VAISALA

UTILITIES MANUAL

IRIS and RDA

M211316EN-D

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CHAPTER 1
GENERAL INFORMATION

1.1 About This Manual

This manual describes the typical operations that users perform with the IRIS utilities: configuration, calibration, monitoring, and testing of the antenna, signal processor, and IRIS. Each utility is described in a separate chapter of this book, organized alphabetically. Some utilities must run before other utilities can operate correctly. When a utility depends on the results of another utility, it is clearly indicated in the text.

Many of these utilities provide interactive menus and color graphics to assist the operator. Because the utilities can affect the calibration and operation of the radar system, only IRIS operators are allowed to run them. All these utilities are available on both IRIS and RDA systems.

1.2 Version Information

Manual Code	Description
M211316EN-D	This manual. Fourth version. September 2014
M211316EN-C	Previous manual. Third version. November 2013
M211316EN-B	Previous manual. Second version. March 2013
M211316EN-A	Previous manual. First version. June 2012

1.3 Related Manuals

Manual Code	Manual Name
M211315EN	IRIS and RDA Installation Manual
M211317EN	IRIS Radar User’s Manual
M211318EN	IRIS Programmer’s Manual
M211319EN	IRIS Product and Display Manual
M211320EN	RCP8 User's Manual
M211321EN	RVP8 User's Manual
M211322EN	RVP900 User's Manual
M211452EN	IRIS and RDA Dual Polarization User’s Manual

You can download the latest versions of the manuals from Vaisala product website, http://www.vaisala.com They can be read online using by Adobe® Reader®, which is installed with IRIS.

Vaisala encourages you to send your comments and/or corrections to:

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email helpdesk@vaisala.com

1.4 Documentation Conventions

Throughout the manual, important safety considerations are highlighted as follows:

WARNING	Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

CAUTION	Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

NOTE	Note highlights important information on using the product.

The following conventions are used throughout this manual:

Menu->**Choice**	Pull-down menu selections are shown in boldface type. The name of the menu is shown first, with an arrow pointing to the menu entry that you should choose. To pull down a menu, position the mouse cursor over the menu bar and press the left mouse button.
"Field Value"	Quotation marks surround the value of a field, such as a status value or the name of a configuration file.
$	The operating system prompt is shown as a dollar sign, through it may differ from one operating system to the next.
`user input command parameter`	User input and command syntax are printed in bold, monospaced type. User-supplied parameters are shown in italics. Enter the command exactly as it is shown and supply the appropriate parameter value. All commands are terminated by a carriage return (not shown.)
`filename directory`	Filenames and directory names are also shown in bold, monospaced type when referenced within the text. They are case sensitive. In addition, all directory specifications are assumed to be relative to the IRIS/Open root directory. The default root directory is `/usr/sigmet`.
`Command output`	Some commands generate output. The text of this output is displayed in monospaced type.

CHAPTER 2

INTRODUCTION TO IRIS UTILITIES

The IRIS operator and/or system manager must make sure all the hardware and software in the IRIS system work together properly from the time of installation through the day-to-day operation. This job includes:

- **Configuration**—Setting up the hardware and software after it is installed or after a software update.
- **Calibration**—Fine-tuning the system so that it generates the most accurate data possible.
- **Monitoring**—Overseeing the day-to-day operation of the system to make sure that it continues to function properly.
- **Testing**—Locating the cause of problems when they arise.

The IRIS utilities are designed to help with these job functions. Table 1 on page 15 lists all the utilities, showing how they are used together to configure, calibrate, monitor and test the radar/antenna, signal processor, and IRIS. Each column of the table is independent of the others; that is, you can configure, monitor, and test the radar/antenna using the utilities listed in the radar/antenna column without regard for the signal processor or IRIS. Similarly, you can configure, calibrate, monitor and test the signal processor separately. IRIS can also be configured independently, though monitoring it is meaningless without the antenna and signal processor.

Table 1 IRIS Utilities by Function

Function	Radar/Antenna	Signal Processor
Configuration	Setup	Setup Dspx
Calibration	—	Ascope Zauto or Zcal
Monitoring/Testing	Antenna Bitex	Ascope Dspx

In general, configuration utilities are run only after installation or after a software or hardware update. Calibration utilities are run periodically or if there is a change to the system hardware. Monitoring and testing are on-going procedures. You run those utilities regularly, or whenever problems arise.

While some of the utilities can be run while IRIS is running, this is not recommended and usually not necessary. Table 2 on page 16 lists the IRIS utilities, with a short description and a checkmark indicating the utilities that can be run while IRIS is running.

In some cases the signal processor utilities for the SIGMET model RVP6 signal processor are not required for the SIGMET model RVP7 Digital Receiver and Signal Processor, i.e., because of the wide dynamic range of the RVP7, utilities relating to receiver gain control are only required by the RVP6.

NOTE

NOTE to IRIS Users: Utilities that use the signal processor can be accessed without quitting the IRIS program (qiris). To do this, simply set the Radar Process button to the off position in the IRIS Radar Status Menu. This will free the SCSI bus to the signal processor so that it can be accessed by the utilities. Another way to run a utility while IRIS is running is to use the -demo option which is available for many utilities. This allows values to be changed and stored. However, these will not take effect unless IRIS is restarted (qiris and siris).

Table 2 Summary of IRIS Utilities

Utility	Run with IRIS	Description
Antenna	Yes	Provides monitoring and control for the RCP antenna controller. This allows keyboard/mouse control of the antenna and radar transmitter/ receiver/servo system for test and verification purposes.

Table 2 Summary of IRIS Utilities (Continued)

Utility	Run with IRIS	Description
Ascope	No	A general purpose data plotting and radar control program. Users can display up to four plots from the available parameters: - Reflectivity vs. Range - Velocity vs. Range - Spectrum Width vs. Range - Log, I and Q Raw A/D Samples vs. Range - Log, I and Q Time Series at Selectable Range - Doppler Spectrum at a Selectable Range In addition, Ascope provides an alternative radar control program for changing pulse width, PRF, clutter filters and data thresholding. Ascope is used to align the LOG and LINEAR channel A/D converters and for overall system verification. The Doppler spectrum display is particularly useful for diagnosing problems in the Doppler receiver.
Bitex	Yes	Provides detailed configuration and observation of the information reported by the Built-In Test Equipment (BITE).
Dspx	No	Helps to debug interface hardware to the signal processor, or debug new software you are developing using the signal processor.

Table 2 Summary of IRIS Utilities (Continued)

Utility	Run with IRIS	Description
Overlay	Yes	Graphical editor to edit and display overlay maps that you develop, so that you can see how they will appear when displayed on the real-time display or other products.
Setup	No	Configures the radar software for the characteristics of the radar, such as the number of pulse widths, the duty cycle limits, the radar wavelength, antenna gain, transmit power, etc. This utility should be run first.
Zauto7	No	Calibrates the slope and offset of a test signal within a linear range. This information is stored in a file and used during programmed radar collection.
Zcal	Yes	Allows the user to manually modify the calibration file.

2.1 Radar/Antenna

on page 18 shows the connection between the radar system and IRIS via the RCP (radar control processor). The radar is connected to the RCP via a number of status and control lines. The RCP is connected to the IRIS workstation via a serial line.

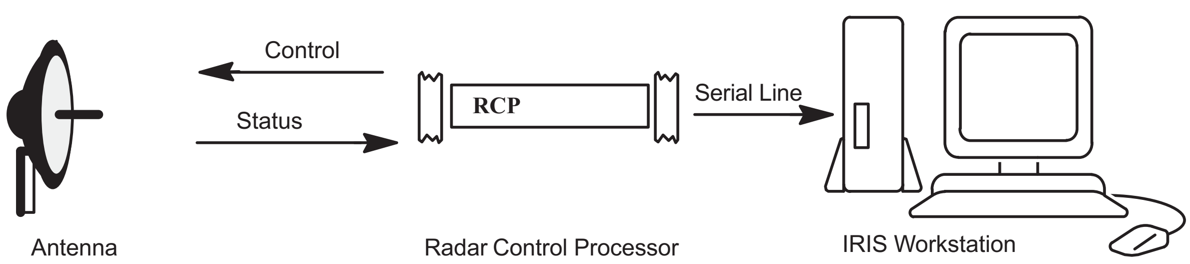


Figure 1 Typical Antenna Installation

The relationship between the radar/antenna, RCP, and IRIS must be configured during installation, then it must be monitored and tested to make sure it continues to function properly.

2.1.1 Configuring the Antenna

IRIS utilities and menus let you control the antenna's position and velocity from a remote workstation. For these utilities and menus to work, you must first configure the antenna using **setup** described in Chapter 10, Setup Utility, on page 165.

Some of the information you supply in the **setup** utility comes from the manufacturer's specifications, such as:

- Minimum and maximum elevation that the antenna can reach.
- Maximum azimuth and elevation velocities.
- Warm-up and settle times.
- RCP serial line format.

The **setup** utility also needs to know information about the antenna's location, such as:

- Height of the ground in meters.
- Height of the antenna in meters.
- Latitude and longitude of the antenna site.

To save time during configuration, gather this information before running **setup**.

After the antenna is configured, run the Antenna utility to test the connection between the antenna and IRIS.

You should also use Antenna to test the antenna's built-in safeguards. These safeguards ensure that the antenna does not exceed its elevation limits. The procedure for testing the antenna safeguards is described in Chapter 3, Antenna Utility, on page 29. It may require two people — one to run the utility, and one to watch the antenna.

2.1.2 Monitoring the Antenna

The Antenna utility gives you access to all of the radar control features through a menu interface, including:

- Setting the azimuth and elevation position and velocity.

- Turning on the transmitter radiate, servo power, and transmitter cabinet.

In addition, it displays antenna status information, including:

- Airflow
- Waveguide pressure
- Magnetron current
- Transmitter radiate on, off, and warning status

After installation or routine maintenance, use Antenna to test the interface between the antenna and IRIS. However, do not run Antenna when IRIS is running because it may interfere with commands that IRIS sends to the radar control processor. Use the Radar Status menu, which gives you access to the same antenna status information without interfering with IRIS commands. See the *IRIS User's Manual* for information on the Radar Status menu.

2.1.3 Testing the Antenna

The Antenna utility's RCP I/O Summary menu is a good place to start when analyzing antenna problems. It can help diagnose problems on the serial line. For example:

- If the output count is frozen, the computer is not transmitting data.
- If the input count is frozen, there is no I/O coming from the RCP.
- If the error count is incrementing rapidly, you may be using the wrong antenna format or baud rate.

If the I/O and error counts appear normal, the problem is not with the serial line. You should then look at the Antenna status panel, which may show an error or fault for one or more antenna controls.

You can also run the **bitex** utility to see if the BITE packets are coming across the line. Information in the BITE packets can further pinpoint the cause of the problem. The **bitex** is described in Chapter 5, Bitex Utility, on page 91.

2.2 Signal Processor

on page 21 shows a typical signal processor installation. The signal processor receives input from the transmitter/receiver through the I, Q, and LOG signals. It controls the gain through the GAIN signal for analog sensitivity time control (STC) or automatic gain control (AGC), or through the instantaneous automatic gain control signal (IAGC) for digital fast AGC. The signal processor is connected to the IRIS workstation via a SCSI interface.

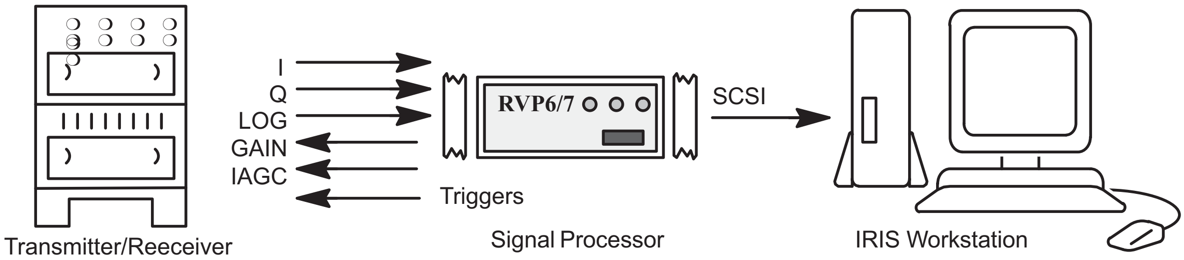


Figure 2 Typical Signal Processor Installation

The relationship between the transmitter/receiver, signal processor, and IRIS must be configured after installation. Each of the gain and offset pots must be adjusted and calibrated. This calibration information is stored on disk so that it can be used during radar data collection. The signal processor must then be monitored and tested to make sure it continues to function properly.

2.2.1 Configuring the Signal Processor

After you install the IRIS hardware and software and before you run the signal processor, you must run the Setup utility. This utility provides commands with which you define the parameters of the radar transmitter, so that the signal processor can process the radar information that it receives.

In the RCP 10.3 Radar Control Processor on page 183, you define the parameters of the radar transmitter/receiver, including:

- Wavelength
- Pulse width
- Minimum, maximum, and default PRF
- Transmitter, receiver and test signal losses

This information can be found in the manufacturer's specification for the radar device.

After the radar and signal processor have been cabled up and configured with Setup, there is only a 50/50 chance that the Doppler velocity sign is set correctly. To check this, run the Ascope utility as described in Chapter 4, Ascope Utility, on page 49. If the sign is not correct, swap the I and Q input cables to the signal processor.

2.2.2 Calibrating the RVP7 or RVP8 Signal Processor

When the signal processor is configured, each of the connections between the transmitter/ receiver, signal processor, and IRIS must be adjusted and calibrated to ensure the most accurate results. The RVP7 Digital Receiver alignment does not require the radar utilities for installation, except for the **zauto** (or manual **zcal**) utilities which are used for calibration. However, the alignment can be done using the **dspx** utility.

2.2.3 Monitoring the Signal Processor

The **ascope** utility is a convenient way to monitor the signal processor. It lets you control the antenna position and velocity, sample data either once or continuously, and plot from one to four output parameters in a graphical display. For example:

- Plot the reflectivity and Doppler spectrum to determine how much dynamic range is available in the linear channel for clutter correction.
- Plot the mean velocity vs. range to make sure the velocity sign is correct.
- Plot the linear channel A/D's vs. range and the LOG channel A/D vs. range to make sure the analog-to-digital converters are aligned correctly.
- Plot the Doppler power spectrum at a selected range to examine interesting weather targets in detail.

2.2.4 Testing the Signal Processor

The RVP7 signal processor performs a series of self-tests when it is powered up. If an error occurs during the power-up cycle, one of the LEDs is turned off. Refer to the *RVP7 (or RVP6) Signal Processor User's Manual* for more information.

The **dspx** utility can help track down a problem with the signal processor. It is especially useful as a debugging tool when developing new hardware or software interfaces to the signal processor. A brief description of the **dspx** utility and an example of its use are given in Chapter 7, Dspx Utility, on page 125. More detailed information about the **dspx** commands can be found in the *RV7 Signal Processor User's Manual*.

2.3 Running the IRIS Utilities

Utilities can be run locally or over the network for remote operation and maintenance. The utilities may be started from either a terminal or a graphical user interface called Utils. These cases are described below.

NOTE	Important: You must be an operator to run the IRIS Utilities. Observers are not allowed to run any utilities that would effect the system configuration or operation.

NOTE	Note: Utilities that use the signal processor can be accessed without quitting the IRIS program (qiris). To do this, simply set the Radar Process button to the off position in the IRIS Radar Status Menu. This will free the SCSI bus to the signal processor so that it can be accessed by the utilities. Another way to run a utility while IRIS is running is to use the -demo option which is available for many utilities. This allows values to be changed and stored. However, these will not take effect unless IRIS is restarted (qiris and siris).

2.3.1 Running the Utilities Locally from a Terminal Window

This is the case for the following:

- The workstation is connected directly to the signal processor via the SCSI-2 bus and the RCP via an RS232 serial line.

The steps for running the utilities are:

1. Start a terminal on the local workstation. On HP and IBM workstations, double click the terminal icon to do this. On SGI workstations, use the system manager menu to start a "Unix Shell". On Linux, right click on desktop and select New "window".
2. Optional– to get a nicer terminal you can immediately type **sigterm**. This will start a terminal that has nice scroll bars, size, background, etc. Note that your user ID (operator or observer) and node name will appear at the top. This is useful if you have several terminals open in a networked environment since for each terminal you will know who you are and where you are.
3. Type the name of the utility followed by any options (e.g., -demo). It is often nice to type "&" after the utility name. This will free-up the terminal after the utility is started. An example is:

```
$ ascope -demo &
```

Note that utility names are typed all lower case. If you are unsure what options are available, type the name of the utility and the option -help. In most cases this will give you a list of options:, for example:

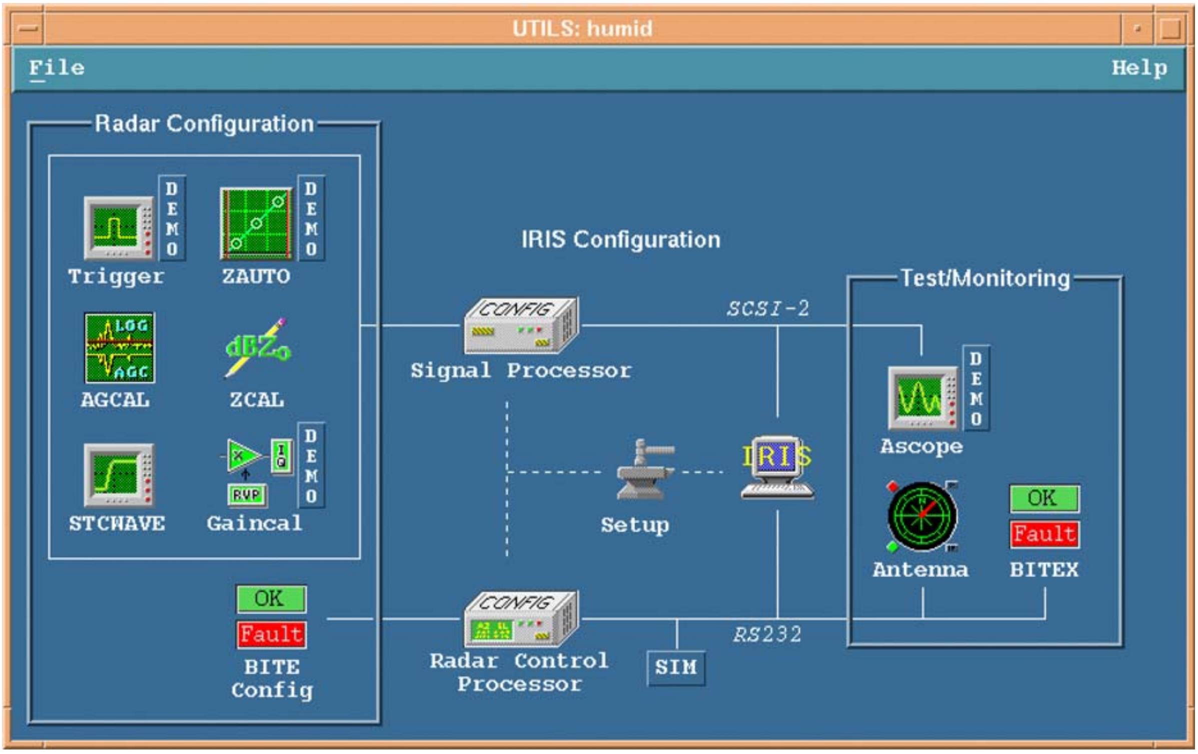
```
$ ascope -help
```

2.3.2 Running the Utilities Locally Using the utils menu

Utils is a convenient graphical user interface to access the IRIS utilities. You can start it from IRISnet Utils icon. Or, start a terminal of "sigterm" and then type:

```
$ utils &
```

The utils menu will appear as shown below (use zoom to see details):



The menu shows an idealized block diagram of a radar system and the interfaces and how the utilities can be used to configure, monitor and test various parts. The node name of the workstation is shown at the top of the menu. This is useful in multi-radar networks for keeping track of where you are.

Any utility can be invoked by double-clicking on an icon. If you only want to start the demo version of a utility (for example for training), double click the demo button.

A special feature of this menu is that the EEROM configuration (terminal setups) for the signal processor and SIGMET's RCP02 Radar Control Processor can be accessed by double clicking on their respective icons (labelled config).

It is very convenient if you are doing installation or configuration work to leave this menu running, but iconified (the . button at the upper right), so that it is ready for fast access.

2.3.3 Running Utilities or the utils Menu from a Remote Workstation

In this case you would be sitting at a workstation on the network and want to run the utilities on another workstation. For example, perhaps you are at a central maintenance facility and want to do remote calibration or configuration of a system.

The first consideration is whether your communications bandwidth is adequate for this. SIGMET recommends a minimum bandwidth of 64 kBits/sec for this type of application, although it depends on the utility that you are running. the Ascope utility is the most demanding in terms of bandwidth.

There are several ways to do this. However each method is using the feature of exporting a display over the network to your workstation.

Running remote utilities from a generic terminal window

- Start a Unix terminal as described in Section 1.3.4.
- rlogin or telnet to the workstation where you want to run utilities, e.g.,

```
$ rlogin nodename
```

where nodename is the host name of the network node you want to go to.

NOTE	Important: Note that you may be prompted for a password, or denied access depending on your network security features. See you system manager if you have questions about Unix security.

- Now that you are logged onto the remote system, you must assign the display to come out on your system by typing:

```
$ export DISPLAY= mynodename:0.0
```

where mynodename is the host name of the workstation that you are on.

- You can now type the name of the utility and the utility display will appear on your screen. Alternatively you can type "utils&" to get the utilities graphical user interface.

Running remote utilities from a sigterm terminal window

Using a sigterm–style terminal is more convenient because you don't have to do the export display step- sigterm does it automatically.

- Start a sigterm terminal as described in Section 1.3.5. by typing:

```
$ sigterm nodename
```

where nodename is the host name of the network node you want to go to. The terminal will pop-up with the node name in the title.

- You can now type the name of the utility and the utility display will appear on your screen. Alternatively you can type "utils&" to get the utilities graphical user interface.

2.4 Getting Online Help

Vaisala documentation is saved as .pdf files, which can be read using Adobe Acrobat Reader. Adobe Acrobat Reader is shipped and installed with IRIS, and it is also installed with most internet browsers. You can access the documentation at any time while running IRIS or the utilities. The Help pull-down menu takes you directly to the relevant chapter of the manual, to the Table of Contents, or Index. Once you are viewing the online documentation, you can access any of the other SIGMET online books as well.

When you start Adobe Acrobat Reader for the first time, it will give you a list of conditions to read and agree.

You can also access Manuals from IRISNet by clicking the Manuals icon. That gives you a Manuals menu, where you can select different manuals for parts of SIGMET software.

NOTE	Note: You can copy the .pdf files from IRIS CD or from Sigmet website to any computer, and use them to study the properties of the software. Adobe Acrobat Reader is available for most operations systems including MS Windows.

2.4.1 Moving Around in the Document

Commands to go to **First Page, Previous Page, Next Page** and **Last Page** can be used from **Document** menu, arrow icons in the toolbar, or by keyboard commands listed in the Document menu.

Embedded within the text are hypertext links, which display as small blue icons. When you click on a hypertext link, it takes you to some other location within the book. Hypertext links let you go immediately to a section of the book from the Table of Contents or Index, or from another chapter.

As you hop around a book looking for information, you can always go back to your previous location by choosing **Document**-> **Go Back** from the menu bar. You can also see the previous files you have accessed, in the end of **File** menu. Note that Table of Contents is abbreviated as T.o.C.

2.4.2 Searching for Information

If you know what information you are looking for but don't know where to find it, you can use Acrobat Readers **Edit** -> **Find..**. commands to look for a string within a chapter. To search through other chapters you have to go to the table of contents (TOC) level.

2.4.3 Printing Online Documentation

Online documentation can be printed from Adobe Acrobat Reader if a postscript printer has been configured, as described in the *IRIS Installation Manual*.

To print a document:

1. Display the chapter that you want to print, then choose **File**->**Print** from the menu bar.
2. Adobe Acrobat Reader pops up a window containing the name or names of print queues that are configured with the system. Choose a printer and the range of pages you want to print, then click on the Print button.

2.4.4 Accessing Other Vaisala Online Books

You can access any of SIGMET's online books. The easiest way is to click the appropriate icon in the Manuals menu (from Irisnet, or by typing Manuals to a terminal window).

Or, you can choose **File**->**Open...** from the menu bar.

CHAPTER 3

ANTENNA UTILITY

The **antenna** utility allows you to manually control and monitor the radar and antenna. The radar host computer communicates with the Radar and Antenna system over a serial line connected to the radar/antenna control processor (RCP). The **antenna** utility allows you to communicate easily with the RCP to test the features of the RCP and its interface to the radar system, including:

- Setting both the Azimuth and Elevation positions or velocities.
- Turning the servo and the transmitter radiate and cabinet powers on and off.
- Checking the Computer/Local switch position.
- Checking the status of the cooling airflow, waveguide pressure, transmit Radiate/OFF/Warning status, magnetron current, and time stamp.
- Tracking the movement of the sun.

Note: Not all of the readouts and controls, described in this chapter, are available on all systems.

At a new installation, or after extensive maintenance, you should run the **antenna** utility before running IRIS to test the interface between the IRIS host computer and the RCP.

In this chapter:

Stable Platform Display	3.6 Stable Platform Display on page 44

3.1 Invoking Antenna

Antenna is an operator privileged program and is designed for experienced maintenance personnel only. IRIS observers and others are not permitted to run this utility.

NOTE	Important: Use caution before running the antenna. Make sure the area surrounding the radar antenna is clear of personnel, who may be injured by the antenna motion or exposed to radiation.

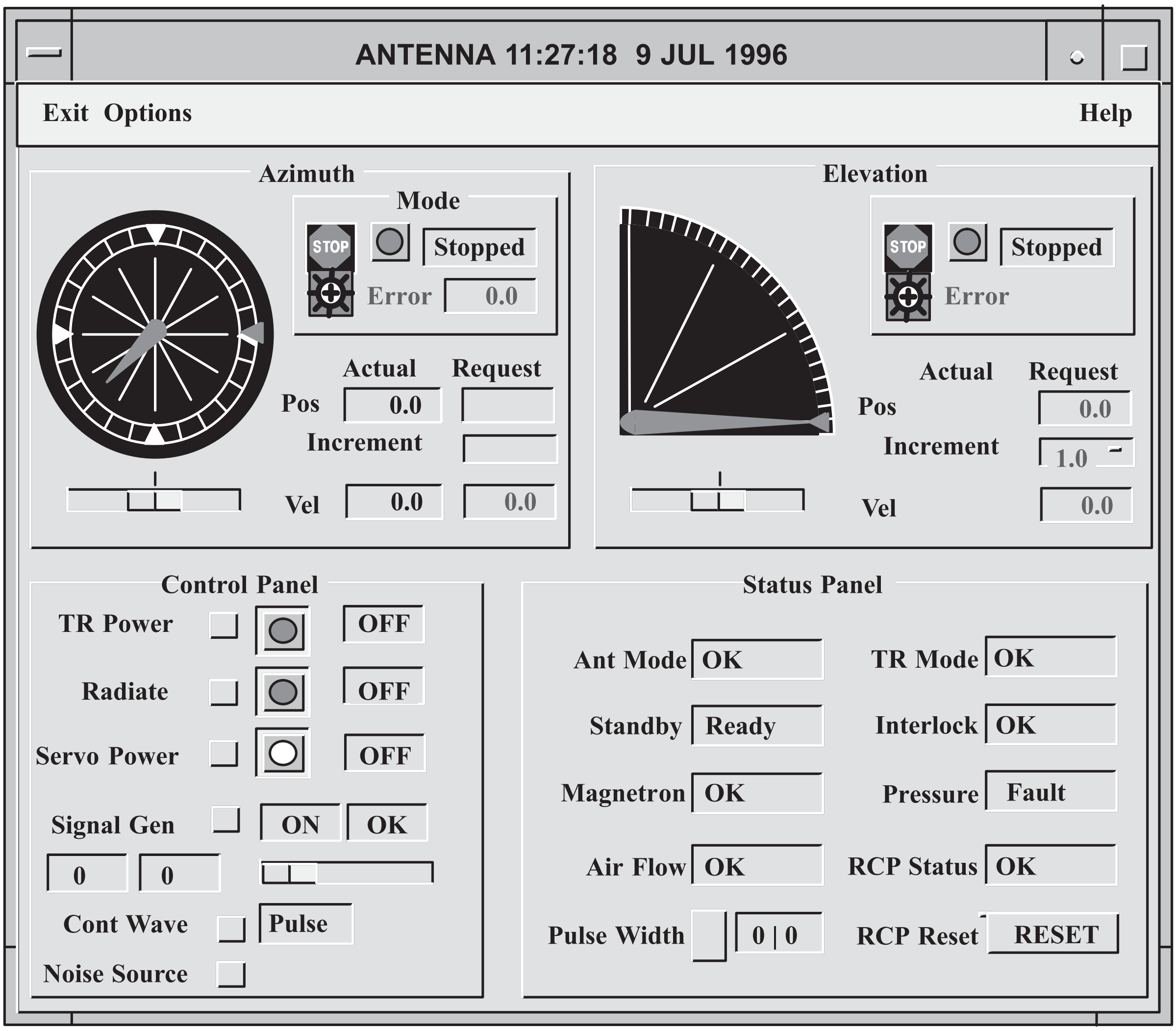
NOTE	Important: Make sure to use setup to configure the antenna limits and Digital Signal processor (DSP) pulse widths before using the antenna or damage to your antenna system may occur.

Command

```
antenna
```

The **antenna** utility should not be running while IRIS is running because of the possibility of interference with IRIS commands to the RCP. During IRIS operation, nearly all of the monitoring information available in the **antenna** utility is displayed in the IRIS Radar Status menu.

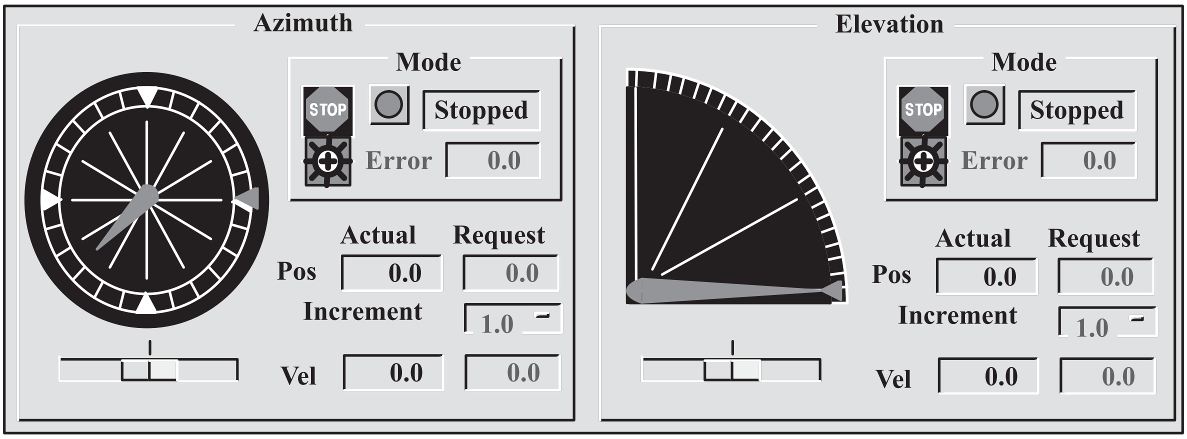
3.2 Antenna Menu



Azimuth and Elevation Panels	Controls both the Azimuth and Elevation positions and velocities for the antenna.
Control Panel	Turns the transmitter, radiate, servo, signal generator, and continuous wave powers on and off.
Status Panel	Displays the status of the radar and RCP.

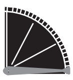
The title bar contains the current date and time so that this information can be saved on menu printouts.

3.2.1 Azimuth and Elevation Section



 **Azimuth Position Indicator**

To set the Azimuth position, move the arrow along the edge of the position indicator. The pointer will display the movement of the antenna to the new position.

 **Elevation Position Indicator**

To set the Elevation position, move the arrow along the edge of the position indicator. The pointer will display the movement of the antenna to the new position.

Mode

The **antenna** utility can operate in the following three modes:

Position	Enables setting the azimuth or elevation position.
Velocity	Enables setting the azimuth or elevation velocity.
SunTracking	Invokes a sun tracking procedure, which computes the direction to the sun from the radar location, and positions the antenna there. See 3.5 Running Antenna in Sun Tracking Mode on page 42 for more information on using the Antenna utility in Sun Tracking mode.

The following buttons, icons, and fields control the antenna mode:

- The Stop button stops the movement of the antenna, regardless of the current mode. The antenna does not stop abruptly when you click on the Stop button, but slows to a stop as indicated by the pointer within the position indicator.
- The Stop light changes from green to red when the antenna is stopped, or from red to green when the antenna is restarted.
- The Status field indicates the current antenna mode —"Position," "Velocity," "Sun Track," or "Stopped."
- The blue and yellow Sun Tracking button puts the antenna into the Sun Tracking mode. Click on this button again to exit from the Sun Tracking mode.
- While in the Sun Tracking mode, the Error field allows you to enter an offset to be added to the sun's position before moving the antenna. This field is disabled when the antenna is not in the Sun Tracking mode.

Sliding Scale

The sliding scales set the requested velocity for either the Azimuth or Elevation position. The scale has a "tick" at velocity 0. For the Azimuth velocity, positive speeds are for clockwise scanning while negative speeds are for counterclockwise scanning. For the Elevation velocity, positive speeds are for upwards scanning (toward the zenith), while negative speeds are for downward scanning (away from the zenith).

Position—Actual and Requested

Both the Actual and Requested position of the antenna are displayed, as they may differ.

When the antenna is in the Position mode, you may enter a position (in degrees) in the Request field. Both the Azimuth and Elevation positions can be observed to change and ultimately end up at or near the requested positions. The Azimuth positions range from 0 to 360º; elevation angles beneath the horizon are displayed as negative numbers.

Note: The RCP has its own "soft" elevation limits. If the antenna elevation does not move all the way up or down, to fulfill a position request, the request may be outside the limits imposed by the RCP. Consult with your manufacturer if you are unsure.

Some RCPs cannot move both axes of the antenna, in a velocity servo, at the same time. On these systems, the following message may be displayed at your request:

"**WARNING**: Bad Combination of Servo Types."

Velocity—Actual and Requested

Both the actual and requested velocities of the antenna are displayed, as they may also differ.

When the antenna is in the Velocity mode, you may enter a velocity in the Request field. Enter the speed as a signed number (in degrees) per second—six degrees per each second is equivalent to 1 RPM. For the Azimuth velocity, positive speeds are for clockwise scanning while negative speeds are for counterclockwise scanning. For the Elevation velocity, positive speeds are for upwards scanning (toward the zenith), while negative speeds are for downward scanning (away from the zenith).

If a velocity request exceeds the maximum velocity allowed by the configuration, set in the Setup utility, then the maximum velocity is substituted.

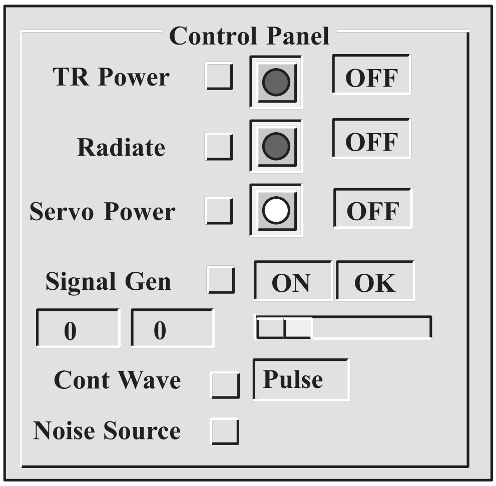
Example: If the upper limit in the Maximum Elevation field of RCP Section (See 10.3.5 Antenna Characteristics on page 191) is 80 degrees and you enter an elevation position of 90 degrees, the Request field will display 80 degrees and the antenna will increase to that elevation. At installation, this feature should be tested to verify that the protection is functioning properly, as described in 3.4 Testing Antenna Safeguards on page 41.

Velocity and Increment Fields

To set the Velocity field with the sliding scale, click inside the scale and the slider will move. If fine adjustments are desired, set the Increment field to 0.1 and click until the correct value appears in the Request field.

To move the Platform parameters, many other values are displayed, such as the pitch, the roll, and the heading angles and velocities. Train-order and elevation-order angles are also displayed including the platform-relative pointing angles of the antenna pedestal. The platform position is also displayed as latitude, longitude, and altitude. There are also two velocities displayed. The first is the speed of the inertial navigation unit, or the center of the ship, and the second is the speed of the radar antenna. To the right of the longitude velocities, under the Xmit field, the velocity correction called Vcor is displayed. This represents the velocity correction in meters per second that needs to be applied to the Doppler date. The Vcor computed by a dot product of the antenna velocity with a unit vector pointing in the direction of the antenna.

3.2.2 Control Panel



The Control Panel controls the transmitter receiver and radiate, the servo, and the signal generator powers. The Indicator lights changes from red to green, indicating if the power is off or on.

TR Power

The TR Power field requests the RCP to turn the main power on or off to the transmitter/receiver cabinet. When the power is off, many of the sensed status fields are reported as faults.

Radiate

NOTE	Important: Make sure that personnel will not be inadvertently exposed to microwave radiation before turning Radiate on.

The Radiate button requests the RCP to turn the transmitter radiate on or off. If there is a problem with a subsystem, such as the waveguide pressure or cooling airflow, the RCP may not grant a radiate request.

Servo Power

The Servo power button requests the RCP to turn the antenna servo amplifier on or off. When the servo power is turned off, the antenna position cannot be controlled.

Signal Generator

The Signal Generator button toggles the calibration signal generator on or off while the sliding scale sets the power level. Status fields display the current state of the Signal Generator, such as "ON" and "OK." Other status fields indicate the power-level setting.

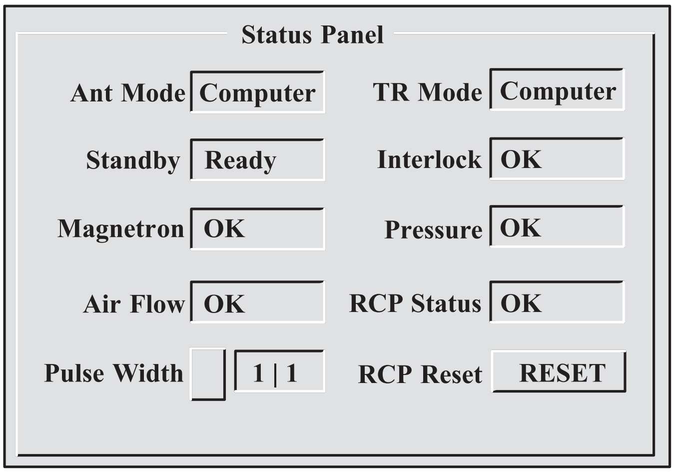
Continuous Wave

The Continuous Wave field toggles between continuous and pulse mode.

Noise Source

The Noise Source button turns the noise source on and off within the radar receiver. This procedure is usually done for testing purposes only.

3.2.3 Status Panel



Ant Mode, TR Mode

The following Mode fields display the position of the control switch on the radar console and indicate when IRIS is collecting radar data:

Computer	The computer controls the antenna and RCP. The mode should be set to "Computer" for normal IRIS operation.Antenna: local mode
Local	Antenna control requests from the computer are ignored, and the antenna is controlled manually using handwheels or a terminal connected to the RCP. This mode is used for testing though, on some systems, you may record manual scans and run Ascope in local mode.
IRIS	This status is displayed when IRIS is controlling the antenna to record data. The control switch is set to Computer.

Other Status Indicators

Other status indicators report "OK," "Ready," or "Fault." Not all systems have the same status indicators, but the following are typical on most systems supplied by Enterprise Electronics Corporation:

- Air Flow refers to the flow of cooling air in the transmitter/receiver cabinets. This is usually sensed by a vane switch.
- Waveguide pressure is usually sensed by a pressure transducer.
- Interlock refers to the interlock on a door that protects a high-voltage or radiation hazard.
- Magnetron displays whether or not the magnetron current is within normal limits.

During installation, the Antenna utility is the best way to check if the various sensors are properly installed and reporting to IRIS.

Pulse Width Request and Status and Pulse Width Control Button

There are two numbers displayed:

- The first number is the pulse width that is currently being requested by the host computer.
- The second number is the pulse width status reported back from the RCP to the host computer.

The pulse widths here are referred to by index rather than microseconds. IRIS supports up to 4 pulse widths and the indices are labeled 0, 1, 2, 3. Most systems only use 2 pulse widths (i.e., 0 and 1).

In most systems the RCP controls the pulse width. In this case you can use the control button next to the pulse width status field to change the pulse width. The selection menu displays both the index and the value in microseconds.

For systems where the signal processor controls the pulse width, this button cannot be used to change the pulse width. The proper request and status will be reported however. Note that in this case the Ascope utility can be used to change the pulse width.

RCP Status

The SIGMET RCI field indicates whether the RCP has shut down by displaying either "OK" or "Shutdown."

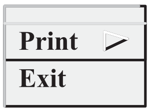
RCP Reset

The RCP button resets the antenna controller. The button will take the antenna controller out of the shutdown state for the SIGMET RCI.

3.3 Antenna Commands

The Antenna utility provides the following commands:

Exit

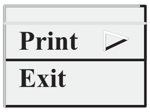


Print creates an X-window dump of the menu you are running, as follows:

- **Print**->**to Printer** sends the output to the Postscript or color printer specified in the Printer Setup menu.
- **Print**->**to File** sends the output to a file in your default home directory.
- **Print**->**Setup** Allows you to configure the printer on your system. See the *SIGMET Installation Manual* for information on configuring a printer.

Exit exits from the Antenna utility.

Options

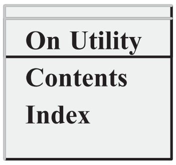


I/O Summary presents a summary of antenna I/O operations.

Time Set sets the system clock.

Stable Platform Params adds a center portion to the display which shows information such as heading, pitch, roll related to shipboard or airborne applications. This is described in 3.6 Stable Platform Display on page 44.

Help



On Utility displays information on the **antenna** utility.

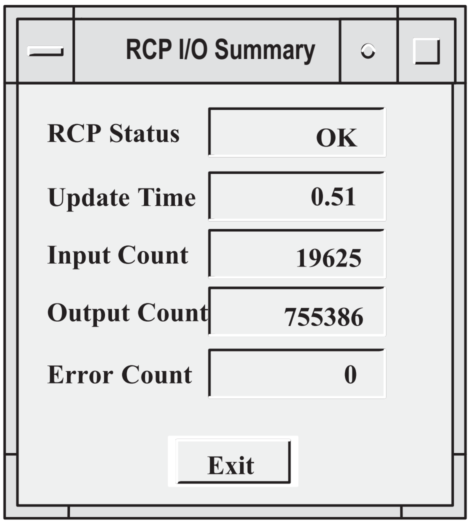
Contents displays the table of contents for the *IRIS Utilities Manual*.

Index displays the index to the *IRIS Utilities Manual*.

See 2.4 Getting Online Help on page 26 for more information on getting online help.

3.3.1 I/O Summary Menu

When you choose **Options**->**I/O Summary**, the Antenna utility displays a summary of the information gathered by the antenna process. Whenever the IRIS or **antenna** first runs after boot-up, an internal antenna process is started in the IRIS host computer. This process, which monitors all I/O to the RCP, runs until it is stopped by a `qant` command or until the computer shuts down.



- **RCP Status** — The status of the RCP, either "OK" or "Shutdown."
- **Update Time** — The time in seconds since the last update was received from the RCP by the antenna process.
- **Input Count** — The total number of bytes read by the antenna process since it was started.
- **Output Count** — The total number of bytes written.

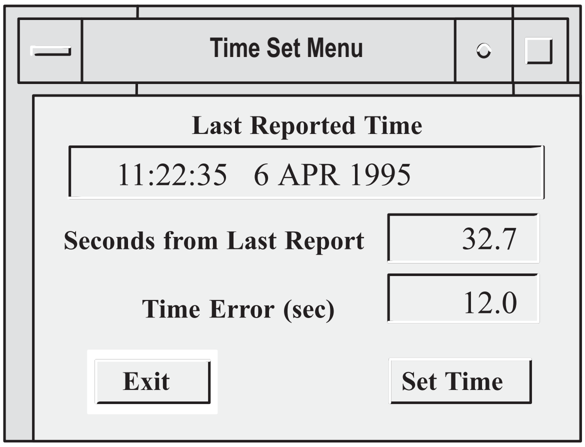
- **Error Count** — The total number of bytes received that were discarded because of an error.

The RCP serial line can receive time reports. This section of the menu allows operators to view the time sent from the RCP and the time error between the host system time and the RCP time. The operator can also reset the system time to match the time reported from the RCP.

Automatic updates can also be done by IRIS. This is configured in the **setup** utility in the General button (10.5 IRIS General Setups on page 204), for the question "Operating system's time".

Note: All automatic updates by IRIS are made only if the time error is between two and five seconds. This compensates for the slow drifts that are typical of computer clocks. However, when automatic time setting is first invoked, there will usually be an error greater than five seconds. In this case, the **Time Set** menu is a convenient way to force synchronization, after which the automatic time resetting will properly track the time.

When you choose **Options**->**Time Set**. the following submenu will appear.



- **Last Reported Time** — The last time report that was received from the RCP.
- **Seconds from Last Report** — The number of seconds elapsed since the last time report.
- **Time Error** — Defined as the system clock minus the RCP time, e.g., for positive numbers the system time is fast.

If the fields are blank, then you are not receiving the time from the RCP. Check with your system manager to see if your RCP has this feature.

If the time is being received from the RCP, then pushing the **Set Time** button causes the system time to be reset to match the RCP time.

3.4 Testing Antenna Safeguards

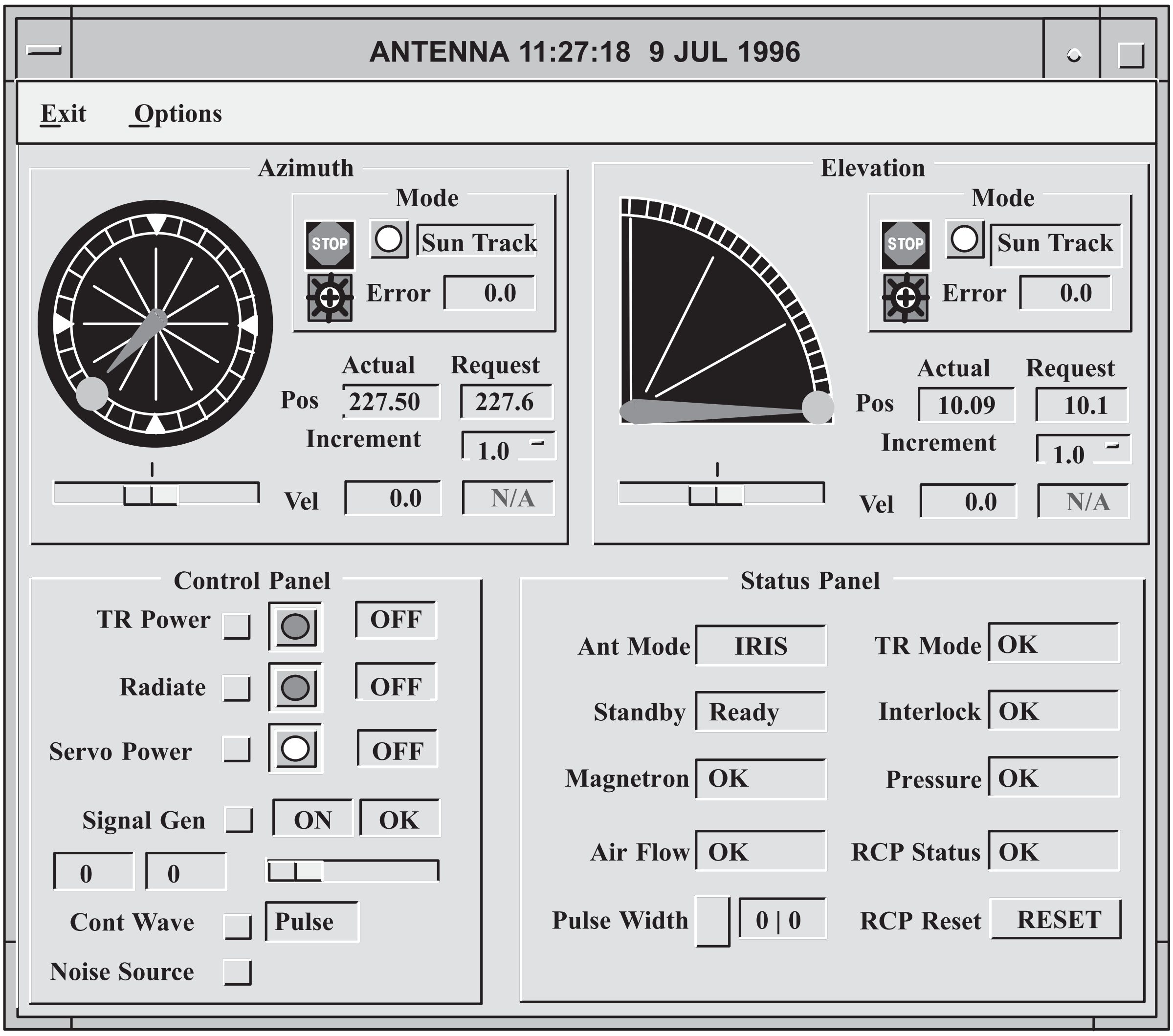
The host computer provides no elevation limit protection in the velocity servo mode. This protection is provided by the RCP. Therefore, it is important to verify with the Antenna utility that the RCP is providing proper limit protection.

All antenna systems are equipped with safeguards against damaging the antenna during elevation scanning. However, at installation these safeguards may not be in place. For this reason, it is important to test the safeguards using **antenna**.

To test antenna safeguards:

1. The first time elevation velocity scanning is used, position an observer safely near the antenna to watch and listen for signs that the antenna drive is trying to push against the stops.
2. Start the **antenna** utility by typing `antenna` at the operating system prompt, then set the antenna controls as follows:
   - Set the Elevation Position to 75. This positions the antenna elevation close to the upper limit.
   - Set the Elevation Velocity field to .5 degrees per second (first + then -) to move the antenna slowly up, then down.
   - For the safety of the observer, be ready to stop the antenna if there is a problem.
3. Start the antenna and be prepared to stop.
4. The observer should hear the antenna drive stop when the RCP soft limit is encountered. The soft limit should be encountered before the limit switch is encountered. If the antenna tries to power up past the soft limit, then the observer should signal the operator to stop the antenna.

3.5 Running Antenna in Sun Tracking Mode



When you enter the Sun Tracking mode, the **antenna** utility computes the direction to the sun from the radar location and positions the antenna there. The Request field displays the azimuth and elevation settings of the antenna. The utility updates the position every ten seconds, which usually produces a change of about 0.01 degrees on both axes.

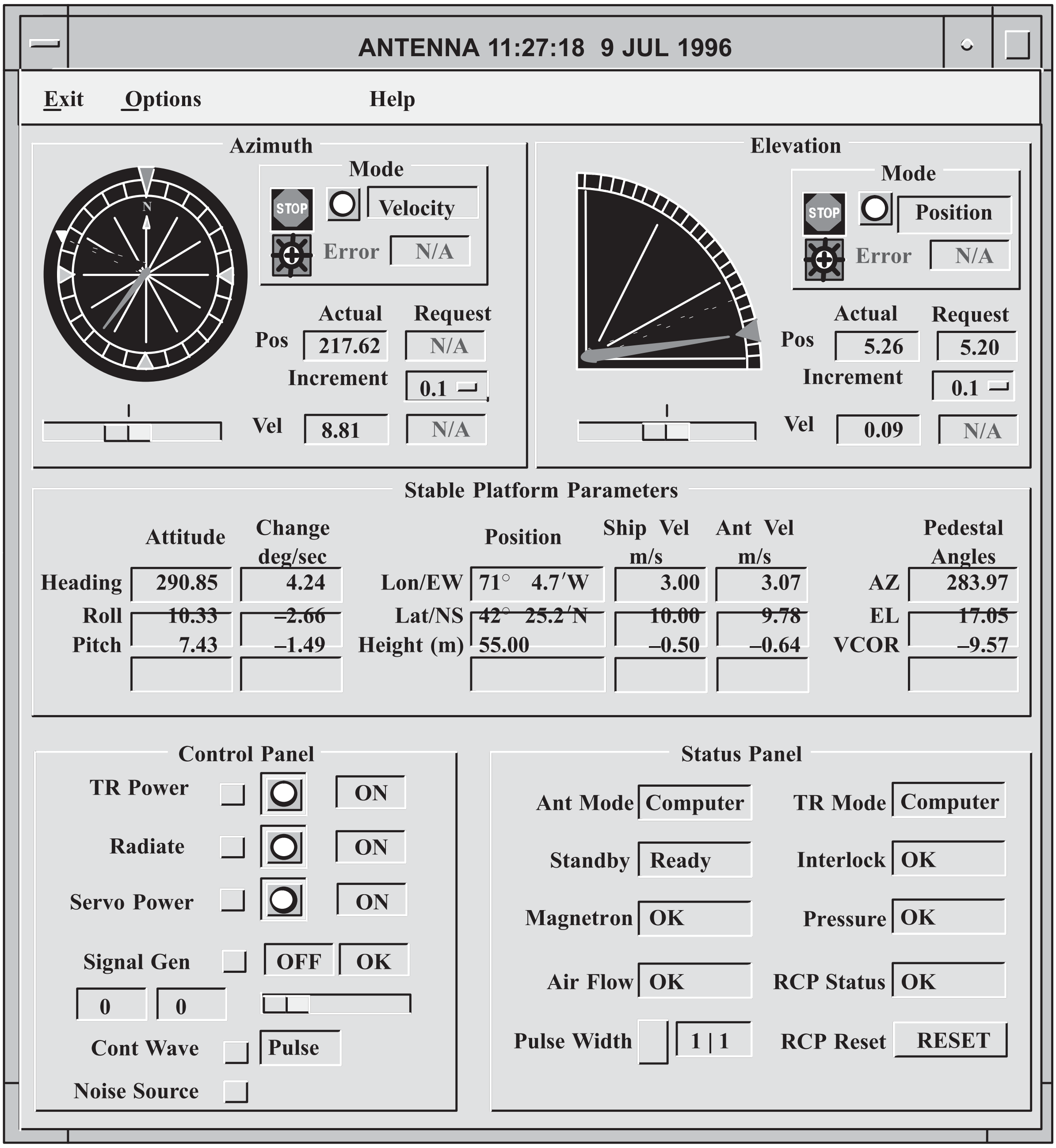
When **antenna** is in the Sun Tracking mode, the arrows within the position indicators are replaced by yellow circles displaying the sun's current azimuth and elevation positions. The Errors field is also enabled, allowing you to specify an offset to add to the sun's position before moving the antenna. This lets you correct for errors.

The purpose of the sun tracking mode is test your radar pedestal's alignment. Because the sun is a black body radiator, it transmits microwaves which you can pick up with your radar, even though the clouds. Briefly, the test consists of moving the antenna until you get the maximum return from the sun, then comparing the pedestal angles with the know position of the sun. Below are some steps to help do this:

1. Do you antenna stabilization and tuning first. You need the antenna to accurately go to a requested position, to within less than 0.2 degrees.
2. Set your system time accurately. SIGMET recommends that you set the time to within a second of the correct time, though a 10 second error will only give you a 0.05 degree error. If you are using time synching, such as ntp, set the time on the server system or turn synching off.
3. Verify that your latitude and longitude are set correctly. For a shipboard radar run **antenna**, then select Options/Stable platform params. For a system with no INU, check **setup**/rcp in the "Radar Site and Antenna Placement" section.
4. Perform the test when the sun is low in the sky. At high elevations, the sun is so wide in azimuth that you cannot measure the azimuth offset accurately.
5. Configure and save a special sun-track mode for **ascope**. We recommend turning off range normalization, displaying T only, sample size of 256.
6. Now press the "Sun" button on antenna. Set the az and el steps to 0.5 degrees. Search around, changing the az and el offsets until you find the sun. The power displayed on **ascope** should be several dB above the noise.
7. After finding the sun, set the step to 0.2 degrees. Then make a pass through each axis. Make a table of the power vs. angle error. It should be possible to figure out the error at the peak.
8. Repeat the same test with the sun in a different azimuth direction (morning vs. afternoon). This will allow you to differentiate a tip in the pedestal from a fixed offset.
9. Enter the measured errors in your antenna controller. For the SIGMET RCP02, enter TTY setups, enter the "axis azimuth" command and set the "Input offset from true orientation". Type in the measured error value. Do the same thing for the "axis elevation". If there was a non-zero offset before, be sure to add the new error to it.

If you are unable to find the sun manually with small offsets, it may be because of a large unknown offset. If the weather is clear, you may be able to spot the sun on the antenna to indicate the correct direction. Alternatively, configure an IRIS sector scan centered on the sun and see if you can spot it on the real-time display.

3.6 Stable Platform Display



3.6.1 Overview of Stable Platform Concepts

This feature is for shipboard or airborne applications where the antenna is stabilized by a SIGMET, Inc. RCI or RCP02 radar control processor that is connected to an inertial navigation unit (INU). The inertial navigation unit provides high-speed accurate information on the attitude (heading, roll and pitch) and position (East-West, North-South and height) of the ship. The RCP uses this information to correct the antenna scanning for the ship motion, i.e., the RCP moves the antenna in 'earth-relative coordinates' just as if the antenna were not on a moving platform. The concept of 'pedestal-relative coordinates' refers to how the antenna is moving relative to the pedestal, or since the pedestal is mounted on the ship, relative to the ship.

Since the motion of the ship effects the Doppler velocity, the **antenna** utility also calculates the velocity correction that is required to remove the effect of ship motion.

3.6.2 Invoking the Stable Platform Display Section

Since most systems do not use this feature, it is normally not displayed in the **antenna** utility. You can invoke the display if your system is configured for shipboard operation with an INU, i.e., the RCP data format RCV03 with shipboard information is selected in the Setup utility. Note that the SIGMET RCP02 can run an INU simulator for test purposes if an INU is not actually connected.

To start the display select

Options->**Stable Platform Params**

The **antenna** utility display will change to show:

- Graphical representation of selected information on the azimuth and elevation displays.
- A center section with numeric read-outs of the INU information and Doppler velocity correction.

Note that there are no new control features introduced when Stable Platform Parameters are selected. All of the shipboard features are display-only.

3.6.3 AZ/EL Graphical Display Features

The azimuth and elevation display features provide additional information as follows:

- The solid red arrows show the earth relative antenna positions. This is the same as if the antenna were not on a moving platform. All antenna scan velocity and position requests are made in earth-relative coordinates. This means that the **antenna** utility for a moving platform behaves in a manner identical to the fixed platform case — the RCP makes all of the necessary corrections to the scanning.

- The yellow outline arrows show the pedestal relative antenna positions. In the example, the ship is heading 290.85 degrees and the earth relative position is 217.62. The pedestal (ship) antenna position is 283.97 degrees.
- For the Azimuth display, a small yellow triangle on the outside of the compass ring is used to denote the ships heading. In the example, the triangle is at 290 degrees.

3.6.4 Stable Platform Parameters Display

The center section of the **antenna** utility shows the parameters associated with the platform motion. These are described below.

Platform Attitude and Change

The platform attitude is described by the heading, pitch and roll as follows:

	Attitude	Change deg/sec
Heading	290.85	4.24
Roll	10.33	–2.66
Pitch	7.43	–1.49

- **Heading** — the angle in which the bow of the ship points measured positive toward true north. Positive angles are clockwise.
- **Pitch** — the up/down angle of the bow of the ship relative to the horizon. Positive angles are bow down.
- **Roll** — the up/down angle of the side of the ship (normal to the long axis of the ship) relative to the horizon. Positive angles are port (left looking forward) side down.

Associated with each of these are rates of change in degrees/second.

Ship and Antenna Position and Velocity

The motion of the inertial navigation unit is described in the middle section of the display as shown below.

	Position	Ship Vel m/s	Ant Vel m/s
Lon/EW	71° 4.7′W	3.00	3.07
Lat/NS	42° 25.2′N	10.00	9.78
Height (m)	55.00	–0.50	–0.64

- **Longitude and Latitude** — Standard conventions are used for North/South and East/West.
- **Height** — is in meters above sea level. This is the height of the INU rather than the antenna.
- **Ship Velocity** — is actually the INU vector (3D) velocity in meters per second. The first entry is positive east, the second entry is positive north and the third entry is positive up.
- **Antenna Velocity** — This is the 3D vector velocity of the antenna feed in meters per second which is generally different from the INU velocity.

The difference between the ship velocity and the antenna velocity is because the INU and the antenna feed are usually not co-located, i.e., there is a moment arm between them. When the ship pitches, rolls and yaws, this moment arm induces a velocity.

Note: The INU is not assumed to be at the center of rotation of the ship. One example is to imagine yourself on a tall mast of a ship where antennae are typically mounted. The rocking of the ship is amplified by the mast. Thus if the INU is located on the deck and the antenna is aloft, this difference is important.

Pedestal Angles and Velocity Correction

Even though the RCP is correcting the antenna scanning for the motion of the ship, sometimes it is important to see the antenna position relative to the pedestal. In some cases when the ship motion is severe, the antenna may not be able to achieve an earth relative elevation because the antenna encounters an elevation limit of the pedestal.

	Pedestal Angles
AZ	283.97
EL	17.05
VCOR	–9.57

- **AZ —** The azimuth angle of the antenna relative to the bow of the ship. Positive values are clockwise from the bow.
- **EL —** The elevation angle of the antenna relative to the "deck" of the ship.
- **VCOR —** is the Doppler velocity correction that is required to compensate measured Doppler velocities for the ship motion.

3.6.5 Sun Tracking Check of Stable Platform Corrections

In sun tracking mode, the antenna should track the sun regardless of the ship motion. The **ascope** utility, digital power meter or oscilloscope and be used to monitor the received power. This is an excellent final check on the stabilization of an antenna system on a moving platform.

CHAPTER 4

ASCOPE UTILITY

The **ascope** utility is a diagnostic and test utility used for aligning and testing the radar and signal processor. In addition, **ascope** provides a stand-alone radar display and control capability. Displays of the signal processor output data are generated vs. range in a graphical format. **Ascope** also generates displays of a single Doppler spectrum, time series, or raw A/D samples vs. range or at a selected range bin. During **ascope** operation, the antenna is usually controlled by hand wheels or the **antenna** utility to select interesting targets.

The supported signal processors are SIGMET Models RVP6, RVP7 and RVP8.

In this chapter:

4.1 Invoking Ascope

CAUTION	Caution: Before running ascope, the setup utility must be run to install the proper wavelength and pulse width configurations. The latter is especially important for duty cycle limit protection.

Command

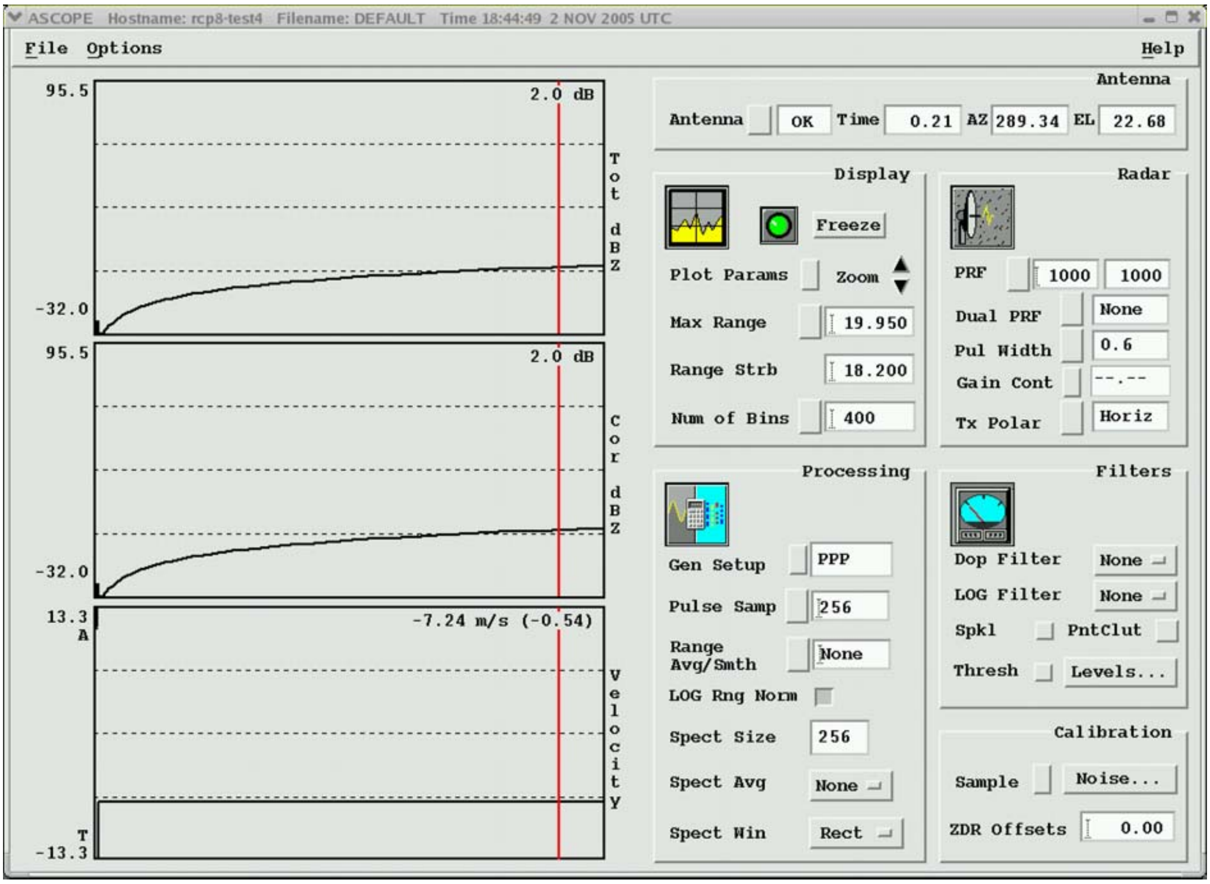
`ascope`

Options

`-demo`	Runs **ascope** without the signal processor, for testing and demonstration purposes.
`-step`	Runs with a special "single step" button enabled.
`-display NODE`	Create the display on NODE, rather than on the default display device.
`<name>`	Starts up with the named configuration, otherwise uses the saved DEFAULT configuration. If neither of these exist then factory default options are used.

If **ascope** cannot talk to the signal processor (for example, if the signal processor is not turned on), an error message is displayed. After repairing the problem, simply restart **ascope**.

4.2 Ascope Menu



Antenna Status	Contains information about the current status of the antenna.
Display Status	Lets you freeze and resume the display and set display parameters, such as choosing the data to be plotted.
Radar Status	Displays information about the status of the radar, such as the PRF and pulse width settings.
Processing Status	Displays information about the processing mode and other processing options.
Filters	Lets you set the Doppler, LOG, Speckle, and Threshold filters.
Calibration	Displays information about DSP calibration. Buttons can take noise samples or set A/D converter offsets and gains

The **ascope** title bar contains the current date and time to log the time in printouts of the menu. See 4.3 Ascope Plots on page 65 for information on the plots that **ascope** can display.

4.2.1 Antenna Status

Antenna

Displays the antenna status as one of the following values:

OK	The antenna is functioning properly.
Dead	No data has been received from the RCP for at least five seconds.

Pressing the Antenna button invokes the **antenna** utility. (See Chapter 3, Antenna Utility, on page 29).

Time

Shows the time between successive frames of the display.

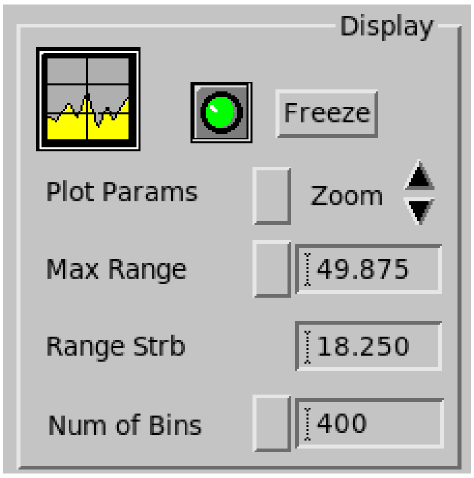
Azimuth

Shows the current azimuth of the antenna. Tag lines must be wired for this.

Elevation

Shows the current elevation of the antenna.

4.2.2 Display Status

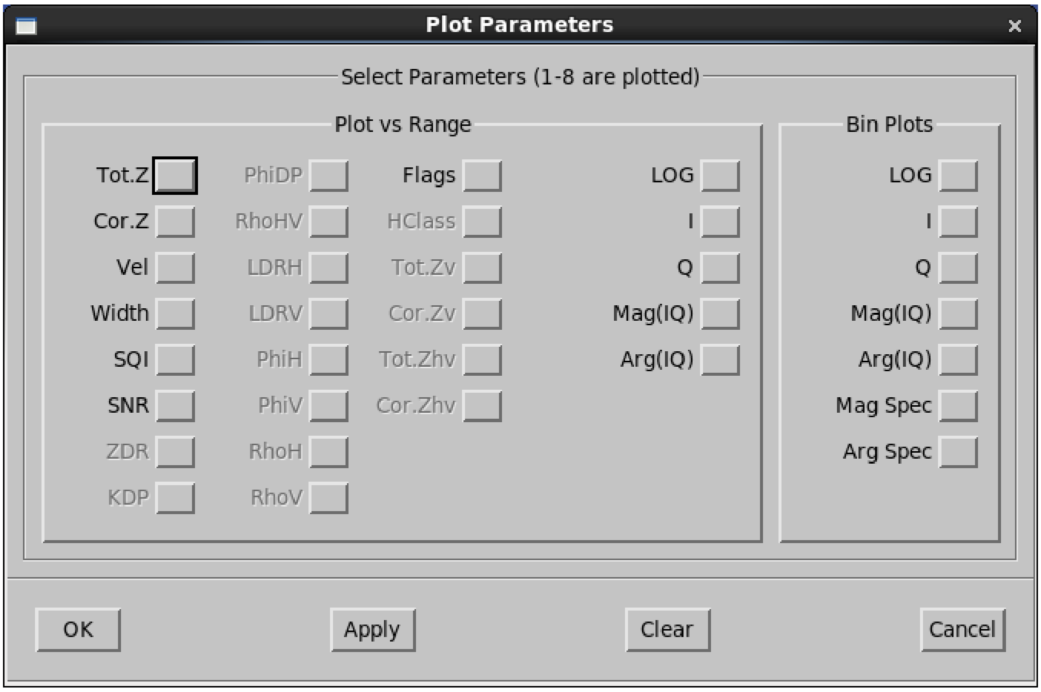


Freeze/Resume

Freezes or unfreezes the display, and stops or starts the signal processor. The green light indicates that the display is not frozen and the signal processor is running; the red light indicates that the display is frozen and the signal processor is not running.

Plot Parameters

Shows the currently selected plot parameters. Clicking on the button pops up the Plot Parameters menu, where you can select from one to four plots displayed in the order you choose. Note that up to sixteen parameters can be selected at once (See Data Recording 4.5 Data Recording and Playback on page 73), but that only the first four will be plotted on the display.



Choose the plot parameters you want to display.

If fewer than four are specified, only the specified plots are displayed.

If more than four are specified, only the first four are displayed.

If no parameters are selected (by clicking on the Clear button), **ascope** displays only one plot — the reflectivity vs. range plot.

Max Range

Shows the maximum range plotted for the selected plot parameters. You can also specify a new maximum range by entering any number or choosing from a menu. If the specified Max Range exceeds the unambiguous range, then the unambiguous range is substituted. The maximum range is constrained to be an integer multiple of the signal processor resolution multiplied by the number of range bins.

Menu choices are: 20, 40, 60, 120, 240.

Range Strobe

Shows the value of the selected range for the spectrum and time series plots, as well as the range for the numerical values displayed in the parameter vs. range plots. This range is also used for noise samples.

The Range Strobe is displayed in the plots as a vertical red line. You can change the value of the Range Strobe field and the position of this line in a number of ways:

- Enter a value directly in the field, and the line is moved to the new position. If the range you enter exceeds the Max Range, then the value for the Max Range field is substituted, and the vertical line is displayed at the far edge of the plot.
- Click the left mouse button within the plot. The vertical line moves to that location and the value of the Range Strobe field is updated to the new value.
- Use the right or left arrow keys to move the line to the right or the left. The value of the Range Strobe field is updated to the new value.

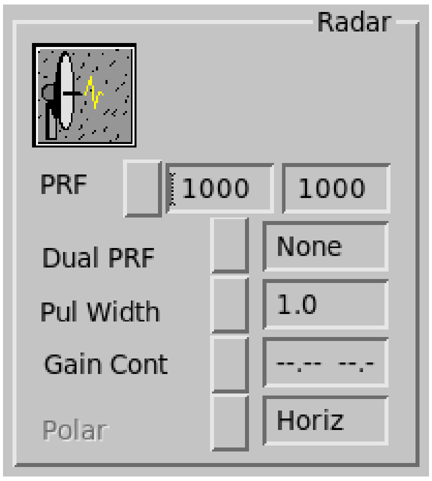
In any case, the Range Strobe is rounded to exactly hit the nearest processed range bin.

Number of Bins

Shows the number of range bins being plotted. Click on the button to select the number of acquired bins. The maximum value that this field can have depends on the signal processor.

The number of bins determines the number of points plotted on the parameter vs. range plots, including the Z, T, V, W, AI, AQ and ALOG plot parameters. Reducing this value can increase the update rate because less data needs to be transferred. This is useful when more rapid updates are required, especially for serial line graphics displays.

4.2.3 Radar Status



PRF

Shows the current PRF selection in pulses per second. Two values are displayed. The left box shows your requested PRF, while the right box shows the measured PRF. In configurations using an external trigger these numbers may differ. You can set this field to any number between the minimum and the duty cycle limit, or choose a value from a pop-up menu. The value shown is the higher PRF if dual PRF is selected. Note that **ascope** automatically limits the PRF to be within the duty cycle limit of the transmitter as configured in the **setup** utility. For this reason, it is important to run the **setup** utility before running **ascope**. The PRF should be set to 300 or greater when alternating polarization is used.

Menu choices are: 250, 300, 500, 600, 1000, 1200.

Dual PRF

For automatic velocity unfolding. This field shows either "None," "3:2," "4:3," or "5:4."

When you change this value, the velocity limits on the data plot are changed appropriately. Note that the PRF displayed as part of the status is the higher PRF rate. If any plots require time series, Dual PRF is set to "None" (no unfolding). In other words, there is no unfolding when I, Q, L, AI, AQ, ALOG, or Spec displays are plotted.

Menu choices: None, 3:2, 4:3, 5:4.

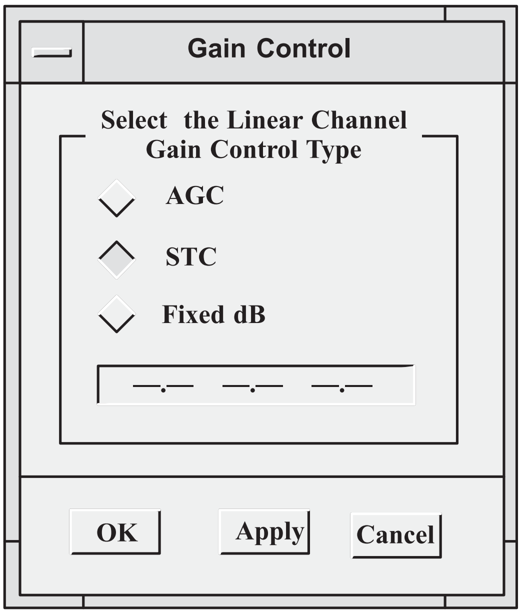
Pulse Width

Shows the current pulse width in microseconds. The pulse width can be changed by choosing from the pop-up menu. Note that this uses the pulse width signal lines of the signal processor and/or the antenna controller to set the pulse width. When switching longer pulse widths, **ascope** automatically lowers the PRF as required to stay within the duty cycle limits established in Setup.

Menu choices: 0.5, 1.0, 2.0, 6.0.

Gain Control

Shows what kind of gain control is being used. Click on this field to change the gain control scheme, using the Gain Control menu.



On the Gain Control menu, choose between the following:

- AGC — Automatic gain control
- STC — Sensitivity time control
- Fixed dB — Gain at a fixed level of attenuation. When you choose Fixed dB and you're running in IAGC mode, you can enter from 1 to 3 dB levels. **Ascope** cycles between these settings.

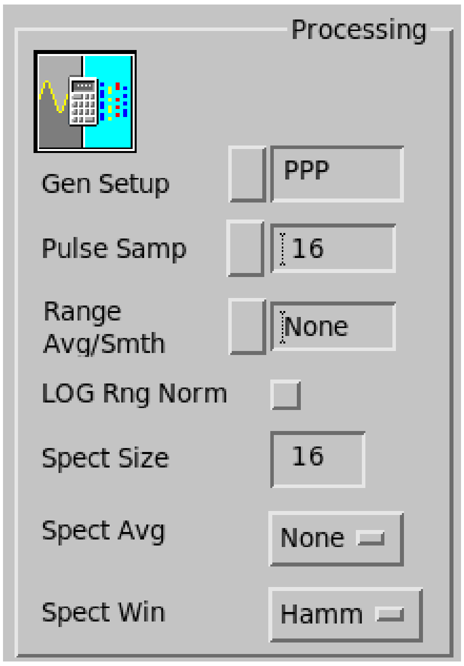
Click on the OK button to close the menu.

Polarization *(available with ZDR option)*

Displays the transmitted polarization and lets you set the polarization and switching scheme. Box is desensitized on single polarization systems.

Menu choices: Horizontal, Vertical, H+V, or Alternating.

4.2.4 Processing Status

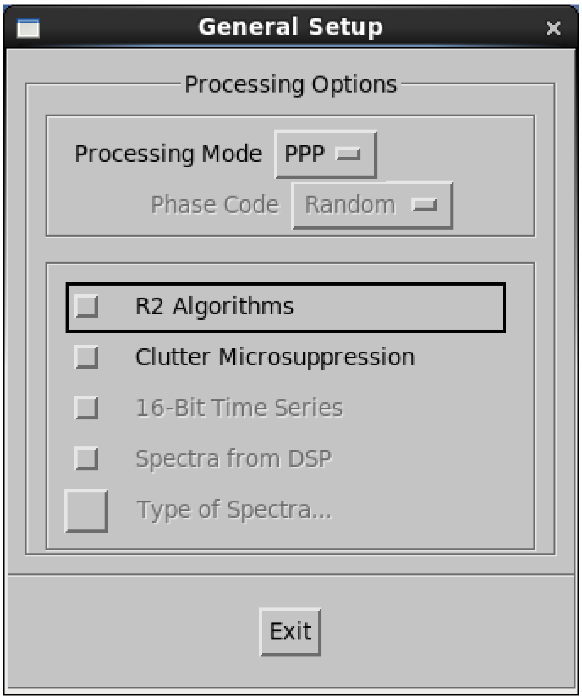


General Setup

Pops up a menu displaying the current processing mode and options. You can use this menu to switch between major modes of the RVP (such as PPP and FFT), and to select other processing options.

- **R2 Algorithms** button–Selects whether the computation for spectral width uses three correlation lags (R0, R1, and R2), or only two (R0, and R1).
- **Clutter Microsuppression** button–Enables the algorithm for removing suspected clutter bins from a run of range averaged samples.
- **16-Bit Time Series** button–Instructs **ascope** to read extended precision samples during the time series modes. It should generally be pressed ON; the OFF position causes 8-bit fixed point data to be read.
- **Spectra from DSP** button–Causes **ascope's** spectrum plot to be drawn from spectral components that are read directly from the DSP, rather than internally computing those components from the raw time series. The DSP spectra are often interesting to view during major modes that employ spectral filtering (such as the "FFT" and "Random Phase" modes).
- **Type of Spectra** button–Is sensitized only in Random Phase major mode and only if spectra are being read directly from the DSP. This

button pops up a menu of eight power spectra and lets you view the data as they progress through the RVP6 and RVP7 processing stages.



All of the buttons in this menu are "live"; they take effect immediately upon being selected. You may keep the menu up on the screen to compare the results with different settings. Click on Exit to remove the menu when you are finished. The Major Mode will remain visible in the button on the main screen.

Pulse Samples

Shows the current number of pulses for averaging of the spectrum moments or for time series. You can also select the number of samples (pulses) to be averaged into each of the V, W, Z or T plots; or the number of I, Q or L time series points to be plotted. The valid range is from 4 to 256. This field also sets the Spectrum Size field.

Menu choices: 8, 16, 32, 64, 128, 256.

Range Average or Smoothing

Sets the number of consecutive range bins to average within the DSP before displays. Choose "None" for no range averaging. Smoothing performs an average in range, but does not reduce the number of recorded range bins. An entry such as "1/4" means no range averaging, but do range smoothing over 4 bins.

Menu choices: None, 2, 4, 8, 1/2, 1/4. Other values available by type in.

LOG Range Normalization

Toggles range normalization of the LOG channel on and off. In some cases, you may want to disable the LOG channel range normalization algorithm in the signal processor. In this case, the reflectivity vs. range plot displays dBm above threshold rather than radar reflectivity factor.

Spectrum Size

Shows the number of samples used for a Doppler spectrum. This is always the greatest power of two less than or equal to the Pulse Samples field. That is, the Spectrum Size is the value of Pulse Samples field rounded down to the nearest of 4, 8, 16, 32, 64, 128 or 256.

For alternating polarization, this number is the sample size at each polarization, and the maximum value is 128.

Spectrum Average

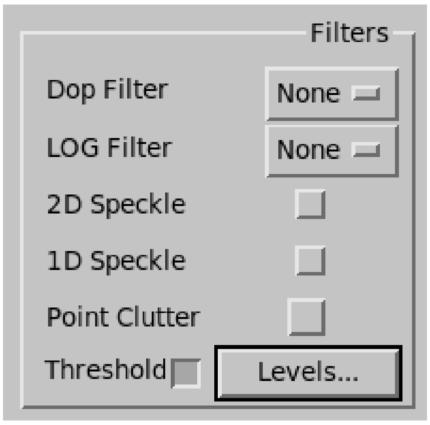
Shows the averaging constant for spectrum averaging. The time constant for spectrum averaging affects only the spectrum display (the Spec plot parameter). The argument "None"corresponds to no averaging. The number 8 corresponds to maximum averaging. This number is the time constant of an exponential average in CPIs. Thus, a value of 1 means that after spectrum is computed, the previous data has weight 1/e. You should allow ample time for the spectrum to settle after changing the averaging. Changing the spectrum size zeroes the averaging. The annotation numbers displayed in the spectrum plot are also averaged.

Menu choices: None, 1, 2, 3, 4, 6, 8.

Spectrum Window

Lets you select the window to be applied to the time series before the spectrum is computed. The three choices are Black (Blackman), Hamm (Hamming), and Rect (Rectangular). The window dramatically affects the spectrum and can affect the computed SQI shown on the plot.

4.2.5 Filters



Doppler Filter, LOG Filter

These fields show the current filter selection.

You can select the clutter filter by number. The RVP6 and RVP7 have filters numbered 0 to 7. In all cases, filter 0 is equivalent to no clutter filter. Refer to the *Signal Processor User's Manual* for a description of the filter characteristics.

The RVP6 supports a LOG receiver base filter called the statistic clutter filter. To turn this filter on, specify two numbers — the first is the Doppler filter, and the second is the LOG filter. The data filtered by the LOG filter is determined by the RVP6 setup.

Menu choices: 0 to 7.

2D Speckle Filter and 1D Speckle Filter

The speckle remover thresholds a data bin for which the bin before and after are already thresholded. Use this toggle button to clean random data from the display.

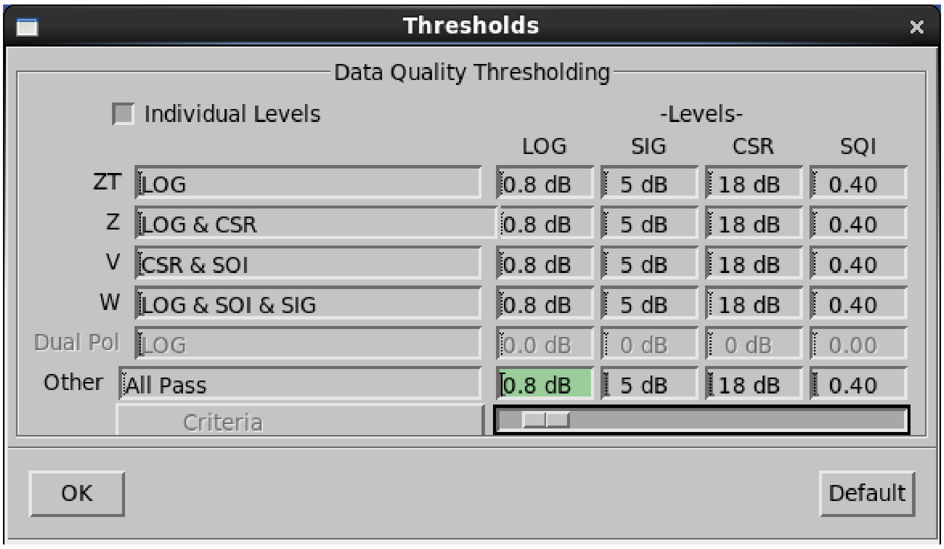
Point Clutter

Turns on/off the point clutter remover. This is a NEXRAD algorithm which runs on the I/Q stream before the data moments are computed. If it sees a sudden spike in power, it will replace with the average values from before and after in range.

Thresholds

Thresholding is the means by which the signal processor removes range bins that have weak signal power or unreliable estimates of the Doppler parameters. The Thresholds toggle button turns thresholding on and off. The Levels button pops up the Thresholds menu for setting the threshold criteria and levels.

For a general discussion of thresholding, see Chapter 3, Antenna Utility, on page 29 of the *IRIS User's Manual*. See also the *Signal Processor User's Manual* for more details.



Criteria for thresholding are set for each of the data parameters — ZT, Z, V, W, Dual Pol, and Other. You can choose to discard the data when one or more of the following threshold parameters are weak:

- LOG — LOG receiver signal-to-noise ratio.
- SQI — Doppler channel signal quality index.
- CSR — Doppler channel clutter-to-signal ratio.
- SIG — A measure of the power from weather targets, excluding noise.

You can set the criteria from pop-up menus (click on the button beside the criteria you want to set), or enter any Boolean equation using the variables SQI, LOG, CSR, and SIG, separated by "and" and "or". Choose or enter "all pass" to accept any value, in effect turning off thresholding.

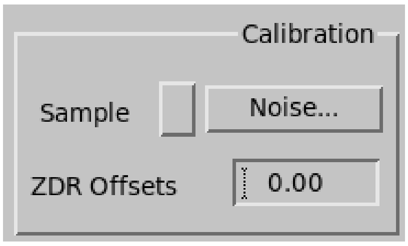
Levels are set by entering a value directly or by moving the sliding scale until the value you want appears in the field.

- LOG — Sets the LOG receiver threshold in dB above noise. If thresholding is turned on and the LOG video signal is below this threshold level, reflectivity is thresholded on the reflectivity plots. You can enter a value between 0 and 5 dB.

- SIG — Sets signal power threshold level in dB above noise. Often this is used to threshold widths. If the LOG video signal power is below this threshold after removal of clutter power, the widths are thresholded. You can enter a value between 0 and 20 dB.
- CSR — Sets the clutter-to-signal ratio threshold. If the ratio exceeds this threshold, and thresholds are enabled, the Doppler data are thresholded. Enter a value between 0 and 50 dB.
- SQI — Sets the Doppler threshold level. Similar to the LOG threshold level except that it is for the Doppler channel signal quality index. If the processor computes an SQI less than the threshold defined here, the velocity and width data for that range bin are not plotted. You can enter a value between 0 and 1. A value of 0 causes nearly all data to be plotted; 1 causes nearly nothing to be plotted. A value of 0.3 generally eliminates the weak signals and passes signals that have good mean velocities. Note that the "noise points" that get by the threshold correspond to speckles on the color display. This is useful for reducing the amount of data that is transferred to serial line graphics displays.

After you have entered your thresholding criteria and levels, click on OK to apply your settings and exit from the menu. If you want to reset the values to their defaults, click on the Default button.

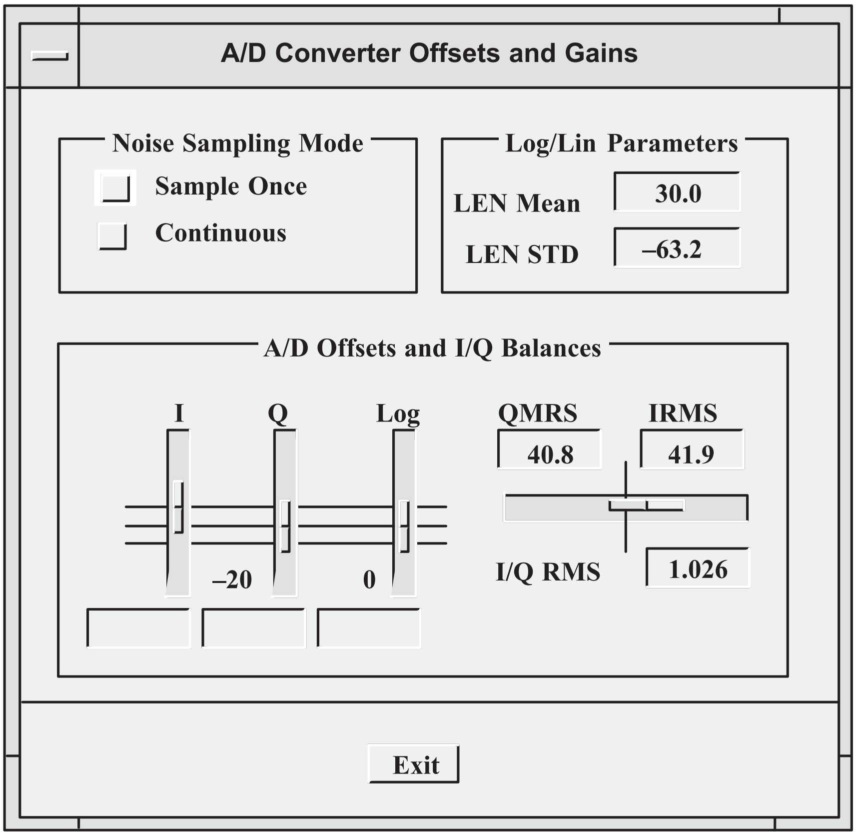
4.2.6 Calibration



Sample Noise

The Samples Noise button takes a new signal processor noise sample at the range specified by the Range Strobe field. Refer to the *Signal Processor User's Manual* for details.

The Offsets button pops up a the A/D Converter Offsets and Gains menu for setting the A/D converter offsets and gains.



In this menu, you can set the Noise Sampling Mode to one of the following:

- Sample Once — Takes a single noise sample.
- Continuous — Takes continuous noise samples. This slows the display speed.

Be careful not to take a noise sample when a test signal is present, or the test signal level is interpreted as the noise level. This leads to erroneous displays of reflectivity.

Log/Lin Parameters are:

- LEN Mean — The linear averaged mean of the LOG samples, expressed in A/D converter units.
- LEN STD — The linear averaged standard deviation of the LOG samples, expressed in A/D converter units.

Set the A/D Offsets and I/Q Balances as follows:

- I, Q, and Log — Show the DC offsets of the A/D channels. I and Q are between -127 and 127; Log is between 0 and 256. You can enter values in the fields or move the sliding scale until the value you want appears in the field.

- IRMS, QRMS — The standard deviation of the I and Q noise samples. These should be nearly the same, or the signal processor must be adjusted (I and Q gain). Enter a value directly into these fields.
- IQRMS — The ratio of the I RMS to Q RMS values. This should be within ±0.03 of 1.00.

When you are satisfied with these settings, click on the Exit button.

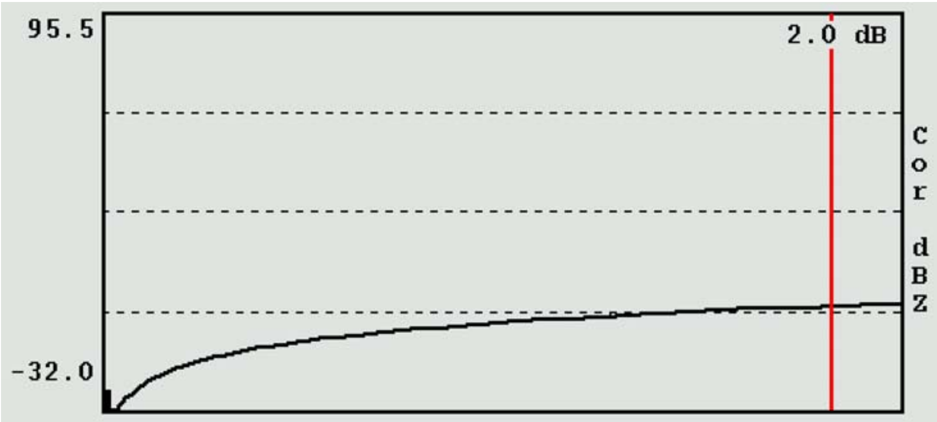
ZDR Offsets *(available with ZDR option)*

Shows the ZDR calibration offset, or "N/A" for systems without ZDR. You can also use this field to set the ZDR offset. The number you enter is added to the differential reflectivity to correct for differences in the receiver chain.

4.3 Ascope Plots

Ascope can plot from one to four parameters at a time. The plots are scaled so that when only one plot is requested, it is zoomed to fill the left side of the menu.

4.3.1 Reflectivity vs. Range Plot (T and Z)

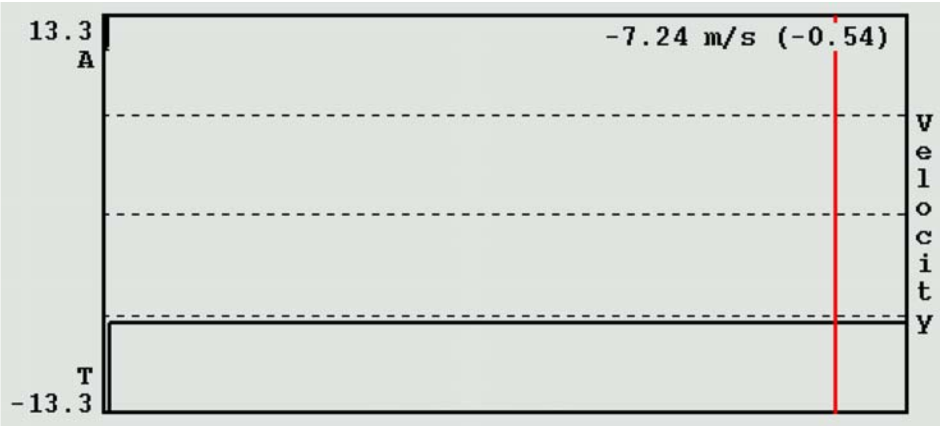


This plot is generated when you choose the T and Z plot parameters. T is the total reflectivity without clutter correction; Z is the reflectivity with clutter correction. These are the equivalent radar reflectivity factors and are fully calibrated estimates. Of course, you need to calibrate your radar system before the values are correct (see the **zauto** utility and the *Signal Processor User's Manual)*. The **ascope** utility lets you temporarily change the slope and offset of the calibration without modifying the calibration file used for the IRIS system.

The data are plotted in decibel values between -32 and 96 dBZ between 0 and the selected Max Range. The numerical value in the upper right portion of the display shows the reflectivity at the selected range, indicated by the vertical red line.

See also the Pulse Samples, LOG Filter, Thresholds, Number of Bins, LOG Range Norm, Calibration ZCAL, and Calibration Slope fields.

4.3.2 Doppler Mean Velocity vs. Range Plot (V)

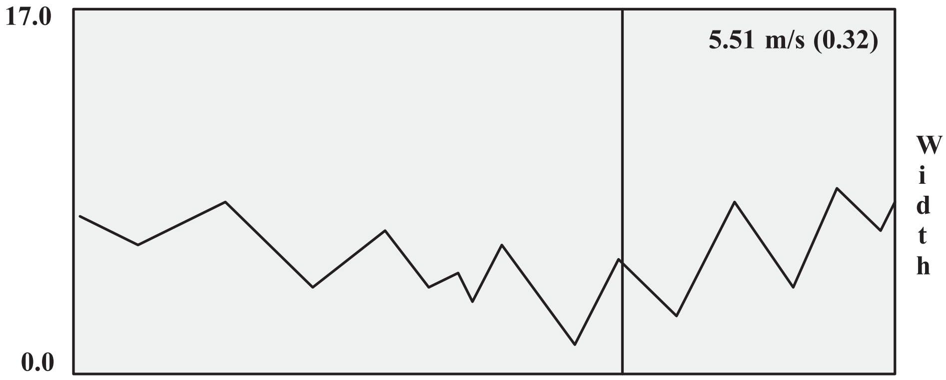


This plot is generated when you choose the V plot parameter. The mean velocity corresponds closely to the peak velocity in the Doppler spectrum display. Velocity is displayed in m/s on the unambiguous velocity interval. "T" indicates toward, and "A" indicates away. This plot should be checked on a known wind to make sure the velocity sign is correct. Otherwise, it is necessary to swap the I and Q inputs of the processor.

Similar to the reflectivity plots, the value of the mean velocity in m/s (and normalized to the interval [-1, +1]) at the selected range is displayed in the upper right corner of the plot.

See also the Pulse Samples, Threshold Levels, Doppler and LOG Filter, Thresholds, and Number of Bins fields.

4.3.3 Spectrum Width vs. Range Plot (W)



This plot is generated when you choose the W plot parameter. The spectrum width is the standard deviation of the Doppler spectrum. (The Doppler spectrum display itself always appears broader than the indicated width, because the spectrum is on a log scale). Width is displayed in m/s up to the unambiguous velocity value. Broader widths are difficult to measure.

Similar to the mean velocity, the numerical value of the width is displayed in m/s and for the normalized velocity interval [-1, +1] for the selected range (as indicated by vertical yellow line).

See also the Pulse Samples, Threshold Levels, Doppler and LOG Filter, Thresholds, and Number of Bins fields.

4.3.4 ZDR vs. Range Plot (ZDR) (available with ZDR option)

This plot is generated when you choose the ZDR plot parameter. The differential reflectivity is the ratio of the reflectivity at vertical polarization to the reflectivity at horizontal polarization. The range displayed is roughly -8 to +8 db.

Similar to the spectrum width, the numerical value of the ZDR in dB is displayed for the selected range (as indicated by vertical yellow line).

See also the Polarization, Plot Samples, ZDR Offsets, and Number of Bins fields.

4.3.5 Linear Channel A/D vs. Range Plot (I and Q or Mag and Arg)

This plot is generated when you choose the I and Q plot parameters vs range. This display is important for alignment of the analog to digital converters. The A/D values are between -128 and 127. The range is between 0 and the Max Range. The number of points plotted is determined by the Number of Bins field.

The I and Q DC offsets (if any) and average amplitudes are displayed in the status display. These are important for the signal processor A to D converter alignment. Note that the I and Q A/D values should never be allowed to saturate — hit the top of the box. If this is observed, the gain of the converters needs to be adjusted as described in 4.7.1 Coarse Adjustment of the Gain and Offset Pots on page 85 and 4.7.2 Fine Adjustment of the Gain and Offset Pots on page 87 of this manual and the *Signal Processor User's Manual*.

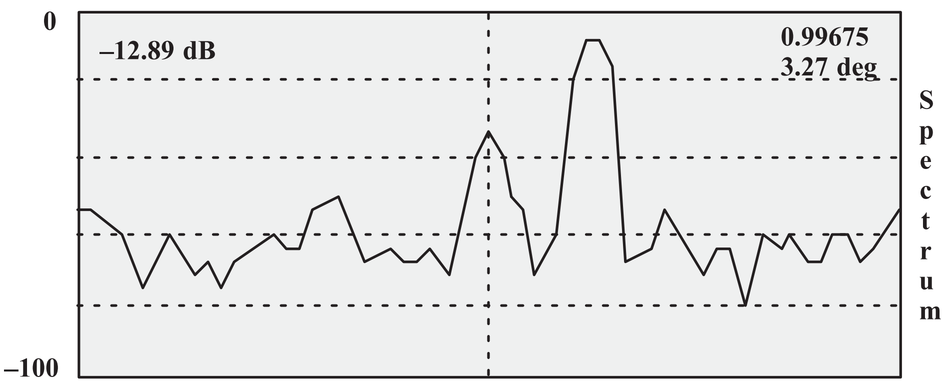
The Mag and Arg choices represent I and Q in polar form as a phaser. The magnitude is the SQRT ($I^2 + Q^2$) while the phase is ATAN (Q / I). These plots are sometimes more intuitive than the I and Q plots.

4.3.6 LOG Channel A/D vs. Range Plots (ALOG)

This plot is generated when you choose the ALOG plot paramter. This plot is similar to the linear channel AI and AQ plots, but the values correspond to the LOG channel analog to digital converter. The values are between 0 and 255.

The Z offset is displayed in the status section. This is the average value of the LOG A/D samples and should be between approximately 10 and 30 A/D units. If it is not, refer to 4.7.1 Coarse Adjustment of the Gain and Offset Pots on page 85 and 4.7.2 Fine Adjustment of the Gain and Offset Pots on page 87 of this manual and the *Signal Processor User's Manual* to align the A/D converter.

4.3.7 Doppler Spectrum Plot (Spec)



This plot is generated when you choose the Spec plot parameter. This is the single most useful plot for monitoring the alignment and performance of the Doppler channel. The Doppler spectrum is computed from the I and Q time series (see 4.3.8 Time Series at a Selected Range (I, Q, and LOG) on page 71) for the selected range. The FFT mode spectrum can be displayed directly. The scale is in dB marked with 20 dB divisions. Zero velocity is indicated by a vertical line. This is the velocity of ground clutter targets. The Doppler spectrum plot is always given twice as much vertical height on the screen as the other plots.

The numerical values in the display are as follows:

- Top left — Linear channel power in dB. This is uncalibrated on an absolute scale. However it is very accurate on a relative scale as long as the linear receiver is not saturated.
- Top right — Signal quality index or SQI (|R1|/R0). This is a value between 0 (white noise) and 1 (pure tone). This is useful in determining how coherent the radar system is (see 4.7 Ascope Checkup Procedures on page 85).
- Top right (beneath SQI) — RMS phase noise in degrees. This includes noise contributions caused by both amplitude and phase errors, and is computed directly from the SQI as follows:

$$PhaseNoise = \frac{180}{\pi} \times \sqrt{-\ln(SQI)}\ .$$

- Time series from the are clutter filtered, so the filter fields can be used to see the effect of various filters on the Doppler spectrum.

The typical Doppler spectrum contains white noise at all velocities, a ground clutter spike at zero velocity, and a weather spectrum. Some points to note:

- With the clutter filter set to "None" (no filter), you can observe a strong clutter target to determine the linear dynamic range of the system. Observe the dB difference between the peak of the clutter and the white noise.
- Coherent artifacts are caused by leakage of other signals, such as 50 or 60 cycle line power into the transmitter/receiver system. These appear as peaks located symmetrically about zero velocity. To obtain the best Doppler measurements, coherent artifacts should be minimized by reducing the leakage of stray signals.
- Image spectra occur when a weather spectrum has a mirror image on the other side of zero velocity. Usually the image is smaller than the primary weather peak. Image spectra are typically caused by the following:

  — Saturation of the A/D converters

  — Gain imbalance of the I and Q channels

To correct these problems, see the *Signal Processor User's Manual* and the procedures described in 4.7.1 Coarse Adjustment of the Gain and Offset Pots on page 85 and 4.7.2 Fine Adjustment of the Gain and Offset Pots on page 87 of this manual.

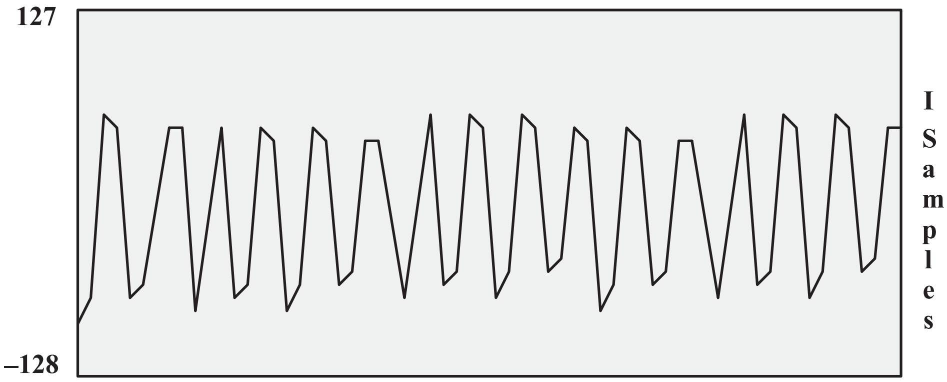
The number of points that are plotted are 4, 8, 16, 32, 64, 128 or 256 as indicated by the Spectrum Size field. The number of points can be changed with the Pulse Samples field. If a number other than a power of 2 is entered, the next lowest allowable value is accepted (for example, a Pulse Sample of 126 sets the Spectrum Size field to 64 points).

When selecting the range for the spectrum, it is useful to display a velocity vs. range (V) or reflectivity vs. range (Z) plot. These plots can show you where there are targets of interest.

Because spectra can be very noisy, **ascope** has a spectrum averaging feature for detecting weak signals. Averaging causes the update rate to slow down. A value of "None" corresponds to no averaging. A value of 8 is the maximum value.

See also the Pulse Samples, Spectrum Average, Spectrum Window, Doppler and LOG Filter and Range Strobe fields.

4.3.8 Time Series at a Selected Range (I, Q, and LOG)



These plots are generated when you select the I, Q and LOG plot parameters. I and Q correspond to the linear channel in-phase and quadrature signals, and LOG corresponds to the LOG channel video signal. These plots are similar to the AI, AQ and ALOG plots except that the samples at a single range are plotted versus time — each point represents a different pulse.

The Pulse Samples field sets the number of points that are plotted. As with the spectrum display, the velocity or reflectivity vs. range plots can help you select a range where there are interesting targets.

An alternative way to show I and Q is to use the Mag and Arg displays (the phaser form of I and Q). The numerical value displayed in the upper right is the RMS value of the fluctuations. When viewing a clutter target, these values can be used to assess both the phase and amplitude stability of the transmitter/receiver.

Note that the RVP6 and RVP7 time series are clutter filtered. When using the time series plots remember that the clutter filter removes low velocity signals. This can be perplexing when a test signal is inserted and no signal time series is observed. It may be that the clutter filter is effectively removing the signal.

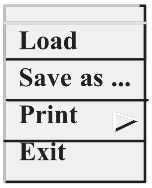
See also the Pulse Samples, Range Strobe, and Doppler and LOG Filter fields.

4.4 Ascope Commands

The **ascope** utility provides the following commands:

File

File



Load pops up a list of configuration files. Choose the one you want to load..

Save As... lets you save your configuration under the same name or under a new name that you specify.

Print creates an X-window dump of the menu you are running, as follows:

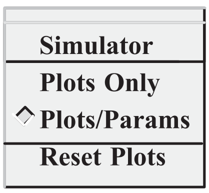
- **Print**->**to Printer** sends the output to the Postscript or color printer specified in the Printer Setup menu.
- **Print**->**to File** sends the output to a file in your default home directory.
- **Print**->**Setup** lets you configure the printer on your system. See the *Software Installation Manual* for details.

Exit exits from the **ascope** utility.

The named **ascope** configurations are stored in the files `*.ASCOPE` in the `config` directory. The default startup configuration is named `DEFAULT.ASCOPE`

Options

Options



Simulator pops up a menu for defining a digital signal. See 4.6 The Digital Signal Simulator on page 80 for information on this menu.

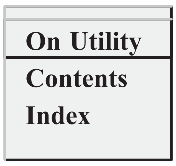
Plots Only removes the plot parameters from the **ascope** menu, so that the plots can take up the entire window.

Plots/Params divides the menu in half, with the plots displayed on the left and the parameters displayed on the right.

Reset Plots

Help

Help



On Utility displays information on the **ascope** utility.

Contents displays the table of contents for the *IRIS Utilities Manual*.

Index displays the index to the *IRIS/RDA Utilities Manual.*

See 2.4 Getting Online Help on page 26 for more information on getting online help.

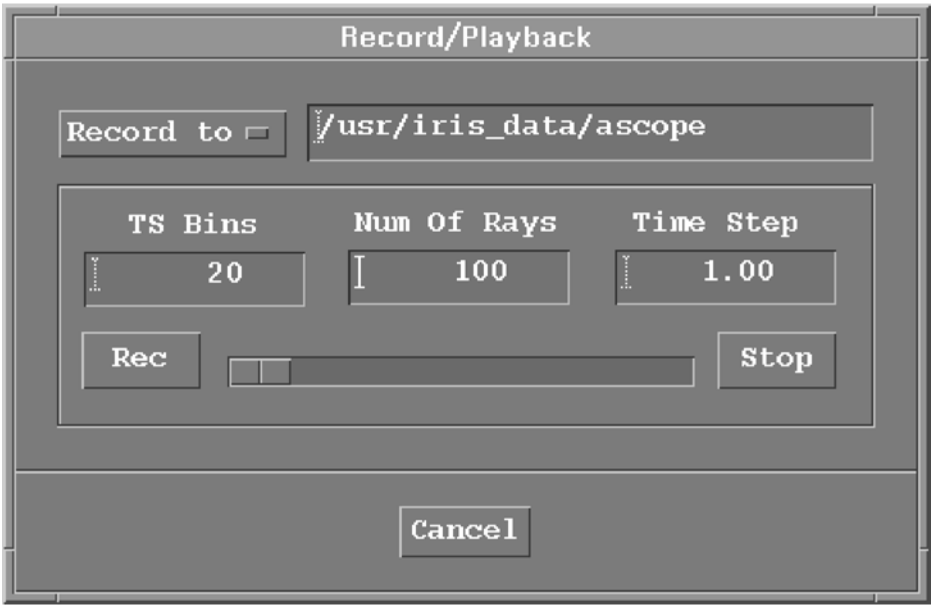
4.5 Data Recording and Playback

The **ascope** utility has the ability to record live DSP data directly to a disk file so that users may develop their own off-line application programs for custom data analysis. The recording procedure is interactive and may be invoked any time that interesting data are observed on the display. The files may also be played back by **ascope**, both to review their contents and to check the integrity of the values.

NOTE	Note: After you have recorded files to disk, you can archive them to tape using UNIX tar, or SIGMET's easy-to-use sigbru backup/restore utility that is based on gnutar. sigbru allows you to selectively backup/restore ascope data files and provides useful tape and disk inventory information. Refer to the IRIS Installation Manual for information on sigbru.

4.5.1 The Record Menu

From the top level menu choose "File->Rec/Play..." to get the following popup. The menu initially appears in the "Record" mode; to switch to the "Playback" mode (described in the next section) use the menu's selection widget.



Information Displayed on the "Record" Menu

The "Record" menu shows the following information:

- Directory in which data files will be recorded. This defaults to `/usr/iris_data/ascope`, but it may be changed to any directory that is writable by the user.
- Number of bins at which time series and/or power spectra will be recorded. The chosen bins will be centered on the range strobe that is selected in **ascope's** main menu. The number of TS Bins must be between 0 and 128.
- The number of rays of data to record. Each "ray" represents the data from one complete iteration of the basic **ascope** loop, i.e., one acquisition of the set of all data types that are selected in the "Plot Parameters" menu. The maximum number of rays that can be recorded is 10000.
- The desired time step between rays. This is the time in seconds between successive recorded rays, and may range from 0 to 600 seconds (ten minutes). Setting this value to zero will give continuous data recording; but larger values may be used to record over a longer time interval without creating too large a data file. For example, a time step of ten seconds would record six rays per minute to disk, even though the DSP and display still update continuously.
- "Rec" and "Stop" push buttons, used to begin recording or to stop before reaching the full number of rays.
- Progress slide bar that gives a visual indication of the progress of the current recording session.

- "Cancel" button to dismiss the menu and return to normal **ascope** operation.

Making a Data Recording

To operate the "Record" menu, begin by configuring **ascope** in the normal manner so that the weather phenomenon is visible on the screen. Select a maximum range and bin spacing that will capture the entire event at an adequate resolution. Setup the PRF, clutter filters, range averaging, spectral averaging, etc. so that the weather target's characteristics are nicely captured.

Ascope operates the DSP in the usual continuous manner when the "Record" menu is first popped up on the screen. You may proceed with modifying **ascope's** main menu and all submenus, including the "Record" menu itself. This makes it easy to create the exact configuration that you would like to record. However, once the "Rec" button is pressed and actual recording begins, all **ascope** menus become desensitized so that no changes can be made during the recording session. The menus and plots remain live and visible, but the only button that can be pressed is "Stop".

During the recording session the menu's slidebar will move from left to right to indicate the progress. Recording will stop automatically when the the full number of rays are recorded and the slidebar has reached 100%; or it may be stopped earlier with the "Stop" button. At that point the entire **ascope** environment becomes resensitized and returns to normal operation.

A valid recording directory should be selected prior to pressing "Rec", but the actual file names are created automatically by **ascope**. The file names are of the form "WWWYYMMDDHHMMSS.ASC" where "WWW" represents the 3-character local site code, and the remaining characters are the 2-digit year, month, day, hour, minute, and second at the start of recording. The ".ASC" suffix is always appended so that these files can easily be spotted in a directory.

Choosing the Parameters to Record

Up to sixteen different parameters may be recorded to disk at once. These are chosen from the "Plot Parameters" menu in the usual way, except that more than just four items can be selected at once. Only the first four parameters will actually be plotted on the screen, but all of the selected items will be archived. This feature makes the process of recording and live monitoring very flexible.

For example, suppose that the six buttons: "Z", "T", "V", "W", "I", and "Q" are selected in that order. **Ascope** will then display the first four parameters versus range, but will record all six as soon as the "Rec" button is pressed. If the time step and number of rays were setup for a long interval of recording, you could monitor the plotted parameters by eye and discontinue recording if the weather event changed or became less interesting.

Ascope can record power spectra, either in place of or in addition to the "I" and "Q" data from which the spectra are derived. If spectra are recorded on their own, then the size of the data files will be reduced by approximately a factor of two. This may be significant when many bins of data are being recorded. But another advantage that spectra offer is that they can be averaged prior to being recorded, and thus could supplement the "I" and "Q" data in a useful way. For example, if "I", "Q", and "Spec" rays were recorded every ten seconds, and if the spectral averaging were set to approximately ten seconds, then the archived data would contain highly averaged spectra plus occasional instantaneous time series.

Each individual data parameter ("T", "V", "Zdr", etc.) is recorded over the full range interval specified by the maximum range and bin count in **ascope's** main menu. Likewise, the single-pulse "AI', "AQ", and "AL" data samples are also recorded over the full range interval. However, time series and spectra are recorded only at the limited number of bins specified in the "TS Bins" field, and centered at the distance of the range strobe. Whenever the "Record" menu is visible, this secondary range interval will be seen as a pair of dotted vertical lines drawn on either side of the range strobe. Thus, to record time series and/or spectra, you must choose a nonzero value for "TS Bins", and must select "I", "Q", and/or "Spec" from the "Plot Parameters" menu.

Note that the MAG and ARG parameters are not available for recording to disk. This is because these parameters are merely computed at display time and are completely redundant with "I" and "Q". They would not add any averaging or data reduction possibilities if recorded. If you press the "Rec" button while a MAG or ARG plot is selected a warning message will appear to remind you that you may not be recording exactly what you think. However, the data file will still properly contain all of the other selected parameters.

4.5.2 The Playback Menu

This menu is used primarily to review the contents of the recorded data files, and to serve as a confidence check on the entire recording process. Any file may be selected for viewing, and the rays may be displayed either individually or as a continuous "movie loop". A sample "Playback" menu is shown below.

Information Displayed on the "Playback" Menu

The "Playback" menu shows the following information:

- Directory from which data files will be played. This defaults to the same directory that was used for recording, but it may be changed to any directory that is readable by the user and which contains **ascope** data files.
- Scrolled list of file names, dates, and times. This list is refreshed each time the "Playback" menu pops up or reappears. The files are displayed in reverse chronological order so that the most recently recorded data are always at the top. The entire menu may be stretched vertically to enlarge the file viewing area. Files are selected (highlighted) by a single-click of the mouse, and they may be deselected in the same manner.
- Slide pot for selecting the ray number to be displayed. The left and right limits correspond to the first and last ray within the selected file. The ray number (starting from zero) is displayed on top of the slider. You may move this control freely to browse the recorded rays. Left-clicking on either side of the slider will increment or decrement the ray number by one.

- "Play" and "Stop" buttons for activating the movie loop playback mode. When the "Play" button is pressed, **ascope** will loop continuously through all of the rays in the data file. This is handy for watching a phenomenon evolve over time.
- "Pause" and "Speed" slide pots for adjusting the end-of-loop pause and frame rate when the "Play" button is pressed. The pause at the end of each loop can be up to ten seconds, and the delay between successive rays can be up to two seconds.
- "Cancel" button to dismiss the menu and return to normal **ascope** operation.

Procedure for Playback of Data

The "Playback" menu may be invoked whenever **ascope** is in its normal mode of operation, i.e., acquiring live data from the DSP. It may also be used off-line (in a system with no DSP) by initially starting the utility with the `"-demo"` option. Each time the menu is activated the playback directory is rescanned for files that match the **ascope** naming convention. This collection of files is then displayed in the scrolling list. The file names and times reflect the start time of each data file.

Initially, none of the file names will be selected and **ascope** will continue to run normally even though the "Playback" menu is exposed. However, the following actions will take place as soon as a file is selected:

- The entire **ascope** configuration is reloaded from the header of the data file. This causes all menus and displays to return to the appearance that they had at the time the recording was made. The name displayed in the top title bar of the main menu will change to the name of the selected file.
- All **ascope** menus become desensitized, except for the "Play" button and slide pots of the "Playback" menu itself. **Ascope** is now bound by the original selections of the highlighted data file; hence, the main menu functions are all disabled.
- The data from the first ray are loaded from the file and plotted on the screen. The ray selection slide bar is initialized to its left edge (ray #0), and the time shown in the top title bar changes to the time of this first ray.
- **Ascope** waits in this state indefinitely, until either the file is deselected or the "Playback" menu is exited. But in the meantime, the recorded dataset may be browsed interactively using the ray slide bar, or continuously via the "Play" function.

Each time a new ray is requested from disk, not only are the data values displayed in the plotting area, but all other numeric fields are updated as well. **Ascope** is able to do this because each recorded ray is tagged with additional header information consisting of the time, TAG bits, and GPARM information. Thus,the azimuth and elevation angles will be displayed, along with the current PRF, error bits, etc., that were originally measured with each ray.

4.5.3 Format of the Recorded Data

The data files are organized as a 1280-byte **asc_stats** configuration structure, followed by the individual ray data in their original order of arrival. Furthermore, each ray is prefaced with a 200-byte **asc_ray_header** structure that holds additional information from the exact moment that each ray was acquired. Both structures are detailed in the public header file **ascope.h** (refer to this file for detailed comments).

To process the contents of an **ascope** data file, begin by opening the file and reading the first 1280-bytes into an **asc_stats** structure. Use the actual ray count **irec_rays_actual**, and ray data length in bytes **irec_ray_size**, to divide the remainder of the file into fixed length blocks. Each block consists of an **asc_ray_header** structure followed by the ray data itself.

The ray data are defined by the **iplottypes[]** array, which lists up to sixteen different data parameters that were recorded. Each parameter is stored in its native format as read from the DSP. These data formats are described in the *Signal Processor User's Manual*, section on the "PROC" command, also in the *IRIS Programmer's Manual*. The length of each data parameter array is rounded up to the next multiple of four bytes to insure that successive elements within the file will be aligned on 4-byte boundaries if they need to be.

There is no difference between "I" and "AI", "Q", and "AQ", etc. in terms of data format. The only difference is that the "A" terms span the full range, and the non-A terms span the full pulse count.

The 4 "derived parameters" MAG_AIQ(10), ARG_AIQ (11), MAG_IQ (15) and ARG_IQ (16) are not actually recorded on disk, since doing so would not add any more information than was contained in the original (I,Q) data. ASCOPE can plot these four parameters (because that is often handy), but they will not be included in the archived disk file. Please include the raw (I,Q) parameters themselves if that's what you want to archive.

As an example, suppose that a recording is made with the following settings:

- 30 bins and 10 pulses are selected in main menu.
- "T" reflectivity and "L" time series are selected in the "Plot Parameters" menu.

- 5 TS-Bins and 7 Rays are selected in the "Record" menu.
- 16-bit time series is selected in the "General Setup" menu.

Then the data file will be 3604 bytes long and will consist of:

- A 1280-byte **asc_stats** header
- Seven ray blocks, each 332-bytes long, comprised of a 200-byte **asc_ray_header** structure, followed by 32 bytes of "T" data, and 100-bytes of 16-bit "L"samples. Note that the length of the "T" data was rounded up to the next multiple of four, and that the "L" sample length is based on:

$$\left(10\ \frac{pulses}{ray}\right)(5\ bins)\left(2\ \frac{bytes}{bin \times pulse}\right) = \left(100\ \frac{bytes}{ray}\right).$$

ASCOPE data file headers can also be examined using the following command:

```
dd < RVP8040722170814.ASC bs=1280 count=1 | structmap
asc_stats -recursive -data
```

4.6 The Digital Signal Simulator

To test the signal processor and evaluate the performance in response to weather targets, **ascope** provides a digital signal simulator (DSS), which allows you to:

- Simulate weather and clutter targets in the host workstation using **ascope**.
- Automatically download the simulated LOG, I and Q signals to the signal processor where they are processed as usual.
- See the processed results displayed in **ascope**.

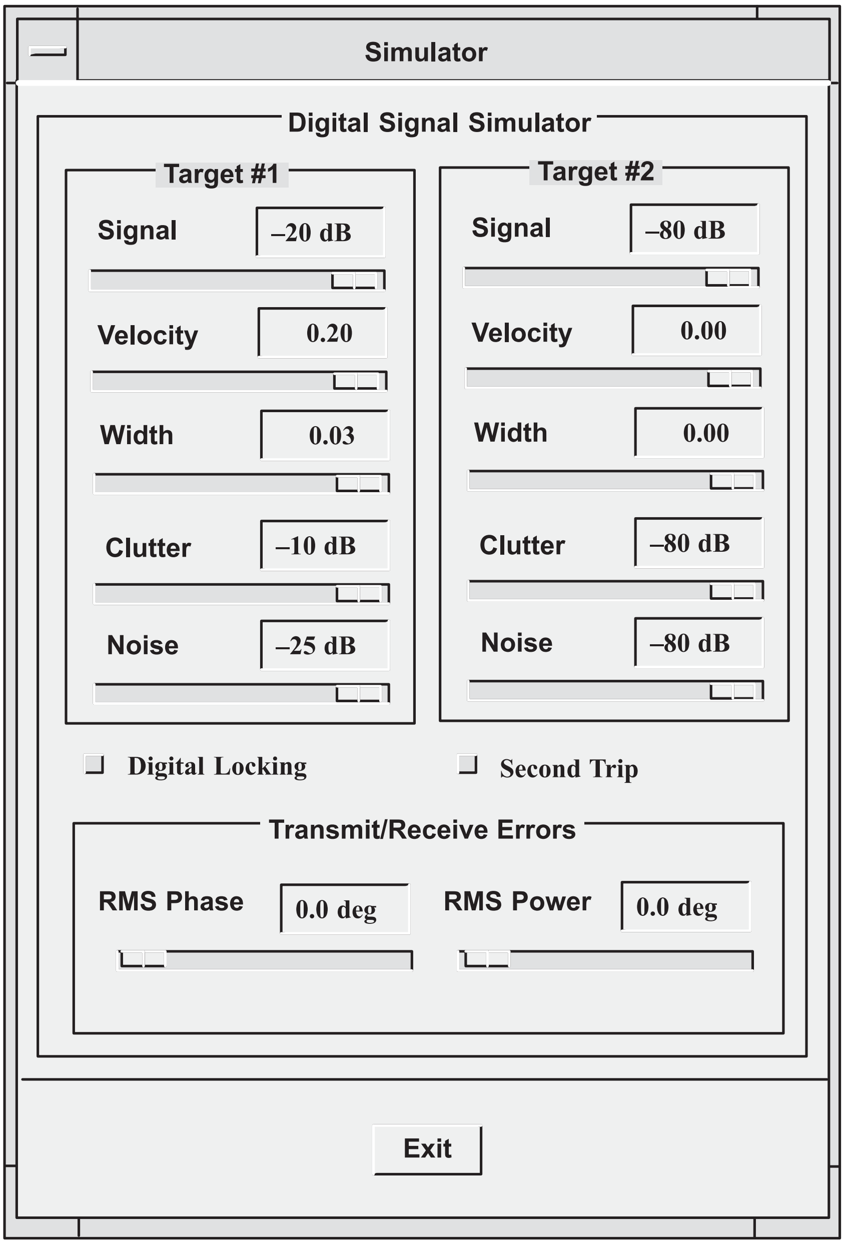
Only one range bin is simulated and the resulting I, Q and LOG time series are then loaded into every range bin that is processed.

The technique is based on Sirmans and Bumgarner's (1975: *Jour. Appl. Meteor.*, **14**, 991–1003) signal simulation approach. A Doppler spectrum is constructed with magnitudes that have Poisson statistics and random phases. This is then inverted to provide digital I and Q values. The simulation approach used in **ascope** is extended to include ground clutter, transmitter/receiver instabilities and second trip echoes.

Starting the Simulator and Viewing the Results

Choose **Options**->**Simulator** to turn on the simulator and display the control panel. For the discussion that follows, we recommend that you display a Doppler spectrum with 128 samples so that you can see the results of any changes that you make. Once you are satisfied with the Doppler spectrum that you have constructed, you can switch to other types of displays.

The DSS can simulate either one or two targets which can occur both in the first trip or the first and the second trip. This tests the random phase range unfolding feature of the RVP6 and RVP7, discussed later. When you first experiment with the DSS, disable Target #2 by setting all of the Target #2 slide pots to the far left. This will make it easier to interpret your results.



Signal

This field sets the signal power of the meteorological target in arbitrary dB. As you raise this value, the Doppler spectrum of weather increases in power.

Velocity

This field sets the mean radial velocity of the weather target normalized between [-1, +1] to correspond to the Nyquist interval (fold point). As you change this value, the Doppler spectrum moves horizontally.

Width

This field sets the standard deviation of the weather target for the normalized velocity interval of [-1, +1]. As you change this value, the spectrum become broader.

Clutter

This field sets the amount of clutter power. As you increase this value, the clutter peak at zero velocity increases. The power is calibrated in the same way as the signal power. For example, if both the Clutter and Signal powers are the same, the clutter-to-signal ratio is 0 dB.

Noise

This field sets the power of the noise. Raising this value causes the noise floor to increase.

Digital Locking

The RVP6 and RVP7 signal processors can do digital phase locking by measuring the phase of the transmitted pulse. This is used for systems that implement 2nd trip echo filtering and recovery. Even if your radar does not implement this feature, you can test it with the simulator.

NOTE	Note: You must enable digital phase locking in the signal processor. This is set in the non-volatile setups which can be accessed via the dspx utility (chat mode). See 7.3 Sample Dspx Session on page 126 for a description of the dspx chat mode.

If digital phase locking is enabled in the processor, pushing this button has no effect on the Doppler spectrum. If digital phase locking is not enabled in the processor, pushing this button causes the spectrum to become incoherent (white noise).

Second Trip and Target #2

Once you have configured Target #1, you can try adding a second target. The **Second Trip** button places target #2 in the second trip. When you first configure Target #2, leave the **Second Trip** button out (disabled) so that Target #2 is in the first trip. Then try pushing the **Second Trip** button. You will see the power from Target #2 put into the white noise of the first trip spectrum.

RMS Phase

Radars are not perfect. This feature simulates phase noise. Typically, a magnetron radar has between 1 and 3 degrees of phase noise. A Klystron system can have as little as 0.1 degrees of phase noise. Increasing the phase noise increases the white noise level in the Doppler spectrum.

RMS Power

This simulates pulse-to-pulse variation in transmitted power. The effect is similar to phase noise.

4.6.1 Testing with the Digital Signal Simulator

The DSS is designed so that you can develop better operational processing strategies. The operational configuration can be configured in **ascope**, then tested using signals from the DSS. A secondary benefit is for training, so that operators can get a feel for what the various signal processing options do.

Velocity, Width and Intensity Display Features for Testing

The DSS lets you input signals of known properties, then view the results in the **ascope** displays. Effects of clutter filters, time averaging and PRF can be determined. The spectrum display is useful for this. However, the following special features of the moment displays are designed to make testing easy:

- The velocity vs. range plot shows the numerical value (in parentheses) of the mean velocity normalized to the interval [-1, 1]. This can be compared directly to the value set in the DSS.
- The width vs. range plot also shows the normalized value of the width for direct comparison with the DSS.
- With no clutter power in the DSS and LOG Range Normalization turned off, the Z or T readouts are 80 dB greater than the DSS setting for signal power (for signal powers > 10 dB).
- With no clutter power in the DSS the MAG(IQ) plot are 3 dB less than the DSS setting for signal power.

When making comparisons, remember that the natural fluctuations of weather echoes are also simulated. This means that you will see fluctuations in the values, particularly if the spectrum width and/or the noise power are large.

NOTE	Note: After you set the DSS, the same time series is loaded into the signal processor every time. To get a new "realization" click on any of the slide pots that you are using. A fresh time series is created.

Random Phase 2nd Trip Echo Testing

The DSS can also be used for testing random phase for 2nd trip echo recovery. This requires that the random phase features of the RVP6 or RVP7 are licensed on your system. Random phase processing filters and recovers second trip echoes which can be a serious problem when operating at high PRF. Refer to the *Signal Processor User's Manual* for a description of random phase processing.

Test random phase as follows:

1. Verify that the RVP6 non-volatile setup (under Mc) has digital phase locking enabled. This question is in the Mb section for the RVP7. See 7.3 Sample Dspx Session on page 126 on the **dspx** utility chat mode.
2. Under **Plot Params**, select spectrum display.
3. Under **General Setup**, select **Major Mode**->**Random Phase**.
4. Under **General Setup**, select **Type of Spectra**->**Raw #1**.
5. On the DSS panel, turn **Digital Locking** on (button in).
6. On the DSS panel, set **Second Trip** off (button out).
7. Use the DSS to configure Target #1 and Target #2.
8. Set **Second Trip** on (button in) to put Target #2 in the 2nd trip.
9. Under **General Setup**, select **Type of Spectra**->**Raw #1, #2, etc.** to verify the various stages of the algorithm.
10. Set up moment plots (Z, V, etc. vs. range) to verify the moments.

You can trace the various filtering steps of the random phase algorithm and experiment with different set-ups for the so-called whitening filters.

4.7 Ascope Checkup Procedures

4.7.1 Coarse Adjustment of the Gain and Offset Pots

NOTE	Note: In the Signal Processor User's Manual, refer to the section on A/D alignment for information on the location and use of the adjustment pots.

This procedure should be done only after all signal line drivers have been adjusted and the I, Q and LOG video signals have been checked with a scope to assure that they are within the proper limits of the signal processor A/D converters. Otherwise at best, the procedure will have to be repeated, and at worst the signal processor could be damaged if an inappropriate voltage is applied.

The analog-to-digital converter section of each DSP contains two potentiometers for each digitized video signal. Nominally, I and Q signals should be between ±1V and the LOG channel between 0 and 2V. The potentiometers allow the A/D converter span and offsets to be adjusted around these nominal values so that the full span of A/D values is available to the signal processor. These pots are on the outside edge of the RVP6. When signal processors are used for reflectivity-only processing, then only the LOG video channel needs to be adjusted.

To adjust the LOG, I, and Q gain and offset pots:

There are two procedures to set these controls. One procedure is documented in the *Signal Processor User's Manual* and does not require **ascope**. The recommended procedure, described here, uses the AI, AQ and ALOG plots to view the raw time series vs. range.

1. Run Zauto and check the value of the calibration slope. Typical values are from 0.3 to 0.5; the default is 0.5. If the calibration slope is 0, set it to the proper value.
2. Disconnect the gain control output from the processor. This assures that the linear receiver is operating at full gain. If the processor gain is not used on your system, check with your manufacturer to see how the receiver can be set to full gain at close range.
3. Type `ascope` at the operating system prompt, then set up **ascope** as follows:

PRF:	250
Max Range:	100
Number of Bins:	100
Plot Parameters:	AI AQ ALOG

4. While running **ascope**, turn on the transmitter and point the antenna in a direction so that the main bang of ground return can be observed. Sometimes it helps to scan the antenna very slowly to get a representative sample of targets.
5. Make sure all test signals are off, then adjust the LOG offset pot so that the far range noise is approximately 10% off the bottom of the plot (as compared to the full range of A/D values). Click the Sample Noise button to invoke a new noise sample and verify that the Z offset in the status section is between 15 and 30 units.
6. Adjust the LOG gain pot so that the saturated main bang at close range is below the high limit. If there is difficulty observing the saturated

main bang close to range zero, reduce the Max Range field to 10 km. Readjust the offset as required, because changing the gain can affect the offset.

Another technique is to use an RF test signal generator to adjust the A/D range to correspond to the dynamic range of the receiver (typically 80 dB). To do this, use **ascope** to observe the LOG channel A/D vs. range plot (ALOG). Do not click on the Sample Noise button or leave the Sample Offset Noise Sampling Mode set to "Continuous." Use the signal generator in CW mode. The transmitter is usually turned off to avoid damage to the signal generator while it is connected. Now starting from the minimum value of the signal generator output, increase the signal level until the LOG A/D values just start to increase. This is the approximate noise level. The gain should be adjusted so that, for example, the LOG A/D values are at approximately 250 when the signal generator level is increased to 80 dB above the noise level.

7. Adjust the I and Q pots until the signal is approximately centered in the display. Click the Sample Noise button to verify that they are within ±5 units of zero. If not, adjust accordingly.
8. Make sure the gain control is disconnected or otherwise disabled so that the receiver is operating at full gain for this test. Adjust the I and Q gain pots so that the strongest clutter targets at close range are just below saturation. The amplitude of the I and Q signals should be adjusted with the gain pot so that they are equal. Slight saturation on the very strongest clutter targets is tolerable because no useful weather information can be obtained in the vicinity of these anyway. Recheck and readjust the offsets as required.

This completes the coarse adjustment of the I, Q and LOG A/D channels. Now continue with the fine adjustment as detailed in the next section.

4.7.2 Fine Adjustment of the Gain and Offset Pots

NOTE	Important: Disconnect or otherwise disable the gain control so that the linear receiver is at full gain during this procedure.

In the previous section, the gain and offset of the I and Q video signals were set to roughly the correct values. In order to get high quality velocities and widths, it is necessary that the I and Q signals have the same amplitude. This is quite easy to do using the **ascope** utility, following the procedure for your processor.

RVP6 Procedure

Any normal weather or noise signal can be observed. Click on the Sample Noise Offsets button and set the Noise Sample mode to "Continuous" to provide continuous updates of the noise information. Adjust the I or Q gain pot until the I/Q STD value is close to 1.00 (within ± 0.03). When they are balanced, adjust the offsets so that the mean is at 0.

4.7.3 Phase and Amplitude Stability Checks

This test establishes how much dynamic range is available in the linear channel for clutter cancellation. This is useful for determining the maximum clutter correction that can be achieved.

NOTE	Important: Disconnect or otherwise disable the gain control so that the linear receiver is at full gain during these test.

1. Set **ascope** to run as follows:

Pulse Width:	0.5
PRF:	Highest value
Plot Parameters:	T Spec
Doppler Filter:	None
LOG Filter:	None
Thresholds:	Off
Max Range:	20
Pulse Samples:	128
Spectrum Window:	Rect

   This creates a Doppler spectrum with a fairly rapid update for searching.

2. Use the Reflectivity vs. Range plot (Total dBZ) to select a range where there are strong clutter targets and observe the peak-to-noise level for the strongest clutter targets. You may want to scan the antenna very slowly, stopping at strong clutter targets. Estimate the peak-to-noise level ratio by eye (20 dB per division) for several of the strongest targets by estimating the average noise level. Spectrum averaging helps to reduce the fluctuations. For a 128-point spectrum (Pulse Samples: 128) the clutter to total noise power in dB is the observed peak-to-noise ratio minus 10 log(128), that is:

   dB(Clutter-to-noise) = dB(Peak-to-noise) - 21 dB

This is a measure of the available dynamic range of the system. If the value is 20 dB, (typical for a magnetron system), then the maximum clutter correction that can be achieved is approximately 20 to 30 dB depending on the number of samples averaged together.

Another way to assess the coherency of the system is to use the SQI and phase noise values displayed in the upper right corner of the spectrum display. The SQI is a number between 1 (perfectly coherent) and 0 (perfectly incoherent) which is related to the pulse-to-pulse phase noise, the peak-to-noise and the clutter-to-noise. Table 3 on page 89 summarizes these relationships. Note that the calculations in the table assume you are looking at a pure clutter target with no weather or coherent artifacts such as 50 or 60 Hz or image spectra. For example, an SQI of .9800 corresponds to a phase noise of 8.1 degrees, a clutter-to-signal ratio of 16.9 dB and a 128-point peak-to-noise (observable in the spectrum plot) of 37.9 dB.

Table 3 Coherency Relationships

SQI	Phase Noise (Degrees)	Clutter-to-Noise (dB)	128-Point Peak-to-Noise (dB)	256-Point Peak-to-Noise (dB)
.99998	0.26	47.0	68.0	71.0
.99996	0.36	44.0	65.0	68.0
.99994	0.44	42.2	63.2	66.2
.99992	0.51	41.0	62.0	65.0
.99990	0.57	40.0	61.0	64.0
.99988	0.63	39.2	60.2	63.2
.99986	0.68	38.5	59.5	62.5
.99984	0.72	38.0	59.0	62.0
.99982	0.77	37.4	58.4	61.4
.99980	0.81	37.0	58.0	61.0
.99970	0.99	35.2	56.2	69.2
.99960	1.15	34.0	55.0	58.0
.99950	1.28	33.0	54.0	57.0
.99940	1.40	32.2	53.2	56.2
.99930	1.52	31.5	52.5	55.5
.99920	1.62	31.0	52.0	55.0
.99910	1.72	30.5	51.5	54.5
.99900	1.81	30.0	51.0	54.0
.99800	2.56	27.0	48.0	51.0
.99700	3.14	25.2	46.2	49.2
.99600	3.63	24.0	45.0	48.0
.99500	4.06	23.0	44.0	47.0
.99400	4.44	22.2	43.2	46.2
.99300	4.80	21.5	42.5	45.5
.99200	5.13	20.9	41.9	44.9
.99100	5.45	20.4	41.4	44.4
.99000	5.74	20.0	41.0	44.0
.98000	8.14	16.9	37.9	40.9

Table 3 Coherency Relationships (Continued)

SQI	Phase Noise (Degrees)	Clutter-to-Noise (dB)	128-Point Peak-to-Noise (dB)	256-Point Peak-to-Noise (dB)
.97000	10.00	15.1	36.1	39.1
.96000	11.58	13.8	34.8	37.8
.95000	12.98	12.8	33.8	36.8
.94000	14.25	11.9	32.9	35.9
.93000	15.43	11.2	32.2	35.2
.92000	16.54	10.6	31.6	34.6
.90000	18.60	9.5	30.5	33.5

4.7.4 Doppler Velocity Sign Check

This test determines whether the mean Doppler velocity has the proper sign. Because of different conventions and the possibility of a cabling error, there is only a 50/50 chance that the velocity has the proper sign (towards or away) when a radar system is first installed. Switching the sign of the velocity is done by simply swapping the I and Q input cables to the signal processor or other location, as determined by your system manager.

To determine if the sign is correct:

1. Make sure your antenna pointing has been properly calibrated.
2. Select a day when there is low level precipitation — ideally, raining at the radar site. Good clear air echoes also work if they are detectable at low levels.
3. Run **ascope**, set the Plot Parameters to V Z W to display the velocity, and manually scan the antenna to observe velocities at low elevation (for example, 0.5 degrees) and close range (<10 km). Select an azimuth where the mean velocity is largest (either toward or away).
4. Go outside and verify that the wind direction is correct.

CHAPTER 5
BITEX UTILITY

The **bitex** utility provides a graphical user interface for the display of status information reported by Built-In Test Equipment (BITE) integrated into the radar and associated systems and reported via the RCP. **Bitex** also allows for operator initiated commands to be sent to these BITE units (again via the RCP).

These features are very useful in that through the graphical user interface of **bitex**, an operator can cause physical functions to take place at the remote radar (i.e. – reset faults, start equipment, switch power systems, etc). Also, button pushes can be decoded by the RCP into control variables which can be further utilized by the RCP in logic equations to make complex functions to take place.

Furthermore, with the RCP, the uncommitted analog and digital inputs of the RCP can be mapped into status variables which in turn can be passed to **bitex** for display as status indicators.

As the **bitex** utility is normally highly integrated with the functioning of the RCP, it is advised to review the *SIGMET RCP8 User's Manual*, especially the appendix on data formats.

Bitex Details

Bitex can handle as many as 256 pieces of data from up to 16 separate BITE units. For example, the antenna sub-assembly many be one BITE unit, the transmitter a second, the radar controller a third and facility equipment (power equipment, building alarms, etc) a fourth.

Traditionally, all BITE units connect electrically to the Radar Control Processor (RCP) via interfaces such as contract closures, analog voltages, or serial communications. The RCP integrates all of this information and sends it via multicast networking to IRIS for ultimate display in the **bitex** utility. These packets are mingled with the RCP antenna controller commands on the same network port.

In this chapter:

5.1 Invoking Bitex

Bitex is invoked graphically from either **irisnet**, **utils** or from the **Radar Status Menu**. However, **bitex** can also be invoked from the command line with the following command:

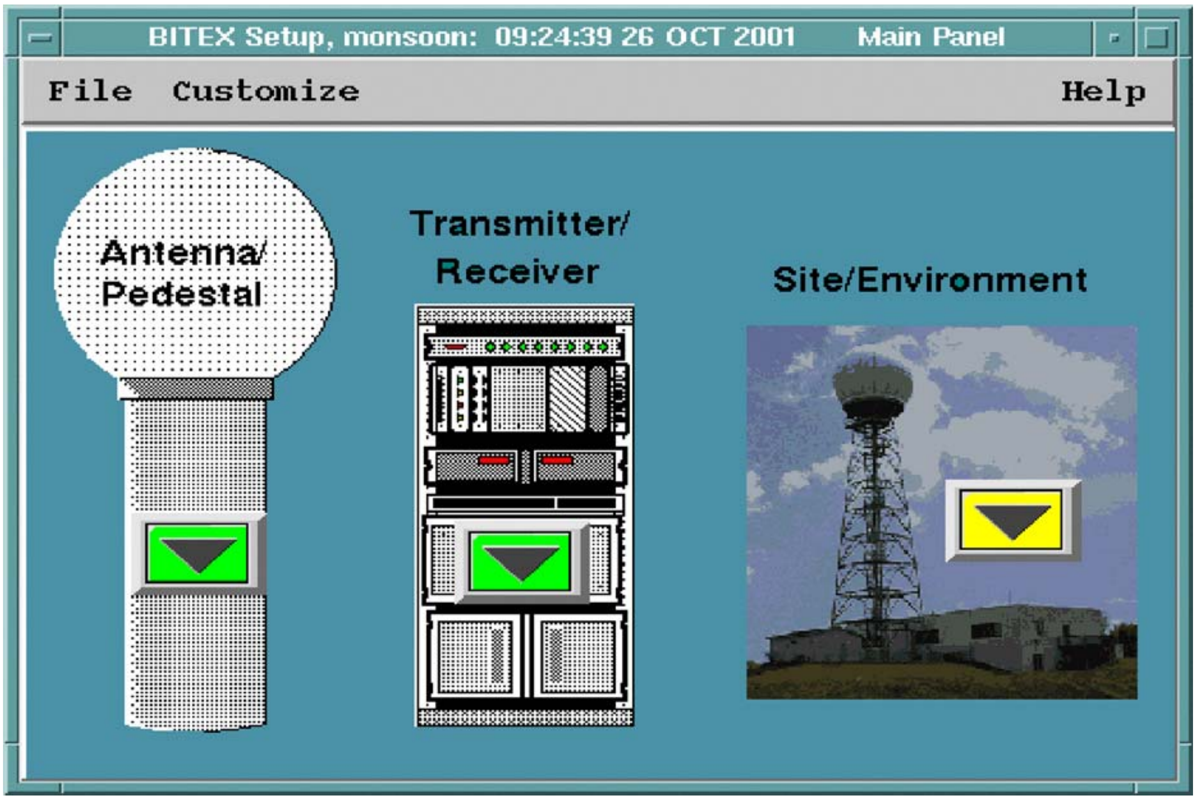
Command

```
bitex
```

Options

`-setup`	Lets you customize the BITE menu contents and layout.
`-upgrade`	Upgrades SIGMET's old format bitex configuration files to the format described in this manual.
`-version`	Prints the version number.

5.2 Bitex Window



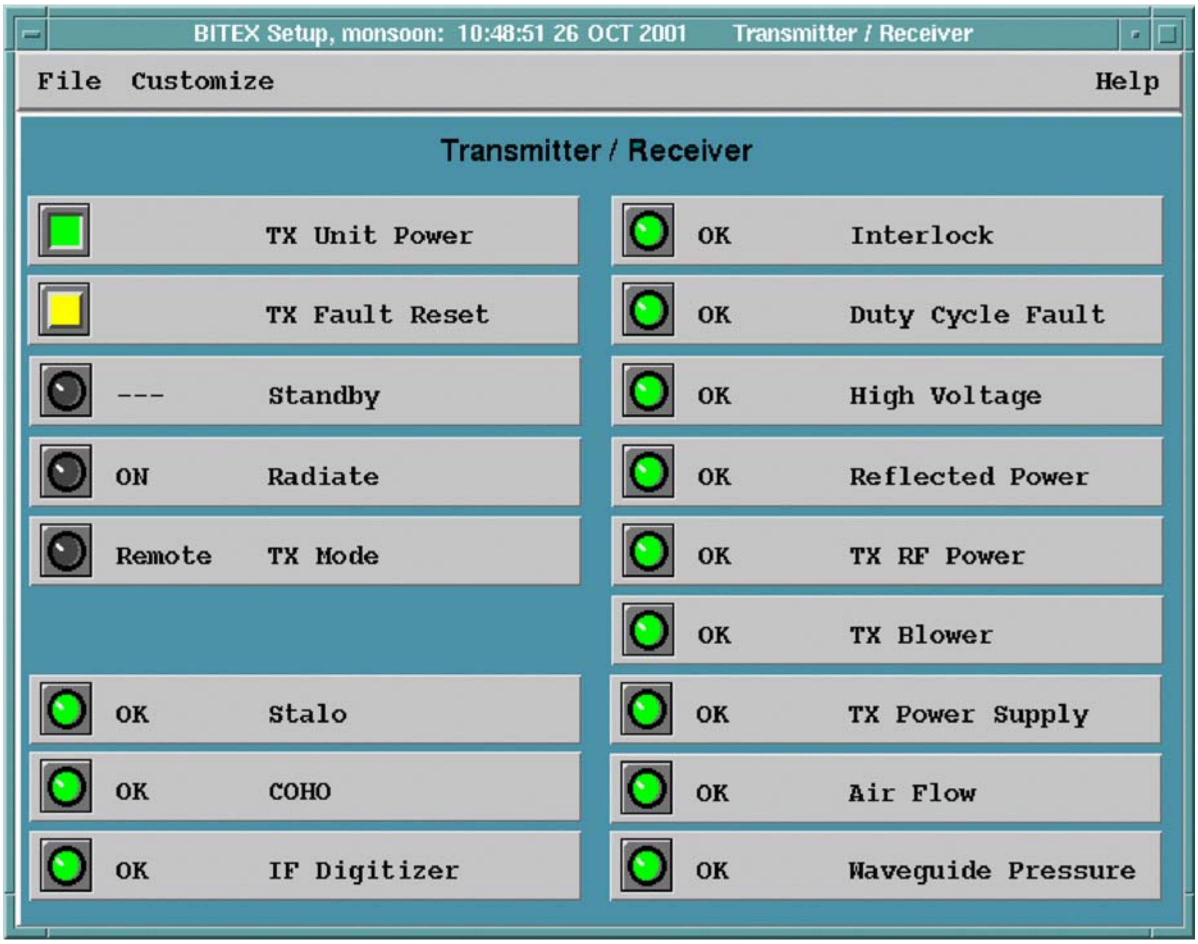
Main Panel

Upon invoking the **bitex** utility, a window such as the one above is displayed. This is know as the **bitex Main Panel**. The main panel gives the File, Customize and Help buttons on the menu bar, and can (as in this example) give a graphical representation of each Bite Unit.

The main panel and each of the sub panels (discussed below), contain the following graphical components:

- Background Image
- Sub Panel indicators
- BITE graphical data points

Each of these items are discussed in detail in the following sections.



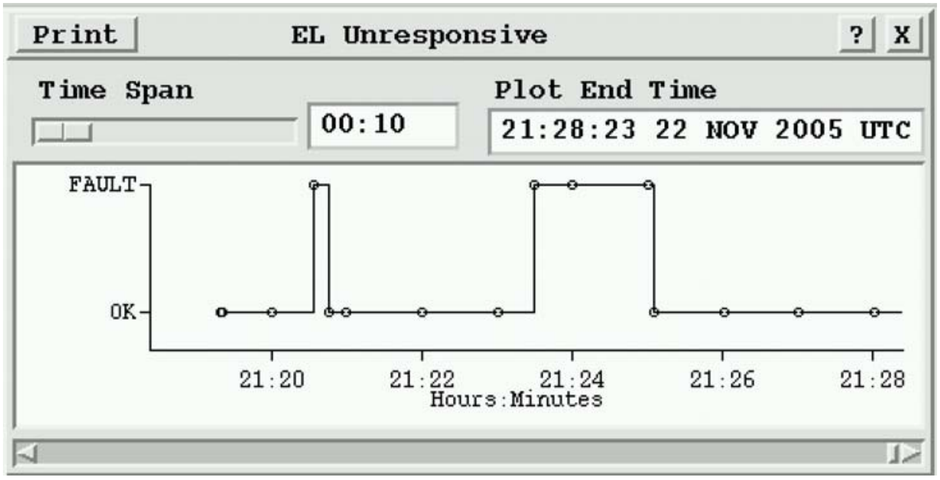
Sub Panels

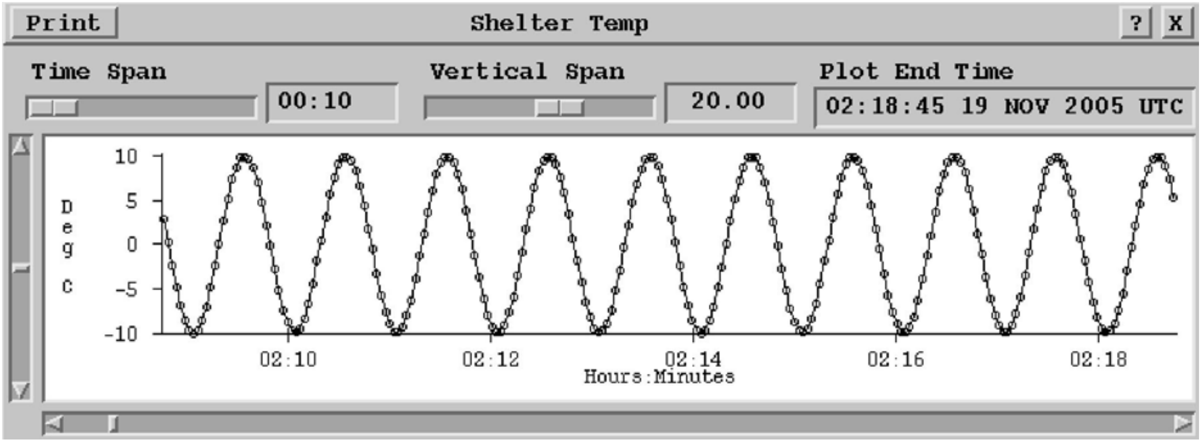
Bitex may contain **Sub Panels**. In the main panel shown above, there are three sub panels available via the main panel (denoted by the downward pointing arrow graphic). If you click on the sub panel in the transmitter / receiver area, an additional window will appear on the screen as shown here (the Transmitter / Receiver sub panel).

You may have any number of sub panels, including none. However, it is usually most convenient to have a few sub panels accessible from the main panel, where each sub panel represents a different functional area of your radar BITE. Note it is also possible to nest sub panels, such that from one sub panel, you can open other sub panels.

In this sub panel example, there is a simple background image, there are no nested sub panels, and there are 17 graphical data points. Of the 17 graphical data points, two (TX Unit Power and TX Fault Reset) are user input data points and the other 15 are all status output data points.

5.3 Histograms





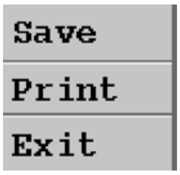
Histograms of the **bitex** status data may be viewed in a graphical display format. The output data points can be analog or digital. The histogram may be opened by right clicking on any of the bitex panels. You cannot pop up the histograms if you started **bitex** in -setup mode. The graphical display can be a valuable tool when assessing the frequency and endurance of faults.

The time scale for viewing the histogram is adjustable from 10 minutes to 96 hours using the Time Span slider. The y-axis scale for analog output is also adjustable with the Vertical Span slider. Each circle represents the time a status packet was received. The graphical display may be printed to a printer or file.

The histogram data files are created in the ${IRIS_LOG} directory. A new log file is generated each day at midnight. An IRIS **setup** question allows the operator to choose how many days of antenna log files to retain at any given time. Keeping old log files preserved is helpful for post analysis of problems.

5.4 Bitex Commands

File



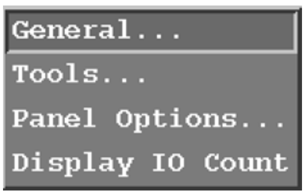
Save applies the current settings and writes them to disk file called `bitex.conf` and `bitex_wgt.conf`. This choice is available only if you invoke **bitex** with the setup option.

Print creates an X-window dump of the menu you are running, as follows:

- **Print**->**to Printer** sends the output to the Postscript or color printer specified in the Printer Setup menu.
- **Print**->**to File** sends the output to a file in your default home directory.
- **Print**->**Setup** lets you configure the printer on your system. See Section the *SIGMET Installation Manual* for information on configuring a printer.

Exit exits from the **bitex** utility.

Customize



Here is a brief description of these controls. Full descriptions are found in following sections. It should be noted that the top three options are only available if **bitex** was started in with the `-setup` option.

`General` accesses the Bitex Customization Menu. This menu allows sets up the serial stream parameters for each BITE unit.

`Tools` accesses the bitex tool suite that allow for creating, deleting and positioning of sub panels and data point items.

`Panel Options` allows for the current panel name to be set and allows for the user to specify a background GIF image for this panel.

`Display IO Count` will place on the top of the bitex display a bar showing the count of byte in and out over the network.

Help

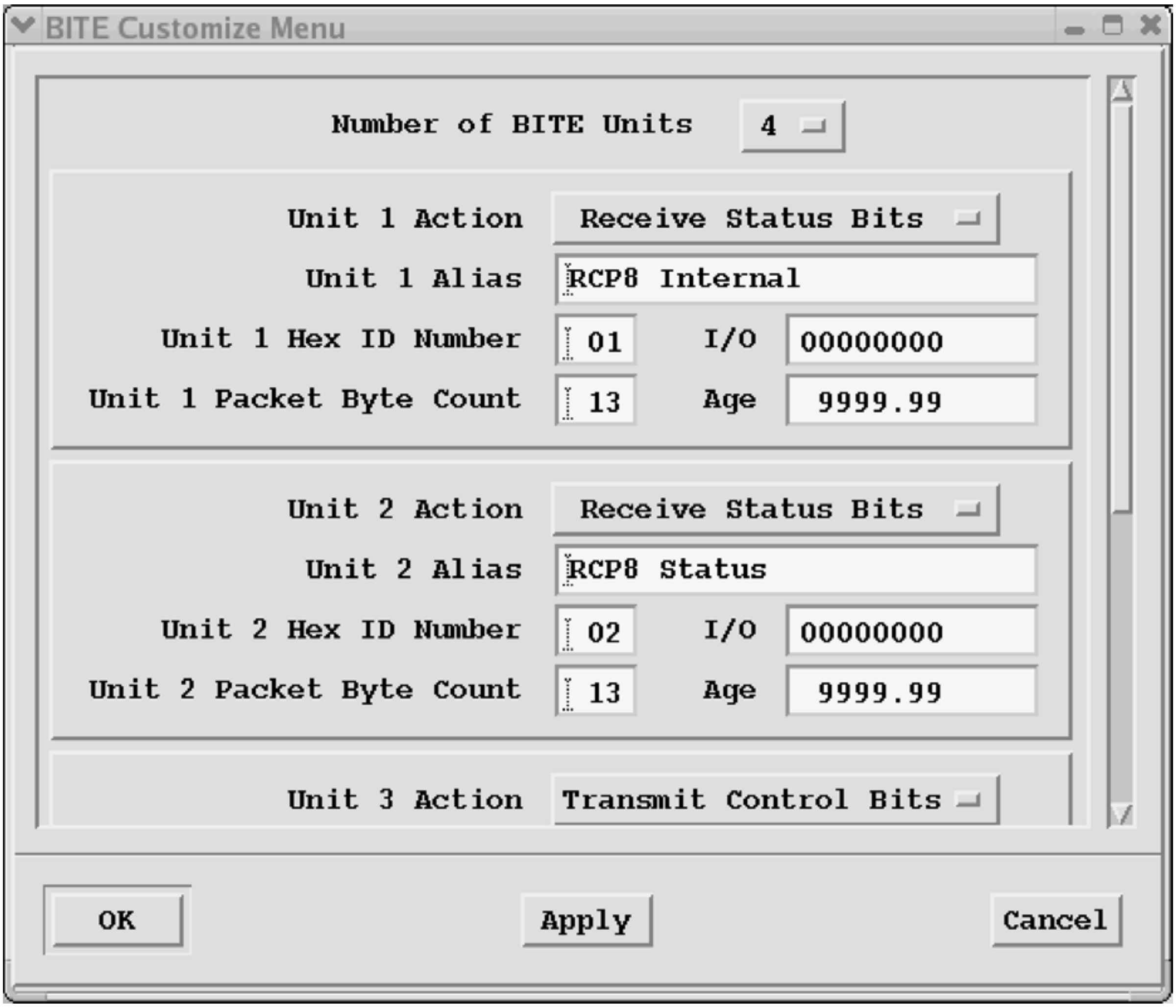
`Help` accesses this manual.

5.5 Customizing of Bitex

If you invoke **bitex** with the `-setup` option, you can customize certain features of **bitex**. All the customization menus are scratch pads, so changes do not take effect until they are applied. Click the OK button when you have filled in the necessary fields. This applies the changes and closes the menu.

After you make changes, you can save the configuration so that it is used the next time the antenna driver starts. Choose **File**->**Save** to save the changes. If you choose **File**->**Exit** and you have not saved your changes, **bitex** asks if you want to save them. Remember that changes do not take effect until you apply them.

5.5.1 General - Bitex Customization Options



To display the BITE Configuration menu, choose **Customize**->**General**. This menu is used to change the format of the BITE packet transmission and reception over the network communications stream. In normal operation, this menu is not needed. To protect against inadvertent changes, you must be in setup mode to make changes.

Number of Units

Select from 1 to 16 BITE units. The number of units and the characteristics of each unit displayed in the menu will changed reflecting the setting of the Number of Units.

Unit Action

The choices for Unit Action are `Receive Status Bits`, `Receive Status QBITE`, or `Transmit Control Bits`. Each of the units is configured independently. If the RCP is configured to send status information to IRIS for this unit, the Unit Action in Bitex should be `Receive Status Bits`. Any data point configured for this unit will then display status information.

If the RCP is configured to receive control information from IRIS for this unit, the Unit Action in **bitex** should be `Transmit Control Bits`. Any data point configured for this unit will be a button for sending actions to the RCP.

Unit Alias

This name is used on the Interrogate menu to identify the purpose for the different BITE units.

Unit Hex ID Number

Each BITE unit has an identification byte (displayed in hex) which determines the meaning of this packet. `Unit IDs` configured in **bitex** should match `Unit IDs` configured on the RCP. Transmit `Unit IDs` are independent of Receive `Unit IDs`, thus they may share the same `Unit IDs` — But within Transmit IDs or Receive IDs, the unit numbers must be unique.

Unit Byte Count Packet

For each BITE unit, you must specify the number of bytes expected in each packet, from 4 – 128. These numbers must match those configured on the RCP for each BITE unit.

I/O

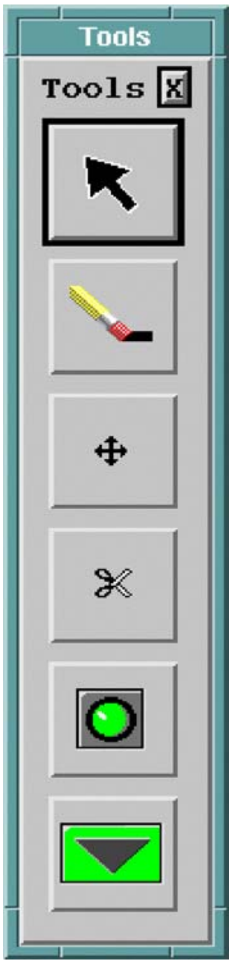
A display-only field showing the number of characters received from or sent to that particular BITE unit.

Age

A display-only field showing the time in seconds since the last packet for this particular unit was received or transmitted.

5.5.2 Bitex Customization Tools

The Bitex Customization tools allow for sub panels and data points to be created, deleted or moved. The tool bar is access by choosing `Customize -> Tools...` from any of the bitex panels. Below is a picture of the tool bar and a description of each of the tool items.



Pointer Tool: Exit edit mode.

Erase Tool: Erases the next data point or sub panel.

Move Tool: Click, hold and drag the next data point or sub panel.

Cut / Paste: Cut the next data point or sub panel. When mouse is put over an unoccupied area and click again, pastes the object just cut.

Add Data Point: Add a new data point object to the next clicked position.

Add Sub Panel: Add a new sub panel data object to the next clicked position.

5.5.3 Bitex Panel Options

The Bitex Panel Option menu allow two items to be configured:

- Whatever is entered for `Panel Title` will be displayed on the title bar of this panel.
- All panels may optionally have a GIF image to be used as the background. Such an image may be as simple (such as a solid color), or as complex as you like it (such as pictures of cabinets and sub-assemblies, etc). To use a GIF background image, either type in its filename here, or use the selection button to choose an image. The images must be located in the /usr/sigmet/config/images/ directory.

5.5.4 Bitex Data Point Configuration

Bitex supports 3 types of data points. There are status data points (information received from the RCP), status QBITE point (from the RCP), and control data points (information sent to the RCP).

Graphically, the status data points looks like the following:

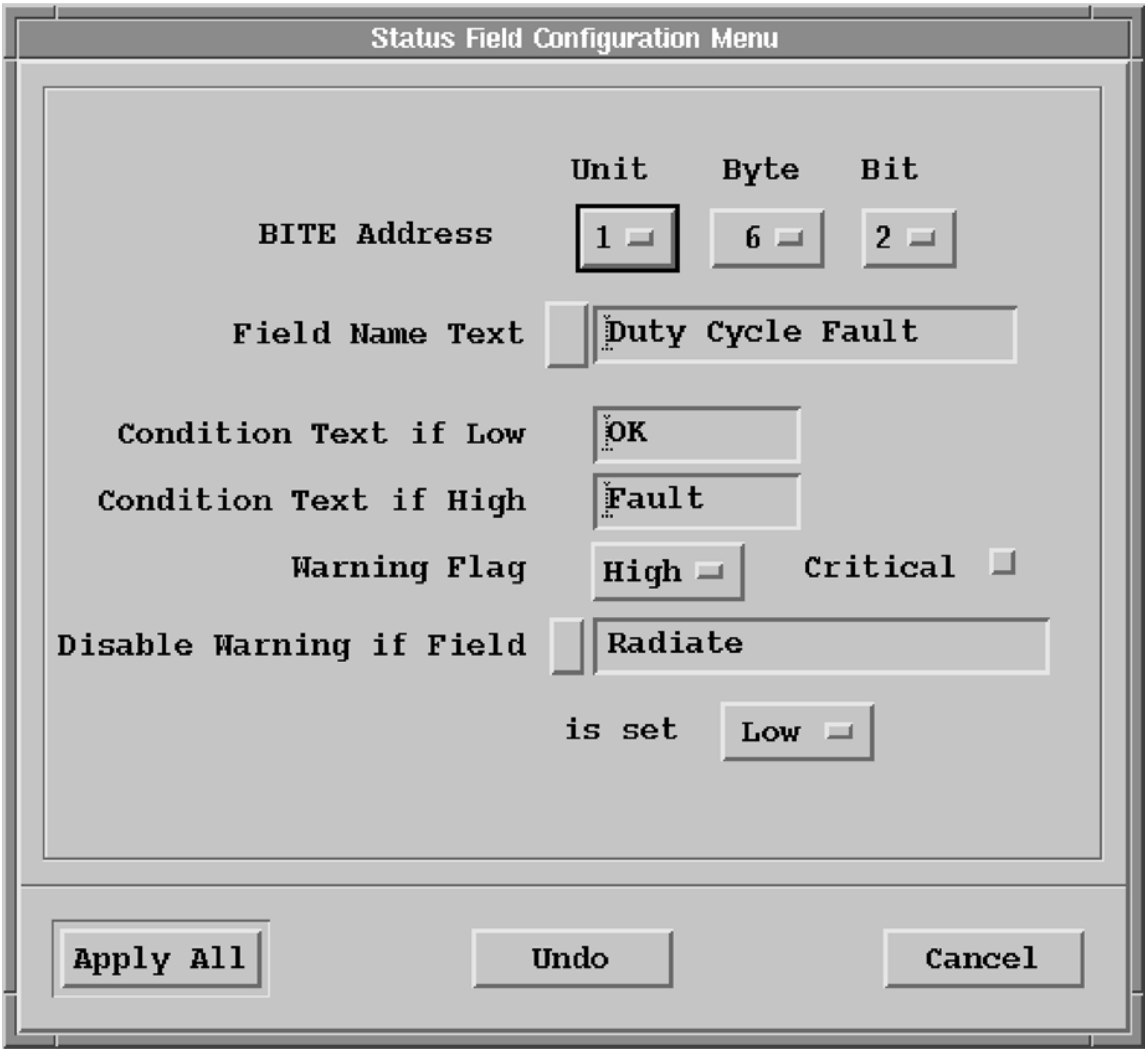
Graphically, the control data point looks like the following:

Graphically, the status QBITE data point looks like the following:

Status points are passive (accept no user input). They graphically display status information as reported by the RCP.

Control data points are active. They provide the operator with a button that can be pressed or toggled. The status of the button is sent to the RCP. The RCP decodes this uses this state to affect electrical outputs.

5.5.4.1 Configuration of Status Data Points



Status data points are configured by right clicking on the data point (see above). This setup feature is only available if Bitex was started with the `-setup` option. Upon clicking, a the `Status Field Configuration Menu` is displayed.

BITE Address

The BITE address is used to specify exactly which byte and bit in the BITE packets from the RCP corresponds to this status item. The BITE address has three parts:

- Unit — Corresponds to the one of the "Received Status Bits" Units defined in the Bite Customization Menu.

- Byte — For this Unit, what byte is used for this data point. Limited to a range between 3 and a customized number of bytes (N) minus 1 for this particular Unit (bytes 1, 2 and N are reserved).
- Bit — Corresponds to the exact bit (in the above Unit number and Byte number) that this data point is mapped to. Limited to the range 0 – 6.

Field Text Name

The text string that appear on this status data point that defines its meaning. This text can be up to 19 characters long. By pressing the button on the left of the field, a pre-defined text string can be chosen. If one of these pre-defined field names is used, this allows the antenna utility to recognize this data point as a "special meaning" data point, and the antenna utility will also display the setting of this data point. Note this is only applicable to system that require an INU (moving platform radars).

Condition Text if Low / High

These fields allow the display of optional text depending on the reported state of this data point. If entered, this text is displayed on the left side of the actual data point display. This text can be up to nine characters long.

Warning Flag

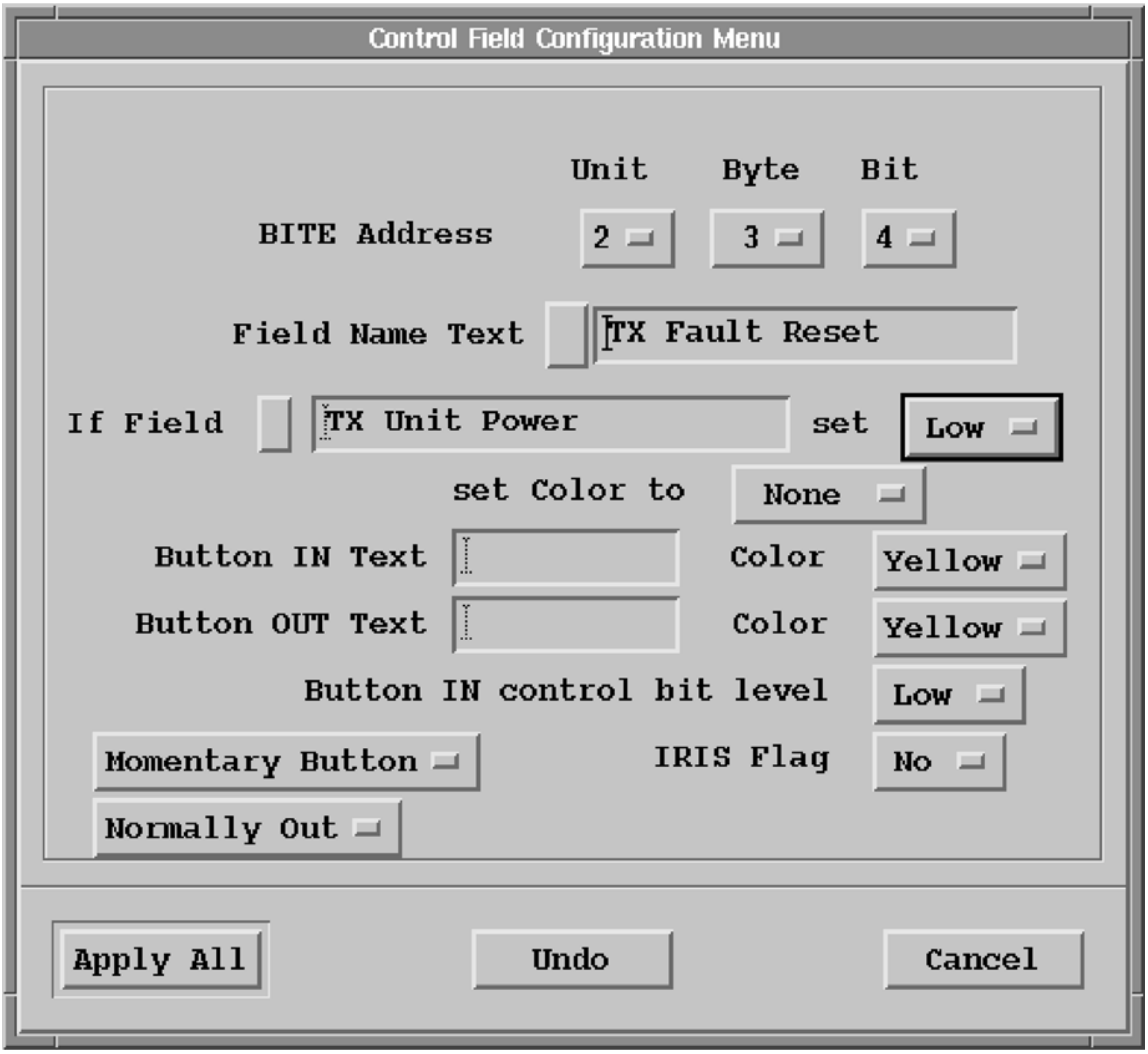
Controls fault generation. This can be set to either "None," "Low," or "High." "None" means not to generate a fault based on this bit, otherwise the warning flag indicates the level considered a fault. If a fault is possible, the fault can be further conditioned with the Disable Warning field.

If the warning flag is set (value other than None), then if the data point is in the unfaulted state, it the LED indicator will be displayed as green. If the data point is in the faulted state, the data point will be displayed as either yellow (non-critical), or red (critical) depending on the state of the Critical button (next to the Warning Flag selection). Furthermore, if the warning flag is set to a value other than None, then this data point will be or'ed into the overall status of this site. Thus this data point could cause this site to be considered faulted, or critically faulted. This information can be used by the RCP to allow channel changing in system employing redundancy.

Disable Warning

Lets you override a warning if a particular field is set to "Low" or "High." This is used when a condition should generate a warning only some of the time. For example, a "High Voltage Missing" condition does not require a warning if the transmitter is turned off. By specifying this additional BITE condition, you disable the warning.

5.5.4.2 Configuration of Control Data Points



Control data points are configured by right clicking on the data point (see above). This setup feature is only available if Bitex was started with the `-setup` option. Upon clicking, a the `Control Field Configuration Menu` is displayed.

BITE Address

The BITE address is used to specify exactly which byte and bit in the BITE packets from the RCP corresponds to this status item. The BITE address has three parts:

- Unit — Corresponds to the one of the "Transmit Control Bits" Units defined in the Bite Customization Menu.

- Byte — For this Unit, what byte is used for this data point. Limited to a range between 3 and a customized number of bytes (N) minus 1 for this particular Unit (bytes 1, 2 and N are reserved).
- Bit — Corresponds to the exact bit (in the above Unit number and Byte number) that this data point is mapped to. Limited to the range 0 – 6.

Field Text Name

The text string that appear on this status data point that defines its meaning. This text can be up to 19 characters long.

If Field ...

The If Field... allows for the button color to change based on some condition. The condition is specified by clicking the button to the right of "If Field" and choosing the conditional data point and to the right of this. This can be either "low" or "high" or "None". Set this to "None" to disable this feature. Finally, the color that the button changes to is selected to the right of the "set color to" text.

Button IN / OUT Text and Color

This field allow text information to be displayed next to the button depending on of the button is pressed in or out, and furthermore, the color of the button can set depending on its position. In the example, no text is desired, thus this information is blank.

Button IN control bit level

This field sets the polarity of the data bit corresponding to this button. The polarity is dependant on if the button is in or out. This field selects the IN polarity and the OUT polarity is the opposite.

Momentary Button / Toggle Button

Buttons can be configured to be either momentary (you must be applying pressure for the button to stay in) or as toggle buttons. This field provides this selection.

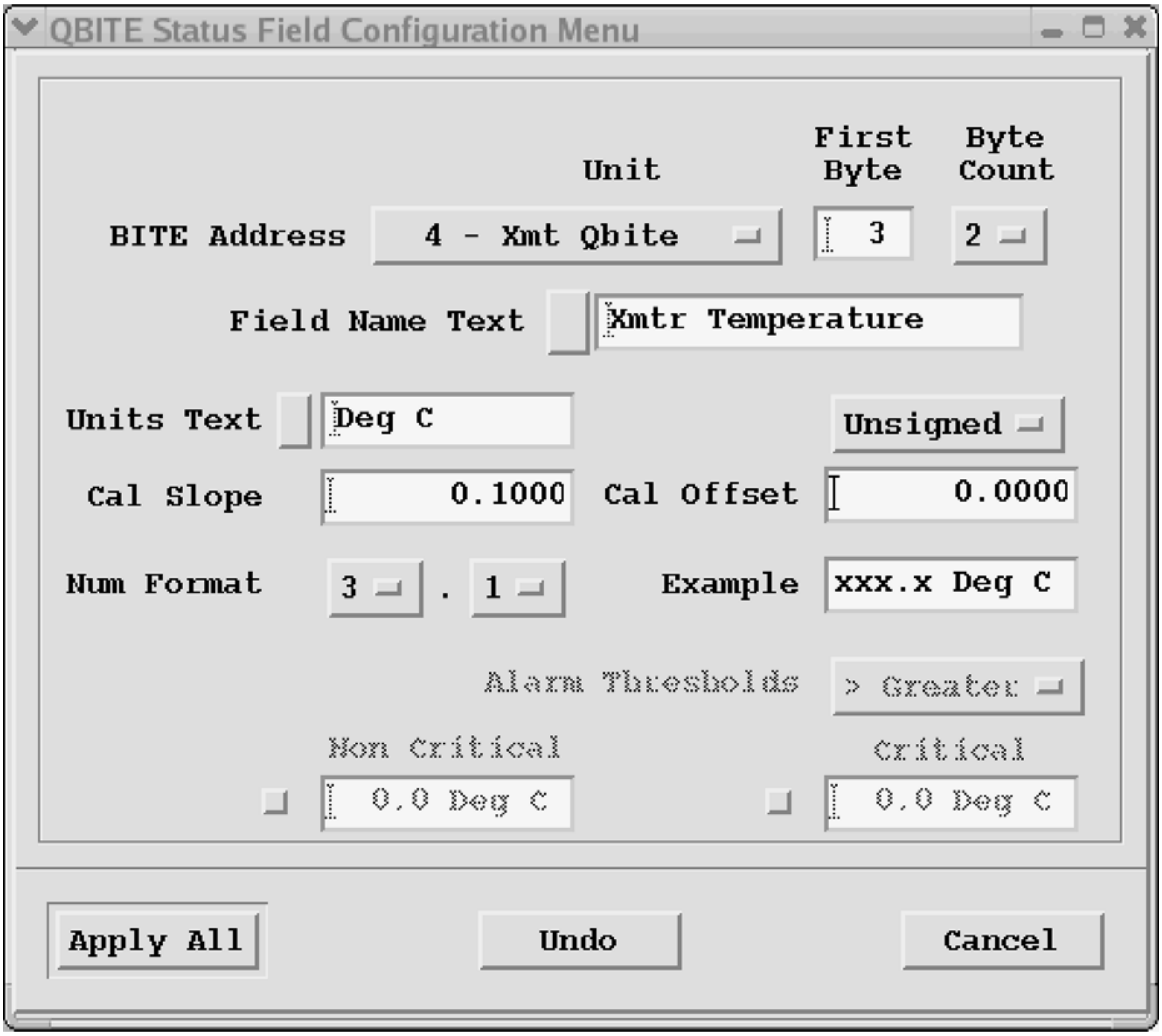
Normally Out / Normally In

This field selects the normal position of the button.

IRIS Flag

This field may be set to either "Yes" or "No". When set to yes, this causes a message to be sent to IRIS whenever the state of the button changes. This message is put into the message log and status product. Setting the button to No disables this feature.

5.5.4.3 Configuration of Status QBITE Points



Status QBITE data points are configured by right clicking on the data point. This setup feature is only available if **bitex** was started with the `-setup` option. Upon clicking, a the `QBITE Status Field Configuration Menu` is displayed. In QBITE, a quantitative value is passed. It is packet in the an integer number of bytes in the data packet, using 7 bits/byte.

BITE Address

The BITE address is used to specify exactly which bytes in the BITE packets from the RCP corresponds to this status item. The BITE address has three parts:

- Unit — Corresponds to the one of the "Receive Status QBITE" Units defined in the Bite Customization Menu.
- First Byte — For this Unit, what byte is used for this data point. Limited to a range between 3 and a customized number of bytes (N) minus 1 for this particular Unit (bytes 1, 2 and N are reserved).
- Byte Count — Specify the number of bytes to combine to get this binary value. Range 1–5.

Field Text Name

The text string that appear on this status data point that defines its meaning. This text can be up to 19 characters long.

Units Text

This is a short string to display right next to the QBITE value.

Cal Slope, Offset, and Signedness

The QBITE value is computed by first concatenating all the bytes together from the data packet. We then interpret this number a either a signed or unsigned integer, which is then multiplied by a slope, and an offset is added. Specify all this here.

Num Format

Here you can specify how many digits to show when displaying the QBITE value.

Alarm Thresholds

Controls fault generation. You can configure the system to generate both a critical and a non-critical fault based on the QBITE value. Specify here the threshold values and whether it should alarm on greater or less than the threshold.

CHAPTER 6
COLOR SETUP UTILITY

In this chapter:

6.1 Overview

The colors in the IRIS graphical displays are configured using the **color_setup** utility. There are two classes of colors that are used in the displays:

Data Colors	For displaying data values as color coded levels.
Special Colors	Used for overlay lines, text, centroids, wind barbs, etc.

There are several concepts that are useful to understand when configuring the colors:

Color Set — This is a group of up to 16 colors used for displaying data. A color set can be used for several different data types and color scales. IRIS supports up to 8 different color sets. For example, one may be used for positive data such as reflectivity or rainfall rate, while another may be used for signed data such as velocity of shear.

Color Scale or Legend — This is a user defined set of numeric values for the color scale, as well as which color set to use. Each data parameter (dBZ, R, V, TOPS, etc.) can have up to 8 custom color scales. The example in on page 113 is for velocity.

Typically, the color sets and color scales are not changed very frequently. Access to **color_setup** requires operator privilege. Observers can select different color scales and make their own uniformly-spaced color scales in the Quick Look Menu.

CAUTION	Caution: Changes to the color palette, color sets and color scales will effect all displays. Operators should coordinate changes with the system manager.

6.2 Starting color_setup

Command typed in terminal window as operator

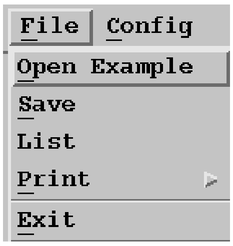
```
$ color_setup
```

The Color Configuration Menu will appear on the screen as show in on page 113.

6.3 Configuring a Color Scale

The Color Configuration Menu is used to configure the numerical data values that are associated with each color band. The menu fields are described below.

File Menu



Open Example—Loads an example color scale for the selected data parameter (for example, velocity, dBZ, etc.). The numerical values of the color seams for all of the examples correspond to the suggested default values that are given at the end of this section.

Save—Saves to disk the modifications to the current color scale. For changes to take effect, restart those applications.

List

Print—Creates an X-window dump of the menu you are running, as follows:

- **Print** > **To Printer**—Sends the output to the Postscript or color printer specified in the Printer Setup menu.
- **Print** > **To File**—Sends the output to a file in your default home directory.
- **Print** > **Setup**—Lets you configure the printer on your system (see the *Software Installation Manual* for details).

Exit–Exits from the **color_setup** utility. If you have not saved your changes, you are prompt to save or cancel your changes.

Config Menu

Color Set Editor—Opens the Color Set Editor

Special Color Editor — Opens the Special Color Editor

HydroClass Name Editor—Opens the HydroClass Name Editor

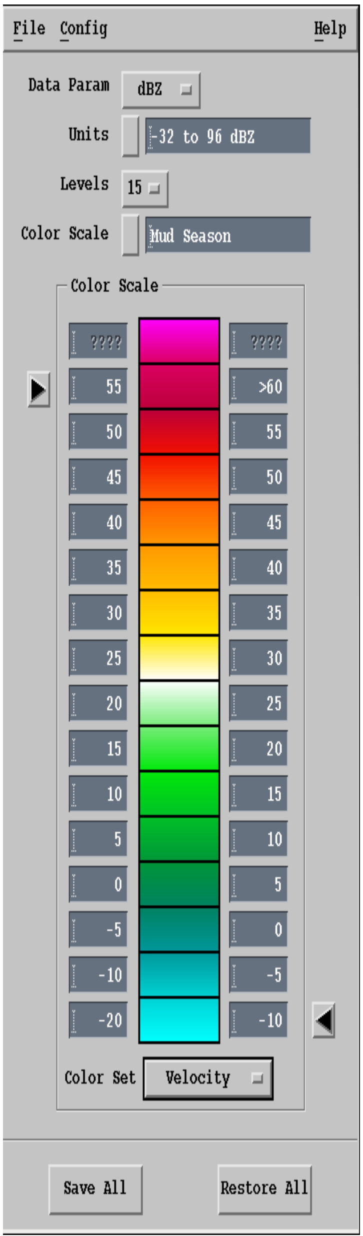


Figure 3 Color Configuration Menu Example for Velocity

Data Params V

Units +–Vu m/s

The first step is to select the data parameter for which you would like to make a color scale. The choices are:

Parameter	Signed (+_) or Positive	Description, Units, and Method
dBZ	Positive (Z)	dB of radar reflectivity factor in $mm^6\ m^{-3}$
R	Positive	Rainfall rate in mm/hr or inches/hr
V	Signed	Velocity in m/s
W	Positive	Spectrum width in m/s
VIL	Positive	Vertically integrated liquid in mm
Height	Positive	Echo top height in km
Rain	Positive	Rain accumulation in mm
Shear	Signed	Wind shear in (m/s)/km
VILDen	Positive	Density of VIL
ZDR	Signed	Differential reflectivity (optional) in dB
KDP	Positive	Specific Differential Phase in degrees/ km
User		
PHI	Positive	Differential Phase in degrees
RHO	Positive	Cross-correlation scalar (0..1)
SQI		Signal Quality Index scalar (0..1)
LDR	Positive	Linear Depolarization Ratio in dB
Time	Positive	Time
Turb	Positive	Turbulence
Temp	Signed	Temperature
Albedo	Positive	Albedo
HClass		Enumerated Echo Classification method dependent indexing (0..8)

The units for these quantities and range of values is displayed in the **Units** field. The table above also indicates whether these quantities are treated as signed or positive only numbers, or as enumerated class identifiers. Note that dBZ can actually be negative if Z is less than 1 since it is a dB value.

The number of levels in your color scale can be 2 to 16. Typically:

When you change the number of levels to be less than the maximum of 16, the unused levels will be desensitized. Also, the top end point indicator will shift.

Color Scale **Default**

This is to select existing color scales for editing or to create new ones. Up to eight are allowed for each data parameter. One of them must be named 'Default'. This leaves seven arbitrary names to be determined by the user. The button displays the following menu:

Default
Summer
Winter
Air Force
New
Delete

<**file name**> — Click on an existing Color Scale name to examine or edit it.

New — Select new to create a new name. If you already have 8 Color Scales names, then you will need to delete one before creating a new one. You can rename an existing one by calling it up and then editing the name.

Delete — Gives you a list of color scale names that can be deleted. Restrictions are:

- The current color scale name cannot be deleted.
- The Default color scale name cannot be deleted.

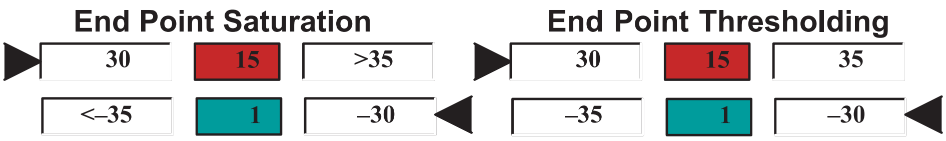
NOTE	Note: You can rename a Color Scale by simply editing an existing name. The old name will be replaced by the new name.

NOTE	Note: When you first enter the Color Configuration Menu, the Default Color Scale is always loaded. You can change the values of this Default but you cannot delete it. For convenience, set the Default scale to be something that you use frequently.

Color Set **Signed**

Select the Color Set name. The Color Set determines the order of colors from top-to-bottom. There are 4 four available Color Sets, one of which must be named Default. Refer to 6.4 Configuring a Color Set on page 117

for more information on color sets.



At the end points of the scale (top and bottom) you can configure the behavior to do either of two things:

Saturate This displays all values outside the last seam as the boundary color. The left example above shows both the bottom and the top using saturation. This is indicated by the > and < signs.

Threshold This choice uses a fixed value as the outside limit. In this case, values beyond the fixed value (either too high or too low) are not displayed. The right example above shows the case for thresholding at the top and the bottom.

The thresholding/saturation choice is toggled by clicking the arrow sign. If you select thresholding, type in the appropriate boundary value. The top and the bottom behavior can be specified separately.

NOTE Hint: For positive-going scales (e.g., dBZ, tops, VIL, R, etc.) use thresholding at the bottom and saturation at the top. This will let you eliminate weak echoes from the display, while allowing you to see all of the very strong echoes.

NOTE Note: The uniform step color scales that can be configured interactively in the Product Configuration Menu and the Quick Look Menu will use whatever end-point behavior that you specify for the Default Color Scale.

Entering Color Scale Seam Values

The color scale values are most easily entered by

- Entering the lower left value first (if you are using thresholding).
- Entering the remaining seam values starting at the bottom right and working upwards in the right column Note that the values in the left column will be filled-in automatically.

If a data value exactly matches a color scale seam, it will be displayed as if it was above the seam. So everything >= the lower seam and < the higher seam is included in a color interval. The values that are entered will be formatted in the same manner as they will be for the actual legends in the color display. The formatting is automatic to make numeric displays easily readable, i.e.,

- Trailing zeroes are suppressed whenever possible. However, if there is a value with 10ths such as 1.1, then the trailing zeroes are used (e.g., 5.0 rather than 5) for better text alignment.
- In most cases two significant figures are shown in the legend, provided that the data type supports it and that it does not cause incidental trailing zeroes.

Save All **Restore All**

After you have made your changes, use Save All to save your results. Note that **File–>Save** accomplishes the same thing. If you try to exit without saving, you will get a prompt to save or cancel your changes.

If you change your mind and want to start over, click Restore All. This will restore the values that were last saved.

6.4 Configuring a Color Set

To change a color set or create a new one (the order of the colors) click **Config–>Change Color Set**. This will take you to the Color Set Configuration Menu. If you had made changes to the color scale, you will be prompted to first save or cancel your changes. The Color Set Configuration Menu will appear as shown in on page 118.

The menu shows the current color set. Each color cell can be either a solid color, or a gradient color which changes continuously to the next value. The buttons on the right of the colors select this. If the button is pressed in, then the color cell is gradient. For all gradient colors, the color at the top seam is set to the same value as the bottom color of the cell above.

To change the colors in the color set, highlight the color level that you want to change and use the scroll bars ath the top to change the RVB values. Your change will be reflected instantly in the color set (and in the color scale in the main menu as well). Note that you can select either the top or bottom of each color cell to adjust. For solid colors, either selection changes the whole cell.

There can be up to 8 color sets, one of which must be named 'Default'. This leaves three set names to be defined by the user.

In the File menubar there are some suggested example color sets for several of the common data types in IRIS. There are two sets of examples, one for gradient colors and one for solid colors.

The procedures for creating, renaming and deleting color sets are identical to those for color scales as described in the previous section.

When you are done, select **File–>Close**. If you did not save your changes you will get a prompt to save or cancel your changes prior to closing.

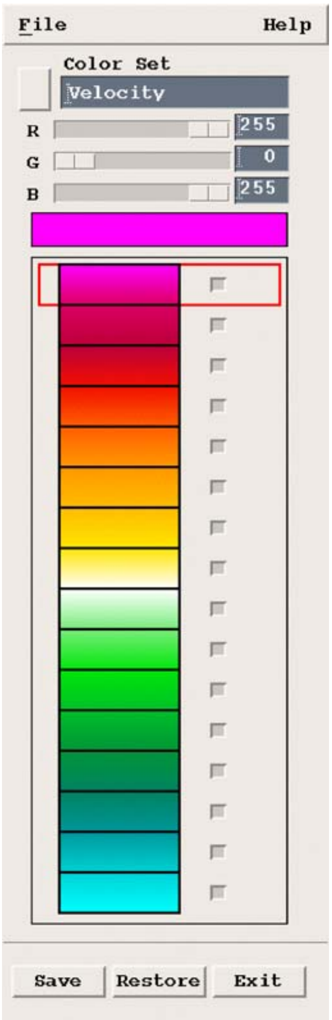


Figure 4 Color Set Configuration Menu example for velocity

6.5 Configuring the Special Colors

Special colors are used for non-data items in the display such as overlays and legends. The table below lists the special colors, their use and some typical values.

Name	Description	Default	R	G	B
Legend Background	Background behind the legend text	Black	0	0	0
Legend Text	Text on the legend background	White	255	255	255
Drop Shadows	Shadows cast underneath echoes for 3D look	Black	0	0	0
Overlay Level 1	Layer 1 lines typically used for geography	Black	0	0	0
Overlay Level 2	Layer 2 lines, e.g., rivers, roads, political	Gray	128	128	128
Overlay Level 3	Layer 3 lines, e.g., rivers, roads, political	Green	0	255	0
Overlay Text Background	Background color for text on the overlay	Tan	196	196	128
Underlay #1	To overlay areas, typically land color	LtBrn	212	155	95
Underlay #2	To overlay areas, typically sea color	Blue	117	117	199
Underlay #3	To overlay areas, typically special areas	Tan	170	155	95
Centroid Ellipses	Fill color for warning centroids, typically bold	DkPink	200	100	220
Blink	Blinking data will alternate with this color	Red	255	0	0
Track Line	Track lines drawn in this color	Black	0	0	0
Highlight	Forecast arrows and protected area hits	White	255	255	255
Shear Line	Shearlines drawn in this color	Black	0	0	0
Wind Barb Color	Wind barb displays	Black	0	0	0
Range Ring Color	Range ring overlays	Black	0	0	0

To configure the special colors click **Config**–>**Set Special Colors** in the Color Configuration menu (main menu). This will bring up the color configuration menu. Use **File**–>**Open** example to get the sample values that are listed in the table above.

6.6 Configuring HydroClass Names

The color scale for HydroClass data is different. In this case, data is not a continuous scale, but instead each numerical value corresponds to an index of a discrete class. The user can customize the class indeces to be displayed. The HydroClass Name Editor (on page 120) allows them to define a name for each class (text to display on the legend). The meanings (associations with a class) of the HClass numerical values is specific to each classification method, as described in *sig_data_types.h*.

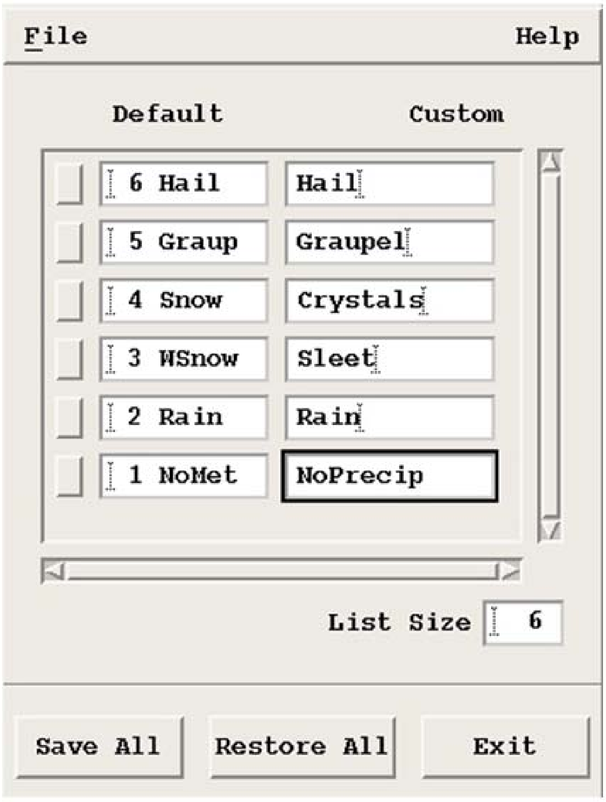


Figure 5 HydroClass Name Editor

In this menu, you select the IRIS default name on the left column, and type in your own custom name on the right. Names are limited to 8 characters. You can use this to name a new class, or to change the language of an existing class.

6.7 Example Values to Get Started

To make it easier to start your operation, example values are supplied for all menus. These are intended as examples only. You can use these until you get a feeling for the climatology and your particular application. The examples are summarized below.

Color Scales

The default color scales are loaded in the Color Configuration Menu. First select the Data Parameter that you went (e.g., dBZ, R, etc.), then click **File**–>**Open Example**. The table below gives the examples for each data type.

Reflectivity-dBZ (mm^6/m^3)				Rainfall-Rate R (mm/hr)		
Level	**Start**	**Stop**		**Level**	**Start**	**Stop**
16	66	>72		16	500	>800
15	60	66		15	200	500
14	55	60		14	100	200
13	53	55		13	80	100
12	50	53		12	50	80
11	44	50		11	20	50
10	39	44		10	10	20
9	37	39		9	8	10
8	34	37		8	5	8
7	28	34		7	2	5
6	23	28		6	1	2
5	21	23		5	0.8	1
4	18	21		4	0.5	0.8
3	12	18		3	0.2	0.5
2	7	12		2	0.1	0.2
1	2	7		1	0.05	0.1

Rain Accumulation — Rain (mm)				Vertically Integrated Liq — VIL (mm)		
Level	**Start**	**Stop**		**Level**	**Start**	**Stop**
16	800	>1100		16	32	>34
15	500	800		15	30	32
14	200	500		14	25	30
13	100	200		13	20	25
12	80	100		12	15	20
11	50	80		11	8	15
10	20	50		10	6	8
9	10	20		9	4	6
8	8	10		8	2	4
7	5	8		7	1	2
6	2	5		6	0.8	1
5	1	2		5	0.6	0.8
4	0.8	1		4	0.4	0.6
3	0.5	0.8		3	0.2	0.4
2	0.2	0.5		2	0.1	0.2

Rain Accumulation — Rain (mm)				Vertically Integrated Liq — VIL (mm)		
Level	**Start**	**Stop**		**Level**	**Start**	**Stop**
1	0.1	0.2		1	0.05	0.1

Velocity -V (+ is away in m/s)				Spectrum Width (W in m/s)		
Level	**Start**	**Stop**		**Level**	**Start**	**Stop**
16	30	>35		16	5.5	>6.0
15	25	30		15	5.0	5.5
14	20	25		14	4.5	5.0
13	15	20		13	4.0	4.5
12	10	15		12	3.5	4.0
11	5	10		11	3.0	3.5
10	2	5		10	2.5	3.0
9	0	2		9	2.0	2.5
8	-2	0		8	1.5	2.0
7	-5	-2		7	1.0	1.5
6	-10	-5		6	0.8	1.0
5	-15	-10		5	0.6	0.8
4	-20	-15		4	0.4	0.6
3	-25	-20		3	0.2	0.4
2	-30	-25		2	0.1	0.2
1	<-35	-30		1	<0.0	0.1

Wind Shear– Shear (m/s/km)				Echo Tops– Height (km)		
Level	**Start**	**Stop**		**Level**	**Start**	**Stop**
16	20	>25		16	???	???
15	15	20		15	16	>17
14	10	15		14	15	16
13	8	10		13	14	15
12	6	8		12	13	14
11	4	6		11	12	13
10	2	4		10	11	12
9	0	2		9	10	11
8	-2	0		8	9	10
7	-4	-2		7	8	9
6	-6	-4		6	7	8
5	-8	-6		5	6	7
4	-10	-8		4	5	6
3	-15	-10		3	4	5
2	-20	-15		2	3	4
1	<-25	-20		1	2	3

Specific Differential phase – Kdp (deg/ km)				Differential Phase – PHI (deg)		
Level	**Start**	**Stop**		**Level**	**Start**	**Stop**
16	20	>33		16	169	>180
15	7.0	20		15	157	169
14	3.1	7.0		14	146	157
13	2.4	3.1		13	135	146
12	1.7	2.4		12	124	135
11	1.1	1.7		11	112	124
10	0.75	1.1		10	101	112
9	0.50	0.75		9	90	101
8	0.33	0.50		8	79	90
7	0.22	0.33		7	68	79
6	0.15	0.22		6	56	68
5	0.10	0.15		5	45	56
4	-0.10	0.10		4	34	45
3	-0.20	-0.10		3	23	34
2	-0.40	-0.20		2	11	23
1	<-.80	-0.40		1	<0	11

Signal Quality Index – SQI (no units)				Depolarization Ratio – LDR (dB)		
Level	**Start**	**Stop**		**Level**	**Start**	**Stop**
16	0.94	>1		16	0	>2
15	0.87	0.94		15	-2	0
14	0.81	0.87		14	-4	-2
13	0.75	0.81		13	-6	-4
12	0.69	0.75		12	-8	-6
11	0.62	0.69		11	-10	-8
10	0.55	0.62		10	-12	-10
9	0.50	0.55		9	-14	-12
8	0.44	0.50		8	-16	-14
7	0.38	0.44		7	-18	-16
6	0.31	0.38		6	-20	-18
5	0.25	0.31		5	-22	-20
4	0.19	0.25		4	-24	-22
3	0.13	0.19		3	-26	-24
2	0.06	0.13		2	-28	-26
1	<0.00	0.06		1	-30	-28

ZDR (db)				HydroClass		
Level	**Start**	**Stop**				
16	5.0	>6.0		16		
15	4.0	5.0		15		
14	3.5	4.0		14		

ZDR (db)				HydroClass		
Level	**Start**	**Stop**				
13	3.0	3.5		13		
12	2.5	3.0		12		
11	2.0	2.5		11		
10	1.5	2.0		10		
9	1.0	1.5		9		
8	0.8	1.0		8		
7	0.5	0.8		7		
6	0.2	0.5		6	6	Hail
5	0.0	0.2		5	5	Graup
4	-1.0	0.0		4	4	Snow
3	-2.0	-1.0		3	3	WSnow
2	-3.0	-2.0		2	2	Rain
1	<-4.0	-3.0		1	1	NoMet

Color Set and Palette Examples

In the Color Set Configuration Menu, click **File–>Open Example** and choose either the velocity example or dBZ example. This will load both a color palette and a color set. Note that the color palette is the same for both examples.

The velocity example shows a convenient color set for signed data. The dBZ example shows a convenient color set for positive data. You may want to save these as "Signed" and "Positive" for your general use.

The RGB values for the default color palette are given in on page 118.

Special Color Examples

In the Special Color Editor Menu, click **File–>Open Example**. This will load examples for all special colors.

CHAPTER 7
DSPX UTILITY

The **dspx** utility can be used to debug the interface hardware to the RVP6 or RVP7 signal processor, and to help in developing new software using the signal processor. It can help to localize a problem when the DSP is suspected of not performing as documented in the appropriate user's manual.

In this chapter:

7.1 Invoking Dspx

Command

```
dspx -nochat or dspx
```

7.2 Dspx Commands and Prompts

When started with the "–nochat" option, **dspx** displays a prompt such as:

```
[110] :
```

For parallel interfaces, the prompt shows (in binary form) the three status lines coming from the DSP. For SCSI interfaces, the prompt shows the equivalent information as obtained through SCSI bus queries. The least significant prompt bit, when 1, indicates that data is available in the DSP output FIFOs. The other bits are unused.

The list of available commands is shown in on page 126.

*****	Perform a complete power-up restart of the DSP.
***f**	Clear the DSP output FIFO.
***n**	Clear the measured noise levels.
chat	Access DSP setup terminal information. The terminal behaves as if it were a TTY plugged into the DSP through the serial edge connector.
d [n [m]]	Display *n* words starting at location *m*. The data are shown in both Hex and Signed Decimal format. Variations on the d command are: du which displays entirely in Unsigned Decimal, and dx which displays entirely in Hex.
q or e	Exit
f n m [#]	Fill, write *n*, *m* times, using DMA size #
gparm	Read the current "gparm" values, and print them in a format that is easy to read.
? or h	Help, print command summary
r [n [#]]	Read up to *n* words, DMA size #
rays	Display history for the last 40 rays that were processed. The table shows the starting and ending Azimuth and Elevation, the number of samples, and the processing time for each ray.
repeat [n]	Repeat line *n* times
w n [n n ...]	Write word
~ [t]	Sleep *t* milliseconds (default 1000)
! [n]	Reexecute last line *n* times
;	Command separator

7.3 Sample Dspx Session

Using the commands in the following sample session, you can manually request the internal processor parameters, and display them in numerical format. Refer to the *Signal Processor User's Manual* for a detailed listing of the available DSP opcodes.

```
$ dspx -nochat

Digital Signal Processor Examiner (DSP#1)

[110] : w 9

1 Words were written.
```

```
[111] : r

64 Words were received.

[110] : d

 0000/ 0:  e000 0096 07d1 e13e -8192  150    2001  -7874
 0004/ 4:  00b6 0780 0514 0000 182    1920   1300  0
 0008/ 8:  0000 0280 0000 0000 0      640    0     0
 000c/ 12: 002d a7d6 001e 0096 45     -22570 30    150
 0010/ 16: 0096 0000 00fa 7530 150    0      250   30000
 0014/ 20: 07d0 1770 2ee0 5dc0 2000   6000   12000 24000
 0018/ 24: 842b 0000 2710 2710 -31701 0      10000 10000
 001c/ 28: 07d0 07d0 0017 0666 2000   2000   23    1638
 0020/ 32: 000d fedf 0066 0050 13     -289   102   80
 0024/ 36: fd89 0005 001e 0000 -631   5      30    0
 0028/ 40: 0000 0000 0000 b3f6 0      0      0     -19466
 002c/ 44: 0033 007a 0000 0780 51     122    0     1920
 0030/ 48: 8000 0000 0000 0000 -32768 0      0     0
 0034/ 52: 0000 0000 0000 0000 0      0      0     0
 0038/ 56: 0000 0000 0000 0000 0      0      0     0
 003c/ 60: 0000 0000 0000 0000 0      0      0     0
```

The corresponding results of a `gparm` command can also be shown:

```
[110] : gparm

==================== GPARM Read Back ====================

Code Revision 14 Serial #: None

L-Status: 0x0000 I-Status: 0x0280 Diagnostics: 0x0000 0x0000

Current A/D Samples: I:5 Q:0 LOG:30

Requested Trigger: 600.00Hz Trig-Out: 600.00Hz Trig-In:
599.40Hz

Last PROC Starting and Ending rates: 600.00Hz, 600.00Hz

Maximum Trigger Rates: 3000.00Hz, 1000.00Hz, 500.00Hz,
250.00Hz

Trigger Count: 2014614 Wave: 0 PW: 0 PW-patterns: 0x842b

Bins in Range Mask: 150 Range Averaging: 1

Last AQ Bin Count: 150 Last Valid Bin Count: 150
```

```
AZ Tags: 0x6539 (142.34) EL Tags: 0x00b6 (1.00)

Noise Range: 250km Noise PRF: 200.00Hz

LOG Noise: 30.00 LENM: 30.00 LENSD: -512.00

I-Mean: 5.08 I-STD: 0.25 Q-Mean: 0.00 Q-STD: 0.03

SOPRM Flags: 0x0017

Thresholds: LOG: 0.81dB WSP: 5.00dB SQI: 0.40 CCOR: -18.06dB

LOG Slope: 0.400 Cal Refl: -39.44dBZ Sample Size: 45
```

The **chat** mode of **dspx** provides a very convenient method of accessing the internal setup information in the signal processor. You may enter **chat** mode directly by starting **dspx** without the "–nochat" argument, or you may enter it via the "chat" command. The former method is much more convenient.

In `chat` mode, you can access the TTY setup commands from the host computer, as if it were a terminal plugged directly into the DSP. When you are in `chat` mode, the normal square-bracket prompt disappears. Begin the dialog with the RVP7 exactly as you would on a real TTY, i.e., by typing the <ESC> key.

```
[110] : chat

<ESC>

SIGMET Incorporated, USA

RVP7 Digital IF Signal Processor Rev.B/13

-----------------------------------------

RVP7> ?

Command List:

F: Use Factory Defaults

S: Save Current Settings

R: Restore Saved Settings

M: Modify/View Current Settings

Mb – Burst Pulse and AFC
```

```
Mc – Board Configuration

Mf – Clutter Filters

Mp – Processing Options

Mt<n> – Trigger/Timing <for PW n>

Mz – Transmitter Phase Control

M* – Stand–alone Settings

M+ – Debug Options

P: Plot with Oscilloscope

Pb – Burst Pulse Timing

Ps – Burst Spectra and AFC

Pr – Receiver Waveforms

P+ – Visual Test Pattern

V: View Jumpers and Status

?: Cmd list (?? Settings list)

*: Power–Up Reset

Q: Quit

>
```

Refer to the *Signal Processor User's Manual* for a description of how to use the interactive TTY setup commands.

One of the more intriguing features of **dspx** is that it will generate an X-Window version of the oscilloscope plots that are produced by the RVP7 plot commands. The scope window will popup as soon as a plot command is entered, and the window will disappear when the plot command is exited. An example of a "ps" plot is shown below.

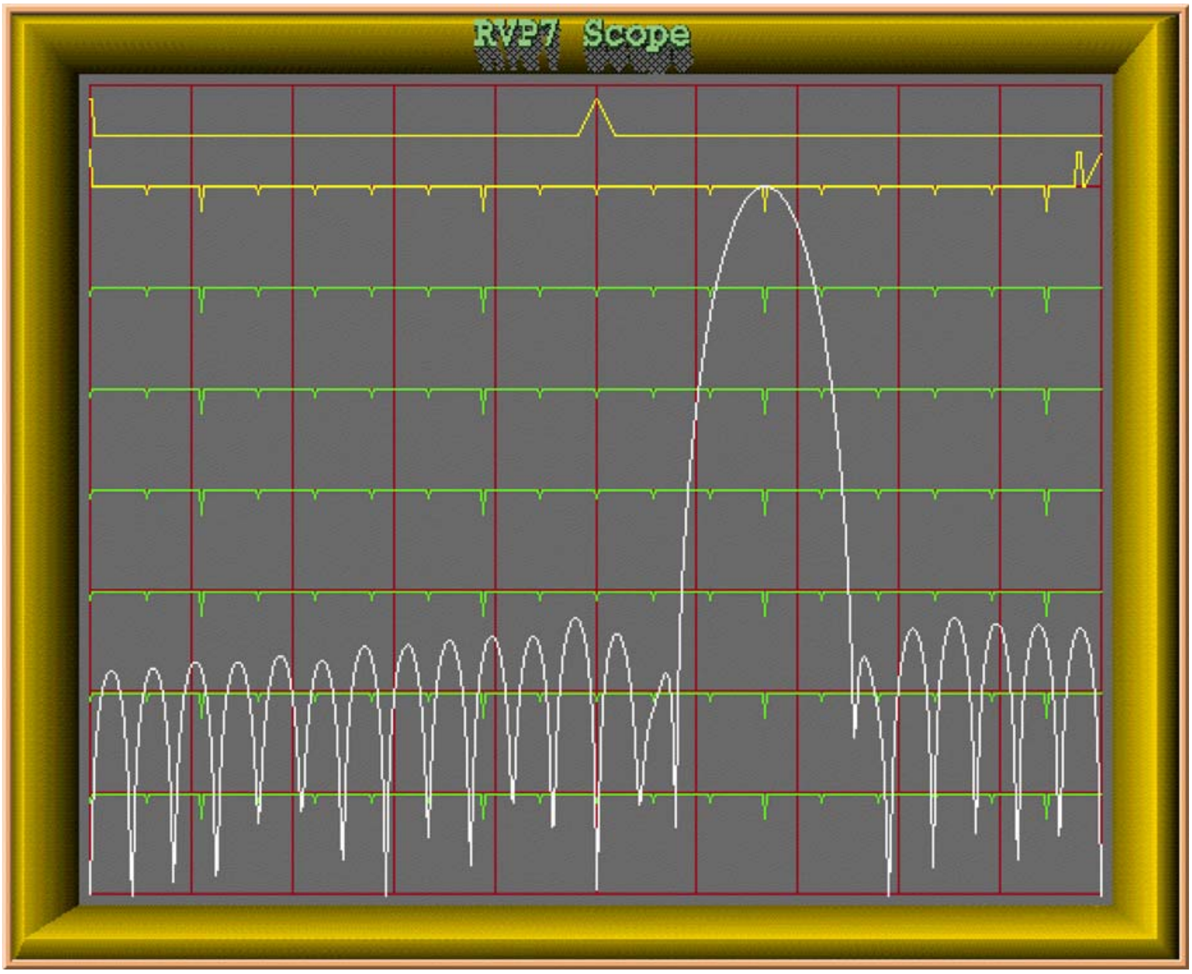
Before exiting from `chat` mode, disconnect the terminal from the DSP using the `q` command. **dspx** waits for you to press Ctrl/C, then returns to the **dspx** prompt:

```
> q

Exiting Setups...
```

```
^C

[110] :
```



CHAPTER 8
OVERLAY UTILITY

IRIS has a flexible overlay feature for drawing overlays, or maps displayed on top of other IRIS/Open products. Overlays are used for product output and the real-time display. The overlays used in product output are specified in the Overlay menu.

An overlay can consist of the following:

- Geographical and political boundaries displayed with or without latitude and longitude lines or range rings.
- Text strings to label areas of interest, such as cities.
- Bitmap Icons that can be constructed by the user and applied to the overlay. Icons can represent any feature, for example, airports, train stations, etc.
- The lines, text and icons mentioned above can be separated into different layers within the overlay file. Then at display time, either all or only a subset of these layers may be displayed giving yielding overlays that appear different based on which layers are active. Layers can be drawn in different colors.
- Underlays are filled regions of color displayed under the radar images where there is no weather data. Underlays are typically used to indicate areas of water.

Each overlay is defined in an ASCII file using a connect-the-dots approach (sometimes called a vector approach). This allows overlays to be drawn to any scale factor.

The **overlay** utility is an interactive tool to create and modify your own overlays. It works in a window on your workstation. Typically, you get the basic map (coastlines, borders, rivers) from SIGMET and fine tune it according to your local needs. It's often convenient to make separate layers for different interests (river catchments, airports). IRIS supports a maximum of 20 overlay files.

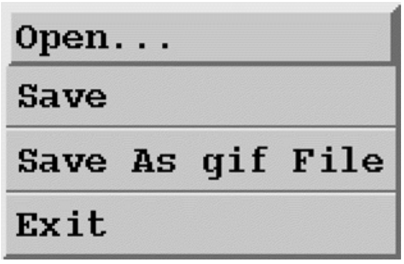
IRIS overlays are ASCII files so you can edit them with any text editor (vi, or emacs which is distributed with IRIS).

In this chapter:

8.1 Invoking Overlay

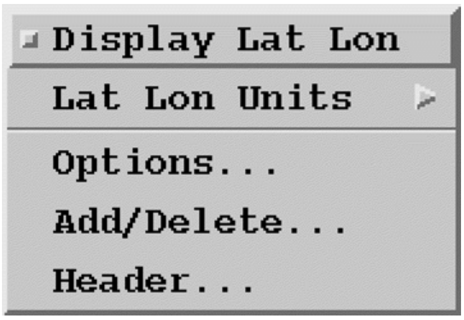
command: overlay

Overlay starts as a default with a empty window on your workstation and two menus: File and Options. Settings from your previous session are still valid when you restart. The File menu is shown in the figure below.



Your first action is to open a .ovr file. Overlay files in use on are stored on disk in a directory called /usr/sigmet/config/overlay. The Product Output process always looks for overlay files in that directory. Then you want to see some options.

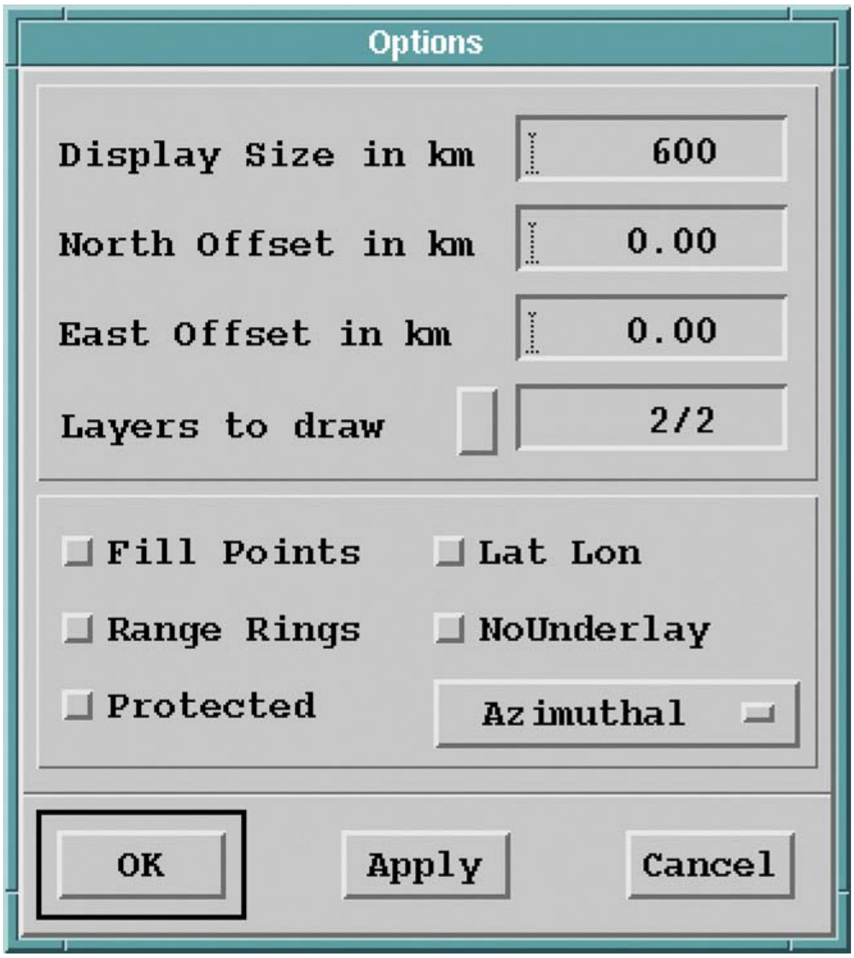
Then you want to see some options.



The first box lets you see the latitude and longitude of your cursor. You can move your cursor around your map with the mouse, but when you want to find a precise point it's often easier to use the arrow buttons of the keyboard which let you move pixel by pixel.

On the second line, you can select the mode to show latitude and longitude: either as degrees and decimals or degrees, minutes and their decimals.

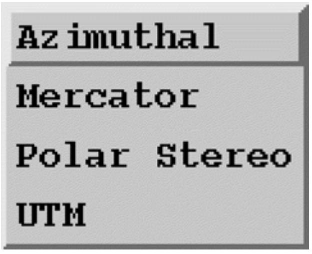
From the third line, you get a menu shown below



In the first box you define the horizontal size of the map in km. Two next ones let you move around your original map and create subareas. Layers to draw defines if you want to work with all of your map layers or only a subset.

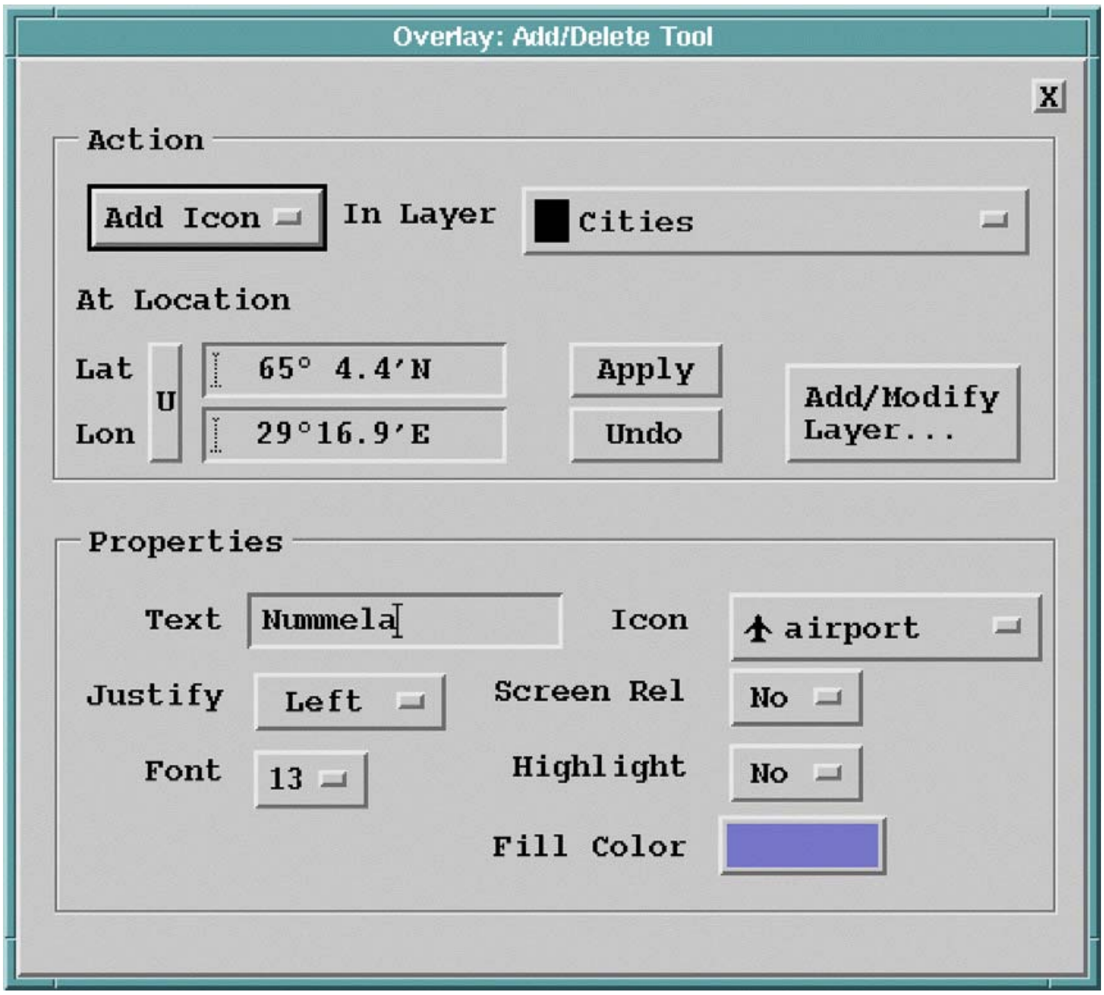
In the lower part, you can tick six options to be shown:

- Fill points indicate the areas, typically lakes, you want to be colored with a certain color.
- Lat Lon gives a latitude-longitude grid
- Range Rings are centered at a predefined point, typically a radar site
- NoUnderlay
- Protected are the areas you use with he WARN product
- The Projection menu lets you select the map projection from a menu

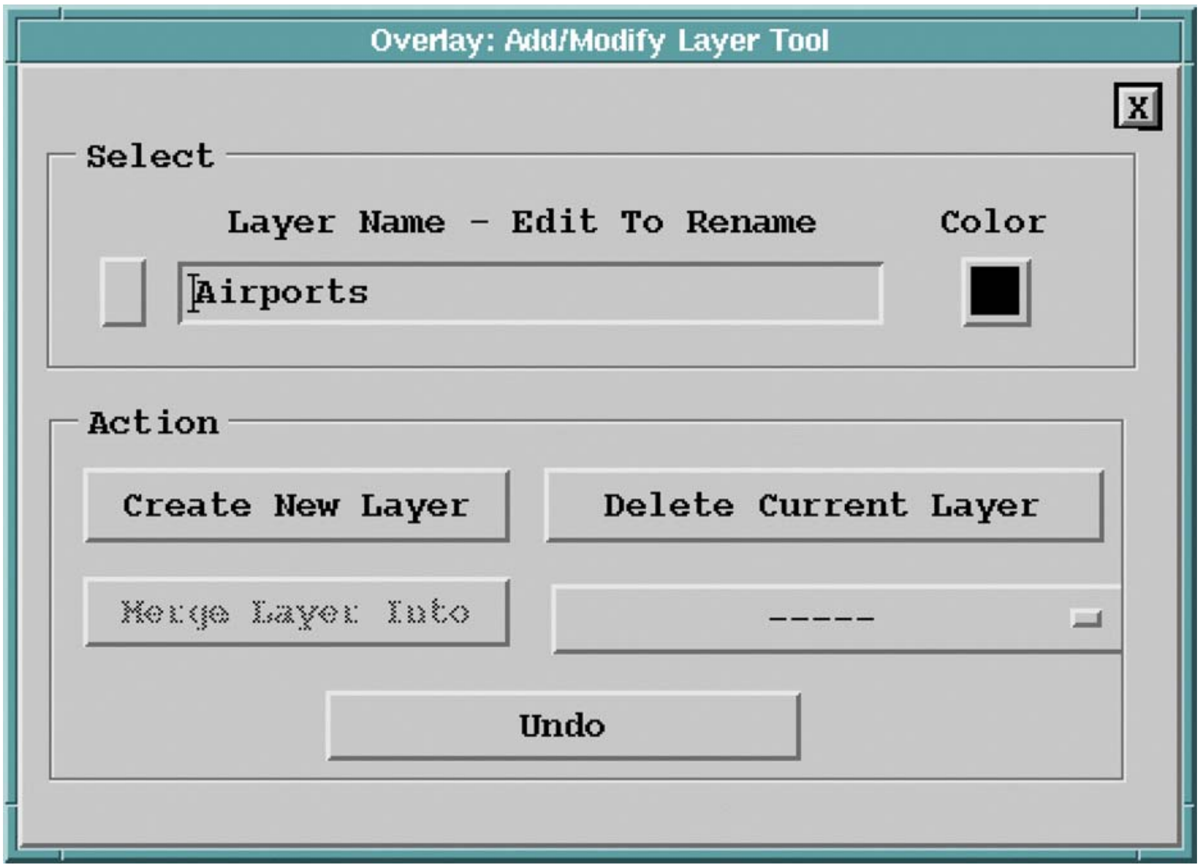


Projections are discussed in detail elsewhere in the manual. Typically, Azimuthal is used in one–radar applications, Mercator in composites in the tropical areas and Polar Stereographic in the composites near the poles.

Next item in the Options menu is the tool to add and delete things. You can add or delete text, icons and fill points. Besides you can select "pointer" which gives you position of you cursor.



Each thing you add goes to a layer. Each layer is in one color, shown in a box next to the layer name. You can create more layers and modify them with the Add?Modify layer tool. Here you can select a color from predefined set. If you want to define more colors use the **color** utility. You can merge two layers by selecting the target layer to the down right bar (shown as with – – – in the figure).

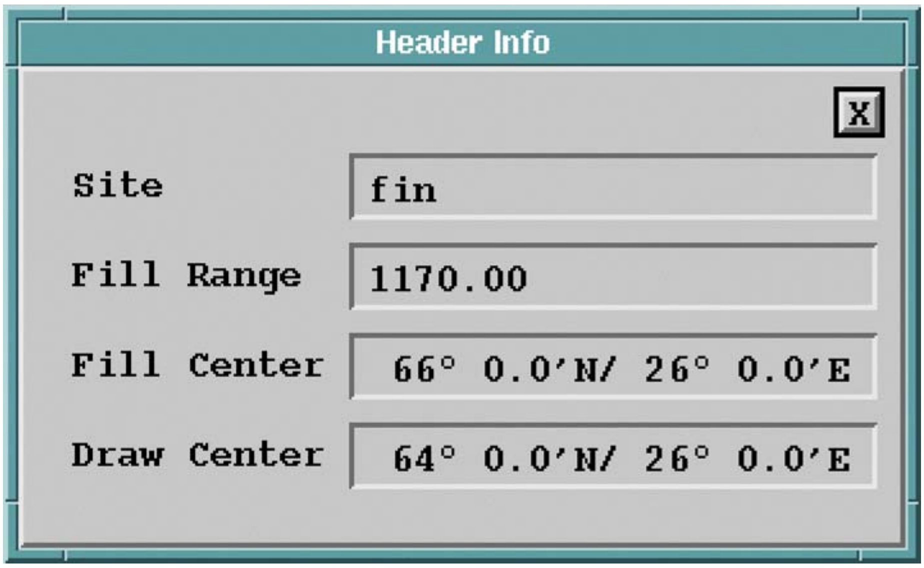


Adding icons includes a text attached to the icon, while text is just plain text. You probably want to justify text to center, so that the point shown with latitude and longitude in the upper column is under the middle character of your text. When you use icons, it's better to justify them right or left, because the icon goes to the point and the text should be next to the icon. You can highlight the text which gives it a colored background.

Fill points are used to make an underlay. An underlay is a range with outer boundaries, a filled area, and a color number specifying the color to use for the filled area. An underlay can contain up to 400 fill points. **Overlay** starts from each of the specified fill points and fills all contiguous areas, stopping at overlay lines. It is fine to enter many fill points for the same filled region. In fact, this is required for a coastline with deep bays, so that the region fills correctly at all scales.Many overlays contain coastline and use a blue underlay for ocean. To prevent the filled color from leaking around the edge of the overlay limits, use the RANGE command to tell **overlay** how far you have drawn your overlay.

When you select a Kill option, your cursor becomes a killer tool and you can delete items from the map by pointing and clicking them. There is a separate kill tool for text, icons and fill points to minimize the risk you kill something you didn't want to kill. If you can't kill what you want, you are probably working with a wrong layer.

Last item in the options menu is a header info panel. It gives you info about the overlay file header, described at 8.4.1 Overlay Header on page 141



8.2 Listing and Printing Overlay Files

Overlay files in use on are stored on disk in a directory called IRIS_OVERLAY. The Product Output process always looks for overlay files in that directory.

To see a list of the overlay files stored on your system, issue the following commands from the operating system prompt:

```
$ cd $IRIS_OVERLAY
```

```
$ ls
```

Overlays for many of SIGMET's IRIS sites are included in the release in the IRIS_ROOT/config_template/overlay directory. **overlay** will default to the IRIS_OVERLAY directory, unless you specify a path in the filename.

The overlay directory should contain only overlay files. Do not use it to store any other kinds of file. In addition, SIGMET recommends that you follow these file naming conventions for any overlay files that you create:

- Use the .ovr suffix or file extension to denote overlays. The Product Output process uses only these files. The **overlay** utility uses files with this extension by default. That is, if the file has the .ovr suffix, you do not need to type the suffix when you display it using **overlay**.
- Use .xbm to denote bitmap overlay icons that are referenced within the overlay files.

Because overlays are ASCII files, you can print them on your system printer.

8.3 Viewing an Overlay with overlay

The overlay template directory contains a file called sample.ovr. It contains some text strings, a simple overlay area, and an underlay area. Later in this chapter, you will see how this sample overlay is defined. Look at it now using the **overlay** utility.

To display sample.ovr:

1. Run the **overlay** utility, specifying the name of the overlay file, as follows:

```
$ cd ${IRIS_ROOT}/config_template/overlay
$ overlay ./sample
```

Overlay processes the file, which may take several seconds. If you supplied the "-v" option, it will respond with summary statistics as follows:

```
12 (max 40) icon files, using 311 (max 12000) bytes:

0: dot9.xbm         1: dot7.xbm         2: dot13.xbm
3: airport.xbm      4: beacon.xbm       5: test.xbm
6: building.xbm     7: golf.xbm         8: hospital.xbm
9: park.xbm         10: poi.xbm         11: train.xbm

Processing Overlay file.
10 (max 200000) points, 25 (max 400) strings, 9 (max
4000) fill points and 0 (max 10) gifs
1 (max 32) named layers:
0: Default
Site Draw center: 42¯24.0'N 71¯ 6.0'W
```

```
Fill center: 42¯24.0'N 71¯ 6.0'W
```

This summarizes the icon files found, then the number of end points, text strings, and fill points in the selected overlay. Finally the latitude and longitude of the draw and fill center are shown. **Overlay** always draws range rings centered at the draw center, while the Product Output menu aligns it with the radar.

2. **Overlay** displays the overlay on the screen in using the colors specified in **color_setup**, as shown in on page 140. Optional range rings or a latitude and longitude grid are drawn in green.

   Filled areas have a maximum range, which is specified in the file. A circle is drawn at that range, the underlay areas are filled, then the circle is removed.

3. When you have finished looking at the overlay file, return to the terminal or window where you invoked **overlay** and press CTRL/C.

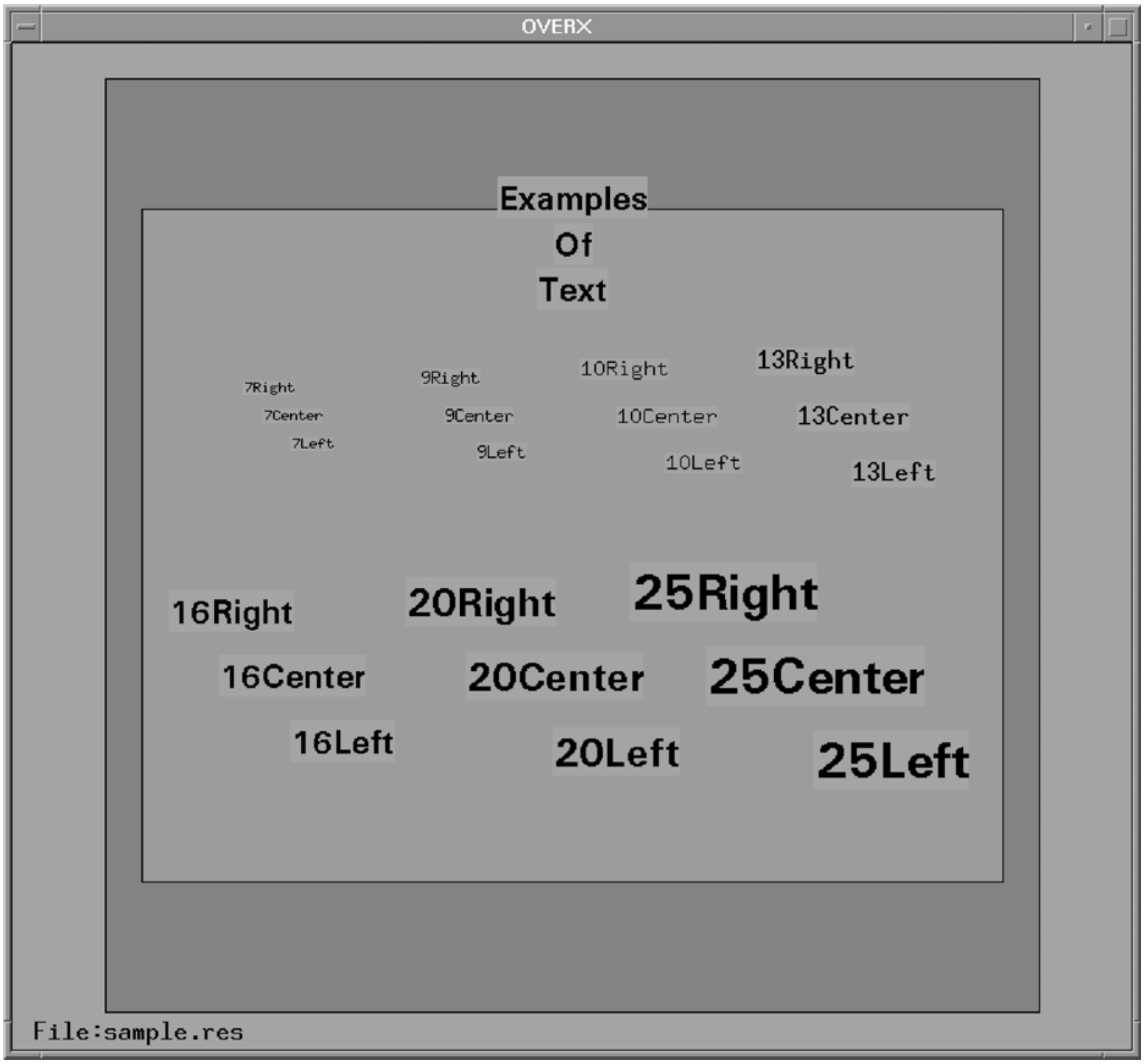


Figure 6 Sample Overlay Display

8.4 Format of Overlay Files

When creating an overlay, you must transfer the points from a map to an overlay file. There are two major paths available to you when building an overlay file. These are either **Absolute**, or **Relative** coordinates.

Overlay files are defined with a special syntax. A small set of simple statements specify the location of the radar and place the text or lines on the map. A semicolon (;) marks the beginning of a comment line. The END statement marks the end of the map. Anything that appears in the file beyond the END statement is ignored. It is sometimes helpful during editing to put an END in the middle of a file, so that **overlay** plots only the map lines and text up to that point.

8.4.1 Overlay Header

If the overlay is defined in absolute coordinates all points in the overlays are given in terms of a LONGITUDE, LATITUDE coordinate pair. This of course sets an absolute position for each point. When using absolute coordinates, the following header commands must be included at the top of the overlay file:

PROJECTION latlon	Informs system overlay is in absolute coordinates.
DRAW_CENTER *lon lat*	Tells **overlay** where to center the image. Generally this is the either the coordinates of the radar site, or a nearby special area of interest (i.e. an airport being monitored).
FILL_CENTER *lon lat*	Specifies center of fill area. Typically this is the center of the array of data points you have generated.
FILL_RANGE *range*	Sets the maximum range that the underlay covers, in km. **overlay** draws a circle at this distance from the fill center before filling the underlay.

If the overlay is defined in relative coordinates, all points are defined in terms of "map units". Map units are any arbitrary unit of measure that is E/W and N/S of an origin (0,0), which can be anywhere on the map. Often millimeters from graph paper are used to designate the points on a map. The map must be in azimuthal equidistant projection, with the specified reference point. A scale factor specifies the conversion between these map units and distance on the surface of the earth. The **"RADAR x y"** command is used to specify the location of the reference point in the map units. The **"SCALE n"** command must also be used to specify how many kilometers each map unit specifies. For example, if a **RADAR 100 200** and a **SCALE 0.5** command are used, then if later a point is specified as **POINT 110 200**, this point will be exactly 5km due east of the reference position. In summary, the following headers commands must be defined at the beginning of an overlay file when using relative coordinates:

PROJECTION aed	Informs system overlay is in relative coordinates.
SCALE *scale*	Sets the scale factor in km/map unit.
RADAR *x y*	Sets the projection point in map units.
REFERENCE *lon lat*	Sets the projection point in absolute coordinates.

DRAW_CENTER *lon lat*	Same as latlon projection above.
FILL_CENTER *lon lat*	Same as latlon projection above.
FILL_RANGE *range*	Same as latlon projection above.

For backwards compatibility, the old **MIDDLE** command still has the meaning of setting both the draw center and the fill center.

8.4.2 Text Strings and Bitmap Icons

You can place many strings of text on the overlay. Use the full ROMAN8 character set. If you wish to include imbedded spaces, please enclose the string in double quotes (").

You can place text on the overlay in terms of map units, specifying the justification — left, center, right, top, or bottom. The justification remains in effect for all subsequent strings until another justification is specified.

You can also choose to place text on the overlay relative to the edge of the display screen. In these cases, the position is in 10000ths of the screen measured from the lower left corner. For example, a location of (5000, 500) is in the middle near the bottom.

Appearance statements:

SIZE #	Set the text size in pixels, range 7 – 26.
HIGHLIGHT	Use highlighted text (reverse video).
NORMAL	Use normal video text.

Map units justification statements:

TOP	Text is top-justified.
BOTTOM	Text is bottom-justified.
LEFT	Text is left-justified.
RIGHT	Text is right-justified.
CENTER	Text is centered.

Screen-relative justification statements:

SCN_CENTER	Text is centered relative to the screen.
SCN_LEFT	Text left-justified relative to the screen.
SCN_RIGHT	Text is right-justified relative to the screen.

String location and content statements:

TEXT *x y str*	Places the text *str* at the specified location.
ICON_TEXT *str*	Same as above TEXT command, but *str* is placed next to the bitmap icon specified in the most recent ICON command.
TEXT *x y str1 str2*	Places the text *str1* at the specified locations.The text *str2* is available in the tabulation key in the display options menu. Generally *str1* is a short abbreviation that fits cleanly on the screen and *str2* is the full string that is not printed on the screen, but is available in the tabulation.
ICON_TEXT *s1 s2*	Same as the above TEXT command, but *s1* is placed next to the bitmap icon specified in the most recent ICON command.

Icon command:

ICON *x y name*	Places bitmap icon specified by *name* at position *x y*.

The bitmap icons that iris supports are black and white icons (.xbm files). Color icons are not supported (.xpm files). Icons can be edited using the icon editor that comes with the UNIX system. Icons of any size are supported by iris, but using large icons would not be practical. The user will find that as icons get larger than 16 by 16 pixels, they tend to take up too much screen real estate. Once icons are edited in the icon editor, the xbm files should be placed in the $IRIS_OVERLAY directory and overlay files can make reference to them by name.

8.4.3 Map Outlines

An overlay typically consists of a lot of lines. You draw a line by specifying the beginning and ending points. The GAP statement denotes a break in the line.

Outline statements:

POINT *x y or x y*	Places a point at the specified coordinates along an overlay line; expressed in map units.
GAP *or* *****	Marks the end of an overlay line.

8.4.4 Layer Functions and Command

Overlay files can be composed of a single layer, or divided up into up to 32 different layers. When only a single layer is used, the complete overlay is always displayed (this includes all lines, text and icons). When multiple layers are defined, any combination of any number of the layers can be displayed at runtime. For example, there may be a main layer called coastlines that is always displayed, then there may be other layers such as roads, rivers, power plants, etc. that can be turn on or off individually. Each layer can contain lines, text and icons, but does not need to contain all three. When defining layers in an overlay file, all entries in the file that occur after the initial layer command are applied to that layer. This continues sequentially through the file until either the file ends, or another layer command is encountered. Below is the summary of the two command associated with layer definitions:

LAYER *name*	This defines a layer called *name*. All commands following in the overlay file (until another LAYER command is encountered) are applied this this layer. This layer can be enabled at run time by selecting its *name* in the display options menu.
LAYER_COLOR *name color*	All lines defined in the layer called *name* will be drawn in the color *color*. Color should be either overlay1, overlay2, or overlay3. These colors are defined in **color_setup**.

8.4.5 Solid Underlay Regions

An underlay is a range with outer boundaries, a filled area, and a color number specifying the color to use for the filled area. We use the term "underlay" to indicate that this color is visible only when there is thresholded radar data, so it seems to be under the data. **Overlay** starts from each of the specified fill points and fills all contiguous areas, stopping at overlay lines. It is fine to enter many fill points for the same filled region. In fact, this is required for a coastline with deep bays, so that the region fills correctly at all scales.

Many overlays contain coastline and use a blue underlay for ocean. To prevent the filled color from leaking around the edge of the overlay limits, use the RANGE command to tell **overlay** how far you have drawn your overlay.

Underlay statements:

FILL_COLOR *color*	Sets the color of the underlay region. Color should be either underlay2 or underlay3.
FILL *x y*	Marks the starting point for the fill area.

8.4.6 GIF Underlay Regions

A GIF underlay is a full color picture used to fill the background between overlay lines and features. Like solid underlays, this is visible only when there is thresholded radar data. Areas outside the radar coverage circle are displayed with a darkened version of the GIF underlay.

Be careful not to mix GIF underlays and filled solid underlays.

GIF Underlay statements:

UNDERLAY_CENTER *lon lat*	Selects the center location of an underlay file.
UNDERLAY_PROJECTION *AED*	Selects the projection of the underlay file.
UNDERLAY_REFERENCE *lon lat*	Selects the projection reference location.
UNDERLAY_STDPAR *par1 par2*	Optional standard parallels.
UNDERLAY_ELLIPSOID *rad 1/flat*	Selects the equatorial radius (km) and flattening of the earth. 1/Flattening of 0 means circular.
UNDERLAY_SCALE *x y*	Selects the projection scale in km/pixel.
UNDERLAY_FILE *file.gif*	Selects the name of an underlay file. The file must reside in the ${IRIS_OVERLAY} directory.

The list of supported projections choices is always growing, at the last revision of this manual it was:

AED	Azimuthal Equidistant
EDC	Equidistant Cylindrical
GAUSS	Gauss Conformal
GNOMONIC	Gnomonic
LAMBERT	Lambert Conformal Conic

MERCATOR	Mercator
POLSTEREO	Polar Stereographic
UTM	Universal Transverse Mercator
PERSPECTIVE	View from geosynchronous satellite

To build a gif underlay:

You can download a GIF underlay from the web. To do this, go to http://geoengine.nima.mil. Click the "Define AOI" (Area Of Interest) tab. Then define the corner latitudes and longitudes. Start for example with a 10 degree by 10 degree area. Then c lick the "Download/Order" tab. Select DTED LEVEL 0, JPEG, and Windows. This will download to you a zipped jpeg image. You can view this directly using xv, and you can incorporate it into your overlay as described below.

The first thing you need to do it convert the downloaded JPEG file to GIF format. You can do this with the linux xpaint program. If is is not installed on your system, it is available as a separate rpm file. Be sure to get the filename extension at ".gif". While in xpaint, you will also want to convert the water to blue. You will find that the ocean has some speckles near the edge, which you can manually edit. Coastline details and flat low countries will require manual repair. Areas far out to sea, away from land, will arrive as white, and need to be repaired. While editing, check the gif scale. It is usually 120 pixels/degree. Compute this by taking the width of the gif image in pixels minus 1 and dividing by the width in degrees.

For images near the poles (such as Sweden), the image may arrive compressed horizontally by a factor of 2, so you will need to repair that. There is also a maximum pixel size supported, and larger areas tend to degrade in resolution, so you may need to download several images and attach them together.

The image is generated in a gray scale. SIGMET recommends that you change to your favorite background color, we suggest a sandy brownish. This will show up better with satellite images, for example. You can use the PC lview program's "color balance" operation for this.

To install the gif image in your overlay:

1) Copy your gif file to the overlay directory.

2) Create a new layer called "Underlay" using the add/delete menu. Go back to the "Options" menu to turn on the new Underlay layer, so you will see it later.

3) Select action "add underlay" in the add/delete menu. Pick the Underlay layer, then fill in everything in the underlay properties box. The projection

type is "Equidist Cylinder". The center and projection reference should be the center of your image. Sometimes the downloaded image seems to be 1 degree or 1 minute off from the expected value. To compute the underlay scale, first compute the range scale, which is the the number of km/degree at your center lattitude. Use the following equation:

$$RangeScale = \frac{\pi}{180} \times 6371km \times \cos(Latitude)$$

Finally divide by the gif scale (in pixels/degree) to give you the underlay scale in km/pixel. For example, an overlay centered at 45 degrees north, will have a range scale of 78.62 km/degree, and at 120 pixels/degree will yield 0.65522 km/pixel.

4) Apply and save.

8.4.7 Example of an Overlay File

```
; This is a sample overlay to demonstrate the overlay
features.

; Put this in ${IRIS_ROOT}config/overlay and call it
sample.ovr

;

; The semicolon ";" is used at the beginning of comment
lines.

;

; All distances are in arbitrary "map units" with coordinate
points

; denoted with E-W first and N-S second. See overlay
description.

;

PROJECTION AED

; The scale factor in km per "map unit":

SCALE 1.000

;

; The radar location in map units:
```

```
RADAR 0 0

REFERENCE -71.100 42.400

;

FILL_CENTER -71.100 42.400

DRAW_CENTER -71.100 42.400

; Next come the text strings:

; First the text size (Height in pixels, range 7 through 25)

SIZE 16

;

; Next the text justification (left, center or right)

SCN_CENTER

;

; Then the text location and text string (E-W first, N-S
second)

HIGHLIGHT

TEXT 5000 8450 Examples

TEXT 5000 8000 Of

TEXT 5000 7550 Text

;

; Here are font and justification examples for many sizes

; First do the size 7

SIZE 7

RIGHT

TEXT -150 85 7Right

; The two lines above cause the text "7Right" to be
positioned with
```

```
; its right at map unit position (250, 350).
CENTER
TEXT -150 70 7Center
; For center, there is no position dot and text "7Center" is
centered
; at the specified location.
LEFT
TEXT -150 55 7Left
; For left, the dot is to the left of the text "7Left"
;
SIZE 9
RIGHT
TEXT -50 90 9Right
CENTER
TEXT -50 70 9Center
LEFT
TEXT -50 50 9Left
;
; Now change the size to 10 and repeat the examples:
SIZE 10
RIGHT
TEXT 50 95 10Right
CENTER
TEXT 50 70 10Center
LEFT
TEXT 50 45 10Left
```

```
; Now change the size to 13 and repeat the examples:

SIZE 13

RIGHT

TEXT 150 100 13Right

CENTER

TEXT 150 70 13Center

LEFT

TEXT 150 40 13Left

; Now change the size to 16:

SIZE 16

RIGHT

TEXT -150 -35 16Right

CENTER

TEXT -150 -70 16Center

LEFT

TEXT -150 -105 16Left

SIZE 20

RIGHT

TEXT -10 -30 20Right

CENTER

TEXT -10 -70 20Center

LEFT

TEXT -10 -110 20Left

SIZE 25

RIGHT

TEXT 130 -25 25Right
```

```
CENTER

TEXT 130 -70 25Center

LEFT

TEXT 130 -115 25Left

;

; Here is a message in the lower left corner of the screen

SIZE 13

SCN_LEFT

TEXT 200 200 File:sample.ovr

; And finally the points for the map lines in map units:

; Example of a small rectangle to enclose text examples:

; E-W first, N-S second.

-230 -180

-230 180

230 180

230 -180

-230 -180

GAP

; The word "gap" above is used to denote the last point of a
map line.

;

; To start another map line, continue entering map
coordinates and

; put "GAP" after the line is complete.

;

; Put "END" at the end of the file. Note that it is sometimes
```

```
; helpful during editing to put "END" in the middle of a file

; so that overlay will only plot the map lines and text up to

; that point.

;

; Here is a large rectangle around everything:

-250 -250

-250 250

250 250

250 -250

-250 -250

; Here are some underlay fill points. These points are used
to start a

; region fill, and should be spaced about the area of
concern.

RANGE 0

FILL_COLOR underlay2

FILL -240 -200

FILL -240 -100

FILL -240 50

FILL -240 150

;

FILL 240 -150

FILL 240 -50

FILL 240 50

FILL 240 150

FILL_COLOR underlay3
```

```
FILL -50 -50

END

; End of SAMPLE
```

8.5 Format of catchment files

Catchment files are similar in format to overlay files. They contain a series of points connected by vectors. They also support a ";' for comments, and "END" to mark the end of the file. There is only one file header command:

DRAW_CENTER *lon lat*	Tells **overlay** where to center the image. Generally this is the either the coordinates of the radar site, or the center of the catchment area.
SIZE *size*	Sets the size to draw subcatchment names. This is the height in pixels, and it applies until the next size command in the file.
WARNING *threshold*	Specifies warning threshold in mm. An alert will be issued if this is exceeded, and it applies until the next warning command in the file. A value of zero means no alerts.

Catchment files are divided into a series of subcatchments. Each one starts with a header specifying the name and label location. Following this header, are the data points. They must define a closed polygon. Make sure the last point matches the first one. There can be a maximum of 512 subcatchments defined in each catchment file.

START *number name*	Tells the number and name of the subcatchment area
LABEL *lon lat*	Specifies the location to draw the name when labeling the subcatchment. This location must be inside the region.

IRIS supports a maximum of 20 catchment files.

8.6 Creating and Editing Overlay Files

NOTE	Creating and editing overlay files should be done only under the supervision of the system manager.

To create an overlay file:

1. Use a computerized geographic database to get the array of coastlines and political boundaries you want.
2. Manually add the header commands, display it with overlay and make needed repairs.
3. Add the desired text and icon features.
4. Add underlay fill points. When doing this you may discover more breaks in the overlay lines which need to be repaired.
5. Test the underlay filling by displaying over a broad range of image sizes, for example 50, 100, 200, 400, and 800 km. It is usually necessary to add fill points in lakes and bays pointing towards the display center.
6. When you are satisfied with your overlay, place it in the $IRIS_OVERLAY directory.

CHAPTER 9

REAL TIME DISPLAY

The IRIS Real Time Display allows the instantaneous viewing of data as they are acquired. The real time display is made in an X-Window on either the radar workstation which is controlling the signal processor, or a networked workstation. The rays of data (e.g., 1 degree) are 'painted' on the display as the antenna scans, with no perceptible delay. Both PPI and RHI display styles are supported.

A real time display is used in a variety of ways:

- It provides observers with immediate feedback on the weather situation.
- For manual TASK operation, it provides radar operators with immediate feedback during manual antenna control (e.g., using handwheels or the antenna utility). This is useful for probing rapidly changing weather features such as a developing hook echo, or weak echo region.
- For system managers, the real time display provides excellent feedback for tuning the signal processor parameters.
- For system managers and radar operators, real time display is another way to verify that the system is operating properly and generating high-quality data.

Real time display is not practical for remote unattended radar sites with low-bandwidth network connections (e.g., <100 KBytes/sec).

In this chapter:

9.1 Launching the Real Time Display

There are several ways to launch the real-time display:

Choose **Menus**–>**Real Time Display** from the IRIS menu bar. You do not need to be connected to an IRIS server to start the display. The real time display will appear in the DEFAULT configuration with a blank (black) background. If data currently are being sent by the radar workstation, then within two seconds, the display will start to paint and the green LED in the upper corner of the display will flash. The real time display receiver can also be invoked in the **irisnet** menu by clicking on your particular site (where you are sitting)

The real time display receiver can also be invoked in the IRISNet menu by clicking on YOUR particular site (where you are sitting) and then selecting the real time display icon.

Another way to start the real time display is to type the following command line on a terminal window:

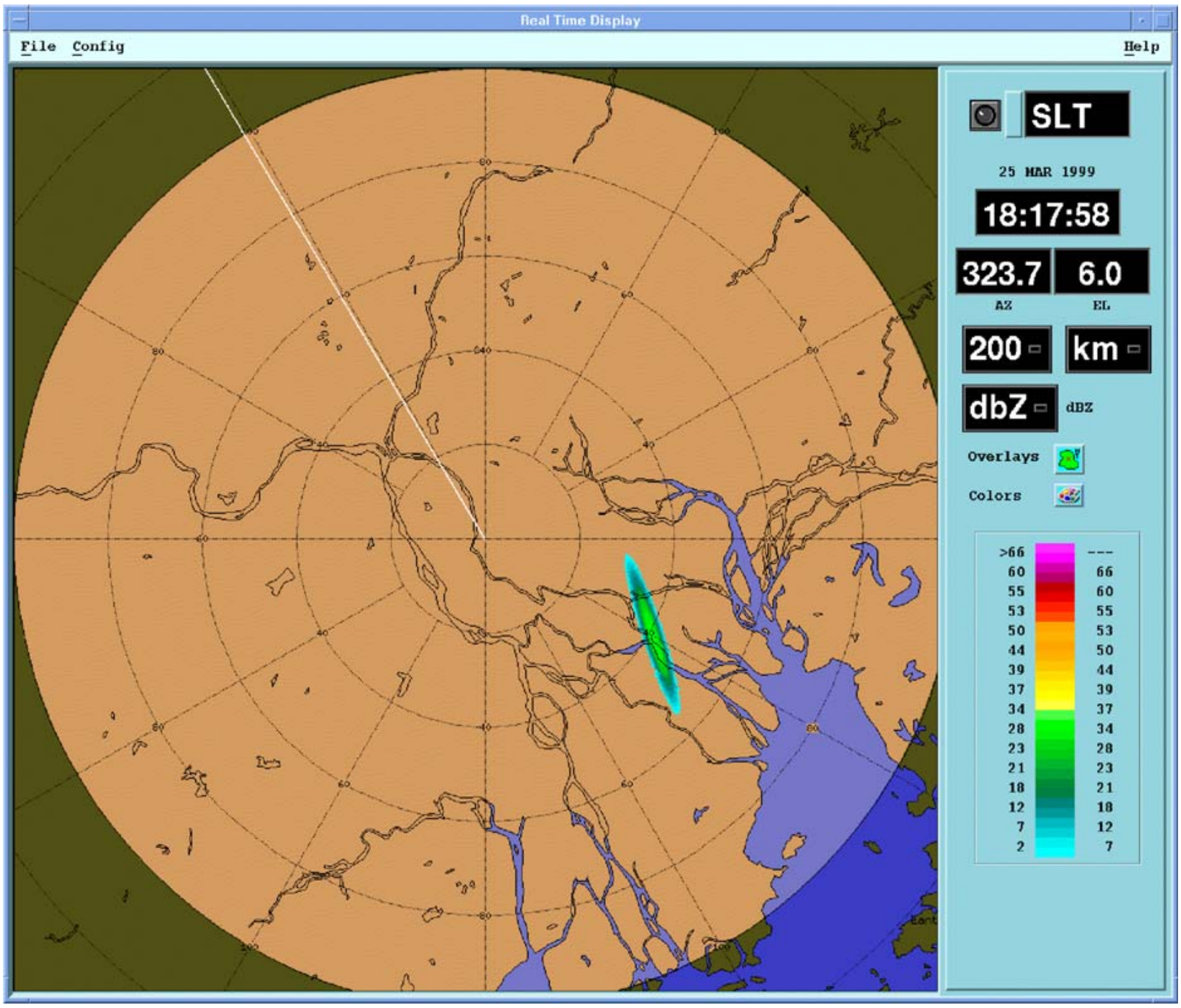
```
$ rtdisp&
```

You may only have one real time display invoked from an IRIS menu bar. To get multiple displays simultaneously, you must first create multiple saved configurations each using a different port number. Then use the command line option to specify which file to use. For example:

```
$ rtdisp -file port30726&

$ rtdisp -file port30727&
```

9.2 Real Time Display Menu Features



File and Config

The **File** menu allows you to open and save files and print real time display images. Saved config files are stored in the ${IRIS_CONFIG} directory with names ending in ".rtdisp". Note that whenever rtdisp is started with no explicit configuration name, it uses the DEFAULT configuration file.

CAUTION	Important: Save as... is used to store your custom display configuration. Be sure to invoke File–>Save as... if you want to save your changes permanently.

The **Config** menu allows you to change some basic parameters.

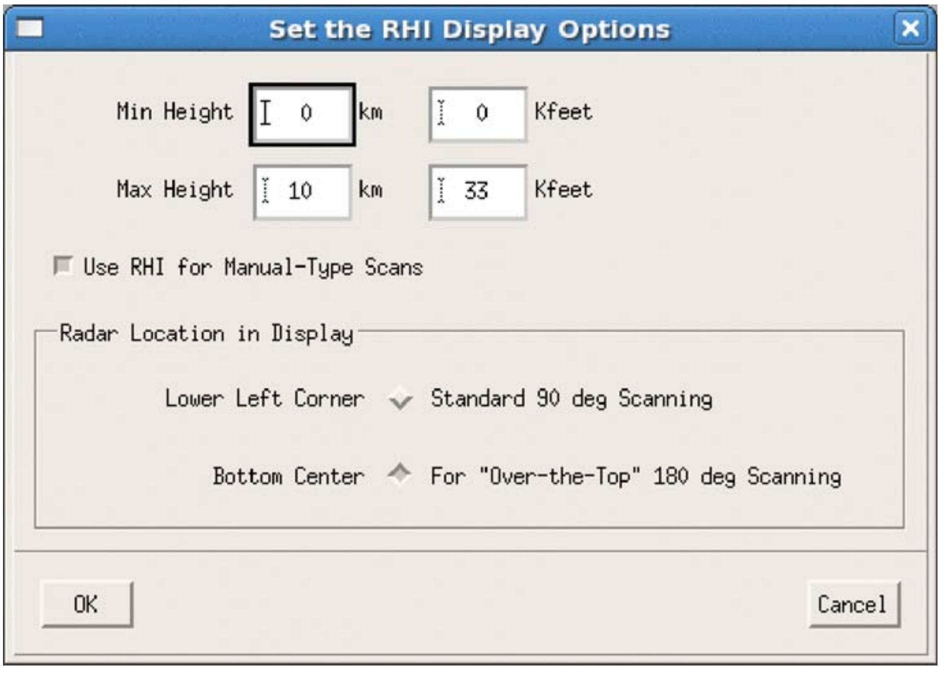
Ranges modifies the list of available display ranges.

RHI Options to set the appearance of RHI displays

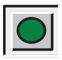
Text Colors Choose color for text in AZ/EL, etc. display.

Sweep Line to enable/disable a line showing the radar sweep

The "Ranges" and "Text Color" menus a self–explanatory. The "RHI Display Opt ..." menu is shown below:



The Max Height can be specified either in km or Kfeet, the latter is used if the horizontal range scale is selected to be nautical miles. The aspect ratio will adjust automatically. The Min Height is normally set to zero. You can set it negative to handle banking on airborne radars. By default, IRIS Manual scans are displayed in PPI format. The button in the menu overrides this causing manual scans to be displayed in RHI format. Finally, the user can select either a standard 90 degree scan or an "Over the top" 180 degree scan depending on the antenna capabilities. Note that all of these settings are saved



Status LED

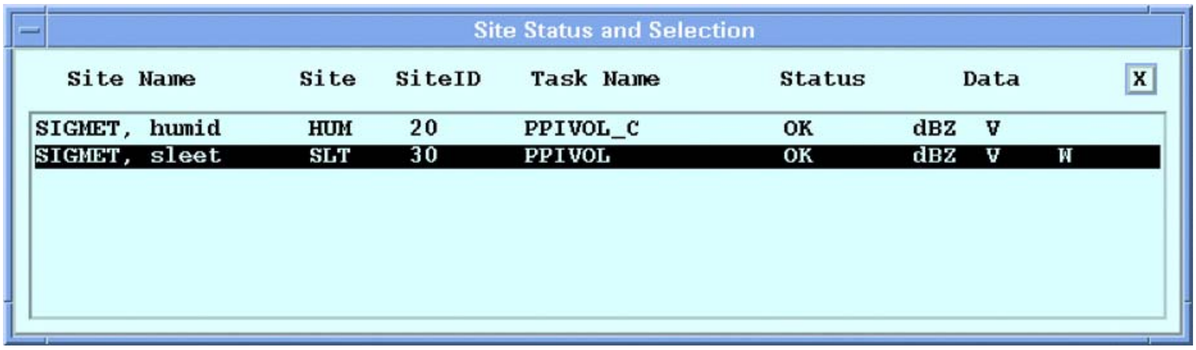
The LED at the top of the display shows the status of the data stream to the real time display.

- Fixed red on startup indicates that no data are being sent, or that data have not been received for five minutes (time-out). Refer to 9.3 Configuring the Real Time Display Transmitter on page 163 to diagnose why data are not being sent.
- Flashing green indicates that data are currently being received.
- Fixed green indicates that data are not currently being received, but data have been received within the last five minutes.

Site ID Field for Multiple Radars

This field shows the three letter radar site ID. For installations that have more than one radar, this field can be used to select which radar will be viewed on the real time display.

If you have multiple radars, click on the button to the right of the LED to get a list of sites. As in the example is shown below. Select the site that you want to display.



Time Display

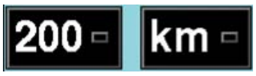
The data time (not the local workstation time) is displayed to the nearest second in large format numerals. This will update approximately once per second when data are arriving. When no data are arriving, the display time will not update so that the time will reflect the data that remain on the screen. The date of the data is displayed in smaller characters above the time.

The large format numerals are designed to be read from several meters distance. The color of the numerals can be changed using **Config–>Set Colors**.

AZ/EL Display

Azimuth and elevation angles are displayed to the nearest tenth degree in large format numerals. This will update approximately once per second when data are arriving. When no data are arriving, the angles will not update so that the elevation angle will reflect the data that remain on the screen.

The large format numerals are designed to be read from several meters distance. The color of the numerals can be changed using **Config–>Set Colors**.



Maximum Range

One of four maximum ranges can be selected by clicking on the numerical field under the AZ/EL display. To set these ranges and the units, use **Config–>Set Ranges**.

The large format numerals are designed to be read from several meters distance. The color of the numerals can be changed using **Config–>Set Colors**.

Data Selection for Display

Click on this field to select the type of data for display. The choices are:

- dBZ
- Velocity
- Width

After you make your selection, the display will reset and start painting the new data type.

CAUTION	Caution: If the radar system IRIS is not configured to collect and transmit the selected data type, then no data will be displayed. See 9.3 Configuring the Real Time Display Transmitter on page 163 for information on configuring the real time display output from the radar IRIS.

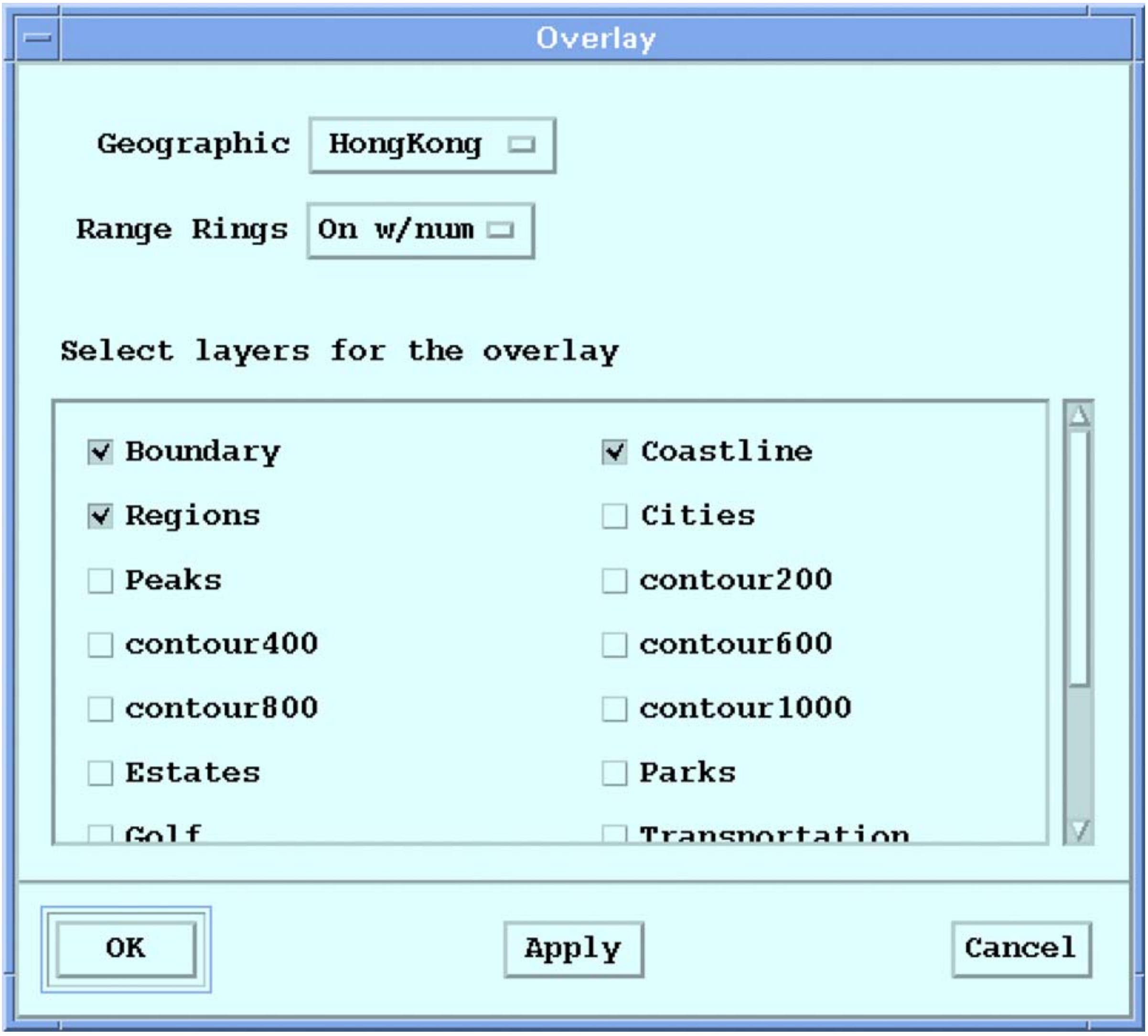
The large format numerals are designed to be read from several meters distance. The color of the numerals can be changed using **Config–>Set Colors**.

Overlays

The overlay features for the real time display include:

- Geographic overlays.
- Range rings or lat/lon lines.

Either or both of these options can be accessed by clicking the **Overlays** button to access the Overlays submenu.



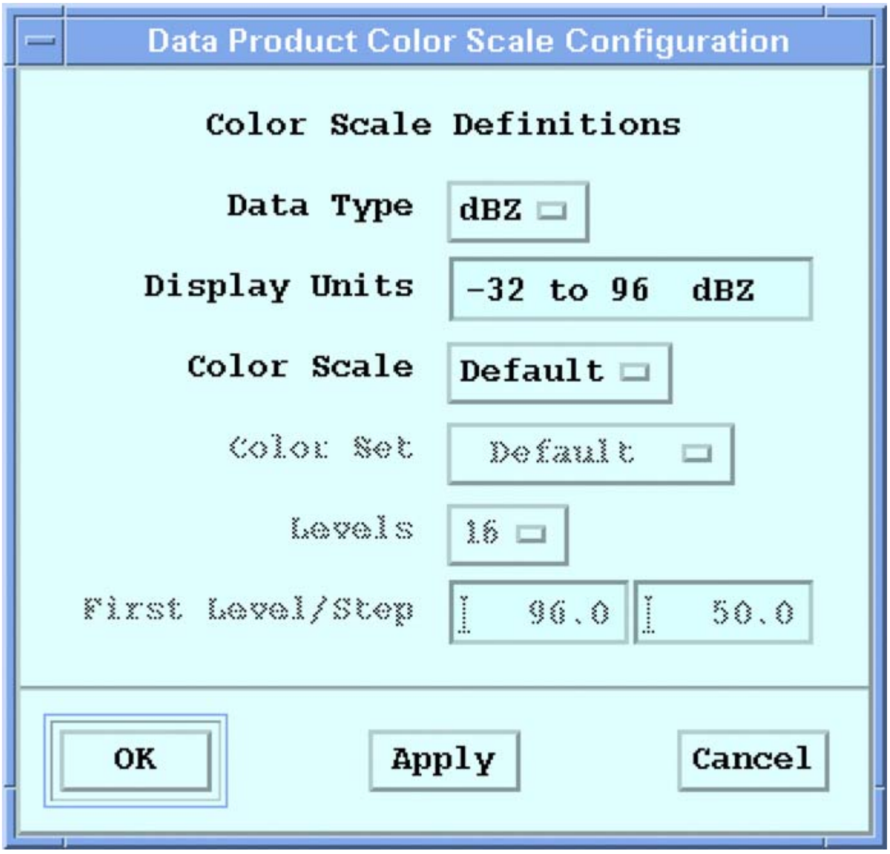
Click on **Geographic** to select from a list of available overlays, or **Off**.

Click on **Range Rings** to select among:

- Off
- On
- On with numeric labels
- Latitude/Longitude grid (with numeric labels)

 **Color Scale**

The colors used to represent the data can be modified. Click on the **Colors** button to get the Color submenu.



This menu is described in the Color Scale Tool section of the *IRIS Product & Display Manual* of this manual. After making a change, the display will reset and be painted with the new color scale.

NOTE	Note: Entering a level step of 0 for velocity has the special meaning to display the full unambiguous velocity range. This range is not known until data are received. The velocity color scale will show all zeroes in this case until data are received.

9.3 Configuring the Real Time Display Transmitter

This section summarizes how to configure the data transmission from the radar site. Configuration requires operator privileges.

Real Time Display Overview

The real time display data are output by the IRIS system that is at the radar site, or directly by the RVP8 signal processor. Ray-by-ray output packets are sent over the network using a UDP broadcast message approach.

This approach allows many workstations to monitor the real time display, without any additional burden on the network traffic after the first one. The number of data parameters and range bins can be tuned to match the available bandwidth of the network. A benchmark configuration is illustrated below:

- Transmitted Parameters Z, V & W only (3 bytes)
- Number of Bins 500
- Scan Rate 4 RPM (24 degrees per second)
- Scan Resolution 1 degree

In this case the data rate is 36 KBytes/sec or 258 KBits/sec. This means that real time display can easily be done for Ethernet (10 MBits/sec) or T1 (1 MBit/sec) connections. However, for slower speed connections it would be necessary to reduce the number of bins, increase the resolution and/or slow the scan rate. Keep in mind that the radar is probably also sending processed or RAW products over the network link so the bandwidth requirement for these must also be considered.

Setup Utility Configuration

The **setup/RVP** utility has several questions relating to both the transmitter and receiver ends of the real time display, i.e.,

- What data are to be sent (dBZ, V, W) by the transmitter.
- The maximum number of range bins to be transmitted.
- The socket port is used for transmission (typically set to 30730).
- What IP broadcast addresses are to be used for transmission.

Refer to the **setup** 10.2.10 Real Time Display (RTD) on page 181 for more information.

Using rtd_echo

To help configure real-time display transmissions on complicated networks, we supply a utility program called **rtd_echo**. This program reads the RTD socket traffic on a computer and retransmits it to another address. It can change both the destination address and port number. All of this configuration is available with command line options, please run "rtd_echo -?" to see the choices. Note that only one program can read from a socket port, so if you are running **rtd_echo** on a machine, then another **rtd_echo**, or the **rtdisp** utility cannot read from the same port.

Typical uses for **rtd_echo** are:

- Transmitting data to a target host which is not directly accessible from the source system. (that is no network route, you cannot ping directly)
- Transmitting data through network routers and switches which do not allow broadcast addresses.
- Transmitting data once through a limited bandwidth line, then echoing with a broadcast address, or multiple distinct addresses to lots of machines.

In the last case, if you are echoing to a network address which includes the echoing machine, you must use a different port number. This is to prevent **rtd_echo** from reading its own output and producing an infinite loop. Here is an example of how to configure:

- Radar machine: 2 outputs in setup/RVP: 127.0.0.1 Port 30730, 192.168.45.1 port 30731.
- Echo machine (192.168.45.1): Run rtd_echo –a:192.168.45.255 –i:30731

This gives the following features:

- All **rtdisp** programs can be configured the same to read from port 30730.
- **Rtdisp** will work on the radar machine (using the 127.0.0.1 address).
- **Rtdisp** will work on all the 192.168.45 network including the echo machine.

Once you have rtd_echo working fine from a shell command, then add it to your /etc/rc.d/rc.local file with a trailing "&" so it runs every time you boot.

CHAPTER 10
SETUP UTILITY

The **setup** utility configures the software for the characteristics of the radar. This is the first utility you should run because the information from **setup** is used by many of the other utilities. You need to obtain detailed information about your radar system to answer some of the **setup** questions.

After upgrading, **setup** will fill in default values for any new questions that were added. It is recommended that you read the release notes, then check the new questions to make sure they are right for your system.

In this chapter:

NOTE Setup of the color scales is done using the color_setup utility described in Chapter 6, Color Setup Utility, on page 109 of this manual.

10.1 Invoking Setup and Built-In Error Checking

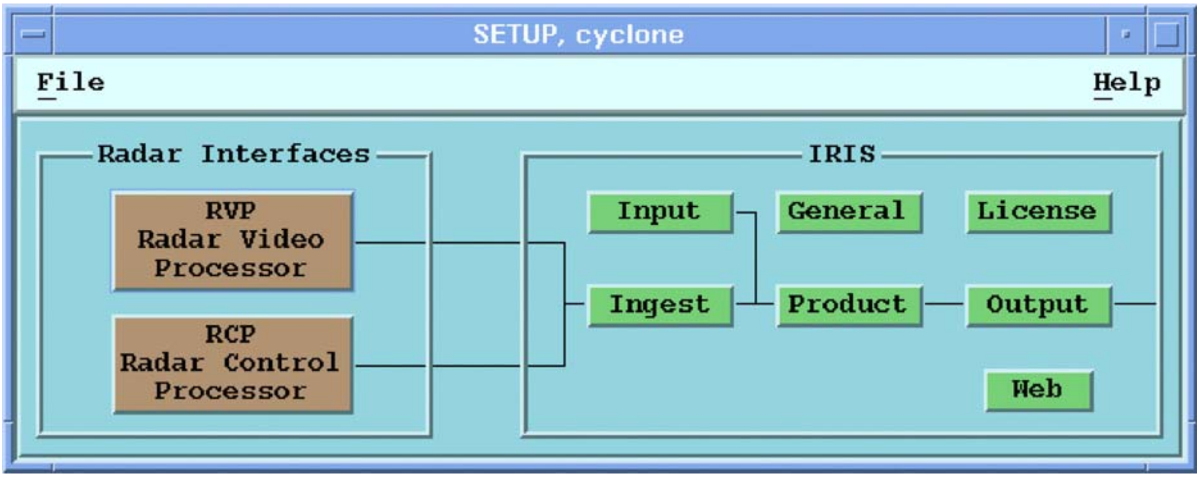
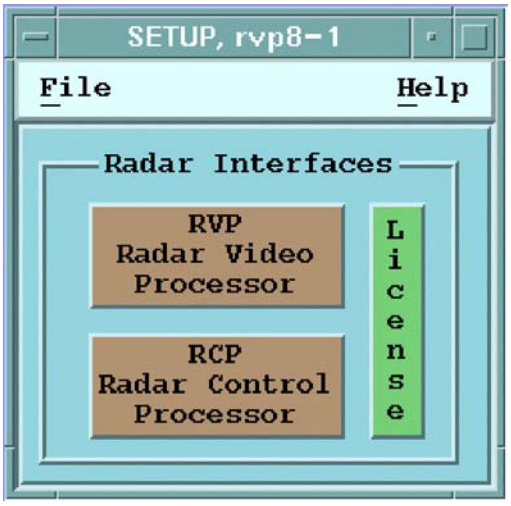


Figure 7 Setup Utility Main Screen for IRIS and RDA



There are two versions of the **setup** utility. The one above is for IRIS and the one to the left is for the RDA, i.e., an RVP8 signal processor or an RCP8 antenna controller. The two menus overlap, but the RDA does not need all of the IRIS setup features so these are not shown.

The descriptions here apply to both styles (IRIS and RDA), for the features that are applicable.

Once you have typed setup at the system prompt or clicked on the **setup** icon in the **irisnet** menu, the utility responds by popping up the **setup** main menu pictured above. From this screen you can select which of the sections that you want to change by clicking on the appropriate button or by selecting it from the menus pull-down. As a new user, the **setup** defaults have been set properly and therefore no configuration errors should occur. If an error does occur, simply follow steps 3 and 4 in the repair procedure below.

At startup for an upgrade, **setup** checks all parameters to verify that they are within reasonable bounds and produces a warning pop-up listing all the problems it finds. The listing gives the name of the variable in question and prompts the user to consider the repair command. Errors are usually related to new features that have not been addressed or outdated features that do not conform to the current upgrade. Although clicking **repair** on the pop-up will replace the mismatch with the appropriate default, some errors may relate to customized fields that are important to your operation. Therefore the recommended procedure is as follows:

1. Check the error list for parameters that you have customized in the past and currently wish to use and correct these customizations.
2. Save your results and re-enter Setup to verify that corrected errors are removed from the list.
3. Click on the **repair** button to make corrections that are necessary for the software but don't need to be customized for your operation.
4. Save again when you're ready to exit.

The bounds checking is also performed when IRIS is first started.

There is special support for making a listing file of the setup configuration. From either the main menu, or one of the subsections, you can select **File->List**. This will produce a listing file called `YYYYMMDDHHMM.setup` in the ${IRIS_LISTINGS} directory.

All the **setup** utility does is edit configuration files which are stored on disk. The changes do not go into effect until the appropriate application or daemon starts after the changes. For changes made in the green IRIS section, it is only necessary to restart the IRIS daemons with a command like:

```
$ sudo /sbin/service iris stop

$ sudo /sbin/service iris start
```

For changes to the RVP section, you will also need to stop any utilities you may be running, as well as restart the RVP9 or RVP8 (if you have one), with commands like:

```
$ sudo /sbin/service iris stop

$ sudo /sbin/service rvp8 stop

$ sudo /sbin/service rvp8 start
```

```
$ sudo /sbin/service iris start
```

For changes to the RCP section, in addition to the above, you will need to stop the RCP8 (if you have one), and stop the antenna daemons, with commands like:

```
$ sudo /sbin/service iris stop

$ sudo /sbin/service rvp8 stop

$ sudo /sbin/service rcp8 stop

$ qant

$ sudo /sbin/service rcp8 start

$ sudo /sbin/service rvp8 start

$ sudo /sbin/service iris start
```

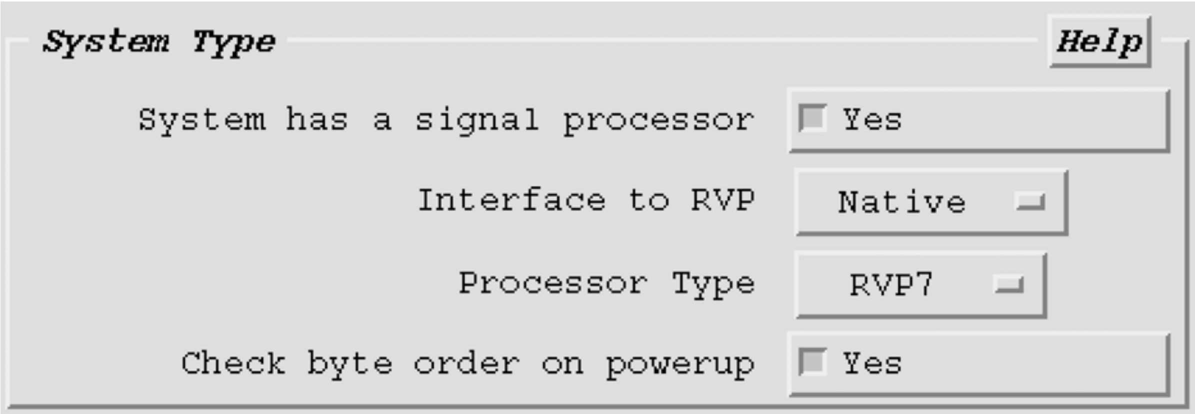
Note that license changes could effect the RVP8 in addition to IRIS.

The RCP8, as well as older RCP02, have configuration state accessible via the **antx** interactive chat program. These changes take effect as soon as you get back to the top level prompt. Be sure to save changes you want to keep.

The RVP7 and older signal processors have configuration state accessible via the **dspx** interactive chat program. These changes take effect as soon as you get back to the top level prompt, be sure to save. The RVP8 and newer signal processors also have configuration state accessible via the **dspx** program. Part of that state is local to the processor, and part of it is the same information as is visible in the **setup**/RVP section. If you make changes here, be sure to restart IRIS and utilities as mentioned above. It is undesirable to make changes in **setup**/RVP, then make changes in **dspx** interactive configuration of an RVP8 which has not been restarted after the changes. The RVP8 will warn you when you try to do this.

10.2 Radar Video Processor

10.2.1 System Type



- *System has processor* — Select "No" is this for an Analysis system or "Yes" if this is for a Radar system. If "Yes" is selected, the following options appear in the next section.
- *Interface type* — Select either "SCSI", "Native" or "DspExport".

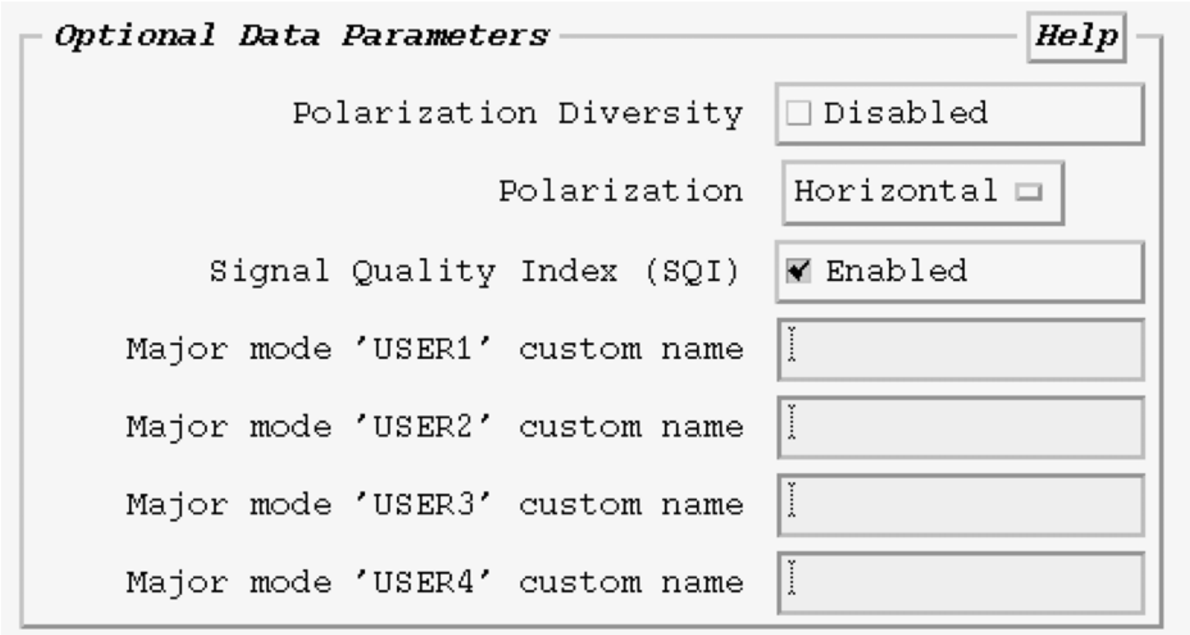
For SCSI interfaces, you will see the following question:

- *Device file* — Type in the path to your SCSI device.

For Socket interfaces, you will see the following two questions:

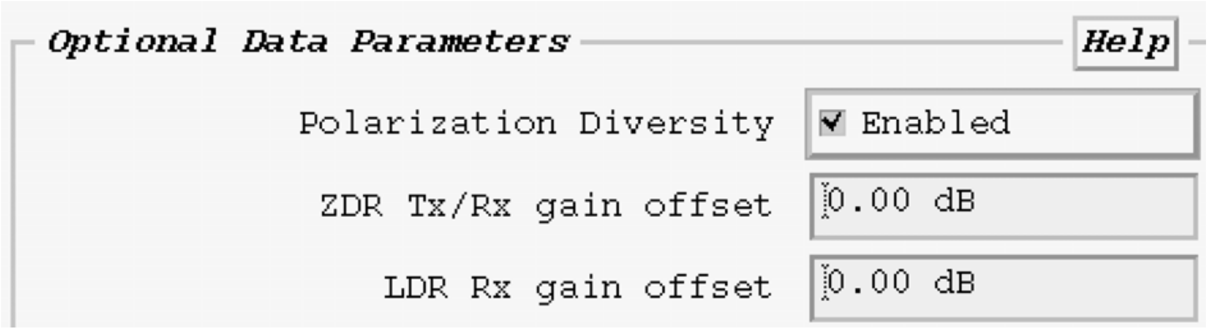
- *RVP host name or IP Address* — Set the host name with the processor.
- *RVP Port* — Set the port number, normally 30740.
- *Processor type* — This question can be answered by selecting one of five options:
  - RVP6 No-AUX
  - RVP6 With AUX
  - RVP7
  - RVP8
  - RVP900
- *Check byte order on powerup* — The recommended setting is "Yes" set it to "No" on systems with a preprocessor which does not support these opcodes.

10.2.2 Optional Data Parameters

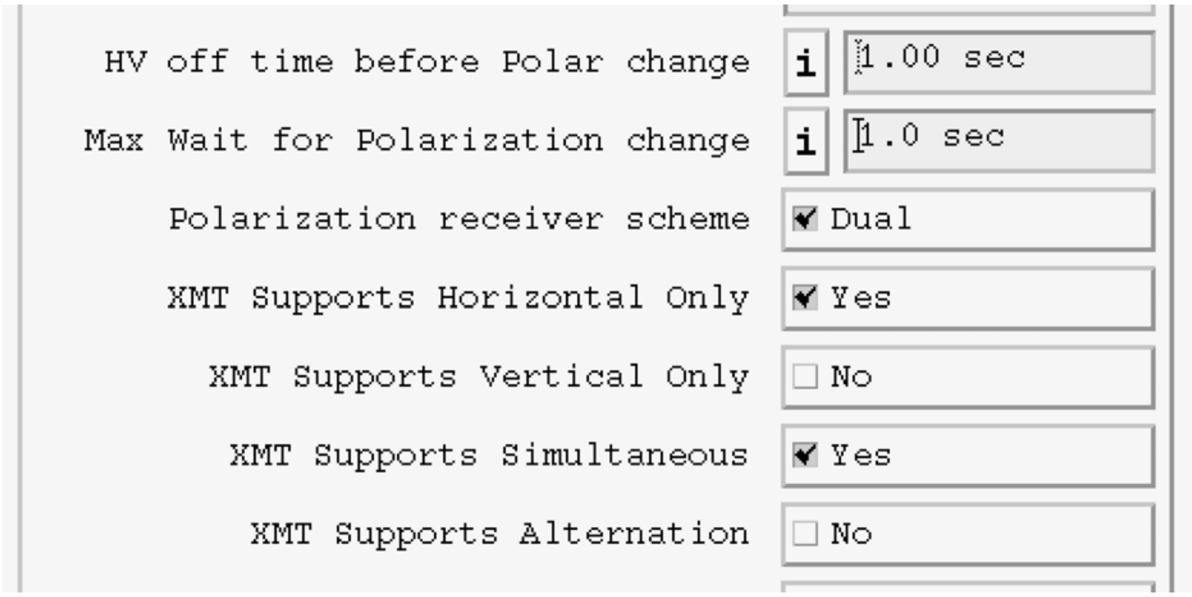


- *Polarization Diversity* — Use this to select whether your radar supports multiple polarizations. Shown above is an example with polarization diversity turned off. Note that the RVP8 requires a license to produce dual-pol data.
- *Polarization* — For fixed polarization radars, enter the type of polarization here. Valid choices are "Horizontal" and "Vertical".
- *Signal Quality Index* — Select here if you wish to allow the recording and display of SQI. SQI is only available on RVP7 or later processors. This will enable the SQI button in the task configuration menu, and in **ascope**.
- *Major mode 'User 1' custom name* — These are optional fields which enable customers to take advantage of the extensibility of the RVP 8 API (application program interface) and specify customized Major modes (for more information, refer to RVP 8 Manual – Appendix F.

For radars with polarization diversity, you will see the following menu:



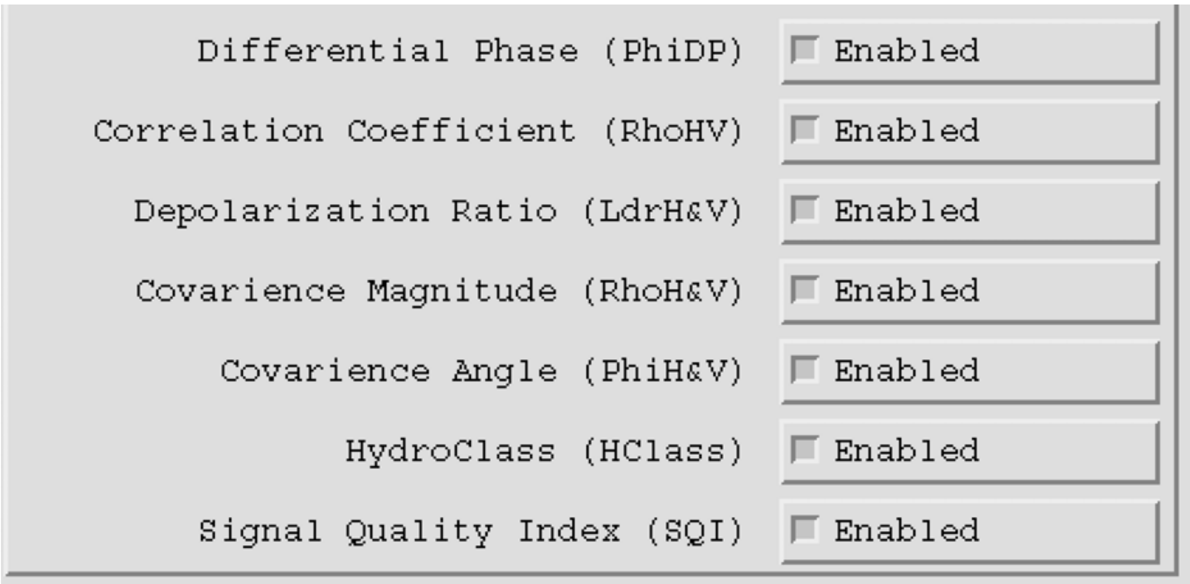
- *ZDR Tx/Rx gain offset* — This is an offset used on ZDR systems if there is a difference between the gain at the two different polarizations which results in a bias. This number is added to the ZDRs otherwise computed. It is stored to the nearest 1/16 of a dB.
- *LDR Rx gain offset* — This is an offset used on LDR systems if there is a difference between the gain at the two different polarization receivers which results in a bias. This number is added to the LDRs otherwise computed. It is stored to the nearest 1/100 of a dB.



In this section, you enter the characteristics about how your radar handles polarization.

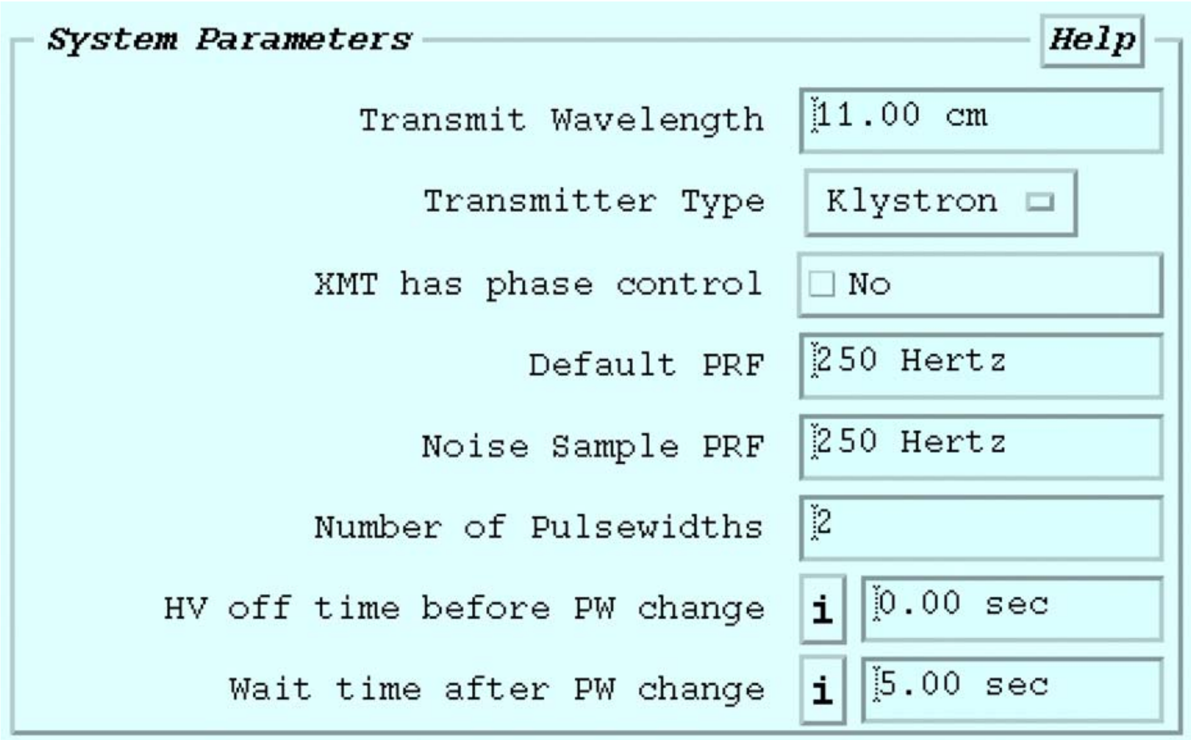
- *HV off time before Polar change* — Whenever the transmit polarization is changed, the dsp library will turn off the high voltage this much in advance of the switch. This is needed on some systems to prevent arcing while switching. Entering a value of zero disables the feature.

- *Max Wait for Polarization change* — Enter the worst case time it could take to switch polarization. The dsp library will wait for confirmation of the new polarization, up until this time is exceeded. If there is no confirmation, then this time is always waited. If the high voltage was turned off before the switch, it is turned back on after the wait.
- *Polarization receiver scheme* — Select here the type of polarization receiver system you have. Choices are "Single" and "Dual". Dual receivers means there is a receiver on both the co- and cross-polarized channels. This allows measurement of depolarized power, for example. For details, see the discussion of Dual Polarization in the Processing Algorithms chapter of the *RVP7 User's Manual*.
- *XMT Supports...* — In these 4 questions, select which types of polarization transmission are available on your radar.



In this section, you enter all the different polarization parameters which can be measured by your radar system. There is no question for ZDR, because that is available on most dual-pol radars. Note that HydroClass requires a license in the RVP8 to run.

10.2.3 System Parameters



- *Transmit Wavelength* — Enter the wavelength in centimeters.
- *Transmitter Type* — Choose the transmitter type of the radar. This example illustrates that the phase control option will be displayed if a Klystron transmitter is used.
- *Default PRF* — Enter the PRF to be used by the utilities if the PRF is otherwise unspecified. Set it below the maximum PRF for the longest pulsewidth to preserve the transmitter duty cycle regardless of the pulsewidth setting.
- *Noise Sample PRF* — Enter the PRF in Hz for noise sampling (refer to the *Signal Processor User's Manual*). Typically, a value of 200 Hz is adequate.
- *Number of Pulsewidths* — Enter a number between 1 and 4 for the number of pulsewidths that are supported.
- *HV off time before PW change*
- *Wait time after PW change*

Whenever IRIS changes the PRF only, and not the Pulse Width, it freely changes it without any delays.

Whenever IRIS changes the Pulse Width only, and not the PRF, it follows this procedure:

1. Turn off the High Voltage (only if it was on, and the "HV off time before PW change" is nonzero).
2. Wait the time specified in "HV off time before PW change".
3. Set the pulse width to the new value.
4. Waits the time specified in "Wait time after PW change".
5. If possible, checks that the pulse width actually changed.
6. Turn High Voltage back on (only if turned off in step 1).

Whenever IRIS changes the Pulse Width and the PRF, it follows this procedure if the new PRF is higher than the old PRF:

1. Turn off the High Voltage (only if it was on, and the "HV off time before PW change" is nonzero).
2. Wait the time specified in "HV off time before PW change".
3. Set the pulse width to the new value.
4. Wait the time specified in "Wait time after PW change".
5. If possible, checks that the pulse width actually changed.
6. Sets the PRF to the new value.
7. Wait the time specified in "Wait time after PW change".
8. Turn High Voltage back on (only if turned off in step 1).

Whenever IRIS changes the Pulse Width and the PRF, it follows this procedure if the new PRF is lower than the old PRF:

1. Turn off the High Voltage (only if it was on, and the "HV off time before PW change" is nonzero).
2. Wait the time specified in "HV off time before PW change".
3. Set the PRF to the new value.
4. Wait the time specified in "Wait time after PW change".
5. Sets the pulse width to the new value.
6. Wait the time specified in "Wait time after PW change".
7. If possible, checks that the pulse width actually changed.
8. Turn High Voltage back on (only if turned off in step 1).

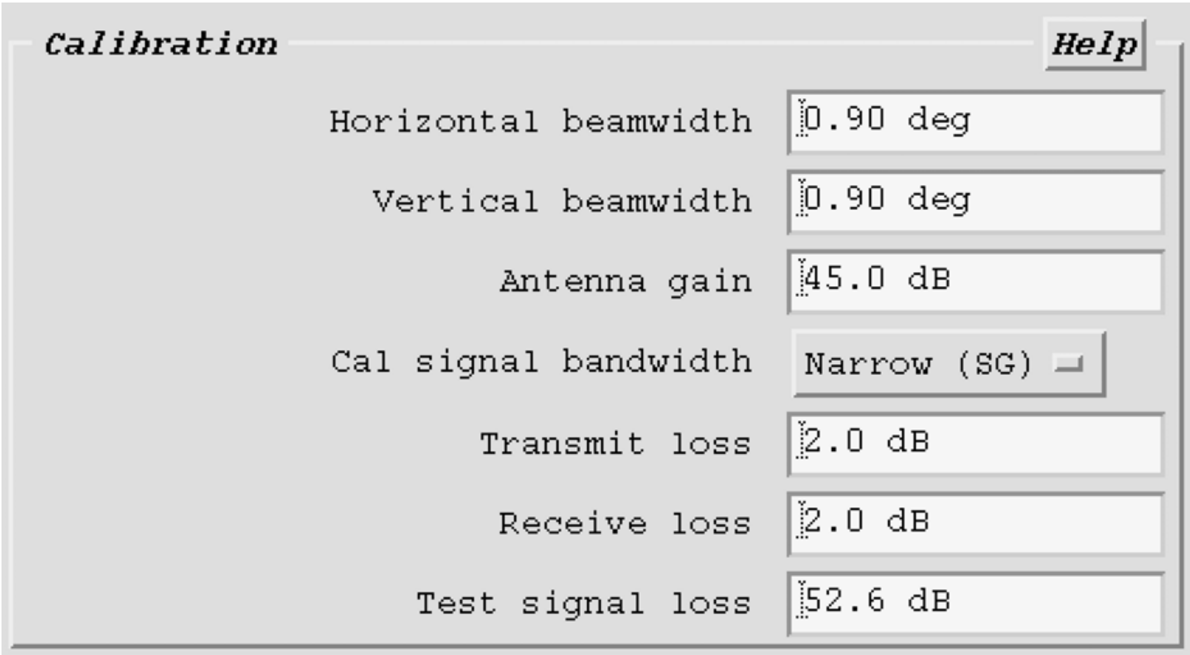
As you can see, the "Wait time after PW change" has 4 meanings:

- How long to wait after changing the PW before we change the PRF.
- How long to wait after changing the PRF before we change the PW.
- How long to wait after changing the PW before we are sure we can detect the new PW state.

- How long to wait after changing the PW before we turn on the HV, if it was turned off.

These delays protect magnetron radar transmitters, which take some time to change their pulse forming networks, and protect systems using the RCP to control the pulse width. When the RCP controls the pulse width, there may be a small variable delay before the command takes effect. The suggested values are 0 for the HV off time, and 1.5 seconds for the Wait time. For Klystrons, TWT systems, and systems with only 1 pulse width, set these both to zero.

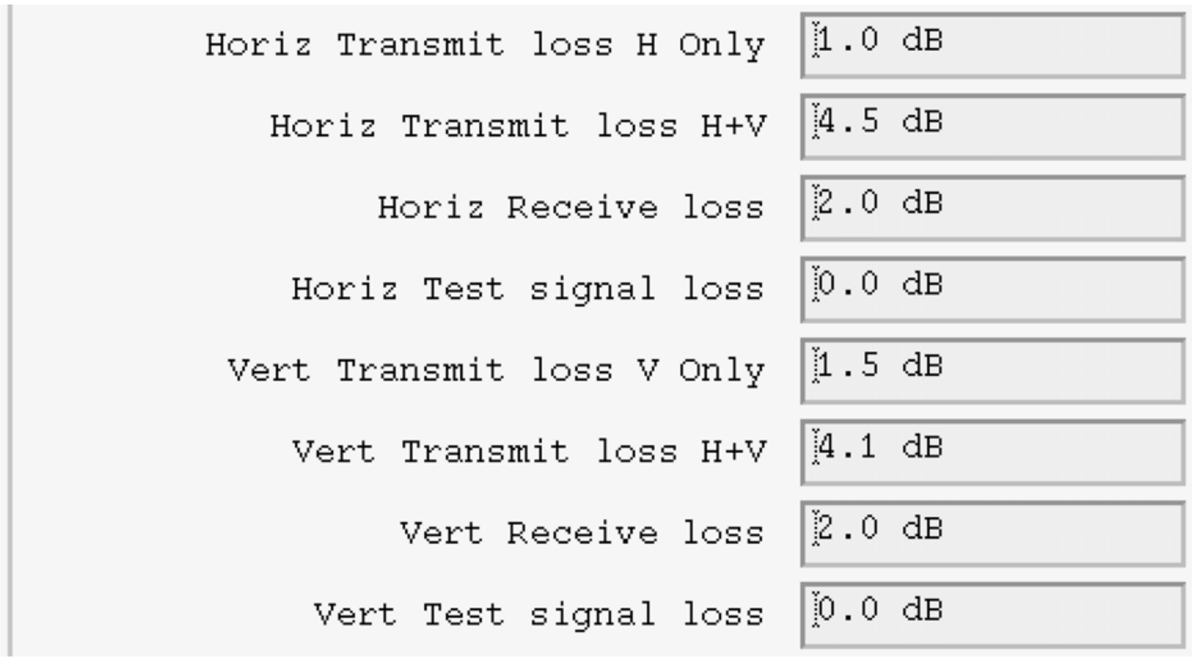
10.2.4 Calibration



- *Horizontal beamwidth/Vertical beamwidth* — Enter the horizontal and vertical antenna half-power beamwidths in degrees.
- *Antenna gain* — Enter the antenna gain on the axis of the antenna in dB.
- *Cal signal bandwidth* — For a normal signal generator enter "Narrow". For a noise source enter "Broad". For noise sources you will also enter the ENR value. The calibration procedure is different. For noise source, we use a single point calibration, while for a signal generator we will use multiple different power levels.
- *Transmit losses* — Enter the transmitter power loss in dB between the magnetron and the antenna feed.

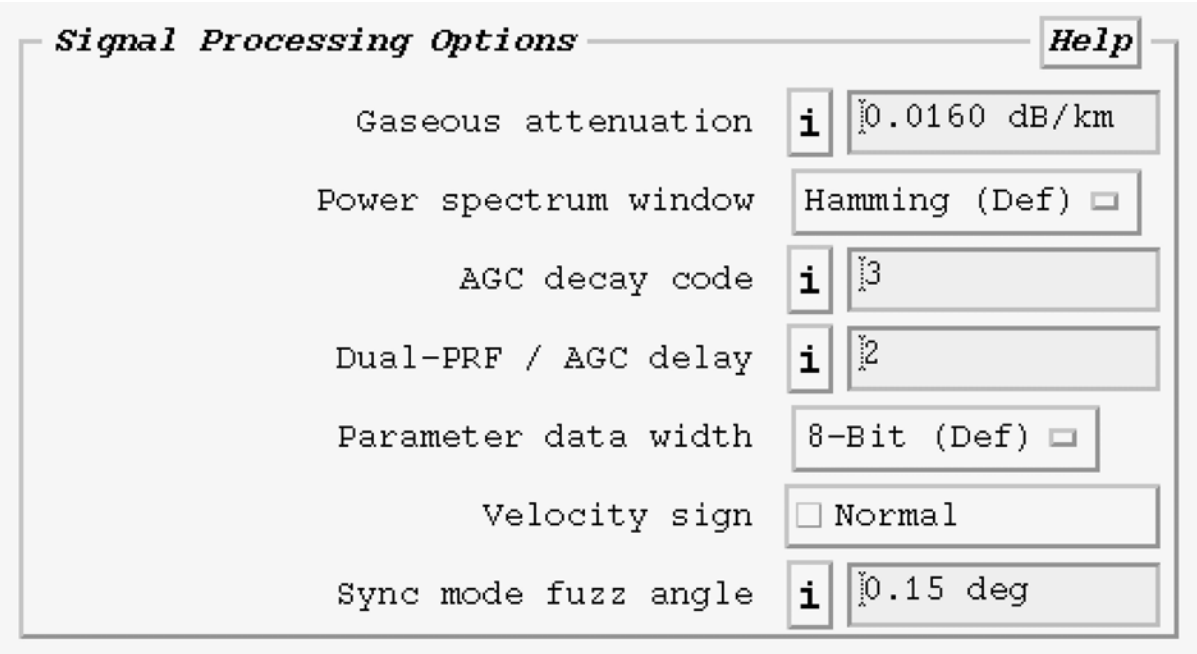
- *Receiver losses* — Enter the receiver loss in dB from the feed to the receiver. This is usually the same as the transmitter loss.
- *Test signal losses* — In performing calibrations, a test signal generator is injected into the system. This accounts for any loss of test signal power in the connection between the test signal injection point and the receiver. Losses in the cabling and in the directional coupler are usually included here. These losses may also be calibrated out when you set up your signal generator.

For dual-polarization radars, there are more loss values to enter, as detailed below. our system may have fewer questions if it has a simpler configuration. You can enter separate numbers for the horizontal and vertical channel. You can use this to effectively deal with differences in the waveguide, as well as correcting for transmitter power effects. For example, if your vertical transmit power is larger than your horizontal, then enter the vertical power as the transmit power, and enter a larger transmit loss for horizontal to cover the lower power.



In the example shown above, we assume that the horizontal and vertical powers are both 200 kW, with a 1.0 dB loss in the horizontal waveguide, and a larger 1.5 dB loss in the vertical waveguide. We also assume that in H+V mode, the power splits unevenly with 90 kW to horizontal and 110 kW to vertical. This gives 3.5 and 2.6 dB losses over the full power case. This is added to the waveguide losses to get 4.5 and 4.1 dB.

10.2.5 Signal Processing Options

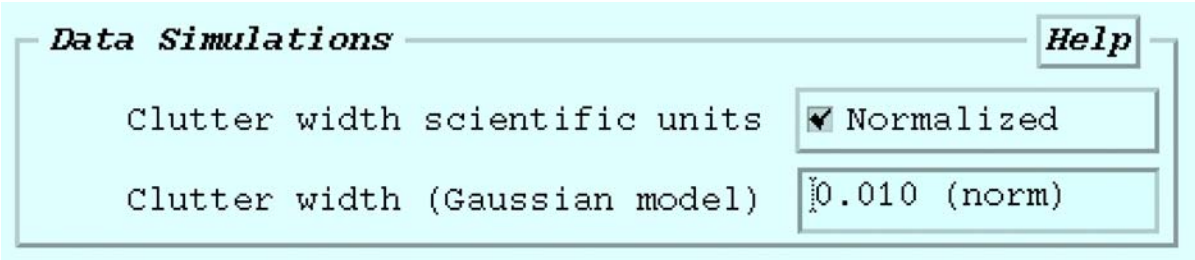


- *Gaseous Attenuation* — The gaseous attenuation constant determines the atmospheric attenuation in dB/km used by the RVP6/7 when acquiring radar data. For a 5-cm radar, a reasonable default value is 0.016 dB/km.
- *Power Spectrum Window* — Select the type of window that the signal processor should use whenever power spectra are computed. Choices are: RECTANGULAR, HAMMING, and BLACKMAN.
- *AGC decay code* — Enter the time constant of the exponential average applied to the log receiver to produce the AGC signal. This is used on the RVP6 processor only, and it is typically set to 3. For more information, see the *Signal Processor User's Manual*.
- *Dual-PRF / AGC delay* — In dual PRF and/or AGC mode, enter the number of pulses to send through the clutter filters prior to the start of each ray. These pulses stabilize the filters. Typically set to 2.
- *Parameter data width* — Choices here are "8-bit" or "8&16 bit". In 8&16-bit mode the task configuration menu will allow the selection of data width. If you have an RVP6, you will need ROM Rev.15 and higher to support the 16-bit formats.
- *Velocity sign* — If you answer "inverted" IRIS inverts the velocities as they are read from the signal processor, and the **ascope** utility reverses the "T" and "A" signs on its display. SIGMET recommends that you set this parameter to "normal" unless you have another

computer wired up to the signal processor which displays velocities reversed and cannot be changed.

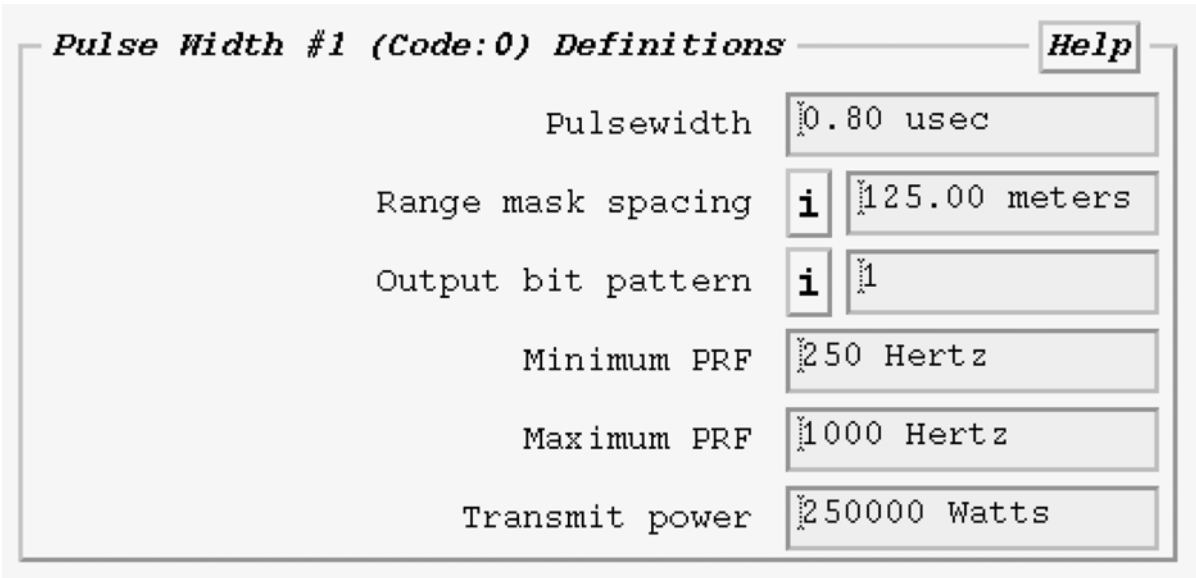
- *Sync mode fuzz angle* — The suggested value for this is 0.15 degrees. If IRIS uses angle sync mode, this controls the tolerance. See your *Signal Processor User's Manual* for details.

10.2.6 Data Simulations



- The data simulator now provides separate time series for every bin that is being processed. Along with advanced features of ascope, this provides a very convenient way to study the bias and uncertainty of processing algorithms on simulated data.

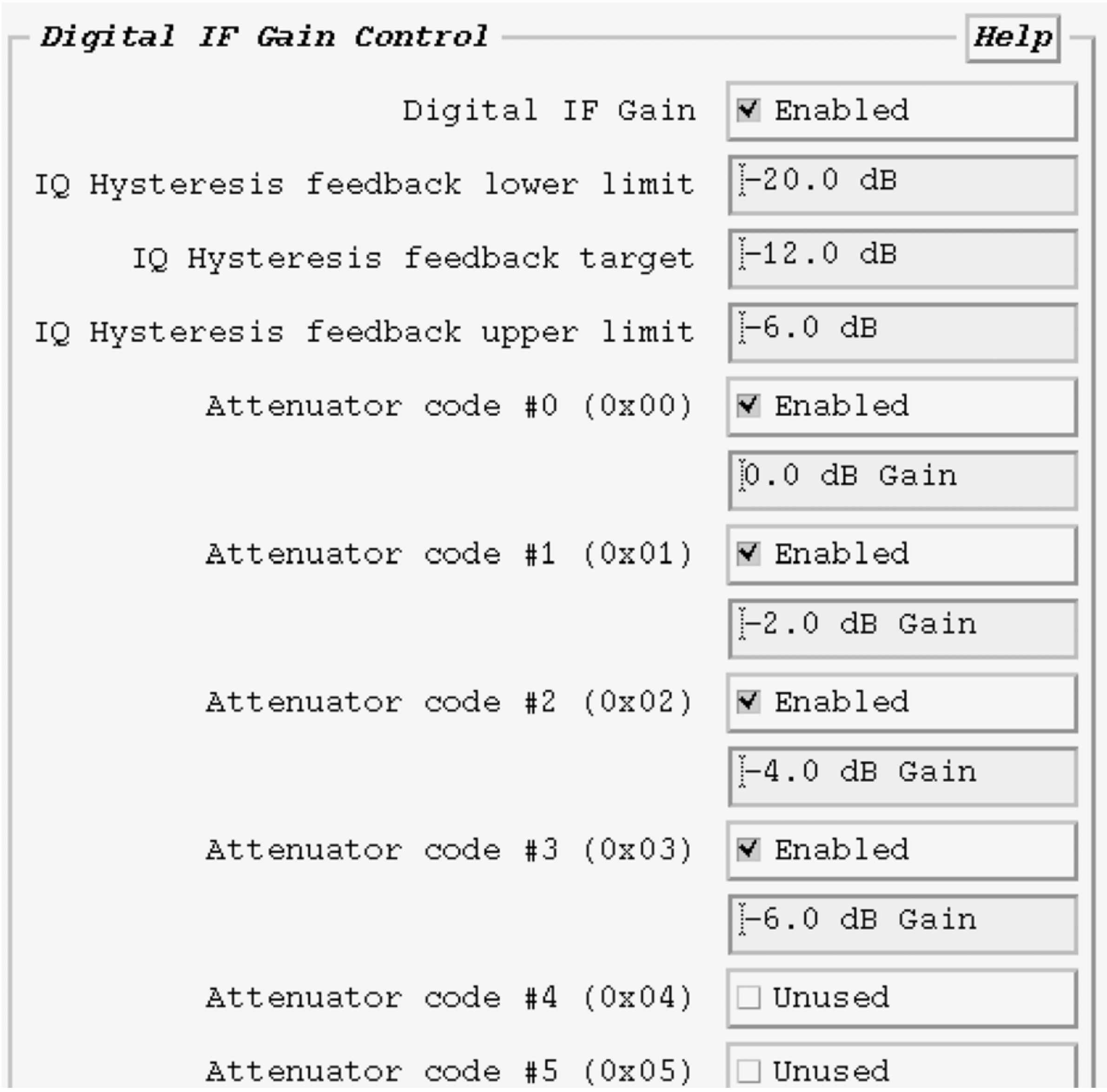
10.2.7 Pulsewidth Definitions



- *Pulsewidth* — Enter the first pulsewidth (usually the shortest) in microseconds. Setup prompts for the other three pulsewidths. If you have only two pulsewidths, enter the minimum pulsewidth for the other values.

- *Range Mask Spacing* — This value should be set to the spacing (in meters) between successive bins in the range mask of your signal processor. The exact value will vary with the type of signal processor, and with the choice of acquisition clock frequency. For the RVP6/7, the range mask spacing with the internal 14.390MHz acquisition clock is 125 meters, but it can be altered to 62.5 meters via the RVP6/7's TTY setups. If the RVP6/7 acquisition circuitry is driven by an external off-board clock, the range mask spacing will, of course, be different. The RVP6/7 TTY setup dialog allows you to specify the acquisition clock frequency, and whether x1 or x2 bin steps will be used. The resulting bin spacing (that should be copied into this setup slot) is also printed in the TTY dialog.
- *Output bit pattern* — Enter the base 10 value of the 4-bit output signals that the signal processor uses to control pulsewidth. Recommended values are 14, 13, 11, and 7. This has no effect on systems that do not use the signal processor to control the pulsewidth.
- *Minimum PRF* — Check with your manufacturer to see if there is any lower limit. A value of 160 Hz is usually acceptable.
- *Maximum PRF* — Enter the maximum PRF in Hz allowed for pulsewidth #1 (specified above). Setup prompts for all four pulsewidths. If fewer than four pulsewidths are specified, Setup still prompts for input for the unused pulsewidths. For these values, use the PRF limit corresponding to the longest pulsewidth (this should be the lowest maximum PRF). This guards against cabling errors.
- *Transmit power* — Enter the peak transmit power in Watts for each of the pulsewidths. Unused pulsewidths can be set to 0.

10.2.8 Digital IF Gain Control (RVP6 REV.B)

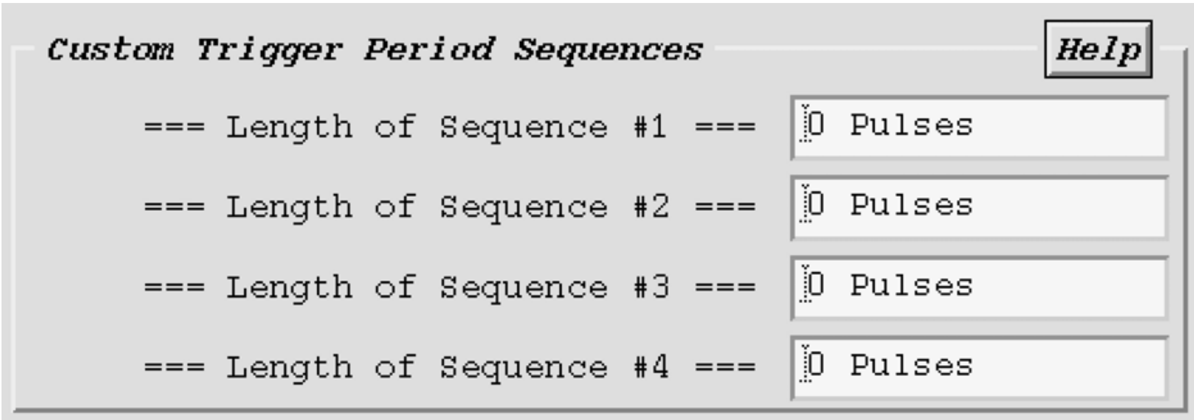


- *Digital IF Gain* — Selecting "disabled" sets the Signal Processor to normal analog STC/AGC gain control. If your signal processor has digital Instantaneous Automatic Gain Control (IAGC) select "enabled." This feature is available only on the RVP6 processor with a REV.B auxiliary board. An "enabled" selection expands the window with the options listed below.
- *IQ Hysteresis feedback lower limit*
  IQ Hysteresis feedback target
  IQ Hysteresis feedback upper limit

IAGC works by attempting to keep the received signal strength within the operating band defined by the lower and upper limits (entered as negative dB values, where 0dB represents the maximum intensity I and Q signal). Whenever the signal strength is outside of these limits, a new attenuator setting is chosen to try to hit the target level.

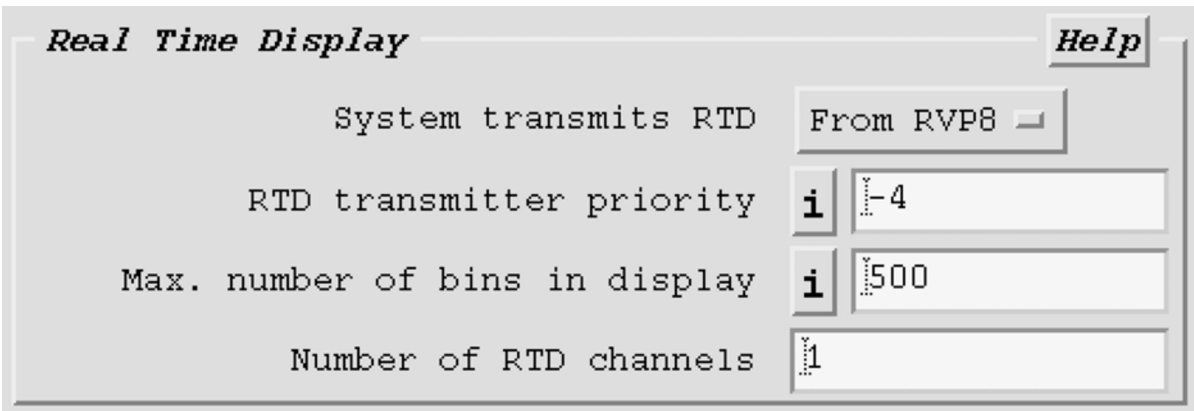
- *Attenuator code (0 – 63)* — For each of the 64 possible 6-bit codes, enter "yes" if it is used or "no" if it is unused. All 64 questions are always asked in this section.

10.2.9 Custom Trigger Period Sequences



This is a feature only implemented on the RVP7. It is only used on ASR9 applications which do not use the procession in the RVP7. Please leave these lengths always set to zero.

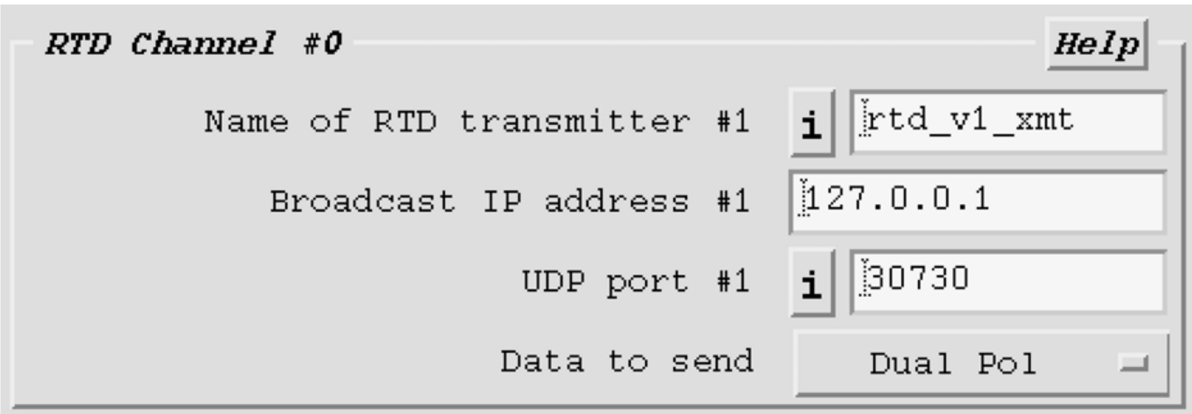
10.2.10 Real Time Display (RTD)



- *System Transmits RTD* — This option will enable/disable the transmission of the RTD and will also show/hide the RTD setup options. When enabled you can specify up to 16 separately configured transmitter channels. Choices are "No", "From App", or "From RVP8". "From App" means that an application program such as IRIS Ingest will issue RTQ library calls to supply the data stream. "From RVP8" means that the RVP8 will source the data. In such a case the host application requires no modification to support the RVP8 generating a display. A single computer cannot generate from both sources, however if you are using **dspexport** then both the host computer and the RVP8 can generate data.
- *Maximum number of bins in display: 512*

  This questions are used to limit the bandwidth of data transmitted over the network for the real time display. It is used only in rtd_v1_xmt. The display will look fine with only a few hundred range bins of data. The maximum size of a ray that can be transmitted over the network is approximately 1500 bytes. Each data type takes up 1 byte. If there are more range bins in a task than can be sent, IRIS will send out only 1 out of every N bins, where N is the smallest number possible.

For more information, see also the Real Time Display in the *IRIS/RDA Utilities Manual*, Chapter 9, Real Time Display, on page 155.



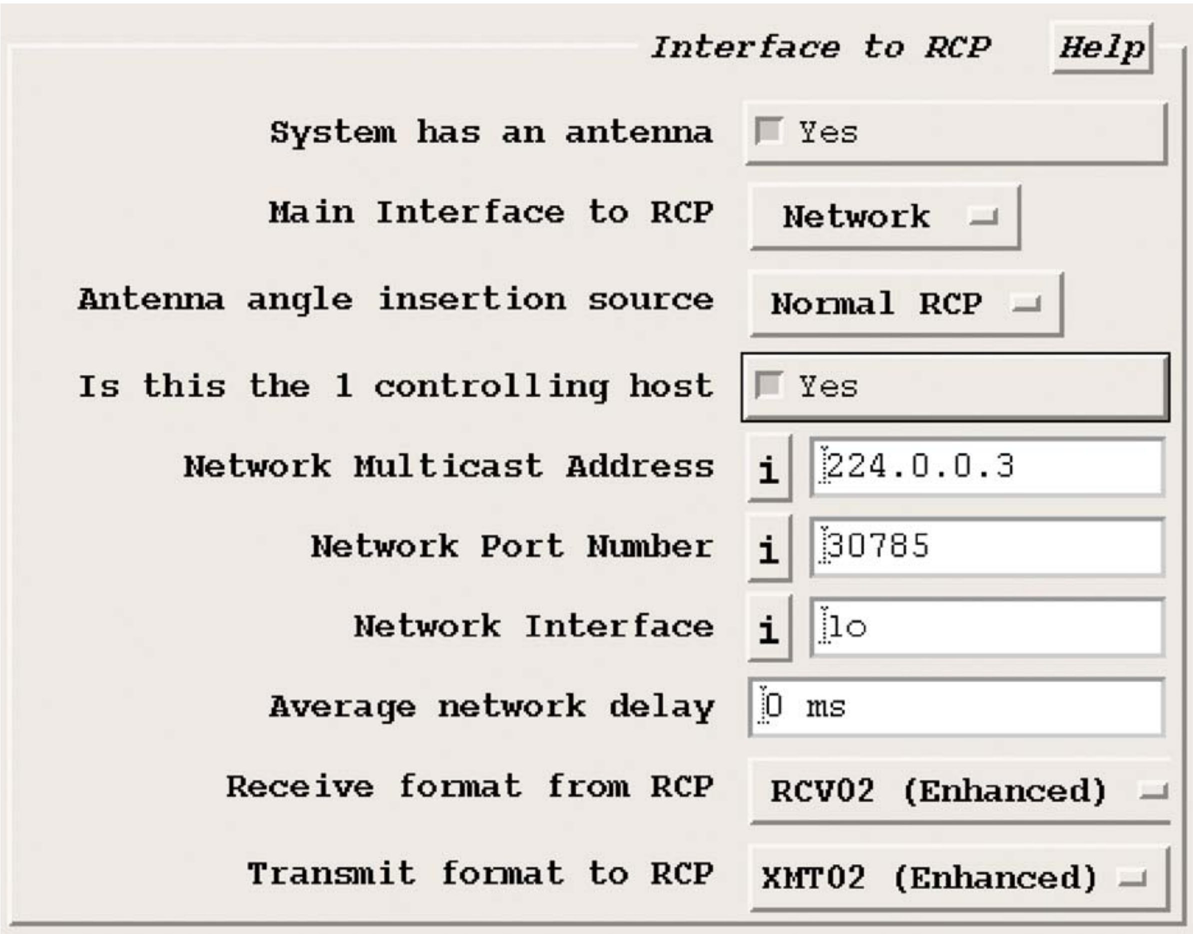
- *Name of RTD transmitter #1* — Specify the name of the executable program which is run to transmit the real time display stream for this channel. SIGMET recommends the default transmitter **rtd_v1_xmt**. SIGMET also ships 2 other transmitter programs: **rtd_v2_xmt** and **rtd_nids3_xmt**. Customers who wish to customize the format and write their own program and enter it here. The API is public, and so are the existing transmitter programs.
- *Broadcast IP address #1* — Specify the broadcast addresses here. Generally only one is used, and it is your network address with the

machine number set to 255. You can use the local loopback address 127.0.0.1 to display only locally. To find your address, type `netstat -nr` to list your interfaces. Suppose your interface is called "eth0". Then type `ifconfig eth0`. This should show your broadcast address. If it is not there, you may need to turn on the broadcast feature.

- *UDP port #1* — Specify your port number here. Any unused port number can be used, but SIGMET suggests using 30730 as a default.
- *Data to send* — You have 3 choices here: Z,V,&W (for minimal data types), Single Pol for all single polarization data, and Dual Pol for all data types. This control also only applies to **rtd_v1_xmt** format. Note that there is an internal limit now of only 10 data types.

10.3 Radar Control Processor

10.3.1 Interface to RCP



- *System has an antenna* — In most environments only the radar host systems will have an antenna. Select "No" for all analysis and display systems.
- *Main Interface to RCP* — See Chapter 12, RVP8/RCP8 Network Export Utilities, on page 265 for detailed configuration examples of how to configure the RCP and RVP interfaces. Choices here are:
  - Network — This is the most frequently used interface on modern RVP8 and RCP8 systems. It uses a multicast network socket to send and receive information from the RCP. For network interfaces you must enter the Multicast Address, Port Number, Interface, and network delay.
  - Serial — This is the legacy serial cable interface. You will need to also enter the serial device file name. For RVP8 systems using a serial tag interface to the RCP, enter "Serial" for the interface and "Normal RCP" for the angle source.
  - AntExport — Not recommended for general use. Allows a low-bandwidth remote host to get antenna control and status. All of the other setup questions will be removed because that information is automatically exported from the main RCP system.
  - None — On an RVP8 system which has a hardware interface for angle input (either parallel tags or synchro inputs) enter "None" for the interface, and "Native RVP8" for the angle source.

- *Antenna angle insertion source* — This tells which angle source we are using to determine the current antenna position. Other information, such as the status and control bits always comes from the "Normal RCP" interface. Choices are:
  - Normal RCP — This means that the antenna angles arrive in the normal network packets from the RCP.
  - Native RVP8 — This means you are on an RVP8 which gets angles from a hardware source.
  - Native RCP8 — This means you are on an RCP8 which inherently knows the antenna position.

- *Is this the 1 controlling host* — You must select only one of your computers to be the controlling host. This will be the only computer to send transmit packets to the RCP. These are the packets which control antenna position and other switches. If you configure more than one host as a controller, you will not be in full control.

For network interfaces expect the following questions:

- *Network Multicast Address* — We suggest using the default address of 224.0.0.3. This is a "link-local" address which by default will not be passed through routers, but it will go through switches and hubs. If you need to go through a router, consider using the "site-local" address 239.255.0.1.

The strength of the multicast addressing scheme is that the antenna position information can go to several recipients simultaneously, so both the RVP8 and the IRIS host can receive antenna information. A drawback is that the packets may travel to other machines on the local network and cause network administrators to complain. Be sure to set the same address and port number on the RCP8 and RVP8 as needed. The multicast addresses have many reserved values, so if you have more than one RCP8 system at a site, we recommend using different port numbers, rather than different addresses.

- *Network Port Number* — Suggested default of 30785. Increment from there if needed.
- *Network Interface* — Specify here which eithernet interface to use for the RCP communication. If the antenna information does not need to leave the local computer, then use the loopback interface of "lo".
- *Average Network delay* — SIGMET recommends that you start with the default value of 0 ms here. This is the packet transmission delay from the RCP8 to the local system. For slow networks measure this by pinging the RCP8 and enter half the average ping time.

For serial interfaces expect the following questions:

- *Main serial device name* — Enter the pathname of the device file for the serial port wired to the RCP. For internal simulation, set this to blank.

  You can freely substitute FIFOs for serial device files. What to do is based on the device name: If the device pathname ends in "-x" or "-y", then IRIS assumes that we are opening a FIFO pair that will be used in some sort of loopback mode.

  Here is an example, first create your FIFOs:

  ```
  $ cd /usr/sigmet/config
  $ mkfifo ant_fifo-x ant_fifo-y
  ```

  Then choose "/usr/sigmet/config/ant_fifo-x" as the device name. IRIS will write to the specified FIFO, and read from the other. If the RCP is a SIGMET RCP8, then choose "/usr/sigmet/config/ant_fifo-y" as the RCP8/SiteHost serial port.
- *Running at and with parity* — Specify the baud rate and parity of the serial port.

For AntExport interfaces expect the following questions:

- *AntExport hostname/IP-Address* — Enter the host of the exporting system.

- *AntExport Port Number* — Suggested default of 30745.

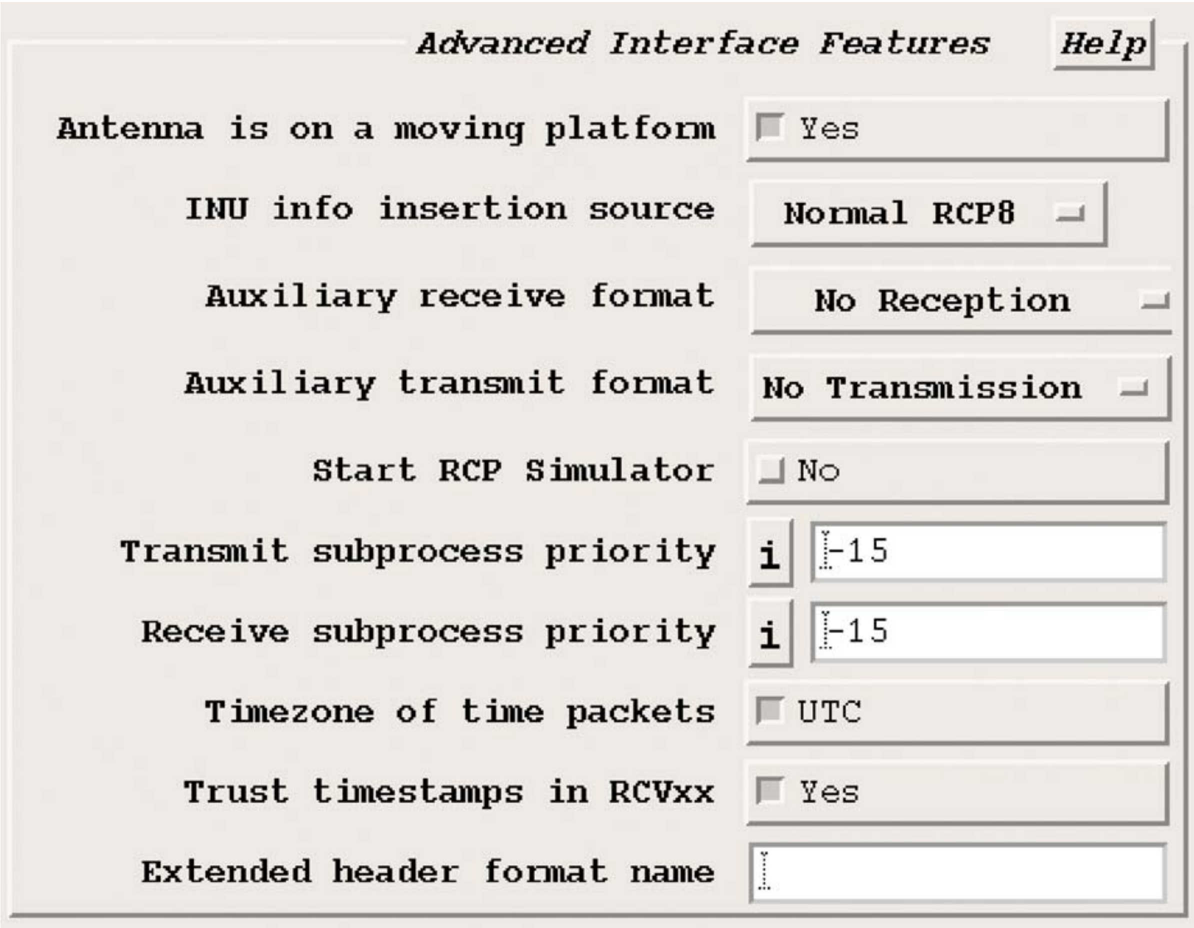
Questions resume for all interfaces:

- *Receive format from RCP* — Enter one of the following antenna reception formats for both the main and auxiliary:
  - No Reception
  - rcv01 (Original RCP)
  - rcv02 (Enhanced RCP)
  - rcv03 (Shipboard Format)
  - rcv05 (Dual System)
  - Scientific Atlanta 3860

  The details of the various formats are in the *IRIS Programmer's Manual*.
- *Transmit format to RCP* — Enter one of the following antenna reception formats for both the main and auxiliary:
  - No Transmission
  - xmt01 (Original RCP)
  - xmt02 (Enhanced RCP)
  - xmt05 (Dual System)
  - Scientific Atlanta 3860

  The details of the various formats are in the *IRIS Programmer's Manual*.

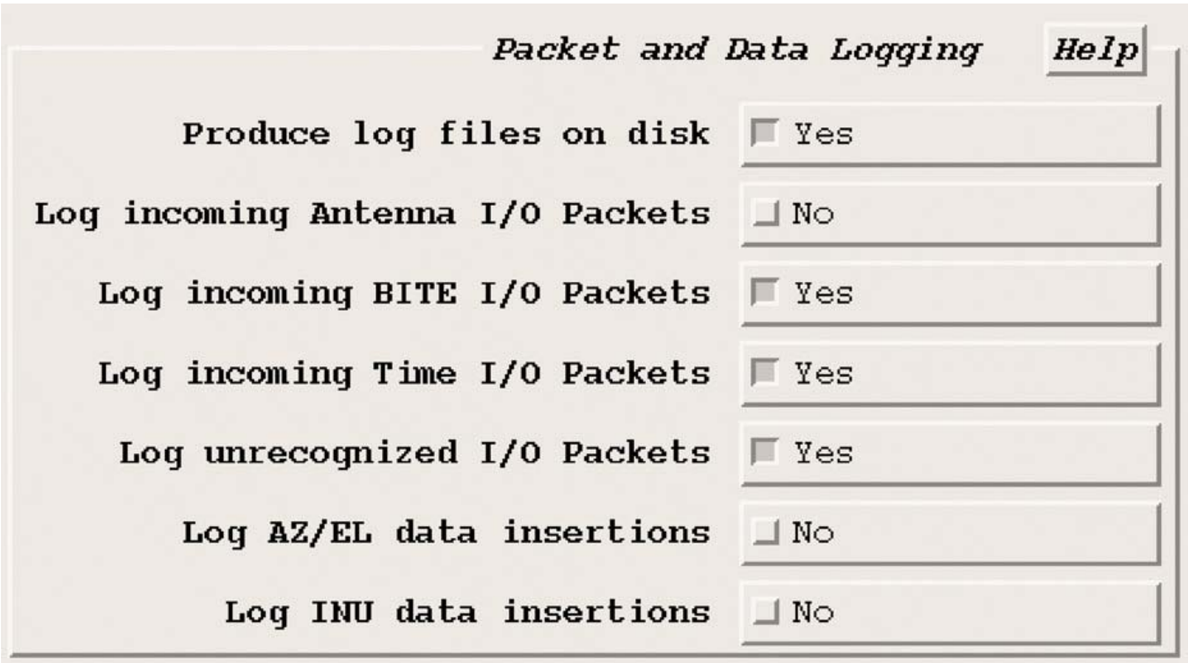
10.3.2 Advanced Interface Features



- *Antenna is on a moving platform* — Use this to enable the INU related setup questions, and platform motion correction in the real-time display.
- *INU info insertion source* — This tells which INU source we are using. Normally we use the RCP8. If we are getting INU information from a custom extended header library, then enter "Custom Header". Only visible on moving platform systesms.
- *Auxiliary receive format* — Some systems have two serial lines transmitting RCP control information. Only the primary line is used to receive information. If your system uses two lines, configure the second line as the auxiliary. Similar question for an auxiliary transmitter.
- *Auxiliary serial device name* — Enter the auxiliary serial device file when used.

- *Start RCP Simulator* — This is a convenience feature for simulated systems to automatically start up the antenna simulator when the antenna driver is started.
- *Receive/Transmit Subprocess Priority* — On UNIX systems, set the priority to -15.
- *Timezone of time packets* — Some RCP's are configured to send the current time to IRIS over the serial link. This is used to set the time of the radar computer at the safest times. This specifies the timezone of that data stream.
- *Trust timestamps in RCVxx* — Some RCP serial formats include a timestamp used to accurately time sequence the received data. Set this to "No" on systems attached to RCPs which do not fill in those numbers.
- *Extended header format name* — Set this to blank for systems with no custom extended header. If you do have custom extended headers, then enter the name of the extended header shared library.

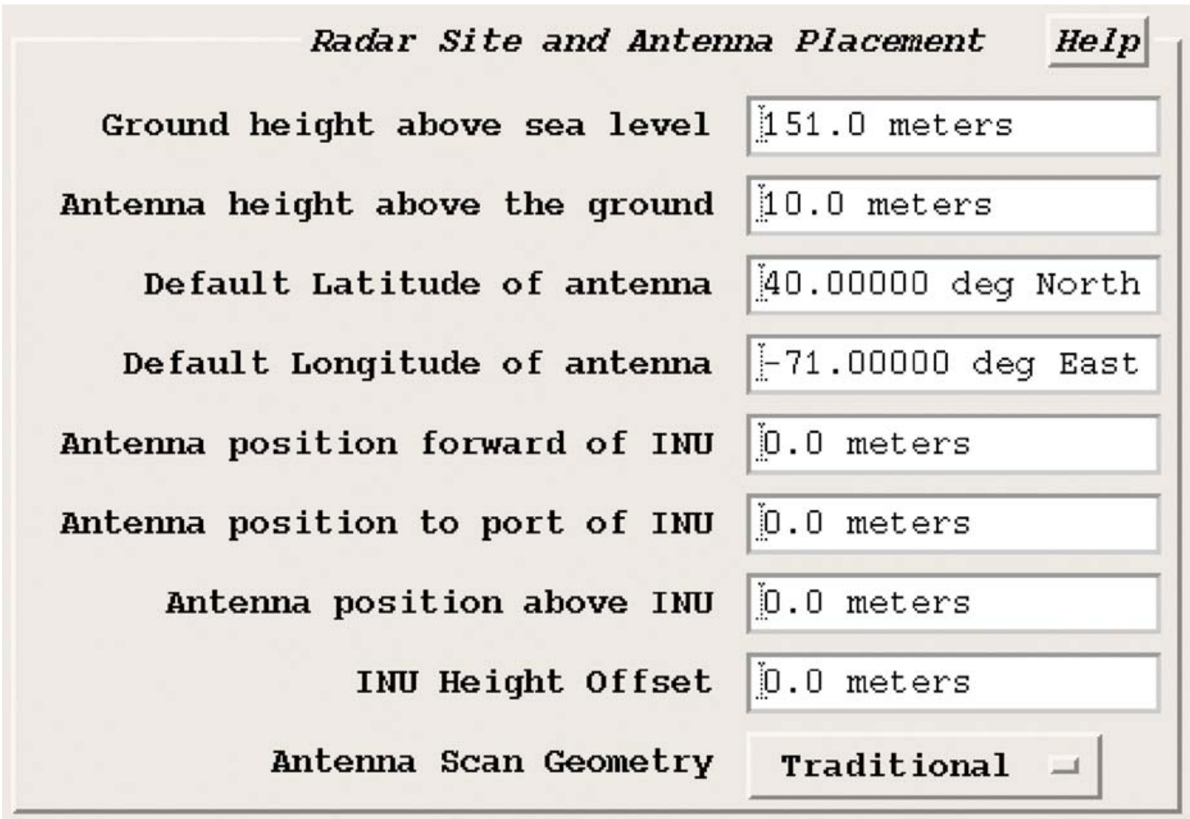
10.3.3 Packet and Data Logging



- *Produce log files on disk* — Choose either "Yes" or "No". Antenna log files are used to debug errors in the antenna position, BITE packets, Time packets, and INU packets. When turned on, a log file called ${IRIS_LOG}antlib.log is created. This log file is rotated using logrotate, as configured by /etc/logrotate.d/sigmet-antlib. These files are also used to produce the BITEX histograms.

- *Log incoming Antenna I/O Packets* — Choose either "Yes" or "No" to log incoming Antenna I/O Packets in the antenna log file.
- *Log incoming BITE I/O Packets* — Choose either "Yes" or "No" to log incoming BITE I/O Packets in the antenna log file.
- *Log Incoming Time I/O Packets* — Choose either "Yes" or "No" to log incoming Time I/O Packets in the antenna log file.
- *Log unrecgonized I/O Packets* — Choose either "Yes" or "No" to log unrecognized I/O Packets in the antenna log file.
- *Log AZ/EL data insertions* — Choose either "Yes" or "No" to log the AZ/EL position of the antenna in the antenna log file.
- *Log INU data insertions* — Choose either "Yes" or "No" to log INU data in the antenna log file.

10.3.4 Radar Site and Antenna Placement



- *Ground height above sea level* — Enter the height above sea level (in meters) of the ground at the radar site. All product heights are referenced to this value. If you wish to make products relative to sea level, enter zero and put the ground height and tower height into the next question. If the radar is on a ship, then a value of 0 is appropriate.

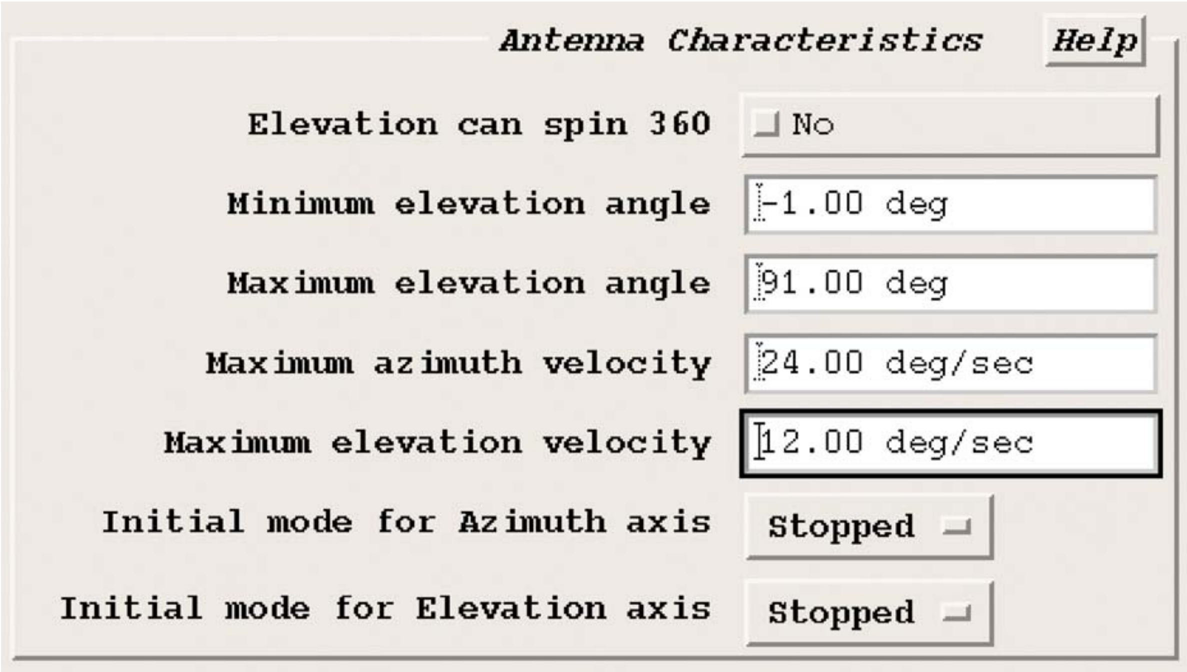
For compositing several radars together, chose a common reference ground, and enter the same value here for all sites.

- *Antenna height above the ground* — Enter the height of the radar antenna above the ground height chosen above. If you are using RCV03 format, this number (set in meters) is overridden by the altitude reported from the antenna controller.
- *Latitude (North) / Longitude (East) of antenna* — Enter these values in decimal degrees with as many places of accuracy as desired (N and E are positive). If you are using RCV03 format, these numbers are overridden by the antenna controller.

The following questions are only for moving platform systems:

- *Antenna position ...* — Enter the distance in meters from the Inertial Navigation Unit location to the antenna location. This is recorded with the data and used for platform motion velocity corrections. For example, if the INU is located in the middle of a ship at sea level, and the antenna is 10 meters above the sea, 15 meters to the stern and centered, enter the values "-15," "0," and "10."
- *INU height offset* — For moving platform systems that do not correctly measure the height of the INU, this number is added to what is reported by the antenna controller.
- *Antenna Scan geometry* — There are two choices: "Traditional" and "Aircraft Tail". For an aircraft tail radar, the elevation angle scans continuously and the azimuth angle is the angle of the scanning cone, where 0 is perpendicular to the elevation axis. See Appendix C of the *IRIS Product & Display Manual* for details.

10.3.5 Antenna Characteristics

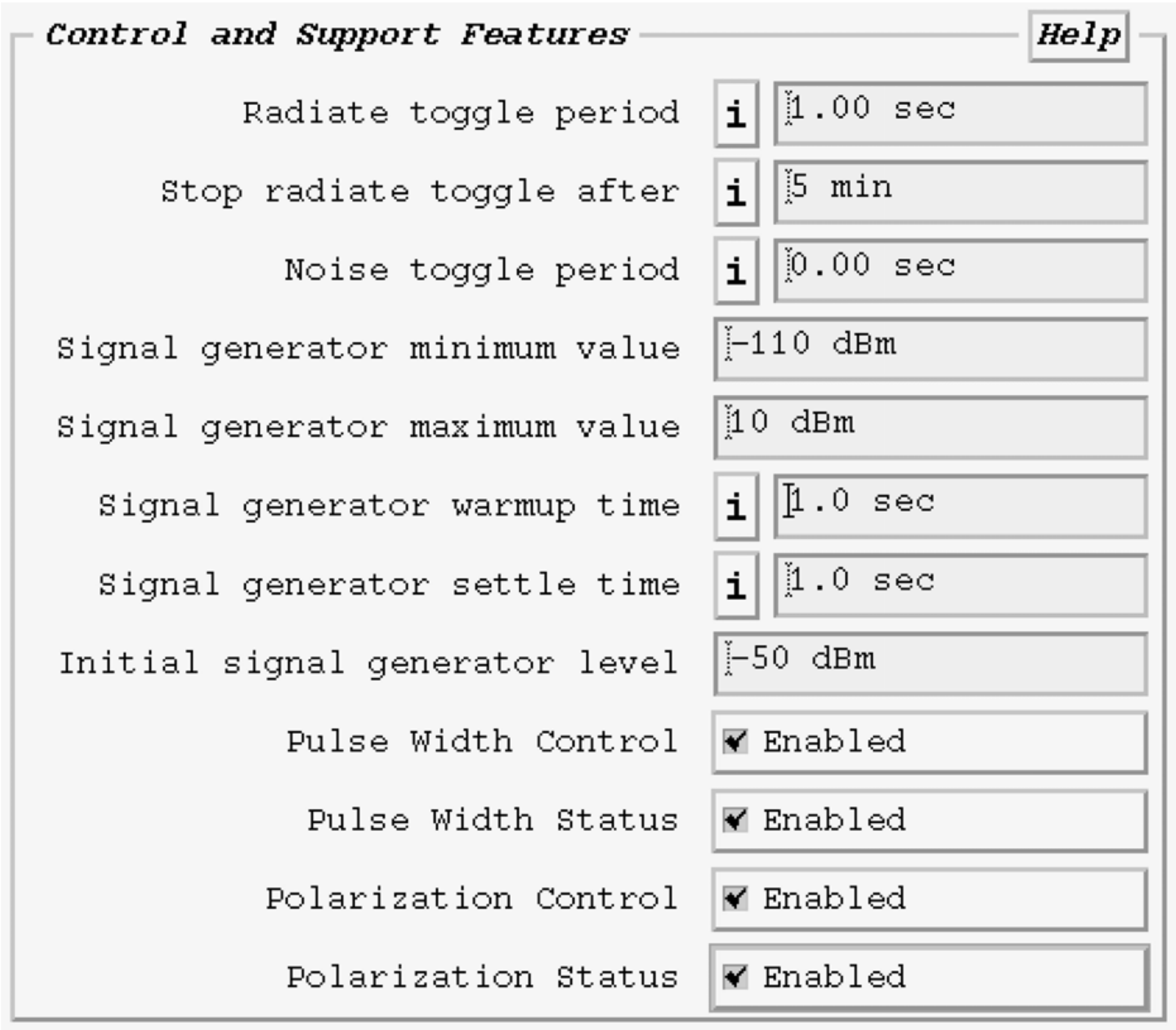


- *Elevation can spin 360* — Setting this to "Yes" will remove the need for the following two questions:
- *Minimum/Maximum elevation* — The minimum and maximum elevation position in degrees that the antenna can safely reach.
- *Maximum azimuth/elevation velocity* — The maximum velocity in degrees per second that the antenna can safely rotate on each axis. This limit applies to both clockwise/counterclockwise and up/down motion. The antenna should be able to achieve the velocity limits set here.
- *Initial mode for Azimuth/Elevation axis* — This parameter sets the mode of the antenna when IRIS is first started. Enter one of the following values:
  - Stop — The antenna is not moving when IRIS is started. This should be the antenna's initial mode at sites where there is a possible hazard to personnel.
  - Position — The antenna is moved to its initial position when IRIS is started.
  - Velocity — The antenna is rotated at its initial velocity when IRIS is started.

If the Initial mode for Azimuth/Elevation axis is not set to "Stopped," the following text boxes appear:

- *Initial Azimuth/Elevation position* — Enter the position in degrees that the antenna should take when IRIS is started; used when the initial mode is set to "position."
- *Initial Azimuth/Elevation velocity* — Enter the degrees/second that the antenna should rotate when IRIS is started; used when the initial mode is set to "velocity."

10.3.6 Control and Support Features



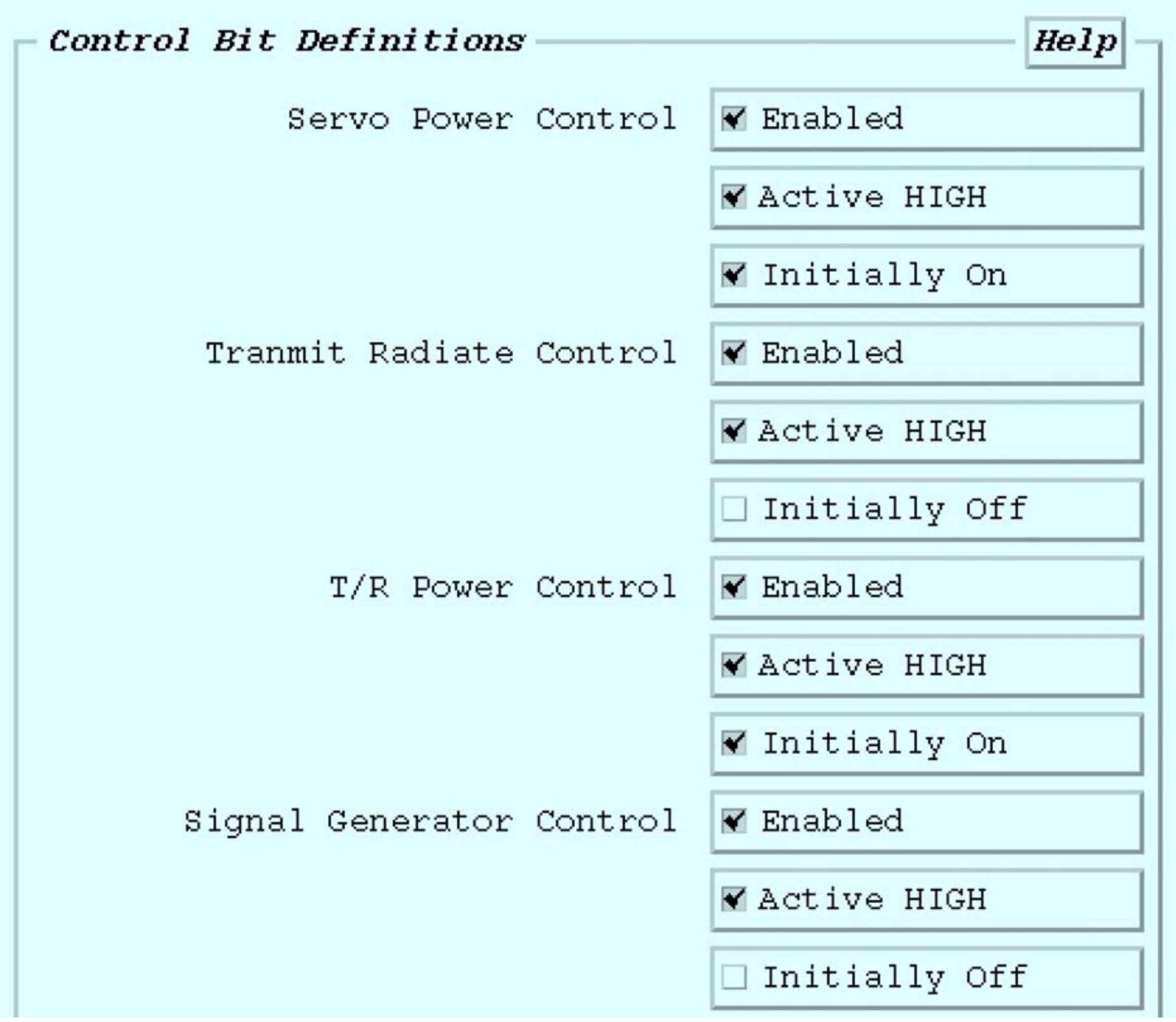
- *Radiate toggle period* — IRIS automatically toggles the radiate control off for this time, then on again, once per task if the following conditions are met:
  1. IRIS can control the radiation.
  2. IRIS can sense the radiation state.
  3. IRIS is requesting the radiation to be on, but it is actually off.

4. Radiate has been requested on more that the "Warmup time for transmitter" set in the ingest setups.
5. Less than the *Stop radiate toggle after* time has passed since the transmitter was not following the request.

   Setting either parameter to 0 disables toggling. The recommended values are 1 second and 5 minutes.

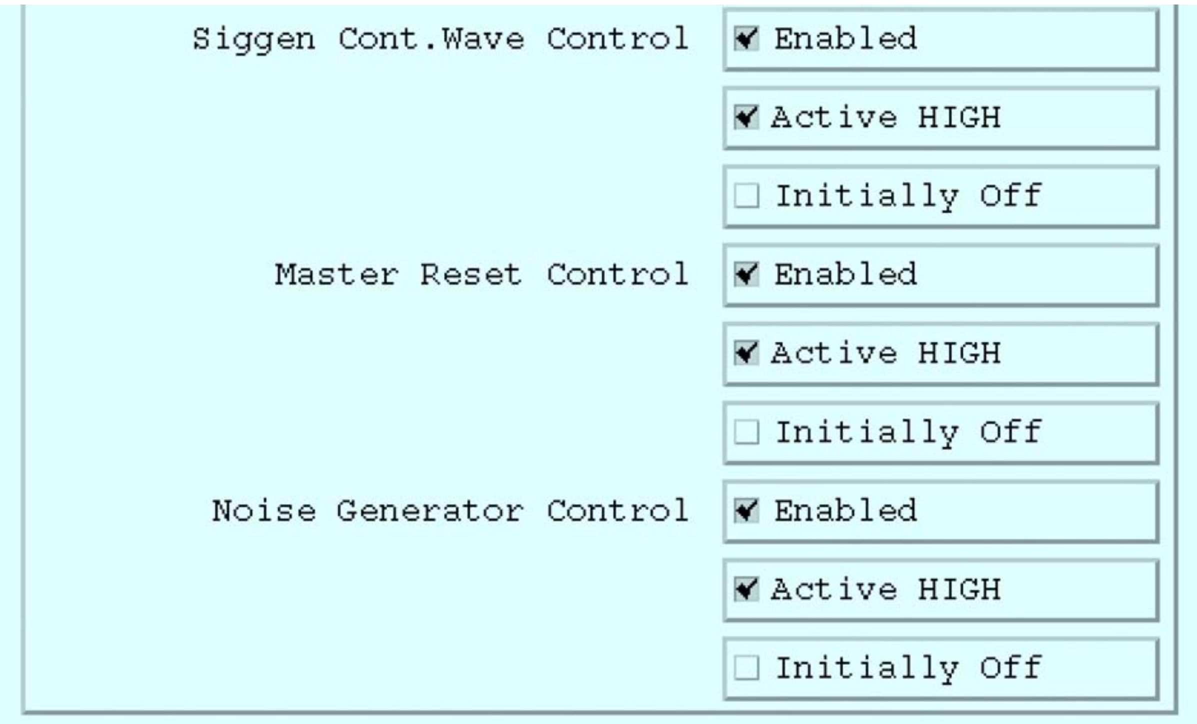
- *Noise toggle period* — Whenever the INGEST process or the **Ascope** utility take noise samples, the signal generator bit in the antenna controller is set for this amount of time after IRIS is through with its noise tasks. This value is used by Gematronik radars for calibration purposes. Set this parameter to 0 if you do not need this feature.
- *Signal generator minimum /maximum value* — The lowest and highest power output of the signal generator in dBm.
- *Signal generator warmup time* — Time allowed after the signal generator is turned on before the signal level is assumed to be correct.
- *Signal generator settle time* — Time allowed after the signal level is set before the received power is measured. A value of 1 second is recommended.
- *Initial signal generator value* — Enter the signal generator level to use when IRIS is started.
- *Pulsewidth Control* — Select either "disabled" or "enabled." On driver powerup, the pulse width will not be set until it is also set in the signal processor.
- *Pulsewidth Status* — Select "enabled" or "disabled" to indicate whether the antenna controller can detect the pulsewidth.
- *Polarization Control* — Select either "disabled" or "enabled." On driver powerup, the polarization will not be set until it is also set in the signal processor.
- *Polarization Status* — Select "enabled" or "disabled" to indicate whether the antenna controller can detect the polarization.

10.3.7 Control Bit Definitions

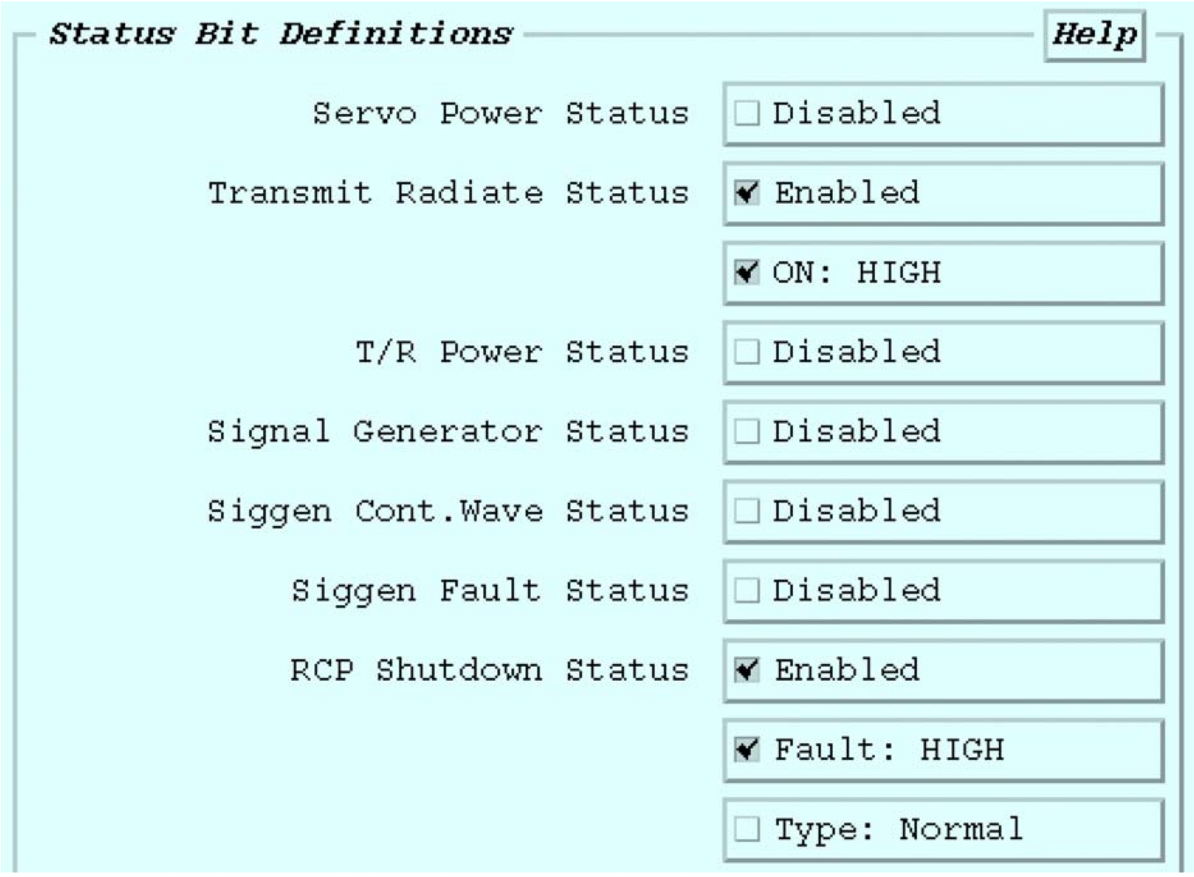


- *Servo Power Control* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can control the servo power. If enabled is selected, an option for "Active HIGH" or "Active LOW" appears as well as an option for "Initially Off" or "Initially On."
- *Transmit Radiate Control* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can control the transmitter radiation. If enabled is selected, an option for "Active HIGH" or "Active LOW" appears as well as an option for "Initially Off" or "Initially On."
- *T/R Power Control* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can control the power to the transmitter and receiver rack. If enabled is selected, an option for "Active HIGH" or "Active LOW" appears as well as an option for "Initially Off" or "Initially On."

- *Signal Generator Control* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can control a signal generator for calibration purposes. If enabled is selected, an option for "Active HIGH" or "Active LOW" appears as well as an option for "Initially Off" or "Initially On."
- *Siggen Cont. Wave Control* — Choose either "disabled" or "enabled" to indicate whether the signal generator can be switched between Continuous Wave (CW) and pulse mode. If enabled is selected, an option for "Active HIGH" or "Active LOW" appears as well as an option for "Initially Off" or "Initially On."
- *Master Reset Control* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can be reset. If enabled is selected, an option for "Active HIGH" or "Active LOW" appears as well as an option for "Initially Off" or "Initially On."
- *Noise Generator Control* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can control a noise source for receiver testing and calibration purposes. If enabled is selected, an option for "Active HIGH" or "Active LOW" appears as well as an option for "Initially Off" or "Initially On."



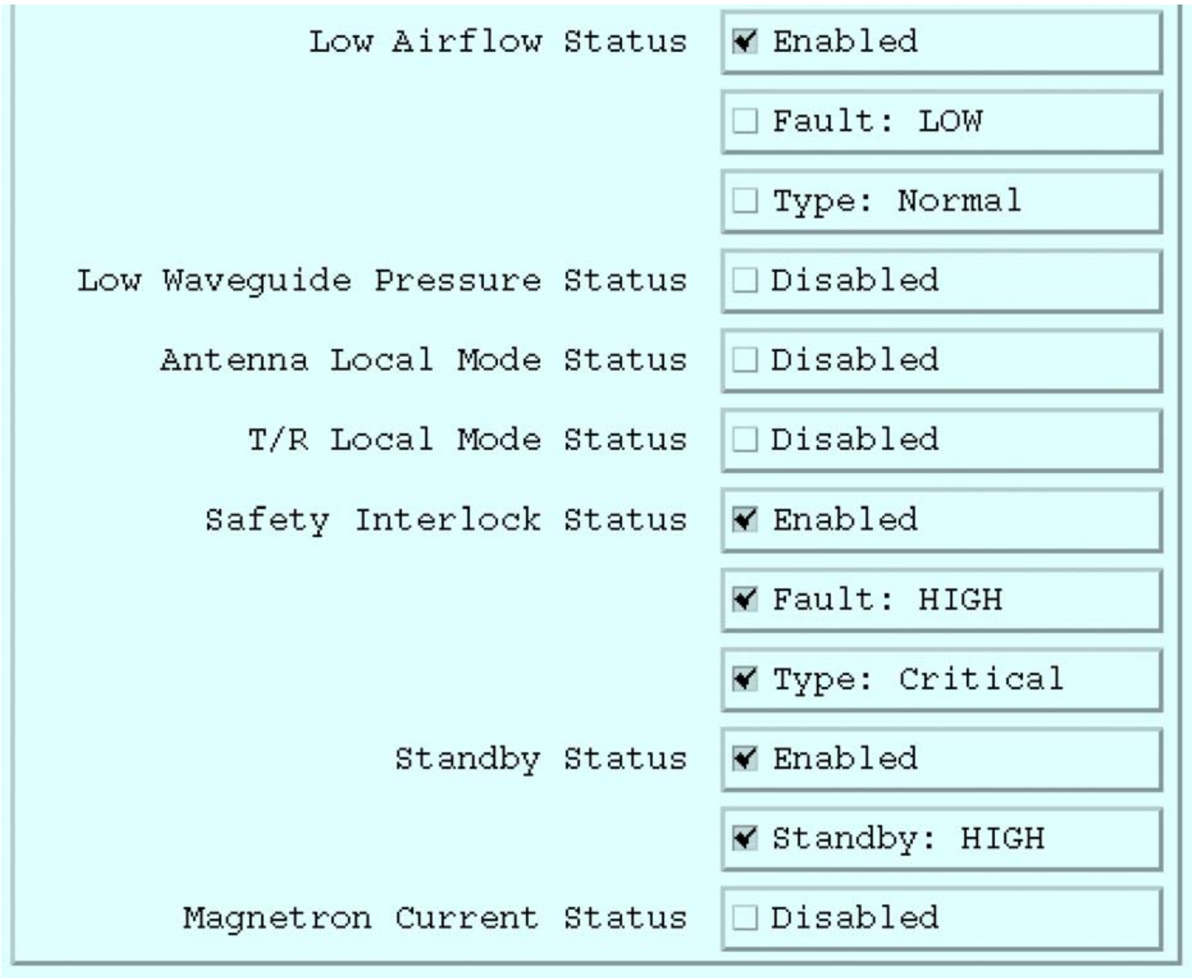
10.3.8 Status Bit Definitions



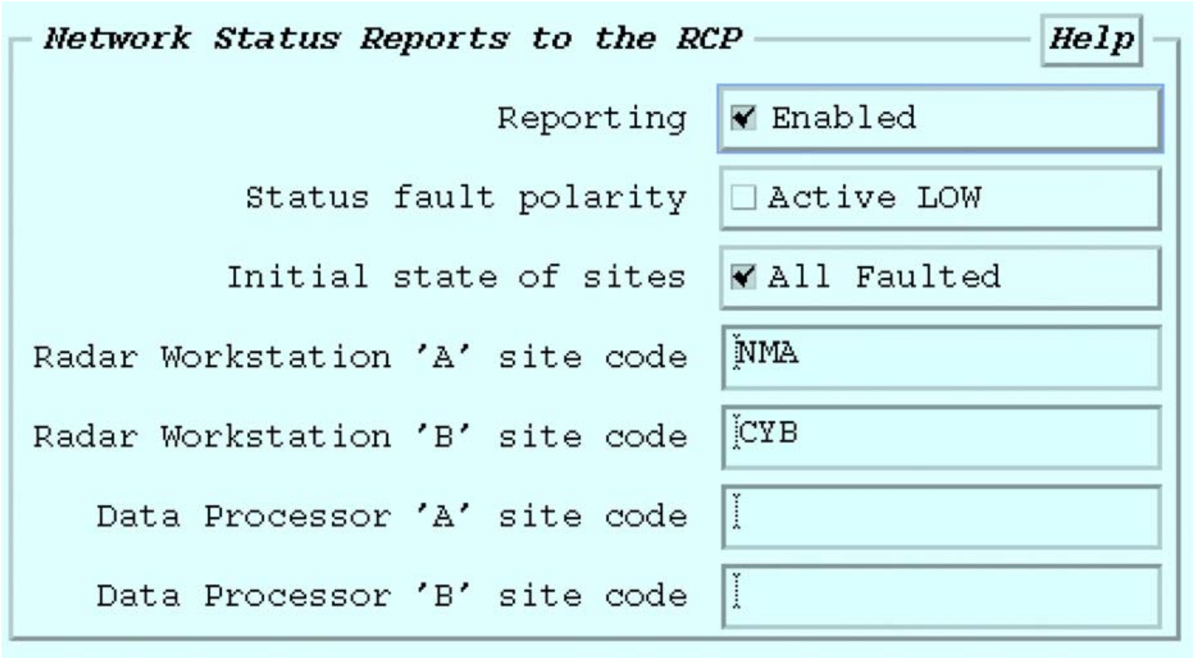
- *Servo Power Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect that the servo power is turned on. If enabled is selected, an option for "ON: HIGH" or "ON: LOW" appears.
- *Transmit Radiate Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect that the transmitter is trying to radiate. If enabled is selected, an option for "ON: HIGH" or "ON: LOW" appears.
- *T/R Power Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect that the power is turned on to the transmitter/receiver rack. If enabled is selected, an option for "ON: HIGH" or "ON: LOW" appears.
- *Signal Generator Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect whether the signal generator is turned on. If enabled is selected, an option for "ON: HIGH" or "ON: LOW" appears.
- *Siggen Cont. Wave Status* — Choose either "disabled" or "enabled" to indicate whether the antenna control can detect when the signal

generator is in continuous wave or pulse mode. If enabled is selected, an option for "Fault: HIGH" or "Fault: LOW" appears.

- *RCP Shutdown Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect if the RCP is turned on. If enabled is selected, an option for "Fault: HIGH" or "Fault: LOW" appears.
- *Low Airflow Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect if the airflow is low. If enabled is selected, an option for "Fault: HIGH" or "Fault: LOW" appears. You also can select whether the fault is treated as a normal or critical fault. Normal faults are marked with yellow, while critical faults are marked with red, and can cause mode switching and window alerts.
- *Low Waveguide Pressure Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect if the waveguide pressure is low. If enabled is selected, an option for "Fault: HIGH" or "Fault: LOW" appears. The fault type is also specified.
- *Antenna Local Mode Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect if it is in local mode. If enabled is selected, an option for "Local: HIGH" or "Local: LOW" appears.
- *T/R Local Mode Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect if the transmitter/ receiver is in local mode. If enabled is selected, an option for "Local: HIGH" or "Local: LOW" appears.
- *Safety Interlock Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect if the safety interlock is open. If enabled is selected, an option for "Fault: HIGH or "Fault: LOW" appears. The fault type is also specified.
- *Standby Status* — Choose either "disabled or "enabled" to indicate whether the antenna controller can detect if the transmitter is in the standby mode. If enabled is selected, an option for "Standby: HIGH" or "Standby: LOW" appears.
- *Magnetron Current Status* — Choose either "disabled" or "enabled" to indicate whether the antenna controller can detect that the magnetron current is not correct. If enabled is selected, an option for "Fault: HIGH" or "Fault: LOW" appears. The fault type is also specified.

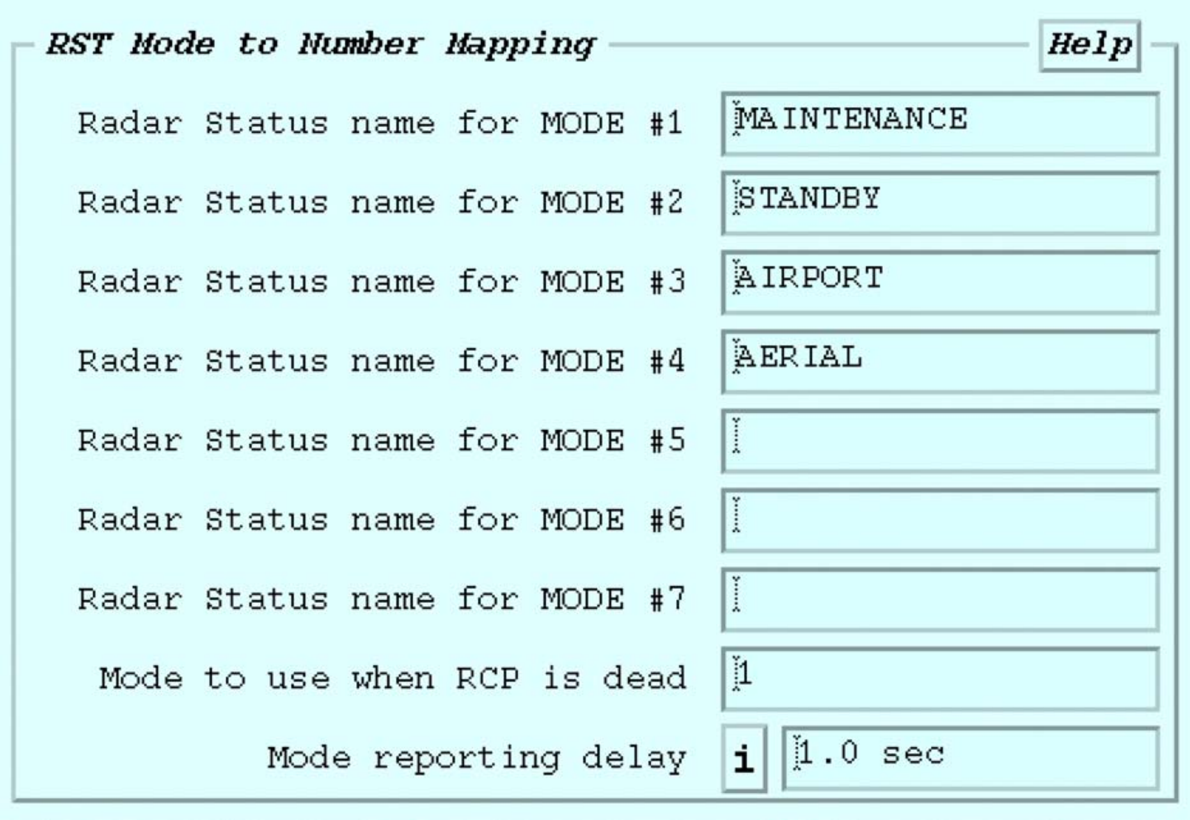

Low Airflow Status
Enabled
Fault: LOW
Type: Normal
Low Waveguide Pressure Status
Disabled
Antenna Local Mode Status
Disabled
T/R Local Mode Status
Disabled
Safety Interlock Status
Enabled
Fault: HIGH
Type: Critical
Standby Status
Enabled
Standby: HIGH
Magnetron Current Status
Disabled

10.3.9 Network Status Reports



- *Reporting* — Select either "disabled" or "enabled." If enabled is selected the following options appears:
  - *Status Fault polarity* — Select either "Active HIGH" or "Active LOW." Since the site status bits in the XMT02/04/05 formats are set to "1" when a site is okay, the recommended fault polarity is "Active LOW".
  - *Initial state of sites* — Select the initial fault status of all four sites as either "All Okay" or "All Faulted."
  - *Radar Workstation 'A' site code*, ... — Enter the site codes whose fault status is to be reported to the RCP for each of the two possible Radar Workstation sites and Data Processor sites.

10.3.10 RST Mode Requests



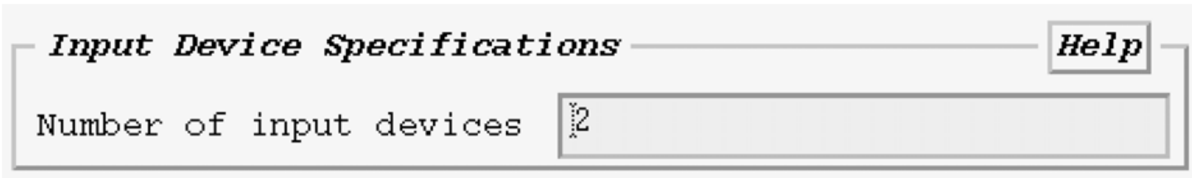
These questions let you define up to seven modes. Each mode has a number and a name, corresponding to a Radar Status menu configuration. Whenever the configuration is changed in the Radar Status menu, the mode is reported back to the RCP. Unrecognized configurations are reported as mode 0. The RCP can also send this mode to the Radar Status menu to change the configuration. A request for mode 0 denotes automatic switch mode, which automatically switches configurations based on warning products.

- *Radar Status name for MODE (1 – 7)* — For each 3-bit nonzero mode value, enter the name of an IRIS configuration that is to be activated whenever that mode is requested.
- *Mode to use when RCP is dead* — This mode will automatically be requested by the IRIS antenna driver whenever it detects theat the RCP is dead, i.e., that the genuine desired mode can not be determined. This is valuable in dual/redundant systems that must switch to a known state when certain errors occur. Setting the mode to zero will cause no mode change to occur for a dead RCP.
- *Mode reporting delay* — To make sure that the RCP mode is never ahead or behind the IRIS task scheduler mode, IRIS will first stop the

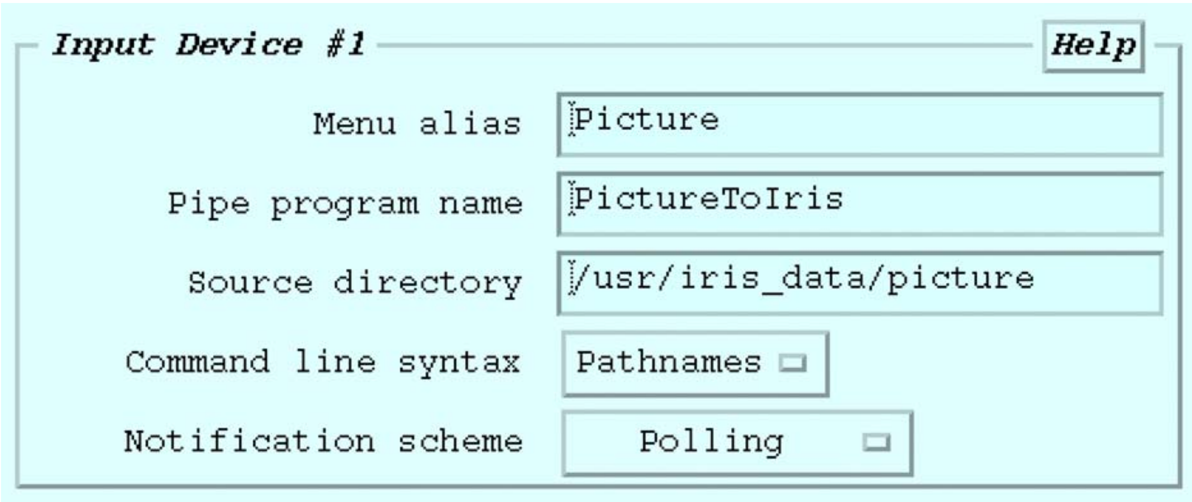
old task, wait the set delay time, report the new mode to the RCP, wait again for the delay, then load the new task schedule, and run it. If your system does not use the RCP mode report, then the default setting is zero. Note that if the RST menu switches modes, both modes have the same task schedule, the tasks are not stopped and no delay is applied. The same is true for the product schedule.

10.4 IRIS Input Setups

IRIS allows the user to configure up to 16 input devices. Each input is a separate process watching a special directory looking for files to arrive. When a file arrives, the process will invoke a conversion program, and insert the resulting data into the IRIS product inventory.



- *Number of input devices* — Enter the number of inputs you wish to configure for your system. The maximum number supported is 16.



- *Menu alias* — Enter a name to use to remember this input.
- *Pipe program name* — Enter the name of a conversion program to run when a file arrives. IRIS will look for this program in the ${IRIS_PIPES} directory. If you enter a blank name here, then it is assumed files are in IRIS product format, and will be directly inserted into the inventory after byte swapping.

- *Source directory* — Enter the directory to monitor for files. Each input channel must have a separate directory. At startup, all files found in the directory are deleted. The input process then checks every few seconds for files. If it finds a file with the same size as last time, it runs the pipe conversion program and deletes the file.

  All files starting with a "." are ignored, so if you are copying between computers you should use what we call "rename notification". In that scheme, the file is first copied to a temporary filename starting with at ".". After the slow copy is completed the file is renamed to the final name. This prevents the input from reading a partial file. If the filename ends with ".gz" then gunzip is applied before processing, similarly if it ends with a ".Z" then uncompress is applied.

  Table 4 on page 202 shows the input pipes currently supplied with the IRIS system, however it is expected that the customer will wish to write their own. For more details see Chapter 3, Antenna Utility, on page 29 of the *IRIS Programmer's Manual*.

Table 4 Input Pipes Supplied with IRIS

Name	Syntax	Purpose
AsciiToGage	Pipe	Converts file to IRIS GAGE product.
AsciiToPlane	Pipe	Converts file to IRIS WARN product.
AsciiToSetup	Pipe	Reads file into **setup_change** utility to change the active setup values.
BMPSatToIris	Pipe	Converts satellite image to IRIS USER product.
BufrToIris	Pathnames	Converts WMO BUFR format to IRIS Cartesian products using OPERA guidelines.
ChangeTaskName	Pipe	Changes task name of an IRIS RAW product.
ChProductName	Pipe	Changes product name of an IRIS product.
HDF5ToIris	Pathnames	Converts HDF5 file to an IRIS product.
HDFSatToIris	Pathnames	Converts HDF4 satellite image to an IRIS USER product.
KmaRadToIris	Pipe	Converts an array to an IRIS CAPPI product.
KmaSatToIris	Pipe	Converts satellite image to IRIS USER product.
PBMSatToIris	Pathnames	Converts a PBM, PGM, or PPM satellite image to an IRIS USER product.
PictureToIris	Pathnames	Converts TIFF, etc. to IRIS IMAGE product.

Table 4 Input Pipes Supplied with IRIS (Continued)

Name	Syntax	Purpose
RainbowToIris	Pathnames	Converts Gematronik Rainbow format to an IRIS RAW product.
UfToIris	Pathnames	Converts UF format to IRIS RAW product.

- *Command line syntax* — There are two choices for how IRIS will run the pipe program:

  1) Pipe:

  ```
  pipe-pathname input-filename <input-pathname >output-pathname
  ```

  2) Pathnames:

  ```
  pipe-pathname ip:input-pathname if:input-filename op:output-pathname
  ```

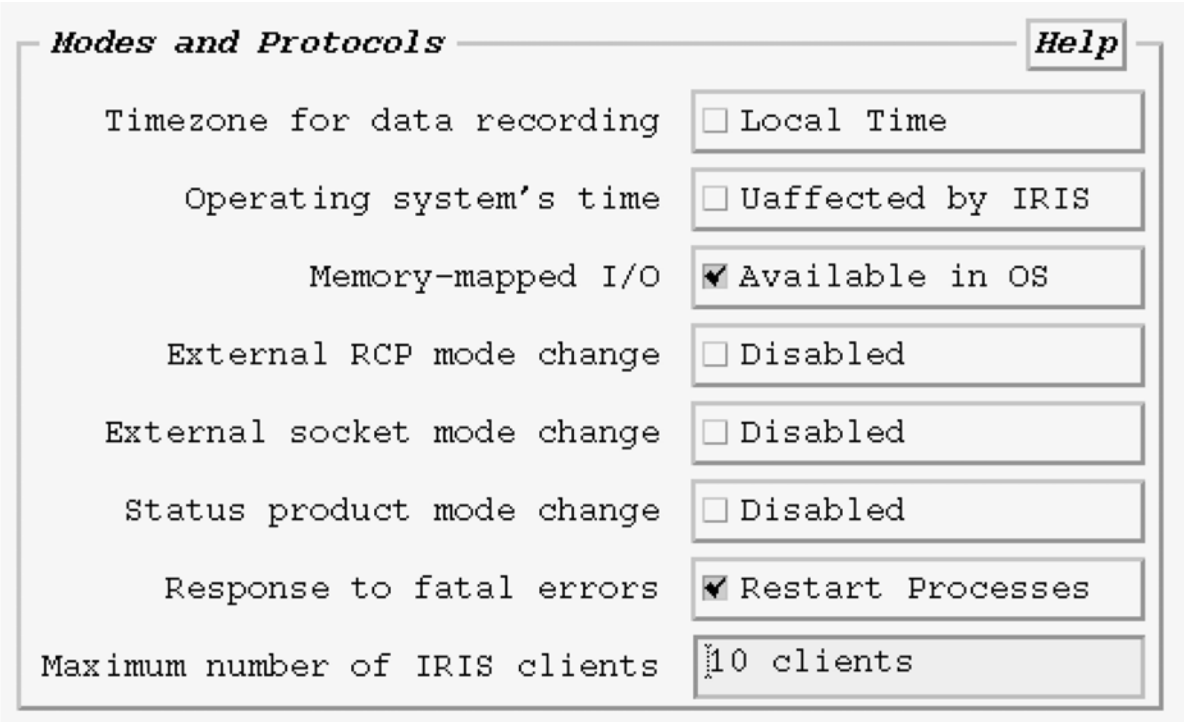
- *Notification scheme* — There are two choices for how IRIS will detect that a new file has arrived:

  1) Polling: IRIS checks every few seconds to see if a new file has arrived. If the file size is the same as last time it checked, then the file is processed.

  2) TCP/IP Socket: IRIS expects to receive a socket message on the specified port number every time a file arrives. This allows immediate input without the delays due to a polling period. The socket message syntax is exactly the same as our normal IRIS network receiver, that is "FILE" followed by the filename and a null.

10.5 IRIS General Setups

10.5.1 Modes and Protocols

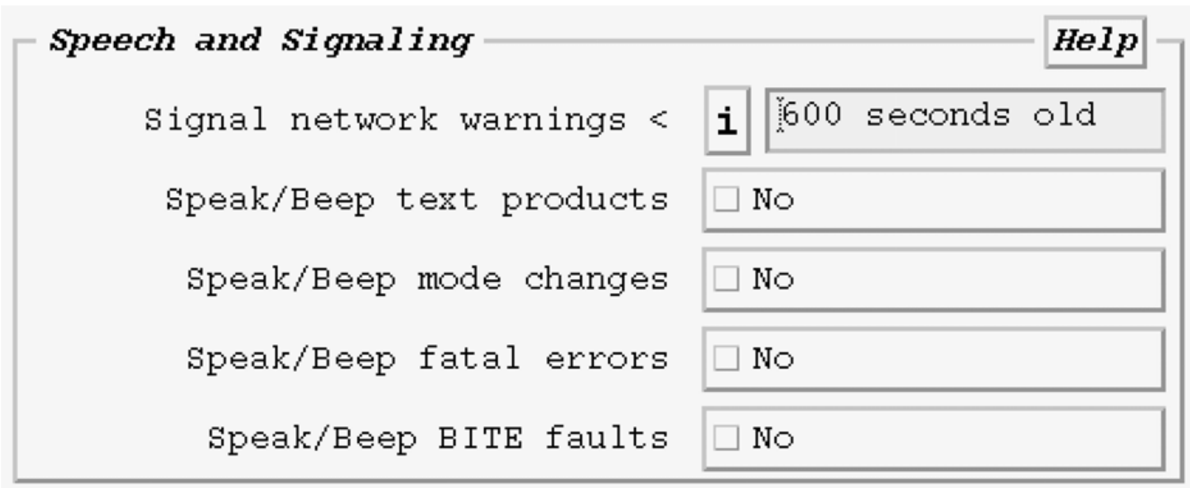


- *Timezone for data recording* — This controls whether the task schedule and the product schedule are run on UTC or on local time. Also the times shown in the menus and in the file names. Note that in either case, you should set your computers system clock to the correct local time zone. In both cases, IRIS records all the information needed to display the data using either UTC or local time. If this is set to "Local Time", be sure to use a local time zone which does not switch to and from summer time. If set to "UTC", it is OK to have the summer time switch.
- *Operating system's time* — Select "select from RCP" to indicate whether the INGEST process should set the system time from the RCP serial line time reports if the time difference is between two and twenty seconds. For values higher than that, it signals a message.

  If your RCP does not report the time, select "unaffected by IRIS."
- *Memory mapped I/O* — Select either "Available in OS" for most systems or "unsupported" for HP9000/800, which does not support a memory mapped I/O file.

- *External RCP mode change* — Answer "enabled" if you want to allow the RCP to control the IRIS configuration that is loaded into the Radar Status menu. This is only available on radar systems, set to "disabled" on analysis systems. If enabled, then the *External socket mode change* feature below is not available, and the automatic mode switch button on the Radar Status menu is not manually controlled.
- *External socket mode change* — Answer "enabled" if you want to allow socket messages to control the IRIS configuration that is loaded into the Radar Status menu. If enabled the automatic mode switch button on the Radar Status menu is not manually controlled.
- *Status product mode change* — Answer "enabled" if you want to slave your system's mode to another IRIS system. Whenever a status product arrives from the selected system, your IRIS will change to match the mode. This is used for redundant system switching. If enabled, you will see:
  - *Supplied by (Site Code)* — Enter the site you wish to slave to.
- *Response to fatal errors* — Select "Restart Processes" or "No Action" to indicate whether you want IRIS processes to restart automatically after a fatal error occurs.
- *Maximum number of IRIS Clients* — Enter the maximum number of IRIS client menu programs that can be connected to the IRIS server at one time. A suggested value for this is 10. IRIS takes about 30 seconds to free a client slot upon disconnection, so this parameter should be set slightly larger than the actual maximum number you want. The menus display the message "IRIS is not running on the selected node" if the client table is full.

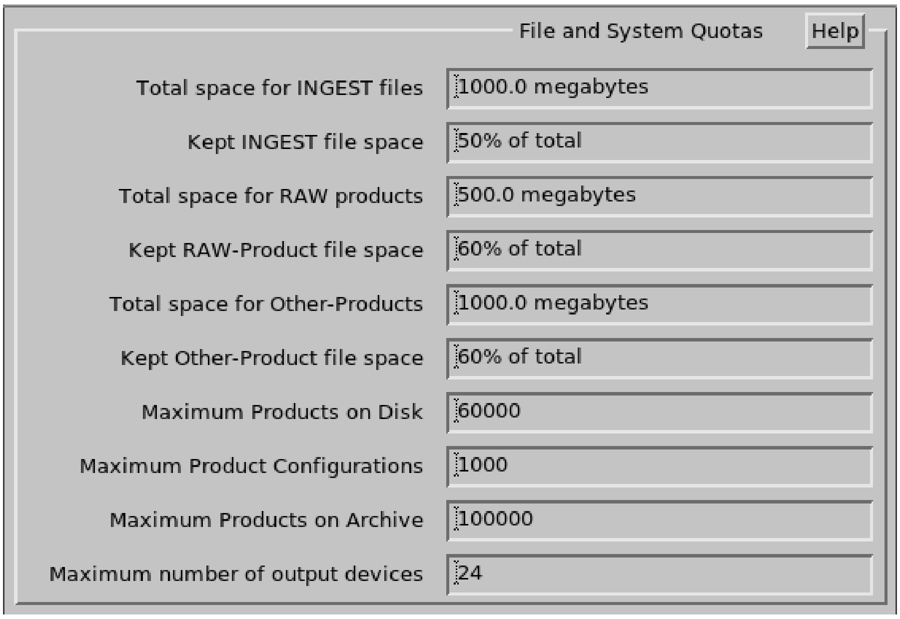
10.5.2 Speech and Signaling



- *Signal network warnings less than* — When a product that contains a warning is received over the network, a signal and beep will be produced if the data time is within the following number of seconds of the current time. Zero means do not signal at all. The default setting is 600 seconds old.

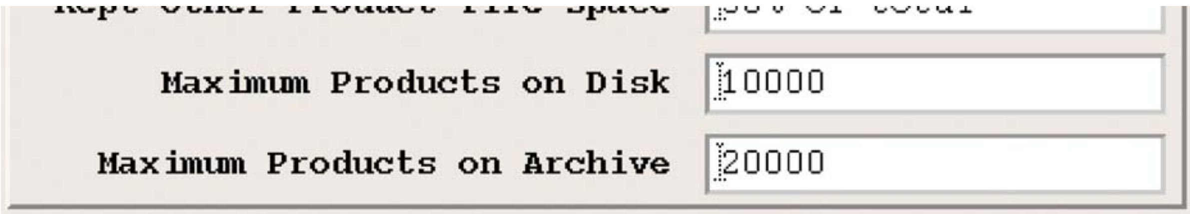
  IRIS can be configured to generate spoken output for important messages. Warning instances are configured in the PRODUCT configuration menu. Other possible speech options are configured here. The **sigaudio** program can configure if you use spoken text, or play a waveform file. Any of the options can be turned off by selecting "No." This setup can be overridden by the newer message configuration file.
- *Speak/Beep text products on arrival* — IRIS has a special product type called "Text products". These products consist of an IRIS header plus an ASCII string. This will cause the string message to be spoken when it arrives on a system.
- *Speak/Beep mode changes* — Audio alert when a mode change is made.
- *Speak/Beep fatal errors* — Audio alert when an IRIS product crashes. This can happen with a program error such as divide by zero, or with the "kill" command.
- *Speak/Beep BITE faults* — Audio alert when a critical BITE fault is signalled.

10.5.3 File and System Quotas

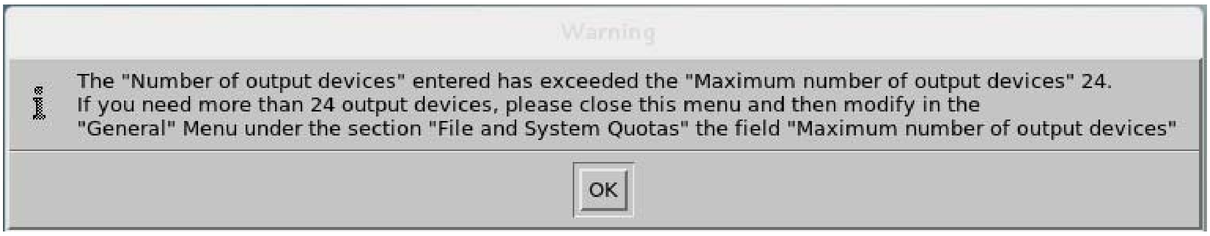


- *Total space for INGEST files* — When the INGEST data exceeds this level, old data is automatically deleted. It is important to keep at least 10% of the disk free when the INGEST, RAW, and other product files have reached their maximum usage. To estimate the available space for these files, delete all the files, then find out how much disk space is available by typing `df`.

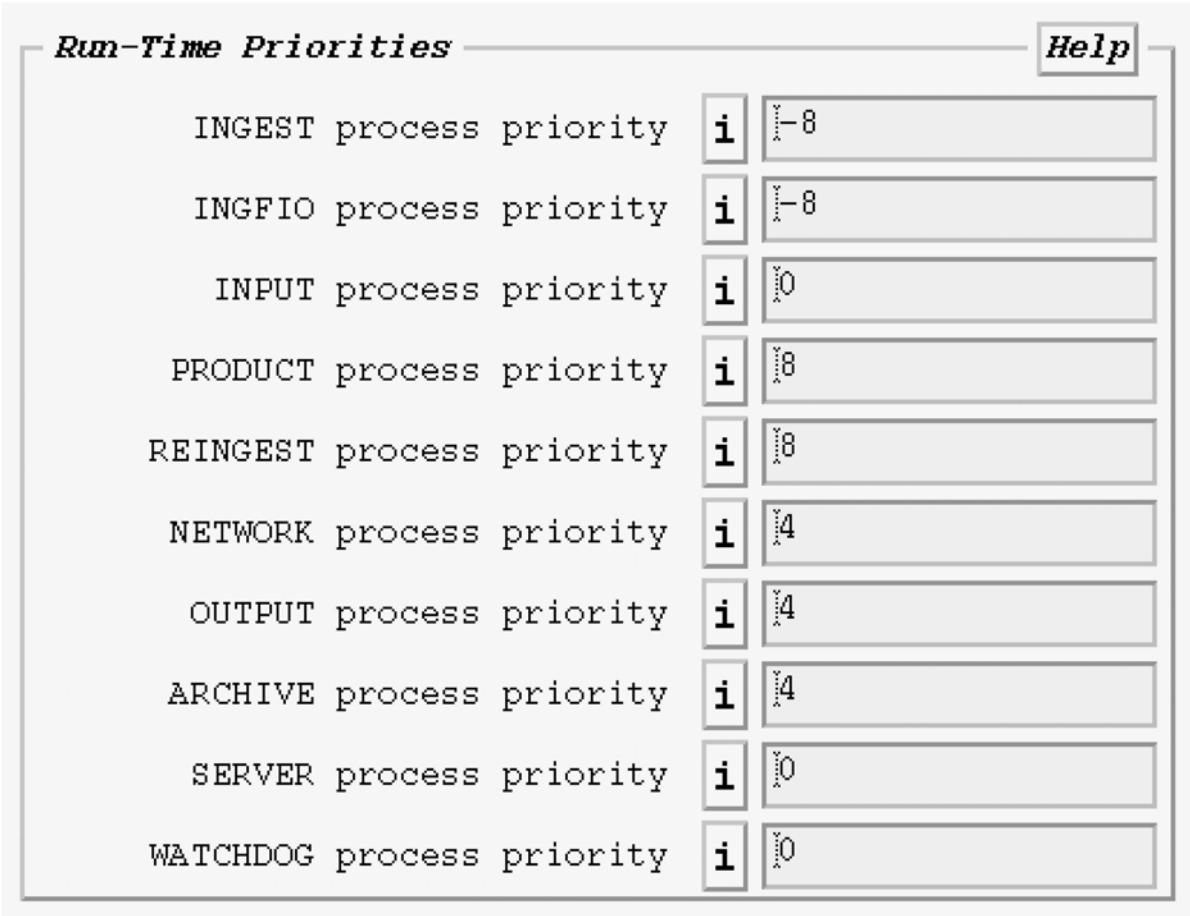
  Take the free size minus 10% of the full size and divide by 2000 to convert blocks to megabytes.
- *Kept INGEST file space* — Enter the percentage of the total disk space that can be used for kept ingest files (files that cannot be deleted by the Watchdog process). When the kept files exceeds this quota, the oldest are deleted first. A reasonable value is 50%.
- *Total Space for RAW Products* — When file space used by RAW product data exceeds this level, old data are automatically deleted.
- *Kept RAW-Product File Space* — Enter the percentage of the total disk space that can be used for kept raw product files. When the kept files exceeds this quota, the oldest are deleted first. A reasonable value is 50%.
- *Total space for Other-Products* — When the file space used by non-RAW product data exceeds this level, old data are automatically deleted.
- *Kept Other-Product file space* — Enter the percentage of the total that can be used for kept product files. If the kept files exceed this quota, the oldest are deleted first. A reasonable value is 50%.
- *Maximum products on Disk* — This is the maximum number of products which will be allowed on disk at one time. It is used to allocate memory for the inventory. A value like 10000 might be typical.
- *Maximum products on Archive* — This is the maximum number of products which be allowed on an archive media. Configure this dependent on your media capacity. A value like 20000 would be a good starting point.



- *Maximum number of output devices* — Enter the maximum number of output devices that can be entered in the field (see 10.9.1 Output Device General Specifications on page 236). The reason the field "Maximum number of output devices" was added is because the larger the value, the longer it will take IRIS to startup. Therefore, if you had a IRIS that would have a maximum number of output devices of 10. Then IRIS would start very quickly at startup time. If 200 output devices are required then IRIS would take longer to startup.

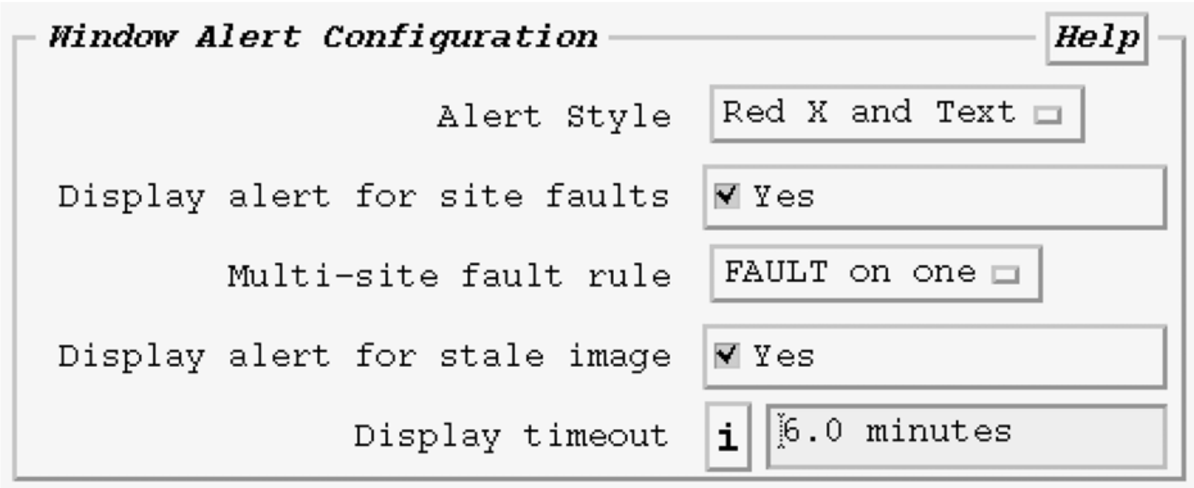


10.5.4 Run-Time Priorities



- *Process priority* — Set the priority of each IRIS process. This is what is called the "nice priority" on UNIX systems. Almost all the normal processes run at nice priority 0. Valid numbers are in the range -20 to +20, and the `ps` command shows these numbers with 20 added to them. The smaller the number, the higher the priority, suggested values are shown.

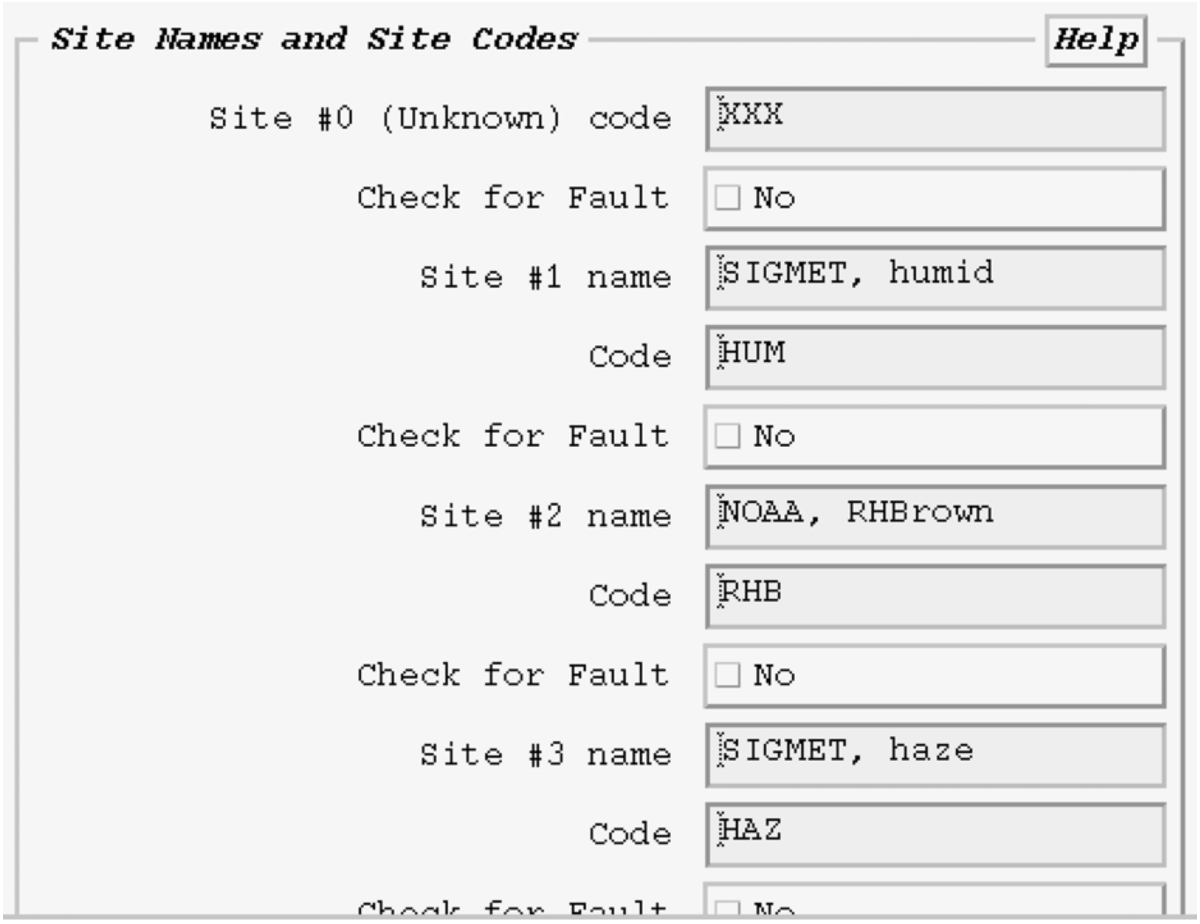
10.5.5 Window Alert Configuration



Window alerts are a way of displaying important fault information in a way impossible to ignore. This consists of displaying a big red "X" on top of the display, and/or a big text message indicating what is wrong. This is intended to clearly indicate that the displayed data is suspect.

- *Multi-site fault rule* — This controls both the widow alert, and the summary shown on the RST menu. You can display a fault if either any one system has failed, or require that all systems fail. The list of sites to consider is selected below in the site name section.
- *Alert Style* — Choices here are: "Disabled", "Red X and Text", "Red X Only", and "Text Only". Selecting "Disabled" turns off the feature, and the remaining questions.
- *Display alert for site faults* — You can enable alerts based on the site fault summary shown on the RST menu. Note that an alert is shown for timeout and critical faults only. Normal faults do not alert.
- *Display alert for stale image* — You can enable an alert when the image displayed on the screen is not current. This is to prevent operators from seeing an old image for many hours without realizing it. This is only done in auto-update mode.
- *Display timeout* — Controls how long since the last update before alerting that it is a stale image.

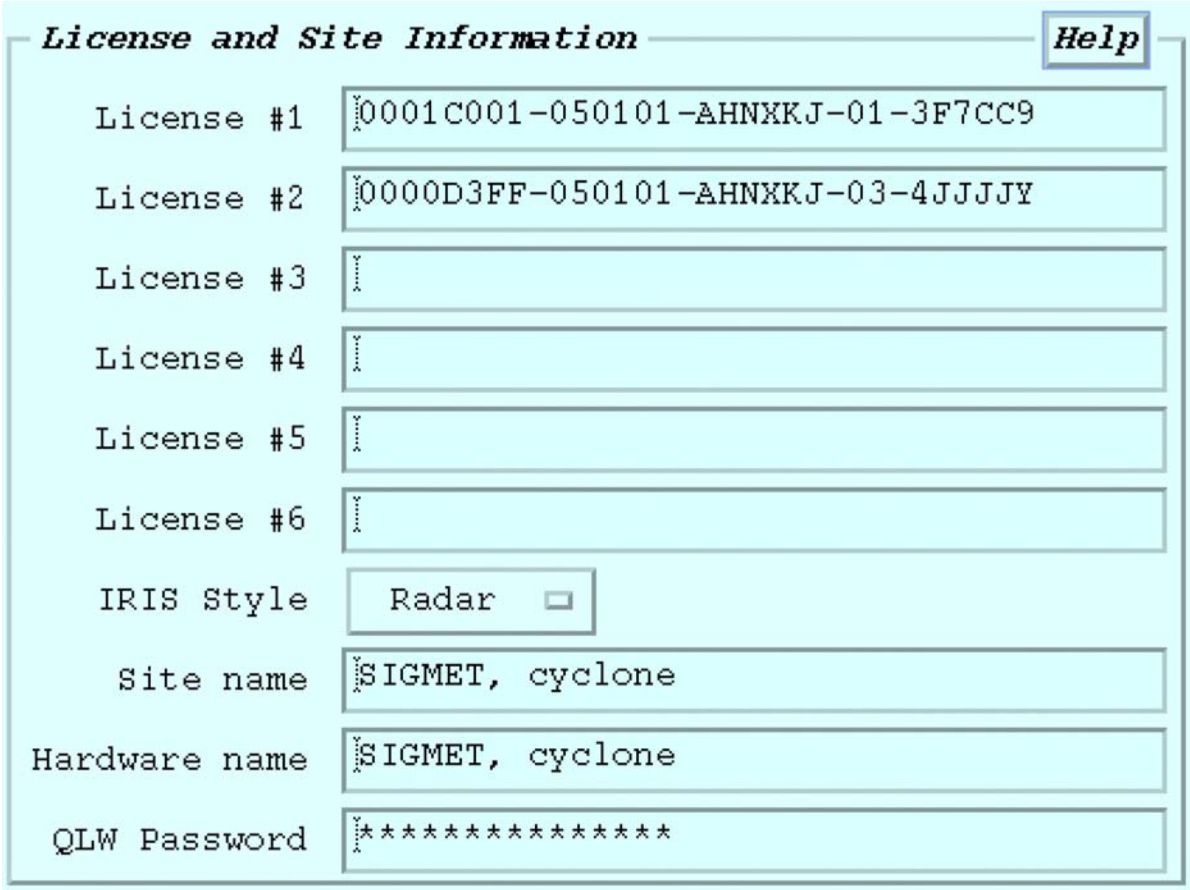
10.5.6 Site Names and Site Codes



- *Unrecognized site code* — The recommended value for the unrecognized site code is "XXX." This is used for all data that does not match anything else in the table.
- *Check for Fault* — Only sites marked will be included in the RST summary and window alerts. This allows you to exclude unimportant display systems.
- *Site #(1–127) name/code* — The remainder of the questions define three-letter site codes for all the expected IRIS sites that generate data on this system. Site codes appear in the Product Output, Ingest Summary, and other menus to indicate the source site. Note that this table is case-sensitive. If you want to remove a site, enter "" for the site name and code.

  There can be a maximum of 128 sites defined, i.e., the unrecognized site, plus 127 others.

10.6 License Setups



- *License #1 – #6* — Use these fields to enter the software licenses you received from SIGMET.. These numerous slots can be used for entering both operational and backup licenses and IRIS will try to start with either license. Also, if you are testing new features using a temporary license from SIGMET, IRIS will automatically grant the cumulative features based on all of the licenses. Once the temporary license expires, IRIS will default to the original operational license.
- *Features license/Products license* — In the license file you receive from SIGMET, there will always be a Features and a Products license, and possibly an RDA license. These licenses can go in any of the six license fields, but SIGMET recommends using the first two fields for organizational purposes. These licenses consist of a 32-character string plus a user comment or description:

  XXXXXXXX-XXXXXX-XXXXXX-XX-XXXXXX comment

  The license is SIGMET's way of copy protecting the software. The license number is machine dependent. To get your license, call SIGMET with your machine code. (The machine code is displayed by typing `show_machine_code` at the operating system prompt.) The machine code changes when the site name is changed or a new version of the operating system is installed.

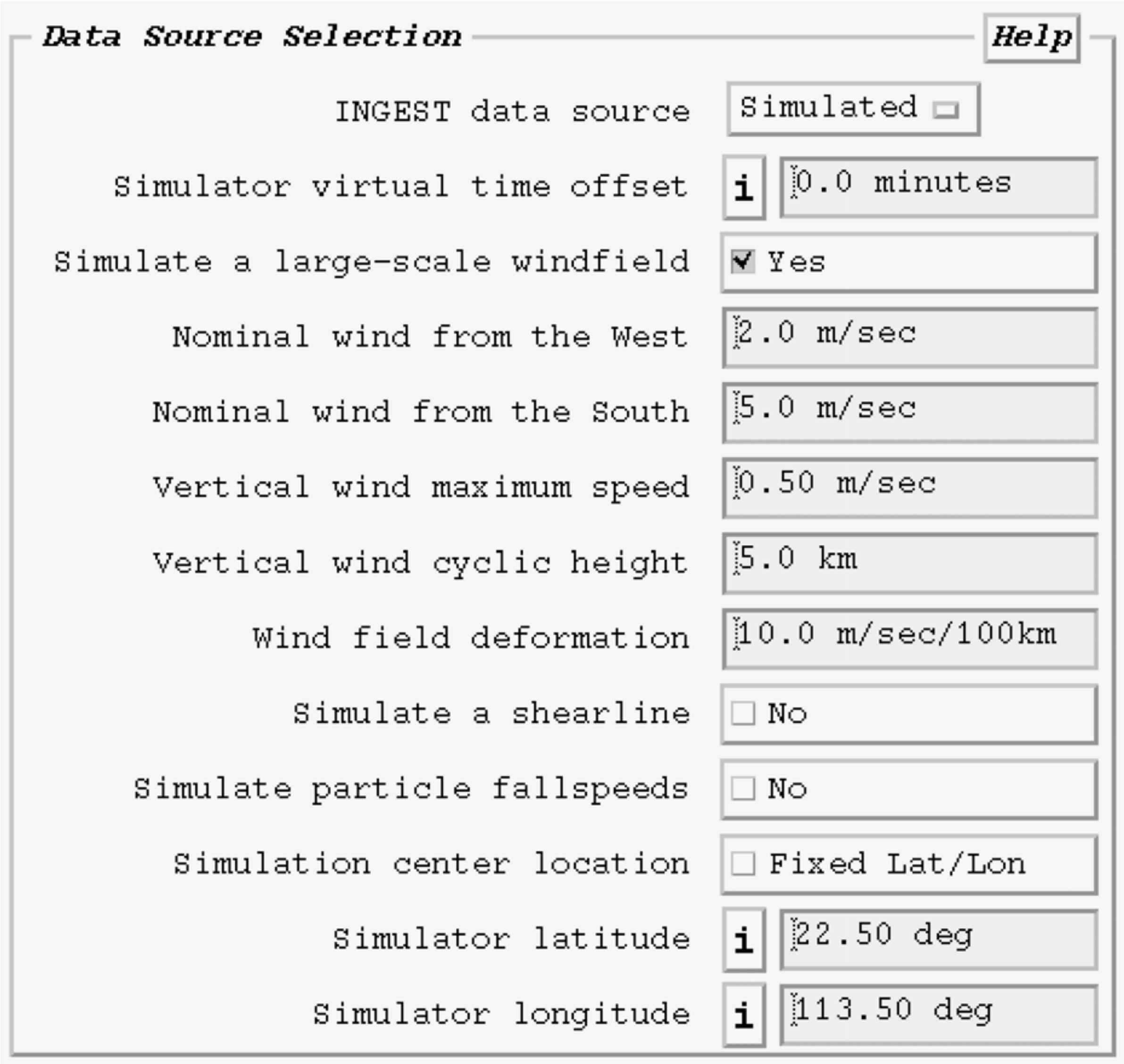
- *IRIS Style* — Enter one of the following IRIS styles to configure the menu selections and remove unneeded fields:

Radar	The full function IRIS/Radar system.
Analysis	The IRIS/Analysis and IRIS/Display systems.

- *Site name* — Enter up to 16 characters of arbitrary text that is saved with the data and placed on color displays and printouts. When the site name is changed, a new license must be obtained from SIGMET.
- *Hardware name* — Normally this is set the same as the site name above. This string is used to tell which computer is running in a dual computer system where two computers have the same IRIS site name. The hardware name is used as the site name when making status products.
- *Window password* — Enter a password of up to 15 characters. The password will not be displayed. This password must be entered by a window user to use an operator privileged feature.

10.7 IRIS Ingest Setups

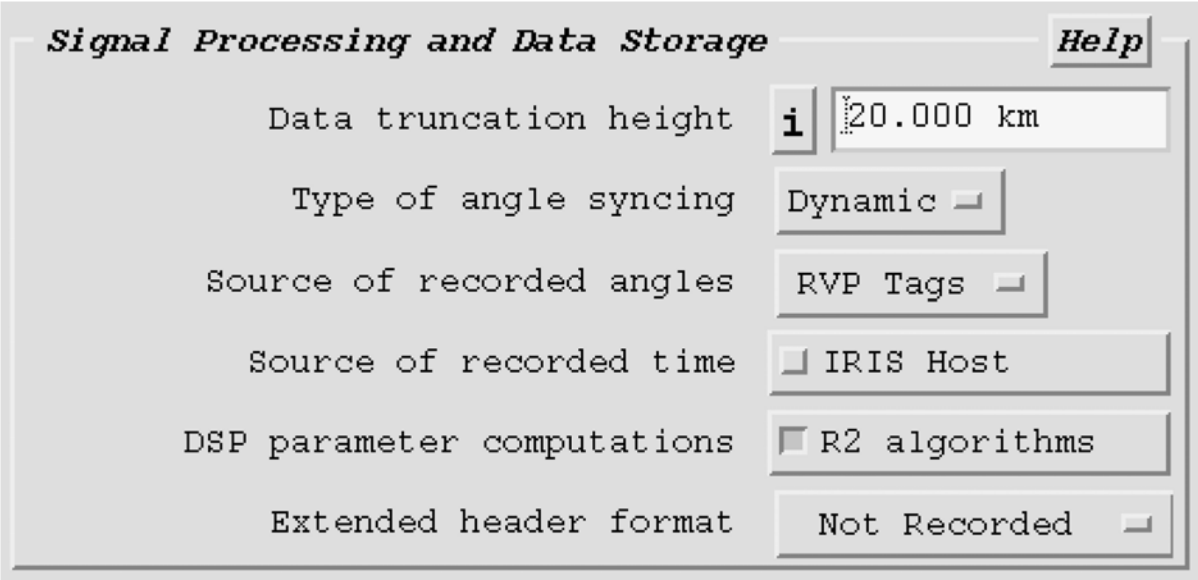
10.7.1 Data Source Selection



- *INGEST data source* — Select either "From DSP" or "Simulated" for the data source. For normal radar operation select "From DSP", and the remainder of the section is blanked.

IRIS supports simulation of a data field of winds and storm cells which move about the radar. For testing compositing, the location and time offsets of the simulated data is configured here.

10.7.2 Signal Processing and Data Storage

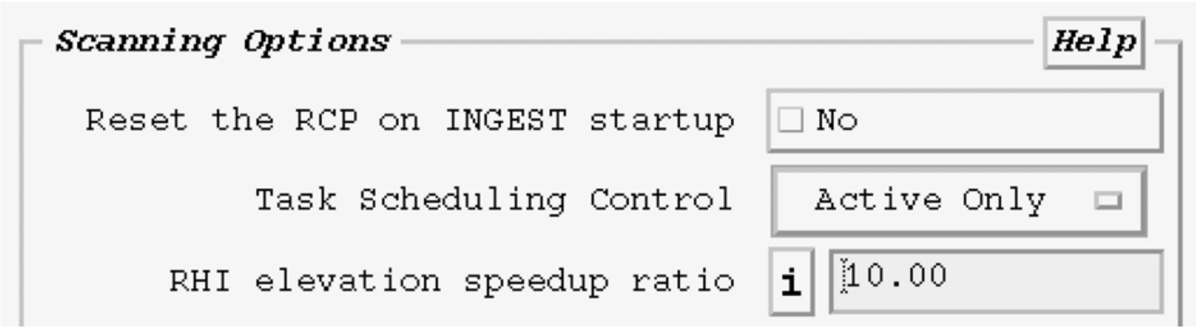


- *Data truncation height* — Any data calculated to be above this height are removed to save disk space. This is typically set to 20km. This is height above the radar dish. This truncation is not applied to manual scans.
- *Type of angle syncing* — Select the method of angle syncing as "Static," "None," or "Dynamic." Also set the RVP6 Setup "Angle Sync" question question to "user" for this setup selection to take effect. The RVP7 & 8 will use dynamic if turned on.
- *Source of recorded angles* — Enter one of the following values:
  - RVP Tags — Angle information supplied by the RVP.
  - IRIS Host — Angles are taken directly from the antenna interface software. This choice is used for simulations where the signal processor does not have angle information. It is not recommended for operational systems.
- *Source of recorded time* — Enter one of the following values:
  - RVP Tags — Time for each CPI is logged on the RVP8. This feature is only available on RVP8 systems. Active Ingest task scheduling is still based on the IRIS host computer, so such systems should be time synched.
  - IRIS Host — Time for each CPI is taken directly from the IRIS host computer. Because of buffering data will arrive and be time tagged in groups of 2 or 3 CPIs.

- *DSP parameter computations* — Choose either "R2 algorithms" or "R1 algorithms." Use the R2 processing algorithms to estimate SNR and spectral width. Also set the RVP6/7 TTY Setup "R2 processing" question to "user" for this Setup selection to take effect.
- *Extended header format* — Enter one of the following values:
  - *Not recorded* — Doesn't record extended ray headers.
  - *V0* — Records time and calculations
  - *V1* — Records time and navigation.

  SIGMET recommends not recording extended ray headers if they are not required.

10.7.3 Scanning Options

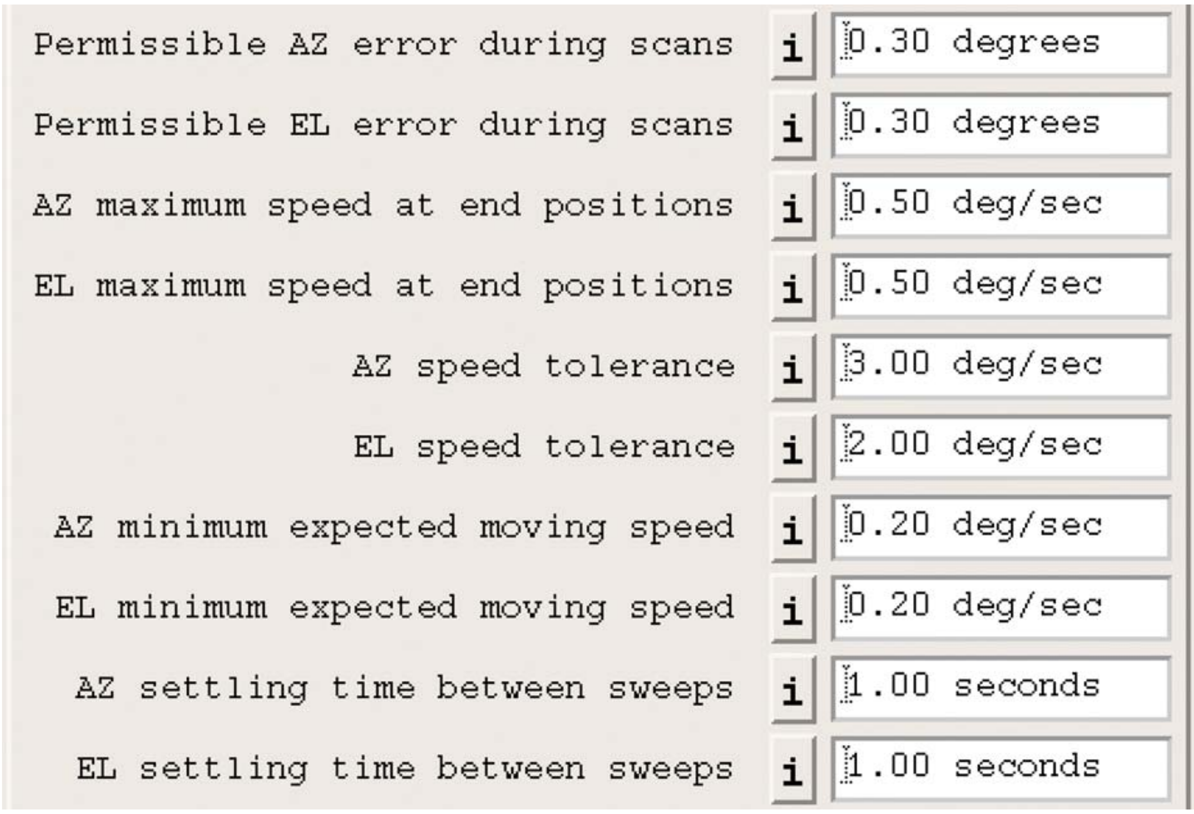


- *Reset the RCP on Ingest Startup* — Causes an *Error Reset* command to be sent to the RCP whenever the INGEST process is started. The reasons that you might want to do this are:
  - In dual/redundant systems, the reset will clear any error conditions that may have accumulated while the RCP was inactive. These generally will not be "real" faults, and it is safe to clear them automatically.
  - In single radar systems. the reset helps to insure that the RCP will actually be ready to respond to ingest's commands.
  - With the reset enabled, you can then clear RCP shutdown conditions easily from the IRIS Radar Status menu by toggling the INGEST process Off/On.

  The main reason *not* to select the automatic reset is that you may prefer a policy in which RCP shutdowns are always manually handled by an operator, after first determining that the original cause of the failure has been repaired.

- *Task Scheduling Control* — Normally set this to "Active Only". IRIS supports a "Passive" mode of data collection in which it is slave to other radar control software. In this mode, IRIS monitors the azimuth, elevation, and PRF of the radar and attempts to match it with the tasks in the task schedule, and to record data. This requires the RVP7 or RVP8 signal processor. See Appendix C of the *IRIS Radar Manual* for details of using passive mode.
- If Passive Only or Active/Passive is selected then the "Passive Type" is specified. The choices are:
    - Multi-Tasking — This intended is for PPI Full scanning when the system controlling the antenna does one or more volume scans. In this case there can be more that one TASK in the TASK Schedule.
    - Single Tasking — This can be used for any scan mode (Sector, RHI, PPI Full, Manual). In this case there may only be one TASK in the TASK Schedule.
    - Status Slaving — This can be used for any scan mode (Sector, RHI, PPI Full, Manual) and there can be multiple TASK's in the Schedule. The controlling computer must send a STATUS product to IRIS to signal which TASK is about to start. In this case, there is an additional question to provide the "Slaved to Site Code" (three letter site code of the site sending the STATUS products.
    - TS Playback — This can be used for any scan mode (Sector, RHI, PPI Full, Manual) and there can be multiple TASK's in the Schedule. Use with tsarchive to play back recorded data. Will select the task based on the name recorded with the data.

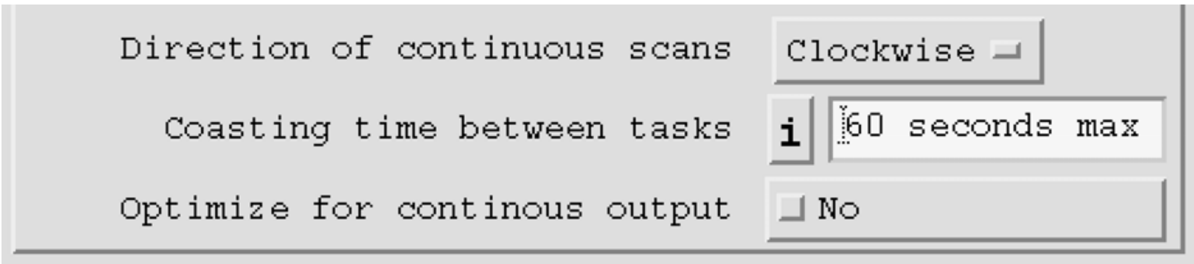
- *RHI elevation speedup ratio* — During RHI scans, the antenna velocity is increased at higher elevations in order to save time. This parameter controls how much faster the antenna goes at 90 degrees elevation compared to 0 degrees. This is typically set to 10.



- *Permissible AZ/EL error during scans* — The IRIS system insists that the antenna get to within this angular distance of any desired position before proceeding. The tolerances are in degrees, and are typically set to about 0.5 degrees.
- *AZ/EL maximum speed at end positions* — These speed limits work in conjunction with the above position limits. When the antenna is positioned within the angle tolerance, it must also be moving at a speed less that these maximums. This prevents falsely proceeding in the case of an underdamped antenna which moves quickly through its settling position several times before coming to a stop. The speed limits also help to remove the initial elevation "starting trail" during continuous PPI scans. SIGMET recommends the setting of 0.5 degrees/sec.
- *AZ speed tolerance* — At the start of each sweep, IRIS waits until the antenna speed is within the value of the requested speed. This prevents the sweep from starting while the antenna may be still moving to fast.
- *EL speed tolerance* — Same as above for RHI Full sweeps.
- *AZ/EL Min expected moving speed* — When IRIS is positioning the antenna using the above angle and speed criteria, it is possible that success is never attained. This can happen if the antenna gets stuck before reaching the destination, or if it oscillates endlessly around that point. During any repositioning operation, IRIS first calculates a maximum time to wait based on the angular distance to be traveled

and the minimum moving speed given here. Five seconds are added to compensate for edge effects. IRIS proceeds after this time limit expires, regardless of what the antenna is doing. This prevents endless waits resulting from antenna defects. Typical values are 1.0 to 5.0 degrees/second. A value of 0 result in a fixed 5-second maximum wait.

- *AZ/EL min settling time between sweeps* — These minimum times allow IRIS to work better when the step between tilts is very small. In addition to the above criteria for determining that the antenna is close to a desired position, IRIS will wait these minimum times.

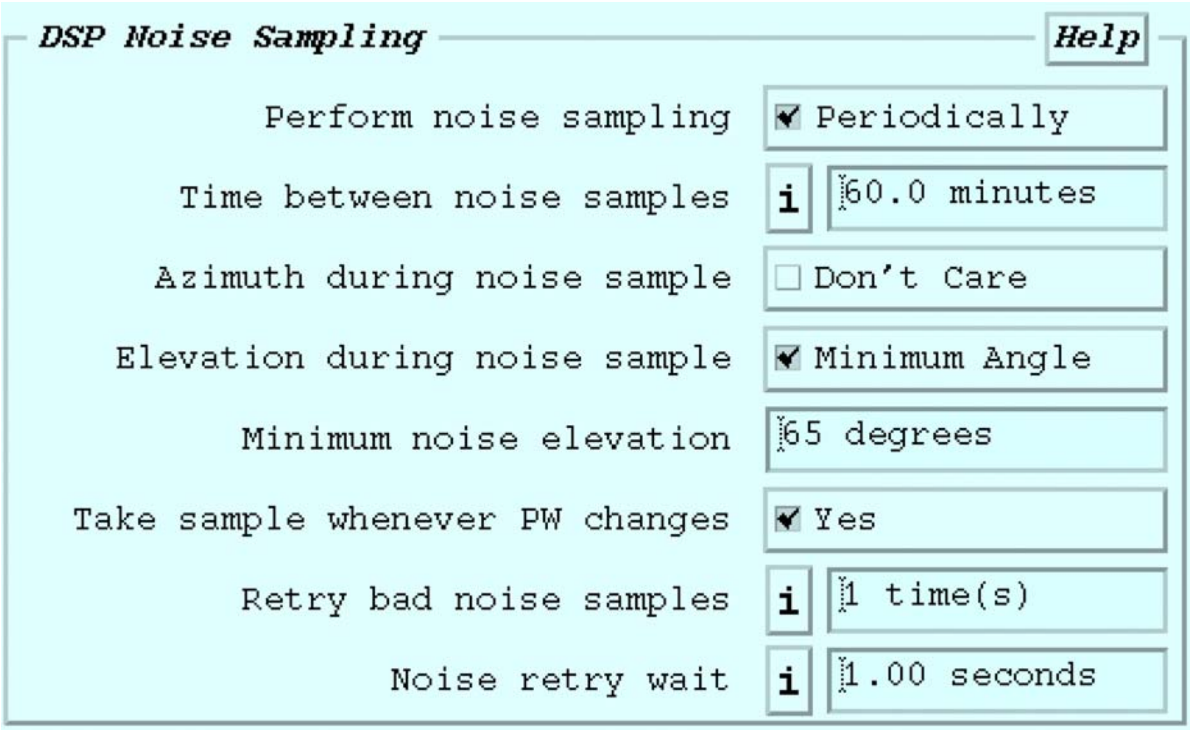


- *Direction of continuous scans* — You can specify whether continuous PPI scans go "clockwise" or "counterclockwise."To equalize the wear on the gears, SIGMET recommends that you change this every few months.
- *Coasting time between tasks* — If the number of seconds between two continuous scan PPI tasks is less than this number, IRIS will not stop the antenna between the tasks. This can prevent wear on the antenna. Set this value to 0 if you want to always stop between tasks.
- *Optimize for continuous output* — If set to "Yes", it will make the following changes from the legacy behavior:

  - Leave the DSP in continuous output mode between tasks.
  - If the same task is running continuously, skip reading the gparm data at the start of the task. This means it would not detect faults like burst pulse missing.
  - Do not set the sweep number value between sweeps.

  Please leave it to "No" unless you want continuous real-time displays. For continuous displays, please also disable the noise sample in ingest. When set to "Yes", you should see only about 1 ray missing between tasks at 3 rpm 1 degree resolution. Consider using instead the real-time data sent directly from the RVP8. This feature is only recommended for the RVP8.

10.7.4 DSP Noise Sampling



- *Perform noise sampling* — Use this flag to disable automatic noise sampling done by IRIS. This is appropriate for passive ingest, and for use with a fixed noise level in the RVP7 or RVP8. It can save scan time, and avoid contaminated samples. Modern IF receivers do not have a noise level drifting problem. When disabled, noise samples are taken from the values stored inside the RVP, be sure to type in and save the powerup noise levels for each pulse width. Operational noise levels are not taken from the value found on the last zauto calibration. The effect of not taking noise samples is different on different processors:
  - RVP6 — Feature not supported, do not use.
  - RVP7 — Current noise level is used. After reset this is the powerup value.
  - RVP8 — Current noise level is automatically set to the powerup value.

- Time between noise samples — When a task starts, if it has been at least this long since the last noise sample, a new sample is taken. This is typically set to 10 minutes.
- *Azimuth during noise sample* — Select either "Don't care" or "Specific Angle." If you select "Specific Angle," an entry box appears

wherein you can specify the azimuth in degrees at which to take the noise sample.

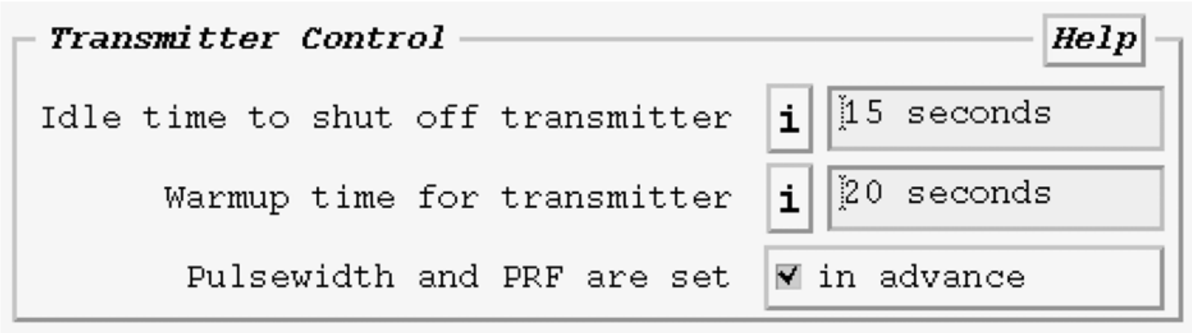
- *Elevation during noise sample* — Select either "Don't care" or "Minimum Angle." If you select "Minimum Angle," an entry box appears wherein you can specify the elevation in degrees at which to take the noise sample.
- *Take sample whenever PW changes* — If the signal processor cannot store separate noise levels for each pulse width, then you must answer this "Yes".
- *Retry bad noise samples & Noise retry wait* — These questions are used to configure the noise sample interference detection. Ingest is attempting to detect the case in which during the noise sample you get interference from another pulsed radar. This interference will cause a higher noise sample, and cause uncalibrated data, similar to hitting the sun at noise sample time. This feature is only available on the RVP6, not on the RVP7 or RVP8.

Each time Ingest detects interference it will signal the message "Interference in noise calculations". Ingest will then wait the retry wait time (typically 1 second), then try it again. This is repeated up to the specified number of times. The assumption is that the other radar is a scanning radar, so if you wait 1 second, it should no longer be pointed at you. After the last attempt, if it still detects interference, it will run the scan anyhow. Therefore if you are getting false positives, you still get the correct data.

The RVP6 noise sample includes both the log average of the signal, and the log of the linear average of the signal. For normal Raleigh noise, these differ by a consistent amount. However, if there are a series of impulses added to the signal, the linear average goes up a lot more than the log average. If it goes up to more than the *Noise Interference Threshold* (typically 1.2) it is flagged as interference. To allow tuning of the threshold, the two noise levels are printed in the signal. These are in unit of 0 to 1, where 1 is the full range of the log A/D convertor. If your calibration slope is set wrong, then the formula will be uncalibrated.

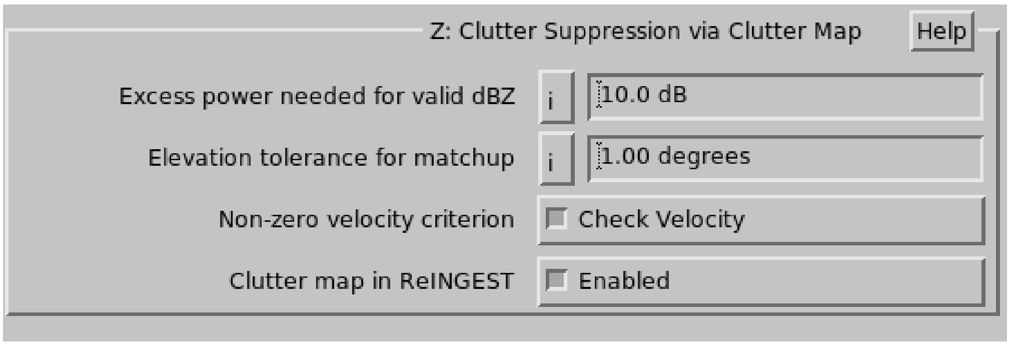
The RVP7&8 has an interference filter for the normal data processing, but not the noise sample. However you can also disable the periodic noise sample for the RVP7&8.

10.7.5 Transmitter Control



- *Idle time to shut off transmitter* — If no task is scheduled to run for this number of seconds, then the transmitter is switched to standby to extend its lifetime (only in radiate automatic mode).
- *Warm-up time for transmitter* — Each time an IRIS task starts, we wait this long since the radiate was turned on. This allows time for a slow on circuit, and also time for the RVP to detect the burst pulse power. Note that on many systems pulse with and polarization changes will require radiate to be turned off. In such cases this warmup time is triggered. If radiate is set to automatic and the transmitter is off, it is turned on this many seconds before the task starts. Be sure to set this less than the idle time above.
- *Pulsewidth and PRF are set* — In addition to warming up the transmitter in advance as specified above, ingest can also set the pulsewidth and PRF. This allows the transients to settle if there is time between scans.

10.7.6 Clutter Suppression

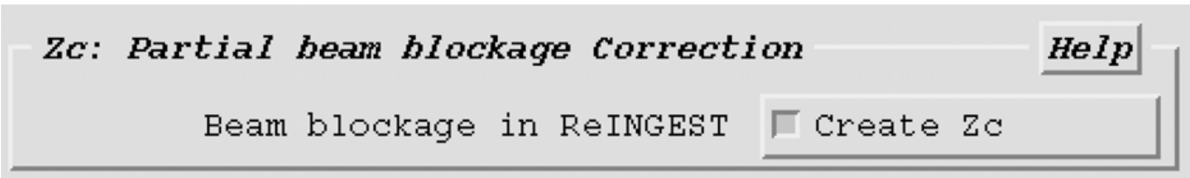


- *Excess power needed for valid dBZ*—This configures IRIS ingest clutter map. If the Task Configuration Menu clutter map button is pressed, IRIS looks for a ingest file marked as the residual clutter map.

All range bins containing data in the clutter map file are thresholded unless the current data is at least this much higher. If we exceed the threshold, the dBZ value is passed unchanged.

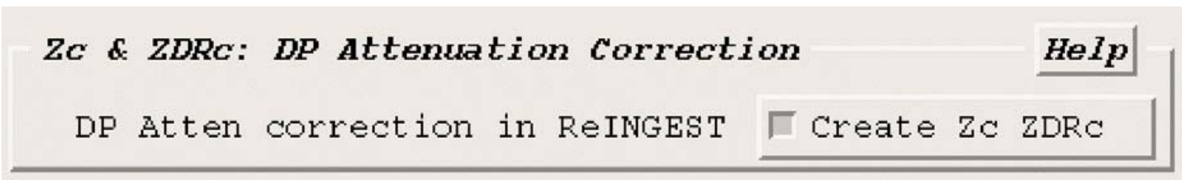
- *Elevation tolerance for matchup*—When looking for the corresponding range bin in the clutter map file, the nearest elevation angle is used up to this maximum difference. If none is found, then no correction is applied.
- *Non-zero velocity criterion*—If this is set to "Check Velocity" then data which would pass the excess power test will be thresholded if the velocity is near zero.
- *Clutter map in ReINGEST*— If this is set to Enabled, the Clutter_map filter is applied to the data in reingest. The filter is only applied if no other clutter map filter has been used. The ingest file from that radar site must have the same task name and be marked as the clutter map.

10.7.7 Beam Blockage



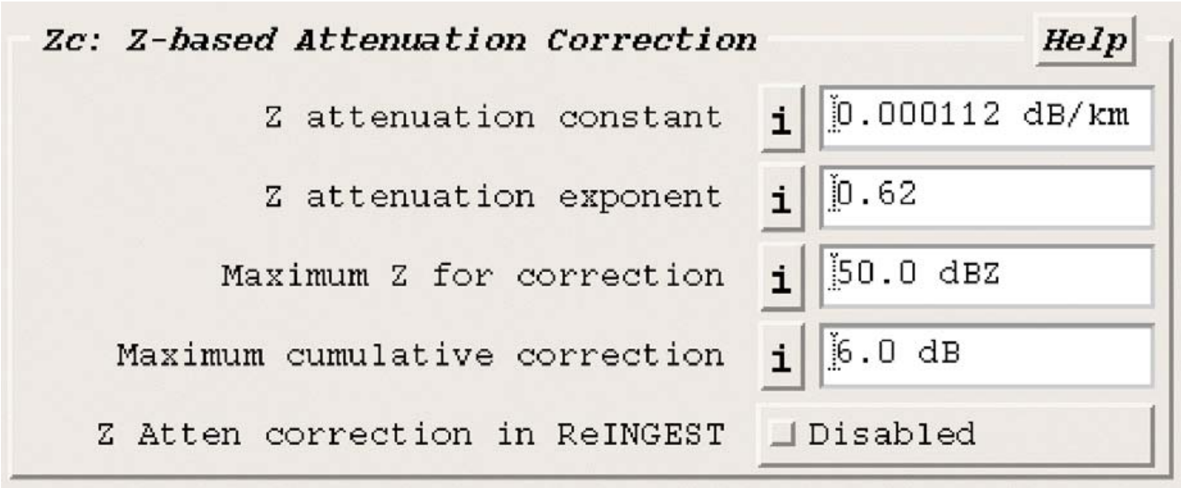
- *Beam blockage in Reingest* — This button enables applying IRIS's partial beam blockage algorithm when data arrives on a system at reingest time. See section 6.1.4 of the *IRIS Radar Manual* for details on the algorithm. The beam blockages config file needs to contain information individually for each radar site to be processed.

10.7.8 DP Intervening Attenuation



This allows turning on/off the Dual-Polarization attenuation correction. The DP attenuation is based on the principle that the attenuation is proportional to the PhiDP. Because of noisy PhiDP at low SNR, the details are fairly complicated. Configuration tuning is done in the file dpolatten.conf.

10.7.9 Z-Based Intervening Attenuation

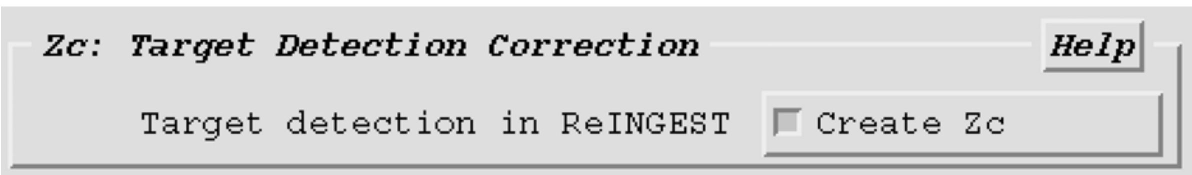


This section allows configuration of the coefficients used for the intervening attenuation correction. When enabled, the corrected reflectivity Zc is computed from Z using the following equation:

$$dBZ_c = dBZ + 2C\Delta r \sum Z^E$$

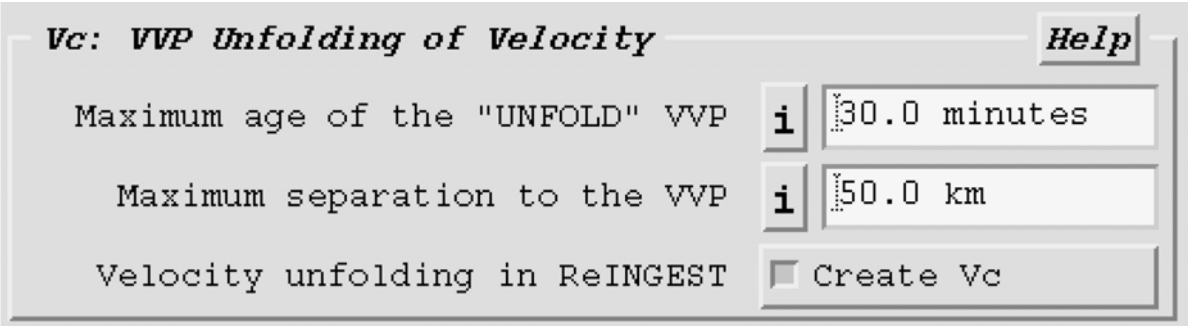
Where C is the constant above, and E is the exponent. All values of Z are clipped at the maximum Z before the calculation, and the total correction is clipped at the maximum cumulative value. We have default values for C and X band radars. We recommend no correction be used for an S-band radar. These numbers are used in both the Ingest process if turned on in the task configuration menu, and at reingest time when data arrives over the network, if the "Atten correction in Reingest" button is pressed. Note that DP-Attenuation takes precedence and we will not apply both attenuations to the same data.

10.7.10 Target Detection



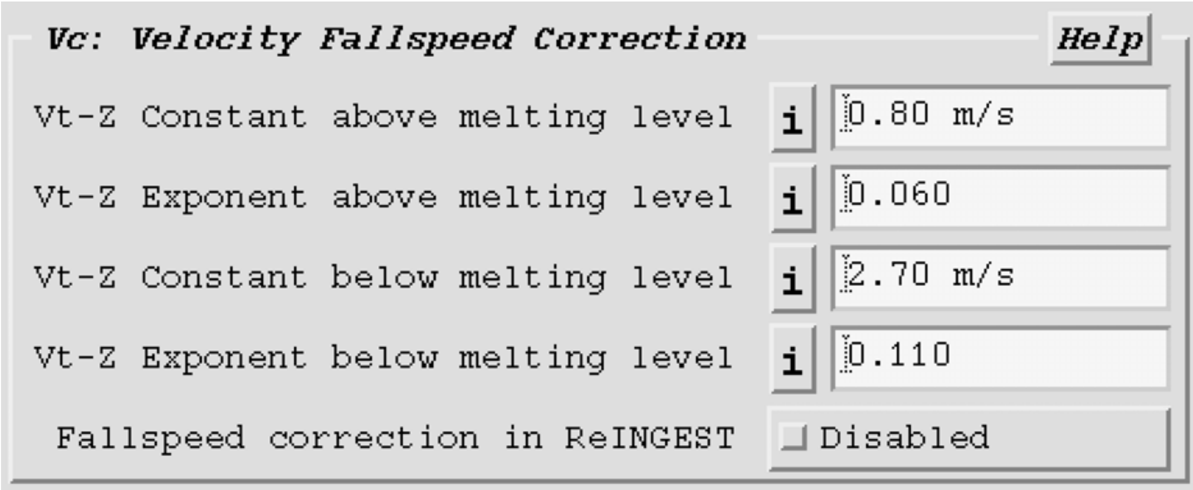
This computes Zc with uniform weather removed. Any input signal of more than 2 range bins in a row is smoothed and then only peaks are passed. The goal is to pick out targets against a weather background. Only use this for target tracking. This can also be computed at ingest time as configured in the task configuration menu.

10.7.11 Unfolding of Velocity



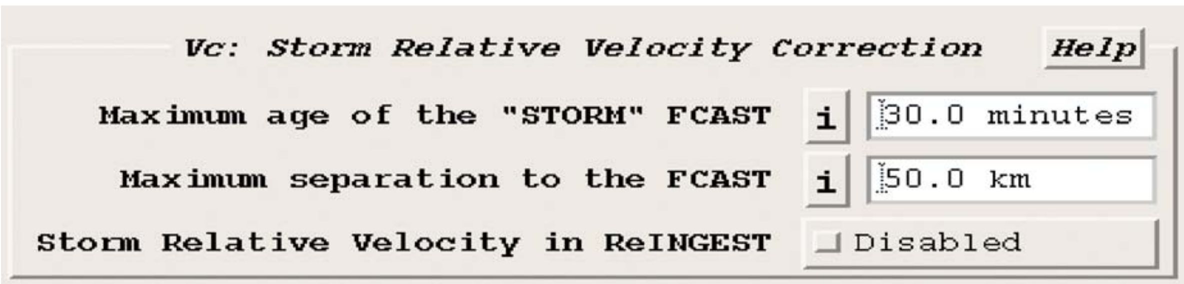
- *Maximum age of the "UNFOLD" VVP7* — IRIS can be configured to automatically unfold velocity data, producing a data type called Vc based on a VVP product on the disk which must be called "UNFOLD". This is the maximum time difference between the data and the time of the UNFOLD product. See the NDOP product configuration section in the *IRIS Product and Display Manual* for details. A zero value disables the check.
- *Maximum separation to the VVP* — This is the maximum distance between the radar location of the VVP product and the data being unfolded. It might be necessary to unfold based on a different radar when one radar's data is imported.
- *Velocity unfolding in ReINGEST* — If enabled, then Vc using unfolding will be computed at reingest time, overriding any previous values. The recommended setting is "Disabled", if unfolding is required, specify it in the task configuration.

10.7.12 Velocity Fallspeed Correction



- *Vt-Z Constant above melting layer* — See the NDOP product configuration section in the *IRIS Product and Display Manual* for a detailed discussion of the fallspeed correction. These questions allow you to specify Vt-Z relationship both above and below the melting layer. "Vt" is the terminal velocity of the precipitation. We use a exponential equation like: $Vt = \text{Constant}\ Z^{\text{Exponent}}$
- *Fallspeed correction in ReINGEST* — If enabled, then Vc using fallspeed correction will be computed at reingest time, overriding any previous values. The recommended setting is "Disabled", if fallspeed correction is required specify it in the task configuration. Note that if either *Fallspeed correction in ReINGEST* or *Velocity unfolding in ReINGEST* are enabled then Vc is made at reingest time.

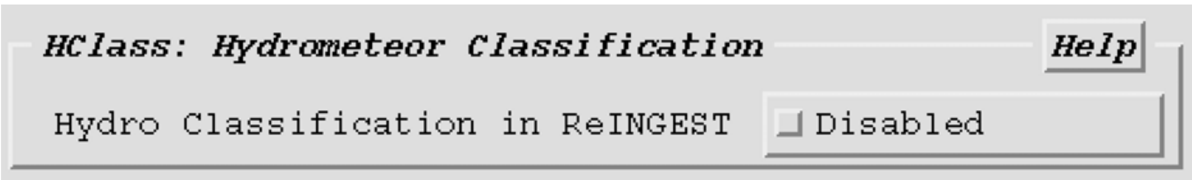
10.7.13 Storm Relative Velocity



- *Maximum age of the "STORM" FCAST*— IRIS can be configured to automatically compute storm relative velocity data, producing a data type called Vc based on a FCAST product on the disk which must be called "STORM". This is the maximum time difference between the data and the time of the STORM product. A zero value disables the check.

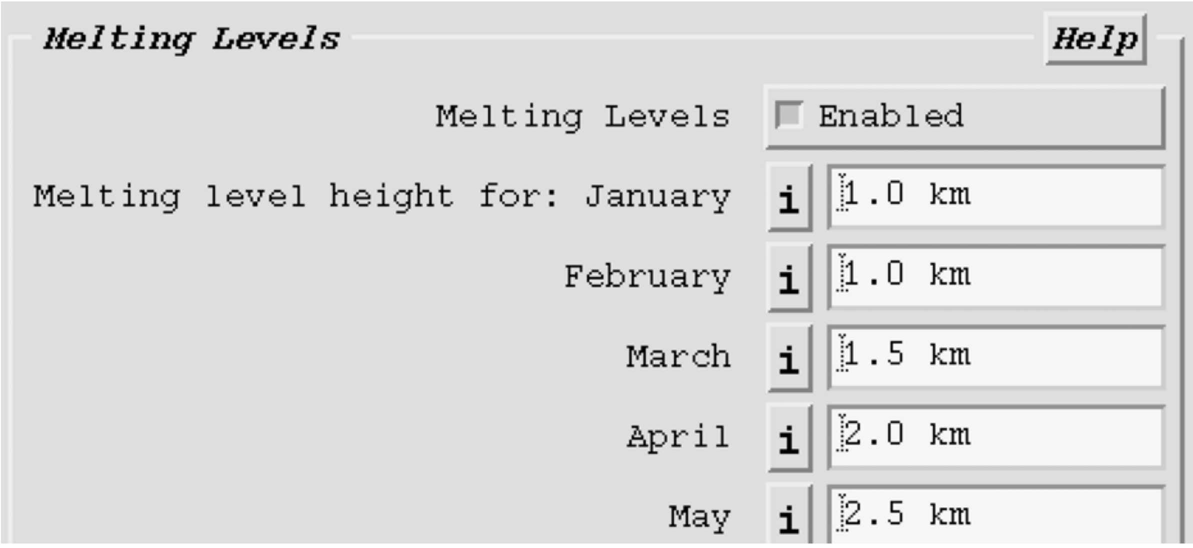
- *Maximum separation to the FCAST* — This is the maximum distance between the radar location of the FCAST product and the data being processes. It might be necessary to a different radar when one radar's data is imported.
- *Storm Relative Velocity in ReINGEST* — If enabled, then Vc of storm relative velocity will be computed at reingest time. The recommended setting is "Disabled", if wanted, specify it in the task configuration if possible.

10.7.14 HydroClass



Hydrometeor classification is called "HydroClass" in SIGMET documentation. See the separate document describing this feature in detail. Enabling this button will cause IRIS to compute HydroClass data at reingest time. It will not control computation of HydroClass inside the RVP8, which is controlled by the Task Configuration Menu. This is a separately licensed feature so you also need to install the appropriate IRIS features license.

10.7.15 Melting Levels

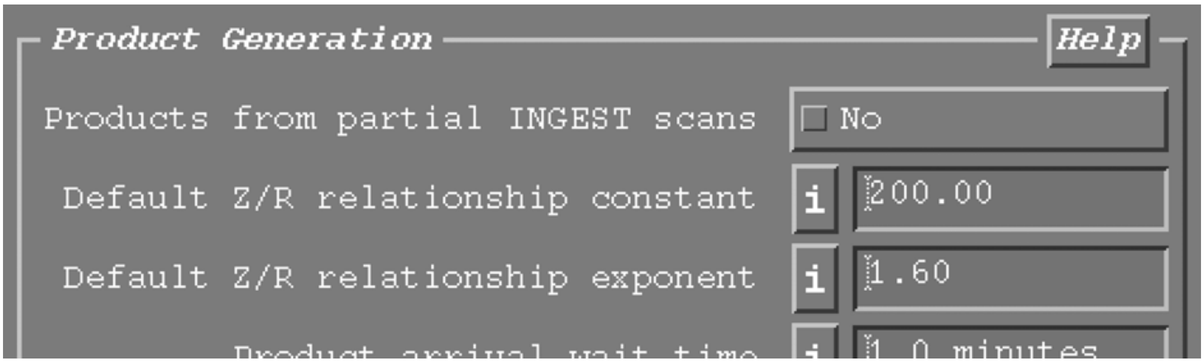


Enter an estimate for the melting level for each month. These are heights above mean sea level. These melting levels on an IRIS/Radar system are loaded into the RVP8 processor, and are also recorded with the RAW radar data. This allows downstream product generators to have access to the correct melting level. The monthly values are default values, we assume that customers will use our feature to change these values dynamically while IRIS is running. The melting level is used in several algorithms: Fall speed correction and HydroClass at least.

If you are not using this feature, and the numbers are not set correctly, they push the button to disable melting levels.

10.8 IRIS Product Setups

10.8.1 Product Generation



- *Products from partial INGEST scans* — Enter "yes" or "no" to indicate whether products can be made from partial INGEST volume scans.
- *Default Z/R relationship constant/exponent* — The system uses the following equation to express the relationship between reflectivity and rainfall rate:

$$Z = aR^b$$

where:

Z is the linear reflectivity.

R is the rainfall rate in mm/hr.

a (relationship constant) and

b (relationship exponent) are empirically determined for each site.

IRIS most often solves for R to convert the radar's reflectivity data to rainfall rate, as follows:

$$R = \left(\frac{Z}{a}\right)^{\frac{1}{b}}$$

Typical values for rain are a = 200 and b = 1.6. Using these values, suppose reflectivity is measured at 20 dBZ. To solve for R, IRIS first converts dBZ to Z:

$$20dBZ = 10\log_{10} Z \therefore Z = 100$$

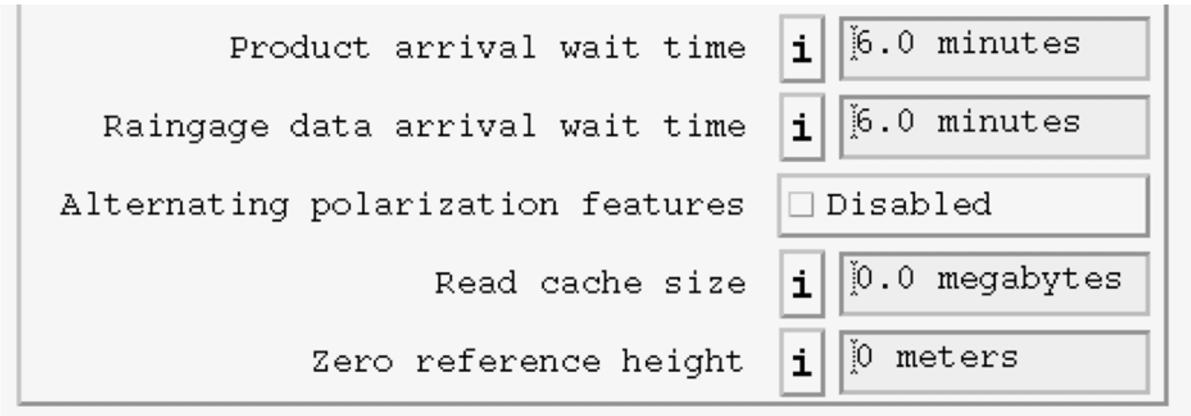
Then solve for R:

$$R = \left(\frac{100}{200}\right)^{.63} = .65 mm/hr$$

An increase in dBZ, from 20 to 50 for example, creates an increase in rainfall rate:

$$50dBZ = 10\ \log_{10}\ Z \therefore Z = 100000 \qquad R = \left(\frac{100000}{200}\right)^{.63} = 50\ mm/hr$$

The values you enter for the constant and exponent depend on the climate at the radar site and experience gathered through use of the IRIS system.

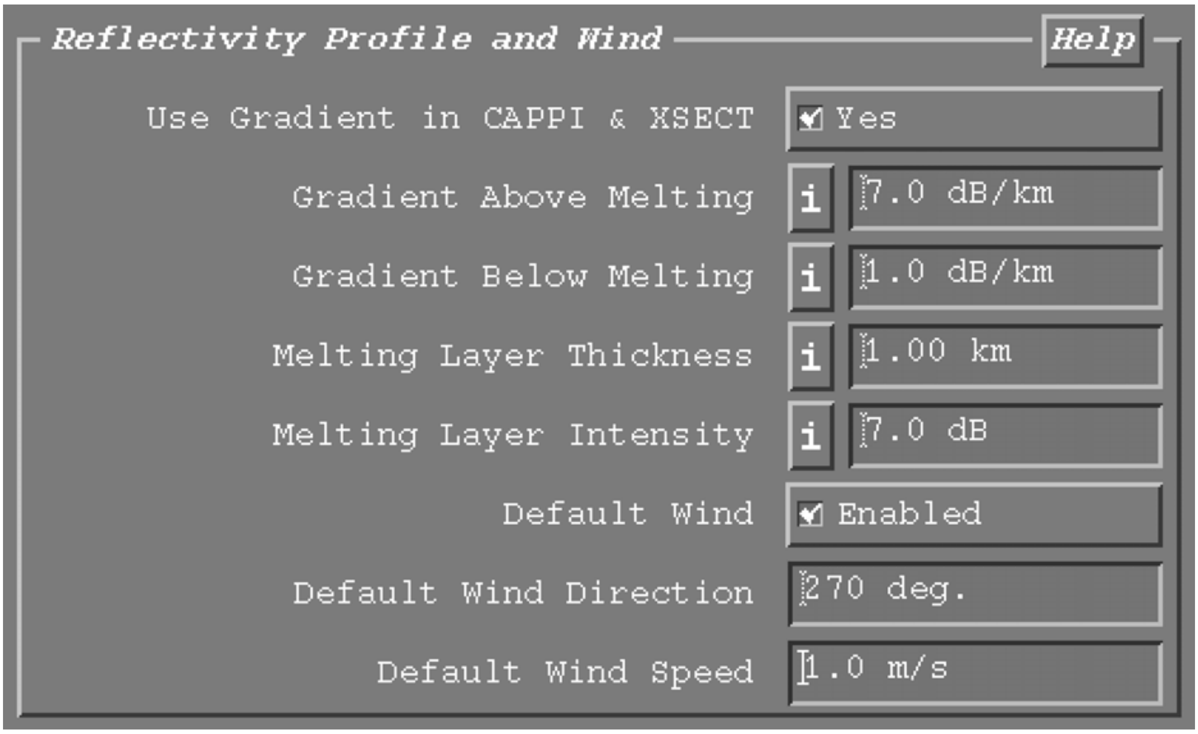


- *Product arrival wait time* — This is in effect a scheduling timeout for products which require several inputs, but which can run when some are missing. Products which use this are: COMP, NDOP (with 3 inputs), and RAIN1. For example: suppose a composite product requires 3 radar site inputs within 5 minutes. It gets two of those inputs, then the 5 minute interval expires. If the *Product arrival wait time* is set to 1 minute, then it will wait for 1 more minute before running. This time is meant to cover possible time differences between the radars and differing network transfer speeds.
- *Raingage data arrival wait time* — The time to wait for raingage data to arrive is set separately. This is used in the rainfall correction of the RAIN1 product.
- *Alternating polarization features* — This question will enable the listing of the data types ZDR and KDP, and also the listing of the K/R relationship in many of the menus. It also enables the following questions on the K/R relationship below:

- *Default K/R relationship* — These number allow control over the default KDP-R relationship, similar to the Z-R relationship above.
- *Read Cache size* — The IRIS memory mapped I/O library routines support caching file read. It only operates for reading files. Making this size nonzero disables memory mapping and uses the specified cache size in the product generator.

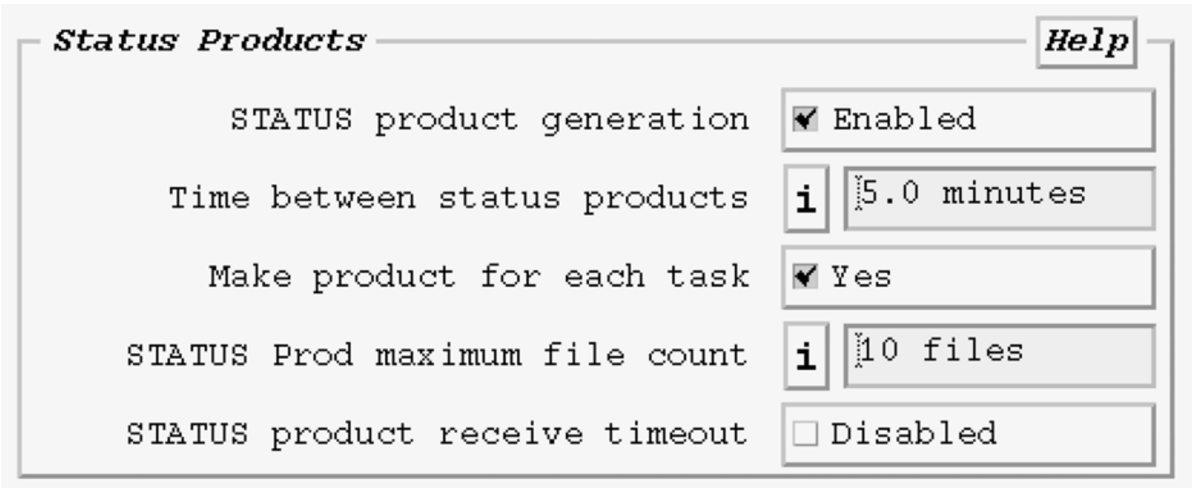
  If your system supports memory mapped I/O, then you may want to keep the caching size at zero. If you do not have memory mapped I/O, then benefits can result by setting the cache size to the approximate size of the INGEST volume scans that are being processed. However, if there is not enough main memory to hold these cached data, then the product generator is swapped to disk and no performance benefit are achieved.
- *Zero Reference Height* — Enter the height in meters above MSL used for zero in the product generator. Generally this should be zero for mean sea level, but for radars far inland, you might want a different reference. All radars to be composited together should have an agreed upon reference. All heights displayed with the user cursor are relative to this reference.

10.8.2 Reflectivity Profile and Wind



- *Use Gradient in CAPPI & XSECT* — This enables a vertical gradient extrapolation in product generation for the CAPPI and XSECT products. This smooths out the top of the products using the "Gradient Above Melting" from the reflectivity profile. This is the minimum value used when a lower sweep has valid data and the upper sweep is below threshold.
- Reflectivity profile: The reflectivity profile consists of a gradient above the melting level, a gradient below the melting level, a melting layer thickness, and a melting layer intensity. The melting layer height, specified elsewhere, is the intersection of the two gradients, and the top of the bright band. These numbers are used in the SRI product profile correction, and in the CAPPI and XSECT smoothing. These numbers can be changed while IRIS is running.
- *Default Wind* — The default wind is recorded with the ingest data and can be used for adjustments to the bird detection algorithm. To use this feature you will need to automatically detect the wind speeds and enter them into the radar system.

10.8.3 Status Products

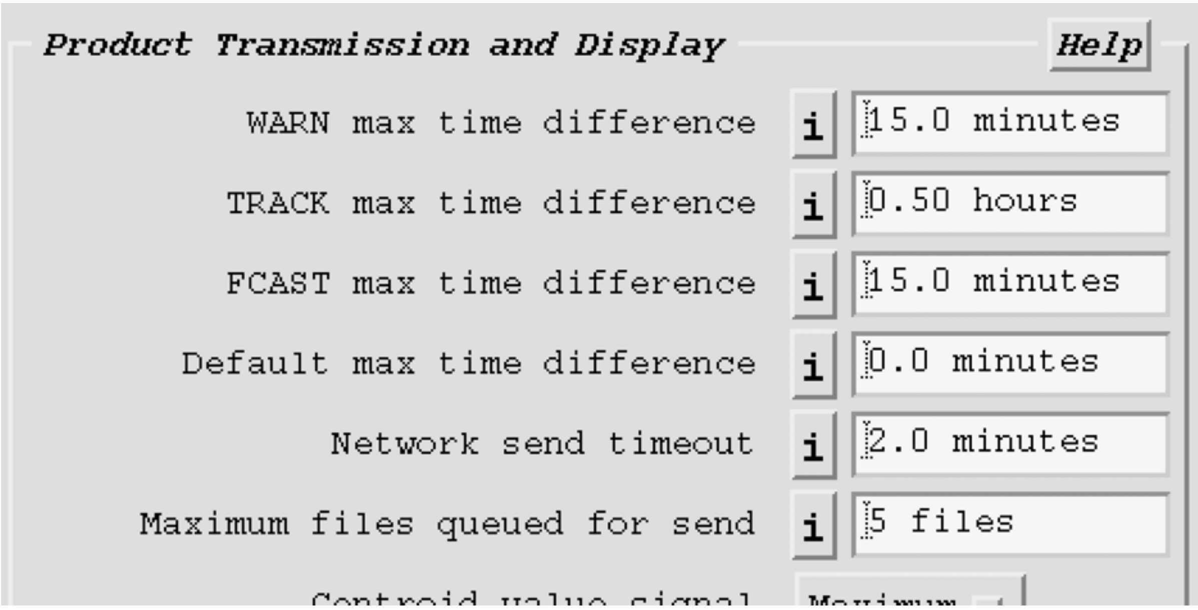


- *Status product generation* — Select either "disabled" or "enabled." If "enabled" is selected, a box appears where you can enter how frequently you want to generate Status products (in minutes), or 0 if you do not want to generate these products. If enabled, IRIS also generates Status products whenever the overall system status changes from OK to Fault, or vice versa.
- *Make product for each task* — This tells IRIS to make a new status product each time a task is started. This is useful if you wish to do status product task slaving.

- *Status Prod maximum file count* — Enter the number of Status product files to be kept on the system.
- *STATUS product receive timeout* — Select either "disabled" or "enabled." If it is enabled, set this time slightly longer than the time between status products. The default value is 11 minutes with products mode ever 10 minutes.

  This feature lets IRIS detect failures of other networked systems. If it has been more than the specified time since a status product has arrived from another system, it will be marked as "Timeout" on the Network Status Display.

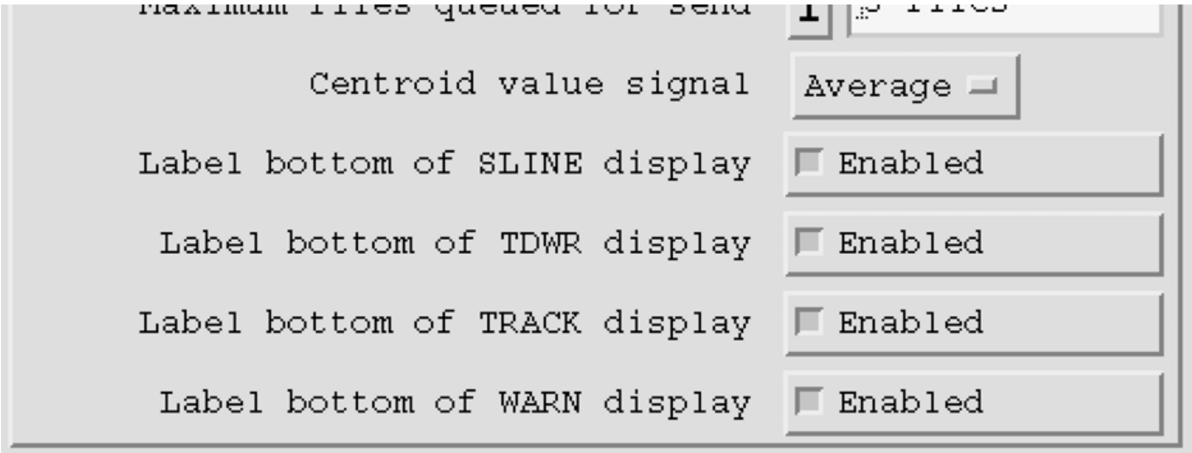
10.8.4 Product Transmission and Display



- *WARNING max time difference* — IRIS allows the automatic display of a warning overlay on top of any PPI or earth projection product. When the product is displayed, the WARN product with the nearest time is overlaid. However, if the time difference exceeds this value, it is not overlaid. The recommended value is 15 minutes. A value of 0 disables the check.
- *TRACK max time difference* — If the time difference between the most recent point in the Track product and the data time of the image exceed this limit, then the overlay is not drawn. A value of 0 disables the check.
- *FCAST max time difference* — Similar for forecast products.
- *Default max time difference* — Similar for all other product types.

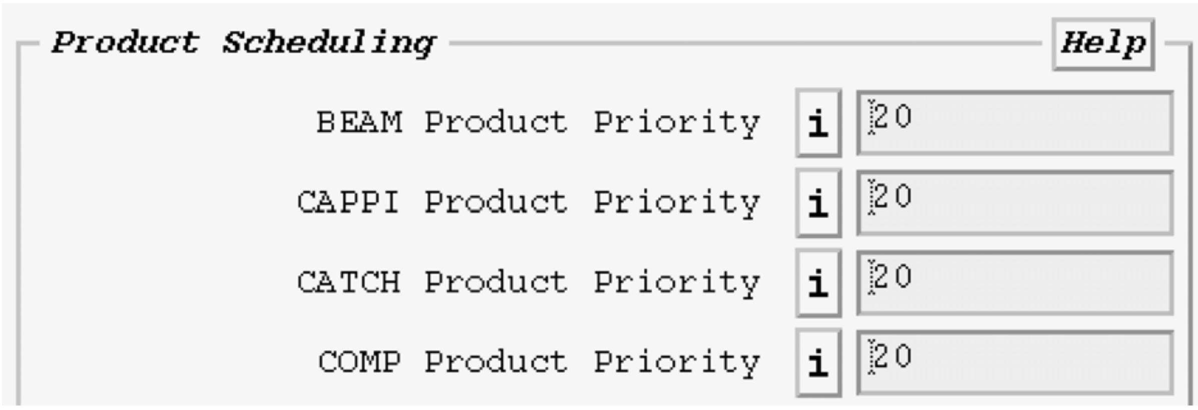
- *Network send timeout* — Each time a network transfer is started by IRIS, a timer is also started. If the timer completes before the transfer completes, then the transfer is aborted. This will prevent an infinite lockup of the system in some cases where the network stops working in the middle of a transfer.
- *Maximum files queued for send* — Enter the maximum files that IRIS will queue for sending to a network output device, other devices have no limit. For example, in the event of a network failure, IRIS will queue files to send. When the link is restored all of the queued files will be sent. The order of transmission is as follows: 1) All STAT products are sent oldest one first. 2) All RAW products are sent oldest one first. 3) All other products are send newest one first.

  The receiving machine will then have to "catch-up" by processing all of the data. For critical real time applications, the number of backlog files in the queue should be kept small (e.g., 2 or 3) so that real time operation will resume quickly. For a system where the data archive is important, then set the number to be large, e.g., to 50, or to 0. A value of 0 means the maximum feature is disabled, and files are queued with no limit. This limit applies only to network devices.
- *Centroid value signal* — When WARN products are generated or arrive over the network, they can optionally generate a pop-up signal if a warning is detected in a protected area. Here you select if the pop-up signal is based on the maximum or average data value. SIGMET suggests using the average value.



All the warning generating products can show the warning message on the bottom of the display window. Use these buttons to enable that feature, if desired.

10.8.5 Product Scheduling Priority

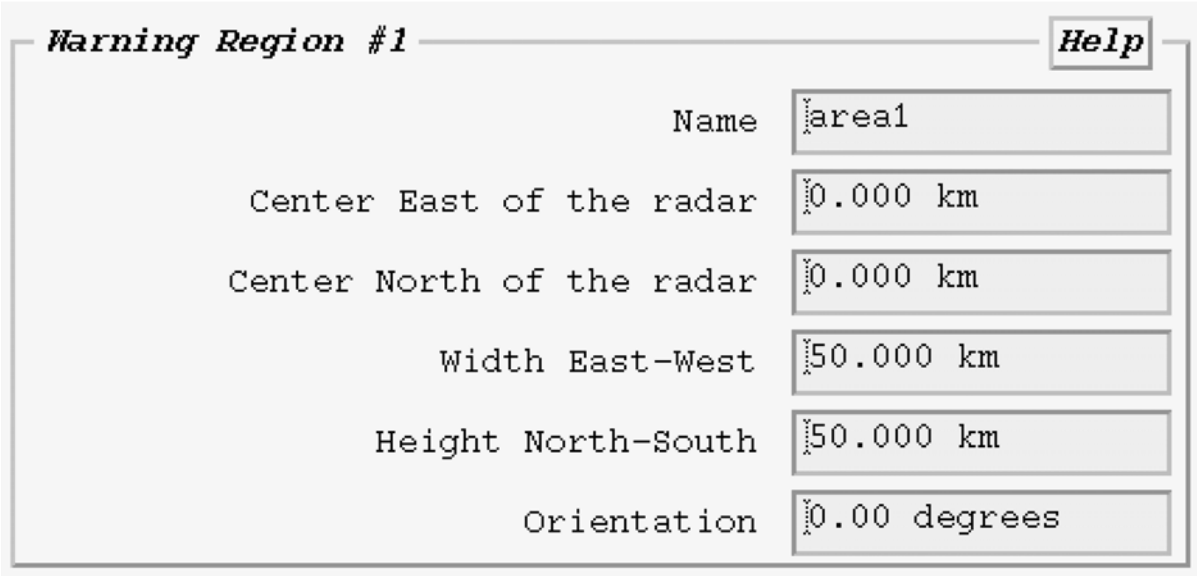


Define the relative priorities for each product type. These numbers range from 0 (lowest priority) to 100 (highest priority). The Product Generator sorts the full schedule of products and determines the next product to run according to the following hierarchy:

1. User-defined product priority. All products of a given priority run in favor of products of a lower priority.
2. Oldest data time. Within a given priority, the product that runs on the oldest input data is scheduled before any others.
3. Order within the schedule, from top to bottom.

A typical schedule might set XSECT products to priority 30, WARN products to priority 40, and all others to priority 20. However, the needs of an individual site might require different settings. For example, a site that must output raw data quickly would increase the priority of RAW products or decrease the priority of products considered "background."

10.8.6 Warning Regions



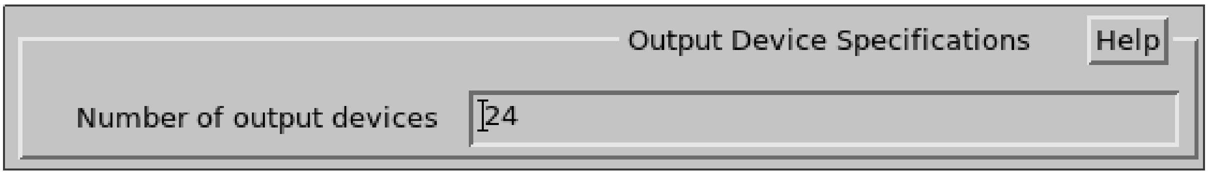
The IRIS warning product allows the selection of up to 32 protected areas. If the warning results fall into one of the selected protected areas, a signal is sent to all the IRIS terminals.

Each protected area consists of a rectangle. The location, size, and orientation can be selected. If the area you wish to protect is of an irregular shape, it can be pieced together with several areas.

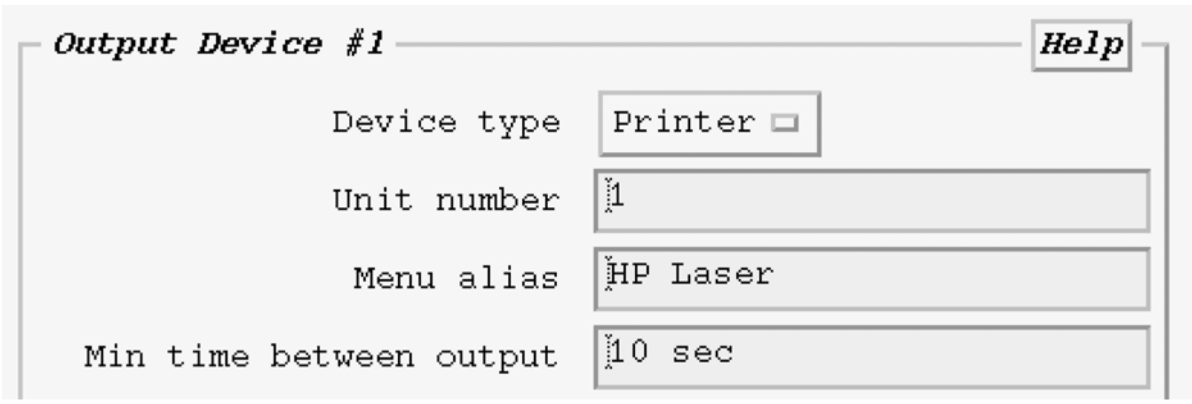
- *Name* — Enter a name for the region. The name can be up to 12 characters long. If the name is blank, then the region is undefined and disabled, and Setup does not ask the remaining questions if the name is blank.
- *Center east/north of radar* — Enter the location of the center of the protected region in kilometers relative to the radar. West and south are entered as negative numbers.
- *Width east-west/north-south* — Enter the width and length of the region in kilometers. These numbers cannot be negative.
- *Orientation* — The region specified with the previous questions can be rotated by up to 180 degrees clockwise from the straight orientation.

10.9 IRIS Output Devices Setups

10.9.1 Output Device General Specifications



- *Number of output devices* — Enter the number of output devices for your system setup. The maximum number supported is 200. For details about how to make the value larger if hitting a maximum limit, see 10.5.3 File and System Quotas on page 206.

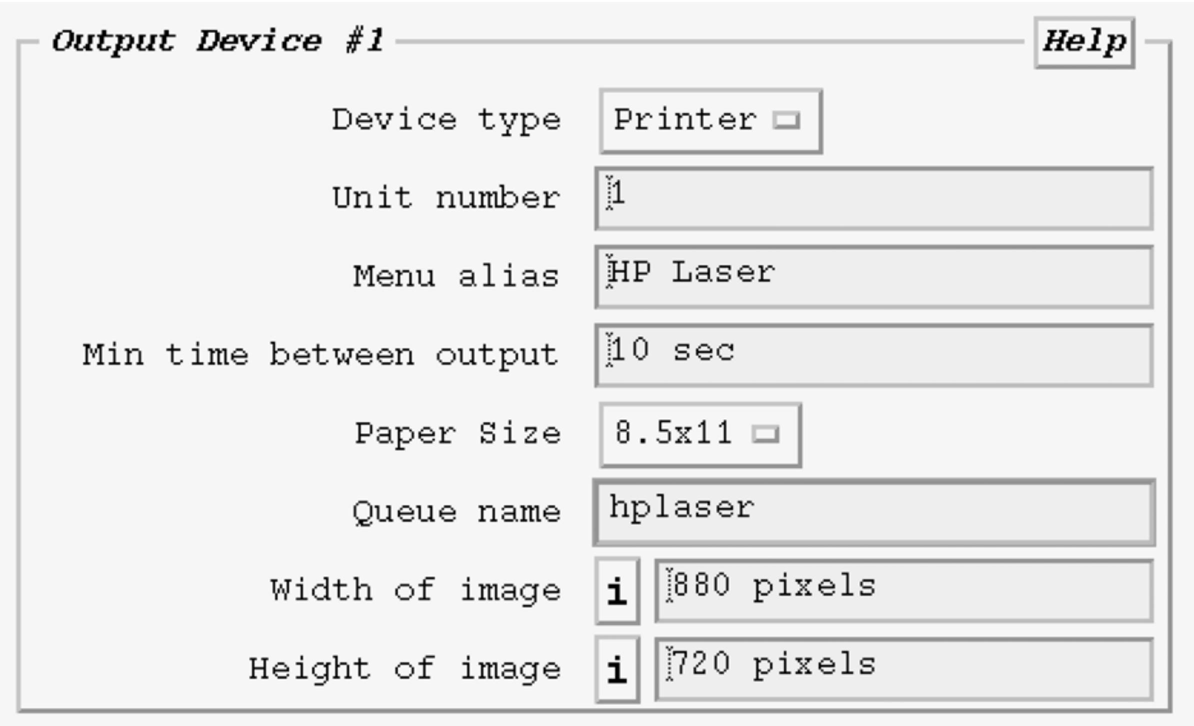


Although the amount of questions vary depending on the device type, the following three questions always appear.

- *Device Type* — Enter the device type of "Archive," "Link," "Network," "Printer," "Window," or "UNUSED".
- *Unit number* — Set this parameter to 1, unless there is more than one device of that type on the system. In that case, set it to 1, 2, 3, 4, etc. Each device of a particular type should have a unique unit number. It is recommended that unit numbers be in increasing order for increasing output device number.
- *Menu alias* — This allows you to select a text alias which is displayed in the pull down menus where you are selecting an output device. The purpose of the alias is to allow easy identification of output devices. For example, you may have window outputs on several different workstations, and you could place the node name here.

- *Min time between output* — For slow network outputs, you may wish to pace the outputs such that some of the outputs are skipped. Select the pacing time here. To turn this feature on you must also tag the product header lines with the "Time Filter" bit in the Product Output Menu.

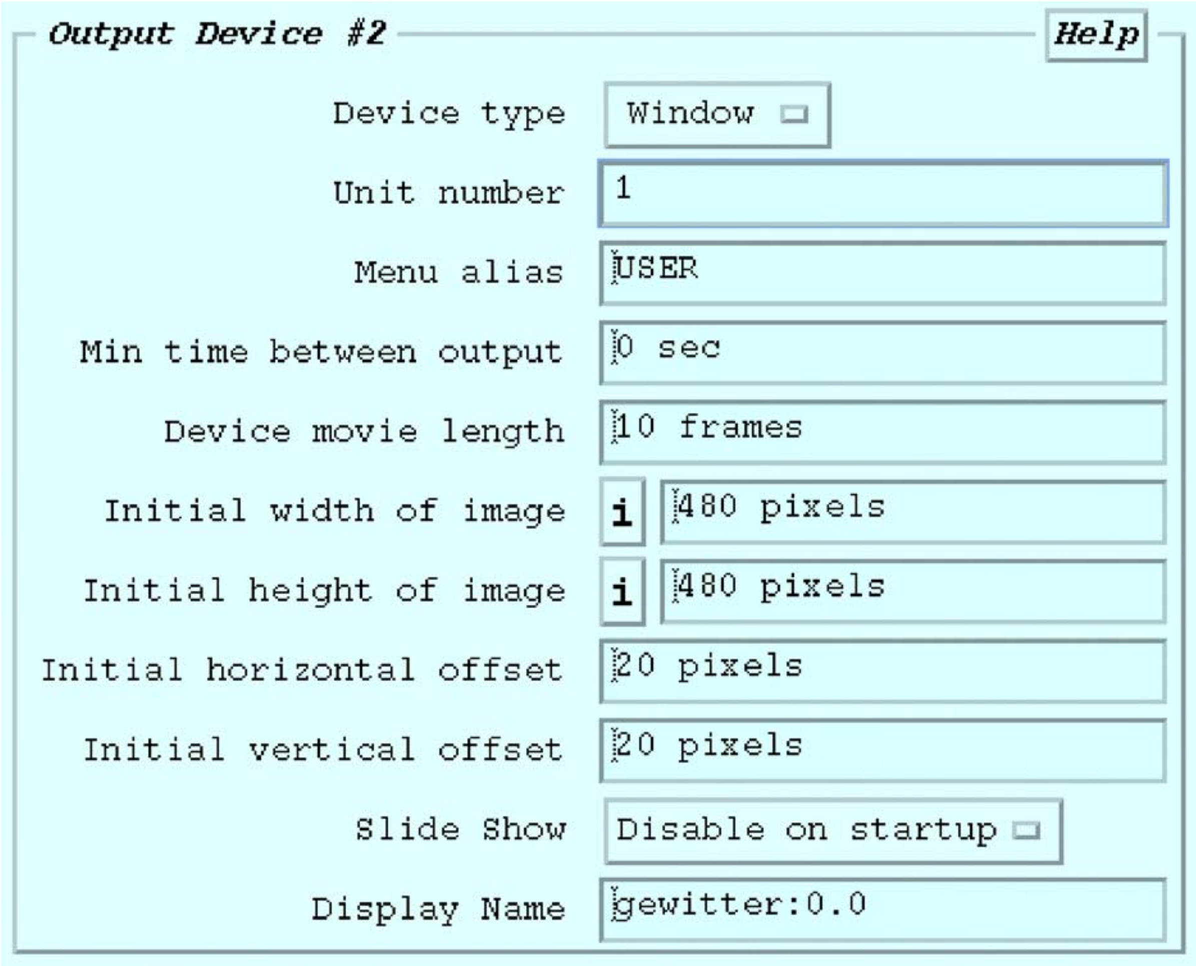
10.9.2 Printer Specific Parameters



NOTE	This setup is for printer output devices selectable from the Product Output Menu. Screen dump style printing is configured from the printer/setup menu. Only Postscript printers are supported.

- *Paper Size* — Select the size of paper in your printer. Choices are 8.5×11, 8.5×14, 11×17, A4 and A3. If the paper size is wrong, the printer will not print.
- *Queue Name* — Enter the name of your printer queue. You can see a list of all the choices by typing "lpstat -a" at the UNIX shell.
- *Width and Height of image* — Enter the dimensions of the print image to be generated and sent to the printer. Note that Postscript printers will rescale to fit the screen.

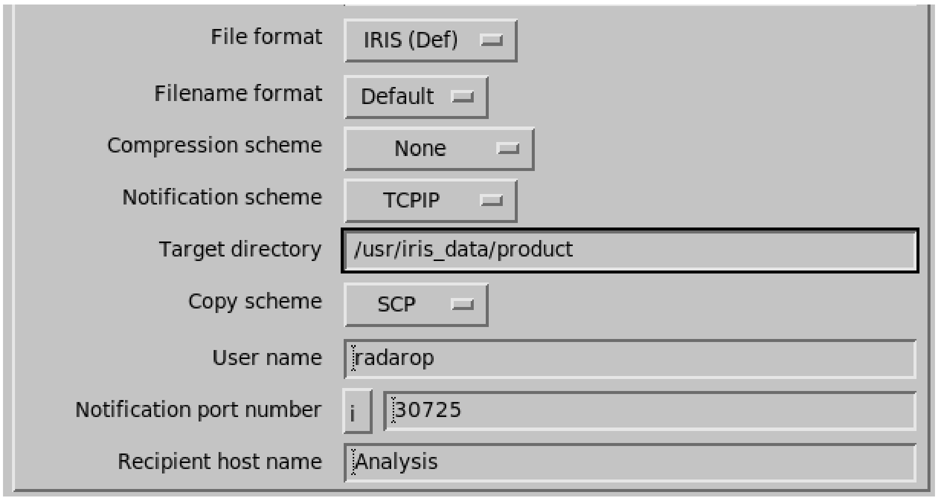
10.9.3 Window Specific Parameters



- Minimum time between output — This can add a "skip" for products sent to a particular destination. For more information on using this feature see,
- *Device movie length* — Enter the number of frames in the Quick Look movie for that device, usually 20.
- *Width/Height of image* — Specify the width and height you want for the target image. This is the initial size and the size can be changed by the mouse. The space reserved for Quick Look movies is based on the the movie length and default image size. If you change the image size during operation, the maximum movie length changes
- *Horizontal/Vertical offset* — Specify the initial position of the window on the screen. This is the upper left corner. On SGI systems an offset of 0, 0 will place the window such that the window manager's border is not visible.

- *Slide Show* — Specify if the window should power up in slide show mode or not.
- *Display Name* — Specify the workstation display and screen number on which the window is to appear.

10.9.4 Network Specific Parameters



- *File format* — Enter the format of the file transferred. The recommended format for IRIS-to-IRIS transfers is "IRIS". Choices are:

  IRIS : File copied without conversion.

  NORDRAD1 : File converted to NORDRAD1 format

  BMP: X bitmap

  GIF: Gif

  TIFF : TIFF format with GeoTIFF header information, you can view the GeoTIFF information with **listgeo**.

  JPEG: JPEG

  PNG: JPEG

  Postscript: Postscript

  None: File is not copied, just notification sent

  Pipe: User specified pipe program

  Header: File header only is copied

- *Pipe program name* — If you select pipe above, then this question appears, and you can specify the name of a user supplied pipe program used to format the output file. The program must be placed in the ${IRIS_PIPES} directory. Table 5 on page 240 shows the output pipes supplied with IRIS. For more details on writing your own pipe

see Chapter 3, Antenna Utility, on page 29 of the *IRIS Programmer's Manual*.

Table 5 Output Pipes Supplied with IRIS

Name	Supported Products	Supported Data Types	Syntax	Purpose
IrisToAdids	PPI, CAPPI, TOPS, BASE, MAX, RAIN1, RAINN, SRI, VIL,VIR,LAYER, HMAX, SHEAR	T, Z, Zc, Ze, V, Vc, W, SQI, ZDR, ZDRc, PhiDP, KDP, RhoHV, LDRh, LDRv, PhiDPh, PhiDPv, HCLAS, VIL, Rain Rate, RAIN, H, SHEAR, SNR	Pipe	Converts IRIS product to ADIDS format.
IrisToArchive2	RAW	Z, V, W	Pathnames	Converts IRIS RAW product to NEXRAD Archive2 format.
IrisToAsterix			Pipe	Converts IRIS product to Eurocontrol ASTERIX format.
IrisToBufr	PPI, CAPPI, TOPS, MAX, RAIN1, RAINN, VVP, SRI, VIL, VIR, RAW	V, W, ZDR, LDRh, Rain Rate, RAIN	Pipe	Converts IRIS Cartesian product to WMO BUFR format using OPERA guidelines.
IrisToEwis	RAW			Converts IRIS to EWIS format
IrisToGrib1	CAPPI, TOPS, BASE, RAIN1, RAINN, SRI, VIL, HMAX, USER	Z, V, W, ZDR, Rain Rate, RAIN, H	Pipe	Converts IRIS Cartesian product to WMO GRIB version 1 format.
IrisToHDF5	PPI(NORDRAD), CAPPI, TOPS,MAX, RAIN1, RAINNN, RHI VVP, XSECT, RAW	Z, V, W, SQI, ZDR, PhiDP, KDP, RhoHV, LDRh, VIL, Rain Rate, RAIN, H	Pathnames	Converts IRIS product to HDF5 format using NORDRAD2 guidelines.
IrisToMcIdas	PPI, CAPPI, TOPS, BASE, MAX, RAIN1, RAINN, SRI, VIL, HMAX, SHEAR	Z, Zc, V, Vc, W, ZDR, LDRh, LDRv, VIL, Rain Rate, RAIN, H, SHEAR	Pathnames	Converts IRIS product to McIDAS area files.

Table 5 Output Pipes Supplied with IRIS (Continued)

Name	Supported Products	Supported Data Types	Syntax	Purpose
IrisToNetCDF	RAW	T, Z, Zc, V, Vc, W, SQI, ZDR, ZDRc, PhiDP, KDP, RhoHV, LDRh, LDRv, PhiDPh, PhiDPv, HCLAS	Pathnames	Converts IRIS RAW product to NetCDF files.
IrisToOdimHdf5	PPI (EWIA files), CAPPI, TOPS, MAX, RAIN1, RAINNN, RHI VVP, VIL, XSECT, RAW	T, Z, V, W, SQI, ZDR, PhiDP, KDP, RhoHV, LDRh, VIL, Rain Rate, RAIN, H, SNR	Pathnames	Converts IRIS product to HDF5 format using OPERA guidelines.
IrisToUf	RAW	T, Z, Zc, V, W, SQI, ZDR, PhiDP, KDP, RhoHV, LDRh, LDRv	Pipe	Converts IRIS RAW product to UF format.
IrisToUKMO			Pipe	Converts IRIS RAW product to UKMO format.
VilToVir			Pathnames	Converts an IRIS VIL product to average Z.

It is not possible to include here in the manual details on configuring all these pipes. To find documentation, first look in the appropriate .conf file for the pipe. There is such a file for each pipe, normally shipped in the config_template/init directory. Copy it to your config directory and edit as required. These usually include comments. For more details, see the source code included in the utils tree.

Pipes are programs which are run separately from IRIS. This gives incredible flexibility because you can install your own, and you can upgrade the program without interrupting IRIS. A downside of this is that detailed error messages cannot be signalled to the IRIS error log. Instead, a generic fault signal is logged saying to look for an error log file. These pipes will write a *.log file in the ${IRIS_LOG} directory. So the pipe configuration tuning cycle consists of: Attempting to output a file, checking the log file, editing the conf file, then trying again.

- *Command line syntax* — Also only asked if you select pipe file format. There are two choices for how IRIS will run the pipe program shown below. In addition, the output process will always send the color seam values and number of colors.

  1) Pipe:

```
pipe-pathname input-filename <input-pathname >output-
pathname
```

2) Pathnames:

```
pipe-pathname --ip:input-pathname --op:output-pathname
```

Note that in addition to these arguments, the pipe program is supplied with the following arguments:

-seams=1:2:3:4	Specifies the seams between colors
-colors=12	Specifies the number of colors
-device=0	Specifies the output device number, origin 0.

- *Filename format* — Enter the format of the file name produced. The six choices are "Default", "Native", "8.3", "METPS", "Original", and "IIA". Native is the same format used in the IRIS internal inventories (with a new random suffix), while original means the exact same name as is used internally. The purpose of the original format is to allow a program to reference the original data files later. The recommended format for IRIS-to-IRIS transfers is "Default". The formats are summarized below. Note that pipe programs have the power to override the output filename, so these choices may be effectively ignored.

  "Default" is nodeYYMMDDHHMMSS.PPPNNNN

  "Native" and "Original" is SSSYYMMDDHHMMSS.PPPXXXX

  "8.3" is node.NNN.

  "METPS" is ATYMDHMS

  "IIA" is PPP_D_PSI_RNG_YYYYMMDDHHMMSS

	Where:
SSS	= 3-letter site code
YYYY	- 4-digit Year
YY	= 2-digit Year (modulo 100)
MM	= 2-digit Month
DD	= 2-digit Day
HH	= 2-digit Hour
MM	= 2-digit Minute
SS	= 2-digit Second
PPP	= 3-letter Product type
XXXX	= 4-letter Random characters
node	= Source system's node name, limited to 8 chars in 8.3 format

NNNN	= 4-digit base 10 number incrementing for each file
AT	= Letters "AT"
YMDHMS	= Year–1990, month, day, hour, minute, second, all base 62.
D	= 1 or 2-letter data type
PSI	= 3-digit product specific information
RNG	= 3-digit maximum range in km

- *Compression scheme* — Select either "None" or "Compress", "Gzip", or "TIFF PackBits". NORDRAD files are always compressed with the NORDRAD scheme. For IRIS-to-IRIS transfers we recommend compressed if it is bandwidth limited, otherwise normal. The filename will get a ".Z" suffix for compress, and a ".gz" suffix for gzip. The "TIFF PackBits" compression is only applicable to outputs in TIFF format.
- *Notification scheme* — IRIS supports five kinds of network output Notification: "None," "NORDRAD1," "TCPIP" (a socket message is sent to the receiver, using address format INET), "RENAME" (the file is renamed after the copy is complete, thus a polling program will find a complete file), and "UNIX" (a socket message is sent to the receiver, using address format UNIX). The recommended notification for IRIS-to-IRIS transfers is "TCPIP".

NOTE The UNIX address format can only be used to communicate with a program on the same computer that IRIS is running on. Therefore it can be used only for communication with a UPI program, and not for communication to another IRIS. It will create a socket file with path name ${IRIS_KEYS}iris_portXXXXX, where XXXXX is the port number.

- *Target directory* — Specify the directory where the file is to be copied. The directory should be a maximum of 56 characters long. The recommended directory for IRIS-to-IRIS transfers is the ${IRIS_PRODUCT} directory on the receiving machine.
- *Copy Scheme* — Choices are "None", "Copy", "RCP", "SCP" or "Script". None means that the product file is not copied at all. Use this if you want to just notify another program about your product. Copy means that the file is copied using program I/O, with fopen, fread, and fwrite. The recommended copy scheme for IRIS-to-IRIS transfers is "RSCP". You would use "Copy" only in two cases: 1) You are copying to the source computer. 2) SCP doesn't work, and you are using NFS. RCP means to use the rcp secure copy shell command. Script means that a user specified copy script program is run to do the copying.

- *User name* — This question is only displayed for Script and RCP Copy Schemes. It is the user name supplied to the script, and used in the rcp command before the "@" sign. The recommended value is "operator".
- *Password* — This question is only displayed for Script Copy Schemes. It is the password supplied to the script. The value is not displayed, and is encrypted in the configuration file.
- *Copy script name* — This question is only displayed for Script Copy Schemes. You can specify the name of a user supplied program used to copy the file to the target. The program must be placed in the ${IRIS_PIPES} directory. The program is supplied with the following arguments:

  SourcePath DestPath DestHost User Password [RenameName]

  The Source path will be in a temporary directory. The destination path will be in the directory specified in above. Table 6 on page 244 shows the copy scripts which are supplied with IRIS.

Table 6 Copy Scripts Supplied with IRIS

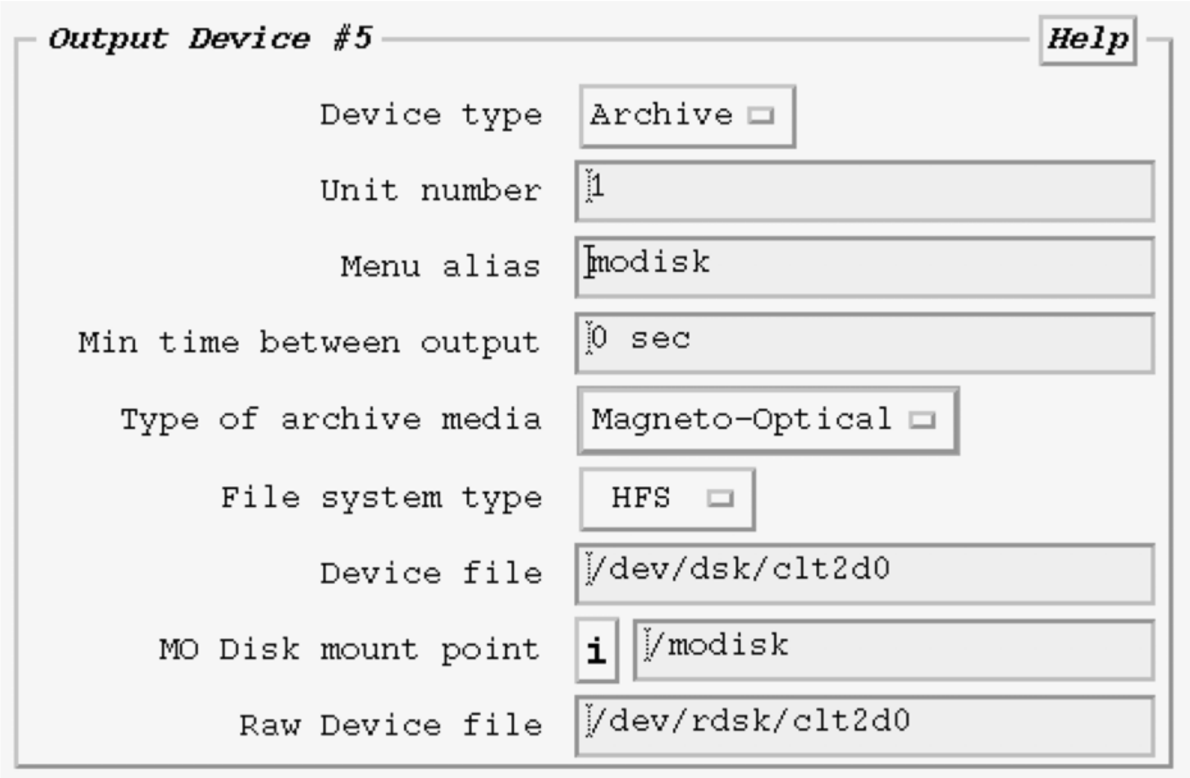
Name	Purpose
sig_ftp	Runs the ftp program to copy files
N2RelayOut	Uses N2 library to store products into NORDRAD2

- *Notify port number* — This question is only displayed for TCP/IP and UNIX notification. For output to an IRIS on another computer please use port number 30725. For output to a UPI program on any computer, use port number 30726. This allows the UPI program to run on a computer node which is also running the IRIS network receiver.
- *Node name* — This question is only displayed for TCP/IP notification. Enter the name of the machine to notify.

If you are outputting to a NORDRAD1 system, here is a summary of how you should configure the system:

File Format: NORDRAD, Filename format: Default, Compression Scheme: None (Nordrad packing is done automatically), Notification scheme: NORDRAD, Target directory: /usr/iris_data/nordrad (not very important), Copy scheme: Copy, Recipient host name: <blank>. Note that the NORDRAD hostname is configured in the NORDRAD_AREAS.DAT file.

10.9.5 Archive Specific Parameters



- *Type of archive media* — Select either "Tape", "Magneto-Optical", "Large Disk" or "DVD" (Linux only) to specify which type of archive device this is.

If you have chosen Tape, the following question appears:

- *Device file* — Set the name of the device file for the tape. Note that this often takes the form of a name like "/dev/rmt/c1t2d0". This means SCSI controller card 1, SCSI address 2, device 0.

If you have chosen Magneto-Optical, the following questions appear:

- *File system type* — Applicable to HP systems only. Set to "HFS" or "VXFS" to match your systems root file system type.
- *Device file* — Set the name of the device file for the disk. Note that this often takes the form of a name like "/dev/dsk/c1t2d0". This means SCSI controller card 1, SCSI address 2, device 0.
- *MO Disk mount point* — Specify the point for the MO disk. The recommended value is "/modisk", but any value could be used.
- *Raw Device file* — Usually the same as the device file, but with a "rdsk" in the path.

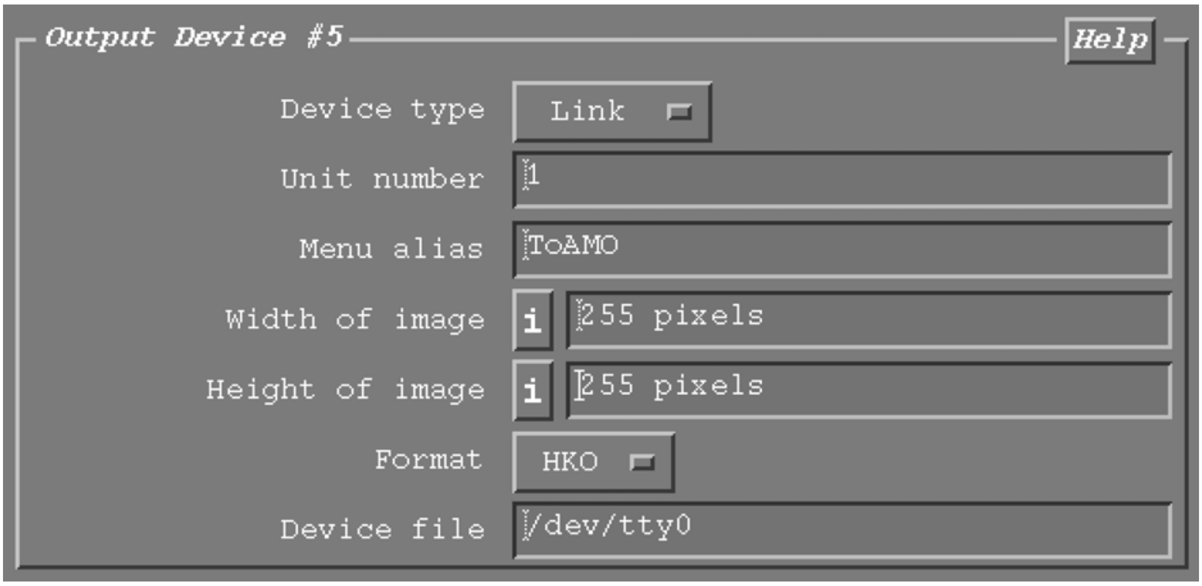
If you have chosen Large Disk, the following question appears:

- *LDA directory* — Specify the LDA directory, typically something like "/usr/iris_data/lda1".

If you have chosen DVD (Linux only) the following questions appear:

- *Device File* — Specify the device file used for the DVD drive. Typically it will look something like /dev/scd0 or /dev/scd1. You can determine this by typing as root `"cdrecord -scanbus"`. Identify the entry for your DVD. The middle number of the leading group of three numbers identifies your device, e.g., 3,0,0 corresponds to /dev/scd0 while 3,1,0 would be /dev/scd1.
- *DVD Disk mount point* — This is usually /mnt/dvd.
- *Buffer Size* — To make the DVD writing more efficient, files are written to a temporary buffer called /usr/iris_data/temp/DvdArchive1 (for DVD 1). When the buffer size specified here is exceeded, then the files are written as a block to the DVD. During the write, IRIS "locks-out" sending new files to the buffer. After the files are written, the contents of the buffer are all deleted and the process repeats automatically. Files queued for send to the DVD are not lost. Note that the buffer is flushed to the DVD if IRIS is stopped (by qiris). Typical buffer size is 200 MB. DVD's can hold approximately 4 GB.

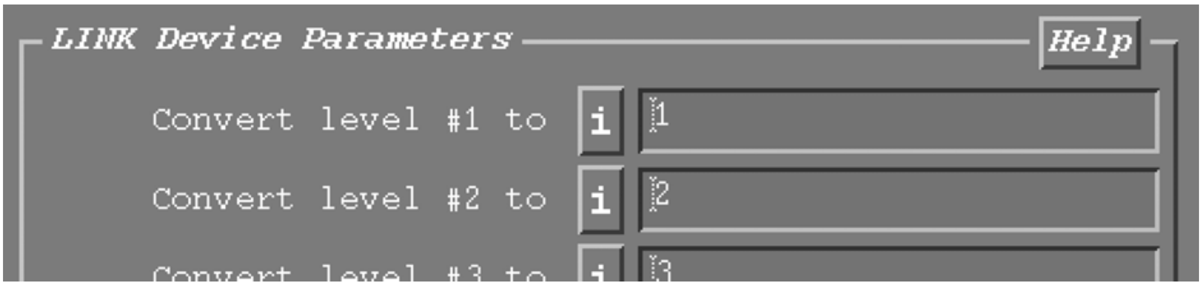
10.9.6 Link Specific Parameters



The link data format allows conversion from data levels to color numbers. If you do not have any link output devices, you can skip this section.

- *Width/Height of image* — Specify the width and height you want for the target image. For link specifications, the image must be set to 255 pixels. For network devices this question is only applicable to TIFF format output.
- *Format* — Specify either "HKO" for Hong Kong Observatory, or "AWS" for Austrian Weather Service.
- *Device file* — Here is where you set the serial device file.

10.9.7 Link Device Parameters



This second section is only displayed if there is a link device defined. It allows control over the mapping of IRIS color levels to the file format.

- *Convert level #(1 – 16) to* — Enter the alternate color number for each level. Note that these are the unzoomed color levels. There are two data formats that you can use. AWS format defines data levels from 0 – 15; HKO format defines levels from 1 – 16. The defaults are set to the HKO format.
- *Convert background to* — Enter the number for the background color. This color is also used for drop shadows.
- *Convert overlay to* — Enter the number for the overlay color.
- *Convert underlay to* — Enter the number for the underlay color.
- *Convert fill to* — Enter the number for the fill color. This color is used for fill1, fill2 and also for the legend text.

The following example shows a link map for systems that use the HKO data format:

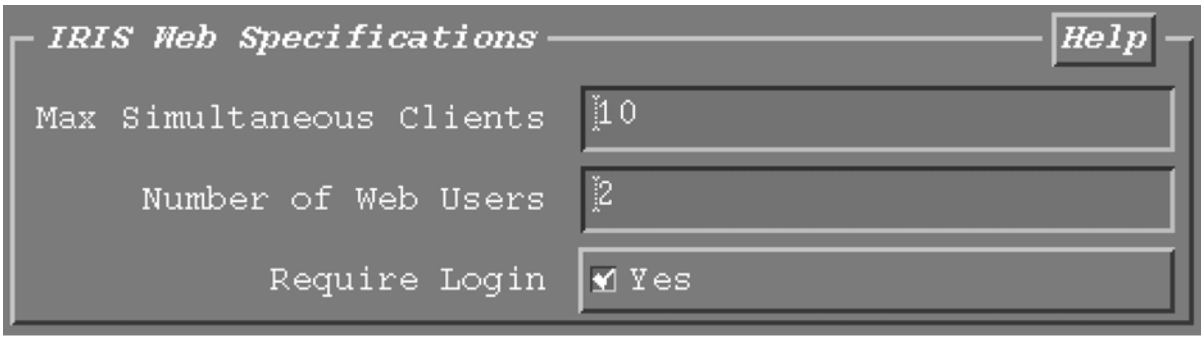
```
Convert level #1 to:      1              New value:
Convert level #2 to:      2              New value:
Convert level #3 to:      3              New value:
Convert level #4 to:      4              New value:
Convert level #5 to:      5              New value:
Convert level #6 to:      6              New value:
```

```
Convert level #7 to:       7              New value:
Convert level #8 to:       8              New value:
Convert level #9 to:       9              New value:
Convert level #10 to:      10             New value:
Convert level #11 to:      11             New value:
Convert level #12 to:      12             New value:
Convert level #13 to:      13             New value:
Convert level #14 to:      14             New value:
Convert level #15 to:      15             New value:
Convert level #16 to:      16             New value:
Convert background to:     14             New value:
Convert overlay to:        14             New value:
Convert underlay to:       15             New value:
Convert fill to:           16             New value:
AWS Site number:           0              New value:
```

When using HKO data format, you should also turn off legend, political overlay, and range rings in the Product Output menu.

- *AWS Site number* — Enter an arbitrary site identification number to be used in the AWS link data transmission format. Enter 0 if you do not want to use this format.

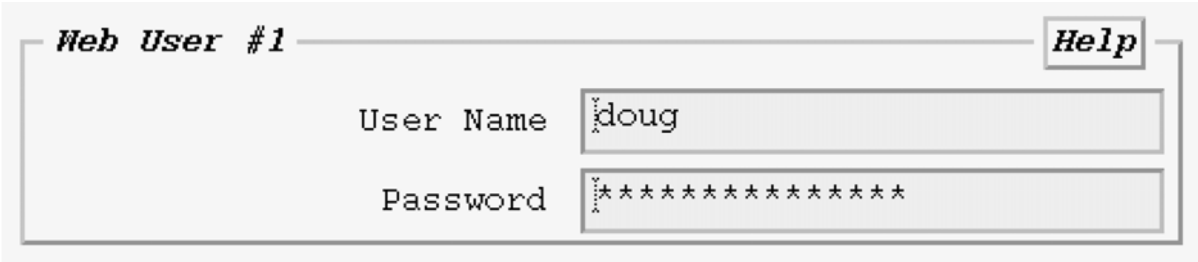
10.10 IRIS Web Setups



- *Max Simultaneous Clients* — This is the maximum number of browsers which are allowed to view the IRIS web page.
- *Number of Web Users* — This is the number of users in the list below. A maximum of 20 are allowed.

- *Require Login* — Enter no if you do not wish to require users to type in a username and password before they are allowed to access the IRIS Web-Look window.

  The following questions appear for each web user account:



- *User Name & Password* — Enter the user name and password. Wildcarding can be used.

CHAPTER 11
SUNCAL UTILITY

The sun may serve as an external radiation source for calibration of a radar system. This technique is simple and requires no external hardware to the radar system. The sun's position can be calculated from any point on Earth at any given time provided that accurate time and lat/lon information is known. This provides a convenient check for the antenna pointing accuracy. The sun's power can also be a useful technique for monitoring the calibration of the receive chain of the radar when used in conjunction with independent measurements of solar flux density. Solar flux densities are known to vary with frequency and are measured accurately over the 100 to 10000 MHz band from various solar observatories. Antenna beamwidth can also be computed from sector scans of the sun

The **suncal** utility is a stand-alone program that performs sector scans of the sun's position and outputs calibration data. The utility is supplied with both the RDA and IRIS releases and will work with the RVP7 and RVP8 signal processors and any antenna controller accessible via the antenna library. The **suncal** utility can be run interactively from a command line and does not use a graphical interface. It can also be inserted into the Task Scheduler as an Exec Task and run on a routine basis.

The **suncal** utility outputs a BEAM product. The BEAM product will contain SNR data with no thresholding and can be viewed on an IRIS system, but is not automatically inserted into an IRIS product directory. The BEAM product is then processed to produce a final calibration results file. On dual-polarization radars, **suncal** can output a second BEAM product containing LDRH data. This is used to compute the LDR offset.

In this chapter:

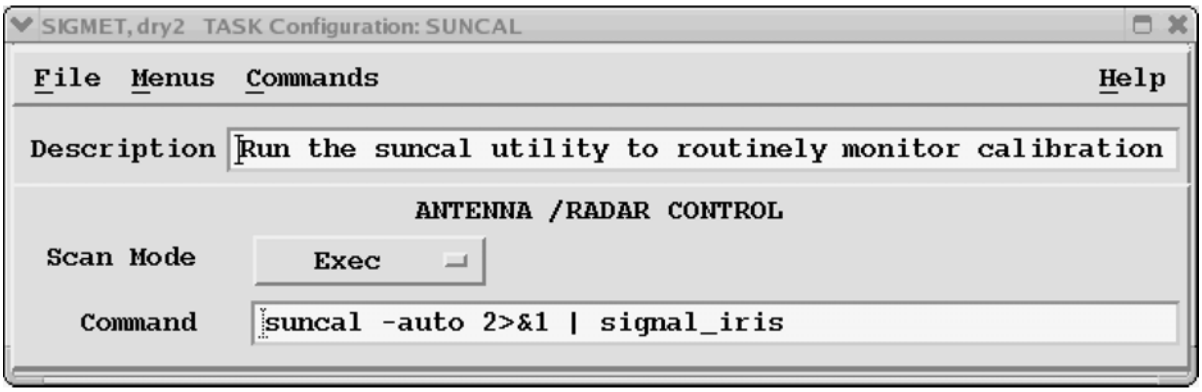
11.1 Invoking Suncal and Options

Command

```
$ suncal
```

Suncal was designed without a graphical utility so it can be run as an IRIS Exec Task. When running automatically from the IRIS task scheduler, **suncal** will produce an IRIS error message for an error (such as the measured sun peak power is below a specified threshold), or a configuration drift (such as the antenna offset errors are larger than desired, or the LDR offset is to big). This is useful for running **suncal** routinely without operator interaction and still being able to monitor the calibration of the receive chain. The –auto option is normally given when running as an Exec Task to preclude output to a terminal window. The "2>&1 | signal_iris" command will cause IRIS to signal the error output from **suncal**.

Suncal Exec Task



Suncal may also be run interactively from the command line. If run interactively, the current status is reported on the terminal as well as reporting the calibration results. There is also an option to process an input BEAM product(s) that may have been created at some earlier date. This is useful for remote testing. For example, a user can run **suncal** and then send Vaisala the resulting BEAM product which we can then process for analysis.

on page 253 lists the command line options to the **suncal** utility.

–auto	Do not log progress on the terminal, skip update.
–full	Do full scan, process, and update phases (default).
–help	Print this list.
–process:<path>	Process an existing BEAM product.
–resave	Reads and saves the suncal.conf file with comments and all new fields filled with default values.
–update[:<file>]	Interactive update from results, most recent if blank.
–version	Prints the version number.

11.2 How Suncal Works

Solar scans are capable of providing the user with antenna pointing offset, antenna beam width measurements, receive chain and LDR offset calibration. Variation in the solar flux of the sun has little effect on the antenna pointing and beamwidth measurements. Changes in the solar flux density will impact the power measured by the receiver. However independent measurements of the solar flux density can be used to verify changes in relative peak power and also calculations of the antenna gain for a radar system. This section will explain the procedure used by **suncal** to measure these quantities.

The operation of suncal is broken down into 3 phases, each of which produces an output used by the next phase. The scan phase, runs the antenna and collects data which is stored in IRIS format BEAM products. The process phase reads in the BEAM product(s) and calculates a results file. The update phase reads the results file and interactively allows the operator to update the calibration of the radar.

11.2.1 Antenna Scanning Sequence

The **suncal** utility uses the antenna library to control the antenna scan. We normally expect that the antenna angles are input to the RVP processor, as would be the case for IRIS. The current UTC time is taken from the local computer system's time to compute the sun's position. You should be sure to check that the time is correct to within a few seconds. A "SUNCAL" PPI sector scan is created and starts centered at the sun's initial position minus half of the elevation span given in the suncal.conf file. This scan will start below the sun's position. It will scan back and forth at the resolution requested in the file. The user has control of the PRF, sample size, range bin spacing and number of bins. This task is not angle synced. The azimuth scan speed is half that implied by the requested PRF and sample size. The data nearest to the desired azimuths will be stored. The first defined pulse width of the signal processor is used. The quality if the sun calibration should not be effected by different pulse widths because the sun is broad band just like the noise. The recorded data is SNR (which in IRIS is dBT with range normalization turned off).

To account for the sun's movement during the scan some corrections need to be made so the output is similar to a non-moving radiation source. To do this the sun's position will be recalculated at the start of each sweep. The change in the sun's position will be subtracted from all angles for that sweep. This correction is output to the terminal window during each sweep when run interactively. For example, if the sun moved towards the horizon by 0.10 degree during the "SUNCAL" task and there were five sweeps the elevation angle increment of each sweep would be numerically decreased by approximately 0.02 degrees. Similar angle corrections are done in the azimuth direction.

11.2.2 BEAM Product Generation

An IRIS BEAM product is automatically produced upon the completion of the sector scan. This BEAM product will range average most of the bins. You can selectively skip nearby bins to avoid clutter. The azimuth and elevation limits of the BEAM product are chosen to be slightly larger than your sector scan. The BEAM product is placed in the specified directory. If you have an IRIS system running, then a nice plan is to place this in the /usr/iris_data/input directory, and configure a blank input pipe to read them. This means you can display them in IRIS. If you do not have IRIS, you can still use our **productx** utility to view the BEAM product numerically. If you requested a dual-polarization calibration, a second LDR BEAM product is produced, covering the same area.

11.2.3 Processing BEAM data into results

The measured location of the sun in the BEAM product is calculated by first thresholding the SNR data above a certain signal-to-noise level which is configured in the suncal.conf file. A 2D second order polynomial is fitted to the resulting data. Note that this fit will fail if you either set the threshold too low (everything passes), or set it too high (nothing passes). Therefore some care must be taken with selecting the threshold and the radars operating noise level. This is best done after looking at some BEAM products produced.

The peak power of the sun measurement, and target beamwidth are determined from the polynomial fit and finding the peak and width. Note that the azimuthal target beamwidth will appear larger than expected by 1/ cosine of the elevation angle because an azimuth degree corresponds to less than a degree of a great circle as you get nearer to the zenith. Because of this, we recommend that you keep the azimuth sector width at least 8 degrees. The "Raw" value is what is measured from the BEAM product. The other value is corrected for this effect. The peak power is also converted to dBm and stored in the results. All other areas are corrected for this effect.

From now on, only data with a signal strength greater than 3 dB below the peak value are used. Again a 2D second order polynomial is fitted to the Zh SNR data. The sun's position is determined by solving that polynomial for zero. The position is then compared to the sun's calculated position at the start of the scan and antenna pointing offsets are given in both azimuth and elevation.

For dual-pol data, the second LDR BEAM product is also processed. We compute the average LDR in the 3dB peak region, and store it in the results. This number should be near zero. This number, when added to the current LDR offset is the new estimate for what the LDR offset should be. A polynomial fit is also calculated for Zv by adding the LDR to the Zh values. The sun's position in V polarization is also printed so you can check the alignment.

Note that you can skip the scanning phase, and pick up processing just at the BEAM product phase by calling **suncal** with the "–process:" command line arguments. For dual-pol data supply 2 –process: arguments, one for the SNR BEAM, and one for the LDR BEAM.

11.2.4 Interactively Updating configs from results

Interactive update is only available for the LDR offset at this time. This is a feature which will automatically change your LDR offset in the setup_dsp.conf file, and put it into use. It will display the difference, and prompt you to answer "y" if you want to make the change. It is up to the operator's judgement to determine if this is a normal drift, or if something has broken in the receiver and the change should not be applied. When changes are made, they are logged to the /var/log/messages and /var/log/ sigmet.log files.

Note that you can skip the BEAM processing phase, and pick up processing just at the Interactive Update phase by calling **suncal** with the "-update" command line argument. This will read in the most recent suncal_results file. If you are running suncal automatically from IRIS's task scheduler, then if a change is detected, you will be signalled to run "suncal -update" manually.

11.3 Using Suncal Results

The calibration results file produced contains lots of information derived from the calibration. For starters there is housekeeping information about the radar, such as the time, location, and site name. Also there is radar calibration numbers such as the noise level and the receiver bandwidth. Finally there are the numbers calculated from the sun. This includes the observed position of the sun, the pedestal angle errors, the area of the sun above threshold, the beam widths, and the peak power of the sun. Below please find an example results file. Your results file may be slightly different due to additional new fields.

```
results.sVersion = "8.12"

results.sSitename16 = "SIGMET, dry2"

results.sSitename3 = "DRY"

results.VolumeYmds.isec = 80657

results.VolumeYmds.imills = 2915

results.VolumeYmds.iyear = 2006

results.VolumeYmds.imon = 3

results.VolumeYmds.iday = 24

results.BeamYmds.isec = 80709

results.BeamYmds.imills = 2374

results.BeamYmds.iyear = 2006

results.BeamYmds.imon = 3

results.BeamYmds.iday = 24

results.FileYmds.isec = 80709

results.FileYmds.imills = 2382

results.FileYmds.iyear = 2006

results.FileYmds.imon = 3
```

```
results.FileYmds.iday = 24

results.fRadarLon = -70.99999996

results.fRadarLat = 41.10000003

results.fRadarAltitude = 95

# Expected location of the sun.

results.fSunAzPos = 263.0827948

results.fSunElPos = 21.18174355

# Results from processing the BEAM product.

results.fTargetArea = 1.483424239

# If 1, then continue processing.

results.bTargetAreaValid = 1

results.fFitError = 0.3933128975

# If 1, then continue processing.

results.bTargetFitValid = 1

results.fTargetAzPos = 263.0988999

results.fTargetElPos = 21.2056663

results.fTargetPowerSnr = -3.364420032

results.fTargetWidthAzRaw = 1.152942299

results.fTargetWidthAz = 1.074832609

results.fTargetWidthEl = 1.07264875

results.fTargetPowerTotal = -80.85394878

results.fTargetPowerSun = -85.86442003

results.fTarget3dBArea = 0.8191843212

# If 1, then continue processing.

results.bPositionsValid = 1

results.fAzError = 0.01610509038
```

```
results.fElError = 0.02392274305

# If 1, then the Az and El errors were within tolerance.

results.bAzElErrorsOK = 1

# Results from the Cross Pol BEAM product.

results.bXpolProcessed = 1

results.fXpol3dBArea = 0.8191843212

# If 1, then offset was calculated.

results.bXpolLdrOffsetValid = 1

results.fXpolLdrMeasured = -2.841477054E-15

results.fXpolLdrOffset = -0.9

# If 1, then the LDR offset error was within tolerance.

results.bXpolLdrOffsetOK = 1

# If 1, then positions were calculated.

results.bXpolPositionsValid = 1

results.fXpolTargetAzPos = 263.0988999

results.fXpolTargetElPos = 21.2056663

# Calibration numbers.

results.fI0Horiz = -81.15

results.fCalNoiseHoriz = -79.98

results.fRadarConstantHoriz = -33.26

results.fActNoiseHoriz = -82

results.fActNoiseVert = -82

results.fReceiverBandwidth = 1

results.iXmtPolarization = 0

results.fWaveLength = 5.4

results.fPulseWidth = 1
```

```
results.fOldLdrOffset = -0.9

results.fOldZdrOffset = 0.25
```

The antenna offset errors can than be used to adjust axis offsets in the RCP8 and the beamwidth can be used to verify manufacturer's stated widths.

11.3.1 Antenna Beam Width Calculation

The target width measured by suncal is a function both of the antenna beamwidth and of the width of the sun. If both signals were Gaussian, it would be a simple matter to correct for the sun's width. Unfortunately the sun is a disk of constant power, and the background noise is within a few dB. Here is a table for approximate conversions:

Table 7 Antenna and Sun Beamwidths

Antenna Beamwidth (Degrees)	Measured Beamwidth (Degrees)	Difference
0.200	0.522	0.322
0.300	0.534	0.234
0.400	0.574	0.174
0.500	0.636	0.136
0.600	0.711	0.111
0.700	0.794	0.094
0.800	0.881	0.081
0.900	0.972	0.072
1.000	1.064	0.064
1.100	1.158	0.058
1.200	1.253	0.053
1.300	1.349	0.049
1.400	1.445	0.045
1.500	1.542	0.042
1.600	1.640	0.040
1.700	1.738	0.038
1.800	1.835	0.035
1.900	1.938	0.033
2.000	2.035	0.031

11.3.2 Using Results to Calculate Antenna Gain

The solar peak power can be used to compute the gain of the antenna. This gain can be monitored over time to determine the stability of the receiver calibration.

For solar calibration antenna gain can be written as:

$$G = \frac{4\pi \times P_s}{F_s B_n \lambda^2}$$

where,

G	Antenna gain (dimensionless) on beam axis.
P_s	Received Sun Peak Power (dBm) (fTargetPowerSun)
F_s	Solar Flux Density ($Wm^{-2}Hz^{-1}$)
B_n	Noise Bandwidth (Hz) (fReceiverBandwidth)
λ^2	Transmit Wavelength (m)

The calculated antenna gain must be corrected to determine the true gain of the system. Solar flux measurements include all polarizations so 3dB must be added to the gain as half the power is lost due to receiving in a single polarization. An additional beam filling correction must be made because the sun radio diameter ($0.56–0.58^0$) is considerably smaller than most antenna's 3dB beamwidth. A beam filling correction for Gaussian main beams is given below:

$$K(dB) = 20\log\left(1 + 0.18\left(\frac{U_s}{U_a}\right)^2\right)$$

For example, a 1.0^0 beam will have a filling correction of 0.49 dB. Experience has shown about #mnplus#0.5 dB fluctuation in true antenna gain due to solar flux and receiver measurement uncertainties.

Observations of solar flux density (F_s) are available publicly on the internet for several frequencies, locations, and times of day. Suggested sites are the Solar Environment Center (SEC), National Oceanic and Atmospheric Administration in Boulder, Colorado; the Dominion Radio Astrophysical Observatory at Penticton, British Columbia, and the IPS Radio and Space Services Observatory in Australia.

If you wish to read the suncal results file into the C++ memory structure, you can use our supplied LoadSuncalResults() function.

11.4 The Suncal Configuration File

The **suncal** utility uses information within the **suncal.conf** file stored in the ${IRIS_CONFIG} directory. Users can adjust their configuration by editing this file with a text editor such as emacs or vi. In the file users can input the details of the scanning strategy, data output directories, whether to create a log file, and iris messaging signal thresholds. Optional sun simulation is built in to the utility to help testing. Be sure to turn this off for operation.

Running the **suncal** utility with the –resave options will read in the old **suncal.conf** file, fill in all new fields with default values, then write out the file including comments. You can run "suncal -resave" when there is no file to create a default file. It is a good idea to do this also whenever you are first using **suncal** after an upgrade. The user can then change parameters within the **suncal.conf** file to suit their needs. When designing the sector task, remember that tasks are limited to 40 elevation angles.

The options to create logging while the **suncal** utility runs, the source of the angle tags, simulation, and minimum sun angle are found at the top of the file. If you wish to run with radiate turned off, and your RVP processor does not sense the radiate control signal, then it will fault with "burst pulse missing". To allow operation in this case, set lAbortOnMessages to 0. The **suncal** utility also checks the elevation angles to ensure they are not outside the position limits of the antenna. A maximum sun angle of 85 degrees has been hard coded into the utility. The following section shows an example of the suncal.conf file where these fields are configured.

```
sun_cal.sVersion = "8.12"

sun_cal.lLogToFile = 1

sun_cal.lLogToTerm = 0

sun_cal.lAbortOnMessages = 1

# 1=RVP Tags, 3=Antlib.

sun_cal.iAngleSource = 1

# Add a simulated sun, set to 0 for operation.

sun_cal.lSimulateSun = 0

# Will not run if the sun is below this angle in degrees.

sun_cal.fMinimumSunEl = 5
```

In the section of the suncal.conf below are the options to configure the PRF, start range, range bin spacing (km), number of input bins, and pulse samples. We suggest that you select a fairly large start range (like 100 km) to avoid interference from weather, clutter, and airplane returns. The azimuth scan speed is half that implied by the requested PRF and sample size. If you have a dual-polarization radar, you configure the transmit polarization here. You must specify a valid polarization which you can transmit.

```
# Configure the recording task here.

sun_cal.fPrf = 800

sun_cal.fRangeStart = 100

sun_cal.fRangeStep = 0.150000006

sun_cal.iBinCount = 1000

sun_cal.iSampleSize = 64

# Choices are 0=Horiz, 1=Vert, 2=Alt, 3=Simul.

sun_cal.iTaskXmtPolarization = 0
```

In the next section the resolution and sector span are configured for azimuth and elevation in degrees.

```
# Spacing between rays in degrees.

sun_cal.Az.fSpacing = 0.200000003

# Span of the sector in degrees.

sun_cal.Az.fSpan = 8

# Spacing between rays in degrees.

sun_cal.El.fSpacing = 0.200000003

# Span of the sector in degrees.

sun_cal.El.fSpan = 8
```

Next we configure the BEAM products. In this section a directory to write the BEAM products is specified. If the BEAM product is inserted into the ${IRIS_PRODUCT} directory it will be eventually removed by the watchdog process. It is likely a better choice to put the BEAM product somewhere else to retained for future reference. To view the BEAM product in the QLW, then a nice plan is to place this in the /usr/iris_data/

input directory, and configure a blank input pipe to read them. If you wish to make an LDR calibration from the sun, then specify a second BEAM product data type here. Choices are to transmit Horizontal, and generate LDR, or transmit simultaneous and generate ZDR. You should be able to get both the LDR offset, and the Vertical position offset. If you wish to calculate the Vertical beam width, please run a Vertical polarization scan.

```
# Configure the BEAM product here.

# Write the beam products to this directory.

sun_cal.sBeamDirectory = "/usr/iris_data/input/"

# Second BEAM data type: 0=none, 25=LDR, 5=ZDR

sun_cal.iBeam2DataType = 25
```

The final section of the suncal.conf file configures the processing to produce the results from the BEAM products.

```
# Configure the results processing here.

# Write the results file to this directory.

sun_cal.sResultsDirectory = "/usr/iris_data/suncal/"

# Power above this level (in SNR)

sun_cal.fBeamPower = -2

# must cover at least this area (in square degrees).

sun_cal.fBeamArea = 1

# The 3dB beamwidth of the sun must be at least this area
(deg**2).

sun_cal.fBeam3dBArea = 0.200000003

# The peak power must be at least this, in SNR.

sun_cal.fBeamPowerThresh = 0

# Alert if the sun's position error is larger than this, in
degrees.

sun_cal.fBeamPosThresh = 0.5

# Alert if the LDR offset error is larger than this, in dB.
```

```
sun_cal.fBeamLdrOffsetThresh = 0.200000003
```

11.5 Configuring syslog.conf

The **suncal** utility will log calibration changes using syslog. This will put a message into the /var/log/messages file. If you wish to put these in a separate file, then edit the file /etc/syslog.conf, and put the following at the bottom:

Log user.info messages to sigmet.log

user.info /var/log/sigmet.log

Note that you must then send "kill –hup" to your syslogd process. All of this requires root privileges.

CHAPTER 12
RVP8/RCP8 NETWORK EXPORT UTILITIES

The RVP8 communicates to a host computer via a standard TCPIP Ethernet connection. The RCP8 communicates via Ethernet or serial line. This section describes the various network configurations that are supported and the settings to realize them.

Two utilities can be used for the network communication:

- DspExport — exports the dsp library over the network to separate host computers. This is the only way to interface to the RVP8 from a separate computer.
- AntExport — exports the antenna library internal state over the network to a separate host computer. This is a low-bandwidth alternative to running programs like **antenna** and **bitex** with their windows exported over the network. This allows multiple computers to control the antenna simultaneously. Vaisala does not recommend using this in most environments.

With these two utilities users have considerable flexibility for implementing the RVP8, RCP8 and IRIS under many different network and hardware platform scenarios, e.g., the RVP8, RCP8 running on separate PCI systems or in various combinations on the same PCI system. Both the DspExport and AntExport utilities are also used for running remote maintenance utilities over low-speed or high-latency network links for which the X-window export technique is not effective.

In this chapter:

Case 1: Separate PC's	12.2.1 Case 1: Separate PC's for RVP8, RCP8 and Host (e.g., IRIS) on page 269
Case 2: Separate RVP8 with Combined RCP8 and IRIS	12.2.2 Case 2: Separate RVP8, Combined RCP8/RCW on page 271
Case 3: Combined RVP8, RCP8 and IRIS	12.2.3 Case 3: Combined RVP8, RCP8/RCW (e.g., IRIS Host) on page 272
Case 4: Combined RVP8 and IRIS	12.2.4 Case 4: Combined RVP8, IRIS Host on page 273
Case 5: Separate PC's with AntExport	12.2.5 Case 5: AMR with separate Main RCP8 and Host on page 274
Case 6: DspExport and AntExport to Remote Maint Host	12.2.6 Case 6: Separate RVP8, RCP8, IRIS and a remote workstation on page 275
Non-Network Angle "TAG" lines	12.3 Non-Network Antenna Angles to RVP8 on page 276
RCP8/Host Serial Interface	12.4 RCP8 on Serial Interface on page 277

12.1 Starting and Stopping DspExport and AntExport

If **DspExport** or **AntExport** are used on a platform, then they should be configured to start automatically when the computer boots. Sigmet software runs as services in the Linux operating system in order to take advantage of built-in management tools for starting and stopping services. This includes a Graphical User Interface for controlling services and built in support for controlling services at different run levels of the operating system. Sigmet software should be turned on for the following levels (indicated by an *).

- 0 Halt
- 1 Single–user mode
- 2 Not used (user–definable)
- 3* Full multi-user mode
- 4* Not used (user–definable)
- 5* Full multi–user mode (with an X–based login screen)
- 6 Reboot

There are several ways to configure how services are started. Vaisala recommends using the command-line utility "chkconfig", but with newer versions of Linux, a GUI program called redhat–config–services can be run as root. The following sections will cover different aspects of starting and stopping both **DspExport** and **AntExport**.

DspExport Automatic start and Test

As root type:

```
# cp /usr/sigmet/config_template/init/dspexport /etc/
init.d/

# cd /etc/init.d

# chmod +x dspexport

# chkconfig --add dspexport
```

NOTE	Note: Systems delivered from the factory or installed using the shipped "Boot and Go" CD will automatically make sure that all of the necessary files and permissions have been set for items in /etc/init.d/.

To verify that the DspExport service will start automatically, as root, type:

```
#chkconfig --list dspexport

antexport 0:off 1:off 2:off 3:on 4:on 5:on 6:off
```

At this point, DspExport has been configured to run the next time the computer is restarted. To start DspExport immediately, type the following command as root:

```
# service dspexport start

starting DspExport: PC Linux [OK]

#
```

The "OK" message will be displayed if startup occurs smoothly. If this message is not displayed, make sure the above steps have been taken and that the service is not already running.

To verify that DspExport is running type the following line and check that the response matches the one shown below.

```
$ ps -eaf | grep DspExport

UID PID PPID C STIME TTY TIME CMD

operator 4019 1 0 16:05 ? 00:00:08 /usr/sigmet/bin DspExport

-daemon
```

```
$
```

To stop DspExport, run the following command as root:

```
#service dspexport stop

Stopping DspExport: [OK]

#
```

The "OK" message will be displayed if shutdown occurs smoothly.

AntExport Startup and Test

For AntExport the configuration is similar to DspExport. As root type:

```
# cp /usr/sigmet/config_template/init/antexport /etc/
init.d/

# cd /etc/init.d

# chmod +x antexport

# chkconfig --add antexport
```

To verify that the AntExport service will start automatically, as root, type:

```
#chkconfig --list antexport

antexport 0:off 1:off 2:off 3:on 4:on 5:on 6:off
```

At this point, AntExport has been configured to run the next time the computer is restarted. To start AntExport immediately, type the following command as root:

```
#service antexport start

Starting AntExport: [OK]

#
```

The "OK" message will be displayed if startup occurs smoothly. If this message is not displayed, make sure the steps above have been taken and that the service is not already running.

To verify that DspExport is running type the following line and check that the response matches the one shown below.

```
$ ps -eaf | grep AntExport
```

```
operator 4019 1 0 16:05 ? 00:00:08 /usr/sigmet/bin/AntExport
-daemon

#
```

To stop AntExport, run the following command as root:

```
# service antexport stop

Stopping AntExport: [OK]
```

The above message will be displayed if shutdown occurs smoothly.

12.2 Example Network Configurations

In the examples that follow, various system architecture options are described. For each option, there is a one page summary diagram that shows the basic topology and the specific "setup" responses for the following:

- setup/RVP — the RVP section of the setup utility
- setup/RCP — the RCP section of the setup utility
- RCP8 TTY setups
- RVP8 TTY setups

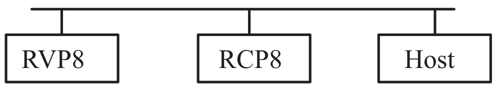
Note that the examples that follow are all for network communication only. There are also two other communications options that have been used on previous systems and are still supported in the RVP8 and RCP8.

- Tag angle input to the RVP8 via parallel tags, S/D convertor or serial line.
- RCP8 communication to a host computer via a serial line.

These are covered in 12.3 Non-Network Antenna Angles to RVP8 on page 276 at the end of this chapter.

12.2.1 Case 1: Separate PC's for RVP8, RCP8 and Host (e.g., IRIS)

This is a very common architecture used on many systems installed by Vaisala. The advantage of this approach is that the hardware for any of the three units can be upgraded without effecting the other units. When upgrading a legacy system, this is often the easiest approach.



DspExport Running	Yes	No	No
AntExport Running	No	No	No
setup/RVP			
System has signal processor	Yes	No	Yes
Interface to RVP	Native	—	DspExport
Processor Type	RVP8	—	—
DspExport Hostname/IP–Address	—	—	e.g. rvp8
DspExport Port Number	—	—	e.g. 30740
System transmits RTD	From RVP8	No	No
setup/RCP			
System has antenna	Yes	Yes	Yes
Main Interface to RCP	Network	None	Network
Antenna angle insertion source	Normal RCP	Native RCP8	Normal RCP
Is this the 1 controlling host	No	—	Yes
Network Multicast Address	224.0.0.3	—	224.0.0.3
Network Port Number	e.g. 30785	—	e.g. 30785
Network Interface	e.g. eth0	—	e.g. eth0
Average Network Delay	e.g. 0 ms	—	e.g. 0 ms
Receive format from RCP	e.g. RCV02	—	e.g. RCV02
Transmit format to RCP	—	—	e.g. XMT02
RCP8 TTY Setups "site host"			
Connection type for host computer I/O:		Network	
Multicast address:		224.0.0.3	
Port number:		30785	
Network Interface		eth0	
Data format transmitted by host		e.g. XMT02	
Data format received by host		e.g. RCV02	
Dspx RVP8 Setups "mc"			
Live angle input – 0:None, 1:Sim, 2:TAGs, 3:S/D : 0			

12.2.2 Case 2: Separate RVP8, Combined RCP8/RCW

This is perhaps the second most common architecture. Here, the RCP8 and IRIS run on separate threads on the RCP8 platform. The RCP8 has more than enough processing power to perform both tasks.

DspExport Running	Yes	No
AntExport Running	No	No
setup/RVP		
System has signal processor	Yes	Yes
Interface to RVP	Native	DspExport
Processor Type	RVP8	—
DspExport Hostname/IP–Address	—	e.g. rvp8
DspExport Port Number	—	e.g. 30740
System transmits real time display	From RVP8	No
setup/RCP		
System has antenna	Yes	Yes
Main Interface to RCP	Network	Network
Antenna angle insertion source	Normal RCP	Native RCP8
Is this the 1 controlling host	No	Yes
Network Multicast Address	224.0.0.3	224.0.0.3
Network Port Number	e.g. 30785	e.g. 30785
Network Interface	e.g. eth0	e.g. eth0
Receive format from RCP	e.g. RCV02	e.g. RCV02
Transmit format to RCP	—	e.g. XMT02
Antx RCP8 Setups "site host"		
Connection type for host computer I/O:		Network
Multicast address:		224.0.0.3
Port number:		30785
Network Interface		eth0
Data format transmitted by host		e.g., XMT02

Data format received by host	e.g., RCV02

Dspx RVP8 Setups "mc"

Live angle input – 0:None, 1:Sim,
2:TAGs, 3:S/D : 0

12.2.3 Case 3: Combined RVP8, RCP8/ RCW (e.g., IRIS Host)

This is a low cost system computer configuration. The IRIS Host should only output RAW data to one other system and should not generate other products in order to keep PC motherboard and network overhead at a minimum.

RVP8	RCP8	Host

DspExport Running	No
AntExport Running	No
setup/RVP	
System has signal processor	Yes
Interface to RVP	Native
Processor Type	RVP8
DspExport Hostname/IP–Address	—
DspExport Port Number	—
System transmits RTD	From RVP8
setup/RCP	
System has antenna	Yes
Main Interface to RCP	Network
Antenna angle insertion source	Native RCP8
Is this the 1 controlling host	Yes
Network Multicast Address	224.0.0.3
Network Port Number	e.g. 30785
Network Interface	lo
Average Network Delay	0 ms
Receive format from RCP	e.g. RCV02
Transmit format to RCP	e.g. XMT02
Antx RCP8 Setups "site host"	
Connection type for host computer I/O:	Network
Multicast address:	224.0.0.3

Port number:	30785
Network Interface	lo
Data format transmitted by host	e.g. XMT02
Data format received by host	e.g. RCV02
Dspx RVP8 Setups "mc"	
Live angle input – 0:None, 1:Sim, 2:TAGs, 3:S/D : 0	

12.2.4 Case 4: Combined RVP8, IRIS Host

This is a special configuration and should only be used with a third party radar controller. The IRIS Host should only output RAW data to one other system and should not generate other products in order to keep PC motherboard and network overhead at a minimum.

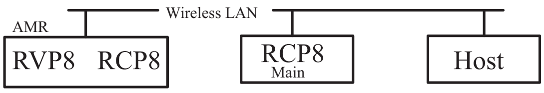
RVP8 Host

DspExport Running	No
AntExport Running	No
setup/RVP	
System has signal processor	Yes
Interface to RVP	Native
Processor Type	RVP8
System transmits RTD	From RVP8
setup/RCP	
System has antenna	Yes
Main Interface to RCP	Serial
Antenna angle insertion source	Normal RCP
Is this the 1 controlling host	Yes
Main Serial Device Name	/dev/ttyS0
running at	38400 baud
with parity	none
Receive format from RCP	RCV02
Transmit format to RCP	XMT02
setup/INGEST	
Manner of Angle Acquisition	Binary
Angle Syncing	Dynamic
Dspx RVP8 Setups "mc'	

Live angle input – 0:None, 1:Sim,
2:TAGs, 3:S/D : 0

12.2.5 Case 5: AMR with separate Main RCP8 and Host

This configuration is used to support Antenna Mounted Receiver Systems for which the RVP8 is in a sealed box above the elevation axis. Communication is via a high-speed wireless LAN. Because of the control and monitoring requirements in the AMR box, the RVP8 also runs an RCP8 "thread" for AMR.

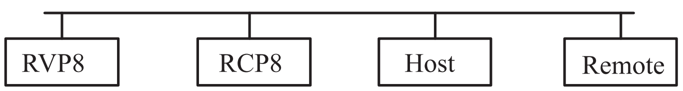


DspExport Running	Yes	No	No
AntExport Running	No	No	No
setup/RVP			
System has signal processor	Yes	No	Yes
Interface to RVP	Native	—	DspExport
Processor Type	RVP8	—	—
DspExport Hostname/IP–Address	—	—	e.g., rvp8
DspExport Port Number	—	—	e.g., 30740
System transmits real time display No	No	No	From App
setup/RCP			
System has antenna	Yes	Yes	Yes
Main Interface to RCP	Network	None	Network
Antenna angle insertion source	Normal RCP	Native RCP8	Normal RCP
Is this the 1 controlling host	No	—	Yes
Network Multicast Address	224.0.0.3	—	224.0.0.3
Network Port Number	e.g. 30785	—	e.g. 30785
Network Interface	e.g. eth0	—	e.g. eth0
Average Network Delay	e.g. 0 ms	—	e.g. 0 ms

Receive format from RCP	e.g. RCV02	—	e.g. RCV02
Transmit format to RCP	—	—	e.g. XMT02
Antx RCP8 Setups "site host"			
Connection type for host I/O:	Network	Network	
Multicast address:	224.0.0.3	224.0.0.3	
Port number:	e.g. 30785	e.g. 30785	
Network Interface	e.g. eth0	e.g. eth0	
Data format transmitted by host	none	XMT02	
Data format received by host	none	RCV02	
Transmits Internal BITE	No	Yes (0x05)	
Transmits AUX BITE	Yes (0x02)	Yes (0x03, for AMR RCP control)	
Receives AUX BITE	Yes (0x03)	Yes (0x02, for AMR RCP status)	
Transmits Analog Q BITE	Yes (0x0F)	Yes as required	
Dspx RVP8 Setups "mc"			
Live angle input – 0:None, 1:Sim, 2:TAGs, 3:S/D : 0			

12.2.6 Case 6: Separate RVP8, RCP8, IRIS and a remote workstation

This configuration is useful in the case of a remote maintenance workstation that is running on a low-speed link or on a high-latency link such as a geosynchronous satellite.



DspExport Running	Yes	No	No	No
AntExport Running	No	No	Yes	No
setup/RVP				
System has signal processor	Yes	No	Yes	Yes
Interface to RVP	Native	—	DspExport	DspExport

Processor Type	RVP8	—	—	—
DspExport Hostname/IP–Address	—	—	e.g. rvp8	e.g. rvp8
DspExport Port Number	—	—	e.g. 30740	e.g. 30740
System transmits real time display	From RVP8	No	No	No
setup/RCP				
System has antenna	Yes	Yes	Yes	Yes
Main Interface to RCP	Network	None	Network	AntExport
AntExport hostname/IP-Address	—	—	—	e.g. iris
AntExport Port Number	—	—	—	e.g. 30745
Antenna angle insertion source	Normal RCP	Native RCP8	Normal RCP	Normal RCP
Is this the 1 controlling host	No	—	Yes	—
Network Multicast Address	224.0.0.3	—	224.0.0.3	—
Network Port Number	e.g. 30785	—	e.g. 30785	—
Network Interface	e.g. eth0	—	e.g. eth0	—
Average Network Delay	0 ms	—	e.g. 0 ms	e.g., 0 ms
Receive format from RCP	e.g. RCV02	—	e.g. RCV02	—
Transmit format to RCP	—	—	e.g. XMT02	—
Antx RCP8 Setups "site host"				
Connection type for host computer I/O:		Network		
Multicast Address		224.0.0.3		
Port number		e.g. 30785		
Network interface		e.g. eth0		
Data format transmitted by host		e.g. XMT02		
Data format received by host		e.g. RCV02		
Dspx RVP8 Setups "mc"				
Live angle input – 0:None, 1:Sim, 2:TAGs, 3:S/D : 0				

12.3 Non-Network Antenna Angles to RVP8

On legacy Sigmet processors, the network tag angles were not supported. The three alternative techniques for bringing-in antenna tag angles are supported on the RVP8.

- Parallel binary or BCD "TAGS"
- S/D convertor
- From RVP8 internal simulator

See 4.2.1 Antenna Status on page 52 of the *RVP8 User's Manual* for details on the "mc" "Live Angle Input" question. In the case of these selections, the setup/RCP section of the RVP8's **setup** utility should be configured to specify the serial line input as follows:

setup/RCP

System has antenna	Yes
Main Interface to RCP	None
Antenna angle insertion source	Native RVP8

Another alternative is to use a serial line input to the RVP8. In this case, the "mc" "Live Angle Input" response should be set to "None" and the setup/RCP section of the RVP8 **setup** utility should be configured to specify the serial line input as follows:

setup/RCP

System has antenna	Yes
Main Interface to RCP	Serial
Antenna angle insertion source	Normal RCP
Is this the 1 controlling host	No
Main serial device name	/dev/ttyS1
Running at	19200
With parity	None
Receive format from RCP	RCV01

12.4 RCP8 on Serial Interface

For this architecture, the RCP is connected via a serial line directly to the host computer. The following must be configured for this:

- RCP TTY setups "site host" section of *RCP8 User's Manual*.
- Host computer setup/RCP configuration (e.g., for IRIS)

setup/RCP

System has antenna	Yes
Main Interface to RCP	Serial

Antenna angle insertion source	Normal RCP
Is this the 1 controlling host	Yes
Main serial device name	/dev/ttyS1
Running at	19200
With parity	None
Receive format from RCP	RCV02
Transmit format to RCP	XMT02

On the RCP8 itself, the setup/RCP should be set to:

setup/RCP

System has antenna	Yes
Main Interface to RCP	None
Antenna angle insertion source	Native RCP8

Please refer to the relevant manual sections for information on the details of setting-up a serial line interface. Note that the serial interface on the RCP8 is the identical interface used on the legacy RCP02 and all setup questions are answered as for the RCP02.

The AntExport utility may then be run on the Host computer to export control out to another computer. This works for either RCP8 or the legacy RCP02.

CHAPTER 13
ZAUTO UTILITY

The RVP7, RVP8, and RVP900 Doppler signal processors output calibrated values of the equivalent radar reflectivity factor. **Zauto** is an interactive graphic utility for calibrating the reflectivity offset of the signal processor. For the older RVP6, use the zauto6 utility. The results are stored in a calibration file that is loaded into the DSP for use during programmed radar data collection.

For a detailed description of the theory of signal processor calibration, refer to the *RVP8 User's Manual* for your system. In general, the same nomenclature is used here.

To perform a calibration, a calibrated RF signal generator (siggen) must be used. **Zauto** can be used with a manually controlled siggen or a siggen controlled by the RCP. For manual operation, it is most convenient if the signal generator control can be located near the workstation where **zauto** is run. The siggen should be configured for CW operation rather than pulse mode.

Setup allows you to input any losses that are present in the system, such as:

- Loss between the transmitter and the antenna feed.
- Loss between the antenna feed and the receiver.
- Loss between the test signal injection point and the receiver.

For the last item, don't forget to add in the loss suffered in the cable that connects the siggen to the injection point, the coupler loss, and any calibration required for the signal generator.

In this chapter:

13.1 Invoking Zauto

13.1.1 Before running zauto

Before running **zauto**, be sure to run **setup**. Verify the setup information or the **zauto** calibrations will not be accurate. For an automatic siggen, use the **antenna** utility to verify that the siggen is setting the correct values.

For magnetron systems, check/adjust the STALO and signal generator frequencies as described below

- Set switch 2 to the A position to run the normal receiver signal into the burst channel.
- Use RVP8 TTY "ps" command to plot burst frequency spectrum. Turn off AFC while you are there.
- Set siggen frequency to an appropriate level.
- Adjust siggen frequency until it reads out the correct IF frequency (often 30 MHz) to within 100 KHz. Alternately use MFC to adjust the STALO frequency. It is worth checking that you are not off by a multiple of 18 MHz, or on the wrong side lobe of the transmitter.
- Exit, switch the switch back, run the **zauto** program.
- When done, recheck the frequency for drift.

13.1.2 Invoking zauto

Command

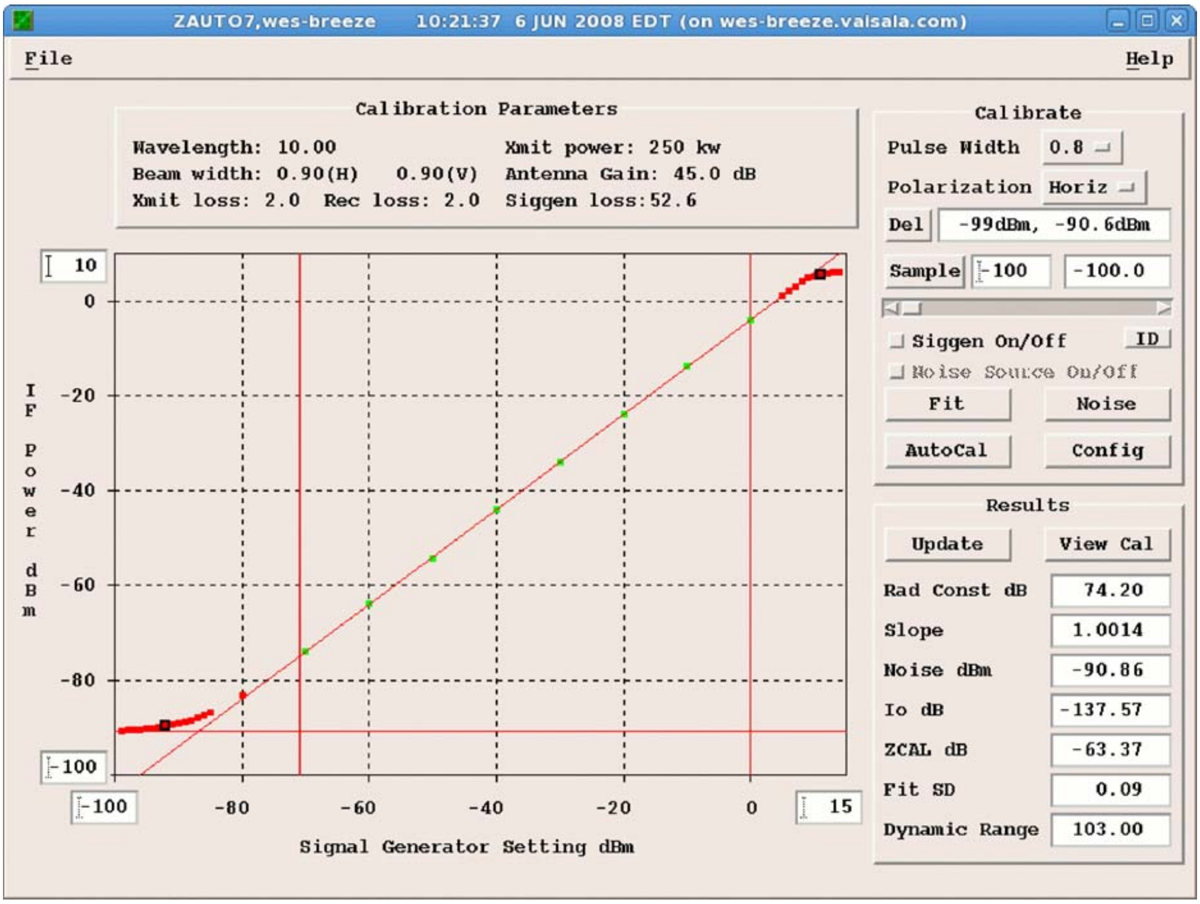
```
zauto
```

Option

`-demo`	Runs the utility without the signal processor, for testing and demonstration purposes.

`-cal`	Performs an automatic calibration without displaying the **zauto** menu. The results are saved to the calibration file, unless there is a value outside the tolerance range. This option is available only with an automatic siggen.
`-amr`	Runs the utility for Vaisala AMR calibration. This mode can't be used with any other hardware. Further documentation is described in *Vaisala AMR Antenna Mounted Receiver User's Guide.*
`-pol H or V`	Forces polarazation to horizontal or vertical in Zauto startup.

13.2 Zauto Menu



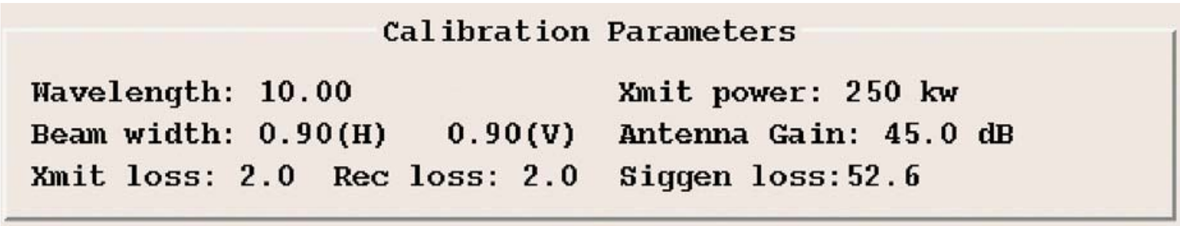
Calibration Parameters	Displays certain calibration parameters defined with the **setup** utility.

Calibration Plot Displays a plot of the IF measured power vs. the signal generator setting.

Calibration Display Lets you control the calibration using the fields and buttons in this area of the menu.

Results Display Shows the temporary calibration information, such as the current noise and Zcal values for the specified pulse width.

13.2.1 Calibration Parameters



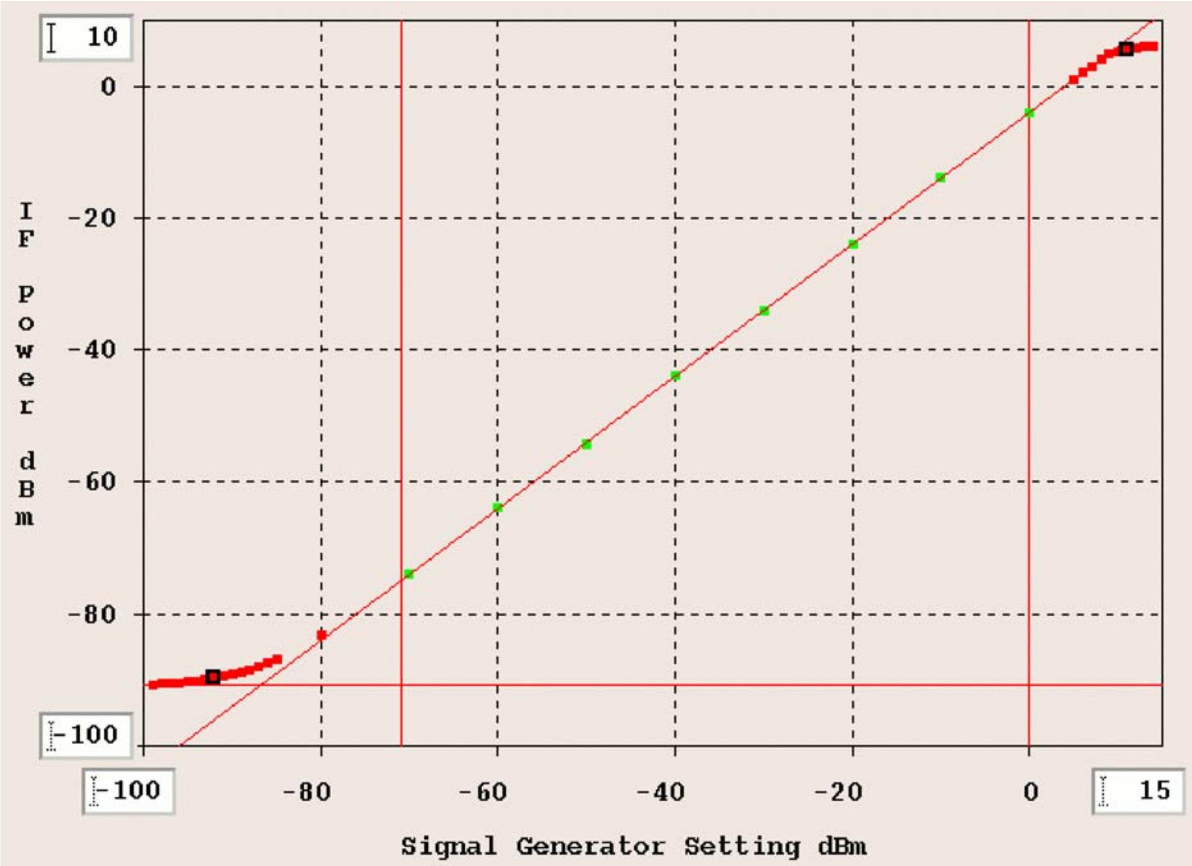
All of the calibration parameters are taken from **setup** and serve as a check that **setup** was properly configured. If you see an error in these parameters, exit from **zauto** and correct the error in **setup** before attempting a calibration. Otherwise, the calibration will be incorrect.

The following Setup parameters are displayed:

- Radar wavelength in centimeters
- Transmit power in kW
- Horizontal and vertical beamwidth in degrees
- Antenna gain in dB
- Transmit loss in dB
- Receive loss in dB
- Siggen loss in dB

These values remain fixed throughout the **zauto** procedure.

13.2.2 Calibration Plot



Zauto displays a plot of the IF power in dBm vs. the signal generator setting, similar to the plot shown in the Reflectivity Calibration section of the *RVP8 User's User's Manual*. In the manual, however, the horizontal axis of the plot is the input signal power at the antenna, which accounts for antenna-to-receiver loss and signal generator loss. **Zauto** corrects for these effects, based on the setup information. In performing the calibration, it displays the signal generator value on the horizontal axis.

Left and Right Plot Limits

Plot range fields at the lower left and right of the calibration plot define the lower and upper limits, in dB, of the signals to be generated. You can change the limits, and **zauto** rescales the plot for the new range. **Zauto** does not allow a new range limit when there would be data points outside the range.

Left and Right Fit Limits

Vertical red lines mark the limits of the least squares fit. They can be moved independently by pointing with the mouse on the graph and clicking the left mouse button. If the fit limits lie outside the plot range, they are shown as colored lines at the corresponding edge of the graph. The default limits are taken from the calibration configuration settings. (See 13.2.4 Configuration Menu on page 287.)

Usually, the fit limits are set after a number of points have been plotted and before doing a least squares fit. You should set the limits so that the fit is made to the linear portion of the plot, typically 15 dB above noise to the saturation point of the LOG receiver. Points that lie outside the fit limits are displayed in red to show that they are not be included in the next fit. The limits can be reset and another least squares fit performed to fine tune the plotted line. When the limits are changed, the last fit and noise lines are removed, along with the appropriate information in the results display.

Plot Points

Plot points are the dots that mark the strength of the signal sampled at a number of specified settings. A black box is drawn about the low and high point used to calculate the dynamic range.

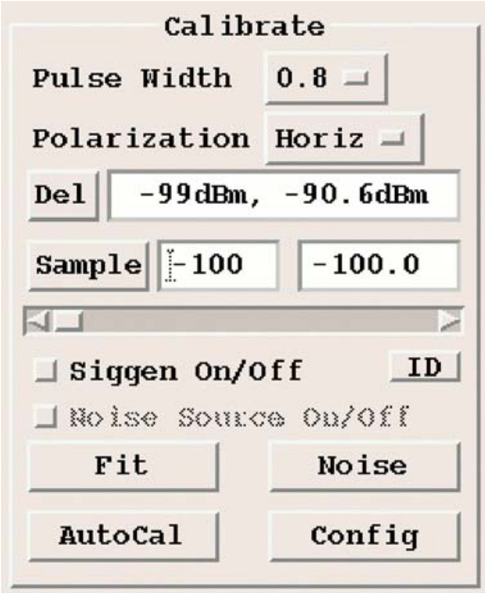
Fit Line

Shows the least squares fit of the plot points that fall within the fit limits.

Noise Level Line

The noise level line is a horizontal line drawn when the siggen is not generating a signal.

13.2.3 Calibration Display



Pulse Width

Begins a new calibration at the specified pulse width, which you select from a pop-up menu. When you switch to a new pulse width, any prior data points and temporary results are discarded. Therefore, **zauto** lets you choose whether you want to save the calibration.

Polarization

On multi-parameter radars, calibration must be performed separately for each polarization channel. For other radars, this should not be changed as changing the polarization will erase the current calibration points.

Delete

Clicking on the Delete button deletes the last calibration point. By clicking Delete many times, you can delete successive points, in reverse order.

Noise

Clicking on the Noise button takes a noise sample and plots the result. The noise sample must be taken after the least squares fit is done. For a manual siggen, you must turn the siggen to its lowest setting or disconnect it before taking a noise sample. **Zauto** does this automatically when the siggen is controlled by the RCI.

When you take the noise sample, a red line is drawn at the A/D noise level. If the noise level is outside the range of 10 to 30 A/D units, align the LOG channel A/D converter by adjusting the appropriate offset pot on the DSP. This can be done using the Ascope utility. Make sure that the A/D converter gain has been adjusted as well.

Sample

The Sample button generates and plots the specified test signal. In the field to the right of this button, you enter the desired siggen setting in dBm. For a manual siggen, you must set the siggen to match this setting. **Zauto** measures the power at IF, and plots the point on the calibration graph.

The siggen setting can be entered in one of the following ways:

- Type a number directly into the field.
- Move the slider within the sliding scale until the desired value is displayed in the field.
- Click inside the scale to move the slider in steps. The size of the step is defined in the AutoCal Configuration menu (see below).

Siggen ON/OFF

Use this button to toggle the siggen off before taking a noise sample, then toggle it on again.

ID

Use this button to identify which siggen is used in the calibration. This is helpful in the future when you want to compare new results to old calibration files.

Fit

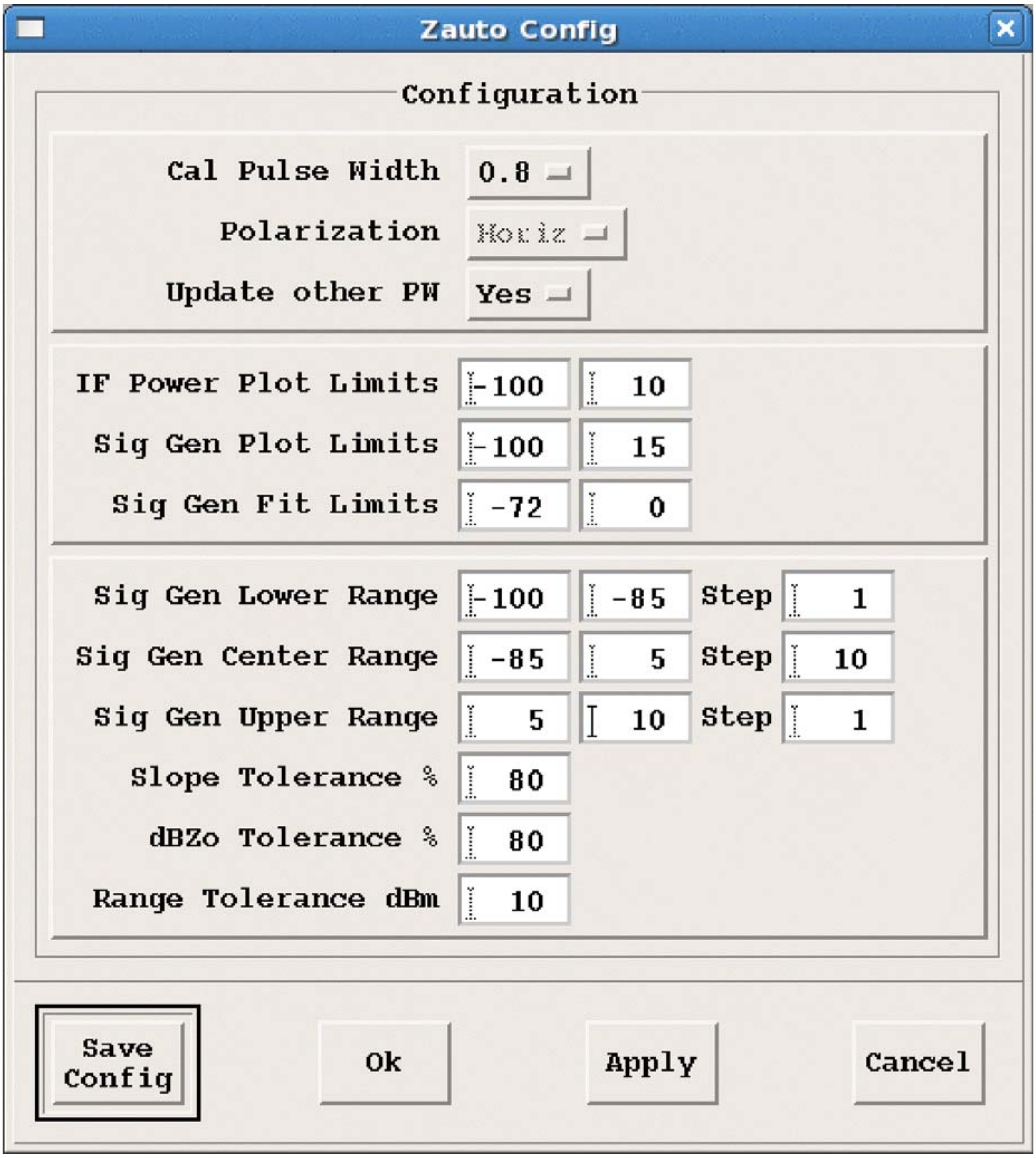
Clicking the Fit button causes zauto to perform a least squares fit to the data points that lie within the specified range limits. The resulting line is drawn on the calibration plot. At least two points are needed. The Results display shows the slope and intercept values for the line.

The fit is a straight line. The fit range limits should be set so that only the points in the linear region of the calibration curve are included. The signal processor corrects for the curved portion of the calibration, which corresponds to weak signals.

Automatic Calibration

Automatic calibration is available only if you have an automatic siggen. Clicking on the AutoCal button generates a series of signals — beginning at the high end, ending at the low end — and plots them on the graph. When it is finished, a noise sample is taken and a least squares fit of the data points is taken. The calibration is then saved. See 13.5 Automatically Calibrating the Signal Processor on page 294 for more information on performing automatic calibrations.

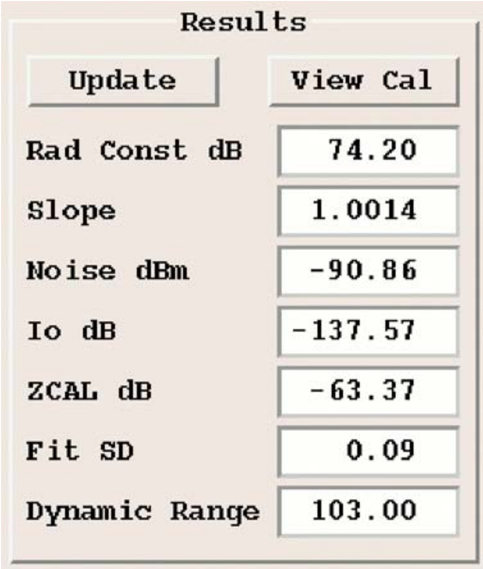
13.2.4 Configuration Menu



Clicking on the Config button pops up a menu in which you can define the parameters of the automatic calibration procedure.

- Cal Pulse Width — Select the pulse width to be calibrated automatically.
- Update other PW — As an alternative to recalibrating for each pulse width, choose "Yes" to copy the results of a calibration at one pulse width to other pulse widths, scaled by the different radar constants for the two pulse widths. For the most accurate results, however, the radar should be recalibrated at each pulse width.
- Polarization — only to be changed for multiparameter radars.
- IF Power Plot Limits — The range of measured signal plotted on vertical axis.
- Sig Gen Plot Limits — The range of signals to be plotted on horizontal axis.
- Sig Gen Fit Limits — The range to be included in the least squares fit.
- Siggen Steps — This controls interval between generated signals. We may want to fine steps at the two rolloff regions in order to get an accurate measure of the dynamic range. Thus you can enter steps for three different power ranges.
- Slope and dBZo Tolerance % — These are positive integers between 1 and 100, used for the comparison with the reference calibration information during an automatic calibration. If the new calibration differs by more than these percentages, AutoCal does not update the calibration.
- Range Tolerance dBm — If the dynamic range changes by more than this value, alert and do not update.

13.2.5 Results Display



The Results display shows the temporary calibration information such as the current slope and dBZ or Zcal values for the specified pulse width. These values apply to the most recent squares fit and noise sample. This display is updated every time a new noise level is taken, or any time the data used for linear fit changes.

Update

Clicking the Update button stores the current calibration for the pulse width you select from the pop-up menu. The slope result is copied regardless of pulse width. The calibration reflectivity is copied over for the specified pulse width.

Radar Constant

Displays the calculated radar constant (see the *Signal Processor User's Manual)*.

Slope

Displays the slope of the straight line fit to the data values in dB per machine number (A/D value) The slope should be close to 1. Less than 1.02 is a reasonable threshold. If a reasonable value is not acquired, adjust the fit range limits.

Noise

Displays the noise level in dBm.

Io

Displays the calibration intercept.

ZCAL

Displays the Zcal value computed from the radar equation (dBZo in the *Signal Processor User's Manual)*.

Fit SD

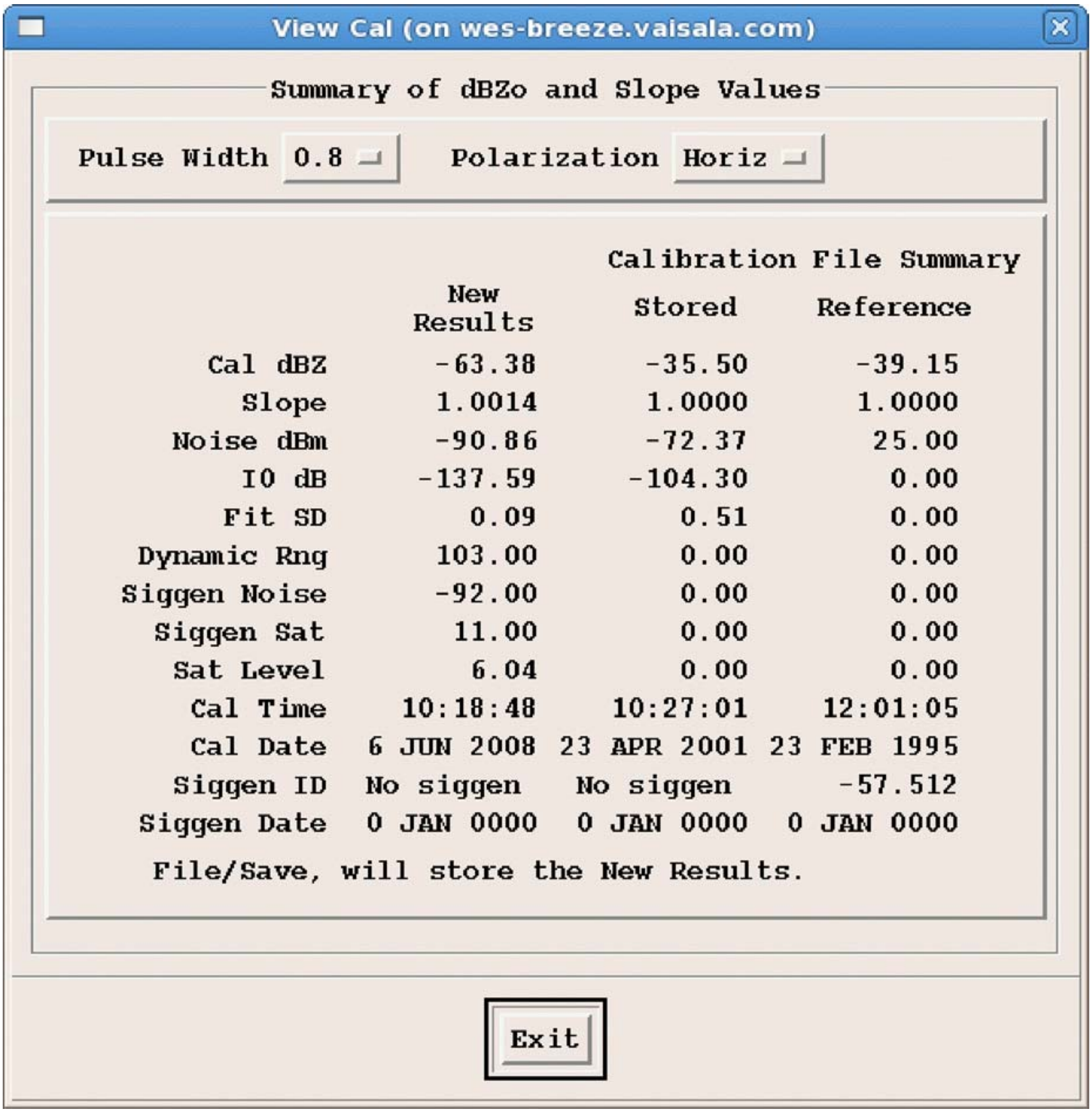
Displays the standard deviation on the least squares fit in dB. This should be under 1 for a good fit. If a reasonable value is not acquired, adjust the fit range limits.

Dynamic Range

Displays the dyamic range of the processor at this pulse width. The dynamic range is defined as the difference in input signal power between a signal measuring at least 1 dB above the noise level, and a signal which is starting to saturate the receiver such that we have 1 dB roll off from the idealized linear fit.

View Calibration

The View Calibration button pops up a menu showing the current results, the last results saved to a file, and the reference calibration set by the **zcal** utility. When you have viewed the information, click on the Exit button to close the menu. An example is shown here:

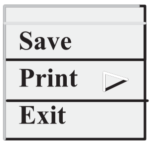


13.3 Zauto Commands

The **zauto** utility provides the following commands:

File

File



Save writes the calibration information to a file.

Print creates an X-window dump of the menu you are running, as follows:

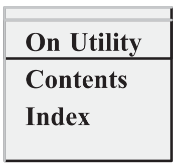
- **Print–>to Printer** sends the output to the Postscript or color printer specified in the Printer Setup menu.
- **Print–>to File** sends the output to a file in your default home directory.
- **Print–>Setup** lets you configure the printer on your system. See the *Software Installation Manual* for details on configuring a printer.

Exit exits from the **zauto** utility.

Calibration information is stored in the `config` directory in a file called `zcalib.conf`. If you do not save the file before you exit from the utility, **zauto** asks if you want to update the file so the calibrations can be used for automatic data collection.

Help

Help



On Utility displays information on the **zauto** utility.

Contents displays the table of contents for the *IRIS Utilities Manual*.

Index displays the index to the *IRIS Utilities Manual*.

See 2.4 Getting Online Help on page 26 for more information on getting online help.

13.4 Manually Calibrating the Signal Processor

NOTE	For manual siggen control, it is best if the control for the signal generator and the workstation are located next to each other. Otherwise, two people and some coordination are required to perform a calibration.

NOTE	Important: The sensitivity and dynamic range of the radar can be affected by the gain of the IF signal entering the IFD. Please adjust the IF signal level first as outlined in Appendix E of the RVP8 User's Manual.

To protect the signal generator, the radar is not usually set to transmit during calibration. Check with your manufacturer. If it is OK to transmit while the siggen is connected, then it should be done because the calibration can better simulate operating conditions. If transmitting is not recommended, everything should be turned on but the transmitter should not be set to radiate. This assures that all sources of noise are accounted for.

Whether or not you are transmitting, set the antenna elevation greater than 20 degrees to reduce the effect of earth temperature noise which is detectable by modern, sensitive receivers. If you are transmitting, this eliminates the possibility of weather signals interfering with the calibration.

The signal generator must be set for the CW (continuous wave) rather than the pulse mode of operation.

To perform the calibration:

1. Select a pulse width. Note that the pulse width lines of the DSP will issue the appropriate signal. If this control is implemented on your system through the antenna controller, it is set correctly.
2. Set the plot range limits. If you have no idea what limits to set, use the defaults until you get a feel for your system. These can be adjusted later without loss of data.
3. Collect the plot points for the calibration, as follows:
   a. Enter the siggen value in the unlabeled field next to the Sample button. You can use the slide bar to do this.
   b. If the siggen is not controlled by the RCI, set the signal generator output to match the specified value. Otherwise, this is done for you.
   c. Click on the Sample button, and **zauto** draws the point on the calibration plot.

Repeat these steps until you have collected a sufficient number of points (for example, six points in the linear range of the curve). If you make a mistake, use the Delete button to remove the point or reset the pulse width and start again.

4. After the points have been collected, set the plot limits to include only those points in the linear range.
5. Turn down or disconnect the signal generator and click on the Noise button. A horizontal line is drawn at the average noise level.
6. Click the Fit button and observe the line and results to make sure they are reasonable. Reset the limits or collect more data as required to get a representative fit to the straight line portion of the curve (typically from 15 dB above noise to 70 dB above noise). The calibration results will be filled in each time the fit button is pressed.
7. When you are satisfied with the calibration, click on the Update button to update the View Calibration display. Results from one pulse width can be used to update other pulse widths. However, for the most accurate results, you should perform a separate calibration for each pulse width. After some experience with your system, you will know if this is necessary. Errors are likely to be less than 3 dB if the update technique is used.
8. Move on to the next pulse width, if necessary, starting with Step 1.
9. When you are finished, the View Calibration display should have the values that you want to save. If so, choose **File–>Save**, then **File–>Exit** to exit from zauto.

Always check the calibration values in the View Calibration display to be sure they are reasonable.

There is an alternate way to modify the calibration file, which uses the **zcal** utility. **Zcal** allows you to simply enter the calibration reflectivity by hand. This is used primarily for testing purposes or after a component has been replaced by another with known calibration.

13.5 Automatically Calibrating the Signal Processor

The **zauto** utility can automatically calibrate the signal processor output, either from the utility itself or from the command line. If you perform the automatic calibration from the utility, **zauto** plots each point on the graph and draws the least squares fit and noise sample lines on the display. If you perform the calibration from the command line, **zauto** displays a series of messages indicating each siggen setting and DSP value. In both cases, the new slope is calibrated, and the results are saved in the calibration file.

Regardless of the method of running the automatic calibration, **zauto** uses the reference information from the calibration file to determine whether to accept the new calibration information. If the new calibration deviates too much from the reference settings, it is not used. This prevents loss of data if the signal generator should fail.

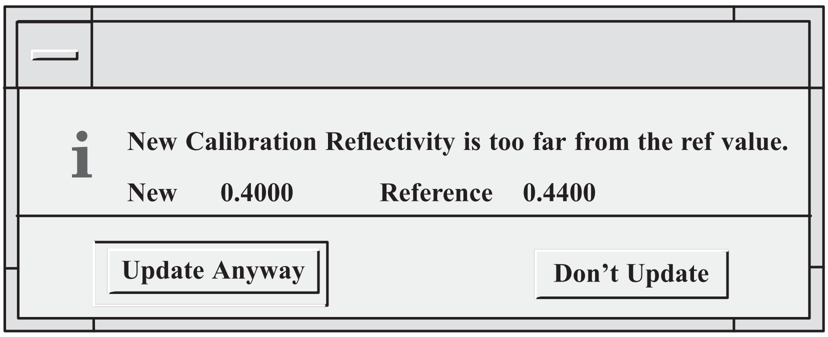
NOTE	The only way to change the reference calibration information is with the zcal utility.

To configure the automatic calibration:

1. From the zauto menu, click on the Config button and pop up the AutoCal Config menu. From this menu, choose the pulse width for the calibration, the siggen step, and other parameters for the calibration.
2. Use the Slope Tolerance % and the dBZo Tolerance % fields to determine the amount of deviation allowed between the reference information and the new calibration. A higher percentage allows for a larger deviation, with 100% allowing any results to replace the old calibration values.
3. Click on the Save Config button to save your configuration settings.

To perform the calibration from the zauto menu:

Click on the AutoCal button. **Zauto** steps through a series of signal values and plots the points. If the new results deviate too far from the old results, **zauto** displays the message:



For each message, you can choose to update the calibration file or reject the new calibration information.

To perform the calibration from the command line:

Enter the following command from the operating system prompt:

```
$ zauto -cal
```

The utility displays a series of messages indicating the siggen values and DSP values used in the calibration, such as the following:

```
Setting        -110.00        DSP Val        25.00
Setting        -105.00        DSP Val        37.50
Setting        -100.00        DSP Val        50.00
Setting        -95.00         DSP Val        62.50
Setting        -90.00         DSP Val        75.00
Setting        -85.00         DSP Val        87.50
Setting        -80.00         DSP Val        100.00
Setting        -75.00         DSP Val        112.50
Setting        -70.00         DSP Val        125.00
Setting        -65.00         DSP Val        137.50
Setting        -60.00         DSP Val        150.00
Setting        -55.00         DSP Val        162.50
Setting        -50.00         DSP Val        175.00
Setting        -45.00         DSP Val        187.50
Setting        -40.00         DSP Val        200.00
Setting        -35.00         DSP Val        212.50
Setting        -30.00         DSP Val        225.00
Setting        -25.00         DSP Val        237.50
Setting        -20.00         DSP Val        250.00
Setting        -15.00         DSP Val        262.50
Setting        -10.00         DSP Val        275.00
Setting        -5.00          DSP Val        287.50
Setting        0.00           DSP Val        300.00
Setting        5.00           DSP Val        312.50
Setting        10.00          DSP Val        325.00
```

```
Slope New: 0.4000 Ref: 0.4400

Reflectivity Pulse Width:0.5 New:-39.4354 Ref:-20.5000

file saved
```

If the new values deviate too far from the reference information, the file is not saved. To have the new values accepted, you must run **zauto** and change the tolerance fields in the AutoCal Config menu, then rerun the utility.

13.6 The Siggen Calibration File

The **zauto** utility can read a calibration file which contains information detailing exactly what power level is output for each nominal setting of the signal generator. This feature is typically used to provide a very accurate calibration of an automatic signal generator which is controlled by IRIS. For example, a requested value of -30 dBm may actually be -30.2 dBm. For manual calibration, with a calibrated signal generator, it should not be necessary to use this feature.

The calibration display in zauto shows both the nominal requested setting as well as the calibrated value. The calibrated value is shown with a resolution of 0.1 dB. This calibration file is created by the user either through a calibration program, or typed in via an editer. The file is SIGGEN_CAL.DAT located in the IRIS_CONFIG directory (e.g., /usr/sigmet/config). A partial example is shown below:

```
# Comments start with #

#

# First set the date of the calibration in the following
format

# Note the D in Date is capitalized.

Date: 10:15:00 20 OCT 1995

#

# Next the signal generator ID string

#

ID: XX aaa_BBB-CCC

#

# Now include a table of the integer nominal siggen values

# followed by the calibrated value as a floating point value.

# Start with the largest value.
```

```
#

0                   0.1
-1                  -1.1
-2                  -2.1
-3                  -3.1
-4                  -4.1
-5                  -5.1
-6                  -6.1
-7                  -7.1
-8                  -8.1
-9                  -9.1
-10                 -10.1
-11                 -11.1
-12                 -12.1
-13                 -13.1
-14                 -14.1
-15                 -15.1
-16                 -16.1
-17                 -17.1
-18                 -18.1
-19                 -19.1
.
.
.
```

Only the 128 dB span immediately below the first entry in the file will be used, all values outside this range, and all missing values will be treated as correctly calibrated. If the file is missing, then all values are treated as correctly calibrated, and the ID string is set to "No siggen file". If the file exists, but does not contain an ID string, the ID string will be set to "No ID in file". The ID, as well as the date are displayed in the **zcal** utility.

CHAPTER 14
ZCAL UTILITY

The **zcal** utility is an alternative to the **zauto** utility for displaying and entering the reflectivity calibration numbers in the calibration file. Zcal can be useful when first setting up a system, before final calibration. It is also the only way to reset reference calibration information. Reference information is applicable only on systems that automatically run calibration. (See Chapter 13, Zauto Utility, on page 279 on **zauto**) If a new calibration deviates too much from the reference, it is not used. This prevents loss of data if the signal generator fails.

Zcal requires no graphics interface. You enter calibration numbers, which have been determined in some other manner. There are separate calibrations for each pulse width and polarization as applicable. A thorough discussion of the reflectivity channel calculations is covered in the *Signal Processor User's Manual*.

In this chapter:

14.1 Invoking Zcal

Command

```
zcal
```

14.2 Zcal Commands and Prompts

Zcal displays the stored and reference calibration information for each pulse width, then prompts you to enter a command. The number of pulse widths may vary, depending on your system. For a large number of pulse widths, you will want to use a large width terminal window. All dates shown are in local time as configured on your computer.

```
----------- Horizontal Calibration -----------
                Sto 1.0us    Ref 1.0us
Fit Slope:      1.1838       1.1838       dB/dB
Cal:            -34.51       -34.51       dBZ
Std Dev:        0.00         0.00
Noise Level:    -93.11       -93.11       dBm
I0:             -57.66       -57.66       dB
Constant:       68.84        68.84        dB
XMT Power:      200.00       200.00       KW
Burst Power:    -10.10       -10.00       dBm
Dynamic Rng:    nan          nan          dB
Siggen Low:     -34.00       -34.00       dBm
Siggen High:    nan          nan          dBm
IF at Low:      -86.74       -86.74       dBm
IF at High:     nan          nan          dBm
IF Maximum:     -50.42       -50.42       dBm
Flag:           0            0
Cal Time:       12:27:21     12:27:21
Cal Date:       24 OCT 2002  24 OCT 2001
Siggen Date:    24 OCT 2012  24 OCT 2012
Siggen ID:      189-111      189-111

           Current Siggen ID:  189-111
     Current Siggen cal date:  24 OCT 2012
ZCAL command (? for help):
```

on page 301 lists the commands that you can enter at the prompt.

Cal	Enter a new calibration reflectivity
ID	Set siggen ID
List	Print out current numbers on terminal
Polar	Switch between horizontal and vertical polarization
Quit	Quit
Refer	Set reference to Stored values
Write	Write calibration file
?	Print help

14.3 Changing Reflectivity Calibration Numbers

To change the calibration reflectivity:

1. Type cal at the command prompt. Zcal displays the prompt:

   ```
   Enter pulse width (choices 1):
   ```

2. Enter the pulse width in microseconds (for example, 1, 1.0, 1.00). Zcal displays the prompt:

   ```
   Enter new cal reflectivity (old was -34.51):
   ```

3. Enter the calibration reflectivity (dBZo) in dB. Typically this is a negative dB number, such as -35, which corresponds to the minimum detectable dBZ at 1 km. Zcal then displays the prompt:

   ```
   Enter new cal noise (old was -93.11, nan for none):
   ```

4. Enter the new value for the calibration-time noise level. If you do not know this number, you can enter "nan" (short for "Not a Number"). This will disable the feature for adjusting the calibration if the noise level changes from that observed at calibration time.

   Zcal then redisplays the calibration information, showing the new calibration reflectivity and noise that you entered.

To change the reference values:

1. Type `refer` at the command prompt.

   Zcal copies the current calibration to the reference calibration and redisplays the calibration information with the new reference information settings. You should issue this command when you are happy with the current calibration. IRIS/Open always uses the current calibration when configuring the DSP. It uses the reference calibration only when performing an automatic calibration. If the new calibration deviates too much from the reference, it is not used.

To write the calibration file:

1. Type `write` at the command prompt.

   Zcal writes the calibration information to the file, then prints the message:

   ```
   File updated successfully.
   ```

To switch polarizations:

Zcal writes displays information for only one polarization at a time. If you radar is capable of transmitting in either horizontal or vertical polarization, then both channels can be calibrated. This is normally done in **zauto**. To switch which polarization is display, type "polar".

CHAPTER 15
ZDRCAL UTILITY

The differential reflectivity (ZDR) is a relative power measurement of the signals acquired in the horizontally and vertically polarized channels in the polarimetric weather radar. ZDR measurement accuracy needs to be at the level of 0.1 dB for applications of quantitative rainfall and echo identification. Such accuracies are challenging if pursued through absolute power calibrations of each radar channel, independently. Accounting for this, RDA calculates the differential reflectivity independently of the reflectivity dBZ, and the related calibration coefficients, while a tunable offset parameter is reserved to maintain the balance of the ZDR calibration, explicitly. Depending on the radar system stability, regular and semi-continuous monitoring of the ZDR calibration and occasional update of the offset parameter are necessary to maintain an accurate ZDR calibration.

It is operationally feasible to maintain the relative power balance of two radar channels at sub-decibel accuracy, by utilizing the external 0 dB reference defined by the atmospheric echo inputs that are averaged over rapid full rotations of the vertically pointing antenna ("bird bath" scans), see References Gourley et al. 2006, Hubbert et al 2008, and Ker#awithdiaeresis#nen et al, 2008.

The **zdrcal** utility is a stand-alone program that performs sequences of vertical scan measurements, accumulates and analyzes qualified data for the purpose of monitoring the radar ZDR calibration. The utility is configured to trigger a message for operator attention, whenever the sampled data allow it to conclude that the radar ZDR calibration has drifted beyond a user configurable threshold for alarm. The utility reports calibration data at a precision which keeps the false alarm rate below 5%. To establish this, the data samples are collected long enough to meet the configured precision. The run durations can be steered in part by the task parameters, while the actual total sample lengths adapt to variable atmospheric conditions. The lengths may vary from a single full sweep (in case of significant precipitation at the radar) up to a configurable upper time limit.

In this chapter:

The utility has an interactive tool for operators to respond to the utility alarm, and to update the radar ZDR offset parameter from the specified previous results. The update action implies that the subsequent ZDR observations of isotropic scatterers are adjusted to 0 dB — the goal of ZDR calibration. The action has minimal inference to normal radar operation, as restart of IRIS/RDA processes is not needed.

The utility is distributed in both the RDA and IRIS releases, and will work with the RVP7, RVP8 and RVP900 series signal processors and any antenna controller accessible via the antenna library, at polarimetric weather radars.

The utility can be run interactively from a command line — it does not use a graphical interface. In IRIS system, it can be inserted into the Task Scheduler as an Exec Task and it then runs routinely either at regularly scheduled times, or it can be set to run at specified weather events, in which a IRIS mode switch is triggered by WARN products.

For each completed task, the zdrcal utility outputs a RAW product, to serve as a reference for detailed quality checks and to allow for (off-site) post-processing, which is equivalent to the run-time analysis. The zdrcal RAW products are composed of one or up to forty full rotations of vertical sweeps. The **productx** utility can be used to view the RAW headers for the full information of the radar settings during the calibration task. The data records contain the differential reflectivity ZDR, accompanied by the standard moments dBZ, V, spectrum width (W), and the co-polar correlation coefficient RhoHV, which are used in zdrcal specific quality considerations and as input to sampling uncertainty estimates in analysis. Through reingest of the zdrcal RAW products in IRIS, the data are available for graphical viewing (Quick Look Window, or standard IRIS products). The measured data, used in zdrcal analysis, are subject to standard RDA quality thresholding (LOG, CCR, SQI, SIG) with configurable settings to correspond typical operational tasks. As default, the zdrcal RAW products are not inserted into IRIS product inventory

($IRIS_PRODUCT_RAW) but can be configured to do so by activating an input pipe.

15.1 Invoking Zdrcal and Command Options

Command

```
$ zdrcal
```

Zdrcal is designed to run either as a stand-alone non-graphic utility, or as part of IRIS scheduler (as an IRIS Exec Task). In both modes, zdrcal reports about its progress, processing and result quality into an output stream which is routed either to the terminal window, or into the zdrcal log history file $IRIS_LOG/zdrcal.log.

Running zdrcal as part of the standard scheduler allows the ZDR calibration status to be routinely monitored without operator interaction. The valid command option for running zdrcal as an IRIS Exec Task is "zdrcal –auto 2 > &1 | signal_iris" (see on page 305) in which the "–auto" option precludes progress report output to a terminal. Most importantly, the utility performs the data acquisition and analysis part in the "–auto" mode, i.e. the calibration status is monitored, not updated. Parameters "2 > &1 | signal_iris" reroute the utility warnings to IRIS message log and popup, including the warning issued whenever the calibration offset has drifted beyond the specified alarm threshold.

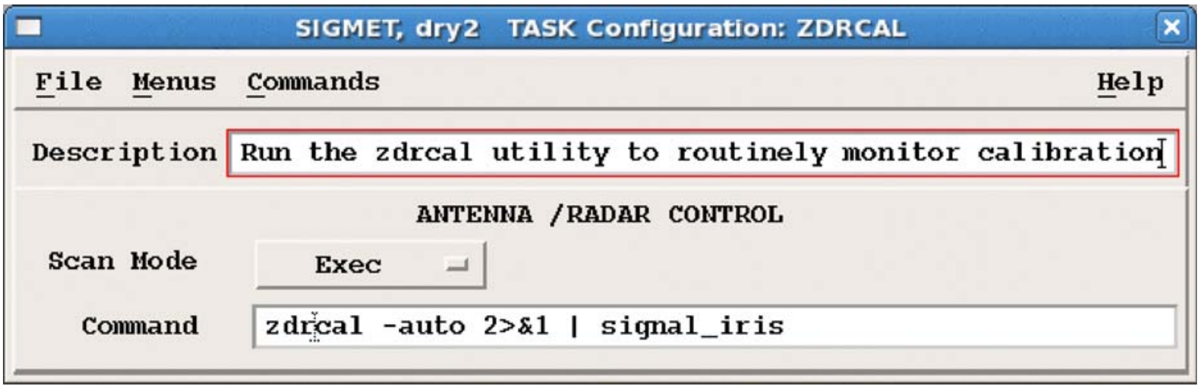


Figure 8 Zdrcal Exec Task

Running zdrcal interactively from the terminal command line allows for a variety of operations and optional inputs, including the command "zdrcal –update", which updates the ZDR offset estimate to become a new radar ZDR offset. Command options are listed in on page 306 below. One should note that operating radar interactively via command line "zdrcal" requires the DSP and antenna be available. The ingest process must be switched off in IRIS. IRIS can stay on, if present. If DSP is reserved for other use, a message "<Export channel is busy>" is generated.

–auto	Do scan and process phases, but skip the interactive update and do not log progress on the terminal. This is meant to be run from from a scripting environment. Warnings are reported out on the error output
–full	Does full scan, process and update phases. Same as –auto followed by –update, except you get progress reports on the terminal. It is to be noted that the update step will be using the latest zdrcal result file available i.e. the update can proceed even if there are no new results. This is the default behavior if no command line option is given.
–help	Prints a compact version of this table.
-process:<path>	Triggers a post-processing mode of zdrcal analysis using an existing zdrcal RAW product.
–resave	Reads and saves the zdrcal.conf file with comments and all new fields filled with default values. The zdrcal utility can run even if zdrcal.conf missing, the utility then uses default settings.
–update[:<file>]	Triggers an interactive update of the current radar ZDR offset using the latest zdrcal result file available for the current radar site. The specifying an explicit file name allows you to pick up a desired (older) result. The specified file resides in the configured zdrcal directory and it is not allowed to originate in data ingested at other radar.
–version	Prints the version number.

15.2 How Zdrcal Works

The zdrcal data acquisition step resembles that of the suncal utility, except that a PPI task consisting of one or more full rotations of the antenna is acquired, instead of automated sector scan around the anticipated sun position. The zdrcal task can be regarded as equivalent to a standard PPI task, except that all elevations are in the vertical position. The data outcome of the vertical scans are formatted as RAW product files for subsequent analysis.

The zdrcal data analysis step consists of retrieval of the RAW product containing the ZDR data fields subject to configurable IRIS/RDA quality thresholding, supplemented with standard moment data of reflectivity dBZ, Doppler velocity V and spectrum width. The data of co-polar correlation coefficient RhoHV completes the input to estimate ZDR offsets and associated uncertainties reported as dedicated result files.

Uses of the auxiliary variables dBZ, V, W and RhoHV are twofold:

1. Zdrcal specific quality criteria are applied gate-to-gate, to enhance the echoes of atmospheric scatterers in the ZDR data sample, while the ground clutter residuals which may remain after Doppler filtering, and other spurious signals such as radio frequency interference, and macroscopic object echoes are diminished.
2. The expected variances of ZDR data values are computed as gate-to-gate sampling variations, by referencing the ZDR distribution as echoes from continuous precipitation in the sampling volume. The formalism in Reference Bringi and Chandrasekar, 2001 (Section 6) is applied.

The ZDR offsets estimates are weighted medians of the qualified ZDR data points, checked for consistency with a maximum probability estimator of the same data set. The check rejects estimates that appear disturbed by excessive non Gaussian tails or other asymmetries biasing the median estimator from the most plausible ZDR offset value. The weighting is based on expected gate-to-gate ZDR variances. Data points of high co-polar correlation and large spectral width are favored, which associate with narrowly distributed ZDR data. The weighting approach is statistically optimal in the sense that it maximizes the precision of the ZDR offset estimates, given variable input quality.

The ZDR offsets estimates are reported with estimates of uncertainty, which are derived from actually observed distributions of the ZDR data sample. Also, the input distributions are characterized in terms of expected and actually observed widths, allowing easy quality control. All estimates of uncertainty are expressed at 68 % confidence level ("one sigma" uncertainties, equivalent to root means square widths RMS of normally distributed data).

The "zdrcal –process:file" triggers a post-processing mode of zdrcal analysis using an existing zdrcal RAW product. This is an unusual option, not used at most operational radars. The RAW product resides in the directory specified in the zdrcal.conf file. The outcome of post processing is equivalent to the run-time result, pending the conditions that the RAW data are appended on the same ZDR history sample, and that the same zdrcal analysis settings are configured. This command mode is useful for general quality control e.g. the effects of variations in quality criteria can be studied. The option allows for monitoring ZDRCAL calibration remotely e.g. at analysis centers of a radar network. It is to be noted that the RAW product need not to originate from another zdrcal utility run, but can be a standard IRIS RAW product, with requirement that the specified data dBZ, V, W, ZDR, RhoHV are available, and those data fields, only.

15.2.1 Typical Use Cases

The default zdrcal configuration settings aim at moderate accuracy (warning threshold at 0.3 dB) with high data availability in stable radar operation (integration limited to 4 days, maximum). The vertical task consists of a single sweep intended for regular repetition as part of the radar scheduler, once in an hour for example.

The utility can be configured to other use cases such as

1. Initial ZDR offset estimation during radar commissioning and start up. Typically, a first estimate of ZDR offset is being looked for to confirm the radar system state. An adequate precision suffices (warning threshold 0.4–0.5 dB). The radar can be allocated full-time to zdrcal runs, for limited time. Operation can be interactive, typically. In this case the utility can be configured to make several sweeps, each run. At fair weather, the number of sweeps can be increased (max 40 seeps). The task scheduler can be set to run zdrcal, continuously, to collect as much observations as possible, in a limited time.
2. High accuracy monitoring in stable radar system. Having obtained good knowledge of the proper settings, stability of the ZDR offset, and stability of the radar, the utility can be configured to high accuracy and to very low false alarm rate, with some compromise on monitoring temporal coverage. To this end, it is recommend to tighten the quality thresholds (LOG, CCR, SQI, SIG), apply harder Doppler filtering and tighten zdrcal specific quality criteria (raise RhoHV threshold, require more qualified gates in each ray, and discard incomplete seeps at high percentage. Eventually, the utility can be limited to run adaptively to selected weather cases (precipitation on radar) using the mode switching feature of IRIS.

15.3 Using Zdrcal Results

The zdrcal ZDR offset estimates are reported in result files *.zdrcal_results. They are intended to be used as input to maintain an accurate radar system level calibration of differential reflectivity ZDR.

The zdrcal utility command mode option "–update" allows for smooth interactive adjustments of the current radar ZDR offset setting. Typically, these adjustments are triggered by the message of zdrcal warning about a significant deviation of the ZDR offset observed from the current radar setting. Alternatively, the adjustment step follows a successful completion of interactive zdrcal run with a valid result as outcome.

In the latter case, zdrcal proceeds into update mode and looks for the most recent *.zdrcal_results file in the directory configured in zdrcal (See 15.4 The Zdrcal Configuration File on page 309). When responding to an alarm triggered at an earlier moment of time, it is recommended that the zdrcal result file, associated with the warning, is first inspected in the configured zdrcal result directory. It can be identified by the warning date and time in the result file name. The file is the latest one, typically. In case more recent result files have been generated, the recommended procedure is to inspect the later evolution of the offset estimate and judge the most likely current and future stable setting, using these added information.

In typical cases, the most recent result file carries the most likely offset estimate. The recommended update procedure is to issue "zdrcal –update", which retrieves the latest zdrcal result. An earlier result file of better quality can be specified with the command "zdrcal –update:XXXyymmddHHMMSS.zdrcal_results" in which the file name refers to the desired result.

Having retrieved the desired result information, zdrcal inspects the result quality features such as:

- the internal consistency of the estimate,
- consistency of the radar site and data time span with respect to the current site and time,
- whether the current ZDR offset setting is consistent with the setting used during the data sampling, and
- whether the result deviates from the configured alarm, significantly.

The utility reports the findings and asks for interactive response how to proceed (i.e. continue the update process, or terminate it). Upon positive responses to all the items interrogated, the utility updates the current radar settings in the signal processor, as well as updates the radar setup files to guarantee the continued use of the new setting after restart of IRIS/RDA processes.

15.4 The Zdrcal Configuration File

The zdrcal utility uses information retrieved in the zdrcal.conf file, which is located in the ${IRIS_CONFIG} directory. Users can adjust the local configuration by editing this file with a text editor such as gedit. Users can respecify the main parameters of the monitor accuracy and the maximum time span of the sample sequence. Users can also specify details of the scanning strategy, zdrcal specific quality criteria, and data output directories, and control the log files.

Running the zdrcal utility with the option "–resave" will read in the old zdrcal.conf file, fill in all new fields of current IRIS/RDA version with default values, then write out the file including updated comments. You can run "zdrcal –resave" to create a fresh default file by removing the existing file first. It is a good idea to run the –resave option whenever you are first using zdrcal after an IRIS/RDA upgrade, to see new features.

The zdrcal configuration file starts with a version info which is not to be modified, and subsequent technical settings for zdrcal logging at $IRIS_LOG/zdrcal.log. The default settings are recommended, in particular in introductory phase. Please note that zdrcal utility appends consecutive run logs into zdrcal.log. In longer run, it is recommended to rename the log file away, from time to time.

```
# ZDRCAL version. Log settings

zdrcal.sVersion = "8.12"

zdrcal.sLogToFile = "YES"

zdrcal.sLogToTerm = "NO"
```

The primary configurable parameter of zdrcal is the threshold for user warning about a significant deviation of the observed ZDR offset from the current radar setting. The max time span prevents zdrcal accumulating data unreasonably long. In field tests, the utility analysis has been found robust up to several days of integration (hourly sampling).

```
# Threshold for ZDR offset warning (dB).

zdrcal.fThresholdForAlarm_dB = 0.3

# ZDRCAL run duration will be adjusted, accordingly,

# in order to keep false alarm rates below 5%
(ZDRCAL_FAR_CL).

# ZDRCAL run will be limited to a max time span (hours),
however.

zdrcal.fMaxTimeSpan_hours = 96
```

The relevant ZDRCAL task parameters are configurable. With all the radar task settings, please keep within the site specific hardware limitations, listed in the setup menu, RVP section. The maximum number of sweeps is limited to 40 in IRIS/RDA, in addition. As first try, quality thresholds LOG, CCR, SQI, SIG should be adjusted similar to the typical operational task settings, while they can be tuned tighter for optimal quality, or relaxed modestly for optimal result availability. The data fields in zdrcal RAW products are thresholded with the configure settings.

```
# Pulse width index, refering to the PWs specified in

setup_dsp.conf.

zdrcal.Task.iPW = 0

# Pulse repetition frequency (Hz).

zdrcal.Task.fPrfHz = 1200

# Range of the first gate, range spacing, and max gate range
in

signal processing (km).

zdrcal.Task.fRangeStartKM = 0.1

zdrcal.Task.fRangeStepKM = 0.1

zdrcal.Task.fMaxRangeKM = 10

# Number of complete antenna rotations.

zdrcal.Task.iNrRotations = 1

# Number of rays (inverse of Az resolution) in a rotation.

zdrcal.Task.iNrRays = 360

# Number of pulses in a ray.

zdrcal.Task.iSampleSize = 64

# Data resolution in bytes. Recomend:2 in long term use

zdrcal.Task.uiBytes = 2

# Standard RDA quality criteria (all measurands LOG, CCR,
SQI;

width SIG in addition)

zdrcal.Task.fLOG_thr = 1
```

```
zdrcal.Task.fCCR_thr = 18

zdrcal.Task.fSQI_thr = 0.29

zdrcal.Task.fSIG_thr = 5

# Index of the Doppler filter, specified in setup_dsp.conf.

zdrcal.Task.iDopplerFilter = 1
```

ZDRCAL applies additional quality checks in data analysis, for qualified ZDR data points to be included in offset estimation. It is to be noted even the lowest reflectivity data have significant signal to noise ratios as they originate at short distances (< 20 km), while the highest practical reflectivities are to be avoided due to receiver saturation at very nearest distances. Please note that the default settings presume Doppler velocity is negative for incoming (falling) echoes. The minimum co-polar correlation coefficient is set, because for low correlation echoes ZDR distribution is excessively broad. Non-atmospheric echoes (RF interference, et cetera) are diminished by requiring several qualified bins in each ray. It is imperative for unbiased measurement that data of full antenna rotations are included only. The fraction of incomplete (or missing) rays must be kept low.

```
# Minimum reflectivity (dBZ)

zdrcal.Analysis.fMinimumDBZ = -15

# Maximum reflectivity (dBZ)

zdrcal.Analysis.fMaximumDBZ = 35

# Minimum fall speed (m/s, v_rain > 0)

zdrcal.Analysis.fMinimumV = -6

# Maximum fall speed

zdrcal.Analysis.fMaximumV = 0.5

# Minimum co-polar correlation coefficient (RhoHV)

zdrcal.Analysis.fMinimumRhoHV = 0.6

#

# Minimum number of qualified bins required in a ray

zdrcal.Analysis.iMinBinsRay = 2
```

```
# The closest range considered (km)

zdrcal.Analysis.fMinRangeKM = 0.850

# The fraction of missing rays allowed in the sample.

zdrcal.Analysis.fMaxMissingRays = 0.001
```

The zdrcal utility result files summarize the ZDR offset obtained in analysis of a given data set. Result reporting is not bound to each radar task (i.e. each RAW product) performed, but the utility integrates over consecutive samples (proximate in time) until the anticipated precision passes the alarm threshold with a safety margin, or reaches the max time span. The offset estimate, it's intrinsic consistency, and actual uncertainty are then evaluated, and the sample is reset.

In this scope, the results can be generated at configurable pace and quality. The option "0" implies that a result file is generated for each complete integration. Result file quality flags may indicate if the result is inconsistent (bResultValid = 0) or if the actual uncertainty was lower than anticipated (bResultPrecise = 0). Option "1" omits reporting inconsistent results, and option "2" reports only the highest quality results. The 5% false alarm rate can be expected for levels >0. The tight settings tend to require smooth precipitation on the radar, and result availability is limited in dry periods.

```
# Level of result reporting:

# -1: result file from each task (RAW). Not recommended in
normal use.

# 0: all available results reported in result files.

# 1: all consistent results reported in result files.

# 2: results at target accuracy (or max sample) reported,
only.

zdrcal.Analysis.iReport = 1
```

The zdrcal utility expects homogenously selected data input, and changes in quality settings are to be avoided. During commissioning phase, such changes may be necessary and the utility has the default policy "YES" to switch to new quality settings and to restart a fresh analysis. However in stable operation, it is recommended to switch the policy to "NO" which allows to process exceptional RAW files (or run special tasks) of different quality as individual runs, while keeping the current main data archive separated i.e. the data and settings unchanged.

```
# Policy in case these quality criteria conflict with the
history settings.

# YES: Reset the history statistics, and assume the new
criteria in future runs.

# NO: Omit the history data, the new settings used in the
current sample, only. The history unchanged.

zdrcal.Analysis.sUpdate = "YES"
```

Zdrcal miscellaneous parameters are technical, and need not to be modified by typical users.

```
# 1=RVP Tags, 3=Antlib.

zdrcal.Misc.iAngleSource = 1
```

The zdrcal utility reports RAW product files as intermediate results, allowing for detailed quality checks and distributed analysis. The default setting is a typical path of IRIS to poll incoming data, and upon activating it in setup menu, input section, RAW products will appear in IRIS product menu for network distribution and for visual inspection after automatic reingest. In this operation mode, the RAW files will be wiped out automatically. In case no input pipe is configured, RAW files will accumulate indefinitely and regular clean up will be necessary.

```
# ZDRCAL RAW product directory:

zdrcal.sRawPath = "/usr/iris_data/input/"
```

The zdrcal utility reports result files in directory which exists as outcome of standard IRIS/RDA installation. It is recommended that zdrcal result files are redirected into a dedicated data directory, such as /usr/iris_data/zdrcal, which needs to be created by the user.

```
# ZDRCAL results directory:

zdrcal.sResultDirectory = "/usr/iris_data/log/"
```

The default setting of zdrcal utility is to use data history for obtaining high data availability at specified precision. For testing purposes, the utility can be switched to process each RAW product as an independent sample (setting "NO")

```
# ZDRCAL accumulates data over subsequent runs (recommended:
YES)

zdrcal.sRunArchive = "YES"
```

15.5 Configuring syslog.conf

The **zdrcal** utility will log calibration changes using syslog. This will put a message into the /var/log/messages file. If you wish to put these in a separate file, then edit the file /etc/syslog.conf, and put the following at the bottom:

```
# Log user.info messages to sigmet.log

user.info /var/log/sigmet.log
```

Note that you must then send "kill -hup" to your syslogd process. All of this requires root privileges.

15.6 References

J.J. Gourley, P. Tabry, J. Parent du Chatele, 2006: Data Quality of the Meteo-France C-Band Polarimetric Radar, *Journal of Atmospheric and Oceanic Technology*,Vol. 23, pp. 1340–1356.

J.C. Hubbert, F. Pratte, M. Dixon and R. Rilling, 2008: NEXRAD Differential Reflectivity Calibration, *24th Conference on IIPS, AMS annual meeting,* New Orleans, USA.

R. Ker#awithDiaeresis#nen, P. Puhakka, and H. Pohjola, 2008: Multi season characteristics of the channel power balance at a polarimetric weather radar, *5th European Conf. on Radar in Meteorology and Hydrology*, Helsinki, Finland.

V.N. Bringi and V. Chandrasekar, 2001: Polarimetric Doppler Weather Radar, Principles and Applications,2001. 636 pp. Cambridge University Press.

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