E. Dual System Operation

E.1 Dual-System Applications

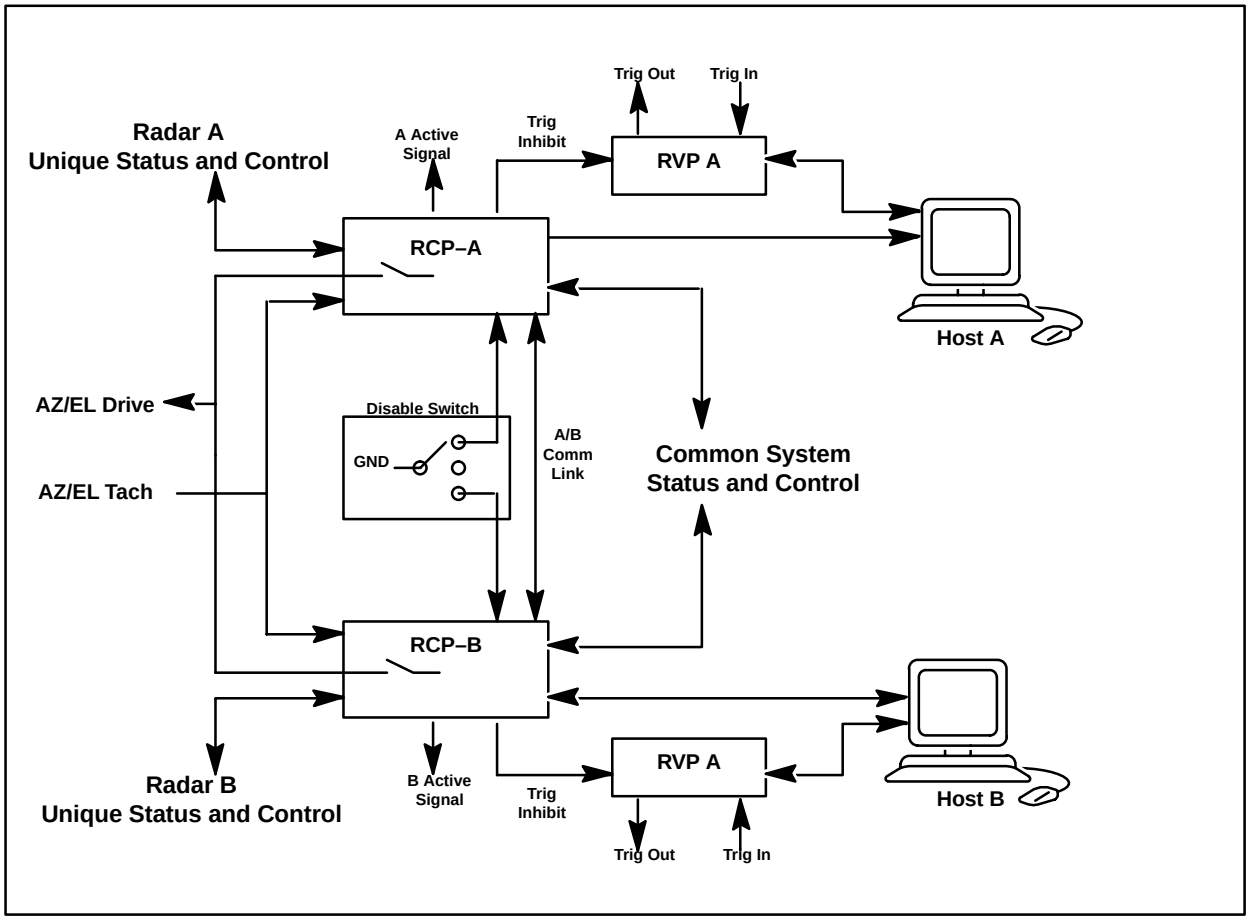
A dual-system is the use of two separate transmitters and receivers through a single antenna. There are two primary applications for dual (A/B) systems:

- **Redundant systems** such that if A fails, B will provide backup or vice versa. For redundant systems, the two systems function exclusively, i.e., they must never be allowed to operate simultaneously. The two systems could be separate radar transmitter/receiver systems sharing the same antenna and/or separate RCP02 systems
- **Dual frequency systems** for which there are two independent transmitters and receivers that share the same antenna. The systems can be operated either exclusively (i.e., one–at–a–time), or simultaneously (in parallel) with one system acting as the master and the other acting as the slave (in passive mode).

Both of these applications share common elements with regard to system control, monitoring and data acquisition. In the case of redundant operation, the systems must be capable of switching automatically when a system fails. In the case of dual frequency operation, the systems must be capable of switching sequentially, as in the redundant case, as well as switching between "active" and "passive" state.

It is assumed throughout this discussion that the signal processor is a SIGMET model RVP7 or equivalent and that the host computer is running SIGMET IRIS software. Note however, that it is possible to use dual-RCP02 control with other signal processor and software applications as well.

E.2 Dual System Architecture



The dual-system architecture is shown in the figure above. The basic features are:

- Two RCP02's that coordinate the system operation via the A/B Comm Link. The RCP's monitor status from the radar, the signal processor and the host computer and decide between them who is "active".
- A "Disable Switch" that removes either system A or B. The switch (or two separate switches) could also be wired in such a way that it would be possible to disable both A and B simultaneously.
- Two host computers, each communicating to its RCP's via an RS232 line. Host computers are treated as "unreliable" systems. In other words, even in the event of failure of a host computer, the RCP02's must still make the correct decision about which system is "active".
- Two radar signal processors communicating to the hosts. In the case of an RVP7 processor, the communication is via a SCSI interface.

The signals in the figure are summarized below:

Unique Status and Control

These are status and control signals that are unique to each system. Examples are radiate on/off status and control, and transmitter status. The normal status/control and extended BITE inputs/outputs are used for these.

Common Status and Control

These are status and control signals that are common to both system. Examples of common status variables are waveguide pressure, safety interlock on the radome door, antenna servo status and site/environment status. Common status inputs should be wired in parallel to both RCP02's to the normal status and BITE inputs.

⚠ **Do not wire common system control outputs in parallel (from both RCP02's). This could result in damage to the RCP02 output drivers.**

⚠ **Do not wire critical common system control outputs to both RCP's without using an external relay to select which is used. A "critical" control output is one that could damage the system in the event that both RCP's commanded the control simultaneously. The A/B Active signal is available for controlling external relays so that only one system can control the output.**

Examples of common control outputs are servo power on/off and any environment control such as obstruction light on/off. Common control functions must be handled differently to prevent the possibility of simultaneous, and perhaps conflicting, control by both RCP02's.

Critical control functions (i.e., those that could potentially damage the radar if both RCP's were to command them), should be routed through an external relay that is controlled by the A/B Active Indicator signal (which can of course be used to control a master relay).

Non-critical control functions (i.e., those that would not damage the radar if both RCP's were to command them), can be routed through any of the spare internal relays in the RCP02 (there are 8 total). The approach of using spare internal relays for these common control outputs relies on the RCP02 control logic equations. The internal variable ***drcp_active*** would be equated to one of the extended BITE control output variables. This would be physically wired to a spare TTL relay on the RCP02. The control output would then be wired through the relay (e.g., servo power on/off). This approach is not fail–safe, since the user could make an error in the control logics, or simply disable the control logics. Therefore it is not appropriate for critical control functions.

Azimuth and Elevation Drive Output Signals

These are routed through an internal relay in the RCP02 which connects the drive lines when the RCP02 is in the active state. This allows only one RCP to control the antenna. The normal drive output back panel connector assignments are used. The wire–wrap jumpers for this are installed on the RCP02 main board per section E.3.

Azimuth and Elevation Tachometer Input Signals

These are wired in parallel to the tachometer inputs on both RCP02's. Tach is sensed by both RCP02's simultaneously, but is not used on the inactive unit. The normal tachometer input back panel connector assignments are used.

Trigger Inhibit

This is an output line from the RCP02 to the signal processor or trigger generator that can be used to inhibit triggers on the inactive system. In the case of an RVP7 the line is the LSB of the normal azimuth output tag line (AZ0). Therefore no special cabling is required.

A/B Active Indicator Output Line

This is an active low TTL signal that is output to indicate that an RCP02 is in active mode. This signal should be used directly to switch (via external relay) critical control functions, i.e., those functions that, if operated simultaneously by both RCP02's could cause damage to the system.

The internal logic variable name for this indicator is ***drcp_active.*** To create a physical output for this, use the logic equations to assign this variable to an unused BITE control output. This approach should only be used for switching non–critical control functions since an operator could disable the control logic function of the RCP02 by responding NO to the first question of the control logic TTY setups. This could possible leave the radar in an unsafe state.

A/B Disable Switch Input

A switch closure to ground on this input will disable a system so that it is not available for automatic switching. This is used, for example, to put a system in "Maintenance Mode". The input can be implemented as a single, three position selector switch as shown in the figure, or as two separate switches. In the case of a single selector switch, the switch can be labeled as an enable rather than a disable (e.g., "A–Auto–B) to indicate the exclusive use of either A or B.

A/B Communications Link

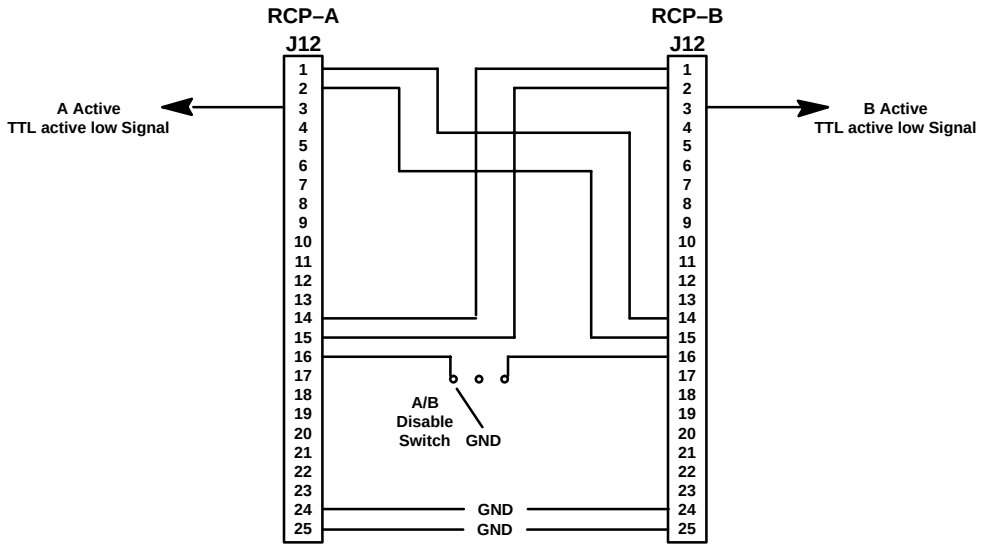
This link is on a special cable between the J12 connectors of the two RCP02's. The link implements a serial protocol that passes status information and requests for control between the two RCP02's. The pin assignments are given in Section E.3.

E.3 Dual-System Special Cabling and Modifications

Dual System Connection Cable and Switch

All of the special cabling requirements for the dual–system are handled on connector J12– a 25DBF connector on the back panel of the RCP02 labelled "MISC I/O". This connector contains the input for the A/B Disable Switch, the output for the A/B Active Indicator signal and the A/B Communications link. The wiring is shown below. The signals are described in the previous section.

Connector J12 "MISC I/O" Dual-System Link Cable



Antenna Drive/Internal Relay Wire Wrap Jumpers

The wire wrap jumper assignments to route the output drive signals through the internal relays are as follows.

XXX

E.4 RCP02 TTY Setups for Dual-System

site custom- Dual-System Setups

The dual–system setups are in the "site custom" section of the RCP02 non–volatile setups. These can be accessed from a setup terminal in the usual way or for IRIS systems via the "antcheck –chat" feature from an X terminal. The questions are as follows:

`Use Dual/Redundant system configuration: YES`

This question is answered YES for dual-system support. Answering NO will disable dual system support.

⚠ **If you answer NO to this question, the safety features that prevent simultaneous usage of the two RCP02's will not be in effect. Therefore SIGMET does not recommend that you answer NO for a dual-system.**

`This RCP02 is the 'A' unit: NO`
`Identifying letter for this unit: 'A'`

The two RCP02's are named the "A" and "B" units. To avoid confusion, SIGMET recommends that you put physical A and B labels on the two units. Respond YES for your A unit and then for the B unit setups respond NO. Note that if you use the "TB" (title bar) option for the first line of the RCP02 front panel display (configured in the site display section), then the characters [A] or [B] will appear on the top line of the RCP02 front panel to reflect your choice.

If the "A" and "B" designators really are not what you want, then use the second question to declare the single-letter identifier that will appear in the TB title bar for each unit.

`Default powerup operating mode: Auto`

You may choose the initial powerup mode (i.e., None/A/B/Auto) of a dual RCP02 system. On powerup, the RCP02 will first wait for guidance, either from IRIS or from the other RCP02, about which mode to enter. If the other RCP02 is dead, and if no mode requests have come in from IRIS, then the unit will switch to its default powerup mode. Otherwise the unit will acquire the mode of the other RCP02, or will follow the direction of IRIS.

Selecting the "AUTO" initial powerup mode handles the case of starting an active scan with no user intervention when just one RCP02 is first switched on. Without this, the user would first have to explicitly choose "AUTO" from an IRIS Dual Switching Menu. But sometimes this is what you want; and by selecting the powerup mode of "None", the system will remain in maintenance mode until the IRIS user makes a specific choice.

`This RCP02 is the 'Preferred' unit: NO`

The concept of a "Preferred" unit is used to resolve negotiation "ties" by the switching algorithm. In other words, when confronted with a choice of using the A or B unit, and all else is equal, the "Preferred" unit is used. SIGMET recommends that you make system A the preferred unit (respond YES) and respond NO for the system B setup.

`Include Data Processor NST faults: NO`

This question allows you to include the fault status of the Data Processor reported by IRIS when determining whether a given channel is okay. Answering "YES" means that both the Data Processor and the Radar Workstation must be working in order for the channel to be considered "okay". Answering "NO" causes only the Radar Workstation to be checked.

```
Cooldown time after becoming inactive:  3.0 sec
Additional warmup time when switching:  3.0 sec
```

For redundant switching of antenna control, a minimum of 2 seconds is required by the RCP02 itself. The value that is used depends on the specific characteristics of the system and should be measured for each system.

`Allow voluntary flipping between units: NO`

The Dual/Redundant system code is capable of switching between systems in response to requests from the host computer. The RCV05 and XMT05 serial formats include two bits to control these transitions. One bit (*WouldUse*) announces that the host computer would like to use the antenna (whether or not it is actually available); and the other bit (*Relinquish*) indicates that control can be voluntarily relinquished to the other system.

When the RCP02 receives a *Relinquish* offer, it checks the other unit to verify that a) it is communicating properly, b) it is not indicating any faults, and c) it has *WouldUse* TRUE and *Relinquish* FALSE. Under these conditions, if control were offered to the other unit, it would actually be in a position to accept it; and so, the switch-over is made at that instant. Since the algorithm will only flip to a system that is actually ready to go, it automatically optimizes scheduling of the antenna as each radar is able to use it.

The additional logic variables *drcp_woulduse*, *drcp_relinquish*, *other_drcp_woulduse*, and *other_drcp_relinquish* will appear in the control logic editor whenever voluntary flipping is enabled.

The next group of questions concerns how the IRIS Mode (as defined in the Radar Status Menu) is forced by the RCP02 whenever an RCP02 switches from ACTIVE to INACTIVE state and vice versa.

The first set of questions is for the switch from ACTIVE to INACTIVE. The example responses are for a redundant system with the modes configured as described in Section E.6:

```
Choose: None Fixed Inherit Resume
Mode switch strategy when INACTIVE: FIXED
Fixed IRIS mode to request: 2
```

The two RCP02's negotiate which is the active system such that only one system can be ACTIVE at any given time. (Note that both systems could be INACTIVE). When a system is switched into active mode, it commands its IRIS to change operating modes (i.e., the Radar Status Menu mode is loaded per the RCP02 command). This question is used to determine what IRIS mode is commanded when a system is switched to active. The RCP02 simply calls the IRIS modes 1-7. The relation to the IRIS mode names is made in the IRIS Setups (RCP section) See Section E.6 for a discussion of the IRIS modes. The different strategy choices are:

- **Fixed-** This is recommended for redundant systems. The RCP02 forces IRIS into a particular operating mode. This is the recommended method of operation for redundant systems since it can be used to force IRIS into a STANDBY mode when its RCP02 becomes inactive. The user is prompted to input the number of the IRIS mode as shown above. In this example mode 2 is used which corresponds to the mode called STANDBY as described in Section E.6.
- **None-** in this case the RCP02 does not request any of the 7 IRIS modes.
- **Inherit**- here the RCP02 switches IRIS into the operating mode that was being used before the switch. This would not be used for redundant systems. If you respond "Inherit", then you will be prompted to say what modes are valid to inherit. This is discussed in detail below in the discussion of the INACTIVE to ACTIVE transition
- **Resume**- in this case the RCP02 will switch IRIS into the mode that the RCP02 was last run in. This is useful in the case of dual frequency systems that are sharing an antenna system since it allows a system to resume operation in passive mode even if it is not the active controller. It is not used for redundant systems.

```
Allow mode changes within IRIS: NO
```

Responding NO will prevent both automatic and manual IRIS mode changes (from the IRIS Radar Status Menu). The RCP02 will continually force the IRIS mode. In the example, the STANDBY mode will be forced when the system goes INACTIVE. Note that this makes it impossible to do any modification of the IRIS mode for development or maintenance. In this case, it is recommended that the user temporarily respond YES to this question.

The next set of questions is for the switch from INACTIVE to ACTIVE. The example responses are for a redundant system with the modes configured as described in Section E.6:

```
Choose: None Fixed Inherit Resume
Mode switch strategy when INACTIVE: Inherit
     IRIS mode #1 is valid to request: NO
     IRIS mode #2 is valid to request: NO
     IRIS mode #3 is valid to request: YES
     IRIS mode #4 is valid to request: YES
     IRIS mode #5 is valid to request: NO
     IRIS mode #6 is valid to request: NO
```

```
      IRIS mode #7 is valid to request: NO
Default mode to resolve illegal requests: 2
```

Here the recommended response for a redundant system is "Inherit" so that when a system becomes active it will continue operation in whatever mode the other RCP02 had been using. This assures that if a system is running and faults, it will continue in the same mode of operation after an automatic switch.

In the case of "Inherited" or "Resume", the RCP02 prompts the user to specify which modes of operation are valid to inherit (or resume) when the system becomes active. In this case, based on the example IRIS mode configuration in Section E.6, the AIRPORT and AERIAL modes would be allowed.

The final question in this sequence above specifies the mode to use when the inherited mode does not match any of the allowed modes. For example, if both systems are in STANDBY when a switch is made, the new ACTIVE system will try to inherit the STANDBY mode (mode 2 in our example). This is not a valid active mode so the ACTIVE system would start mode 2 (AIRPORT) instead.

```
Mode to request during Maintenance ACTIVE: 0
Mode to request during Maintenance INACTIVE: 1
    Allow mode changes from within IRIS: YES
```

These questions specify what IRIS modes should be set when the RCP02 is intentionally disabled (placed in "Maintenance Mode") by either the hardware A/B switch or the Select switch in the IRIS Switching menu.

You may choose the IRIS mode to request for Maint Active and for Maint Inactive. If the requested mode is nonzero, then an additional question appears to choose whether auto mode switching is allowed. A recommended strategy is to request a mode of zero in Maint Active, so that a running RCP will continue doing whatever it was doing already. Maint Inactive should request the IRIS maintenance RST mode, and allow auto switching.

site display- Front Panel Display Setups

The only other setup questions for dual-system support are to configure the front panel display (the site section of the TTY setups). This is recommended for maintenance personnel since these front panel displays can provide excellent status without the need to look at a workstation.

In "site display" if you select TB for the first line (title bar), the title will show the labels [A] and [B] in the middle to indicate if the RCP02 is the A or B system, for example:

```
–AZ–        [A]        –EL–
```

For the bottom line of the display it is recommended that you select the choice DRCP (dual/redundant state) which shows four fields, for example:

```
En/En    Ok/Ok    On/––    Au
```

The first field shows the status of the hardware A/B disable switch for system A/B. In this case both systems are enabled (En). Other states are "Di" for disabled and "??" for unknown.

The ?? is used for all fields to indicate that the RCP02 does not know a particular state. For example, if the other RCP02 is turned off or the A/B comm link is disconnected, then the RCP02 has no knowledge about whether the other system is disabled by the switch.

The second field shows the overall status (readiness) of both the A/B systems. The possible states are Ok, Er (error) and ??. A system is not available for use if it has state Er. Ok indicates that it is ready for use. These indicators are identical to the "Ready" indicators in the IRIS Dual System Switching Menu described in Section E.7.

The third field shows whether the A/B system is active (On), inactive (—) or "warming" (Wm). "Warming" is a transition state that occurs just prior to a system becoming active. This corresponds to the "Active" indicators in the IRIS Dual System Switching Menu described in Section E.7.

The fourth field shows the software control mode, i.e., from the IRIS Dual System Switching Menu described in Section E.7. Only a single status indicator is shown for both systems, since this state is negotiated between the two systems, i.e., they both must agree. The state A or B indicates whether system A or B is requested exclusively. The "Au" state indicates that the system will switch automatically between A and B in response to failures.

E.5 RVP7 TTY Setups for Dual-System Support

The only setup required by the RVP7 is whether to inhibit the trigger when its associated RCP is inactive. Whether or not this is necessary is determined by the radar manufacturer. The only setup is to respond the following questions in the **mt** (general trigger setup) section:

```
Blank output triggers according to TAG#0: YES
Blank when tag input is high: YES
Blank triggers 1:YES 2:YES 3:YES 4:YES 5:YES 6:YES
```

These questions control trigger blanking based on the TAG0 input line. You first select whether the trigger blanking feature is enabled; and then optionally choose the polarity of TAG0 that will result in blanking (consistent with the RCP02 setups), and which subset of the six user definable triggers are to be blanked.

Note that for maintenance, the RVP7 on the inactive system can be made to generate a trigger by any one of the following techniques:

- One of the 6 triggers can be set to "Blank triggers NO". This could be used to provide a permanent maintenance trigger.
- Temporarily respond "Blank output .. TAG#0: NO"
- Install a physical override switch on one of the RCP02 BITE inputs and then, via the control logic, enable the triggers by XXX.

E.6 IRIS Configuration for Dual-System Support

The basic concept behind the IRIS configuration is to separately configure systems A and B so they they can function independent of one another. After this is done, then the dual–system operation can be tested. The special setups for the dual-system support are described here.

IRIS Radar Status Menu Mode Configuration

The IRIS "Mode" is determined by the Radar Status Menu, i.e., the name at the top of the menus. When IRIS is first started, the "DEFAULT" mode is loaded. During operation, the mode can be changed by any of the following three mechanisms:

- Manual mode change by doing a F**ile–>Open ...** selection in the Radar Status Menu.
- Automatic mode change forced by a warning product. This is often used for switching between a surveillance mode and perhaps a volume scan or wind shear detection mode.
- External mode switched forced by the RCP02. The RCP02 can be configured to either constantly force a mode (prohibiting manual or automatic mode changes), or trigger a mode change and then allow a manual or automatic mode change from the Radar Status Menu.

The specific modes that are configured for dual system redundant applications are discussed here. The example used here is for redundant system operation of a wind shear detection system that has two operational modes called AERIAL (for general weather monitoring) and AIRPORT (for optimized for wind shear detection. A summary of the IRIS configuration is provided in the table below:

RCP02 Mode Number	Radar Status Menu (IRIS mode name)	TASK Schedule	Product Schedule	Output Schedule
1	MAINTENANCE	MAINTENANCE	MAINTENANCE	MAINTENANCE
2	STANDBY	AERIAL (inactive)	PRODUCT	OUTPUT
3	AERIAL	AERIAL	PRODUCT	OUTPUT
4	AIRPORT	AIRPORT	PRODUCT	OUTPUT

It is assumed that the same product schedule and output schedules are configured for all modes except the MAINTENANCE mode, i.e., these schedules include all of the required products for all of the modes. It is possible to have different product and output schedules, but this increases the configuration maintenance. The modes are summarized below:

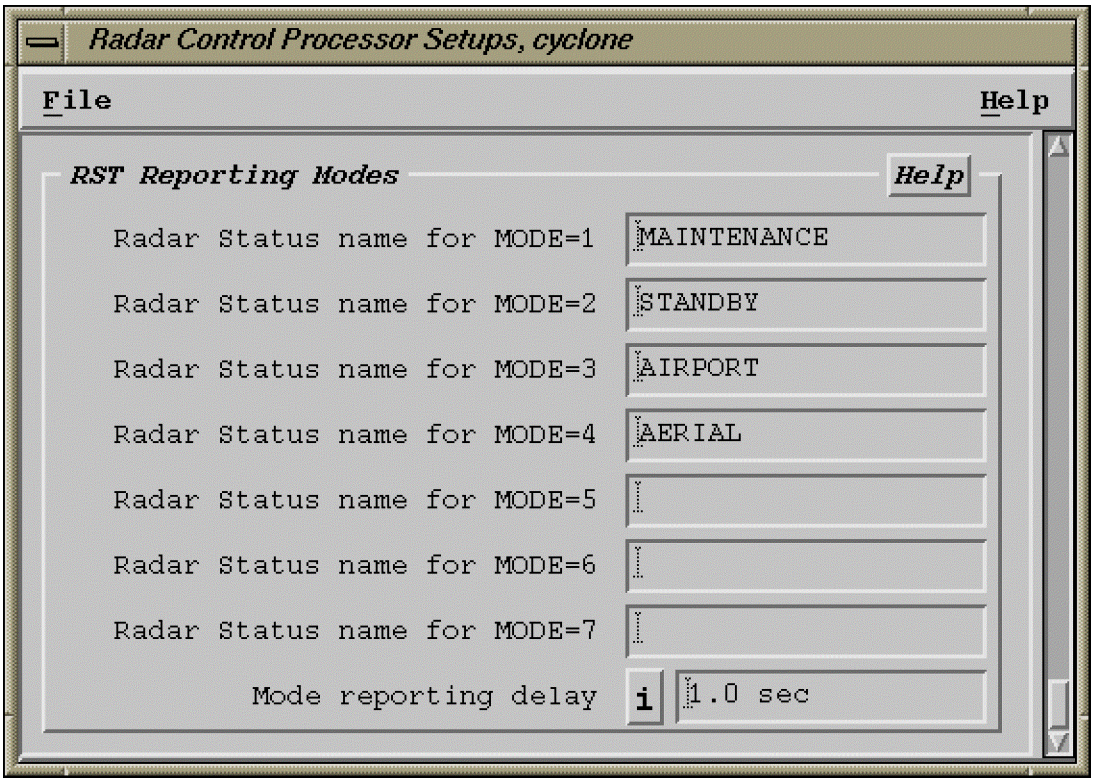
- STANDBY mode is configured identically to the AERIAL mode except that the TASK scheduler is set to inactive (no TASK scheduled). Also, the servo power and radiate should be set to OFF in the radar status menu for safety.

- AERIAL- this mode would be configured for a long range surveillance scan and a volume scan for routine weather monitoring.
- AIRPORT- this mode would be optimized for wind shear detection.
- MAINTENANCE– This is the mode that will be entered when the system is intentionally disabled by either the hardware or software selector switches. It is recommended to blank the TASK Schedule, clear all output assignments and generate no products. For safety, the servo power and radiate can be set to off in the Radar Status Menu.

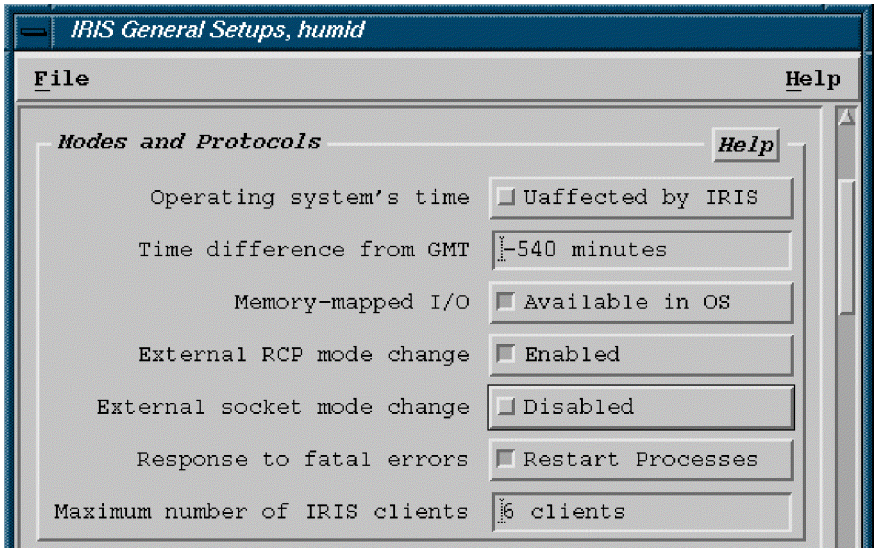
⚠ **Note that for the recommended redundant configuration, you will need to have the system disabled by the hardware A/B switch or the A/B select in the Switching menu to configure IRIS modes. For normal redundant configuration of the RCP02 this will force IRIS into MAINTENANCE mode and then release IRIS to allow manual mode changes for configuration of the other IRIS modes.**

IRIS Setup Utility Mode Configuration

The various modes of operation should be configured into the IRIS Setup Utility in the RCP section as shown below. Note that the first column in the table above gives the numbers for each mode that are used in the example.



The modes are coded 1-7 and must match the mode names configured in the IRIS Radar Status Menu. To force IRIS to switch to the requested mode you must also enable External RCP Mode Change" in the IRIS Setup General question as shown below. The "External Socket" mode change should be disabled.



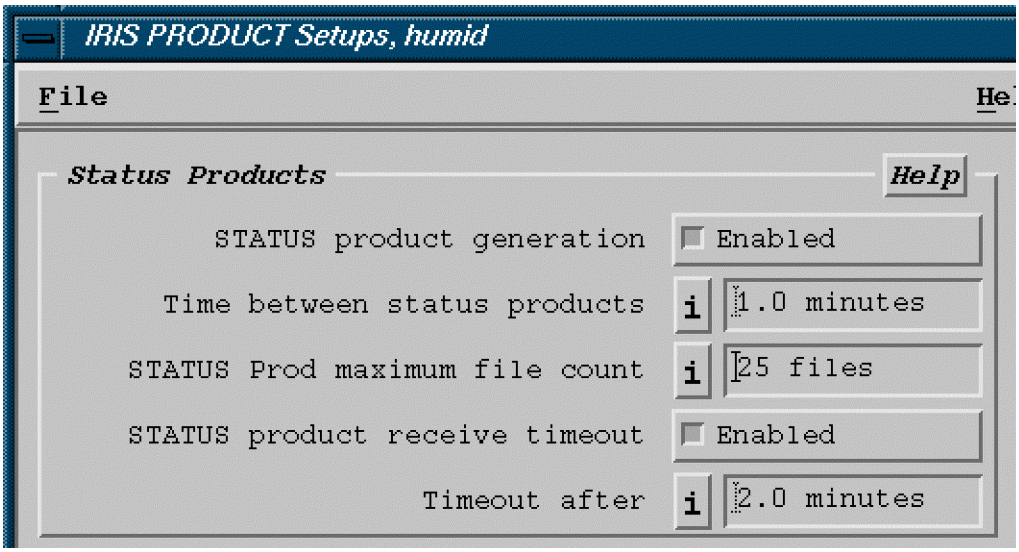
IRIS Status Product Configuration

The Status Product is produced at regular intervals at each of the IRIS radar workstations (A and B). These are used by the RCP02's to assess whether a system is OK or in FAULT, i.e., whether a system is available for use. The Status product collects information from various sources and will fault if any of the following occurs:

- BITEX critical faults.
- RCP02 communication failure (RCP02 "DEAD").
- RVP7 signal processor error.
- IRIS internal critical fault. These are internal errors that are flagged as critical in IRIS.

Thus the Status product provides information on all system components. For a redundant system, IRIS A must be configured to send its Status product results to both RCP A and IRIS B and vice versa.

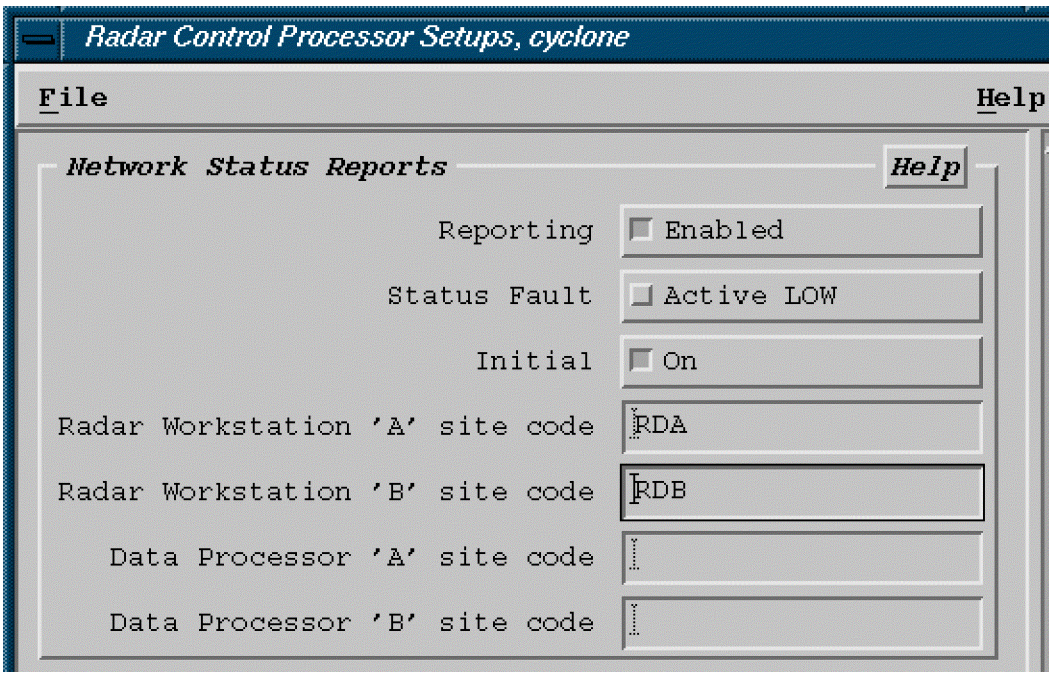
To configure the status product for dual system support, first enable status product generation in IRIS setup/product, configure the fields as shown below:



i

In the event of a change in status such as a critical fault, the Status product is generated immediately. The configuration is in setup/product is for the maximum time between status products.

The IRIS Status product result (OK/FAULT) is sent to the RCP02 via the serial line. It is necessary to identify which sites are being reported. Use the IRIS Setup/RCP section as shown below for the case of two sites in a redundant system called "RDA" and "RDB":

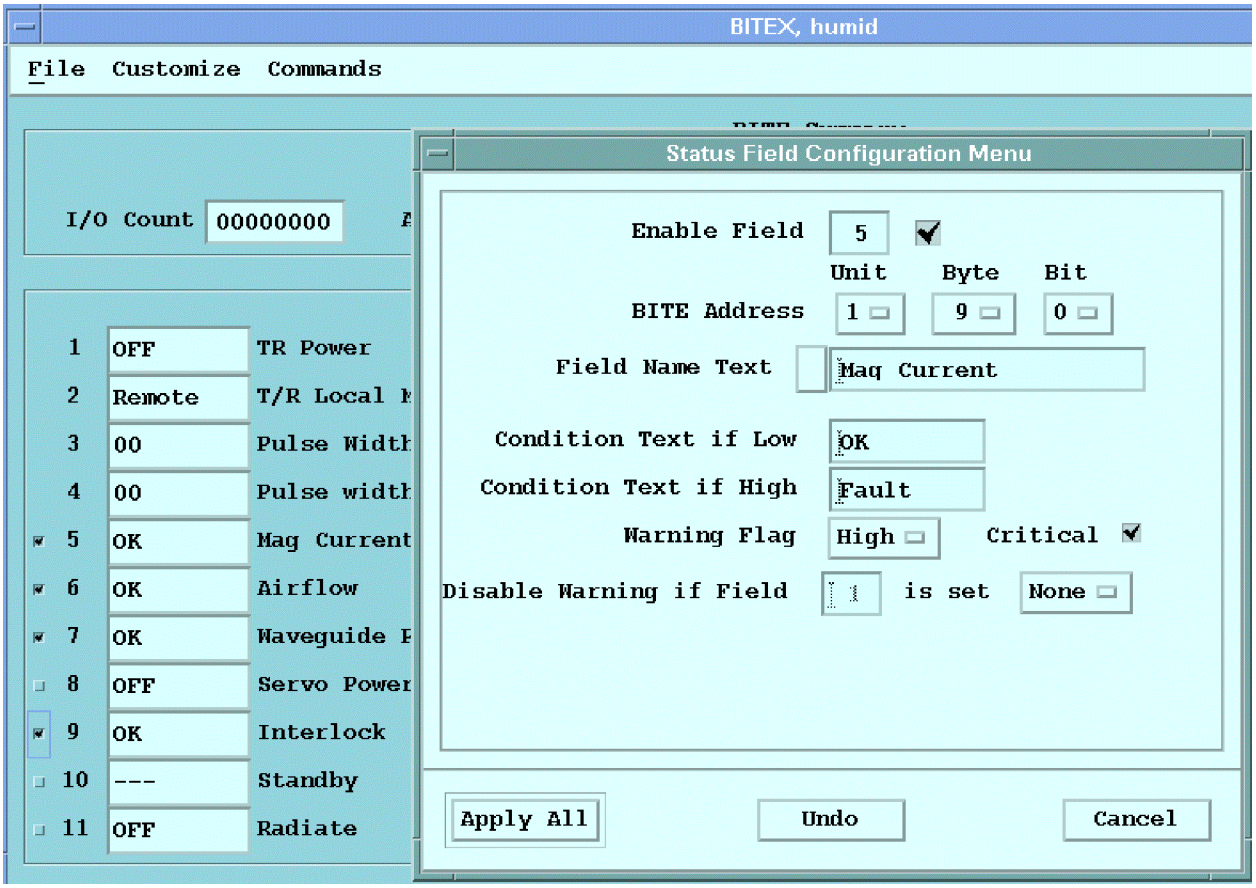


The three–letter site code is used for this. These are configured in Setup General as for a standard IRIS system.

These configurations should be made identically on both systems. The final step is to use the Product Output Menu to send the Status product from IRIS A to IRIS B and vice versa.

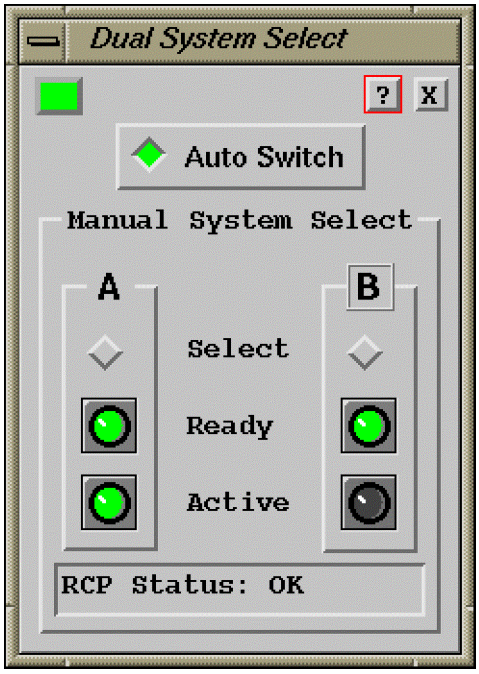
BITEX Setup

BITEX is configured in the usual manner to display all of the available status parameters. The only additional step is to identify those parameters that signal a "Critical Fault". To do this you must enter as "bitex –setup" with operator privilege. The small button to the left of each field sets the critical fault flag. Alternatively the sub menu for configuring each field also has a critical flag (right click on the field number).



In the example above the fields for Mag Current, Airflow, Waveguide Pressure and Interlock are set as critical faults. When IRIS receives a critical fault message from BITEX, the IRIS site status is set to fault. This message is passed back to the RCP and, by network transfer of the status product, to the other IRIS system.

E.7 IRIS Dual-System Switching Menu



Overview

The Dual–System Switching Menu (Switching menu) provides an easy user interface for control and monitoring of the dual–system. The Switching menu allows the operator to see which system (A and/or B) is ready for operation and which one is currently active (only one can be active at any time). The operator can select (actually request) the exclusive use of either A or B, or enable automatic switching which will occur in the event of a fault. Most of the time the menu is set for automatic switching. The menu can be run locally at either Radar Workstation A or B or remotely over the network to allow remote control and monitoring.

When running the menu on system A, the menu talks directly to RCP02 A via the RCP–to–IRIS serial line. However, the menu also talks indirectly to B via the RCP–to–RCP communications link. Thus control and status monitoring of both systems A and B are possible through a single menu.

An important concept is that the Switching Menu does not control the RCP02 switching, rather it submits switch requests to the RCP02s which then negotiate whether the request can be fulfilled. For example, if the operator requests that System A be used, but system A is not available because it is in fault or has been disabled by the hardware A/B switch, then the request will not be fulfilled. In this case neither system will become active. If the operator requests auto switching (the recommended mode of operation), then the RCP02s would negotiate to activate the available system.

Starting the Switching Menu

Operator privilege is required to access this menu. The Switching menu, can be started from either of two places:

antenna utility (Reference: *IRIS Utilities Manual*)

Select **Options–>Dual System Selection ...** at the top of the antenna utility.

This is convenient if IRIS is not running, e.g., for configuration and initial testing. You can start antenna by typing "antenna &" in an X terminal or through the Utilities menu which is most easily accessed through IRISnet.

IRIS Radar Status Menu (Reference: *IRIS User's Manual)*

Select **Mode–>Dual System Selection ...** at the top of the IRIS Radar Status Menu.

The IRIS Menus must be connected to either Radar Workstation A or B, although the menus themselves can be running on any networked workstation. This method is very convenient for overall control and monitoring since the Radar Status menu provides access to all status monitoring features of IRIS including the **bitex** utility.

As with all IRIS menus, multiple copies of the Switching menu can be run. This is convenient for monitoring status from multiple locations on the network. All menu copies also have control functions and the IRIS server will process every request in the order in which it is received (this is the same for all IRIS menus). The Operator password protection allows the System Manager to limit access so that only authorized personnel can use the menu.

The menu itself can be connected to either system A or B. A small box is drawn around the letter A/B over the status lights to indicate the system to which it is connected. This is a convenient reminder if you are displaying two menus– one connected to A and one connected to B on the same screen.

Menu Features

Flashing Light (upper left)

The flashing light at the top-left indicates that the menu is alive. A green flashing light indicates that communication with both RCP's is OK. A red flashing light indicates a communication failure of either the IRIS–to–RCP link, or the RCP–to–RCP link. The status field at the bottom will also show red and describe the nature of the failure. In addition X symbols will be drawn over the status indicators for the system for which communication has failed. This is described in more detail in the Trouble–Shooting section.

Ready Indicator

The Ready indicator shows 2-bits of information, i.e., whether the system status is OK/Fault, and whether the hardware A/B switch at the radar is set to disable the radar. The light is color-coded as follows:

- Green — the system status is OK.
- Red — the system status is in fault, i.e., it cannot be used until the fault is cleared.
- Yellow Bezel— indicates that the hardware A/B select switch at the radar has disabled the system, e.g., placed it in a maintenance mode. The system cannot be used operationally until the switch is set to enable the system.
- X the status is unknown because of a communication problem.

For a system to be used for operation, the Ready light must be green (status OK) and the Bezel must be gray (not disabled). This makes it easy to see from a single indicator whether the system is ready for operation, and if not, what course of action would make it operational.

The RCP front panel display also shows the status for both systems (Ok or Er) and the disable switch state (En or Di).

Active Indicator

- Green — the system is active, i.e., it is running or could run an IRIS TASK.
- Off — the system is inactive. Either the system is in standby (ready to become active) or it has been disabled.
- Yellow — The system is transitioning from inactive to active, i.e., it is going through a warm–up period. See Section E.4 for a discussion of the configurable switching time.

The Active indicator is also displayed on the RCP02 front panel as described in Section E.4. This shows either On or —.

The Automatic Switching and A/B Select Buttons

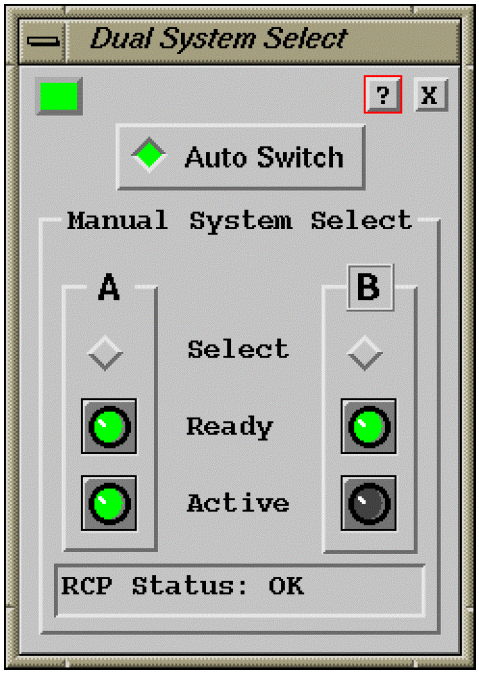
For normal operation the Automatic Switching button is enabled. This allows the RCP02s to negotiate which system to use. However, operators can request the use of only system A or B. For normal maintenance functions however, the selection of a single system should be done by the hardware A/B selector switch at the radar and the Switching menu left in the Auto position.

Sometimes it is useful to temporarily force the systems to switch and then immediately reset back into the Auto mode, just to exercise or test the other system.

E.8 Trouble Shooting with the Switching Menu

The Switching Menu is the primary user interface for trouble shooting problems related to switching. This section provides examples of how the Switching menu is used to diagnose different problems on the system.

Normal Switching Menu



Both systems have OK status. Neither system is disabled by the hardware A/B switch. System A is currently active, but B is ready to run in the event of a fault.

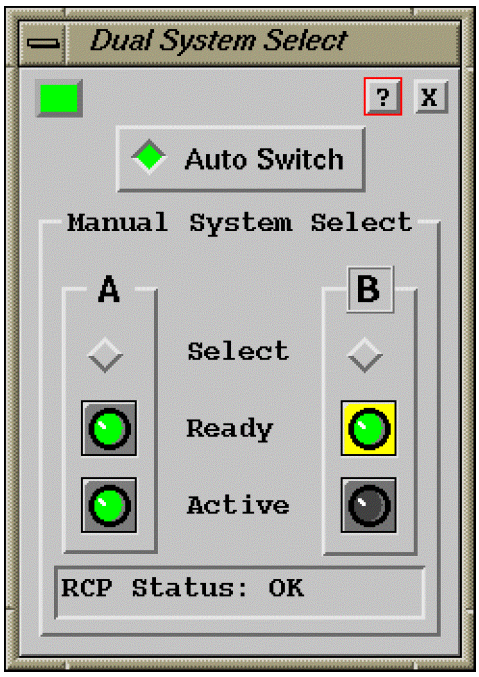
Auto Switch		Grn
A		B
Off	Select	Off
Grn/Gry	Ready	Grn/Gry
Grn	Active	Off

Notation of Printed Colors

Because of the use of color, is best viewed on–line rather than on the B/W hardcopy reproductions. The colors will be indicated for each example as Red, Grn (green), Gry (Gray). Also note that "off" is displayed as gray (the light appears to be off).

The "Ready" light notation shows two colors to indicate the center light color and the bezel color. Recall that the center light color indicates status (OK–green, Fault–red) while the outer bezel color indicates the state of the hardware A/B switch (system enabled is gray, system disabled is yellow). In the example above the Ready light for both systems is Grn/Gry indicating status OK/ Enabled.

System B Disabled (Maintenance Mode) by Hardware A/B Switch

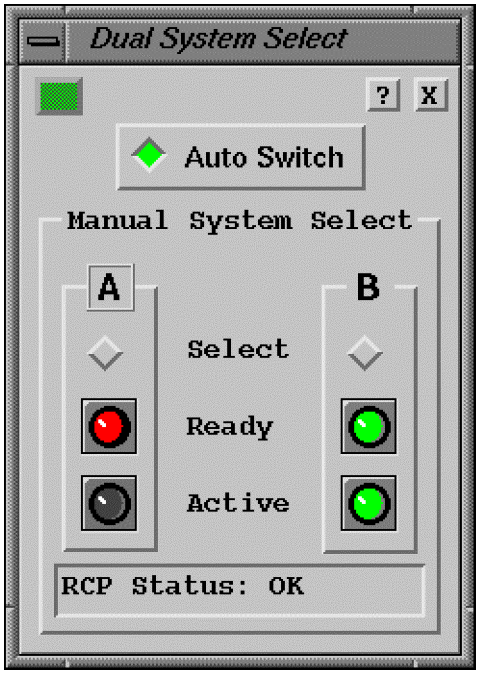


Here, the yellow bezel of the Ready light indicates that ,maintenance personnel have disabled system B.

Action: To make B ready for operation set the hardware switch to enable B (i.e., to allow automatic switching).

Auto Switch		Grn
A		B
Off	Select	Off
Grn/Gry	Ready	Grn/Yel
Grn	Active	Off

System A in Fault, System B Running



System A has faulted as indicated by the red Ready light. System B is now running.

Action: use the Radar Status Menu for system A to determine the nature of the fault. Check:

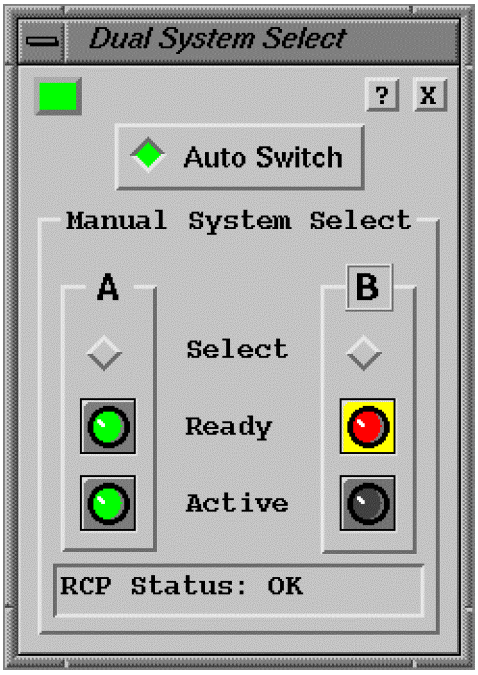
Subsystem Status of RVP and RCP (lower right)

BITE status (summary display and access lower left).

Message menu (top middle).

Auto Switch		Grn
A		B
Off	Select	Off
Red/Gry	Ready	Grn/Gray
Off	Active	Grn

System B in Fault and Placed in Maintenance mode

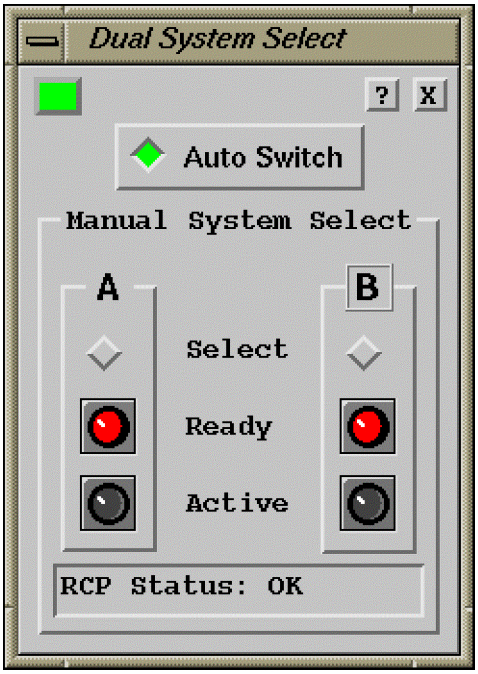


System B has faulted as indicated by the red Ready light. The yellow bezel on the system B ready light indicates that B has been disabled by the hardware switch. It has probably under repair by maintenance personnel.

Action: Use the Radar Status Menu to identify the fault. When the fault is cleared, put set the switch to enable system B.

Auto Switch		Grn
A		B
Off	Select	Off
Grn/Gry	Ready	Red/Yel
Grn	Active	Off

Both Systems Faulted, No Operation Possible

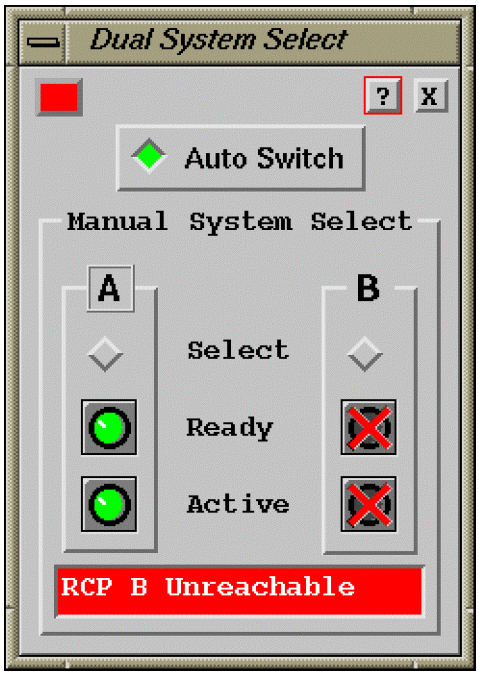


Both Ready lights are red indicating that neither system can be run. The Active lights are both off indicating that neither system is running To make matters worse, the Ready light bezels are both gray indicating that maintenance personnel may not be working on the problem (the hardware switch has not been set to maintenance mode for either system).

Action: Use the Radar Status Menu to identify the faults. When the fault is cleared the system will automatically resume operation on the good system.

Auto Switch		Grn
A		B
Off	Select	Off
Red/Gry	Ready	Red/Gry
Off	Active	Off

RCPB is Unreachable (as viewed from system A)



Here the menu is being viewed from system A as indicated by the small box around the letter "A". The X's for the Ready and Active lights on system B indicate that we cannot get the status of these because of a communication failure of the RCP–to–RCP link.

Problem: The RCP–to RCP link has failed, or RVP02B has been turned off.

Action: Check if RCP02 B has been turned off. Check RCP–to–RCP link cable.

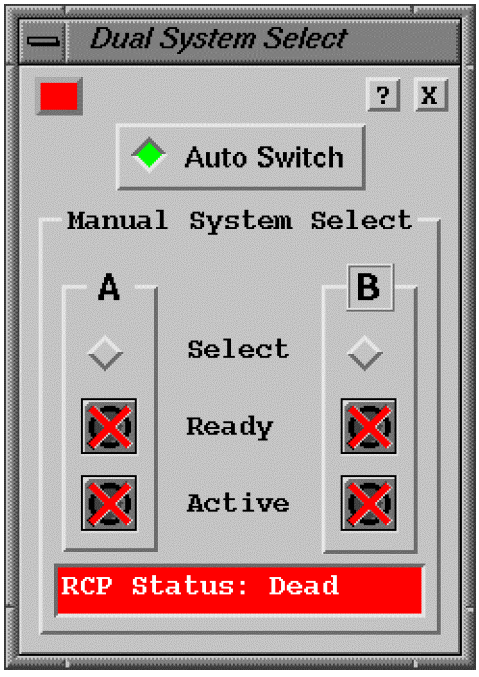
1. Checking the front panel.

2. Checking the Radar Status Menu for system B ("RCP Dead" in Subsystem Status).

3. Starting the Switching menu on system B and observing 4 X's.

Auto Switch		Grn
A		B
Off	Select	Off
Grn/Gry	Ready	X
Grn	Active	X

My RCP is Dead



The 4 X's indicate that our RCP (in this case for system B as indicated by the [B]) is not communicating to the IRIS workstation.

Problem: The IRIS–to–RCPB link has failed, or RVP02B has been turned off.

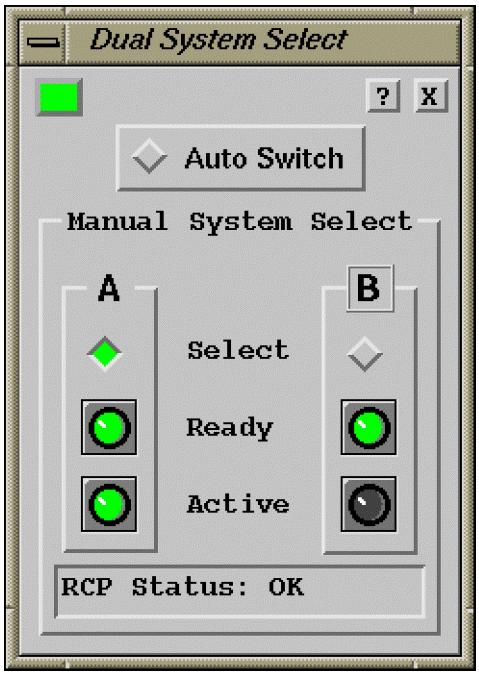
Action: Check if RCP02 B has been turned off. Check IRIS–to–RCPB link cable. To see if the RCP has been turned off:

1. Check the front panel.

2. Check the Radar Status Menu for system B ("RCP Dead" in Subsystem Status).

Auto Switch		Grn
A		B
Off	Select	Off
X	Ready	X
X	Active	X

Operation Forced to A– Auto Switching Disabled, B Disabled,

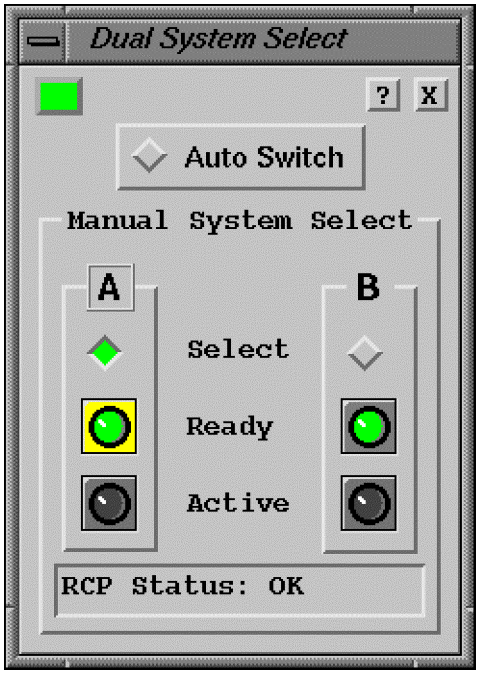


Here the A Select is green indicating that it has been selected (by pushing the button in this menu) to be the exclusive system. The A Active and Ready lights are both green. B is disable by this action, similar to disabling B via the hardware switch. However, B's Ready light is green so that it could be used.

Action: The system should be restored to Auto Switch mode as soon as possible. If the selection of A was made because of intermittent behavior of B, then isolate the problem. It is recommended to set the hardware A/B switch to disable B during maintenance and then re–enable Auto Switch. This way when maintenance on B is complete, the system is ready to Auto switch without any operator intervention.

Auto Switch Off		
A		B
Off	Select	Off
Grn	Ready	Grn
Grn	Active	Off

Non Operational, Both Systems Disabled

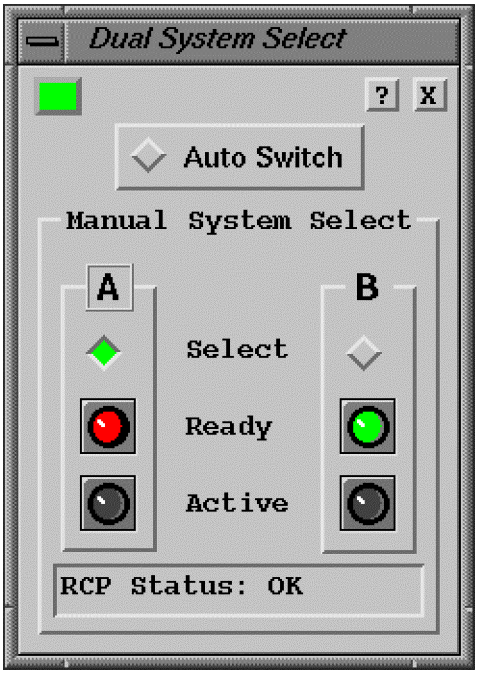


Both Active lights are off indicating that no operation is possible. The reason is that the hardware A/B switch has disabled A and the software switch in this menu has disabled B.

Action: Set for Auto Switch. B will automatically be switched to active.

Auto Switch		Off
A		B
Grn	Select	Off
Grn/Yel	Ready	Grn/Gry
Off	Active	Off

Non Operational, System A is Menu-Selected, but Faulted



Both Active lights are off indicating that no operation is possible. The reason is that system A has faulted and software switch in this menu has disabled B. However, B is ready to use.

Action: Set Auto Switch on. B will automatically be switched to active. Use the Radar Status Menu on A to determine the fault.

Auto Switch		Off
A		B
Grn	Select	Off
Red/Gry	Ready	Grn/Gry
Off	Active	Off

Avoiding Non–Operational Conditions- Enable Auto Switch

These last two examples illustrate that it is best to leave this menu with Auto Switch enabled at all times. To place a system in maintenance mode, it is recommended that the hardware switch be used. If absolutely necessary, this menu can be used to disable a system temporarily until someone can go to the radar site and set the hardware A/B switch. The only other reason for selecting A or B is to force the systems to switch to "even–out" or test the usage of each system. After the switch is forced, Auto Switch should be immediately re-enabled.

E.9 Dual-System Parallel Operation

Another application of the dual-system RCP02 is for operation of two separate transmitter/receiver systems through the same antenna pedestal system, i.e., a dual–frequency system. In this case, a "radar" can be thought of as the transmitter/receiver of each system and its associated RCP02, RVP7 and IRIS system. These two "radars" must share the same antenna/pedestal. The constraint is that only one RCP02 can control the antenna/pedestal at a time. There are two modes of operation possible in this case:

- **A or B ("Flip") mode: Selectable or Alternating Active Radar:** This case is identical to the operation in the case of a redundant system, i.e., either radar A or radar B is used exclusively. The switching menu or the hardware selector switch can be used to force the exclusive use of one "radar" or the other. In addition, the TASK Scheduler menu provides support to "flip" between the two radars so that IRIS can automatically run a TASK from on one radar and then relinquish control so that the other radar can run a TASK.
- **A and B mode: Simultaneous Active/Passive mode:** In this case, one "radar" system is used to actively control the antenna scanning while the other radar system acquires data passively. This allows both radars to operate simultaneously. The RVP7 of the passive system in this case still generates pulse width change output and triggers and the associated passive RCP02 still has control to turn-on the radiate and T/R power. The IRIS Status Product, sent from the active system, is used by the passive system to determine which TASK in the schedule should be run in passive mode.

Note that in principle it is possible to operate in using the "flip" mode (A or B) and the active/passive (A and B) mode simultaneously. In this case the radars would flip between active and passive. However, this is more complex to configure. For active/passive operation, it is simpler to select one radar to always be the active system and never "flip" the active system to the other radar.

A major difference between the dual-redundant case and the the dual-system parallel operation is that the RCP02 is typically not setting the mode of operation, i.e., not controlling the IRIS mode selection in the Radar Status Menu. In the redundant case, it is important that in the event of a failure, IRIS be told what to do after an automatic switch-over, i.e., the RCP02 that is taking control tells IRIS the operating mode. For dual system parallel operation, IRIS is telling the RCP02's how to operate, i.e., which is active and which is passive. This means that the setup of the RCP02 (on the RCP02 and the IRIS end) does not involve defining all the operating modes, mode reporting and mode switching strategies.

The RVP7 setups do not require special consideration for dual-system operation. In most cases, the RCP02 and IRIS setups for dual-system parallel operation are identical to those for the dual redundant system. The differences are described in the following sections.

E.9.1 RCP02 Setups for "Flip" or Simultaneous Operation

- **Site Custom–>Allow voluntary flipping YES**
  This is set to "Yes" if you intend to use the Flip (A or B) feature. This must be done on both RCP02's. This allows the TASK Scheduler of one radar to assume control, and then relinquish control ("flip") to the other radar. The IRIS TASK Scheduler menu provides support for this in the "Flags" column (i.e., the "Flip" flag).
- **Site Custom–>Mode Switch Strategy When ACTIVE (INACTIVE) NONE**
  These questions are described in detail in section E.4. Set the responses to both of these questions to "NONE" on both RCP02's. In this case, the special mode 0 will always be requested by the RCP02 which means that the operator controls the IRIS mode, not the RCP02.
- **Site Custom–>Mode to request during Maint ACTIVE (INACTIVE) `0`**
  Respond "0" to both of these questions on both RCP02's. "Maintenance Mode" is defined to be when either the hardware switch or the software switch (Switching Menu) is set to disable a radar. Setting the Mode request from the RCP02 to 0 allows the normal IRIS Radar Status Menu mode to be controlled by the operator without interference from the RCP02's, i.e., the RCP02's will not force IRIS mode changes. See also section E.4 for more information on these setup questions.

E.9.2 IRIS Setups for "Flip" or Simultaneous Operation

- **setup/ingest/Scanning Options–> Task Scheduling Control Active/Passive**
  To use the simultaneous active/passive feature, set this to "Active/Passive" on both RCP02's. This is recommended since it allows either radar to assume the active role. However, it is possible to set one radar to "Active Only" and the other to "Passive Only" if you would like to dedicate the systems to these roles. In this case, you would not be able to use the passive system on its own.
- **setup/ingest/Scanning Options–> Passive: use external trigger rate No**
  Responding NO allows the RVP7 of the passive system to generate its own trigger. This is generally recommended so that the two radars can be triggered independently by their own RVP7, e.g., to use dual PRF. Set this on both systems.
- **setup/ingest/Scanning Options–> Passive: use status product task Yes**
  Respond YES to slave the passive system TASK to the active one via the Status Product. You should do this on both systems. You will also need to make sure that Status Products are enabled (per section E.6) and set the Product Output Menu to automatically send the Status product to the other system. This should be done for both systems.

  The next question asks for the 3–letter site code of the other system. Do this for both systems, each referring to the other.

- **setup/rcp02/Status Reports to the RCP–>**

```
Reporting                        : Enabled
Status fault polarity            : Active LOW
Initial state of sites           : All Faulted
Radar Workstation 'A' site code  : MPK
Radar Workstation 'B' site code  : MPW
Data Processor 'A' site code     :
Data Processor 'B' site code     :
```

  These settings enable the two RCP02's to know the status of each radar. This is necessary for switching between the two systems in "flip" mode or using one or the other system under manual control. If the status of a system is FAULT, then switching of active control is disabled to that system.

- **setup/rcp02/RST Mode to Number Mapping–>**

```
Radar Status name for MODE #1    : DEFAULT
Radar Status name for MODE #2    : DEFAULT
Radar Status name for MODE #3    : DEFAULT
Radar Status name for MODE #4    : DEFAULT
Radar Status name for MODE #5    : DEFAULT
Radar Status name for MODE #6    : DEFAULT
Radar Status name for MODE #7    : DEFAULT
Mode to use when RCP is dead     : 0
Mode reporting delay             : 1.0 sec
```

  The RCP02 can send commands to IRIS to change operating modes. These commands are codes (1–7) that are associated here with different Radar Status Menu names. In general, the RCP is always requesting mode 0 which is a special code that allows the operator to specify the IRIS mode in the Radar Status Menu. As a safety feature, the DEFAULT IRIS mode is set for all of the other numerical codes (1–7) that could be commanded by the RCP. Thus, in the event that the RCP were to request a mode (other than 0), it would be the DEFAULT Radar Status Menu configuration.

- **setup/general/Modes and Protocols–>**
  External RCP mode change: Disabled

  Setting this to disabled will assure that IRIS modes changes cannot be forced by the RCP02.

E.9.3 IRIS TASK Scheduler: "Flip" Operation

To use the "Flip" feature, the Switching Menu must be set to the "Auto" position so that the RCP02's can negotiate which radar to use.

The TASK Scheduler Menu is where the "Flip" feature is activated. Right-click the mouse in the "Flags" column to toggle the "Flip" flag on/off. Here is how it would work. Suppose that you want a TASK to run on radar A and then another TASK on radar B. You would setup the TASK Schedules with the appropriate TASKS on the two systems and set each to "Flip". After radar A runs its TASK it sees that the flip flag is set and then tells the RCP02's that it is willing to relinquish the radar control. If radar B wants to run its TASK (because it is the scheduled time), then it tells the RCP02's that it wants to run. The RCP02's then automatically release control to radar B, etc. For example, if each TASK is set to run continuously, ("Repeat" set to 00:00), then the TASKS on the A and B radars will alternate.

Be sure NOT to set the Late Skip flag to "Yes". This could interfere with the flipping since in general a flip is forced by a TASK that is late, i.e., it wants to run but it can't because the other radar is in control.

SIGMET recommends that you include the word "flip" or other code in the TASK Schedule and perhaps the Radar Status Menu operating mode to indicate that the systems will flip, e.g., for the TASK Schedule PPIVOL_FLIP and for the IRIS Radar Status Menu FLIP_MODE.

E.9.4 IRIS TASK Scheduler: Simultaneous Active/Passive Operation

To use the simultaneous active/passive feature, the Switching Menu must be set to specify the active system. The active system can be forced by selecting it exclusively. The Switching Menu can also be left in Auto mode after the active system is forced.

At the top of the TASK Scheduler Menu, is a field labeled "Active" or "Passive". You can toggle between these two choices if the setup/ingest/scanning is set to active/passive. Otherwise, the text will be fixed to either active or passive depending on your selection in setup.

For simultaneous active/passive operation, the TASK Scheduler Menu of one system should be set to "Active" and the other set to "Passive". In the active system, configure the TASK as usual. On the passive system, configure a TASK with the same name. All of the TASK parameters can be configured independently except for the antenna scanning parameters (Scan Mode, Azimuth, Elevation, Scan Speed). The scan Resolution does not have to be the same. For example, for a PPI scan mode, the elevation angles in the passive system TASK must match those in the active system TASK. Similarly, if you are doing RHI's, the elevation limits and selected azimuth angles must match on the two TASKS. Other than the scan parameters, you have complete freedom to select PRF, processing mode, range, resolution, etc.

You also need to make sure that the Status Products are enabled on the active system and that the Status Product is output (via the Product Output Menu) to the passive system. This is how the passive system learns which TASK to run.

In operation, when the active system starts a TASK, it sends a Status product to the passive system. The passive system reads the status product and checks to see if there is a passive TASK in the TASK Scheduler with the same name. If there is, it runs the passive TASK.

You should save the TASK Scheduler menu with a name to indicate active or passive. Likewise, the IRIS mode (Radar Status Menu name) should be saved with a name to reflect active or passive (e.g., ACTIV_1 or PASSV_1).