VAISALA

USER'S MANUAL

IRIS Radar

M211317EN-C

PUBLISHED BY

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CHAPTER 1

GENERAL INFORMATION

This chapter provides general notes for the manual and the product.

1.1 About This Manual

This manual provides information about the IRIS Radar software.

1.2 Contents of This Manual

IRIS supports the following user types:

- **Operators**
- **Observers**
- **System Managers**

For more information about user types, see 2.3, Types of IRIS Systems, on page 14.

This manual provides information about the IRIS **Radar** software. It is organized around the IRIS menus. Each chapter indicates the types of user who can access the menu.

All Users	Chapter 2, Introduction to IRIS, on page 13 Introduces all users to the IRIS system, its hardware and software, and the concepts on which it is built. It provides an overview of the IRIS menus and describes how to perform basic menu operations.
All Users	Chapter 3, Running IRIS Menus, on page 31 Describes how to start the client menus, how to use the IRIS menu bar, and how to performs those operations that are common to all the IRIS menus.

Operators	Chapter 5, Radar Status Menu, on page 57 Describes how to control and monitor the IRIS system using the Radar Status menu.
All Users	Chapter 6, Handling Errors, on page 71 Describes how IRIS displays messages when errors occur, how to access the messages in the Message List menu, and how to handle some common problems.
Operators	Chapter 7, Configuring Radar TASKS, on page 77 Describes how to use the TASK Configuration menu to define radar TASKS — the operating parameters for the radar antenna, transmitter, receiver and signal processing system.
Operators	Chapter 8, Scheduling Radar Tasks, on page 105 Describes how to schedule and run radar TASKS using the TASK Scheduler menu.
All Users	Chapter 9, Products and Display at IRIS/Radar, on page 117 Provides a short summary or checklist about Products and Displays. The summary is written to include as much information about these as is typically needed at the radar site. You can read much more about products and displays in the *IRIS Product & Display Manual*.
All Users	Appendix A, Glossary of Terms and Abbreviations, on page 121 Defines common terms and abbreviations used by IRIS.
Operators	Appendix B, Task Configuration Example, on page 131 Describes two comprehensive examples of IRIS configurations — one to perform general weather monitoring, the other to detect and alert users of wind shear events. alert users of wind shear events.

1.2.1 Version Information

Table 1 Manual Revisions

Manual Code	Description
M211317EN-C	This manual. November 2013
M211317EN-B	Previous manual. March 2013
M211317EN-A	Previous version.

1.2.2 Related Manuals

Manual Code	Manual Name
M211315EN	IRIS and RDA Installation Manual
M211316EN	IRIS and RDA Utilities Manual
M211318EN	IRIS Programmer's Manual
M211319EN	IRIS Product and Display Manual
M211320EN	RCP8 User's Manual
M211321EN	RVP8 User's Manual
M211322EN	RVP900 Digital Receiver and Signal Processor 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:

Vaisala Inc.
7A Lyberty Way
Westford, MA 01886
email helpdesk@vaisala.com

1.2.3 Manual 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.
–>**Choice**	Pop-up menu choices are shown in boldface type, with the arrow pointing to the menu choice that you should make. Pop-up menus are position-dependent. That is, the menu that appears depends on the position of the mouse cursor over a particular field. The text tells you were to position the mouse. To pop up a menu, press the right 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 dollar sign is used to show the operating system prompt, though it may differ from one system to the next.
`command parameter`	Command syntax is printed in bold, monospace type. User-supplied parameters are shown in italics. Enter the command exactly as it is shown and supply the appropriate parameter value.

CHAPTER 2
INTRODUCTION TO IRIS

IRIS is a powerful weather monitoring, tracking, and forecasting system for either Doppler or non-Doppler weather radar applications. IRIS provides virtually all of the features required for the operation of a radar network and distribution of radar products, including:

- Local and remote radar control
- Real-time display for the local or networked workstations
- PPI, RHI and interactive manual scanning
- Advanced radar signal processing and control features for data acquisition
- Advanced radar product generation—CAPPI, PPI, RHI, vertically integrated liquid, echo tops, cross section, maximum reflectivity, wind shear, and rainfall accumulation—with full interpolation in polar coordinates
- Centroid definition with automatic warnings
- Forecaster features like loop, geographic cursor, storm tracking and forecasting, and interactive cross-section modes
- Archiving and playback of products and raw data
- Comprehensive alignment and calibration
- Comprehensive diagnostic and system monitoring
- Product generation from both real-time and archived data

2.1 User Types

IRIS supports several types of user, each having different privileges for viewing products or controlling IRIS features:

- **Operators–**Responsible for the daily operation of IRIS. They define and schedule radar TASKS and determine how the radar data is output.
- **Observers**–Define radar TASKS and output, but they are not allowed to perform any scheduling. This could interfere with the operation of the radar device.
- **System Managers**–Responsible for installing and maintaining the IRIS software and the platforms on which it runs. The system manager has special privileges and is responsible for granting access to the users of the system. Special training is recommended in the platform hardware and software, and also in networking.

2.2 License Types

There are four types of IRIS licences:

- IRIS **Radar** runs at the radar site, controls the measurement, and packs the measured values to files.
- IRIS **Analysis** runs typically on a separate computer, it reads the files created by IRIS Radar and processes the polar volume measurement to various different products, and sends these to displays or Archives.
- IRIS **Display** lets the user to see the IRIS products on Quick Look Window, zoom, create animations and cross sections, and control other display options.
- IRIS **Full** Licence allows the user to perform all the above mentioned processes on one computer.

2.3 Types of IRIS Systems

Three types of IRIS system are available:

IRIS/Radar Installed at the radar site, the IRIS/Radar system runs the radar and signal processing hardware, generates ingest files and raw data for other IRIS sites. It can support either the basic or the full product set.

IRIS/Analysis Installed at a central office, the IRIS/Analysis system receives raw data products from the radar site over the network or from an archive device, such as a tape or optical disk. It supports the full product set. Remote control and monitoring are also supported.

IRIS/Display Installed at remote workstations, the IRIS/Display system receives processed product files or raw data over the network or from an archive, and uses them for display purposes. It supports the basic product set. Remote control and monitoring are also supported.

2.4 IRIS Hardware

IRIS is an integrated hardware and software product. The hardware components are shown in on page 17 and on page 18 for typical configurations of a standard IRIS System.

2.4.1 Workstation

IRIS can run on a PC running the RedHat Linux operating system.

The workstation can run the IRIS processes and menus, or function as an output device for IRIS products.

2.4.2 Signal Processor

The signal processors supported by IRIS are RVP6, RVP7, and RVP8 floating-point programmable radar video processors. They can be expandable by the addition of processing cards, and programmed to perform virtually any radar signal processing task. RVP8 is an innovative standard computer PCI based solution that harnesses the processing power of today's computer processors.

The signal processor connects to IRIS via a SCSI2 interface (RVP6/7) or TCP/IP connection. The signal processors are self-testing. The green GO light indicates that the processor has passed its power-up self-tests. The red USER light on the RVP6/7 indicates that IRIS is properly talking to the processor. The light does not turn on until IRIS is started.

IRIS provides an extensive software package for signal processor test and alignment. Refer to the *IRIS/RDA Utilities Manual*.

2.4.3 Radar Control Processor

The Radar Control Processor (RCP) handles the microprocessor control of the radar transmitter/receiver and antenna system. It is supplied either by the radar manufacturer or Vaisala (Model RCP8). Through the RCP, IRIS can control such things as the radiate ON/OFF, the power to various parts of the system, the antenna motion, as well as obtain status on critical components such as the waveguide pressure and the cooling airflow.

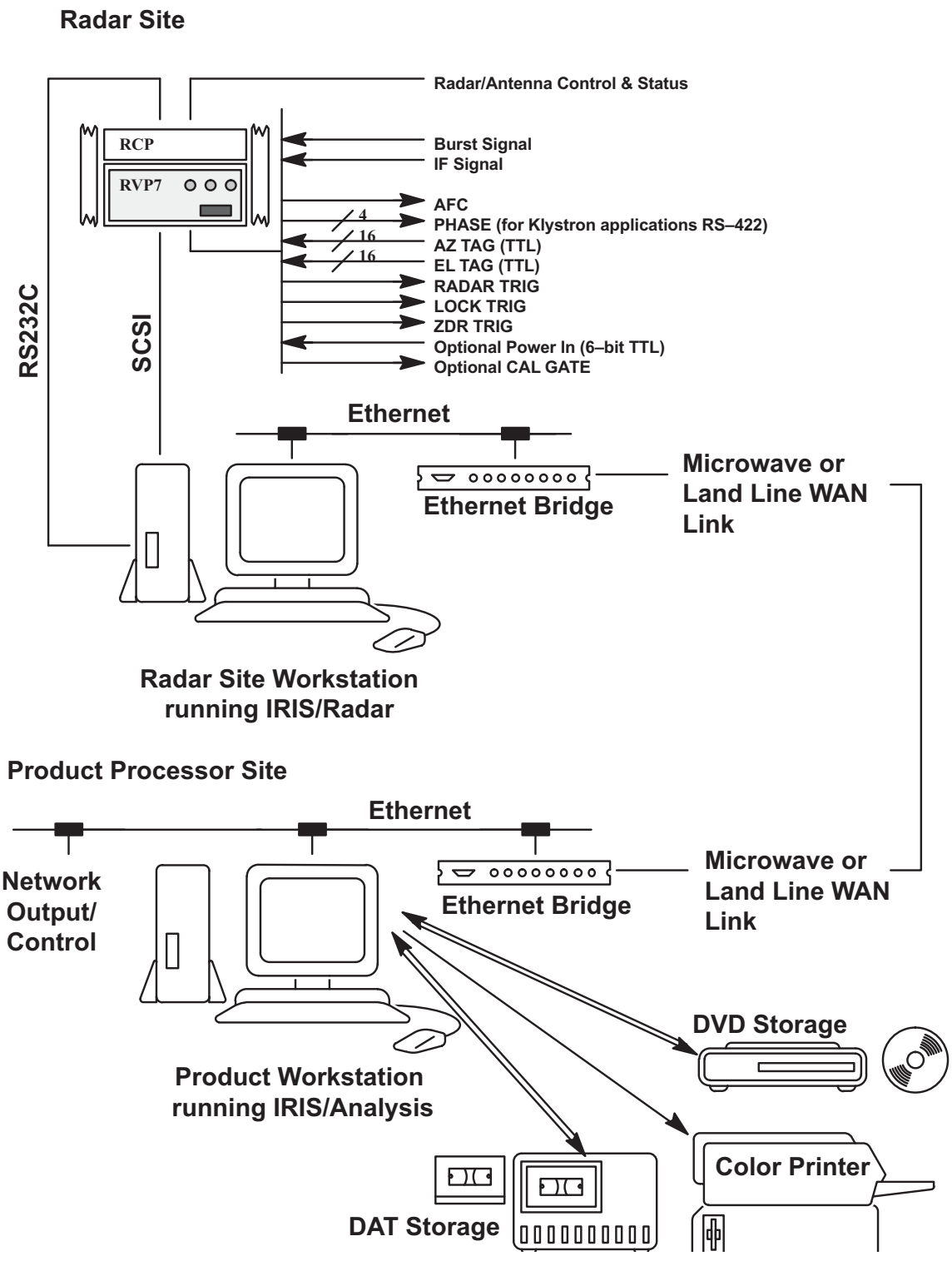


Figure 1 Example of IRIS Configuration

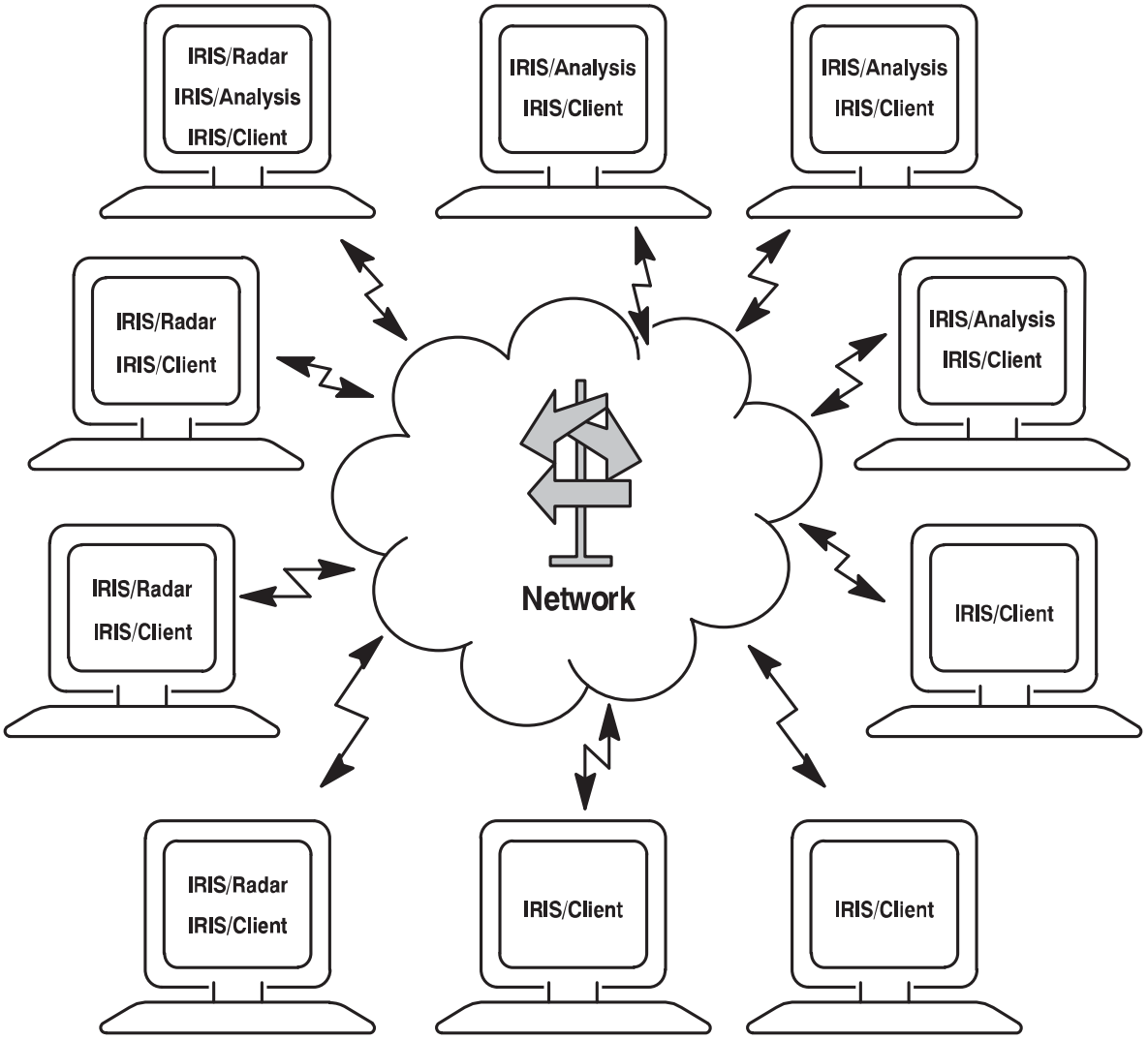


Figure 2 Schematic of Network IRIS Connections

RCP connects to the host computer via an asynchronous serial line or a standard TCP/IP network connection. In addition, the antenna angles are brought to the radar signal processor over a high-speed parallel interface (16 bits for AZ and EL) or a standard TCP/IP network confection so that the data collected by the processor are properly tagged with the correct angle.

Some radar manufacturers supply extensive BITE (built-in test equipment). The BITE unit is interfaced through the RCP. IRIS provides the **bitex** utility for monitoring the BITE parameters. The RCP test and control utility, called **antenna**, is also provided as part of IRIS. Refer to the *IRIS/RDA Utilities Manual*.

2.4.4 Color Printer and Output File Formats

An optional color printer serves as a hardcopy products output device. The printer is also used for printing tape/DVD disk inventories and other system maintenance and documentation functions. Color postscript printers are supported.

The output files can be formatted as IRIS Native, TIFF with optimal compression, BMP, GIF, JPG, Postscript or Compressed serial link format. That makes it easy to use radar images in external applications such as web pages.

2.4.5 Tape Drive or DVD Storage

Typically a system is equipped with a CD-ROM, which is used for IRIS installation. Archive/retrieve is supported on DAT tape, DVD+RW drivers, and large disk archives (LDA's) implemented on a local or remote hard disk.

2.5 IRIS Architecture

IRIS is made up of a number of processes to convert radar data into output formats for display, printing, or storing on tape or disk, as shown in on page 20.

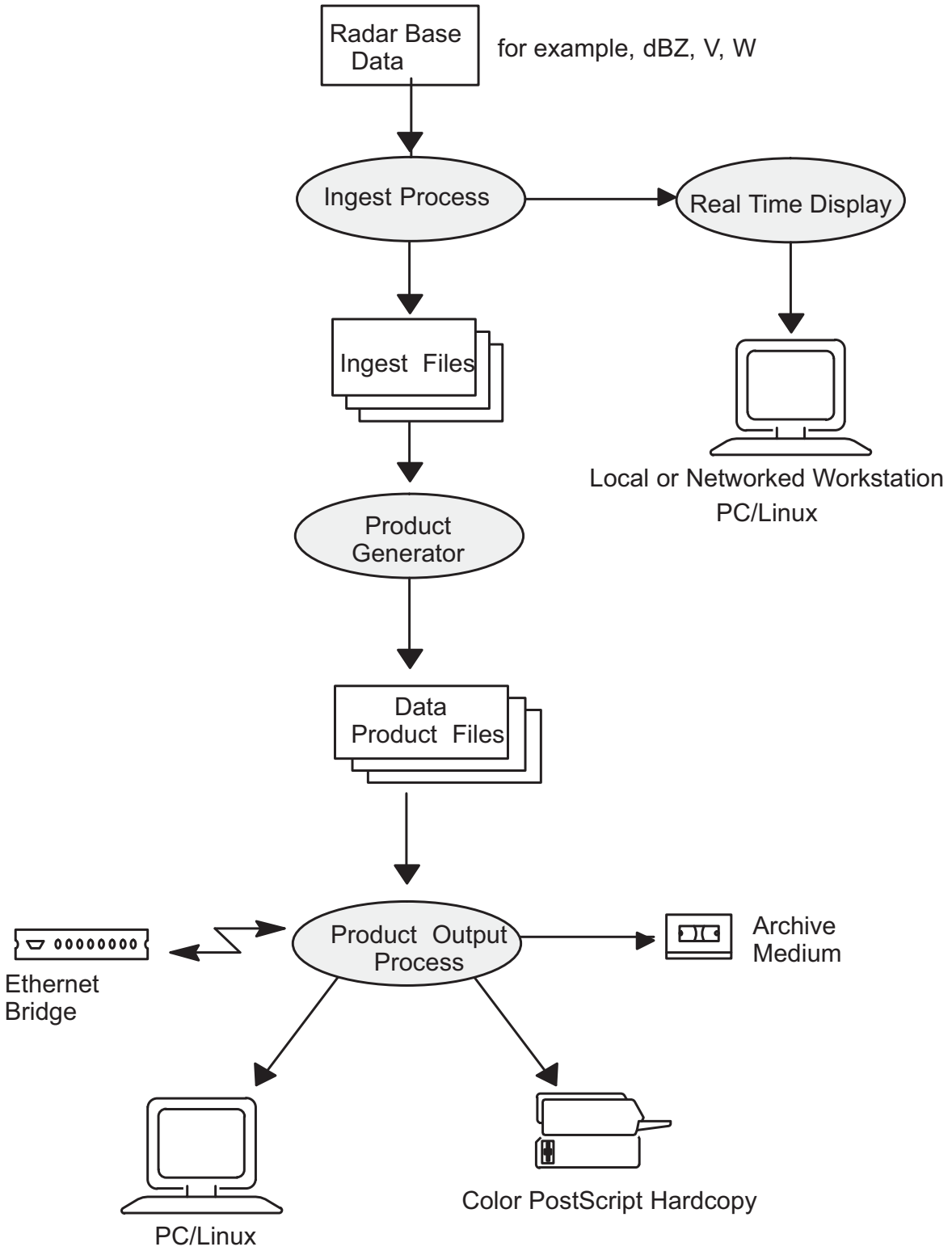


Figure 3 IRIS Processes

Ingest Process

The signal processor sends base data to the IRIS Radar Ingest process. IRIS can handle any of the following kinds of radar data:

V	Linear channel Doppler mean velocity.
W	Linear channel Doppler spectrum width.
Z	Log channel reflectivity corrected for clutter.
T	Total log channel reflectivity (not clutter corrected).
SQI	Signal Quality Index.

On dual polarization radars some or all of the following radar data is available::

ZDR	Differential reflectivity.
LDR	Linear Depolarization Ratio.
PhiDP	Differential phase.
KDP	Specific Differential phase.
RhoHV	Dual polarization correlation magnitude.

Ingest Process

The signal processor sends base data to the IRIS Ingest process.

The Ingest Process controls the signal processor and RCP for the data acquisition. A TASK is a set of instructions to perform a scan, such as a single RHI scan or a PPI volume scan at multiple elevation angles. The antenna scanning, signal processor configuration, PRF, pulse width, and so on, make up the parameters of the TASK, or "TASK configuration."

IRIS can execute only one TASK at a time, but up to eight separately defined TASKS can be scheduled to run at different times, and up to 26 TASKS can be linked together to form a single hybrid TASK.

Thus, there are two aspects to running the radar:

- Defining the TASK configuration
- Defining the TASK schedule

IRIS provides interactive menus for performing these operations and allows you to save the results on disk so that TASK configurations and schedules can be recalled easily. IRIS can store many hours of volume scans of raw ingest data, depending on the size of the disk that is available.

Real Time Display Output Process

The Ingest data from the signal processor are also split to the real time display output process which constructs ray-by-ray packets (for example, 1 degree) that are broadcast over the network using the UDP socket approach. Any networked workstations that are running the real time display receiver software (included with all IRIS systems) can view the radar scan. The real time display can also be viewed on the local workstation where the data are collected. The broadcast approach allows the simultaneous use of multiple-networked real time displays without burdening the network.

Product Generator Process

Ingest files serve as the starting point for the IRIS products. They are the input to the Product Generator, which creates meaningful representations of the raw data, called product files. The complete list of products that IRIS can generate is given in the *IRIS Product & Display Manual*.

Like TASKS, products are configured and scheduled. For example, to produce a CAPPI picture product:

- The product configuration defines the required height of the CAPPI surface, the maximum range to display, the parameter to display, the pixel resolution of the display, and the default color assignment. The configuration also defines the TASK that provides the ingest file for computing the CAPPI product.
- The product schedule defines how often IRIS should generate the product, that is, every time the associated TASK runs, only the next time the TASK runs, or only for selected ingest files.

IRIS provides menus to perform these operations, and like TASKS, these products can be saved to disk and recalled for later for product generation.

The Product Generator takes the ingest file for the TASK, computes the product, then stores the result in a product file. Results from one product file may also be required to compute another product.

Product Output Process

Product files can be requested by the various IRIS users or sent automatically to any of the following output devices:

- Interactive X-Windows graphics displays.
- Disk files on networked workstations, where the products are available for local display and manipulation. Many different formats are supported.
- Tape drives, DVDs, or Large Disk Arrays for data recording (archiving).

- Printers for hardcopy.

In each case, a Product Output process takes the product file, reformats and/or compresses it as required by the device, and transmits it over the appropriate interface. Custom reformatting is made easy by the use of IRIS output "pipes". These are open source software routines that can be linked to a network output.

IRIS can record to tape or DVD and retrieve any product file. This means that retrieved products are available for display as if they were generated in the normal way. The RAW product allows ingest files to be restored so that they are available for subsequent product generation.

IRIS Quick Look Windows

IRIS products can be displayed in a workstation window. Up to nine display windows can be configured on an IRIS system.

Watchdog Process

By design, the disk space on an active IRIS system is nearly always full so that the maximum amount of information is available to users. To make room for new ingest and product files, a Watchdog process automatically deletes files according to their age.

Network Process

Because of its general architecture, IRIS is well suited for operating in a network environment. For example, the Product Generation process can run on a different computer on the network to free the primary IRIS host to control the radar (Radar process) and handle user interactions (Product Output process). Remote control and monitoring of IRIS on another workstation is an integral part of the design because the IRIS menus provide complete access to all aspects of the radar control. This software architecture also makes it easy to support new output devices and products for new applications.

You send products to the display in either of the following ways:

- From the Product Output menu, send products according to a product output schedule, or manually.
- From the Quick Look Window directly via interactive buttons.

2.6 IRIS Menus

IRIS menus give operators, observers, and remote display users flexibility in determining how IRIS collects, processes, and displays radar data. They

provide an easy mechanism for creating and saving standard operating modes for "hands-off" operation.

In many cases, the IRIS menus permit multi-user access, provided there is no conflict. That is, two users cannot configure the same file or try to use the same device.

Some menus can be controlled only by operators. However, even if you are not allowed to control a menu, IRIS lets you view it. For example, an observer may view the TASK Scheduler menu to see what TASKS are currently scheduled to run, but cannot modify it.

Table 2 on page 24 lists the IRIS menus and the users who are authorized to access them.

Table 2 Access to IRIS Menus

Menu	Users	Description
IRIS Menu Bar	All Users	For selecting other menus and exiting from IRIS.
Radar Status	Operators Observers[1]	For monitoring and controlling the hardware components and the IRIS configuration.
TASK Configuration	All Users	For configuring the details of a radar and signal processing TASK, such as a volume scan. This menu may be entered either from the IRIS menu bar or from the TASK Scheduler.
TASK Scheduler	Operators	For scheduling the execution of TASKS. Schedules may be repetitive (for example, every 15 minutes), or a single execution.
Product Configuration	All Users	For specifying the TASK configuration — the TASK that provides the ingest files, the type of product, and the type of output (text, picture, or data).
Product Scheduler	Operators Observers[2]	For scheduling products to run.
Product Output	All Users	For showing what products are available on disk and selecting products for transmission to workstations. Operators can transmit products and overlays to any workstation, printer, or tape/DVD.
Quick Look	All Users	Designed especially for forecasters. This menu provides easy access to IRIS data for forecasting applications.
Real-Time Display	All Users	Designed especially for forecasters and operators to view the instantaneous PPI scan of the radar in real time.

Table 2 Access to IRIS Menus (Continued)

Menu	Users	Description
Archive Menu	Operators	For controlling the IRIS tape / DVD / LDA operations, including recording and retrieving. This menu also displays archive logs that list the contents of a device.
Projection Menu	Operators	For configuring map projections which are required when compositing multiple radars.
Ingest Summary	Operators Observers[3]	For listing the ingest files on disk, for manually deleting files, or setting the Keep flag so that files are not deleted by the Watchdog process.
Messages	All Users	For viewing error and status messages logged on your IRIS software.
Overlay Menu	All Users	For choosing which overlay to use when viewing data from a particular radar site.

1. Observers may view the contents of the menu only.
2. Observers may view the contents of the menu only.
3. Observers may view the contents of the menu only.

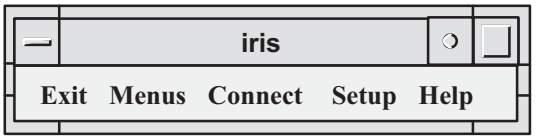
Figure 4 on page 26 shows how the IRIS menus fit into the IRIS architecture.

2.6.1 Starting IRIS Client (Menus)

IRIS menus can run from the same or a different system than the host, as long as they are connected to the host over a network connection. To start the IRIS menus, click the Conductor icon in IRISnet, or enter the following command from the operating system prompt:

```
$ iris
```

After a short pause, the IRIS menu bar appears:



2.6.2 To exit from the IRIS menus

Choose **Exit**–>**Exit** from the menu bar.

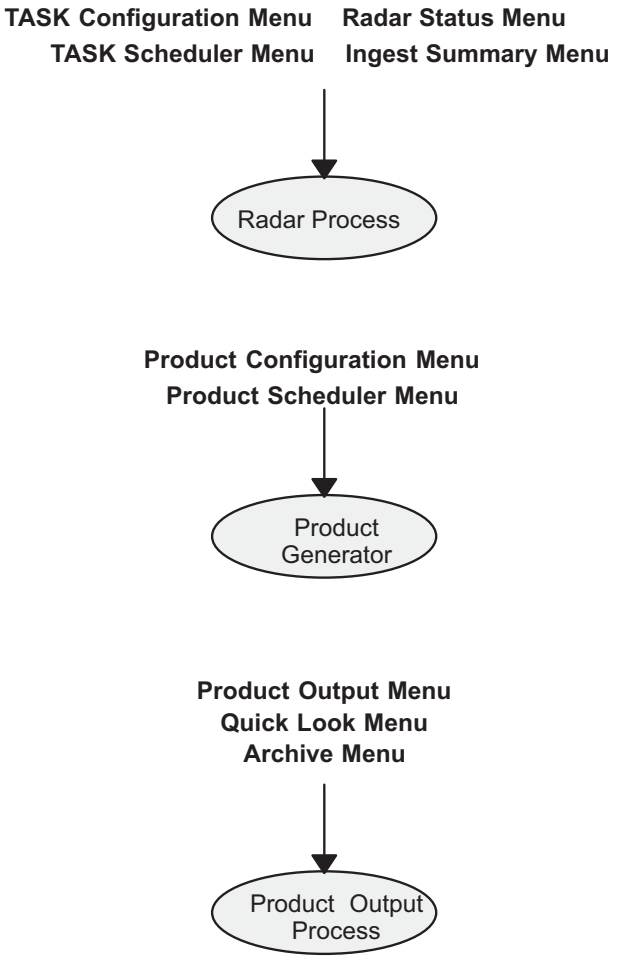


Figure 4 IRIS Menus in the IRIS Architecture

2.7 IRIS Quick Look Windows

IRIS products can be displayed in a workstation window. Display windows are configured with the **setup** utility. Up to nine display windows can be configured on an IRIS system. Figure 5 on page 27 shows an example of a display window. For details on window features see the *IRIS Product & Display Manual*.

You send products to the display in either of the following ways:

- From the Product Output menu, send products according to a product output schedule.
- From the Quick Look Window directly via interactive buttons.

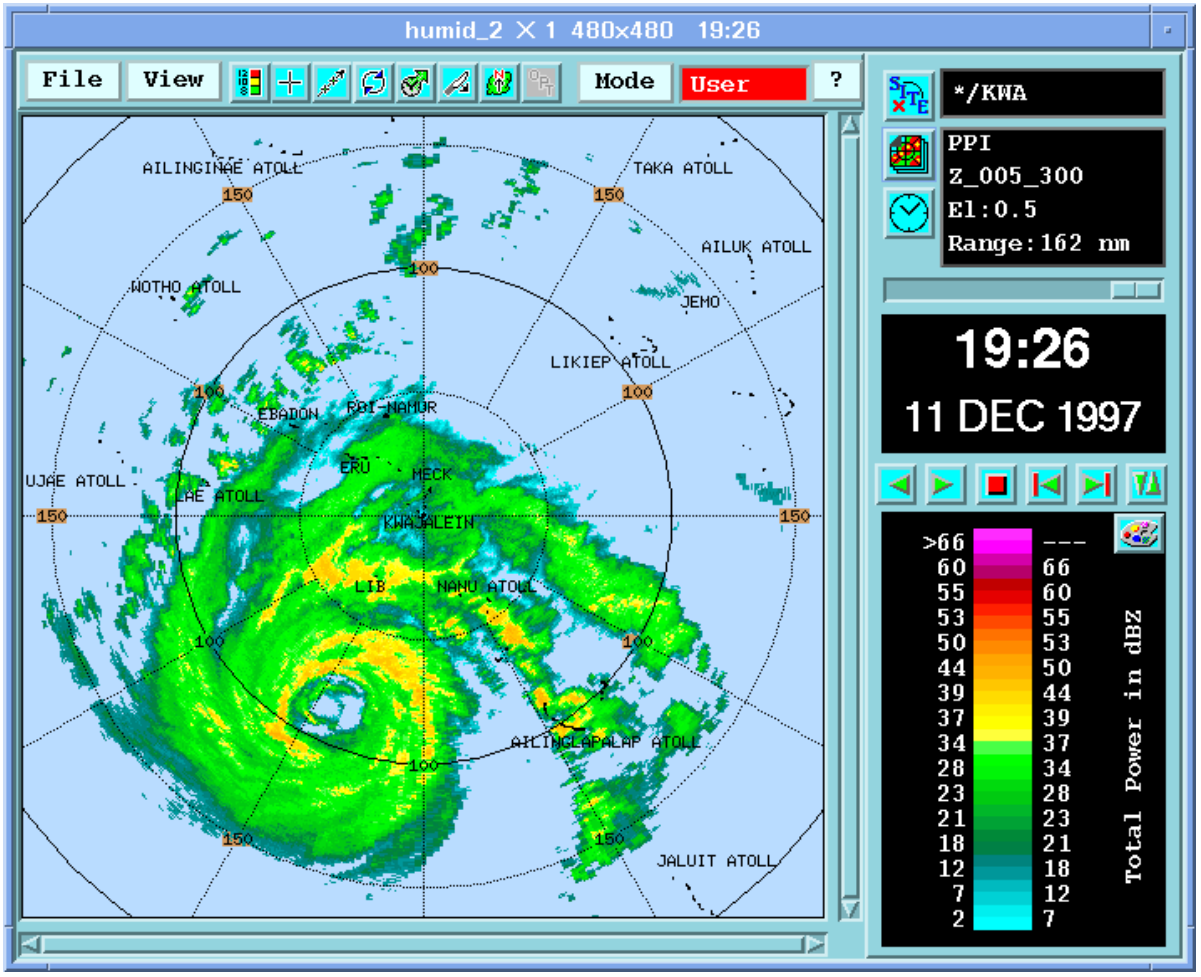


Figure 5 IRIS Display Window

2.8 Starting the IRIS Client/Server Model

IRIS runs in two parts:

- The IRIS host runs the processes, the radar and signal processor, product generator and output processes. It collects data and creates ingest file as defined by TASKS and schedules. It acts as a server for IRIS clients.
- The IRIS client runs the menus — the user interface for viewing products and managing the host. The client is run locally on the user's computer and connects to an IRIS server somewhere on the network — perhaps even on the same computer. The client menus let users define products and TASKS, establish schedules, and monitor the host's activities.

There is always at least one host running on an IRIS system, and many clients can connect to it. The advantage of this architecture is that the client/server communication is much more efficient in terms of bandwidth than the approach of simply exporting a window. This allows the menus to be responsive even when the network speed is limited.

2.8.1 Booting the Host Computer

Typically, the host computer is left running 24 hours a day. If it is turned off, or if there is a power failure, the system must be rebooted. Booting the computer, getting it running when power is first applied, is the responsibility of the system manger or an operator designed by the system manager.

Most systems, and unattended systems, are configured to boot up automatically when the power is turned on. This can take several minutes to complete. If your system should boot up automatically but does not, check the BIOS configuration.

NOTE	You should never switch off a running UNIX or LINUX computer from the power switch.

Instead,

- if you are logged in as operator or observer, logout (EXIT X windows)
- login as **root**
- unmount tapes and floppies if necessary
- shut the computer safely down by typing the command

  LINUX SYSTEMS:

  ```
  # shutdown -h now
  ```

  HP-UX SYSTEMS:

  ```
  # reboot -h -t now
  ```

2.8.2 Logging on to the Host Computer

All users must have a unique username and password assigned by the system manager.

Initially, all systems configured at the factory by Vaisala have the following default usernames and passwords:

Username	Password
root	xxxxxxxx
operator	xxxxxx
observer	xxxxxx

These are subject to change by the system manager. To log on to the host, enter your username and password. After a short pause, the system should display its operating system prompt.

2.8.3 Starting the IRIS Host

Some systems are configured to start IRIS automatically on boot-up. If your system is not configured in this way, you must start IRIS. The IRIS start-up procedure can be performed by any operator; it does not have to be done by a system manager.

Check that power is applied to the radar and all IRIS devices. While this is not essential to starting IRIS, it must be done at some point.

IRIS Host can be started remotely or locally using the **irisnet** utility (see 4.1 Starting IRISnet on page 45) In **irisnet**, the color of the icon for each computer indicates whether IRIS is already running on that node: green for running, yellow for not-running and red for not accessible over the network. Double clicking an **irisnet** icon of any host computer, gives a menu where the icon for starting IRIS (a green traffic light) can be double-clicked.

Alternatively, to start IRIS from the operating system prompt, type:

```
$ siris
```

Siris starts various processes and initializes several files. At each step, it displays a message. When start-up is complete, the operating system prompt reappears, and IRIS is ready to use.

NOTE If you are having any trouble with your system, be sure to read the siris startup messages since these can often tell you what the problem may be.

As part of the start-up procedure, **siris** checks the configuration of the setup files. If an error is detected it is signaled. Refer to the *IRIS Utilities*

Manual section on the setup utility for information on resolving these errors.

CAUTION	Caution: When IRIS starts up, it tries to execute default operating TASKS. If there is a danger to personnel from antenna motion or radiation, your radar console switch should be set in the "Local" position, so that IRIS cannot take control. You can also configure a mode named DEFAULT that does not start the radar antenna and transmitter (see Chapter 5, Radar Status Menu, on page 57).

2.8.4 Shutting Down the IRIS Host

Shutting down the IRIS host is an operator responsibility. Typically, IRIS is stopped only for maintenance reasons, such as before halting or rebooting the computer. Otherwise, it is best to leave IRIS running at all times.

The IRIS Host can be stopped remotely or locally using the IRISNet Utility (see 4.1 Starting IRISnet on page 45) Double clicking an icon of any host computer, gives a menu where the icon for quit IRIS, *qiris* (a red traffic light) can be double-clicked.

Alternatively, to shut down IRIS from the operating system prompt, type:

```
$ qiris
```

Qiris prompts to be sure this is what you want to do, then it goes through a shutdown procedure to leave the radar and antenna in a safe, non-operating state. IRIS clients are disconnected.

CHAPTER 3
RUNNING IRIS MENUS

Many IRIS menus can run and connect to the same IRIS host at the same time. The menus provide access to the information that the host gathers. They define tasks, products, and schedules, output the products to tape, another system, or to a display.

The IRIS menus are controlled by a menu bar, which connects and disconnects the the user with the host server. It also provides access to the other IRIS menus, such as the Radar Status menu. This chapter describes how to start up and exit from the IRIS menus, and how to use the IRIS menu bar.

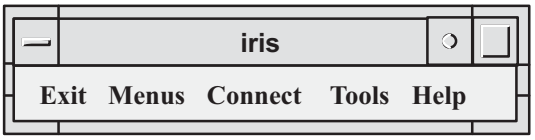
In addition, all the menus share common conventions for navigating the system and for entering information into menu fields. This chapter describes these common conventions.

To start the IRIS menus:

IRIS menus can run from the same or a different system than the host, as long as they are connected to the host over an Ethernet. To start the IRIS menus, log onto the client system as described in 2.8.2 Logging on to the Host Computer on page 28, then enter the following command from the operating system prompt:

```
$ iris
```

After a short pause, the IRIS menu bar appears:

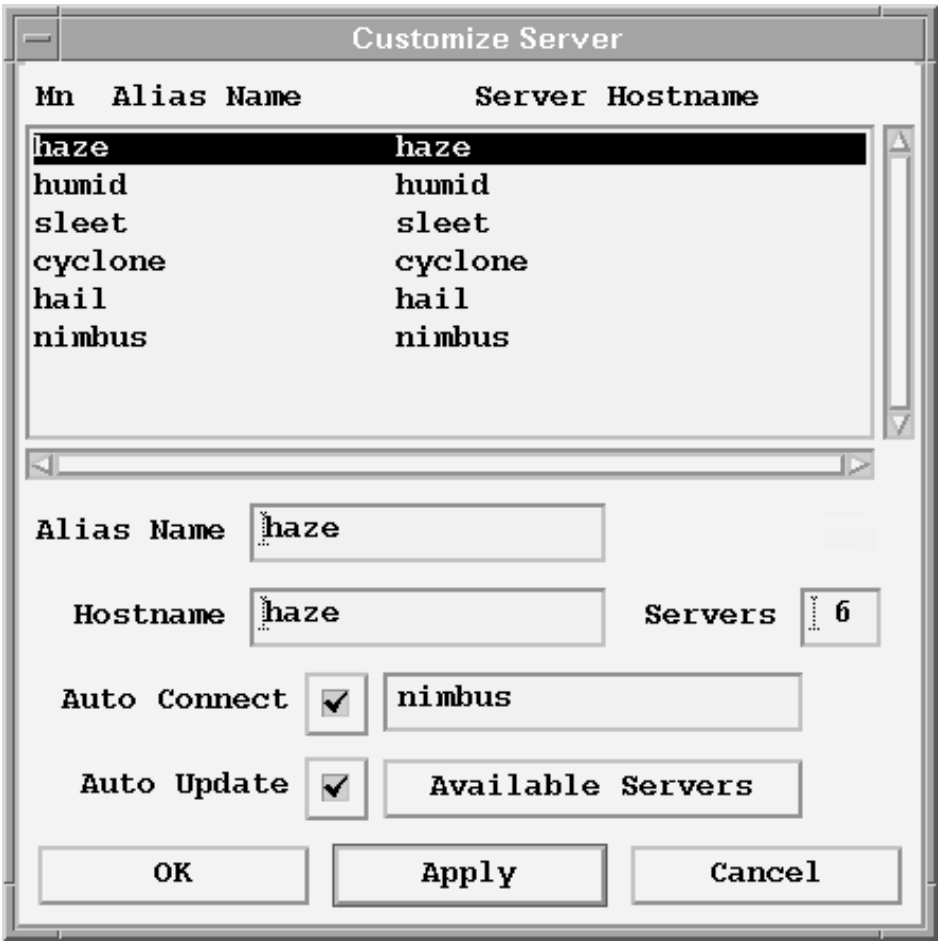


To exit from the IRIS menus:

Choose **Exit**–>**Exit** from the menu bar.

3.1 Customizing the List of Servers

The IRIS client menus run locally on your workstation. You can connect these menus to your local IRIS server or IRIS servers on other computers where IRIS is running. When you run the IRIS menus for the first time, you must define the list of IRIS servers that you want to be able to access.



To add a server:

1. Choose **Connect**–>**Customize Server** from the IRIS menu bar. This opens the Server menu shown above.

   The top of the server menu contains the list of servers. "Button name" is the default entry which is used for adding new servers. When you run IRIS for the first time, they are all "Button Name" entries. The bottom of the menu contains the fields which you use to add or change server definitions.

2. Select a list entry. This places the server information into the fields at the bottom of the menu.
3. Enter the server name in the Button Name field and the server's node name (network node name of a computer where IRIS is installed).
4. Click on the Save button to add the server to the list. The server list is stored on disk so that the entries you make in one session are available in the next.

   Click on the Exit button when you are satisfied with your definitions.

For the server that is running on your local workstation, it is customary to name this "local". The Server name is the node name of your workstation or simply left blank.

You can increase or decrease the number of servers allowed in the list by entering a number in the Servers field. If the number of servers is larger than the number of known servers, unused entries are listed as "Button Name" entries. If the number of servers is smaller than the number of entries in the list, entries are removed, beginning with the last server in the list.

Press the "Auto update" button to configure IRIS to automatically search the network to see if these nodes are running IRIS. An asterisk (*) will be placed next to each node with a running IRIS.

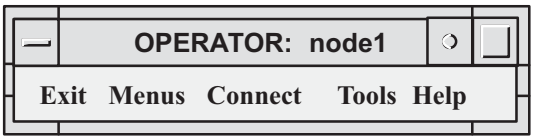
Select a default node, and press "Auto Connect" to configure it to automatically connect to a node if available. This is the preferred way to configure for a single radar system.

3.2 Connecting and Disconnecting Servers

None of the IRIS menus can be activated unless you are connected to a server running an IRIS host. In addition, you can be connected to only one server at a time.

To connect to a server:

Choose **Connect** from the IRIS menu bar and pull down a list of servers that are available. The list should contain the names of the servers that you added in 3.1 Customizing the List of Servers on page 32. Choose one from the list. The IRIS menu bar title changes, displaying the class of use (either OPERATOR or OBSERVER) and the name of the server node, as shown below:



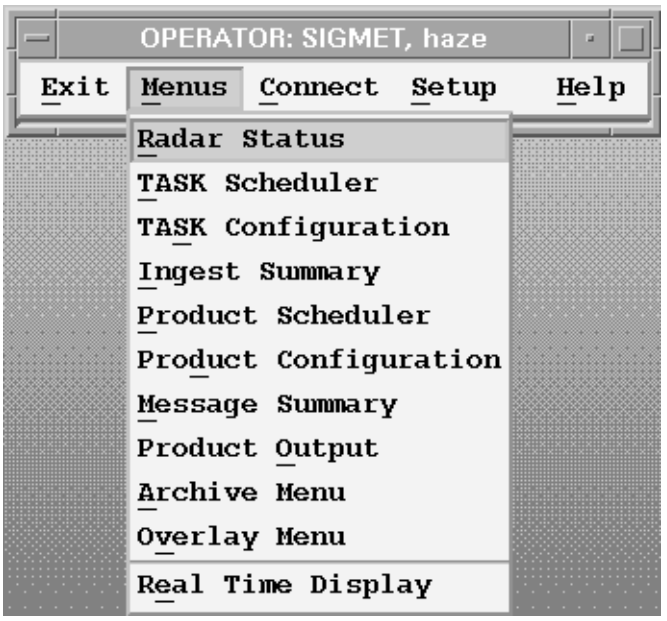
NOTE	If you are an IRIS observer, you can connect a host and view menus but will not be able to change menus that control the radar or network operation.

To disconnect from a server:

Choose **Connect**–>**Disconnect** from the IRIS menu bar.

3.3 Moving Among the IRIS Menus

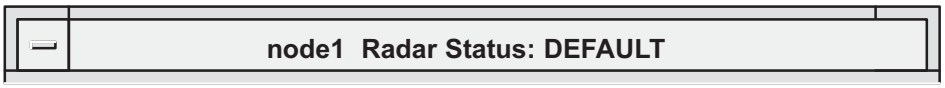
You can access the IRIS menus from the IRIS menu bar. Simply choose **Menus** and the name of the menu you want to access. You can also access the same list of menus from each menu. In that case it will dismiss the current menu, in effect switching menus. The Real-Time-Display button actually launches a separate stand-alone rtdisp application.



3.4 IRIS Menu Conventions

All IRIS menus share certain characteristics and conventions.

3.4.1 Menu Title

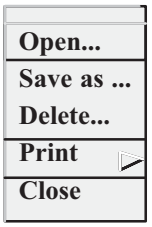


The title of every IRIS menu contains the name of the server to which IRIS is connected, the name of the menu, and the name of any configuration file that has been loaded into the menu. Often, if you have not explicitly loaded any configuration files, the configuration file named DEFAULT is loaded for you.

3.4.2 Common IRIS Menu Commands

Pull-down menus provides access to common operations. The following commands are available from most IRIS menus.

File



Open pops up a list of configuration files. Choose the one you want to load into the menu. In menus where the data is "live," this choice is called **Load**. (In "live" menus, such as the Overlay menu, you see the results of your menu choices immediately.)

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

Delete erases the configuration file that is currently loaded into the menu.

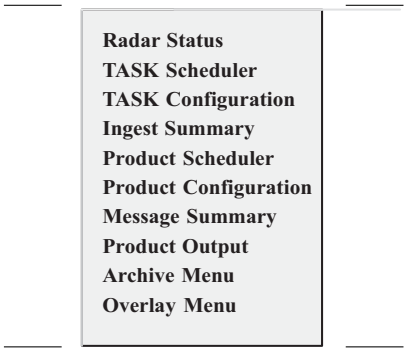
Print creates an X-window dump of the menu you are running, as follows:

- **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. The file name consists of a three-letter abbreviation of the menu name, the current date and time, and the `.xwd` file extension.

- **Print**–>**Setup** lets you configure the printer on your system. See Appendix C, Passive IRIS Features, on page 141 of the *Software Installation Manual* for details.

Close exits from the menu and returns you to the IRIS menu bar.

Menus



You can access any IRIS menu from any other IRIS menu. Simply pull down the **Menus** menu and choose the one you want to access.

Commands

When many IRIS menus are running at the same time on a network, information can get out of sync. **Update Now** brings all information up to date.

If you should change the size of a menu, you can use the **Reset Size** command to reset the menu back to its default size.

Help

On Menu opens the online documentation at the first page of the chapter describing the menu.

Contents opens up the online documentation at the Table of Contents. You can access any section of the book directly from the Index.

Index opens up the online documentation at the first page of the Index. You can access information anywhere in the book directly from the Index.

See 3.6 Help and the Manuals Menu on page 41 for information on viewing the documentation online.

3.4.3 Entering Information in Menus

The IRIS menus require a minimum amount of typing. Most operations can be performed by making selections from lists or by clicking a mouse button. There are a few basic types of field in all the IRIS menus:

Text Fields

Text fields contain textual information, such as the name of a configuration file or numeric value. You can simply enter the text directly into the field or click on the button next to the field and pop up a list of valid values.

Lists of Objects

Some menus display a list of objects. The Product Scheduler, for example, contains a list of products that have been configured on the system. You can select products from the list and schedule when they should run.

When a menu contains a list, you can often position the mouse cursor over a particular entry or over a particular field and pop up a menu of commands. Click the right mouse button to pop up menus of valid commands for list entries.

You can select a group of entries, so that you can perform the same operation on all of them. There are a number of ways to select one or more entries from a list:

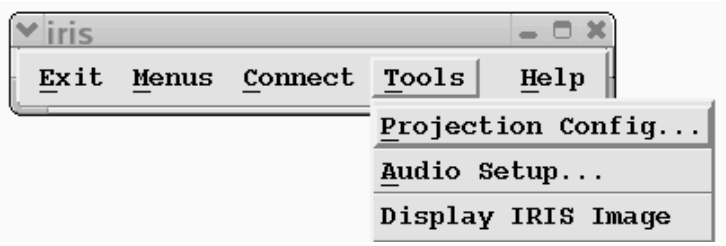
- Click the left mouse button over a single entry, and it is selected. Any previously selected entry is deselected.
- Click and drag the mouse over a group of entries, and they are all selected. Any entries that were previously selected are deselected.
- Press the Ctrl key and click the left mouse button to select a single entry without deselecting any previous entries. Using this method, you can select a group of entries that are not next to each other in the list.

- Press the Ctrl key, then click and drag the mouse. This selects a group of entries without deselecting any previous selections. This method lets you select multiple blocks of entries.

Toggle Buttons

Toggle buttons have two possible states — on or off. Click the left mouse button once to toggle these buttons "on" (the button appears to be pushed in), once more to toggle the button "off" again.

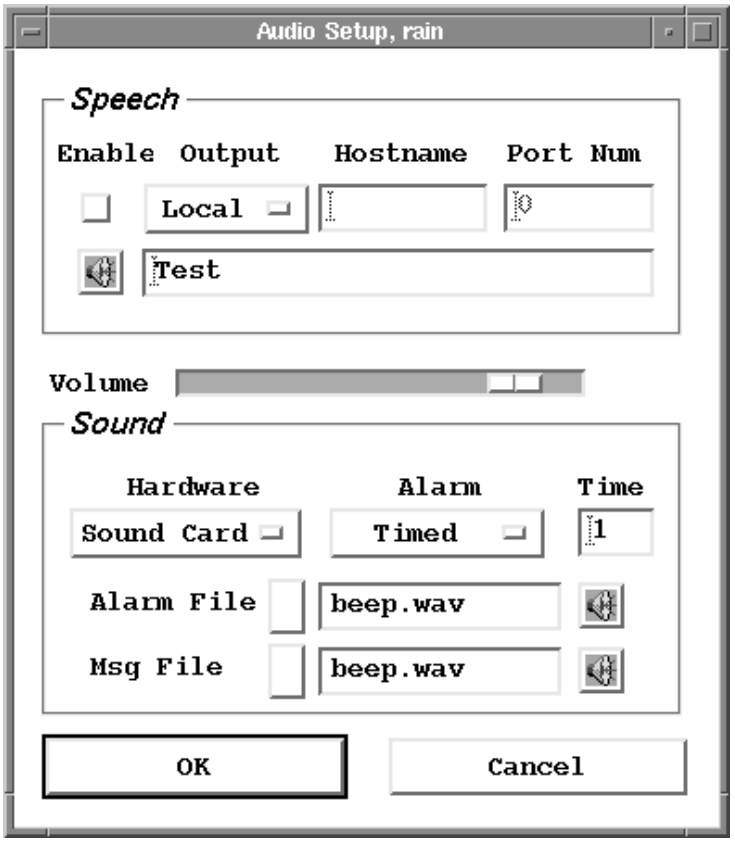
3.5 The Tools Pull-Down



The tools pull-down gives you access to two separate configuration tools: The Projection Configuration menu, and the Audio Setup menu, as well as allowing you to toggle the IRIS Image on or off. For details on the projection configuration menu, please see see section 2.1.2 of the *IRIS Product and Display Manual*. The other features are discussed below.

3.5.1 Using the Audio Setup

The Menu is located under Tools in the IRIS Main Menu bar. Select –> Tools/Audio Setup ... and the following menu appears.



The upper "Speech" panel controls the IRIS Speech options

Enable

This button enables or disables all speech originating from your local workstation.

Output

The selection option here is either Remote or Local. "Local" means output on the sound card in your workstation. "Remote" means output to the specified PC using the specified port number.

Hostname

For remote output, enter the host name of the workstation.

Port Num

For remote output, enter the port number here, the recommended value is 30731.

Test

Pressing this button causes IRIS to send the test string on the menu as a spoken output.

Volume

This slide bar is common to all audio options, both speech and other sounds.

Sound: the lower panel controls other sounds than speech

Hardware

If you have sound card, select it, otherwise select Bell.

Alarm

Select Continuous or Timed alarm.

Time

For timed alarm, select time (in seconds) for how long beep, honk or other sound you want to hear. This only applies to the Alarm messages.

Alarm File

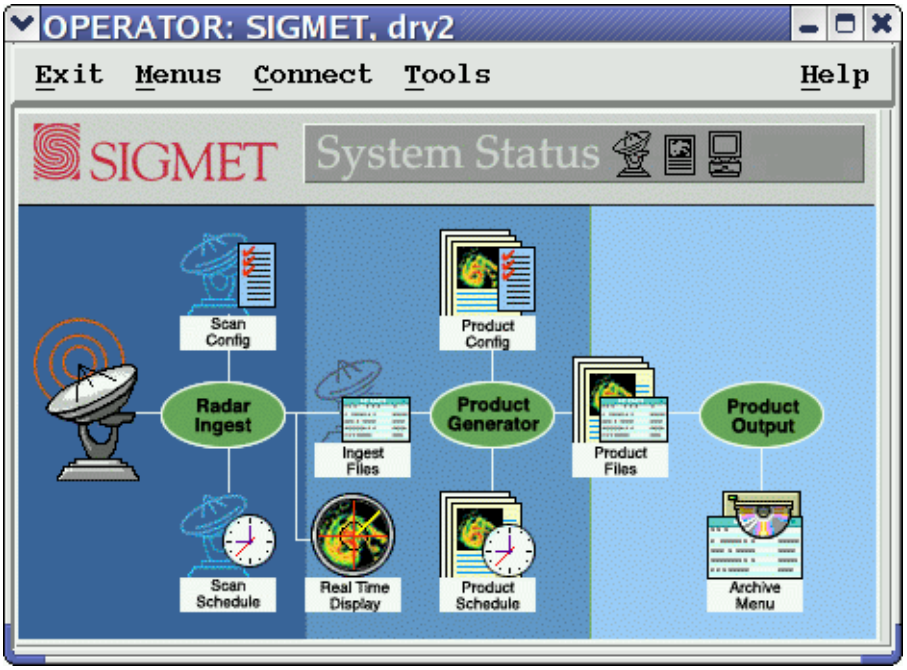
Select the .wav file you want to hear when IRIS gives an alarm message. The loudspeaker icon plays you a sample so you can see if you like it. Note that options are available only if you have a sound card. The alarm messages are tagged in the message summary menu with an "s" (short for "spoken").

Msg File

Select the .wav file you want to hear when IRIS gives a non-alarm message. The loudspeaker icon gives you a sample.

3.5.2 The IRIS Menu-bar Image

This graphical interface display is toggled on/off in the IRIS Main Menu bar. Select –> Tools/Display IRIS Image. Here is how the image looks:

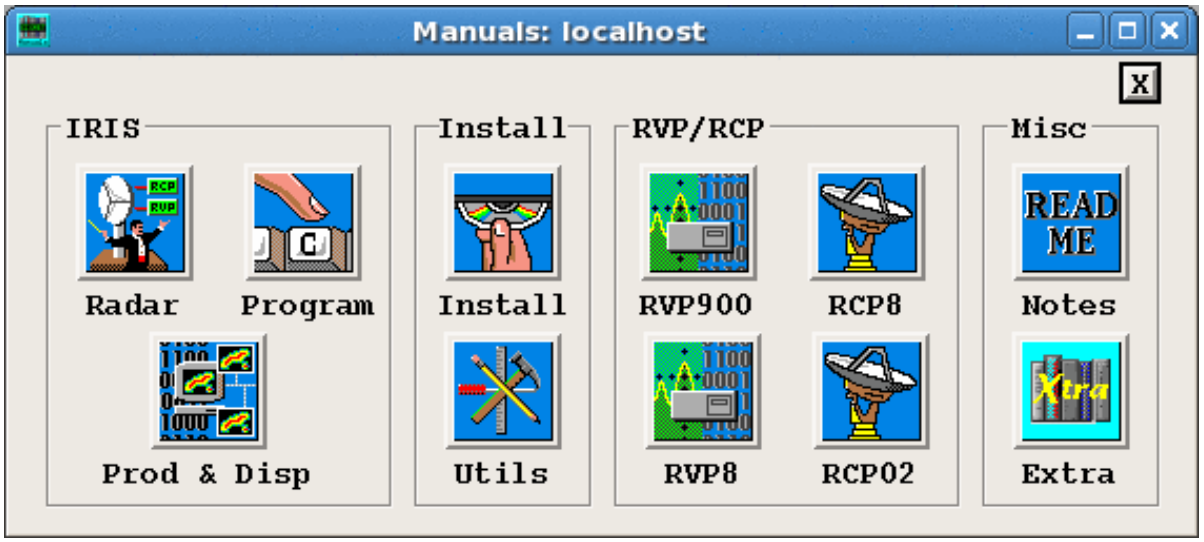


This image allows the user to select the various IRIS menus by clicking the cursor on the various graphical icons in the display.

3.6 Help and the Manuals Menu

Vaisala's product line documentation can be read online using **acroread**™, an online documentation viewer produced by Adobe™. You can access the documentation at any time while running the menus as follows:

- By clicking on Help in any IRIS Menu. This will take you to the appropriate manual and chapter for the menu that you are in.
- By using the Manuals Menu shown below.



The Manuals Menu is can be started from a terminal by typing:

```
$ manuals &
```

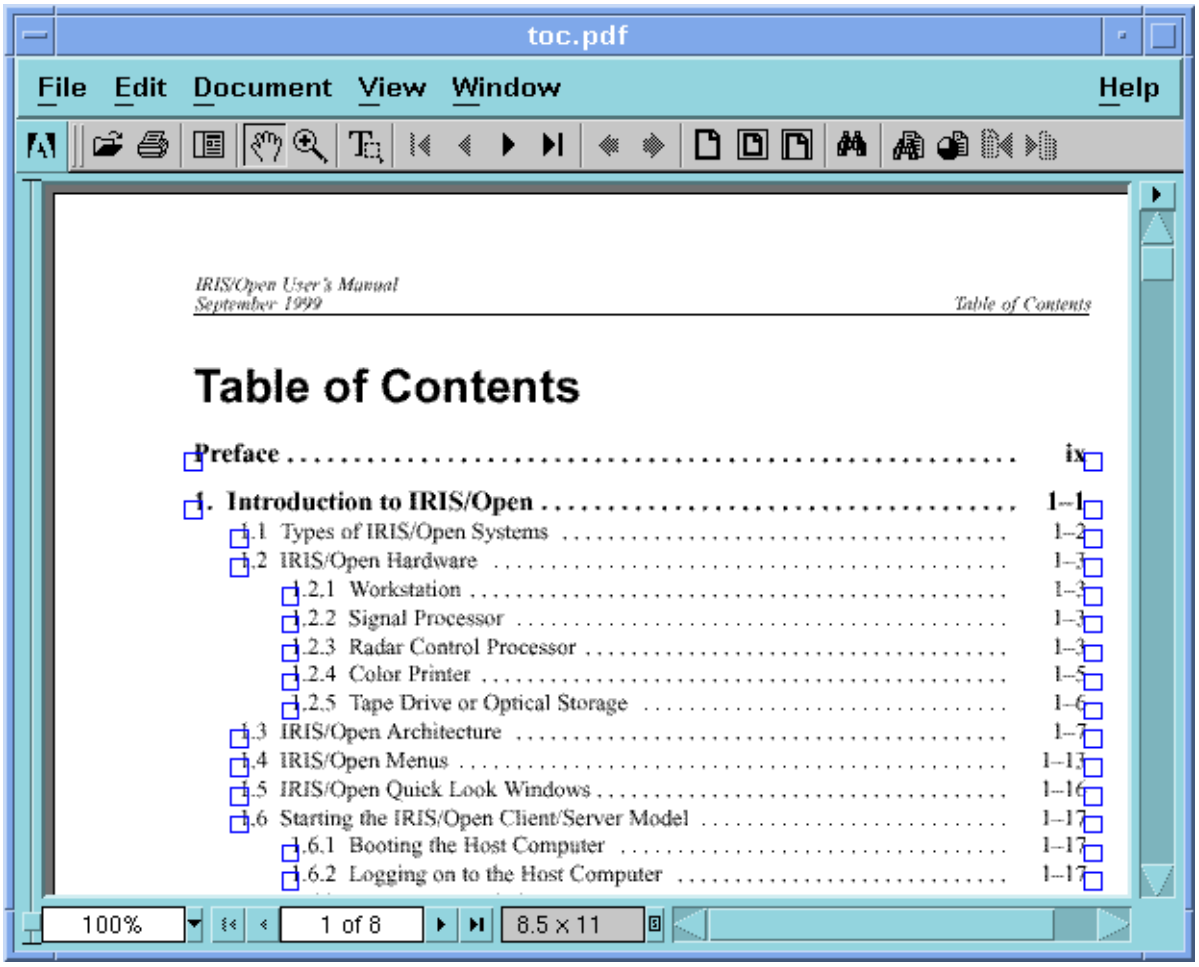
The Manuals Menu can also be started by double clicking the Manuals icon in the IRISNet utility. If you system's software does not include IRIS, you will see menu without the IRIS box on the left.

When you launch a manual from the Manuals Menu, you are taken to the Table of Contents. Select the chapter and section that you want and then click on the hot link symbol to navigate to that section.

Manuals have internal hot links to assist you with cross-referencing other sections of the same manuals. The hot links do not connect different manuals. Switching among manuals is done via the Manuals Menu.

3.6.1 Moving Around in the Document

When you launch a manual, the reader will start and then the reader window will appear as shown below.



The reader comes equipped with its own on–line help (upper right) to assist you with the various features such as:

- The Page Up and Page Down keys scroll forward and backward through the book, one page at a time.
- The arrows at the top will take you previous next page, beginning and end of document and previous and next screen.
- Zoom and pan (with scroll bars).

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.

3.6.2 Searching for Information

Edit/Find allows you to search for specific text. This is useful when you do not know what section of a chapter contains the information that you want.

3.6.3 Printing Online Documentation

Online documentation can be printed using File/Print if a postscript printer has been configured, as described in the *Software Installation Manual*.

To print a document:

1. Display the chapter that you want to print, then choose **File**–>**Print** from the menu bar.
2. The reader pops up a printer dialog window. Choose the range of pages that you want to print and the print options.

3.6.4 Accessing Other Online Books

You can access any of the online books via the Manuals Menu as described in the beginning of 3.6 Help and the Manuals Menu on page 41. The *RVP7 User's Manual* is online, but not included in the GUI. If you wish to read it, you must type in the directory manually.

3.6.5 Getting Additional Help on Adobe Acrobat Reader

Online help for the reader is available through the Help pull-down menu in the reader window.

CHAPTER 4

USING IRISNET

The **IRISnet** menu provides a top-level graphical view of the workstations on an IRIS network. It also provides access to many functions of IRIS such as starting and stopping the IRIS server and client menus as well as accessing IRIS Utilities. From **IRISnet**, you can access nearly every IRIS feature.

4.1 Starting IRISnet

The IRISnet menu provides a graphical status monitoring and user interface into all IRIS features on a network. When you are logged in as 'operator' or 'observer' to a computer where IRIS has been installed, there is an IRISnet icon at the main menubar of your display. If the settings have been changed, simply type 'irisnet' on a terminal window.

4.2 Interpreting IRISnet Status

The menu shows a graphical representation of the radar network. The example is for a network architecture that has 6 radar sites and a central site with 8 displays, an analysis computer (named Products) and a Net Manager. The screen shot is from the net manager's computer. Where you are sitting is indicated by the white highlight around the node name. It is important to remember where you are sitting in the network.

The status will be re–checked automatically every 10 seconds. You can monitor the update cycle from the bar in upper left corner. If you want an immediate update, click **Options–>Update**.

Node Icons Symbols and Color Status Indication

There are two types of node icons in IRISnet:

- **Radar Sites**– these nodes are workstations that are running either IRIS/Radar software. These nodes have signal processors that collect data from the radar. In the case of an active IRIS control system, these nodes will also have a radar control processor (RCP).
- **Analysis/Display Sites**– these nodes are workstations that are running either IRIS/Analysis or IRIS/Display software.

Each network node is assigned a color to indicate its status (like traffic lights):

- **Green** indicates that IRIS is running on the node.
- **Yellow** indicates that IRIS is not running on the node. This includes the case of the node turned off or disconnected from the network.
- **Red** indicates that the node is missconfigured with an invalid hostname or the network is misconfigured so that the host can not be reached.

Each green IRIS site node can show two types of fault alarms:

- **Red cross** indicates a critical error, such as Radar process turned off or BITE fault.
- **Yellow cross** indicates a non–critical error.

Critical and non critical faults are detailed in the Radar Status Menu of each system.

Network Connection Lines and Color Status Indication

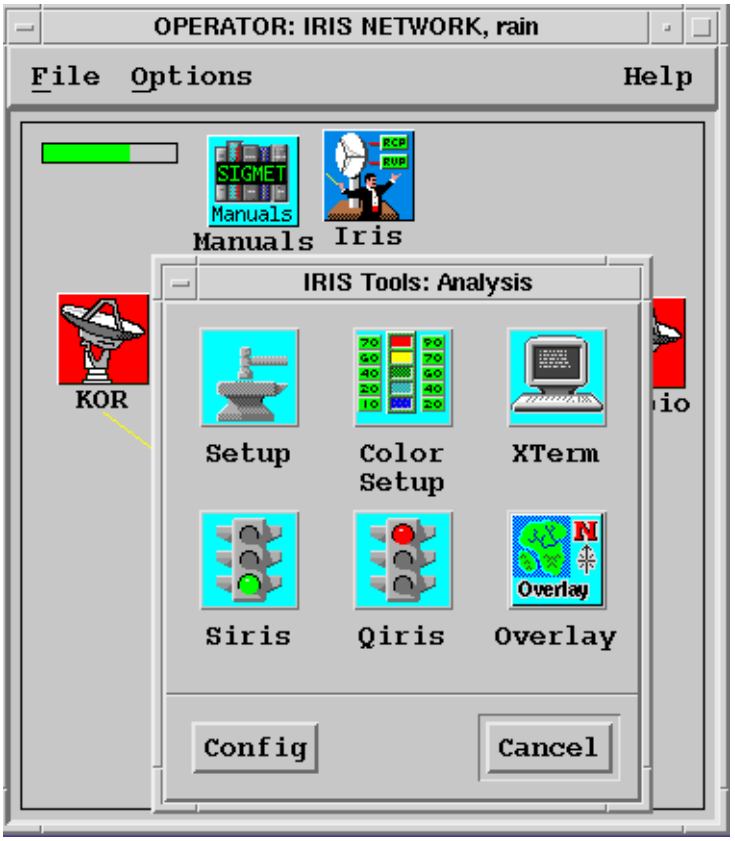
Each node may have one or more network connections to the various other nodes. These are indicated by lines that are color–coded to indicate status:

- **Green** indicates that the communication between the nodes is OK.
- **Red** indicates problems. There could be a problem with the line or with the node.
- **Yellow** indicates that the communication line cannot be sensed from where you are sitting. This depends on the details of how communications are routed through various nodes. In the example figure, the IRISnet menu is being run from the "Net Manager" workstation (indicated by the white highlight around the text "Net manage"). The line connection "Products" to "Display" is shown as yellow.

4.3 Launching IRIS Applications from IRISnet

IRISnet provides a convenient way to launch applications either on your workstation or remotely over the network. These are described below.

Launching the IRIS Client Menus and Manuals



To start the IRIS Client Menus, simply double-click the icon labelled "Iris" (the radar conductor). These menus run locally on your workstation and allow you to connect to any workstation on the network. These menus are described in detail in this manual, which you can also read online by double-clicking the icon labelled "manuals".

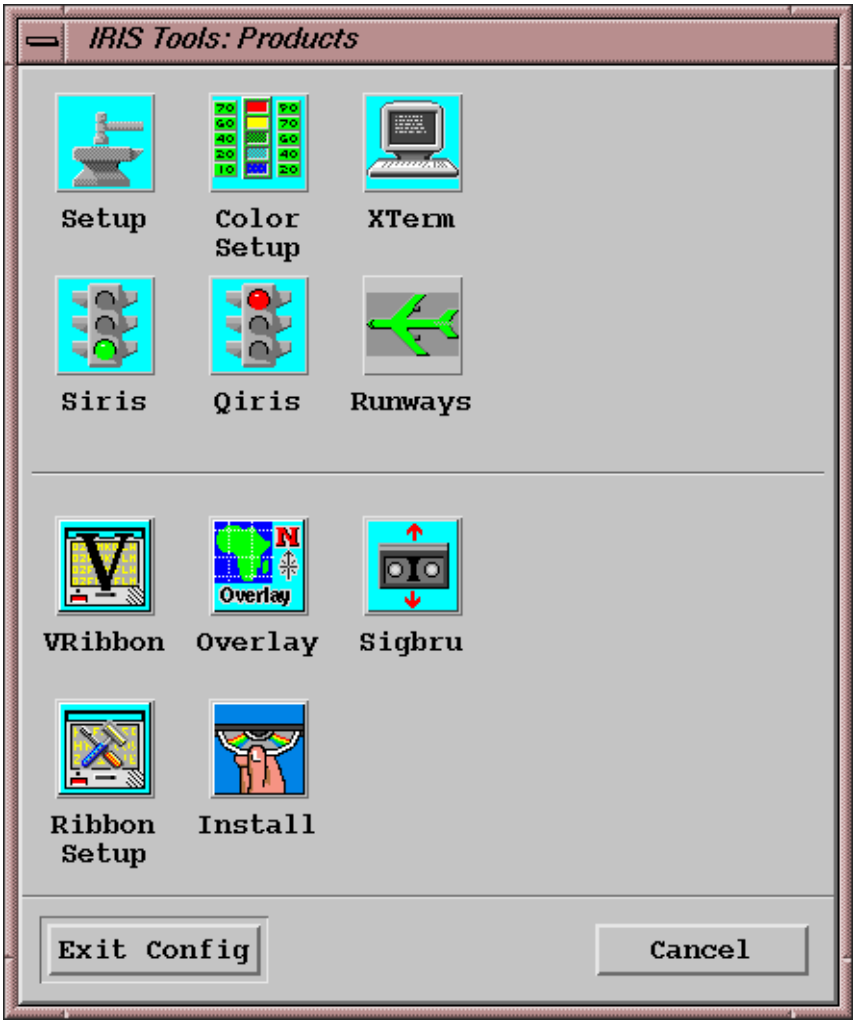
IRIS Tools Window for Easy Remote System Access

Double click on a network node icon to pop–up the IRIS tools menu for that node as shown in the example above. This provides convenient remote access to the major IRIS functions:

- **Setup**– the major configuration utility in IRIS (see *IRIS Utilities Manual*).
- **Color Setup**– to configure the IRIS color scales (see *IRIS Utilities Manual*).

- **Siris and qiris**– to start and stop the main IRIS server program.
- **Utilities**– to start the graphical utilities menu (see *IRIS Utilities Manual*).
- **Overlay** – to edit your background maps (see *IRIS Utilities Manual*).
- **Real–time Display** – to see an instant radar display.
- **Xterm**– starts a remote "sigterm" X-terminal. This terminal knows about the IRIS profile and there is no need to type the "export DISPLAY" command to run an application so that the display appears on your workstation– sigterm does this automatically.
- **Sigaudio** – to control the Iris sound features
- **Install** – to copy IRIS software from one node to another.
- **Sigbru** – to perform tape backup/restore operations.
- **VRibbon** – for optional IRIS/TDWR Option (see *Appendix E*).
- **Runways** – for optional IRIS/TDWR Option (see *Appendix E*).
- **Ribbon setup** – for optional IRIS/TDWR Option (see *Appendix E*).

Configuring the tools

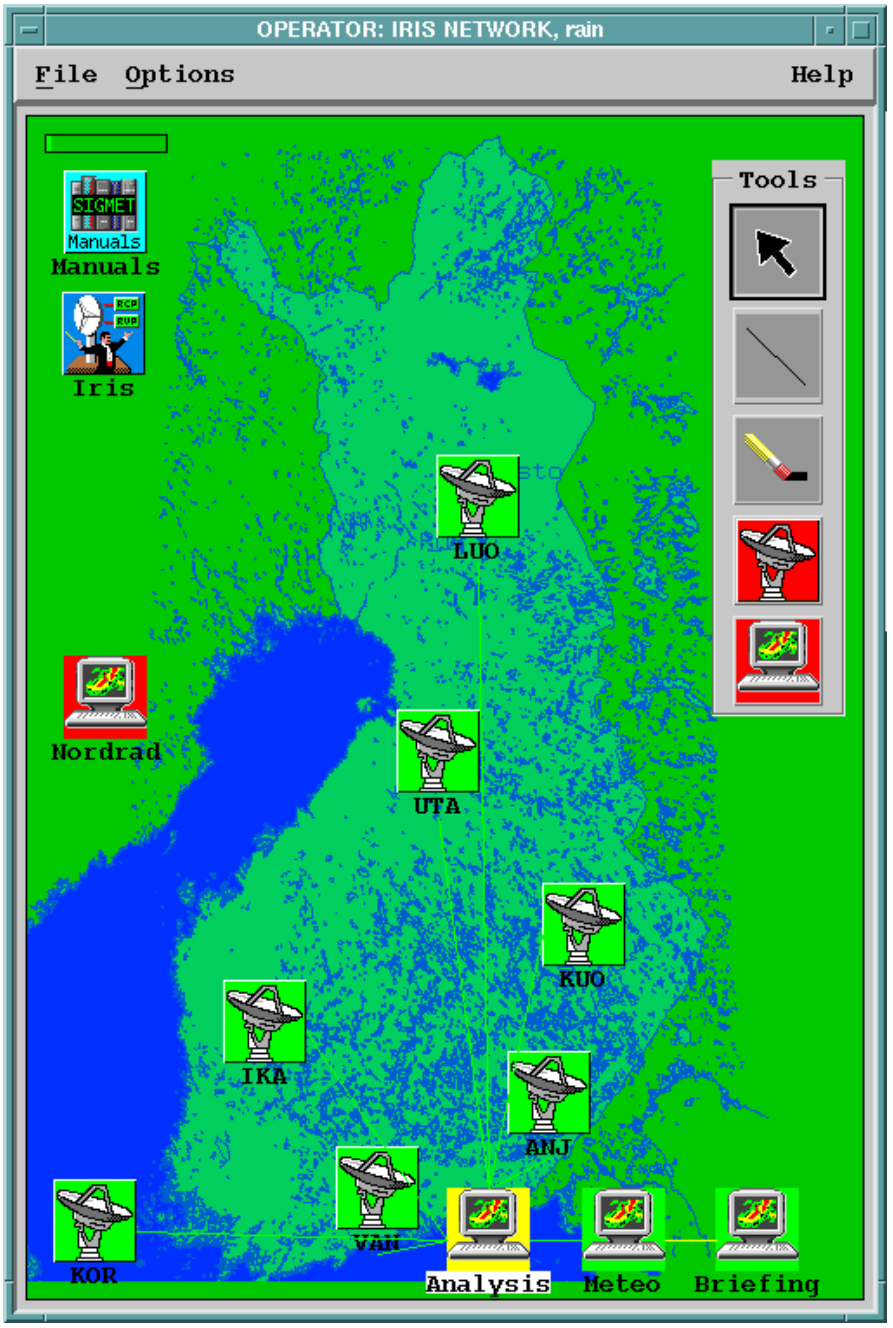


In the tools menu, click "Config" to see a full list of the tools. The top part shows the active tools selected for the site, while the bottom part shows inactive tools (not selected). If you need one of the inactive tools, simply select it by clicking and it will move up to the active portion of the tools menu. You can de-select a tool by clicking it to move it down to the inactive tools.

Status menu

When you launch an application, you will often get a Status menu to show you the progress of the application. For example, when you launch **siris**, the Status menu will give you all of the messages associated with starting the IRIS software. You can cancel the status menu at any time by clicking the **Cancel** button. This will not effect the application that you started. If you want to see the Status menu to review something, you can click **Options**–>**Status Menu**. If it is blank, then there are no status messages yet.

4.4 IRISnet Drawing Tools



NOTE	You must have operator privilege to change the IRISnet menu.

IRISnet has drawing tools so that you can easily draw your network block diagram and save it. First, you should collect information from you system manager concerning the names of network nodes and what nodes are running IRIS, etc.

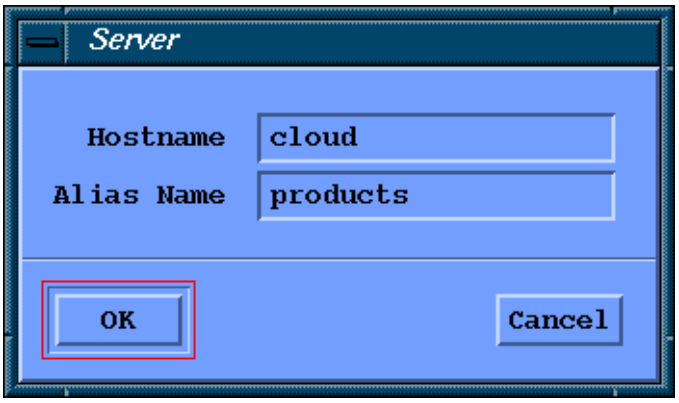
Starting the drawing tools

To select the drawing tools click **Options**–>**Tools**. The **left** or **right** determines if the tool bar is displayed on the left side or the right side of IRISnet so that you don't cover a section where you want to draw. An example is shown in the figure above with tools placed to the right.

Adding new nodes

To add a node, click the tool icon for either a radar site icon or an analysis/ display site icon. Now move your cursor (which has changed to a ghost of the icon) into the menu and click to plant the icon. You can click and drag an icon to position it (dragging is only available if the tool bar is displayed).

Naming and Re–Naming Network Nodes



To start naming, set the Tools off. To name a node, double-click on the node name field at the bottom of the icon. The menu labelled "Server" will appear as shown above. The "Hostname" should be the name that is recognized by the network (as assigned by your network manager). The "Alias Name" is anything the name that will appear on the icon in IRISnet.

NOTE We recommend that you set the Alias Name to be something logical like a radar location or a workstation function. It is best if the host name is the same. Note that you can alias hostnames as well in the Unix network configuration. Check with your network manager if you want to alias an un-friendly hostname such as xnrf0327 (this is almost as bad as an IP address) to something more recognizable such as BOS_Radar.

Adding Network Link Lines

To connect the network nodes, click on the line drawing tool and then click on a node attachment point. There are four attachment points on a node icon– one each centered on each side. Next drag the line over to the

attachment point on another icon and release the mouse. If you miss you will need to re–click the line tool and try again.

Erasing Mistakes

If you make a mistake or simply want to remove a node or a line, click the eraser tool and then click the object that you want to delete. When you are in erase mode, the cursor shape show a universally recognized warning symbol to caution you that the next click of the mouse will erase the nearest object.

Shifting Node Positions (rubber–banding)

Another editing feature is that after you have made connections among the various nodes, you can still move things around. The node lines will "rubber–band".

Save Your Work Periodically

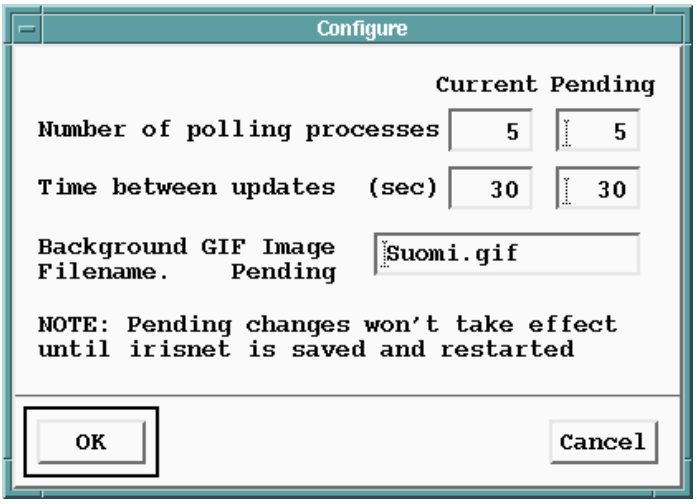
As with any drawing utility, it is always good practice to click **File**–>**Save** periodically so that you save your progress.

Using a background image

IRIS provides you tools to tailor your control display with a background image. This is why the **overlay** utility (see *IRIS Utilities manual*) has a Save as .gif–option.

- *Preparing the background:* For background image, edit a pretty map with the **overlay** utility. Save it as a gif. Or, select another GIF/image, e.g., a photograph of your headquarters (so you can show at which floor each computer is located). The **overlay** utility stores the gif automatically in the /usr/sigmet/config/images directory. You might want to edit the gif image with graphic tools such as xv or xpaint. It sometimes is a good idea to draw a grey box to represent the headquarters, or other site with several computers.
- *Importing image to IRISnet:* Select the gif file you want to use as IRISnet background, from the IRISnet –> options –> Config menu. Note that the image isn't shown before you save and restart irisnet. So save and restart.
- *Setting the icons:* Then move the radar and computer icons around the map so that each site is approximately at its geographical location. Note, that you can also monitor other computers in your network, even if they are not running IRIS. They are shown as red or yellow, indicating if they are connected to network.

4.5 IRISnet Options–>Config



At the Options –> Configuration menu you can change the polling scheme of your IRISnet. This is something you typically do not have to do. You mainly need this menu to set the background image for your IRISnet.

Number of polling processes:

This is the number of background processes that wakeup after a specified number of seconds (Time between updates) and check the state of the IRIS's that are displayed in irisnet. If an IRIS computer is taken out of the IRIS network, but IRISnet still shows the computer, the polling process that was checking the removed computer will hang for a 2 minute timeout. This leaves one less polling process for checking IRIS status.

The min number of polling processes is 2, and the max is 15. Typical is 5. The key thing to remember here is, once an iris computer is removed from the iris network, but the computer is still shown in IRISnet, a polling process will hang for 2 minutes so it is possible to "hang" **irisnet** in the event that the entire network goes down and all polling processes are in timeout.

Time between updates (sec):

This is the time in seconds the polling processes will sleep. Once they wakeup they check the status of the IRIS's in the irisnet and then sleep again. The min time between updates in seconds is 15, and the max is 120. Typical is 30 seconds.

Background GIF Image Filename:

This is a gif image that can be used for **irisnet**'s background. The gif image MUST be located in directory ${IRIS_CONFIG}overlay. The Background GIF Image Filename must be the exact name of the image in the directory ${IRIS_CONFIG}overlay. If filename is left blank, then no image will be displayed.

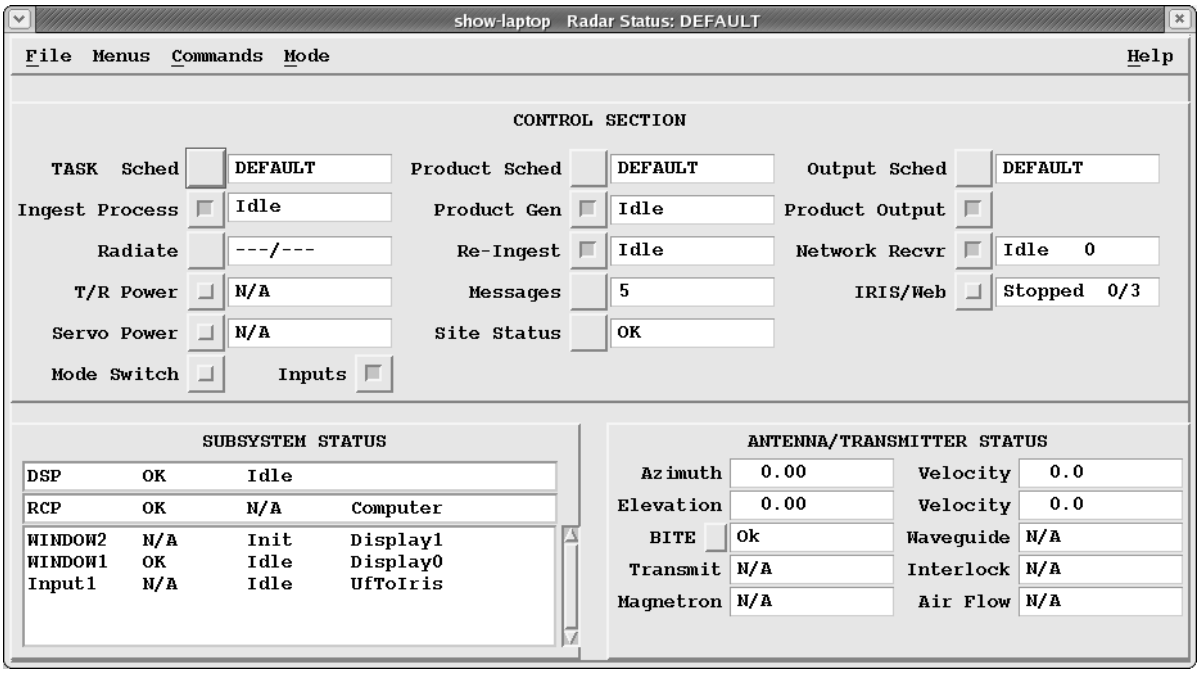
NOTE	NOTE: All values changed will be pending. Therefore the user must save, exit and then restart irisnet before they are valid.

CHAPTER 5

RADAR STATUS MENU

The Radar Status menu provides the primary mechanism for controlling and monitoring an IRIS radar or analysis system. The name assigned to the Radar Status Menu defines a complete mode of operation. Thus a mode of operation can be set-up and then captured by simply naming and saving the Radar Status Menu. Because it involves real-time processes, the Radar Status menu is an operator menu. Note, however, that anyone may view the menu.

5.1 Radar Status Menu

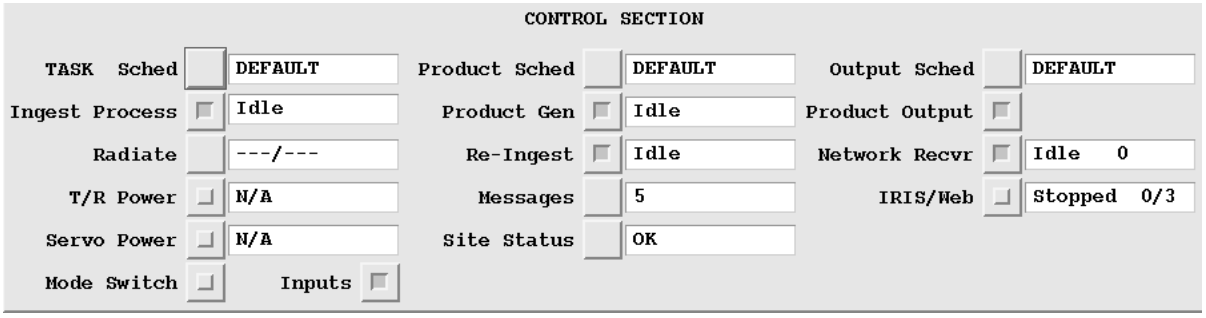


To start the Radar Status Menu

Choose **Menus**–>**Radar Status** from the IRIS menu bar or from any of the IRIS menus. When IRIS starts, the IRIS configuration named DEFAULT is loaded.

Control Section	Contains all the major switches and status for IRIS operation. The IRIS configuration can be loaded or saved from the environment. Individual software processes may be turned on and off.
Subsystem Status	For display only. This section of the window shows the status of the various devices connected to IRIS. The exact display depends on the devices purchased for a particular system.
Antenna and Transmitter Status	Displays the status for the antenna, transmitter and BITE systems, including antenna position and velocity.

5.1.1 Control Section



CAUTION Set the DEFAULT IRIS configuration so Radiate and Antenna Servo Power are off if there is a possible hazard to personnel when IRIS starts.

The control section of the menu shows the various configuration files that are active. It contains all of the control features for starting and stopping the major IRIS processes. It also provides control for the radar transmitter and allows you to perform device resets for selected equipment.

TASK Schedule

This field determines which TASK schedule is run. You can click on the button to pop up a list of available TASKS or enter the name of a schedule directly into the field.

Ingest Process

The Ingest Process field provides control and status for the software that runs the radar system and creates ingest files. Toggle this button on to start the radar process; toggle the button off to stop the antenna.

NOTE The Ingest Process Button, when toggled off/on, effects the Signal Processor and Radar Control Processor as follows.

1. RCP will be reset. This is a convenient way of resetting from a shutdown. Note that this will also cause the RCP reset output line to toggle, which may be configured to reset other equipment at the radar site.

2. The Signal Processor will take a noise sample before resuming data collection. This is a convenient way of forcing a noise sample.

The text area to the right of the toggle button shows the status of the radar process. The possible entries are:

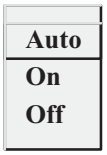
Running The current TASK is running normally.

Idle No TASK is running, but the radar process is ready to run TASKS. Either TASKS have not been scheduled, or it is not time for a scheduled TASK to run.

Stopped The radar process is off.

Radiate

This field controls the transmitter radiate. Click on the button and choose from the following pop-up menu:



Auto — For normal operation. IRIS turns the transmitter radiate on and off automatically. For example, if there is no TASK to be run for five minutes or more, IRIS temporarily turns the radiate off to preserve the life of the magnetron.

On — The transmitter radiate is on at all times during IRIS operation.

Off — The transmitter radiate is off at all times during IRIS operation. A warning message is generated if you run a TASK with Radiate turned off.

The Radiate status is reported as either "On" or "Off." See also the Antenna/Transmitter area of the menu, which provides additional information.

Transmitter/Receiver (T/R) Power

This toggle button controls power to the transmitter cabinet. The status is reported as either "On" or "Off." When power is turned off, the sensors for some of the Antenna/Transmitter status items do not function properly.

Servo Power

This switch turns the antenna servo drive power on and off. The status is reported as "On" or "Off."

Product Schedule

This field determines which product is generated. Click on the button to pop up a list of available products. Choose one from the list or enter the name directly into the field.

Product Generator

Toggles Product Generator process on and off. The status is shown as "Idle," "On," or "Off."

Reingest

The reingest process takes a RAW product file and makes ingest files, which can be processed to make products. There are three ways that the reingest process can be activated:

- Automatically, whenever a RAW product is restored from tape.
- Automatically, whenever a RAW product is received over the network.

The reingest process can be toggled on or off. The status is displayed as either "Idle," "Running," or "Stopped."

NORDRAD

If your system is licensed to receive product output from the Nordic Radar Network System (NORDRAD), this button lets you turn NORDRAD on and off, and the field shows the status of the receive process as either "Running," "Idle," or "Stopped."

Messages

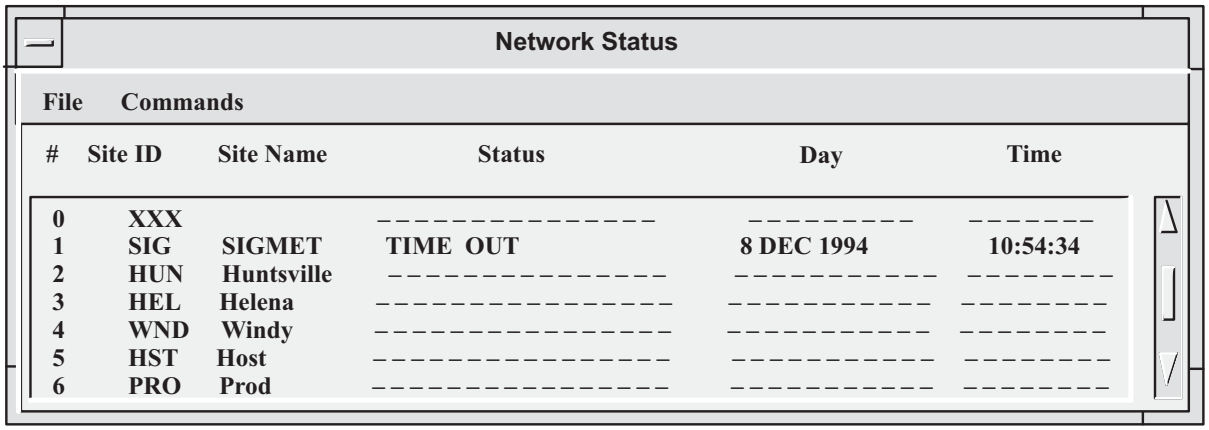
Pressing this button opens the Message Summary menu, described in Chapter 6, Handling Errors, on page 71. When you exit from the Message Summary menu, you return to the Radar Status menu.

Site Status

The Site Status menu gets its information from Status products that are either received over the network or made locally. These are made automatically at each radar site on a fixed schedule (for example, every 10 minutes) as set in the setup/product utility (see the *IRIS Utilities Manual*). The Status product can then be sent automatically over the network via the Product Output Menu. For example in a radar network, each radar may send routine status products to a central maintenance facility.

If there is a fault in a Status product, or if a Status product fails to arrive in the expected time, this field turns red and shows the ID of the site where the problem occurred. If more than one site has encountered a fault or time out, the field displays the ID of the first site in the list that experienced the problem.

Clicking on the button next to the field pops up a menu showing all sites and their status.



Output Schedule

This field indicates which product is output to a display device. Click on the button to pop up a list of available products.

Product Output

This toggle button controls whether products can be output to various display devices or tape. It is a convenient way to stop all output to all users if a problem develops. This field does not display any status.

If you are configured for network operation to another computer, it is sometimes necessary to toggle the Product Output button off and on to reestablish the network output after a network connection has been broken.

Network Receiver

If your system is licensed to receive product output from another IRIS host or workstation, this field shows the status of the receive process, as either "Running," "Idle," or "Stopped."

The field also displays the number of IRIS systems to which you are connected. If the number is "0," you are not currently connected. The other computer may not be running IRIS or the connection may be broken. You can toggle this field on and off to attempt to reestablish a broken connection. Check with your system manager if you are uncertain.

IRIS/WEB

If your system is licensed as an IRIS/Web server, this field shows the status of the server process, as either "Running," "Idle," or "Stopped." The information next to the server status shows how many clients are currently connected and the maximum allowed. This is configured from the Web section on **setup**.

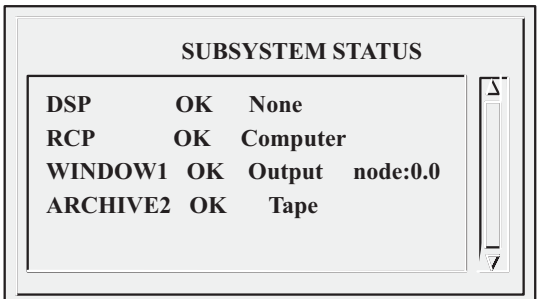
Mode Switch

When this button is pressed in, automatic reconfiguration is allowed, that is, IRIS automatically changes the configuration in response to a warning product. Use the Automatic Mode Switch menu to define the warning products to check and the configurations to load in the event of a warning. (See 5.4 Switching IRIS Configurations Automatically on page 68 for a description of the Automatic Mode Switch menu.)

Inputs

IRIS input process can be polling directories looking for arriving files. This is configured from the Input section on **setup**. The inputs switch turns the inputs on/off.

5.1.2 Subsystem Status



This area of the menu displays the status of the various subsystem devices connected to IRIS. The contents vary from system to system. The specific entries depend to some extent on the hardware options that have been purchased with the system.

Use the **setup** utility to configure the devices that appear in this area of the menu.

Depending on the device, the status is obtained from self-tests invoked when the Radar process is started and/or from Watchdog process that monitor the device during normal operations. Status information is displayed with an additional status message. "NA" (not available) indicates that a device has not been installed.

RCP (Radar Control Processor)

Radar Control Processor (RCP) may be either "OK" or "Error," and it may be set to either "Computer" or "Local" control by a switch at the radar site (typically on the radar console).

NOTE	Important: The RCP must be set to "Computer" control for IRIS operation. "Local" control is for maintenance purposes only.

DSP (Doppler Signal Processor)

This may be either an RVP7 or RVP8 signal processor. Status may be either "OK" or "Error," with an additional message if a problem occurs.

Window1 (X-Window Displays)

This entry shows the status of any X-window displays. The windows are usually on the local IRIS host, but the display can be exported to another display on the LAN.

The status information may show "OK" or "Error." When the window is successfully created, the node name is also displayed. When the status is "Error," the window X-device may be off. Check that the workstation is on and properly booted, then toggle the product output off/on to restart things.

Network1 *Node Name* **(Network Output)**

This entry shows the status of the network output process. That is output to another network computer that is running IRIS, or output through a convertor pipe to a disk file in a different format.

The first few letters of the target node name are displayed to the right. If the status shows "Up Init," you are not connected. IRIS tries to reestablish a connection every minute. If it does not, toggle the Product Output button off and on to reestablish the connection. If you cannot get a connection, either the other IRIS is not running on the other computer, or the network has failed. Leave the IRIS menu and check to see if the other node is up. If the target node is up and you are authorized to do so, log on to the node, see if IRIS is running, and start it, if necessary.

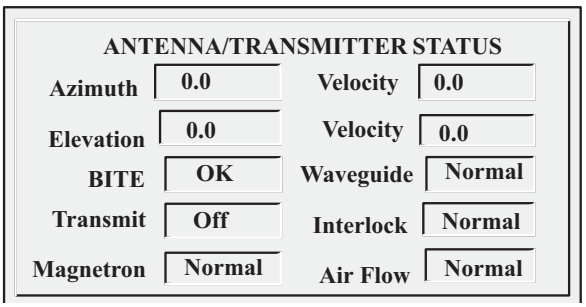
Archive2

You can have many archive drives on the system. These are either tapes, DVDs, or simply large disks. The status is reported as "OK" or "Error," with an additional message to show the activity of the drive.

Printer1

You can configure IRIS to support automatic output to your system's Postscript printers. The status is reported as either "OK" or "Error," with an additional message to show the activity of the printer. The message shows either "Running" or "Free" (the device is available for system-wide use, not just IRIS).

5.1.3 Antenna/Transmitter Status



This area of the menu provides read-outs for the status reports typically available from the radar system built-in test equipment (BITE). The Setup utility configures the information displayed in this portion of the menu.

Azimuth and Elevation Antenna Position and Velocity

These fields show the position and speed of the antenna. For the sign of the velocity, clockwise and upward motion are taken as positive, while counterclockwise or downward motion are taken as negative. Antenna speeds are given in RPM.

Transmit

This entry shows the status of the transmitter as one of:

Not Ready	The transmitter is still warming up.
Standby	The transmitter is ready to transmit, but has not been set to radiate via the Radiate button.
Radiate	The transmitter is radiating.

See also the description of the Radiate button.

Safety Parameters

These entries display the status of various safety and monitoring parameters reported by the radar built-in test equipment. The specific reports depend on the installation, but typical examples are summarized below:

Air Flow	Shows whether the cooling air flow in the transmitter cabinet is "Normal" or "Fault."
Interlock	Shows whether a safety interlock on a high voltage cabinet door is "Normal" (door closed) or "Fault" (door open).
Magnetron	Shows the magnetron current as "Normal" or "Fault."
Waveguide	Shows the waveguide pressure as "Normal" or "Fault."
BITE	Shows "OK" or "Fault" for the optional BITE unit.

If a fault is indicated, check the separate **bitex** utility described in the *IRIS Utilities Manual*.

Fault alarms sent to IRISnet

The fault indicator in IRISnet (red or yellow X) reflects the state of the Radar Status Menu on a host. Basically, a red field in Radar status menu

causes a cross indicator to the IRISnet icon. The cross is red for critical alarms, and yellow for non critical ones.

There is one important exception: the Site Status field of radar status menu is not indicated in IRISnet. Since Site Status reflects other sites, it would be very confusing if a fault in Site A caused an IRISnet Red X on site B just because site B was receiving status products from A. A local fault can also cause the site status to go red, but that fault will be indicated somewhere else in the Radar Status Menu so there is no need for IRISnet to check the Site Status field.

Some faults can be set to critical/non critical by user. Examples of Critical and non–critical faults are:

- Radar, Product Generator or Output Processes turned–off (buttons at the top). These are always critical.
- DSP or RCP communication error (Sub system status fields). These are always critical.
- Antenna/Transmitter Status: BITE (configurable in **BITEX** to be null, critical or non–critical)
- Antenna/Transmitter Status: Air Flow, Waveguide, Interlock, Magnetron (configurable in **setup/rcp** to be critical or non–critical).

5.2 Running IRIS from the Radar Status Menu

Using the Radar Status menu, you can completely reconfigure and run IRIS with only a few keystrokes, as follows:

1. After IRIS is started, choose **Menus**–>**Radar Status** from the IRIS menu bar.

   Choose **File**–>**Open** and select a configuration file from the list. If you get the message, "IRIS is active," turn off the IRIS Radar and Product Processes and try again.

   The DEFAULT configuration is automatically loaded when IRIS first starts, and it should be configured to be either a benign, non-operating state, or the desired working state.

CAUTION	Safety precaution: Do not set the DEFAULT IRIS configuration for the Radiate switch to come up as "On" or "Auto" if it could represent a hazard to personnel. For installations where this could be a problem, create a DEFAULT file which starts the radar with Radiate and Antenna Servo off, so the antenna does not start scanning automatically when the IRIS command is issued.

2. Check the status of the various devices to make sure all subsystems are functioning normally. In particular, check that the RCP status is "Computer" and not "Local." If "Local" is shown, set the mode switch on the radar console so IRIS can control the system.
3. Verify that the Radar Process, Product Generator and Product Formatter are turned on. The real time display can be toggled on or off, as required.
4. Toggle the T/R Power and Servo Power buttons on, and set Radiate to "Auto" or "On," as required. Remember that "Auto" allows IRIS to automatically turn the transmitter off when the system is idle.

If TASKS are scheduled and one is running, the Radar Process shows the name of the active TASK, and the antenna speed and position indicators show that the antenna is moving. At this point, you may schedule additional TASKS or products.

5.3 Mode Switching in IRIS

Mode switching is very complicated because there are lots of different possible configurations. There are five different types. This section explains their uses and interactions.

5.3.1 Manual Mode Switching

Manual mode switching is accomplished by using the Radar Status Menu to load a new configuration. It not available if either the RCP Mode Switching or the Socket Mode Switching are enabled, and that source is forcing the mode.

5.3.2 RCP Mode Switching

RCP mode switching is accomplished by allowing the RCP to control the mode of the system. It is only applicable to a Radar system. This is normally used for switching between redundant systems due to fault detection. While the RCP Mode Switching is enabled in IRIS, then Socket Mode Switching and Status Product Mode switching are not available. Note that the RCP has two choices: 1) It can force the mode to switch. This disables all other choices, so Manual Mode Switching and Automatic Mode Switching are disabled. 2) It can enable enable the other choices. Note that in RCP Mode Switching, the Automatic Modes Switching Button is controlled only by the RCP.

5.3.3 Socket Mode Switching

Socket mode switching is similar to RCP Mode Switching. In this case, modes are supplied by a socket message. It is only available when the RCP Mode Switching is disabled. This is normally used when you wish to mode switch based on input from another software system. Note that the RCP has two choices: 1) It can force the mode to switch. This disables all other choices, so Manual Mode Switching, Automatic Mode Switching, and Status Product Mode Switching are disabled. 2) It can enable enable the other choices. Note that in Socket Mode Switching, the Automatic Mode Switching Button is controlled only by the socket.

5.3.4 Status Product Mode Switching

Status Product Mode Switching allows a system to slave its configuration to a master system based on the status products from that master. Each time a status product arrives from that other system, the mode is forced to match. This is used as part of a passive IRIS system, or to slave a RPG computer to a RDA computer in redundant systems. Between times, the user can change modes through Manual Mode Switching or Automatic Mode Switching.

5.3.5 Automatic Mode Switching

In Automatic Mode Switching, mode transitions can be controlled by warning products. This is used to change modes based on weather. Between times, the user can change modes through other types of mode switching.

5.3.6 Automatic Mode Switching Button

This button is used to turn on/off the Automatic Mode Switching. It is not under user control if we have RCP Mode Switching or Socket Mode Switching enabled.

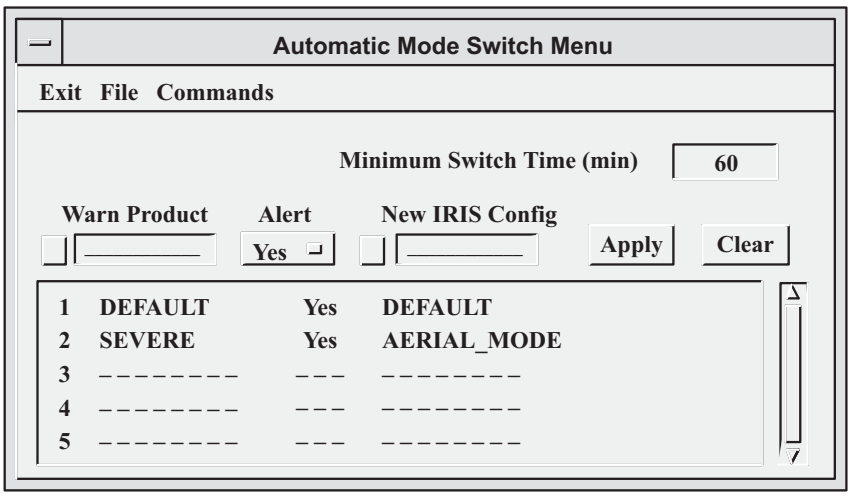
5.4 Switching IRIS Configurations Automatically

You can define up to 16 situations in which the IRIS configuration is automatically switched. For example, you may want to switch configurations automatically when a wind shear is detected. Because configurations can also be switched when a warning is absent, you can define the conditions under which to automatically switch back to a default

configuration. A series of warning products can be chained together, triggering a series of actions, each requiring a different configuration.

To define a series of automatic mode switches:

1. Pop up the Automatic Mode Switch menu, by choosing **Mode**–>**Auto Mode Switch** from the Radar Status menu bar.



2. Enter the information into the fields, as follows:

   Minimum Switch Time — Enter the number of minutes that must pass before the configuration can switch again.

   Warn Product — Enter the name of a warning product directly into this field, or pop up a list of products to choose from. When this warning is encountered (or when it is absent) the IRIS configuration switches automatically.

   Alert — Set the Alert field to "Yes" if the configuration should switch when the warning is encountered; set it to "No" if the configuration should switch when the warning is absent.

   New IRIS Config — Enter the name of a configuration directly into the field, or pop up a list of configurations to choose from. This configuration is loaded into the Radar Status menu when the warning condition is met.

3. Click on the Apply button to add the definition to the list; click on Clear to erase the fields and start again.
4. Repeat Steps 2 and 3 for up to 16 warnings. If at any time you want to discard your definitions, choose **File**–>**Reload** from the pull-down menu. This loads the most recently saved definitions.
5. When you are satisfied, save the definitions by choosing **File**–>**Save** from the pull-down menu.

To enable automatic mode switching:

You can turn automatic mode switching on and off from the Radar Status menu. Press the Auto Mode button in to enable automatic switching, or press it out to disable this feature.

To change or delete a definition:

1. In the Automatic Mode Switch menu, select a definition from the list. Its warning and configuration names are displayed in the fields above the list.
2. Enter a new warning product or configuration name if you want to change the definition.

   Set the Alert field to "- - -" if you want to delete the definition.
3. Click on the Apply button to make the change or deletion.

CHAPTER 6
HANDLING ERRORS

When running IRIS, you may occasionally encounter errors of one kind or another — mistakes that you make, such as trying to enter an IRIS menu before connecting to a server, or errors in the IRIS software. Whenever possible, IRIS tries to tell you how to fix user errors. Usually, you can proceed with only minor interruptions. Software errors are more difficult to fix. If you run into this kind of error, you must contact Vaisala for assistance. The more information you can provide, the better. It will help the software engineers track down and fix the problem more quickly.

Whenever an error occurs, IRIS takes the following actions:

- It displays a message in the IRIS Message menu. The message can help you determine the cause of the error, and it can suggest ways to fix the error.
- It adds the message to the Message List menu, including additional information about the cause of the error. This information is useful if you need to report a software error. Because the list spans IRIS sessions, it can also serve as a history of IRIS usage.

The IRIS Message menu pops up whenever an error occurs. You must take some action to dismiss it and continue running IRIS. The Message List menu is like the other IRIS menus.

To enter the Message List menu:

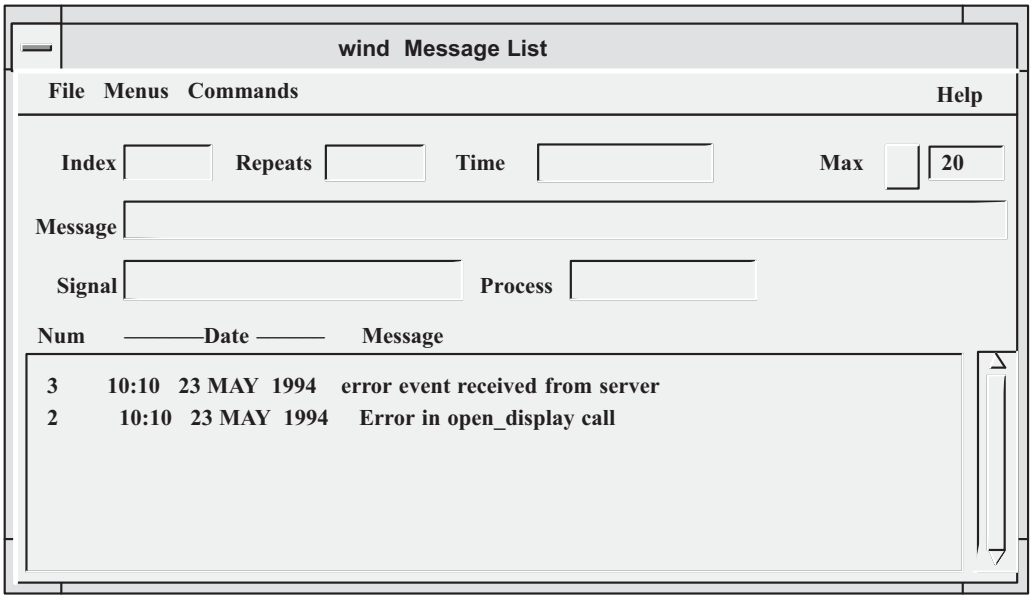
Choose **Menus**–>**Message Summary** from the IRIS menu bar or from any of the IRIS menus. You can also enter the Message List menu by clicking on the Messages button in the control section of the Radar Status menu.

6.1 IRIS Message Popup

The text of the message is displayed at the top of the menu. To dismiss the menu, you must click on one of the following buttons:

- **OK** — The OK button dismisses the Message menu so that you can proceed with IRIS operations.
- **Cancel** — The Cancel button also dismisses the Message menu so that you can proceed with IRIS operations.
- **Help** — The text of the message may provide enough information to help you fix the problem. However, if you need additional information, click on the Help button. The help text gives possible reasons why the error occurred and suggests actions you can take to correct it.

6.2 Message List Menu



The Message List menu is divided into the following areas:

Message Summary	Contains information about the cause of the error, such as the signal that was generated and the code module that handled the error.
Message List	Contains a list of the messages, in chronological order with no duplicates.

When you first enter the Message List menu, the fields in the message summary area are blank. To display summary information about a particular message, highlight the message in the list. IRIS then fills in the summary information.

Index

Every message is assigned a number in the order in which it occurred. The Index field shows the number of the latest occurrence of this message.

Repeats

The Repeats field shows the number of times the message has occurred.

Time

The Time field shows the time of the most recent occurrence of the message.

Max

The Max field lets you choose how many unique messages can appear in the list.

Message

The Message field contains the message text—the same text that is displayed in the Message menu.

Signal

Every error generates a signal, or error condition code, which is trapped and handled by IRIS. The Signal field shows the name of the the signal that was generated. This information is useful if you have to report a software error to Vaisala.

Process

The Process field shows the name of the code module that trapped and processed the error. This information is useful if you have to report a software error to Vaisala.

Num

The Num field shows the index number of the most recent occurrence of a message. To save space, duplicates are not included in the list.

Date

The date and time of the most recent occurrence of a message.

Message

This Message field also contains the message text.

6.3 Fixing Common Problems

The following common problems can arise when running IRIS. Here are some suggestions for fixing them.

6.3.1 Making Display Windows Appear

Displaying a product in a window on another workstation can present a range of problems:

- The other workstation may be turned off.
- The network may be turned off or disconnected, or the node may not exist.
- The user who is logged on may not authorize a display.

Because of limitations of the X-protocol, it is often impossible to distinguish these cases. For any problem that prevents the window from starting, IRIS signals the message,

```
OUTPUT, Error in open_display call.
```

The Radar Status menu also indicates "Error" and "Exit" next to the window process in question.

If the workstation is turned on and the network is up and running, you should check the user authorization of the display workstation. Go to the workstation where the window should appear and enter the following command at the operating system prompt:

```
xhost+
```

Return to the host computer and run the Restart IRIS utility by typing:

```
restart_iris
```

IRIS displays a series of messages as it tests each process and restarts any that have stopped.

CHAPTER 7
CONFIGURING RADAR TASKS

A radar TASK is a set of operating parameters for the radar antenna, transmitter, receiver and signal processing systems. The TASK Configuration menu allows you to create or modify radar TASKS. After configuring and saving a TASK, you use the TASK Scheduler menu to execute the TASK (see Chapter 8, Scheduling Radar Tasks, on page 105). The data acquired during the TASK are stored on disk as ingest files, which serve as the data base for subsequent product generation. Examples of TASKS include:

- A surveillance PPI scan at a single elevation angle.
- A complete volume scan at multiple elevation angles.
- A PPI sector scan at either single or multiple elevation angles.
- An RHI scan at either single or multiple azimuth angles.

In all cases, the TASK Configuration menu allows you to specify the antenna scanning, as well as other radar parameters, such as pulse width, PRF, number of samples to average and the type of data to process (Z, V, or W).

NOTE Hint: Appendix B, Task Configuration Example, on page 131 provides suggested TASK configurations to start from.

To enter the TASK Configuration menu:

Choose **Menus**–>**Task Configuration** from the IRIS menu bar or from any of the IRIS menus. You can also enter the TASK Configuration menu from the TASK Scheduler. Position the mouse cursor over a TASK name or ID, and choose –>**Edit** from the pop-up menu.

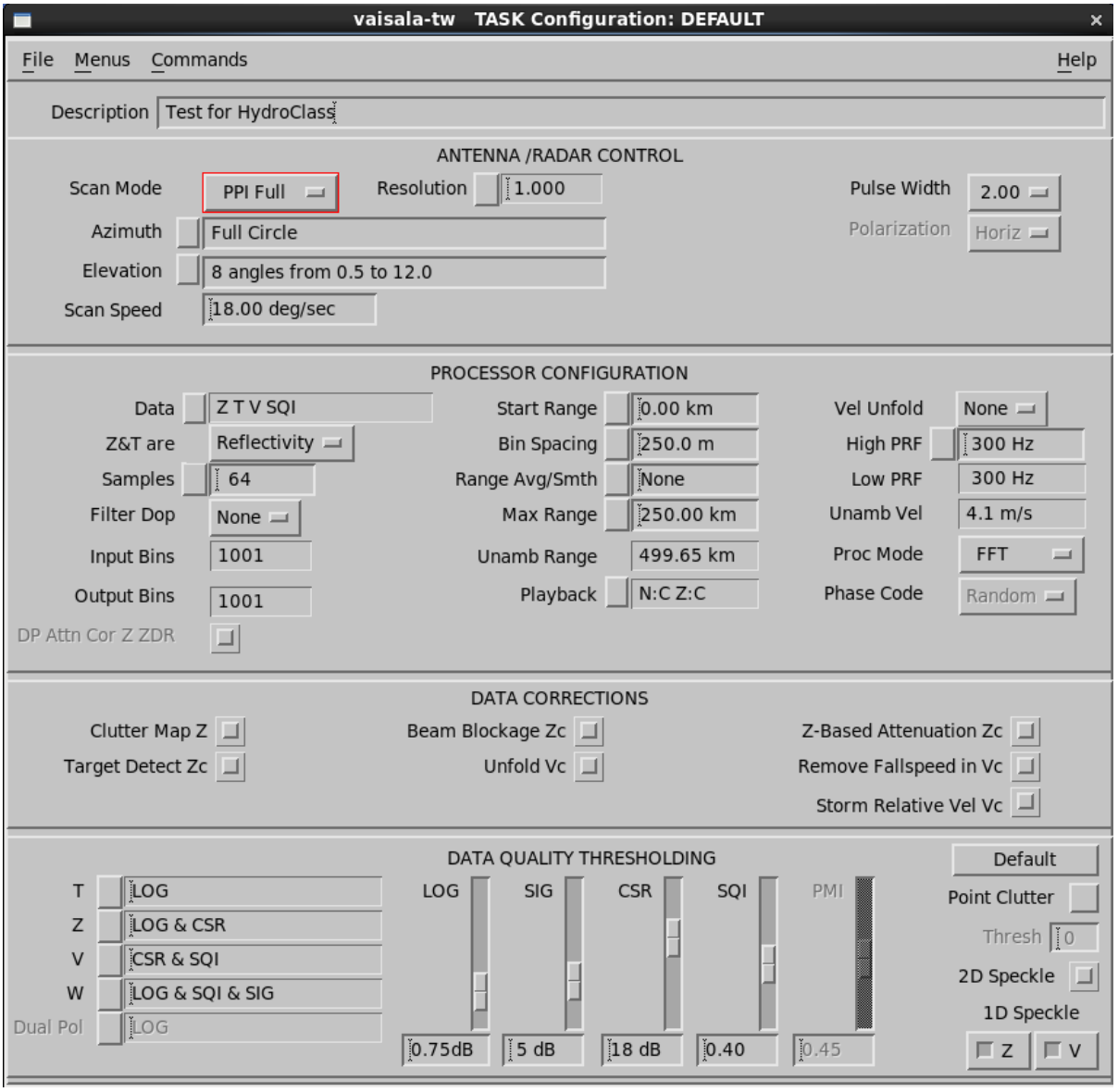
The TASK Configuration menu may be accessed by any user. Because it does not control any real time processes until a TASK is scheduled, more

than one copy of a TASK can be in use at any time. The only constraints are:

- If a TASK is scheduled, it cannot be modified.
- Only one user can edit a particular TASK at a time.

These constraints prevent possible conflicts among users.

7.1 TASK Configuration Menu



Antenna/Radar Control Sets up radar and antenna operations.

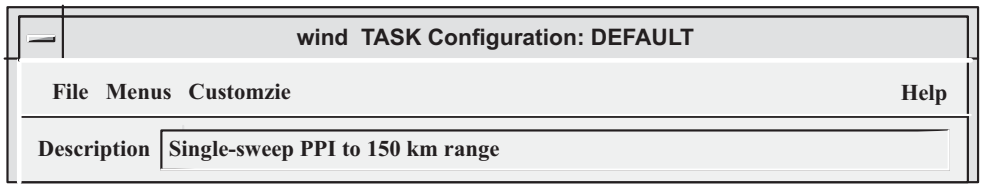
Processor Configuration Sets up the output data, ranges and averaging used by the signal processor.

Data Correction Determines corrections made from output data.

.

Data Quality Thresholding Sets up the threshold levels and criteria for real time data quality control.

7.1.1 TASK Names and Descriptions



TASK names make it easy to save and load configurations. You give the TASK its name when you save the TASK configuration. The TASK name is used extensively by IRIS, so it is a good idea to select a name that summarizes the task. For example:

PPI_VOL	Denotes a volume scan.
RHI_230	Denotes an RHI at azimuth 230.
SURV_500	Denotes a 500 km surveillance scan.
PPI_A	The first SUBTASK of a hybrid TASK (see below).

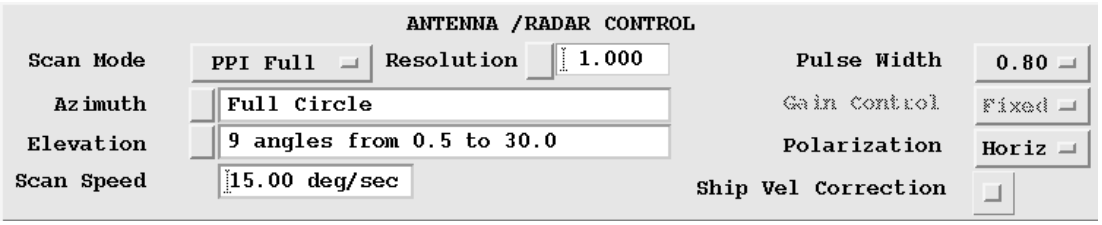
Up to 12 characters may be used for a TASK name. Because these names are also used to name the disk files that store the TASK configurations, no spaces are allowed. In the examples above, the underscore character is used instead of a space.

NOTE Helpful Hint: While not required, it is convenient to use the text "RHI" when naming an RHI TASK. This makes it easier to associate the RHI TASKS with the RHI products during product configuration.

The TASK Scheduler supports hybrid TASKS, which are made up of up to three SUBTASKS. The TASK configuration file names for these must end in _A, _B and _C to denote the first, second and third SUBTASKS. See Chapter 8, Scheduling Radar Tasks, on page 105 for information on scheduling hybrid TASKS.

The TASK description is a brief (less than 65 character) text description of the task. It is displayed as the first field in the TASK Configuration menu. You can enter any text into this field.

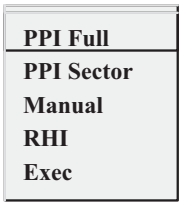
7.1.2 Antenna/Radar Control



The Antenna/Radar Control area of the menu sets up radar and antenna operations. From this portion of the menu, you control the TASKS and products that run.

Scan Mode

The Scan Mode button lets you choose one of the following modes:



PPI Full — The antenna scans continuously in azimuth without stopping during the TASK.

PPI Sector — The antenna starts and stops at azimuth boundaries that you specify.

Manual — You control the antenna while the real time display shows live weather updates.

RHI — The antenna scans in elevation at a specified azimuth.

Exec — Execute any shell command, see 7.3 Exec Tasks on page 103.

For PPI scans, IRIS holds the elevation constant and scans in azimuth. For RHI scans, IRIS holds the azimuth constant and scans in elevation between specified limits.

Manual scans are used for interactive real time applications, observation of tornado or microburst signatures.

Azimuth and Elevation

For the PPI Sector and RHI scans, it is necessary to specify start and stop limits for the swept antenna coordinate, and a list of discrete angles for the unswept coordinate. There is a duality between the PPI and RHI scans in that the lists and limits that apply in one case can be carried over to the other case by reversing the roles of azimuth and elevation.

To set up the antenna azimuth limits for a PPI Sector scan, the start and stop angles are entered by positioning the cursor on Azimuth field and typing the desired limits to the nearest whole or 1/10 degree. The sector is defined to be in the clockwise direction from the first limit to the second limit. For example:

Azimuth	90.0	270	Scans the southern half of the radar circle.
Azimuth	270.0	90.0	Scans the northern half of the radar circle.

For PPI Full scans, the Azimuth field shows "Full Circle."

For both Full and PPI Sector scans, you must enter the list of elevation angles to be used on successive sweeps. Click on the Elevation button to pop up a window containing up to 40 elevation angles. When you finish editing them, click first on the Apply button, then on the Exit button. (The Clear button erases the list of angles, if you want to start over.) After editing is complete, the menu entry shows the number of tilt angles that were specified and the minimum and maximum angles.

When a PPI Sector scan runs, the antenna scans back and fourth between the azimuth limits at a rate that achieves the requested azimuthal resolution between each processed ray. The first sweep of the scan is performed using the first elevation angle from the elevation list; the second sweep using the second angle, and so on. For PPI Full, the antenna scanning is continuous in azimuth.

For RHI scans, the set-up procedure is similar to the PPI Sector case, except that the start and stop limits are entered in the Elevation field, and the angle list is entered in the Azimuth field. Note that the elevation limits for RHI scans are constrained by the limits specified in the **setup** utility. (See the *IRIS Utilities Manual*.)

For manual scans, the Elevation and Azimuth fields show "NA." These fields are not applicable because the antenna is controlled interactively.

Resolution

The resolution is the required spacing between successive data rays in the scanned direction. For PPI's, specifying 1.0 degree resolution means that

for every degree of azimuth there is a new set of samples of, for example, the reflectivity at all ranges.

You can choose a resolution from a pop-up menu or enter the value directly into the field. For PPI's, the range is limit to between 0.352 and 2.000. For RHI scans, IRIS picks and displays the closest choice among 0.2, 0.4, 0.6, and 0.8. For manual scans, IRIS picks and displays the closest choice among 90, 180, 270, and 360, either continuous or non-continuous.

During PPI scanning, the antenna and signal processing are coordinated so that data are collected at the specified resolution interval. Sampling is the nearest N*(Resolution) starting with 0 degrees. For example, if the resolution is 1.0, then rays of data are collected at 0, 1, 2, ... degrees. The PPI antenna scan rate is adjusted automatically to scan as rapidly as possible to achieve the requested resolution. (Look at the Radar Status menu for a display of the scan rate that is actually achieved.)

The Resolution field has a somewhat different meaning for RHI scans, because the elevation angular velocity used for the scan is not constant. A fixed velocity would result in too much time being spent at high elevation angles where only the initial 20 km (or so) of the ray contains useful data. Likewise, too little height resolution would be obtained for low elevation angles and far ranges.

To compensate for these effects, the elevation velocity for RHI scans is a function of the elevation angle itself — the velocity increases as the angle increases. The resolution you select represents the desired angular ray spacing at zero degrees elevation. This generally corresponds to a small elevation velocity near zero degrees, but by the time the antenna reaches its zenith the elevation velocity is approximately ten times greater. The RHI velocity algorithm attempts to maintain constant distance spacing along the maximum range and height boundaries of the scan. This tends to produce a properly filled color display presentation of the data.

If you plan to use manual scanning at your site, configure a scan so that it is ready when the situation arises. Specify the number of rays of data that you want stored (up to 1024 angles or rays) and how long IRIS should continue to collect data, as follows:

Continuous	The manual scan continues indefinitely until it is halted manually in the TASK Scheduler. New rays overwrite the old ones on disk such that the maximum number of rays is fixed at the requested number.
Non-Continuous	The manual scan stops automatically after the prescribed number of rays has been collected.

In most cases, you probably want to use the continuous data collection option so that the TASK does not stop in the middle of your observation. For more information on running manual scans, see 8.4 Scheduling and Running Manual Scans on page 111.

Scan Speed

The scan speed of the antenna can be automatically computed by IRIS to match the sampling to the requested resolution, or the user can specify the scan speed. The selections are as follows:

Auto	Recommended for RHI scans. Enter the text Auto or 0 to have IRIS automatically match the scan speed to the requested resolution.
Numerical value degrees/sec	Enter the scan speed in degrees per second. Note that 6 deg/sec is 1 RPM, 12 deg/sec is 2 RPM, etc.

When testing a Task, use the Radar Status Menu to observe the actual scan rate. If you are in the Auto mode and the scan rate is not exactly what you want you can tune the scan rate by changing the various fields in the radar status menu and then retesting. To increase the scan rate in Auto mode you can do any of the following:

- Increase the PRF
- Decrease the number of Samples
- Decrease the scan Resolution

For additional fine tuning of the scan rate you can adjust the AZ and EL Scan Speed Multipliers. Refer to the setup/ingest utility in the *IRIS Utilities Manual*.

Pulse Width

Some systems support multiple pulse widths. The desired pulse width can be selected from a menu or entered directly into the field in microseconds (for example 1.0 microseconds). IRIS picks the closest available value. Typical systems support one or more of 0.50, 1.00, 2.00, and 6.00 (in microseconds).

The PRF is automatically reduced to the maximum permissible value if the new choice exceeds the duty cycle limit of the transmitter.

Gain Control

This field selects the type of gain control used to adjust the gain of the linear (Doppler) channel receiver. It is accessible for Doppler systems

only. The choices in the pop-up menu are only available for the RVP6 processor. The RVP7 does not require gain control.

The choices are:

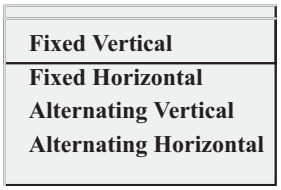
- **AGC** — Automatic gain control dynamically adjusts each sampling period (over the specified number of pulses) to match the receiver gain with the measured reflectivity vs. range.
- **STC** — A $1/R^2$ gain vs. range profile. This works to attenuate strong clutter targets at close range.
- **Fixed** — You specify the attenuation in dB. A new field appears to the right of the Gain Control field. Position the cursor at this field and enter the desired attenuation in dB (sign is ignored).

The optimal choice is the AGC approach because AGC adjusts the receiver gain at each range for the echo that is actually measured.

Fixed @00.0 is typically used if the radar is configured with IF limiting. Otherwise, STC should be used to reduce the effects of strong clutter at close range. Note that with STC, the gain is typically set to full after the first 50 km. (See also the **stcwave** utility in the *IRIS Utilities Manual*.)

Polarization

This field is accessible for systems that have a polarization switch and the ZDR Option Package software and hardware. Polarization is chosen from a pop-up menu.



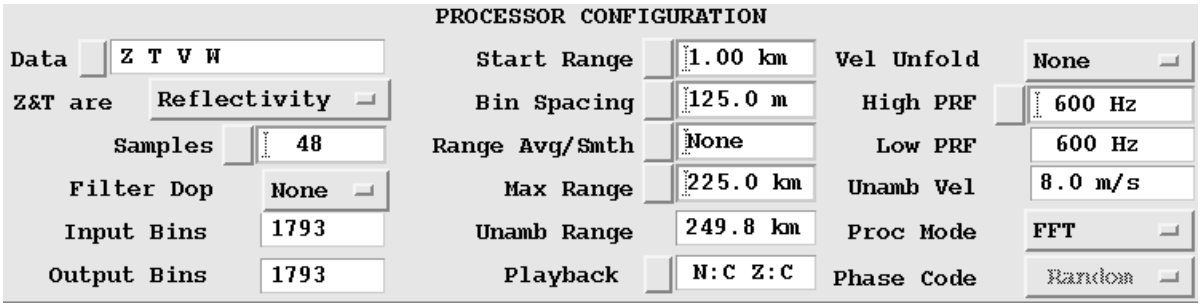
The polarization may be either fixed, as for a standard radar, or alternating between horizontal and vertical from pulse-to-pulse. When the polarization is fixed, you specify which polarization to use for sampling. Typically, horizontal is selected because of the slightly greater returned power from meteorological targets. In the case of alternating polarization, you still select the polarization required for the standard output parameters.

For a standard radar at fixed horizontal polarization, the field appears as "N/A."

Ship Velocity Correction

This button turns on/off a radial velocity correction to account for moving radar platforms. The velocity correction used in IRIS allows for two different types of ship motion sensing, an Inertial Navigation Unit (INU) or a Gyro System with GPS. Refer to the Appendix C, Passive IRIS Features, on page 141 in the *IRIS Product & Display Manual* for more information concerning this correction.

7.1.3 Processor Configuration



The Processor Configuration area of the menu lets you set up the output data, ranges and averaging used by the signal processor.

DSP Data

This field is used to select the types of data output by the signal processor and stored in the ingest files. Click on the DSP Data button to pop up a list of types. Naturally, you will only be shown data appropriate for you system, and it will only allow selection of data types for you task's configuration. You can also select here whether to record in 8-bit format or 16-bit.

Table 3 Data types available in Task Configurations

T	Total reflectivity (not clutter corrected)
Z	Reflectivity (clutter corrected)
Vel	Doppler mean velocity
Width	Doppler spectrum width
SQI	Signal Quality Index
ZDR	Differential reflectivity
KDP	Specific differential phase
PhiDP	Differential phase
RhoHV	Cross channel correlation coefficient
Tv	Total reflectivity in vertical channel
Zv	Reflectivity in vertical channel
LDR*	Depolarization Ratio
Rho*	Cross channel correlation coefficient, when transmitting only one

Refer to the *Signal Processor User's Manual* for details on the algorithms that compute these parameters. You may select any combination of parameters from the menu. After your choices are made, exit from the menu, and the choices are displayed in the field.

If T (the uncorrected reflectivity) is the only selection, the signal processor operates in the intensity-only processing mode without performing any Doppler processing. This allows more range bins to be processed because of the lower processing difficulty. The number of parameters selected here affects directly to the size of your Ingest and Raw product files.

T&Z are

Here you can select whether T and Z are calibrated radar "Reflectivity" factors or simply the measured signal-to-noise ratio or "SNR". The Reflectivity choice is almost always the right one. SNR is used for diagnostic/troubleshooting purposes and for radar antennae with non-

standard beam patterns. Note that when SNR units are selected, the clutter correction is still applied to Z and not to T.

Samples

This field allows you to specify how many pulses are averaged (from 2 to 256, continuously selectable) to obtain the final estimates of the radar parameters for each ray. As a rule of thumb, approximately 40 samples are required to obtain acceptable averages and reliable clutter cancellation. In general, the number of samples should be as large as possible. The drawback is that the bigger number of samples is, the slower the antenna scan speed must be.

Filter Dop

These fields are used to specify a clutter filter type. There are eight filters available, including "no filter". Specify an integer between 0 and 7, where 0 is no filter.

See the *Signal Processor User's Guide*, which shows how to configure the clutter filters. Typically this is done so that filter 1 is the least aggressive and filter 7 is the most aggressive.

The selection of a clutter filter depends on the scan rate, antenna beamwidth and the operational objectives. In general, the narrower the filter the better, since a broad clutter filter has a greater adverse effect on the weather echoes. Some experimenting with the best combination of clutter filters and thresholds is usually required (see 7.2.1 Optimizing thresholds on page 99). By trying different clutter filters on a rainy day, and comparing Z and T (the corrected and uncorrected reflectivity) on the real time display, you can determine which filters best reduce the effects of clutter while doing the least damage to the weather. Be sure that when you optimize the Doppler filter, the CSR threshold is not used as the Z threshold criterion.

Aside from IRIS, the **ascope** utility can measure the actual width of clutter Doppler spectra as a function of the scan rate (which can be controlled via the **antenna** utility). This is the best way to determine the appropriate filter. (See *IRIS Utilities Manual*.)

Start Range

The Start Range field specifies the required range of the first data bin to the nearest 1/10 km. Usually this is set to 0.0 so that sampling starts at the closest possible range. However, when two TASKS are used to define a sampled volume, it is sometimes useful to have one TASK sample an inner range at a high PRF, and the other TASK sample an outer range at a low PRF.

Bin Spacing

The Bin Spacing field specifies the desired range resolution of the data. Selection is made by entering the desired value to the nearest meter or by choosing from a list of values. IRIS then picks and displays the allowable bin spacing that is closest to your choice. This depends on the processor, with a typical value of 125 meters.

For the RVP6, the minimum bin spacing (125 or 62.5 m) is selected in the **setup** RVP section and must match the internal configuration of the signal processor. Refer to the *IRIS Utilities Manual* and *RVP6 User's Manual* (TTY Non-Volatile Setups).

Range Averaging, Input Bins, and Output Bins

Range averaging means that the data obtained at the output bins is obtained by averaging two or more (16 max) input bins. The number of input bins is a display parameter.

The pop-up menu choices for range averaging are:

None — No range averaging. In this case the Input Bins and Output Bins fields are identical.

2 – **5** — Range averaging over 2 to 5 bins.

For "None," no range averaging is performed, and single-point sampling is done for each of the output bins. If 2 is selected, IRIS doubles the number of input bins by placing new bins halfway between each of the output bins, then averages two bins together to obtain each of the final output bins. For 3 bins, IRIS creates three times as many input bins as output bins. Data at each output bin is the result of averaging three equally spaced input bins. The total number of input bins is limited by your processor (3072 bins for RVP8, less for RVP7&6). If you specify a range average that results in greater than 3072 input bins, IRIS reduces the maximum range to be consistent with 3072 input bins.

Max Range

The Max Range field defines the maximum range in km of data collection. Whenever fields such as the PRF, Range Averaging or Bin Spacing are

changed, IRIS attempts to fill in range bins to the full unambiguous range. If this is successful, the Max Range field is equal to the unambiguous range. There are two limitations that sometimes cause the Max Range field to be less than the Unambiguous Range field:

Processing Speed	IRIS reduces the number of range bins (and hence Max Range) so that the average range bin spacing over the unambiguous interval is within the real time processing constraints of the processor. See the *Signal Processor User's Manual* for details.
Total Number of Range Bins	Limited to 2048. For a single-board RVP6, limited to 1024.

The Max Range field will turn red if it exceeds the unambiguous range. A Max Range that exceeds the unambiguous range is allowed for users using their own major processing mode. It is also useful to allow the Max Range to exceed the unambiguous range by 1 range bin to make the Max Range an even value, for example 150 km instead of 149.9 km. In all other cases data that exceeds the unambiguous range will be nulled so it is recommended for most users to keep the Max Range less than the unambiguous range.

Regarding the processing speed constraint, a rule of thumb is that the RVP6 can operate at a 375 m bin spacing for Doppler mode and 250 m bin spacing for reflectivity only mode for up to 1024 bins.

For example, at 500 Hz PRF, the unambiguous range is 300 km. The RVP6 can process no more than approximately 800 range bins of Doppler data over this interval. If you specify 250 m output bin spacing, IRIS reduces the max range to approximately 200 km, so that 800 bins are processed at 250 m resolution. You can further trim this range, if required, by entering a lower value. The max range can be extended by increasing the bin spacing so that the 300 range bins are spread over a wider range. The start range can be increased to provide a larger max range. Also, the start range can be increased so that the available number of bins can be placed at greater range.

Unambiguous Range

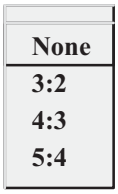
This is a display-only field. The unambiguous range is the maximum range for "first trip" echoes — the maximum range from which an echo can be received before the next pulse is issued. It is affected whenever the PRF is changed.

Playback

The Playback field is used to determine which noise floor and calibration level used by the RVP8 when playing recorded time series data. The possible options are to use the current noise floor and calibration level of the RVP8 or the values recorded in the time series. The Playback field will have no effect on the noise floor and calibration level of the RVP8 during normal operations.

Velocity Unfolding

For Doppler systems, this field determines whether dual PRF control and processing are performed. Pop-up menu choices are:



None — Single PRF operation with no velocity unfolding.

3:2 — Dual PRF with ratio of 3:2. This provides 2X velocity unfolding as compared to the unambiguous velocity for the larger PRF.

4:3 — Dual PRF with ratio of 4:3. This provides 3X velocity unfolding as compared to the unambiguous velocity for the larger PRF.

5:4 — Dual PRF with ratio of 5:4. This provides 4X velocity unfolding as compared to the unambiguous velocity for the larger PRF.

For more information on velocity unfolding, refer to the *Signal Processor User's Manual*. Note that IRIS does not permit dual PRF operation except when velocity is selected as an output parameter under Processed Data. The Unambiguous Velocity and the Low PRF are display fields on this menu. The High PRF is specified as described in the next section. For LOG-only systems, this selection is fixed at "None."

High PRF and Low PRF

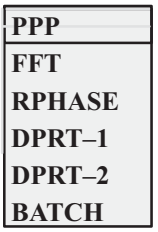
This is specified by entering the desired value to the nearest whole Hz, or by choosing one of the values from the pop-up menu. The computed Low PRF is displayed in the adjacent column (display only). The maximum and minimum values depend on the duty cycle limit of the transmitter for the selected pulse width. If you enter a PRF that exceeds either of these limits, IRIS inserts the limited value.

Unambiguous Velocity

This is a display-only field. It is effected whenever the High PRF or Velocity Unfolding fields are changed.

Major Mode

This field determines the processor mode. Choose from the following options:



PPP — Pulse pair processing.

FFT — Fast Fourier transform.

RPHASE — Random phase.

DPRT–1 — Dual PRT mode 1.

DPRT–2 — Dual PRT mode 2.

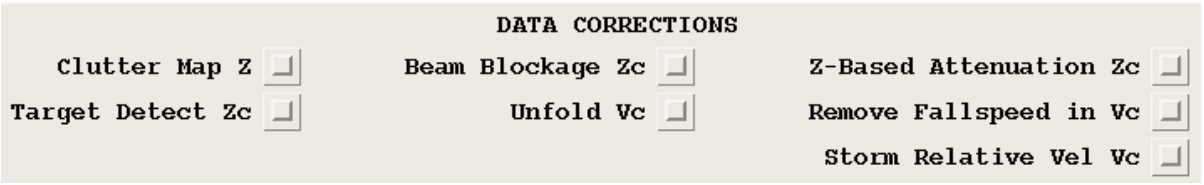
BATCH — Batch Mode Processing.

Phase Code

The transmission phase of a Magnetron transmitter is always random. For Klystron and TWT amplifier transmitters the phase of the transmission may be controlled using a phase shifter. This field allows the signal processor to specify the phase of each pulse.

"Fixed" is the legacy mode for Klystron and TWT amplifier transmitters. "Random" allows a Klystron or TWT amplifier to mimic the pulse phase of a Magnetron which is useful for second trip echo cancellation. "SZ 8/64" is a predetermined phase code algorithm which mitigates range ambiguities and allows for better recovery of weak 1^{st} trip spectral moment estimates which have been contaminated by stronger 2^{nd} trip estimates.

7.1.4 Data Corrections



Clutter Map Z

When no Doppler filtering is available, clutter mapping is one of the few tools to remove clutter. For a clutter map, you make a volume scan in a weather situation without any precipitation, thus representing typical clutter in your images. Then you tag this product as Clutter Map in the Ingest Summary Menu, and turn on this bit in the task configuration. It will modify the Z data to remove any signal weaker than the clutter scan. If the goal is removing clutter from the RAIN1 products, then another option is to tag a RAIN1 product as clutter map.

Target Detect Zc

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.

Beam Blockage Zc

Because of obstructions to the radar horizon (towers, buildings, mountains) the radar beam can be partially or totally obstructed. This feature allows the Ingest process to compute Zc by correcting the measured Z values for partial beam blockage. Note that corrections up to 10 dB can be done. Larger corrections (for example, more than 90% of the beam power lost) are not practical.

The configuration of this feature is via a file (beam_block.conf) in the IRIS configuration directory (for example, /usr/sigmet/config) that contains the following for each elevation angle used in the volume scan:

- Azimuth angle span
- Range at which the blockage starts
- Blockage in dB up to 10 dB
- Elevation angle tolerance

The file format details are documented in the example beam_block.conf file shipped with your system. These feature works best when dynamic

angle synchronization is used so that the azimuth "rays" are collected over the same angle span every time (or example, for 1 degree resolution, the angle spans would be 0.5–1.5, 1.5–2.5, etc.).

The blockage correction is based on the assumption that part of the beam is blocked, and part continues on to reflect from weather targets. Thus all signal returns beyond the blockage have a lower power than the correct value. We correct for this by adding the appropriate constant to all range bins beyond the blockage. There is no correction to handle complete beam blockage. Up to 2 beam blockages are supported in each direction.

Unfold Vc

VVP unfolding can be used to unfold Doppler speeds in individual range bins, when the value is compared to a reference VVP product.

NOTE	You must create a reference VVP product with a product name of "UNFOLD" to perform this correction. Unfolding for IRIS corrected velocity, Vc, is especially important for NDOP (Multiple Doppler) product. There is a detailed discussion of this in the NDOP product configuration section of Chapter 3 in the IRIS Product & Display Manual.

Attenuation Zc

This computes a Zc by correcting for the intervening attenuation. In the Ingest setups you can set a Z attenuation constant and exponent, maximum Z for correction and maximum cumulative correction. Here, you can select for each task if you want the attenuation correction to be used or not. Values are suggested for X and C bands. We recommend the attenuation option is not used in S band. If multiple corrections are turned on for Zc, the order of operations is: 1st Beam Blockage, 2nd Intervening Attenuation, then 3rd Target Detection.

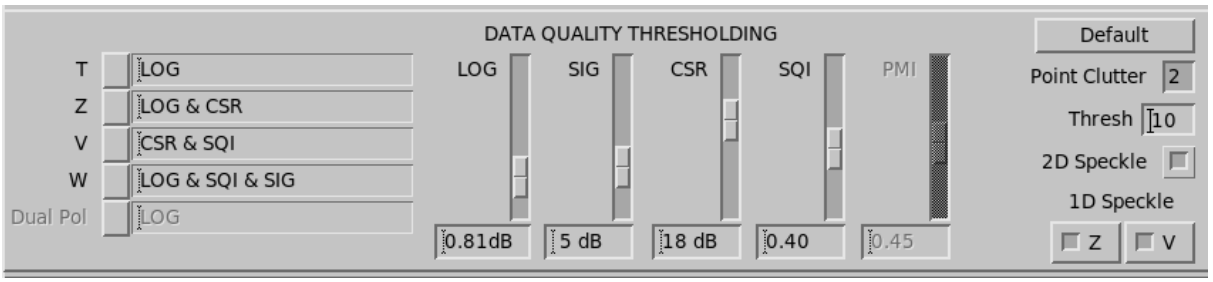
Remove Fallspeed in Vc

Radial winds are assumed to be caused by the horizontal winds only. The fallspeed of the hydrometeors (of order 1 m/s for snow to 10 m/s for rain) can make a significant contribution to the radial velocity. To estimate and remove this effect, the water phase (snow or rain) of hydrometeors must be known. If you use this correction, add the height of the melting level to the setup information (see **setup** manual). This correction is mainly used when making the NDOP product. Also see the discussion on the SRI product in the *IRIS Product and Display Manual* for details on how to set the melting level dynamically.

Storm Relative Vel Vc

Removes the storm motion from the radial velocities. The source of the storm motion is and IRIS FCAST product. You must configure one with a product name "STORM".

7.1.5 Data Quality Thresholding



An important feature of IRIS is that of real time data editing to remove range bins

- with weak signal power,
- with unrealiable estimates of Doppler parameters,
- with polarimetric parameters that suggest echo is of undesired origin, for example not precipitation.

This process, called thresholding, is performed by the signal processor. IRIS provides a great deal of flexibility for thresholding to assure clean displays, promote efficient execution and transmission of the products, and reduce the amount of tape and disk space required to hold compressed data and product archives.

There are several concepts that are useful in understanding thresholding:

Threshold Parameters

LOG — The 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.

PMI — Polarimetric meteo index

The first four are available in all modes of Doppler processing, while PMI is available at polarimetric radars operating in the mode of H+V transmission.

Threshold Criteria

The parameter to use as the criterion.

For example, the Z values could be discarded whenever the log receiver signal is weak. Likewise, V values could also be discarded whenever the log receiver signal is weak. In both cases, LOG is the threshold criterion for thresholding Z and V.

Threshold Levels Acceptable levels for the signal.

Using the same example, the threshold level for the LOG may be set at 1 dB above noise. In this case, the velocity and reflectivity are discarded if the LOG receiver power does not meet or exceed 1 dB above noise. This is done on a bin-by-bin basis.

Each of the four threshold parameters (LOG, SQI, CSR and SIG) has its own user-defined threshold level as described below:

LOG Level (dB) The average LOG channel power in dB at each range is compared to the LOG threshold level (typically 1 dB). If the measured LOG power at a bin is greater than the threshold, the range bin is "passed" for LOG.

SQI Threshold [0,1] The SQI is a measure of the coherence or Doppler power of the linear channel. The SQI is between 0 and 1, where 0 corresponds to a signal that is "white noise" (no coherent power) and 1 corresponds to a signal that is a perfect point Doppler target (all power is coherent). An SQI greater than approximately 0.4 is required to measure mean velocity and spectrum width. If the measured SQI at a bin is greater than the threshold, then the range bin is "passed" for SQI.

CSR Threshold (dB) The CSR (clutter-to-signal ratio) compares the ground clutter power to the meteorological signal power in the Doppler channel. The CSR is calculated for each range bin and compared to the user-defined threshold, typically set to 20 to 40 dB depending on the coherence of the transmitter/receiver system. If the measured CSR at a range bin is **less** than the threshold level, then the bin is "passed" for CSR.

SIG Level This refers to the weather signal power. That is, the signal to noise ratio corrected for clutter. This is typically set to about 10 dB, and used to threshold widths. This is because the spectrum width cannot be measured from a very weak signal. If the measured SIG at a range bin is greater than the threshold level, then the bin is "passed" for SIG.

PMI Treshold The PMI describes the consistency of the data with the hypothesis of precipitation (the default preference). Theestimate is obtained from the ratio of the rule strengths of the HydroClass pre-classifier class ”Meteo” to themaximum rule strengths of the alternative hypotheses “Bio Scatter” and “Ground Clutter / AnomalousPropagation”. As default, the ratio is transformed into a score function that lies smoothly between 0 and 1, where 0 corresponds to a signal that is unlikely ”Meteo” (low ”Meteo” rule strength) while 1 corresponds to a signal that is very likely the preferred class ”Meteo”. The value 0.45 is the threshold where the pre-classifier declares the bin DB_HCLASS data to “Meteo”, in the default HydroClass configuration.

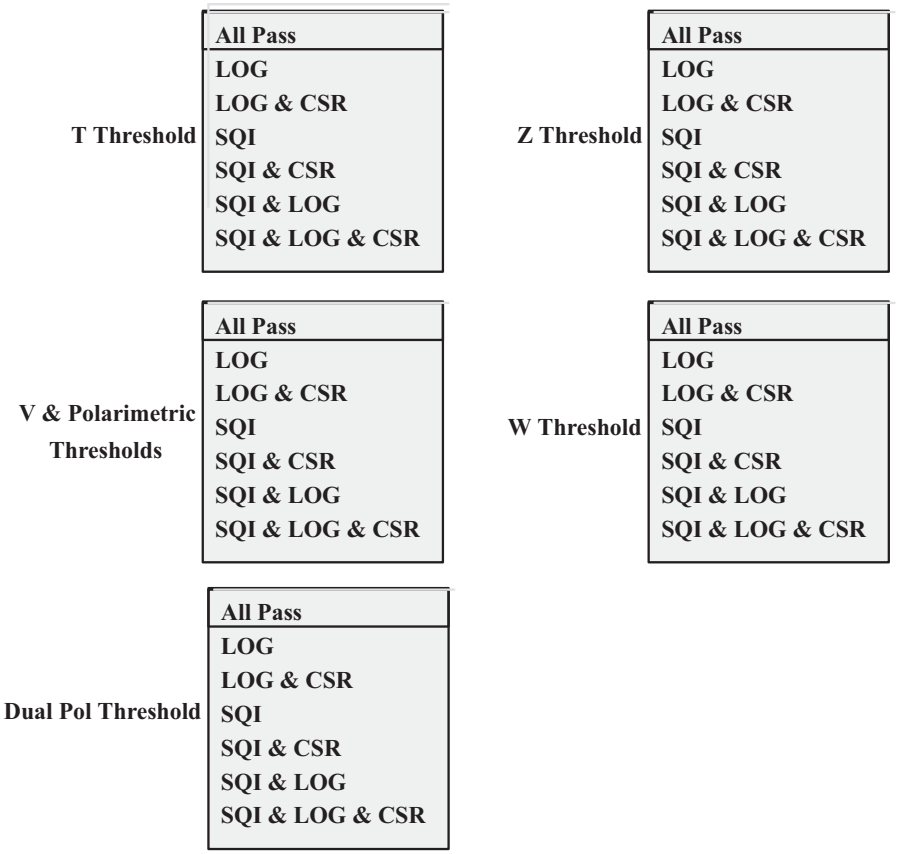
For each range bin, actual values of the threshold parameters are computed and compared with the user defined threshold levels. The result is either a "pass" or "fail" for each threshold parameter.

The second part of thresholding is to decide whether a particular type of data (T, Z, V W, and Dual Pol) should be accepted for each range bin. You define which thresholds to apply to each of these output parameters. This is the threshold criterion. For example, the reflectivity is usually set so that the Z values (and T) is accepted if the LOG test passes. As a further constraint, you can accept the corrected reflectivity values (Z) only if both the LOG and CSR tests pass. This assures not only that the signal is strong enough for a good estimate, but that the ground clutter is not so strong that the estimate is unreliable.

Threshold Levels and Criteria

To set the threshold levels, position the cursor on the appropriate level field and type the value or move the slider within the scale until the desired value is displayed in the field. Typical values for a magnetron system are described at the end of this chapter.

The threshold criteria are changed by entering a Boolean expression directly into the field or by selecting an option for each parameter from a list of choices in pop-up menus:



"All Pass" means that any value is accepted, in effect turning off thresholding. Note that the polarimetric variables are treated identically to Dual Pol.

Defaults

Clicking on this button resets thresholding to the default values.

Point Clutter Filter

Point Clutter is a target that has strong total power in one or two successive range bins but is bordered on either side in by bins of significantly lower power.Meteorological targets rarely appear this way, but aircraft and ships do. The Point Clutter Filter is very effective in removing small, strong targets having some velocity causing standard clutter suppression to not work as well.

The Point Clutter Filter is applied in the signal processor using the autocorrelation data (T_0, R_0, R_1, and R_2) after the Doppler spectrum clutter filtering. A range bin will be flagged as containing clutter if it's total power (T_0) exceeds that of its neighboring range bins by more than a specified detection threshold (in dB). The neighboring range bins may be configured to be up to 3 bins away from the central bin. This is used when having small

bin resolution, such as 25 meters, as some point targets will appear in more than one successive range bin. When a range bin is flagged, the averages of the autocorrelation values from its neighbors are assigned to the flagged range bin. In this way point clutter can effectively be removed from data, even when contained within valid meteorological data.

The PntCtl button in the menu toggles on or off the Point Clutter suppression feature of the signal processor. The number in the toggle selects how far away the neighboring range bin should be along the radial for the comparison. The detection threshold is defined in the Thresh field and may have a value between 0 and 20 dB.

Z and V Speckle Filters

A speckle is a range bin that has valid data but is bordered on either side in range by bins that do not have valid data (empty bins). Meteorological targets rarely appear this way, but towers, aircraft and "lucky noise" do.

One final thresholding feature of the signal processors is the Speckle Filters buttons, which can be toggled on or off in the menu. There is a separate filter for the LOG channel parameters (labeled Z for Z, T and ZDR) and the linear channel parameters (labeled V for V and W). It is recommended that the speckle filters be toggled off initially and that the number of samples be adjusted so that there are only a few speckles on the real time display. At this point, the speckle filters can be toggled on to achieve a cleaner display.

7.2 Obtaining High Quality Data

7.2.1 Optimizing thresholds

In defining the thresholds for your system, it is important to experiment to obtain the best combinations for your application. Here are some simple rules to assist in making the tradeoffs that are inherent in signal processing:

- Use large numbers of samples (>>50). The greater the number of samples, the better the estimates of all parameters. The tradeoff is that the antenna must scan more slowly when the number of samples is larger and a slow scan rate may not be consistent with the operational objectives. A scan rate of 1 to 3 RPM is typical for good estimation, but the slower the better.
- Use a large PRF. All of the Doppler estimates tend to be better when the PRF is large. The tradeoff is that the larger the PRF, the shorter the unambiguous range.

- Do not use a clutter filter that is broader than necessary to remove the ground clutter. A clutter filter that is too broad can damage weather information without improving the clutter cancellation. The required filter width depends on the selected scan rate. Use the **ascope** utility to observe the width of Doppler spectra at close range to estimate the width of the clutter filter that is required. Note that the **antenna** utility can be used to scan the antenna while **ascope** is running so that actual IRIS operation can be simulated. (**ascope** and **antenna** are described in the *IRIS Utilities Manual*.)

A recommended starting point is:

T	LOG
Z	LOG & CSR
V	SQI & CSR
W	SIG & SQI & LOG
Dual Pol	LOG

LOG LEVEL	0.75
SQI LEVEL	0.4
CSR LEVEL	18.0
SIG LEVEL	5.0
PMI LEVEL	0.45
Speckle filters	on

IRIS and the **ascope** utility make it easy to experiment with different configurations so that the best combination can be determined.

To really find the right threshold values for your system you have to watch data from different weather situations. It helps to have independent sources of weather information (satellite images, synoptical maps, images from other radars) to determine what kind of situations you have: clutter only, rain, snow, convective or widespread precipitation. Also, you might want to make special monitoring products such as low elevation PPIs with color scale down to -20 dBZ, and RAINN products over a long period. In the following table is a collection of some common problems and the first guess for how to cure them.

If you have this problem...	**..try first to change this threshold**
Mountains	Filter Dop bigger or CSR smaller
Underestimation of rain over mountains	CSR bigger
Doppler snake (no echo at side wind)	Filter Dop smaller
Noise at all elevations	Log bigger
Dots at low elevations	Speckle filter on
Second trip echoes	SQI bigger

Vanishing strong showers	SQI smaller

7.2.2 Compromising samples, antenna speed and PRF

Acquisition limits

To determine the right number of samples is balancing two factors: the bigger number of samples you have, the better the Doppler speed estimate and clutter filters work. On the other hand, taking many samples means you can't move your antenna so fast.

Setting of PRF tells how many pulses you send per second. Scan rate tells how many degrees the antenna moves in second. Resolution tells how long sector is scanned for a single ray, and number of samples tells how many pulses you include in one ray. Thus maximum number of samples can be calculated

SAMPLES = PRF * RESOLUTION / SCAN RATE

IRIS lets you determine all four parameters in this equation, and then determines which parameter it should adjust in each case. That logic is discussed in the following chapter.

Determining the number of samples per ray

The fundamental unit of data output from the signal processor is a **RAY** of data. A ray is a collection of pulses (samples) that are integrated together into a single data output. Because of flexibility of the RVP signal processor, there are several parameters that influence exactly what samples are included in a ray. The key parameters that determine the number of samples in a ray are **Angle Syncing, Major Mode**, and **Dual PRF Velocity Unfolding**. Below is a listing that describes exactly what constitutes a ray based on the setting of the above three parameters. In these listings, it should be noted that Manual Tasks are always done with angle syncing off, regardless of the IRIS setting for angle syncing. And the operation of RPHASE mode is equivalent to FFT mode in terms of this discussion.

- **ANGLE SYNCING ON, PPP MODE, SINGLE or DUAL PRF:** A ray of data is output by the signal processor every RESOLUTION degrees of antenna motion. Each ray consists of the integration of all pulses during the previous RESOLUTION degree of antenna motion. Thus all radials are RESOLUTION degrees wide. The pulses selected for integration are centered on the position (N * RESOLUTION); where N is the number of this radial. In the case of RESOLUTION =

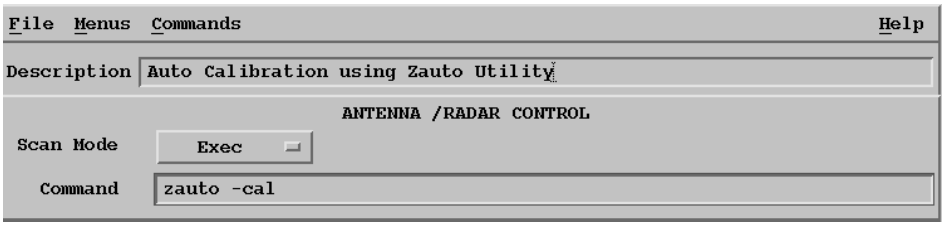
1.0 degrees, this causes rays to be centered on integer values with ray starting and ending values on 0.5 degree boundaries. The setting of SAMPLES is ignored for this case.

- **ANGLE SYNCING ON, FFT MODE, SINGLE PRF:** A ray of data is output by the signal processor every RESOLUTION degrees of antenna motion. Each ray consists of SAMPLES number of pulses. This implies that the width of each radial is not necessarily equal to RESOLUTION. A ray may be wider or narrower depending on the setting of SAMPLES. The pulses selected for integration are centered on the position (N * RESOLUTION); where N is the number of this radial.
- **ANGLE SYNCING ON, FFT MODE, DUAL PRF:** A ray of data is output by the signal processor every RESOLUTION degrees of antenna motion. The low PRF rays consist of SAMPLES number of pulses, unless there are fewer than SAMPLES number of pulses available during the previous RESOLUTION degrees of antenna motion. If there are fewer number of pulses available, then the ray consists of the integration of all pulses during the previous RESOLUTION degrees of antenna motion. The number of pulses integrated in the high PRF rays consists of SAMPLES multiplied by the DUAL PRF RATIO. The same limitation applies for the high PRF rays as described here for the low PRF rays. This implies that the width of a ray may be narrower than RESOLUTION, but never wider. The pulses selected for integration are centered on the position (N * RESOLUTION); where N is the number of this radial.
- **ANGLE SYNCING OFF, PPP MODE, SINGLE OR DUAL PRF:** A ray of data is output by the signal processor every SAMPLES number of pulses consisting of the integration of all of these pulses. IRIS reads all rays. For manual tasks, all rays are stored. For non-manual tasks, the rays with the best angular fit are stored every RESOLUTION degrees of antenna motion. If rays are too infrequent to fit every slot in the scan, some slots will have missing rays. If rays are made too frequently to fit every slot, the extra rays are discarded.. It should be noted that in the DUAL PRF case, rays made at the low PRF will be longer in time (and usually in angular distance) then the rays made at the high PRF.
- **ANGLE SYNCING OFF, FFT MODE, SINGLE PRF:** A ray of data is output by the signal processor at the CPU limit of the signal processor consisting of the integration of SAMPLES number of pulses. This implies that rays may be partially overlapping. Thus one ray may share many of the same samples with the previous ray. This sharing iterates among all rays. The amount of overlapping may be reduced by setting the "Free Running Ray Holdoff" in the RVP7 NVRAM setups. IRIS reads all rays. For manual tasks, all rays are stored. For non-manual tasks, the rays with the best angular fit are stored every RESOLUTION degrees of antenna motion. If rays are

too infrequent to fit every slot in the scan, some slots will have missing rays. If rays are made too frequently to fit every slot, the extra rays are discarded.

- **ANGLE SYNCING OFF, FFT MODE, DUAL PRF:** A ray of data is output by the signal processor every SAMPLES number of pulses consisting of the integration of all of these pulses. IRIS reads all rays. For manual tasks, all rays are stored. For non–manual tasks, the rays with the best angular fit are stored every RESOLUTION degrees of antenna motion. If rays are too infrequent to fit every slot in the scan, some slots will have missing rays. If rays are made too frequently to fit every slot, the extra rays are discarded.. It should be noted that rays made at the low PRF will be longer in time (and usually in angular distance) then the rays made at the high PRF.

7.3 Exec Tasks



Use this option to execute an arbitrary shell command scheduled by the task scheduler menu. Note that the signal processor is released from use before this runs. This allows the command to include programs which use the signal processor, such as **zauto**.

CHAPTER 8
SCHEDULING RADAR TASKS

The Task Scheduler configures the automatic operation of the radar. It tells IRIS which radar Tasks to run and when to run them. It can also run interactive manual tasks, as well as exec tasks used to schedule maintenance jobs. There are two menus related to task scheduling: The TSC Monitor Menu (which shows what is currently happening), and the TSC Editor Menu (which allows editing of the Task Schedules). Because it controls real time processes, these menus can be modified only by an operator.

You can schedule Tasks to start at regular times or call for Tasks to run as soon as possible (ASAP). Regularly scheduled Tasks are typically used for the routine operation of IRIS. Schedules can be created, tested, saved and recalled for different modes of operation.

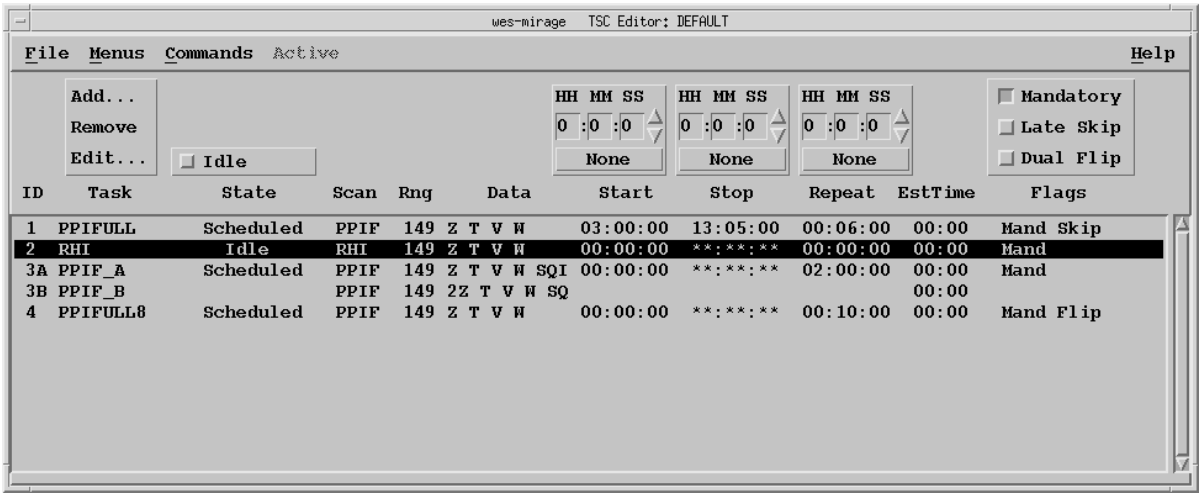
The Task Scheduler can run Tasks individually or link many Tasks together to create a "Hybrid Task". For example, a volume scan uses a low PRF to get a large, unambiguous range at low elevation angles and a high PRF to get a large, unambiguous velocity at high elevation angles where range folding does not occur. These two Tasks can be linked to scan both the low and high elevation angles in a single hybrid Task.

The Task Scheduler also supports running in either "Active" or "Passive" data acquisition. Most systems use Active data acquisition where IRIS controls the antenna scanning. However, in some installations, an external system is controlling the antenna and in passive mode, IRIS acquires the data by simply "listening" to what the radar is doing and synchronizing to the external control.

To enter the Task Monitor:

Choose **Menus**–>**TSC Monitor** from the IRIS menu bar or from any of the IRIS menus. Similarly for the TSC Editor.

8.1 TSC Editor Menu



The body of the menu contains a list of the Tasks that make up the schedule. You can edit this list as described below.

File on Menubar

This is the standard on IRIS menus, you can open, save, and delete the named configurations. You are not allowed to delete the DEFAULT configuration, or the currently running configuration, or the configuration currently being edited. If you save the currently running configuration, it will prompt you for confirmation, and if given the change is saved and goes into effect immediately.

ID and TASK

IRIS assigns a sequential ID number to each TASK in a schedule. Members of a hybrid TASK have the same number, plus an A, B or C to differentiate them. This information is shown in the first field of the list, labeled ID. The Task field shows the name of the Task assigned in the Task Configuration menu.

State

You can set the state of each task by positioning the mouse cursor over the State field and choosing a command from the pop-up menu:

Scheduled The task will run according to the schedule.
Idle The task is on standby and will not run.

For hybrid Tasks, all are scheduled together so only one state is displayed.

Scan

This is a display–only field showing the type of scan being performed by the Task, such as a PPI Full or PPI Sector scan. This information is taken from the Task configuration.

Range

This is a display–only field showing the value of the Max Range field, taken from the Task configuration.

Data

This is a display–only field showing the first few data types to be recorded, taken from the TASK configuration.

Start, Stop, and Repeat

These fields control when a scheduled TASK runs. IRIS can schedule TASKS to run at a specific time (based on a 24-hour clock), or as soon as possible regardless of the clock time. For hybrid TASKS, the B and C parts are left blank because a hybrid TASK is treated as a single TASK for scheduling purposes. The times specified are either UTC or local based on a question in **setup**/general.

Use the spin tool above the list to change these times. You can select the hours, minutes, or seconds field and raise or lower it with the arrow buttons. Press the "None" button to clear the time selection. None for repeat time means that it will run continuously without any pausing.

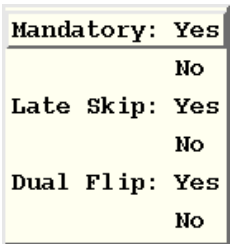
Est Time

The EstTime field is a display-only field that shows the estimated time required to run the Task. This is helpful in creating new schedules. As a

simple example, if the run time is 00:05:30, the Task should not be scheduled to run more frequently than every 5 1/2 minutes.

Flags- Mandatory, Skip, Flip

These flags control options relating to priorities and to dual system operation, that is, when two IRIS systems are controlling two different radars through the same antenna.



Mandatory and Skip- These selections are used to set scan priorities and resolve schedule conflicts. When Mandatory is set to "yes," the task can interrupt a non-mandatory task when its scheduled time arrives. When Skip is set to "yes," the task is skipped if the radar is busy with another task when its scheduled time arrives. The task can run late by up to 60 seconds before it is skipped. For hybrid TASKS, the B and C parts are left blank because a hybrid TASK is treated as a single TASK for scheduling purposes.

Dual Flip- This is a special feature used only for dual IRIS systems that operate two different transmitter/receivers through the same antenna. One mode of operation is that when one of the systems finishes the scan, it gives up control of the radar to the other system. In this way, the two systems, perhaps operating at two different wavelengths, can "take turns" such that one system runs a TASK and then the other system runs a TASK. For example, setting the Flip flag to "Yes" on system A will allow system B to run a TASK after A has completed its TASK. If system B does not start a Task within 3 seconds, then system A is free to resume its Tasks.

8.2 Adding, Editing, and Removing Tasks in a Schedule

To add a TASK to a schedule:

1. Select the line in the schedule which you want to put the new task after.

2. Push the "Add..." button or press the right button over the ID or TASK field and choose –>**Add** from the pop-up menu. IRIS then displays a list of available Tasks.
3. Choose a TASK from the list, and IRIS adds it to the schedule, filling in the information for the selected TASK.

Up to eight TASKS can be loaded into the schedule in this way. To load or view TASKS that are off the screen, use the scroll bar.

Hybrid TASKS are composed of multiple individual TASKS. Names for hybrid Tasks, assigned in the Task Configuration menu, have the special form:

```
any_name_A

any_name_B

any_name_C
```

The _A, _B and_C added to the end of the Task name denote the first, second and optional third part of a hybrid Task.

For scheduling purposes, hybrid TASKS are treated as a single TASK. When one part of the TASK is added into a schedule, all the other parts are added as well.

To edit a TASK configuration:

If more information is needed about a Task, or if you want to modify the Task, IRIS provides a convenient way to go directly to the Task Configuration menu.

Select the task of interest in the list, and press the **Edit...** button. Be sure to save changes when you are through editing.

To remove a TASK from the schedule:

Select the task and push the **Remove** button. If it is a hybrid task, all of them are removed.

8.3 Scheduling Automatic TASKS

You can schedule a TASK to run at regular clock intervals and assign priorities to each Task. This is important when system operation requires that products be generated on a regular basis.

TASKS are scheduled by setting the Start, Stop, and Repeat fields, as follows:

- Start specifies the first time after midnight that the TASK runs.
- Stop specifies the last time after midnight that the TASK runs. If a TASK should run the entire day, specify "None."
- Repeat specifies the interval between successive runs.

For 24-hour clock scheduling, the schedule is repeated daily. Consider the following examples:

Schedule	TASK	Start Time	Stop Time	Repeat
Hourly, on the hour, all day		00:00:00	None	01:00:00
5 minutes after the hour, every 15 minutes, all day		00:05:00	None	00:15:00
Every 2 hours on the half hour from 02:30 to 8:30, and hourly for the rest of the day	1 2	02:30:00 09:30:00	08:30:00 01:30:00	02:00:00 01:00:00

In the third example, two identical tasks are defined with different ID's and scheduled at different times. The second TASK is scheduled to start at 09:30 to achieve hourly runs after the first TASK ends at 08:30. The second TASK is scheduled to stop at 01:30 because that is the last possible time the TASK can run before the first TASK starts again at 2:30.

Ideally, you should adjust the scheduling so that no conflicts occur — no two TASKS should run at the same time. However, if new TASKS are created to observe specific phenomena, such as an RHI scan through a thunderstorm that needs to run "ASAP," it is possible for even the best planned schedule to fall behind.

The Mandatory flag can help resolve scheduling conflicts. It defines the priority of the TASK. To set this flag, position the mouse cursor over the field and choose –>**Mandatory- Yes** from the pop-up menu if the TASK must run at the scheduled time without interruption; choose –>**Mandatory- No** if the TASK can be interrupted. If a TASK is interrupted, the resulting data base is complete up to the time of interruption.

When a mandatory TASK is running and another TASK comes up to run, the second TASK is placed on hold. When this happens, operations can fall behind schedule. The Skip feature can help get the system back on schedule. If the Skip flag is set to "Yes," the late TASK is simply skipped. If it is set to "No," the scheduled TASK runs as soon as possible after completion of the current TASK. In the case of multiple late TASKS, IRIS picks the latest to run next, starting with any mandatory TASKS.

The following summarizes the priority of Tasks:

- Mandatory Tasks always interrupt non-mandatory Tasks.
- Mandatory Tasks can never be interrupted.
- If a mandatory Task is late and the Skip flag is set to "No," it runs before any non-mandatory Task.
- If more than one mandatory Task is late and the Skip flag is set to "No" for these, then the latest runs first.

When the Go Immediately command runs a Task immediately, the priority of the Task is used to arbitrate conflicts in a manner identical to that described above. The Skip flag does not apply because the Task runs only once.

If Tasks are running consistently late, the overall scheduling should be reexamined and adjusted accordingly.

8.4 Scheduling and Running Manual Scans

Manual Tasks are inserted into the schedule the same way other scan types are inserted, except that antenna control is not automatic. For interactive manual scans, you should use the **real time display** and the **antenna** utility (both described in the *IRIS/RDA Utilities Manual*). This will let you have interactive control and feedback. IRIS will never take a noise sample before running a manual scan.

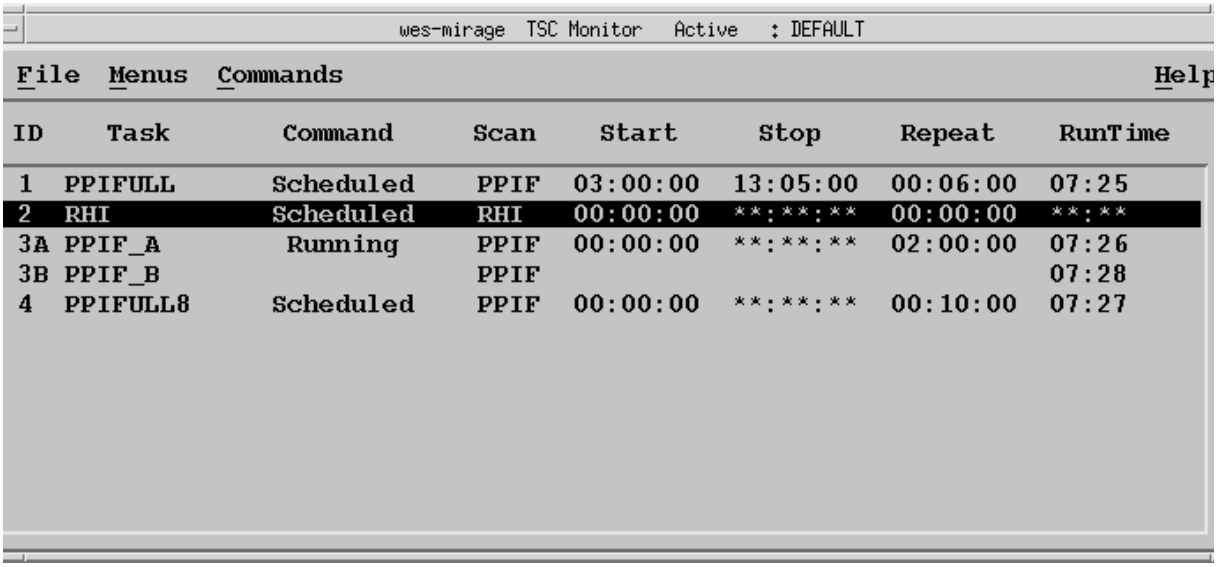
To run a manual scan Task, first insert it into the schedule. The TASK can be scheduled identically to any other TASK, but in most cases, you should use a manual scan TASK on an *ad hoc* basis. In this case, you do not want the manual scan TASK to interfere with your regularly scheduled TASKS. Here are some tips for doing this:

- Set the Stop field to "None" so the scan can work at any time of day.
- Set the Repeat field to "None."
- Set the Mandatory field to non-mandatory, so it does not interfere with mandatory scans, such as a regularly scheduled volume scan.
- Set the Skip field to "Yes," so that if it is preempted, it does not run.
- Set the State field to "Idle," so it will not start automatically.

To run it, use the Task Monitor menu, and choose either –>**Go Schedule** or –>**Go ASAP** to start it. The Go command delays the start of the TASK according to the Repeat field, like any other TASK. If the Repeat field is set to "None," the Go and Go Now commands have the same effect.

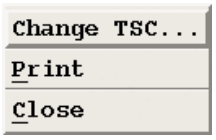
When the Task configuration is set to "Non-Continuous," the TASK stops automatically after it has collected the prescribed number of data rays (up to 720). If the TASK configuration is set to "Continuous," you must stop the TASK manually by issuing the Halt command. You should usually set the TASK configuration to "Continuous", especially if your are doing and interactive scan with the real time display and the **antenna** utility. (See Chapter 7, Configuring Radar TASKS, on page 77 for information on configuring a manual scan.)

8.5 TSC Monitor Menu



Similar to the TSC Editor menu, the body of the menu contains a list of the Tasks that make up the schedule, but it is always showing the currently running mode. It also shows which Task is currently running. By selecting a line with the mouse, you can manually intervene with the schedule to stop and start tasks at will. Many of the columns in the menu are the same as the TSC Editor, and will not be described here.

File on Menubar



Selecting "Change TSC..." will pop up a list of Task Schedules previously configured with the TSC Editor menu. If you pick one, it will change the TSC mode to the new configuration.

Command

You can issue commands to start and stop TASKS by positioning the mouse cursor over the Command field and choosing a command from a pop-up menu:

Go (Schedule) runs the Task according to schedule.

Go (ASAP) runs the Task immediately subject to the priority of other Tasks.

STOP (When Done) stops a Task as soon as it finishes running.

STOP (Right Now) stops a Task immediately.

Interrupt/Reschedule similar to Stop (Right Now) except that the Task is stopped immediately and then rescheduled.

This field also shows the status of the Task as one of the following values:

Inactive	The Task has not been activated by the Go command.
Scheduled	The Task has been activated by the Go command, but it is not the Task's turn to run.
Running	The Task is currently running.
ASAP	The Task is scheduled to run as soon as possible. This is the status of a Task after a Go Now command has been issued.

For hybrid Tasks, the B and C part show only the message "Running" when the TASK is running. Otherwise, this field is blank.

Run Time

The RunTime field is a display–only field that shows the actual time used to run the Task when the Task last ran.

8.6 Running and Stopping a Task

To run a Task:

1. Select the Task you want to run.
2. Position the mouse cursor over the Command field and choose either: –>**Go (Schedule)** or –>**Go (ASAP)** from the pop-up menu.

The Go (Schedule) command starts automatic operation according to the TASK's schedule. Note that the TASK status changes from "Inactive" to either "Running" or "Scheduled" when the Go command is issued.

The Go ASAP command is similar, but the first run of the TASK starts immediately, subject to the priority of other TASKS that may be running. This is used for interactive operation. The status changes to "ASAP," indicating that the TASK is scheduled to run as soon as possible. The TASK runs once, then the status changes to "Scheduled" — it is inserted into the schedule as if the Go command were issued.

To stop a Task that is running:

1. Select the TASK you want to stop.
2. Position the mouse cursor over the Command field and choose either –>**Stop (When Done)** or –>**Stop (Immediately)** from the pop-up menu.

If the TASK is not running (its status is "Scheduled"), the Stop and Stop ASAP commands behave the same. However, if a TASK is "Running," the Stop (When Done) command allows the TASK to complete, while the Stop (Immediately) command stops the TASK immediately, even though it has not completed.

CAUTION	Caution: When Stop Immediately is used, TASK data may be lost.

8.7 Passive IRIS

For some installations, IRIS is not in active control of the radar. Rather the radar system is controlled by an external system and IRIS merely "listens" and acquires data. This is called "passive IRIS". For more information, refer to Appendix C, Passive IRIS Features, on page 141.

The configuration of the **Setup** utility (setup/ingest/scanning) determines whether your system functions as:

- Active only
- Passive only
- Active/passive (selectable)

In the first two cases, there is no user configuration to do and the TSC Editor menu will simply show either Active or Passive in the top line of the menu on the right side. In the third case, where you can select active or passive operation, this selection is made in the TSC Editor on the first menu line.

In passive mode, the Task schedule should be loaded with the Tasks corresponding to what the active system is doing and these should all be set to the command "scheduled".

CHAPTER 9

PRODUCTS AND DISPLAY AT IRIS/ RADAR

This chapter will describe briefly how to make and display some products at IRIS Radar site. For operational product configuration, see the *IRIS Product & Display Manual*.

9.1 Configuring products

At IRIS Radar, you typically want to configure only two kinds of products: RAWs and PPIs. A RAW file contains all the information collected during a measurement task, and it is compressed to a small file so it can be sent over network to IRIS Analysis. A PPI shows data from one elevation, all azimuths, and at the radar site it can used for quality control.

You can also configure some other products: WARN, FCAST... See IRIS analysis manual for these.

Configuring RAW products

- Choose **Menu** -> **Product Configuration** from IRIS menu bar.
- Choose **Type** -> **RAW**.
- Click the button next to TASK name, and pick a task from the pop up list.
- If you will have to copy the product files over a slow network connection, click the button "Make sweep-by-sweep?" **On**, otherwise leave it **Off**.
- Choose **File** -> **Save as..** and give a name for the RAW file.

Configuring PPI products

- Choose **Menu** -> **Product Configuration** from IRIS menu bar.

- Choose **Type** -> **PPI**
- Click the button next to TASK name, and pick a task from the pop up list.
- Click the button next to Data:Display, and select one parameter to be displayed, typically Z for reflectivity.
- Enter Maximum Range (in kilometers) and elevation angle which suit the TASK you have selected (you can see task information in upper part of the menu).
- **File** -> **Save as...** and give a name for the PPI file.

9.2 Scheduling products

- Choose **Menu** -> **Product Scheduler** from IRIS menu bar. You will get a list of all the product types on the system.
- On first line of menu, press the button next to **Add For...** and select the code for your local radar.
- In the list of product headers, left click the line **RAW —Product —**
- From the pop up menu, select the name of the RAW product you have just configured.
- From request field, click to get a pop up many which lets you to select **All** – **Next** – **Stop**. Select **All** to get this product for all the future tasks of the given TASK name.
- Repeat the three last steps for other RAW and PPI products.
- Choose **File** -> **Save** and give a name for this product scheduler.
- If you want to make products from old data, use **Next**–**Product**–**Time buttons** to go backwards in time.

9.3 Quick Look Window to view products

Quick Look window is the main tool of IRIS User to see the products. As minimum, you only need three buttons to control this display, and they are all located in the upper right corner of the window.

The first icon **Site**, lets you select a site from all the sites configured at General Setup. Pick the one that means your own, local radar.

Clicking the second icon **Product** pops up a list of available products. Typically at the radar site, you only have PPI products, and you can select one of the PPIs from the list. If the list contains only N/A then no products are available on the disk for the radar site you have selected. (To see other than PPI products, first click PPI to see all the available product types and then select the product. Note that RAW products can not be displayed.)

Third icon, **Time**, indicated with a clock symbol, shows actual times at which there are images for the product name you have selected.

After you have selected **Site, Product** and **Time**, you should see a product in the big window, and information about it in the small side windows as shown above. The slide bar lets you to browse through older and newer images.

APPENDIX A
GLOSSARY OF TERMS AND ABBREVIATIONS

AGC

Abbreviation for Automatic Gain Control. This is a feature in which the gain of the linear channel video signals is adjusted based on an estimate of what the signal level will be. For example using the average power of the last few pulses at that range.

Archive menu

IRIS menu for controlling the recording of product output files to archive media and retrieving them from archive media. The media can be either tape or MO disk.

Associated TASK

The TASK that is associated with a product generation. The associated TASK is assigned in the Product Configuration menu. For example, a PPI product requires an associated TASK that uses the PPI scan mode (Full or Sector).

BEAM product

Abbreviation for a cartesian product similar to the Cross Section perpendicular to the radar which displays data at a fixed range (or averaged over a range interval) on an azimuth vs. elevation grid. This is useful for testing the antenna beam pattern when used with a reference transmitter.

Bright band

Altitude range over which the falling snow is partially melted, but not completely changed into rain. Wet snow and wet ice has a higher

reflectivity than either dry snow or rain, so it forms a band of stronger returns. The top of this band is called the Melting Level or 0C height.

CAPPI product

Abbreviation for constant altitude plan position indicator. A CAPPI product is a horizontal slice through the atmosphere at a given height. The positioning and orientation of the cross section is arbitrary.

COMP product

This is the composite product. It compines a group of CAPPI, VIL, PPI, or TOPS products from different radars together into one larger image.

dBZ or Z and dBT or T

10*LOG (Base 10) of the equivalent radar reflectivity factor in units of $mm^6 m^{-3}$. *See also* Reflectivity. In IRIS, Z or dBZ is used to denote that this is corrected by the signal processor for ground clutter. T or dBT are used to denote the reflectivity without clutter correction.

dBZc

10*LOG (Base 10) of the equivalent radar reflectivity factor in units of $mm^6 m^{-3}$. *See also* Reflectivity. This is the same as dBZ but with additional corrections performed by IRIS such as attenuation and beam blockage. These are selected in the TASK Configuration Menu.

Doppler velocity spectrum (or Doppler spectrum)

The spectrum of the power returned as a function of the Doppler velocity (towards or away from the radar). The mean of the Doppler velocity spectrum is the mean velocity computed by the signal processor. The standard deviation of the Doppler spectrum is the spectrum width (in m/s)

Doppler mean velocity (*see*Velocity)

Doppler spectrum width (*see also*Doppler velocity spectrum)

The standard deviation of the Doppler spectrum in m/s. The spectrum width is a measure of the shear and turbulence in the radar pulse volume at a given range.

Hybrid Task

A group of up to three tasks with the same scan type which are scheduled together and used together to make products. This allows considerable flexibility of volume scanning schemes.

Ingest file

A disk file of raw polar coordinate data that is collected during the execution of a TASK. Ingest files are used for subsequent product generation. (*see also* RAW product).

Ingest Summary menu

Shows the current ingest files that are on disk. Allows files to be tagged for keeping so they are not deleted by the Watchdog process when more disk space is needed. Files can also be tagged for deletion.

INU

Abbreviation for Inertial Navigaion Unit. This is required on a shipboard system to accurately report the radar's position and orientation.

IRIS

Abbreviation for Vaisala’s Interactive Radar Information System.

IRIS menu bar

The first menu that appears on the screen after starting up IRIS. The IRIS menu bar provides access to all of the IRIS menus and is used to exit the menus and return to the operating system prompt.

KDP or Specific Differential Phase (*see also***PhiDP)**

This is the range derivative of the differntial phase (PhiDP) expressed in degrees per km. It is nearly linearly proportional to the rainfall rate.

Manual scan

This is an IRIS task scan mode in which data is recorded while the antenna is controlled manually or via a separate program. Feedback is provided by the real time display.

MAX product

Shows the horizontal projection and the E-W and N-S vertical projections (in display side panels) of the maximum reflectivity in a user defined layer.

Melting level

Altitude at which falling snow starts to melt. This forms the top of the Bright Band, and is also sometimes called the 0C height.

NDOP product

Dual-Doppler velocity product. Combines the velocity measurements from two or three radars together to get the actual wind direction and speed.

PhiDP or Differential Phase (*see also*KDP)

This is the phase difference between the HH and VV (co-polarized) channels of a polarization radar. It is calculated by taking the argument of the covariance of these two channels. The differential phase increases with range more rapidly in regions of heavy rain.

PhiH or PHIV

The average phase difference between the co- and cross-polar channels for a dual channel polarization radar operating in fixed or switching mode. Primarily of research interest. The H and V notation indicates the transmit polarization.

PP02 (Pulse Pair Processor)

The PP02 Pulse Pair Processor is eight times faster than the RVP5. It is preferred for wind shear applications where high-speed, high-resolution sampling is required.

PPI product

Abbreviation for plan position indicator. This is the classic radar scan geometry where the elevation angle is held constant and the antenna is scanned in azimuth. The resulting display is a two-dimensional image (looking down) at a constant elevation angle.

PPI Full

An IRIS scan geometry during which the antenna scans continuously in PPI mode without stopping between elevation angles.

PPI Sector

An IRIS scan geometry where the radar scans in PPI mode between two azimuths.

PRF

Abbreviation for pulse repetition frequency.

Product

Products are calculated from ingest files that are collected during the execution of a TASK. Products may be pictures, data or text. Examples of products are PPI and RHI.

Product Configuration menu

Menu for configuring the parameters required for product generation. For example, a PPI product configuration requires the user to specify the data parameter, elevation angle, maximum range, output display levels, and the associated TASK.

Product Output menu

Menu for requesting that a product be sent to an output device. Typically, the output device is a color display, but it may also be a printer or a tape drive (for recording).

Product Scheduler menu

Menu to schedule which products are generated the next time the associated TASK runs.

Protected areas

Regions arround the radar (such as runway locations) for which special alerts are required based on detected radar data.

PRT

Abbreviation for pulse repetition time.

RAW product

Spherical coordinate data product obtained directly from the raw ingest data. The data are stored in compressed format so they can be recorded on tape or sent to a workstation for further processing.

Radar Status menu

IRIS operator menu to monitor and control the IRIS hardware and software systems.

Rainfall Rate or R

The rate of accumulation of precipitation in units of mm/hour. In the case of snow this is usually refering to the liquid equivalent.

Real time display

Denotes the image that is created for each scan of the radar. Sometimes this term is used to refer to the software process that creates these images.

Reflectivity (*see also***dBZ)**

Most properly this is the equivalent radar reflectivity factor abbreviated as Z and usually expressed in units of mm^6 per m^{-3}. For example, a rainfall density of (on average) a single 1 mm diameter drop per cubic meter of air would have an equivalent radar reflectivity factor of 1 mm^6 m^{-3}. Usually, Z is expressed in dB units (dBZ) by taking 10*LOG (base 10). For example:

Z	dBZ
0.1	-10
1	0
10	10
100	20
1000	30

RHI product

Abbreviation for range height indicator. This is a classic radar scan geometry used in IRIS where the azimuth is held constant and the antenna is scanned in elevation. The resulting picture is a two-dimensional vertical slice through the atmosphere.

RhoHV

The magnitude of the correlation between the HH and VV channels of a dual polarization radar operating in STAR mode or switching mode. It is in the range [0,1]. Rain will have values typically >0.98. Wet tumbling hail will have smaller values. Therefore it is useful in helping to identify the particle type.

RhoH or RhoV

The magnitude of the correlation between the co-and cross-polarized channels in a dual channel receiver polarization radar operating in fixed or alternating H and V transmit mode. Primarily of research interest.

RVP7 (Radar Video Processor)

The RVP7 is a floating-point programmable signal processor which directly samples the IF signal from a radar. This bypasses the need for many of the traditional video frequency components. An auxiliary processing board can be added for more speed.

RVP8

The RVP8 is a floating-point signal processor implemented in software on a Linux PC. It uses an "RX" PCI card to receive time series samples of the IF signal sent from the IFD. Optionally another "TX" PCI card is available to generate the transmit waveform for compressed pulses.

SHEAR product

Product used for identifying microburst, gust fronts, cold fronts and atmospheric waves. It calculates the radial wind shear in the radial direction and is sensitive to atmospheric convergence and divergence.

SLINE product

Short for "Shearline". Product used for identifying a front and fitting a line to it. It looks for elongated regions of high shear and connects them to make a line.

Signal processor

Also Doppler signal processor. A dedicated programmable device for digitizing and processing the video signals from the radar receiver. For IRIS, Models RVP6 or RVP7 (manufactured by Vaisala) may be used.

SQI or Signal Quality Index

The autocorrelation of the received signal at lag 1 divided by lag zero. This is a number in the range [0,1] where 1 is the perfect Doppler point target and 0 is white noise. Typically used for thresholding velocity and width at a level of ~0.3–0.4.

TASK

Also radar TASK. A set of instructions to the radar and signal processing systems including, but not limited to, the scan type (PPI or RHI), PRF, pulse width, signal processing data types, time and range averaging criteria. For example, a PPI volume scan at multiple elevation angles or an RHI at a single azimuth.

TASK Configuration menu

IRIS menu for configuring all of the antenna scanning, radar control and signal processing parameters required to specify a TASK.

TASK Scheduler menu

IRIS menu for scheduling which TASKS should run and when. This menu is also used for controlling the real time display, its associated products and the RAW data product.

TOPS product

PPI format display of the height of a selectable dBZ echo contour. The heights are color coded.

TRACK product

An interactive tracking product that is made in the Quick Look menu. The operator tags echo features with the mouse. IRIS then inserts points into a track and extends the track to show the forecast echo motion for a selectable time.

Velocity (V, Doppler velocity, mean velocity, radial velocity)

The average radial speed of motion (towards or away from the radar) of the scatterers in the radar pulse volume at a particular range.

Vc

Same as velocity or V except corrected by IRIS for the effects of folding. Note that dual PRF velocity unfolding performed by the processor is stored simply as V rather than Vc. Vc is used primarily for dual Doppler wind field computation which requires unfolded velocities.

VVP product

The velocity volume product calculates the vertical profile of the mean wind speed, direction, divergence and deformation. The algorithm assumes a linearly varying wind field and performs a least squares fit over a large volume surrounding the radar.

VIL product

The vertically integrated liquid product allows the operator to specify a layer in the atmosphere, and integrates the total liquid contained within the layer. The point estimates of the liquid are based on a user-defined Z-W relationship.

WARN product

The WARN product looks at other products to determine if significant weather is present. The operator can define the warning criteria and thresholds. The locations (centroids) of weather features are also calculated.

Width (W, spectrum width)

The standard deviation of the Doppler spectrum displayed in m/s. Large width values indicate high turbulence and/or shear in the pulse volume. It is difficult to measure the spectrum width when the spectrum width is more than 1/3 of the total Nyquist interval because of uncertainty in the estimator for broad spectra.

WIND product

Uses the velocity volume algorithm to calculate a 2-D horizontal profile of the horizontal wind speed and direction. The algorithm assumes zero vertical velocity and a fixed wind field over a sub-region of the area covered by the radar.

XSECT product

A vertical slice through a volume scan. The product is similar to an RHI except that it is constructed from PPI data collected at multiple elevation angles.

Z or Zc (see dBZ or dBZc or reflectivity)

ZDR

Abbreviation for differential reflectivity. Expressed in dB, this is the ratio of the powers of the horizontal / vertical receiver channels of a dual polarization radar. Typically it is in the range of 0 to 6 dB.

IRIS Month Abbreviations

January	Jan
February	Feb
March	Mar
April	Apr
May	May
June	Jun
July	Jul
August	Aug
September	Sep
October	Oct
November	Nov
December	Dec

IRIS Data Parameter Abbreviations: Standard Systems

dBT or T	Uncorrected Reflectivity
dBZ or Z	Clutter Corrected Reflectivity
dBZ c or Zc	Reflectivity with corrections for attenuation, occultation, etc.
Vel or V	Mean Radial Velocity
Vc	Radial velocity corrected for folding
Width or W	Doppler Spectrum Width
Rain or R	Rainfall Rate
Liq	Rainfall Depth
Tops	Echo Top Height
VIL	Vertically Integrated Liquid
Wind	Wind Speed and Direction
Shear	Wind Shear
SQI	Signal quality index for Doppler coherency [0 to 1]

IRIS Data Parameter Abbreviations: Polarization Systems

ZDR	Differential Reflectivity
PhiDP	Correlation differential phase between HH and VV channels
KDP	Specific differential phase (degress/km) between HH and VV channels. Based on derivative of PhiDP.
RhoHV	Correlation magnitude between HH and VV channels
LDRH(or V)	Linear depolarization ratio for H (or V) transmit cross-/co-polar.
RhoH(or V)	Correlation magnitude between H and V receive for H(or V) transmit
PhiH (or V)	Correlation phase between H and V receive for H(or V) transmit

APPENDIX B
TASK CONFIGURATION EXAMPLE

This appendix provides two examples of a set of operational parameters for IRIS, and convenient naming conventions for TASKS and products. The intention is to provide you with a starting point for defining the standard operational mode that is best for your particular application.

IRIS is a flexible system that lets you configure a variety of scan geometries and products. The IRIS configuration in the Radar Status menu provides a convenient mechanism for creating and saving entire sets of IRIS operating parameters. There are two operating modes illustrated here:

Weather Monitoring	This is an IRIS configuration named MONITOR, optimized for general weather monitoring and product generation.
Wind Shear Alert	Configured for each active runway of an air terminal. These shall be referred to as Terminal Doppler Weather Radar (TDWR) modes. They are optimized for the timely and accurate detection of wind shear events (requires optional SHEAR product).

Each of these modes of operation has a separate IRIS configuration and is described separately.

For installations whose primary responsibility is wind shear detection, you must switch between modes of IRIS operation by changing the IRIS configuration name in the Radar Status menu. For example, if there is no significant weather in the immediate area, the IRIS configuration is set to MONITOR. If there is weather in the wind shear detection zone, the IRIS configuration is set to a TDWR mode. An automatic Warning product in the MONITOR configuration (called SEVERE) signals when to switch into TDWR mode. After weather departs the terminal area, you manually

reset the IRIS configuration back to the MONITOR mode in the Radar Status menu.

Note that to change the IRIS configuration, you must first turn off the Radar Process and Product Generator to deactivate IRIS. The various IRIS configurations are presented in the following sections.

B.1 Summary of Configuration Examples

Table 4 MONITOR MENUS

Menu	Name
Radar Status	MONITOR (or DEFAULT)
TASK Scheduler	MONITOR
Product Scheduler	MONITOR
Product Output	MONITOR

Table 5 MONITOR TASKS

TASK Name	Purpose
PPI_VOL	General product generation
SURVEILLANCE	Long range surveillance PPI
VVP	Wind profiling
RHI	*Ad hoc* RHI's through significant weather
MANUAL	*Ad hoc* manual scanning

Table 6 MONITOR Products

Product Type	Product Name	Associated TASK	Display Parameter	Configuration Parameter	Range
CAPPI	Z_010_120	PPI_VOL	Z	1.0 km Height	120
	Z_020_240	PPI_VOL	Z	2.0 km Height	240
	Z_030_240	PPI_VOL	Z	3.0 km Height	240
	Z_050_240	PPI_VOL	Z	5.0 km Height	240
	Z_100_240	PPI_VOL	Z	10.0 km Height	240
	Z_150_240	PPI_VOL	Z	15.0 km Height	240
MAX	Z_0_16_240	PPI_VOL	Z max	0 – 16 km Height	240
PPI	Z_005_300	SURVEILLANCE	mm liquid	0.5 Elevation	300
RAIN1	HOURLY	PPI_VOL	mm liquid	1 km CAPPI	240
RAINN	03_HOUR	PPI_VOL	mm liquid	3 hour rain	240
	06_HOUR	PPI_VOL	mm liquid	6 hour rain	240
	12_HOUR	PPI_VOL	mm liquid	12 hour rain	240
	24_HOUR	PPI_VOL	mm liquid	24 hour rain	240
RHI	Z_XXX_100	RHI	Z	Selectable AZ	100
TOPS	10_DBZ_240	PPI_VOL	height	10 dBZ Contour	240
TRACK	TRACK1	-NA-	-NA-	-NA-	-NA-
	TRACK2	-NA-	-NA-	-NA-	-NA-
VIL	010_180_240	PPI_VOL	mm liquid	1 to 18 km layer	240
VVP	VVP	VVP	wind	10 km height	60
WARN	SEVERE	PPI_VOL	message	3 km dBZ>30	240
XSECT	Z_SECTION	PPI_VOL	Z	Selectable Location	

Table 6 MONITOR Products (Continued)

Product Type	Product Name	Associated TASK	Display Parameter	Configuration Parameter	Range
	V_SECTION	PPI_VOL	V	Selectable Location	

Table 7 TD_RWY_09 Menu Configuration Names

Menu	Name
Radar Status	TD_RWY_09
TASK Scheduler	TDWR
Product Scheduler	TD_RWY_09
Product Output	TDWR

Table 8 TD_RWY_09 TASKS

TASK Name	Purpose
TDWR	Sector scanning over runway 09/27 at elevations .09 and 1.0

Table 9 TD_RWY_09 MONITOR Products

Product Type	Product Name	Associated TASK	Display Parameter	Configuration Parameter	Range
PPI	010_RWY_09	TDWR	Z	EL 1.0 degrees	30
SHEAR	009_RWY_09	TDWR	Shear	EL 0.9 degrees	30
	010_RWY_09	TDWR	Shear	EL 1.0 degrees	30
WARN	RWY09	TDWR	Shear>10 m/s/km for both		30
			0.9 and 1.0 EL angles. 3km^2 area.		

B.2 Setting Up the Weather MONITOR Mode

Step 1: Configure the Monitor TASKS

There are four TASKS used for the Monitor mode:

SURVEILLANCE A single-tilt PPI at 0.5 degrees of elevation to 300 km range for long range weather monitoring.

PPIVOL A 15-tilt volume scan TASK to 240 km range. Most of the products are derived from this TASK, which runs continuously.

RHI A single RHI sweep to 100 km at an angle selected in real time. Run this TASK on an *ad hoc* basis when there is interesting weather.

MANUAL A manual scan to 100 km for interactive scanning, identical to the RHI scan except that the scan mode is set to "Manual."

Recommended TASK configurations are shown in on page 135 through on page 136. Each should be tuned based on your requirements, experience, and the particular characteristics of your radar and site.

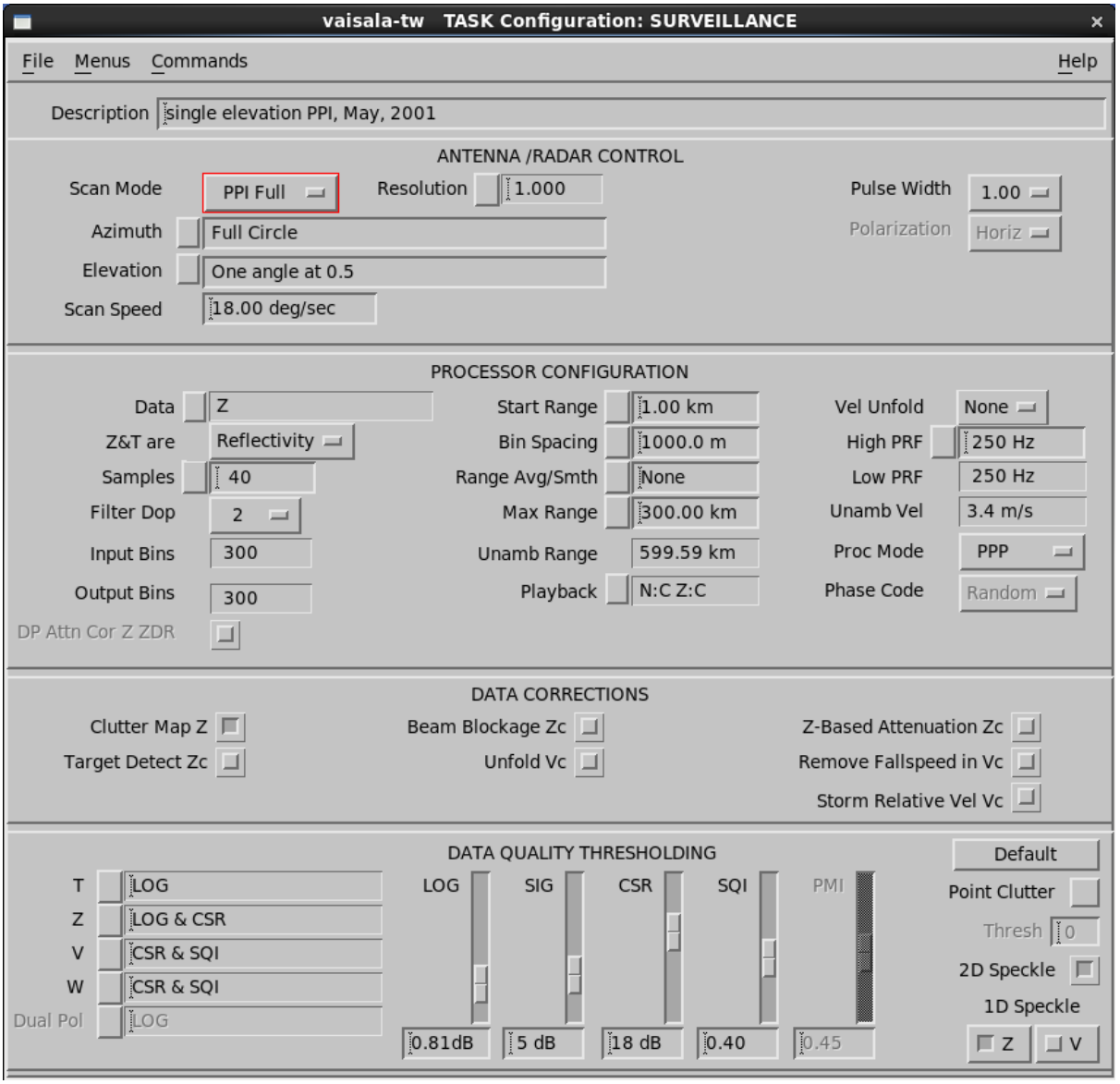


Figure 6 SURVEILLANCE TASK Configuration

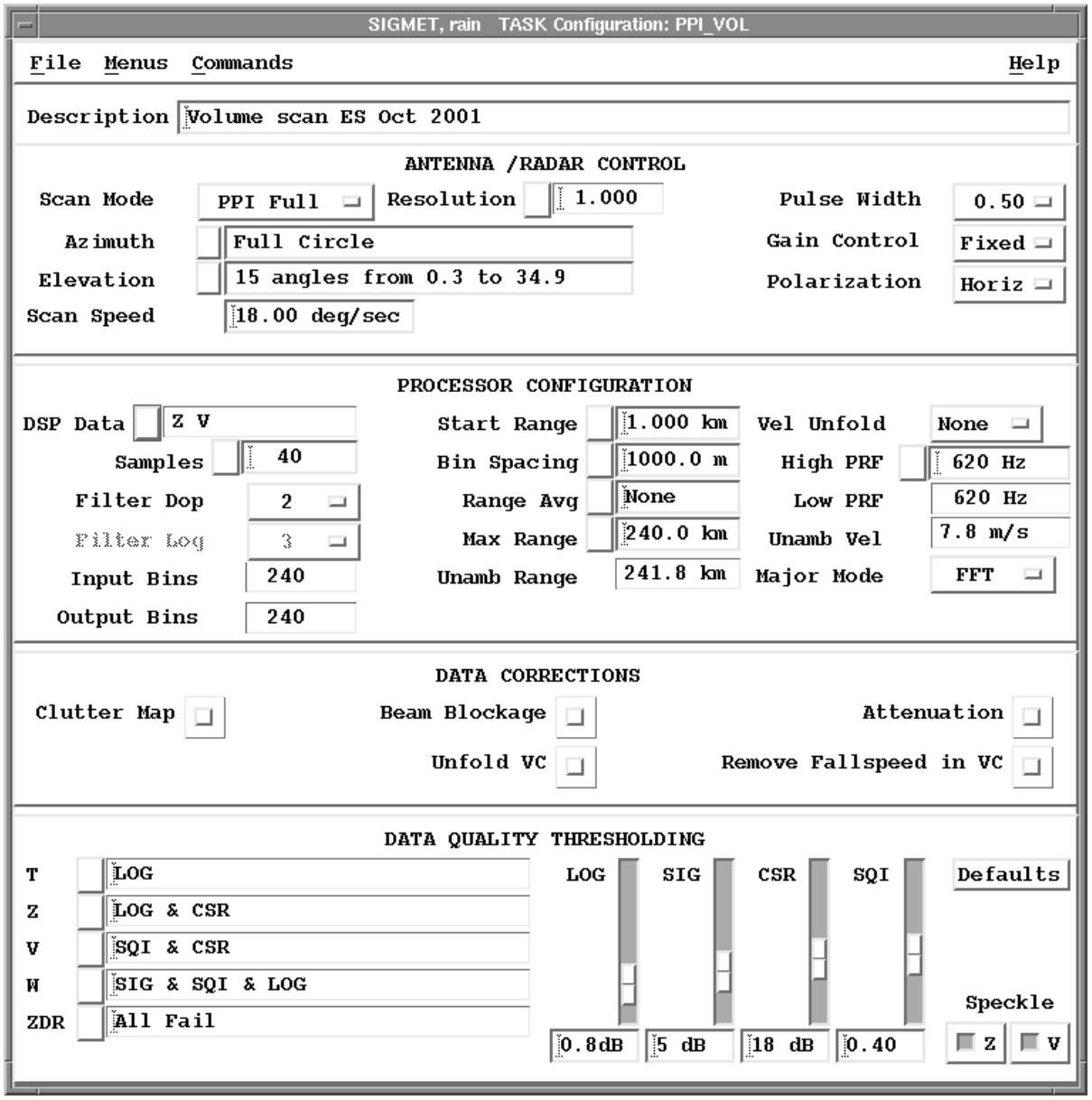


Figure 7 PPI_VOL TASK Configuration

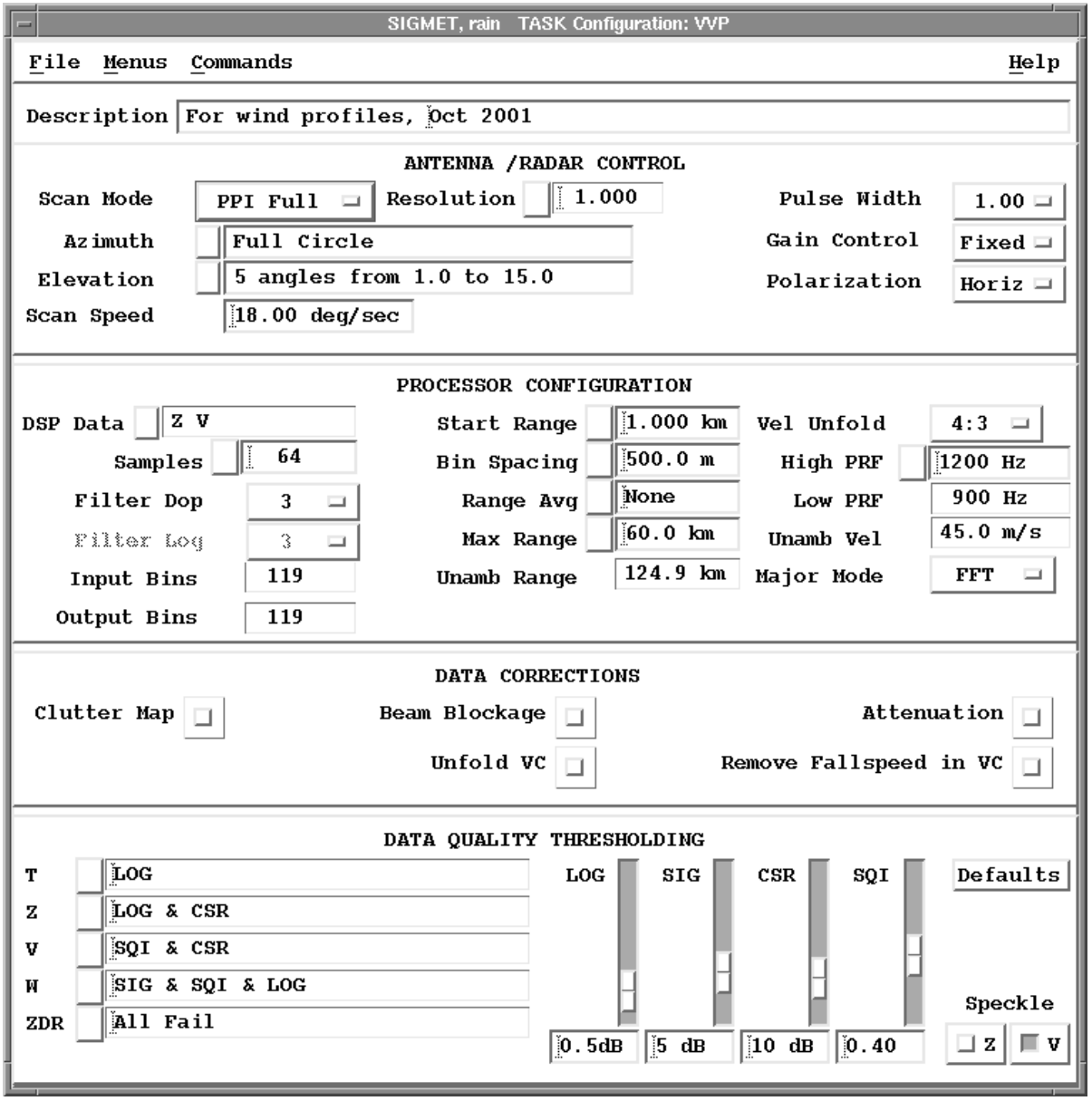


Figure 8 RHI TASK Configuration

The MANUAL TASK is identical except that the scan mode is set to Manual.

Step 2: Configure the MONITOR TASK Schedule

The TASK schedule for the MONITOR mode is shown in on page 138, set for a 15 minute cycle, as follows:

- PPI_VOL, the primary TASK, is set to run on the even 15 minutes.
- SURVEILLANCE is set to run at 7 minutes after the hour and every 15 minutes thereafter. (When PPI_VOL is run, the run time can be

read from the Task scheduler and thus a suitable schedule can be selected.)

- RHI is set to be non-mandatory so that it will be interrupted by more important TASKS if the operator is running it during a scheduled time.
- RHI_MANUAL is set to be non-mandatory as for RHI.

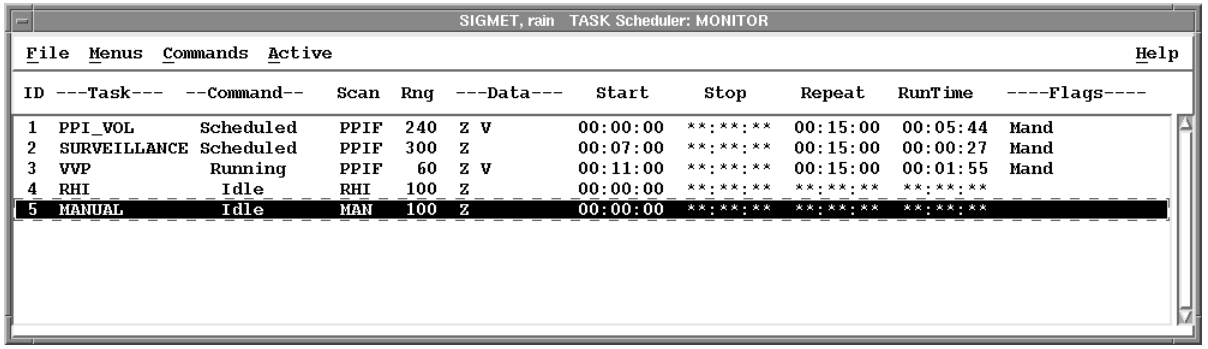


Figure 9 MONITOR TASK Schedule

Step 5: Configure the Radar Status Menu for the MONITOR Mode

The top part of the Radar Status menu should be configured and saved as shown in on page 138.

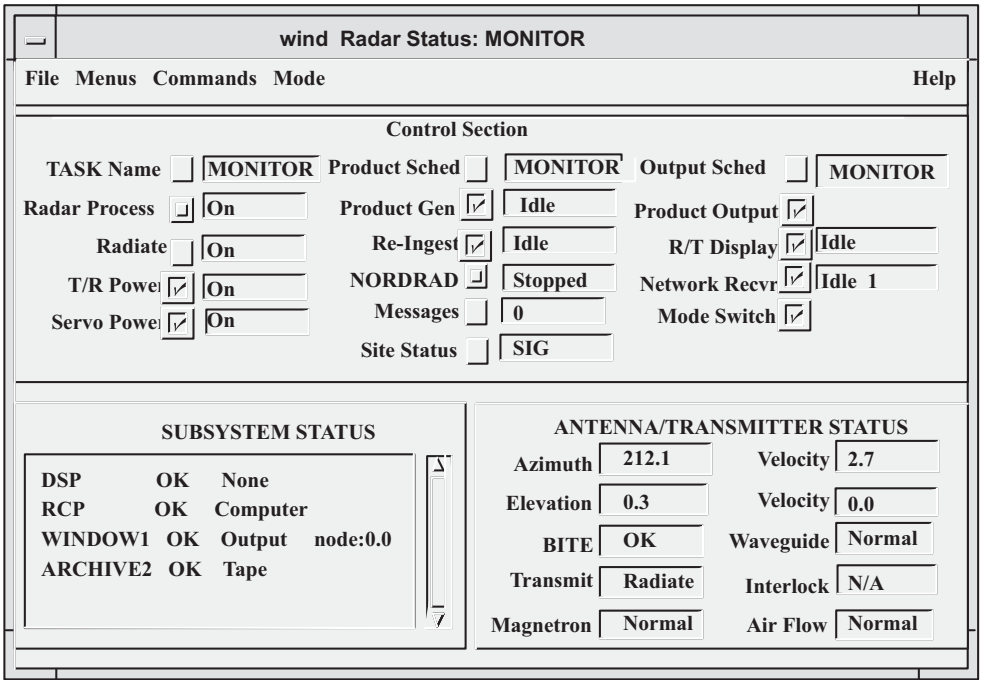


Figure 10 MONITOR Mode Radar Status Menu

Note that there are two options regarding start-up:

- Start-up in standby DEFAULT mode.

  If you want IRIS to start-up in a standby mode, make a separate DEFAULT configuration that has the radar process, product generator, radiate and servo power in the off position. Then switch the IRIS configuration to MONITOR. Note that the radar process and product generator must be set to off before IRIS lets you switch the IRIS configuration to MONITOR.
- Start-up in MONITOR mode

  If you want IRIS to be in MONITOR mode when IRIS starts, name the IRIS configuration DEFAULT.

CAUTION	CAUTION: If the radar antenna motion or radiation could pose a personnel hazard on automatic start-up, do not use this approach.

Step 6: Configure the MONITOR Output Assignments

The output configuration in the Product Output menu varies from system-to-system. Here are some hints for best performance.

- Determine what products to send to the various output devices and network computers on a regular basis. The output from these products should be directed to the corresponding devices and the configuration should be saved as MONITOR in the Product Output menu.
- In this example of the MONITOR configuration, the Warning product called SEVERE is used to signal when there is significant weather in a protected area, called TERMINAL. For wind shear applications, the corresponding warning situation display should be sent to a display so that the location of the warning can be viewed. When this warning product indicates the presence of weather in the terminal area, the IRIS configuration should be switched to the wind shear alert mode (see the TDWR example in the *IRIS Products Manual*).

Step 7: Test the MONITOR Configuration

The configuration should be tested to verify that it is functioning properly, as follows:

- Verify that the TASK schedule can run on schedule without falling behind. Note that RHI's are done only on an *ad hoc* basis through interesting weather. If you fall behind, you should consider eliminating the separate VVP TASK and using the PPI_VOL TASK for VVP products. You can also eliminate the highest angle in

PPI_VOL. Other performance trade-off factors are discussed in this manual.

- Verify that the product schedule can run without falling behind. For the example, the products are scheduled on a 15-minute basis. This is verified by checking the Product Scheduler times. Note that the system may temporarily fall behind at the beginning of an hour because there is considerable processing related to the RAIN1 and RAINN products, which occur on the hour.

  If the product schedule consistently falls behind, reduce the number of products set to "All" to those that are used most often. For example, you may not need all the different CAPPI heights. You should also verify that the Product Configuration menu's Smoother field is not set to a large value, or turn the Smoother off (set to 0) in products that require little smoothing.
- View each product to verify that it is being generated properly and that the color scales are appropriate for your season and location. You will probably need to tune the color scales in the Product Configuration menus to match the intensity of precipitation.
- For wind shear detection applications, verify that the SEVERE product (used for indicating when to switch from the MONITOR to the TDWR mode) is appropriate for your application. The suggested product sounds a warning whenever there is an area of 10 sq. km or greater of 30 dBZ or greater echo at 3 km height in a protected area called TERMINAL. TERMINAL should be an area centered about the air terminal (nominally a box 60 km on each side). This product should be tuned by changing the area size and the threshold so that sensitivity is maintained with a low false alarm ratio.

APPENDIX C

PASSIVE IRIS FEATURES

C.1 Overview

For most installations, IRIS is in "active" control of the radar and antenna via the RVP processor and the RCP. However, for some installations, the radar and antenna are controlled by an external RCP and IRIS is merely connected to the radar by the signal processor. In this case, the external control system performs the scanning and IRIS simply "listens" to the signal processor in "passive" mode. In passive mode, the radar TASKS in IRIS are configured to match the scanning that is performed by the external control system and IRIS synchronizes to the external scanning, that is, IRIS deduces which TASK should be running, starts the TASK and acquires the TASK data from the signal processor.

Passive IRIS is ideal when IRIS must be installed in parallel with an existing data acquisition system. The existing system can then "do its own thing" and IRIS will simply follow along. Another application is when two radars at different frequencies (and correspondingly two IRIS's) share the same antenna. In this case, one of the IRIS systems can operate in active mode and the other operate in passive mode to allow simultaneous data collection from both radars. Another application is when using time series playback.

Passive IRIS requires that antenna angle information be supplied to the RVP. It requires a minimum of the RVP7. For time series playback, a minimum of RVP8.

C.2 Passive IRIS Configuration in setup

Passive IRIS is enabled in the **setup** utility (Ingest/Scanning Options). Please refer to the *IRIS Utilities Manual* for details. Please be sure to also turn off noise sampling.

TASK Scheduling Control (select one of)

- **Active Only-** the normal IRIS active control.
- **Passive Only-** for a system that can function only in passive mode. This is the most common type of passive IRIS.
- **Active/Passive-** for systems that can assume either role. In this case, the selection of active versus passive is done in the TASK Scheduler menu.

Passive: use external trig rate (Yes/No)

This tells IRIS that we should monitor the current PRF and use it to help guess which task is currently running. This assumes we are using an external trigger, or are playing back time series.

Passive type

See C.3 TASK Configuration, Scheduling and Synchronization on page 142.

C.3 TASK Configuration, Scheduling and Synchronization

Passive IRIS must determine what the active system is doing and then follow along acquiring data. The TASK Configuration and TASK Scheduler menus must be properly configured for this to work.

TASK Configuration

For each "TASK" that is run by the active system, you must configure a corresponding TASK to be run on the passive system. For example, if the active system is running a volume scan, then you would configure a corresponding volume scan in the passive system with exactly the same elevation angles.

Aside from the angles, the only other critical element of the TASK Configuration is the radar trigger. If the trigger is generated externally, then you must configure the correct PRF. Note that dual PRF is not supported by passive IRIS when an external trigger is used. If the RVP is generating the trigger then you can configure any allowed trigger including dual PRF.

TASK Scheduler

With regard to the other signal processing you have complete flexibility to configure any processing options. Thus while passive IRIS must scan the same as the active system it can be doing very different processing.

The TASK Scheduler should be configured with the same TASK's as are run by the active system. It is required that the TASK's be in the same order as are run on the active system unless you are using Status–Slaving (see below). Also if your system can run in Active or Passive mode, then the Active/Passive menu selection at the top of the TASK Scheduler should be set to "Passive". This state is saved when you save the TASK Scheduler configuration.

TASK Scheduler Synchronization (Passive type)

There are four ways that passive IRIS synchronizes the TASK that it is running to the the active control system. The TASK Scheduler in the passive system must be configured to contain the TASK's that are being run by the active system and all TASKS must be set to "Scheduled". The methods are:

- **Multi-Tasking**

  In this case, Passive IRIS tries to run the first TASK in the schedule. It waits until the PRF and the starting angle match the TASK configuration and then starts acquiring data for the TASK. Passive IRIS then waits for the PRF and angle for the 2nd TASK in the Scheduler and so on. If at any time it notices that the PRF and elevation angle are a better match for the start of a different task, then it will interrupt to switch tasks. Note that this mode only supports continuous PPI scans.

  In all cases it may be necessary to adjust the angle tolerances in **Setup/ingest** to tune the TASK so that it runs properly. For example, if the angles of the TASK are very close together, then the angle tolerance should be set smaller than the angle spacing. Also, the antenna may not actually achieve the desired elevation angle, in which case it is better to modify the TASK in passive IRIS to match the actual rather than the nominal elevation angles.

- **Single–Tasking**

  In this case IRIS will allow only one task to be scheduled in the task scheduler. IRIS waits until the PRF and the starting angles match the TASK configuration and then starts acquiring data for the TASK. This mode supports all scans including RHIs.

- **Status–Slaving**

  This case requires that a Status product be sent to the passive system. In the case when the active system is another IRIS, the Status product on the active system is generated automatically whenever a TASK is started and contains the name of the TASK that is currently running.

When the passive system receives this, it starts (or continues running) the same TASK. The Status product must be configured to be output automatically over the network to the passive system. This mode supports any scan geometry including RHIs.

- **TS–Playback**

  This is used when trying to synchronize to old time series being played back via the **tsarchive** utility. Support is required by **tsarchive** and by the **RVP8** or later processor. This is a variation of the Multi-Tasking mode described above. We are assuming that a single volume scan is being played back. This volume scan may be approximated in IRIS using a single task, multiple tasks, or a hybrid task. IRIS will aggressively try to remain synchronized to the sweeps of the original data. In the event that a sweep ends before the full 360 degrees were acquired, IRIS will immediately switch to the next to prevent losses at the start. Similarly if the sweep is filled before the data is complete, IRIS will continue to read rays from the RVP. This is important to make sure that the next sweep does not start with the last few rays of the previous sweep. This mode only supports continuous PPI scans.

C.4 TS Playback using tsarchive

Running passive IRIS on **tsarchive** playback data presents some unique challenges discussed here. This feature is only available on RVP8 and later DSPs. Make the following configurations in **setup**:

In **Ingest** *Signal Processing and Data Storage:*

```
Source of Recorded angles: RVP Tags

Source of recorded time: RVP Tags
```

In **Ingest** *Scanning Options:*

```
Passive type: TS–Playback

Passive: use external trig rate: Yes (not critical)

Optimize for continuous output: No
```

In **General** *Modes and Protocols:*

```
Timezone for data recording: UTC
```

TIme is not current, possibly repeating

Much of the configuration of the playback RVP8 must be set the same as the RVP8 used for recording. Any easy way to do this is to use the same RVP8. They must both have the same IFD sample clock rate. The pulse widths and range resolutions must match. The local time zone must match, because IRIS will read this from the RVP8.

For successful playback, a task must be configured to match the original task name, and to have many matching characteristics. Things to match are: Major Mode, Range bin count, dual-prf unfolding, pulse width, Phase Modulation, Polarization, and PRF. Note that IRIS supports only integer PRFs. Select the next lower integer for data with non-integer PRFs. When you attempt to playback and there is a mismatch of one of these, you will get a signal pop-up. To see details of the mismatch please halt the task right then so the end of task code can read the time series configuration. You can also get the same information manually from **tsview**.

Since the playback data is not from the current time, it will appear in the Ingest Summary Menu under the data time. You cannot record the exact same time data multiple times in IRIS. To address this we have added a "playback version" number. All live data has the playback version number set to zero. To control this, first start the IRIS task. Then in **tsarchive** increment this value to some other value, then play the data once. In the Ingest Summary menu a 2-digit playback version number is added to the 3-character site code when the playback version is nonzero. The product generator will always run on the largest version file it finds.

C.5 Testing Passive IRIS

To verify the proper functioning of passive IRIS, use the following:

- Watch the TASK Scheduler and verify that the TASK's are being sequenced properly ("Running" means a TASK is acquiring data).
- Observe the Ingest Summary menu to verify that all sweeps of each TASK are being collected.
- Use the **rays** utility to verify that there are no missing rays. Note that depending on the nature and accuracy of the antenna control system, it may not be possible to eliminate missing rays at the end of individual sweeps.
- Make individual PPI products for each sweep of a volume scan. An easy way to do this is to specify " * " (wild card) in the elevation angle field of the PPI Product Configuration. The PPI products will show any missing rays that are >2 degrees. Single missing rays will not be apparent.

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