU Tab

The DACU tab, shown in Figure 105, provides the ACU's internal I/F DACU PCB information and firmware revision.

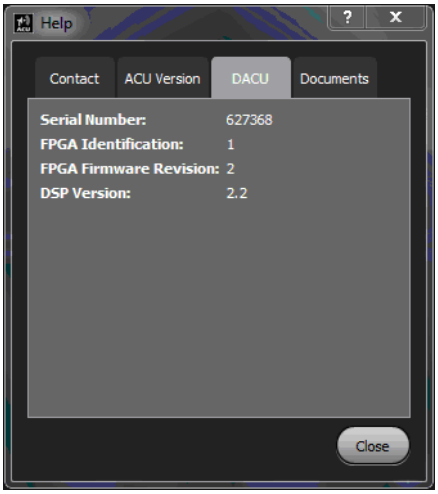

Figure 105: Help Window, DACU Tab

3.5.4 Documents Tab

The Documents tab, shown in Figure 106, launches the PDF version of this software manual, provided during the Quasonix GUI software installation.

Click on the User Manual button to load the Adobe Reader software and the software manual at the same time. This provides operator access to the current manual on the ACU front panel display.

Figure 106: Help Window, Documents Tab

3.6 Tool Bar - Request Control (Rqst Ctrl)

The Request Control icon located on the ACU's Tool bar and shown in Figure 107, gives the operator the ability to take control, from a remote location, of a Local ACU through its back panel Ethernet connection.

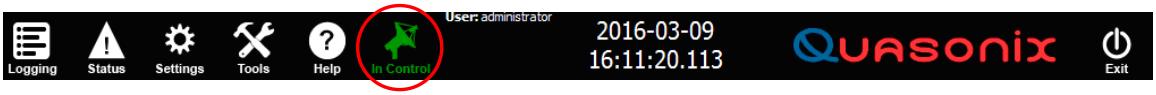

Figure 107: AGC Tool Bar, Request Control

Request Control enables a remotely located ACU or other terminal to control the pedestal or system through the attached local ACU.

- When the *local* ACU has control, the RQST CTRL icon changes to green.
- When a *remote* ACU terminal is in control, the RQST CTRL icon on the *local* ACU turns red after the control request is granted by the local ACU.
- When the *remote* ACU terminal is in control, its RQST CTRL icon is green.

For example, when the remote ACU GUI software is launched from a Windows 7 desktop on a laptop, the Connecting dialog box displays and attempts to connect to the last entered IP address for the local ACU. If the remote terminal cannot connect, the user must select the ACU SETTINGS button to open the ACU Settings dialog box. Refer to Figure 108.

The new IP address of the Local ACU can be entered into the Settings dialog box to complete the connection. When the OK button is selected, the Settings box closes and the Connecting box stays open until a connection is made.

When a connection is established between the Remote and Local ACU, the Local's GUI displays on the remote terminal however, *the remote does not have control of the system until the remote operator selects the (red) RQST CTRL icon on the Tool bar*.

If the Local operator approves the request, the remote terminal is in control of the system and the remote terminal's RQST CTRL icon turns green.

If there is no Local operator present to grant the request, the remote takes control after a 30 second waiting period. If the Local operator is present and is conducting a test with the Local ACU, they can deny the connection request from the remote terminal and continue normal operations.

Figure 108: Remote ACU with Connection Request Dialogs

3.7 Tool Bar - Date and Time

The system Date and Time is continuously displayed on the ACU Tool bar, as shown in Figure 109. The date and time is currently set and updated from the Windows 7.0 time tools.

Figure 109: Tool Bar with Date and Time

3.8 Tool Bar - Exit

The Exit icon is located on the ACU Tool bar, as shown in Figure 110. It is used to close the ACU GUI and return to the Window 7.0 desktop.

Figure 110: Tool Bar, Exit

4 Maintenance Instructions

The Antenna Control Unit requires no regular maintenance, and there are no user-serviceable parts inside.

5 Product Warranty

The Antenna Control Unit carries a standard parts and labor warranty of one (1) year from the date of delivery.

5.1 Quasonix Limited Warranty Statement

This Limited Warranty Statement (this "Limited Warranty") applies to all hardware and software products and internal components of such products (the "Products") sold by Quasonix, or its representatives, authorized resellers, or country distributors (collectively referred to herein as "Quasonix"). EXCEPT AS EXPRESSLY SET FORTH IN THIS LIMITED WARRANTY, QUASONIX MAKES NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ANY PRODUCTS SOLD BY IT. Quasonix expressly disclaims all warranties and conditions not stated in this limited warranty. There are no warranties which extend beyond the description on the face hereof. Capitalized terms not otherwise defined herein shall have the meaning set forth in those certain General Terms and Conditions of Sale for Standard Product, as amended from time to time.

Quasonix warrants to customer that for one (1) year from the date of shipment of the Products by Quasonix (the "Warranty Period"), such Products purchased from Quasonix or its authorized affiliate will materially conform to the specifications set forth in the applicable Quasonix Specifications, if any, and are free from defects in materials and workmanship under normal use during the Warranty Period. As used herein, "normal use" means the intended use of the Products for which it was designed by Quasonix.

This Limited Warranty extends only to the original purchaser of the Products and is not transferable to anyone who obtains ownership of the Products from the original purchaser.

Quasonix's software, whether incorporated into the Products or sold separately, is warranted solely to the extent that problems or "bugs" are found in the software and affect the functional operation of the Products. At no time shall requests for changes in the software architecture or visual esthetics be considered a warranty item.

The Products are manufactured using new materials only. Replacement parts may be new or equivalent to new. Replacement parts are warranted to be free from defects in material or workmanship for thirty (30) days or for the remainder of the Warranty Period of the Products in which they are installed, whichever is longer.

During the Warranty Period, Quasonix will repair or replace the defective Products. All components or hardware products removed from the Products under this Limited Warranty become the property of Quasonix. All warranties are limited to the repair or replacement of the Products.

In no event shall Quasonix be liable for any special, consequential, incidental or indirect damages of any kind, including, without limitation, loss of profits, loss of data, "down-time," loss of use or damage to other equipment, or personal injury or death, whether or not Quasonix has been advised of the possibility of such loss.

Notwithstanding anything to the contrary herein, Quasonix's entire liability hereunder from any cause whatsoever and regardless of the form of action shall be limited to the amount actually received by Quasonix.

Quasonix shall not be liable for a breach of the warranty set forth in this Limited Warranty unless: (i) the customer gives written notice of the defect, reasonably described, to Quasonix's Contracts Administrator within thirty (30) days of the time when customer discovers or ought to have discovered the defect and obtains a Return Materials Authorizations ("RMA") number; (ii) Quasonix is given a reasonable opportunity after receiving the notice to examine such Products and customer (if requested to do so by Quasonix) returns such Products to Quasonix's facility in Moorpark, CA, unless otherwise approved by Quasonix; and (iii) Quasonix reasonably verifies customer's claim that the Products are defective.

Subject to the foregoing, with respect to any such Products during the Warranty Period, Quasonix shall, in its sole discretion, either: (i) repair or replace such Products (or the defective part) or (ii) credit or refund the price of such

Products at the pro rata contract rate provided that, if Quasonix so requests, customer shall, at Quasonix's expense, return such Products to Quasonix.

The customer is responsible for all costs associated with packaging and shipping of the defective Products to Quasonix's facility and clearly marking or affixing the given RMA number on the shipping label. Quasonix is not responsible for any loss or damage during shipment to Quasonix's facility. Following repair or replacement of covered Products, Quasonix will assume responsibility for the costs associated with the return of the material to the customer to an address provided by the customer. Notwithstanding the foregoing, items returned to Quasonix's facility and found to be operational or otherwise not covered by this Limited Warranty shall be returned to the customer at the customer's expense.

This Limited Warranty does not apply to expendable parts, such as cables, lamps, fuses, connectors, etc. This Limited Warranty does not extend to any Products which have been damaged or rendered defective (a) as a result of accident, misuse, abuse, or external causes; (b) by operation outside the usage parameters stated in the user documentation that shipped with the Products; (c) as a result of a failure to follow the instructions in the Operations & Maintenance Manual (d) by the use of parts not manufactured or sold by Quasonix; or (e) by modification or service by anyone other than (i) Quasonix, (ii) an Quasonix authorized service provider, or (iii) your own installation of end-user replaceable Quasonix or Quasonix approved parts if available for the Products in the servicing country.

THE TERMS OF THE WARRANTIES CONTAINED HEREIN DO NOT IN ANY WAY EXTEND TO ANY PRODUCT OR PART THEREOF OR SOFTWARE MATERIALS WHICH WERE NOT MANUFACTURED BY SELLER OR PREPARED BY SELLER OR ANY OF ITS AFFILIATES.

These terms and conditions constitute the complete and exclusive warranty agreement between the customer and Quasonix regarding the Products purchased. This Limited Warranty is applicable in all countries and may be enforced in any country where Quasonix or its authorized affiliates offer warranty service subject to the terms and conditions set forth in this Limited Warranty.

These terms and conditions supersede any prior agreements or representations (including representations made in Quasonix sales literature or advice given to the customer by Quasonix or an agent or employee of Quasonix) that may have been made in connection with the purchase of the Products. No change to the conditions of this Limited Warranty is valid unless it is made in writing and signed by an authorized representative of Quasonix.

5.1.1 Extended Warranties

Extended warranties or extra coverage are available upon request. Please contact Quasonix for details and pricing.

THE REMEDIES SET FORTH IN THIS LIMITED WARRANTY STATEMENT SHALL BE THE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH HEREIN.

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6 Technical Support and RMA Requests

In the event of a product issue, customers should contact Quasonix via phone (1-513-942-1287) or e-mail (support@quasonix.com) to seek technical support. If the Quasonix representative determines that the product issue must be addressed at Quasonix, a returned materials authorization (RMA) number will be provided for return shipment.

Authorized return shipments must be addressed in the following manner:

Quasonix, Inc.
ATTN: Repair, RMA #
6025 Schumacher Park Drive
West Chester, OH 45069

To ensure that your shipment is processed most efficiently, please include the following information with your product return:

- Ship To – Company name, address, zip code, and internal mail-drop, if applicable
- Attention/Contact person – Name, Title, Department, Phone number, email address
- Purchase Order Number – If applicable
- RMA Number – provided by the Quasonix representative

Please note that Quasonix reserves the right to refuse shipments that arrive without RMA numbers.

7 Appendix A - ACU Front Panel GUI

Appendix A identifies each part of the ACU front panel GUI.

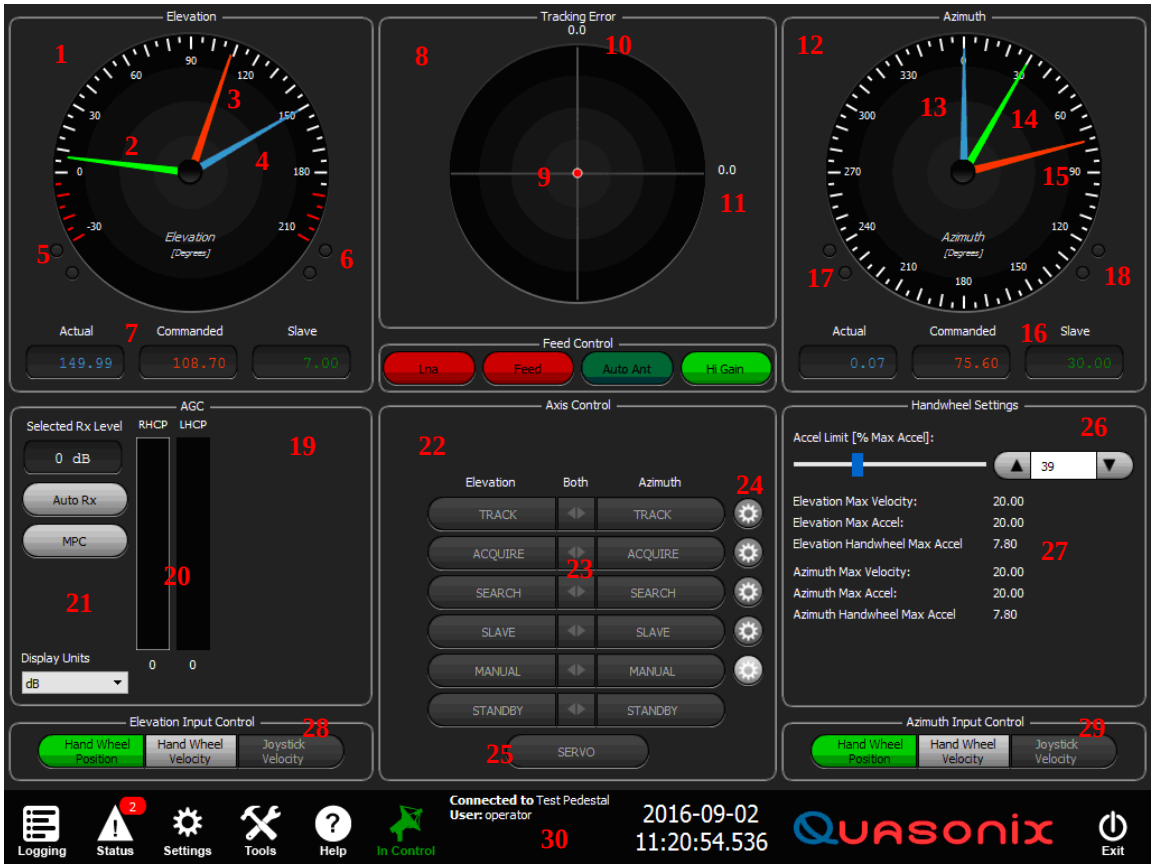

Figure 111: ACU Front Panel GUI with Parts Numbered

7.1 Elevation Axis Window

1. Elevation angle Feedback/Reporting
2. Green Elevation Slave position pointer within EL analog angle reporting dial
3. Orange Elevation Commanded Position pointer within analog dial
4. Blue Elevation Actual EL axis pointing angle within analog dial
5. Elevation Down Limit LED indicators for the soft and hard electrical limits
6. Elevation Up Limit LED indicators for the soft and hard electrical limits
7. Elevation Digital Position Readouts for the Commanded, Actual, and Slave axis positions

7.2 Tracking Error Window

8. Tracking Information

9. Tracking Error dial with center dot (meatball) error pointing indicator
10. Elevation error digital readout
11. Azimuth error digital readout

7.3 Azimuth Axis Window

12. Azimuth angle Feedback/Reporting
13. Blue actual Azimuth axis pointing angle pointer within AZ the analog dial
14. Green Elevation Slave position pointer within the AZ analog reporting dial
15. Orange Elevation Commanded Position pointer within the AZ analog dial
16. AZ axis Digital Position Readout for the Actual, Commanded, and Slave axis positions
17. AZ CCW Limit LED indicators for the soft and hard electrical limits (active in cable wrap system)
18. AZ CW Limit LED indicators for the soft and hard electrical limits (active in cable wrap system)

7.4 AGC Signal Level Reporting Window

19. AGC signal reporting area
20. AGC 2 channel (RHCP and LHCP) power level ribbon meters
21. Auto RX (automatic receiver channel selector On-Off button), MPC (multi path clipping On-Off button), the selected RX receiver power level readout window and the Display Units drop down menu.

7.5 Axis Control Window

22. Axis control area
23. Manual selection buttons for AZ and EL axis motion control selection operations
24. Gear icon hot buttons used to open the multi-function display window for immediate access control parameters
25. SERVO On-Off button

7.6 Multi-Function Display Window

26. Multi-function display window with Handwheel Settings window displayed
27. Axis manual control parameter display and quick access acceleration slider tool, available when the Gear icon hot button next to the associated manual buttons is selected. The Multi-function display changes with each hot button selection.

7.7 Elevation Input Control Buttons

28. Elevation (manual) Input Control buttons; Provides for the selection of hand wheel position and/or velocity input control and Joystick velocity control

7.8 Azimuth Input Control Buttons

29. Azimuth (manual) Input Control buttons; Provides for the selection of hand wheel position and/or velocity input control and Joystick velocity control

7.9 Tool Bar

30. Tool bar containing the system Logging, Status, Settings, Tools, Help, and Control icons. The date and time display, connection information, and GUI Exit icon are also contained on the Tool bar.

8 Appendix B - Required Tracking Calibrations-Adjusting TDC Offsets and Slopes

8.1 Error Display Calibration Steps - Correct Phasing of the AM and TDC Signals

8.1.1 First Condition – Only AZ Errors are Present

Note - The Slope setting has been updated and divided into two parameters – Detector Gain and Tracking Slope. TDC calibrations are the same for each version of the software. For additional information concerning the Detector Gain parameter and the Tracking Slope calibration, refer to section 3.3.4.2. The steps in this section refer to the older version of the software where only TDC and Slope are calibrated for correct tracking. The new Detector Gain parameter is primarily for refining the Error Meter's Volts per degree alignment versus varying Antenna size.

1. Connect the ACU to the external receiver using the ACU's back panel AGC and AM BNC input ports. Each receiver's AM and AGC outputs connect to a separate pair of AGC and AM inputs (Receiver 1 connects to AGC 1 and AM 1, Receiver 2 to AGC 2 and AM 2).
2. Do the following:
   a. Ensure that the ACU's FEED and LNA buttons are On (Green).
   b. Aim the antenna at a suitable transmitting boresight.
   c. Tune the receiver to the boresight's transmitting frequency.
   d. Peak the antenna up on the boresight in AZ and EL to receive maximum signal strength.
   e. Ensure that the Error dial displays error and that the small center dot is green (indicating that the TDC signal from the feed is present).
   f. Verify that the ACU AGC signal level meter shows signal level on the highlighted (selected receiver) AGC ribbon meter.
   g. Move the antenna in AZ and EL to place the green dot (meatball) in the center of the Error dial crosshairs. At this location, the received signal should also be maximized.
   h. After the antenna is peaked up on the boresight, place the Elevation axis in Standby. All calibrations are performed using the AZ axis to reduce ground reflection issues.
3. Select the Settings icon from the Tool bar, then select the TRACKING button. With the Track Setting dialog box open, select the Receiver tab to open the Receiver dialog box. Select the receiver to be calibrated from the drop down menu (in this example, Receiver 1, Band 1 has been selected for calibration).
4. Move the Azimuth ONLY slowly CW, and then CCW, back and forth. Typically the AZ axis only needs to move about half of the beam width to each side of the boresight position. *Do not move the Elevation axis. Elevation should be in Standby.* If the tracking calibration is good, the meatball appears to move along the horizontal (AZ) line of the Track Error dial and will not deflect up or down. There should be NO, or very little, Elevation error when moving the antenna across the boresight in Azimuth. In this example, no changes to the TDC offset would be necessary. The TDC signal is aligned (phased correctly) with the AM, however, the polarity may be reversed, so the AZ tracking ability needs to be checked.
5. Figure 112 illustrates this example peaked up on the boresight in AZ and EL, with the meatball (green dot) centered on the crosshairs of the Tracking Error dial. In a perfectly calibrated system, the meatball moves across the Error dial on the horizontal line when the antenna is moved in Azimuth across the boresight.

Figure 112: Track Settings Condition 1-Adjusting TDC Offsets

To check the tracking ability (and polarity) using the Azimuth axis only:

1. Move the AZ CCW (or CW) slowly, keeping the meatball in the Track Error dial.
2. Slew in Azimuth to about half the beam width of the antenna (2-3 degrees CW or CCW).
3. When AZ TRACK is selected from the Manual AZ TRACK buttons, the antenna should move back to the boresight position, and the Track Error dial crosshairs appear to move back to the meatball target and center on it. If the crosshairs "push off" and do not return to center on the meatball, the phasing of the TDC is approximately 180 degrees out of phase (AM and TDC are 180 degrees out of phase with each other). The TDC offset must be set to about 180 degrees from the present offset to correct the AZ tracking (polarity) error.
4. In Figure 112, if the crosshairs pushed off from the meatball with the TDC offset set to 60 degrees, it would be necessary to add about 180 degrees to the present offset (180° + 60° = approximately 240° as the new TDC offset). This should flip the meatball to the opposite side of the error meter. With the new TDC offset applied, select the Apply button. This saves the settings and exits the Receiver tab. On the ACU front panel, select the Azimuth TRACK button in the Axis Control window. The crosshairs of the meter should move to center on the meatball target. The TDC phasing is now correct, and the system should track the boresight in both the AZ and EL axes.

   With the system correctly tracking on to the boresight in the AZ axis, the same test can be performed with the Elevation axis, by centering the meatball on the error meter's center crosshairs, then moving the meatball up and down. The meatball should appear to move along the vertical axis of the error meter without deflecting off to each side. (Some deflections most likely will occur due to multipath in the EL axis.) Move the EL axis up about two (2) degrees. The meatball moves along the vertical axis. On the ACU front panel, select the Elevation TRACK button in the Axis Control window. The error meter crosshairs should move to center on the meatball (boresight) target. Repeat for the down direction.

5. Another method for changing the phasing without adjusting the TDC offset (as long as the meatball stays centered on the horizontal line of the error meter as the AZ axis is moved side to side CW to CCW) is to change the sign of the AZ slope. For example, in Figure 113, if the error meter crosshairs "push off" from the meatball target, change the AZ slope (which is currently +5) to -5. The error meter crosshairs should pull back on to the meatball target in AZ when the Azimuth TRACK button is selected.

   The same tracking calibrations and methods apply to the Hi Gain and Lo Gain settings.

Figure 113: Track Settings Condition 1-Adjusting TDC Offset, AM TDC Phasing OK

The ability to track the target (meatball) is tested after the TDC offset is in place. The crosshairs are moved off of the target meatball in AZ CCW or CW (Elevation is not moved). Azimuth TRACK is selected. The crosshairs push off and away from the target meatball. The TDC and AM are out of phase, and the TDC offset must be adjusted by about 180 degrees. In the TDC Offset field, enter 180 (degrees), then select the Apply button.

However, if the crosshairs pull on, and center on, the meatball target (green), the AZ phasing is correct and the TDC signal from the feed, and the AM from the receiver, are in phase and aligned.

8.1.2 Second Condition – AZ and EL Errors are Present

A second possibility exists when the antenna is peaked up on the boresight and the received signal is maximized. The Elevation axis is placed in Standby, and the Azimuth axis is moved slowly CW and CCW across the boresight position. The meatball appears to move diagonally across the Track Error dial. There are AZ and EL errors present during the AZ motion. The TDC offset must be changed to eliminate the Elevation error.

When moving in AZ, there should be NO Elevation error, or a very small EL error. To adjust the AM and TDC phasing, the TDC offset is increased or decreased until the meatball seems to move along the horizontal line of the Error dial when the Azimuth axis is slowly moved CW and CCW. In Figure 114, the AZ axis is about two to three degrees off from the boresight. TDC must be increased or decreased to "walk" the meatball down to the horizontal

line of the Track Error meter. The TDC Offset can be adjusted incrementally, with the Apply button selected after each TDC Offset change. When the meatball is finally on the horizontal line, moving the AZ axis CW and CCW moves the meatball back and forth along the horizontal line (AZ error line) with almost NO EL deflection. The meatball should not deflect up or down as it crosses the center of the error meter. The EL error voltage/degree readout at the top of the Track Error meter should stay at about 0 (or so) as the AZ axis is slowly moved back and forth.

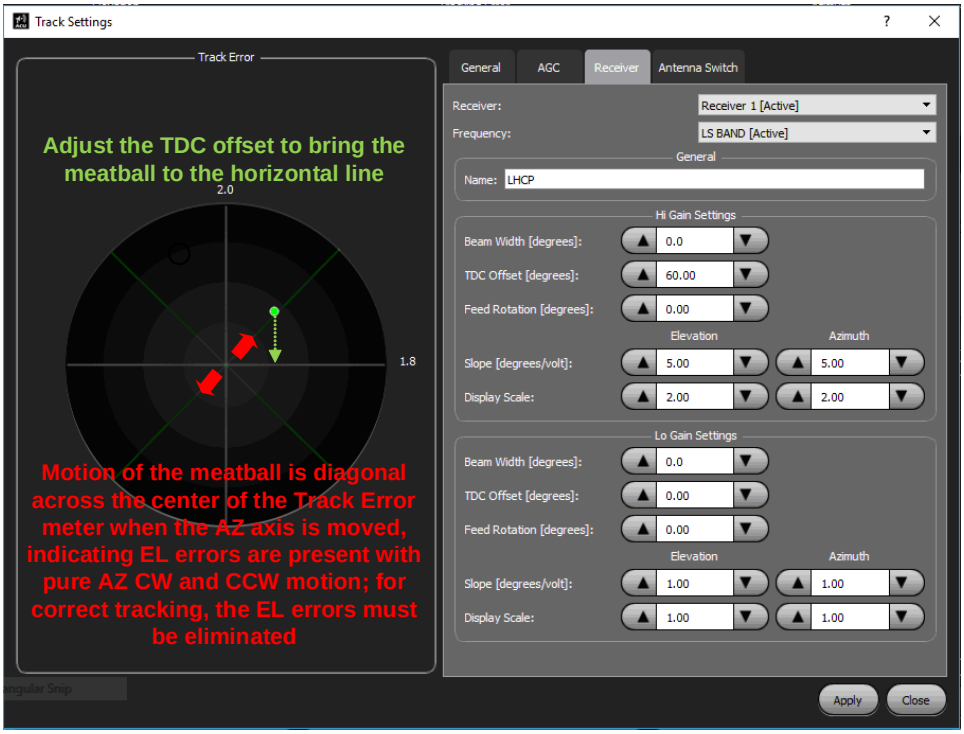

Figure 114: Track Settings Condition 2-Adjusting TDC Offset, AZ and EL Errors

In a perfectly aligned system, when the Azimuth axis is moved in the CW and/or CCW directions, the meatball (target) appears to move along the Horizontal line with NO up or down deflections (EL errors).

With the TDC now set to align the meatball with the horizontal line of the meter, the ability of the system to track the boresight should be tested. Like the first example, the antenna is moved off from the boresight 2-3 degrees in Azimuth only. After the meatball is placed off center, the Azimuth TRACK button is selected to force auto track in the AZ axis. The crosshairs of the Track Error dial should pull back to center and line up on the meatball target.

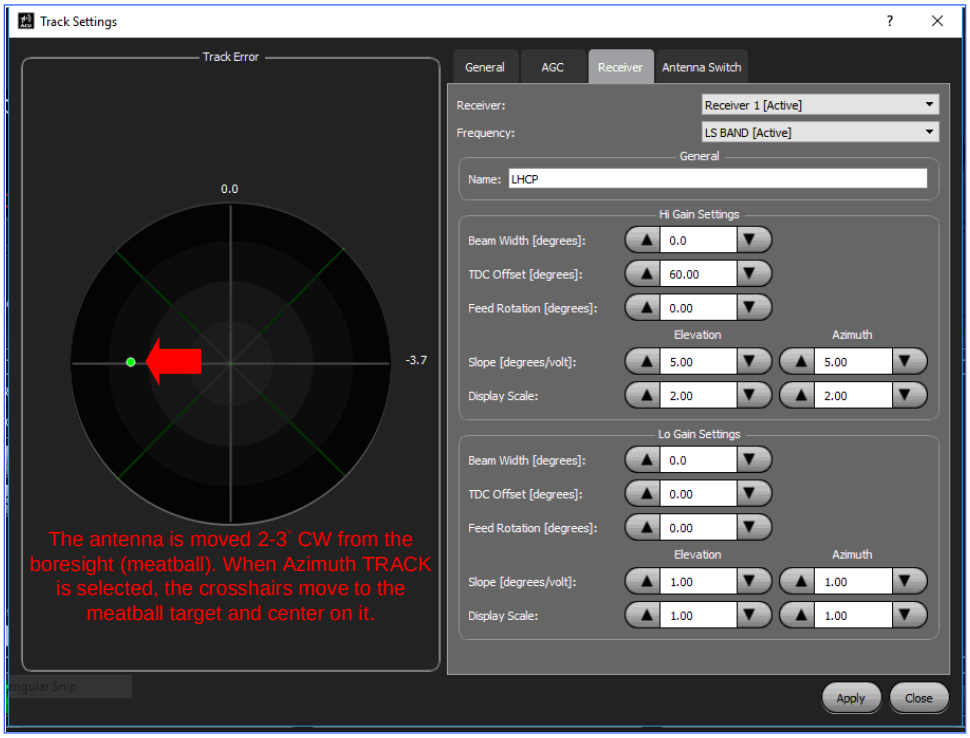

Figure 115: Condition 2-Check System Tracking Ability in AZ/EL After TDC Offset Adjustments

To check the tracking in both AZ and EL:

1. Move the meatball target to one of the upper quadrants by moving both the AZ and EL axes equally.
2. In the example shown in Figure 116, the AZ and EL axes have been moved CCW and down placing the meatball in the upper right quadrant of the Track Error dial (both error numerical display readouts should be about equal).
3. Select two-axis track by pressing the Both button in the Axis Control window between the Elevation and Azimuth TRACK buttons. This forces the ACU to track the target in AZ and EL at the same time. The meatball target appears to move back to the crosshairs and center on them (or crosshairs will move directly up and CW to center on target).
4. If the TDC offset is correct and there are minimal ground reflections, the meatball appears to move directly back to center on the crosshairs without "hunting" around the Track Error dial.
5. This process can be repeated for each of the four (4) Track Error dial quadrants (Q1 through Q4 in Figure 116), keeping in mind, that the lower quadrants (where the antenna is aiming down in Elevation) may see ground reflections, causing the antenna to hunt around before centering the meatball on the crosshairs.

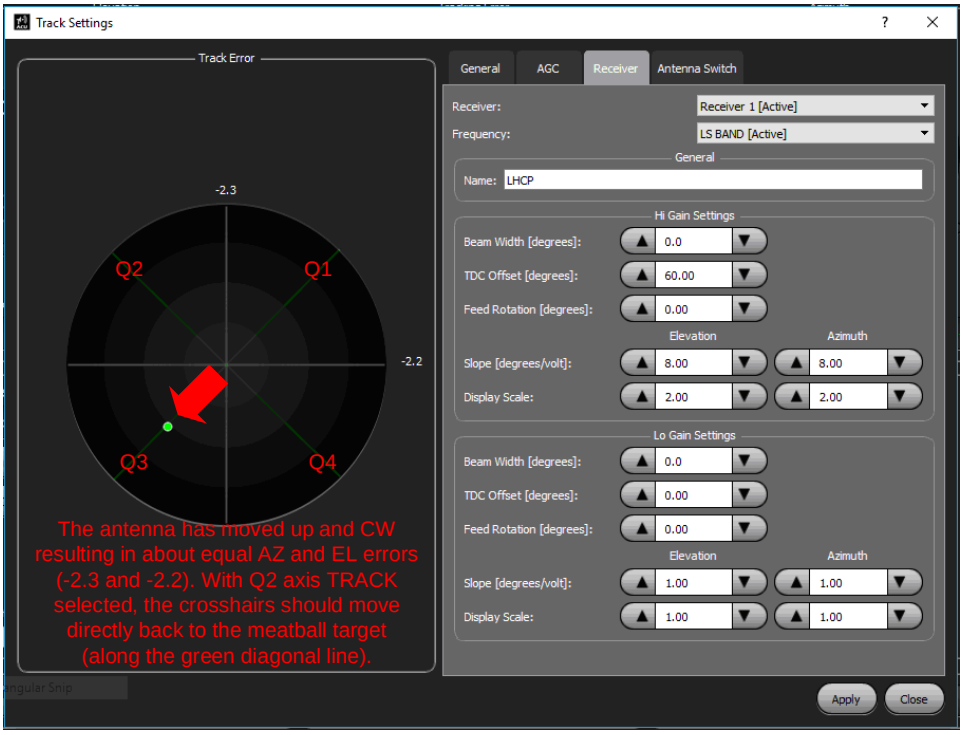

Figure 116: Condition 2-Check System Tracking Ability in AZ/EL After Adjusting TDC Offset

8.1.3 Adjust the Slope Setting

After the TDC offsets are in place and the antenna correctly tracks the boresight target from all four quadrants of the Track Error dial, the rate at which the antenna appears to move back to the target (tracking gain) is set by adjusting the Slope setting, as shown in Figure 117. The larger the slope setting the quicker the antenna appears to slew back to the target when the TRACK Button is selected. Setting the slope too high causes the antenna to oscillate back and forth across the target (boresight) causing the tracking to be “too hot” and the ability to center or pull on to the target to become poor. The slope should be set as a compromise between the speed at which the antenna tracks back to the boresight and the centering up on the target.

The slope must be set for each receiver connected to the ACU through the back panel AM and AGC inputs. The slope (and TDC offset) must be set for each antenna present in the system, usually a low gain (ACQ AID) and a high gain reflector.

The Slope field is used to adjust the tracking Gain of the system. It is set for each receiver connected to the ACU and each antenna present in the system (Low gain and/or High gain). The slope is adjusted to provide smooth tracking of the target with enough speed to track correctly but without introducing oscillations in the system during the track. The slope can be adjusted up to make the track “hotter” but should not be adjusted to the point of causing oscillations around the target.

If during track, the system appears to be jittery or oscillates around the boresight target, it may be necessary to lower the slope settings for each antenna present in the system. A misadjusted TDC setting may also result in jittery tracking of the boresight, or hunting around the target boresight, instead of slewing directly to the target and aligning the cross hairs on the target meatball.

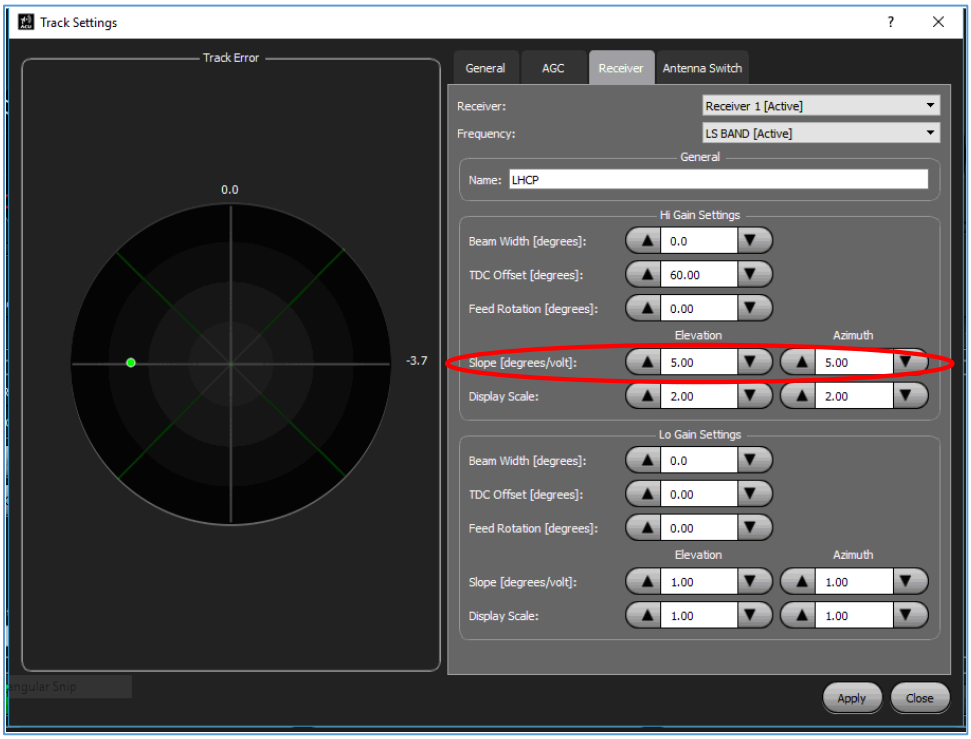

Figure 117: Adjust the Slope Setting to Set the Tracking Gain

Figure 117 shows equal slope settings of +5 for the AZ slope and the EL slope. The slope settings do not have to be equal. For better target tracking, it may be necessary to have the horizontal motion (AZ Track) a little "hotter" than, the up and down motion (EL Track) of the system.

In addition, changing the sign of the slope from plus (+) to minus (-) inverts the TDC setting. For example, if the system is tracking correctly in AZ (error meter cross hairs "pull on" to the target meatball when AZ track is selected), changing the AZ slope sign causes the system to "push off" from the target meatball when AZ track is selected.

9 Appendix C - Set AGC Meters to Match Attached Quasonix Receiver

Ensure that the receiver is connected to the ACU correctly. The AM output from the first receiver should be connected to the AM1 BNC on the back panel of the ACU. The AGC output from the first receiver should be connected to the AGC 1 input BNC on the back panel of the ACU. If a second receiver is present, connect the AM and AGC outputs from that receiver to the AM2 and AGC2 BNC connectors on the back panel of the ACU. These connections are the same for any attached Telemetry Receiver, however, the Quasonix receiver is used in the following example.

The Receiver signal level indicators, shown in Figure 118 and generated from the Quasonix receiver, should be matched to the ribbon meters in the AGC window on the front panel of the ACU GUI. The noise floor setting should be adjusted to match the Quasonix receiver's of -130 dBm. The ACU ribbon meters should be set to display in dBm by selecting the drop down arrow and choosing the dBm setting.

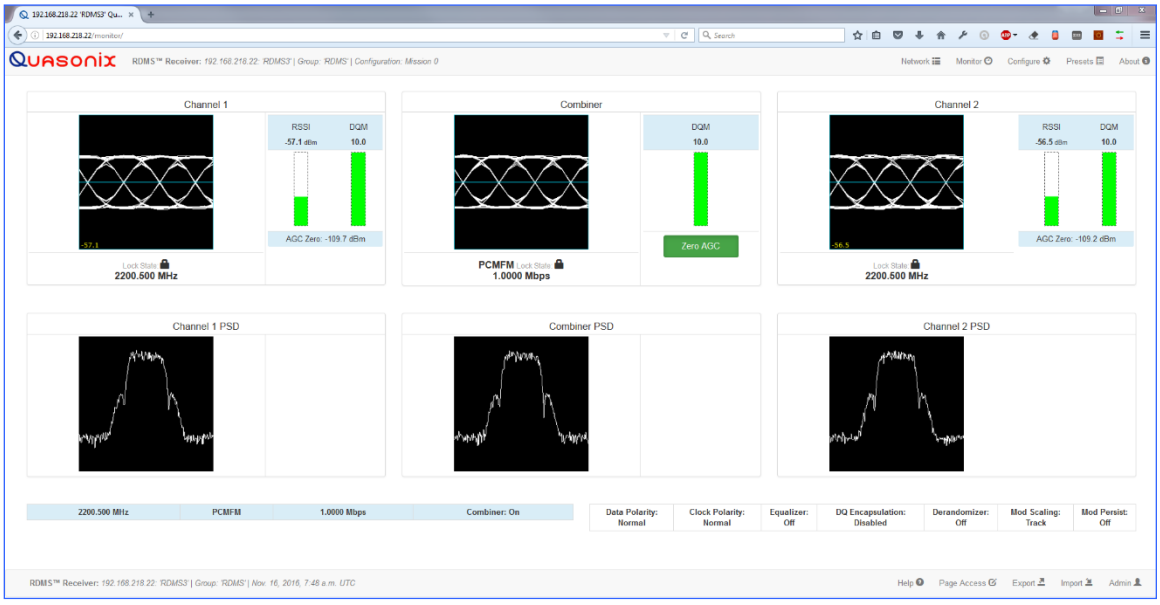

Figure 118: Quasonix Receiver Graphical User Interface Display Via Network Connection

The ACU front panel is shown in Figure 119. The AGC window is set to display one signal strength ribbon meter (LHCP) and the meter is recording signal level in dBm. The meter is currently showing an approximate signal level of -72 dBm, while the Quasonix receiver shows a signal strength of -57 dBm.

The ACU can be set to display the AGC signal level in dBm or dB, as indicated by the Display Units drop down menu. When mated to the Quasonix receiver, the ACU AGC ribbon meter(s) should be set to dBm to match the Quasonix receiver's signal level output display.

The ACU Noise Floor level should be set to match the Quasonix receiver's noise floor of -130 dBm. To set the ACU noise floor, the Settings > (Remote ACU window) TRACKING button is selected and the AGC tab opened. The noise floor level is entered in the Acquire Settings window. The noise floor setting can also be entered by selecting the Gear icon located next to the Manual Acquire button. Track Settings window opens to showing the same settings including the Noise floor setting field.

AGC ribbon (signal strength) meters in the AGC window are set to match the Quasonix Receiver's signal strength display by selecting the dBm setting from the Display Units drop down and by setting the noise floor to -130 dBm in the Settings > Tracking > AGC Tab > Noise Floor field. These settings should approximately match the ACU signal strength display (ribbon) meters to the Quasonix receiver signal strength meter(s).

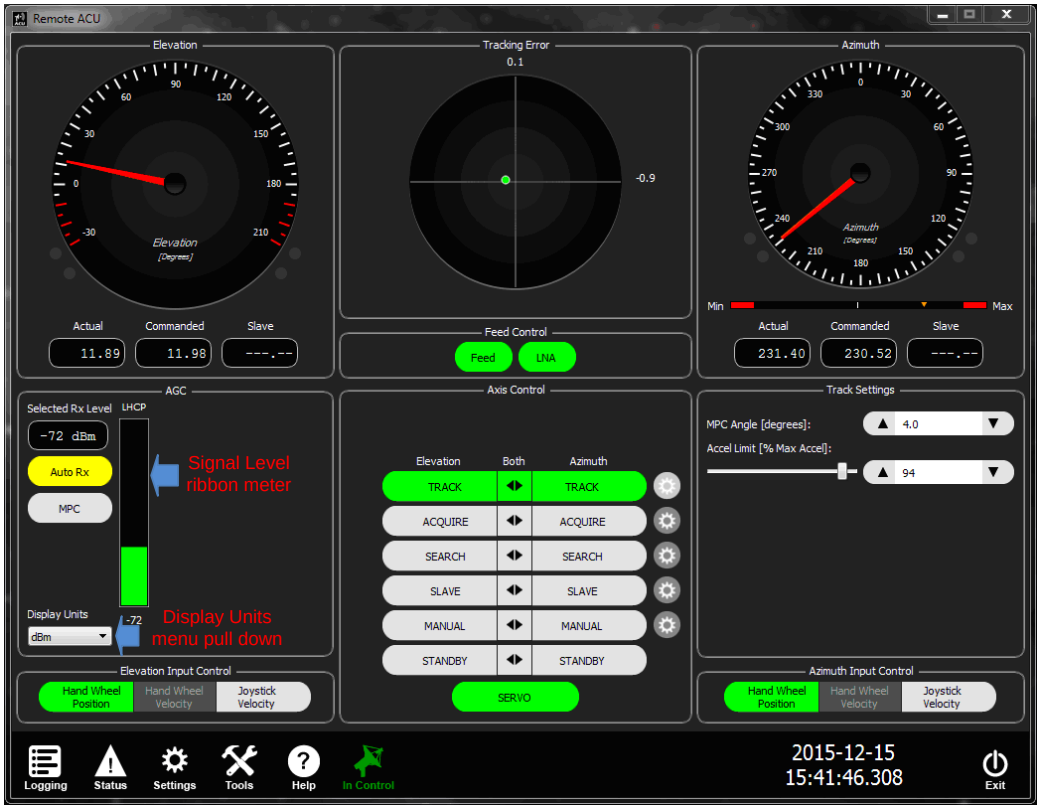

Figure 119: ACU Front Panel, AGC Window Labeled

After the ACU's AGC signal strength display meter(s) are set to match the Quasonix receiver's signal strength display meter and the ACU noise floor setting is matched to the receiver, the connected receiver and ACU can be calibrated together.

1. The receiver/antenna system is calibrated by pointing the antenna to 90 degrees Elevation (straight up) to minimize any received signals.
2. The Feed and LNA are turned On.
3. The Quasonix Receiver's AGC is then zeroed out by selecting the Zero AGC option from the Quasonix front panel AGC menu. There is a slight flash on the front panel but no message. The blue AGC zero line displays in the signal meter.
4. The ACU front panel signal level ribbon meter(s) and the Quasonix receiver front panel signal strength meter(s) should be zeroed and both sets display an approximate zero signal level reading. If the dBm scaling is selected, both ACU and Quasonix receiver ribbon meters will be at the same noise floor position (at approximately -130 dBm). When tracking a radiating target, the Receiver front panel signal level meter and the ACU AGC area ribbon meter should be at approximately the same level.

10 Appendix D – Lever Arm Measurements

(when the SBG Ellipse IMU and the Hemisphere Differential GPS are attached to the system)

Note: Refer to the SBG (IMU) and Hemisphere Differential GPS factory documentation for detailed lever arm measurement requirements and procedures.

10.1 Basic SPG IMU/Hemisphere Differential GPS Set Up

This section explains basic set up instructions for SPG/IMU and Hemisphere Differential GPS, and the process for Lever Arm determination.

The top of the SPG IMU module is represented in Figure 120. The X arrow represents the pitch axis of the SPG IMU Module. The Y arrow represents the roll axis of the module. The yaw is provided by the Hemisphere differential GPS, and is fed to the SPG IMU module, which is then communicated to the Quasonix DACU card over an RS-422 signal line.

The DACU interprets the data, and reports the pitch, roll, and yaw in the Stabilization window on the front panel of the ACU GUI, as well as in the Tools > Test > IMU Test screen.

The lever arm parameters are the distance from the SPG IMU module to the Hemisphere Differential GPS unit, as illustrated in Figure 120. After the lever arm measurements (in meters) are established, the numbers can be entered into the Settings > Local ACU > IMU Configuration screen. When entering the IMU X, Y, and Z lever arms, ensure that the sign (+ or – meters) is correct for each parameter entered. Incorrect measurements or signs result in unstable or incorrect stabilization correction position information to the pedestal.

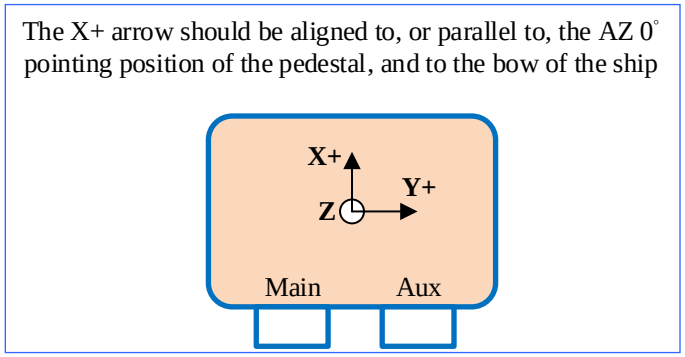

Figure 120: Top of SPG IMU Module

The basics of the lever arm measurements are illustrated in Figure. The measurements will change with the placement of the SPG IMU module in relation to the Hemisphere differential GPS unit.

The lever arm measurement process between each axis of the IMU (X, Y, and Z) and the Hemisphere GPS unit is illustrated in the SPG (IMU) Manual. This manual should be consulted to establish the correct distance measurements between the SPG IMU module and the Hemisphere GPS unit.

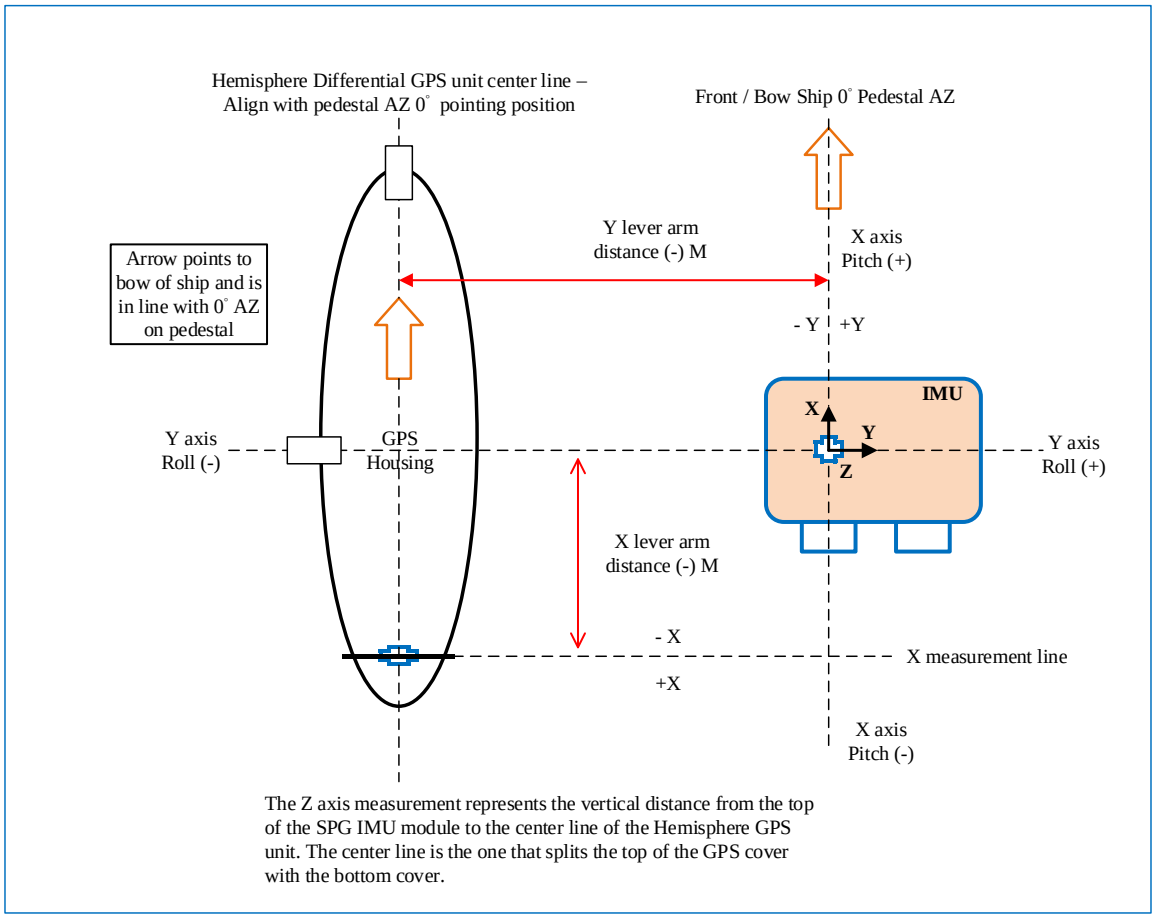

Figure 121: Basic X and Y Lever Arm Measurements

Figure 121 illustrates the basic lever arm measurement locations between the SPG IMU module and the Hemisphere Differential GPS antenna unit. The X distance is the left/right (side to side) distance from IMU to GPS housing, the Y distance is the front to back distance to the IMU module, and the Z distance is the up/down distance from the GPS housing to the IMU. Both modules must be parallel to the pedestal AZ 0° axis and pointing to the same location on the ship, typically the bow. Additional information describing the lever arm measurement methods are available in the Ellipse SPG IMU manual. All measurements must be within two (2) inches, or 0.50 meters.

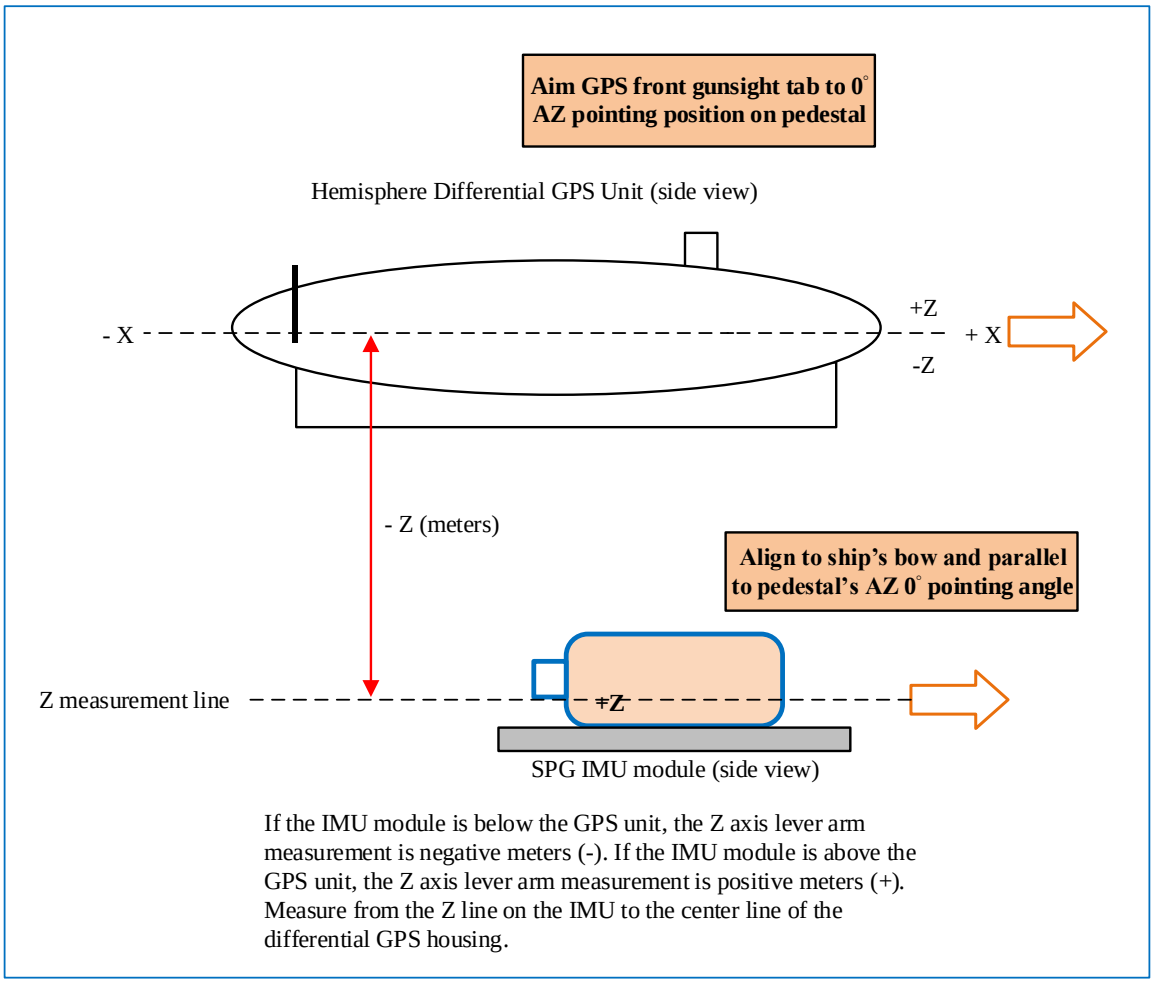

Figure 122: Z Axis Lever Arm Measurements

Figure 122 illustrates the Z axis lever arm measurements between the SPG IMU module and the Hemisphere Differential GPS unit. The lever arm measurement is positive if the IMU module is above the GPS housing, and negative if it is below the housing. The Z axis measurement is from the approximate center line of the IMU module to the center line of the GPS housing, or the line which splits the GPS housing top cover from the bottom cover. Both units should then be placed parallel to the AZ 0° pointing axis of the pedestal and aligned with the bow of the ship for correct yaw positioning. All measurements are to be within two (2) inches, or .050 meters.

11 Appendix E – Stabilization Set Up and Operation

(when the SBG Ellipse IMU and the Hemisphere Differential GPS are attached to the system)

This section explains the set up and operation of the ACU for system stability operations when the SPG IMU (Ellipse Series) and the Hemisphere Differential GPS units are attached and correctly calibrated. Aligning the IMU and differential GPS is explained in section 10, Appendix E, and in the SPG Systems documentation. The SPG IMU firmware parameter settings are pre-set for Marine use and are designed for correct operation with the Quasonix ACU and the PD450 stabilized tracking system. Refer to the SPG, Ellipse series IMU Documentation for additional parameter set up information.

The SPG IMU and the Hemisphere Differential GPS antenna housing ports are connected to the ACU via a specialized interface cable, which provides both power and RS-422 communication lines. The IMU provides pitch, roll, and yaw pointing information, while the Differential GPS unit provides Earth Location, as well as, North Pointing (AZ 0° Heading) information to the ACU.

Powering up the servo control box and the ACU provides power to the SPG IMU and the Differential GPS units. Selecting the STAB button in the lower right-hand corner of the AXIS Control area (small red circle) opens the Stabilization window in the ACU's right side, multi-function display area.

Figure 123 shows the ACU front panel with stability turned ON. The STAB button is light grey to indicate it is selected. The green LED next to the STAB button indicates that stability is Enabled (stabilization switch is in the ON position and displaying in green), and the system is stabilized. The yaw, pitch, and roll corrections are being received by the ACU.

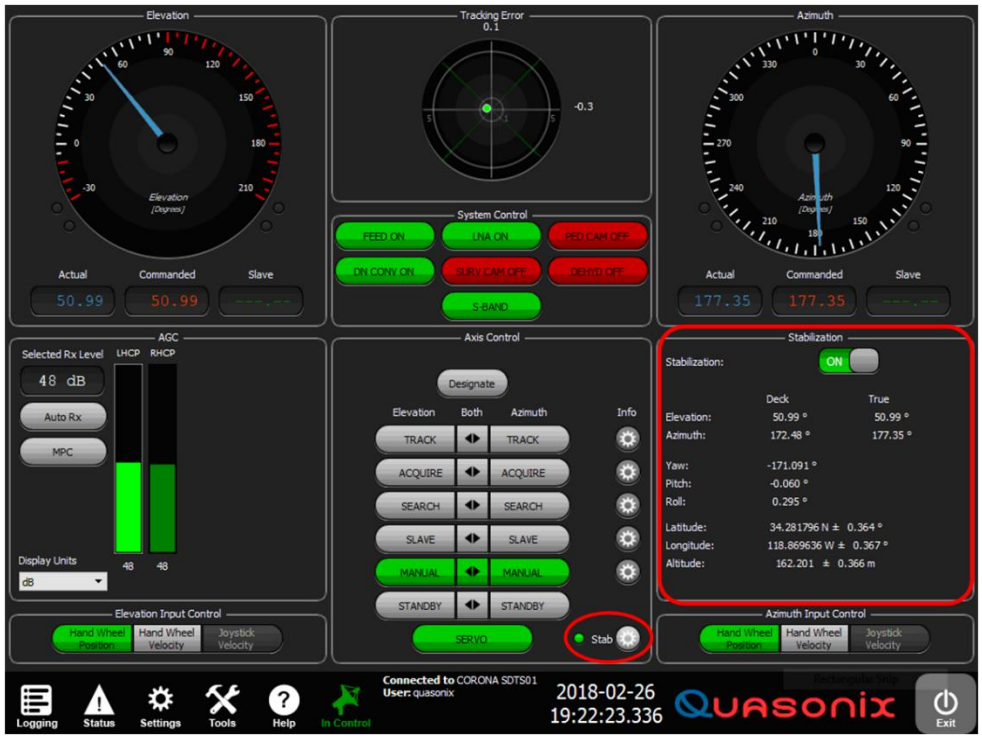

Figure 123: ACU Front Panel with Stability Selected

The Stabilization window displays the current pitch, roll, and yaw information provided by the SPG IMU, as well as, the latitude, longitude, and altitude information (if the GPS has acquired a sufficient number of satellites). The Stabilization window also shows the antenna system's Deck and True pointing angles. The window contains the Stabilization On/Off selection switch, which gives the operator the ability to turn stabilization On and Off by touching the on screen button. When stabilization is selected On, the LED to the left of the STAB button illuminates green. When stabilization is selected Off, the STAB LED will be off (not illuminated).

In addition to the stabilization information displayed in the Stabilization window, more detailed IMU and GPS data information is available to the operator by selecting the TOOLS > IMU TEST window (refer to section 3.4.2.5). Here, the operator can see the values of various parameters provided by the SPG IMU and the Differential GPS, as well as, the check box parameters that must be available for correct stability computations.

Stabilization will not be enabled if certain required parameters are not received by the ACU, or if certain parameters are determined by the software to be unreliable. If this is the case, the Stabilization On/Off button will be greyed out and not available to the operator.

Note: The displayed Stabilization parameters are dependent upon the uploading of correct lever arm measurements into the IMU Configuration window (refer to section 3.3.3.13 and section 11, Appendix E).

11.1 Setting Up the Stabilized PD300 / PD450 Antenna System

1. For correct operation, the IMU and Differential GPS should be lined up with the AZ Zero (0°) pointing position of the antenna. The required lever arm measurements (in meters) between IMU and the GPS antenna housing must be entered into the IMU Configuration window for correct stabilization operation (refer to Appendix E).
2. Connect all cabling between the IMU, the differential GPS, the servo enclosure and the ACU, then power up the servo and the ACU. Make sure the Differential GPS has a clear view of the sky, and the IMU module is level to the AZ rotator.
3. On the front panel of the ACU, select the STAB button, located in the lower right-hand corner of the Axis Control area. The right-hand side Multi-function display area opens to show the Stabilization window. It may take up to 10 minutes for the Differential GPS to lock on to a sufficient number of satellites for the correct Earth position to be displayed with a small tolerance value (< 0.5). After good satellite lock is obtained, the correct Earth position (latitude, longitude, and altitude) display, along with a small error tolerance (0.5 - 0.2 °/m). The IMU displayed parameters for pitch, roll, and yaw are also shown.

   The Stabilization window, shown in Figure 124, shows good IMU and GPS lock with correct parameters. The system stabilization has been turned Off by selecting the Stabilization On/Off button. Selecting or touching the Off button again turns system stabilization On.

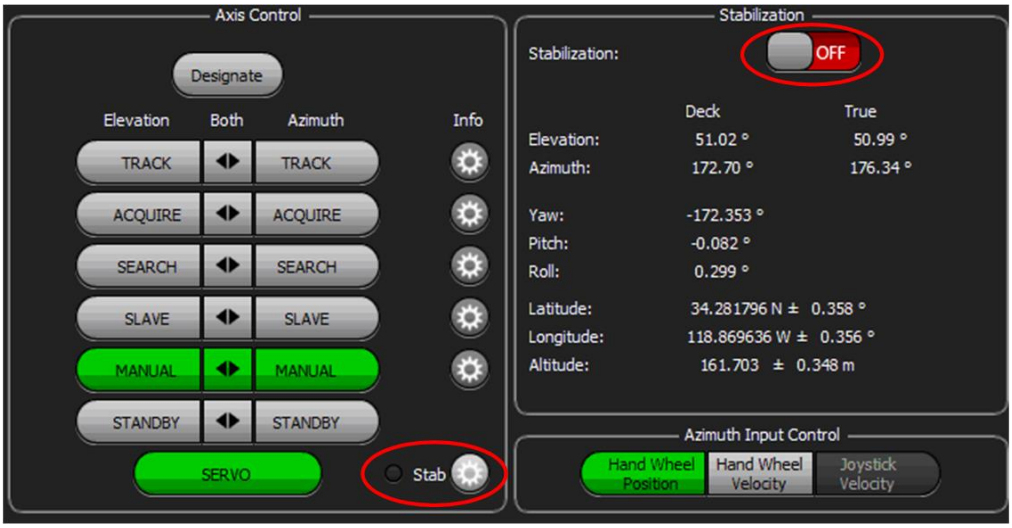

Figure 124: Stab Button and Stabilization Window On/Off Selection

If all Stabilization parameters are within tolerance, the Stabilization On/Off button is active. If some parameters are out of tolerance, the On/Off button is greyed out, and stabilization is not available and cannot be enabled by the operator.

If the displayed GPS parameters are out of tolerance, and the IMU parameters do not appear stable, the Status window should be opened to see if the required stabilization (IMU and GPS) parameters are available and locked (green LEDs illuminating). The status screen is accessible by selecting the Status icon ACU Tool bar (at the bottom of the screen), and launching the Status screen, shown in Figure 125. The required Stabilization parameters display green LEDs. All stabilization parameters, with the exception of the IMU GPS Course Used and the IMU GPS Velocity Used parameters, which are not required for stabilization, should display a green LED.

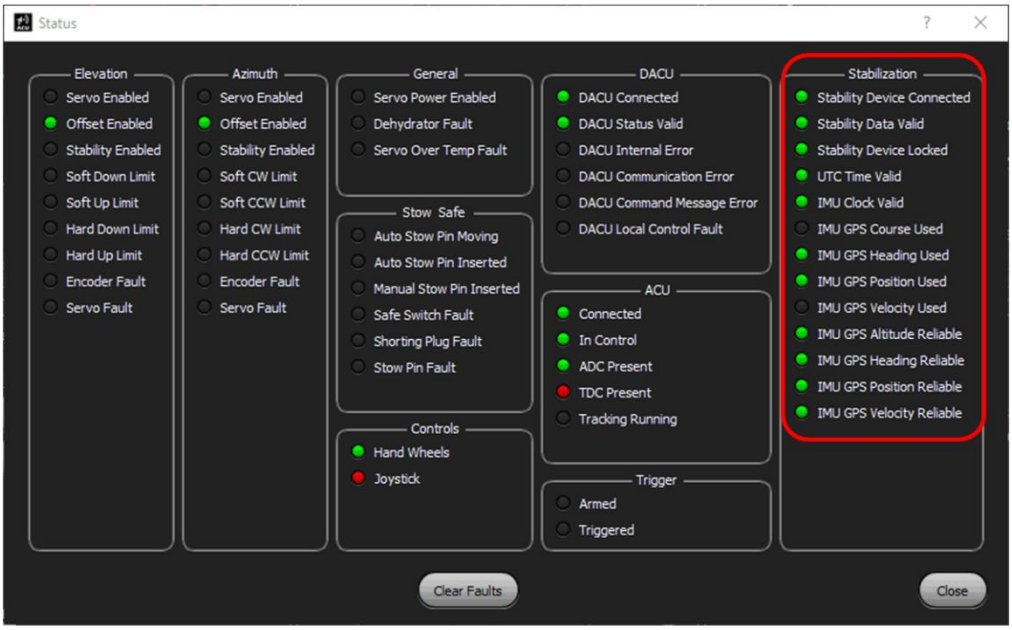

Figure 125: Status Screen

In addition to the Status screen, all status messages from the IMU and GPS are also displayed in the IMU TEST screen, as shown in Figure 126. This screen is accessed by selecting the TOOLS > TEST AREA > IMU TEST button. All numerical status messages from the IMU and GPS are displayed, as well as, the IMU status check boxes. This screen displays all available status messages received by the DACU PCB, and communicated to the ACU, via the system's internal Ethernet line. Parameters with unchecked boxes are not necessary for stabilization corrections.

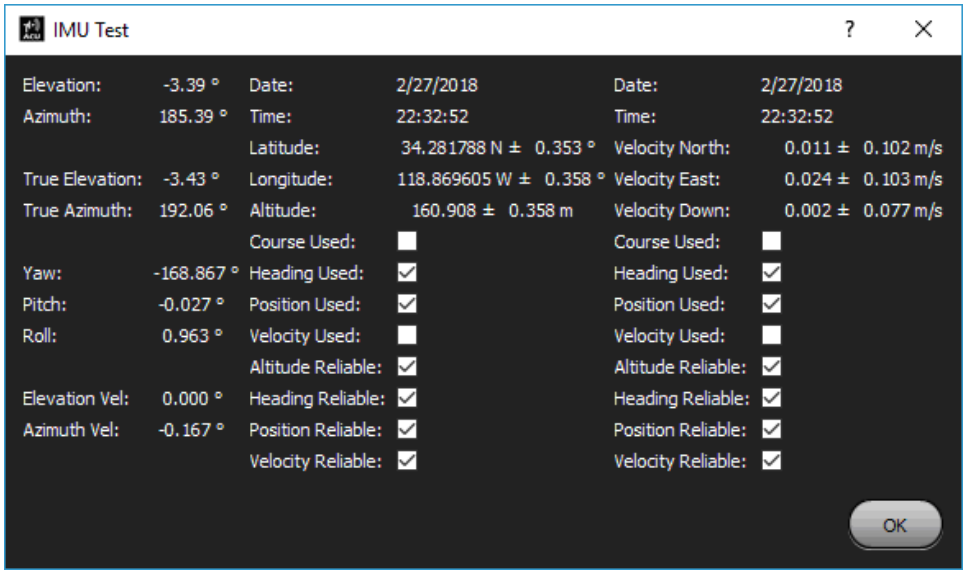

Figure 126: IMU Test Screen

4. When the tracking system, the IMU, and the Differential GPS are aligned correctly and all parameters are within tolerance, the system Stabilization button can be turned On (green), as shown in Figure 127. With the system stabilized, the Stabilization window displays the IMU generated yaw, pitch, and roll angles, the Differential GPS derived present location with latitude, longitude, and altitude, as well as, the displayed AZ and EL Deck and True derived angles. The motion of the ship is detected by the SPG IMU, and the yaw, pitch, and roll angles change to reflect this motion. The ship's present position and heading are also updated on screen by the information received from the Differential GPS unit. All required stability parameters displayed are within tolerance and are reliable.

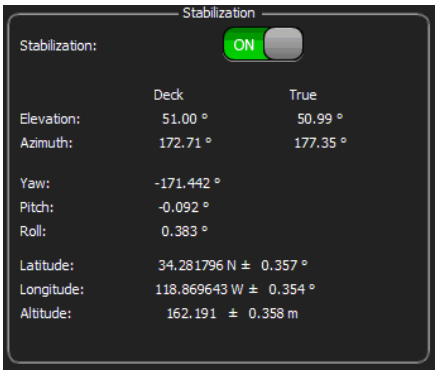

Figure 127: Stabilization Window with Switch Set to On

5. To check stabilization and heading, (North Pointing Angle - AZ 0°) the DESIGNATE button is selected and Sun Designate is highlighted in the Designates Menu. When the GO button is touched, the reflector should point directly at the sun, such that, the shadow of the feed is in the center of the dish or close to it. This test indicates that the SPG IMU and the Differential GPS are correctly in line with the AZ Axis Zero (0°) pointing angle of the antenna, and all correct lever arm measurements have been loaded into the ACU. For specific information about Sun Designate operation, refer to section 2.4.2 in this manual.

   Note: The time (UT or GMT) at the systems location, must also be correct for the Sun Designate to point the antenna accurately.

11.2 The Pedestal Coordinate System – Deck and True Pointing Angles

11.2.1 The Deck Pointing Angles

The ACU uses Deck and True coordinate systems for the positioning of the antenna. The Deck coordinates are used when a system *IS NOT* in stabilized mode. The Deck coordinates are the actual AZ and EL axes encoder angles, plus any offsets installed by the operator. For example, if the systems Elevation axis is pointed at 45°, the system is attached to a pitching and rolling ship, and system stabilization is Off, the ACU's EL angle readout will show 45°, however, the antenna points at different locations depending on the motion of the ship. If the antenna is pointed directly at the bow of the ship with the EL axis angle readout showing 45°, and the ship is pitching up and down +10°, the actual pointing position of the EL axis varies between 35° and 55°.

11.2.2 True Pointing Angles

The True coordinate system is used when the system *IS* in stabilized mode and is relative to the True North pointing position as located on a map. The calculation of the True coordinates is done using the information provided by the Hemisphere Differential GPS module, including the latitude, longitude, and altitude, (which provides North Pointing AZ = 0° heading), and the motion data (pitch, roll, and yaw) received from the SPG Ellipse Inertial Measurement Unit (IMU). The Differential GPS provides the true heading of the platform regardless of vessel motion, while the IMU provides pitch, roll, and yaw, which is used to compensate the pedestal position (AZ and EL pointing) for vessel motion. The SPG IMU and the Hemisphere Differential GPS unit are interconnected via their common interface cable, and both are necessary for the stabilization information provided to the ACU for position corrections.

When the operator aims the antenna at a unique position (AZ=X, EL=Y) and then enables stabilization (stabilization button is selected On and is green), the antenna's pointing position or AZ and EL true position, will remain AZ=X, EL=Y. The motion of the ship or deck position will be constantly changing, however, the motion compensation data from the IMU and GPS compensates for this and commands the ACU to drive the AZ axis and EL axis in such a manner as to keep the antenna pointed at its unique true position (AZ=X, EL=Y).

With the system in stabilization mode, as shown in Figure 128, the Elevation true position is 48.41° (the antenna needs to keep pointing at 48.41° in EL). The deck position has pitched up to 51.57°, and the IMU is compensating for the pitch up with a -2.811° pitch position, which means that the EL axis needs to move down about -2.811 ° to keep the antenna pointed at the required true elevation position of 48.41°.

Note: The above example is simplified. The ACU uses all pitch, roll, and yaw data from the IMU to provide a compensating pointing angle. The amount of each is dependent upon many things, especially the AZ pointing position of the antenna. As the Azimuth pointing angle changes, the pitch, roll, and yaw compensation angles change, and are factored together to keep the EL true position at 48.41°.

Figure 128: Stabilization Window with Stability Enabled (On), All Parameters Present and Reliable

12 Appendix F – Trigger/Slave Set Up and Operation

12.1 Trigger Tool Operational Review

The ACU Trigger tool is a hardware and a software system, which allows the ACU to automatically start a pre-selected test file (or slaving file) that is activated by an externally generated command or trigger pulse. The antenna begins to slew to the preprogrammed AZ and EL positions contained within the slaving/test file when the trigger pulse is received by the ACU. In addition, as part of the trigger operation, the ACU's Acquire-Track function can be automatically enabled by setting a trigger delay value (in seconds). At the end of the desired delay time, the Acquire-Track function will automatically enable, and the system begins to Auto-Track the radiating target when the received signal level moves above a preset threshold level. If the received signal level does not move above the desired preset Threshold, the system will not Auto-Track the target, but will continue to follow the slave angles generated by the test file.

Figure 129 shows the front panel screen. In the Axis Control window, the Acquire Info button is selected. This causes the Trigger window to display available settings.

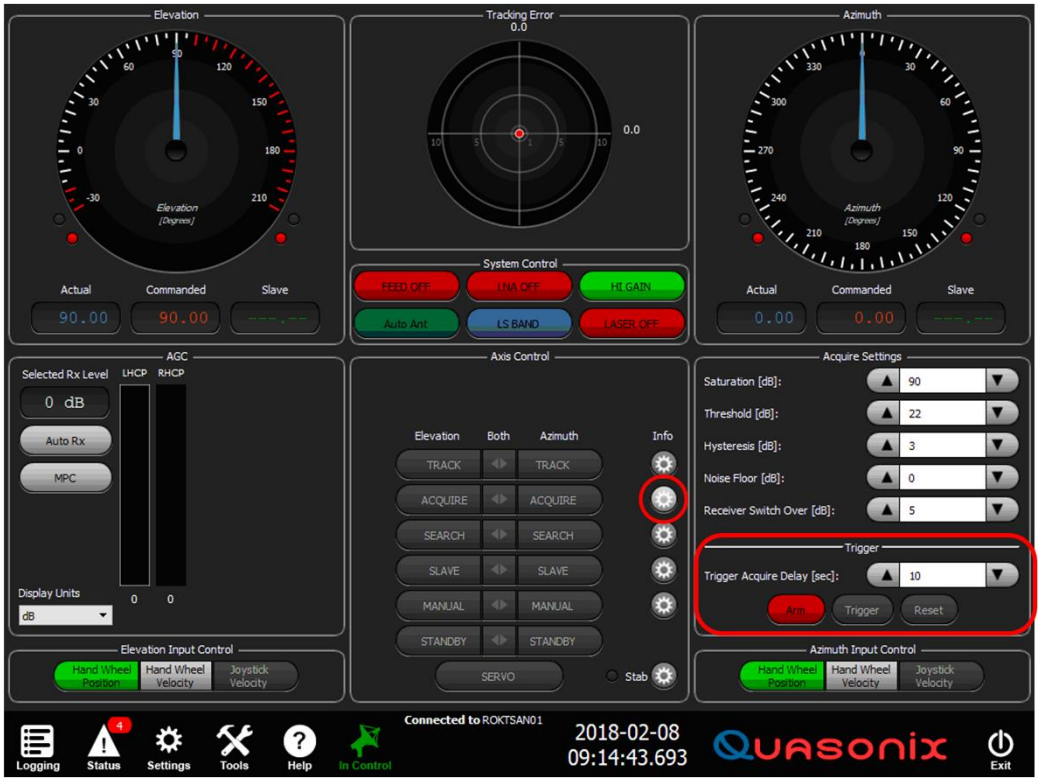

Figure 129: Front Panel with Info and Trigger Window Highlighted

12.2 Slave Trigger Set Up

Use the following steps to set up the slave trigger.

1. Connect the external slave trigger source pulse cable to the back panel of the ACU slave trigger input BNC Connector. Refer to Figure 131.

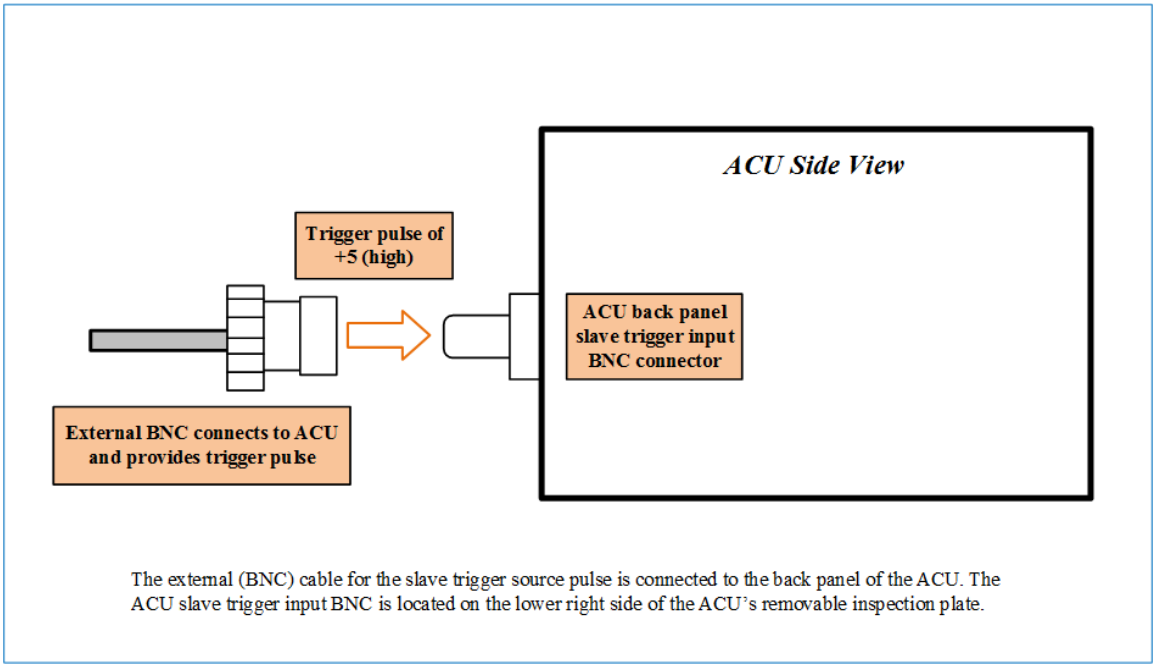

Figure 130: External Slave Trigger Source BNC Cable Connection to ACU

2. Open Windows Explorer. Copy slave test files for the slave trigger system into the Test Files folder located in the Documents folder. (Documents > Test files > Slave trigger files)
3. Select the Settings Icon at the bottom of the main ACU screen.
4. Select the Slave Source button to open the Slave Sources window.
5. Select the ADD button, then enter the name and location of the test file to be used for the slave trigger operation. Use the BURN FILE designation when entering the slave source file. Select the APPLY button to close the entry window, then select the SAVE button to save the list of slave sources.
6. In the main ACU screen, Axis Control window, select the INFO button next to the SLAVE buttons. The available slave source files are displayed in the viewing window to the right. Use the drop down menu to select one of the slave source files. This file is used for the remote trigger operation and will automatically start the AZ and EL motion when the slave trigger source pulse is received by the ACU.
7. To select the slave trigger operation, select the INFO button next to the ACQUIRE buttons in the Axis Control window. The Acquire Settings and Trigger windows display. Acquire settings include Threshold, where the desired signal level (in dB) is set for the switch over from ACQUIRE to TRACK. The Threshold is set to the desired signal level where the antenna system will switch over from ACQUIRE to AUTO TRACK, and automatically start tracking the radiating target. The Trigger window includes ARM, TRIGGER and RESET buttons, as well as the Trigger Acquire Delay (sec) parameter selection.
8. To start the Slave-Trigger/Acquire-Track operation, select the SLAVE buttons and the ACQUIRE buttons in the Axis Control window, as shown in Figure 131.
9. Next, set the desired Trigger Delay in seconds. This delays the activation of the ACQUIRE-AUTO TRACK function for the duration of the time selected in the time delay box. When the time delay ends, the system automatically starts auto tracking the target, providing that the received signal level is above the Acquire-Threshold setting. Refer to Figure 131 and Figure 132.

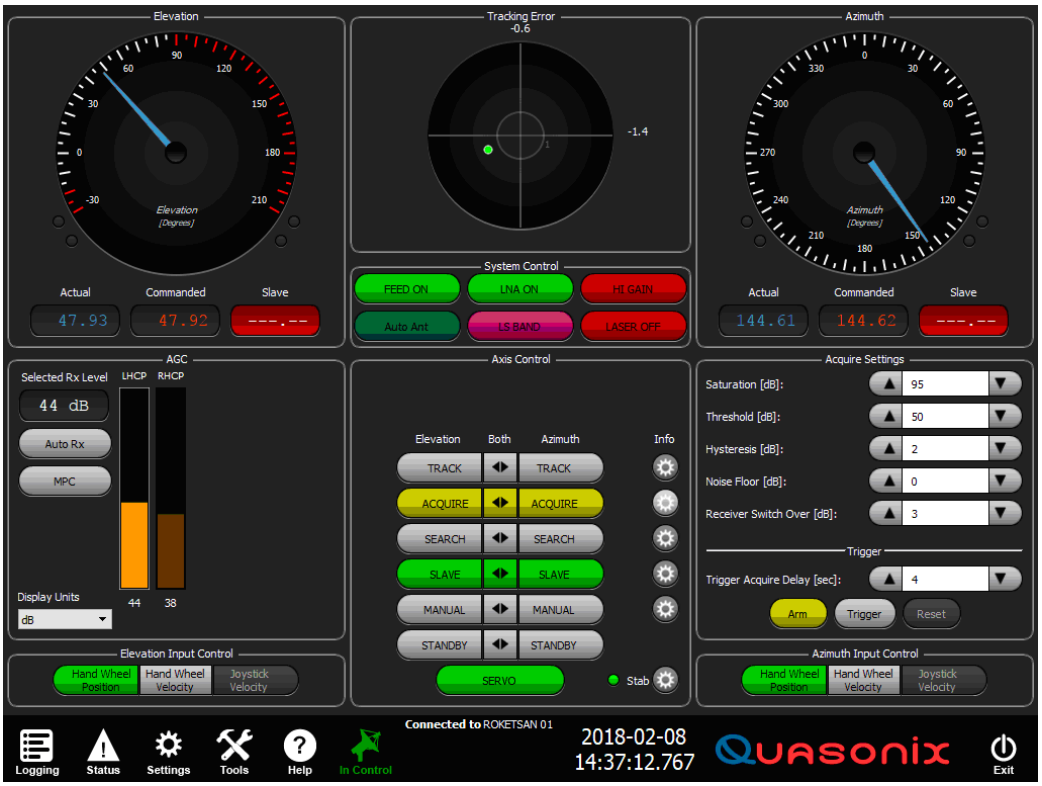

Figure 131: ACU Front Panel Ready to Accept External Slave Trigger Pulse

The Acquire and Slave Axis Control buttons are shown selected. The Acquire-Track Threshold is set to 50 dB, and the Trigger Acquire Delay time is set to four (4) seconds. The trigger ARM button is yellow, indicating it is ready to accept an external slave trigger pulse. The digital slave angle readouts are red, indicating the two axis slave source is selected, but the slave test file is not yet running.

If the grey TRIGGER button is selected, the slave source file starts running and the time delay counts down normally. Selecting the grey TRIGGER button acts the same as receiving an external trigger pulse.

10. When an external trigger pulse (of +5 V) is detected by the ACU, the selected slave file starts and the AZ and EL axes slew to the displayed angles in the Digital Slave angle readout displays. In addition, the green Slave Pointers display in the analog axis angle readout meters and will move per the slave file motion commands. At the end of the trigger acquire time delay, the system switches automatically. Select Two Axis TRACK, if the received signal level is above the Acquire Threshold setting. At this point, the system auto tracks the radiating target, and ignores the running slave file, as shown in Figure 132.

    The front panel of the ACU shows that an external trigger pulse has been received, because the trigger ARM button is green. The selected slave file is running, and the current slave angles are displayed by the green pointers in the analog meters and the digital slave readout meters (also green). The received signal level is 68 dB, which is above the Acquire threshold setting of 50 db. The four (4) second time delay has expired, and the system has automatically switched to Two Axis Track, as indicated by the green TRACK buttons. The slave file is still running in the background, but will not affect axis motion unless the signal level falls below the threshold level. If the signal level falls below the threshold level, the system reverts to the slave file as the axis motion control source, and the TRACK buttons turn grey since the system is no longer Auto-Tracking the target.

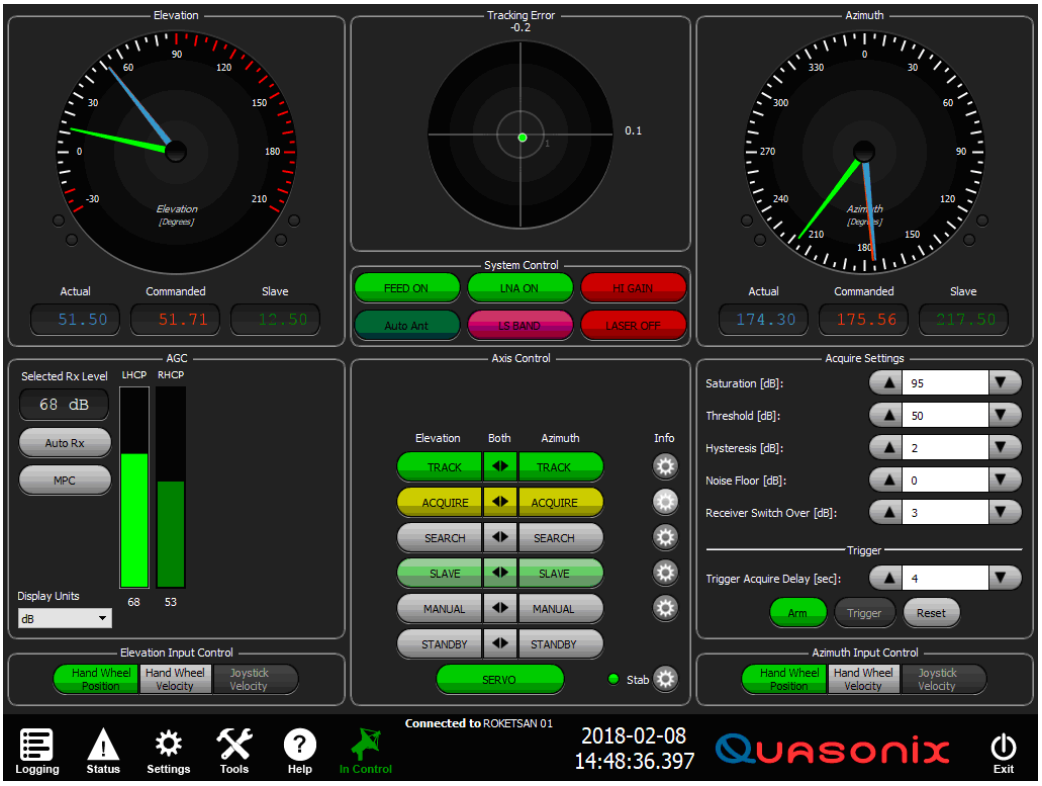

Figure 132: ACU Front Panel, External Trigger Pulse Received

13 Appendix G – Acronym List

Acronym	Description
ACU	Antenna Control Unit
AGC	Automatic Gain Control
AM	Amplitude Modulation
AQPSK	Variant of Quadrature Phase Shift Keying
ARTM	Advanced Range Telemetry
AUQPSK	Variant of Quadrature Phase Shift Keying
AZ	Azimuth
BEP	Bit Error Probability
BER	Bit Error Rate
BNC	Bayonet Neill-Concelman Connector (RF Connector)
BPSK	Binary Phase Shift Keying
CCW	Counterclockwise
CD	Compact Disk
CPM	Continuous Phase Modulation
CW	Clockwise
CWM	Cable Wrap Meter
DACU	Digital Antenna Control Unit
DB-9	D-subminiature 9 pin Serial Connector
DC	Diversity Combiner
DHCP	Dynamic Host Configuration Protocol
DPM	Digital Phase Modulation
DQE	Data Quality Encapsulation
DQM	Data Quality Metric
EL	Elevation
FPGA	Field Programmable Gate Array
G/T	Gain per Temperature
GPS	Global Positioning System
GUI	Graphical User Interface

Acronym	Description
IF	Intermediate Frequency
IP	Internet Protocol
kbps	Kilobits per second
KHz	Kilohertz
LCD	Liquid Crystal Display
LDPC	Low Density Parity Check
LED	Light-emitting Diode
LHCP	Left Hand Circularly Polarized
LNA	Low Noise Amplifier
mbps	Megabits per second
MCX	Snap on subminiature connector
MHCPM	multi-h Continuous Phase Modulation
MHz	Megahertz
MPC	Multipath Clipping Control
N	(connector type) Threaded RF connector
OQPSK	Offset Quadrature Phase Shift Keying
PCB	Printed Circuit Board
PCMFM	Pulse Code Modulation/Frequency Modulation
PM	Phase Modulation
PSK	Phase Shift Keying
QPSK	Offset Quadrature Phase Shift Keying
RDMS	Receiver DeModulator Synchronizer
RF	Radio Frequency
RHCP	Right Hand Circularly Polarized
RJ-45	Ethernet Connection Jack
RM	Rack-Mount
RS-232	Recommended Standard 232 (Serial Communications)
SAW	Sawtooth Wave
SDI	System Degradation Indication
SNR	Signal to Noise Ratio

Acronym	Description
SOQPSK	Shaped Offset Quadrature Phase Shift Keying
SOQPSK-TG	Shaped Offset Quadrature Phase Shift Keying –Telemetry Group
STC	Space-Time Coding
TDC	Top Dead Center
TRL	Tracking Loop
TTL	Transistor Transistor Logic
UDP	User Datagram Protocol
UQPSK	Unbalanced Quadrature Phase Shift Keying
USB	Universal Serial Bus
VAC	Voltage Alternating Current
WAN	Wide Area Network