

## 3.6 Connecting Power

### 3.6.1 Radar

AIMS Radar systems are all designed for 48 VDC input. Clients can optionally order 24 VDC versions as well, but these must have a 24 volt universal communications module version feeding it. AIMS radar systems are power conditioned, so they can be powered by four 12 volt car or RV batteries. **A volt meter and cut-off switch should be installed if running on batteries to ensure the radar is not damaged from drooping voltage as the battery dies.** The CPU will shutdown if voltage droops significantly. If this occurs, communications to the client software will discontinue and the radar will require cycling powering to restart the radar server software. AIMS Fast-Scan radar systems come in a variety of ranges. For 1.5 km systems, the power pull will be a consistent 2 AMP load, or 98 Watts when running. There is a rush pull of current (spike) at startup, which can be high as 2.5 AMPS. Power draw and current rush increases for further range systems. For 20 Watts, the power draw is about 150 watts (varies slightly with options) with a 200 Watt rush at startup.

### 3.6.2 Cameras

Most thermal cameras use DC voltage. The range of voltage is 12 to 28 VDC for the most part. DMT has 24 VDC supply for the purpose of feeding thermal cameras. A 12 or 15 VDC supply is also included for powering onboard electronics. This can be routed to the wiring block for use by the camera (see wiring block diagram for Universal Communications Module – Figure 14). The power draw for many uncooled thermal cameras are less than 25 watts of power. Cooled thermal cameras or multi-sensor camera products can pull considerable current. Check that the power draw is less than 75% of the power rating on the 24 VDC power brick (printed on the brick). Many dome security companies use 24 VAC. Optionally, the Universal Communications Module can be fitted with a 24 VAC supply. This supply is rather large and should be able to power any dome camera on the market that uses 24 VAC. **Check the camera literature before using this supply to ensure you have selected the right power.** Some newer models of dome cameras have switched to DC voltage, so damage can occur if the wrong selection of DC or AC is made.

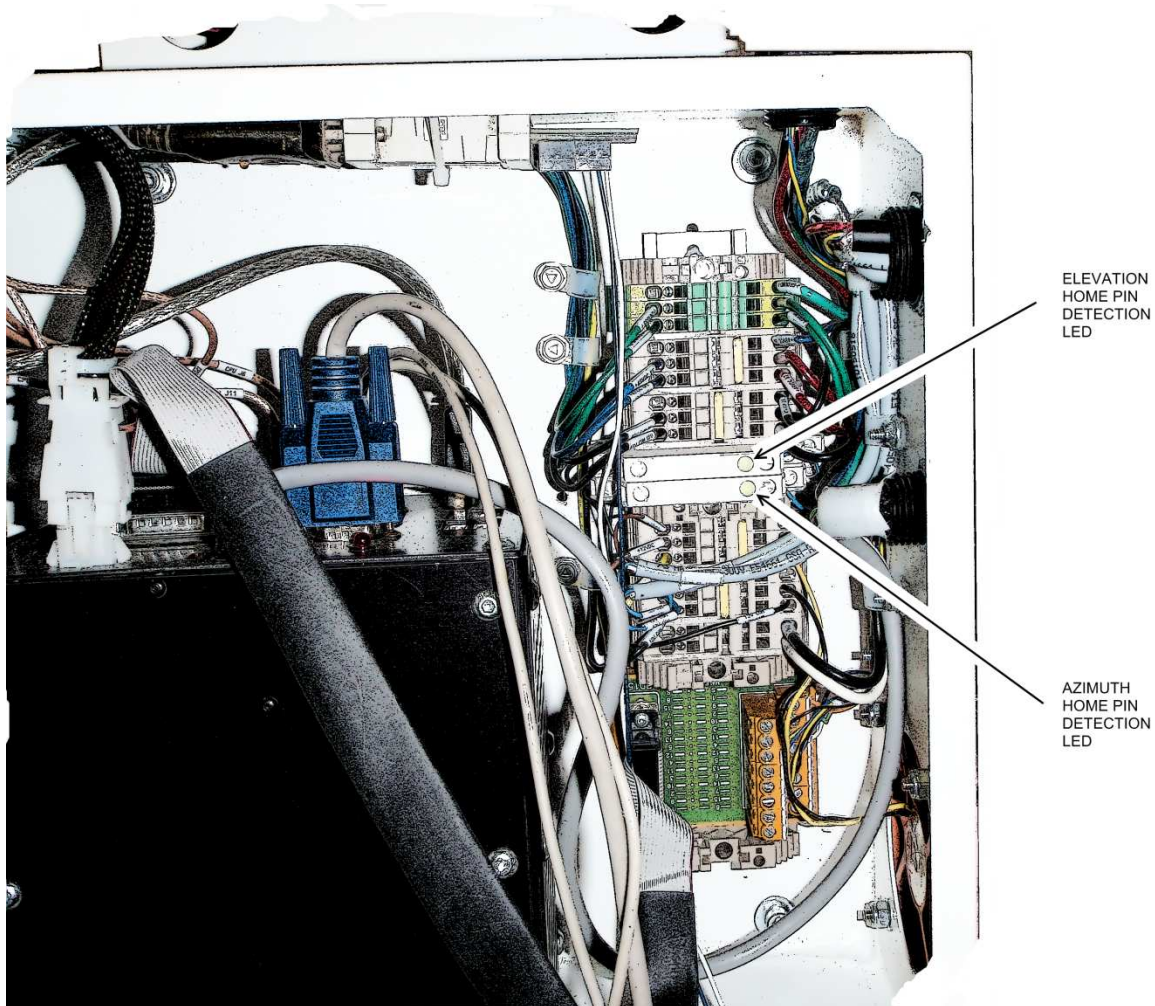
### 3.6.3 Universal Communications Module and Utility Enclosures

The Universal Communications Module (UCM) and the base tower utility enclosures accept 120 to 240 VAC, 40-63 Hz (auto-ranging). Power conditioning is present on every enclosure provided by DMT, however, the power should be within 25% of the rated supply voltage.

Circuit breakers exist in all enclosures provided by DMT. These protect the radar, cameras and other equipment from faulty hookups or power problems. These are a safety measure supplied by DMT and are not a substitute for proper planning, preparation and care.

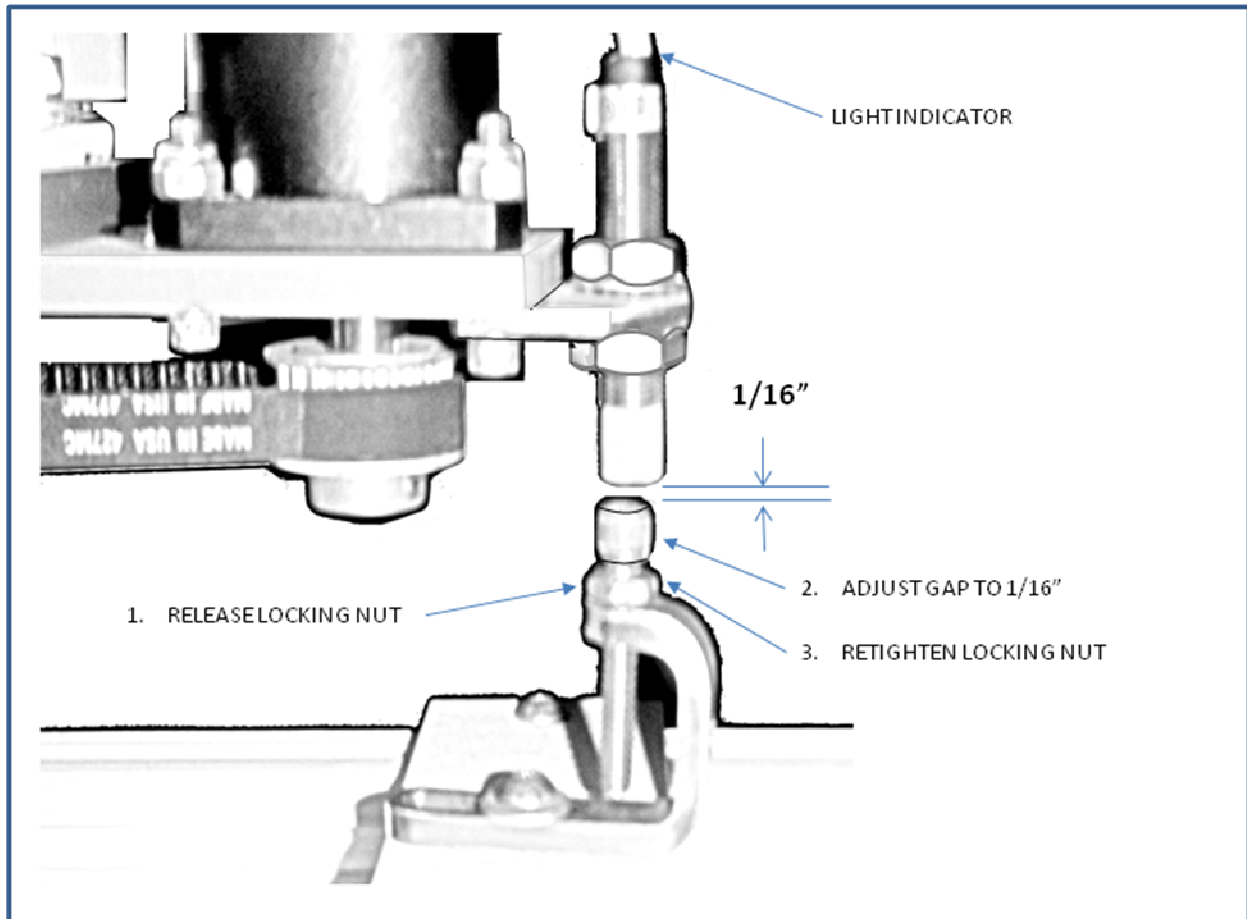
### 3.7 Hardware Adjustments

The antenna is controlled by two motors, an azimuth motor for bearing and an elevation motor for elevation relative to the ground. Under normal circumstances, both of these should be properly adjusted and require no modification. When set to the home position (0° azimuth, 0° elevation) both of the home pin detection LEDs should be lit (see below). If not, these may require adjustment detailed in the following two subsections.



### 3.7.1 Adjusting the Azimuth Home Pin

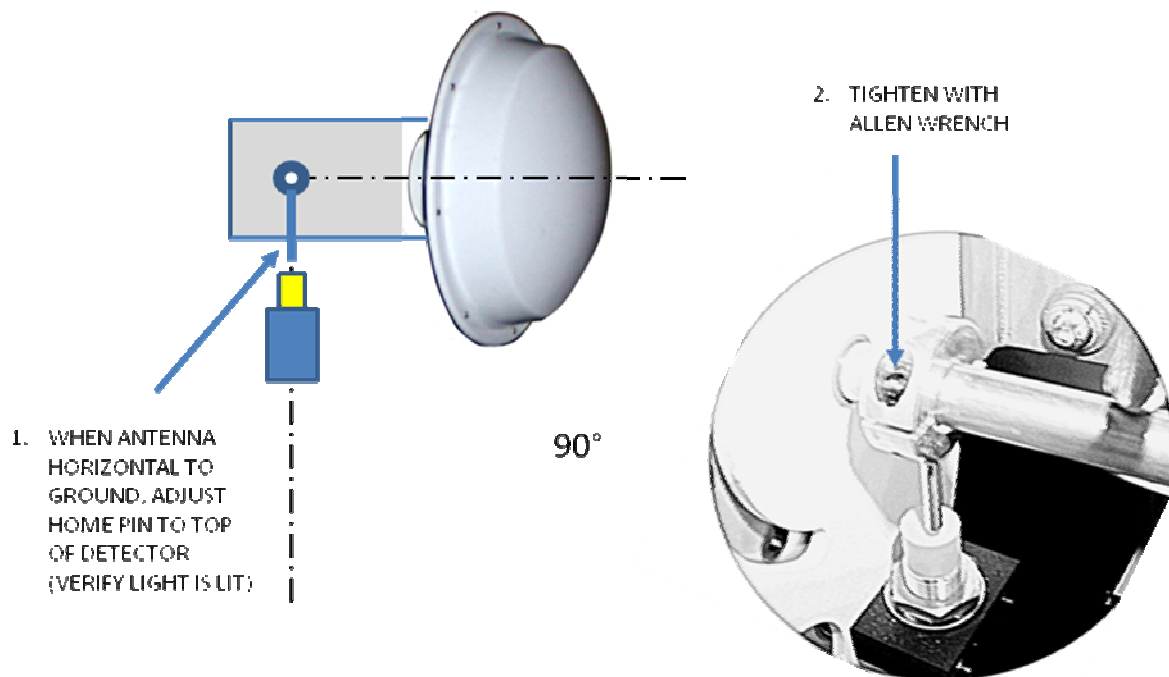
The adjustment of the azimuth home pin positions the top of the home pin close enough for the hall-effect sensor to detect it while far enough away to prevent accidental collision between the detector and the home pin during use or transport. The adjustment is fairly simple and only requires an adjustable open end wrench and hex key (see below).



While adjusting the azimuth home pin, remember that the radar will always spin to the right (clockwise) when searching for the home pin.

### 3.7.2 Adjusting the Elevation Home Pin

The adjustment of the elevation home pin positions the home pin directly over the hall-effect sensor while the antenna is aimed parallel to the horizon. The adjustment is fairly simple and only requires a hex key (see below).



When adjusting the elevation home pin, remember that the radar will always assume the antenna is resting in a downward position and will elevate the antenna to search for the home position.

## 4 Server Software

Although most all of the software parameters may be modified through the server interface, it is recommended that the normal use and modification of the system parameters be performed from the client interface where more comprehensive error-checking and boundary conditioning is performed to prevent the user from configuring an abnormal operating condition.

Nonetheless, in this section we will introduce the reader to the user screens available at the server interface and will advise which parameters must be setup from the server interface.

### 4.1 Configurable Features

The table below provides a brief overview of the configurable parameters within the AIMS radar server. Additional features are available from the client interface.

Waveform Generation	Signal Processing	Motion	Display / Save Data	Other	BITE
PRF Rate	A/D Sample Rate	Mode <ul style="list-style-type: none"> <li>• Positional</li> <li>• Velocity</li> </ul>	Graphing	GPS	Check A/D Limits
Pulse Width	Range Bins <ul style="list-style-type: none"> <li>• No of bins</li> <li>• Zero range</li> </ul>	Scripts	Segment Trunc.	Compass	
No. of Pulses	Filters <ul style="list-style-type: none"> <li>• Smoothing</li> <li>• Matched</li> <li>• Ramp</li> </ul>	Limits <ul style="list-style-type: none"> <li>• Azimuth</li> <li>• Elevation</li> </ul>	Autosave Data	Cameras <ul style="list-style-type: none"> <li>• Track to Alarm</li> <li>• FOV</li> <li>• Comm.</li> <li>• Video Svr</li> <li>• Offsets</li> </ul>	
	Lobe Removal <ul style="list-style-type: none"> <li>• Main Lobe</li> <li>• 2<sup>nd</sup> Lobe</li> <li>• 3<sup>rd</sup> Lobe</li> </ul>	Offsets	Broadcast Interval	Network <ul style="list-style-type: none"> <li>• IP Addr</li> <li>• Port</li> </ul>	
	Tracker <ul style="list-style-type: none"> <li>• AB Tracker</li> <li>• Associator</li> </ul>	Autoscan	Save Settings		
	TX Frequency	Tilt Compensation	Restore		
	Zones	Motion Compens.	Replay		
	Sensitivity		Start/Stop		
	Speed Threshold				
	Normalization				

Basically, the configurable features entail;

- Defining the transmitted pulse (waveform generation)
- Selecting how to process the received signal (signal processing)
- Aiming the antenna (motion)

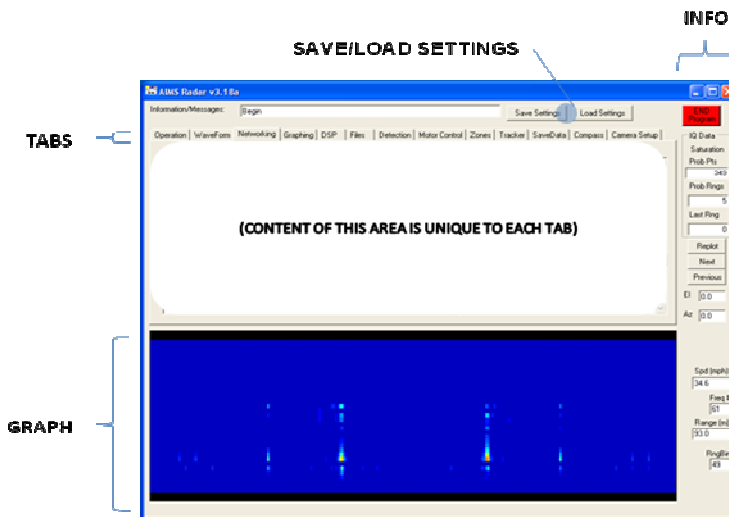
Additional configurable features include;

- Configuring geo-positional devices (GPS, compass)
- Integrating cameras
- Saving/replaying captured data

These configurable features are organized in an array of ‘tabs’ that provide user friendly check boxes and option lists and are described in the following section, “Server Interface Screens”.

## 4.2 Server Interface Screens

The basic server screen appears like (picture below):



**GENERAL SCREEN LAYOUT**

The information sidebar on the right hand side of the screen provides general information about antenna elevation and azimuth angles, saturated points (too much signal), and details about where the mouse cursor is positioned (speed, freq #, and range/rangebin) over the FFT Graph, when enabled.

The controls along the right edge of the main form are seldom used during normal operation. “End Program” is used to stop the application when the radar is operating (in the operation loop). Replot, Next, and Previous are used for playing back stored data. Replot will prompt the user for data files to be replayed. The files are now stored in the directory, “<r>:\data”. Next and Previous allow the user to scroll forward and back through the list of files. When



files are selected to replay (Replot is clicked) the option to plot data is automatically selected. The radar should always be in a stopped state before data is replayed. The El and Az text boxes provide the present Elevation and Azimuth pointing angles for the radar.

The Graph area displays the currently selected graph mode (none, FFT, or line plot) and remains visible regardless of which tab is currently selected.

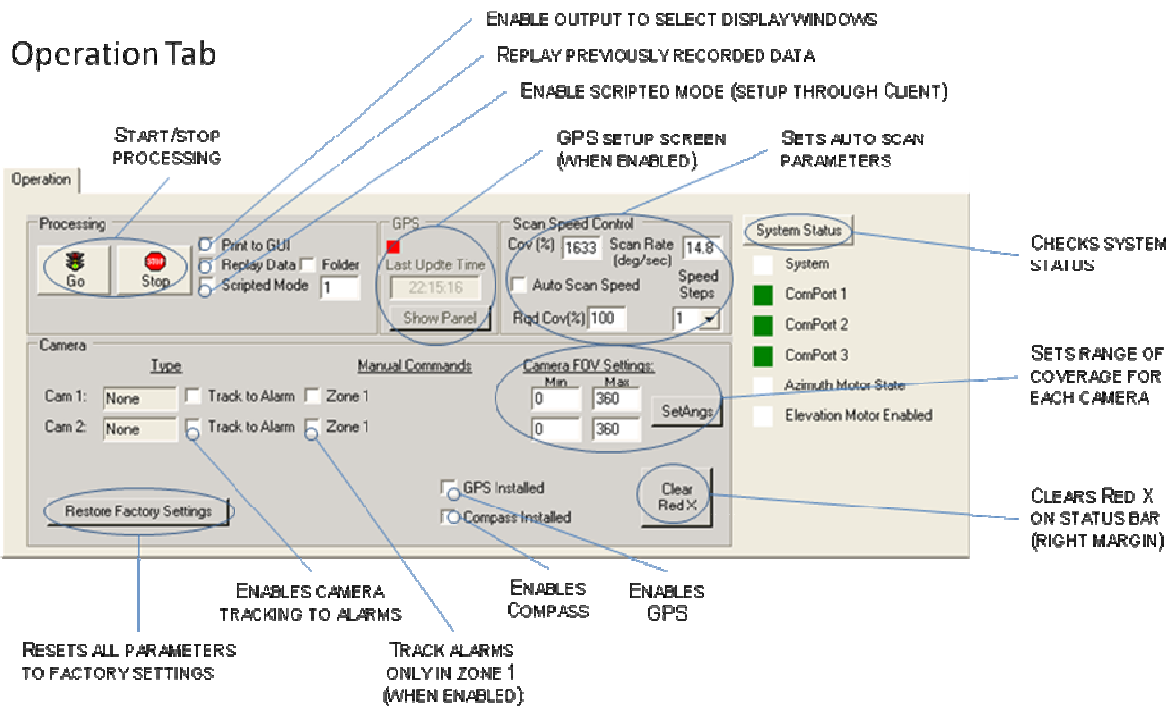
The tabs provide access to the various features that may be changed to configure the system. The tabs include;

- Operation
- Waveform
- Networking
- Graphing
- DSP
- Files
- Detection
- Motor Control
- Zones
- Tracker
- SaveData
- Compass
- Camera Setup

The following subsections briefly discuss each tab and its parameter settings.

### 4.2.1 Operation Tab

Controls on the Operation tab are intended to be the most used controls once the application is running. In addition to controls status lights let the user know if there are problems with the communications ports, or motors.



#### 4.2.1.1 Processing Parameters

The Go and Stop buttons are used to start and stop the radar. Clicking the Go button sets a flag and puts the radar into the OperateLoop. Once entered the loop is continuous. Pressing the Stop button sets another flag that prevents the Operate subroutine from being called. The Operate loop is where the digitized data is processed.

Several check box options are available

- *Print to GUI.* The detection data is printed in the box on the Detection Tab.
- *Replay Data/Folder.* Prompts the user to select files for plotting. This is a diagnostic mode and should only be selected when the radar is stopped. To change the list of

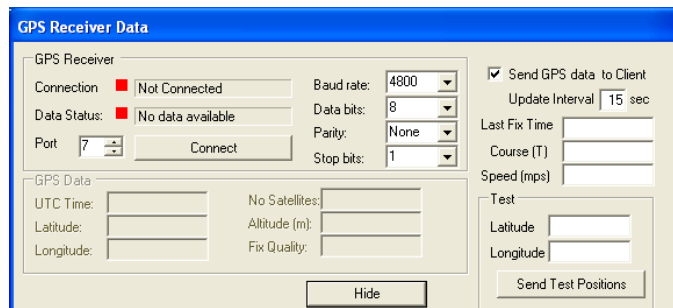


selected files the check box should be cleared and then checked again. To replay all files in a folder, check the folder checkbox.

- *Scripted Mode.* Checking this box results in values for the min and max ranges and the elevation angle being read from a file. The values stored are indexed by the azimuth angle and are intended to allow the radar to follow an outline created for an area of interest (configurable only through the Client interface).

#### 4.2.1.2 GPS Parameters

When “Show Panel” is selected, a new window is created allowing the user to configure the GPS parameters and to check the status of the unit.



The GPS settings include;

- Communication Parameters
  - Serial Port
  - Baud Rate
  - Data bits
  - Parity
  - Stop Bits
- Connect (attempts to communicate GPS device)
- Send GPS data to Client (allows the update of GPS data to connected clients)
- Update Interval
- Test (allows user to manually enter a geo-position for testing)

#### 4.2.1.3 Auto Scan Control

Auto Scan is a learning algorithm that tries to set the optimum motor speed dynamically to insure the desired overlap in azimuth beam positions. It evaluates the min and max ranges for each angle and the processing speed to determine the best speed setting. It works best for very wide sector scans and 360° rotation. The Auto Scan control parameters include;

- Enable/disable Auto Scan Speed
- Required Coverage% (1-100%)
- Speed Steps

Also displayed in this area are;

- Actual Coverage %
- Current Scan Rate (deg/sec).

**4.2.1.4 Camera Parameters**

For both Camera 1 and 2, the camera tracking settings include;

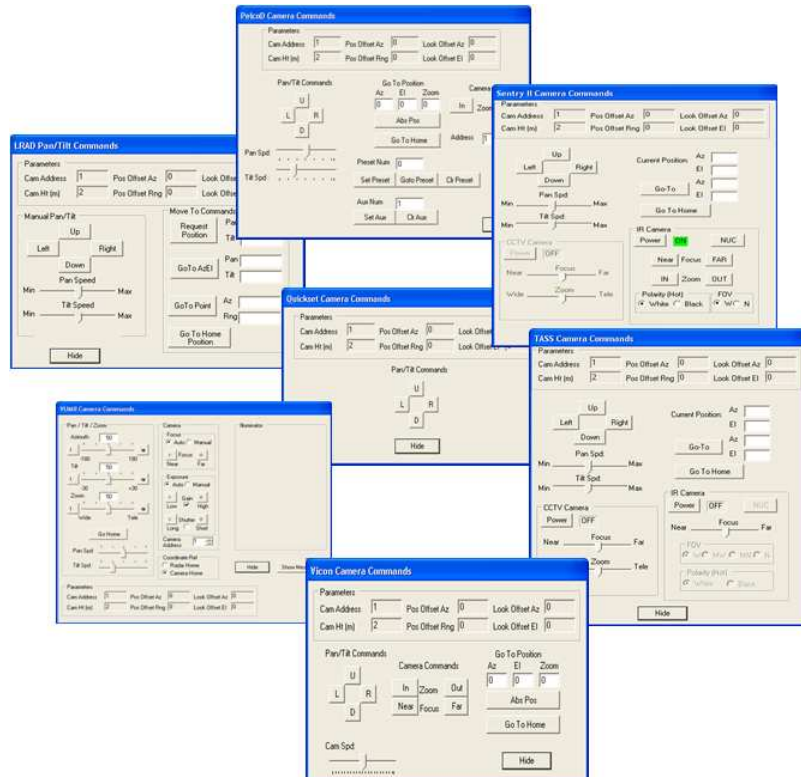
- *Track to Alarm.* Checking this box will enable slew-to-cue tracking of the camera to alarm detections.
- *Zone 1.* If Track to Alarm has been checked, the checking of this box restricts the tracking to alarms detected within *Zone 1 only*.
- *Camera FOV Settings.* The minimum and maximum field of view (FOV) settings are used to limit camera tracking to range of coverage for each camera (after entering new values in text boxes click SetAngs to load values in system).

If a camera had been setup there would also appear another button *Show Cmds* immediately to the right of the *Zone1* checkbox. Selecting this feature brings up a new window containing camera management tools uniquely setup for each camera *Type* (see Camera Setup tab). Some example camera management screens appear below.

**4.2.1.5 GPS/Compass Installed**

These two check boxes used to enable other functions supporting the and Compass. When selected, the configuration tools for GPS (see GPS Parameters, above) and Compass (see Compass are enabled for editing.

**4.2.1.6 System Status**



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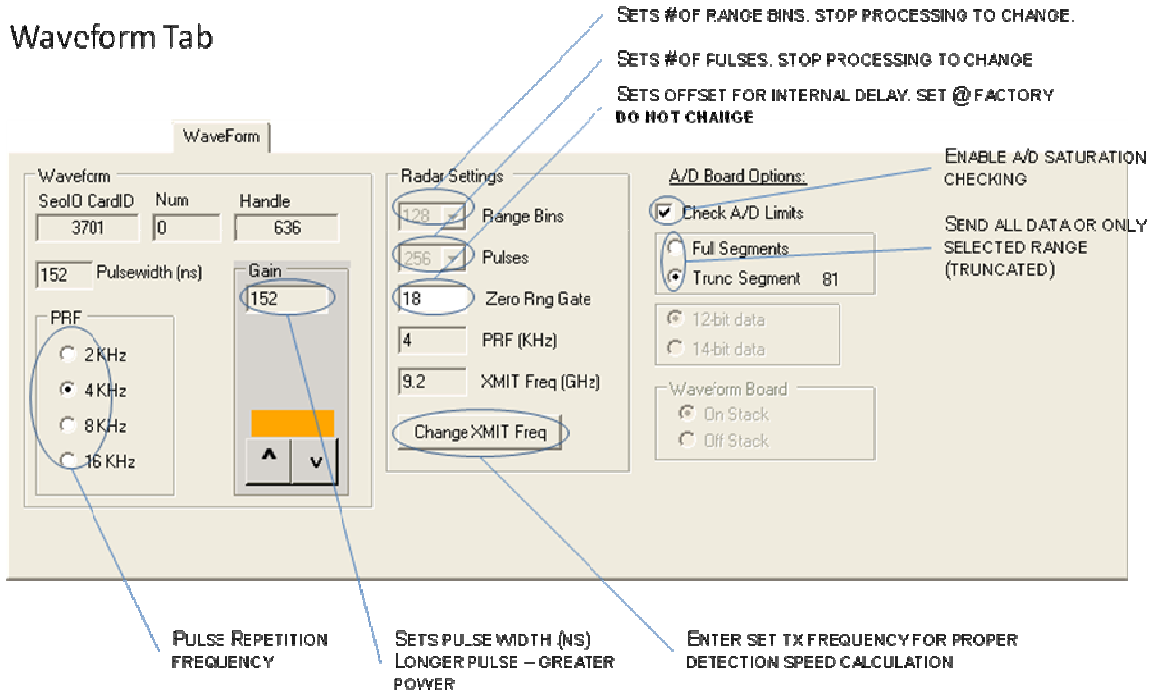
Selecting this button engages a built-in test function that verifies communications with the serial communication ports 1, 2 and 3, interrogates both the azimuth and elevation motors and verifies no other errors have been reported.

#### *4.2.1.7 Restore Factory Settings*

Used when all other efforts have failed to restore the operational state of the equipment! Before the equipment has left the DMT factory, during the final testing process, a factory settings file is created (“FactorySettings.txt”). Like the Saved Settings file (“SrvrSetMR.txt”), the Factory Settings file is used to restore the equipment to a known operational state. Please do not alter this file.

### 4.2.2 Waveform Tab

The Waveform Tab (see below) is used to set the basic radar waveform parameters, such as pulse width, pulse repetition rate, zero range gate (0 offset), number of range bins and number of pulses.



#### 4.2.2.1 Waveform Settings

The waveform settings include;

- PRF.** The pulse repetition frequency (PRF) sets the rate the pulses are generated. The Pulse Repetition Frequency (PRF) controls the maximum unambiguous velocity interval. It sets the maximum number of radar pulses (energy bursts) per second emitted by the radar. Increasing the PRF increases this interval. The default setting of 4 KHz allows targets traveling at speeds of  $\sim \pm 33$  m/s (72 mph) or slower to be resolved. Objects faster than that speed will be detected, but their speeds will be reported incorrectly. The Doppler resolution is affected by this setting as well. Example: 4 kHz PRF yields a maximum unambiguous Doppler of 72 mph. If 256 pulses are used in the FFT (algorithm used to calculate Doppler), then the smallest resolvable speed is  $72 / (256 / 2) = 0.56$  mph. If the number of pulses integrated is 1024, then the smallest resolvable speed is  $72 / (1024 / 2) = 0.14$  mph

- *Gain*. The gain control value changes the amount of energy radiated by increasing the pulse width in nanoseconds.

Also displayed in the area are;

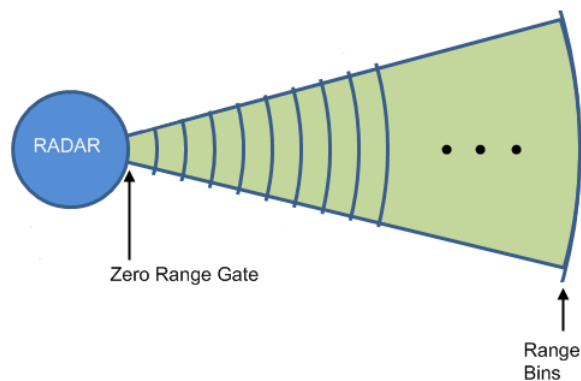
- SeaIOCardID.
- Num
- Handle

These values are returned by the radar's digital I/O board on initialization. If the values displayed in these boxes are not simple integers, the A/D board may not be properly setup (consult DMT for technical assistance).

#### 4.2.2.2 Radar Settings

The radar settings include;

- *Range Bins*. Defines the total number of range bins to be processed (including zero range gate) on each dwell.
- *Pulses*. Defines the number of pulses to be transmitted on each dwell.
- *Zero Range Gate*. The "zero range gate" defines the internal delay (in 'bins') before the transmitted pulse actually leaves the antenna. This is a factory-set parameter and should not be changed. This value is normally set between 15 and 20.
- *XMIT Frequency*. This entry is set to the center frequency configuration of the system so the graphing function correctly displays the Doppler information (use Change XMIT Freq to set). Note: It is important that this number is properly set. It is used in the calculation of the detected speed of an intruder.



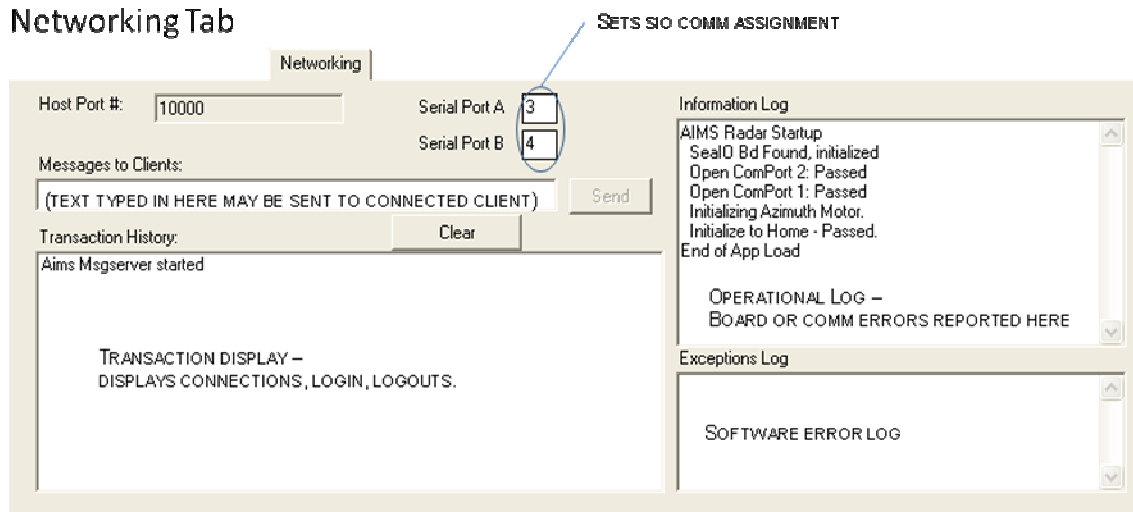
The Doppler Resolution is expressed by the number of pulses integrated by the radar in a given look direction (azimuth angle). It also sets the number of pulses used by DMT's FFT (Fast Fourier Transform) algorithm (discussed in the Processing Section of this document). The default setting is 256 pulses and is incremented in powers of 2 (i.e.,  $2^n$ ) steps. Increasing the number of pulses increases integration time on objects in the radar beam, which results in stronger return strength. Therefore, increasing the number of pulses will increase range performance. Longer integration time (increasing the number of pulses) also lengthens the processing time. As processing time increases, scan rates must be reduced to prevent voids in coverage. It also takes longer to receive larger numbers of pulses. For instance, it takes 0.064 seconds to collect 256 pulses at a PRF setting of 4 kHz. It takes 0.256 seconds to collect 1024 pulses at the same PRF rate. This factor of 4 increase in collection time means the radar must spin by a factor of 4 slower to keep the radar beam on the object for the entire integration sequence. So scan rates should be lowered considerably for scan rates of 1024 and higher. The Dop Resolution control gets its names because the number of pulses also determines the Doppler resolution. The larger the number of pulses, the finer the increments of Doppler measured. An example of Doppler resolution is covered in the description of the PRF control.

#### **4.2.2.3A/D Board Options**

The A/D Board options include;

- *Check A/D Limits.* This enables the error checking of the A/D board configured state.
- *Segments Sent.* As the received signal data segments are processed they are sent from the server to the connected client interfaces. If truncated segments is selected, only those segments that are within the min/max range bins settings (Graphing Tab) are sent. This is useful to minimize data bandwidth and speed, but should not be used if collecting/saving data.

### 4.2.3 Networking Tab



For the most part, this is an informational tab that may be used to check the operational status of the equipment. There are only two settable features here, the communications port assignment for Serial Ports A and B (default ports for Camera 1 and Camera 2, respectfully)..

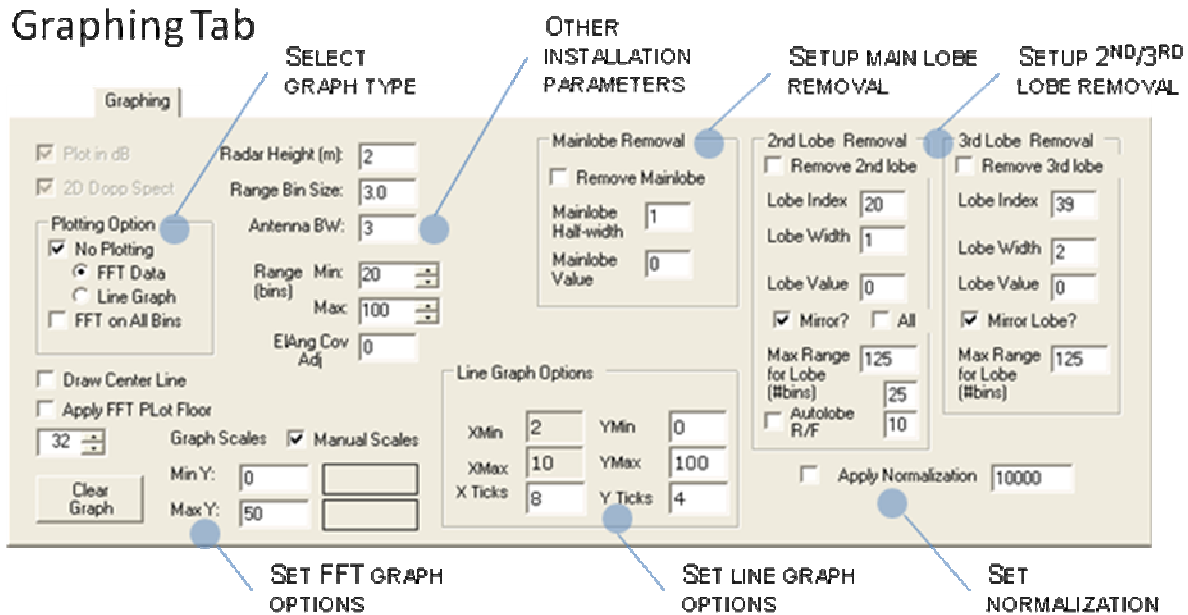
A single line message may be sent from the Server site to a connected Client by using the “Messages to Clients” text box (click “Send” after entering message).

Three log displays are arranged to fill in the remainder of this tab;

- Transaction History. All connections, logins and logoffs are displayed here.
- Information Log. Displays any data communications or board errors.
- Exception Log. All detected software errors are reported here (should be empty!).

### 4.2.4 Graphing Tab

The Graphing Tab (below) defines the attributes that affect the display of the data processed. Additionally, this tab allows the set some installation values (height, antenna beam-width) and to apply some data filtering (lobe removals, normalization).



#### 4.2.4.1 Select Graph Type

The Graph Type options include;

- *No Plotting.* Disables graph plotting on Server.
- *FFT Data.* Selects FFT Data plotting.
- *Line Graph.* Selects Line Graph plotting.
- *FFT on All Bins.* Enables FFT processing of all bins. Otherwise only those defined within min and max Range bins are processed.

The blue FFT graph (below) displays data based on Doppler (frequency shift) and amplitude data. A vertical bar down the center of the screen indicates the area where no Doppler component was detected (non-moving). Objects moving away from the radar appear to the right while objects approaching the radar appear to the left of center. The bottom of the screen depicts

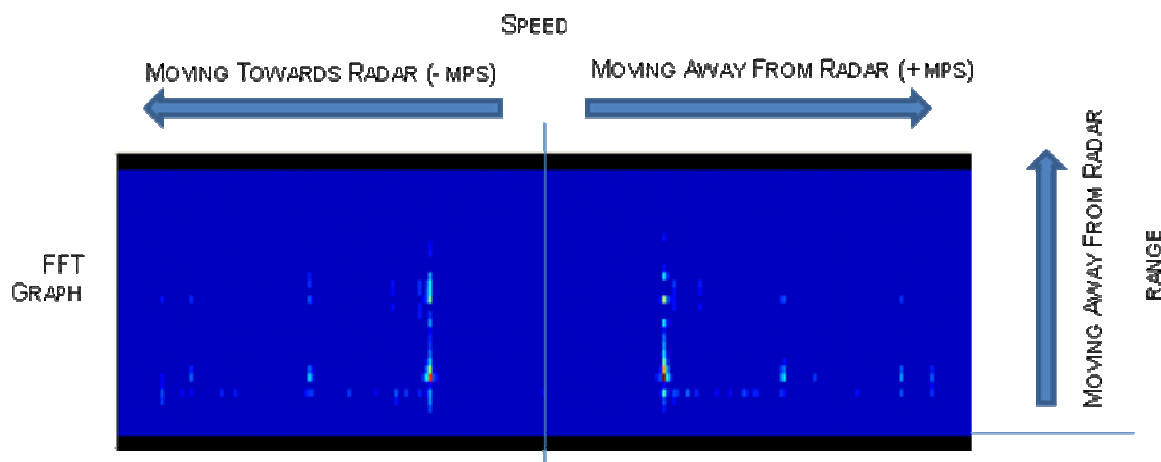


the position of the radar (0 distance) while the top depicts the maximum range (max range bins). The color of the object depicts the intensity of the received signal (blue – white – red).

The line graph provides a simpler display depicting the strength of the peak received signal versus distance from the radar. The default mode is autoscale where the Y axis auto ranges based upon the most recent sample (a check box allows manual scale – discussed later).

#### 4.2.4.2 Set FFT Graph Options

The Graph tab can be used to display the Doppler data from the AIMS Server. This is normally used during system installation and setup or for diagnostic purposes and should not be left on during normal operation. In addition to providing a graphical representation of the Doppler data positioning the cursor on the graph provides distance and speed of objects of interest (Graph Reference). The Set Scales command is used to affect the dynamic range of colors used in displaying the data. Doppler data is viewed by selecting the Plot FFT Data option.



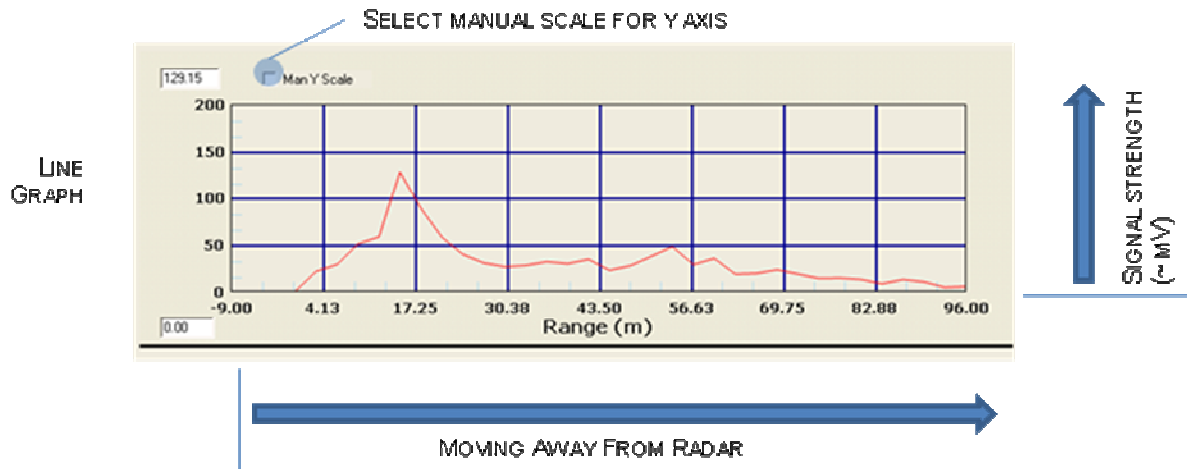
The FFT Graph options include;

- *Draw Center Line.* Provides a visual alignment of where the center line is (0 Hz offset).
- *Apply FFT Plot Floor.* This selection applies the entered threshold (text box) to reduce the plotting of signals not of interest.
- *Manual Scales.* Allows the user to set color range used to indicate signal intensity.

#### 4.2.4.3 Set Line Graph Options

The Plot Line Graph option on the Line Graph tab plots the maximum Doppler return for each range. This is essentially a two dimensional representation of the FFT data. When selected, a line plot will be updated with each processing cycle of the AIMS Radar. The divisions on the plot can be changed by entering new values for the number of X or Y ticks. The values for the Y

Axis, Ymin and Ymax can be set by selecting the Man Y Scale option. It is recommended that the Plot Line Graph option be disabled when changing the values for graphing.



The Line Graph options include;

- *YMin.* When Man Y Scale is enabled for Line Graph, this parameter sets the minimum Y-axis value.
- *YMax.* When Man Y Scale is enabled for Line Graph, this parameter sets the maximum Y-axis value.
- *YTicks.* When plotting Line Graph, this parameter sets the number of Y-axis gradient lines.
- *XTicks.* When plotting Line Graph, this parameter sets the number of X-axis gradient lines.

#### 4.2.4.4 Setup Main Lobe Removal

Main Lobe Removal (sometimes referred to as Clutter X or clutter notch) allows for the removal of nuisance alarms around zero Doppler (very slow or non moving objects) by setting all values in and around 0 Hertz to the Mainlobe Value. Clutter X is very useful for removing the response from swaying trees, moving water, or windblown heavy brush. Setting Clutter X too high can reduce the ability of detecting walking humans.

The Main Lobe Removal options include;

- *Remove Mainlobe.* Enables the main lobe removal.
- *Mainlobe Half-Width.* The Mainlobe Half-Width represents the number of Doppler bins (frequency slices) around 0 Hertz that are set. “0” in this text box equals to 0 Hertz only. “1” in this text box represents one Doppler bin on either side of 0 Hertz is set. Commonly set values are 0 to 2.

- *Mainlobe Value.* Appropriate settings for the Mainlobe Value are usually 0 or negative numbers. (Note: A negative number lowers the plotted color of the notch to black and thereby, is easier to see when looking at Doppler Plot). However, this value should be set to zero when Autolobe is being used.

#### 4.2.4.5 Setup 2<sup>nd</sup>/3<sup>rd</sup> Lobe Removal

Additional lobe removals may be necessary to eliminate noise generated by swaying trees, power lines, roof fans, windmills, etc.

The 2<sup>nd</sup> and 3<sup>rd</sup> Lobe Removal options include;

- Remove 2<sup>nd</sup>/3<sup>rd</sup> lobe. Enables lobe removal.
- Lobe Index. Locates the lobe by frequency index.
- Lobe Width. Defines the width of the lobe area.
- Mirror. Enables the removal of a mirrored lobe (+/- freq index)
- Max Range for Lobe. Sets range to apply lobe removal, in bins.

For just the 2<sup>nd</sup> lobe removal there are a couple additional options;

- Autolobe R/F. Enables auto location and setting of 2<sup>nd</sup> lobe. The auto lobe function constantly searches across the FFT data for peak sustained levels around a specific frequency index and across consecutive range bins. When enabled, this function reports (DSP Tab) the frequency index values for highest and next highest results.
- All. Enables the removal of all harmonic lobes (+/- n\*freq index)

#### 4.2.4.6 Apply Normalization

Normalization is used to reduce the value of the reported signal level before processing, applied only when the received signal levels are consistently reported very high. When enabled, the normalization function divides the data values by the number entered in the adjacent text box. The function is rarely used.

#### 4.2.4.7 Other Installation Parameters

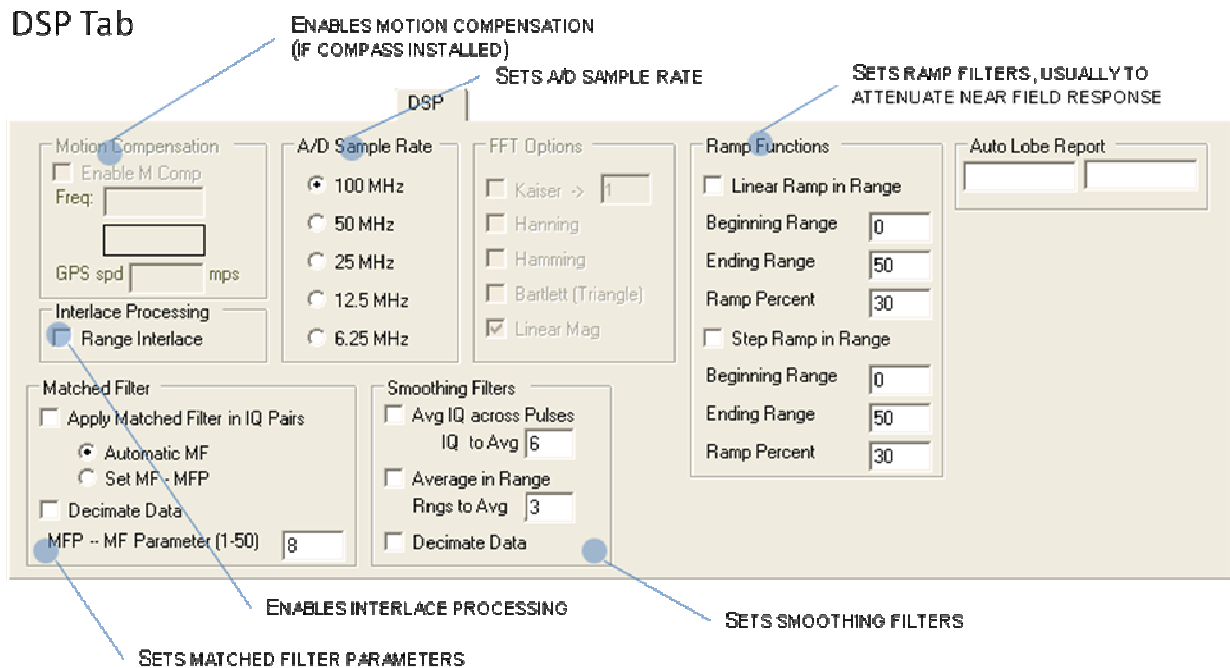
Other installation parameters include;

- *Radar Height.* Sets height of radar installation (off ground).
- *Antenna BW.* Sets the antenna horizontal beamwidth value used by autoscanning feature and used to calculate coverage %.
- *Range Min.* Sets minimum distance for detection (in bins).

- *Range Max.* Sets maximum distance for detection (in bins)
- *ELAng Cov Adj.* Sets offset adjustment for antenna elevation.

### 4.2.5 DSP Tab

The DSP Tab (shown below) provides the user the ability to affect changes to the digital signal processing functions performed on the received signal.



#### 4.2.5.1 Motion Compensation

When enabled, the software corrects for any detected motion of the radar (vehicle) itself. Motion compensation parameters include;

- *Enable M Comp*. Enables motion compensation. The motion compensation algorithm looks primarily for the effects of linear motion in the collected data and digitally corrects it.

Also displayed in this area are;

- *Freq*. Reports the amount of Doppler shift resulting from the radar's movement.
- *GPS speed*. Reports the speed provided by GPS unit.

#### 4.2.5.2A/D Sample Rate

The A/D Sample Rate is set automatically based on the Radar Range selection to allow the best range resolution while maintaining full coverage for the maximum range selected. The A/D board may be configured to sample data at various frequencies;

- 100 MHz (3m range bins)
- 50 MHz (6m range bins)
- 25 MHz (12m range bins)
- 12.5 MHz (24m range bins)
- 6.25 MHz (48m range bins)

The faster the sampling rate, the better the resolution but it also requires a longer processing time (usually set to either 50MHz or 100MHz).

#### 4.2.5.3 Matched Filter

The Matched Filter is a digital signal processing technique that matches the receiver characteristics to the transmitted characteristics. More directly, the pulse width and pulsed shape are matched. Since the radar pulse for AIMS is very square (that's a good thing), the matched filter can be generated by simply matching receiver gate width to the transmitted pulse width. This is accomplished by coherently summing the range bins until the sum equals the pulse width. Since pulse width is in nanoseconds, it must be converted to meters ( $\text{pw (meters)} = \text{pw (nanoseconds)} * (3 * 10^8)$ ). This implementation is sometimes referred to as a "boxcar" matched filter. The result is improved range performance and clutter rejection. The size of the filter is a function of the pulse width or length and can be set for Auto calculation (Auto MF) or set manually (Set MF to MFP). Auto MF will allow the radar to calculate the appropriate number of range bins needed to match the pulse width automatically. Set MF allows the user to override the automated calculation. DMT has found that performance for the radar is often better when the MF constant is a little lower than the value calculated by the Auto MF procedure. The MF constant value is set and reported in the text box in the lower right corner of the Matched Filter settings box. The matched filter routine is implemented before the FFT algorithm.

Decimating data permits the MF algorithm to step thru range bins at a step size equal the MFP. This differs from the normal MF step size of 1. The result is fast processing, but at the cost of degraded resolution.

The matched filter options include;

- *Apply Matched Filter in IQ Pairs.*
- *Automatic MF.*
- *Set MF-MFP.*
- *MFP – MF Parameter (1-50).*

- *Decimate Data.*

#### 4.2.5.4 Smoothing Filter

The smoothing filters are used to average out spurious signals from legitimate detections and may be applied across both the time domain (across pulses) and spatially (across range).

The smoothing filter options include;

- *Average IQ across pulses.* When enabled, this function averages the raw IQ values across successive pulses (defined by the *IQ to Average* value). Ideally, the effect suppresses spurious emissions occurring around the same time as signals received from valid targets.
  - *IQ to Average.*
- *Average in Range* When enabled, this function averages the raw IQ values across successive range bins (defined by the *Ranges to Average* value). If *Decimate Data* is enabled, the averaging increments by the *Ranges to Average* value (rather than one). Again, the ideal effect will suppress spurious emissions co-located around valid targets.
  - *Ranges to Average.*
  - *Decimate Data.*

#### 4.2.5.5 FFT Options (disabled)

Currently this function is disabled for user modification and is permanently set to Linear Magnitude. Contact DMT to receive an enabled version. These options are FFT windowing functions – each with its own merits. All help to reduce frequency sidelobes generated by the FFT, but at the sacrifice of signal strength.

#### 4.2.5.6 Ramp Functions

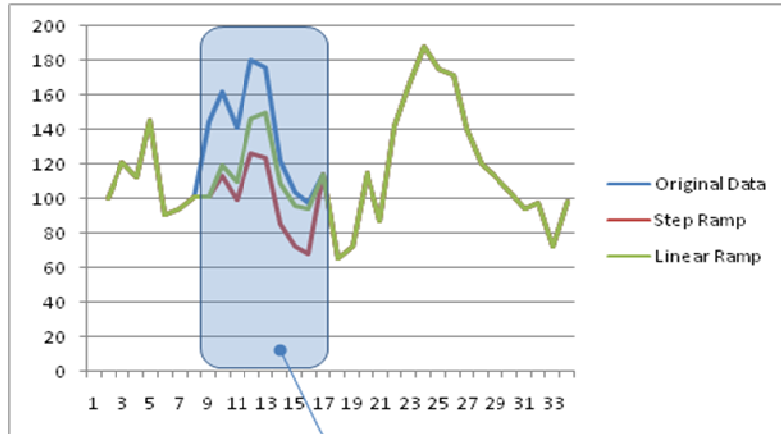
The ramp functions are used to digitally lower signal strength over a given range swath. They are particularly useful for reducing the affects of processing artifacts generated from very large objects located at close ranges. Large objects at close ranges can reflect so much energy that it saturates the radar at that range. Saturation can cause false target detection.

The ramp function options include;

- *Linear Ramp in Range*
  - *Beginning Range.*
  - *Ending Range*
  - *Percent*

- *Step Ramp in Range.*
  - *Beginning Range.*
  - *Ending Range*
  - *Percent*

Ramp functions lower the signal strength to levels below alarm thresholds. The Beginning Range indicates the first range bin for which the function is applied and the Ending Range indicates the final range bin. The Ramp Percent represents that maximum percentage applied to the measured magnitude (signal strength). So a Ramp Percent value of 30 means that the signal strength will be reduced to 30% of its current value. Linear Ramp in Range means the reduction is applied over a linear slope from 0 to Ramp Percent, which the above example is 30%. This linear slope is applied over the Beginning Ranges to Ending Ranges. Step Ramp in Range means the reduction is an equal percentage over the entire range swath defined (Beginning Range to Ending Range).

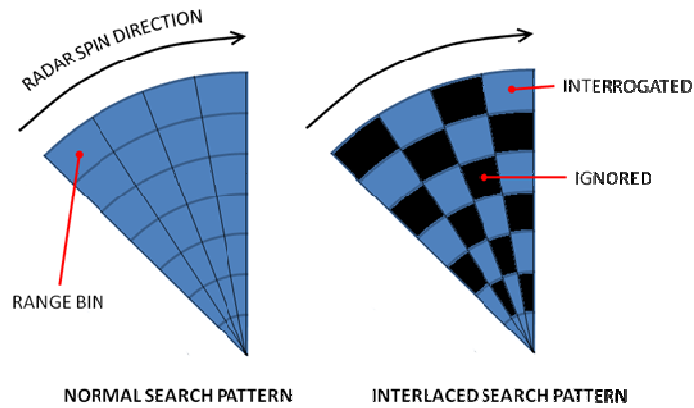


Used to eliminate localized near field noise

#### 4.2.5.7 Interlace Processing

Range interlacing is an algorithm that mimics the methods used by search and recue teams to quickly scan large areas in less time. DMT has added this algorithm to speed up search by reducing the number of range bins that must be processed. Figure 8 illustrates this principle. *The process should only be used when rotation speed of the radar becomes critical.*





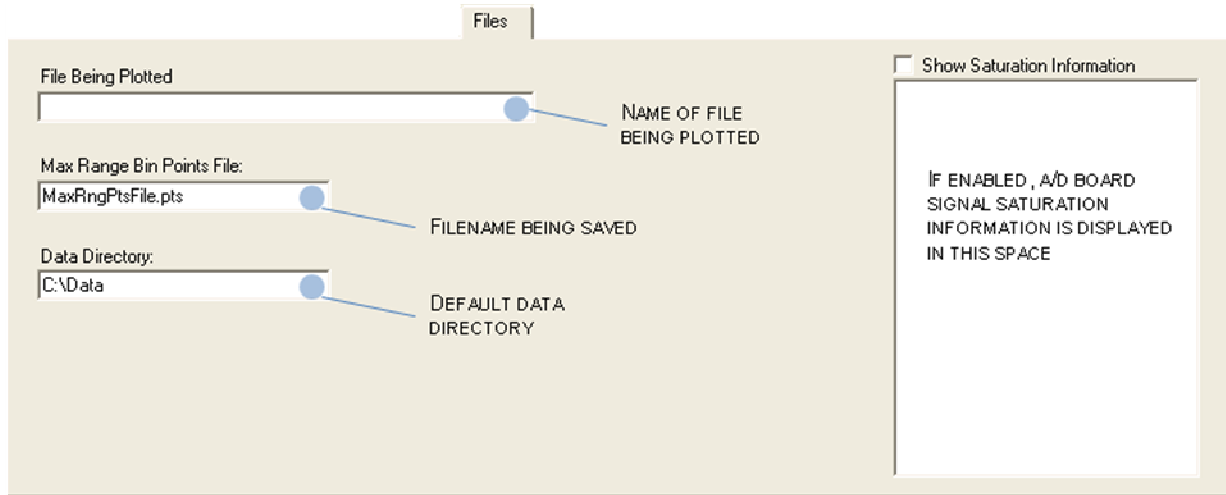
#### ***4.2.5.8 Auto Lobe Report***

If Autolobe R/F is enabled (Graphing Tab), the auto lobe information is output here. The first value (on left) reports the frequency index of the primary autolobe. The second value represents the frequency index of the next highest autolobe detected.

## 4.2.6 Files Tab

The Files Tab is shown below.

### Files Tab

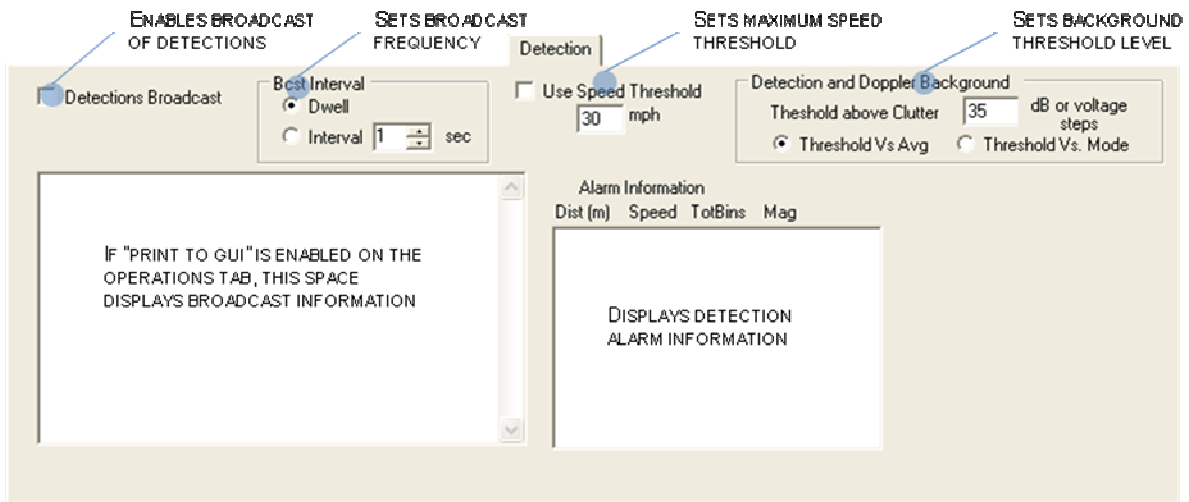


The configurable parameters in this tab include;

- *Files being plotted.* When the Replay Mode is enabled (Operations Tab) this field shows the name of the files that contains the data being replayed.
- *Max Range Bin Points File.* This field contains the name of the files where data is currently being saved in.
- *Data Directory.* This field contains the name of the subdirectory where data is being saved to (when enabled).
- *Show Saturation Information.* When enabled, saturated signal level information is sent to this box. For each range bin containing saturated points, the range bin number is identified in the leftmost column and the column to the right reports the number of saturated points in that range bin.

## 4.2.7 Detection Tab

### Detection Tab



The detection tab options include;

- *Detections Broadcast.* Enables the broadcast of detections.
- *Bcst Interval.* Sets the broadcast interval on each dwell, or on a specific time interval.
- *Speed Threshold.* Sets a maximum speed threshold to reduce reported detection activity. The Use Speed Threshold is an option that can be used to focus on targets of interest. The threshold limits reported detections to targets traveling slower than the threshold speed; for example only targets traveling 10mph or slower.
- *Detection and Doppler Background.* Sets noise threshold relative to the Average or Mode value  $((\max + \min)/2)$  calculated across the range bins. When using the client interface this value is referred to as the Sensitivity setting.

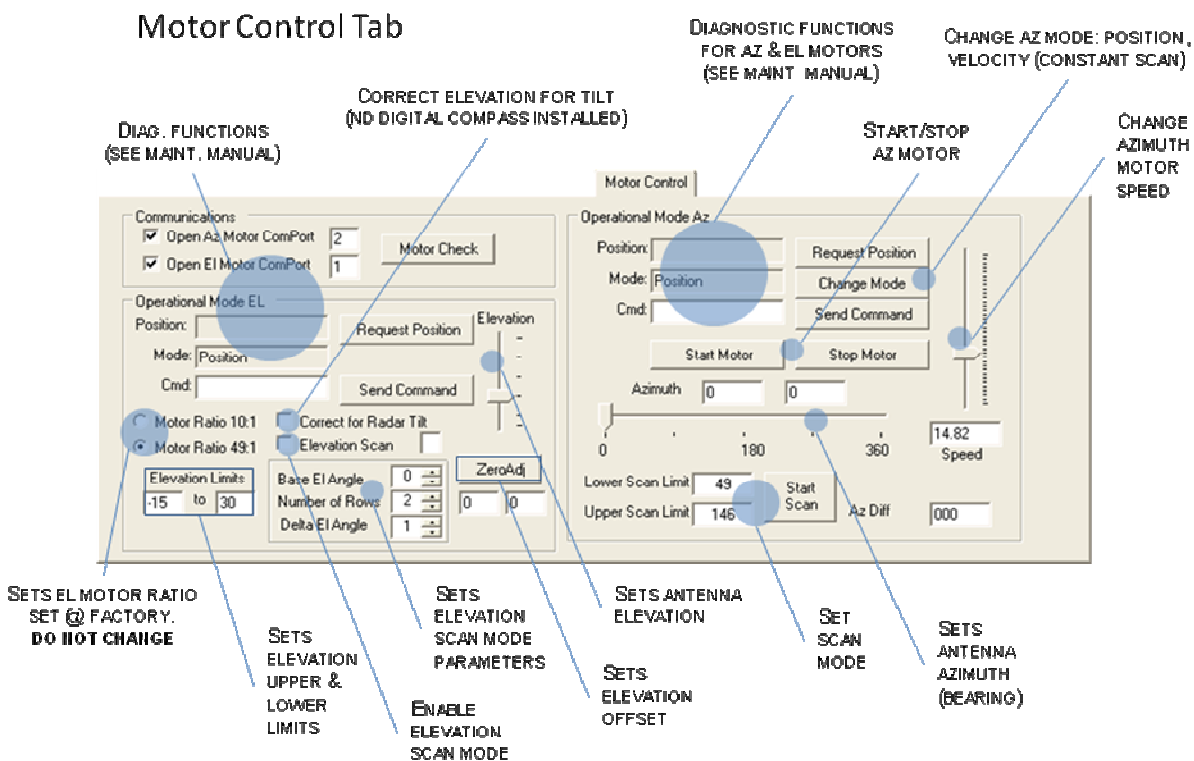
There also two display boxes

- *Broadcast Information.* If “Print to GUI” (Operations Tab) is enabled, broadcast detections information is printed to this box.
- *Alarm Information.* Detected alarm information is sent to this box.



### 4.2.8 Motor Control Tab

Antenna movement and position can be controlled using the commands on the Motors tab. This is primarily intended for use during initial setup, sensor tuning, and troubleshooting. When in position mode the radar can be moved to a specific location (azimuth and elevation) by clicking on the map. To operate in this mode select the Move Radar to Point on Map check box and simply click on the map. Caution: Verify the Azimuth motor is in the Position Mode before selecting this option. Problems with the antenna motors are indicated by AIMS Server via a message to the AIMS Client. The AIMS Client will display “Error” for the reported position (Rpt Pos), Figure 10.



#### 4.2.8.1 Motor Controls

There are several commands available for working with the Azimuth motor. The primary commands are Change Mode and Start/Stop Scan. Change Mode is used to transition the azimuth motor between Position and Velocity modes. When in Position mode a sector scan can be accomplished by setting lower and upper limits and clicking Start Scan. The button text will change to Stop Scan and the azimuth motor will move between the lower (Lwr) limit and upper

(Upr) limit continuously until Stop Scan is clicked. Scan limits should be entered using negative angles so that the minimum scan angle is always less than the maximum. For example, to scan from 350 degrees to 20 degrees enter -10 to 20 for the minimum and maximum scan limits respectively. The commands; Stop Motor, Get State, and Reset Motor were added for safety. The Stop Motor command will send an immediate stop command to the motor. Once stopped the Reset Motor command must be issued before any positioning or Change Mode commands can be issued. The Reset Motor command starts the motor and sends it to the home or 0° position. Once the motor has reached the home position it will automatically enter the position mode. The Get State command will provides a status message that indicates the current mode of the motor; position or velocity. The Position Mode and Velocity Mode options are intended to reflect the status on the server only. The mode is changed by clicking on the Change Mode button. The Change Mode button in the Azimuth antenna control toggles the Azimuth or Panning antenna between the Constant Velocity mode (continuous spinning) and the Position mode. When leaving the Constant Velocity mode the antenna will first return to the home position, 0°, before entering the Position mode. Absolute position commands should not be issued until the antenna has returned to the home position (Position Mode option is on). In position mode the slider can also be used to position the antenna. As the slider is moved by clicking and holding the mouse left button the angle is reported in the Goto Pos text box. When the slider is released, left mouse button up, the go to position is transmitted to the AIMS Radar (server). The Elevation or Tilt motor remains in the Position mode. Adjustments in elevation (tilt) are made using the slider bar or by clicking on the map (assuming the Move Radar to Point on Map option is selected). To change the elevation using the slider bar click, hold and move the slider to the desired angle and release. As the slider is moved the angle will be reflected in the Set El Pos text box. When released this elevation position will be transmitted to the radar. As the Antenna moves to a new location the angle will be reported in the Current El Pos text box.

The elevation and azimuth motors are ‘smart’ motors and are managed via a special protocol. Generally, the standard motor settings meet the needs of most installations. Occasionally, however, modifications to basic motor settings are necessary because of the specific equipment installed. For instance, a very large antenna would not be able to accelerate as quickly as a small antenna without incurring vibration that would impact both the radar and the viewed image of a camera mounted on top of the radome. The motor acceleration should be reduced to minimize this potential impact. Changing the motor settings may be accomplished by typing the command in the *Cmd* field and clicking on *Send Command*. To change acceleration you would type in the *Cmd* field:

ACCELERATE 75% OF NORMAL  
"A=75 G"  
GO

And click *Send Command*. More details may be found in the document “SmartMotor and RTC3000 Controller Expanded Capabilities List”, dated May 5, 2001 (Animatics Corp). **Before**

**using these commands you should consult with a certified DMT installer or DMT technical representative.**