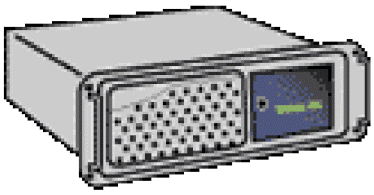
2. Hardware Installation

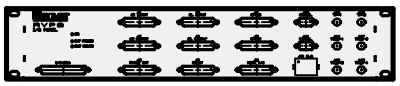
In this chapter:

2.1 Overview and Input Power Requirements

This section describes how to install the RCP8 hardware. Topics include mechanical installation and siting, electrical specifications of the interface signals, system-level considerations and the standard connector panel that is provided. There are three major modules supplied with the RCP8. These are:



Main Chassis Usually mounted in 19" EIA rack.
Input Power 60/50 Hz 115/230 VAC Manual Switches



I/O-62 Connector Panel
Usually mounted in 19" EIA rack within 1 m of Main Chassis

Much of the RCP8 I/O is configured via software. This makes the unit very flexible. Also, since there is virtually no custom wiring, it is very easy to insert spare modules and circuit cards. The software configuration of the I/O is described in the softplane section of the *Software Installation Manual*. This section, in conjunction with **Appendix C**, describes the physical installation of the hardware.

⚠ **WARNING: The Main Chassis redundant power supplies are NOT auto-ranging like the IFD. These are factory configured for the expected voltage, but should be VERIFIED by the customer before power is applied to the system.**

2.2 Initial Power–Up Prior to Connecting to Radar

⚠ **WARNING: The RCP8 initial power-up should be done with no connections to the radar to avoid possible damage to the antenna system before it has been configured with the various safety parameters.**

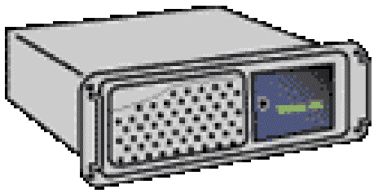
The very first time that the RCP8 is powered–up, caution must be exercised to assure that no damage is done to the antenna system. The reason for this is that the RCP8 needs to go through an antenna stabilization procedure as described in **Section B** before the fail-safe features can be activated.

The initial power-up procedure is as follows:

- ❑ Verify that the input line power to the RCP8 is correct as described in **Section C.1.3.**
- ❑ Install the RCP8 in its rack on the slides provided by SIGMET per **Section 2.3.2**.
- ❑ Install the Connector Panel in the rack and cable it to the I/O-62 card in the RCP8 using the 1.8 m (6 foot) cable provided by SIGMET per **Section 2.4**.
- ❑ Install the keyboard, mouse and monitor per **Section 2.3.3**. These shall be used for local diagnostic and configuration work. They can be disconnected after the installation is completed.
- ❑ Disconnect ***ALL*** I/O from the connector panel for the initial power–up. The various connectors will be installed later, one-at-a-time, and then configured and tested using the procedure described in **Section B**.
- ❑ Turn on the monitor.
- ❑ Push the power–on button on the lower right of the front panel.

When the RCP8 is powered-up, the Linux operating system will boot-up and the RCP8 software process will start automatically, first running a set of diagnostic self-tests.. The progress of the boot can be monitored on the local display. The front panel display will show the final results of the diagnostics with "Status:OK" and a moving arrow that indicates that the RCP8 is happily running.

At this point you you should prepare, but not connect the various cables described in the following sections, then you are ready to go through the alignment procedure described in **Section B**. You should first review the various TTY control and monitoring commands in **Section 3** setup commands described in **Section 4** since these will be used extensively in the alignment procedure.



2.3 RCP8 Chassis

2.3.1 RCP8 Chassis Overview

The RCP8 main chassis can assume a variety of forms depending on the customer requirements. **Section C** describes a standard SIGMET system. A typical unit supplied by SIGMET contains at least the following:

- A dual CPU on either motherboard or SBC in a passive PCI backplane
- I/O-62 Card and Connector Panel

Note that additional I/O-62 cards and Connector Panels can be added to expand the I/O capabilities of the system, along with standard PCI cards.

The system is also shipped with an integrated hard disk drive (HDD), 1.44 MB floppy (FDD) and CDRW unit. There is an LED display panel on the front of the chassis that is used to report system status and display AZ and EL angle information. Redundant "hot swap" power supply modules are used.

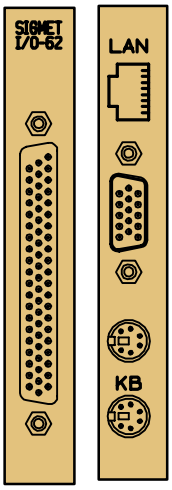
2.3.2 Power Requirements, Size and Physical Mounting

⚠ **WARNING: The Main Chassis redundant power supplies are NOT auto-ranging like the IFD. These are factory configured for the expected voltage, but should be VERIFIED by the customer before power is applied to the system.**

There a three redundant power supplies

The standard SIGMET chassis is a 19" EIA 4U rackmount unit, 17" (43 cm) deep. The chassis is usually mounted in an equipment rack on rack slides (provided as standard). The Connector Panel is usually mounted on either the front or the rear of the same rack. The standard cable provided to connect the I/O-62 card in the main chassis to the connector panel is 6 feet long (1.8 m) .

2.3.3 Main Chassis Direct Connections



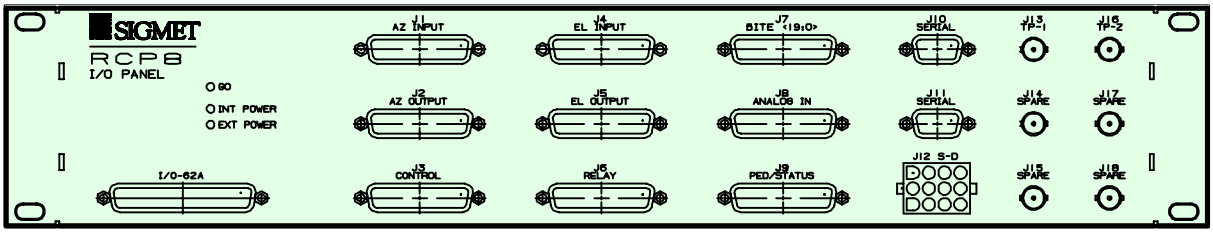
The direct connections to the RCP8 chassis are made either to the back of the unit to PCI cards (e.g., left) or to the remote connector panel. The direct connections are summarized in the table below.

Note that the appearance of the system is different depending on whether an SBC or motherboard is used. The card at the right shows the typical appearance of the SBC version. **Section C.1.4** shows the typical appearance of the motherboard version

Table 2–1: Direct Connections to RCP8 Main Chassis

IFD I/O Summary		
Connector Label	**Style**	**Description**
SBC or Motherboard Connections		
Network	**RJ-45**	**10/100/1000 BaseT TCP/IP**
Keyboard	**PS/2**	**Standard PC Keyboard**
Mouse	**PS/2**	**Standard PC Mouse**
Monitor	**VGA**	**Standard PC Video Monitor**
Serial	**DBM9**	**Standard COM1 and COM2 connections are available on most systems. COM1 is typically used for connection to an external host computer. The default baud rate is 9600.**
I/O-62 Connections		
<no label>	**DB-62F**	**SIGMET-supplied cable to IO62/CP remote panel**

2.4 RCP8 Connector Panel



Most of the connections between the radar and the RCP8 are made using the RCP8 Connector Panel which connects to the I/O-62 by 1.8m (6 foot) cable. The panel is usually mounted on the front or the back of the same 19" EIA rack that contains the RCP8 chassis. The I/O-62 cable may be plugged into either the front or the back of the connector panel to optimize the cable run.

The Connector Panel uses a DC–DC converter to convert 12V unregulated input from the PCI card into regulated +5V, +3.3V, and +/–12V to run the main electronics on the panel. The LEDs on the panel are described below:

- **EXT LED** indicates that the 12V input power is present
- **INT LED** indicates that +3.3V is present
- **GO LED** indicates that the panel is properly communicating with the PCI card. It will blink slowly when communication is absent and very rapidly during the BRIEF times that the backpanel firmware are being updated with an rdaflash command. It will be solid when the panel is being used by the RCP8 software.

The pin assignments to the panel are actually configured in software using the **softplane.conf** file. The labels reflect the default settings for the **softplane.conf** file which is described in the *Software Installation Manual*. The discussion in this section describes the default configuration as well as how the connector pin assignments can be re–mapped to serve other functions.

The specification table in **Section 1.3.7** provides a summary of the I/O for each connector. Detailed pin–out assignments for the default configuration are given in **Section C.2**. Descriptions of the various signals are provided below.

J1 & J4- AZ/EL Input: TTL parallel angles

This connector has 20 digital inputs or outputs. In the default **softplane.conf** file it is configured for input of 16–bit binary or 16–bit BCD angles. Whenever antenna angle data are required, the RCP8 reads the azimuth lines up to ten times in a row (spaced by 0.5 μsec) until two successive values compare as equal. This "de-bouncing" is done so that unsynchronized input data will be latched in a valid state. If after ten retries, the lines were never observed in a consistent state, then the last observed state is used. Sampling for elevation is identical.

If fewer than 16 bits are used for the binary angles, then the high order bits should be connected (LSB on pin 1). If a wiring error is made, it is fairly simple to correct it in the **softplane.conf** file (e.g., LSB and MSB reversed).

The BCD format is as follows.

- Hundreds digit: Bits 12–15
- Tens digit: Bits 8–11
- Ones digit: Bits 4–7
- Tenths digit: Bits 0–3

For example, if the tenths digits are not used, bits 3–0 would be left unconnected however, the wiring of the other BCD digits would remain unchanged.

Remember, the higher-order digits must all be wired, even though the elevation position may be constrained to a limited angle, for the elevation axis. If this is not done, the negative angles will be read incorrectly. An elevation of –0.1° must be input as 359.9°.

J2 & J5- AZ/EL Output: TTL parallel angles

This connector has 20 digital inputs or outputs. In the default **softplane.conf** file it is configured for output of a 16–bit TTL binary angle. Detailed pin assignments are given in **Section C.2** This feature could output the parallel angles to a signal processor such as the RVP7 or RVP8.

J3- Control:

16 lines can be used as differential RS422 or as single–ended TTL input or output. In the default **softplane .conf** file it is configured for various standard Status and Control I/O. Configuration can be made in groups of 4 with regard to RS422 vs Single–ended, I/O sense and input termination of single–ended lines. See the pin assignments in **Section** B for details.

J6- RELAY: Control for external equipment

Note that the default **softplane.conf** file makes no assignments to this connector. Often, external equipment in the radar will require relay control (e.g., power on, radiate on, environmental systems, reset lines, slow polarization switch). This connector has connections for 3 internal relays that are on the connector panel itself. The maximum current through the relay contacts is 0.5 A continuous. The switching load is 0.25 A and 100V, with the additional constraint that the total power not exceed 4VA.

If larger current and voltage loads are required, then the connector panel relays can be used to switch external relays provided by the customer. Another alternative to power external relays is to use the additional 4, 12V relay signals (up to 200mA) that are also supported on this connector.

⚠ **Hazard: External relays must be equipped with proper diode protection against back-EMF or damage to the I/O-62 and or the connector panel might result.**

J7 BITE: Configurable 20 lines of TTL I/O

This connector supports 20 lines of TTL each of which can be configured as either input or output. The default softplane.conf file configures these to be inputs. The inputs are multiplexed into the BITE message to the host computer and can be used internally by the RCP8 in control logic equations.

J8 SPARE: Analog Inputs

Note that the default **softplane.conf** file makes no assignments to this connector. Ten differential analog inputs, up to ±20V max multiplexed into a single A/D convertor sampling each at >1000 Hz. This can be used for monitoring environmental systems at the radar site. Results are put into the "Q–BITE" (quantitative BITE) message to the host computer. In addition, the RCP8 can threshold the Q-BITE numerical values and use the logical results in control logic equations.

J9- PED/STATUS: RS422 I/O, D/A and A/D

14/7 additional I/O-62 digital lines, 2 each dedicated (non–multiplexed) A/D inputs (±70 V with pot adjust) and D/A outputs (±10V). For the digital lines, configuration can be made in groups of 4 with regard to RS422 vs single-ended, I/O sense and input termination of single-ended lines. In the default **softplane.conf** file, this connector is configured for the differential AZ/EL tachometer inputs, AZ/EL drive outputs and several status variables.

J10-11: RS232C I/O

In the default **softplane.conf** file, these are not used. The two connectors can be used for serial angle input. The most common format is the RCV01 format (see **Section A**), although custom formats from antenna/pedestal manufacturers such as Orbit, Andrew and Scientific Atlanta can also be supported. Note that J11 also has +12 V, –12 V and +5 V regulated power supply outputs for external equipment.

J12: S-D- AZ and EL synchro input

For systems that have AZ/EL synchro position sensors, the RCP8 can accept direct synchro inputs. The nominal voltage and frequency are 90V @ 60 Hz. S/D conversion is performed in the I/O-62.

J13,J16: TP1 & TP2- Programmable test point scope outputs

The default **softplane.conf** file makes no assignments to the test points and other BNC connectors.

An exciting feature of the RCP8 is the programmable test points. These are usually used to connect to an oscilloscope. The user can then specify what is output to the test points in the form of an analog voltage for display on the scope. This can be useful for example to observe the results of logic equations.

The advantage of using the test points is that technicians can leave them permanently connected to a rackmount oscilloscope and then select what is displayed. This saves time and reduces cabling errors when switching test cables.

J14, J15, J17, J18: SPARE- spare BNC connections

The default **softplane.conf** file makes no assignments to the test points and other BNC connectors.

2.5 Host Computer Serial Interface

The RCP8 typically connects to a host computer via the COM1 RS232C serial line. The default baud rate is 9600. The connector on the RCP8 is located on the main chassis. On some systems, a null modem may be required to connect to the host computer. On most systems, this is referred to as /dev/ttyS0.

The serial line protocol is documented in **Section A.** It supports the following:

- Standard status packets from the RCP8 to the host computer (e.g., antenna angles and angular speed for AZ and EL, Interlock, Local Mode Switch, etc.). Several formats are supported. The antenna utility on the host computer provides the user interface for display and testing.
- Standard control packets from the host to the RCP8 (e.g., position and velocity servo requests, Radiate On, etc.). Several formats are supported. The antenna utility on the host computer provides the user interface for display and testing.
- Arbitrary BITE packets from the RCP8 to the host based on the auxiliary status input bits. The bitex utility on the host computer provides the user interface for display and testing.
- Arbitrary Control Packets from the host to the RCP8 to set the auxiliary control output bits. The bitex utility on the host computer provides the user interface for display and testing.
- Q-BITE packets from the RCP8 to the host computer. The bitex utility on the host computer provides the user interface for display and testing.

2.6 Socket Interface

The RCP8 can be configured to listen on a network port. It does this via a program called **AntExport**. It is also ready to run some commands on the RCP8 itself. The RCP8 comes with some built–in SIGMET supplied utilities such as **setup, antenna** and **bitex**. These utilities are described in the *IRIS Utilities Manual*.

How AntExport Works

AntExport is a daemon program which can be configured to run all the time. When it receives a socket connection request it will establish a bi-direction connection to the RCP8. The remote client is normally another computer running the SIGMET antenna library. This remote library contains internal state storing current information about the antenna. This state will be slaved to the RCP8 state. To see if it is running on your RCP8, try typing

```
$ ps –aef | grep DspExport
```

During development, it can always be started up manually by typing "AntExport" at a shell prompt. It can be started with the "–v" option for move detailed logging. It defaults to using port 30745. If you wish to use another port, start it with an option such as "–port:12345". The command line option "–help" lists these options.

Source Examples

The source code for **AntExport** and for the antenna library is supplied on the RCP8 release cdrom. This can be optionally installed as part of the upgrade procedure as discussed in the *Software Installation Manual.* You will find **AntExport** in ${IRIS_ROOT}utils/antenna, and you will find the antenna library in ${IRIS_ROOT}libs/antenna. In the library, you will find example code which talks to **AntExport** in file ant_iosubs.c, ant_rcv.c and iant_pwrp.c. Search for the string "SOCKET".

Socket protocol

The socket interface basically transmits to the remote system all commands changing state on the local system. These are all in the form of a sync character, followed by a single byte count, followed by an ASCII command.