PowerNet/IX Server

Reference Manual

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1 Overview

Introduction

PowerNet is the link between wireless RF data collection networks and wired data processing networks as shown in Figure 1-1. In addition to functioning as a wireless RF network to wired network bridge, PowerNet allows the system administrator to set up and maintain the attached wireless RF Local Area Networks (LANs). Additional add-on products support a wide variety of host connectivity environments.

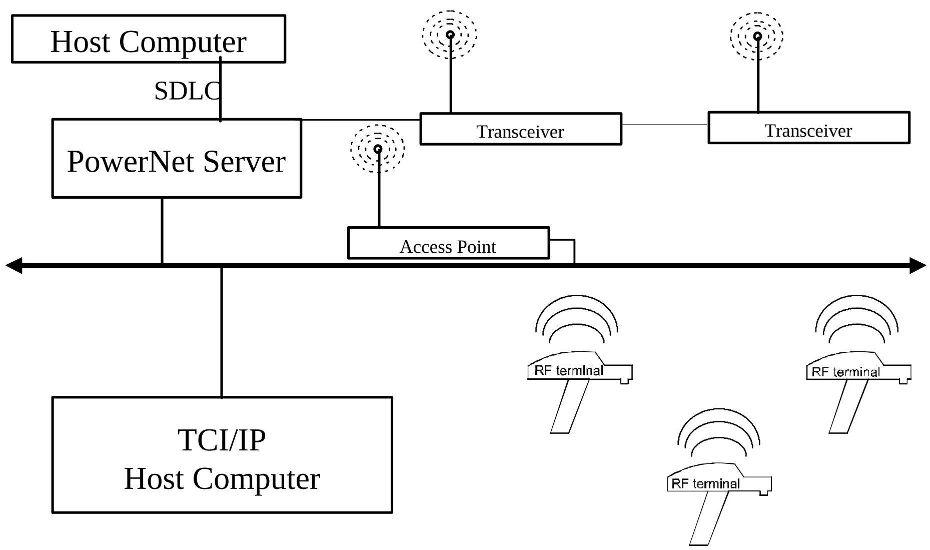

Figure 1-1 PowerNet Linking Networks

Features

PowerNet offers many benefits in addition to functioning as an RF network controller and host computing environment bridge, including:

- **Multi-protocol/Multi Host Combinations -** PowerNet, built on a UNIX platform, employs an open systems architecture where up to 4 combinations of host connectivity packages can coexist in one PowerNet. As UNIX is a multitasking operating system, a modular software approach was taken in the design of the PowerNet software to take advantage of its inherent support of multiple host connections. PowerNets are constructed from a variety of connectivity packages that are available for the UNIX environment. The range of choices is extensive since media such as Ethernet, Token-Ring, SDLC, Serial (Async), and higher level protocols including TCP/IP, SNA, NetBIOS, and DECnet were implemented in the design of this system.

- **Multi-LAN Capability for Spectrum One RF Networks -** With the use of an asynchronous multiport adapter card, up to 32 RF LANs can be controlled with one PowerNet. Seamless and /or segmented topology can be implemented on a LAN by LAN, or on a system-wide basis. If an RF LAN must be installed at a site remote from the PowerNet, a WAN can be implemented using this feature and a connection such as a T1 line with the appropriate devices to allow a reliable end-to-end asynchronous connection.

- **Support for Access Point RF Networks -** Using TCP/IP protocols for supporting access point devices combined with the PowerNet's data management resources provide unmatched performance for large numbers of users in an RF environment.

- **Client Streaming or Terminal Emulation -** PowerNets can operate with hosts and RF terminals using either client streaming or terminal emulation software. The implementation of client streaming programming methodologies offer efficient use of RF network bandwidth and maximum battery life since applications can be designed to utilize processing capabilities of the remote terminals allowing terminals to transmit data only when necessary to complete a transaction. Not only does the PowerNet offer unmatched options for implementing connectivity to a variety of host computing networks in a client streaming environment, it also supports 3270, 5250, HP700, VT220 and VT100 terminal emulation. Terminal emulation offers easy set up and wireless implementation using existing legacy systems and applications.

- **Statistical Trend Analysis -** RF Network and terminal data is continually collected by the System Accounting Facility (SAC) and the Performance Facility, which is saved in files and can be viewed as reports on screen. This statistical data can be used at any time to check system operating trends in a quick manner. The data can be exported to a spreadsheet or used by other programs specifically designed to analyze these files for more complete and careful examination.

- **Diagnostics/Logs -** Remote diagnostics are available to the users' support staff so that immediate diagnosis can begin upon receiving a problem report. Logs can be set to report different levels and types of information and for variable intervals. Reports are generated as the system is running. Facilities are available for the RF LAN and individual components, as well as for the host connection.

- **Ease of Use -** The menu-driven program requires no UNIX knowledge other than a basic knowledge of *vi* or other UNIX based text editor during initial configuration. The system menu program shields the installation and support personnel from the operating system. When certain files require modification, the program calls up and opens the proper file and forms are used to provide information that is inserted into the file.

- **Fault Resilience -** Since the end-user can choose which points to cover in the event of a component or software failure, the system may be said to be fault resilient. PowerNet products are offered with dual and triple built-in fault resiliency. In addition, analysis by systems personnel helps to define, design, and implement resilient RF systems that include not only the PowerNet, but RF networks and connections to host(s) network environments as well.

- **Direct TCP/IP for Spectrum One -** Direct TCP/IP for Spectrum One allows end-users to configure Spectrum One transceiver networks to be supported over TCP/IP serial terminal servers. PowerNet allows support for these devices when used to access Spectrum One transceivers.

- **Optimization and data compression for terminal emulation -** PowerNet, taking an active role in terminal emulation data management, optimizes host data sent to the RF terminals. Rather than sending large amounts of screen data (which in some case, includes inordinate amounts of spaces) to a remote device over the RF network, PowerNet incorporates RLE space compression and presentation space management to only send needed information to the terminal. By utilizing these schemes, the sends to the remote device only the data that is displayed to the user of the remote device on the smaller size display.

- **Centralized control of terminal functionality -** PowerNet allows system administrators full control and support of remote RF devices from one system. When used in a terminal emulation environment, administrators can have full control of system tuning, functionality, and presentation parameters used in supporting remote RF devices.

Documentation

The manuals for this product consist of this document, the *PowerNet Reference Manual,* and one or more *Reference Manuals*. This PowerNet manual contains information that is applicable to all systems. The menus common to all PowerNets are shown and each option is explained. General information about RF networks, Spread Spectrum technology, site surveys, etc., is given as well as specifics about all common PowerNet and RF network components. This manual also contains sections on set up and configuration of the RF LAN(s) using PowerNet software. Summaries of important features such as statistical analysis, error determination and correction using logs, and the use of resiliency are presented.

As applicable by individual product orders, this document is accompanied by one or more *Reference Manuals,* with specific material for the connectivity system and/or option that was purchased.

Conventions

Keys to press, information that should be entered, and menus and messages that appear on screen are all distinguished using different typographical conventions within this manual. They are explained below.

- Keys that are to be pressed are enclosed in angle brackets, < >.
- Instructions to enter keystrokes at the command line are shown in **`bold courier font.`**
- File name and directory names appear in **bold type**.
- Code and other material that appears on your screen are shown in `normal courier font.`
- As the UNIX operating system is *case-sensitive*, please enter the information exactly as it appears in the manual with regard to upper- and lower-case type. For example, the file **filename.hex** is a file that differs from the **filename.HEX** file.

For example, if the following instruction appears in the manual,
“Type the following at the command line:”
`tec <Enter>`
“type” the letters <`tec`> and then press the <Enter> key.

Quotation marks, besides their normal use in writing, may be used for messages or other information that appears on the screen. Menu names and menu options and other special terms appear in *italics*, making them easily distinguishable. **Bold** type is used to emphasize certain points, and **Note** and **Caution** draw attention to important information.

The Interface

PowerNet software has an easy to use menu-driven interface . When you start the program, an opening screen similar to that shown in Figure 1-2 is displayed. The screen you see may vary according to the installed connectivity packages and options.

```
                        Symbol PowerNet R5.0-A01

         Main Menu
          1 Operations
          2 Spectrum One
          3 Access Point
          4 TCP/IP
          5 VTERM
          6 3270 SDLC
          7 TN3270
          8 5250 SDLC
          9 TN5250
         10 Hot Spare
         11 Object Editors
        *12 Utilities


                  <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 1-2 Opening Screen

Opening Screen

The program title, *PowerNet*, appears in the top center. The *Main Menu* appears below the title, on the left-hand side of the screen. Active keys are listed at the bottom. For the PowerNet program, three basic screen formats are used— menus, forms, and logs.

Menus

The menu-driven program begins with the *Main Menu*. Choose an option with the up/down <Arrow> keys. The option is highlighted and/or has an asterisk (*) on the left. Alternately, you may also type the number of the selection followed by the <Enter> key which moves the highlight and/or asterisk to the option. Press <Enter> to select the chosen option. When a *Main Menu* option is selected, a sub-menu is layered on top of the previous menu. Only the most recently selected menu is active. In the user documentation, only active menus are shown.

The options that appear on the *Main Menu* depend upon which software modules make up the system. The main menu components discussed in this manual, *Operations*, *Spectrum One*, *Access Points*, and *Utilities*, are part of *all* PowerNet systems. These functions are used to set up and maintain the RF LAN(s) and provide system management. These menu components and related options are explained in subsequent chapters of this manual. Menu selections that are unique to specific connectivity packages are discussed in the related connectivity manuals. Reference manuals are available for TCP/IP, 3270, and 5250.

Forms

Forms are used to collect information from the user. Fields appear on forms in which you must select from various fixed choices, toggle between two or more selections, or enter other information. On screen messages indicate whether a field is toggled or requires operation specific input. This information may be a new file name or the address of a specific network component for which statistics are displayed.

The keys on a VT100 terminal type for toggling, or selecting, and moving to a new field are explained in the section *Keys* below.

Logs

System logs, which are dynamic, use a different format. The information constantly being written to the log is displayed on the screen with the latest information on the last line of the log. To exit from the log display, press <Del> (or <Ctrl><C> on AIX and HPUX systems).

Keys

Keys, as noted previously, are displayed within angle brackets. Certain keys move the cursor on a menu or form, others select a menu option, display information, or exit a log, etc., as indicated below.

Key	**Function**
<↑>	The up arrow moves the cursor up one line on a menu, or to the previous field on a form.
<↓>	The down arrow moves the cursor down one line on a menu, or to the next field on a form.
<!>	When the exclamation mark (!) key is pressed, you leave the PowerNet menu program temporarily and return to a UNIX shell. This key is only active when at a system menu or sub

menu. This function allows for the entry of other commands so additional tasks can be executed. To return to the program, type the following at the **#** prompt: `exit <Enter>`

<Bksp> When this key is used in toggle fields within a form, this key displays the previous allowable field value.

<Del> Press the Delete key to exit from a log, or from a *Utility* option (or <Ctrl><c> on AIX and HPUX systems).

<Enter> Use the Enter key to select the menu option on which the cursor is positioned. On forms, press Enter to accept the value displayed in the active field and move to the next field.

<Esc> Use the Escape key to quit the program from the *Main Menu*, proceed to a previous menu, or to leave a form. If changes were made to a form, a prompt to save them appears.

<Space Bar> The space bar toggles through a selection of choices in a toggle form field.

<Tab> Use the Tab key to move between fields on a menu page.

<*n*> <Enter> <Enter>
Use this key sequence to select an item from a menu by using the option number (*n*) followed by pressing the Enter key twice.

<U> Press the *U* key to display the previous page of a form, or the previous Frequency Scan Report (FSR).

<D> Press the *D* key to display the next page of a form, or the next FSR.

<Ctrl><c> Hold down the Control key and press the *c* key to stop a process if the <del> key does not exit you from a process.

<Ctrl><\> Hold down the Control key and then press the \ (backslash) key to breakout of a process “when all else fails.” Note that a core dump file results from this action.

Caution: Some terminal emulation packages use this key for an internal function. In this case, you must create a macro to send this key combination.

Non-English Language Support

For a description of how Connect implements the international character set, please see the Connect document PowerNet TCP/IP Terminal Emulation Product Specificaton. Appendix E *ISO 8859-1 Character Set* shows the implementation of the ISO character set. Several European languages are supported by Symbol International products.

2 System Operation and Utilities

Introduction

This System Operation chapter starts with accessing the PowerNet software and follows with an overview of the program menu structure. Included with the PowerNet are several utilities that are used to verify system software, authorize installed software, tune memory usage, capture diagnostic data, transfer files, backup and restore software, cleanup disk space, and gracefully cycle system power.

Log In

There are **three** ways to access the PowerNet software. *First* is to dial into the system modem. *Second* is to attach a portable computer to the service port COM1. Please see *Chapter 3* for more connection information. Additionally, TCP/IP equipped systems allow for a *third* option to access the controller via *telnet*. When a connection is made, the remainder of the actions are merely following standard procedure. The prompts and responses that need to be entered are as follows:

Prompt	**Response**
`login:`	**`tec<Enter>`**
`Password:`	**`tec123<Enter>`**

System information is then displayed. It includes the last successful login and the version of UNIX loaded on the PowerNet. Next, a prompt for the type of terminal that is being used appears. It is suggested that a VT-100 terminal or VT-100 terminal emulation be used, and therefore, enter at the prompt:

Prompt	**Response**
`TERM=(dialup)`	**`vt100<Enter>`**

To access the PowerNet software, you must log in as superuser and start the program by entering the information below at the `$` system prompt.

`$`**`su - ops<Enter>`** (**Note**: Spaces are important.)

Prompt	**Response**
`Password:`	**`ops123<Enter>`**
`TERM = (vt100)`	**`<Enter>`**

The opening screen shown in Figure 1-2 is displayed. Once the user name, passwords, and terminal type are entered and the PowerNet program started, the *Main Menu* appears.

Exit

When at the *Main Menu* level, you may exit to the UNIX operating system by pressing <Esc>. The system then displays the prompt `Exit (Y/N)`. By responding to the prompt with **Y**, you are exited from the *su* (superuser) shell and into the UNIX system as the original user name you used when starting the session (e.g., **tec**).

Standard Menu System

A standard system menu map, displaying the relation of sub-menus to the *Main Menu*, is shown in Figure 2-1. A summary of all menus and options appears after the figure. Please note that this menu is common to all systems and some options shown here may not appear based on the host connectivity and system options installed on the PowerNet Controller.

Operations Menu	**Hot Spare Menu**[+]
Wireless View	Setup
Spectrum One Startup *	Startup
Spectrum One Shutdown *	Shutdown
Access Point Startup **	Hadax Status
Access Point Shutdown **	**Object Editor Menu**[+ ++]
<wired connectivity> Startup[++]	Keyboard/Mapping[++]
<wired connectivity> Shutdown[++]	Keyboard/Macros[++]
Spectrum One Menu*	Scanner/Data Mapping[++]
Port Setup	Scanner/Data Editing[+++]
Network Setup	Scanner/Decoder Control[++]
Terminals	Display/Mapping[++]
Transceivers	Display/Formatting[+++]
Host List	Printer/Init[++]
Diagnostics	Dialog[++]
Activity Report	Failover[+]
Performance Report	**Utilities Menu**
Loader	Verify
Access Point Menu**	Authorize
Ports	Tune
Server	Snapshot
AP Init	Cleanup
MAC to IP Listing / AP Config	Transfer
Host List / Diagnostics	Reboot
Performance Report / Loader	Power Down

* Items included with the Spectrum One Option.
\+ Items Included with the Hot Spare Option.
+++ System Options ordered as add-ins.
** Items Included with the Access Point Option.
++ System Options included with all Terminal Emulation Packages, i.e., TCP/IP, SNA, etc.

Figure 2-1 Standard System Menu Map

Main Menu

This menu has three standard selections and also includes specific host connectivity options that are not discussed here as these options vary from system to system. Information specific to the host connectivity installed on the PowerNet server is contained in the Reference Manuals. The standard selections on this main menu include *Operations*, *Spectrum One* and/or *Access Point*, and *Utilities*.

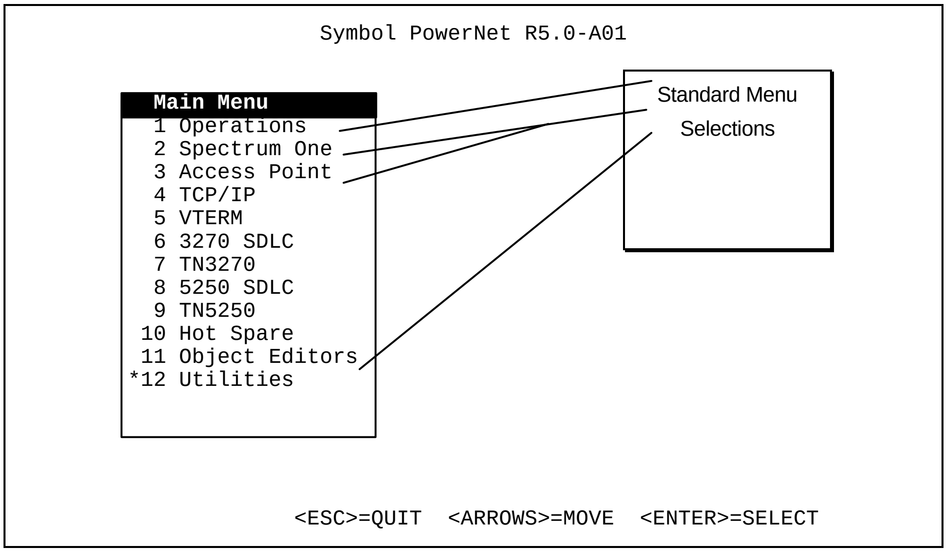

Figure 2-2 Sample Main Menu Screen

Operations Menu

This selection provides access to the *Wireless View* utility which displays network topology and statistics, has options for resetting the LAN, and creates and configures log files, etc. The other menu choices on the *Operations Menu* are used for starting-up and shutting-down the PowerNet RF network(s). The following menus/options are available from the *Operations* screen.

Wireless View When selected, presents a display of current network topology with statistics for transceiver(s), Access Points, and terminal(s) in the network.

Spectrum One Startup Activates RF activity on RF LANs in the Spectrum One environment.

Spectrum One Shutdown Stops all RF activity on all RF LANs in the Spectrum One environment.

Access Point Startup Activates RF activity on RF LANs in the access point environment for the PowerNet controller.

Access Point Shutdown Stops all RF activity on all RF LANs in the access point environment for the PowerNet controller.

<wired connectivity> Startup Activates host connection activity to the PowerNet in the TCP, SNA, and NetBIOS connectivity environments. See note below.

<wired connectivity> Shutdown Stops all host connection activity to the PowerNet in TCP, SNA, and NetBIOS connectivity environments.

Note There is a <wired connectivity> startup and shutdown for each network/host connectivity installed in the PowerNet server. Additional menu items appear in this menu for each installed connection type.

Spectrum One Menu

This menu includes Spectrum One RF network utilities which are used for setting channels, managing terminal and transceiver addresses, downloading terminal software, and generating reports.

Port Setup A factory-set screen that shows the configured serial ports.

Network Setup Provides a form used for initial setup. Chip seeds, channels, ports, etc., are defined for each Spectrum One RF LAN here.

Terminals A form displays terminal addresses in use and those available.

Transceivers A form displays the transceiver addresses in use and those available for each LAN.

Host List The *Host List* specifies the hosts and applications that are available to the RF terminals.

Diagnostics Provides testing facilities for transceiver LANs and allows diagnosis of problems—cable breaks, faulty transceivers, etc.

Activity Report Constructs data traffic and active node reports from available data.

Performance Report Performance Reports for the system, including transaction data, are created in either graphical or tabular form.

Loader Downloads **.HEX** files to RF terminals.

Access Point Menu

This menu includes RF Access Point network utilities which are used for setting and managing terminals and transceivers, downloading terminal software, and generating reports.

Ports Designates the serial ports available for use by the PowerNet serv

Server Configures the Access Point server. It is used to set log levels, IP etc.

AP Init Establishes a serial communications session with an attached Access Point. You are required to set the Access Point's IP address before it can be attached to the network.

MAC to IP Listing Displays a list of known terminal MAC addresses and their assigned IP addresses that were reported by the PowerNet server as attaching to the AP network.

AP Config Establishes a telnet session with an active Access Point. This provides access to all of the control and setup functions available on the AP.

Host List The Host List function allows system administrators to configure the hosts, applications, and functions that are available to the RF terminals.

Diagnostics Provides testing facilities for Access Point networks and allows diagnosis of problems.

Performance Report Performance Reports for the system, including transaction data, are created in either graphical or tabular form.

Loader Used to download program files to RF terminals.

Note Connectivity menu selections that have been ordered appear in the main menu. The fields of these connectivity menus follow.

Hot Spare Menu

This menu appears on the System Menu if the Hot Spare option is ordered and installed on the PowerNet server. This menu includes Hot Spare setup utilities which are used for setting the hot spare options, starting and stopping the process, as well as viewing Hadax intelligent switch status.

Setup Form allowing setup of the Access Point monitor parameters.

Startup Starts the Hot Spare monitor running on the current system.

Shutdown Stops the Hot Spare monitor running on the current system.

Hadax Status Communicates with the Hadax controller's serial controller port for statistical viewing and configuration editing purposes.

Object Editor Menu

The object editor menu provides for the selection of installed options based on the PowerNet server configuration and/or other options ordered. The Object Editor menu allows for selection and operation of the options installed. Provisions in this menu can vary from system to system based on the controller configuration and can include *Keyboard Mapping, Scanner Data Mapping, Scanner Data Editing, Scanner Decoder Control, Display Mapping, Display Formatting, Printer Initialization file editing, Dialog Script Editing,* and *Failover control*.

Keyboard/ Mapping Allows the administrator to define custom keyboard layouts using the keyboard mapping utility that allows definition of key functions based on terminal type and handler functions.

Keyboard/Macros Allows defining strings to be transmitted when a function key is pressed.

Scanner/Data Mapping Allows definition of specific bar code patterns that map to specific key functions. An example of this would be mapping a bar code containing *$*&*, when scanned, sends a *PF10* to the host system

Scanner/Data Editing Allows the system administrator to modify the way certain bar code data is passed to the host system. An example of this would be stripping the first and last character from a 12 digit bar code.

Scanner/Decoder Control Allows the system administrator to define what bar code symbologies are recognized by the RF terminal's scan decoder.

Display/Mapping Allows the system administrator to define character set mapping for the remote terminal's display.

Display /Formatting Calls an external utility, *tsf*, that allows the system administrator to modify existing host application screen(s) to effectively present incoming host screens to the smaller screen sizes of the remote devices.

Printer/Init The Printer/Init object editor selection starts a system editor session that allows the system administrator to create custom printer setup and/or initialization files that may be required by some printer families. An example of the use of this function is defining a printer form containing repeatable information that allows the host application to send only the required variables.

Dialog The Dialog object editor function starts a system editor session allowing the administrator to edit dialog scripts that are commonly used to automate common tasks when starting terminal emulation sessions such as logging on, waiting for host signon information, starting applications on the host, etc. Use of this function allows for local communication between the host system and the PowerNet server for automating these tasks, thus eliminating RF traffic that would normally be required for these tasks.

Failover The Failover object editor function starts a system editor session that allows the system administrator to edit and/or modify failover scripts that are used with the Hot Spare option.

Utilities

These PowerNet *Utilities* allow backup and restoration of site-specific files, updated software installation, as well as DOS and UNIX diskette copying.

Verify Checks all installed software. Each installed package component is compared against the software release database and reports all deviations, including authorized software patches.

Authorize Checks which software this PowerNet server is authorized to use. It shows which packages are installed and authorized along with the number of terminals authorized for use.

Tune Views how the PowerNet system memory is being utilized. It also allows you to "tune" UNIX Streams.

Snapshot Creates a complete image of the current status of the PowerNet server. This option creates a complete archive of all system logs and other relevant information. This utility is designed to help support personnel diagnose problems with the controller.

Clean up Removes the UNIX console messages (**/usr/adm/messages**) and log files.

Transfer Invoke the File Transfer Manager. This utility is designed to ease the task of dealing with UNIX files.

Reboot Performs a reboot on the system which may be required for resetting the system after configuring devices.

Power down Performs a UNIX **haltsys** on the system in order to 'nicely' shut down the UNIX services in preparation for turning the power off.

Utilities Menu Introduction

Included with PowerNet are several utilities that are used to verify system software, authorize installed software, tune memory usage, capture diagnostic data, transfer files, backup and restore software, cleanup disk space, and gracefully cycle system power.

The *Utilities Menu*, selected from the *Main Menu*, is shown in Figure 2-3.

```
                      Symbol PowerNet server R5.0-A01

        Main Menu
          1 Operations
           Utilities
             1 Verify
             2 Authorize
             3 Tune
             4 Snapshot
             5 Cleanup
           * 6 Transfer
             7 Reboot
             8 Power Down
         1
        *12 Utilities


                    <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 2-3 Utilities Menu

The options on the *Utilities Menu* are explained in the following sections.

Verify

Select *Software Verify* to check all installed software. Each installed package component is compared against the software release database which contains a 32-bit CRC of all files. Any deviations, including authorized software patches, are also reported. The software release database is in the file is in the working directory. This file is included with each system at time of shipment.

Note: *Verify* can take up to 30 seconds to analyze the system before displaying information on the screen.

```
                           Software Verification
                Scanning ...

Sep 25 16:03 1996   Page 1
VERIFICATION DATABASE LOADED:
 27 package entries, 171 file entries, 0 errors
PACKAGE SCAN
VERIFIED PACKAGES:
  Base System 5.0.0
  Spectrum One 5.0.0
  Access Point 5.0.0
  Base TCP/IP 5.0.0
  Base SNA 5.0.0
  SMI 5.0.0
  PTY-256 5.0.0
  VTERM 5.0.0
  3270 SDLC 5.0.0
  TN3270 5.0.0
  5250 SDLC 5.0.0
  TN5250 5.0.0
  Formatter 5.0.0
  Scan Editor 5.0.0
  Hot Spare 5.0.0
  SNA Drivers 5.0.0
  SCO TCP/IP 5.0.0
  Serial/Digi 5.0.0
  TokenRing/tok0 5.0.0
        Report is in "xfer/vfy092596"
        Press ENTER to continue
```

Figure 2-4 Sample Output of Verify

Authorize

Select *Software Authorize* to examine or update the authorized number of users and installed software packages. This menu option also permits resubmission of the authorization code when software and/or hardware is added or removed from the system.

The authorization code is submitted at time of installation. An unauthorized system operates for 7 days, allowing for completion of the authorization procedure described in the Authorization form supplied with the system. After the 7 day grace period, the system disables PowerNet access until the authorization procedure is completed.

```
                           Authorization

                  Machine ID [2CF055995                ]
          Authorization Code [226D-2209-5B8F]

      New Authorization Code [              ]

                       Users [16  ]
                Spectrum One [yes]
                Access Point [yes]
                       VTERM [yes]
                        3270 [no ]
                        5250 [no ]
            Client Streaming [no ]
                 Scan Editor [yes]
                   Formatter [yes]
                          <ESC>=QUIT
```

Figure 2-5 Sample Output of Authorize

Note: It is of the utmost importance to complete the authorization form prior to the final installation of any PowerNet system. Failure to authorize a PowerNet results in failure of the system to operate for more than seven (7) days.

This page left intentionally blank.

Urgent Authorization Required

Please follow the instructions shown on the next page and then fax this to Connect, Inc., (630)963-8919.

Machine ID (carefully showing *UPPER* and *lower* case!) from the on screen Authorization Menu:

[__]

Serial number from diskettes:

[__]

Your Company Name (please print):

Location (City, State, Province, Country): ____________________________________

____

____

Your first and last name (please print): ____________________________________

Your fax number with country code / area code: (   )   -

Your phone number with country code / area code: (   )   –

New authorization code to be supplied by Connect on a return fax.

[__ __ __ __ – __ __ __ __ – __ __ __ __]

If you can not enter the new authorization code into your system, call us at (630) 963-8800.

Connect, Incorporated, Customer Satisfaction Survey:

To provide feedback to our improvement process, please answer the questions below.

Please write down the date when the equipment was received at your facility. ____________________

Did the equipment arrive damaged? (circle one) Yes — No. (If yes, please describe damage.)

____

____

Are you satisfied with the performance of this product? (circle one) Yes — No (If no please describe.)

____

____

Would you like us to phone you about any problems with this equipment? (circle one) Yes — No

1. The system which you have purchased requires an authorization code to be entered so that the software will run continuously. If this authorization code is **not** entered, the system runs for only 7 days. Then you must enter an authorization code before you can proceed.

2. Turn on the power to the PowerNet server and follow the instructions in the PowerNet Manual to get to the *Utilities* menu then go to the sub-menu called *Authorize*.

3. On the *Authorization* screen, find the field called **Machine ID**. In the space provided on the preceding page, print clearly the ID number shown between the brackets (carefully showing *UPPER* and *lower* case!). (Note: The character string may not be long enough to fill all of the blanks.)

4. Fax this page to (630) 963-8919 between 9:00 AM and 5:00 PM (Central Time) Monday through Friday. We fill in the line **New Authorization Code** and fax it back to you.

5. When you receive our return fax, please enter onto your screen the New Authorization Code **exactly** as shown on our fax (i.e., all letters capitalized where needed, and dashes entered). Next, press the **<Esc>** key. The following appears on the screen:
   ```
   Submit new authorization code (y/n)?
   ```
   Answer *yes* by pressing the **<y>** key. Go to instruction 8.

6. If you entered an invalid authorization code, the following appears on the screen:
   ```
   Invalid code, press ENTER to continue
   ```

7. After you press the **<Enter>** key, the cursor returns to the New Authorization Code field. Change the code previously entered. Be sure it matches the code **exactly as shown** on the fax (carefully entering *UPPER* and *lower* case!) from Connect. Then press the **<Esc>** key to resubmit, and follow the prompts.

   Note: If problems continue, call us at (630)963-8800, and our technical support help desk will provide assistance. They may ask you to *a)* attach a telephone line to the internal modem port labeled *LINE* for us to provide dial-in assistance or *b)* attach the external monitor and keyboard (optional equipment) to enable you to enter diagnostic commands.

8. When the code is accepted, the authorization code you entered now appears on the line labeled *Authorization Code* and the cursor returns to a blank New Authorization Code field. When these steps are completed, you have successfully entered the New Authorization Code into the system. Now press the <Esc> key to return to the *Utilities* menu.

Tune

Select *Tune* to view and modify system memory utilization. The factory-set defaults are satisfactory for most installations and should not be modified. **Caution**: Do not change any of these parameters unless instructed to do so by Connect Technical Support.

```
                              Memory Setup
  Authorized Users [ 16]
          Capacity [ 37]

     ----------- Summary -----------        -------- Streams ---------
                     Mbytes  Pages          Block Size Default  Actual
       Installed RAM [ 15.6] [ 3993]                 4 [ 512]   [ 512]
         Base Kernel [  3.4] [  860]                16 [ 512]   [ 512]
            Tunables [  0.6] [  155]                64 [ 512]   [ 512]
      UNIX Processes [  0.8] [  200]               128 [ 512]   [ 512]
        Spectrum One [  0.6] [  150]               256 [ 256]   [ 256]
              TCP/IP [  0.7] [  175]               512 [ 128]   [ 128]
        Access Point [  0.4] [  100]              1024 [  64]   [  64]
                 SNA [  0.4] [  100]              2048 [  32]   [  32]
             NetBIOS [  0.0] [    0]              4096 [  16]   [  16]
              DECNET [  0.0] [    0]
      Per RF Handler [  0.2] [   60]
     Total Allocated [  6.8] [ 1740]
                Free [  8.8] [ 2253]
                            <ESC>=QUIT  <ARROWS>=MOVE
```

Figure 2-6 Sample Output of Tune

Snapshot

Select *Snapshot* to create a complete image of the current status of the system. This option copies all logs, system information, disk usage, network status, configuration, etc. to the *snaps* subdirectory and, at the user's discretion, may create a compressed archive file for subsequent transfer using the Transfer menu option. **Note:** *Snapshot* may take 30 to 45 seconds to complete and for all information to appear on the screen.

```
        Snapshot Utility
                Log files ...
                Activity and Performance data files ...
                Site configuration files ...
                SNA info ...
                SAR info ...
                Process info ...
                Disk info ...
                Console messages ...
                Hardware configuration ...
                TCP/IP network info ...
                LLI info ...

                Archive Format
                1 TAR
                2 CPIO
                3 ZIP
                q Quit

                Selection: 1
                Enter archive filename: junk
        Creating compressed TAR format archive ...
        Archive is "/crf/xfer/junk.Z"
        Snapshot files in “snaps”
                Press ENTER to continue
```

Figure 2-7 Sample Output of Snapshot

Use of the archive format is self explanatory. When prompted for the archive format, select the type of archive the system should create to save all of the snapshot files in. If no archive is to be created, simply select **q** when prompted for the archive format. All snapped files are then saved in the **/crf/snaps** directory without creating an archive file in the **/crf/xfer** directory.

Cleanup

Select *Cleanup* to remove the PowerNet server activity and performance database files, the UNIX console messages (**/usr/adm/messages**) file, garbage files in **/lost+found** that result from non-graceful shutdowns, and wireless terminal handler logs. All of these files are purged automatically on a weekly basis by a UNIX *cron* function that runs in the PowerNet server. Below is a picture of the screen representing the possible files to be removed from the PowerNet server. Each prompt is to be responded to with either a **y** or **n** response. After the cleanup process is complete, press **<Enter>** to return to the *Utilities* menu.

```
Cleanup

        Clear console messages file (y/n)?: n
        Clear /lost+found (y/n)?: y
        Removing files in /lost+found
        Clear handler logs (y/n)?: y
        Clear packet logs (y/n)?: y

        Cleanup complete.  Press ENTER to continue
```

Figure 2-8 Sample Output of Cleanup

Transfer

Select *Transfer* to invoke the File Transfer Manager. This utility is design to ease the task of transferring files and archives via modem and diskette. It is also the tool used to create a backup of all site-specific files and configurations.

General Operation

The current subdirectory and its contents are displayed in the left-hand panel. Names shown between square brackets, such as [..], represent directories; all other names are files. A file or directory is selected, or “marked,” by using the arrow keys to move the cursor to the name and then pressing the <space> bar; the name then appears in boldface. In the case of directories, selection results in a display of the files in that directory. The directory name [..] represents the parent of the current directory.

There are three basic functions of the File Transfer Manager - Directory Selection, File Selection, and File Management. The file transfer manager is dynamic in that as the cursor is navigated around the screen, the file transfer manager assumes one of these three roles. For example, when the cursor is next to a directory name, the file transfer manager is in directory selection mode to allow navigation to the selected directory by pressing the <Enter> key. When the cursor is next to a file name, the file transfer manager is in file selection mode allowing selection of files to be acted on by marking them with the <Enter> key. When the cursor is at the available selections along the bottom of the screen, file management functions can be selected. Descriptions and examples of each of file transfer modes are outlined in the following descriptions.

Directory Selection Mode

When in the Directory Selection mode, the file transfer manager allows the system administrator to navigate through the available system directories in order to view the file lists associated with each directory. Figure 2-9 shows the file transfer manager in directory selection mode.

```
                              File Transfer Manager
 /crf/xfer
[..]
vfy092596
ss25Sep.Z
backup1.zip
bckup2.zip







     Diskette          Communications              Archive
[DOS] [TAR] [CPIO]  [ZMODEM] [KERMIT]      [BACKUP] [RESTORE]          [QUIT]
                                           [ZIP] [TAR] [CPIO]


   <ESC>=QUIT  <ENTER>=DIRECTORY  <CTRL-D>=PGDN  <CTRL-U>=PGUP  <ARROWS>=MOVE
```

Figure 2-9 File Transfer Manager in Directory Selection Mode

When the file transfer manager is in directory selection mode, select the desired directory with the arrow keys to position the cursor next to the directory name. Pressing the <Enter> key then displays the contents of the selected directory.

File Selection Mode

When in the File Selection mode, the file transfer manager allows the system administrator to mark files that are acted on in the file management mode.

```
                          File Transfer Manager
 /crf/xfer  ────────────────────────────────────────────────────────────
[..]
vfy092596
ss25Sep.Z
backup1.zip
bckup2.zip

──── Diskette ─────── Communications ───────── Archive ──────────────────
[DOS] [TAR] [CPIO]  [ZMODEM] [KERMIT]     [BACKUP] [RESTORE]          [QUIT]
                                          [ZIP] [TAR] [CPIO]

     <ESC>=QUIT  <ENTER>=MARK  <CTRL-D>=PGDN  <CTRL-U>=PGUP  <ARROWS>=MOVE
```

Figure 2-10 File Transfer Manager in File Selection Mode

With the file transfer manager in file selection mode, select the desired file for action with the arrow keys to position the cursor next to the file name. Pressing the <Enter> key marks the file name in reverse video for action when the file transfer utility is in file management mode. Figure 2-10 shows 3 files marked for action when in file management mode.

File Management Mode

Once files to be acted on are marked, or if files need to be transferred to the system from a remote computer, moving the cursor to the function area near the bottom of the screen invokes file management mode. Keep in mind that one or more files may be "marked" using the file selection mode for *Diskette*, *Communications*, or *Archive* operations handled while in file management mode. When in the File Management mode, the file transfer manager allows the system administrator to act on in the selected files. Figure 2-11 shows the file transfer manager in file management mode.

```
                     File Transfer Manager
 /crf/xfer ────────────────────────────────────────────────────────
[..]
vfy092596
ss25Sep.Z
backup1.zip
bckup2.zip

──── Diskette ────── Communications ──────── Archive ───────────────
[DOS] [TAR] [CPIO]  [ZMODEM] [KERMIT]    [BACKUP] [RESTORE]   [QUIT]
                                         [ZIP] [TAR] [CPIO]
Copying /crf/xfer/kjl.zip to a:kjl.zip ...


                   <ESC>=QUIT  <ENTER>=SELECT  <ARROWS>=MOVE
```

Figure 2-11 File Transfer Manager in File Management Mode

When the file transfer manager is in file management mode, select the desired file action with the arrow keys to position the cursor within the function area. Pressing the <Enter> key then marks the file name in reverse video for action when the file transfer utility is in file management mode. The example in figure 2-11 shows 3 files ‘marked’ for action. The cursor is positioned at the DOS action field, ready to transfer files to a DOS format diskette when the <Enter> key is pressed.

The file management functions available when in file management mode are described in the following sections. Please note that when file management is in process, status messages appear on the screen as shown by example in figure 2-11. Although each status message is not described here, these messages provide useful information regarding the status of the selected file management operation.

Diskette Operations

`[DOS]` Used to transfer marked file to and from DOS format diskettes.

`[TAR]` Used to transfer marked files from diskettes written in TAR format and to create a TAR format diskette with marked files.

`[CPIO]` Used to transfer marked files from a diskette written in CPIO format, and to write marked files in CPIO format to diskette.

Communications Operations

`[ZMODEM]` Used to transfer marked files from the PowerNet server to the user’s system via Z-modem. If no files are marked, Z-modem enters the receive mode and waits for 60 seconds to begin receipt of a file from the user’s system.

`[KERMIT]` Used to transfer marked files from the PowerNet server to the user’s system via Kermit. If no files are marked, Kermit enters the receive mode and waits for 60 seconds to begin receipt of a file from the user’s system.

Archive Operations

`[BACKUP]` Used to backup all site specific files and configurations. The user is prompted for the desired archive format (ZIP, TAR, or CPIO). Subsequently the archive may be transferred to diskette or downloaded using one of the communications facilities.

```
Backup Options
1 ALL site specific files
2 Selected subsystem files
q Quit
Enter Selection:
```

Figure 2-12 Backup Options Menu

If `ALL site specific files` (menu item 1) is selected from this menu, the system archives all configuration files related to the PowerNet configuration. Figure 2-13 shows a list of files backed up by the system. Please note that files listed and file counts in the example may differ depending on the PowerNet model and configuration.

```
                Backup Options

                1  ALL site specific files
                2  Selected subsystem files
                q  Quit

                Enter Selection: 1

        Installation configuration ... 2 file(s)
        Serial port configuration ... 2 file(s)
        RF network and menu system configuration ... 25 file(s)
        RF handlers
                configuration ... 8 file(s)
                keyboard mapping objects ... 16 file(s)
                keyboard macro objects ... 22 file(s)
                dialog objects ... 13 file(s)
                formatter objects ... 109 file(s)
                scan editor objects ... 28 file(s)
                scan data mapping objects ... 2 file(s)
                scan decoder control objects ... 2 file(s)
                printer initialization objects ... 4 file(s)
                display mapping objects ... 2 file(s)
        Hot spare configuration ... 1 file(s)
                failover objects ... 3 file(s)
        TCP/IP network configuration ... 25 file(s)
        SNA network configuration ... 29 file(s)
        DECNET configuration ... 0 file(s)
        System startup files (/etc/rc2.d) ... 2 file(s)
        System TCP/IP configuration files ... 4 file(s)
        System CRON files ... 9 file(s)


        Total files:     304

                Archive Format

                1 TAR format and COMPRESS
                2 CPIO format and COMPRESS
                3 ZIP

                Selection:
```

Figure 2-13 Sample - ALL site specific files Backup Option

If `Selected subsystem files` (menu item 2) is selected from the backup menu, the system only archives configuration files related to the PowerNet configuration that the system administrator requests. Figure 2-14 shows a list of files that the operator is prompted through in order for the system to backup. Please note that files listed and file counts in the example may differ depending on the PowerNet model and configuration. Respond to each prompt with a `y` or `n` response.

```
              Backup Options

              1  ALL site specific files
              2  Selected subsystem files
              q  Quit

              Enter Selection: 2

              Selective Backup

              Installation and serial port setups (y/n): y
              RF network and handler setups (y/n): y
              Hot spare setups (y/n): y
              Host network setups (y/n): n
              System setups (y/n): y

       Installation configuration ... 2 file(s)
```

Figure 2-14 Selective Backup System File Prompts

Please note that once the files for selective backup are selected, the backup procedure screen appears as it did in figure 2.13.

Once all requested files have been collected in either case (all or selective), the archive selection menu appears on the bottom of the screen as seen in figure 2-15. From this screen, select the archive type to create the site backup file with.

Once the file type is selected, the system prompts for an archive filename as shown below in figure 2-15 at the prompt **`Enter archive filename:`**. Once the file name is entered, the system reports the saved file name and prompts **`Press ENTER to continue`**.

```
              1 TAR format and COMPRESS
              2 CPIO format and COMPRESS
              3 ZIP

              Selection: 3

              Enter archive filename: test

       Creating ZIP archive ...

       Archive is "/crf/xfer/test.zip"

       Press ENTER to continue
```

Figure 2-15 Sample - Archive type selection and results.

`[RESTORE]` Used to restore a file. This facility is most commonly used to restore site backups. The utility determines the format of the file (ZIP, TAR, or CPIO), and then prompts the user to determine if the archive is a site backup. If so, the files are de-archived referencing the root directory. Otherwise, the files are de-archived into the current directory.

`[ZIP] [TAR] [CPIO]` Used to create a compressed archive file(s) in the respective format. If using ZIP or TAR, an error, “Argument list too long...”, may occur if the number of files is too large for the compression software. In that case, select CPIO as the archive method.

Reboot System

This option performs an orderly UNIX system shutdown, and then automatically reboots the system. When selected, the system prompts:

```
Are you sure you want to reboot this system (y/n)
```

At this prompt, respond with a y or n response.

Caution: Please note that if this selection is started remotely, the remote session is disconnected and requires re-connection to the PowerNet server.

Power Down

Selecting this option tells the UNIX system to shutdown in an orderly fashion. Once this has completed, the system can then be powered off. It is permissible to instead, just turn off the PowerNet server, but using this option makes the next system startup faster since the cleanup programs do not have to run.

Caution: **Do not select power down during a remote support session!** Doing so disconnects the active support session from the PowerNet server, prevents remote access to the PowerNet server, and requires someone to physically power off and power on the server in order to re-establish remote support.

3 Configuration

Introduction

This chapter lists the hardware and software options that are available for PowerNet servers. All product numbers and related hardware must be ordered separately. Please note that some hardware may be customer dependent or customer supplied.

Connection of Spectrum One LAN equipment and Access Point LAN equipment, including the PowerNet server, follows. A section on fault resiliency also appears at the end of this chapter. Host and wired network connectivity hardware options appear in each *Reference Manual*. Specific system component information, such as network interface cards (NICs), cables, connectors, etc., are also found in the connectivity manuals.

Hardware

The name of each PowerNet, along with the number of connectivity options are listed below.

Name	Connectivity Options
PowerNet 1000	2
PowerNet 2001	3
Integrated RM 2501	4
Dual 2501	4
Triple 2501	4

Controller Model Selection

The first step in the selection process is determining the network performance requirements. Based on how the terminal is used (terminal emulation or client streaming), two factors affect performance of the PowerNet server: terminal count and required bandwidth. Both factors must be taken into consideration to achieve satisfactory performance.

The second step in the selection process is determining the number of Spectrum One RF networks. The number of networks impacts the serial port option that is selected.

Client Streaming vs. Terminal Emulation

Two types of software packages are available for different connectivities, client streaming (CS) and terminal emulation (TE). These software packages differ in the mode of communication used and the environment that is implemented. Selection of a package depends in part on what the host applications and sites require.

Client streaming supports a large number of RF terminals due to more efficient use of host network resources. The implementation of client streaming programming methodologies offer efficient use of RF network bandwidth and maximize battery life. Applications can be designed to utilize data processing capabilities of the remote terminals allowing terminals to transmit data only when necessary to complete a transaction. The result - fast, efficient, transaction oriented applications. Operation in the client streaming environment requires custom applications to be developed on both the host and remote RF terminal sides. PowerNet provides an Application Programming Interface (API) for custom application development.

During system operation with a client streaming package, the PowerNet server appears to the host as a server node on the network and Spectrum One RF terminals appear as transaction terminals attached to the server node. PowerNet functions solely as an intelligent pass-through data server handing data to and from the host to the terminal devices while providing terminal management services.

Terminal emulation software, is typically used when the host application being used requires a character mode data stream (i.e., standard VT-100), as would be the case with legacy systems and applications written to handle input from traditional ‘glass-tube’ workstations. The benefit of using terminal emulation is quick implementation, which can be desirable with existing 3270, 5250, VT100, VT220, and HP700 type applications in order to provide information to the user as quickly as possible using a wireless RF network. When terminal emulation is being implemented, the RF terminals appear to the host as terminals on a terminal server, which is the PowerNet server.

An improvement in terminal emulation (TE) performance is seen when CCP (Common Client Program) software is used on the remote terminal in conjunction with TE packages on the PowerNet server. With typical implementations of VT100, VT220, and HP700 terminal transactions, a ‘block mode’ data stream is created and sent to the RF terminal from the character-oriented data stream coming from the host to the PowerNet server. Information is therefore sent to and from RF terminals in a faster, more efficient, manner. RF traffic load is reduced, terminal battery life is improved, and system throughput is increased. Behind the scene, the PowerNet server ‘optimizes’ the incoming host data (presentation space), stripping out whatever the user of the remote terminal user cannot ‘see’ given the smaller display of the remote device, compresses any imbedded spaces, and passes only pertinent data to the RF terminal. Typical incoming host screens consisting of 1920 bytes (in 24x80 character screens) are condensed into transactions to the RF terminal (with an 8x20 display size) averaging somewhere around 40 bytes using this optimization and data compression scheme.

Terminal Count

Terminal count supported by the PowerNet server is determined by the PowerNet server model ordered. The maximum number of terminals that a particular PowerNet server can accommodate taking into consideration processing power and memory sizing, regardless of terminal emulation or API (client streaming), is shown below:

Model	Max Terminal Supported
500	8
1000	32
2002	104
2502	240 +

When considering the maximum number of terminals in use, you must also consider the concurrent number of host sessions required. The standard *hot key* features allow each terminal to maintain up to four emulation sessions at one time and switch between them. These *hot key* sessions have the same load on the host as individual terminals. Please keep this in mind when selecting a PowerNet server model. If you are unsure on the number of *hot key* sessions to be used, then multiply terminal count by four to determine the maximum number of terminals required and choose the PowerNet server model capable of handling that terminal count.

Controller Bandwidth for Spectrum One Networks

Each PowerNet server is rated for a maximum effective serial bandwidth in bytes per second. Calculating the needed bandwidth requires the following information: number of RF transactions, total effective size of each transaction in bytes, and time period in seconds. A transaction is defined as an exchange of data to and from the PowerNet controller. For example, the bandwidth required for 200,000 transactions in a 1 hour period or, 3,600 seconds, (200 RF terminals running at a rate of one transaction every 3.6 seconds) with an average effective transaction size of 80 bytes is calculated as follows: (200,000 ∗ 80) / 3,600 = 4444. A PowerNet server with an effective serial bandwidth of at least 4444 bytes per second is required. he bandwidth (bytes per second) of each PowerNet server model is shown in the following table. A model 2501 would satisfy the requirements of the previous example.

Model	Bandwidth (BPS)
1000	2000 BPS
2001	4000 BPS
2501	7000 BPS

Transceivers and Number of Spectrum One Networks

In addition to serial bandwidth requirements, the results of the site survey may affect the number of Spectrum One networks required, particularly in large installations. Although each Connect/RF PowerNet server can support up to 16 transceivers on each of 32 networks, it is recommended that each network be limited to a maximum of 8 transceivers. Therefore, a site survey calling for a total of 24 transceivers should be segmented into at least 3 Spectrum One networks. The 4-port serial option would be required for this network.

Spectrum One LAN Bandwidth

Each properly configured Spectrum One RF LAN can handle throughput of up to 57.6Kbps. Including overhead of the Spectrum One protocol, this translates into a “real-data” hauling capacity of 3000 bytes (characters) per second when run at 57.6Kbps. In the previous example our configuration called for a data hauling capability of at least 4444 bytes per second. This configuration called for a model 2501 controller. However, since each Spectrum One network capacity is 3000 bytes per second, a second RF LAN needs to be utilized in order to provide the proper RF bandwidth. Adding additional RF LANs to a PowerNet server increases the RF bandwidth incrementally. Keep in mind though, that each model of PowerNet server is rated up to a specific bandwidth in characters (bytes) per second as well.

When running Spectrum One LANs at serial connection speeds lower than 57.6Kbps, the RF network bandwidth decreases proportionally. Running an RF network at 38.4Kbps means that the data hauling capacity of the network is 1500 bytes per second. This factor should be considered when implementing Spectrum One RF networks in remote facilities where lower serial connection speeds to the RF networks may be required.

Multiport Adapter Options

A variety of options are available for each model, such as RF LAN capacity and provisions for fault resilience. The fault resilience options are covered in the *Redundancy* section. The multiport adapter products for serial ports are listed below.

Product #	Description	Number of RF LANs (Capability)
CNT5000-1200	2-port addition	2
CNT5000-1201	4-port addition	4
CNT5000-1202	8-port addition	8
CNT5000-1203	16-port addition	16
CNT5000-1204	32-port addition	32

The interface converter is specified below.

Product #	Description
CNT5000-1210	RS-422/RS-232 Converter

Standard Features

All models have the capacity to support up to 32 Spectrum One RF networks. **A multi-port adapter that provides serial ports for networks must be ordered with every PowerNet server**. The smallest capacity board supports two LANs. The RF LANs can be a combination of transceivers and cradle networks. Initially, there must be at least one cradle network configured. The transceiver networks operate at 9600 baud through 57.6 Kbaud, with speed being software configurable.

- With transceiver firmware versions 2.04 and higher, serial link speeds of 19.2 kbps and 57.6 kbps are possible.

- With transceiver firmware versions 2.06 and higher, serial link speeds of 19.2 kbps, 38.4 kbps, and 57.6 kbps are possible.

Remote diagnostics are available for all systems, since every PowerNet server has an internal modem with a dial-up modem port. A modular-to-modular, 4-conductor phone mounting cord is supplied. Each system also includes a local service port, allowing the user to connect a PC running local terminal emulation. **Note**: The customer must have a compatible phone line available to use remote diagnostics.

Spectrum One Network Connectivity Options

In Spectrum One implementations, serial ports for RF networks are added in increments of 2, 4, 8, 16, or 32. The multiport adapter comes with the necessary cable(s). **An optional RS-232 to RS-422 converter is recommended for each RF LAN operating at 57.6 Kbaud. If converters are used, RS-422 cabling is needed for the serial connection from the to the first transceiver. A second converter may be needed for signal amplification (dependent upon cable length).** (See *Cabling Options* in Chapter 2.)

A combination un-interruptible power supply (UPS) and power conditioner is recommended for systems in areas which are subject to frequent power problems.

In Access Point Networks, the APs are attached to an Ethernet backbone which is shared with the PowerNet server. All communications to/from radio terminals are handled via this network.

Customer Supplied Equipment

As mentioned, all PowerNet servers have a service and a modem port that can be used for system administration functions. When connecting a computer to the service port, a standard null modem cable with a female DB-9 connector is needed.

The computer, which is used to access network management functions, must be capable of emulating a VT-100 terminal. We recommend *ProComm* from Datastorm Technologies, Inc. be purchased for this purpose, although the VT-100 emulator Microsoft *Windows Terminal* is also a good choice. With networks that implement TCP/IP, controllers with TCP/IP connectivity installed have TELNET capabilities that allow remote users to access the controller management functions.

Spectrum One Network Components

Spectrum One transceivers, cradles, and terminals must be ordered separately. Quantities are determined by customer need and should be discussed with your hardware representative. For a complete network, one transceiver, one terminal, one cradle, and cabling are the minimum necessary components.

Access Point Network Components

As in the above discussion of Spectrum One network components, RF access points, cradles, and terminals must be ordered separately to implement access point networks. Quantities are determined by customer need and should be discussed with your hardware representative. For a minimal complete network, one access point, one terminal, one cradle, and cabling are the minimum necessary components.

Software

PowerNet comes complete with the UNIX operating system. In addition, all PowerNet server and connectivity software is factory-installed. The complete system is thoroughly tested and must successfully pass a complete quality assurance program prior to shipment.

Connections

Wiring and connectors vary with the model purchased. Selected diagrams pertaining to various key system elements are presented. All connectors are labeled and, when installing the system, locate the proper connector using the label and the instructions that follow. **CAUTION: DO NOT power up the PowerNet server until the installation is complete. Do not power up any Spectrum One LAN components until all components are installed.** A representation of a 4-port Multiport adapter with the attached multi-port cable is shown in Figure 3-1.

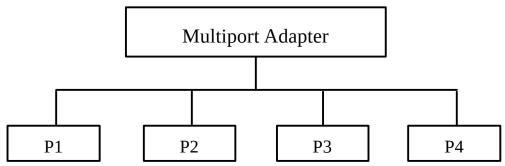

Figure 3-1 Multiport Adapter 4-port

A Figure 3-2 shows a 4-LAN PowerNet server with RS-422 interface converters (Ics) as well as connections to an access point network.

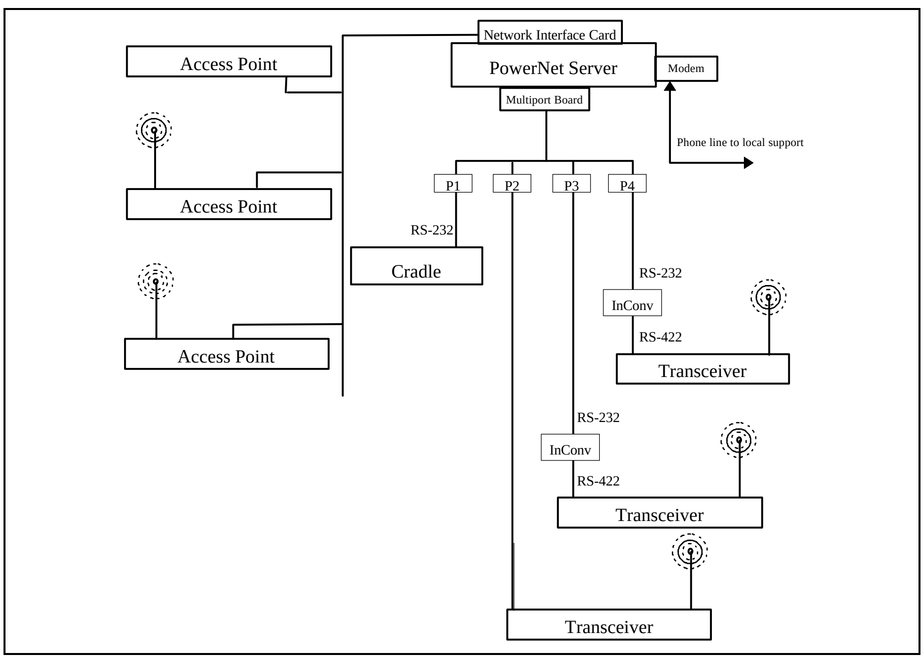

Figure 3-2 PowerNet 4-LAN Configuration with ICs

Ports And Connections

COM1—This serial port is the service port for the PowerNet server. It has a male DB-9 connector. This service port is configured at 9600 baud, 8 data bits, 1 stop bit, and no parity. This service port can be used to access the PowerNet software, by directly connecting a computer or terminal, using a null modem cable.

COM2—This serial port may be configured as either a cradle LAN or a Spectrum One RF LAN connection for the PowerNet server. It has a male DB-9 connector.

Modem—Internally, this modem is configured as COM3. Connect one end of the phone mounting cord to the RJ-11 phone jack provided by your telephone vendor and the other end to the RJ-11 receptacle marked *Wall* or *To Jack* on the card.

Power Receptacle—The *Power In* receptacle may be connected to a source directly, or with a UPS/power conditioner in line (recommended).

Multiport adapters:
These multiport cards are used to attach transceiver and cradle RF LANs. The configuration of these boards depends upon the number of ports involved and are therefore explained below by this number.

2-Port Multiport adapter—The two-port multiport adapter has two male DB-9 connectors. Connect one standard RS-232 cable with female DB-9/female DB-25 connectors to the board and to either the male DB-25 connector on the first transceiver, or on an RS-422 interface converter.

Connect the cradle to the other multiport adapter port. Use a standard null modem adapter with female DB-9/appropriate DB-25 connectors (dependent upon cradle model). **Do not use a Symbol cradle cable.** Use null modem adapters instead.

4 and 8 Port Multiport adapters - Attach the Multiport adapter cable (single connector end) to the board connector. This cable terminates with male DB-25 connectors labeled P1, P2, P3, ... (depending upon the number of ports purchased). These ports can be used for RF LANs (either transceiver of cradle LANs) or, in some cases, special control and communication ports as used with the hot spare systems.

Caution: This connection between the multiport cable and the adapter board contains many small pins which are easily damaged. Please use care when connecting and ensure that the cable is fully seated and fastened in place by tightening the thumbscrews on the connector.

If RS-422 interface converters are used, connect the converter to the Multiport adapter cable. The converter is then connected to the first transceiver via an RS-422 cable with female DB-25/female DB-25 connectors.

Use one or more ports for the cradle(s). Cradle cables are RS-232 standard null modem cables with female DB-25/appropriate DB-25 connectors (dependent upon cradle model).

16 and 32 Port Multiport adapters - The 16- and 32-port multiport adapters have an external concentrator(s) and are supplied with custom cables that connect the adapter board in the PowerNet server to the external unit(s). Plug the cable into the multiport adapter and to the concentrator box. The box has 16 male DB-25 connectors that are attached to transceivers directly with female DB-25/female DB-25 RS-232 cables, or to ICs which are in turn connected to transceivers with RS-422 female DB-25/female DB-25 cables.

RS422 Interface Converters—Connect the RS-422 IC to the first transceiver with a female DB-25/female DB-25 RS-422 cable. The RS-422 pin wiring is as follows:

Converter Pin #   Transceiver Pin #

```
           17 <–> 11
            5 <–> 13

            2 <–> 23
           14 <–> 25

Shield      7 <–>  7
```

NOTE: This cable is to be wired with shielded twisted pairs as shown in the diagram above. This is a balanced line and the pairs need to be matched. Also, there has always been some debate as to carry pin 7 (ground) through the cable connection end to end. It has been our experience that carrying pin 7 through over long distances has attributed to data loss and framing errors - possibly due to ground plane differences between electrical circuit branches. There are some that recommend tying the shield to pin 7 only on one end. Preference on the use of pin 7 ground shield is left to the discretion of the installer.

Power

Once the system has been set up, apply power to the PowerNet server. Next, apply power to the interface converter(s) by plugging them in to a power source. The interface converter device does not have an on/off switch.

Spectrum One LAN Specification

The Symbol Spectrum One Network used with the PowerNet server utilizes a combination topology—serial and coaxial. The connection(s) to the PowerNet server are by RS232 serial connection. It is then possible to daisy chain up to 15 additional transceivers (in an coaxial type wiring scheme for longer distances) from the serially attached transceiver.

As previously discussed, the PowerNet server family of controllers all have the ability to run multiple RF LANs - up to 32 per PowerNet server. This multiple-LAN capability coupled with a standard serial connection, offers great flexibility in topology options. For example, it is possible to use one PowerNet server, centrally located, that can either manage multiple sites or buildings. This configuration requires that the connection normally provided by wire is replaced with some other medium that carries RS232 data. As long as a reliable asynchronous end-to-end connection can be provided from the PowerNet server to the remote site, remote site support can be implemented.

This document is not intended to recommend modem or equipment types, but rather to provide enough information that a communication consultant or modem manufacturer can use for equipment selection and setup. Keep in mind that you are replacing an extremely reliable technology (wire), with one that is more dependent on the work environment (radio). The selection and setup methods work well, but they do require planning, customer education, and thorough testing. Customers have implemented remote Spectrum One networks over leased line, microwave, fiber optic, dial-up modems, etc.

Symbol Spectrum One

The Symbol Spectrum One network supports two types of serial connections:

RS232 Standard signaling techniques, limited to about 10 feet max. at 57.6 Kbps.

RS422 Differential pair signaling methodology, used for longer cable runs can be attained by using a pair of RS422 converters—one at the PowerNet server and the other at the transceiver.

Both are done with a standard DB25 connector. The transceivers accept a connection to either method by placing the RS422 signals on unused RS232 pins. Later releases of the firmware for the transceivers have an enhancement that allows auto-baud detection between multiple rates. This enhancement helps greatly in making these types of connections possible. It permits driving the network at a lower rate if the medium is unable to support 57.6 Kb.

NOTE: Implementing RF LAN connections at speeds lower than 57.6Kb impacts response time of the RF terminal devices.

Serial Ports

Baud Rates:	57.6 KB, 38.4 KB, 19.2 KB, 9.6 KB
Bit Pattern:	8 Bits, No Parity and 1 stop bit
Data Type:	Asynchronous, full binary, medium **must** be binary transparent
Duplex:	Full
Latency:	*No* latency recommended, but not to exceed 40 MS.
	No hardware or software flow control on either end.

Note: Latency is defined as a fixed overhead to data transfer. Some mediums (Ethernet to serial converters) may have a serial collection time that adds overhead to each data exchange. This is important since Spectrum One is a packed protocol with built-in error checking, timing, and recovery schemes.

Access Point Configuration

For Access Point configuration follow these steps. Keep in mind that the hardware vendor also has configuration documents which should be consulted.

- Connect a serial cable from the cradle port of the PowerNet server to the serial port on the Access Point.
- From the PowerNet server Access Point menu, choose the “AP Init” selection. This establishes a serial connection to the Access Point.
- Perform the serial Access Point configuration as documented in the manufacturer’s Access Point manual.
- Press <ENTER> This action exits the communications program and returns to the PowerNet server menu.

This process is only necessary when the IP address for the Access Point is being set. Once the IP address is set, the *AP Configure* menu option or telnet can be used to login to the Access Point to perform configuration tasks.

PowerNet Access Connections

There are two standard methods of accessing the PowerNet software—one for on-site access and one for remote dial-in. These are explained below.

- *Modem*: Every PowerNet server has a modem. If a telephone line is connected to the modem card, a user can dial in to the system. The settings for the modem are 144 Kb, 8 data bits, 1 stop bit, and no parity. (Older models may operate at a lower baud rate, typically 9600 or even 2400 baud.)

- *Service Port:* The service port for the PowerNet server is a serial connection that allows direct connection of a terminal or PC running terminal emulation. The settings for COM1 are 9600 baud, 8 data bits, 1 stop bit, and no parity.

A computer, with a terminal emulation program loaded, is used. *ProComm* is recommended. When setting up emulation, make sure that the *BS-Translation* (backspace) parameter in *Terminal Setup* is set to NON-DEST (non-destructive). *Line Wrap* should be set to OFF.

When establishing a connection, the PowerNet server uses automatic baud rate detection based on framing errors. Use the <Break> key to cycle through the baud rate detection process steps. Since a standard PC keyboard does not have a “break” key, check for the translation in the terminal emulation software. (Older *ProComm* use <Alt><F7>, newer versions use <Alt><B>).

As another option, available in PowerNet servers that implement TCP/IP connectivity, standard TELNET and RLOGIN capabilities are supported by the PowerNet server. These capabilities allow system administrators to access the PowerNet Menu System over existing TCP/IP networks.

Redundancy

Planning ways to reduce or eliminate RF network down-time is an important consideration when planning an installation. All possible failure points can be made **redundant** to ensure the most resistant and resilient network possible. Cost must be balanced with mission-critical activities and applications. An example of a completely redundant installation is shown in Figure 3-3.

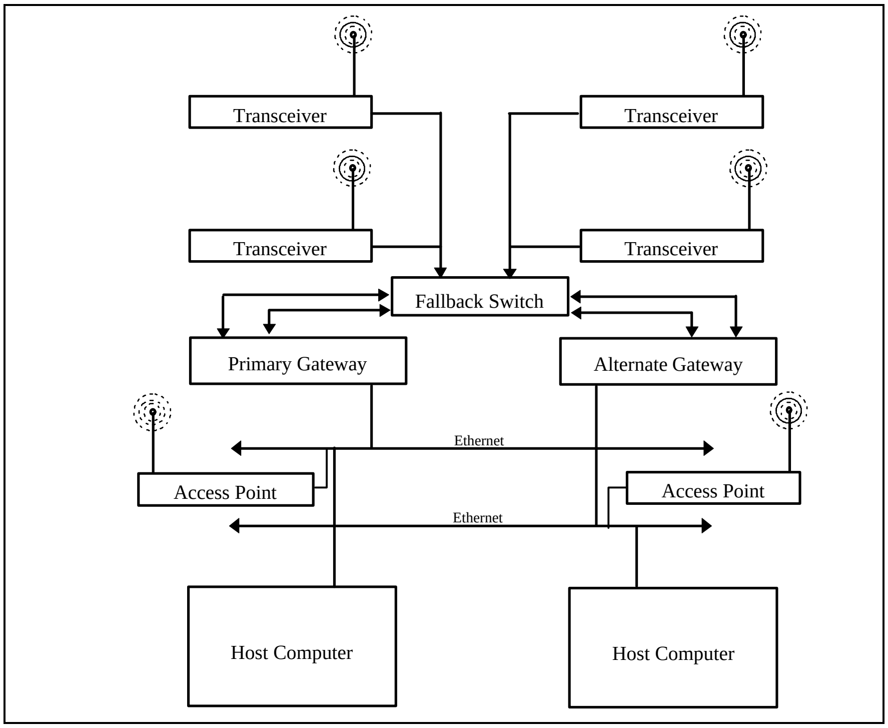

Figure 3-3 Redundant Installation

In Figure 3-3, the redundant points are as follows:

- **Transceivers**—Two transceivers, operating on the same RF channels on the same LAN, are located within close proximity of each other. If one fails, RF signals from terminals communicating with that transceiver is switched automatically to the other when the terminal distresses. Sessions are not interrupted and there is no need to log in again.

- **RF Networks**—Two Spectrum One LANs are attached to the PowerNet servers through a fallback switch. The transceivers on the two LANs are in close proximity and are configured with identical parameters. RF traffic is divided up over the two LANs and managed by the PowerNet server. If one LAN fails, all traffic is routed on the one functioning LAN provided that the transceiver firmware is capable of doing the re-routing. Sessions are not interrupted and there is no need to log in again.

- **PowerNet servers**—Two PowerNet servers are installed, a primary and a hot standby (alternate). If the primary fails, the alternate, which is monitoring the primary, **automatically** becomes operational and assumes control of the RF networks. In this case, there is approximately 3–5 minutes of down-time and all RF terminal operators must log in to the alternate PowerNet server to re-establish host sessions.

- **Host Networks**—Two host network connections, one to each PowerNet server, ensure that the connection to the hosts are independent and redundant.

- **AP Networks**—In the same way that host networks are redundant, two AP network connections, one to each PowerNet/Host, ensure that the connection to the environment is independent and redundant.

Hosts Redundant hosts may be configured depending upon the type of connectivity implemented. If duplicate hosts can be used, they can be configured to collect identical sets of data. If one host is down, only the redundant host is used. Delays may occur in logging on to the redundant host.

4 Spectrum One LAN Software Setup

Introduction

This chapter describes the software setup procedures for the Release 5.0 PowerNet. Throughout this section, certain hints, tips, and suggestions are made at points within the text referred to as *Management functions*. These functions are not meant to sidetrack the reader, but to provide these tips in a reference format as this section is frequently reviewed during installation and support of the PowerNet server .

When initially installing the PowerNet server, **only the PowerNet server should be powered-on**, although the entire system should be connected. A summary of the setup steps follows:

- Shut down Spectrum One
- Complete the *Spectrum One Network Setup*
- Start Spectrum One and apply power to the cradle
- Apply power to transceivers, one at a time while checking *Wireless View*
- Download software to RF terminals
- Configure terminals and check address assignment

Note that procedures for connecting and configuring host networks are described in specific *Reference* manuals and should be performed only after the RF network setup has been completed and confirmed.

Initial configuration requires access to the PowerNet server menu system. Follow the hardware connection instructions and the *Login* instructions outlined in earlier information in previous chapters.

Network Management - Spectrum One Shutdown

Prior to configuring a PowerNet server for the first time, it is important to shut down the RF processes on the PowerNet server in order for configuration parameters to take effect once setup is complete. In order to shut down the RF processes, from the *Main Menu* (see Figure 1-2), select *Operations*. The *Operations Menu*, shown in Figure 4-1, is displayed.

```
                             PowerNet
        Main Menu
      * 1 Operations
           Operations
             1 Wireless View
             2 Spectrum One Startup
           * 3 Spectrum One Shutdown
             4 Access Point Startup
             5 Access Point Shutdown
             6 TCP/IP Startup
             7 TCP/IP Shutdown
       1     8 SNA Startup
       1     9 SNA Shutdown
       1

                    <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 4-1 Operations Menu

Note: Connectivity selections appear on the screen depending on your specific PowerNet server and what it was ordered with.

Select the Spectrum One Shutdown and confirm the action when prompted. A message similar to the following appears on the screen:

```
Are you SURE you want to shut down Spectrum One (y/n): y
Spectrum One Shutdown
 Status check ...
 Terminal check ...
  Deactivating terminal process 4177
Timer ...
Server ...
LANs
Status check ...
Press <Enter> to continue
```

Press <Enter> and the screen displays the *Operations Menu*. Return to the *Main Menu* by pressing <Esc>, then select Spectrum One from the main menu to begin the setup process.

Spectrum One Menu

The *Spectrum One Menu* is shown in Figure 4-2. Please note, the *Spectrum One Port Setup Form* from this menu is completed when the PowerNet server is configured at the factory. Menu options are selected using the up and down arrow keys and pressing <Enter>. Alternately, menu items can be accessed by typing the number of the menu item, pressing <Enter> to mark the item, and pressing <Enter> again to select it.

```
                         PowerNet

        Main Menu
          1 Operations
        *  Spectrum One
           * 1 Port Setup
             2 Network Setup
             3 Terminals
             4 Transceivers
             5 Host List
             6 Diagnostics
             7 Activity Report
             8 Performance Report
             9 Loader

       <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 4-2 Spectrum One Network Menu

Spectrum One Menu - Port Setup

The PowerNet server is configured at the factory with UNIX port assignments when the system is built. This screen is for informational purposes only and should not be modified in any way unless requested by support personnel. A sample of the port setup screen for a PowerNet server with a 4-port multiport adapter is shown in Figure 4-3. This screen may appear differently depending on the multiport adapter installed in the PowerNet server. (**Note**–Symbol transceivers support a three wire circuit (pins 2, 3, and 7 with no flow control) as a DCE device which looks like a modem. Please refer to your terminal servers manual for the appropriate port configurations.)

Note: When setting up Direct TCP/IP, the IP address and socket number must be entered in the *Port Setup* menu. To force an update of the configuration files for RF LANs, enter the *RF Setup* menu and toggle any menu item. This action forces the configuration files to be rewritten. This procedure is only for Direct TCP/IP; serial ports are on an alias list and do not require the rewriting of configuration files.

```
                                  Port Setup
  Port  Type   Device                      Port  Type   Device
  C1   [COM ] [none                  ]  P16  [DIGI] [none                 ]
  C2   [COM ] [none                  ]  P17  [DIGI] [none                 ]
  P1   [DIGI] [/dev/ttyi1a           ]  P18  [DIGI] [none                 ]
  P2   [DIGI] [/dev/ttyi1b           ]  P19  [DIGI] [none                 ]
  P3   [DIGI] [/dev/ttyi1c           ]  P20  [DIGI] [none                 ]
  P4   [DIGI] [/dev/ttyi1d           ]  P21  [DIGI] [none                 ]
  P5   [DIGI] [none                  ]  P22  [DIGI] [none                 ]
  P6   [DIGI] [none                  ]  P23  [DIGI] [none                 ]
  P7   [DIGI] [none                  ]  P24  [DIGI] [none                 ]
  P8   [DIGI] [none                  ]  P25  [DIGI] [none                 ]
  P9   [DIGI] [none                  ]  P26  [DIGI] [none                 ]
  P10  [DIGI] [none                  ]  P27  [DIGI] [none                 ]
  P11  [DIGI] [none                  ]  P28  [DIGI] [none                 ]
  P12  [DIGI] [none                  ]  P29  [DIGI] [none                 ]
  P13  [DIGI] [none                  ]  P30  [DIGI] [none                 ]
                        <ESC>=QUIT  <ARROWS>=MOVE
```

Figure 4-3 Sample Port Setup Screen

Spectrum One Menu - Network Setup

The PowerNet server is supplied with a default configuration that is acceptable in the majority of single and redundant RF network installations. It can also be used to verify correct operation of the LAN(s). However, a number of other RF network topology options can be used. These options were discussed in *RF Topology* in Chapter 2.

Network Setup Form

The *Network Setup Form* (see Figure 4-4) consists of four pages. When the form is first displayed, the cursor is positioned on the Channel 1 field of LAN 0. The form fields, their type, text entry or toggle, valid entries or choices, and how to change them follows. Note that prior to completing the form, the 6 channels, chipping sequence (chipseed), type of LAN (transceiver or cradle), speed and port used for each LAN should be determined. To view other pages of the network setup form, press <Ctl><F> to page through the setups.

```
                       Spectrum One Network Setup   Page 1

             LAN 0   LAN 1   LAN 2   LAN 3   LAN 4   LAN 5   LAN 6   LAN 7
  Channel 1  [06]    [14]    [22]    [30]    [38]    [46]    [06]    [14]
  Channel 2  [14]    [22]    [30]    [38]    [46]    [06]    [14]    [22]
  Channel 3  [22]    [30]    [38]    [46]    [06]    [14]    [22]    [30]
  Channel 4  [30]    [38]    [46]    [06]    [14]    [22]    [30]    [38]
  Channel 5  [38]    [46]    [06]    [14]    [22]    [30]    [38]    [46]
  Channel 6  [46]    [06]    [14]    [22]    [30]    [38]    [46]    [06]
       Type  [TRAN]  [TRAN]  [TRAN]  [CRAD]  [TRAN]  [TRAN]  [TRAN]  [TRAN]
      Speed  [57.6]  [57.6]  [57.6]  [38.4]  [57.6]  [57.6]  [57.6]  [57.6]

        Chip Seeds    Ports                        Options
  LAN 0 [689725285]  [P1 ]                       Log level [1 ]
  LAN 1 [689725285]  [P2 ]                       Log Lines [5000 ]
  LAN 2 [689725285]  [P3 ]                    SAC Interval [1200 ]
  LAN 3 [689725285]  [P4 ]                 Total Addresses [447]
  LAN 4 [689725285]  [OFF]
  LAN 5 [689725285]  [OFF]
  LAN 6 [689725285]  [OFF]
  LAN 7 [689725285]  [OFF]


      <ESC>=QUIT <SPACE>=CHANGE <ARROWS>=MOVE <CTRL><B>=PGUP <CTRL><F>=PGDN
```

Figure 4-4 Network Setup Form

Definitions of the RF Network Setup form fields follow:

Channel Lists [Toggle Field] Six channels can be assigned to each LAN. If unacceptable levels of interference are detected, the channel can be changed. In addition, this feature field makes it possible to design and implement seamless and segmented RF topologies. Select the first channel using the <Tab>, <Space>, or <BkSp> keys if values other than the default settings are to be used. Valid entries are 02-50. (Except in Australia, where entries are limited to 26-50.) Use the right or down arrow keys to proceed to the next channel. When all channels are entered, the cursor moves to *Type*.

Type	[Toggle Field]	The two selections for the type of RF LAN that is attached are **Tran** (transceiver) and **Crad** (cradle). Use the <Tab> key for selecting from this (and all other) toggle fields.
Speed	[Toggle Field]	The choices for speed in Kbaud are **57.6**, **38.4**, **19.2**, and **9.6**. Use either 57.6, 38.4, 19.2, or 9.6 for transceiver LANs and 38.4 for cradle LANs. **Note:** If type **Crad** above is selected, speed is fixed at 38.4.
Chip Seeds	[Text Field]	A range of chipping sequences has been predetermined. Any number between 10,000 and 1,000,000,000 may be entered.
Port	[Toggle Field]	Port assignments must be the same as those used when assembling the hardware and are indicated as P1, P2, ... The selections in this field match the factory-configured ports shown in the *Port Setup* screen (see Port *Setup* in chapter 7). **OFF** should be selected when LANs are not implemented.

Options: The form fields appearing under this heading are global and affect all active LANs attached to the PowerNet server.

Log Level	[Toggle Field]	There are 10 levels that can be used for RF logs. The lowest, zero (0), gives system activity information. It may be set to a higher values, 9 provides the most information. Log Level may be useful for resolving system setup problems. Level 1 is the default setting. Production systems with high transaction rates should be set to zero (0) to minimize the impact of disk logging on system performance. *Caution*: Using levels higher than 1 may slow the system.
Log Lines	[Text Field]	The file size of all logs is limited with this field. The default size is 5000 lines. When the limit is reached, the log is deleted. A new log is then started. It may be set to a larger value when the Log Level is set above zero to accommodate the additional information that appears in the log. Production systems should be left at the 5000 line setting to minimize disk space usage.

SAC Interval	[Text Field]	This option controls the RF Network System Accounting facility which generates network load and volume data that can be analyzed with a spreadsheet program. The accounting interval default setting is 600 seconds (10 minutes). A setting of zero disables accounting.
Total Addresses	[Text Field]	The number appearing in this field is the number of available network addresses for assignment to terminals.

When all required RF LAN and cradle configurations on the form are complete, press <Esc>. If the form has been modified, a prompt to save the new information is presented. Press <Y> to save the form.

Note Changes to channel lists, chipping sequences, port assignments, and other options within this utility for transceiver networks **do not take effect until after the RF network has been shut down and then restarted**. However, changes may be made to the cradle channel list and chipping sequence at any time, and these changes take effect immediately.

Network Management - Spectrum One Startup

Once the *Spectrum One Setup Form* has been completed, the Spectrum One Network should be started. Return to the *Operations Menu* (see Figure 4-1) and select *Spectrum One Startup*. Information similar to the following appears on the screen during Spectrum One startup.

```
Spectrum One Startup
Status check
SMI active
Server ...
Timer ...
LAN 0
(other messages for lan startup)

Press ENTER to continue
```

Figure 4-5 Spectrum One Startup

Press <Enter> and the screen displays the *Operations Menu.* All LANs are active and have the parameters that were set in the *Spectrum One Setup Form*.

Spectrum One Menu - Terminals

The *Spectrum One Menu* option, *Terminals* (see Figure 4-2), provides access to a utility that manages RF terminal network addresses, which begin at 65. Select this option and the *RF Terminal Address Management Form* appears (see Figure 4-6).

The default configuration of this form has no assignments. When a terminal has an address assigned, an *X* is placed next to the address. Addresses are automatically assigned when terminals are configured.

```
                      Terminal Address Management    Page 1

 65[ ]   66[ ]   67[ ]   68[ ]   69[ ]   70[ ]   71[ ]   72[ ]   73[ ]   74[ ]
 75[ ]   76[ ]   77[ ]   78[ ]   79[ ]   80[ ]   81[ ]   82[ ]   83[ ]   84[ ]
 85[ ]   86[ ]   87[ ]   88[ ]   89[ ]   90[ ]   91[ ]   92[ ]   93[ ]   94[ ]
 95[ ]   96[ ]   97[ ]   98[ ]   99[ ]  100[ ]  101[ ]  102[ ]  103[ ]  104[ ]
105[ ]  106[ ]  107[ ]  108[ ]  109[ ]  110[ ]  111[ ]  112[ ]  113[ ]  114[ ]
115[ ]  116[ ]  117[ ]  118[ ]  119[ ]  120[ ]  121[ ]  122[ ]  123[ ]  124[ ]
125[ ]  126[ ]  127[ ]  128[ ]  129[ ]  130[ ]  131[ ]  132[ ]  133[ ]  134[ ]
135[ ]  136[ ]  137[ ]  138[ ]  139[ ]  140[ ]  141[ ]  142[ ]  143[ ]  144[ ]
145[ ]  146[ ]  147[ ]  148[ ]  149[ ]  150[ ]  151[ ]  152[ ]  153[ ]  154[ ]
155[ ]  156[ ]  157[ ]  158[ ]  159[ ]  160[ ]  161[ ]  162[ ]  163[ ]  164[ ]

                          [X]=assigned   [ ]=available
                            Total Addresses: 328
                                     In Use: 0
                                  Available: 328

      <ESC>=QUIT <SPACE>=CHANGE <ARROWS>=MOVE <CTRL><B>=PGUP <CTRL><F>=PGDN
```

Figure 4-6 Terminal Address Management Form

If a terminal address is assigned on this form before configuration, remove the assignment. Use the <Arrow> keys to position the cursor and the <Tab> key to toggle the field to blank.

Terminal Management - Terminal Addresses

In the event that a terminal is replaced with a new unit, it can be given the original terminal address. First, remove the *X* from the field next to the number that is be assigned; be sure that all addresses up to this number are marked as used (*X*). Press <Esc> and save the form when prompted. Place the terminal in the cradle for configuration. It is assigned the first available address, which should be the one that was just cleared. If this procedure is not performed, the next unused terminal address is automatically assigned to the new terminal. Eventually, all available addresses are used and additional terminals cannot be added to the system.

Spectrum One Menu - Transceivers

After Spectrum One networks are active and transceiver configuration complete, use the *Transceiver Address Management Form* to manage the addresses of up to 60 transceivers on each of LAN. Select the *Transceivers* form from the *Spectrum One Menu* (see Figure 4-2) to display the *Transceiver Management Address Form* shown in Figure 4-7.

```
                               Transceiver Address Management
--- LAN 0 -- 3[ ]  4[ ]  5[ ]  6[ ]  7[ ]  8[ ]  9[ ] 10[ ] 11[ ] 12[ ] 13[ ]
14[ ] 15[ ] 16[ ] 17[ ] 18[ ] 19[ ] 20[ ] 21[ ] 22[ ] 23[ ] 24[ ] 25[ ] 26[ ]
27[ ] 28[ ] 29[ ] 30[ ] 31[ ] 32[ ] 33[ ] 34[ ] 35[ ] 36[ ] 37[ ] 38[ ] 39[ ]
40[ ] 41[ ] 42[ ] 43[ ] 44[ ] 45[ ] 46[ ] 47[ ] 48[ ] 49[ ] 50[ ] 51[ ] 52[ ]
53[ ] 54[ ] 55[ ] 56[ ] 57[ ] 58[ ] 59[ ] 60[ ] 61[ ] 62[ ]
--- LAN 1 -- 3[ ]  4[ ]  5[ ]  6[ ]  7[ ]  8[ ]  9[ ] 10[ ] 11[ ] 12[ ] 13[ ]
14[ ] 15[ ] 16[ ] 17[ ] 18[ ] 19[ ] 20[ ] 21[ ] 22[ ] 23[ ] 24[ ] 25[ ] 26[ ]
27[ ] 28[ ] 29[ ] 30[ ] 31[ ] 32[ ] 33[ ] 34[ ] 35[ ] 36[ ] 37[ ] 38[ ] 39[ ]
40[ ] 41[ ] 42[ ] 43[ ] 44[ ] 45[ ] 46[ ] 47[ ] 48[ ] 49[ ] 50[ ] 51[ ] 52[ ]
53[ ] 54[ ] 55[ ] 56[ ] 57[ ] 58[ ] 59[ ] 60[ ] 61[ ] 62[ ]
--- LAN 2 -- 3[ ]  4[ ]  5[ ]  6[ ]  7[ ]  8[ ]  9[ ] 10[ ] 11[ ] 12[ ] 13[ ]
14[ ] 15[ ] 16[ ] 17[ ] 18[ ] 19[ ] 20[ ] 21[ ] 22[ ] 23[ ] 24[ ] 25[ ] 26[ ]
27[ ] 28[ ] 29[ ] 30[ ] 31[ ] 32[ ] 33[ ] 34[ ] 35[ ] 36[ ] 37[ ] 38[ ] 39[ ]
40[ ] 41[ ] 42[ ] 43[ ] 44[ ] 45[ ] 46[ ] 47[ ] 48[ ] 49[ ] 50[ ] 51[ ] 52[ ]
53[ ] 54[ ] 55[ ] 56[ ] 57[ ] 58[ ] 59[ ] 60[ ] 61[ ] 62[ ]



                    <ESC>=QUIT  <SPACE>=CHANGE  <ARROWS>=MOVE
```

Figure 4-7 Transceiver Address Management Form

Note that the default configuration of this form has no assignments. When the first transceiver has power applied to it, an X appears. Addresses cannot be assigned manually; only the automatic assignment of the PowerNet server can be used. The lowest address (03) is the first address used when transceivers are powered on, and numbers are assigned in order.

Note If a transceiver address is assigned on this form before configuration, remove the assignment. Use the <Arrow> keys to position the cursor and the <Tab> key to toggle the field to be blank. When the form is complete, press <Esc> and save the form when prompted.

Transceiver Management - Deleting and Replacing Transceivers

To delete a transceiver from the network, shut down the Spectrum One system. (*Shutdown* is discussed in chapter 5.) Remove the transceiver and display the *Transceiver Address Management Form*. Delete the *X* next to the address of the transceiver that was removed. This address is now free for reassignment.

Note Transceivers can be removed from active networks that cannot be shut down. The removed transceiver unit continues to appear in the Wireless View Topology Display until the system is shut down and restarted.

If a transceiver needs to be repaired or replaced, the address in use can be saved for that position on the LAN by leaving the X on the form. Although there is no unit at that position on the backbone, the address is saved. When a transceiver is returned, remove the X, apply power to the transceiver, and use that same number if no other lower numbers are free. If they are, they can be blocked with an *X*.

Transceiver Management - Address Conflicts

If two transceivers are assigned the same address or if a transceiver is being moved to another LAN where a transceiver already has that same address, the NVM must be cleared to remove the address from memory. In the case of conflicts on one LAN, both transceivers involved should be cleared. Consult the manufacturer's guidelines for resetting transceiver addresses.

Transceiver Management - Transceiver Configuration

When setting up the RF LANs for the first time, it is important to power-on each transceiver and let each one configure automatically before continuing on to the next. To aid in this process, select *Wireless View* from the *Operations Menu* to monitor this configuration process. The *Wireless View* screen appears with no transceivers or terminals present. Details of the Wireless View screen are discussed in Chapter 8.

Every transceiver within each RF LAN must have a unique network address. This address is assigned by the PowerNet server when power is first applied to the transceiver. The *Wireless View* utility provides valuable feedback to the installer while this configuration process is taking place by displaying the transceiver and its status on the screen. Apply power to the first (serial) transceiver of the LAN and it appears on the *Wireless View* screen. (See Figure 4-8.) Please note that in the figure, access points are displayed as well since they can co-exist in a PowerNet server environment. Access points are discussed Chapter 5.

```
                                  Wireless View
──────────────────── TOPOLOGY ──────────────┬─────────── UNIT STATISTICS ─────────
    │S0-62    P0-03   067.172  067.179      │        LAN-Tran: 0-62
────┼**1──────**2─────────3────────4────────┤      Connection: Serial
  1 │++078                                  │          Status: COMPLETE
  2 │  200                                  │            Load: 2
  3 │                                       │    Total Errors: 0
  4 │                                       │         Tx NAKs: 0
  5 │                                       │         Rx NAKs: 0
  6 │                                       │         Resends: 0
  7 │                                       │      Duplicates: 0
  8 │                                       │
  9 │                                       │
 10 │                                       │
 11 │                                       │
 12 │                                       │
 13 │                                       │
 14 │                                       │
────┴───────────────────────────────────────┴──────────────────────────────────
       <ESC>=QUIT <U>=UNIT <C>=CONTROL <F>=FSR <L>=LOG <N>=NETWORK
```

Figure 4-8 Sample Wireless View - Spectrum One Serial Transceiver

Transceiver configuration should occur within 90 seconds. The screen display is updated automatically and the following status should be seen in the *Unit Statistics* window for the serial transceiver, S0-62:

```
Status:      PENDING
```

after a period of time, the status changes to:

```
Status:      COMPLETE
```

The **P**, in P0-03, shows the pending status. It changes to C0-03 (**C** for coaxially attached). At times an ***i*** can precede the address. It shows that the transceiver is initializing. The lower-case letter **c** indicates the transceiver is configuring. **S** as the first character indicates a serially attached transceiver

Note If after 45 seconds the status does not change, the backbone cable and connections to it should be checked for possible problems.

Apply power to the second transceiver and ensure that it has completed its configuration by monitoring the topology and *Unit Statistics* information before applying power to the next transceiver. Use the *Unit Menu* or press the <Tab> key to select the transceiver once it has appeared on the screen. Once a transceiver is selected, the *Unit Statistics* area of the screen displays information for the specified transceiver. The two transceivers then appear on the topology display as shown in Figure 4-8.

The second transceiver, C0-03 in this figure, appears along with the first transceiver. Repeat this procedure for each transceiver, powering them on one at a time and checking the display for complete configuration. To add more transceivers at a later date, follow the same procedure.

Conflicts can occur if correct procedures are not followed or hardware problems arise. Failure of a transceiver to appear on the topology display can be the result of a bad connection, duplicate addressing, or transceiver failure. Conflicts can be resolved with the *Transceiver Address Form* and the *Clear NVM* option from the *Wireless View Control Menu*. (See *Address Conflicts* later in this chapter.)

RF LAN Management - Multiple Spectrum One LAN Configuration

Repeat the transceiver configuration procedure for each Spectrum One LAN. Note that each LAN uses an identical numbering system with valid addresses 03 to 62. This does not present a problem as the transceiver is identified by the LAN number in conjunction with the transceiver number. But, do not move a transceiver from one LAN to another as the addresses may then conflict. If this must be done, the nonvolatile memory (NVM) must be cleared first, and then a new number assigned. (See *Clear Transceiver NVM* in Chapter 4.)

When transceivers are displayed for multiple LANs in *Wireless View*, they are first sorted by LAN number. Use the *right* <Arrow> key to display the groups of transceivers starting with LAN zero.

Transceiver Management - Clear Transceiver NVM

Transceivers store their address and other configuration information in nonvolatile memory. To change an address, channels, speed, or chipping sequence, select *Wireless View*. Press <C> to select the *Control Menu* (see Figure 4-8). This menu appears on the left-hand side of the *Wireless View* screen as shown in figure 4-9.

```
   Control
 * 1 Set Base Log
   2 Set AP Log
   3 Set Handler Log
   4 Reload Host List
   5 Clear NVM
   6 Reset LAN
   7 Ping Test
   8 Set Location
```

Figure 4-9 Control Menu

Select *Clear NVM* and a *Transceiver Selection Box*, shown in Figure 4-10, appears.

```
LAN-Transceiver:
```

Figure 4-10 Transceiver Selection Box

Enter the LAN-Transceiver address of the transceiver which has its NVM erased and then press <Enter>. The transceiver must then be manually powered off. Select *Reset LAN* from the *Control Menu* and enter the LAN number of which the transceiver is part. Press <Enter> to reset the LAN.

Remove the transceiver address assignment from the *Transceiver Address Form* (delete the *X*). Next, power on the transceiver. It is configured using the lowest available address. Ensure that configuration is complete. Check the *Wireless View* topology to ensure that the process has proceeded successfully. For situations where there are address conflicts, clear the NVM of both transceivers, power both off, clear the address, and then configure one at a time.

Spectrum One Menu - Loader

The Spectrum One network must be prepared to recognize the RF terminals. Terminal software must be downloaded to the terminals and they must be configured with the chipping sequence and channels used to allow them to connect to the RF network. All of this occurs with terminals in cradles.

Terminal Management - Loading RF applications to the Terminals

Use the *Loader* option from the *Spectrum One* menu (see Figure 4-2) to download the appropriate **.HEX** software to the terminals through the cradle. The **.HEX** file is required to be loaded on every terminal before assigning addresses.

Place terminals needing the RF program downloaded in the cradle and then select *Loader* from the *Spectrum One* menu. (See Figure 4-2.) A short listing similar to the following appears on the PowerNet server:

```
Status check ...
Unlinking Cradle ...
HEX files
--------------
filename1nnn.HEX
filename2nnn.HEX
--------------
Enter filename:
```

Here *filename* is the name (e.g., *step*, *tip, whip, whap*, etc.), and *nnn* is the version number of the **.HEX** file which was loaded on the PowerNet server and is listed on the screen. Type the ***filenamennn*.HEX** at the prompt, and then press <Enter>.

Note that vehicle-mounted terminals cannot be inserted in cradles and are connected to the PowerNet server via a null modem cable. See the VRC terminal documentation for more information. When performing the download procedure, start with terminals that are powered-off.

Instructions for preparing various terminal models are then displayed; they are a concise version of those shown below**. To boot in command mode, press and hold down the two letter keys listed, and then press and release the power key, followed by the release of the letter keys.** To set up terminals for program downloading:

1. Place terminal in Command Mode using the key combinations shown below:

38x0	35 key LRT:	`<PWR><BKSP><SHFT><PWR>`
38x0	46 key LRT:	`<PWR><F><I><PWR>`
38x0	35 key PRC:	`<PWR><BKSP><SHFT><PWR>`
38x0	56 key PRC:	`<PWR><A><D><PWR>`
38x0	54 key VRC:	`<PWR><A><D><PWR>`
38x0	35 key:	`<PWR><BKSP><SHFT><PWR>`
38x0	46 key:	`<PWR><F><I><PWR>`

2. Place the terminal in the cradle.

3. Use the down arrow key on the terminal to select *Program Load*, then Press <ENTER> on the terminal to erase the EEPROM.

4. Use the down arrow key to select a baud rate of 19200, and then Press <ENTER>.

5. Use the down arrow key to select 8 bits, then Press <ENTER>.

6. Press <ENTER> to select NONE for flow control.

7. Press <ENTER> to start program load.

After this procedure is performed, press <Enter> at the PowerNet server. The following appears on the screen while the file is loaded on the terminal(s).

```
SENDHEX: /dev/ttyild 19200 8n1 filenamennn.HEX
128 10880 502,824  (21.0%)
```

To quit this procedure after it has been completed, press <Del> at the PowerNet server. Once the **.HEX** file is successfully loaded on the terminal, the terminal screen displays the line: `Status: 0000  Download Successful`

Terminal Management - Spectrum One Terminal Configuration

The terminal configuration procedure requires a cradle if configuration is not done manually through CCP (see Handheld Terminal Software). After a terminal has been loaded with the **.HEX** file, it is ready to be configured with a network number, channel list, and chipping sequence.

Note When using terminal programs, unmodified software may prompt for information before the terminal can be configured. Please see chapter 6 if you are unfamiliar with these prompts. If the software has been modified, these screens may not be displayed on the terminal. Ask your hardware representative for more information, if necessary.

A terminal is *cold-booted* and then placed in the cradle, **one terminal at a time**. For vehicle-mounted terminals, the null modem cable is attached to the port designated for the cradle LAN.

Note If the cradle has more than one slot, be sure that the other slots are empty.

Use the following key sequences to cold boot terminals.

Terminal	Keys
38x0 35 key LRT	<SPACE><FUNC><UP ARROW><PWR>
38x0 46 key LRT	<A><B><D><PWR>
33x0 35 key PRC	<SPACE><FUNC><UP ARROW><PWR>
33x0 56 key PRC	<F1><F4><ENTER><ON/OFF>
39x0 54 key VRC	<F1><F4><ENTER><PWR>
31x0 35 key	<SPACE><FUNC><UP ARROW><PWR>
31x0 46 key	<A><B><D><PWR>

When performing the above procedure, start with a terminal that is powered off. **To cold boot, press and hold down the <Letter> keys and then press and release the <Power> key, followed by the release of the <Letter> keys.**

The terminal screen may prompt for information, enter any that is required. Wait until a prompt to place the unit in the cradle (or connect the cable) appears on the RF terminal. For CCP terminals, select *ONLINE* and then the cradle prompt appears.

Once the terminal is in the cradle, the cradle LAN channel list and chipping sequence settings are downloaded to the terminal. A prompt appears on the terminal screen to remove the terminal after it has been configured. During this configuration procedure, the PowerNet server assigns a network address to the terminal. This process occurs within 15 to 30 seconds.

Caution This dynamic addressing scheme makes it possible to assign duplicate addresses resulting in unpredictable terminal operation. To protect against this event, the PowerNet server manages a database of terminal addresses. An address cannot be re-used without operator intervention through the *Terminals* utility available from the *Spectrum One Network Menu.*

Address assignment, can be monitored with *Wireless View.* Terminal addresses appear on the screen below the transceiver with which it is communicating after the terminal is removed from the cradle. Terminals are shown in Figure 4-8. The total number of available terminal addresses is set using the *Terminals* field within the *Spectrum One Network Setup Form*. The PowerNet server can manage a maximum of over 240 terminals.

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5 Access Point LAN Software Setup

Introduction

This chapter describes the software setup procedures for the Release 5.0 Access Point. Throughout this section, certain hints, tips, and suggestions are made at points within the text referred to as *Management functions*. These functions are not meant to sidetrack the reader, but to provide these tips in a reference format as this section is frequently reviewed during installation and support of the PowerNet server.

When configuring the PowerNet server to the AP network for the first time, **only the PowerNet server should be powered-on**, although the entire system should be connected. A summary of the setup steps follows:

- Shut down Access Point
- Complete the *Access Point Network Setup*
- Start Access Point and apply power to the cradle
- Apply power to Access Points, one at a time while checking *Wireless View*
- Download software to RF terminals
- Configure terminals and check address assignment

Note that procedures for connecting and configuring host networks are described in specific connectivity manuals and should be performed only after the RF network setup has been completed and confirmed.

Initial configuration requires access to the PowerNet server menu system. Follow the hardware connection instructions in Chapter 3 and the *Login* section information in chapter 4.

AP Management - Access Point Shutdown

Prior to configuring a PowerNet server for the first time, it is important to shut down the RF processes on the PowerNet server in order for configuration parameters to take effect once complete. In order to shut down the RF processes, from the *Main Menu* (see Figure 1-2), select *Operations*. The *Operations Menu*, shown in Figure 5-1, is displayed.

```
                                PowerNet
          Main Menu
        * 1 Operations
            Operations
              1 Wireless View
              2 Spectrum One Startup
              3 Spectrum One Shutdown
              4 Access Point Startup
            * 5 Access Point Shutdown
              6 TCP/IP Startup
              7 TCP/IP Shutdown
         1    8 SNA Startup
         1    9 SNA Shutdown
         1

              <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 5-1 Operations Menu

Note: Connectivity selections appear on the screen depending on your specific PowerNet server and what it was ordered with.

Select the Access Point Shutdown and confirm the action when prompted. The following appears on the screen:

```
Are you SURE you want to shut down the AP network (y/n): y
      AP Network Shutdown
       Status check ...
       Terminal check ...
        Deactivating terminal process 4177
       Timer ...
       AP Server ...
       LANs
       Status check ...
Are you sure you want to shutdown Hot Key (y/n)? y
      Hot Key Shutdown ...
       Deactivating Hot Key ...

      Press ENTER to continue
```

Figure 5-2 Access Point Shutdown

Press <Enter> and the screen displays the *Operations Menu*. Return to the *Main Menu* by pressing <Esc>, then select Access Point. For systems with *Spectrum One* and *Access Point* networks, you may run either *Spectrum One* or *Access Point* or both.

Access Point Menu

The Access Point *Menu* is shown in Figure 5-3. First, the *Access Point Setup Form* from this menu is completed. Select *Setup* to begin. This option presents a default data entry form for selecting network parameters.

```
                              PowerNet

          Main Menu
           1 Operations
             Access Point
        *  * 1 Ports
              2 Server
              3 AP Init
              4 MAC-IP Map
              5 AP Config
              6 Host List
              7 Diagnostics
          1   8 Performance Report
          1   9 Loader
          1
          13 Utilities



                <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 5-3 Access Point Menu

Access Point Menu - Ports

The PowerNet server is configured at the factory with UNIX port assignments when the system is built. This screen is for informational purposes only and should not be modified in any way unless requested by support personnel. A sample of the port setup screen for a PowerNet server with a 4-port multiport adapter is shown in figure 5-4. Please note that this screen may appear differently depending on the multiport adapter installed in the PowerNet server.

```
                                    Port Setup

   Port  Type   Device                       Port  Type   Device
   C1    [COM ] [none                     ]  P16   [DIGI] [none                     ]
   C2    [COM ] [none                     ]  P17   [DIGI] [none                     ]
   P1    [DIGI] [/dev/ttyi1a              ]  P18   [DIGI] [none                     ]
   P2    [DIGI] [/dev/ttyi1b              ]  P19   [DIGI] [none                     ]
   P3    [DIGI] [/dev/ttyi1c              ]  P20   [DIGI] [none                     ]
   P4    [DIGI] [/dev/ttyi1d              ]  P21   [DIGI] [none                     ]
   P5    [DIGI] [none                     ]  P22   [DIGI] [none                     ]
   P6    [DIGI] [none                     ]  P23   [DIGI] [none                     ]
   P7    [DIGI] [none                     ]  P24   [DIGI] [none                     ]
   P8    [DIGI] [none                     ]  P25   [DIGI] [none                     ]
   P9    [DIGI] [none                     ]  P26   [DIGI] [none                     ]
   P10   [DIGI] [none                     ]  P27   [DIGI] [none                     ]
   P11   [DIGI] [none                     ]  P28   [DIGI] [none                     ]
   P12   [DIGI] [none                     ]  P29   [DIGI] [none                     ]
   P13   [DIGI] [none                     ]  P30   [DIGI] [none                     ]
   P14   [DIGI] [none                     ]  P31   [DIGI] [none                     ]
   P15   [DIGI] [none                     ]  P32   [DIGI] [none                     ]

                              <ESC>=QUIT  <ARROWS>=MOVE
```

Figure 5-4 Sample Port Setup Screen

Access Point Menu - Server

The *Access Point Server* Setup (see Figure 5-5) consists of one page. When the form is first displayed, the cursor is positioned on the ON/OFF field of Status. The form fields, their type, text entry or toggle, valid entries or choices, and how to change them follows.

```
                              Access Point Server Setup

                 Status [ON ]
                Adapter [sme0 ]
              Node Name [trn2001a       ]
             IP Address [206.183.67.184 ]
                IP Port [1800]
       Serial Load Port [OFF ]
              Log Level [0]
           SAC Interval [0    ]

                              Direct Interface
       Port     Host Name                            Port     Host Name
      [    ]   [            ]                       [    ]   [            ]
      [    ]   [            ]                       [    ]   [            ]
      [    ]   [            ]                       [    ]   [            ]
      [    ]   [            ]                       [    ]   [            ]



                      <ESC>=QUIT  <SPACE>=CHANGE  <ARROWS>=MOVE
```

Figure 5-5 Setup Form

Definitions of form fields follow:

Status	[Toggle Field]	This factory set field allows the system administrator to enable or disable the access point connectivity to the PowerNet server controller. *ON* enables this function while *OFF* disables the connection.
Adapter	[Toggle Field]	The factory set field is used to select the specific adapter that the PowerNet server uses to converse with the attached access points. The values used for this toggle field depend on the connectivity hardware installed in the PowerNet server.
Node Name	[Toggle Field]	The Node Name field is used to determine the IP address of the hardware device to which the access point network becomes attached. The values for this field come from the TCP/IP node list.
IP Address	[Display Only]	The site specific IP Address is used to display the IP address of the node chosen in the previous input field. This value must match the Remote IP assignment set on the terminals.

IP Port	[Text Field]	The IP Port assignment must be entered by the system administrator and is used as the port address for communicating to the Remote devices on the access point network. The value of this entry must match the factory set Remote IP port assignment set on the terminals.
Serial Load Port	[Toggle Field]	The Serial Load Port assignment is used for loading terminal software to the remote devices and is indicated as P1, P2, ... (see *Chapter* 3). The selections in this field match the factory-configured ports shown in the *Port Setup* screen (see *Port Setup* in this chapter). This port is also used as the serial port to perform the initial IP address assignment for the Access Points (see *AP Init* in this chapter). **OFF** should be selected when Serial Load Port LANs are not implemented.
Log Level	[Toggle Field]	There are 10 levels that can be used for RF logs. The lowest, zero (0), gives system activity information. It may be set to a higher value, with 9 providing the most information. This may be useful for resolving system setup problems. Level 1 is the default setting. Production systems with high transaction rates should be set to zero (0) to minimize the impact of disk logging on system performance.
SAC Interval	[Text Field]	The SAC interval option controls the RF Network System Accounting facility which generates network load and volume data that can be analyzed with a spreadsheet program. The accounting interval default setting is 150 seconds (1.5 minutes). A setting of zero disables accounting.

Direct Interface Fields

The direct interface fields allow definition of an IP port number and directly associate it with a Host list entry. In this manner, a terminal can attach to the PowerNet server and it's appropriate host list entry by virtue of opening a TCP/IP socket connection to the correct port number. This allows CCP based terminals to directly proceed to the specific host entry without having to display the entire host list first, based on the port number assigned in the PowerNet server interface setup on the terminal.

These fields are also used to allow non-CCP based terminals to interface through the NCU into the PowerNet server interface programs such as *steptcp*, *sabhost* and *tcphost*. For example, setting port **6500** to interface to *sabhost* allows Symbol Spectrum 24 (port 6500) terminals running The Symbol product STEP to interface through the NCU to the enabler host (sabhost) via a multiplexed serial connection.

Port	[Text Field]	The Port assignment must be entered by the system administrator and is used as the port address for communication to the Remote devices on the access point network. The value of this entry must match the Remote IP port assignment set on the terminals accessing the system via this method.
Host Name	[Toggle Field]	The Host Name field is used to determine the IP address of the hardware device to which the access point terminal becomes attached when accessed through the IP port. The values for this field come from the TCP/IP node list.

AP Management - Access Point Startup

Once the *Access Point Setup Form* has been completed, the Access Point Network should be started. Return to the *Operations Menu* (see Figure 5-1) and select *Access Point Startup*. The following appears on the screen.

```
Access Point Network Startup
 Status check ...
 SMI active
 Server ...
 Timer...

Press ENTER to continue
```

Figure 5-5 Access Point Startup

Press <Enter> and the screen displays the *Operations Menu.* All LANs are active and have the parameters that were set in the *Access Point Server Setup*.

Access Point Menu - AP Init

If the Access Points are new, their IP address need to be set at this time. Connect a serial cable from the serial load port to the serial connector on the Access Point. Then choose the AP Init option. This opens a serial communications session with the Access Point. Once this connection has been established, set the IP address in accordance with the instructions furnished with the Access Point. Once setup is complete, type the sequence **`<ENTER><~><.><ENTER>`**, which exits the communications program and returns to the Access Point Menu.

Every Access Point within the RF LAN must have a unique IP network address. This address is assigned by the System Administrator prior to installing the Access Points on the network. The *Wireless View* utility provides valuable feedback to the installer once this configuration process has taken place by displaying all known transceivers and their status information on the screen. Figure 5-6 shows the Wireless View screen with an active access point.

```
                                  Wireless View

---------------- TOPOLOGY --------------------------- UNIT STATISTICS -----------
     067.172                                |    Access Point: 067.172
----|-**1--------2--------3--------4--------|        MAC Addr: 032.068
  1 |                                       |      Network ID: 101
  2 |                                       |            Load: 0
  3 |                                       |  Known Stations: 0
  4 |                                       |         Tx KBps: 0
  5 |                                       |         Rx KBps: 0
  6 |                                       |
  7 |                                       |
  8 |                                       |
  9 |                                       |
 10 |                                       |
 11 |                                       |
 12 |                                       |
 13 |                                       |
 14 |                                       |
----------------------------------------------------------------------------
    |                                       |
       <ESC>=QUIT <U>=UNIT <C>=CONTROL <F>=FSR <L>=LOG <N>=NETWORK
```

Figure 5-6 Wireless View - Access Point

AP Management - Replacing Access Points

Caution If an Access Point needs to be repaired or replaced, the IP address should be set in accordance to the manufacturer's instructions for the device before it is installed on the network.

Access Point Menu - MAC to IP Listing

The MAC to IP Listing function allows the system administrator to view system known MAC addresses and their associated IP address. Since some Access Point network devices can have their IP addresses changed or even lost (as in the case of sending devices in for repair), it is common to assign known MAC addresses with an IP address that has been assigned to that particular MAC address. Selecting this function will bring up a list of known devices on the network. The MAC address (usually on a label on the back of the device) can be looked for in this table and the associated IP address can be found. An example of this function is shown in Figure 5-7.

```
00:00:00:00:00:00=206.183.067.243;
00:A0:F8:10:40:DC=206.183.067.207;
00:A0:F8:10:40:E0=206.183.067.247;
00:A0:F8:10:41:BE=206.183.067.239;
00:A0:F8:10:45:D2=206.183.067.240;
00:A0:F8:10:49:42=206.183.067.244;
00:A0:F8:10:49:BD=206.183.067.250;
00:A0:F8:10:49:DB=206.183.067.233;
00:A0:F8:10:4A:FC=206.183.067.231;
00:A0:F8:10:4B:07=206.183.067.234;
00:A0:F8:10:4B:24=206.183.067.235;
00:A0:F8:10:4B:4B=206.183.067.243;
30:41:53:53:55:52=206.183.067.234;
30:41:53:64:6C:6F=206.183.067.234;
31:51:48:42:00:00=206.183.067.232;
31:51:48:42:20:20=206.183.067.230;
00:A0:F8:10:4B:07=206.183.067.234;
00:00:00:00:00:00=206.183.067.243;
(EOF):
```

Figure 5-7 MAC-IP Map function

Access Point Menu - AP Config

The AP Config function allows system administrators to view and configure access point parameters via the AP network backbone. Accessing this function through the Access Point menu displays a screen similar to the one shown in figure 5-8.

```
Access Points:
206.183.67.138
206.183.67.137
206.183.67.136

Please enter the name or IP address of the AP:
```

Figure 5-8 AP Config - Access Point Selection Screen

At the access point selection screen, enter the IP address of the access point to be selected. Once a device is selected, essentially a TELNET connection is established with the selected device. Any configuration parameters specific to the device can be accessed via this method. Refer to the device manufacturer's reference manuals regarding these parameters.

Please note that devices may appear on the access point setup screen that may have been removed from the active network. If one of these devices is selected, the connection will time-out after 75 seconds or so. In order to quit sooner, press <Del> or <Ctl><C> to break the connection.

RF Terminals

The last components of the Access Point network that must be prepared for use are the RF terminals. Terminal software must be downloaded and then the terminals must be configured with the IP address and the IP port assignment.

Access Point Menu
Loader for Symbol Terminals

Use the *Loader* option from the *Access Point Menu* to download the appropriate **.HEX** software to the terminals through the cradle. The **.HEX** file is required to be loaded on every terminal before assigning addresses.

Place terminals in the cradle and then select *Loader* from the *AP Network Menu*. (See Figure 5-2.) A message similar to the following appears on the Gateway:

```
Status check ...
Unlinking Cradle ...
HEX files
--------------
filename1nnn.HEX
filename2nnn.HEX
--------------
Enter filename:
```

Here *filename* is the name (e.g., *step*, *whip,* etc.), and *nnn* is the version number of the **.HEX** which was loaded on the Gateway and is listed on the screen. Type the ***filenamennn*.HEX** at the prompt, and then press <Enter>.

Note that vehicle-mounted terminals cannot be inserted in cradles and are connected to the Gateway via a null modem cable. See the VRC terminal documentation for more information. When performing the download procedure, start with terminals that are powered-off.

Instructions for preparing various terminal models are then displayed. They are a concise version of those shown below. To boot in command mode, press and hold down the two letter keys listed, and then press and release the power key followed by the release of the letter keys.

To set up terminals for program downloading:

1. Boot terminal to Command Mode

38x0	35 key LRT:	<BKSP><SHFT><PWR>
38x0	46 key LRT:	<F><I><PWR>
33x0	35 key PRC:	<BKSP><SHFT><ON/OFF>
33x0	56 key PRC:	<A><D><ON/OFF>
39x0	54 key VRC:	<A><D><PWR>
31x0	35 key:	<BKSP><SHFT><PWR>
31x0	46 key:	<F><I><PWR>

2. Place the terminal in the cradle.

3. Use the down arrow on the terminal to select *Program Load*, then press <ENTER>. Press <ENTER> on the terminal to erase the EEPROM.

4. Use the down arrow to select a baud rate of 19200, and then press <ENTER>.

5. Use the down arrow to select 8 bits, then press <ENTER>.

6. Press <ENTER> to select NONE for flow control.

7. Press <ENTER> to start program load.

After this procedure is performed, press <Enter> at the Gateway. The following appears on the screen while the file is loaded on the terminal(s).

```
SENDHEX: /dev/ttyild 19200 8n1 filenamennn.HEX
128 10880 524,828  (21.0%)
```

To quit this procedure after it has been completed, press <Enter> at the Gateway. Once the .HEX file is successfully loaded on the terminal, the terminal screen displays the following:

```
Status: 0000 Successful Download
```

6 RF Terminal Software

Introduction

In order for remote RF terminals to access the PowerNet server, run terminal emulation and/or client streaming applications, and manage the RF protocol, they must have an application program to do so. These executable application programs are created and combined with other software modules into EEPROM images called *HEX* files which are down-loaded to the terminals using the *loader* function.

As explained earlier, software is downloaded to RF terminals as **.HEX** files and then configured with parameters (channels, chip seed, terminal address). If the terminal **AUTOEXEC.BAT** file is modified, certain steps documented below may appear differently. If the **AUTOEXEC.BAT** is not modified, the user is prompted for information which is explained in this chapter. In addition, procedures for changing the configuration information are given, along with using various test programs available for **whip.HEX** (Wireless Handheld Interface Program), **ccp.HEX** (CCP for Access Points) and **step.HEX** (for enabler/SAB based applications). For other terminal software programs, see the accompanying user manuals.

CCP

When a new RF terminal is loaded with the ***ccpnnn*.HEX** program and is cold-booted for configuration, it executes its startup procedures (BIOS, Scan 3000, etc.) which appear on the screen. When the boot process is complete, it displays the following screen (see Figure 6-1).

```
PRESS ANY KEY TO
CONTINUE
```

Figure 6-1 CCP Start Screen

Normal Startup

When starting the terminal or exiting from handler applications, the terminal always returns to the main CCP screen as shown in Figure 6-1. To start the RF process that accesses the host list, simply press any key on the terminal keypad. When this is done, the terminal starts the RF process, showing a series of screens as illustrated below.

```
CCP n.nnn

   Series 3800
```

Figure 6-2 CCP Version Screen

After a few seconds, the following appears.

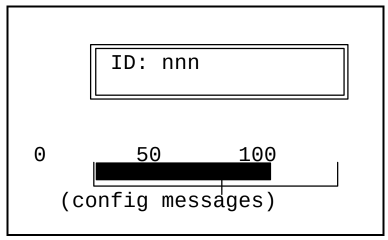

Figure 6-3 CCP RF Activity/Status Screen

And finally, once a terminal accesses the PowerNet server, the following appears.

```
Host/APP List  1/1
TEST
STEPCHECK
Connect-TST
3270-1
TN5250
```

Figure 6-4 Sample Host List

Terminal Management -Configuration

If you attempt to start the host list and the terminal has not been configured, you are prompted to insert the terminal in the cradle. Do so, and the terminal configures with the proper RF chip sequence, operating channels, and terminal ID. Alternately, terminals may be manually configured as outlined later under Terminal Utilities.

CCP Utilities

CCP not only allows access to the RF network through the CCP main screen, but also allows access to certain utilities that allow system administrators access to configurations and test tools to further support the network.

To access the utilities, press the <TAB> or <CLR> key on the remote terminal one time when the screen displays the ship start screen (Figure 6-1) and the screen shown in Figure 6-5 appears.

NOTE 1: Some remote devices are shipped with different keyboard membranes and/or overlays that may differ in 'key-top' name. Remember that the key in the upper left corner of the remote terminal keypad (usually labeled TAB or CLR on the membrane) accesses the utilities.

NOTE 2: Pressing the <TAB> or <CLR> key more than once exits the *CCP* application to the terminal operating system prompt. If this happens, simply type **`run`** and press <ENTER> to return to the CCP start screen.

<1> Radio Config, <2> Survey, and <3> Scan are discussed on the following pages. <4>EXIT exits the CCP Utilities

```
---- UTILITIES ----
 1: Radio Config
 2: Survey
 3: Scan
 4: EXIT
 5: More
```

Figure 6-5 Utilities Menu Page 1

To see page 2 of the Utilities Menu, Press <5> More on the terminal and the display shown in Figure 6-6 appears.

```
---- UTILITIES ----
 6: Transfer file
 7: Reload NVM
 8: NVM Config
 9: Previous
 A: EXIT
```

Figure 6-6 Utilities Menu Page 2

<6> Transfer files is no longer an implemented utility. <7> Reload NVM allows the user to reprogram the non-volatile memory (NVM) of the terminal with a new HEX image. <8> NVM Config allows the user to program the chipping seed, "garbage" channel, and 6 operating channels for the radio. It also allows the terminal ID to be selected, and the language identifier to be set. <9> Previous displays the previous screen. <A>EXIT exits the CCP Utilities.

Utilities Menu - Radio Config

The radio config utility allows the system administrator to view, clear, or set the radio configuration for the remote terminal. These radio configuration utilities are handy for support desk personnel in handling support issues. Selecting the radio config option from the utilities menu displays the radio setup screen shown in Figure 6-7.

```
Radio Setup nn.nn

1) Current Config
2) Clear Config
3) Set Config
4) EXIT
```

Figure 6-7 Radio Setup Menu

Menu item 1 - Current Config

The *Current Config* selection allows the system administrator to view the current radio operating parameters as shown in Figure 6-8. This screen is for informational purposes only and is useful for identification of a particular terminal ID and operating channel list. Press the <Enter> key on the terminal keypad to return to the radio setup menu.

```
CHIP: AB 30 77 55
33 15 9D B0 96 D1
35 D1 D9 51 39 B8
6B C8 F0 9A CA 9A
CHANNELS:
06 13 22 30 38 46
Terminal ID:  66
ANY KEY TO CONTINUE
```

Figure 6-8 Radio Configuration Display

Menu Item 2 - Clear Config

The *Clear Config* option allows the operator to reset the terminal's radio operating parameters. When cleared with this function, the terminal must be configured to operate with the RF network either via the cradle or by manually configuring the terminal as outlined in the next section.

Menu Item 3 - Set Config

The *Set Config* option allows the operator to set the radio operating parameters manually. This screen needs to be set in accordance to the RF network operating characteristics outlined in Chapter 4 (RF network Setup Form) or the terminal does not attach to the RF network. A sample of the set config screens are shown in Figures 6-9 through 6-11.

```
   Radio Config
Chip Seed _________


     F3 - EXIT
```

Figure 6-9 Radio Config - Set Chip Seed

Set Chip Seed

At the prompt for the chip seed, enter the chip seed for the RF network that the terminal is being set-up to operate on - as can be viewed on the PowerNet server. This chip seed must match or the terminal does not attach to the RF network once it has been configured. Press <enter> on the terminal keypad once the chip seed is entered and the screen shown in Figure 6-10 appears, prompting for channels.

```
   Radio Config
Chip Seed 689725275
Channel 1 __

     F3 - EXIT
```

Figure 6-10 Radio Config - Set Channels

Set Channels

As in setting the terminal chip seed in accordance to the RF network setup form, terminal communication channels must be set as well. As channels are set by typing in the channel number and pressing <enter> after each entry, the terminal stores these settings in memory. There are 6 channels that must be set at this screen, and the terminal displays a new prompt for each channel until the 6th one is entered. At this point, the terminal prompts for a Terminal ID as shown in Figure 6-11.

```
   Radio Config

Chip Seed 689725275
Channel 6 22
Terminal ID: ___

     F3 - EXIT
```

Figure 6-11 Radio Config - Set Terminal ID

Set Terminal ID

Caution: It is very important at this point to view the terminal address screen to select unused terminal addresses required for this step in configuration. Selecting a terminal address that is already in use at this point causes operational problems with the terminal communications. If there is more than one RF device configured with the same ID operating on the network at the same time, the result is lost packets, and missed exchanges.

When the prompt to set the terminal ID is shown as in Figure 6-11, type in the selected terminal ID and press <enter> on the terminal's keypad. A brief message "Terminal Configured" appears on the screen and operation returns to the radio setup menu shown in Figure 6-7.

Menu Item 4 - EXIT

To exit the radio setup program, select the *EXIT* function from the radio setup menu. This returns to the *Utilities* menu shown in Figure 6-5.

Utilities Menu - Survey

The Survey program is useful for analyzing RF coverage for a given RF LAN as well as providing capabilities to the system installer or administrator to perform load tests on the RF network to determine data hauling capacities.

To execute the *Survey* program, select it from the *UTILITIES Menu* by entering <2> as the selected option. The radio is activated, the RF network is acquired showing the status screens (similar to figure 6-3), and the *Survey Menu* is displayed (see Figure 6-12).

```
  Survey  nn.nn

 1) TEST
 2) SETUP
 3) STATISTICS
 4) EXIT
```

Figure 6-12 RF Survey Menu

The *TEST* option runs a loopback test with the PowerNet server, passing data packets between the two. The information from this test is analyzed and displayed with the *STATISTICS* option. The *SETUP* selection is used to change the parameters of the loopback test. Use the *EXIT* function to return to the *Utilities Menu*. Use the <UP> or <DOWN> arrow keys to select an option and then press <Enter> to implement it or press the number of the option to select it. Follow the on-screen help and prompts to use the *Survey* options.

Menu Item 1 - TEST

When *TEST* is selected, a real-time test screen displays the loopback data as it occurs. A sample of the survey screen is shown in Figure 6-13. The fields on this screen are explained following the figure.

```
   COVERAGE TEST
LAN-TRN 00-62   T066
S      C      L   ms
165    165    275
Average   - 0185
Packets   - 786
AVG Grade - 99
     F1 - HELP
```

Figure 6-13 Survey Coverage Test Screen

LAN-TRN Address of the transceiver that is participating in the loopback test.

T Address of the remote terminal from which the test is being implemented.

C Amount of time for the current complete loopback transaction. The unit of time is milliseconds (ms). A complete loop transaction involves sending a data packet from the terminal to the PowerNet server where it is modified and returned to the terminal where it is received into a buffer. As each transaction takes place the time is displayed on the screen. Note that a time of 300-330 ms is typical.

S Shortest time in which a complete loopback transaction took place. The unit of time is milliseconds.

L Longest transaction time in which a complete loopback transaction took place. The unit of time is milliseconds.

Average Average exchange time of the last 16 exchanges.

Packets This field displays the total number of records that have been generated up to the current point in time. A record is produced for each loopback transaction.

AVG Grade Average grade for the test is a percentage from 0 to 100. It is defined as the following:

$$\frac{\text{Total Number of Packets Sent - Total Number of Errors} \times 100}{\text{Total Number of Packets Sent}}$$

The average grade, and therefore the success of the test, depends upon the distance between the terminal and transceiver, RF interference, and hardware performance. Several (or all) terminals and transceivers should be tested at varying distances from the transceivers. The following grade ranges and their ratings should be considered typical.

Range %	Rating
90-100	Excellent
80-90	Good
70-80	Fair
60-70	Marginal
00-60	Problems Exist

When the test is done, press <FNC><7> to exit. The statistical analysis of the test records can then be examined.

Menu Item 2 - Setup

The setup utility is useful for configuring packet information and parameters that are used during execution of the Survey test. Of special interest here, exchange sizes and transaction rates can be set to match actual use averages in order to perform self-running system load and network performance testing. Most fields in these setup forms are not explained here as they are strictly for engineering purposes only and are in effect only during operation of the Survey program. To configure survey parameters, select the setup option (2) from the Survey menu. Press the <DOWN> arrow key to get to page 3 of the setup screen to configure the terminal record sizes and exchange rates for setting load test parameters.

```
 SETUP          1/3

TOUT Protocol: 15_
TOUT Recv Tic: 2184_
MSG Recv Tic : 150__
TOUT Send Tic: 2184_
MSG Send Tic : 150__
F3-ACCEPT    F7-QUIT
```

Figure 6-14 Survey Setup Page 1 of 3

Continue pressing the down arrow key to get to page 3.

```
SETUP          2/3

TOUT RANG Tic: 2184_
MSG RANG Tic : 0____
Poll-1 Tics  : 1____
Poll-2 Tics  : 36___
Fall Back Tic: 1092_
F3-ACCEPT    F7-QUIT
```

Figure 6-15 Survey Setup Page 2 of 3

Continue pressing the down arrow key to get to page 3.

```
SETUP          3/3

Record Size  : 23___
PKT Delay(ms): 330__
Binary Data  : Y


F3-ACCEPT    F7-QUIT
```

Figure 6-16 Survey Setup Page 3 of 3

At page 3 of the setup form is where all parameters relating to load test record size and exchange rates are found. When performing system load tests, it is important that the terminal data exchange settings closely match the real-use parameters that the PowerNet/RF Network is expected to perform under.

For example using a hypothetical case, a site is expected to use 50 RF terminals. Each terminal operator can, as measured during initial system design, scan up to 100 items in an hours time. When an item is scanned 10 bytes are sent to the host application and 30 bytes are returned to the terminal - resulting in a 40 byte aggregate transaction size. Knowing that an operator can scan 100 items/hour, the average transaction rate is 3.6 seconds (3600 milliseconds).

Using these values, you may configure 50 terminals with a 40 byte record size, a packet delay of 3600ms, using binary data (as typical of a terminal emulation environment) exchanges in order to simulate a live operational environment. This test can be run over a given period of time. Performance reports at the controller can be gathered and analyzed to measure actual system performance.

Menu Item 3 - Statistics

Select *Statistics* from the *RF Survey Menu*. The statistics displayed are summaries of the last test that was run. There are five screens for each test. A sample screen is shown in figure 6-17

```
PROTOCOL          1/5
Config Status 1
Terminal ID   66
Current Freq  30
Tran Status   1
Transporter   6
Status        15
     <F7>-QUIT
```

Figure 6-17 Statistics sample Page 1 of 5

When this option is selected, the first statistics screen, displaying the parameters used for the test, appears. Use the right <Arrow> key to display subsequent screens. The statistics fields shown on the displays are below.

Config Status Indicates 1 if the terminal configuration is valid.

Terminal ID Displays Terminal ID.

Current Freq Displays current channel number in use.

Tran Status Indicates 1 if last connected to a transceiver.

Transporter Current status of transport layer.

Status Status of the Spectrum One protocol.

Bytes Received Total number of bytes received (totaled from all packets received successfully) by the terminal.

Packets Received	Total number of packets that were sent from the PowerNet server and received successfully by the terminal.
Datagrams Received	The packets are sent as datagrams, so the number of datagrams received should be equal to the number of packets received.
Bytes Sent	Total number of bytes sent (totaled from all packets sent successfully) by the terminal.
Packets Sent	Total number of packets that were sent successfully by the terminal.
Datagrams Sent	The packets are sent as datagrams, so the number of datagrams sent should be equal to the number of packets sent.
NAKS Received	This is the count of negative acknowledgments received by the terminal from the PowerNet server (NAKs are signals sent to the transmitting source that data has been received incorrectly by the destination).
NAKS Sent	Count of negative acknowledgments sent by the terminal to the PowerNet server when the terminal received packets incorrectly.
Packet Retries	Number of times that the terminal tried to resend a packet.
Bad Packets	Total number of bad packets (packets that have incorrect headers, sizes, etc.)
Bad Checksum	Number of packets with incorrect checksums (checksums–values calculated from data and used to test data integrity).
Bad Unit IDs	Number of times during the packet exchange process that the unit number of the terminal from which the data came did not match the expected number.

Bad Header Scans When the radio exchange process between the terminal and PowerNet server is in progress, both sender and recipient must be synchronized. Correlation headers are used in this process and if any errors occur, such as a missing or incorrect header, they are totaled in this field.

Good Exchanges The number of successful complete test transactions. A complete loop transaction involves sending a data packet from the terminal to the PowerNet server where it is modified and returned to the terminal, where it is received into a buffer.

After all the statistics screens have been examined, press *F7* to redisplay the *RF Survey Menu*.

FYI - About The RF Survey Program

The RF Survey program, as an integrated part of CCP (Common Client Program), is the common survey presentation manager used by all Connect RF products, regardless of connectivity. RF Survey allows testing the RF and performing other types of diagnostic and performance testing. RF Survey should be used for this purpose only. It was not designed to be compatible or as a replacement of a Geiger-type program, nor was it designed to be used as an initial site survey tool or final RF hardware diagnostics tool. It was designed for system acceptance testing, spot checks of coverage on installed systems, and engineering RF testing.

The main use of the RF Survey program is for systems acceptance testing. On any well managed RF integration there needs to be the step of acceptance by the customer. This is the stage when the integrator proves compliance to the customers requirements. Without this step, a complete system is not possible. RF Survey allows setting up terminals to match transaction and throughput requirements and then proving compliance using the tools in RF Survey, Performance and Accounting reports.

FYI - RF Survey Internal Operation

This section details the internal operation of RF Survey to include a logical flow of operation and the math and methods used for the grades it generates during the operation.

STEP 1 SHIP Attach—Survey makes a normal Host Interface Protocol (HIP) to the host name SURVEY. This is a special attachment that is always available regardless of the handler setup.

STEP 2 Reset Timer—The timer for response time is started. This timer has a 55MS resolution.

STEP 3 Receive Packet and Compare to Transmit Packet—The terminal sits in receive mode awaiting the return of the packet from the. It uses the Symbol Spectrum One function called *chars-in-q* to await the receipt of the packet from the.

STEP 4 Stop Timer and Store Value—The response time value is calculated for display.

STEP 5 Read Stat Call—RF Survey issues the Symbol Spectrum *One Read STAT* command that returns the low level details of the RF engine in the terminal.

STEP 6 Calculate Grade and perform update Terminal Display

STEP 7 Loop to STEP 2—RF Survey is basically a loopback or ping test. It continues in this loop until stopped.

Grade Calculation Math

The grade displayed during the test is a percentage of the errors compared to the total packets moved. The math for this calculation is the following:

```
If "total errors" is greater than "total packets" then
grade = 0%
else
Grade = ("total packets" - "total errors" ) x 100 / total
packets

Note:     Total packets   =    packets out + packets in
          Total errors    =    Naks Received +
                               Naks Sent +
                               Packets Retried +
                               Bad Packets +
                               Bad Checksums +
                               Bad Unit IDs +
                               Bad Header Scans
```

Utilities Menu - Scan

Scan is a test program that allows testing of the terminal's bar-code scanning device. Select *Scan* by entering <3> on the terminal from the Utilities menu. Then scan a bar code with the terminal. The screen then displays the code that was scanned along with its type. A sample of this screen is shown in Figure 6-18. Several bar codes should be scanned. If all are correct, press <F3> to return to the *UTILITIES Menu*.

```
  Scan Test nn.nn

039007141067_______
UPCA

 F3-EXIT   F7-SETUP
```

Figure 6-18 Scan Test

Scan - SETUP

The *Scan* test program can be set up to support several types of scanners. By default, the scanner type is set to *LASER.* The scan setup program screen is shown in Figure 6-19.

```
     SCANNER SETUP

     Scanner Type
        LASER
    Spotting Beam
         ON

F3-QUIT   F7-MODIFY
```

Figure 6-19 Scanner Setup Screen

To modify the scanner settings, press <Func> then <7> on the terminal's keypad to modify the settings. Press <FUNC> then <3> to quit.

The scan setting modification screen is shown in Figure 6-20. To select the desired field to modify, user the <UP> or <DOWN> keys to highlight the field to be changed. Settings for the selected field can be changed by pressing <FUNC> and <UP> or <FUNC> and <DOWN> on the terminal's keypad to select the field value desired. Available settings for scanner type are *LASER, CONTACT with pulse, CONTACT no pulse, AUTO with pulse, AUTO no pulse,* or *WAND simulator*. Spotting beam values can be *ON* or *OFF*. When settings are complete, press <FUNC> then <7> to save the changes or <FUNC> then <3> to quit without saving. The terminal displays the scan test screen as shown in Figure 6-18 when complete.

```
↑↓Select  <>CHANGE

  Scanner Type
     LASER
 Spotting Beam
      ON

F3-QUIT     F7-SAVE
```

Figure 6-20 Scanner Setup Modification Screen

Terminal Management - CCP Waiting for Data Message

The “waiting for data” message is one of the messages that CCP may generate during normal operation. CCP operates in query/response mode. It is either in the *send* or *receive* state. Query is when the operator keys or scans information and then hits a key to *send* off this query. Response is the mode when the terminal waits to *receive* a response from the host.

Exceptions exist when the terminal is unaware of the host’s not responding or if the response thrashes in the RF Backbone and is yet to be delivered. These cases need to be separated with traces of the system differentiating the RF delay from the host delays.

First check the performance monitoring tool. If checking here shows a large percentage of host responses over 5 seconds, this situation can account for these messages. There is a control allowing the operator to turn off this message. This action is generally not recommend because the operator has no visual feedback and can not distinguish between a terminal “lockup” and a legitimate waiting condition. The logical program flow is as follows:

1. Terminal does a send of data to the host.

2. Terminal then goes into the receive state waiting for a response from the host.

3. The timer is started and set for 150 clock ticks (there are 18.2 per second).

4. If data is received the terminal acts on this data.

5. If NO Data and timer is at 150 clock ticks (8.2 seconds) then display “Waiting for Data.”

STEP

STEP, a product of Symbol Technologies, is supported by the PowerNet server when used in conjunction with the Enabler products in a Client Streaming environment. Details regarding the entire operation of the STEP product are not discussed here, rather minimal requirements for configuring STEP terminals are presented in this section.

When a terminal is loaded with the **step.HEX** program and cold-booted for configuration, it executes its startup procedures (BIOS, Scan 3000, etc.) and when complete, it displays the screen shown in Figure 6-21.

```
NETWORK INTERFACE-

1.  NetBIOS  (Block)
2.  TELNET  (Stream)



       Select:
```

Figure 6-21 Network Interface Screen

Configuration

Select *NetBIOS* for most systems, unless otherwise instructed in the specific *Reference Manual*. Select *TELNET* to run ANSI terminal emulation as opposed to VT-100 (run when NetBIOS is selected). Press <Enter> to display the *Keyboard Selection Screen* shown in Figure 6-22.

```
-----KEYBOARD-----

1.  Standard
2.  ANSI



      Select:
```

Figure 6-22 Keyboard Selection Screen

Select *Standard* for most systems, unless an *ANSI* keyboard is required. The *STEP Menu* shown in Figure 6-23 appears.

```
---STEP MENU 2.00-27
1.  STEP
2.  Backup
3.  Download
4.  Configure
5.  Scan

    Select/Clr:
```

Figure 6-23 STEP Menu

NOTE: Only STEP version 2.00-27 is discussed in this document.

Select *STEP* by pressing <1>. The *SRCP Options* screen appears on the terminal. Press <Enter> to accept the defaults. The terminal then displays a prompt to place it in the cradle for configuration. Remove the terminal from the cradle when prompted.

For more information on the *SRCP Options* values, refer to the *Series 3000 Symbol Terminal Enabler (STEP) Application Programmer s Guide,* document number 59932-00-92, available from Symbol Technologies, Inc.

Erase Configuration

If the terminal address, channels, or other information need be changed, the configuration information is erased using the following procedure. From the *STEP Menu*, shown in Figure 6-6, select <4>, *Configure.* The *Configure Menu*, shown in Figure 6-24 appears.

```
--Configure Menu 1--

1. Connection (SRCP)
2. ANSI Term  (SATP)
3. Enabler    (STEP)
4. Reset Radio
5. More ...
    Select/Clr:
```

Figure 6-24 Configuration Menu

Select <4> *Reset Radio* to erase the information. A confirmation prompt appears. Press <Y> to confirm the action. To configure the terminal, follow the steps in the previous section.

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7 Hot Spare

Introduction

This section describes the hardware required to set up a pair of PowerNet servers equipped with the Hot Spare option. Prior to this, each PowerNet server must be configured (from a software standpoint) in an identical manner with the exception of the mode for Hot Spare where one PowerNet server is designated as Primary and the other as the Alternate. Software options and the Hot Spare Menu are discussed below.

All dual Model 1000 systems use a fall-back switch (FBS) requiring field installation. Dual 2001 and dual/triple Model 2501 systems use intelligent, rack-mount fall-back switching systems (ISS) which are shipped installed in the system. **Automatic fail-over is deactivated before shipment from the factory and must be activated after successful installation and test of the system at the customer location.**

Once the *Hot Spare* option has been activated on the alternate PowerNet server, the host network connection on the alternate system may be set to be inactive until a cut-over occurs. The “alternate” PowerNet server monitors the operation of the “primary” and upon detection of a fault (loss of the primary controller “heartbeat” signal or indication of failover response for example), takes control of the RF LANs. The cutover completes automatically within 3 to 5 minutes. All terminal sessions active prior to the cutover must be re-established by the terminal operators by rebooting the remote terminals.

On thing to keep in mind regarding hot-spare systems is that these configurations are not entirely *fault tolerant*. Certain points of the RF LAN can be configured as fault tolerant (redundant RF coverage with multiple transceivers/access points for example), thereby seamlessly and transparently switching terminals to other RF LAN segments in case of a RF transceiver/access point fault. However, fault detection/recovery of the PowerNet server is not transparent to the RF terminal user. If a PowerNet server device fails, RF terminal operators must restart the terminal to establish a new route to the host environment.

Fallback Switch Installation Summary

The following is a summary of the procedure used to set up redundant systems using Fallback Switch (FBS).

- Shutdown the host and RF networks on both PowerNet servers.
- Install FBS and null-modem adapters for each transceiver LAN.
- Connect PowerNet server ports and null-modem adapter for the heartbeat communications connection.
- Configure software on each PowerNet server (see Page 7-33).
- Restart networks on both PowerNet servers.

Hardware Setup for FBS Systems

The following describes the procedures required to set up a standalone *Dual-system Fault Resilient PowerNet server*. Note that that this does not apply to systems using the Intelligent Switching System (ISS). The two PowerNet servers are connected to each other using a serial port (heartbeat cable) on the Multiport adapter, or the service port, on each system. A null modem adapter is required (customer-supplied). Each transceiver LAN requires a Fallback Switch (FBS), connected as shown in Figure 7-1.

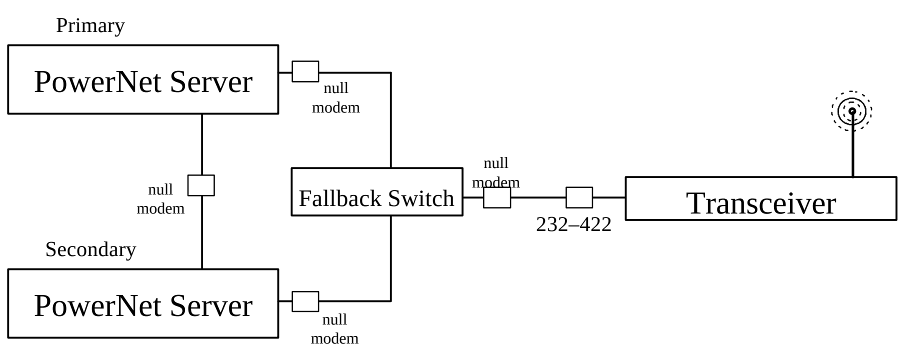

Figure 7-1 Fallback Switch Options

The three DB-25, RS-232 female connectors on the FBS are marked *Primary*, *Alternate*, and *Master* respectively. The FBS master port is connected to the RF transceiver (or RS-422 converter), and the primary and alternate ports are connected to their respective PowerNet servers.

There are several Fallback Switch (FBS) options for the PowerNet server. With the Model 1000 and 2001 controllers, an external FBS device is used. With this device, the Data Set Ready (DSR) signal line, on the alternate port controls the automatic cut-over. Two female-to-male and one male-to-male DB-25 adapters with the following wiring must be inserted between the three ports and their respective destinations. Standard null-modem adapters and gender change connectors can be used and are included with the standalone FBS.

DB-25 Pinouts		DB-25 Pinouts
1	⟷	1
2	⟷	3
3	⟷	2
4	⟷	5
5	⟷	4
6	⟷	20
7	⟷	7
8	⟷	8
20	⟷	6

Please note that you must ensure that the internal jumper settings of the FBS are set for fallback mode (FB) at the factory as outlined in the switch's manual.

The other option for the Fall Back Switch is an intelligent rack-mounted switching system (ISS) used with the Model 2501. The unique feature with this setup is that the alternate controller does not rely on the use of Data Set Ready (DSR) to cause the FBS to switch. Instead, a separate control line from the alternate controller is used to send commands to the switch chassis in the event of a switchover. Setup for this type of system is outlined later in this section.

Hot Spare Menu

Systems equipped with the *Hot Spare* option have an additional *Main Menu* entry, *Hot Spare*. When this menu option is selected, the following *Hot Spare Menu* appears.

```
Hot Spare
 1 Setup
 2 Startup
 3 Shutdown
 4 HADAX Status
```

Figure 7-2 Hot Spare Menu

Select *Shutdown* on each of the PowerNet servers, while setting up the system. The following confirmation is displayed on the screen after selection.

```
Are you SURE you want to shut down Hot Spare (y/n):
```

Press <**y**> on each PowerNet server followed by the <Enter> key.

Setup

Next, select *Setup* from each *Hot Spare Menu*. The form shown in Figure 7-3 appears. The form fields, their type, and settings are as follows.

```
                              Hot Spare Setup

       All Systems                                       Primary
              Role [PRIMARY  ]                  Poll Timer [10 ]
    Heartbeat Port [P1 ]                         Alternate
         Log Level [1]                 Poll Response Timer [10 ]
   Failover Checks                     No Response Retries [1  ]
        Disk Space [ON ]                  Automatic Return [NO ]
  Failover Objects                           Enable Return [NO ]
                 1 [        ]           Dual&Tri-Alternate
                 2 [        ]          Switch Control Port [OFF]
                 3 [        ]         Tri-System Alternate
                 4 [        ]              Primary-A Setup
     Host Networks                                    Bank [0]
    Startup Object [        ]                   Low Switch [0 ]
   Shutdown Object [        ]                  High Switch [15]
                                           Primary-B Setup
                                                 Heartbeat [OFF]
                                                      Bank [1]
                                                Low Switch [0 ]
                                               High Switch [15]


                  <ESC>=QUIT  <SPACE>=CHANGE  <ARROWS>=MOVE
```

Figure 7-3 Hot Spare Setup Form

Hot Spare Setup Form - Fields

All Systems Section

Role	[Toggle Field]	Select the **Role** for each PowerNet server, which is either *Primary* for the main system or *Alternate* for the Hot Spare system. Make sure that the PowerNet server, which is the one to be used as the main PowerNet server system, has the *Primary* designation and that the Hot Spare PowerNet server is the *Alternate*.
Heartbeat Port	[Toggle Field]	Select the serial port that connects each PowerNet server to the null-modem adapter that is used (P1, P2, P...). These other choices are the ports configured in the *Port Setup Form* (see Page 7-17). Make sure that this port does not conflict with an RF LAN port assignment. A port setting of *Off* disables the *Hot Spare* option.
Log Level	[Toggle Field]	This field selects the level of logging performed by the *Hot Spare* option. The *Log Level* can be set to any value between 0 and 9, with 0 being error logging only and 9 providing full logging of all debug data. This field should normally be set to 1. Settings of 5 or higher may degrade overall system performance.

Failover Checks Section

Disk Space [Toggle Field] Setting this field to *ON* causes the PowerNet server to periodically check that the available disk space on the system has not fallen below 2 Mb. If the disk space falls below this level, a failover condition occurs. Values for this field are *ON* or *OFF*.

Failover Objects Section

1, 2, 3, 4 [Toggle Field] These four fields allow adding additional test programs or scripts (objects) for failover conditions. An example failover script is the TCP/IP Host Test documented later in this chapter. Additional scripts may be written by the user if desired. The operational rule for the script (or program) is that a return code of zero indicates that the failover condition did **not** occur, and a return of 1 indicates that it **did**. If a return of 1 is detected, a failover takes place. When adding test objects, be aware of the time they can take to complete. It may require setting the *Poll Timer* and the *Poll Response Timer* to higher values to allow sufficient time for all of the tests to complete to prevent false failovers. Select the failover object to be used by toggling through the list. Creation of these objects is handled through the *Object Editor* selection from the Main Menu.

Host Networks Section

Startup Object [Toggle Field] The startup object allows the user to configure custom startup of host networks or other options when the hot spare software is activated. During normal operation, the host connection is operational but, in some cases, there may be a need not to activate the host link until a hot spare switchover occurs. In this case, a custom shell script can be created that allows the PowerNet server to start the host link *only* when the PowerNet server is active. Toggling through this field lists any available failover startup scripts that may be on the system.

Shutdown Object	[Toggle Field]	The shutdown object allows the user to configure custom shutdown of host networks or other options when the hot spare software indicates the need for a system to halt all control of the RF system. During normal operation of RF shutdown, the host connection is operational but, in some cases, there may be a need to deactivate the host link when a hot spare switchover occurs. In this case, a custom shell script can be created that allows the PowerNet server to stop the host link *only* when the PowerNet server is inactive. Toggling through this field lists any available failover shutdown scripts that may be on the system.

Primary Section

Poll Timer	[Text Field]	Enter the time in seconds that the primary system expects a poll from the secondary (alternate) in order to gain control of the RF system. If the system is designated as the primary, then the primary is the one responsible for servicing the RF network and respond back to the polls by the alternate PowerNet server. If the primary system sees no polls coming from the alternate PowerNet server within the value set at this field, then the primary continues to maintain control of the RF networks.

Alternate Section

Poll Response Timer	[Text Field]	Enter the time in seconds that the alternate system expects a poll response from the primary PowerNet server in order to gain control of the RF system. If the system is designated as the alternate, then the alternate machine is the one responsible for determining the health of the primary. It services the RF network only when the primary fails to respond to polls or sends back a poll response reporting to the alternate that there is a problem. If the alternate system sees no poll responses coming from the primary PowerNet server within the value set at this field, then the alternate forces a switch to take control of the RF networks.

Caution: Be aware of the execution time of any process added to the *hotspare* script. If the test(s) total execution time is longer than the Hot Spare poll time, it can cause false failovers. The

Hot Spare is on a timer and if a poll does not occur during this period, it considers this a fail and executes the failover. The poll time can be adjusted in this field.

No Response Retries	[Text Field]	Enter the number of times that the alternate system continues to poll the primary controller without hearing a response from the primary before taking control of the RF network. In some cases, the primary controller may be too busy as the time the alternate issues a poll in order to respond quickly enough, causing a false failover. In most cases, it is recommended that at least one extra retry be issued before a failover condition is determined.
Automatic Return	[Toggle Field]	When this field is set to *YES*, the alternate PowerNet server returns control of the RF network system to the primary controller as soon as the primary failover condition is corrected. If set to *NO*, control of the RF network remains with the alternate - regardless of the state of the primary PowerNet server. In this case, returning control back to the primary PowerNet server must be forced using the Enable Return field (see below)
Enable Return	[Toggle Field]	This field is used to enable control of the RF network back to the primary if *Automatic Return* is set to *NO.* This field only takes action when the *Automatic Return* field is set to NO. This field always returns to NO once the primary controller re-gains responsibility of the RF network. To enable control of the network back to the primary PowerNet server, toggle this field to *YES* and exit the setup screen. Cutover back to the primary should take place within 10-30 seconds after receiving positive poll responses from the primary PowerNet server.

Tri-System Alternate Section, Primary A Setup

In setting up “tri-redundant” hot spare systems, basically there are two “primary” controllers that are backed up by a single alternate controller. In these cases, the alternate controller can act as a backup system to *either* of the primary controllers (primary A or primary B), taking over control of the RF networks, in case either or both primary device(s) fail. This option is only available in the series 2500 model PowerNet servers using the intelligent fallback switch.

Bank	[Toggle Field]	This field selects the switch bank on the alternate system that is used to attach all RF LANs connected to the primary controller. The alternate controller needs to be aware of which bank of switches to control in the event of a fail-over condition. The switch bank is indicated in this field.
Low Switch	[Toggle Field]	This field selects the lowest individual Hot Spare switch installed in the intelligent switch chassis that is controlled in the event of a fail-over condition. This field is a toggle field and sets the low switch range.
High Switch	[Toggle Field]	This field selects the highest individual Hot Spare switch installed in the intelligent switch chassis that is controlled in the event of a fail-over condition. All switches in the range of Low Switch-High Switch is switched in the event of fail-over. This field is a toggle field and sets the high switch range.

Tri-System Alternate Section, Primary B Setup

Heartbeat	[Toggle Field]	This field selects the serial port that connects the Primary B PowerNet server to the null-modem adapter that is used (P1, P2, P...). These other choices are the ports configured in the *Port Setup Form*. Make sure that this port does not conflict with an RF LAN port assignment. A port setting of *Off* disables the *Primary B Hot Spare* option.
Bank	[Toggle Field]	This field selects the switch bank on the alternate system that attaches all RF LANs connected to the primary controller. The alternate controller needs to be aware of which bank of switches to control in the event of a fail-over condition and is indicated in this field.

Low Switch	[Toggle Field]	This field selects the lowest individual Hot Spare switch installed in the intelligent switch chassis that is controlled in the event of a fail-over condition. This field is a toggle field and sets the low switch range.
High Switch	[Toggle Field]	This field selects the highest individual Hot Spare switch installed in the intelligent switch chassis that is controlled in the event of a fail-over condition. All switches in the range of Low Switch-High Switch are switched in the event of fail-over. This field is a toggle field and sets the high switch range.

After configuring both systems, press <Esc> to save the forms. Confirmations are required, press <Y> to save the entries and return to the *Hot Spare Menu*.

Startup

Changes to the setup information on the *Primary* or *Alternate* system do not take effect until after the Hot Spare software is started or the RF and host network connections are shut down and restarted through the *Operations* menu. Select the *Startup* option on both systems. (Another option would be to return to the *Main Menu* and select *Operations*.) Select *Shutdown RF Network* followed by *Startup RF Network* on both PowerNet servers. When using a system with a standalone FBS, a restart of the networks on the *Alternate* system dose not occur until a failure is detected on the *Primary.* With an "intelligent" switch, both RF network processes restart in the primary and alternate machines immediately but only attach depending on the switch condition.

```
        Hot Spare Startup
         Status check ...
         Hot Spare Primary Startup
Press ENTER to continue
```

Hadax Management - Manual Switch Control

Hadax equipped controllers may be manually gang switched. By pressing the Lamp Test/Gang Enable Switch simultaneously with the Gang Switch, a switching operation is performed on the entire rack to the A or B position. These switches are located on the upper left corner of the Hadax front panel.

Failover Objects

Hot Spare allows support for additional external programs to decide when it is necessary to failover from the primary to the secondary system. This allows adding such tests as available disk space, TCP/IP ping of a host, etc., to the criteria which can initiate a failover. This is accomplished by creating Hot Spare objects with the object editor utility.

Caution: Be aware of the execution time of any process added to the Hot Spare script. If the test(s) total execution time is longer than the Hot Spare poll time, it can cause false failovers. The Hot Spare is on a timer, and if a poll does not occur during this period, it considers this a failure and executes the failover. The poll time can be adjusted as detailed earlier in the *Poll Timer* section.

Hotspare examines the return code from the hotspare failover object and determines if it is non-zero. If it is, then the test has determined a failure and a failover should occur. A zero return indicates that the test passed, and no failover is necessary. An example of a failover test would be to ping a remote host over TCP/IP and failover if it does not respond to the ping. An example of this script is shown in the following section regarding the failover object editor.

Failover Object Editor

Failover objects are created using the *Object Editors* function from the PowerNet server *Main Menu* as shown in figure 7-5.

```
                    Symbol PowerNet server R5.0-B02
        Main Menu
         1 Operations
           Object Editors
             1 Keyboard/Mapping
             2 Keyboard/Macros
             3 Scanner/Data Mapping
             4 Scanner/Data Editing
             5 Scanner/Decoder Control
             6 Display/Mapping
             7 Display/Formatting
        1    8 Printer/Init
       *1    9 Dialog
        1  *10 Failover

                    <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 7-5 Object Editor Selection from Main Menu

Selecting the Failover selection from the Object Editors screen calls the editor file selection screen shown in Figure 7-6.

```
                          Object Editor Selection
                                Failover Objects
sample1
baseping
hsckping

[EDIT]  [QUIT]  [DELETE]                   Object[sample1 ]   Editor[vi]


                    <ESC>=QUIT  <ENTER>=SELECT  <ARROWS>=MOVE
```

Figure 7-5 Object Editor File Selection Screen

At this screen, all available failover scripts are displayed for editing. To select a file to edit, use the arrow key to move the cursor to the Object field and type the name of the file to edit. A specific editor to use (*vi* or *vedit*) can be selected as well by moving to the Editor field and pressing <space> to toggle the field value. See the chapter on System Editor for details about using *vi* and *vedit*. Once a file and editor type are selected, move to the EDIT field and press <enter>. When the editing is complete, the object editor automatically makes the failover script executable for use in the failover object fields in the setup form.

Sample Object: TCP/IP Host Test

```
hsckping:
        /usr/bin/ping -c 2 90.0.0.1 > ./hstmpout
        if grep ", 100\% packet loss" ./hstmpout > /dev/null
        then
                #total packet loss, failover
                exit 1
        else
                #at least some got thru, stick around
                exit 0
        fi
```

This script attempts to ping the host at 90.0.0.1 twice. If both pings fail (100% packet loss), it returns non-zero to the Hot Spare program causing a failover. The **hsckping** script also points out some of the pitfalls of writing test scripts. In the example, we ping the host twice because the first ping may be missed and improperly indicate failure. In a configuration where the remote host was connected over multiple or slow connections, it might even be necessary to try several times.

Another consideration in this test is routers. If both the primary and secondary boxes are going through the same router, the ping should be to the router, not the remote host. In this way, failover occurs if the primary could not talk to the router (which the secondary might still be able to do) but no failover occurs if our connection to the router was good but the host wasn't responding. A failover in this case does not accomplish anything because the problem affects both of the systems. Another point is the **hsckping** script's getting around programs that do not necessarily exit with failure (non-zero) returns. By saving the output from the program and *carefully* checking for keywords, it is still possible to determine if the check was successful or not.

When adding additional tests, be aware of the polling timing used by Hot Spare. By default, the secondary polls the primary every ten seconds and looks for a response within 5 seconds. Additional tests, when employed, are initiated *after* the poll response is sent. You must control the following poll response, allowing a maximum of 15 seconds for all of the tests to complete. If the primary is running tests for more than 15 seconds, the secondary would initiate a failover due to non-response. In the **hsckping** example, it can take as long as 16 seconds for two pings to fail, which would lead to a timeout. To overcome this situation, adjust the *poll* values in the setup form, giving a sufficient time for all of the tests to complete by causing a slower poll rate. In our example, a timeout value of 30 seconds for both the primary and alternate would allow sufficient time to complete both the disk check and the ping test.

An additional factor to consider is the number of LANs being brought up. For each eight LANs, increase the retries counter by one. For example, a site with 28 LANs would have the retries counter set to three. This setting allows the primary enough time to bring up all of the LANs.

Sample Object: NetBIOS Host Test

```
hscknbio:
        /usr/bin/nbstatus <remote host name> > ./hstmpout
        if grep "No response" ./hstmpout > /dev/null
        then
                #NetBios Link Fail
                exit 1
        else
                #NetBios OK
                exit 0
        fi
```

The above script *hscknbio* is similar to the TCP/IP test. (Note that the name *hscknbio* does not exceed the naming limit of 8 characters.) *hscknbio* uses a standard UNIX command to test the NetBios link. The user *grep*s for the result, and then sets the error level to signal the **hotspare** program. With this test, like all external tests, be aware of execution time. On a busy network, this test may take some time to complete and the Hot Spare poll rate should be adjusted accordingly.

Sample Object: Spectrum One Transceiver Ping Test

A program called **hschkx** interfaces with the Hot Spare system and allows actively pinging a transceiver to determine if it is still operational or not. **hschkx** is called with two arguments, the LAN number and the transceiver number to be checked. For example, to check transceiver number 03 on LAN 0, the program would be run as *hschkx 0 3*. When run from a console, the program displays a text message indicating if the transceiver responded or not. If run automatically from a program such as Hotspare, **hschkx** exits with an on-zero return status if the transceiver did not respond, and a zero if it did. To use **hschkx** with Hot Spare, create a shell script that actually checks the transceivers and then reports the results to Hot Spare. This is necessary to avoid failing over because one transceiver isn't working even though others may be. Example: If you have a 3 LAN RF network (0, 1 and 2) with two transceivers on each LAN(3 and 4, 5 and 6, 7 and 8), then the shell script to be called would be as follows:

```
   #can we ping the serial base on lan 0?
   if hschkx 0 3
   then
          #yes, at least some comm works so we're OK
          exit 0
   fi


   #how about lan 1 serial base?
   if hschkx 1 5
   then
          #yes, we're OK
          exit 0
   fi
   #how about lan 2 serial base?
   if hschkx 2 7
   then
          #OK, at least we heard from someone
          exit 0
   fi
   #didn't hear from any of the serial bases, time to
failover
   exit 1
```

Be aware that **hschkx** can take up to 15 seconds to run so the poll rate for Hotspare would need to be adjusted accordingly.

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8 Administration & Maintenance

Introduction

Previous chapters explained menu selections necessary for initial system setup. Options used for system administration and maintenance, including diagnostic testing, are documented in this chapter.

Operations Menu - Wireless View

```
                          Symbol PowerNet server

         Main Menu
        * 1 Operations
            Operations
           * 1 Wireless View
             2 Spectrum One Startup
             3 Spectrum One Shutdown
             4 Access Point Startup
             5 Access Point Shutdown
             6 TCP/IP Startup
             7 TCP/IP Shutdown

                    <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 8-1 Operations/Wireless View Menus

The *Wireless View* facility, available from the *Operations Menu*, shown in Figure 8-1, has many features and uses. An important maintenance function is the ability to display statistics for each transceiver or terminal. *Statistics* can be used to determine how well the RF system, and each of its components, performs. Note that connectivity packages which have been ordered appear on this screen.

```
(uname)                           Wireless View                (Date and Time)

────────────── TOPOLOGY ─────────────────────┬──────── UNIT STATISTICS ────────
    067.172  067.179                          │  Access Point: 206.183.67.179
───┬ **1─────**2───────3───────4─────────────┤      MAC Addr: 00A0F80070B8
  1│                                          │    Network ID: 101
  2│                                          │          Load: 0
  3│                                          │ Known Stations: 0
  4│                                          │       Tx KBps: 0
  5│                                          │       Rx KBps: 0
  6│                                          │
  7│                                          │
  8│                                          │
  9│                                          │
 10│                                          │
 11│                                          │
 12│                                          │
 13│                                          │
 14│                                          │
 ──────────────────────────────────────────────────────────────────────────

[UNIT]  [CONTROL]  [FSR]  [LOG]  [NETWORK]                   [HELP]   [QUIT]
```

Figure 8-2 Operations/Wireless View Menus

Wireless View

When this utility is selected, a display of current network topology is presented along with statistics for a transceiver. The following menus/options are available from the *Wireless View* screen. The options may be selected by pressing the key representing the first character of the desired option (e.g. Press <u> to select the Unit function) followed by the <enter> key to execute the selection.

The *uname* field in the upper left corner of the screen displays the machine name. The *date and time* field in the upper right displays MM/DD format for the date and HH:MM:SS.mm for the time. The value of this field depends on the system clock setting.

Unit Allows the system administrator to select a specific Spectrum One transceiver, Access Point, or terminal in order to view the device's statistics.

Control Options are used for reloading the host list, changing log levels, and for Symbol products resetting individual LANs, clearing transceiver NVM, and testing transceivers individually.

FSR Displays a *Frequency Scan Report* for the currently selected transceiver for Spectrum One networks.

Log Starts the Log View utility.

Network Provides a summary screen of the number of components in the system.

Help Displays a list of keys used while in the Wireless View screen.

Quit Terminates the Wireless View Utility and returns to the Operations Menu

<esc> Terminates the Wireless View Utility and returns to the Operations Menu

Note that the following figures show in turn each of the screens available within Wireless View. All of these screens are accessed from the main Wireless View menu as show in Figure 7-1. Select the desired function from this view by selecting the first character of the selection and pressing <Enter>. To move from one screen to another, you must always return to the main Wireless View screen. Entering <Esc> while in any of these sub-menus returns you to the main Wireless View menu.

Wireless View Option - Unit Menu

The Unit menu selection from the Wireless View screen allows the system administrator to select a specific Spectrum One transceiver, Access Point, or terminal in order to view the device's statistics. Select the UNIT option by pressing the <U> key to display the screen shown in figure 8-2.

```
trn2001a                        Wireless View                  10/11 13:16.07

 --------------- TOPOLOGY ------------------------ UNIT STATISTICS ----------
      S0-62    067.135  067.179  067.209  |      Terminal: 206.183.067.233
 -----**1--------**2-------**3-------**4------|  Tx Host Pkts: 0
   1    066              -067.233         |      Tx Bytes: 0
   2                                      |  Rx Host Pkts: 0
   3         Unit                         |      Rx Bytes: 0
   4       * 1 Terminal                   |
   5         2 Transceiver                |
   6         3 Access Point               |
   7                                      |
   8                                      |
   9                                      |
  10                                      |
  11                                      |
  12                                      |
  13                                      |
  14                                      |
 ----------------------------------------------------------------------------

                              <ESC>=QUIT
```

Figure 8-2 Unit Menu

Unit Menu - Transceiver Unit Statistics

Select *Transceiver* from the *Unit* selection menu to display statistics for a specific transceiver. Alternately, the <tab> key can be used to select transceiver/access point statistics screens. Enter the address in the selection box that appears and press <Enter>. The screen, Figure 8-3, is displayed in the unit statistics area of the wireless view screen.

```
----- UNIT STATISTICS ---
-
     LAN-Tran: 0-62
   Connection: Serial
       Status: COMPLETE
         Load: 1
 Total Errors: 0
      TX NAKs: 0
      Rx NAKs: 0
      Resends: 0
   Duplicates: 0
```

Figure 8-3 Transceiver Unit Statistics

Transceiver Unit Statistics Fields

LAN-Tran Address of the transceiver for which statistics are displayed.

Status Displays the configuration state of the transceiver, *pending* or *complete*.

Connection Type of connection that this transceiver has with the RF LAN, *serial* or *coax*, is shown in this field. Coaxial connections are displayed with the serial transceiver to which they are connected.

Load Transceiver load is the number of terminals with which it is communicating.

Total Errors Total number of RF errors that occurred. These errors include Transmit and Receive NAKs, Resends, and Duplicates.

TX NAKS Total number of Negative Acknowledgments transmitted by the transceiver.

RX NAKS Total number of Negative Acknowledgments received by the transceiver.

Resends Total number of packets that were sent and then re-sent by the transceiver.

Duplicates Total number of packets received more than once by the transceiver.

Unit Menu - Access Point Unit Statistics

Select *Access Point* from the *Control Menu* to display statistics for a specific transceiver. Here, the <tab> key can also be used to select an access point unit as well. Enter the address in the selection box that appears and press <Enter>. The screen, Figure 8-4, is displayed.

```
 ----- UNIT STATISTICS ----
  Access Point: 206.183.067.135
      MAC Addr: 00A0F88070B8
    Network ID: 101
          Load: 2
Known Stations: 9
       TX Kbps: 0
       Rx Kbps: 0
```

Figure 8-4 Access Point Unit Statistics

Access Point Unit Statistics Fields

Access Point The AP's IP address for which statistics are displayed.

MAC Addr The AP's MAC address.

Network ID Displays the network ID of the AP.

Load The number of terminals with which AP is communicating.

Known Stations The number of remote terminals that the AP is aware of since the AP became active on the network.

TX Kbps The rate at which data is transmitted by the AP.

RX Kbps The rate at which data is received by the AP.

Terminal Unit Statistics Fields - Spectrum One Devices

Select *Terminal* from the *Unit Menu* and enter the address of the Spectrum One RF terminal in the selection box that appears. Alternately, the up and down <arrow> keys can be used to select a terminal unit from the topology display. Press <Enter> and the *Unit Statistics* screen shown in Figure 8-5 appears.

```
----- UNIT STATISTICS ----
     Terminal: 066
     LAN-Tran: 0-62
  RX Pkt/Data: 82/216
  TX Pkt/Data: 81/1404
        DCRs: 5
    DCR Trans: 0
 VA Attempted: 0
 VA Completed: 0
      VA Time: 40 ms
 Total Errors: 0
      TX NAKs: 0
      Rx NAKs: 0
      Resends: 0
   Duplicates: 0
```

Figure 8-5 Terminal Statistics

Spectrum One Terminal Statistics Fields

Terminal Address of the terminal for which statistics are displayed.

LAN-Tran LAN number and transceiver address which the specified terminal currently is communicating with.

RX Pkt/Data Number of packets and the number of data bytes received by the terminal. Note that the field wraps, therefore, values are only relative and should not be used for calculations. This statistic is used as an indicator of packet exchange.

TX Pkt/Data Number of packets and the number of data bytes transmitted by the terminal. Note that the field wraps, therefore, values are only relative and should not be used for calculations. This statistic is used as an indicator of packet exchange.

DCRs Distress Call Report (DCR) tally. When the terminal cannot communicate with the current transceiver or if it has been powered on, it sends out a Distress Call (DCR) to the RF network. When a terminal first logs on to the network, DCRs are also sent and are included in the total.

DCR Trans Number of transceivers that received a distress call from the selected terminal.

UA Attempted Unit Assign (UA) Attempts are summed in this field. When a terminal cannot communicate with the transceiver, an attempt to hand off the terminal to another transceiver can occur.

UA Completed Total number of times that a UA Attempt was successful.

UA Time Amount of time it took to de-assign the terminal from one transceiver and to assign it to the new transceiver. The time is in milliseconds (ms).

Total Errors Total number of RF Errors that occurred. These errors include Transmit and Receive NAKs, Resends, and Duplicates.

TX NAKS Total number of Negative Acknowledgments transmitted by the terminal.

RX NAKS Total number of Negative Acknowledgments received by the terminal.

Resends Total number of packets that were sent and then re-sent by the terminal.

Duplicates Total number of packets received more than once by the terminal.

Terminal Unit Statistics Fields - Access Point Devices

Select *Terminal* from the *Unit Menu* or use the up/down <arrow> keys to display statistics for a specific access point addressable terminal device. Enter the address in the selection box that appears and press <Enter>. The screen, Figure 8-6, is displayed.

```
----- UNIT STATISTICS ----
     Terminal: 206.183.067.235
 Tx Host Pkts: 0
     Tx Bytes: 0
 Rx Host Pkts: 0
     Rx Bytes: 0
```

Figure 8-6 Access Point Unit Statistics

Access Point Terminal Unit Statistics Fields

Terminal The Device's IP address for which statistics are displayed.

Tx Host Packets The number RF packets transmitted by the terminal.

Tx Bytes The number of bytes transmitted by the terminal.

Rx Host Packets The number RF packets received by the terminal.

Rx Bytes The number of bytes received by the terminal.

Wireless View Option - Control Menu

The Control Menu (see Figure 8-7) is used for setting, resetting, and clearing various parameters used for diagnostics and maintenance of the Spectrum One Network. Select the Control Menu from *Wireless View* by pressing <C> followed by <enter>.

```
trn2001a                        Wireless View                 10/11 13:16.07

 ───────────────TOPOLOGY ─────────────────────┬───────UNIT STATISTICS ─────────
     S0-62    067.135  067.179  067.209       │    Terminal: 206.183.067.233
 ────**1 ──────**2 ──────**3 ──────**4  ──────┤ Tx Host Pkts: 0
  1 │ 066             -067.233                │     Tx Bytes: 0
  2 │                                         │ Rx Host Pkts: 0
  3 │       ┌ Control                   ┐     │     Rx Bytes: 0
  4 │      * 1 Access Point Log Level   │     │
  5 │       │ 2 Spectrum One Log Level  │     │
  6 │       │ 3 Terminal Log Level      │     │
  7 │       │ 4 Reload Host List        │     │
  8 │       │ 5 Ping Test               │     │
  9 │       │ 6 Set Location            │     │
 10 │       │ 7 Clear NVM               │     │
 11 │       │ 8 Reset LAN               │     │
 12 │       │                           │     │
 13 │       └───────────────────────────┘     │
 14 │                                         │
 ──────────────────────────────────────────────────────────────────────────────


                                  <ESC>=QUIT
```

Figure 8-7 Control Menu

Control Menu - Access Point Log Level

The *Access Point log* is used for recording information relating to the access point network activity. This log records all transactions to and from the access point networks and is written to a log file on the PowerNet server up to the number of lines as set in the *log lines* field in the *Access Point Setup* Screen. The amount of detail, or logging level, of this file can be set or changed with this option.

There are 10 levels of detail that can be used for logs. The lowest, 0, gives only system activity information and is the default setting. It may be set to a higher value, with 9 providing the most information. Setting log levels at 6 or higher can be done, but is normally used strictly for engineering debugging purposes and degrades system performance. This is useful for resolving problems with access points and LANs. A level of 1 is sufficient for system administrator debugging purposes.

> ***NOTE:*** Production systems should be reset to *zero* after a problem has been resolved to minimize the impact of disk logging on system performance.

Choose *Set RF Log* and a *Log Level Selection Box* (see Figure 8-8) appears in the Wireless View screen.

```
Access Point
Log (0-9):
```

Figure 8-8 Log Level Selection Box

Type in the appropriate log level and press <Enter>. This overrides the log level set with the *Access Point Setup Form*. A message showing the level that was set appears in the lower left-hand section of the screen. Press <Enter> to remove the message and to return to the *Control Menu*.

Control Menu - Spectrum One Log Level

The Spectrum One log is used for recording information relating to the Spectrum One transceiver network activity. This log records all transactions to and from the transceiver networks and is written to a file on the PowerNet server up to the number of lines as set in the *log lines* field in the *Spectrum One Network Setup* Screen.

The amount of detail, or logging level, of this file can be set or changed with this option. There are 10 levels of detail that can be used for logs. The lowest, 0, gives only system activity information and is the default setting. It may be set to a higher value, with 9 providing the most information. Setting log levels anywhere beyond 6 can be done, but this is normally used strictly for engineering debugging purposes. This is useful for resolving problems with transceivers and LANs. A level of 1 is sufficient for system administrator debugging purposes.

> **Note** Production systems should be reset to zero (0), after a problem has been resolved, to minimize disk-logging impact on system performance.

Choose *Spectrum One Log Level* and a *Log Level Selection Box* (see Figure 8-9) appears within the Wireless View screen.

```
Spectrum One Log
(0-9):
```

Figure 8-9 Log Level Selection Box

Type in the appropriate log level and press <Enter>. This overrides the log level set with the *Spectrum One Network Setup Form*. A message showing the level that was set appears in the lower left-hand section of the screen. Press <Enter> to remove the message and to return to the *Control Menu*.

Control Menu - Terminal Log Level

Every terminal has a separate terminal log file that is kept to record terminal activity. The log level for a specific terminal log can be changed with the *Terminal Log Level* option.

```
Terminal Log
Level (0-9):
```

Figure 8-10 Terminal Log Level Selection Box

This log details application level terminal activity, such as when data records are sent and received, etc. If a terminal appears to be malfunctioning, then the level of its log can be adjusted and data analyzed to determine related issues. More information regarding terminal behavior on the network can be collected. A level of *6* provides a hexadecimal format data dump.

First, select the specific terminal from the *Unit Menu*. Next, select the *Terminal Log Level* option. A *Log Level Selection Box* similar to the one shown in Figure 8-10 appears. Enter the log level (valid entries are 0 - 9) and press <Enter>. A confirming message appears briefly in the lower left-hand section of the screen. Press <Enter> again to remove it and continue. Note that if the RF terminal is rebooted, the terminal log reverts to its original setting as specified in the handler (host list) setup.

Control Menu - Reload Host List

This option resets the RF network without terminating current RF sessions. New parameters that have been set, such as log level settings at the handler level, are changed by reading the modified handler file when this option is implemented. A message appears on the lower left portion of the *RFview* screen indicating that a reset is taking place. Press <Enter> to remove the message.

Control Menu - Ping Test

The *Ping Test* tests an individual transceiver with a single query packet. When *Ping Test* is selected, the transceiver to be *pinged* is specified (see Figure 8-11) and then <Enter> is pressed to begin the test.

```
trn2001a                        Wireless View                  10/11 13:16.07

─────────────── TOPOLOGY ─────────────────────── UNIT STATISTICS ──────────
     S0-62    067.135  067.179  067.209          Terminal: 206.183.067.233
────**1──────**2──────**3──────**4──────     Tx Host Pkts: 0
  1   066              -067.233                  Tx Bytes: 0
  2                                          Rx Host Pkts: 0
  3           Control                            Rx Bytes: 0
  4             1 Access Point Log Level
  5             2 Spectrum One Log Level
  6             3 Terminal Log Level
  7             4 Reload Host List
  8           * 5 Pin
  9             6 Set LAN-Trans or AP:
 10             7 Cle
 11             8 Reset LAN
 12
 13
 14
─────────────────────────────────────────────────────────────────────────


                              <ESC>=QUIT
```

Figure 8-11 Ping Test LAN-Tran/AP Selection Box

The PowerNet server generates a query packet that is sent to the device chosen. The service then sends a reply packet to the PowerNet server.

In pinging a LAN-Trans (Spectrum One) the result, whether the test was successful or not, is recorded in the lower left-hand corner of the screen. Press <Enter> to remove the message and continue.

Should the test fail, ensure that all connectors are properly mated and that there are no breaks in the coaxial cable. If problems with the cabling or connectors are not detected, then the *Diagnostics* option, available from the *RF Network Menu*, (see *Diagnostics* section later in this chapter) should be used for further investigation.

In pinging an access point, a TCP/IP ping test is used. Results of the ping are displayed on the screen as the test is being done. A sample of this test is shown on Figure 8-10. Press the <Del> key to stop the test.

```
Press Delete to Return to Screen
PING 206.183.67.135 (206.183.67.135): 56 data bytes
64 bytes from 206.183.67.135: icmp_seq=0 ttl=10 time=680 ms
64 bytes from 206.183.67.135: icmp_seq=1 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=2 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=3 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=4 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=5 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=6 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=7 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=8 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=9 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=10 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=11 ttl=10 time=0 ms
64 bytes from 206.183.67.135: icmp_seq=12 ttl=10 time=0 ms
```

Figure 8-12 - AP Ping Test

Control Menu - Set Location

The *Set Location* menu item allows system administrators or installers set a verbal description as to the location of a given access point or Spectrum One transceiver. Once a location for a device is set, the location name for that device appears in the Unit Statistics area of the Wireless View screen. Locations cannot be assigned to terminals.

```
Location:
```

Figure 8-13 Set Location Prompt Box

Control Menu - Clear NVM: For Spectrum One LANs Only

Transceivers store their address and other configuration information in nonvolatile memory. To change an address, channels, speed, or chipping sequence, select *Clear NVM* from the *Control Menu*. A *Transceiver Selection Box*, shown in Figure 8-14, appears.

```
LAN-Transceiver:
```

Figure 8-14 Transceiver Selection Box

Enter the LAN-Transceiver address of the transceiver which has its NVM erased and then press <Enter>. The transceiver must then be manually powered off. Once this is done, select *Reset LAN* from the *Control Menu* and enter the LAN number of which the transceiver is part. Press <Enter> to reset the LAN.

Control Menu - Reset LAN: For Spectrum One LANs Only

Individual Spectrum One LANs can be shut down and brought back up, without affecting other LANs attached to the PowerNet server, with the *Reset LAN* selection. An example of the use of this function is when *Clear NVM* is selected for a transceiver. The LAN, to which that transceiver is attached, must be reset to effect the change. Another use of this function is when changing the operating frequency (channel) for a given RF LAN. Make the channel change in the *RF Network Setup Form* and then reset the affected LAN.

> ***NOTE*** Use this option with caution, as transceivers prior to revision 2.04 may not retain their current addresses. Older transceivers must be powered off, the *Transceiver Address Form* cleared, and then powered on, one at a time, as in the installation procedure (see *Transceiver Configuration* in Chapter 5).

Select *Reset LAN* from the *Control Menu* and enter the number of the LAN that is to be reset, in the *LAN Address Box* that appears (Figure 8-15). Press <Enter> and the LAN is reset. A message appears in the lower left-hand part of the screen. Press <Enter> to remove the message and continue.

```
LAN:
```

Figure 8-15 LAN Address Box

Wireless View Option - Log Menu

System logging in general is a powerful feature that allows system administrators to track data through all RF network points of the PowerNet server. The Log option utilizes a Log Viewer utility that allows viewing of up to 4 simultaneous log files at a time. This, combined with the fact that multiple logs can be viewed 'real-time,' allows targeting potential problem areas for quick resolution. In addition, the log viewer allows capturing snapshots of viewed log files that can be saved and reviewed a later time. Details on the use of the log view utility will be discussed in the following text.

RF Log files that can be accessed through this log view utility are the access point logs, spectrum one logs, terminal logs, base reset logs, base status logs, terminal reboot logs, assign exception logs, de-assign exception logs, NAK pending logs, NAK logs, and RNAK logs. From this utility, special host log files for use with client streaming systems include SAB Emulator logs, STEP-TCP/IP logs, STEP-DEC logs, TCP/IP Client Streaming logs, and Serial Client Streaming logs. The level of detail contained in these log files is controlled via host and handler setups, network setups, and, for terminal and RF network logs, via the *Wireless View* screen.

> **NOTE:** Log files are created on an 'as-needed' basis. Not all files listed below may appear on selection screens while using the log view tool. For example, the base status log file will appear as a selection if Spectrum One transceivers with firmware 2.14 or higher are connected to the network.

Log Files

Spectrum One Logs

Spectrum One logs contain all RF based transactions passed between the PowerNet server and the RF transceiver network(s) in a Spectrum One environment. These logs can also include data sent to/from all terminals connected in this environment.

Access Point Logs

Access Point logs contain all RF based transactions passed between the PowerNet server and the access point network in an access point environment. These logs can also include data sent to/from all terminals connected to these devices.

Terminal Logs

Terminal logs contain information regarding RF data activity for individual terminals. Where the associated Access Point or Spectrum One (base) logs contains information regarding all terminal traffic connected to the network, these logs contain information relating only to a particular device.

Base Reset Logs (Spectrum One Only)

Base reset logs contains information regarding distress calls sent to the PowerNet server from Spectrum One transceivers. Since a distress call from a transceiver should only occur when transceivers reset (i.e., initially established to a LAN, forced to reset, or powered on), entries in these log files should be minimal if the RF network is active at all times. Although base distress calls are also contained in the Spectrum One log file, this file is created as an 'exception' file for these unusual types of events to aid in troubleshooting Spectrum One networks.

Base Status Logs (Spectrum One Only Transceiver firmware 2.14 or higher)

Spectrum One Base status logs contain information regarding the RF LAN number, transceiver ID, and the version of firmware running in the transceiver. Although base status calls are also contained in the Spectrum One log file, this file is created as an 'exception' file for these types of events to aid in troubleshooting and identifying transceiver firmware in Spectrum One networks.

Terminal Reboot Logs (Spectrum One Only)

This file captures occurrences of terminal reboots (restarts) whenever a Spectrum One terminal is rebooted while within an active host session. This log file is useful to track down terminals and/or operators that have to frequently restart the terminal sessions.

Assign Exception Logs (Spectrum One Only)

The assign exception log file is generated when transceivers fail to acknowledge terminal assignment requests from the PowerNet server. These assign commands to transceivers tell the transceiver to take responsibility for a terminal—any communication with a terminal must take place through a given transceiver. If the transceiver does not acknowledge the assign command, an event is logged here.

De-assign Exception Logs (Spectrum One Only)

The de-assign exception log file is generated when transceivers fail to acknowledge terminal de-assignment requests from the PowerNet server. These de-assign commands to transceivers tell the transceiver to 'give-up' responsibility for a specific terminal. If the transceiver does not acknowledge the de-assign command, an event is logged here.

NAK Pending Logs (Spectrum One Only)

Pending NAKs sent to terminals are recorded here. A pending NAK is a NAK (data not acknowledged) that is sent to a terminal, waiting for the terminal to respond with a repeat of the data that was NAK'd. If a terminal takes too long to respond to the NAK, the terminal sending the data is re-NAK'd. The event is logged here.

NAK Logs (Spectrum One Only)

Every time the PowerNet server has to NAK data sent by a terminal, an event is logged here.

RNAK Logs (Spectrum One Only)

Every time the PowerNet server receives a NAK from a terminal against data the PowerNet server was trying to send, an event is recorded in this file.

SAB Emulator Logs

SAB emulator logs record all transactions to and from a SAB host application. In the case of SAB emulator, two log files are generated - a SAB host Read log file and a SAB host write log file.

STEP-TCP/IP Logs

STEP-TCP/IP logs record all transactions to and from a STEP based TCP/IP host.

STEP-DEC Logs STEP-DEC logs record all transactions to and from a STEP based DECNET host.

TCP/IP Client Streaming Logs TCP/IP Client Streaming logs record all transactions to and from a TCP/IP based Client Streaming host application. In the case of TCP/IP Client Streaming, two log files are generated - a TCP/IP CS host Read log file and a TCP/IP CS host write log file.

Serial Client Streaming Logs Serial Client Streaming logs record all transactions to and from a Serial based Client Streaming host application. In the case of Serial Client Streaming, two log files are generated - a Serial CS host Read log file and a Serial CS host write log file.

Log Files Demystified

Overview

All Connect programs, including most of the interactive programs, provide event logging for performance and trouble analysis. In addition, each of the terminal emulation processes maintain separate log levels for specific library routines, such as presentation space management, datastream handling, and reformatting.

Log Levels

Log levels range from a minimum level of 0 to a maximum of 9, where each level includes the logging of all levels below it. For example, level 6 includes all messages from 0 to 5. In general, log levels conform to the following conventions:

Level 0	Exceptional events only
Level 1	Data transmit and receive size
Level 2-6	Engineering debug messages
Level 7	Data in hex format
Level 8-9	Engineering debug messages

Engineering debug messages are, for the most part, useful only to the Connect programming staff.

Log Format

All processes written by Connect, with the exception of the Enabler program *stepd*, use the following log entry format:

```
MM/DD hh:mm:ss msec [ message ]
```

`MM`	Month
`DD`	Day of month
`hh`	Hour
`mm`	Minute
`ss`	Second
`msec`	Milliseconds since previous log event

When level 7 (or higher) is set, data is logged in hexadecimal format as follows:

```
HH HH HH HH HH HH HH HH HH HH HH HH HH HH HH HH  AAAAAAAAAAAAAAAA
```

The hexadecimal value is represented above as HH, and the ASCII graphic value is represented as A. The format provides for one line per 16 bytes of data. Non-graphic characters are represented in the ASCII portion as a period.

By default, all processes "wrap" the log file at 1000 lines, which translates into roughly 60,000 bytes. The wrap is accomplished by removing the file and re-creating it. The exception to this is the Spectrum One Packet log files (**PKT*.log**), which are opened and closed for each entry and are never wrapped. Note that hex format lines (level 7 or above) are not part of the wrap count.

The line wrap count of the Spectrum One driver can be increased using the RF Network Setup form followed by a shutdown and startup.

Spectrum One Driver Log

The default log level for the Spectrum One protocol driver is set via the RF Network Setup menu. The level can also be set dynamically via the Control Menu of RFView for run-time changes. In the normal production environment, this log should be set to zero. All log levels above 1 are for Connect engineering use only. Even at level 0, all unusual or exceptional Spectrum One events are stored in separate Spectrum One Packet log files for problem troubleshooting.

The name of the Spectrum One log is **base.log**, and it conforms to the following format:

```
MM/DD hh:mm:ss xx obj-id dir [ comment ]
```

MM	Month
DD	Day of month
hh	Hour
mm	Minute
ss	Second
xx	Milliseconds since previous log event
obj	Object
id	ID relative to a terminal or transceiver
dir	Direction: to object is <--, from object is -->

The object field may be one of the following:

rNN	RF network, where NN indicates the number (00-31)
cNN	Cradle network, where NN indicates the number (00-31)
app	Application process
smi	SMI

Spectrum One Packet Logs
The following table list the packet log file names and briefly describes the Spectrum One protocol sequence involved:

PKTua.log	Completed Unit Assigns (handoffs)
PKTuaex.log	Unit Assign exceptions
PKTdaex.log	Unit De-assign exceptions
PKTnak.log	NAKs sent to terminal
PKTnakp.log	Pending NAK sequences
PKTrnak.log	Negative acknowledgments received from terminal
PKTfail.log	NAK and RNAK sequence recovery failures
PKTdc.log	Distress calls from transceivers

The purpose of these logs is to identify trends that may indicate a problem requiring further study. Keep in mind, however, that all of these files accumulate entries over time, even on a system that is functioning perfectly.

For example, the **PKTua.log** records every successful handoff. However, if the same terminal is performing a unit assign every 500 milliseconds, there is reason to suspect a coverage or radio problem.

Excessive numbers of entries in the **PKTdaex.log** and **PKuaex.log** tend to indicate serial or coaxial backbone problems; that is, packets sent by the NCU to the transceivers are not being received by the transceivers.

The **PKTnak.log**, **PKTrnak.log**, and **PKTnakp.log** indicate collisions on the RF network, and in redundant networks may indicate crosstalk between overlapping transceivers set to the same channel and chipping sequence. Networks with hundreds of terminals tend to generate a high number of NAK sequences, particularly if the individual data record sizes are larger than 100 bytes.

The **PKTfail.log** generally only generates an entry when a terminal is rebooted in the middle of a data transfer, or after a terminal session has been terminated by the NCU. High numbers of entries here may indicate that the Resend (RF Network Setup) limit is too low for the site.

The **PKTdc.log** normally registers an entry each time the RF Network is restarted. Entries during normal network operation indicate that a transceiver lost power.

Terminal Process Log

The terminal process log file is created using the following naming convention: rf<NNN>.log, where NNN is a 3 digit terminal number with leading zeros. Each terminal emulation handler process provides one or more of the following log levels in addition to the standard debug log level:

Dialog	Dialog script
PS	Presentation space
Formatter	Screen formatter
LU	SNA datastream
SNA	SNA product logging

With the exception of the SNA level, all of these levels force a message output to the terminal process log file. In the case of SNA, an additional file is created using the following convention: **lu<NN>.log** where *N* is the LU number.

Client Streaming Host Process Logs

The client server interface to a host provides that terminal traffic is multiplexed over 2 connections, one for read (or receive) and another for write (or transmit). The file naming conventions are as follows:

SAB read	sabhost<N>r.log
SAB write	sabhost<N>w.log
TCP/IP read	host<N>r.log
TCP/IP write	host<N>w.log
APPC TR read	trhost<N>r.log
APPC TR write	trhost<N>r.log
APPC SDLC read	sdhost<N>r.log
APPC SDLC write	sdhost<N>r.log

In all of the above cases, N indicates the host number (0-3) as defined in the host network setup for the specific connectivity. Host connection logs are not maintained for DECNET or NetBIOS connections; instead, the terminal logs represent the host interface log.

The *Log* option, from the Wireless View Menu, is used to view either RF logs or specific terminal logs. If a terminal log is viewed, first select the terminal of interest with the *Unit Menu*. Press <L> and <enter> to select *Log* from *Wireless View* and, the *Logs Menu* is displayed (see Figure 8-16).

```
trn2001a                         Wireless View           10/11 13:16.07

 ───────────────TOPOLOGY ──────────────────┬─────────── UNIT STATISTICS ────────
     S0-62    067.135  067.179  067.209   │       Terminal: 206.183.067.233
────┬**1──────**2──────**3──────**4───────│   Tx Host Pkts: 0
  1 │ 066              -067.233           │       Tx Bytes: 0
  2 │                                     │   Rx Host Pkts: 0
  3 │         ┌ Logs ────────────────┐    │       Rx Bytes: 0
  4 │         │* 1 Access Point Network│  │
  5 │         │  2 Spectrum One Network│  │
  6 │         │  3 Terminal Handler    │  │
  7 │         └────────────────────────┘  │
  8 │                                     │
  9 │                                     │
 10 │                                     │
 11 │                                     │
 12 │                                     │
 13 │                                     │
 ────────────────────────────────────────────────────────────────────────────
                                    <ESC>=QUIT
```

Figure 8-16 Logs Menu

Select either *Access Point Network Log*, *Spectrum One Network Log,* or *Terminal Handler Log* from this menu*.* Once selected, the system will prompt with a second level menu as shown in figure 8-17 asking for the log type - either *Trail* (real-time) or *Browse* (to review the current file). Once selected, the proper log is displayed. A level 1, Spectrum One Network Log, is shown in Figure 8-18.

```
┌ <Name of log> LOG ┐
│* 1 Trail          │
│  2 Browse         │
└───────────────────┘
```

Figure 8-17 Log Type Selection Menu

```
── Spectrum One (Browse) 179800 (2268) ──────────────────────────────
10/17 11:05:42.270    70ms r00-062 -->  3 7 3 Resync Request Report for 100
10/17 11:05:42.270     0ms app-100 <--  5 - - Control Msg: End Session
10/17 11:05:42.280    10ms r00-062 <--  4 4 7 Unit Assign 100 with reset
10/17 11:05:42.310    30ms r00-062 -->  0 X 4 ACK
10/17 11:05:42.310     0ms r00-100 *** UA-END: 100 0-000 -> 0-062 reset 40ms
10/17 11:05:42.590   280ms r00-062 -->  3 0 4 Transport reset for 100
10/17 11:05:42.590     0ms r00-062 <--  0 X 0 ACK
10/17 11:05:42.600    10ms r00-062 <--  0 X 0 ACK
10/17 11:05:42.970   370ms r00-100 -->  4 0 7 Data-EOC (1QHB)
10/17 11:05:42.970     0ms app-100 *** -- - - HIP query
10/17 11:05:42.980    10ms r00-100 <--  0 X 0 ACK
10/17 11:05:42.980     0ms r00-100 <-- 23 0 0 Data-BOC (.HRL11VTERM          S
10/17 11:05:42.980     0ms r00-100 <-- 23 1 0 Data-BOC (TEP           PTTY
10/17 11:05:44.170  1190ms r00-100 *** RESEND N=0 TRY=1
10/17 11:05:44.170     0ms r00-100 <-- 23 0 0 Data-BOC (.HRL11VTERM          S
10/17 11:05:44.610   440ms r00-062 -->  7 1 4 DCR for 100 over 00, 0 errors
10/17 11:05:44.610     0ms r00-062 <--  0 X 1 ACK
10/17 11:05:44.670    60ms r00-100 *** PICK END: 0-062 (no choice)
10/17 11:05:44.670     0ms r00-100 *** UA-BEG: 100 0-062 -> 0-062
10/17 11:05:44.670     0ms r00-062 <--  4 5 0 Unit Assign 100 no reset
10/17 11:59:51 ──────────────────────────────────────────────────
[FILE]  [VIEW]  [SNAP]  [FIND]  [PICK]  [ALIGN]                  [HELP]  [QUIT]
```

Figure 8-18 Spectrum One Log view (Browse Mode)

A Terminal Log, set for log level 1, is shown in Figure 8-19. Notice that when a terminal log is opened, the associated access point or spectrum one log is opened as well.

```
── Spectrum One (Browse) 194990 (46372) ─────────────────────────────
10/17 12:14:19.630   100ms r00-100 -->  0 X 7 ACK
10/17 12:14:19.630     0ms app-100 <--  5 - - Control Msg: Ready
10/17 12:14:21.130  1500ms r00-062 -->  0 X X Chitchat
10/17 12:14:31.150 10020ms r00-062 -->  0 X X Chitchat
10/17 12:14:32.700  1550ms r00-100 --> 19 1 7 Data-EOC (0AStest            )
10/17 12:14:32.710    10ms app-100 *** -- - - HIP Assign (test            )
10/17 12:14:32.710     0ms r00-100 *** host "test"
10/17 12:14:32.790    80ms r00-100 *** system(./rfvt rf100 163 -cf test.cf )=00
10/17 12:14:32.800    10ms r00-100 <--  0 X 1 ACK
10/17 12:14:32.800     0ms r00-100 <--  5 0 1 Data-EOC (.PR00)
── Terminal rf100.log (Browse) 13379 (12634) ────────────────────────
10/17 12:14:08.860     0ms Closing psuedo-tty
10/17 12:14:08.910    50ms TERMINATED
10/17 12:14:32.800     0ms BEGIN: rfvt S1 5.0.0 rf100
10/17 12:14:32.810    10ms Configuration file: 'test.cf'
10/17 12:14:32.820    10ms  0 errors
10/17 12:14:32.820     0ms Configuration file: 'test.cfm'
10/17 12:14:32.830    10ms  file not found
10/17 12:14:32.910    80ms Init port=163 netport=8
10/17 12:14:33.350   440ms tip_rcv: RCV RDY
10/17 12:16:12 ───────────────────────────────────────────────────
[FILE]  [VIEW]  [SNAP]  [FIND]  [PICK]  [ALIGN]                  [HELP]  [QUIT]
```

Figure 8-19 Spectrum One Terminal Log View (Browse Mode)

Using The Log Viewer

The log view utility allows system administrators to review RF network activity from several aspects - communications to/from the remote device, application communications to and from Client Streaming based hosts, and RF network data communications through the PowerNet server. There is also the ability to access other types of ‘exception’ log files that contain useful information as to the state of the RF network.

Control of the viewer is done by selecting options from the log viewer menu bar as seen near the bottom of the screen in figure 8-19. Options from this menu bar are selected by typing the first character of the option (which moves the cursor to the desired option) and then pressing <enter>. Optionally, the <tab> key allows selection of display windows or menu bar options.

Log Viewer Key Use

A cursor is positioned over the current active item - either a file view window (view panel) or a menu bar option. The <TAB> and <Arrow> keys move the cursor through selections on the screen

The log viewer has several special keys that are active during the viewing of log files and a list of keys can be viewed at any time by selecting the HELP option from the log viewer menu bar.

<TAB> Move the cursor to next menu option or viewing panel.

<ARROWS> Move the cursor between menu options or up/down a log file within a view panel.

<ENTER> Select current menu option.

<CTL><L> Go to last page of log displayed in the current view panel window.

<CTL><U> Up one page within a selected view panel.

<CTL><D> Down one page within a selected view panel.

<CTL><N> Search for next occurrence of a find string—see FIND.

Log Viewer Menu Bar Options

Menu bar options are selected by using the <TAB> or <Arrow> keys to move the cursor over the desired option. The various options are defined below.

FILE Select a log file to view (up to 4 may be selected).

VIEW Select the log viewer viewing mode (Trail or Browse). While in browse mode, screen updates are locked and all log files can be navigated through using the arrow keys. While the view mode is set to Trail, all currently displayed log files are updated to the screen as records are written to the files.

SNAP Copy currently viewed log files to the 'snaps' subdirectory for browsing. This is handy when looking for a captured event without having to be concerned with log files being erased and re-written when file size limits are met.

FIND Find a specified string in currently displayed file.

PICK Display only those lines within a log view containing specified string.

ALIGN Align all file panels to time in current file panel.

HELP Display the help screen.

QUIT Exit the log viewer application and return to the wireless view screen.

Up to four log file viewing 'windows' can be open at a time. Using the FILE function from the viewer menu bar allows the user to open and close selected log files. The VIEW

Wireless View Option - Network Summary

The *Network* selection displays a summary screen of all RF networks. It is shown in Figure 8-20. Press <N> to activate this option. The total number of all transceivers, terminals (active and inactive), and LANs in the installation is reported. In addition, the terminal traffic information is shown.

```
trn2001a                        Wireless View                  10/11 15:52.12

 ───────────────TOPOLOGY ─────────────────────────── UNIT STATISTICS ──────────
     I0-03    S0-62    067.135  067.179        Access Point: 067.135
 ───── -1 ───── 2 ─────**3 ─────**4 ──────           MAC Addr: 00A0F80070B8
  1                Network Summary              Network ID: 101
  2                               LANS: 4             Load: 1
  3                  Transceivers/APs: 5       n Stations: 23
  4                  Active terminals: 2          Tx KBps: 1
  5                Inactive terminals: 0          Rx KBps: 1
  6                ACTIVE TERMINAL TRAFFIC
  7                 Minutes   Count  Code
  8                 0 - 1       0    **
  9                 2 - 5       1    *
 10                 6 - 10      0    ++
 11                11 - 30      0    +
 12                31 - up      1    -
 13
 ──────────────────────────────────────────────────────────────────────────────
                                 <ENTER>=CONTINUE
```

Figure 8-21 Network Summary Display

Spectrum One Menu

Various options on the *Spectrum One Menu* are used for maintenance; others come factory-set and are for reference. These options are explained in the following sections. The *Spectrum One Menu* is shown in Figure 8-22.

```
                                Symbol PowerNet server

       Main Menu
       1 Operations
     *   Spectrum One
        * 1 Port Setup
          2 Network Setup
          3 Terminals
          4 Transceivers
          5 Host List
          6 Diagnostics
          7 Activity Report
          8 Performance Report
          9 Loader

                    <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 8-22 RF Network Menu

Spectrum One Menu - Port Setup

The *Port Setup* option displays the *Port Setup Form*. All fields are factory-set and should not be changed. For details regarding this screen, see Chapter 4.

Host List

The *Host List* specifies hosts and host applications that are available to RF terminal users. This list appears on RF terminals once they are logged in and configured. The *Host List* is constructed and changed with the *Host List Setup Form*. There is no need to use a line editor.

The default contents of the *Host List* correlates with the connectivity option(s) that are part of each system and are explained in the specific *Reference Manuals*. In addition, there are *pseudo-host* applications resident on the PowerNet server that are used for testing. These selections are dependent upon the .HEX terminal software being used and are default entries that are provided with the system.

```
                              Host List Setup

 Menu Name      Handler   Active                Custom Options
[VTERM        ] [VTERM   ] [yes]  [                                            ]
[PTTY         ] [PTTY    ] [yes]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
[             ] [NONE    ] [no ]  [                                            ]
```

Figure 8-23 Host List Setup Form

When Host List is selected from the RF Network Menu, the form shown in Figure 8-23 appears. To enter a new option into the Host List, use the right or down <Arrow> keys to place the cursor on a blank line under the Menu Name column. Enter the name of option as it appears on the RF terminal (using upper and lower case where needed).

Press the right <Arrow> to proceed to the Handler field. This is a toggle field and the <Tab> key is used to change the selection. The choices depend upon the connectivity packages that are installed. As of this printing, the following are available, UNIX, TELNET, LAT, 3270, TN3270, TN5250, TCP/IP, DECnet, NetBIOS, X.25, SERIAL, SAB, APPC, 4GL/RF, CHECK, Other, and DAMON.

The handler refers not only to the type of connectivity that the application/ host works under, but also to the software that process (handle) that application/host in the PowerNet server. The following tables show the relationship between specific connectivity packages, handlers, and terminal software.

Terminal Emulation Connectivity	Handler	Application Interface	Terminal Software
TCP/IP Ethernet	VTERM PTTY	VT100 VT220 HP700/92 Pseudo TTY Pseudo TTY	CCP SVTP SATP Custom SVTP SATP Custom
TCP/IP Token Ring	VTERM	VT100 VT220 HP700/92 Pseudo TTY Pseudo TTY	CCP SVTP SATP Custom SVTP SATP Custom
SNA 3270 Token Ring	3270	SNA 3270	CCP

Terminal Emulation Connectivity	Handler	Application Interface	Terminal Software
SNA 3270 SDLC RS-232	3270	SNA 3270	WHIP
SNA 3270 SDLC V.35	3270	SNA 3270	WHIP
TN3270 Ethernet	TN3270	TN3270	WHIP
TN3270 Token Ring	TN3270	TN3270	WHIP
SNA 5250 SDLC RS-232	5250	5250	WHIP
SNA 5250 SDLC V.35	5250	5250	WHIP
DECnet LAT	VTERM PTTY	VT100 V220 Pseudo TTY	WHIP SVTP SATP Custom
Serial	VTERM PTTY	VT100 VT220 HP700/92 Pseudo TTY Pseudo TTY	WHIP SVTP SATP Custom SVTP SATP Custom
VTERM	VTERM	VT100 VT220 HP700/92 Pseudo TTY Pseudo TTY	WHIP SVTP SATP Custom SVTP SATP Custom
SoftServer(All Variants)	VTERM PTTY	VT100 VT220 HP700/92 Pseudo TTY Pseudo TTY	WHIP SVTP SATP Custom SVTP SATP Custom

Client Streaming Connectivity	**Handler**	**Application Interface**	**Terminal Software**
TCP/IP Ethernet	TCP/IP	UNIX STEP Enablers	STEP, Custom
TCP/IP Token Ring	TCP/IP	UNIX STEP Enablers	STEP, Custom
DECnet	DECNET	VAX/VMS STEP Enabler	STEP, Custom
NetBIOS	NetBIOS	STEP Enablers	STEP, Custom
SAB Emulation	SAB	Symbol SAB	STEP, Custom
Serial	Serial	Custom	STEP, Custom

In addition to this information, please see the specific *Reference Manual* for more information about completing this form.

Once a handler is chosen, press the <Enter> key to view the specific *Handler Setup Form.* Again, please see the *Reference Manual* for more information.

Use the right <Arrow> key to proceed to the *Active* field. Initially the *Host List* option is not active, when it is completely configured, use the <Tab> key to make the option active, and it appears in the *Host List* on the RF terminal.

Activity Report

The system accounting facility (SAC) generates network load and volume statistics for all nodes on each RF LAN. It creates an accounting file, *s1sac.dat,* that does not wrap and grows to a maximum of 2 megabytes. The file can be removed at any time and is re-created at the next interval. By default, the system automatically generates a summary report text file every Monday morning at 1:00 a.m. and then removes the accounting file.

The data is displayed in activity reports that include traffic summaries with packet, data, and error count totals, LAN and transceiver load distributions, throughput, and error rates.

When *Activity Report* is selected, *RF Network Traffic Summary By Time Of Day* reports are displayed on screen, by date (see Figure 8-24). Press <Enter> at the colon (:) to display the next screen.

RF NETWORK TRAFFIC SUMMARY
BY TIME OF DAY
4/29/94

	Data				Exceptions					
			Percent			Percent				
Time	Packets	Bytes	Recv	Xmit	Total	Total	Nak	Rnak	Dup	Rsnd
1:00am	0	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0
2:00am	0	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0
3:00am	0	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0
4:00am	0	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0
5:00am	0	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0
6:00am	0	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0
7:00am	0	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0
8:00am	0	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0
9:00am	276	2274	50.0	50.0	0	0.0	0.0	0.0	0.0	0.0
10:00am	1240	13568	50.0	50.0	6	0.5	33.3	0.0	66.7	0.0
11:00am	353	2581	50.1	49.8	12	3.3	0.0	0.0	100.0	0.0
12:00pm	212	1643	50.0	50.0	12	5.4	0.0	0.0	100.0	0.0
1:00pm	0	0	0.0	0.0	12	100.0	0.0	0.0	100.0	0.0

:

Figure 8-24 Traffic Report - By Time Of Day

Information is shown on an hourly basis and is organized as data packets and exceptions, which are errors (NAKs, RNAKs) duplicate packets, and resends. Columns are totaled at the end of the 24 hour report. These reports give an indication about the total activity at the site.

After all of the traffic reports appear, the next set of reports are displayed for the same dates by pressing the <Enter> key. These are *RF Network Traffic Summary By Terminal Reports* (see Figure 8-25).

RF NETWORK TRAFFIC SUMMARY
BY TERMINAL
4/29/94

	Data				Exceptions					
			Percent			Percent				
Terminal	Packets	Bytes	Recv	Xmit	Total	Total	Nak	Rnak	Dup	Rsnd
65	1845	18143	50.0	50.0	174	8.6	1.1	0.0	98.8	0.0
67	480	3750	50.0	50.0	0	0.0	0.0	0.0	0.0	0.0
	2325	21893	50.0	50.0	174	7.0	1.1	0.0	98.8	0.0

Figure 8-26 Traffic Report - By Terminal

The terminal reports can show trends such as an RF terminal that is operating marginally. The third report, displayed by pressing *Enter*, is the *Active Node Summary By Time Of Day*. It is shown in Figure 8-27. It displays the number of terminals and transceivers active during each one hour interval. It can indicate trends such as few terminals were powered on at certain hours, or only certain LANs were being used.

```
                      ACTIVE NODE SUMMARY
                        BY TIME OF DAY
                           4/29/94

                     Pct.        Pct.                  Pct.
         Terminals of Max LANs of Max Transceivers of Max
======== ========= ====== ==== ====== ============ ======
  1:00am         0    0.0    0    0.0            0    0.0
  2:00am         0    0.0    0    0.0            0    0.0
  3:00am         0    0.0    0    0.0            0    0.0
  4:00am         0    0.0    0    0.0            0    0.0
  5:00am         0    0.0    0    0.0            0    0.0
  6:00am         0    0.0    0    0.0            0    0.0
  7:00am         0    0.0    0    0.0            0    0.0
  8:00am         0    0.0    0    0.0            0    0.0
  9:00am         1   50.0    1   50.0            1   33.3
 10:00am         2  100.0    2  100.0            3  100.0
 11:00am         2  100.0    1   50.0            2   66.7
 12:00pm         2  100.0    1   50.0            1   33.3
  1:00pm         1   50.0    1   50.0            1   33.3
  2:00pm         1   50.0    1   50.0            1   33.3
:
```

Figure 8-27 Active Node Summary - By Time Of Day

When all of the reports have been displayed, the PowerNet server prompts to save the reports to a file, *sac.rep*, confirm to save and press <Enter>.

The *s1sac.dat* file from which the reports are derived, can be exported to a *Windows*-based program, *RFstats*, for graphical analysis. Or, the file can be exported to any user-defined program. The accounting interval is controlled through the *RF Network Setup Form* and is normally set to 600.

The field definitions for each line entry of *s1sac.dat* are as follows:

Field	**Definition**	
1.	Sequence	Interval number
2.	Interval	Interval size in seconds
3.	LAN	Network number
4.	Base	Transceiver number
5.	Terminal	Terminal number
6.	LAN load	Total number of nodes attached (Note 1: Year)
7.	Base load	Total number of terminals attached (Note 1: Month)
8.	TX packets	Packets transmitted (Note 1: Day)
9.	RX packets	Packets received (Note 1: Hour)
10.	TX data	Data bytes transmitted (Note 1: Minute)
11.	RX data	Data bytes received (Note 1: Second)
12.	NAK errors	NAKs received from terminal
13.	RNAK errors	NAKs sent to terminal

14. DUP errors Duplicates received from terminal
15. Timeout errors Timeouts awaiting terminal ACKs

Note 1: Field content when unit (network, transceiver, and terminal) number is zero.

Performance Report

Performance Reports help gauge the real-time and application response times of your system. The information can be displayed in graphical and tabular formats. When this option is selected, the program prompts for the format. A graphical display of transaction time is shown in Figure 8-28.

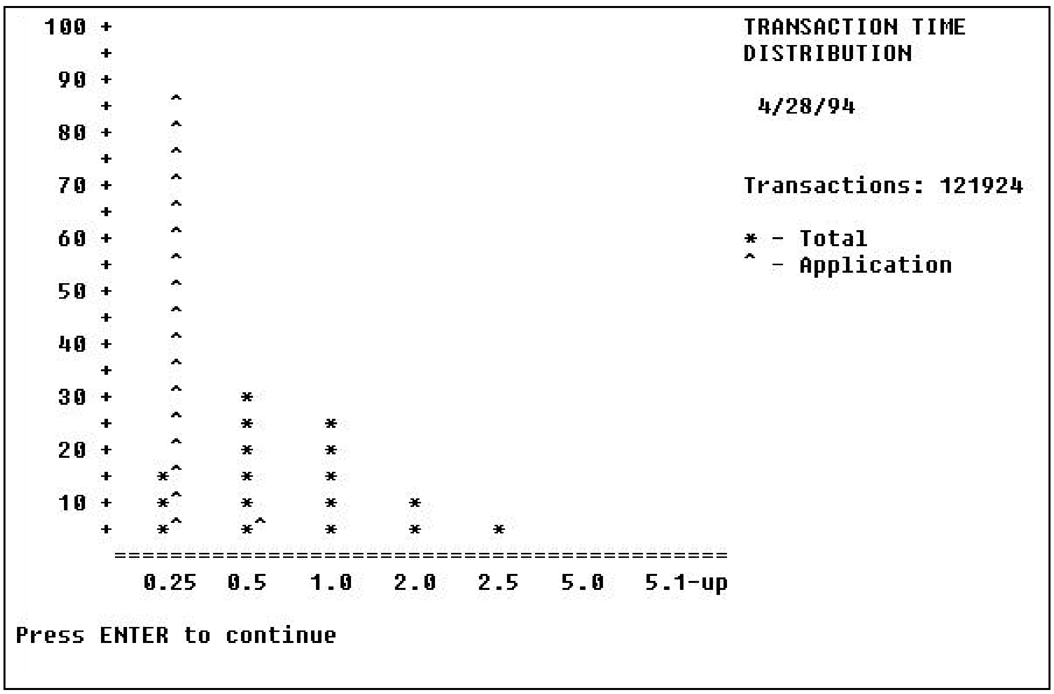

Figure 8-28 Transaction Time Distribution Graph Format

The unit for the Y-axis is transactions in percent and, for the X-axis, is time in seconds. The same data is shown in tabular format in Figures 8-29 and 8-30. Note that the data in tabular format is shown on two screens and <Enter> is pressed to display the rest of the data, as well as the next set of data. Columnar data is summed at the end of the report.

TRANSACTION VOLUME
AND
REAL TIME DISTRIBUTION BY PERCENTAGE
4/28/94

Time	Total Transactions	0.00 to 0.25	0.26 to 0.50	0.51 to 1.00	1.01 to 1.50	1.51 to 2.00	2.01 to 5.00	5.01 and up
		+-----------	Range	In Seconds			----------	+
1:00am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2:00am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3:00am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4:00am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5:00am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6:00am	72	23.6	36.1	11.1	16.7	8.3	4.2	0.0
7:00am	10083	18.8	30.8	25.7	14.6	6.7	3.0	0.2
8:00am	11159	19.3	29.8	24.8	15.8	6.6	3.5	0.2
9:00am	10128	20.7	31.5	26.5	11.3	7.1	2.8	0.2
10:00am	9977	19.6	31.7	26.8	11.5	6.7	3.5	0.2
11:00am	9283	17.2	30.3	28.1	12.4	7.9	3.8	0.2

:

Figure 8-29 Transaction Vol. & Real Time Distribution

TRANSACTION VOLUME
AND
APPLICATION PROCESSING TIME DISTRIBUTION BY PERCENTAGE
4/28/94

Time	Total Transactions	0.00 to 0.25	0.26 to 0.50	0.51 to 1.00	1.01 to 1.50	1.51 to 2.00	2.01 to 5.00	5.01 and up
		+-----------	Range	In Seconds			----------	+
1:00am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2:00am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3:00am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4:00am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5:00am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6:00am	67	98.5	0.0	0.0	0.0	0.0	1.5	0.0
7:00am	9923	86.5	10.4	1.8	0.6	0.2	0.4	0.1
8:00am	11112	88.8	8.4	1.0	1.4	0.2	0.2	0.1
9:00am	10067	90.0	6.3	1.4	1.7	0.2	0.2	0.1
10:00am	9936	88.2	8.0	2.1	1.2	0.2	0.2	0.1
11:00am	9257	87.8	7.1	2.0	2.5	0.3	0.2	0.1

:

Figure 8-30 Transaction Volume and Application Processing

The second graphical display is the *Record Size Distribution*, shown in Figure 8-31.

```
100 +                                          RECORD SIZE
    +                                          DISTRIBUTION
 90 +   *
    +   *                                       4/28/94
 80 +   *
    +   *
 70 +   *                                      Receive : 121190
    +   *                                      Transmit: 121086
 60 +   *^
    +   *^                                     * - Receive
 50 +   *^                                     ^ - Transmit
    +   *^
 40 +   *^
    +   *^
 30 +   *^
    +   *^
 20 +   *^            ^
    +   *^            ^
 10 +   *^            ^
    +   *^            ^     ^     ^
     ======================================
        23    46    92    184   368   512

Press ENTER to continue
```

Figure 8-31 Record Size Distribution

The same data is shown in tabular format in Figures 8-32 and 8-33.

RECEIVED RECORD SIZE
DISTRIBUTION BY PERCENTAGE
4/28/94

		+------------ Size Range in Bytes ------------+					
Time	Total	0-23	24-46	47-92	93-184	185-368	369-512
1:00am	0	0.0	0.0	0.0	0.0	0.0	0.0
2:00am	0	0.0	0.0	0.0	0.0	0.0	0.0
3:00am	0	0.0	0.0	0.0	0.0	0.0	0.0
4:00am	0	0.0	0.0	0.0	0.0	0.0	0.0
5:00am	0	0.0	0.0	0.0	0.0	0.0	0.0
6:00am	67	89.6	10.4	0.0	0.0	0.0	0.0
7:00am	9936	95.2	4.3	0.4	0.0	0.0	0.0
8:00am	11117	95.3	4.2	0.4	0.0	0.0	0.0
9:00am	10069	93.7	5.9	0.4	0.0	0.0	0.0
10:00am	9945	94.6	4.5	0.8	0.0	0.0	0.0
11:00am	9264	93.3	6.0	0.7	0.0	0.0	0.0
12:00pm	3319	91.8	6.9	1.2	0.0	0.0	0.0
1:00pm	11922	93.9	4.8	1.3	0.0	0.0	0.0
2:00pm	9931	94.5	4.9	0.6	0.0	0.0	0.0

Figure 8-32 Received Record Size Distribution

```
                      TRANSMITTED RECORD SIZE
                     DISTRIBUTION BY PERCENTAGE
                              4/28/94

                    +------------ Size Range in Bytes ------------+
    Time      Total    0-23   24-46   47-92  93-184 185-368 369-512
======== ========== ======= ======= ======= ======= ======= =======
  1:00am          0     0.0     0.0     0.0     0.0     0.0     0.0
  2:00am          0     0.0     0.0     0.0     0.0     0.0     0.0
  3:00am          0     0.0     0.0     0.0     0.0     0.0     0.0
  4:00am          0     0.0     0.0     0.0     0.0     0.0     0.0
  5:00am          0     0.0     0.0     0.0     0.0     0.0     0.0
  6:00am         67    55.2     0.0    32.8     6.0     6.0     0.0
  7:00am       9923    62.4     0.1    14.9     8.0    14.6     0.0
  8:00am      11112    64.0     0.1    15.0     5.8    15.1     0.0
  9:00am      10067    62.8     0.1    22.0     7.3     7.8     0.0
 10:00am       9936    63.2     0.1    21.8     8.6     6.2     0.0
 11:00am       9257    62.8     0.2    19.7    10.2     7.0     0.0
 12:00pm       3318    58.0     0.0    20.2    14.7     7.0     0.0
  1:00pm      11916    63.1     0.2    20.0     7.4     9.2     0.0
  2:00pm       9928    63.1     0.0    21.6     7.4     7.9     0.0
:
```

Figure 8-33 Transmitted Record Size Distribution

When all of the reports have been displayed, the PowerNet prompts to save the reports to a file, *prf.rep*. Confirm to save and then press <Enter>.

The *s1prf.dat* file, from which the reports are derived, can be exported to a *Windows*-based program, *RFstats*, for graphical analysis. (Please see your sales representative for more information.) Or, the file can be exported to any user-defined program.

The field definitions for each line entry of *s1prf.dat* are as follows:

Field	**Description/Value**
1	Sequence Number
2	Elapsed Time in Seconds
3	Unit Number
4	End-End Transaction Times 0ms to 250ms (Note 1: Year)
5	End-End Transaction Times 251ms to 500ms (Note 1: Month)
6	End-End Transaction Times 501ms to 1000ms (Note 1: Day)
7	End-End Transaction Times 1001ms to 1500ms (Note 1: Hour)
8	End-End Transaction Times 1501ms to 2000ms (Note 1: Minute)
9	End-End Transaction Times 2001ms to 5000ms (Note 1: Second)
10	End-End Transaction Times over 5001ms
11	Application Transaction Times 0ms to 250ms
12	Application Transaction Times 251ms to 500ms
13	Application Transaction Times 501ms to 1000ms
14	Application Transaction Times 1001ms to 1500ms
15	Application Transaction Times 1501ms to 2000ms
16	Application Transaction Times 2001ms to 5000ms
17	Application Transaction Times over 5001ms

18	Receive Records Size 0-23 bytes
19	Receive Records Size 24-46 bytes
20	Receive Records Size 47-92 bytes
21	Receive Records Size 93-184 bytes
22	Receive Records Size 185-368 bytes
23	Receive Records Size 369-512 bytes
24	Transmit Records Size 0-23 bytes
25	Transmit Records Size 24-46 bytes
26	Transmit Records Size 47-92 bytes
27	Transmit Records Size 93-184 bytes
28	Transmit Records Size 185-368 bytes
29	Transmit Records Size 369-512 bytes

Note 1: Field content when Unit Number (field 3) is zero.

Diagnostics

The *Diagnostics* facility, available from the *RF Network Menu*, provides a software tool that tests transceivers and their connections. When tests are run, the PowerNet server sends request packets to transceivers. They respond with reply packets that contain information from internal registers. In addition, a transceiver may send packets to other transceivers. While test are being run, there is a risk of affecting performance, especially on large systems. Note: If transceivers seem to disappear during the test indicates a cabling problem.

The information, including errors that occur, is recorded in real-time on the screen and can be examined for each transceiver as it is tested. Determination of transceiver malfunction can be drawn from these results and from the complete statistics displayed with the *Transceiver* specification option.

When *Diagnostics* is selected, the screen shown in Figure 7-24 is shown. The transceiver address is contained in the first two columns, *LAN* and *Tran*. Here, the transceiver to the left is 00-03, and the one in the center is 00-04 (leading zeros are not displayed). The *Packets* register displays the total packets transmitted and received by the transceiver and the *Errors* register totals all errors that occur during the test. Initially all transceivers are shown with *Packet* and *Error* totals of zero.

At the bottom of the screen are choices for running the test in various modes. Three modes of packet transmission are available, *Alternate*, *Continuous*, and *Simultaneous*.

Alternate Press <A> to use the alternate mode, where each transceiver, on each LAN, is tested separately (alternately). Request packets are sent to a transceiver, replies gathered, and totals recorded before the next transceiver is tested. A total of approximately 1000 packets are involved in each test. The test stops when each transceiver has been tested once. Results of a diagnostic, run in alternate mode, is shown in Figure 8-34.

```
                              RF TRANSCEIVER DIAGNOSTICS

 LAN Tran Packets Errors    LAN Tran Packets Errors    LAN Tran Packets Errors
   0    3    1002      0      0    4    1014      0




    <ESC>=QUIT <A>=ALTERNATE <C>=CONTINUOUS <S>=SIMULTANEOUS <T>=TRANSCEIVER
```

Figure 8-34 Diagnostics Form - Alternate Test Results

Continuous Press <C> to run the diagnostic test in continuous mode, where the test repeats until stopped manually. Each transceiver runs through one cycle of approximately 1000 packets, then a second round of all transceivers is tested. This continues until <Del> is pressed. The continuous mode is particularly useful for diagnosing **intermittent** transceiver problems which may not be immediately apparent.

Simultaneous Press <S> to test transceivers simultaneously, where every transceiver receives and transmits packets at the same time. The test ends when all transceivers have received at least 1000 packets. Usually the serial transceiver has received/transmitted many more than 1000 packets when the furthest downstream, coaxial transceiver, reaches 1000. Sample results of this test are shown in Figure 8-35.

```
                              RF TRANSCEIVER DIAGNOSTICS

 LAN Tran Packets Errors    LAN Tran Packets Errors    LAN Tran Packets Errors
   0    3    2921      0      0    4    1004      2
```

Figure 8-35 Simultaneous Mode Diagnostics Result

Once a test is finished, the complete results may be viewed for each transceiver. Press <T> to select the specific transceiver and then enter the address when prompted. The statistical information is shown in Figure 8-35 for the serial transceiver, 00-03, displayed in Figure 8-36.

```
Statistics For Transceiver 0-03

  Coax Communications                        Checksum
      638 Pkts received                            0 Remote Checksum Errors
      360 Pkts transmitted                         0 Base RF Checksum Errors
        0 Serial errors reported                   0 Coax Checksum Errors
        0 Invalid pkt size                         0 Serial Checksum Errors
        0 Missed tail interrupts             Scheduler
  Serial Communications                        98087 Entered
      720 Serial Pkts received                106393 No scheduled tasks
     1203 Serial Pkts transmitted             125844 Hi priority tasks
        0 Serial Errors                       107198 Mid priority tasks
  Remote Communications                       102408 Low priority tasks
        0 Remote Pkts received
        0 Remote Pkts transmitted
        0 Missed exchanges
        0 Distress calls
        0 Too busy
```

Figure 8-36 Serial Transceiver Results

The statistical information for the coaxial transceiver, 00-04, is shown in Figure 8-37.

```
Statistics For Transceiver 0-04

  Coax Communications                        Checksum
      360 Pkts received                            2 Remote Checksum Errors
      638 Pkts transmitted                         0 Base RF Checksum Errors
        0 Serial errors reported                   0 Coax Checksum Errors
        0 Invalid pkt size                         0 Serial Checksum Errors
        0 Missed tail interrupts             Scheduler
  Serial Communications                       117276 Entered
        0 Serial Pkts received                 87204 No scheduled tasks
        4 Serial Pkts transmitted             129971 Hi priority tasks
        0 Serial Errors                        99599 Mid priority tasks
  Remote Communications                        95251 Low priority tasks
        2 Remote Pkts received
        0 Remote Pkts transmitted
        0 Missed exchanges
        0 Distress calls
        0 Too busy



 Hit any key to continue
```

Figure 8-37 Coaxial Transceiver Results

Appendix A   RF Networks

Introduction

The PowerNet server manages all attached RF LANs and completes the data path between the terminals and host. This chapter reviews Spectrum One and Access Point networks along with PowerNet server RF management features.

Spectrum One LANs

Spectrum One Networks are proprietary (of Symbol Technologies) RF LANs using cellular, Spread Spectrum technology. A wired backbone of transceivers connects to the Portable RF terminals obtain data by scanning bar codes or from operator input. Data is transmitted to transceivers, passed to the PowerNet server, and then to the host (see Figure A-1). The reverse path is used for data sent from the host.

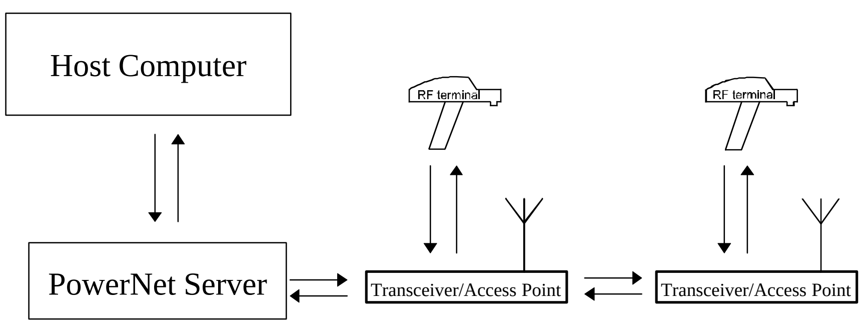

Figure A-1 Data Path

LAN Components

The components of a Spectrum One Release 2 Network are listed in the following sections along with the functions they perform.

PowerNet Server

The PowerNet server performs the controlling and maintenance functions for the RF LAN, and also provides access to the host. At times, the PowerNet server can also act as a host with the application program(s) installed on its hard disk. A multitasking UNIX operating system makes this possible. Note: Caution must be used in multitasking situations. (See the *Soft NCU Installation Manual*).

There are several different models of the PowerNet server, but all provide the same basic functions that are necessary for proper operation of the wireless LAN. These include:

- Management of all radio functions. Assignment of 6 RF operating channels is made to each transceiver, cradle, and RF terminal. One chipping sequence is assigned to all devices so they all can decipher RF transmissions on a per LAN basis.

- Data packaging of terminal information which is sent to the host and proper formatting of replies sent to terminals. This is in accordance with specific connectivity protocol(s) being used.

- Address management for LANs, transceivers, terminals, and cradles using Spectrum One and Access Point definitions.

- Providing serial connections for the attachment to the first transceiver of each Spectrum One RF LAN (sometimes referred to as the serial transceiver or serial base). Up to 32 serial ports for RF LANs can be installed on each PowerNet server.

- Providing Ethernet connectivity to TCP/IP networks for terminal access via Access Points.

Transceivers

Note: Only Release 2 transceivers or Access Points (see below) can be used with this release of the system.

Transceivers provide the communication link between the RF terminals and the PowerNet server, sending data packets back and forth. Transceivers contain a radio unit for communication with terminals. An antenna is installed on each transceiver. Transceivers are connected to a coaxial bus/cable and the first transceiver on the bus is connected by a serial cable to the PowerNet server.

Transceivers and terminals act as a cellular network. When terminals are taken too far from the transceiver they are communicating with, the terminal sends out a distress signal, Distress Call Report (DCR). When the DCR is received by other transceivers, it causes the PowerNet server to reassign that terminal to the transceiver best receiving the DCR. This is called *handing off* the terminal to another transceiver.

Release 2 transceivers, with firmware v2.0.4 and above, can operate at either 57.6 or 19.2 Kbaud. Firmware v2.06 and above can operate at 57.6, 38.4, or 19.2 Kbaud. Firmware v2.14 and above can operate at 57.6, 38.4, 19.2 Kbaud, as well as 9600 baud. This does not require any hardware/software changes at the transceiver level as transceivers incorporate automatic detection and selection of the appropriate baud rate.

Access Points

Access Points (APs) are devices that provide a communications link between remote RF terminals and an Ethernet network using a wireless protocol defined under IEEE standard 802.11. The PowerNet server also sits on this Ethernet backbone and provides data management/optimization functions for the Access Points.

Similar to transceivers, Access Points contain a radio unit for communication with terminals. An antenna is installed on each access point. Access points are connected to either a coaxial Ethernet backbone (10base2) or to a hub using twisted pair wiring (10baseT). In some cases, Access Points can also support PPP connections to a TCP/IP network. These Access Points and the data transferred to and from the remote terminals are managed by the PowerNet server.

Cradles

Terminal cradles perform battery recharging for RF terminals. A second important function is for downloading of files and information. Software files that provide operating instructions for terminals can be downloaded from the PowerNet server to terminals that are placed in cradles. RF channel selection and chipping sequences are also given to terminals when they are placed in cradles for configuration. The cradle is connected to the PowerNet server via a serial port and is sometimes referred to as the cradle network. Cradles can be daisy chained together if there is a need for charging many terminals.

Terminals

Various models of RF terminals can be used, some with scanners, some wrist-mounted, others re attached to vehicles. All have radios that communicate with transceivers or Access Points and have screens and keyboards that allow the user to log in to the system.

The main function of a terminal is to send collected data to the host and respond to replies from the host. Communication is accomplished via RF transmissions to and from the transceiver/access point, which communicates with the PowerNet server.

Terminal Software

All terminals must have a program loaded in order to operate on a wireless network. These commands are issued by host applications and/or the PowerNet server communicating with the terminal. The following terminal programs are available as of the release of this document:

- Wireless Handheld Interface Program (WHIP)
- Wireless Hardware Access Point (WHAP)
- Symbol Terminal Enabler Program (STEP)
- Symbol ANSI Terminal Program (SATP)
- Symbol VT100 Program (SVTP)

WHIP is shipped with the PowerNet server. It supports VT-100, VT-220, HP700/92, 3270, and 5250 terminal emulations. STEP, SVTP, and SATP must be purchased separately. Symbol STEP is supported by the PowerNet server SAB Emulation Connectivity and STEP Enabler products. SVTP and SATP are supported by the Pseudo-TTY software which is now included with the VTerm Connectivity package and with all Soft NCU packages. *Symbol* products are proprietary to Symbol Technologies.

Custom terminal applications are supported by *Client Streaming* packages. In these implementations, the PowerNet server acts as a pass-through routing device. The host application interface is described in Appendix A, *Client Streaming API*.

Note All of these programs are downloaded to terminals as **.HEX** files and the procedures for this are explained in earlier chapters.

Cabling Options

Spectrum One Networks

Spectrum One network cabling consists of two segments, a serial connection from the PowerNet server to the first transceiver and transceiver-to-transceiver backbone cabling (see Figure A-2).

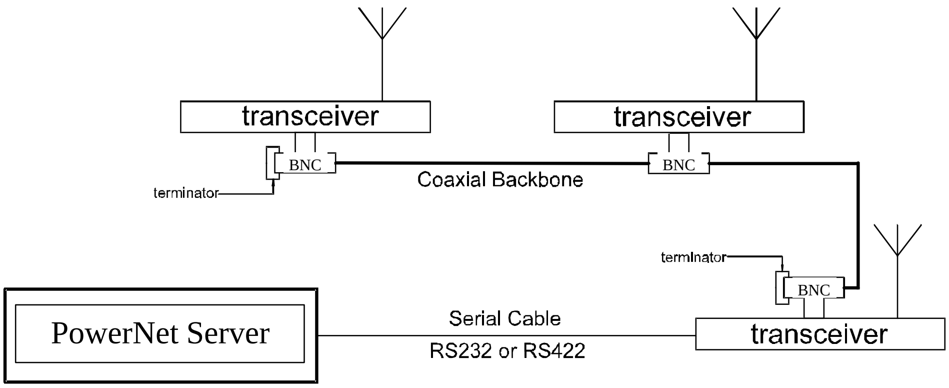

Figure A-2 RF LAN Cabling

The serial cabling can be either RS-232 or RS-422 (RS-422 being recommended). **RS-232 cabling should not be used for distances exceeding 10 feet for networks running at 57.6 Kbaud**. At 19.2 Kbaud, it can be used for up to 50 feet.

An RS-232 to RS-422 converter is needed to use RS-422 cabling and it is inserted at the connection from the PowerNet server. RS-422 cabling can be used for distances up to 1,000 feet. This length can be extended if a second converter is inserted before the first transceiver for signal amplification. Use shielded 4-wire twisted pair cable for RS-422 and shielded 22 AWG stranded cable for RS-232.

The backbone coaxial cable length can extend for longer distances using RJ-58 coaxial cable. Transceivers are attached with BNC T-connectors. A 50-ohm terminator is placed at each end of the cable.

Converters

When RS-232 to RS-422 converters are used with Spectrum One networks, the cable pinouts are as follows:

Signal	Converter Pin Number		Transceiver Pin Number
+ data from transceiver	17	—	11
- data from transceiver	5	—	13
- data to transceiver	2	—	23
+ data to transceiver	14	—	25
signal ground (shield)	shield	—	shield

Access Point Networks

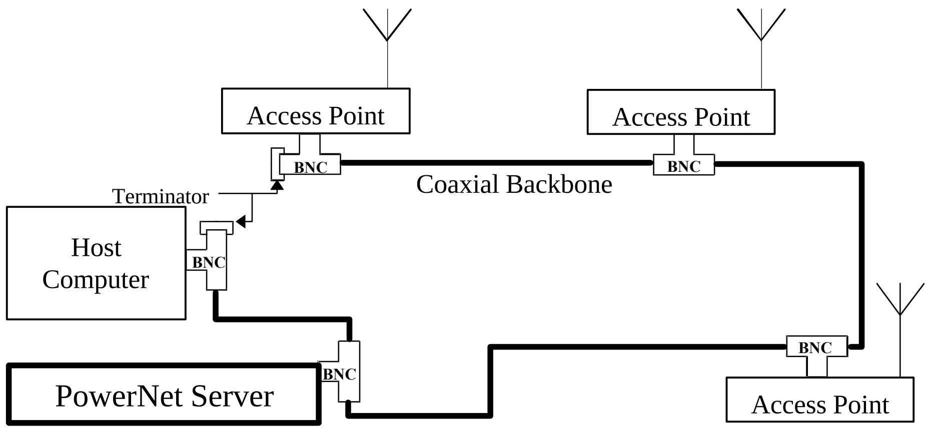

Figure A-2a RF LAN Coaxial Configuration

Figure A-2a shows a simple LAN connected with a coaxial-backbone cable. Access Points and the PowerNet server are attached to the coaxial cable with BNC T-connectors. (The host computer is not connected to the coaxial backbone in cases of the host's using SDLC, Token Ring, etc.) Access Points use standard Ethernet cabling and can use conventional Ethernet wiring schemes. The backbone coaxial cable length can extend up to 600 feet using coaxial cable. Distances may be increased with repeaters if needed.

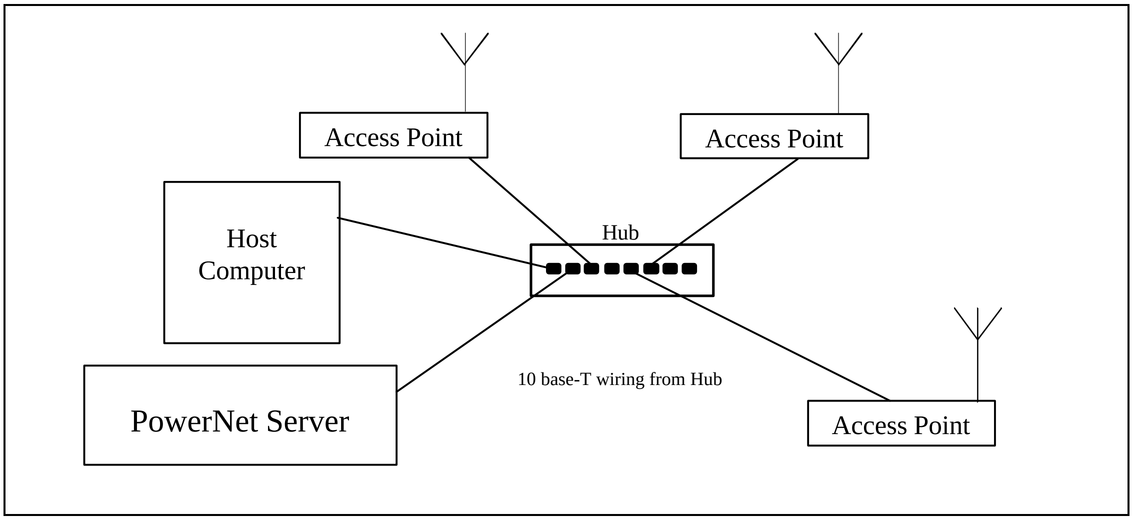

Figure A-2b RF LAN Hub Configuration

Figure A-2a shows a simple Hub-LAN connected with 10 base-T Ethernet. Access Points and the PowerNet server are attached to the Hub with 10 base-T Ethernet wiring. The cable length is limited by the standard Ethernet constraints. (As above, the host computer is not connected to the coaxial backbone in cases of the host's using SDLC, Token Ring, etc.)

MultiLAN Capabilities

With the use of multiport adapters, 2,4,8,16, or 32 serial ports for RF LANs can be added to a PowerNet server. These serial ports can be configured for transceiver and cradle LANs, which are all managed by the PowerNet server.

WANs

Wide area networks (WANs) can be implemented when the RF LAN(s) must be in a location remote from the PowerNet server. An example is when the host connection must be directly attached to the PowerNet server and the site is miles away.

Leased and T1 lines, as well as satellite and microwave links, have been used to connect serial ports on the PowerNet server to the first transceiver of remote Spectrum One networks. Ensure that there is no latency in the data communications equipment and that it does not require flow control.

Component Addresses

Spectrum One Networks

A numbering scheme, used by Spectrum One LANs, makes all components addressable. Since multiple LANs require specifying to which LAN a component belongs, LAN numbering is modified to include the LAN number as explained in the following paragraphs. The component numbering scheme is shown below:

Addresses	Component
0-2	Reserved
3-62	Transceivers
63	Reserved
64	Cradle
447	Terminals

LANs are numbered with a zero-relative numbering scheme with the first LAN designated 00 and the second, 01. When selecting components, these formats are used.

LAN#
LAN#-Transceiver#
LAN#-Cradle#
Terminal#

For example, 02-15 would specify the transceiver with address number fifteen on the third LAN (LAN 02).

Access Point Networks

Access Points are assigned IP addresses based on the network to which they are attached. Since the display software uses the last two octets of the IP address to identify equipment, it is suggested (though not required) that all Access Points and Stations be assigned IP addresses that are unique in these two octets (i.e., 206.181.*90.1* and 206.181.*90.2*).

RF Communications

Radio frequency (RF), wireless communications have proved to be one of the fastest and most accurate ways of collecting data in situations that require user mobility. Spread Spectrum and narrowband communications can be used to fill the RF requirement, but Spread Spectrum is proving to be the radio technology of choice.

Spread Spectrum Technology

Originally developed by the military, Spread Spectrum technology is now used for business sites such as warehouses, department stores, airports, shipping companies, or any business where data connection radio technology is beneficial.

Spread spectrum use does not require an FCC license. It is a redundant signal and therefore very robust for data delivery. It supports multiple users, withstands interference, and is resistant to interception and decoding by outside sources.

The data rate for the RF portion of the data path is 60,000 bps. The Spread Spectrum frequency range is 902 - 928 MHz and, using the spreading technique, a 1 MHz bandwidth is employed. The available frequency range has been divided up into 53 channels (49 usable), to make frequency selection easier. The signal level is low and additional range is added to the system with transceivers.

Direct sequence is used by the Spectrum One Network to distribute an output signal over the 1 MHz bandwidth. This requires a chipping sequence, which is a pseudo-random pattern of ones and zeros, to produce the output signal. Use of this technology prevents others from deciphering the transmitted data/signal.

Site Surveys

Prior to installing Spectrum One Network or Access Point equipment, a site survey should be conducted. Radio reception tests help determine the number of transceivers required for the site as well as their optimum placement. This, in turn, will help define cable lengths and installation requirements. Note there is a need to verify transaction rate *capacity*, i.e., while one transceiver may cover a large area, it will not support 50 RF terminals with a high volume transaction rate.

The site survey will provide information about RF coverage of portable terminals from all locations at the site. The quietest channels (those with the least interference) are selected, and the network is established accordingly.

As RF interference characteristics can vary over time (e.g., the store next door may start using RF equipment), the PowerNet server software includes features that allows you to determine RF activity and change channels as needed.

Frequency Scan Reports

Spectrum One Systems Only

Use the *Wireless View* utility, which is available from the *Operations Menu*, to generate Frequency Scan Reports (FSRs). The RF environment surrounding each transceiver is measured and displayed for all Spread Spectrum channels (0-52). Note that channels 0, 1, 51, and 52 are not used for data transmission.

See an example of a *Frequency Scan Report (FSR)* in Figure Appx. A-3.

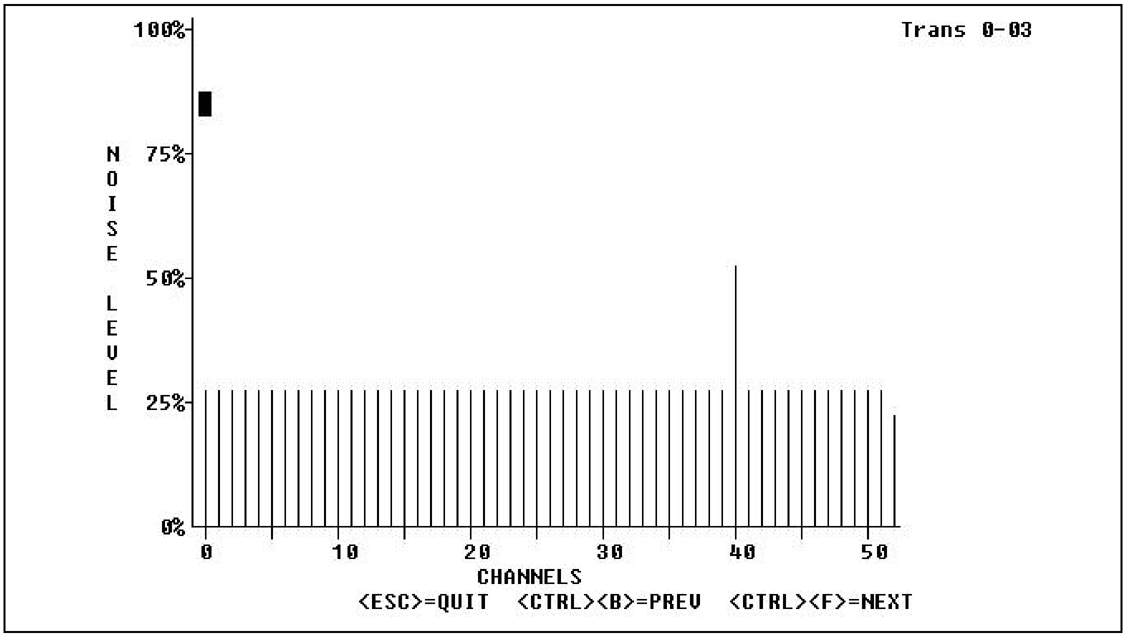

Figure A-3 Frequency Scan Report (FSR)

The X-axis of this report displays the Spread Spectrum channels 0-52. The Y-axis of the FSR is a relative measure of the noise level (RF activity) in percent. Although it is not a fixed quantity, it is suggested that a level of 50% or higher indicates that a channel should not be used. If a channel in use has a level of 50% or greater, the channel should be switched to one that is quieter (i.e., with less radio activity).

Poor data transmission may result from interference on the channel in use on a particular RF LAN. Examining *FSRs* you will usually be able to identify potential problem areas. Since interference may only occur in the vicinity of one or two transceivers, all transceivers should be examined when a problem occurs.

To select the next transceiver *FSR*, press **<CTRL><F>**, and to re-examine the previous *FSR*, press **<CTRL><B>**.

Certain combinations of transceiver firmware use a different FSR reporting convention than the one described in this manual. In this case, the channels are normally at a 0% noise level instead of the nominal 25% noise level shown in Figure Appx A-3.

WHIP-CHECK

Another change that can occur on Spectrum One Systems, once the system has been installed, is the addition of equipment that blocks transmission or reception of signal. Shelving, equipment, walls, cubicles, etc., can change the cellular coverage and lead to a need for new transceiver placement or additional transceivers.

A convenient application, *WHIP-CHECK*, has been included to check terminal-transceiver communication. The software for this application is loaded on the PowerNet server and appears on the *Host List.* It can be selected from the list on the terminal once STEP, or other terminal software, has been downloaded to the terminal and an RF session established.

Once selected, the terminal sends data packets to the PowerNet server and the PowerNet server responds with data packets. It also expects an acknowledgment (ACK) back from the terminal upon receipt of the data. As you change locations with the terminal to check transmission/reception, the performance data is displayed on the terminal and areas that are not covered or covered poorly become evident.

See *Chapter 6* for more detailed information on *WHIP-CHECK*.

RFsurvey

On Spectrum One Systems, CCP terminal software includes the ability to run another application *RFsurvey* to check terminal–transceiver communication. The software runs a loopback test between the terminal and the PowerNetNT server. It displays the particular transceiver that is communicating with the terminal for the current test and assigns an “average” grade.

This grade indicates how good the coverage is. Tests can be run with different transceivers from varying distances. Dead spots can be identified easily with this option.

RF Topology

Two types of RF topology, seamless and segmented, can be implemented when more than one RF LAN is set up. The ability to assign the same, or different, channels and chipping sequences makes this possible.

In the seamless LAN topology, two or more LANs are set to identical channels and chipping sequences, creating redundant transceiver networks in the same location. In addition, physically separated LANs can use this design to provide seamless coverage between networks. Terminals communicating with a LAN in one location can be moved to another, which has a different LAN, without affecting active terminal sessions.

Segmented LAN topology has two or more LANs set to different selections of channels and different chipping sequences. This RF topology option can be used to divide and distribute RF traffic, thus optimizing network bandwidth. Terminals communicating with transceivers on one network, will not be "heard" by the transceiver on other network(s). To make terminal configuration easier in this case, two (or more) cradle networks can be assigned the different channels and chipping sequences. If only one cradle network is available, the groups of terminals for each LAN must be configured separately to match the channels and chipping sequences in use. Note that segmentation can be full or partial.

In large installations, a combination of both of these RF topological strategies can be used. For example LAN 0, 1, 2, and 3 may be seamless transceiver LANs, while 4, 5, and 7 may be segmented transceiver LANs. Then 8, 9, 10, and 11 may be used for cradle LANs.

NOTE: When managing segmented LANs, the cradle channel list and chipping sequence can be changed without resetting the RF network.

The PowerNet server default channel and chipping sequence settings are acceptable for the majority of single or seamless multiple LAN installations. However, in the event that *Frequency Scan Reports* indicate high levels of interference on one or more of the selected channels, it may be necessary to modify the channel lists.

Access Point systems can achieve the same seamless and segmented configuration by setting the RF parameters as indicated in the Access Point Users Guide.

Crosstalk Resolution

For Spectrum One Networks Only

When two separate RF LANs are configured for seamless overlapping coverage, it is possible to introduce crosstalk between the two networks. This condition manifests itself as a high percentage (greater than two or three percent) of NAKs and RNAKs in the System Activity Reports. To prevent crosstalk between transceivers from each LAN, either of two configuration methods can be employed, full or partial segmentation.

For full segmentation, configure each RF LAN so that the first channel on each network is different and widely separated. Set a different chipping sequence for each LAN. In this configuration, the RF terminal software must be configured to switch between the two channels and chipping sequences. (See information on WHIP in Chapter 6.)

For partial segmentation,

- Configure each RF LAN so that the first channel on each network is different and widely separated.
- Set identical chipping sequences on each LAN.
- Configure the second channel on each RF LAN (and consequently the terminals that will work with each LAN) so that it matches the first channel on the other RF LAN.

When using this method, the terminals will automatically migrate between the two RF networks by switching channels as they roam from one network to the other.

The partial segmentation method has one weak point which occurs infrequently. If a transceiver becomes disconnected from the RF network for any reason, but the radio remains operational, any terminals in communication with the original transceiver do not immediately switch to another transceiver. The terminal is handed off to another transceiver only when it moves out of range of the disconnected transceiver. This is true even when the terminal is rebooted.

Physical LAN Topology

The PowerNet server software provides a visual display of current RF LAN topology with the *Wireless View* option (available from the *Operations Menu*). An example is shown in Figure A-4. The display is useful for diagnosing backbone cabling problems, malfunctioning transceivers, and terminals that are not performing properly. Note that with Access Point Network, the last two octets are displayed.

```
                            Wireless View


--------------- TOPOLOGY ------------------------- UNIT STATISTICS --
-----[redacted]
             C0-04                       ¦         LAN-Tran: 0-05
----**1------**2--------3--------4-------¦       Connection: Serial
  1    **066                             ¦           Config: COMPLETE
  2                                      ¦             Load: 2
  3                                      ¦     Total Errors: 0
  4                                      ¦          Tx NAKs: 0
  5                                      ¦          Rx NAKs: 0
  6                                      ¦          Resends: 0
  7                                      ¦       Duplicates: 0
  8                                      ¦
  9                                      ¦
 10                                      ¦
 11                                      ¦
 12                                      ¦
 13                                      ¦
 14                                      ¦
--------------------------------------------------------------------




       <ESC>=QUIT <U>=UNIT <C>=CONTROL <F>=FSR <L>=LOG <N>=NETWORK
```

Figure A-4 Topology Display

The left-hand side of the display shows transceivers that are a part of, and terminals that are logged into, each LAN. In this figure, S0-03 shown in the shaded area is the serial transceiver on LAN 0. Terminal 066 (positioned below this transceiver) is communicating with transceiver S0-03. Transceiver C0-04, is attached to the coaxial backbone cable of LAN 0, “downstream” from the serial transceiver.

Next to each terminal and below each transceiver, is a symbol that indicates the last time communication took place with the RF network. The symbols and definitions are listed below.

Symbol	Definition
**	Communicated within the last 1 minute
*	Communicated within the last 2-5 minutes
++	Communicated within the last 6-10 minutes
+	Communicated within the last 11-30 minutes
-	No communication within the last 31 minutes

Wireless View is used to monitor transceivers as they are being powered-on, one at a time. It is also used to display terminals as they are configured. If an address conflict occurs, it will be readily apparent and easily resolved (see *Chapter 5)*

Statistics, which are shown on the right-hand side of the screen, can be selected for components that are displayed. In addition, other features such as a network summary, logs, and tests are available from *Wireless View* (see *Chapter 7*).

System Testing

Several software testing and diagnostics tools are included in the PowerNet server package. They are discussed in this manual. Please see the specific product manual or on-line help for use the of those products. Also refer to Appendix E in this manual for a project management overview and tutorial.

Diagnostics Facility

This facility provides a means of testing transceivers by sending request packets from the PowerNet server to transceivers. The transceiver(s) then return(s) reply packets with data from various internal registers, giving overall error rates. The use of this facility is discussed in *Diagnostics* in Chapter 6.

Single Transceiver Testing

A similar packet transmission and reception test is available from the *Wireless View Control Menu*. This *Ping Test* option sends a packet to a specified transceiver and records whether the *Ping* was successful.

If pinging the transceiver was unsuccessful, the wiring, connectors, multiport adapter, etc., should be checked. See *Ping Test* for more information.

Dynamic Barcode Control

This section documents the methods used to control the terminal scanner both from host program control and from the controller by use of a control file. It describes the parameters used to control the active barcodes when using VTerm.

In all emulation modes (vt-100, vt-220, hp700/92), a configuration file can be created using the object editor which sets the active barcodes whenever a handheld is brought online. In addition, when using the VT-100/220 emulation, there is an extended command set which allows issuing escape sequences having most of the functionality of the configuration file. As an example, this capability could be used to turn on UPC-A when prompting the user to scan the UPC code on a case. Then UPC-A could be turned off and I2of5 turned on to input the packing code. This prevents the user from scanning the wrong type of barcode for a given field.

Add the appropriate command lines from the lists below. The only rule on sequencing the lines is that the *state* command (i.e., *dc_codabar_state*) must be the first line for that code type. The following example file enables the host TEST to scan code-39 in full ASCII mode and UPC-A with optional 5-digit supplementals.

file *test.cfb*

```
dc_code39_state=1;
dc_code39_minlen=1;
dc_code39_maxlen=30;
dc_code39_depend=1;
dc_upca_state=1;
dc_upca_minlen=0;
dc_upca_maxlen=1;
dc_upca_depend=2;
```

Note that all lines must be terminated with a semicolon (;).

Be aware of the following rules when enabling/disabling barcodes:

- When a handheld is brought online, the emulator checks for the presence of a barcode command file. If the file exists, the first action taken is to disable ALL barcodes so you must add command lines to turn back on all of the codes desired. If the file does not exist or does not contain any commands, then ALL barcodes are enabled.

- When turning a code on, **minlen**, **maxlen** and **depend** all default to zero. If the zero state is not wanted, add the modifying line.

- All other commands are NOT reset when the handheld is rebooted. For example, if you turn *on* editing and then decide later that it should be *off*, you must include the disable command in your control file.

CODABAR

dc_codabar_state—disable/enable codabar scanning

0—disabled
1—enabled

dc_codabar_minlen—minimum valid barcode length

1-54

dc_codabar_maxlen—maximum valid barcode length. The maximum length must be greater than or equal to the minimum length.

1-54

dc_codabar_red—is one valid laser sweep sufficient or does the scanner have to make two valid sweeps (redundancy)

0—codabar redundancy disabled
1—codabar redundancy enabled

dc_notis_edit—remove the stop and start characters from codabar prior to transmission to the host.

0—disabled
1—enabled

dc_clsi_edit—change 14 digit codabar into 17 digits by adding spaces after the first, fifth and tenth digits. Additionally, the start and stop characters are removed.

0—disabled
1—enabled

VT-100 Extended Command: <ESC>[?0;<state>;<minlen>;<maxlen>;0z

CODE 11

dc_code11_state—disable/enable code 25

0—disabled
1—enabled

dc_code11_minlen—minimum valid barcode length

4-54

dc_code11_maxlen—maximum valid barcode length. The maximum length must be greater than or equal to the minimum length.

4-54

dc_code11_red—is one valid laser sweep sufficient or does the scanner have to make two valid sweeps (redundancy)

0—disabled (single scan sufficient)
1—enabled (two valid scans required)

dc_code11_depend—number of check digits

0, 1 or 27

dc_code11_rptchk—should check digits be transmitted to the host

0—do not transmit
1—transmit check digits

VT-100 Extended Command:
<ESC>[?11;<state>;<minlen>;<maxlen>;<depend>z

CODE 128

dc_code128_state—disable/enable code 128 scanning

0—disabled
1—enabled

dc_code128_minlen—minimum valid barcode length

1-54

dc_code128_maxlen—maximum valid barcode length. The maximum length must be greater than or equal to the minimum length.

1-54

dc_code128_red—is one valid laser sweep sufficient or does the scanner have to make two valid sweeps (redundancy)

0—code 128 redundancy disabled
1—code 128 redundancy enabled

VT-100 Extended Command: <ESC>[?2;<state>;<minlen>;<maxlen>;0z

CODE 39

dc_code39_state—disable/enable code 39 scanning

0—disabled
1—enabled

dc_code39_minlen—minimum valid barcode length

1-54

dc_code39_maxlen—maximum valid barcode length. The maximum length must be greater than or equal to the minimum length.

1-54

dc_code39_red—is one valid laser sweep sufficient or does the scanner have to make two valid sweeps (redundancy)

0—disabled
1—redundancy enabled

dc_code39_chkb—code 39 check digit

0—check digit ignored if present and just transmitted to the host as data.
1—check digit required and must be valid.

dc_code39_depend—disable/enable full ascii code 39 interpretation.

0—disabled
1—full ascii enabled

VT-100 Extended Command: <ESC>[?3;<state>;<minlen>;<maxlen>;<depend>z

CODE 49

dc_code49_state—disable/enable code 49 scanning

0—disabled
1—enabled

VT-100 Extended Command: <ESC>[?4;<state>;0;0;0z

CODE 93

dc_code93_state—disable/enable code 93 scanning

0—disabled
1—enabled

dc_code93_minlen—minimum valid barcode length

1-54

dc_code93_maxlen—maximum valid barcode length. The maximum length must be greater than or equal to the minimum length.

1-54

dc_code93_red—is one valid laser sweep sufficient or does the scanner have to make two valid sweeps (redundancy)

0—disabled
1—enabled

VT-100 Extended Command: <ESC>[?5;<state>;<minlen>;<maxlen>;0z

I 2 of 5

dc_coded25_state—disable/enable code 25

0—disabled
1—enabled

dc_coded25_minlen—minimum valid barcode length

1-54

dc_coded25_maxlen—maximum valid barcode length. The maximum length must be greater than or equal to the minimum length.

1-54

dc_coded25_red—is one valid laser sweep sufficient or does the scanner have to +make two valid sweeps (redundancy)

0—d2of5 redundancy disabled (single laser scan sufficient for validation)
1—d2of5 redundancy enabled (two laser scans required for validation)

VT-100 Extended Command: <ESC>[?6;<state>;<minlen>;<maxlen>;0z

INTERLEAVED 2 OF 5

dc_codei25_state—disable/enable interleaved 2 of 5 scanning

0—disabled
1—enabled

dc_codei25_minlen—minimum valid barcode length

1-54

dc_codei25_maxlen—maximum valid barcode length. The maximum length must be greater than or equal to the minimum length.

1-54

dc_codei25_red—is one valid laser sweep sufficient or does the scanner have to make two valid sweeps (redundancy)

0—Interleaved 2of5 redundancy disabled
1—d2of5 redundancy enabled

VT-100 Extended Command: <ESC>[?7;<state>;<minlen>;<maxlen>;0z

EAN-13

dc_ean13_state—disable/enable EAN-13 scanning

0—disabled
1—enabled

VT-100 Extended Command: <ESC>[?8;<state>;0;0;0z

EAN-8

dc_conv_ean8to13—should ean8 barcodes be zero padded to 13 digits

0—do not pad
1—add padding zeroes

dc_ean8_state—disable/enable EAN-8 scanning

0—disabled
1—enabled

VT-100 Extended Command: <ESC>[?9;<state>;0;0;0z

PLESSEY/MSI

dc_msi_state—disable/enable code MSI scanning

0—disabled
1—enabled

dc_msi_minlen—minimum valid barcode length

4-54

dc_msi_maxlen—maximum valid barcode length. The maximum length must be greater than or equal to the minimum length.

4-54

dc_msi_red—is one laser scan sufficient or does the scanner have to make two valid scans (redundancy)

0—single scan sufficient
1—two valid scans required

dc_msi_depend—number of check digits

0, 1 or 2

dc_msi_rptchk—should check digits be transmitted to the host

0- do not transmit
1—transmit check digits

VT-100 Extended Command:
<ESC>[?10;<state>;<minlen>;<maxlen>;<depend>z

UPC-A

dc_upca_state—disable/enable UPC-A scanning

0—disabled
1—enabled

dc_upca_chkb—should the check digit be transmitted to the host

0—do not transmit
1—transmit check digit

dc_upca_preamble—transmit no prefix characters (0), prefix the number system for the code type (1), or prefix a zero followed by the code type number system (2)

0—no prefix
1—prefix the code type number system
2—prefix 0 followed by the code type number system

VT-100 Extended Command: <ESC>[?13;<state>;0;0;0z

Note In order to control supplementals, use the SUPPLEMENTAL BARCODE HANDLING sequences presented later in this chapter.

UPC-E0

dc_upce0_chkb—should the check digit be transmitted to the host

0—do not transmit
1—transmit check digit

dc_upce0_depend—expand 6 digit UPC-E0 to a 12 digit UPC-A

0—do not expand
1—expand to UPC-A

VT-100 Extended Command:
<ESC>[?14;<state>;<minlen>;<maxlen>;<depend>z

UPC-E1

dc_upce1_chkb—should the check digit be transmitted to the host

0—do not transmit
1—transmit check digit

dc_upce1_depend—expand 6 digit UPC-E0 to a 12 digit UPC-A

0—do not expand
1—expand to UPC-A

dc_upce1_preamble—transmit no prefix characters (0), prefix the number system for the code type (1), or prefix a zero followed by the code type number system (2)

0—no prefix
1—prefix the code type number system
2—prefix 0 followed by the code type number system

VT-100 Extended Command:
<ESC>[?15;<state>;<minlen>;<maxlen>;<depend>z

General UPC Options

dc_linear_upc—require decoding UPC blocks in a single sweep of the laser

0—multiple sweeps are allowed
1—UPC must decode in a single sweep

dc_upcean_security—how stringent should the UPC decode algorithm be.

0—3

dc_conv_upce1to2a—expand 6 digit UPC-E1 to a 12 digit UPC-A

0—do not expand
1—expand to UPC-A

dc_upce_preamble—transmit no prefix characters (0), prefix the number system for the code type (1), or prefix a zero followed by the code type number system (2)

0—no prefix
1—prefix the code type number system
2—prefix 0 followed by the code type number system

Supplemental Barcode Handling (UPC/EAN) Options

dc_supps_state—this flag should always be set to one.

dc_supps_minlen—two character supplementals enabled/disabled (only applies to transmit mode 1)

0—no codes with two character supplementals decoded
1—codes with two character supplementals decoded

dc_supps_maxlen—five character supplementals enabled/disabled (only applies to transmit mode 1).

0—no codes with five character supplementals decoded
1—codes with five character supplementals decoded

dc_supps_depend—supplementals transmit mode

0—no supplementals transmitted to host, supplemental enable/disable ignored
1—only codes with the appropriate supplemental (from minlen/maxlen) decoded
2—all codes sent as is, supplemental enable/disable ignored

dc_supp_max—how many passes should be made to attempt to decode UPC supplementals.

2-10

VT-100 Extended Command:
<ESC>[?12;<state>;<minlen>;<maxlen>;<depend>z

General Barcode Options

dc_xmit_codeid—if non-zero, prefix the scanned bar code with the indicated character as shown below:

A—UPC, UPCE, UPCE1, EAN13, EAN8
B—Code39
C—Codabar
D—Code 128
E—Code 93
F—Interleaved 2 of 5
G—D 2 of 5 , IATA
H—Code 11
J—MSI

0—disabled
1—enabled

dc_bidir_red—for any barcodes that have redundancy enabled, the two sweeps must be in opposite directions

0—same direction scans sufficient
1—opposite direction scans required

The VT-100 extended command below has no equivalent in the configuration file. It is used to disable ALL barcodes on the handheld. Typically this would be issued before turning on an individual barcode type just to make sure of the state of the active barcodes.

VT-100 Extended Command: <ESC>[?z

Appendix B Editors

System Editor

The system editor, which is the UNIX *vi editor*, is used by installation and support engineers to customize Gateway files. It is a full function screen-oriented text editor, but only a minimum number of keys and operations are required to use the editor effectively for file modification. Only these functions are described in this chapter. For further information, see a UNIX Operating System User Reference Manual.

The *vi* program works with any ASCII terminal keyboard with an <Esc> key. A mouse, function keys, and arrow keys are not required. The editor provides several modes of operation which make use of the available keys.

Command Mode

The command mode provides cursor positioning, editing mode, and exit/save functions. When the editor is started, it is in command mode. During operation the editor can be put into the command mode at any time by pressing <Esc>. To start editing a specific file, type the following at the command line:

`vi` ***`filename`*** **`<Enter>`**

`filename` is the name of the file to be edited. When the file opens, the cursor is positioned at the beginning of the file. Note that the *vi editor* commands are case-sensitive.

Cursor Position

When starting, place the cursor at the location of the text that needs to be changed, or where text needs to be added. The following keys provide cursor positioning from within the command mode.

Use This Key	To Move the Cursor
`<Space Bar>`	Move right one character
`<h>`	Move left one character
`<j>`	Move down one line
`<k>`	Move up one line

After the cursor has been positioned at the selected line or character, enter the edit mode.

Edit Mode

The edit mode either adds or deletes text from a file. The first four commands are used to enter the edit mode for text addition. The last two are for text deletion. The editor remains in the edit mode until <Esc> is pressed, which returns the editor to the command mode.

To append text to the file, <a> is used. Text that is typed after this command appears one space to the right of the cursor. The <i>, <o>, and <O> commands are used to insert text at the cursor position. When a new line is specified, above or below, a blank line appears with the cursor at the beginning.

Use This Key	**To Perform This Function**
`<a>`	Append (insert after current position)
`<I>`	Insert at current cursor position
`<o>`	Insert a line below current line
`<O>`	Insert a line above current line

To remove text from the file, use the following keys. Make sure that the command mode is active and the cursor is positioned on the character or line that is to be deleted, before issuing these commands. Note that the editor returns to the command mode immediately after the function is performed.

Use This Key	**To Perform This Function**
`<x>`	Delete character at current position
`<d><d>`	Delete current line

Exit

Within the command mode, the colon (:) begins a save and/or exit command sequence. The options allow the following:

- Changes made to file are saved, *vi editor* is active, and file is still open.
- Changes to the file are saved and the editor exited.
- Changes are ignored, the file closed, and the editor exited.

To begin, press <Esc> to make sure that the program is in command mode. Next enter a colon by pressing <Shift> and the <:> key. The cursor and colon are placed at the bottom of the screen. Enter the rest of the key sequence as listed below and press <Enter>.

Use This Key	**To Perform This Function**
`<:><w>`	Save the changes.

`<:><w><q>`	Save the changes and leave the editor.
`<:><q><!>`	Leave the editor, do not save changes.

Keyboard Mapping Editor

The *VTerm Handler* has a custom option that allows you to establish new keyboard layouts and functions for certain terminal keys. This function redefines new characters which are sent to the host when the key is pressed.

A key mapping object file is created with the object editor. The file name is then referenced in the *Keyboard - Mapping Object* field within the handler setup, which causes it to be loaded when VTerm is executed.

Mapping Object File

The mapping definition file is created on the PowerNet server using the Object editor. The file indicates the key that is redefined, and the new character or function and how it is handled when that key is pressed. The file is automatically created with the proper structure when created using the object editor and then referenced in the *Keyboard - Mapping Object* field of the VTerm Handler Setup screen as a value for the toggleable field.

Accessing the Mapping Object Editor

The Keyboard Mapping object editor is accessed through the *Object Editors* function from the *Main Menu* which displays a menu of object editing functions as shown in figure 10-1. For discussion here, we refer only to the *Keyboard/Mapping* function shown in this menu.

```
PowerNet Server R5.0-B03

             Main Menu
              1 Operations
              2 Spread spectrum
              3 Access Point
                Object Editors
               * 1 Keyboard/Mapping
                 2 Keyboard/Macros
                 3 Scanner/Data Mapping
                 4 Scanner/Data Editing
                 5 Scanner/Decoder Control
             1   6 Display/Mapping
             1   7 Display/Formatting
             1   8 Printer/Init
             1   9 Dialog
             1  10 Failover
             1
            *16 Object Editors
             17 Utilities

                                 <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 10-1 Keyboard Mapping Object editor selection menu

Object Menu

To work on a particular mapping object, select the *Object Menu* from the *Main Menu* bar of the keyboard mapping editor and press <Enter>. The *Object Menu* shown in Figure 10-2 is displayed.

```
 Object - Setup - Format - Info - eXit
 Directory
 New
 Load
 Save
 Copy
```

Figure 10-2 Mapping Object Menu

The object can be loaded into memory with two selections, which are the *Directory* and *Load* options. The *New* option clears memory for creation/loading of new objects, *Save* allows the user to save formatted sessions and *Copy* allows copying of previously captured host screens or formatted sessions.

Mapping Object Menu   Directory

Select *Directory* to view a list of all the keyboard mapping objects available to the system (see Figure 10-3).

```
-Object - Setup - Format - Info - eXit ----------------------
 D  Directory
 N  * sample1.380046
 L    bob.380046
 S    test.380046
 C    matt.380046
      bo-spec
      bob-spec.380046
      3510.350047
      tedst.380046
      380046.
```

Figure 10-3 Mapping Object Directory List

Use the up/down <Arrow> keys to select a mapping object from the list and press <Enter>. An *Object Selection Form* (see Figure 10-4) appears with the object that was selected and is loaded in parentheses.

```
Object (sample1):
```

Figure 10-4 Mapping Object Selection Prompt

If this is the correct mapping object to load, press <Enter>. If not, type in the name of the object to load at the colon (:), then press <Enter>. The object is then loaded into system memory.

Mapping Object Menu   New

The *New* option clears system memory during a mapping session and create a fresh mapping object into which host screens can be captured.

Mapping Object Menu   Load

The *Load* option can be used if the name of the object is known and if you do not need to view a list. Select *Load* and the *Object Selection Form*, shown in Figure 10-4, is displayed. Type in the name of the object to load, which overrides the default that appears in parentheses. Press <Enter> to load the object.

Mapping Object Menu Save

The *Save* option saves all mapping session work. It is good to use *Save* frequently during a keyboard mapping session. If the mapping is exited improperly, all work may be lost. Get in the habit of using the *Save* option prior to exiting the mapping session even though it prompts you to save before exiting. Remember, one wrong keystroke during exit can loose all of your work.

To save an object in its current state, select *Save* from the *Object Menu* and the confirmation display shown in Figure 10-5 appears.

```
Saved sample1
```

Figure 10-5 Save Mapping Object Confirmation

Mapping Object Menu Copy

The *Copy* function creates copies of previously mapped sessions. If you want to save an unedited copy of the mapping object, make the copy before any editing takes place. Select *Copy* from the *Object Menu*. The *Copy Form* shown in Figure 10-6 is displayed. Enter the name of the object to copy, and press <Enter>.

```
Object to copy:
```

Figure 10-6 Copy Mapping Object Selection Form

The program prompts for a new name of the copied object (see Figure 10-7). Type in a new name, and press <Enter>.

```
New object name:
```

Figure 10-7 Copied Object Name form

A confirmation message appears to confirm the operation has completed. Press <Enter> to remove the message from the screen.

Setup Menu

The *Mapping Setup* follows object loading. It is important that this step be done immediately after loading a new mapping object as all terminal specific characteristics and keys are set here for the remainder of the mapping session.

When *Setup* is selected from the *Main Menu* bar, the *Setup Menu* shown in Figure 10-8 is displayed.

```
Object - Setup - Format - Info - eXit

     Keyboard
   * 38x0 - 35 Key
     38x0 - 46 Key
     31x0 - 46 Key
     35x0 - 47 Key
```

Figure 10-8 Mapping Setup Menu

Setup Menu   Setting the Terminal s Keyboard

The *Setup* option allows the user to define which terminal model keyboard layout to use for the terminal keys that are available. When this menu is selected from *Setup*, use the <arrow> keys to select the terminal model and keyboard layout the mapping editor uses. Press <enter> when complete.

Format Menu Option

The mapping menu option allows re-mapping of the modification of current terminal key layouts to new key layouts for the terminals. After objects are loaded and setup using the appropriate menu selections, the *format* option is used for keyboard modification. When the keyboard format option is selected, a graphical map of the selected keyboard is displayed allowing the user to modify key layouts in any manner. An example of the graphical key map is shown in figure 10-9.

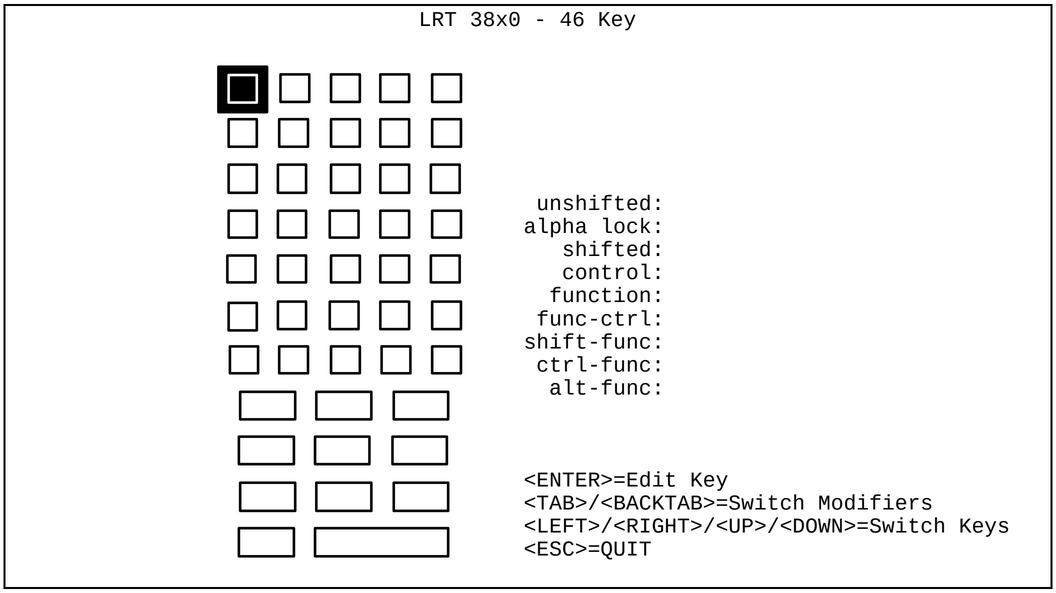

Figure 10-9 38x0 46 key keyboard layout

Using the Key Map Formatter

The keyboard mapping screen lay out is in two sections. The left side of the page displays the key selection area using a graphical key map. Terminal keyboard keys to modify are selected on the keyboard graphical map by using the up, down, left, and right <arrow> keys. The right side of the page shows the applicable key modifiers. Switching between modifiers is accomplished by using the <tab> and <bktab> keys. These modifiers, when selected, allow re-mapping of the standard key definitions to key definitions that the user specifies. Allowable keyboard session states are as follows:

unshifted The unshifted keyboard state applies when no other key is pressed to modify the keyboard state.

alpha lock The alpha lock state applies to the keyboard when <FUNC><SHF> is pressed on the terminal. Any subsequent key presses are in the alpha lock mode until <FUNC><SHF> is pressed again to return the keyboard back to unshifted mode.

shifted The shifted state is applied when the <SHF> key on the terminal's keyboard is pressed. Any key pressed immediately thereafter is handled as a shifted character. The keyboard state returns back to the unshifted state once the character key is pressed.

control The control state is applied when the <CTL> key on the terminal's keyboard is pressed. Any key pressed immediately thereafter is handled as a control character. The keyboard state returns back to the unshifted state once the character key is pressed.

function The function state is applied when the <FUNC> key on the terminal's keyboard is pressed. Any key pressed immediately thereafter is handled as a function character. The keyboard state returns back to the unshifted state once the character key is pressed.

func-ctrl The function-control state is applied when the <FUNC><CTL> keys on the terminal's keyboard are pressed in sequence. Any key pressed immediately after is handled as a function-control character. The keyboard state returns back to the unshifted state once the character key is pressed.

shift-func The shifted-function state is applied when the <SHF><FUNC> keys on the terminal's keyboard are pressed in sequence. Any key pressed immediately thereafter is handled as a shifted-function character. The keyboard state returns back to the unshifted state once the character key is pressed.

ctrl-func The control-function state is applied when the <CTL><FUNC> keys on the terminal's keyboard are pressed in sequence. Any key pressed immediately after is handled as a control-function character. The keyboard state returns back to the unshifted state once the character key is pressed.

alt-func The alternate-function keyboard state is applied when the <FUNC><CTL><FUNC> keys on the terminal's keyboard are pressed in sequence. Any key pressed immediately thereafter is handled as a alternate-function character. The keyboard state returns back to the unshifted state once the character key is pressed.

To modify a given key, select the key to be modified using the up, down, left or right <arrow> keys. Once a keypad key is selected, use the <tab> or <bktab> keys to select the keyboard state modifier for which the key is to be modified. Pressing the <enter> key displays a pop-up selection box allowing the user to select the particular key code to implement. An example of this pop-up box is shown in figure 10-10. Key codes can be selected by pressing the first letter of the desired code repeatedly until the code appears on the screen. The user may also use the up and down <arrow> keys to scroll through the list to select the key code.

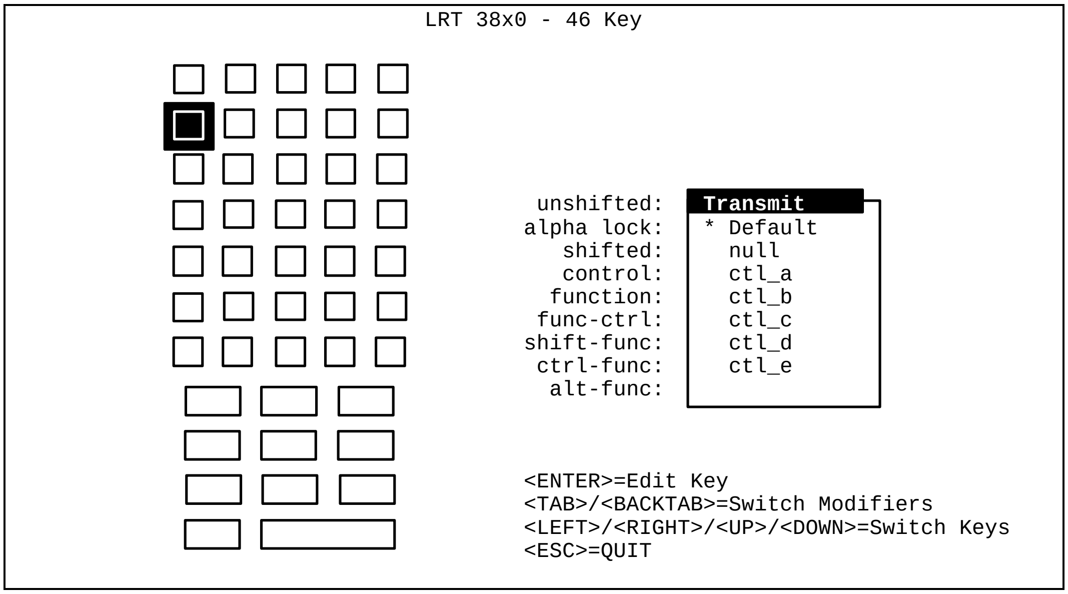

Figure 10-10 38x0 46 key keyboard layout with pop-up key selection

Once the key code is selected, press <enter> and a key mode box appears as shown in figure 10-11.

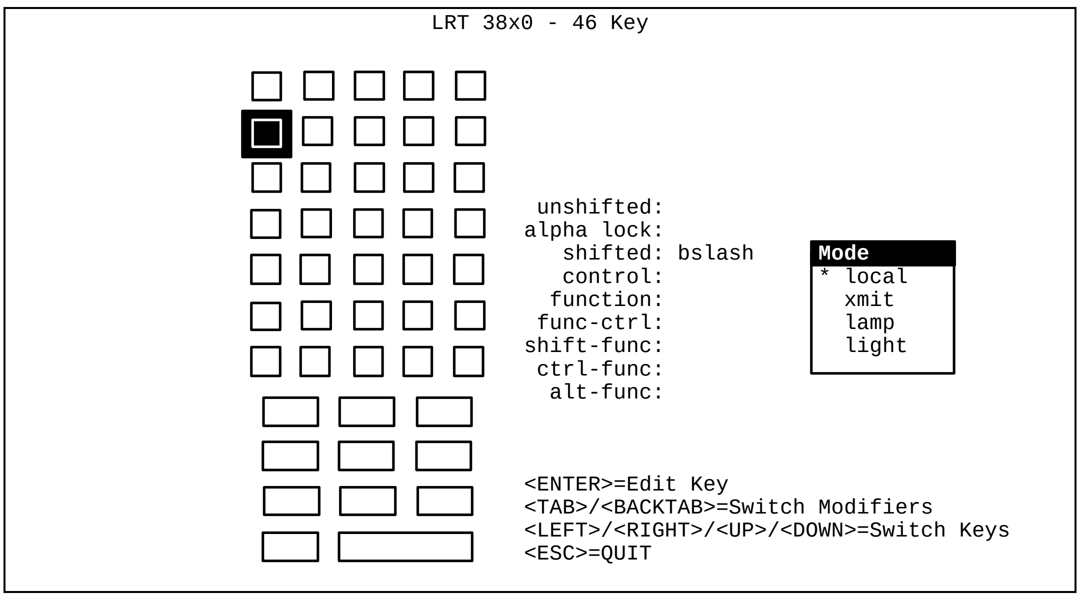

Figure 10-11 38x0 46 key keyboard layout with pop-up key mode

The key modes are as follows:

local Handle the specified key locally on the terminal, send (if required, as in the case of alphanumeric characters and symbols) when

<enter> on the terminal is pressed.

xmit Transmit the key immediately to the host

lamp Turn on the terminal’s backlight.

light Lighten the display contrast.

dark Darken the display contrast.

noop Don’t do anything.

edleft Non-destructive backspace (move) to the left of the cursor within a field.

edrite Non-destructive space (move) to the right of the cursor within a field.

edbksp Destructive backspace (move) to the left of the cursor within a field.

edeeof Destructive space (move) to the right of the cursor within a field, to the end of the field.

edefld Edit mode.

lhelp This key, when pressed, displays the terminal ID, date, time, and terminal software version number.

scan Set a key that, when pressed, triggers the scanner to scan.

Program Information

The *Main Menu* bar selection, *Info*, displays program information which includes the release version (see Figure 10-12). This is important for technical support questions and is easily obtained.

```
Object - Setup - Format - Info - eXit

    kbdset rel 5.0.0
    LRT 38x0 - 46 key
```

Figure 10-12 Program Information

Exit Option

The exit option terminates the mapping session. If work has been done but not saved, the mapping program prompts with the following:

```
Save Changes [y/n]?
```

Press <n> to exit without saving changes, or press <y> to save and exit. The system then returns to the Object Editor menu.

Keyboard Macros Editor

The *VTerm Handler* has a custom option that allows you to establish macro transmit strings for certain terminal keys. This macro function redefines new character strings which are sent to the host when the key is pressed.

A macro file is created with the object editor. The file name is then referenced in the *Keyboard - Macro Object* field within the handler setup, which causes it to be loaded when VTerm is executed.

Macro File

The macro definition file is created on the server using the Object editor. The file indicates the key that is redefined, and the new character string that is transmitted, when that key is pressed. The file is created with the object editor and then referenced in the *Keyboard - Macro Object* field of the VTerm Handler Setup screen as a value for the toggleable field.

Accessing the Macro Object Editor

The Keyboard Macro object editor is accessed through the *Object Editors* function from the *Main Menu* which displays a menu of object editing functions as shown in figure 5-1. For discussion here, we refer only to the *Keyboard/Macros* function shown in this menu.

```
                           PowerNet Server R5.0-B06

         Main Menu
          1 Operations
          2 Spread spectrum
          3 Access Point
            Object Editors
              1 Keyboard/Mapping
           *  2 Keyboard/Macros
              3 Scanner/Data Mapping
              4 Scanner/Data Editing
              5 Scanner/Decoder Control
         1    6 Display/Mapping
         1    7 Display/Formatting
         1    8 Printer/Init
         1    9 Dialog
         1   10 Failover
         1
        *16 Object Editors
         17 Utilities

                    <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure 10-13 Keyboard Macro Object editor selection menu

When the *Keyboard/Macro* object editor is selected, the object file selection screen is displayed as shown in figure 10-14.

```
                           Object Editor Selection
                            Keyboard Macro Objects
kjl2_mac
gps_macr
ss_macro
boa_macr
sej_macr
sph_macr
wn_macro
kaw_macr
fft_macr
lde_mcro
jgl_MACR

[EDIT]  [QUIT]  [DELETE]                   Object[kjl2_mac]
Editor[vi      ]

                    <ESC>=QUIT  <ENTER>=SELECT  <ARROWS>=MOVE
```

Figure 10-14 Keyboard Macro Object selection screen

At this screen, any available keyboard macro objects are shown allowing selection of the macro file to edit. To create a new macro file, simply use the <tab> or <arrow> keys to go to the *Object* field and type the name for the new object to create. To edit an existing macro file, type the name of the macro file to edit in the *Object* field. Once this action is done, use the <tab> or <arrow> keys to navigate to the *Edit* prompt selection and press <enter>. This starts an edit session using the file and the selected editor. An example of a macro file in edit mode is shown in figure 10-15. Refer to the *System Editor* section of the *PowerNet Reference Manual* for using the system editor.

```
pf1=test5\015;
pf2=passwd5\015;
pf3=vt100\015;
pf4=rscan\015;
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
"kjl2_mac.kbm" 4 lines, 61 characters
```

Figure 10-15 Macro file being edited

Defining Macro Keys

The following is a list of keys (key codes) that can be redefined and the key presses that generate them. Note that a key that is being redefined does not have to exist for the current emulation. Thus, you can use this file to add keys to an emulation. As an example, the function 9 key can be assigned when in a vt100 emulation, even though the key is not normally defined for a vt100 terminal. Since these are macro keys and the object has defined what sequence should be transmitted for the keystroke, there is no problem.

Key Press	Key Code	Key Press	Key Code
<FUNC>1	pf1	<left arrow>	left_a
<FUNC>2	pf2	<right arrow>	right_a
<FUNC>3	pf3	<down arrow>	down_a
<FUNC>4	pf4	<up arrow>	up_a
<FUNC>5	pf5	<CTL>A	ctl_a
<FUNC>6	pf6	<CTL>B	ctl_b
<FUNC>7	pf7	<CTL>C	ctl_c
<FUNC>8	pf8	<CTL>D	ctl_d
<FUNC>9	pf9	<CTL>F	ctl_f
<FUNC>0	pf10	<CTL>N	ctl_n
<FUNC>U	pf11	<CTL>O	ctl_o
<FUNC>V	pf12	<CTL>R	ctl_r

<FUNC>W	pf13	<CTL>W	ctl_w
<FUNC>X	pf14	<CTL>X	ctl_x
<FUNC>Y	pf15	<CTL>Y	ctl_y
<FUNC>P	pf16		
<FUNC>Q	pf17		
<FUNC>R	pf18		
<FUNC>S	pf19		
<FUNC>T	pf20		
<FUNC>K	pf21		
<FUNC>L	pf22		
<FUNC>M	pf23		
<FUNC>N	pf24		
<FUNC>O	pa1		
<FUNC>F	pa2		
<FUNC>G	pa3		

Figure 10-16 Key Code name table

Macro Object Format

Each key being redefined is placed on a new line which ends with a semicolon (;). The key is followed by an equal (=) sign and then the new string. The file format is as follows:

```
KEY_CODE=NEW_CHARACTER_STRING;
```

`KEY_CODE` is the key being remapped. **`NEW_CHARACTER_STRING`** is the new string that is transmitted. Control characters are represented in octal. ASCII characters, <space> through <~>, are typed in, except for semicolon. Since a semicolon is used to indicate the end of the line in this file, octal (\074) is used for a transmitted semicolon. An example for remapping the <FUNC>9 key to transmit **`<ESC>[Pz`** follows.

```
pf9=\033[Pz:;
```

In the sample file shown in figure 10-17, the PF1 key was assigned to send *login5* followed by a carriage return (octal 015) to the host system when pressed.

```
pf1=login5\015;
pf2=passwd5\015;
pf3=vt100\015;
pf4=rscan\015;
```

Figure 10-17 Sample Macro Object

Dialog Object Editor

Small installations can easily use the *Quick Start* features of the PowerNet 3270 Connectivity Package. Larger sites can benefit greatly from the more robust scripting capabilities that are included.

Dialog scripts are created using the system editor and the Dialog Language. Scripts reduce the impact of inherent differences between genuine, full screen terminals and handheld units. Although the entire host display area and keyboard are processed using both the *Quick Start* and scripting methods, there are two primary reasons for using the script facility—performance and operational simplicity.

The performance of the server is optimized by maintaining a block-oriented, half-duplex flip/flop environment when using *Dialog Language Scripts*. Block-oriented is a term indicating that each exchange consists of a single unit of information. Half-duplex flip/flop describes a network relationship in which the two partners alternate between transmit and receive states.

In contrast, the *Quick Start* environment is a full-duplex contention environment. The communicating partners are always ready to receive and may transmit simultaneously. Radio, being a multiple access network media, does not lend itself well to this kind of environment, due to the transmit collisions. When traffic is low, the collisions are infrequent, but as traffic increases, so do collisions, which affect network performance.

The Dialog Language Script allows the server, rather than the terminal, to deal with the logon screens and unsolicited host updates without involving the radio network. Also, this task is removed from the operator's responsibilities list.

3270 Session Overview

Developing a dialog script for 3270 sessions requires some familiarity with the behavior and terminology associated with 3270 Hosts and terminal networks. The presentation space (PS) is the 24 by 80 character display area of the 3270 terminal. A 3270 PS may be field formatted, in which case data is entered into unprotected fields. The Dialog Language provides for program controlled data entry into both the formatted and unformatted PS and allows for field addressing within the formatted PS.

Mainframe 3270 installations perceive the PowerNet server as a terminal cluster controller. The server is connected to a front-end processor (FEP) running a Network Control Program (NCP), and the FEP is channel-attached to the Host running a communications control program, known as the Virtual Terminal Access Method (VTAM). VTAM supplies access to mainframe regions and application programs within those regions.

In the IBM SNA environment, the combination of NCP and VTAM provide a set of host network services known as the System Services Control Point (SSCP). Initially, the SSCP establishes two sessions with the server, one for Control Point (CP) exchanges, and another for Physical Unit (PU) exchanges. These command and control sessions use the first two addresses (0 and 1) of the 256 Logical Unit (LU) addresses available within each PU.

NCP and VTAM make use of configuration tables to determine what services are available to the terminal. While the NCP is deciding what to do with a terminal LU requesting activation, the LU is unowned. Depending on the configuration tables, the LU is then connected to VTAM and in session with the SSCP, which expects the terminal to select a host region. Following region selection, the terminal BINDs to a Host application, or transaction, which is known as the Primary LU (PLU).

On most hosts, the first host transaction is a security program requiring user name and password input. Following security clearance the terminal is generally able to select the desired application transaction.

Session States

The state of the LU session and the data within the PS are both available to the Dialog Language Script programmer. The LU states are summarized as follows:

inactive	Link is down.
unown	Waiting for a session.
sscp	In session with VTAM.
plu	In session with host.
busy	In session, host is busy.

Initially, a session on an active link is in the *unowned* state. The state changes to *sscp* after VTAM recognizes the terminal. In this state, the PS is normally unformatted. Depending on the host configuration, entry of a region name is required at this point. Once a region has been assigned and a host transaction is attached to the terminal, the state changes to *plu*.

3270 Keystrokes

Several special keys are defined for 3270 sessions. The <Enter> key forces a transmission to the host. Within an unformatted PS, all data entry is followed by the <Enter> key. Within a formatted PS, the <Tab> or <Backtab> key is used to move between entry fields. Once the required data has been entered, the <Enter> key is usually used to send the field information up to the host. Some host transactions also call for the use of the clear and programmable function <*pf*> keys during the logon procedure. The Dialog language provides for the generation of all of these keystrokes.

Script File Format

The script file is a text file created and edited with the system editor. Each line in the file is a single entry that may contain one of the following constructs:

Command
Comment
Blank line

The command verbs and their arguments are presented in the following sections. Comments entries must begin with the # character on the left margin. Tabs and spaces may precede all other entries. The script file is named using the convention of up to 8 lower case characters followed by **.cmd** (lower case). The script is placed in the **crf** directory of the server.

If necessary, multiple scripts can be created and used in diverse situations. These are linked to specific Host List entries with the 3270 handler. Terminal operators can then select options from the Host List which appears on the RF Terminal.

Command Verbs and Arguments

The command verbs provide conditional branching and control over both the terminal and host sessions. Many commands require arguments. In the case of verbs with multiple arguments, the arguments are separated by commas and the command line requires a semicolon character for termination. Verbs with less than two arguments must **not** have a semicolon terminator.

Those verbs with argument lists require that all arguments are supplied. If an argument is blank, indicated this with a hyphen (-).

Substitutable Parameters

Up to 10 substitutable parameters may be used for string and numeric data storage and manipulation within the script. They are numbered from 0 to 9. The parameter value is substituted for the argument when preceded by the $ character. In the event argument strings actually begin with this character, the character may be changed using the *Host List Custom Options* field.

To change the $ character, enter the following in the Custom Options field:
`-sparm # >`
Here, # is the decimal value of the desired ASCII character.

Command Verb Descriptions

The following sections describe each verb and its arguments in detail. A quick reference summary is provided following the detailed information.

label target—Defines a branch target for the conditional verbs, *onfail*, *equal*, *compare*, ***host state***, and ***host scan***, and the unconditional branch verb, ***goto***. The target name may be up to 20 characters long.

goto target—Script execution begins unconditionally and immediately at the named target.

onfail target—Provides for the handling of script syntax errors and for errors that occur within session verbs, such as **host on**. Upon detection of a line or system error, script execution continues at target.

equal 0-9,value,target;—Script execution resumes at target, if the value of the substitutable parameter indicated by the first argument, equals value. Otherwise, execution continues with the next verb in the file.

compare 0-9,operator,value,target;—Script execution resumes at target if the result of comparing the value of the substitutable parameter, indicated by the first argument, and the value argument, is true. The possible comparison operators are the following:

$=	String equality.
$!=	String inequality.
=	Numeric equality.
!=	Numeric inequality.
<<	Numerically less-than.
>>	Numerically greater-than.

Execution continues with the next verb in the file, if the comparison is not true.

host state statename,target;—Script execution resumes at target if the host session is in the state indicated by statename, which may be one of the following: *inactive*, *unown*, *busy*, *sscp*, or *plu*. Execution continues with the next verb in the file if the host session is not in the specified state.

host scan top,bot,searchstring,target;—Script execution resumes at target if *searchstring* is found within the range of PS lines specified by the first two arguments; otherwise, script execution continues with the next verb in the file. The top and bottom line values may range from 0 to 23.

exit—Unconditionally terminates script execution and the terminal process.

log message string;—Writes the message string argument to the terminal process log file.

sleep seconds—Suspends script execution for the specified number of seconds.

setparm 0-9,value;—Sets the substitutable parameter indicated by the first argument to value.

modify 0-9,operator,value;—Adds to, or subtracts from, the value of the substitutable parameter indicated by the first argument by the amount indicated in the second argument. The + operator indicates addition, and the **-** operator indicates subtraction.

concat 0-9,string;—Concatenates string to the substitutable parameter indicated by the first argument.

insert 0-9,string;—Inserts string to the beginning of the substitutable parameter indicated by the first argument.

host on—Request establishment of a host session.

host off—Terminates the host session.

host update hsec—Waits up to *hsec* half-seconds for an update of the host PS or state. This verb must be called to obtain the current PS and state prior to use of the host scan or host state verbs.

settle dsec—Operation is similar to the host update command with the following exception. It does not return until the specified number, *dsec*, of deciseconds has been reached, regardless of the number of host screen updates that have occurred.

host send field_number,value,key;—Places value and key into the host PS. In the case of an unformatted host PS, the field number argument is ignored and the value is placed at the current cursor position within the PS. Within a formatted host PS, value is placed at the start of the indicated field (field numbers start at 0).

A value of **-** indicates that no data is to be placed in the PS and only the key is generated. The key may be one of the following:

enter	*clear*	*sysreq*	*tab*	*backtab*
pf1	*pf2*	*pf3*	*pf4*	*pf5*
pf6	*pf7*	*pf8*	*pf9*	*pf10*
eof	*reset*			

term clear—Transmits a clear screen command to the terminal.

term logoff—Transmits a logoff command to the terminal.

term wait—Waits for terminal input. The returned string is discarded; this command is useful at startup while waiting for the terminal network logon message, and is also useful when an operator controlled pause is needed.

term display row,string;—Transmits a display command to the terminal that displays the string value at the indicated terminal row. Terminal row numbers begin at 1.

term input 0-9,row,column,length;—Transmits an input command to the terminal and waits for a response; the string value of the response is stored in the substitutable parameter indicated by the first argument. The row and column numbers start at 1.

term noecho 0-9,row,col,length;—Performs the same function as the term input verb, except that the terminal is instructed not to echo the keystrokes entered. This is used for password entry.

Session—Places the terminal into session with the host. This verb does not complete until an *endkey* is generated by the terminal. By default, the *endkey* is FNC 10.

Command Verb Summary

The following is a quick reference summary of all of the verbs and their arguments.

Script Control Commands

```
label target
goto target
onfail target
equal 0-9,string|-,target;
compare 0-9,$=|$!=|=|!=|<<|>>,value,target;
host state busy|sscp|plu|unown|inactive,target;
host scan top,bot,searchstring,target;
exit
log message string;
sleep seconds
```

Parameter Control Commands

```
setparm 0-9,value;
modify 0-9,+|-,value;
```

```
concat 0-9,string;
insert 0-9,string;
```

Host Session Commands

```
host on
host off
host update hsec
host send field_number,string|-,KEY;
```

Terminal Session Commands

```
term clear
term logoff
term wait
term display row,string;
term input 0-9,row,col,length;
term noecho 0-9,row,col,length;
session
```

3270 Keystrokes

enter	clear	sysreq	tab	backtab
pf1	pf2	pf3	pf4	pf5
pf6	pf7	pf8	pf9	pf10
eof	reset			

Script Examples

Three script examples follow.

Session Startup

The following script demonstrates the startup of a 3270 terminal session with the host. The start routine waits for the CCP logon message from the terminal before activating the session. It then enters the *get_screen* loop. Within this loop, the state of the host session is used to control subroutine branches.

```
label start
      onfail err_fail
#### set loop counters
      setparm 9,0;
      setparm 8,0;
      setparm 7,0;
      log Waiting for terminal logon;
      term wait
      term display 8,CONNECTING TO HOST;
```

```
      log Connecting to host;
      host on

#### place logon collection routine here
      goto get_screen

label get_screen
      modify 7,+,1;
      compare 7,>,20,err_loop;
      host update 5
      host state busy,busy;
      host state inactive,inactive;
      host state unown,unown;
      host state sscp,sscp;
      host state plu,plu;
      goto get_screen

label busy
      log BUSY;
      term display 8,BUSY        ;
      sleep 2
      goto get_screen

label inactive
      log INACTIVE;
      term display 8,LU INACTIVE    ;
      term wait
      goto end_session

label unown
      log UNOWN;
      term display 8,UNOWN       ;
      goto get_screen

label sscp
      log SSCP;
      term display 8,SSCP        ;
      goto session

label plu
      log PLU;
      term display 8,PLU;
      goto session
```

```
label session
      session
      goto end_session

label err_loop
      log ERROR: loop;
      term display 8,LOOP ERROR     ;
      term wait
      goto end_session

label err_fail
      log ERROR: failure;
      term display 8,SESSION FAILURE  ;
      sleep 5
      term logoff
      exit

label end_session
      term logoff
      host off
      exit
```

Logon Data Collection

The following script fragment demonstrates the collection of logon data. The *userid* is stored in parameter 0, the password in parameter 1, the CICS region in parameter 2.

```
label get_info
      term display 1,LOGON INFO     ;
      term display 3,NAME;
      term input 0,3,6,14;
      equal 0,-,err_badlogon;
      term display 4,PSWD;
      term noecho 1,4,6,13;
      equal 1,-,err_badlogon;
      term display 5,REGN;
      term input 2,5,6,12;
      equal 2,-,err_badlogon;
      insert 2,/for ;
      term clear
      log Logon info collected;
      goto get_screen

label err_badlogon
      log BAD LOGON;
```

```
term display 8,BAD LOGON       ;
term wait
goto end_session
```

Logon Automation

The following script fragment demonstrates how the original *sscp* and *plu* routines can be modified to make use of the collected logon information for an automated logon.

```
label sscp
   log SSCP;
   term display 8,SSCP        ;
   modify 8,+,1;
   compare 8,,10,err_loop;
   host scan 1,23,CONNECTION IN PROGRESS,get_screen;
   host scan 1,23,INVALID TERMINAL,err_terminal;
   term display 8,REGION       ;
   host send -,$2,enter;
   goto get_screen
label plu
   log PLU;
   term display 8,PLU        ;
   modify 9,+,1;
   compare 9,>,10,err_loop;
   host scan 1,23,LOGON COMPLETE,session;
   host scan 1,23,LOGON IN PROGRESS,get_screen;
   host scan 1,23,INVALID USERID,send_clear;
   host scan 1,23,PASSWORD EXPIRED,err_expired;
   host scan 1,23,USERID:,logon;
   goto send_clear
label logon
   log LOGON;
   term display 8,LOGON       ;
   host send 0,$0,tab;
   host send 1,$1,enter;
   goto get_screen
label send_clear
   log Sending CLEAR;
   term display 8,CLEAR       ;
   host send -,-,clear;
   goto get_screen
label err_expired
   log EXPIRED PASSWORD;
   term display 8,PASSWORD EXPIRED  ;
```

```
term wait
goto end_session
```

Failover Object Editor

See Chapter 7 of this manual.

Appendix C
Client Streaming API

Introduction

This appendix describes the protocols and conventions used to establish and maintain client streaming. This produces an environment of transaction-oriented sessions, between RF terminals and host applications. The client-streaming protocols utilize a pair of sessions to multiplex all terminal traffic. It is the most efficient method available for handling large numbers of terminal sessions.

This API is common across all connectivities, including TCP/IP, DECnet, X.25, Serial RS-232, etc. The API can be used with terminals running standard terminal emulation software such as CCP, STEP, VTERM, etc. It can also be used with custom client applications developed for RF terminals.

Host Assignment for RF Terminals

The PowerNet server implements the HIP protocol for host system and/or application selection by way of the *Handler*.

At a minimum, establishing a terminal session with the host requires that the terminal issue a HIP ASSIGN or ATTACH request. Refer to the SHIP protocol documentation for details.

The PowerNet server converts the host names received in HIP ASSIGN or ATTACH requests to terminal processes using the *Host List* and *Handler* options. Editing of the *Host List* is performed with the PowerNet server software and is available from the specific connectivity *Network Menu*. Changes are registered immediately without interrupting RF network operation.

Host Session

Each host interface uses two logical sessions, each in half duplex mode. One session is for transmitting data from the PowerNet server to the host (Host RX), and the other is for transmissions from the host to the PowerNet server (Host TX).

TCP/IP Host Sessions

PowerNet servers using TCP/IP connectivity are supplied with an Internet Address of 90.0.0.10 and 90.0.0.1 is used for the Host Address. The first host RX Internet ports are defaulted to 1028. Options within the specific connectivity *Network Menu* allow you to change the Internet and Port addresses and allow for a total of four hosts.

MUX Packet

The PowerNet server multiplexes each RF terminal session over the host RX session by inserting a four character header in front of the terminal data. The resulting three-field packet is [H][XXX][DATA] where H is the MUX HEADER character, XXX is the MUX ID field, and DATA is the transaction data field. APPC and TCP/IP connections provide data integrity at the data link layer and therefore, a frame check sequence is not required.

The MUX HEADER byte is used to distinguish between data and control transactions. The header byte of a data transaction record is the ASCII character, M. Polling packets, discussed later, are identified by the header byte ASCII character, P. The MUX ID field contains three ASCII digit character, 0-9, that are right-justified with leading zeros. The decimal value is generated by the PowerNet server and corresponds to a unique RF terminal address. Note that the value is mapped on the PowerNet server, so that terminal number 65 is represented as 128, number 66 as 129, and so on. The MUX DATA field may not exceed 508 bytes in length. For all host connection types, except serial, the data field is transparent to both the PowerNet server and RF network and therefore may contain binary data. Transparency over serial connections is dependent upon the protocol being used.

The MUX header must be present in the host TX transmission and will be stripped prior to transmission to the RF terminal.

Polling

The PowerNet server can be configured to generate a poll message to the host at regular intervals. This message is identified by a MUX HEADER that is the ASCII character, P. This facility can be used by host applications to implement an active link monitor.

Client Streaming Application Development in TCP/IP Environments

This section contains guidelines for developing client streaming applications for RF systems using the TCP/IP PowerNet server. In client streaming applications the host application is design specifically for RF terminals. Instead of sending video terminal commands, these applications exchange specialized packets with the RF terminals. When correctly implemented, client streaming allows support to a greater number of terminals and higher transaction rates, at the cost of greater development effort (when compared to video terminal emulation). Client streaming can also result in longer battery life. The Figure C-1 shows a TCP/IP client streaming configuration:

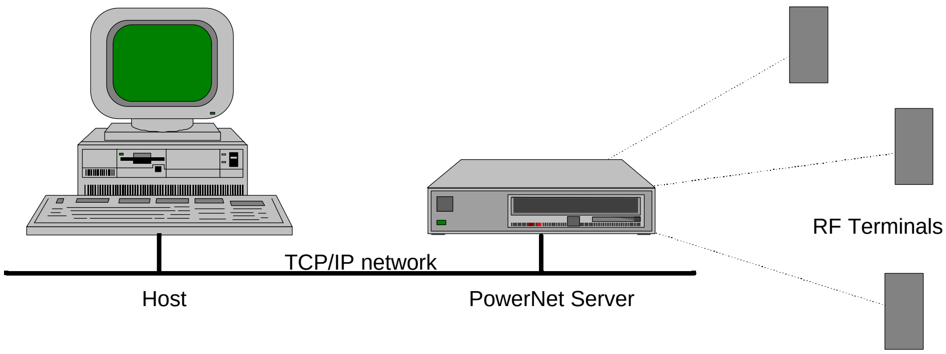

Figure C-1 TCP/IP Client Streaming Configuration

RF Terminal Software

There are two basic options for RF terminal software in a client streaming environment:

- STEP—This Symbol standard software, with commands to display messages, creates input forms, sends data to a printer connected to the terminal, etc. Since STEP is ready and tested, it can reduce the development costs of a client streaming application. On the other hand, it is generic software, with little option for doing special data processing in the terminal (i.e., input validation).

- Custom Software—With this option, the developer can optimize the RF communication for his specific application and implement specific data processing in the terminal. On the other hand, this development requires learning the RF terminal software architecture and development tools.

On most applications, STEP is recommended, unless it is unable to fulfill some basic application requirement. Should you decide to write your own RF terminal software, keep in mind that:

- A decisive factor in realizing the client streaming potential is the specification of the packets' exchange between the host application and the RF terminal. The packets' sizes should be kept minimum, do not leave wasted positions and code the data in binary.

- Battery life is significantly affected by how long the radio stays active. Lower battery consumption is achieved by working in an exclusive transactional form, alternating transmission and reception, instead of allowing unsolicited messages from the host.

The RF terminal can communicate in two modes: *datagram* and *session*. *Datagram* is more efficient, but there is no delivery guaranty; *session* gives reliable message delivery, at the cost of greater overhead. For most applications session mode is preferred.

Host Software How PowerNet servers communicate with host applications

TCP/IP allows the communication between two applications, be they in the same or in different computers. Each side in a TCP/IP communication is defined by two values:

- The IP address, that defines the machine where the application is. On most computers there is a table to associate names to these addresses.

- The port number, that selects the application in a machine. Some of the port numbers are reserved for standard tasks, like remote terminal connection (Telnet), communication testing (Echo), etc.

TCP/IP defines two protocols for inter-application communication, the User Datagram Protocol (UDP) and the Transmission Control Protocol (TCP). UDP allows connectionless Datagram exchange, with no delivery guaranty. TCP gives a reliable message delivering service. he communication between the PowerNet server and the host application uses two TCP connections, one for transmission and one for reception. The messages for all the RF terminals are multiplexed over these two connections.

Host Software PowerNet Server Configuration

Before connecting the PowerNet server to the TCP/IP network, it is necessary to make a few configuration changes. All TCP/IP PowerNet server configurations are in the TCP Network menu, that is found in the Main Menu:

```
+  Main Menu       +
|  1 Operations    |
|  2 Spectrum One  |
|  3 Access Point  |
|* + TCP/IP           +
|  |* 1 Addresses      |
|  |  2 Local Setup    |
|  |  3 Adapter Status |
|  |  4 Network Status |
|  |  5 Ping Test      |
|  +------------------+
| 11 SAB Emulation  |
| 12 TCP/IP-CS      |
```

```
       | 13 Serial-CS      |
       | 14 TCP/IP-STEP    |
       | 15 Hot Spare      |
       | 16 Object Editors |
       | 17 Utilities      |
       --------------------+

                   <ESC>=QUIT  <ARROWS>=MOVE  <ENTER>=SELECT
```

Figure C-2 Main Menu

The first step is to configure the TCP/IP Network Addressing option with the name and address of the involved machines:

```
                       TCP-IP Network Addresses

      Name            Address                 Name            Address
[ncu            ][90.0.0.1        ]     [               ][               ]
[winnt          ][90.0.0.2        ]     [               ][               ]
[               ][                ]     [               ][               ]
[               ][                ]     [               ][               ]

                           <Esc> = Quit         <Arrows> = Move
```

Figure C-3 TCP-IP Node Addresses

In the above screen we defined two machines, the PowerNet server, named *ncu* with IP address 90.0.0.1 and the host, named *winnt* with IP address 90.0.0.2. Next, configure the NCU parameters in the PowerNet server addressing option:

```
                               Local TCP/IP Setup

                        Interface 0          Interface 1
              State [ON ]                  [OFF]
            Adapter [sme0 ]                [     ]
          Node Name [trn2001p         ]    [                 ]
            Address [206.183.67.183 ]      [                ]
            Netmask [255.255.255.128]      [                ]
          Broadcast [206.183.67.255 ]      [                ]
        Router Name [                 ]    [                 ]
         Token Ring
     Source Routing [NO ]                  [NO ]
         Ring Speed [16]                   [16]
              Media [UTP]                  [UTP]

                   <ESC>=QUIT  <SPACE>=CHANGE  <ARROWS>=MOVE
```

Figure C-4 PowerNet server TCP-IP Setup

The next step is to define the TCP connections that will be used. The PowerNet server allows up to four TCP connections, defined in the TCP/IP-CS Setup option. This option is accessed through the TCP/IP Setup screen. Return to the Main Menu and select TCP/IOP-CS.

```
                     TCP/IP-CS Setup

                                   Host     Gateway  Log
       State  Host Node Name       IP Port  IP Port  Level  Poll
Host 0 [ON ] [winnt            ]  [1029 ]  [1028 ]  [0]    [0    ]
Host 1 [OFF] [ttysrv           ]  [1028 ]  [1029 ]  [0]    [0    ]
Host 2 [OFF] [ttysrv           ]  [1028 ]  [1030 ]  [0]    [0    ]
Host 3 [OFF] [ttysrv           ]  [1028 ]  [1031 ]  [0]    [0    ]
```

```
               Host 0       Host 1       Host 2       Host 3
Record Format [DELIMITED]  [DELIMITED]  [DELIMITED]  [DELIMITED]
    Delimiter [124]        [124]        [124]        [124]
```

Figure C-5 Transaction Port Setup

In the above screen there is only one TCP connection active (state = on), with the following characteristics:

- The host application is in the *winnt* machine and waits for calls from the PowerNet server on port 1029.
- The PowerNet server waits for call from the host application on port 1028.

Finally, it is necessary to create a host list entry for the application:

```
                           Host List Setup

 Menu Name      Handler   Active                 Custom Options
[WHIP-CHECK  ] [CHECK   ] [no ]  [                                  ]
[STEP-CHECK  ] [CHECK   ] [yes]  [                                  ]
[tcp-cs      ] [TCP/IP  ] [yes]  [-cm -slp -test                    ]
[            ] [NONE    ] [no ]  [                                  ]
[            ] [NONE    ] [no ]  [                                  ]
```

Figure C-6 Host List Setup

In the above screen, the entry `tcp-cs` is the one that used to connect to the host application. Access this screen by returning to the Main Menu and selecting the Spectrum One option and then the Host List option. The options in the Custom Options field have the following meanings:

- **-cm**—Obligatory with TCP/IP Client Streaming, assures that some commands from the RF driver do not go to the TCP/IP driver.

- **-slp**—Stops SLP headers from being sent to the host application. The SLP protocol is used by the Symbol RF terminals only when in Session mode.

- **-test**—Makes the PowerNet server respond to the “host ready” test made by the SLP protocol, speeding up the RF terminal connection to the host application.

In the Handler Setup for the TCP/IP entry we select which host, defined in the Transaction Ports screen, is used:

```
                              Local TCP/IP Setup

                       Interface 0            Interface 1
              State [ON ]                  [OFF]
            Adapter [sme0 ]                [     ]
          Node Name [trn2001p        ]     [                ]
            Address [206.183.67.183 ]      [               ]
            Netmask [255.255.255.128]      [               ]
          Broadcast [206.183.67.255 ]      [               ]
        Router Name [                ]     [                ]
         Token Ring
     Source Routing [NO ]                  [NO ]
         Ring Speed [16]                   [16]
              Media [UTP]                  [UTP]
```

Figure C-7 Handler Setup

The diagram below shows the relationship between all these configurations:

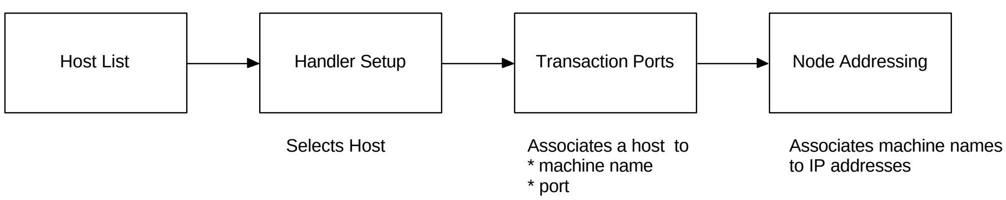

Figure C-8 TCP/IP Configuration

Host Software

Communication between PowerNet server and host applications

The communication between the PowerNet server and the host application uses two TCP connections, one for transmission and one for reception. The establishment of these two TCP connections is as follows:

- The PowerNet server gets from the Transaction Port Setup the host name, and converts it to an IP address, using the Node Addressing. The host application port number is also gotten from the Transaction Port Setup.

- The PowerNet server tries to establish a connection to the host application, with this IP address (that selects the host machine) and port number (that selects the application in the host).

- The host application, when it detects the first connection, will then establish the second connection, using the PowerNet server's IP address and port number. The first connection will be used to sent messages from the PowerNet server to the host application and the second connection will be used the other way.

The diagram below shows the connections for the configuration screens shown before. Note that, just like in phone connections, callers need to know the "number" (IP address and port number, in our case) of whom they are calling, but not the other way around. So, the port numbers indicated by xxx and yyy are irrelevant.

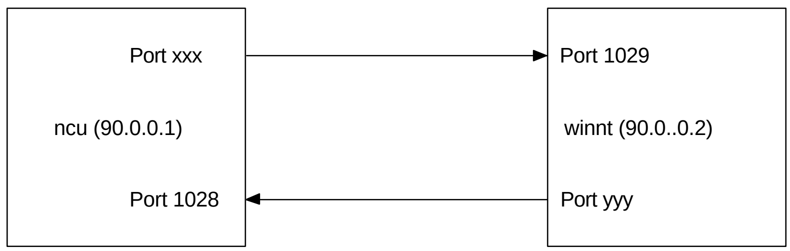

Figure C-9 TCP/IP Port Connection

Host Software Format Exchanged by PowerNet server and Host Application

As before, the messages exchanged by the host application and the many RF terminals are multiplexed over the two TCP connections. This is done by a three digit number that identifies the RF terminal that sent or will receive the message. The PowerNet server generates this number by subtracting 49 from the RF address of the terminal.

At the end of each message a delimiter must be appended. The default value for this delimiter is '|' (ASCII code 124) and it cannot be used inside the message. This delimiter can be changed to any other ASCII character by the inclusion of the option **-er xxx** (where xxx is the decimal ASCII code of the character) in the *Custom Options* field in the *Host List*.

The application in the RF terminal receives and sends messages without a header and delimiter. For example, to send the message ABC to a RF terminal with address 65, the following message should be sent to the PowerNet server:

```
M 0 1 6 A B C |
```

It is important to note that the RF terminal address, and how it is converted in the three digit number, is irrelevant to the application. When a terminal connects to the RF network, it should send a *Logon Ready* message to the application. When it receives this message, the application will store the number generated by the PowerNet server and use it to send messages to the terminal and to recognize the messages it sent.

Host Software Using Sockets Interfaces in Host Application

- Create (using the socket function) two sockets, one to wait for the PowerNet server call and the other to establish the transmission connection.
- Associate (using the bind function) the first socket to the local address (IP address + port number).
- Associate a queue (using the listen function) to this socket and wait for a connection (using the accept function) from the PowerNet server.

When a connection from the PowerNet server is received, the accept function returns a new socket that will be used to receive messages from the PowerNet server. Associate (using the bind function) the second socket to the local address (IP address + port number) and connect (using the connect function) to the PowerNet server. From this point, the application can start to receive (using the read function) and send (using the write function) messages.

Before exiting, the application should close (using the close function) all the sockets.

Host Software Example

This example was developed under Windows/NT, using the WinSock interface. It assumes that the terminal is running STEP.

```
#include <stdio.h>
#include <conio.h>
#include <ctype.h>
#include <stdlib.h>
#include <winsock.h>

void main (int argc, char *argv[]);

// STEP command buffers
// & will be replaced by ESC
char buf_gret[] = "&C00&D0401020Greating from TCP/IP&I0510001|";
char buf_loff[] = "&L|";

void main (int argc, char *argv[])
{
  WSADATA wsaData;
  WORD wVersionReq = 0x0101;
  SOCKET s_listen, s_snd, s_rcv;
  SOCKADDR_IN addr, ncuaddr;
  IN_ADDR ncuIn;
  int sizncuaddr;
  int i;
  int nrec;
  char buf_rx [512];
```

```
    char buf_tx [512];

  // Prepares STEP command buffers
    for (i = 0; i < sizeof(buf_saud); i++)
      if (buf_gret[i] == '&')
       buf_gret [i] = 0x1B;
    for (i = 0; i < sizeof(buf_loff); i++)
      if (buf_loff[i] == '&')
       buf_loff [i] = 0x1B;

    // Tests if arguments where given
    if (argc != 3)
    {
      printf ("Usage: tcpcs ncu_port host_port\n");
     exit (1);
    }

    // Starts WinSock
    if (WSAStartup (wVersionReq, &wsaData) != 0)
    {
      printf ("Error %d in startup!\n", WSAGetLastError ());
     exit (2);
    }
    printf ("WinSock %s initialized.\n", wsaData.szDescription);

  // Creates two sockets
    s_listen = socket (AF_INET, SOCK_STREAM, 0);
    s_snd = socket (AF_INET, SOCK_STREAM, 0);
    if ((s_listen == INVALID_SOCKET) || (s_snd == INVALID_SOCKET))
    {
      printf ("Error in socket creation!\n");
     if (s_listen != INVALID_SOCKET)
       closesocket (s_listen);
     if (s_snd != INVALID_SOCKET)
       closesocket (s_snd);
      WSACleanup ();
      exit (3);
    }
    printf ("Sockets were succeffuly created.\n");

    // waits for NCU call
    addr.sin_family = AF_INET;
    addr.sin_port = htons ((u_short) atoi (argv[2]));
    addr.sin_addr.s_addr = htonl (INADDR_ANY);
    if (bind (s_listen, (LPSOCKADDR) &addr, sizeof(addr)) ==
  SOCKET_ERROR)
    {
      printf ("Error %d in bind!\n", WSAGetLastError());
      closesocket (s_listen);
      closesocket (s_snd);
      WSACleanup ();
      exit (4);
    }
    printf ("Bind OK.\n");
    if (listen (s_listen, 1) == SOCKET_ERROR)
    {
      printf ("Error %d in listen!\n", WSAGetLastError());
      closesocket (s_listen);
      closesocket (s_snd);
      WSACleanup ();
      exit (5);
    }
    sizncuaddr = sizeof (ncuaddr);
    s_rcv = accept (s_listen, (LPSOCKADDR) &ncuaddr, &sizncuaddr);
    if (s_rcv == INVALID_SOCKET)
    {
      printf ("Error %d in accept!\n", WSAGetLastError());
      closesocket (s_listen);
```

```
    closesocket (s_snd);
    WSACleanup ();
    exit (6);
  }
  memcpy (&ncuIn, &ncuaddr.sin_addr.s_addr,4);
  printf ("Received call from NCU (IP=%s, port=%d).\n",
          inet_ntoa(ncuIn), ntohs(ncuaddr.sin_port));
// makes second conection with the NCU
  addr.sin_family = AF_INET;
  addr.sin_port = 0;
  addr.sin_addr.s_addr = htonl (INADDR_ANY);
  if (bind (s_snd, (LPSOCKADDR) &addr, sizeof(addr)) == SOCKET_ERROR)
  {
    printf ("Error %d in second bind!\n", WSAGetLastError());
    closesocket (s_listen);
    closesocket (s_snd);
    closesocket (s_rcv);
    WSACleanup ();
    exit (7);
  }
  printf ("Second bind OK.\n");
  addr.sin_family = AF_INET;
  addr.sin_port = htons ((u_short) atoi (argv[1]));
  addr.sin_addr.s_addr = inet_addr (inet_ntoa (ncuIn));
  if (connect (s_snd, (LPSOCKADDR) &addr, sizeof(addr)) ==
SOCKET_ERROR)
  {
    printf ("Error %d in connect!\n", WSAGetLastError());
    closesocket (s_listen);
    closesocket (s_snd);
    closesocket (s_rcv);
    WSACleanup ();
    exit (8);
  }
  printf ("Connect OK.\n");
// Loop to talk with the RF terminals
  while (!_kbhit())
  {
    nrec = recv (s_rcv, buf_rx, sizeof(buf_rx), 0);
    if (nrec == SOCKET_ERROR)
    {
      printf ("Error %d in reception!\n", WSAGetLastError());
      closesocket (s_listen);
      closesocket (s_snd);
   closesocket (s_rcv);
      WSACleanup ();
      exit (8);
    }
    else if (nrec == 0)
    {
      printf ("Conection closed!\n");
      closesocket (s_listen);
      closesocket (s_snd);
   closesocket (s_rcv);
      WSACleanup ();
      exit (8);
    }
    else
    {
     printf ("Message received:\n");
     // list buffer
     for (i = 0; i < nrec; i++)
     {
       if (isprint (buf_rx [i]))
            printf ("%c  ", buf_rx [i]);
          else
            printf ("%2.2X ", buf_rx [i]);
          if ((i & 15) == 15)
```

```
                printf ("\n");
        }
        if (i != 0)
          printf ("\n");

        printf ("Sending answer: ");
        memcpy (buf_tx, buf_rx, 4);         // Mxxx
        if (buf_rx [5] == 'L')              // Logon Ready
        {
          printf ("Greatings.\n");
              memcpy (buf_tx+4, buf_saud, sizeof (buf_saud)-1);
              send (s_snd, buf_tx, 3+sizeof(buf_saud), 0);
        }
        else
        {
          printf ("Log off.\n");
              memcpy (buf_tx+4, buf_loff, sizeof (buf_loff)-1);
              send (s_snd, buf_tx, 3+sizeof(buf_loff), 0);
        }
       }
     }

     // final clean-up
     getch ();
     closesocket (s_listen);
     closesocket (s_snd);
     closesocket (s_rcv);
     WSACleanup ();
     printf ("Normal End.\n");
     exit (0);
   }
```

Note: In this example WinSock blocking functions were used. In a practical application it is recommended the use of the Asynchronous (non-blocking) functions, that will not block the application until the communication operation is concluded.

Conclusion

With client streaming, it is possible to create high performance RF applications that support a large terminal population with high transaction rates. Even though client streaming application development is more complex than simple video terminal emulation, it requires only a limited knowledge of RF terminals and TCP/IP as well as following of some basic guidelines.

Reference Materials

Spectrum One Development System - Application Programmer's Guide, Symbol Technologies, 1992

Series 3000 STEP, Application Programmer's Guide, Symbol Tech., 1992
Network Controller Interface - Programmer's Guide, Symbol Tech., 1991
Programming WinSock, Arthur Dumas, Sams Publishing, 1995

Appendix D Miscellaneous Hardware/Software Issues

Hardware

Physical/Environmental Specifications

MODEL 1000

- EMI Meets FCC Class A emission limits
- POWER SUPPLY 200 Watts Maximum

  +5V @ 20A, +12V @ 7.5A, -5V @0.5A, -12V @0.5A
- POWER INPUT AC 115V @ 5A or 230V @3A

  Switchable, 50 ~ 60Hz, with cooling fan
- DRIVE BAY Two 5.25 inch drives

  Two 3.5 Inch drives
- CHASSIS Steel case
- SPEAKER Built-in 8 OHM speaker
- SWITCH / JACK System reset switch

  Lighting power on/off switch
- WEIGHT 21 lbs.
- PHYSICAL DIMENSION 17.25 in X 16.5 in X 4.59 in
- OPERATING TEMPERATURES 0° ~ 40° C
- STORAGE TEMPERATURE 0° ~ 50° C
- RELATIVE HUMIDITY 5% ~ 95%, Non condensing

MODEL 2001

- EMI Meets FCC Class A emission limits
- BACKPLANE

  Built-in 4-layer 6-slot passive backplane with bus power check circuit

  Keyboard Connector X 1

  Hidden Reset Switch X 1

- POWER SUPPLY 100 Watts Maximum

  +5V @ 10A, +12V @ 4A, -5V @0.3A, -12V @0.3A

  Power-good signal

- POWER INPUT

  AC 115V @3.5A or 230V @1.7A

  Switchable, 50 ~ 60Hz, with cooling fan

- DRIVE BAY

  Drive housing for one 3.5-inch FDD and HD

- FRONT PANEL INDICATOR

  Low battery alarm LED X 1

  Power Status LED X 1

  7 Segment error code display

- CHASSIS Steel case with PVC coating
- SPEAKER Built-in 8 OHM speaker
- FAN

  Dimensions: 92 X 92 X 25.5 mm

  30 CFM filtered cooling fan

- SWITCH / JACK

  System reset switch

  Lighting power on/off switch

  Power input/output jacks

- I/O PORTS

  Keyboard connector

  Reserved port for 9-pin connector X 1

  Reserved port for 25-pin connector X 2

- KEYLOCK Lock for keyboard
- WEIGHT 12.14 lbs. (5.5 Kg)
- PHYSICAL DIMENSION

  9.4 in X 15.7 in X 6.9 in

  (238mm X 400mm X 175mm)

- OPERATING TEMPERATURES 0° ~ 50° C
- STORAGE TEMPERATURE 0° ~ 75° C (32° ~ 167° F)
- RELATIVE HUMIDITY 5% ~ 95%, Non condensing

MODEL 2501

- EMI FCC Class A and CISPR 22 approved
- BACKPLANE

  Built-in 4-layer 12-slot passive backplane with bus power check circuit

  Keyboard Connector X 1

  Hidden Reset Switch X 1

- POWER SUPPLY 300 Watts Maximum

  +5V @ 23A, +12V @ 15A, -5V @0.1A, -12V @0.5A

- POWER INPUT

  AC 115V @7A or AC 230V @4A

  Switchable, 50 ~ 60Hz, with cooling fan

- DRIVE BAY

  2 half height 5.25 inch drives

  1 half height 3.50 inch drive

- CHASSIS Heavy-duty steel

  SPEAKER Built-in 8 OHM speaker

- FANS

  Two 114 CFM fans at the front panel (Flow In)

  One 37 CFM fan at rear panel (Flow out)

  Dimensions: 120mm X 120mm X 38mm (Front fan)

  80mm X 80mm X 25mm (rear fan)

  Cooling fans are equipped with dust filters

- SWITCHES

  Power On/Off Switch

  Reset Switch

- CONNECTORS

  Keyboard connector X 2

  Reserved port(s) for 9-pin connectors X 2

  Reserved port(s) for 25-pin connector X 1

- SAFETY UL, CSA, and TUV approved
- KEYLOCK Lock for keyboard
- WEIGHT 38.6 lbs. (17.5 Kg)

- PHYSICAL DIMENSION

  19 in X 17.4 in X 7 in (482.6mm X 441.8mm X 177.8mm)

- OPERATING TEMPERATURES 0° ~ 60° C (32° ~ 140° F)
- STORAGE TEMPERATURE 0° ~ 75° C (32° ~ 167° F)
- RELATIVE HUMIDITY 5% ~ 95%, Non condensing

Printer Support under TAP

Introduction

This appendix describes the way that Connect's terminal application (TAP) handles the printer RS-232 port. Printing in each of the emulation modes is described first, and then an example is given of printing using VTerm in VT-220 emulation mode.

RS232 port capabilities under TAP

In the setup of each of the emulation handlers, there is a field where the user can insert from a choice of recognized printers. There is also a field where an *init* file name can be inserted. This *init* file should have the name ***.ini** and should be located in the work directory (usually **/crf**). This *init* file contains the string which is sent out to the terminal at start up and output to the printer. Thus, it could contain pre-defined form text or other set-up information. The following printers are recognized by the emulators.

ps1000
9600 baud, 8 data bits, no parity, 2 stop bits, software flow control

ps1001
9600 baud, 8 data bits, no parity, 2 stop bits, software flow control

ps1004
9600 baud, 8 data bits, no parity, 2 stop bits, software flow control

]monarch
9600 baud, 8 data bits, no parity, 1 stop bit, hardware flow control.

pddumb
9600 baud, 8 data bits, no parity, 1 stop bit, no flow control. (Does not wait for device to go ready.)

comtec (COMTEC 5022 non-SYMBOL version)
19200 baud, 8 data bits, no parity, 1 stop bit, hardware flow control.

rascal (Monarch 9450 "Rascal")
9600 baud, 8 data bits, no parity, 1 stop bit, hardware flow control.
Note: Configure printer using following string: ^A|5|N|8|D|^

codewriter (CodeWriter 4102)
9600 baud, 8 data bits, no parity, 1 stop bit, hardware flow control.
Note: Set dip switches as follows: (S1-1 OFF, S1-2 ON, S1-3 OFF, S1-4 ON, S1-5 ON, S1-6 ON, S1-7 ON, S1-8 ON)

comtec(s) (COMTEC 5022 S SYMBOL version primarily for 3800 terminals)
19200 baud, 8 data bits, no parity, 1 stop bit, hardware flow control.

Note: Any other printer number sent down is treated as code 4, a **pddumb** printer.

TAP Print Command

When the Connect emulator, (e.g., VTerm) sends data to the base module it converts native host commands (e.g., VT220) into TAP command strings which are documented elsewhere. The TIP command to send data to the attached printer on the terminals RS-232 port only delivers the data to the terminal, it does not specify what goes into the data packet to control the printer. This is the format of the command:

```
D<LENGTH><DATA...>
```

LENGTH Values from 01 to FF, (00 is reserved), in a binary format.

DATA The data to be printed, including all of the control sequences required by the printer.

Terminal response format: No terminal response is sent.

If the label requires a build up string larger than 255 bytes, it is achieved by sending another D command with data until the label string is complete. At this point, the D0 command is issued and causing the terminal to dump the data out of the RS232 port to the attached printer.

Printing under IBM 3270 & 5250 Emulation

General

Under 3270 (SDLC, TN3270, and Token Ring) and 5250 (SDLC & TN5250), the printer is controlled by characters placed in the SNA presentation space by the host application. The appearance of a Flag Byte at a specific Flag Row and *Flag Column* position in the screen causes the handler on the NCU to take all characters after the flag byte, up to the next appearance of the flag byte, and send them to the printer on the terminal. **Note: The print data upper limit is 1.5 K.**

After the printer data has been sent, the handler sends the specified Response Key to the host application. At this point, the host application must clear the printer data from the 3270 screen, or replace it with the next set of printer data.

For the purpose of initializing a printer and for testing print data, an Init File text file can be placed on the NCU in the **/crf** directory. The contents of this file will be transmitted to the terminal when the RF terminal attaches to the IBM handler on the NCU.

IBM Handler Configuration

a) Refer to the “Printer” section on Page 1 of the 3270 and 5250 Handler setup screen.

b) Set the printer type as appropriate.

c) Set the decimal value of the ASCII-converted “Flag Byte” to be used by the host application.

d) Set the zero-based row and column for the Flag Byte. For example, a host 3270 application set for row 1, column 1 is Flag Row 0, Flag Column 0 within the handler setup.

e) Set the Response Key that signals the application to either remove or replace the print data from the screen.

f) In the event the printer requires initialization data and/or the actual print data must be tested for validity, enter the name of the file in the *Init File* field.

Printing under VTERM VT100/220 Emulation

To output data to the RS-232 port on the terminal under VT100/220 emulation your application must call the Media Copy (MC) feature of the VT-220 device. This uses the following escape sequence:

ESC [5i All data following this escape sequence will be output to the terminal RS232 port until the escape sequence **ESC [4i** is reached.

VTerm Handler Configuration

a) Refer to the “Printer” section on Page 1 of the VTerm Handler setup screen.

b) Set the printer type as appropriate.

c) In the event the printer requires initialization data, and/or the actual print data must be tested for validity, enter the name of the file in the “Init File” field.

Example of printing under VTerm/VT220 Emulation

Note: The upper limit of print data is 1.5 K.

The following is an example taken from several traces of a print sequence on a VTerm/TIP system. Here is the *rfvt* log. Note that the *label* print operation is started by the command **ESC[5i**.

```
11/13 07:14:37     0ms RCV AP DATA: 240 bytes (240 total)
08 1B 5B 4B 20 20 1B 5B 35 69 0A 4E 0A 44 36 0A   ..[K...[5i.N.D6.
      (Print start cmd is 'ESC[5i')
53 31 0A 5A 54 0A 41 37 35 30 2C 31 31 35 30 2C   S1.ZT.A750,1150,
32 2C 34 2C 31 2C 31 2C 4E 2C 22 45 6C 69 64 61   2,4,1,1,N,"Elida
20 47 69 62 62 73 20 55 6E 69 6C 65 76 65 72 20   .Gibbs.Unilever.
49 54 22 0A 41 31 37 30 2C 31 31 35 30 2C 32 2C   IT".A170,1150,2,
32 2C 32 2C 32 2C 4E 2C 22 49 4E 54 45 52 49 22   2,2,2,N,"INTERI"
0A 41 35 32 30 2C 31 31 30 30 2C 32 2C 33 2C 32   .A520,1100,2,3,2
2C 32 2C 4E 2C 22 45 53 50 52 45 53 53 22 0A 41   ,2,N,"ESPRESS".A
35 38 30 2C 31 30 33 30 2C 32 2C 35 2C 36 2C 36   580,1030,2,5,6,6
2C 4E 2C 22 43 5A 22 0A 41 37 35 30 2C 36 35 30   ,N,"CZ".A750,650
2C 32 2C 32 2C 31 2C 31 2C 4E 2C 22 44 61 74 61   ,2,2,1,1,N,"Data
20 46 61 74 74 2E 3A 22 0A 41 36 30 30 2C 36 35   .Fatt.:".A600,65
30 2C 32 2C 33 2C 31 2C 31 2C 4E 2C 22 31 30 2D   0,2,3,1,1,N,"10-
30 33 2D 39 35 22 0A 41 34 35 30 2C 36 35 30 2C   03-95".A450,650,
32 2C 32 2C 31 2C 31 2C 4E 2C 22 4E 75 6D 2E 41   2,2,1,1,N,"Num.A
11/13 07:14:38   100ms poll: 1 events PTY=00000001 SMI=00000000
11/13 07:14:38     0ms RCV AP DATA: 572 bytes (812 total)(Start of second host block)
6C 6C 65 73 74 2E 3A 22 0A 41 33 30 30 2C 36 35   llest.:".A300,65
30 2C 32 2C 33 2C 31 2C 31 2C 4E 2C 22 20 31 30   0,2,3,1,1,N,".10
30 39 35 22 0A 41 31 38 30 2C 36 35 30 2C 32 2C   095".A180,650,2,
32 2C 31 2C 31 2C 4E 2C 22 56 69 61 67 2E 3A 22   2,1,1,N,"Viag.:"
0A 41 38 30 2C 36 35 30 2C 32 2C 33 2C 31 2C 31   .A80,650,2,3,1,1
2C 4E 2C 22 30 31 22 0A 41 37 35 30 2C 36 30 30   ,N,"01".A750,600
2C 32 2C 31 2C 31 2C 31 2C 4E 2C 22 20 20 41 72   ,2,1,1,1,N,"..Ar
74 69 63 6F 6C 6F 20 20 20 20 20 20 20 20 20 20   ticolo..........
20 43 6F 6C 6C 69 2F 50 7A 20 20 20 20 20 20 20   .Colli/Pz.......
20 20 50 65 73 6F 20 28 4B 67 29 20 22 0A 41 37   ..Peso.(Kg).".A7
34 30 2C 35 37 30 2C 32 2C 33 2C 31 2C 31 2C 4E   40,570,2,3,1,1,N
2C 22 31 31 32 32 38 30 30 34 34 20 20 20 20 20   ,"112280044.....
20 20 20 31 34 34 20 20 20 20 20 20 20 31 32 30   ...144.......120
2C 33 22 0A 41 37 35 30 2C 35 30 30 2C 32 2C 32   ,3".A750,500,2,2
2C 31 2C 31 2C 4E 2C 22 54 69 70 6F 20 50 61 6C   ,1,1,N,"Tipo.Pal
6C 65 74 2E 3A 22 0A 41 35 37 30 2C 35 30 30 2C   let.:".A570,500,
32 2C 33 2C 31 2C 31 2C 4E 2C 22 45 55 52 22 0A   2,3,1,1,N,"EUR".
41 34 35 30 2C 35 30 30 2C 32 2C 32 2C 31 2C 31   A450,500,2,2,1,1
2C 4E 2C 22 50 65 73 6F 28 4B 67 29 3A 22 0A 41   ,N,"Peso(Kg):".A
33 35 30 2C 35 30 30 2C 32 2C 33 2C 31 2C 31 2C   350,500,2,3,1,1,
4E 2C 22 20 20 32 35 2C 30 22 0A 41 34 35 30 2C   N,"..25,0".A450,
34 35 30 2C 32 2C 32 2C 31 2C 31 2C 4E 2C 22 54   450,2,2,1,1,N,"T
6F 74 2E 20 50 65 73 6F 28 4B 67 29 3A 22 0A 41   ot..Peso(Kg):".A
32 35 30 2C 34 35 30 2C 32 2C 33 2C 31 2C 31 2C   250,450,2,3,1,1,
4E 2C 22 20 31 34 35 2C 33 22 0A 42 37 35 30 2C   N,".145,3".B750,
```

```
33 30 30 2C 32 2C 31 2C 34 2C 31 32 2C 31 35 30   300,2,1,4,12,150
2C 42 2C 22 36 30 30 30 30 33 34 4E 4F 52 36 35   ,B,"6000034NOR65
34 33 32 31 36 31 22 0A 50 0A 1B 5B 34 69 0A 20   432161".P..[4i..
         (End Print cmd is 'ESC[4i')
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20   ................
20 20 1B 5B 48 1B 5B 4A 20 48 55 49 1B 5B 35 43   ...[H.[J.HUI.[5C
54 45 53 54 20 53 54 41 4D 50 41 20 45 54 49 43   TEST.STAMPA.ETIC
48 45 54 54 20 20 31 33 2F 31 31 2F 39 36 1B 5B   HETT..13/11/96.[
33 3B 39 48 54 45 53 54 20 53 54 41 4D 50 41 20   3;9HTEST.STAMPA.
45 54 49 43 48 45 54 54 45 1B 5B 38 3B 31 31 48   ETICHETTE.[8;11H
46 31 20 41 6E 6E 75 6C 6C 61 20 46 32 20 43 6F   F1.Annulla.F2.Co
6E 66 65 72 6D 61 20 5F 1B 5B 4A 08               nferma._.[J.
11/13 07:14:38   280ms prt_out_unseg: 672 bytes in
11/13 07:14:38     0ms prt_out_unseg: 254 bytes out
11/13 07:14:38     0ms RF SND 256 bytes
44 FE 0A 4E 0A 44 36 0A 53 31 0A 5A 54 0A 41 37   D..N.D6.S1.ZT.A7
         (1st TIP cmd D with length FE [254 chars])
35 30 2C 31 31 35 30 2C 32 2C 34 2C 31 2C 31 2C   50,1150,2,4,1,1,
4E 2C 22 45 6C 69 64 61 20 47 69 62 62 73 20 55   N,"Elida.Gibbs.U
6E 69 6C 65 76 65 72 20 49 54 22 0A 41 31 37 30   nilever.IT".A170
2C 31 31 35 30 2C 32 2C 32 2C 32 2C 32 2C 4E 2C   ,1150,2,2,2,2,N,
22 49 4E 54 45 52 49 22 0A 41 35 32 30 2C 31 31   "INTERI".A520,11
30 30 2C 32 2C 33 2C 32 2C 32 2C 4E 2C 22 45 53   00,2,3,2,2,N,"ES
50 52 45 53 53 22 0A 41 35 38 30 2C 31 30 33 30   PRESS".A580,1030
2C 32 2C 35 2C 36 2C 36 2C 4E 2C 22 43 5A 22 0A   ,2,5,6,6,N,"CZ".
41 37 35 30 2C 36 35 30 2C 32 2C 32 2C 31 2C 31   A750,650,2,2,1,1
2C 4E 2C 22 44 61 74 61 20 46 61 74 74 2E 3A 22   ,N,"Data.Fatt.:"
0A 41 36 30 30 2C 36 35 30 2C 32 2C 33 2C 31 2C   .A600,650,2,3,1,
31 2C 4E 2C 22 31 30 2D 30 33 2D 39 35 22 0A 41   1,N,"10-03-95".A
34 35 30 2C 36 35 30 2C 32 2C 32 2C 31 2C 31 2C   450,650,2,2,1,1,
4E 2C 22 4E 75 6D 2E 41 6C 6C 65 73 74 2E 3A 22   N,"Num.Allest.:"
0A 41 33 30 30 2C 36 35 30 2C 32 2C 33 2C 31 2C   .A300,650,2,3,1,
11/13 07:14:39  1460ms RCV CM_RDY
11/13 07:14:39     0ms prt_out_unseg: 254 bytes out
11/13 07:14:39    10ms RF SND 256 bytes
44 FE 31 2C 4E 2C 22 20 31 30 30 39 35 22 0A 41   D.1,N,".10095".A
         (2nd TIP cmd D with length FE [254 chars])
31 38 30 2C 36 35 30 2C 32 2C 32 2C 31 2C 31 2C   180,650,2,2,1,1,
4E 2C 22 56 69 61 67 2E 3A 22 0A 41 38 30 2C 36   N,"Viag.:".A80,6
35 30 2C 32 2C 33 2C 31 2C 31 2C 4E 2C 22 30 31   50,2,3,1,1,N,"01
22 0A 41 37 35 30 2C 36 30 30 2C 32 2C 31 2C 31   ".A750,600,2,1,1
2C 31 2C 4E 2C 22 20 20 41 72 74 69 63 6F 6C 6F   ,1,N,"..Articolo
20 20 20 20 20 20 20 20 20 20 20 43 6F 6C 6C 69   ...........Colli
2F 50 7A 20 20 20 20 20 20 20 20 20 50 65 73 6F   /Pz.........Peso
20 28 4B 67 29 20 22 0A 41 37 34 30 2C 35 37 30   .(Kg).".A740,570
2C 32 2C 33 2C 31 2C 31 2C 4E 2C 22 31 31 32 32   ,2,3,1,1,N,"1122
38 30 30 34 34 20 20 20 20 20 20 20 20 31 34 34   80044........144
20 20 20 20 20 20 20 31 32 30 2C 33 22 0A 41 37   .......120,3".A7
35 30 2C 35 30 30 2C 32 2C 32 2C 31 2C 31 2C 4E   50,500,2,2,1,1,N
2C 22 54 69 70 6F 20 50 61 6C 6C 65 74 2E 3A 22   ,"Tipo.Pallet.:"
0A 41 35 37 30 2C 35 30 30 2C 32 2C 33 2C 31 2C   .A570,500,2,3,1,
31 2C 4E 2C 22 45 55 52 22 0A 41 34 35 30 2C 35   1,N,"EUR".A450,5
11/13 07:14:41  1370ms RCV CM_RDY
11/13 07:14:41     0ms prt_out_unseg: 164 bytes out
```

```
11/13 07:14:41     0ms RF SND 166 bytes
44 A4 30 30 2C 32 2C 32 2C 31 2C 31 2C 4E 2C 22   D.00,2,2,1,1,N,"
      (3rd TIP cmd D with length A4 [164 chars])
50 65 73 6F 28 4B 67 29 3A 22 0A 41 33 35 30 2C   Peso(Kg):".A350,
35 30 30 2C 32 2C 33 2C 31 2C 31 2C 4E 2C 22 20   500,2,3,1,1,N,".
20 32 35 2C 30 22 0A 41 34 35 30 2C 34 35 30 2C   .25,0".A450,450,
32 2C 32 2C 31 2C 31 2C 4E 2C 22 54 6F 74 2E 20   2,2,1,1,N,"Tot..
50 65 73 6F 28 4B 67 29 3A 22 0A 41 32 35 30 2C   Peso(Kg):".A250,
34 35 30 2C 32 2C 33 2C 31 2C 31 2C 4E 2C 22 20   450,2,3,1,1,N,".
31 34 35 2C 33 22 0A 42 37 35 30 2C 33 30 30 2C   145,3".B750,300,
32 2C 31 2C 34 2C 31 32 2C 31 35 30 2C 42 2C 22   2,1,4,12,150,B,"
36 30 30 30 30 33 34 4E 4F 52 36 35 34 33 32 31   6000034NOR654321
36 31 22 0A 50 0A                                 61".P.
11/13 07:14:42  1050ms RCV CM_RDY
11/13 07:14:42     0ms RF SND 2 bytes
44 00                                             D.
      (TIP cmd to dump data out of serial port)
11/13 07:14:42   310ms RCV CM_RDY
11/13 07:14:42     0ms prt_out_unseg: all segments complete
```

All of this processed host data is sent off to the base program to format and send to the terminal. Some excerpts follow of the base log which show this:

```
FRAME: Mode BASE  09:49:36     <-- 33 bytes
 Frame ID: Data-BOC
      S  T U    N A ST    Topology
Hdr:  1B 1 0105 0 4 00    U=0001 Downstream
H: 3B 81 69 80
D: 2C 32 2C 34 2C 31 2C 31 2C 4E 2C 22 45 6C 69 64
,2,4,1,1,N,"Elid
D: 61 20 47 69 62 62 73
a.Gibbs
C: BF 48 4B 2C (in=2C4B48BF,calc=2C4B48BF)
```

Each of these messages is ACK'd by the terminal, building up the print string in the terminal's print buffer, and on receipt of the *D0* message the print string is sent out of the RS-232 port.

Comtec Printer Setup

This section shows how to set up a Comtec printer Models MP 5022 and MP 5044. The Comtec printer Models MP5022 and MP5044 are DOS like printers. They have within them an **autoexec.bat** and **config.sys** file. They are also supplied with a utility disk that allows setting up and testing the printer. When the printers are sent from the factory, they have a DEMO **autoexec.bat** file installed which causes it to print DEMO labels on power-up. While the DEMO labels are printing, it is not possible to communicate with the printer. The following procedure shows how to set up the printer for the Connect/RF product family and erase the DEMO program.

PROCEDURE

- Install Comtec Printer Utilities on a DOS PC
- Power down Comtec printer.
- Hold and depress FEED key.
- Depress and release power ON key.
- Printer will print a setup label and interrupt the DEMO **autoexec.bat**.
- Run menu from Comtec utility directory.
- Select appropriate port and baud rate.
- Select "Read Printer Status" from menu (this insures there is communication).
- Select "Print Test Label" form menu.
- Type delauto (This deletes the DEMO autoexec.bat file).
- Select "Set Printer Parameters" from menu.
- Set printer for:

  19,200 KB.
  DTR Power off disabled.
  XON/XOFF enabled.

- Connect printer to terminal with cable.
- Use Printer *ini* function to test printer.

Note: You can use some of the ***.lbl** files from the Comtec utility disk. The following is the output from the “Read Printer Status” from a properly configured printer.

```
Comtec MP Series Printer Utilities Ver 3.40
(c) 1994 Comtec Information Systems, Inc.
-- Printer Status--
Baud rate is: 19200
Inactivity time-out is: 180 Seconds
Low-battery Shutdown level is: 155
User-Label-Count is xxx (Does not include form feeds)
DTR power off: Disabled
XON/XOFF: Enabled

(Hit ENTER Key to Continue)
```

The Symbol Spectrum One network uses a standard RS232 connection to its network. There are many commercial devices that can be used to either move RS232 data or convert from one medium to another. The direct TCP/IP option use a standard RS232 to TCP/IP converter commonly called “Terminal Server.” These devices allow single serial devices (Printers, terminals, etc.) to be connected to a TCP/IP network without the expense of a dedicated work station.

The Direct TCP/IP option capitalizes on this industry standard equipment and an enhancement to the Connect/RF software to allow Spectrum One to be run over TCP/IP networks. The schemes work best where there is an existing TCP/IP network to tie into. It is seldom cost effective to propose this system from the beginning, because the normal cabling method for Spectrum One is generally more cost effective.

In existing systems with TCP/IP installed, this option can allow management of multiple sites using one centrally located controller. This setup allows each remote site that is covered by TCP/IP to have only a low cost terminal server and a network of Spectrum One transceivers. The one caution is that something extremely reliable (wire) is being replaced with something less reliable. It must be made clear that the maintenance of this wire (TCP/IP network) and effect on loading and response times is outside our control. Before any attempt be made to install this product, a network performance test should be done prior to installation to gauge health and reserve capacity of the TCP/IP network. The effect on loading of the TCP/IP network that the Spectrum One protocol adds can be factored using normal TCP/IP modeling techniques.

Description

This new communications interface program allows using TCP/IP terminal servers instead of high speed serial connections to interface from the PowerNet server into Spectrum One RF bases. This interface may be used alongside the current serial interface or by itself, allowing the user to mix and match as needed to work in their environment. There are no restrictions beyond normal TCP/IP rules as far as routers or bridges are concerned, other than Symbol Spectrum One timing constraints, allowing the integration of the interface without worrying about abnormal restrictions. The interface program is available with SCO, AIX, and HP-UX PowerNet servers.

The TCP/IP interface works by establishing a raw-socket connection between the PowerNet server and a port on the terminal server. A *Raw Socket* connection is defined as the ability for the host to initiate a socket connection to a specific serial port and transparently pass data in and out of the port. Xyplex and Lantronix both support this capability by assigning a specific socket number to each port. By connecting to the appropriate socket (i.e., socket 2200 is port 2 on Xyplex), data can freely pass data in and out of the serial connection.

From the terminal server, a serial cable is run to the interface port on the RF base. In order for this to work, the terminal server must support transparent raw sockets. Currently, the Xyplex *1608* and the Lantronix *mss1* have been validated as working in this manner. The Lantronix *mss1* is a relatively low-cost single port terminal server, which allows adding dedicated terminal servers to accomplish the TCP/IP interface function.

As far as the bases and PowerNet server are concerned, the TCP/IP interface is a transparent replacement for the serial connection.

For the user, this means bases can be connected to terminal servers on a one-to-one basis or a terminal server can be used to drive a coax connected RF LAN just as if it had been a serial connected base. For example, if a user had a campus-wide Ethernet and needed to run RF in several different warehouses, the Ethernet could be used to distribute the RF network to each of the warehouses, at which point the bases in each warehouse could be wired as traditional coax connected LANs.

DATA FLOW

POWERNET SERVER —>TCP/IP—>TERMINAL SERVER—>SPECTRUM ONE

The data path above shows connections and data flow.

1. The PowerNet server ties directly to the TCP/IP network through an Ethernet or Token Ring connection. This requires that the PowerNet server be configured with the proper TCP/IP host kit to match the target TCP/IP Topology.

2. The TCP/IP Network transfers Spectrum One packets wrapped inside TCP/IP packets

3. The remote terminal server unwraps the spectrum One packets and delivers them or receives them from the Symbol Spectrum One Network

Sending binary files across a non-transparent communications network

Purpose

This appendix section documents the methods to send binary files over a network that does not allow or tolerate binary data. However, the use of the *File Manager* utility for the prime mode file transmission is strongly recommended.

Introduction

It has been reported that when executables and other UNIX type files are sent out over the Internet they are frequently received corrupted. This is because compressed UNIX files are stored in a binary format, and it is possible for this data to be misinterpreted by the messaging application (e.g., electronic mail package) as invalid ASCII symbols (such as the DC1 and DC3 symbols) which can interfere with the messaging protocol, resulting in the message becoming corrupted.

This problem can be avoided using the UNIX commands *uuencode* and *uudecode*, which were designed to convert binary files into a valid textual equivalent. (Use the UNIX *man* pages for more information about these commands.)

The following appendix entry describes a procedure which avoids this problem. As usual with UNIX systems, the syntax should be followed **exactly** and for safety, use a normal *login* rather than *root*.

Method for encoding attachment files

The following steps should be followed in the order presented. For this example, assume that the files that you wish to send, have the names **file1.HEX**, **file2.dat**, **file3.sh** and **file4** although more (or less) files than this can be sent out together. (These files can be executables or text files.) The important lines in the following screen dump are **bold**, other lines are simply for information.

```
# ls -l
total 1418
-rw-r--r--   1 root     other     528644 Apr 16 14:02 file1.HEX
-rw-------   1 root     other      67676 Apr 16 14:02 file2.dat
-rwxr-xr-x   1 root     other       2722 Apr 16 14:04 file3.sh
-rwxrwxrwx   1 root     other     119076 Apr 16 14:07 file4
# tar -cvf tarfile file1.HEX file2.dat file3.sh file4
a file1.HEX 1033 tape blocks
a file2.dat 133 tape blocks
a file3.sh 6 tape blocks
a file4 233 tape blocks
# ls -l tarfile
-rw-r--r--   1 root     other     722432 Apr 16 14:19 tarfile
# sum tarfile
46654 1411 tarfile
# compress -FHv tarfile (Note: FH options may not be available on all systems)
tarfile: Compression: 52.50% -- replaced with tarfile.Z
# uuencode tarfile.Z tarfile.Z > uencoded
```

```
# ls -l uencoded
-rw-r--r--   1 root     other     474542 Apr 16 14:35 uencoded
# /crf/bin/sz uencoded
sz: 1 file requested:
uencoded

Sending in Batch Mode
**#
#
```

Description

All of the commands in this screen dump have been keyed in at the UNIX command line.

- **ls** lists the contents of the current working directory.
- **tar** combines the named files into a single tar file named **tarfile.**
- **sum** gives a check-sum for the **tar** file. This number should be recorded in the main body of the e-mail message so that the recipient can check for possible corruption of the files during the mailing process.
- **compress** uses maximum compression to reduce the size of the tar file and renames it with the suffix .Z.
- **uuencode** is responsible for converting the binary into a text format file and has two arguments.
    - The first argument is the name of the file to encode (*tarfile.Z*)
    - The second argument is the name that the file will be given when it is later *unencoded* on the remote system. (This may be a different file name with or without a path, although you should bear in mind that this may result in an identically named file in the same location on the remote system being overwritten.) This encoded file will be stored on the system as the file *uencoded*, (bear in mind that DOS file names should not exceed 8 characters).
- **sz** uses the Z-Modem application to upload the file from the PowerNet server into the attached PC.

Method for decoding attachment files

Decoding attachment files is achieved using the **uudecode** command and then reversing all of the other commands in the sequence shown above. If the name of the file when it is decoded on the remote system has not been reported in the e-mail message, then it can be seen by using the **pg** command to look at the top of the file *uencoded*. The first line of the file will be in the format ‘begin *mode filename*’ with the mode in numeric format and the filename will include any pathing that was set up by the sender. This line can be modified if necessary (using a text editor) if it is unsuitable for the remote system.

```
# /crf/bin/rz
rz ready. To begin transfer, type "sz file ...” to your modem program
**B0100000027fed4
**B0100000027fed4
# ls
uencoded
# uudecode uencoded
# ls -l
total 1614
-rw-r--r--   1 root     other     344406 Apr 16 14:52 tarfile.Z
-rw-r--r--   1 root     other     474542 Apr 16 14:35 uencoded
# compress -dv tarfile.Z
tarfile.Z:  -- replaced with tarfile
# ls -l
total 2354
-rw-r--r--   1 root     other     722432 Apr 16 14:52 tarfile
-rw-r--r--   1 root     other     474542 Apr 16 14:35 uencoded
# sum tarfile
46654 1411 tarfile
# tar -xvf tarfile
tar: blocksize = 20
x file1.HEX, 528644 bytes, 1033 tape blocks
x file2.dat, 67676 bytes, 133 tape blocks
x file3.sh, 2722 bytes, 6 tape blocks
x file4, 119076 bytes, 233 tape blocks
# ls -l tarfile
-rw-r--r--   1 root     other     722432 Apr 16 14:52 tarfile
#
```

Description

- **/crf/bin/rz** calls the Z-modem receive application to down-load the file onto the PowerNet server into the current working directory.
- **uudecode** then converts this file back to a binary file giving it the name (and path) that is stated in line one of the file **uencoded**, in this case **tarfile.Z**
- **compress** decompresses the file also removing the **.Z** suffix from the file name.
- **sum** then calculates the check-sum of the file. This should be checked against the originally stated check-sum to check for file corruption.
- **tar** then separates out the original files from the tar file overwriting any identically named files that already exist in the working directory.

Setting Token Ring Speed

This section of the Appendix documents the procedures used to set the Token Ring speed. by anyone changing the Token Ring Speed (4 or 16 Mbps) on a PowerNet server using an SMC 8115T Tokencard.

The native UNIX EZSETUP program supplied by SMC to configure the firmware of their Token Ring cards does not really change UNIX view of the Token Ring card's setup. It does change the token card's firmware settings. The SCO UNIX NETCONFIG software does not provide a way to change cable types and ring speeds.

See the menu for local TCP/IP setup under the TCP/IP menu or NetBIOS setup under the NetBIOS menu (both are available through the main menu). These menus contain setable parameters that your system administrator may adjust for you system. Changes take effect without a kernel rebuild or system reboot.

Note: The Type 1 and RJ45 connectors cannot be connected simultaneously.

Dialog Language Objects (Scripting)

Dialog scripts are created using the system editor and the Dialog Language. Scripts reduce the impact of inherent differences between genuine, full screen terminals and handheld units. Although the entire host display area and keyboard are processed using both the *Quick Start* and scripting methods, there are two primary reasons for using the script facility—performance and operational simplicity.

The performance of the server is optimized by maintaining a block-oriented, half-duplex flip/flop environment when using *Dialog Language Scripts*. Block-oriented is a term indicating that each exchange consists of a single unit of information. Half-duplex flip/flop describes a network relationship in which the two partners alternate between transmit and receive states.

In contrast, the *Quick Start* environment is a full-duplex contention environment. The communicating partners are always ready to receive and may transmit simultaneously. Radio, being a multiple access network media, does not lend itself well to this kind of environment, due to the transmit collisions. When traffic is low, the collisions are infrequent, but as traffic increases, so do collisions, which affect network performance.

The Dialog Language Script allows the server, rather than the terminal, to deal with the logon screens and unsolicited host updates without involving the radio network. Also, this task is removed from the operator's responsibilities list.

3270 Session Overview

Developing a dialog script for 3270 sessions requires some familiarity with the behavior and terminology associated with 3270 Hosts and terminal networks. The presentation space (PS) is the 24 by 80 character display area of the 3270 terminal. A 3270 PS may be field formatted, in which case data is entered into unprotected fields. The Dialog Language provides for program controlled data entry into both the formatted and unformatted PS and allows for field addressing within the formatted PS.

Mainframe 3270 installations perceive the PowerNet server as a terminal cluster controller. The server is connected to a front-end processor (FEP) running a Network Control Program (NCP), and the FEP is channel-attached to the Host running a communications control program, known as the Virtual Terminal Access Method (VTAM). VTAM supplies access to mainframe regions and application programs within those regions.

In the IBM SNA environment, the combination of NCP and VTAM provide a set of host network services known as the System Services Control Point (SSCP). Initially, the SSCP establishes two sessions with the server, one for Control Point (CP) exchanges, and another for Physical Unit (PU) exchanges. These command and control sessions use the first two addresses (0 and 1) of the 256 Logical Unit (LU) addresses available within each PU.

NCP and VTAM make use of configuration tables to determine what services are available to the terminal. While the NCP is deciding what to do with a terminal LU requesting activation, the LU is unowned. Depending on the configuration tables, the LU is then connected to VTAM and in session with the SSCP, which expects the terminal to select a host region. Following region selection, the terminal BINDs to a Host application, or transaction, which is known as the Primary LU (PLU).

On most hosts, the first host transaction is a security program requiring user name and password input. Following security clearance the terminal is generally able to select the desired application transaction.

Session States

The state of the LU session and the data within the PS are both available to the Dialog Language Script programmer. The LU states are summarized as follows:

inactive	Link is down.
unown	Waiting for a session.
sscp	In session with VTAM.
plu	In session with host.
busy	In session, host is busy.

Initially, a session on an active link is in the *unowned* state. The state changes to *sscp* after VTAM recognizes the terminal. In this state, the PS is normally unformatted. Depending on the host configuration, entry of a region name is required at this point. Once a region has been assigned and a host transaction is attached to the terminal, the state changes to *plu*.

3270 Keystrokes

Several special keys are defined for 3270 sessions. The <Enter> key forces a transmission to the host. Within an unformatted PS, all data entry is followed by the <Enter> key. Within a formatted PS, the <Tab> or <Backtab> key is used to move between entry fields. Once the required data has been entered, the <Enter> key is usually used to send the field information up to the host. Some host transactions also call for the use of the clear and programmable function <*pf*> keys during the logon procedure. The Dialog language provides for the generation of all of these keystrokes.

Script File Format

The script file is a text file created and edited with the system editor. Each line in the file is a single entry that may contain one of the following constructs:

Command
Comment
Blank line

The command verbs and their arguments are presented in the following sections. Comments entries must begin with the # character on the left margin. Tabs and spaces may precede all other entries. The script file is named using the convention of up to 8 lower case characters followed by **.cmd** (lower case). The script is placed in the **crf** directory of the server.

If necessary, multiple scripts can be created and used in diverse situations. These are linked to specific Host List entries with the 3270 handler. Terminal operators can then select options from the Host List which appears on the RF Terminal.

Command Verbs and Arguments

The command verbs provide conditional branching and control over both the terminal and host sessions. Many commands require arguments. In the case of verbs with multiple arguments, the arguments are separated by commas and the command line requires a semicolon character for termination. Verbs with less than two arguments must **not** have a semicolon terminator.

Those verbs with argument lists require that all arguments are supplied. If an argument is blank, indicated this with a hyphen (-).

Substitutable Parameters

Up to 10 substitutable parameters may be used for string and numeric data storage and manipulation within the script. They are numbered from 0 to 9. The parameter value is substituted for the argument when preceded by the $ character. In the event argument strings actually begin with this character, the character may be changed using the *Host List Custom Options* field.

To change the $ character, enter the following in the Custom Options field:
`-sparm # >`
Here, # is the decimal value of the desired ASCII character.

Command Verb Descriptions

The following sections describe each verb and its arguments in detail. A quick reference summary is provided following the detailed information.

label target—Defines a branch target for the conditional verbs, *onfail*, *equal*, *compare*, ***host state***, and ***host scan***, and the unconditional branch verb, ***goto***. The target name may be up to 20 characters long.

goto target—Script execution begins unconditionally and immediately at the named target.

onfail target—Provides for the handling of script syntax errors and for errors that occur within session verbs, such as **host on**. Upon detection of a line or system error, script execution continues at target.

equal 0-9,value,target;—Script execution resumes at target, if the value of the substitutable parameter indicated by the first argument, equals value. Otherwise, execution continues with the next verb in the file.

compare 0-9,operator,value,target;—Script execution resumes at target if the result of comparing the value of the substitutable parameter, indicated by the first argument, and the value argument, is true. The possible comparison operators are the following:

$=	String equality.
$!=	String inequality.
=	Numeric equality.
!=	Numeric inequality.
<<	Numerically less-than.
>>	Numerically greater-than.

Execution continues with the next verb in the file, if the comparison is not true.

host state statename,target;—Script execution resumes at target if the host session is in the state indicated by statename, which may be one of the following: *inactive*, *unown*, *busy*, *sscp*, or *plu*. Execution continues with the next verb in the file if the host session is not in the specified state.

host scan top,bot,searchstring,target;—Script execution resumes at target if *searchstring* is found within the range of PS lines specified by the first two arguments; otherwise, script execution continues with the next verb in the file. The top and bottom line values may range from 0 to 23.

exit—Unconditionally terminates script execution and the terminal process.

log message string;—Writes the message string argument to the terminal process log file.

sleep seconds—Suspends script execution for the specified number of seconds.

setparm 0-9,value;—Sets the substitutable parameter indicated by the first argument to value.

modify 0-9,operator,value;—Adds to, or subtracts from, the value of the substitutable parameter indicated by the first argument by the amount indicated in the second argument. The + operator indicates addition, and the **-** operator indicates subtraction.

concat 0-9,string;—Concatenates string to the substitutable parameter indicated by the first argument.

insert 0-9,string;—Inserts string to the beginning of the substitutable parameter indicated by the first argument.

host on—Request establishment of a host session.

host off—Terminates the host session.

host update hsec—Waits up to *hsec* half-seconds for an update of the host PS or state. This verb must be called to obtain the current PS and state prior to use of the host scan or host state verbs.

settle dsec—Operation is similar to the host update command with the following exception. It does not return until the specified number, *dsec*, of deciseconds has been reached, regardless of the number of host screen updates that have occurred.

host send field_number,value,key;—Places value and key into the host PS. In the case of an unformatted host PS, the field number argument is ignored and the value is placed at the current cursor position within the PS. Within a formatted host PS, value is placed at the start of the indicated field (field numbers start at 0).

A value of **-** indicates that no data is to be placed in the PS and only the key is generated. The key may be one of the following:

enter	*clear*	*reset*	*eof*	*tab*
baktab	*backtab*	*home*	*noop*	*sysreq*
pf1	*pf2*	*pf3*	*pf4*	*pf5*
pf6	*pf7*	*pf8*	*pf9*	*pf10*
pf11	*pf12*	*pf13*	*pf14*	*pf15*
pf16	*pf17*	*pf18*	*pf19*	*pf20*
pf21	*pf22*	*pf23*	*pf24*	
pa1	*pa2*	*pa3*		

term clear—Transmits a clear screen command to the terminal.

term logoff—Transmits a logoff command to the terminal.

term wait—Waits for terminal input. The returned string is discarded; this command is useful at startup while waiting for the terminal network logon message, and is also useful when an operator controlled pause is needed.

term display row,string;—Transmits a display command to the terminal that displays the string value at the indicated terminal row. Terminal row numbers begin at 1.

term input 0-9,row,column,length;—Transmits an input command to the terminal and waits for a response; the string value of the response is stored in the substitutable parameter indicated by the first argument. The row and column numbers start at 1.

term noecho 0-9,row,col,length;—Performs the same function as the term input verb, except that the terminal is instructed not to echo the keystrokes entered. This is used for password entry.

Session—Places the terminal into session with the host. This verb does not complete until an *endkey* is generated by the terminal. By default, the *endkey* is FNC 10.

Command Verb Summary

The following is a summary of all of the verbs and their arguments.

Script Control Commands

```
label target
goto target
onfail target
equal 0-9,string|-,target;
compare 0-9,$=|$!=|=|!=|<<|>>,value,target;
host state busy|sscp|plu|unown|inactive,target;
host scan top,bot,searchstring,target;
host copy row,col,len,target
exit
log message string;
sleep seconds
```

Parameter Control Commands

```
setparm 0-9,value;
modify 0-9,+|-,value;
concat 0-9,string;
insert 0-9,string;
```

Host Session Commands

```
host on
host off
host update hsec
host send field_number,string|-,KEY;
```

Terminal Session Commands

```
term clear
term logoff
term wait
term display row,string;
term input 0-9,row,col,length;
term noecho 0-9,row,col,length;
session
```

3270 Keystrokes

enter	*clear*	*reset*	*eof*	*tab*
baktab	*backtab*	*home*	*noop*	*sysreq*
pf1	*pf2*	*pf3*	*pf4*	*pf5*
pf6	*pf7*	*pf8*	*pf9*	*pf10*
pf11	*pf12*	*pf13*	*pf14*	*pf15*
pf16	*pf17*	*pf18*	*pf19*	*pf20*
pf21	*pf22*	*pf23*	*pf24*	
pa1	*pa2*	*pa3*		

Script Examples

Three script examples follow.

Session Startup

The following script demonstrates the startup of a 3270 terminal session with the host. The start routine waits for the CCP logon message from the terminal before activating the session. It then enters the *get_screen* loop. Within this loop, the state of the host session is used to control subroutine branches.

```
label start
      onfail err_fail
#### set loop counters
      setparm 9,0;
      setparm 8,0;
      setparm 7,0;
      log Waiting for terminal logon;
      term wait
      term display 8,CONNECTING TO HOST;
      log Connecting to host;
      host on

#### place logon collection routine here
      goto get_screen

label get_screen
      modify 7,+,1;
      compare 7,>,20,err_loop;
      host update 5
      host state busy,busy;
      host state inactive,inactive;
      host state unown,unown;
      host state sscp,sscp;
      host state plu,plu;
      goto get_screen
```

```
label busy
      log BUSY;
      term display 8,BUSY        ;
      sleep 2
      goto get_screen

label inactive
      log INACTIVE;
      term display 8,LU INACTIVE    ;
      term wait
      goto end_session

label unown
      log UNOWN;
      term display 8,UNOWN       ;
      goto get_screen

label sscp
      log SSCP;
      term display 8,SSCP        ;
      goto session

label plu
      log PLU;
      term display 8,PLU;
      goto session

label session
      session
      goto end_session

label err_loop
      log ERROR: loop;
      term display 8,LOOP ERROR     ;
      term wait
      goto end_session

label err_fail
      log ERROR: failure;
      term display 8,SESSION FAILURE  ;
      sleep 5
      term logoff
      exit

label end_session
      term logoff
```

```
host off
exit
```

Logon Data Collection

The following script fragment demonstrates the collection of logon data. The *userid* is stored in parameter 0, the password in parameter 1, the CICS region in parameter 2.

```
label get_info
      term display 1,LOGON INFO     ;
      term display 3,NAME;
      term input 0,3,6,14;
      equal 0,-,err_badlogon;
      term display 4,PSWD;
      term noecho 1,4,6,13;
      equal 1,-,err_badlogon;
      term display 5,REGN;
      term input 2,5,6,12;
      equal 2,-,err_badlogon;
      insert 2,/for ;
      term clear
      log Logon info collected;
      goto get_screen

label err_badlogon
      log BAD LOGON;
      term display 8,BAD LOGON       ;
      term wait
      goto end_session
```

Logon Automation

The following script fragment demonstrates how the original *sscp* and *plu* routines can be modified to make use of the collected logon information for an automated logon.

```
   label sscp
      log SSCP;
      term display 8,SSCP        ;
      modify 8,+,1;
      compare 8,,10,err_loop;
      host scan 1,23,CONNECTION IN PROGRESS,get_screen;
      host scan 1,23,INVALID TERMINAL,err_terminal;
      term display 8,REGION       ;
      host send -,$2,enter;
      goto get_screen
```

```
label plu
   log PLU;
   term display 8,PLU        ;
   modify 9,+,1;
   compare 9,>,10,err_loop;
   host scan 1,23,LOGON COMPLETE,session;
   host scan 1,23,LOGON IN PROGRESS,get_screen;
   host scan 1,23,INVALID USERID,send_clear;
   host scan 1,23,PASSWORD EXPIRED,err_expired;
   host scan 1,23,USERID:,logon;
   goto send_clear
label logon
   log LOGON;
   term display 8,LOGON       ;
   host send 0,$0,tab;
   host send 1,$1,enter;
   goto get_screen
label send_clear
   log Sending CLEAR;
   term display 8,CLEAR       ;
   host send -,-,clear;
   goto get_screen
label err_expired
   log EXPIRED PASSWORD;
   term display 8,PASSWORD EXPIRED  ;
   term wait
   goto end_session
```

Appendix E - ISO 8859-1

Description	Char	Dec	Hex
non-breaking space		160	A0
inverted exclamation	¡	161	A1
cent sign	¢	162	A2
pound sterling	£	163	A3
general currency sign	¤	164	A4
yen sign	¥	165	A5
broken vertical bar	¦	166	A6
section sign	§	167	A7
umlaut (dieresis)	¨	168	A8
copyright	©	169	A9
feminine ordinal	ª	170	AA
left angle quote, guillemot left	«	171	AB
not sign	¬	172	AC
soft hyphen	-	173	AD
registered trademark	®	174	AE
macron accent	¯	175	AF
degree sign	°	176	B0
plus or minus	±	177	B1
superscript two	²	178	B2
superscript three	³	179	B3
acute accent	´	180	B4
microsign	µ	181	B5
paragraph sign	¶	182	B6
middle dot	·	183	B7
cedilla	¸	184	B8
superscript one	¹	185	B9
masculine ordinal	º	186	BA
right angle quote, guillemot right	»	187	BB
fraction one-fourth	¼	188	BC
fraction one-half	½	189	BD
fraction three-fourths	¾	190	BE
inverted question mark	¿	191	BF

Description	Char	Dec	Hex
capital A, grave accent	À	192	C0
capital A, acute accent	Á	193	C1
capital A, circumflex accent	Â	194	C2
capital A, tilde	Ã	195	C3
capital A, dieresis or umlaut mark	Ä	196	C4
capital A, ring	Å	197	C5
capital AE diphthong (ligature)	Æ	198	C6
capital C, cedilla	Ç	199	C7
capital E, grave accent	È	200	C8
capital E, acute accent	É	201	C9
capital E, circumflex accent	Ê	202	CA
capital E, dieresis or umlaut mark	Ë	203	CB
capital I, grave accent	Ì	204	CC
capital I, acute accent	Í	205	CD
capital I, circumflex accent	Î	206	CE
capital I, dieresis or umlaut mark	Ï	207	CF
capital Eth, Icelandic	Ð	208	D0
capital N, tilde	Ñ	209	D1
capital O, grave accent	Ò	210	D2
capital O, acute accent	Ó	211	D3
capital O, circumflex accent	Ô	212	D4
capital O, tilde	Õ	213	D5
capital O, dieresis or umlaut mark	Ö	214	D6
multiply sign	×	215	D7
capital O, slash	Ø	216	D8
capital U, grave accent	Ù	217	D9
capital U, acute accent	Ú	218	DA
capital U, circumflex accent	Û	219	DB
capital U, dieresis or umlaut mark	Ü	220	DC
capital Y, acute accent	Ý	221	DD
capital THORN, Icelandic	Þ	222	DE
small sharp s, German (sz ligature)	ß	223	DF

Description	Char	Dec	Hex
small a, grave accent	à	224	E0
small a, acute accent	á	225	E1
small a, circumflex accent	â	226	E2
small a, tilde	ã	227	E3
small a, dieresis or umlaut mark	ä	228	E4
small a, ring	å	229	E5
small ae diphthong (ligature)	æ	230	E6
small c, cedilla	ç	231	E7
small e, grave accent	è	232	E8
small e, acute accent	é	233	E9
small e, circumflex accent	ê	234	EA
small e, dieresis or umlaut mark	ë	235	EB
small i, grave accent	ì	236	EC
small i, acute accent	í	237	ED
small i, circumflex accent	î	238	EE
small i, dieresis or umlaut mark	ï	239	EF
small eth, Icelandic	ð	240	F0
small n, tilde	ñ	241	F1
small o, grave accent	ò	242	F2
small o, acute accent	ó	243	F3
small o, circumflex accent	ô	244	F4
small o, tilde	õ	245	F5
small o, dieresis or umlaut mark	ö	246	F6
division sign	÷	247	F7
small o, slash	ø	248	F8
small u, grave accent	ù	249	F9
small u, acute accent	ú	250	FA
small u, circumflex accent	û	251	FB
small u, dieresis or umlaut mark	ü	252	FC
small y, acute accent	ý	253	FD
small thorn, Icelandic	þ	254	FE
small y, dieresis or umlaut mark	ÿ	255	FF

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Appendix F MIB for SNMP

The following MIB definition may be enhanced periodically but will *always* remain downward compatible.

```
CRF-MIB DEFINITIONS ::= BEGIN

IMPORTS
   enterprises, OBJECT-TYPE, IpAddress
           FROM RFC1155-SMI
   DisplayString
           FROM RFC1213-MIB
   OBJECT-TYPE
           FROM RFC-1212;

crf OBJECT IDENTIFIER ::= { enterprises 1334 }

specOne OBJECT IDENTIFIER ::= { crf 1 }
accessPoint OBJECT IDENTIFIER ::= { crf 2 }

s1Status OBJECT-TYPE
   SYNTAX   INTEGER {
                    active(1),
                    inactive(2)
           }
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
           "If active, the s1base program is actively running. If inactive,
            s1base is not currently running"
   ::= { specOne 1 }

s1BaseCnt OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
           "The total number of bases active on this NCU."
   ::= { specOne 2 }

s1TermCnt OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
           "The total number of s1 terminals active on this NCU."
   ::= { specOne 3 }

s1BaseTable OBJECT-TYPE
   SYNTAX   SEQUENCE OF S1BaseEntry
   ACCESS   not-accessible
   STATUS   mandatory
   DESCRIPTION
           "The table of spectrum one point information."
   ::= { specOne 4 }

s1BaseEntry OBJECT-TYPE
   SYNTAX   S1BaseEntry
   ACCESS   not-accessible
   STATUS   mandatory
   DESCRIPTION
           "An entry in the s1BaseTable table. Instance-identification
           is taken from s1BaseNumber and consists of `1' sub-identifiers
           in length."
   INDEX    { s1BaseIndex }
   ::= { s1BaseTable 1 }
```

```
S1BaseEntry::=
 SEQUENCE {
    s1BaseIndex
             INTEGER,
    s1BaseLan
             INTEGER,
    s1BaseNumber
             INTEGER,
    s1BaseLastRcv
             TimeTicks
 }

s1BaseIndex OBJECT-TYPE
    SYNTAX   INTEGER (1..512)
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
    "A value which uniquely identifies an entry in the s1BaseTable table.
     The value is a index. This number ranges between 1 and the number
     of entries in the AccessPointTable table."
    ::= { s1BaseEntry 1 }

s1BaseLan OBJECT-TYPE
    SYNTAX   INTEGER
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
    "The RF LAN number that the base is attached to"
    ::= { s1BaseEntry 2 }

s1BaseNumber OBJECT-TYPE
    SYNTAX   INTEGER
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
    "The id number of the base. This number must be unique within the LAN"
    ::= { s1BaseEntry 3 }

s1BaseLastRcv OBJECT-TYPE
    SYNTAX   TimeTicks
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
    "The 100ths of a second since anything was received from the base"
    ::= { s1BaseEntry 4 }

s1TermTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF S1TermEntry
    ACCESS   not-accessible
    STATUS   mandatory
    DESCRIPTION
             "The table of spectrum one terminal information."
    ::= { specOne 5 }

s1TermEntry OBJECT-TYPE
    SYNTAX   S1TermEntry
    ACCESS   not-accessible
    STATUS   mandatory
    DESCRIPTION
             "An entry in the s1TermTable table. Instance-identification
             is taken from s1TermNumber and consists of `1' sub-identifiers
             in length."
    INDEX    { s1TermIndex }
    ::= { s1TermTable 1 }

S1TermEntry::=
 SEQUENCE {
    s1TermIndex
             INTEGER,
    s1TermLan
             INTEGER,
    s1TermBase
             INTEGER,
    s1TermNumber
             INTEGER,
    s1TermLastRcv
```

```
            TimeTicks
 }

s1TermIndex OBJECT-TYPE
   SYNTAX   INTEGER (1..512)
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "A value which uniquely identifies an entry in the s1TermTable table.
    The value is a index. This number ranges between 1 and the number
    of entries in the s1TermTable table."
   ::= { s1TermEntry 1 }

s1TermLan OBJECT-TYPE
   SYNTAX   INTEGER
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "The RF LAN number that the terminal is attached to"
   ::= { s1TermEntry 2 }

s1TermBase OBJECT-TYPE
   SYNTAX   INTEGER
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "The id number of the base the terminal is attached to."
   ::= { s1TermEntry 3 }

s1TermNumber OBJECT-TYPE
   SYNTAX   INTEGER
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "The id number of the terminal."
   ::= { s1TermEntry 4 }

s1TermLastRcv OBJECT-TYPE
   SYNTAX   TimeTicks
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "The 100ths of a second since anything was received from the terminal"
   ::= { s1TermEntry 5 }

apStatus OBJECT-TYPE
   SYNTAX   INTEGER {
                     active(1),
                     inactive(2)
            }
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
            "If active, the apbase program is actively running. If inactive,
             apbase is not currently running"
   ::= { accessPoint 1 }

apBaseCnt OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
            "The total number of access points active on this NCU."
   ::= { accessPoint 2 }


apTermCnt OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
            "The total number of AP terminals active on this NCU."
   ::= { accessPoint 3 }


accessPointTable OBJECT-TYPE
```

```
   SYNTAX   SEQUENCE OF AccessPointEntry
   ACCESS   not-accessible
   STATUS   mandatory
   DESCRIPTION
            "The table of access point information."
   ::= { accessPoint 4 }

accessPointEntry OBJECT-TYPE
   SYNTAX   AccessPointEntry
   ACCESS   not-accessible
   STATUS   mandatory
   DESCRIPTION
            "An entry in the AccessPointTable table. Instance-identification
            is taken from AccessPointNumber and consists of `1' sub-identifiers
            in length."
   INDEX    { accessPointIndex }
   ::= { accessPointTable 1 }

AccessPointEntry ::=
 SEQUENCE {
   accessPointIndex
            INTEGER,
   accessPointIP
            IpAddress,
   accessPointMAC
            DisplayString,
   accessPointLastRcv
            TimeTicks
 }

accessPointIndex OBJECT-TYPE
   SYNTAX   INTEGER (1..512)
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "A value which uniquely identifies an entry in the AccessPointTable table.
    The value is a index. This number ranges between 1 and the number
    of entries in the AccessPointTable table."
   ::= { accessPointEntry 1 }

accessPointIP OBJECT-TYPE
   SYNTAX IpAddress
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
            "This IP address is just here as an example of how
             to read and write an object with a syntax of NetworkAddress."
   ::= { accessPointEntry 2 }

accessPointMAC OBJECT-TYPE
   SYNTAX   DisplayString
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
            "The MAC address of the access point is given here."
   ::= { accessPointEntry 3 }

accessPointLastRcv OBJECT-TYPE
   SYNTAX   TimeTicks
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "The 100ths of a second since anything was received from the access point"
   ::= { accessPointEntry 4 }

apTermTable OBJECT-TYPE
   SYNTAX   SEQUENCE OF APTermEntry
   ACCESS   not-accessible
   STATUS   mandatory
   DESCRIPTION
            "The table of access point information."
   ::= { accessPoint 5 }

apTermEntry OBJECT-TYPE
   SYNTAX   APTermEntry
   ACCESS   not-accessible
```

```
   STATUS   mandatory
   DESCRIPTION
            "An entry in the AccessPointTable table. Instance-identification
            is taken from AccessPointNumber and consists of `1' sub-identifiers
            in length."
   INDEX    { apTermIndex}
   ::= { apTermTable 1 }

APTermEntry ::=
 SEQUENCE {
   apTermIndex
            INTEGER,
   apTermIP
            IpAddress,
   apTermMAC
            DisplayString,
   apTermLastRcv
            TimeTicks
 }

apTermIndex OBJECT-TYPE
   SYNTAX   INTEGER (1..512)
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "A value which uniquely identifies an entry in the apTermTable table.
    The value is a index. This number ranges between 1 and the number
    of entries in the apTermTable table."
   ::= { apTermEntry 1 }

apTermIP OBJECT-TYPE
   SYNTAX IpAddress
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
            "This IP address is just here as an example of how
             to read and write an object with a syntax of NetworkAddress."
   ::= { apTermEntry 2 }

apTermMAC OBJECT-TYPE
   SYNTAX   DisplayString
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
            "The MAC address of the access point is given here."
   ::= { apTermEntry 3 }

apTermLastRcv OBJECT-TYPE
   SYNTAX   TimeTicks
   ACCESS   read-only
   STATUS   mandatory
   DESCRIPTION
   "The 100ths of a second since anything was received from the base"
   ::= { apTermEntry 4 }


END
```

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