REAL TIME MONITORING SOFTWARE (RTMS)
INSTRUCTION MANUAL

2/95

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REAL TIME MONITORING SOFTWARE (RTMS)
TABLE OF CONTENTS

APPENDIX A. TROUBLESHOOTING THE RTMS NETWORKS

GLOSSARY

SECTION 1. RTMS SYSTEM OVERVIEW

Real Time Monitoring Software (RTMS) is PC software designed to enhance the capabilities of the CR10T and future Campbell Scientific dataloggers. RTMS provides data collection, monitoring, and control for applications involving one or more CR10T dataloggers. RTMS is designed to do several tasks concurrently. OS/2 was chosen as the operating system. Using OS/2 multitasking, data can be collected, displayed, analyzed, routed, and archived simultaneously.

The computer running RTMS, dataloggers, and the various communications interfaces (RF95T, SC32A, MD9, phone modems, etc.) form a network with a physical communications path to and from each of the dataloggers. The DataLogger Services Manager (DlsMgr) module manages the network, organizing the exchange of information between the computer and the dataloggers. This information can be datalogger data, control information, datalogger programs, etc. DlsMgr handles multiple data requests from multiple CR10T sites simultaneously within the network. Since the most common request is for datalogger data, this communication is optimized so that datalogger table data can be retrieved quickly in an ongoing method. DlsMgr in turn makes the datalogger data available to other applications such as DBSelect and RTM.

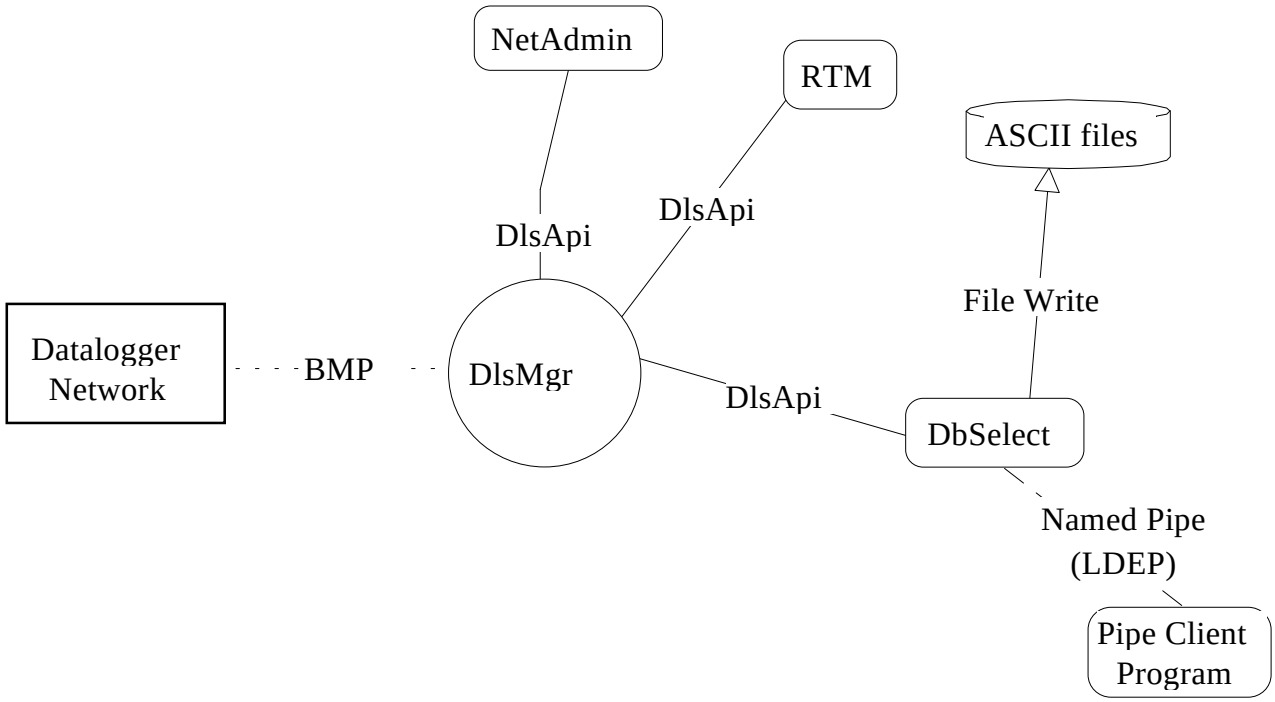

FIGURE 1-1. RTMS System

COMPONENTS OF RTMS

BMP – Block Mode Protocol, use to communicate with dataloggers, etc.

DBSelect – Data collection for storage, and routing including TCP\IP, named pipes, and ASCII files. This is data for archive or routing to another computer.

DlsMgr – Data**L**ogger **S**ervices **M**ana**G**e**R**. Manages all communication with datalogger network. Provides uniform interface for other programs requiring datalogger services. Starts automatically when needed by other programs.

DlsApi – Datalogger Services application Interface, used by programs to access datalogger services provided by DlsMgr.

Datalogger Network – The dataloggers and communication hardware used with them.

EDLOG – Prompting editor for datalogger programs. Used to create the ".DLD" datalogger programs.

Extract – (Not shown) used to extract a specific range of data from ASCII data files.

NetAdmin – Network Administration program, Used to: monitor network communication, status, and health, edit network descriptions, set or check clocks, download datalogger programs, interact directly with dataloggers, and test RF links.

RTM – Real Time Monitor, Monitor datalogger data in "real time" with various graphical displays and tables.

Pipe Client Program – Used to route DBSelect collected data to external database, user-written program, or other computer.

DBSelect, RTM, and NetAdmin can be run independently of each other. When more than one is running concurrently, requests for ongoing collection of datalogger data combine to avoid redundant collection. The interconnecting lines on the diagram represent a protocol that the two connected components use to communicate. Using RTMS requires no knowledge of these protocols unless special software is being written.

SECTION 2. OS/2 OPERATING SYSTEM

2.1 USER INTERFACE

Before RTMS can be installed, OS/2 (Version 2.1 or newer) must be installed and running. The SYSTEM MONO-SPACED FONT should be installed (this is default) as part of the OS/2 installation. Running the tutorial provided with OS/2 is a good way to become familiar with the OS/2 user interface. The manual 'Using the Operating System' provided with OS/2 also provides a good introduction to the OS/2 Workplace Shell. This RTMS document does not give detailed explanations of common user interface actions but offers the following brief definition of some of the terms used.

Click or **Click on** – Press and release mouse button (usually left button) while mouse cursor is positioned on an object.

Select – Click on object, double click on object, or press ENTER key when object is highlighted. Buttons and menus usually require a single click.

Double Click – Click twice rapidly on an object, often a shortcut for a common operation. For example, double clicking on a file name (in a file dialog box) is a shortcut for selecting a file name and then selecting the OK button.

Drag – Press and hold the mouse button while mouse cursor is over an object. Object is moved while mouse is moved as long as the mouse button remains pressed.

Drop – Releasing the mouse button after dragging when the object is in desired position.

Icon – Graphical representation of the program or other object. RTMS programs have icons, as shown in Figure 3-1.

Folders – Icon containing other icons. Used to organize programs, etc. Similar to a directory.

Start or **Open –** Double click on program icon to start program, double click on folder icon to open it.

Close – Remove the window, view, or folder. Closing the main window of a program will halt its execution as well. Clicking on the small box located in the upper left corner of window next to the title bar will display a menu of options available for the window. Double clicking on the box will usually close the window.

Minimize – Reduce the window to an icon. Program execution continues. This option is found on the option menu described in the close section above. Selecting the minimize button (button displaying a small box) will also minimize the window. This button is located in the upper right section of the window between the title bar and the maximize/restore button.

Maximize – Make the window as large as possible. Use the pop-up option menu (described in **Close**) or select button in the upper right corner next to the minimize button. When a window is maximized, the maximize button becomes a restore button and will return the window to the size it was before maximizing.

Size – The Option menu previously described in **Close** contains options to size the window. Windows can also be sized using the maximize button in upper right corner of window and by dragging the sizing border when available.

Certain keys have special uses. The TAB key moves the cursor to the next parameter, button, or object. The SHIFT-TAB key moves to the previous item. The ENTER key is used to indicate you are done with the current dialog box.

While many of the above actions can be accessed from the keyboard, most are designed for the mouse.

2.2 PRIORITY, MULTITASKING, AND SYSTEM RESOURCES

Since OS/2 is a multitasking system, many programs can be run at the same time. RTMS uses this multitasking to collect, process, display and store data at the same time. As more programs are run, heavier demands are made on finite system resources (i.e., memory, microprocessor time (CPU time), disk space etc.). At some level of activity the OS/2 system cannot provide enough system resources for RTMS to run correctly. Under normal conditions, all of the RTMS programs can be run concurrently without difficulty. However if other programs are running, multiple copies of some of the RTMS programs are running, or if hardware resources are insufficient (e.g., not enough RAM or disk space) OS/2 and RTMS performance may suffer. The following are indicators of insufficient resources:

- Sluggish responses to mouse and keyboard.
- Low memory warning on NETADMIN network health screen.
- Real time displays (e.g., strip charts) do not keep up.
- Status, warning, fault messages indicating queue overflows.
- DBSelect stop collecting due to insufficient hard disk space or because the Named Pipe breaks.

Some suggestions to diagnose and remedy these kinds of problems:

- Keep plenty of disk space free. OS/2 does not run well with less than 15+ megabytes free.
- OS/2 runs best with 8+ megabytes of memory (RAM). 16 megabytes is desirable.
- Do not run more programs than needed. Close unused DOS and OS/2 full screens, programs, folders, and windows.
- The DBSelect status window gives indications of hard disk space and virtual memory status.
- The PULSE program (supplied with OS/2) can be used to check CPU usage. If the graph indicates complete usage of the CPU, reduce the number of programs being run.
- The program on top of the OS/2 Desktop (the program with the focus) has higher priority than those running in the background. Keep the focus on important programs.

RTMS programs are compiled with priority so the background module (DLSMGR) task that communicates with the datalogger has highest priority. This helps ensure that data will be available for DBSelect and RTM. When system resources are taxed, DBSelect and RTM may not be able to process the data as fast as DLSMGR collects it. DLSMGR uses buffering and will keep the data until DBSelect and RTM can process it, if the heavy demands on the system resources are temporary. However when running with a continual lack of system resources, so RTM and DBSelect cannot keep up, DLSMGR buffers will eventually overflow and some collected data will be discarded. DBSelect will request that this data be recollected, provided the data is still available in the datalogger. However, when all of the CPU resources are being used, long-term operation is not reliable.

2.3 RESTARTING OS/2

By default, OS/2 automatically starts all programs that were running when OS/2 was stopped. This means if the RTMS programs were running when OS/2 was stopped, they will automatically restart when OS/2 restarts. This applies if they are started by double-clicking on their icons. NetAdmin and DBSelect use initialization (.ini) files to keep track of their state and will continue where they were previously when restarted. RTM will not automatically load and monitor with a template unless configured to do so. See Section 6.1.10 for information on how to do this.

SECTION 3. GETTING STARTED WITH RTMS

3.1 RTMS INSTALLATION

To install RTMS, select a full OS/2 screen or an OS/2 window. Change to the drive containing the RTMS disk #1. At the OS/2 prompt type INSTALL followed by ENTER. Follow the prompts given. The installation program allows the user to select whether it should modify the CONFIG.SYS file. When the changes are enabled, the install program:

- Adds the RTMS directory to the SET PATH directories.
- Adds the RTMS directory to the LIBPATH directories.
- Adds the RTMS directory to the SET HELP directories.

The installation program also allows the selection of the subdirectories where the programs will be installed. The default directory is C:\RTMS. A data directory is also specified. This directory will be used to store initialization files, datalogger program file, log files, etc. needed for RTMS. Normally datalogger data files will be stored in subdirectories under the data directory.

The installation program creates an RTMS folder on the OS/2 desktop. This folder contains ICONS for NetAdmin, RTM, DBSelect, and EDLOG (DOS) (see Figure 3-1).

NOTE: EDLOG is a DOS program and needs to be added to the OS/2 DOS PATH before it can be used. The RTMS install program does not do this as part of the installation.

To add EDLOG to the path, start a DOS session (full screen or windowed), change to the root directory (CD\), and edit the Autoexec.Bat file (EDIT AUTOEXEC.BAT). Find the path statement and add the directory where RTMS was installed. For example, the following sample path statement:

PATH
C:\OS2;C:\OS2\MDOS;C:\OS2\MDOS\WINOS2;

should be changed to:

PATH
C:\OS2;C:\OS2\MDOS;C:\OS2\MDOS\WINOS2
;C:\RTMS;

if RTMS was installed in the C:\RTMS subdirectory.

3.2 GETTING HELP WITH RTMS PROGRAMS

The RTMS programs offer on-line help. Most parameters and menu selections have help available. Pressing F1 while an option is highlighted will provide context-sensitive help. Selecting the HELP button or selecting HELP on the menu will also provide information about specific parameters.

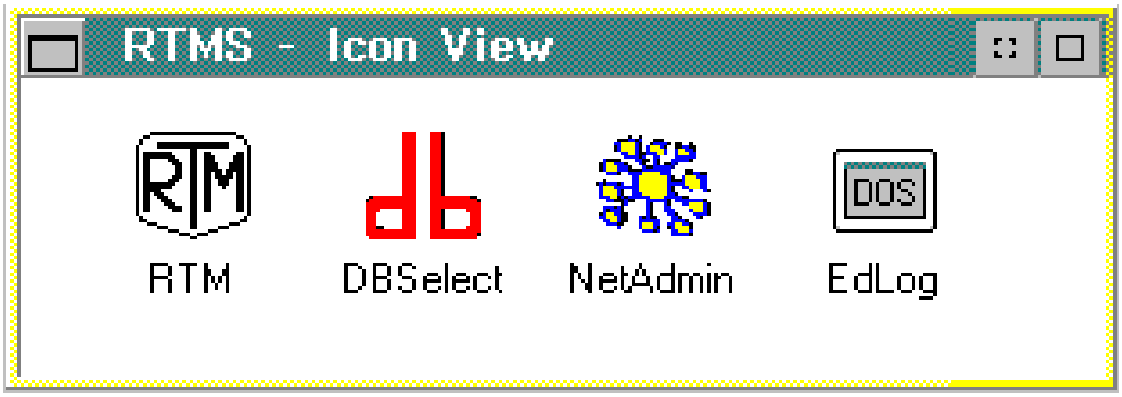

FIGURE 3-1. Contents of the RTMS Folder

3.3 RTMS STARTUP OVERVIEW

Campbell Scientific dataloggers are general purpose and require programming for specific applications. The datalogger manuals describe datalogger programming. EDLOG is a prompting editor for creating datalogger programs. EDLOG runs in a DOS window or full screen. The RTMS installation program created an icon for EDLOG. A separate manual contains information on using EDLOG.

Before data can be collected or displayed each datalogger site needs to be set up. Typically, that can be accomplished with the following sequence describing the task and the module used.

1. Create a network description. Entering stations and communication paths (NetAdmin).

2. Set or check the clock at each station (NetAdmin).

3. Download a '.DLD' datalogger program (created with EDLOG) to each datalogger station as necessary (NetAdmin).

DLSMGR will attempt various communications with all remote sites specified in the active network description. Retries will be attempted if any problems exist. With multiple remote sites several tasks can be happening at the same time. If several new sites have been added to the network description all at once, it may be difficult for the user to determine the status of the remote sites during the startup period. When problems exist (i.e., network description errors, bad communication links, etc.), DLSMGR will provide information on the network health screen and in the message logs. Some users have found it to be advantageous to add stations one at a time, verifying communication with each before adding the next station. With radio networks, using the RF link test can help identify communication problems with remote sites before adding them to the network. Once the network has been described and set up, the following can be done:

- The data for archive or routing to other programs or computers can be selected and collection started (DBSelect).

- Set up real-time graphical displays (RTM).

- Set up computer/datalogger control (RTM).

- Automate checking of the datalogger clocks (NetAdmin).

SECTION 4. DLSMGR

4.1 INTRODUCTION

DataLoggeR Services ManaGeR (DlsMgr) provides all communication with the datalogger network. RTMS users do not interact directly with DlsMgr but it is helpful to have an understanding of how it works.

DlsMgr is given information regarding the layout of the network as a Net Description. NetAdmin provides DlsMgr with this description based on user-entered parameters. Once it has received a Net Description, DlsMgr uses the dialing and path information to communicate with the dataloggers in the network.

When new dataloggers are listed in the Net Description, DlsMgr queries each new datalogger in the network to obtain a list of data available at that site. This information, known as Table Definitions, is used to provide lists of what data is available to programs requiring datalogger data. In addition, DlsMgr initiates an ongoing system for delivery of information (packets) both to and from the dataloggers. With this packet delivery system in place, programs such as RTM, NetAdmin, and DBSelect can request services regarding the dataloggers.

The DlsMgr provides services including: a list of stations in the network, a list of data available at any station, collection of specified data from sites, reading and setting of clocks, reading and setting of ports and flags, and others.

4.1.1 PACKET DELIVERY

DlsMgr implements a packet delivery system that is independent of the information contained in the packets. This means that multiple jobs can be going on at once. For example, clock sets can be done while the normal ongoing data collection is taking place.

DlsMgr periodically checks each datalogger for any packets the datalogger needs to send, including data. This polling for packets is based on the polling interval the user-specified with NetAdmin. Most of this packet delivery system is done by the computer, however the RF232T (radio base station) takes an active role in the delivery of packets through the radio network.

4.1.2 RETRIES

DlsMgr tracks jobs to ensure their completion. DlsMgr will retry jobs that fail or jobs for which DlsMgr does not receive a response in the retry period specified by the user. In addition to these 'top level' retries, the underlying packet delivery system may attempt immediate local retries. For example, if a packet transmitted over a serial link fails a signature test the packet will be sent again. As expected, the exact behavior of the system varies with the link being used.

Telephone – The packet delivery system will make two attempts to establish a phone connection. Once the phone connection is established, the packet delivery system will deliver any packets to the datalogger and will pause briefly to accept any packets from the datalogger. If transactions for other dataloggers that require the phone line are pending, DlsMgr will complete the transaction and accept one additional packet from the datalogger before terminating the connection. This prevents one datalogger from monopolizing the phone line. If all the stations utilizing the telephone are scheduled to call at the same time then only one packet will be accepted from each station before calling the next. This can cause DlsMgr to spend most of its time dialing and switching from site to site. Using the same calling interval for all stations, but using the offset parameter to stagger the calls within the interval, leads to a more efficient ratio of calling time versus data collected.

RF – The base station takes an active role in delivery of packets both to and from the remote dataloggers accessed via radio. The base station periodically does a broadcast based on the user entered polling interval and offset. When the remote RF95T modems hear the broadcast, they check the CR10T they are connected to for any packets. Each remote, in turn, sends the packets back to the base. This polling is normally used for data collection.

If repeaters are being used, the repeater will do the broadcast and receive replies from the remote RF95T modems. The repeater then relays all the packets back to the base. When the base receives packets destined for a

remote, the RF base will direct the packets to the CR10T using the specified path and return the response as soon as possible.

If directly routed packet deliveries fail, the base will attempt several retries. Retries are done at the end of each polling cycle for remotes that failed to respond to the broadcast. When retries fail consistently, the base will mark the remote site as not responding and will not attempt further packet delivery or collection from that site until it responds to a broadcast.

Direct connect, short haul, and MD9 – The computer handles packet delivery with these systems. Signature and dialing failures are retried immediately. The remote dataloggers are checked at the user-entered polling interval for any packets they need to send to the computer (normally data). Direct connect (SC32A) and short haul modems (Rad modems) access one datalogger per serial port. The MD9 modems allow multiple remotes on the same serial port. With MD9 modems, the computer accesses the remotes sequentially by dialing the base MD9.

4.1.3 DATA COLLECTION

DlsMgr also oversees the data collection process. If the current retry period or four times the polling period (whichever is longer) elapses without a valid data response from a datalogger, DlsMgr will restart the data collection from that site. The datalogger will send a valid response even if it has no data to send as long as it is configured to send data. This prevents DlsMgr from restarting the data collection if slow data (compared to the retry and polling interval) is being collected. Normally DlsMgr will need to restart data collection when the following type of event occurs:

- The datalogger is called by a computer other than the RTMS computer (i.e., GraphTerm or other RTMS computer).
- The datalogger has cancelled sending data because a long period has elapsed since the last valid collection.
- The datalogger has lost power.
- The datalogger has been reprogrammed.

SECTION 5. NETADMIN

5.1 OVERVIEW

NetAdmin provides seven basic functions for setting up and maintaining the network. The network health is displayed on the NetAdmin main screen. The other functions are accessed from the submenu displayed when VIEW is selected from the NetAdmin main menu. Each function is briefly introduced here and described in detail in following sections.

NETWORK HEALTH (Main Screen)

Provides a pictorial representation of the network with each station colored to show its status, the time stamp the last data collected from each station, the total number of stations where data is being collected, and a graph indicating the status of each station for the last 12 hours. Additional displays are provided to monitor and log low-level port activity including a slider control to pause all network communication for a period of time.

NETWORK DESCRIPTION (View Submenu)

Used to describe the datalogger network. The left side of the screen shows the pictorial representation of the network as entered, the right side shows specific information for the selected device.

STATUS/WARNING/FAULT (View Submenu)

Displays color coded messages (Black for status, Blue for warning, and Red for faults) about the network. A setup screen allows the selection of the type of messages (Status, Warning, or Fault) and from which stations messages should be displayed. These messages can be logged to disk.

CLOCK CHECK/SET (View Sub menu)

Allows the clocks in the network to be set or checked. This can be done manually or automatically at a user-specified interval.

PROGRAM DOWNLOAD (View Sub menu)

Allows '.DLD' datalogger programs to be downloaded to the dataloggers. Multiple stations and programs can be selected and queued.

KEYBOARD/DISPLAY (View Submenu)

Allows remote keyboard access of each datalogger in the network.

RF LINK TEST (View Submenu)

Allows the testing of Radio (RF) links. To test RF links the ID switch settings of the RF95T or RF232T must be known. This allows testing of the radio hardware before the stations are brought on-line.

All of these functions, accessed from the VIEW submenu, are active as long as NetAdmin is running. The individual windows (views) may be closed without affecting their operation if the NetAdmin main program with the network health display is left running (e.g., the automatic clock sets will take place, even if the Clock Check/Set window is closed, as long as NetAdmin is running). NetAdmin can be minimized and the functions will still be active.

5.2 NETWORK DESCRIPTION (NODES, PATHS, AND ADDRESSES)

NetAdmin is used to create descriptions of the datalogger network. When the MAKE THE OPEN NET DESCRIPTION ACTIVE menu option is selected, NetAdmin transfers the current network description to DLSMGR. DLSMGR will use the current information to establish communication with the dataloggers (stations). Net descriptions can be saved at any time. Descriptions are saved with a ".NET" extension. When a description is saved, a text (printable) version is also saved with a ".TXT" extension. Multiple descriptions can be entered and saved but only one can be active at a time. Once a description is made active, DLSMGR will continue to use it even if NetAdmin is stopped and restarted. It is unnecessary to make a description active again unless the description is changed or a different one is used.

A network description contains information regarding what dataloggers are in the network and what devices are used to communicate with the dataloggers. The dataloggers and communication hardware are organized as a hierarchy. This can also be thought of as a

parent-child organization or a tree structure. Basically the structure starts with the Computer (PC1) at the top, a datalogger (CR10T) at the end of each branch, and various communication hardware in between. Each entry in the structure is referred to as a node. In the pictorial representation, a child node is listed under its parent and indented to the right. Some examples should help clarify this structure.

Consider a PC with a CR10T attached to each of its four serial (COM) ports. The PC is considered the parent and each of the CR10T dataloggers is a child. Pictorially it would look like this:

PC1
- CR10T1 - COM1
- CR10T2 - COM2
- CR10T3 - COM3
- CR10T4 - COM4

All the children nodes of a given parent (siblings) do not have to be the same type of devices. If there were 3 CR10T dataloggers and a radio base station (RF232T) attached to the PC and there were two remote radio sites (CR10T and RF95T) attached the network would look like:

PC1
- CR10T1 - COM1
- CR10T2 - COM2
- CR10T3 - COM3
- RF232T - COM4
  - CR10T4 - 1
  - CR10T5 - 5

Notice that the PC1 is always a parent, an RF232T is a child of the PC but a parent to the two remotes. The RF232T is also a sibling of CR10T1, CR10T2, and CR10T3. The numbers by CR10T4 and CR10T5 indicate their RF modem addresses.

Nodes are entered by highlighting a parent node and selecting the ADD CHILD button or highlighting a child node and selecting the ADD SIBLING or INSERT SIBLING button. The ADD CHILD and ADD SIBLING buttons add the new node at the bottom of the entered children or siblings. The INSERT SIBLING button moves the highlighted sibling and those under it down, making a space for the new sibling.

Each device that DLSMGR will use (talk to or dial) directly is entered as a node. All other devices and information are entered as parameters. For example, to communicate with a datalogger over an RF (radio) link that uses a repeater, DLSMGR must communicate directly with the RF base; thus, the base is entered as node. DLSMGR does not talk specifically to the repeater, so it is not entered as a node. The RF base does use the repeater so it is entered as part of the RF path parameter. Once a parent node has been defined, only certain devices can be added as a child to that parent. For example, an RF (radio) base station, when entered as a parent node, can only have remote RF stations as child nodes. The specific examples below should help clarify what is entered.

The user enters a descriptive name for each station. All future reference to the station will be by this name. The devices and information are needed from the user: COM ports, devices (e.g., SC32A, Hayes Modem, MD9, etc.), and dial string (e.g., phone number). Addresses are also entered for addressed peripherals (e.g., RF95T or MD9). In addition, the user enters the interval at which the station should be checked for new data. Once entered, these parameters are saved by NetAdmin. The user can also save the description to be edited later if the network changes. This part of NetAdmin is not used again unless stations are added or removed from the network.

5.1.1 ENTERING A NETWORK DESCRIPTION

Open the RTMS folder by double-clicking on its icon. This will display the icons for the RTMS software. Start the NetAdmin program by double clicking on its icons. The main NetAdmin screen will be displayed.

Select VIEW from the main menu, and then NETWORK DESCRIPTION from the submenu. The screen in Figure 5-1 will be displayed if NetAdmin is being run for the first time. This network description indicates that the computer (PC1) is the only node (device) in the network. PC1 is always present in a network.

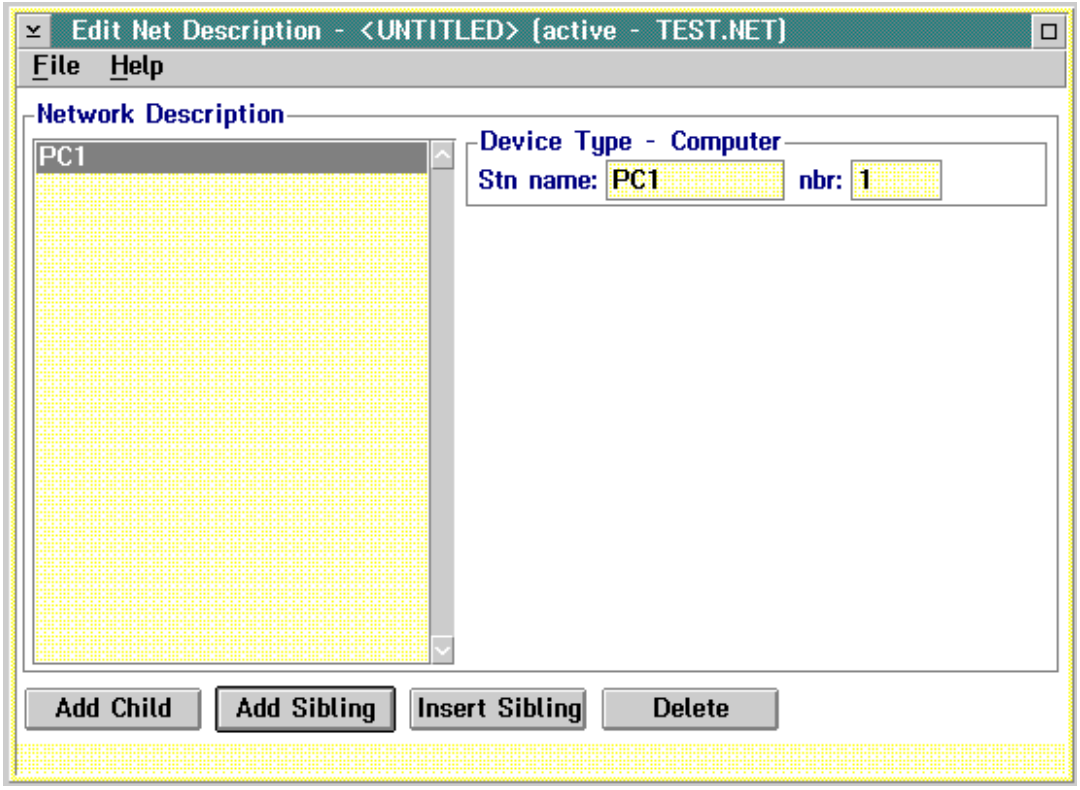

FIGURE 5-1. Initial NetAdmin Screen

As the network is constructed, the left part of the screen will visually indicate the network as it is described. The right part of the screen will show the specific parameters for the node highlighted on the left. As a node is entered by selecting one of the child or sibling buttons, a list box will allow the selection of the device (i.e., RF232T, CR10T, etc.) for that node. The list of devices offered in the list box will vary depending on the parent node already selected or may not be presented if only one selection exists. For example, when entering a child node for a RF232T base station, only a remote CR10T site can be selected. After the device has been selected, the left side of the screen will allow the editing of parameters for that node.

Section 5.1-2 describes all of these node parameters. The actual parameters displayed varies depending on the selected device.

5.1.2 DEVICE TYPE PARAMETERS:

The **STATION NAME** parameter is a user-entered name for each node. NetAdmin will supply a default name (Stn1, Stn2, etc.) for each station but a more descriptive name is suggested. The entered name will be used throughout RTMS to refer to the station.

> **NOTE:** Station names must start with a letter and contain only letters, numbers or the '_' character. Each station name must be unique and names can be up to eight characters long.

The **NBR** parameter is used to assign a unique identification number to each node in the network, The default number is adequate although the user may change the numbers as long as they are kept unique. This number should not be confused with the address set with switches in RF95T and MD9 modems.

The **ON** button is checked to allow communication with that station. If the button is not checked, DLSMGR will inhibit all communication directed to that station.

BMP PARAMETERS (Block Mode Protocol)

The **SECURITY CODE** parameter is used to specify the security code needed to use a given node.

The **DO___RETRIES USING A ____ SEC PERIOD THEN USE _____ SEC**. prompts allow the scheduling of fast and slow retries. When an operation (e.g., clock set) fails, it is retried until it succeeds, is canceled by the user, or is canceled by the program that initiated it. This parameter allows the user to control how often these retries occur. The number of retries specified in the first blank are attempted at the interval specified in the second blank. If the operation is still unsuccessful it is then retried at the second interval until it succeeds.

> **NOTE**: These intervals must be long enough to complete the entire operation including telecommunication time. For example, a large program may take 10 to 15 seconds to download and compile, even on a direct connection. If the retry interval is not long enough, the download will restart before the previous one completes.

5.1.3 SERLINE PARAMETER (SERIAL LINE COMMUNICATIONS)

The **POLLING INTERVAL** parameter is used to specify how often the affected node (or child nodes for some parent nodes) is checked for data. Several factors are affected by it:

1. Delay from when data is stored in the datalogger until it is available in the computer. Polling a station once a minute ensures the data is available at (or at least en route to) the computer within a minute of it being stored in datalogger memory.
2. How much time the network is active and busy versus amount of time idle. The delay involved in non-data type operations (e.g., clock sets) is affected by how busy the network is polling. Polling at fast rates may cause other jobs of lower priority to be delayed or even postponed indefinitely.
3. The cost of running the network is affected; frequent polls means frequent phone calls in telephone networks. Frequent polling in other networks causes more power consumption, increasing demands on batteries.

> **NOTE:** For RF Radio frequency, poll at least every 20 minutes.

The **OFFSET** parameter is used to determine when, in the polling interval, a poll is made. For example, setting the polling interval to 60 and the offset to 30, would cause the polling to take place every minute (60 seconds) but 30 seconds into the minute.

The **EXTRA COMMS ALLOWANCE** (Msec) is used to increase the amount of time DLSMGR will wait for a response to serial packet data it sends. Normally this is left at zero.

The **MAX PACKET SIZE** is used to manually decrease the size of packets DLSMGR uses. This is only required for special links. Normally the default value is used.

The **BAUD RATE** parameter should be set to match the selected device.

5.1.4 VIA PARAMETERS

This parameter is used to specify the link between the node being described and the parent node. For nodes connected directly to the PC it specifies the COM port used. For a remote station accessed by telephone it specifies the telephone number dialed to reach the station. For RF it is the hardware addresses of the station and repeaters used to reach the remote site. For MD9 networks it specifies the hardware addresses of the remote MD9 nodes.

5.1.5 RF POLL OFFSET

In an RF network, the base polls the remotes at the same interval it is polled by the computer. This box is present for the first child of the RF base node. It can be used to alter when, in the polling interval, the RF begins polling. This allows independent polling offsets for when the computer polls the RF base and when the RF base polls the remotes. For example, if the datalogger stores data on the even minute, starting the RF polling 5 seconds after that ensures the most recent data is available.

5.1.6 STATUS LINE

The bottom of the screen contains a one line status box. Relevant status information is displayed.

5.1.7 EXAMPLES

Following is a description of what nodes need to be entered for various communication configurations. Network descriptions can use multiple serial ports. For example, a modem on COM1 can communicate with a network of dataloggers via telephone lines while a RF base on COM2 uses radio to communicate with other dataloggers. The PC1 (computer) node is present in all networks.

Direct Connect (SC32A) – Each remote datalogger is entered as a node (child node of PC1). No other nodes are necessary. Each datalogger (each on its own serial port) has its own polling interval.

Phone Modem (DC112) – Enter a node for the phone modem at the computer site (phone-base). Each remote datalogger will be entered as a child node of the phone-base node. Each remote will have its own polling interval with no polling interval for the phone-base. See Section 4.1.2 for more information on scheduling.

RF (radio frequency) – Enter a node for the RF232T (RF base station) as a child of the computer. The polling interval is entered for the base and will be used to poll all the dataloggers that communicate with the base.

> **NOTE:** For RF Radio frequency, poll at least every 20 minutes.

Repeater only sites (no CR10T) are not entered as nodes. Enter a node for each remote datalogger. To use a repeater (either a repeater only site or a CR10T/ RF95T site), enter the communication path as part of the node description for the site being communicated with. Enter the communication path in the VIA RF network parameter as a series of repeater IDs separated by commas. End the string with the ID of the remote site. For sites not using repeaters, just enter the ID of the remote RF95T as the VIA RF network parameter. A RF95T ID is determined by its switch settings. See the RF manual for infor-mation on how to set the switches. In Figure 5-2, a remote site (station name of Logan) has its switches set as ID 1. The communication path is through a repeater with the switches as ID 4.

Multidrop (MD9) – Set the base MD9 address to 255 and set each remote so the addresses are unique. Enter a node for the base MD9. Enter the remote nodes as children of this node. Enter the address (switch setting) for each remote in the VIA MD9 parameter. See the MD9 manual for information on setting the switches. Each remote CR10T will have its own polling interval.

Phone to RF or Phone to MD9 – Enter a node for the phone modem. Enter Phone to RF base or Phone to MD9 base as a child of this node. The remote sites are children of this node. Phone to RF and Phone to MD9 with measurement capability (a CR10T at the site) is NOT supported by RTMS.

When the network description is complete, save the description. Next select the option to MAKE THE OPEN NET DESCRIPTION ACTIVE. Both options (save and make active) are found under the FILE selection on the main menu. The status line at the bottom will confirm these actions. This window can now be closed.

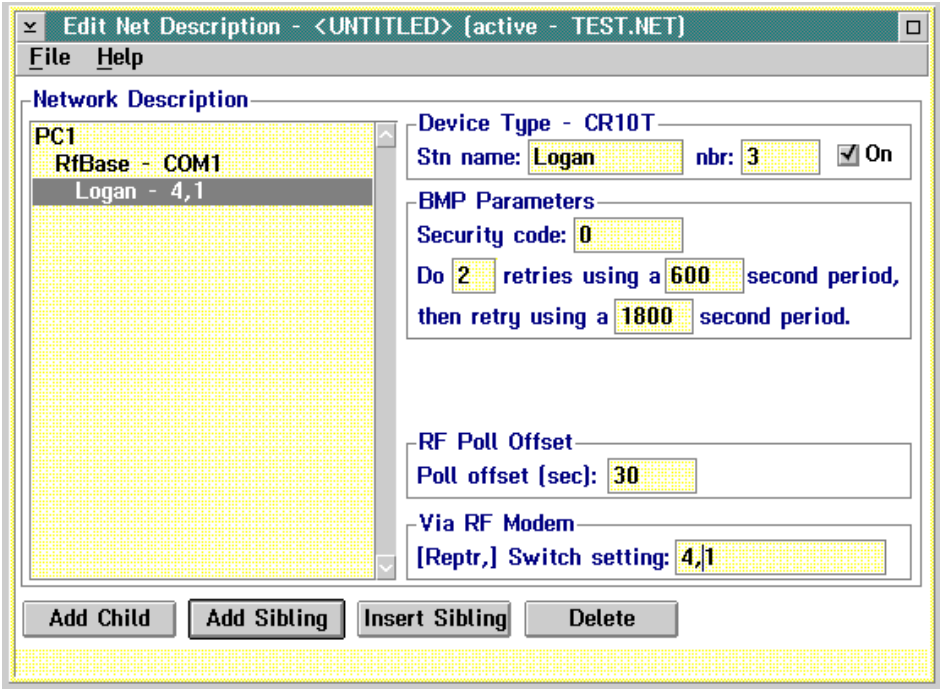

FIGURE 5-2. Editing a Sample RF Network

5.2 NETWORK HEALTH

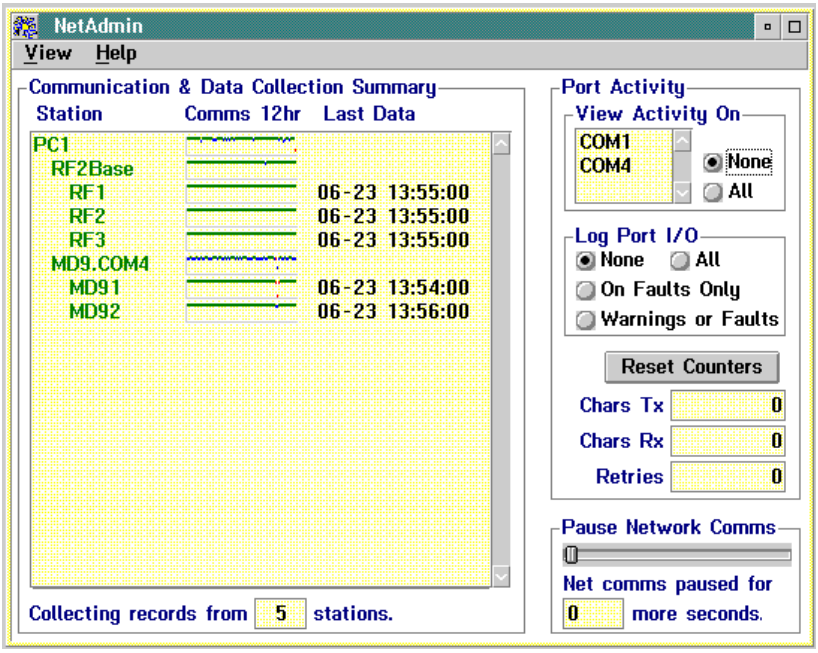

FIGURE 5-3. Main NetAdmin Screen Showing Network Health

When a description is made active, the communications module (DLSMGR) will attempt to establish communication with each new station in the network. The NetAdmin main screen (see Figure 5-3), will show each station entered in the description. The stations will be black until communication is attempted. A green color indicates successful communication, blue indicates a warning occurred, and red indicates a fault.

If a station is blue or red, there will also be warning or fault message generated. These messages can be viewed by selecting STATUS/ WARNING/FAULT from the VIEW submenu. See Section 5.5 on SWF messages. The net description should also be checked to ensure the affected station was entered correctly. Check the path, dialing strings, and switch settings. Repeat the "make active" procedure if any corrections are made.

A flashing indicator (the Memory Low Indicator) will give warning when less than 2 megabytes of virtual memory is available. OS/2 attempts to free memory by swapping block to the hard disk. Low virtual memory can indicate that hard disk space is low. This may also be a sign that too many programs are being run concurrently. Long term operation with insufficient memory or hard disk space is not reliable. The indicator appears in the bottom right corner of the Communication and Data Collection box.

The PAUSE NETWORK COMMUNICATION allows pausing communication to all nodes in the network. The pause time is increased by dragging the "slider" control to the right. The box below the control indicates how much longer the communication will be paused. When DLSMGR is started, it will pause before starting communication with the datalogger network. This allows NetAdmin to be started and the paused time increased before communication begins. This is only important when preventing communication is necessary.

5.3 CLOCK SET/CHECK

For most applications it is important to keep the datalogger's clocks synchronized with each other and the computer. However when manually setting the clocks or when scheduling unattended clock sets, it is important to consider three consequences of changing the datalogger's clocks.

First, make sure the computer clock is set correctly as it is used as the reference time. Many computers have inaccurate clocks.

Second, consider when the datalogger's clock is changed. If the dataloggers are collecting data, setting the clock may cause the datalogger to miss or cause an extra output interval if the clock is changed when the datalogger is near an output interval. For example, if the datalogger clock says it is 12:01 and the datalogger has just stored hourly data

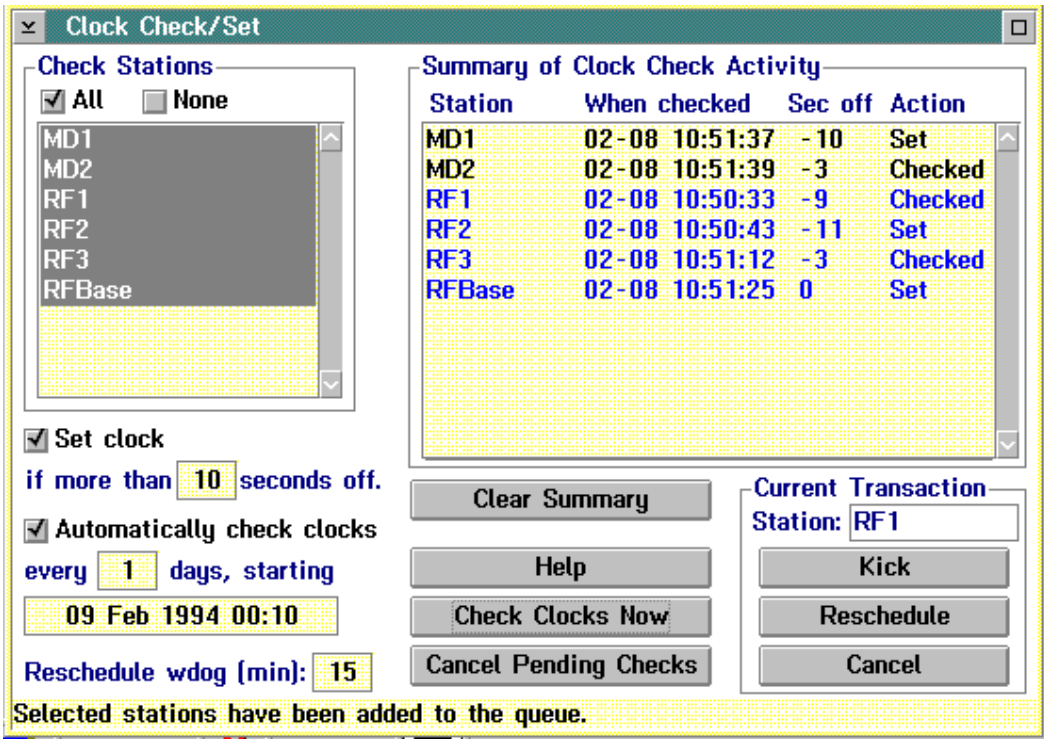

FIGURE 5-4. Clock Check/Set View

(at 12:00) setting the datalogger clock back to 11:59 will cause an additional 12:00 output to be stored. The datalogger will store correct data based on the number of samples, etc. but two records will have the same time stamp of 12:00. The clock set utility allows the specification of when the clocks are automatically set.

Third, if the datalogger clock is outside the allowable tolerance (specified as the SET CLOCK IF MORE THAN ___ SECONDS OFF parameter), the clock set utility will attempt to set the clock (several times if necessary) until the clock is within the allowable tolerance. Even though it compensates for the telecommunication link in use, if the tolerance is too tight the clock utility maybe unable to set or even check the clock accurately enough. For example, it is difficult to set the clock at a datalogger site where the communication path utilizes several radio repeaters, to within one second of the computer clock. With radio, a tolerance of 5-10 seconds is more practical.

To set or check the datalogger clocks, select CLOCK SET/CHECK from the VIEW sub menu. A list of stations with clocks will be displayed in the CHECK STATIONS box (see Figure 5-4). Select all the stations where the clock will be set or checked according to the computer's clock. The ALL or NONE buttons can be used to select all or none of the stations at once. Individual stations can be selected or unselected by clicking on them.

If the SET CLOCK button just below the CHECK STATIONS BOX is checked, the clocks will be set if they are off by more than the value specified in the IF MORE THAN _____ SECONDS OFF box. Otherwise the clocks will just be checked.

Select CHECK CLOCKS NOW button to start setting or checking the clocks. As each clock is done a message will appear or will be updated in the SUMMARY OF CLOCK CHECK ACTIVITY box on the right part of the screen. Existing messages for clocks being set are colored blue until the operation is complete. The message will then be colored black. If a clock cannot be set/checked, it will be retried until the RESCHEDULE WDOG period (watchdog period), specified in the lower left hand part of the screen, elapses. If this occurs the clock set for that station will be moved to the end of the queue (list of clocks to be set) and the clock set will continue with next station. This can be done manually by selecting the RESCHEDULE buttons in the CURRENT TRANSACTION box. The CANCEL button there will cancel the current clock set/check. Until the watchdog period elapses, clocks will be retried at the intervals specified in the network description.

You can manually force a retry by selecting the KICK button in the CURRENT TRANSACTION box. The STATION box displays the clock set/check currently being worked on. Stations will be retried each time they come to the top of the queue until they succeed or are canceled. The CANCEL PENDING CHECKS can be selected to cancel all remain clock sets/checks. If the AUTOMATICALLY CHECK CLOCKS button is checked, the selected clocks will be checked/set on the defined schedule. Enter a starting time and interval just below the button. The starting time box allows the day, hour, and minutes to be entered. The interval box has units of days. Each time the entered number of days elapses, the clocks will be set/checked at the time specified in the starting box.

Once the options have been selected, the clock window can be closed. The selected operation will continue as long as NetAdmin is left running. The bottom line of the clock set screen is a status line that will indicate the status of the current operation.

5.4 PROGRAM DOWNLOAD

The Program Download View is used to transfer a datalogger program from the computer to the datalogger (Download). Datalogger programs are created on the computer with EDLOG. The programs are then transferred over the telecommunications link to the datalogger. No site visit is required. The download window is displayed by selecting PROGRAM DOWNLOAD from the VIEW sub menu (see Figure 5-5).

The displayed sub window has a list of station names, files with the ".DLD" extension, and a list of disk drives and sub directories. For each station needing a program downloaded, use the following steps:

1. Select the desired station.
2. Select the ".DLD" file for that station. Selecting a different drive or sub directory will update the list of ".DLD" files with those contained in the selected directory.
3. Add the station and accompanying ".DLD" file to the DLD DOWNLOAD QUEUE by selecting the INSERT button.
4. Repeat the process for each station requiring a download.

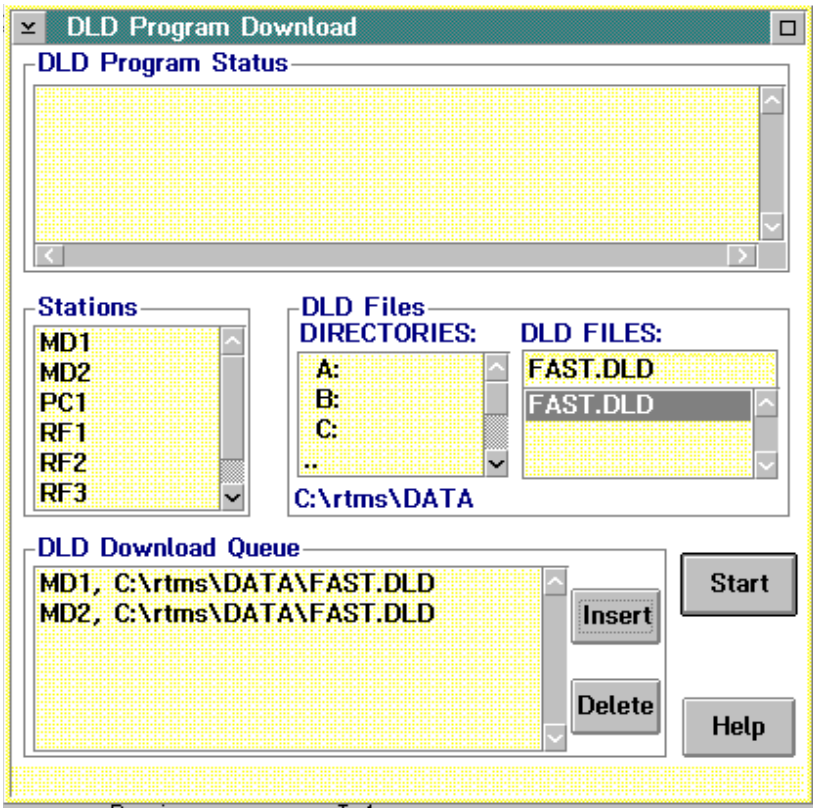

FIGURE 5-5. DLD Program Download View

When all stations that need to have programs downloaded are in the queue, select the START button. The programs will be downloaded one at a time. When a download is complete it will be listed in the .DLD PROGRAM STATUS box at the top of the window. This will replace any earlier message regarding the station. A station and ".DLD" file combination can be removed from the queue by highlighting it and selecting the DELETE button. The status line on the bottom of the window will give information on the current download. Once the start button has be selected, the DLD PROGRAM DOWNLOAD window can be closed at any time. The downloads will continue as long as NetAdmin is left running. A message indicating successful download (including program signature) will be displayed in the STATUS WARNING FAULT message window. NetAdmin will attempt to download each program file until it is successful or the user cancels that particular operation. If a site cannot have a program downloaded (e.g., does not respond), the other downloads following it in the queue will not be attempted until the download being attempted succeeds or is canceled.

5.5 STATUS/WARNING/FAULT MESSAGES

Messages relating to the computer, communications, and the dataloggers can be viewed and stored to disk. Messages are classified as a status, warning, or fault. Status messages give information about clock sets, program downloads, and datalogger data being collected. Warning messages indicate that a potential problem occurred or that something unexpected happened. For example, a communication retry occurred. Fault messages indicate that an operation failed. Most operations are retried after a fault.

Select STATUS/WARNING/FAULT from the VIEW menu to display a list of these messages. Clicking on any message or on the scroll bars on the right side of the window will pause the display of new messages at the end of the list. To resume the display, select the VIEW END OF LIST button on the bottom of the screen. When this button is checked, the newest messages will be displayed as they arrive.

The SETUP... button displays the setup window when selected. The setup window allows the selection of what messages are displayed. Selections include which type of message (status, warning, faults), which stations the messages are about, and which stations the messages are from. When the OK button is selected, the display window is updated to reflect current choices. NetAdmin buffers the last 100 messages of each type regardless of the setup selections, so it is possible to change the selections and see a different display of the same group of messages.

The messages logged to disk are also filtered by the setup selections. The selections that are current when the message arrives determine whether the message is written to disk or not. When logging messages to disk, they are written to a file named SWF$.log (see Section 8.1).

5.6 RF LINK TEST

Before adding RF stations to the net description or when checking existing stations, it is desirable to test the radio communication path to a site. Found on the NetAdmin VIEW menu, this option allows low level testing of radio links. Stations and repeater only sites can be tested. Stations being tested do not have to be entered into the NetAdmin description but the RF BASE station does. To perform a test, select the RFBASE station from the list of stations displayed under the caption "RFBASE STATION". Enter the address of the remote RF95T to test in the [REPEATER] SWITCH SETTING: box. To test a link using repeaters, enter the repeater address or addresses followed by the remote address. Separate addresses with a space. Select the BEGIN button to start the test. The results will be displayed in the TEST STATUS/RESULTS window at the bottom. A row of five numbers will be returned for each RF95T in the test, including the RF BASE. The first number in each row indicates the size of the packet and should be around 238, depending on the link tested. If it is about one half that size or smaller, then there is probably outside interference on the frequency in use. The next four numbers indicate the quality of the link and should be around 80 to 125 (see Section 8.4). Poor numbers here can indicate antenna, power problems, or bad communication path. The rows of numbers start at the remote and work back to the RFBASE. Results are also written to a file (see Section 8.1).

The RF Link Test also returns the signature of the prom in the Remote RF95T. Featuring the RFBASE address in the switch setting box will file the signature of the prom in the RFBASE.

5.6.1 KEYBOARD/DISPLAY

This option provides CR10KD emulation on the computer. The menu allows the selection of the station to be communicated with.

5.6.2 NETADMIN COMMAND LINE PARAMETERS

OLETS - Show options for OLETS communication.

LT1 - Show options for Level Tech hardware.

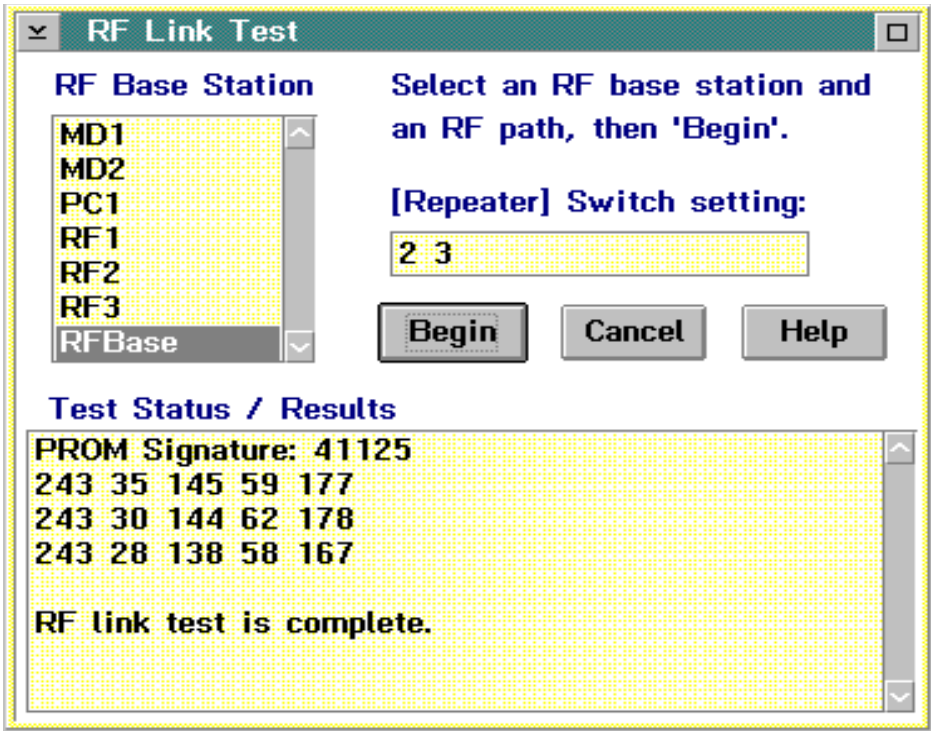

FIGURE 5-6. Radio Link Test View

SECTION 6. RTM (REAL TIME MONITOR)

RTM is used to monitor data values from stations in the RTMS network. RTM offers a variety of data displays including strip charts, bar charts, numerical displays, X/Y plots, etc. Multiple data displays, text, rulers, and drawings (maps) can be combined by the user into a single template (Figure 6-1). Once created, a template can be named and saved for later use.

RTM has two modes; Edit and Monitor. The mode is changed from the mode submenu, accessed by selecting MODE on the main menu.

6.1 EDIT MODE

The edit mode is used to create new templates or edit existing templates. RTM automatically enters the edit mode when it is started. When RTM is monitoring, selecting EDIT from the MODE submenu will halt the monitoring and RTM will enter the edit mode.

6.1.1 BACKGROUND COLORS AND BITMAPS (MAPS OR DRAWINGS)

Normally RTM templates have a solid white background. Select BKGND COLOR from the OPTIONS submenu (on the main menu) to change the background color. If desired, a map or drawing can also be used as the background to give additional information about the displayed data. For example, a map may be used to show where the data was collected. RTM will display .BMP type files. Many paint and screen capture programs create .BMP files. For example the paint program supplied with WIN-OS2 can create bitmap files. Bitmaps are added by selecting BITMAP BKGND from the submenu displayed when OPTIONS is selected on the main menu. Bitmaps are referenced to the lower left corner of the display and must be large enough to cover the desired area.

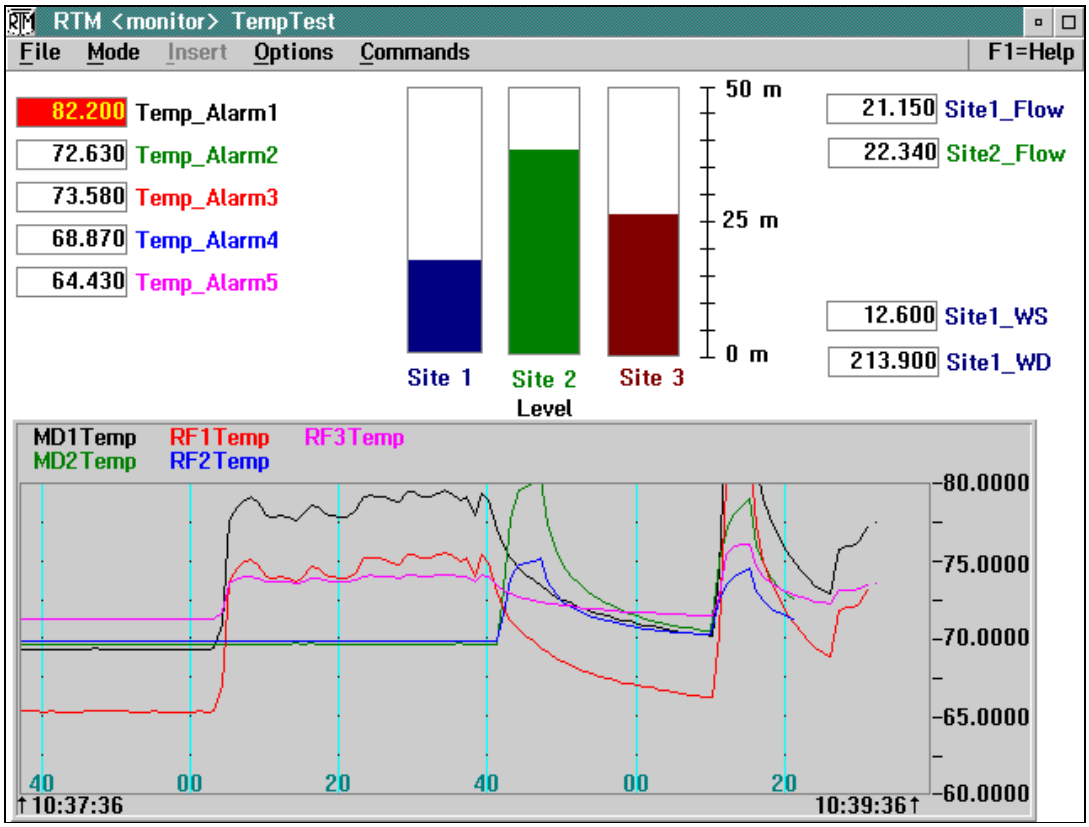

FIGURE 6-1. RTM Template Using Strip Chart, Bar Chart, and Numerical Displays

6.1.2 CREATING A TEMPLATE

Creating a template consists of adding the desired displays to the template. Data displays are used to display data retrieved from the dataloggers or to issue control commands to a datalogger. This includes numeric, bar chart, strip chart, X-Y plots, and other displays. Accessory displays are used to enhance data displays and give information about the computer. Accessory displays include rulers (scales), text, and computer date/time. Adding a new display (either type) uses four basic steps repeated for each display added. The four steps are:

1. Select the display to be added.
2. Position the display.
3. Describe/define the display.
4. Size the display.

6.1.3 SELECTING A DISPLAY

While in Edit mode, the cursor gives a visual indication of the currently selected display type while the cursor is positioned in an unused area of the template. A display of the currently selected type may be placed without using the menu. If a different type display is desired, move the cursor to 'INSERT' on the main menu. The cursor will change back to the standard pointer when the cursor leaves the template area. Selecting INSERT gives a list of the available displays. Highlight and select the desired display. This becomes the default display type until a different display type is selected. The cursor will give visual confirmation of the display type selected when it is placed back in the template area.

6.1.4 AVAILABLE DISPLAYS

The following displays are available under the INSERT submenu:

NUMERIC – Displays single numeric field with label. Allows color of label to be selected. Display grays when data becomes old. Used to set alarms. Label text color can be selected.

NUMGROUP – Used for easy selection of multiple numeric fields from same datalogger and table. Automatic arrangement and labeling of fields.

BIG NUMERIC – Uses a large font, making single numeric display stand out and easy to read.

STRIP CHART – Plots up to 12 traces against time. Each display can have a separate color and separate Y axis. Simple cursor mode allows numeric display of trace values.

X-Y PLOT – Plots points based on two fields; one for the X value and one for the Y value.

BAR CHART – Rectangular box with color filled height proportional to value. Allow selection of color, minimum value, and maximum value.

PORT OR FLAG – Displays port or flag status. Optionally allows port or flag to be toggled with mouse. Ports and flags can be labeled for easy identification.

INPUT LOC – Displays single numeric value. Allows value to be edited, changing value in datalogger.

CONTROL – Allows port, flag, numeric value conditions in one datalogger to be used to change port, flag, or Input location in another datalogger.

RULER – Used to add scale to bar chart, etc. Horizontal or vertical orientation with user specified number of tick marks.

WIND VECTOR – Compass-like display of wind speed and direction. Also numerically displays wind speed and direction. Optionally leaves dots for up to 99 values giving some historical information.

RECORD DISP – Tabular display of entire data table. Will scroll vertically through buffered records. Buffers as many records as will fit in 32K characters. Scrolls horizontally for tables wider than display.

TEXT – Places text on template. Allows selection of text color.

TIME ON LAST REC – Gives time stamp of last data received from selected station.

CURRENT TIME – Displays computer time information on template.

6.1.5 POSITIONING THE DISPLAY

Once the display type has been selected, a display of that type can be placed on the template. A display is placed by moving the mouse cursor to the desired position on the template and clicking the left button once. The mouse cursor position is where the lower left hand corner of the display will be. A dialog box, used to define the display, will appear when the button is clicked. After the dialog box is filled out, the actual display will appear.

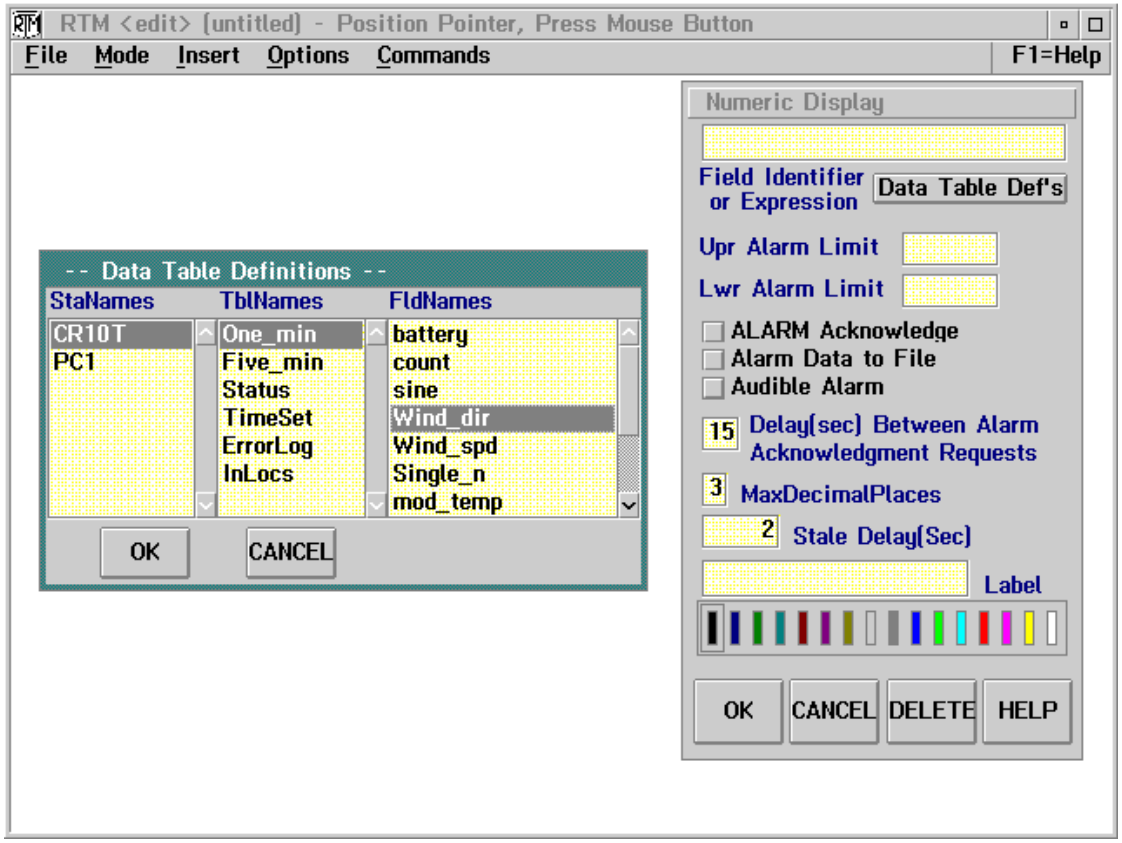

FIGURE 6-2. RTM Screen Showing Station.Table.Field for a Numeric Display

To move a display, place the mouse pointer on the display and click the left button. A four-headed arrow will appear. Press and hold the left mouse button and drag the display until it is in the desired location. Clicking on some areas of the display may not show the arrow, for example, the actual strip chart area of the strip chart. Experience will show which areas can be used. Dragging can be used to position the display anywhere on the screen; even on another display or partially out of the template area. However, the part that is partially covered will not be updated when monitoring is started.

6.1.6 DEFINING THE DISPLAY

Each data value displayed must be defined in terms of a Station.Table.Field expression. These are selected from lists of those that are available. These data display definitions can also contain math expressions. The following displays do not support expressions:

NumGroup
StripChart
Port/Flag
Input Loc
Ruler
RecDisplay
Text and Time of Last Rec

For example the expression "(DALLAS.MIN.TEMP) *1.8+32" would take the temperature collected from a station named "DALLAS", and convert it to Fahrenheit. Available operators and functions are listed below. Expressions may optionally contain parentheses and floating point constants (e.g., Station.Table.Field - 32/1.8).

Available Operators and functions are: +, -, *, /, >, >=, =, <=, <, <>, Not, Mod, Or, PF, Xor, And, Sin, Cos, Log, Sqrt, Exp, Abs, Ave, Time, Pow, and Trunc.

The resulting value could then be displayed with any of the displays (e.g., bar chart). The "(DALLAS.MIN.TEMP)" part of the expression is a data value from a station named "DALLAS" with a table named "MIN" (minute output) and a field named "TEMP" (temperature).

The Station.Table.Field can be selected from a list of those available (see Figure 6-2). This list is displayed by double-clicking in the FIELD IDENTIFIER OR EXPRESSION box or by selecting the DATA TABLE DEF'S button. Selecting a station, table, or field from the list, inserts that definition (as if it had been typed in) at the cursor in the expression box. It does not remove previous selections or entries. Be sure to completely erase the old expression if entering a new one. The expression box allows cursor movement and editing. If the Station.Table.Field elements are entered manually be sure the case matches that given in the lists as these elements are case sensitive.

In addition to the Station.Table.Field definitions, a display may require high-low limits, alarm limits or other parameters. Accessory displays may require parameter regarding units, size, or similar questions. Use the mouse or the TAB and SHIFT-TAB keys to move the cursor from parameter to parameter. When finished filling out the parameters, select the OK buttons to close the dialog box and show the display. Pressing CANCEL or DELETE will remove a new display.

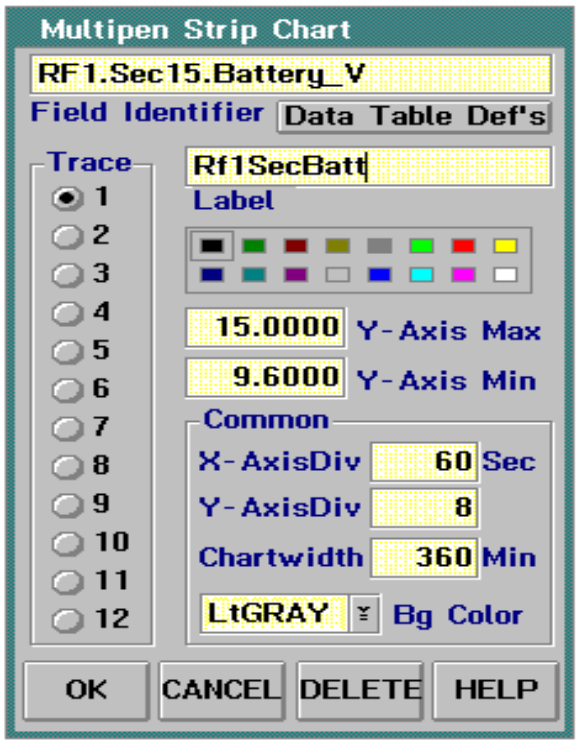

FIGURE 6-3. Multipen Strip Chart Definition

6.1.7 SIZING THE DISPLAY

Once a display has been placed, and the dialog definitions complete the final display will appear. Some displays are sizable. If a display is sizable, a sizing border will appear around the display when it is selected. When the mouse pointer is placed on this border, it will change to double headed arrow indicating the axis (horizontal or vertical) in which the display can be sized. Click and hold the left mouse button while moving the mouse (dragging) in indicated direction to increase or decrease the size of the display along that axis. Dragging on a corner of the sizing border allows the display to be sized along both axes at once.

6.1.8 EDITING EXISTING DISPLAYS

While in the edit mode, existing displays can be sized, moved, edited, or deleted. The techniques to move or size the display are explained in the sections on placing and sizing the display. To edit a display's definition, select the display and then select EDIT PARAMETERS from the COMMANDS sub menu or double click the left mouse button with the pointer on the display. The dialog box will appear and the parameters can be edited (see Figure 6-3). Press the OK button to use the changes and show the display. Press the CANCEL button to disregard the changes and use the previous definition. Press the DELETE button to remove the display completely. Deleting an existing display will display a window asking for confirmation of the deletion.

6.1.9 LOADING AND SAVING TEMPLATES.

Once created, a template should be saved. This allows the template to be used again without having to place and define all of the displays. If the computer loses power (power failure), is turned off, or is rebooted the current template will be lost if it has not been saved. Select the FILE option from the main menu and a menu of file options including those to LOAD and SAVE template will be shown. Selecting SAVE allows a new template to be named and saved, or an existing template to be saved with the same name. The SAVE AS option allows a template to be saved with a new name. The LOAD option allows a different template to be loaded. Loading a different template will erase the current template if it is not saved first. The NEW option clears the current template so a new template can be started. The current template will be lost if not saved before NEW is selected.

6.1.10 STARTING RTM IN THE MONITOR MODE.

RTM normally starts in the edit mode. To have RTM automatically start monitoring a given template, enter the template name along with a /F in the OS/2 setting for RTM. For example, to have RTM start monitoring with a template named LOGAN, the following would be entered in PARAMETER box under the OS/2 settings for RTM:

/F LOGAN

The .RTM extension is optional. The OS/2 setting for RTM are accessed by clicking the right mouse button on the RTM icon. Then select OPEN followed by SETTINGS. Select the PROGRAM tab and fill out the PARAMETER box.

Once these settings are done, RTM will load and run the template when the associated RTM icon is double-clicked. Different RTM icons can be configure to load and run different templates. These settings also allow RTM to start monitoring with a template when it is restarted automatically by OS/2 (i.e., following a power failure). See Section 2.3 of this manual on Restarting OS/2 in the Installing RTMS.

6.2 MONITOR MODE

When a template has been created (and saved) monitoring can be started by selecting MONITOR from the MODE submenu. The data displays within the template are updated as data is acquired from the dataloggers via DLSMGR. The rate at which the data displays will be updated depends on the frequency of update of the data value in the datalogger, the interval at which the datalogger is polled, the HIPRIORITY setting, and the communication path to the datalogger.

While RTM is running (in the Monitor mode) display information will be updated whether the display is visible or not. Monitorings continue even if RTM is 'Minimized' (reduced to an icon) or covered by another application. Alarm limits will be checked and alarms requiring acknowledgment will be displayed. When the template is visible again the displays will be updated so they are current.

Displays can be moved and sizable displays can be sized while in monitor mode. Templates may also be saved. Parameters cannot be edited, however.

OPTIONS Sub Menu

Enabling HIPRIORITY (enabled when check mark is visible) causes DLSMGR to attempt to get data as rapidly as possible for the data used on the current template. This must be selected while in EDIT mode. By default, HIPRIORITY is not enabled.

Enabling BACKFILL (also uses check mark) causes RTM to request historic data from the datalogger(s) to fill in all strip charts when monitor mode is started. This may take a minute or two depending on the number of traces, dataloggers, and communication links. This must be selected in EDIT mode. BACKFILL is only done for interval tables. Tables that output every execution or based on a flag will not backfill.

The BKGND COLOR selection allows the background template color to be selected. The default color is white.

The BITMAP BKGD selection allows a .BMP file to be displayed as the template background.

SECTION 7. DATA COLLECTION (DBSELECT)

DBSelect is used to select the data for archival or routing to a different application or a different computer.

7.1 POLLING, HOLE DETECTION, AND HOLE COLLECTION THEORY

The data collection done by DBSelect consists of two processes; polling and hole collection. DBSelect makes full use of polled data since it provides the most efficient means of data collection. DBSelect will also optionally use hole collection to collect any data unavailable with polling.

After the user specifies what data is needed, DBSelect sends a description of the data it requires to DLSMGR. DLSMGR combines this request with any requests for data from any other programs (i.e., RTM) and advises each datalogger what data is required from it. This is done with a command known as a "Data Advise". After being advised, the dataloggers are checked for Data Advise data or "polled" at the user specified polling interval. When polled, the datalogger returns any advise data it has stored since the last time it was polled. Since the datalogger was advised before polling only a simple short exchange is needed to check for new data. In RF a poll can be broadcast.

When only polling is done, data stored in the CR10T before the Data Advise will not be collected. Despite retries, any data missed because of adverse conditions encountered during the polling process will not be collected by polling. These holes may be acceptable if receiving new data (for DBSelect or RTM) as rapidly as possible is more important than having a complete archive of old data. If it is desirable to maintain a complete archive of data, hole collection should be enabled along with polling. When hole collection is enabled, DBSelect will attempt to collect any data records it determines are missing from the data collected by polling (holes). Typically hole collection is needed to collect data caused by the following events:

- When first starting DBSelect, the data stored since the datalogger was programmed until it receives a new "Data Advise" (containing DBSelects requirements) will be a hole.
- If DBSelect is stopped, the data stored while DBSelect is stopped up to the new Data Advise will be a hole.
- If DBSelect or any other program is changed so its data requirement from a datalogger changes, a new Data Advise will be sent to that station. Changing from the old Advise to the new Advise may cause a hole that will be hole collected.
- When a program is downloaded to a datalogger or if data cannot be collected for a long period from a datalogger, it will cancel the current data advise. The data stored will be a hole until it receives a new Data Advise.
- Any data sent from the datalogger but not received or not correctly received by DLSMGR (i.e., signature fails) will be a hole. These occurrences are minimized by local retries, signature checking, and error detection.

Using hole collection, DBSelect can collect the specific data records that are missing. Hole collection happens concurrently with polling, allowing newly stored data and older hole data to be collected at the same time. Programs requiring new data do not have to wait for the missing hole data to be collected. The hole collection process is slower and uses more system resources than polling. In a normally functioning network most data will be collected with polling. Hole collection is the infrequent exception, usually occurring as the result of a user initiated change and occurs with small holes that are rapidly filled. Usually, it is possible to use hole collection and polling without sacrificing timely data collection.

A user-entered polling interval (entered in NetAdmin) determines how often the CR10T is polled for data. Specifying a short interval will reduce the time the stored data waits in the CR10T before it collected thus reducing the time before it is received by RTMS. However short intervals (faster polls) also cause an increase in network activity and battery drain and can affect how long hole collection takes.

A typical data collection sequence would be:

1. A Data Advise is sent to each station.
2. DLSMGR polls for data at the user entered interval.
3. When data is received DLSMGR sends the data to the module (i.e., DBSelect) that requested the data.
4. If DBSelect detects that the data it received was not the data it expected (i.e., one or more records are missing) a hole collection is started.
5. The polled data is stored in the shadow files or sent through the Named Pipe.
6. When hole collection data is received, it is also stored in the current shadow file or sent through the Named Pipe. Polling continues during the hole collection sequence.

7.2 DATA FILE NAMES, HEADERS, BALING, AND ARCHIVING

Data files are stored in ASCII in a comma delineated format. Each file has an ASCII header describing the field's names of data contained in the file. Section 8.6 gives a detailed description of the header and file format. The DBSelect ASCII Data files are suitable for archiving or importing to spread-sheet or other analysis software

When ASCII data files are created, DBSelect continuously stores the data. Periodically it produces (bales) data files that the user (or user application) can access.

DBSelect stores the baled files for a particular station in a subdirectory with the station's name. A data file name consists of a filename (up to 8 characters) and a 3 character extension (name.ext). The filename matches the table name and the extension is a 3 digit number (000-999) chosen to make the filename with extension unique. For example, the first baled data file from a table named 'HOURLY' in a station named 'Dallas' will be stored in a sub directory DALLAS\ in a file named 'HOURLY.000'. When data from a different table at the 'Dallas' station is collected it is stored in the same sub directory with an appropriate filename. DBSelect will store the next baled file with the next available extension. When all 1000 file extensions are used the oldest file will be overwritten.

DBSelect should produce a complete set of data, however the records may not be sorted by time and may be found across multiple baled files. This is due to hole collection. A separate utility EXTRACT.EXE can be used to sort, merge, and check baled files producing a single data file (see Section 8.2). DBSelect does not use these files once they are baled. The baling takes place on a user specified interval.

Between the times when DBSelect bales files (during the baling interval), DBSelect stores the data it collects in temporary or 'shadow' files. These files, located in user selected directories, should not be accessed by anything other than DBSelect. A BALE NOW button is available if current data is needed before the next time to bale. After each baling, DBSelect will start execution of a REXX file named "BALEEXIT.CMD". This can be used to process or move the baled files.

7.3 RUNNING DBSELECT

Double click on the DBSelect icon. If DBSelect has been run before, it will use the same settings it used previously and resume collecting data automatically.

7.3.1 SELECTING THE DATA'S PRIMARY DESTINATION

DBSelect will collect and deliver a complete set of the selected data to one of two destinations; ASCII files or an Acknowledged Named Pipe. DBSelect can only supply a complete set of data to the selected destination. Only one of these destinations maybe selected. When this destination is changed, DBSelect will not resend all data that was previously sent, so it is important to have this set correctly.

7.3.2 ACKNOWLEDGED NAMED PIPE

The Acknowledged Named Pipe is used with TCP\IP links to other computers or with custom user supplied software such as a program to feed the data to a commercial database (see Figure 7-1). Select NAMED PIPE ACKNOWLEDGED from the FILE menu to enable the acknowledged named pipe. The software receiving the data from the named pipe (Named Pipe Client program) must also be started. The protocol used with the named pipe is found in Section 8.5. Sample source code for client software is available, including C source code for TCP\IP server and REXX source code for an IBM DB/2 database feed program. The pipe name is "\PIPE\RTMS."

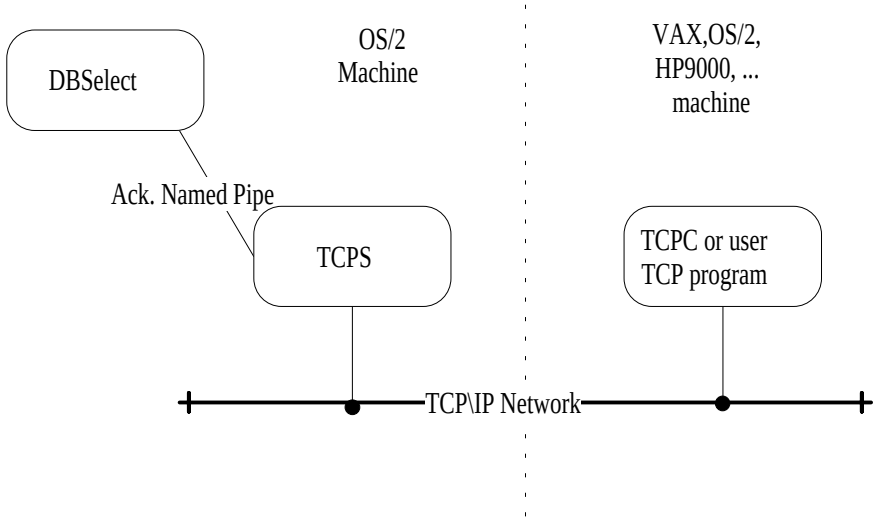

FIGURE 7-1. Example Named Pipe Client Software for TCP/IP Use

7.3.3 ASCII FILES

To use ASCII files as the destination, select ASCII FILES... off the FILES submenu (see Figure 7.2). Fill out the parameters as follows:

Specify the location (parent directory) for the 'baled' files for the BALE PATH: parameter. DBSelect will create a subdirectory for each station in this directory where the data from that station will be stored.

Specify the location for pending (shadow) files. Like the bale path, DBSelect will create a subdirectory for each station. DBSelect stores temporary data in these locations. The files should not be accessed by anything besides DBSelect.

The
BALE EVERY: _____ MINUTES
STARTING _____ MINUTES AFTER
_____

Entries allow an interval, offset and starting time for baling to be specified. This determines how often and when DBSelect will produce baled files.

> **NOTE**: The ASCII FILES ENABLED button must be checked for data to be stored in ASCII files.

Select OK to accept and use changes or CANCEL to disregard settings and use previous selections. When data collection is taking place, the BALE NOW button can be select to force DBSelect to produce baled files now instead of waiting until the next interval.

7.3.4 SECONDARY DATA DESTINATIONS

In addition to the two data destinations described above, DBSelect will also route data to two secondary destinations; an unacknowledged named pipe and DBSelect$.LOG ASCII files. DBSelect does not track what data is sent to these destinations that may result in duplicate or missing data. DBSelect will send all data it receives through an unacknowledged named pipe regardless of whether a program is in place to receive it. If selected (FILE submenu) DBSelect will store all data it receives in files named DBSelec0.log through DBSelec9.log overwriting the oldest if all ten files exist, otherwise creating a new file when the DBSelect$.LOG file gets to be about 1.2 megabytes in size. The unacknowledged named pipe and the DBSelec$.log files have data from all station and tables intermixed. Each row of data contains information regarding its source (Station, table, fields). The unacknowledge named pipe name is "\PIPE\RTMA."

7.3.5 ENABLING HOLE COLLECTION

The COLLECT HOLES button on the DBSelect main screen must be selected if hole collection is to be used.

> **NOTE**: If hole collection is not enabled an incomplete set of data will be stored.

7.3.6 SELECTING WHAT DATA IS COLLECTED.

To select data for collection, select a station (from the station list in the left box) where data collection is desired (see Figure 7-3). Once the station is selected, a list of the tables available from that station is displayed in the middle box. Select the table to be collected. Multiple tables may be selected by holding the CTRL key while clicking on the tables. To add a selected table (or tables) to the list of collected tables (right box) select the button marked **>>>>**. Double-clicking on a table will also add it to the list of selected tables in the rightmost box.

Additional tables from other stations can be selected using the same process. The *.TABLE button will select tables with the same name from the remaining stations.

Tables can be removed from the list of tables that will be collected by highlighting them and selecting the DELETE button.

7.3.7 STARTING DATA COLLECTION

When all the desired tables have been selected (are listed in the rightmost box), select the UPDATE button to use the changes.

The status line at the bottom of the screen will indicate DBSelect status. The network health displays in NetAdmin should be checked to monitor the data collection process.

Additional tables and stations can be added or deleted to the selected table list without stopping DBSelect. Adding table is done just as before, deleting tables is done by highlighting the tables to delete in the right most column and then pressing the DELETE button. When the desired changes have been done, the UPDATE button should be pressed.

DBSelect will stop collecting all data for the following reasons:

- DBSelect is closed (not minimized but closed).
- Less than 5 megabytes of free disk space.
- The Acknowledged Named Pipe client (e.g., TCPS TCP\IP program) is not acknowledging data and DBSelect can buffer no more data while waiting for acknowledgment (if the acknowledged pipe is being used).

If the list of stations and/or tables available in the network changes, data selected for collection may no longer be available. In this case, DBSelect will produce an error message and keep checking the list of available stations and tables to see if the data becomes available again. This continues until the table becomes available or the list of tables to be collected is altered by a user. Typically the list of table changes when a CR10T is powered down or has a new '.DLD' file downloaded.

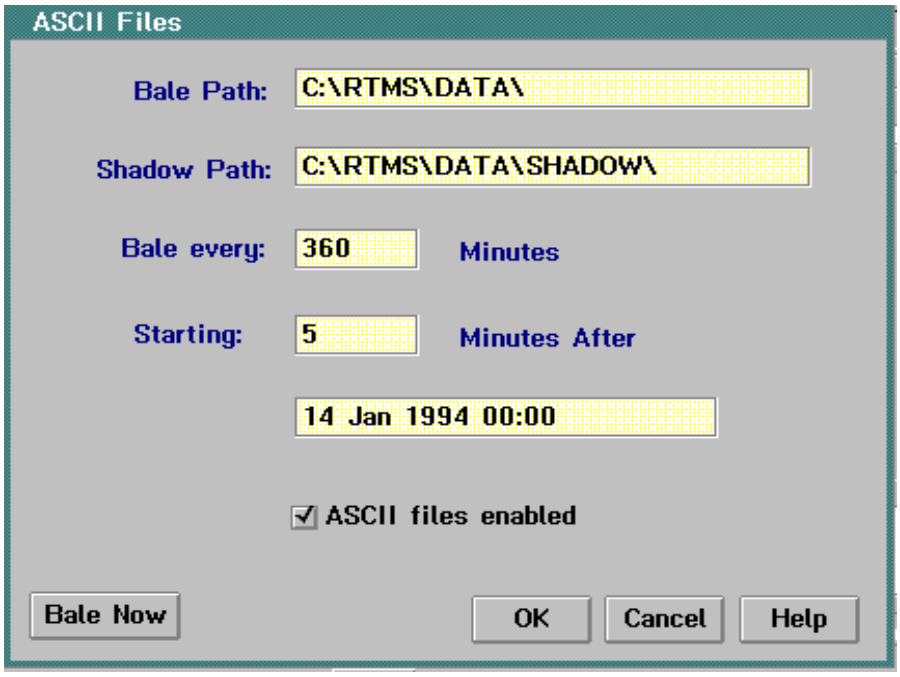

FIGURE 7-2. ASCII Files Setup

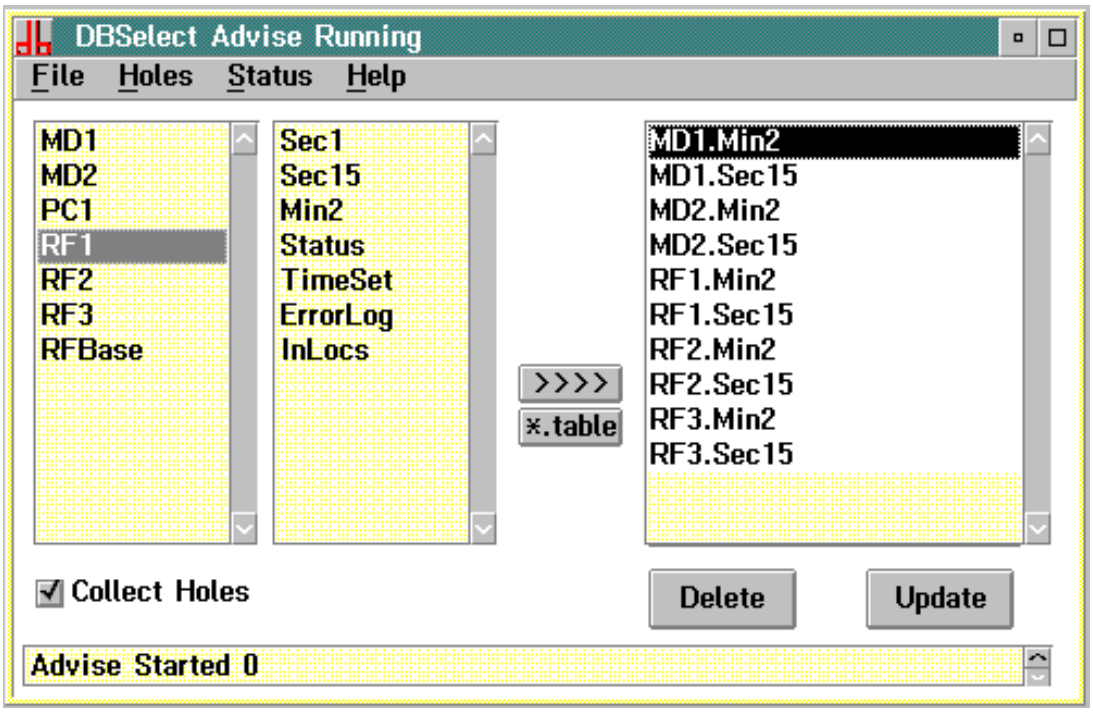

FIGURE 7-3. Selection of Data to be Collected

7.4 HOLE COLLECTION STATUS AND MANUAL HOLE COLLECTION

Selecting HOLES on the DBSelect main menu displays the hole collection screen, as shown in Figure 7-4. The box at the top shows all holes that are pending including the one currently being worked on. The

I WILL WAIT _____ SECONDS FOR A HOLE
I HAVE BEEN WAITING _____ SECONDS

parameter boxes give information on the current hole collection. In the event that the full 900 seconds elapse without the current hole being finished collecting, DBSelect will move that hole to the end of the hole queue and proceed with the next hole. This prevents a hole cannot be collected from due to communication failure, and also prevents hole collection at other stations.

The _____ HOLES ARE IN THE LIST parameter gives the total number of holes in the queue.

Message relating to hole collection will be stored in a file named HOLE$.LOG (see Section 8.1). This log is enabled from the FILE entry on the DBSelect main menu. If HOLE$.LOG is enabled, the box on the bottom right portion of the screen will also display these messages regarding the detection, queuing, and collection of holes.

DBSelect will calculate whether the hole data still exist in a datalogger before attempting to collect a given hole. If the data is not available DBSelect will not attempt to collect it. This reduces unneeded communication in the network. When this occurs, DBSelect writes a message indicating the hole was too old to the HOLE$.LOG file if the log is enabled. When DBSelect requests a range of data from a datalogger, the datalogger will return all, some, or none of the requested data depending on what is available. How long a given hole is available depends on the size of the table, and how rapidly data is written to the table. All datalogger data is erased when a new datalogger program is downloaded or if power is removed from the datalogger.

Users can manually request a range of data by adding a hole to the hole queue. This is done by selecting a station and table and then specifying a start and stop time. The boxes and buttons to do this are located in the middle of the hole collect screen. Once the desired range is specified, selecting the ADD button adds the hole to the queue. If a hole is added manually and DBSelect automatically collects the data, duplicate data will be stored. If the *.TABLE buttons are selected after selecting a station, table, and specifying a range of data, a

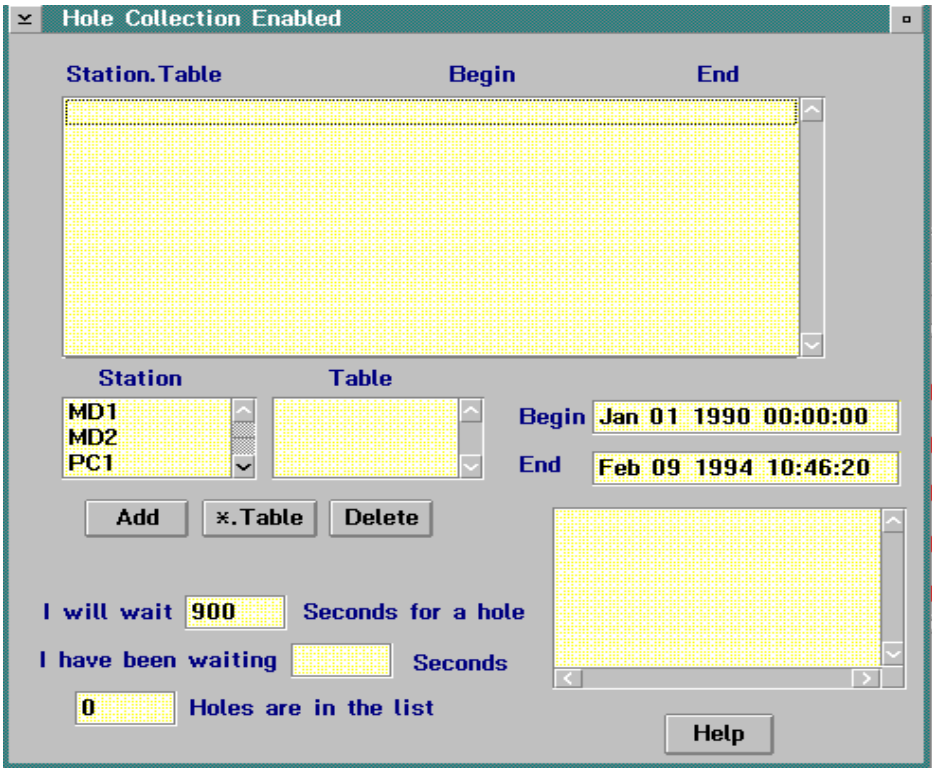

FIGURE 7-4. Hole Collection View

hole of the specified range will be inserted into the queue for each station in the network with that table. Selecting one or more entries in the hole queue and selecting the DELETE button will remove the holes from the queue. This will result in missing data if DBSelect added the holes to the queue.

DBSelect will periodically check for a file named AUTOHOLE.DAT. If this file exists, DBSelect will add the holes contained in the file to its queue of holes to collect. DBSelect will delete the hole file after it adds the holes to the queue. Section 8.3 describes the format for this file.

DBSelect Status

Selecting STATUS on the DBSelect main menu displays information on disk space, rate of disk usage, ASCII file baling, etc.

Multiple copies of DBSelect and command line parameters

Under some conditions it may be desirable to run two independent copies of DBSelect. When two copies are run, the second copy MUST be run in a separate directory and MUST use the following command line parameters:

DBSelect name directory

where name is used to create the names for the named pipes (acknowledged and unacknowledged) associated with second DBSelect. Since named pipes are global throughout OS/2 the second copy must have different names even if the named pipes are not being used. The acknowledged named pipe "\PIPE\SECOND" uses the name as specified on the command line. The unacknowledged named pipe will use name with an 'a' appended to it. If name were "SECOND" then the acknowledged name pipe would be "SECOND" and the unacknowledged would be "SECONDA".'

The directory specifies the directory where DLSMGR can find its initialization files. This is necessary when starting the second copy of DBSelect that is not located in the main RTMS directory. Each copy of DBSelect keeps its own initialization files in their respective directories but DLSMGR keeps its initialization files in the directory of the program that started it. If the second copy is started first at a later date, DLSMGR will look in the second's DBSelect directory for its files and not find them.

SECTION 8. FILES, PROTOCOLS, AND UTILITIES

8.1 LOG FILES

Log files are produced for several reasons. Documenting events that occurred is a primary reason. Logs are also useful as a diagnostic tool. Some of the logs are optional, stored only when enabled. Other logs are always active. Most logs have built-in restrictions that prevent them from consuming all available disk space even if neglected.

Most log filenames contain a $ character in the name. When the file reaches its maximum allowed size, it is renamed, replacing the $ with a single digit and the original name is reused. When the rename is attempted, the oldest existing file will be overwritten if all the allowable filenames already exist.

For example, the SWF$.LOG files contain Status, Warning, and Fault messages. When this file is about 1.2 megabytes in size, it is renamed to SWF0.LOG. The next time SWF$.log is 1.2 megabytes big, it is renamed to SWF1.log. This continues until files SWF0.log - SWF6.log exist because only six SWF log files can be created (see Section 8.1.1). The next time SWF$.log gets to be 1.2 megabytes the oldest file SWF0.log is overwritten and the process continues. This process ensures that the log files will not get too big to fit on a floppy disk and that log files will not consume all hard disk space if neglected.

8.1.1 NETADMIN AND DLSMGR

SWF$.LOG -- Creates up to six 1.2 megabyte files containing Status, Warning, and Fault messages. May be enabled and filtered with the Status, Warning, Faults submenu in Netadmin.

IO$COMx.LOG – Where x is the serial port being logged. Contains a log of actual communications through serial port. Enabled and setup on NetAdmin network health screen (main screen). Will create up to eleven 1.2 megabyte files.

CLKSET$.LOG – Log of each clockset. Does not log clock checks. Always enabled. Will create two files each 100k before overwriting oldest.

LNKTEST$.LOG – Log of quality numbers from RF link testing. Always enabled. Will create 2 files each 100k before overwriting oldest.

PROGDN$.LOG – Log of each '.DLD' program download. Always enabled. Will create 2 files each 100k before overwriting oldest.

POSTED.LOG, HALTED.LOG, DEADLOCK.LOG – Internal diagnostic information. Will create one 10k file for each. After file reaches 10k, no new information will be logged until file is moved or renamed. Always enabled.

8.1.2 DBSELECT

HOLE$.LOG – Log of hole collection activity. Logs the detection, queuing, and removal of holes from the hole queue. Primarily used as diagnostic tool. Enable on DBSelect main menu under FILE menu. Will create up to eleven 1.2 meg. files.

DBSelec$.LOG – Log of all data collected by DBSelect. May be used as diagnostic tool, secondary data storage, or backup. These log files are not intended to be used as a reliable source of a complete set of data. Will create up to eleven 1.2 megabyte files.

DBACK$.LOG – Log's indication of when data was written to the named pipe and when it was acknowledged. Used as a diagnostic tool. Enabled when the Acknowledged Named pipe is being used and the DBSelec$.LOG is enabled. Will create up to eleven 1.2 megabyte files.

QUEUE.DAT – DBSelect will buffer data it has received but is unable to deliver via the named pipe. Eventually when buffering is no longer possible, DBSelect will append this data to QUEUE.DAT before dumping it. When enabled, hole collection from the dataloggers is the primary means to recover this data. When normal pipe operation is restored, DBSelect will recollect all data that was not delivered through the named pipe. If the data is no longer available for hole collection because enough time has elapsed that some of the datalogger data tables have been overwritten, the user may

be able to manually find the missing data in QUEUE.DAT. QUEUE.DAT is not intended to be used as a reliable backup for an intermittent pipe connection. There is no size restriction on QUEUE.DAT but it does not increase in size under normal conditions.

8.1.3 RTM

Template.ALM – Where template is the name of the RTM template detecting the user defined alarm. Logging of alarms is optional, as part of the RTM numeric display. This file continues to grow until manually erased.

8.2 EXTRACT UTILITY

The Extract utility is used to sort, check, and combine ASCII files created by DBSelect and GraphTerm when used with a CR10T datalogger. Extract will take data from multiple files, sort the data based on the record numbers, remove any duplicate records and notify the user of any missing records. A start and stop time may be specified.

Extract uses command line parameters. The syntax is as follows:

EXTRACT <source> [<destination> [<begin> [<end>]]]

Source – Is the name (without extension) of data files. This is usually something like "LgrName\TblName".

Destination – Is the complete path and file name where the extracted records will be written.

Begin and end – Are times used to specify the time swath of data to be extracted. Extracted records will be greater than or equal to 'begin' and less than 'end'. The date/time field must be enclosed in quotations if it contains spaces or commas.

The [ ] brackets indicate optional parameters. Only the source name is required. The default destination filename is TEMP.DAT and all records in the source files are included by default.

The following gives an example of extracting data from a site named mtlogan with a table named one_min:

extract mtlogan\one_min temp.dat "3-8-94 00:00:00" "3-8-94 24:00:00"

In response, Extract gives the following type of information:

Extracting 'one_min' from '1994-03-08 00:00:00' to '1994-03-09 00:00:00'.

Scanned 'ONE_MIN', 181 records, 181 match.

First record starts at "1994-03-08 09:15:00".

Duplicate - "1994-03-08 09:15:00",0,13.44,1,0.017,1

Duplicate - "1994-03-08 09:15:00",0,13.44,1,0.017,1

Duplicate - "1994-03-08 10:04:00",49,12.89,50,0.766

Duplicate - "1994-03-08 10:05:00",50,12.88,51,0.777

Last record is at "1994-03-08 10:06:00".

52 records written to 'temp.dat'.

8.3 FORMAT OF THE AUTOHOLE.DAT FILE

DBSelect looks for a file named AUTOHOLE.DAT in its default directory. If such a file exists DBSelect will read it and insert the holes described there into the hole queue as if they had been inserted by hand from the hole dialog.

The format for the file is a follows:

> **NOTE**: The format for the holes.ini is identical.

HOLECOLLECT01

{stationname tablename start end flag CRLF}

examples:

HOLECOLLECT01
Stn2 ONESECND 631152000 1262304000 1
Stn2 Status 631152000 1262304000 1
Stn2 TimeSet 631152000 1262304000 1
Stn2 ErrorLog 631152000 1262304000 1
Stn2 ErrorLog 0 12 0

What it means:

The first line of the file is a validity check, this is HOLECOLLECT version 01. Each successive line contains:

- StationName Space TableName Space Beginning Space End Space Flag.
- StationName and TableName limited to 8 characters.
- Space is the ASCII space character.
- Beginning is the beginning time stamp or record number.
- End is the ending time stamp or record number.
- Flag is a 0 or 1.
- Flag of 0 Indicates beginning and end are Record Numbers.
- Flag of 1 Indicates beginning and end are time stamps.
- Time stamps are represented as the number of seconds since midnight January 1, 1990.

8.4 RADIO TEST RESULTS

Completed link test results are shown in the "Test Status/Results" box. If successful, test results show the PROM signature of the RF modem whose switch setting is last in the RF path, and a communication "Quality Report" with a record for each hop specified in the path. The number of "Quality Records" reported in the test response depends on the number of RF modems listed in the RF path. If one remote node is listed in the command then there will be two quality records. The first record shows how well the remote node was able to receive from the base, the second shows how well the base was able to receive from the remote. With two or more modems listed in the path, the first quality record will indicate how well the most remote modem received. The rest of the quality records show how well data was received with each hop going from the most remote node back to the base. So, if two RF modems were listed in the test path, there would be three quality records in the response. The second quality record would apply to how well the repeater received from the remote, and the third record would apply to how well the base received from the repeater.

A "Quality Record" is made up of five values as follows:

First Value	test packet size;
Second Value	front of 2T envelop;
Third Value	back of 2T envelop;
Fourth Value	front of 1T envelop;
Fifth Value	back of 1T envelop.

The "test packet size" is usually around 238, but varies a little depending on network layout. This value will be half or less of the expected 238 if packets are being lost for one reason or another. For example, if packets are being walked on by outside RF activity, the test packet will not make it though and will be retransmitted at a smaller size. Over RF, data is transferred as a stream of bits encoded into short and long periods of time between transitions. We call the short time a "1T" period and the longer a "2T" period. Each transition is expected to fall within a certain window of tolerance to be valid. If there is too much error in the signal and the transition falls outside its allotted window, the packet will be in error and be retried. As a packet is received the RF95T keeps track of the transition that occurred closest to the front of the allowable window and closest to the back. These values are kept for both the 2T and 1T windows and are the last four values of the "Quality Record". Both windows are 204 ticks long, so if the transmission was perfect, the data envelope front and back would both be close to 102. The closer the front value gets to 0 and the closer the back value gets to 204, the worse the quality.

8.5 CSI LOGGER DATA EXPORT PROTOCOL

The CSI Logger Data Export Protocol (LDEP) is used on top of network transfer protocols such as OS/2 Named Pipes and TCP/IP Berkeley Sockets to transfer datalogger measurement records from one computer (or process) to another. The computer responsible for collecting data from the datalogger network (the server) will make a pipe or socket connection available. The computer that receives data (the client) must connect to the provided pipe or socket to receive data.

The server has the responsibility to see that every collectable record is collected from the network of dataloggers. To ensure that all of these records are transferred to the client, LDEP will make use of an acknowledgment scheme. The basic idea behind the protocol is that as each record is sent to the client, the client will report the Station Name, Table Name, and Record Number back to the server after it has secured that record. The server will use the acknowledgment to mark the progress of the transfer. When the session is broken, the server will buffer unacknowledged records until the connection is re-established. The server will maintain transfer progress information on disk so that if the server goes down, it can recover and continue to transfer all collectable records.

Limitations and issues of concern to the client application include:

1. Each record must be acknowledged before the next record will be sent.
2. Records will occasionally be transferred out of time sequential order.
3. The same record may be transferred multiple times.
4. When a session breaks, the server's buffering is limited and may ultimately depend on buffering in the datalogger and re-collection to provide as many records as possible when the session is re-connected.

The record acknowledgment allows the server to make sure that every record that it intended to send was successfully received by the client. This capability, coupled with reasonable algorithms that make sure every record logged by the datalogger is received by the server, allows for reliable data collection.

Records are occasionally sent out of time sequential order because 1) it allows real time monitoring to take priority over the collection of older data missed due to communication failures, and 2) the user can initiate the collection (or re-collection) of any records still buffered in the datalogger. It is hard to predict just how "out of order" records will get, but usually, once network communication is stable, records will come in order and as close to real time as possible.

There are two reasons why records may be sent multiple times. First, the server application is shut down, then brought back up, and second, the user initiated the re-collection of records from the datalogger. The mechanisms used to verify that all records are sent are state oriented. If the server is shut down in the wrong state, some states will be repeated, thus causing the same records to be sent multiple times. If the initialization files were erased from disk, then all records still buffered in dataloggers may be sent again.

Client and server state diagrams are shown in Figures 8.5-11 and 8.5-12 that document the states and activities of the client and server programs. These diagrams are applicable to either Named Pipe or Socket implementations. The diagramming notation is by Booch[1] who claims to have adopted it from Harel[2].

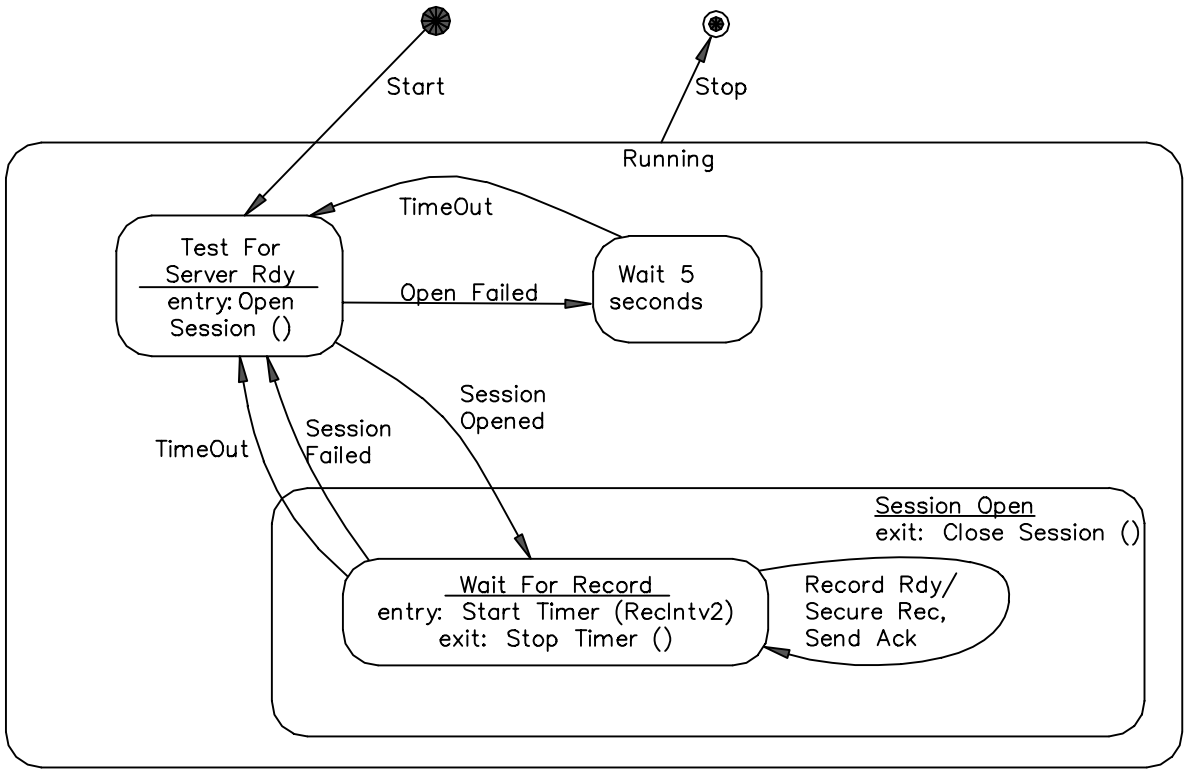

FIGURE 8.5-1. Client State Diagram

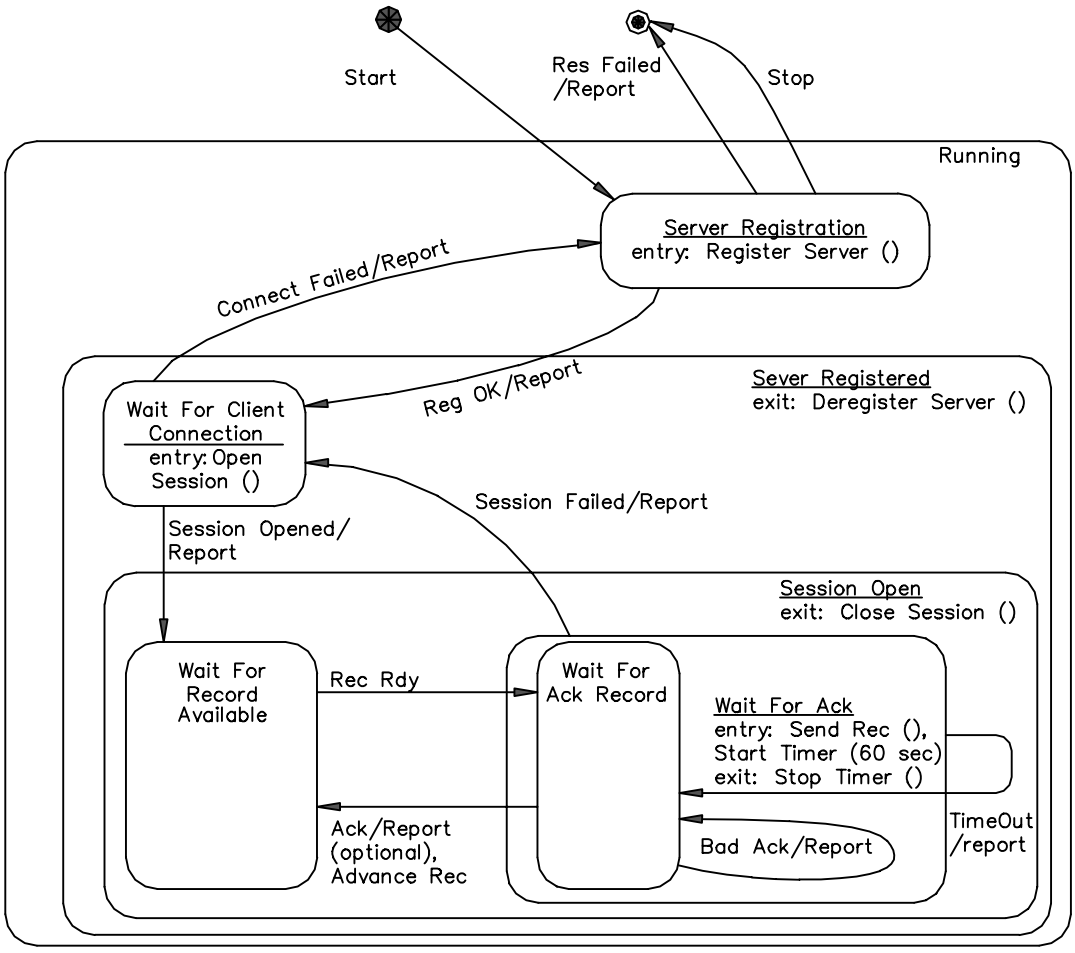

FIGURE 8.5-2. Server State Diagram

Key concepts from the state diagrams are shown in the following tables with key words (bold) from the diagrams.

CLIENT STATE DIAGRAM:

Test For Server Rdy – With Named Pipe and Socket API's, there will usually exist a function used to open the pipe or socket. In this state, the client program should attempt to open the pipe or socket. If **Open Failed**, the client should wait a while (5 seconds) and try again.

Wait For Record – In this state the client is waiting for the next data record from the server. When a record is received it should be "secured" (saved to disk or data base), then an acknowledgment should be sent back to the server. Once the server has processed the acknowledgment it will not send that record again. The client should use a watchdog timer while waiting for a data record. If the client is in the **Wait For Record** state for longer than expected (**RecIntv2**) then it should assume that the server has died and close the session. This watchdog operation may be difficult to implement, but it seems that some implementations of pipes and sockets do not properly report a broken pipe or socket, so the watchdog is necessary for reliability.

Rec Intv 2 – This is an amount of time greater than 2 times the expected interval between data records. It is just longer than the longest period between records the client would expect to receive from the server. If the client goes longer than this interval without receiving a new record then it should close and reopen the pipe or socket thus allowing the server to recover if it has broken

Secure Rec – The secure record action is taken when a **Record Rdy** event occurs while the client is in the **Wait For Record** state. Before the client sends an acknowledgment to the server it should secure the data record well enough so that if a power failure or crash occurs the data will be safe.

Send Ack – The send acknowledgment action is done in response to the **Record Rdy** event, after the record is secured. In **Send Ack** the client forms an acknowledgment record from information taken from the data record and sends it to the server.

Stop – It is important to note that the Stop event could occur at any time. If it occurs while in the Session Open state then the pipe or socket should be closed (**Close Session**) before program termination.

SERVER STATE DIAGRAM:

Wait For Record Available – In this state the server is waiting for the next record to become available from the server's data record source.

Wait For Ack – In this state the server is waiting for the client to acknowledge that it has secured the record. If an acknowledgment for the wrong record comes in, the server will just continue to wait. After waiting for a minute, the server will re-issue the data record and wait again.

Advanced Rec – The advance record action is executed after the server receives a valid acknowledgment record from the client while in the **Wait For Ack Record** state. This is the point at which the server makes a note of the fact that the client has secured a record and the server relinquishes responsibility for the well being of that record. The server moves on to the next record.

Stop – Note that in the **Session Open** and **Server Registered** states there are "exit" actions that need executed on the **Stop** event.

Communication between the client and server is conducted using ASCII records where each record is terminated by a Carriage Return - Line Feed (CRLF) pair. Record length varies quite a bit. For each datalogger record there is exactly one ASCII record. Because of the Block Mode Protocol used to communicate with dataloggers, the maximum size datalogger record is limited to something less than 1024 field values. Figuring 6 characters per value, 13 characters per field name, and 6 characters per field type designation, a single ASCII record could come out to be a little longer than 25K characters. Typical datalogger programming will produce record sizes of about 150 characters. It would not be unusual to see records that contain one or two hundred values that would come out to a length of 2 to 3K characters in ASCII.

To express the format of ASCII records used for communication between the client and server, we will use Extended Backus Naur–Formalism (EBNF), a notation used to express syntax. This notation was adopted from Wirth[3], and extended here a little more by adding a repetition count preceding some brackets. EBNF is summarized in the following table where A, B and C are syntactic entities of the language being described. Where one of these entities is a literal string it is enclosed in quotations.

TABLE 8.5-1. ASCII Record Format

Expression	Means
A = BC	The construct A consists of B followed by C.
A = B | C	A consists of B or C.
A = [B]	A consists of B or nothing.
A = {B}	A consists of any number of B's including none
( )	Brackets used to group sections of an expression

The EBNF description of LDEP syntax is as follows:

```
Record = (DataRecord | AckRecord) CRLF.
DataRecord = StationName "," TableName " ("FieldSpecs ") VALUES (" FieldValues ")".
AckRecord = StationName "," TableName "," RecordNumber.
FieldSpecs = FieldName " " FieldType {"," FieldName " " FieldType}.
FieldValues = FieldValue {"," FieldValue}.
StationName = Label.
TableName = Label.
FieldName = Label.
Label = Letter { Letter | Digit }.
FieldType = ( "TIMESTAMP" | Decimal | "FLOAT" | "INTEGER" | VarChar ).
```

Decimal = "DECIMAL(" Digit [Digit] "," Digit [Digit] ")".
VarChar = "VARCHAR(" Digit { Digit } ")".
FieldValue = (TimeStamp | RecordNumber | Number | String).
TimeStamp = """ Year "-" Month "-" Day " " Hour ":" Minute ":" Second """.
Year = 4(Digit).
Month = 2(Digit).
Day = 2(Digit).
Hour = 2(Digit).
Minute = 2(Digit).
Second = 2(Digit) ["." { Digit }].
RecordNumber = 10{ Digit }.
Number = { Digit } ["."] { Digit }.
String = """ { Character } """.
A typical data record might look something like this:

Lgr,Sec15 (TMSTAMP TIMESTAMP,RECNBR DECIMAL(10,0),Battery_V FLOAT,Temp FLOAT) VALUES ('1993-12-08 15:02:00',123456,13.5,72.123)

only without the tabs and carriage return in the middle. One with strings might look like this.

PC1,StatMsg (TMSTAMP TIMESTAMP,RECNBR DECIMAL(10,0),SrcStn VARCHAR(256),AbtStn VARCHAR(256),Hop DECIMAL(3,0),MessageVARCHAR(256)) VALUES ('1993-12-08 15:02:02.25',13355,'PC1',0,'DBSelect End Pipe Queue Dump')

The acknowledgment records to be sent back to the server for the two records shown above would be:

Lgr,Sec15,123456

and

PC1,StatMsg,13355

8.5.1 IMPLEMENTATION

With RTMS, a Named Pipe version of the server is implemented in the **DBSelect** program. **DBSelect** is used to select tables that are made available via the Named Pipe and to ensure that all collectable records are transferred to the client.

The name of the Named Pipe provided by **DBSelect** is **"\PIPE\RTMS"**. With an appropriate network operating system this pipe can be accessed over the network.

DBSelect also provides an unacknowledged version of LDEP on a pipe named **"\PIPE\RTMA"**. On this pipe the server sends data records in the exact same format as specified by LDEP, but the server does not wait for acknowledgment records to come back. It is a simple one way unacknowledged flow that can be used by programs like "copy".

The **TCPS** program, when used with **DBSelect**, is used to provide the TCP/IP Sockets version of LDEP. **TCPS** reads records from the Named Pipe and writes them to a TCP/IP Socket.

TCPC is an example program used to show how a user-written client would connect to the **TCPS** server.

8.5.2 REFERENCES

[1] Booch, Grady 1994. Object-Oriented Analysis and Design, Second Edition. The Benjamin/ Cummings Publishing Co., Inc.

[2] Harel, D. 1987. Statecharts: A Visual Formalism for Complex Systems. Science of Computer Programming vol. 8.

[3] Wirth, Niclaus 1983. Programming in Modula-2, Second, Corrected Edition. Springer-Verlag. Part 1.3 (A notation to describe syntax).

8.6 SAMPLE ASCII FILE CREATED BY DBSELECT

The following describes the header found in this ASCII file created by DBSelect:

- TOACI1 indicates the file type and is always present.
- MD91 is the user specified station name.
- Min2 is the user specified table name.
- TMPSTAMP is the field name for the time stamp field and is always present.
- RECNBR is the field name for the record number field and is always present.
- Battery_V -to- Pot are the user specified field names for each of the fields.

NOTE: The text names (labels) are quoted as is the time stamp field. There is a CRLF after the table name, the last field name, and separating each record (row of data).

TABLE 8.6-1.Sample ASCII File

```
"TOACI1","MD91","Min2"
"TMSTAMP","RECNBR","Battery_V","Count_sec","Sine","WindDir","WindSpd","Single_n","Panel_DegC","seconds"
,"minutes","Sawtooth","TC1_F","TC2_F","TC3_F","TC4_F","Pot"
"1994-06-21 09:40:00",54749,13.35,84,0.995,357,13.96,2.486,26.52,0.125,40,0.234,78.12,-7999,-7999,78.34,50
"1994-06-21 09:42:00",54750,13.36,204,-0.407,106.2,4.153,-1.017,26.49,0.125,42,0.567,77.87,-7999,-7999,78.28,50
"1994-06-21 09:44:00",54751,13.35,324,-0.588,73.78,2.885,-1.47,26.49,0.125,44,0.901,77.75,-7999,-7999,78.22,50
"1994-06-21 09:46:00",54752,13.33,84,0.995,357,13.96,2.486,26.29,0.125,46,0.234,77.31,-7999,-7999,77.78,50
"1994-06-21 09:48:00",54753,13.4,204,-0.407,106.2,4.153,-1.017,26.46,0.125,48,0.567,77.62,-7999,-7999,78.15,50
"1994-06-21 09:50:00",54754,13.35,324,-0.588,73.78,2.885,-1.47,26.46,0.125,50,0.901,77.66,-7999,-7999,78.15,50
"1994-06-21 09:52:00",54755,13.35,84,0.995,357,13.96,2.486,26.46,0.125,52,0.234,78,-7999,-7999,78.23,50
"1994-06-21 09:54:00",54756,13.41,204,-0.407,106.2,4.153,-1.017,26.43,0.125,54,0.567,78.07,-7999,-7999,78.43,50
"1994-06-21 09:56:00",54757,13.35,324,-0.588,73.78,2.885,-1.47,26.43,0.125,56,0.901,78.19,-7999,-7999,78.46,50
"1994-06-21 09:58:00",54758,13.35,84,0.995,357,13.96,2.486,26.44,0.125,58,0.234,78.24,-7999,-7999,78.52,50
"1994-06-19 10:00:00",53319,13.34,178,0.035,185.3,7.245,0.087,26.67,0.125,0,0.495,78.76,-7999,-7999,78.78,50
"1994-06-19 10:02:00",53320,13.34,298,-0.883,20.95,0.819,-2.207,26.67,0.125,2,0.828,78.7,-7999,-7999,78.79,50
"1994-06-19 10:04:00",53321,13.34,58,0.848,330.8,12.94,2.12,26.67,0.125,4,0.161,78.88,-7999,-7999,78.8,50
"1994-06-19 10:06:00",53322,13.35,178,0.035,185.3,7.245,0.087,26.67,0.125,6,0.495,78.87,-7999,-7999,78.73,50
```

APPENDIX A. TROUBLESHOOTING THE RTMS NETWORKS

A.1 STATION TEST

The best tool for determining network status is NetAdmin. Examine the network health screen (main NetAdmin screen). Is each station shown on the NetAdmin network health screen? Stations must be part of the Net Description if data is to be collected.

If a station is not shown, check the following:

- If the station was never added to Net Description, it should be added. Otherwise the Net Description has been changed or has become invalid (computer or hard disk failure/crash).

- Reload Net Description from netname.NET file. If netname.NET file is corrupt or missing, restore a good copy from backup. If a good netname.NET file is unavailable, re-enter Net Description by hand The netname.TXT file can be used if a good copy exists.

> **NOTE:** Netname is the name the user specified when the Net Description was saved. Whenever the Net Description is changed select the MAKE THE OPEN NET DESCRIPTION ACTIVE option found under the FILE selection on the EDIT NET DESCRIPTION menu.

- Total number of stations being collected from.

- The COLLECTING RECORDS FROM _____ STATIONS indicator. This box indicates the total number of stations where data is being retrieved for RTM or DBSelect. If this number is less than expected, try the communication test listed in Section 1.2.

A1.2 COMMUNICATION TEST

Use this section to determine if the computer and datalogger are communicating.

View each station on the NetAdmin main screen noting the color and the time of the last data collected. Is the time of last data current and the color of each station green? If so communication with the station is probably fine. If not, check the time of last data displayed on the screen. If it is current communication with the datalogger is probably fine (see Section 1.3.).

If not, there are two things to check:

- Check if Terminal Mode or a clock check with the datalogger works. If it does work, communication with the datalogger is probably fine, but data is not being collected. Data collection can stop because the datalogger program has been changed, datalogger was reset due to battery failure, communication has been paused, or data is no longer being requested by DBSelect and/or RTM (see Section 3).

- If the clock check or Terminal mode fails, there is probably a communication problem with datalogger. See Section 2

A1.3 CHECK LAST 12 HOURS OF COMMUNICATION

Check communications indicators for last 12 hours (COMMS 12HR) on the network health display. There are 72 pixels each representing a 10 minute period of the last 12 hours (720 minutes), and one pixel for the current 10 minute period. The color of each pixel represents the “worst” type of message that occurred during the period. If any faults occurred the pixel will be red. If warnings occurred but no faults, the pixel will be blue. If no warnings or faults occurred, only successful communications, the pixel will be green. If no pixel is drawn, no communication took place. The height of the trace (each pixel) is determined by the ratio of successful communications to total communications during the 10 minute period. If the trace is high and green then communication is good. If the trace is high and occasionally blue, communication is still probably good. With most communication links serial errors will occur as characters are occasionally missed. This results in a warning message like those described in Section 4. These can occur more frequently on machines that run OS/2 more slowly, i.e., 386 with 8 meg. RAM and where polling is done frequently. These serial errors are retried and usually succeed. Repeated failure will result in a fault message being generated. If a trace is red and very low then some problem does exist (see Section 2).

A.2 COMMUNICATION PROBLEMS

The approach taken here is to isolate where communication is having difficulty and then attempt to remedy the problem. There is a section for each type of communication link. Keep in mind that DlsMgr will attempt to communicate with a datalogger when it has a reason to do so. The most common reason is to poll the datalogger for data. Other reasons include checking the clock, terminal mode, etc. When these operations fail due to communication problems, they will be retried based on the retry values entered in the net description. Messages relating to communication are only generated when these operations are taking place. Some operations (like the clock set) have a button to force an immediate retry (KICK button). The Terminal mode also will force a communication attempt.

If RTMS or the OS/2 computer is suspect, DOS based GraphTerm (GT) Version 2.2 or newer can be used to verify the communication hardware and datalogger.

It is important to try some of these troubleshooting techniques while a network is functional. It can be very difficult to recognize abnormal behavior when not familiar with normal operations.

Messages from the NetAdmin SWF$.LOG are used in the following sections. The format of these messages is TIMESTAMP,TYPE,FROM, ABOUT,MESSAGE.

- TIMESTAMP indicates when the message occurred
- TYPE indicates type of message: STATUS, WARNING, or FAULT
- FROM indicates which station originated the message.
- ABOUT indicates which station the message is about.
- MESSAGE is the text of the message. The messages shown here came from several example networks.

PC1 is the computer, CR10T is a datalogger directly connected to COM1. Stn2 is a datalogger site accessed via telephone modem on COM1. MD91 is accessed via MD9. RF2BASE is a RF232T base station and RF1 is a radio remote datalogger station. The RF2BASE is connected to COM1.

A2.1 DIRECT CONNECTION (SC32A OR RAD MODEMS)

With direct connection there are several things to check. Section 1.2 will verify that data is not being updated. Attempt a clock check or try the terminal mode. If they succeed then it is probably not a communication problem but a data selection or computer problem (see Section 3).

Check the PORT ACTIVITY box on the NetAdmin main screen. Select the COM port used to communicate with the station. Select the RESET COUNTERS buttons. Examine the CHARS TX, and CHARS RX, and RETRIES boxes. The TX box indicated how many characters are sent to the datalogger and the RX indicates how many characters are received. The TX box will be non-zero when communication is attempted. The RX will be non-zero when the datalogger responds. The most common case is when the datalogger fails to respond. In this case the TX box will be growing larger while the RX box remains at zero. The SWF$.LOG will have warnings and faults like the following:

'08-18-94 15:01:17','W','PC1','CR10T', 'SerLine timeout retry on: COM1.'

'08-18-94 15:01:18','W','PC1','CR10T', 'SerLine timeout retry on: COM1.'

'08-18-94 15:01:18','W','PC1','CR10T', 'SerLine timeout retry on: COM1.'

'08-18-94 15:01:19','W','PC1','CR10T', 'SerLine timeout retry on: COM1.'

'08-18-94 15:01:20','F','PC1','CR10T', 'SerLine timeout retry on: COM1.'

'08-18-94 15:01:28','F','PC1','CR10T','Link failed.'

This pattern will repeat with several warnings preceding each fault.

Things to check:

- Ensure that the correct COM port is selected in the Net Description.
- Ensure that each cable is connected properly.
- The cable connecting the computer and the SC32A should not be a “Null Modem” cable, but should be a standard serial RS232

cable. A straight through 9-pin cable connects the SC32A to the datalogger.

- With RAD modems and the SC932, verify the switch and jumper setting with those given in the manual.
- Do a continuity test on the cable used between the RAD modems.
- Do a loop back test to verify each RAD modem.
- Does the hand-held keyboard display work? If so, the datalogger has power and should respond.
- Does the datalogger have power? Check the 12 Volt supply with a volt meter.

A2.2 TELEPHONE

The first step is to determine if the computer and modem are communicating correctly.

If multiple remote sites are in use, with the phone modem, do any of the remotes work? If some sites work that would indicate either a Net Description problem or a hardware problem for the remote sites that do not work.

To check communication with the modem. Check the PORT ACTIVITY box on the NetAdmin main screen. Select the COM port used to communicate with the modem. Select the RESET COUNTERS button. Wait until a call is attempted. Examine the CHARS TX, and CHARS RX, and RETRIES boxes. The TX box indicates how many characters are sent to the modem and the RX indicates how many characters are received. The TX box will be non-zero when communication is attempted. The RX will be non-zero when the modem responds or echoes characters. When the modem fails to respond, the TX box will be growing larger while the RX box remains at zero. This can also be verified with external modems that have TX and RX lights. If the RX box remains at zero, the SWF$.LOG file will have warnings and faults like the following. Note that STN2 is the datalogger station not the phone modem at the computer. The first message will occur whenever dialing is attempted and does not indicate a problem.

'08-24-94 13:38:57','S','PC1','Stn2','Hayes dialing: '' (COM1).'

'08-24-94 13:39:06','F','PC1','Stn2','Communication with Hayes modem failed (COM1).'

'08-24-94 13:41:38','F','PC1','Stn2','Link failed.'

When communication with the base fails any communication with remotes will also fail. There will probably be messages generated for the various remotes. These messages should cease when communication with the base works, provided the rest of the communication is fine.

Check the following:

- Ensure the correct COM port is selected in the Net Description for the modem.
- The modem is powered up?
- Check each cable to ensure it is connected properly.
- The cable connecting the computer and the modem should not be a “Null Modem” cable but should be straight through.
- Are special dialing strings required?
- Once communication works with the base modem, the phone line should be checked. Again if the base modem works with other sites, the phone line is probably fine.
- If the modem has a speaker, can the dial tone be heard when dialing occurs? Does the remote site ring and answer?
- If the remote modem does not respond then the SWF$.LOG will have errors like these:

  '08-24-94 13:42:15','S','PC1','Stn2','Hayes dialing: '513' (COM1).'

  '08-24-94 13:42:52','F','PC1','Stn2','Hayes modem failed to detect carrier (COM1).'

  '08-24-94 13:42:53','F','PC1','Stn2','Link failed.'

Notice the difference between these messages and the previous ones, i.e., communication with Hayes modem failed versus Hayes modem did not detect carrier.

The following are things to check when no carrier is detected:

- Ensure that phone line is plugged in the proper jack on the modem. Most modems have two jacks, one for the phone line and one for a telephone. Use the jack labeled “Teleco or To Line”. Attach the standard telephone to the phone line being used and manually dial the number. If you hear a dial tone, the remote site ringing, the

remote site answering and then a high pitch tone, then the phone line is probably fine.

- If the modem dials but the remote site does not answer, the SWF$ messages will be the same as those given previously. First, ensure that the correct number is being called. Check the Net Description for the remote site.

If the remote just rings and never answers, check the following:

- Does the datalogger and DC112 have power? Check 12 Volt supply for the datalogger. The DC112 modem gets its power (5 volts) from pin 1 on the 9-pin SERIAL I/O connector.
- Check the 9-pin cable connecting the DC112 to the datalogger. It should be straight through, i.e., no lines crossed. Check connections at both ends. Try a spare 9-pin cable if available.
- Check the phone line at the remote site with a standard telephone. Is the telephone line properly connected to the DC112.
- The DC112 has a jumper to enable it to answer the phone. Check that this jumper is in the correct position.

If the phone is busy:

- Is someone else calling the site?
- If the line is always busy, disconnect the DC112 modem and try the line. If the line is still always busy there may be a problem with the line and it should be checked by the phone company. If the line is always busy only when the DC112 is connected the DC112 or datalogger may have a hardware problem and should not be left connected until the problem is determined.
- If the two modems seem to get a phone connection but the base modem does not detect carrier, or if carrier is detected but communication is poor with many retires, the phone line may be noisy or of poor quality and should be checked by the phone company. Experience has also shown that some base modems do not perform as well as others.

A2.3 MD9 COMMUNICATION.

The MD9 at the computer (MD9 base) should be connected to the computer through an SC532 interface. The switches in the base MD9 should be set so the address is 255. The computer dials the base MD9 to communicate with remote dataloggers much like it would dial a telephone modem. The first step is to verify communication with the base MD9. Carefully examine the network health screen. Note if the base MD9 is red or blue along with the remote that is not communicating or if just the remote. This helps determine if the base is working or not.

If multiple remote sites are in use with the base MD9, do any of the remotes work? If some sites work that would tend to indicate either a Net Description problem or a hardware problem for the remote sites that do not work.

To check communication with the base MD9, examine the PORT ACTIVITY box on the NetAdmin main screen. Select the COM port used to communicate with the base MD9. Select the RESET COUNTERS buttons. Examine the CHARS TX, and CHARS RX, and RETRIES boxes. The TX box indicates how many characters are sent to the base MD9 and the RX indicates how many characters are received. The TX box will be non-zero when communication is attempted. The RX will be non-zero when the base MD9 responds. When the base MD9 fails to respond, the TX box will be growing larger while the RX box remains at zero. If the RX box remains at zero, the SWF$.LOG file will have warnings and faults like the following. This indicates the base is not communicating. Note that MD91 is the datalogger station trying to be communicated with.

'08-24-94 14:27:52','F','PC1','MD91','MD9 base failed to respond.'

'08-24-94 14:27:56','F','PC1','MD91','MD9 base failed to respond.'

'08-24-94 14:27:57','F','PC1','MD91','Link failed.'

When communication with the base fails, any communication with remotes will also fail. The will probably be messages generated for the various remotes. These messages may cease when communication with the base works.

Things to check include:

- Ensure that the correct COM port is selected in the Net Description for the Base MD9.
- Is the SC532 is powered up, i.e., plugged in?
- Check each cable to be sure it is connected properly.
- The cable connecting the computer and the SC532 should not be a “Null Modem” cable but should be standard serial RS232 cable.
- Swap cables if spares are available.
- Check that the base MD9 address is set to 255 with the switches.
- Power down the base MD9 by disconnecting the 9-pin cable from the I/O port. Disconnect the serial cable coming from the computer to the SC532. Reconnect the 9-pin cable to the base MD9. Ensure that the SC532 is plugged in. Reconnect the serial cable between the computer and the SC532. Examine communication again.

Once the base MD9 is communicating with the computer, verify communication with the remote(s). Here, the only clues are the network health screen, the SWF$.LOG, and user's observations. The SWF$.LOG will indicate problems with messages like the following. Again MD91 is the remote MD9-datalogger station name. For this example the remote MD9 Switches were set for ID = 1.

'08-24-94 14:28:41','W','PC1','MD91','MD9 dial operation failed (id = 1).'

'08-24-94 14:28:45','W','PC1','MD91','MD9 dial operation failed (id = 1).'

'08-24-94 14:28:48','W','PC1','MD91','MD9 dial operation failed (id = 1).'

'08-24-94 14:28:52','W','PC1','MD91','MD9 dial operation failed (id = 1).'

'08-24-94 14:28:52','F','PC1','MD91','Link failed.'

Note that when the link does not work several warnings precede a fault. This pattern repeats each time the computer attempts communication with the remote MD9 site.

Things to check include:

- Do the datalogger and DC112 have power? Check 12 Volt supply for the datalogger. The MD9 gets its power from pin 1 on the 9-pin SERIAL I/O connector (5 Volts).
- Check the 9-pin cable connecting the MD9 to the datalogger. It should be straight through, i.e., no line crossed. Check connections at both ends. Try a spare 9-pin cable if available.
- Check that each remote MD9 has a unique address (ID).
- Check the coaxial cable between the base MD9 and the remote. See MD9 manual for details.
- Disconnect the 9-pin cable from the MD9. Disconnect the coaxial cable from the MD9. Reconnect the 9-pin cable then the coaxial cable. Examine communications again.
- Occasional errors on MD9 networks. Occasionally the computer may fail in its attempt to communicate with or dial the base MD9. The following type of warnings and faults may occasionally be found in the SWF$.LOG.

  '08-24-94 14:29:06','W','PC1','MD91','MD9 dial operation failed (id = 1).'

  '08-24-94 14:27:46','F','PC1','MD92','MD9 base failed to respond.'

  '08-24-94 13:48:40','W','PC1','MD92','SerLine bad signature on: COM1.'

  This is normal, especially on an OS/2 computer with limited resources. As long as data is being collected these messages occasionally occurring are no reason for concern. Failures are characterized by repeated warnings and fault messages.

A2.4 RADIO (RF)

This section deals with troubleshooting radio network from the software perspective. It does not give specifics on radio transmission problems regarding antennas, etc. Information on these can be found in the RF Telemetry manual.

The switches in the base RF232T should be set so the address is unique regarding other RF stations and not set to 255 (255 is reserved for Phone to RF bases).

The first step is to verify communication with the base RF232T. Carefully examine the network health screen, note if the base RF232T is red or blue along with the remote that is not communicating or if just the remote. This helps to determine if the base is working or not.

If multiple remote sites are in use with the base RF232T, does any of the remotes work. If some sites work that would tend to indicate either a Net Description problem or a hardware problem for the remote sites that do not work.

To check communication with the base RF232T:

- Examine the PORT ACTIVITY box on the NetAdmin main screen.
- Select the COM port used to communicate with the base RF232T.
- Select the RESET COUNTERS buttons.
- Examine the CHARS TX, and CHARS RX, and RETRIES boxes. The TX box indicates how many characters are sent to the base RF232T and the RX indicates how many characters are received. The TX box will be non-zero when communication is attempted. The RX will be non-zero when the base RF232T responds. When the base RF232T fails to respond, the TX box will be growing larger while the RX box remains at zero. If the RX box remains at zero, the SWF$.LOG file will have warnings and faults like the following. This indicates the base is not communicating. Note that RF2BASE is the RF232T station.

'08-24-94 14:26:00','W','PC1','RF2Base','SerLine timeout retry on: COM1.'

'08-24-94 14:26:01','W','PC1','RF2Base','SerLine timeout retry on: COM1.'

'08-24-94 14:26:02','W','PC1','RF2Base','SerLine timeout retry on: COM1.'

'08-24-94 14:26:03','W','PC1','RF2Base','SerLine timeout retry on: COM1.'

'08-24-94 14:26:03','F','PC1','RF2Base','SerLine timeout retry on: COM1.'

When communication with the base fails any communication with remotes will also fail. There will probably be messages generated for the various remotes. These messages may cease when communication with the base works.

Things to check include:

- Ensure that the correct COM port and Baud rate are selected in the Net Description for the RF232T Base.
- Is the RF232T turned on and plugged in.
- Check each cable to ensure it is connected properly including the 9-pin ribbons connecting the small circuit board to the RF95T inside the RF232T.
- The cable connecting the computer and the RF232T should not be a “Null Modem” cable but should be a standard serial RS232 cable.
- Swap cables if spares are available.
- Check that the base address is set correctly with switches including switch 9 (see RF Telemetry manual).

When the RF232T is powered on, the carrier detect light should blink twice. If it blinks continuously there maybe a hardware problem. Note that the carrier detect light flashes in

response to transmissions the radio hears. If the frequency is in use, turn off the radio and repeat the power up test.

With successful communication to the base RF232T, the remotes should be verified. The best tool for verifying RF communication with a remote is the RF LINK TEST found in NetAdmin. Section 2.4 of the RF Telemetry manual gives information on using this test. Section 4.2.2 of the RF Telemetry manual describes the RF LINK TEST using the DOS-based GT program. The following type messages CAN indicate a RF remote failure. Note that RF1 is the remote site and RF2BASE is the RF232T base. With a failure, several warnings will usually precede a fault message. This pattern is repeated each time polling occurs.

'08-24-94 14:22:02','W','RF2Base','RF1',' RF Broadcast failure.'

'08-24-94 14:22:02','W','RF2Base','RF1',' RF Broadcast failure.'

'08-24-94 14:22:02','W','RF2Base','RF1',' RF Broadcast failure.'

'08-24-94 14:22:02','F','RF2Base','RF1',' RF Poll failure.'

For direct maintenance operations (e.g., clock set) the following type messages indicate a failure.

'08-24-94 14:26:15','W','PC1','RF1','SerLine timeout retry on: COM1.'

'08-24-94 14:23:38','F','PC1','RF1','Link failed.'

The following message indicates a link that was failing is working again.

'08-24-94 14:25:22','S','PC1','RF1', 'Communication restored with: RF1.'

Section 2.5 of the RF Telemetry manual gives suggestions of things to check when a remote RF station does not respond.

The RF Broadcast failure warning message may occur occasionally on RF networks that are functioning properly. These can be caused by outside interference or conditions affecting the quality of the link. They also can occur if the Net Description has been changed. As long as data is collect properly, occasional messages are probably no reason for concern. Failures are characterized by repeated warning; followed by a fault.

A.3 COMPUTER COMMUNICATES WITH DATALOGGER, BUT RTM IS NOT DISPLAYING DATA, AND/OR DBSELECT IS NOT STORING OR ROUTING DATA.

Is DBSelect program started? If started, is data collection running? The title bar of DBSelect should indicate the data collection status (running or stopped). If the title bar says that DBSelect is stopped or does not indicate status, check the SWF$.LOG to see if any messages indicate why DBSelect stopped. The common reasons are indicated by the following type messages:

'08-18-94 15:44:13','F','PC1','PC1', 'DBSELECT Acknowledged Named pipe broken, Memory low'

'08-18-94 15:44:13','F','PC1','PC1', 'DBSELECT shutting down too little disk space'

'08-18-94 15:44:13','F','PC1','PC1', 'DBSELECT detected less than 3760128 bytes Free'

'08-18-94 15:44:13','S','PC1','CR10T','Send: Data Advise.'

'08-18-94 15:44:14','S','PC1','PC1', 'DBSELECT Stopped'

These indicate either there was insufficient hard disk space or that there was not enough memory (these can be related). See Section 2.2 of the RTMS manual for specific OS/2 requirements.

DBSelect will also stop if the program receiving data via the named pipe stops acknowledging data. The following type messages will be generated when this happens.

'08-18-94 15:30:00','S','PC1','PC1', 'DBSELECT DosWrite error on Acknowledged named pipe 109'

'08-18-94 15:30:00','S','PC1','PC1',
'Transaction was canceled by client.'

'08-18-94 15:30:00','S','PC1','PC1',
'DBSELECT Stopped'

'08-18-94 15:30:00','S','PC1','PC1',
'DBSELECT Begin Pipe Queue dump to
C:\RTMS\DATA\QUEUE.DAT'

'08-18-94 15:30:01','S','PC1','PC1',
'DBSELECT Dumping 20 Queue Records'

'08-18-94 15:30:01','S','PC1','PC1',
'DBSELECT End Pipe Queue Dump to
C:\RTMS\DATA\QUEUE.DAT'

'08-18-94 15:30:01','S','PC1','PC1',
'DBSELECT Acknowledged Named Pipe
\PIPE\RTMS Server Waiting for connection'

Sections 7 and 8 in the RTMS manual give information on use of Named Pipes and the Queue.Dat file.

To start data collection with DBSelect:

- Press the UPDATE button.
- With RTM, ensure that MONITOR MODE is selected.

If the DBSelect and/or RTM program is running and is collecting data but no data is displayed, check the following:

- Has enough time elapsed that the data has been collected. For example, daily data may only be available at midnight. With radio or phone there may be some delay as data is being collected.
- Check that the correct data are selected and that they matched what is available from the datalogger. To check the list of available data tables from the station, add a new display in RTM or highlight the station name in DBSelect. With RTM the field selections should also be checked.
- If the list of tables has changed then the data the datalogger is storing no longer matches what is selected for collection. Either the datalogger program or the DBSelect or RTM selections are incorrect and will need to be updated to solve this problem. Table names like T01 indicate that the datalogger has no data labels in the program. This can result from using a keyboard display to program the datalogger. DBSelect and RTM will generate messages like the following when data selections and the data available from the datalogger do not match:

'08-18-94 15:01:38','F','PC1','PC1',
'RTMadviseWait:DlsBadTable: One_min'

'08-18-94 15:07:36','S','PC1','PC1',
'DBSELECT DlsWaitForTable returned
DlsBadTable CR10T.Five_min'

'08-18-94 15:07:36','S','PC1','PC1',
'DBSELECT DlsFieldListGet returned
DlsBadTable'

The following messages from the datalogger can indicate that its programming was changed:

'08-18-94 15:01:38','S','PC1','CR10T','Send:
Get Table Definitions.'

'08-18-94 15:01:39','S','PC1','CR10T','Table
Definitions from 'CR10T' changed.'

If the list of tables for a datalogger only contains the INLOCS, STATUS, TIMESET, and ERRORLOG tables with no user defined data tables (created with P84 in datalogger program.DLD file), the datalogger has probably lost power or has not been programmed. If so the .DLD program should be downloaded. Downloading will erase all data in the datalogger so download with caution. Along with the messages above, the following message may also be logged if power was lost.

'08-18-94 15:01:39','W','PC1','CR10T',
'Program not downloaded'

'08-18-94 15:07:34','W','PC1','CR10T',
'Station Number changed from 0000 to
0002 '

If RTM strip charts are not displaying data, check the current time on the strip chart display. If the current time is red the datalogger clock is ahead of the computer's clock (used as the reference for strip charts). The following messages will also be found in the SWF$.LOG.

'08-18-94 15:21:42','W','PC1','PC1','RTM: StripChart, Data TimeStamp greater than System Time'

The datalogger and/or computer clock should be checked.

If the RTM and DBSelect selection are correct and match the data available from the datalogger, and RTM, DBSelect, or both are running, then there may be communication problem between DlsMgr and DBSelect or RTM. This may be caused by insufficient computer resources or running to many programs on the OS/2 computer. See Section 2.2 in the RTMS manual. Try reducing the demands on the PC or increasing its capability by adding RAM, etc.

The following message indicating DBSelect or RTM are not reading data they requested..

'08-18-94 15:11:53','W','PC1','PC1','Client not reading data (CR10T).'

RTM and DBSelect may also give messages indicating Bad Sessions or DLS Halted, in which case the RTMS programs may need to be completely stopped and restarted.

A.4 DLSMGR MESSAGES AND WHAT THEY MEAN

Messages from the NetAdmin SWF$.LOG are described in the following sections. This is not a list of all possible messages but the common ones. Other messages can occur. The format of these messages is TIMESTAMP,TYPE, FROM,ABOUT,MESSAGE. Where TIMESTAMP indicates when the message occurred. TYPE indicates type of message; STATUS, WARNING, or FAULT. FROM indicates which station originated the message. ABOUT indicates which station the messages are about. MESSAGE is the text of the message. These actual messages come from several networks. PC1 is the computer, CR10T is a datalogger directly connected to COM1. Stn2 is a datalogger site accessed via telephone modem on COM1. MD91 is accessed via MD9. RF2BASE is an RF232T base station and RF1 is a radio remote datalogger station. The RF2BASE is connected to COM1.

'08-18-94 14:58:22','S','PC1','CR10T','Pkt to 'CR10T' rejected, communication is paused.'

The pause slider on the network health screen has been moved pausing all communication with network. This message also occurs when DlsMgr is first started as it pauses the network a few seconds when starting. This allows time to start NetAdmin and extend the pause time if it is important to stop the actual communication before it starts.

'08-18-94 15:01:37','W','PC1','CR10T', 'Station Number changed from 0000 to 0002 '

When DlsMgr first communicates with a datalogger it assigns the datalogger a station number. The datalogger remembers this number until it is assigned a new one. When a new number is assigned, the datalogger generates a warning message. When the station number changes from 0000 the datalogger is being communicated with for the first time since it was powered up. If the number changes, GT may have been used with the station or the Net Description involving the datalogger has been edited.

'08-18-94 15:01:39','W','PC1','CR10T', 'Program not downloaded'

The datalogger is being communicated with but is indicating that no program (.DLD file) has been downloaded. If this is not a new station the datalogger may have lost power.

'08-18-94 14:59:54','S','PC1','CR10T','Data CR10T.InLocs RecNbr 18280 for 1.'

'08-18-94 15:01:03','S','PC1','CR10T','Data CR10T.One_min RecNbr 3119 for 1.'

Indicated polling type collection of a data record from the datalogger. These messages are normal and should occur. See Section 7.1 of the RTMS manual for discussion of polling and hole collection.

'08-18-94 15:06:01','S','PC1','CR10T','Send: Hole Collection.'

'08-18-94 15:06:02','S','PC1','CR10T','Hole CR10T.One_min RecNbr 0 for 2.'

First message indicates the RTM or DBSelect requested a specific range of data using hole collection. Second message indicates what data was collected using hole collection. Several hole collections may be required to collect a single hole depending on the amount of data. Normally these messages can occur following Data Advise messages (see next message) or when holes are manually entered in DBSelect. See Section 7 in RTMS manual. RTM optionally uses hole collection to backfill strip charts when the monitor mode is started. Frequent hole collection during routine operation (i.e., no user intervention or changes) may indicate that data is being lost en route from datalogger to DBSelect. A poor but sometime functional communication link could cause this (check communication Section 1.3 above). If the OS/2 computer is exceedingly burdened (Section 2.2 in RTMS manual) data may be collected but discarded because the computer cannot process it as fast as it is collected and buffers overflow.

'08-18-94 14:59:52','S','PC1','CR10T','Send: Data Advise.'

'08-18-94 15:01:24','W','PC1','CR10T', 'Advise Transaction re-started (CR10T).'

The computer sent a list of the data it requires to the datalogger (advised the datalogger). This normally occurs when RTM or DBSelect is stopped, started, or edited so the data needed from the datalogger changes. This can also occur when the datalogger clock has changed or has a new program downloaded. Abnormally these messages occur when DlsMgr tries to reset data collection with a given datalogger. DlsMgr does this when it detects that a significantly long period has elapsed without data or a valid no data response is being received from the datalogger. Period is current retry period or four times the polling interval (whichever is longer). Note that the datalogger will return a valid no-data response as long as it has been “advised” of what data to return. This prevents DlsMgr from resetting data collection when slow data is being collected. If DlsMgr successfully restarts the transaction data should resume. Check communication with datalogger (see Section 2). Check RTM and DBSelect to see if they have stopped collecting data from station (see Section 3).

'09-02-94 16:03:59','S','PC1','RF1','Unused 'Data Advise Notification' from 'RF1'.'

This indicates that data from a previous data advise arrived. These messages occur normally when the list of data to be collected has been changed. Data already en route to the computer will be based on the old list of data to be collected (data advise) and will not be used by the computer. Once the new data advise is in place, these messages should stop. Note that when the data advise changes, usually there will be some data hole collected.

'08-24-94 13:42:15','S','PC1','Stn2','Hayes dialing: '513' (COM1).'

DlsMgr is attempting communication with a remote station accessed by telephone. The station name is Stn2, and the phone number is 513. This message occurs each time the phone is dialed.

'08-18-94 15:01:38','S','PC1','CR10T', 'Send: Get Table Definitions.'

The computer has requested a list of data available from the datalogger. This normally occurs when the station has just been added to the network or a datalogger program.DLD file has been downloaded. Otherwise, it indicates that DlsMgr thinks the datalogger program has changed. This can indicate that power has been lost at the datalogger site or the datalogger has been reprogrammed manually, i.e., keyboard display or laptop.

'08-18-94 15:01:39','S','PC1','CR10T','Table Definitions from 'CR10T' changed.'

A follow up message to a previous message indicats that the data available from a datalogger has changed. Same conditions as previous message.

'08-18-94 15:02:31','S','PC1','CR10T','Send: Clock Set/Check.'

'08-18-94 15:02:31','S','CR10T','CR10T', 'Clock changed'

'08-18-94 15:19:11','S','CR10T','CR10T', 'Clock changed; Program running'

Clock was checked or set (first message). This message occurs when the clocks are

set/checked automatically (must be enabled) or manually. Second message is from the datalogger indicating its clock was changed but that no program is running, i.e., no program (.DLD file) has been downloaded. Third message, also from the datalogger, indicates its clock was changed and there is a program running. There is no response generated when the clock is checked. Clock changes are logged in CLKSET$.LOG files. See Section 8 in the RTMS manual.

'09-02-94 14:50:08','W','PC1','CR10T','Hole detected in table 01'

This warning usually occurs when the datalogger clock is changed so an output interval is missed. It indicates that a gap occurred in the time stamps of the records from the tables. The record numbers of the records will not have a gap.

'08-18-94 15:03:24','S','PC1','CR10T','Send: Program Download.'

'08-18-94 15:03:37','S','CR10T','CR10T', 'Download complete; Signature: +56647.'

'08-24-94 13:49:20','F','PC1','CR10T','E22'

'08-24-94 13:50:11','F','PC1','CR10T','E99'

A datalogger program was downloaded to datalogger. If the datalogger can compile and use program, the second message is returned from the datalogger. If the datalogger receives the program but cannot compile it due to an error, it will return a message like the third message (E22 indicates a missing END statement). The last fault messages indicates that the datalogger received the file but did not recognize it as a datalogger program.

'08-18-94 15:19:58','S','PC1','CR10T','Send: User I/O.'

Keyboard display mode (terminal mode) was used with the datalogger.

08-18-94 15:19:58','S','PC1','CR10T','Send: Control.'

Command to set datalogger port, flag, or load INLOC was sent by RTM.

08-18-94 15:19:58','S','PC1','CR10T','Send: RF Link Test.'

RF test link option in NetAdmin was used.

'08-18-94 15:01:18','W','PC1','CR10T', 'SerLine timeout retry on: COM1.'

'08-24-94 13:48:40','W','PC1','CR10T', 'SerLine bad signature on: COM1.'

'08-24-94 13:48:40','W','PC1','CR10T', 'Bytes were received while sending low level packet (COM1).'

'08-18-94 15:01:37','W','PC1','CR10T', 'Redundant packet received from 'CR10T' (PktType 7).'

The first message indicates that the device the DlsMgr (computer) was attempting communication with did not respond. The second indicates a received packet failed the signature test (and was retried usually).

The third packet indicates the DlsMgr received characters on the serial port when it did not expect them.

The fourth message indicates the DlsMgr received an extra response to a command.

These messages are usually not cause for concern when they occur occasionally as serial communications are not perfect. When warnings occur repeatedly and are followed by fault messages, there is a communication problem. When this occurs, the following gives some probable causes:

The first indicates the device is not responding. See Section 3.0 above.

The second would indicate that characters are routinely missed. This can mean the OS/2 computer has insufficient resources or too many programs are being run concurrently. It may also indicate a bad serial port or device.

The third indicates that the wrong device may be attached to the COM port and is echoing characters when it is not expected. For example a Hayes modem echoes characters while a MD9 base does not. If the Net Description incorrectly specifies the COM port

or device, DlsMgr may be attempting communication with the wrong device.

The third can indicate that DlsMgr is retrying operations before the previous one completes. This usually indicates that the retry periods specified in the Net Description are too short. Otherwise, operations are taking longer than the should and there may be other communication problems.

A.4.1 RTM MESSAGES

'08-18-94 15:21:42','W','PC1','PC1', 'RTM:StripChart, Data TimeStamp greater than System Time'

RTM strip charts cannot display data properly because the datalogger clock is ahead of the computer clock.

The current time displayed on the strip chart will also be shown in red.

Section 3 contains additional information and RTM messages.

A.4.2 DBSELECT MESSAGES

'08-18-94 15:05:16','S','PC1','PC1', 'DBSELECT Acked Pipe Name set to \PIPE\RTMS'

'08-18-94 15:05:16','S','PC1','PC1', 'DBSELECT Non Acked Pipe Name set to \PIPE\RTMA'

'08-18-94 15:05:16','S','PC1','PC1', 'DBSELECT Background modules will get INIs from C:\RTMS\'

'08-18-94 15:05:16','S','PC1','PC1', 'DBSELECT Will get INIs from C:\RTMS\DATA\'

'08-18-94 15:05:16','S','PC1','PC1', 'DBSELECT Unacknolwaged Named Pipe, \PIPE\RTMA Server Waiting for connection'

'08-18-94 15:05:24','S','PC1','PC1', 'DBSELECT ASCII files Enabled'

The above messages indicate the selections made with the DBSelect menus. DBSelect gives these type of messages when it is started or when a selection is changed.

'08-18-94 15:05:27','S','PC1','PC1', 'DBSELECT Advise Started 0'

DBSelect has requested the data it needs from DlsMgr.

'08-18-94 15:06:00','W','PC1','PC1', 'DBSELECT table wraparound in CR10T.One_min'

A table in a datalogger has the record number go from a large number to a smaller one. This indicated that the datalogger was reprogrammed (with the same table names) or the table numbers reached the largest possible record number and then wrapped around to one. The record number would probably only wrap around on fast tables or where the datalogger has been running with program change for a long time.

'08-18-94 15:09:23','W','PC1','PC1', 'DBSELECT Data Base Will be collecting Data and Not Storing or Exporting it'

DBSelect has been started and updated but no data destination (ASCII files or Named Pipe) has been specified. This should be corrected, as data will not be stored or recollected automatically!

'08-18-94 15:09:49','S','PC1','PC1', 'DBSELECT Baling Begin'

'08-18-94 15:09:54','S','PC1','PC1', 'DBSELECT Baling End'

DBSelect has moved data files from the SHADOW directory to the data directory. This is done on the user-specified interval. This is normal when ASCII files are in use. See Section 7 of the RTMS manual for information on baling of files.

'08-18-94 15:09:51','F','PC1','PC1', 'DBSELECT Non data file in SHADOW directory Q.BAK'

'08-18-94 15:09:51','F','PC1','PC1', 'DBSELECT DosDelete d:\BIN\BCAHAGBG.000 returned 5'

These messages indicate error conditions. The first is that a file that is not a DBSelect data file was found in the SHADOW directory. Users should not access the SHADOW directory or

the files contained there at all. The second error indicates the DBSelect could remove a file from the shadow directory after it baled it. DBSelect needs full rights to the SHADOW directory and the data directory.

'08-18-94 15:26:50','S','PC1','PC1',
'DBSELECT Stopped'

DBSelect has stopped. The program is running but no data is being collected. See Section A3 above and Section 7 of the RTMS manual for more information.

Section 3 contains additional information and DBSelect messages.

GLOSSARY

Acknowledged Named Pipe – See Named Pipe. Exchange of data through a named pipe where the program or process (client) receiving data must acknowledge each record of data it receives.

Advise – See Data Advise

Baling – When DBSelect stores data in ASCII files, it periodically makes data files available for the user or user programs. This process is known as baling and happens on a user specified interval.

Baud rate – Communication speed between two serial devices. Baud rates must match for successful communication.

Block Mode Protocol – Protocol used by DlsMgr to communicate with CR10T dataloggers and RF95T RF modems.

BMP- See Block Mode Protocol.

Broadcast – Part of the radio (RF) technique of polling remote radio modem dataloggers sites. A single modem sends a message (broadcast) that all affected remotes hear and respond to.

Carrier – An electrical signal used to convey data or other information. For example, radio and phone modems use carrier signals. Phone modems attempt to detect carrier when the call is placed. The red LED on the RF95T lights when the modem detects carrier.

Chars. RX – Number of characters (bytes) received by the computer. Part of NetAdmin network health display.

Chars. TX – Number of characters (bytes) transmitted by the computer. Part of NetAdmin network health display.

Child node – See node. A node that is accessed through another device (parent node). For example a remote radio (RF) site is accessed through the base RF232T. All nodes are children nodes of the PC.

Coaxial cable – Special type of cable with two conductors (center conductor and outer shield conductor). Classified by size, impedance, and loss characteristics. Used to connect MD9 modems and to connect radios to antennas.

COM Port – RS-232 Serial port, i.e., COM1, COM2, etc.

CR10T – Campbell Scientific datalogger supported by RTMS, used to make measurements at remote sites.

Data Advise – List of data to be collected, usually from a datalogger. Sent to "advise" datalogger of what data is needed. Based on dataloggers Table Definitions.

Data Advise Notification – Packet of data sent by datalogger based on the Data Advise it received.

DBSelect – RTMS program for data collection, storage, and routing including named pipes, and ASCII files.

DC112 – 1200 Baud telephone modem for use with a CR10T datalogger. Powered by the CR10T datalogger.

DLD file – See EDLOG. CR10T datalogger programs are usually developed on the computer and then sent to the datalogger. These datalogger programs have a .DLD extension.

DlsMgr – Datalogger Service ManaGeR. Manages all communication with datalogger network. Part of the RTMS programs.

Extract – Utility program to extract ranges, sort, check, and merge ASCII data files created with DBSelect.

Fault – Message relating to network activity where repeated problems or errors have occurred. Repeated faults usually indicate a failure of some kind.

Health – See Network Health.

Hole – See hole collection. Because of the way current and older datalogger data are collected simultaneously, there can be sequences of older data that are available from the datalogger but have not yet been collected. DBSelect tracks and optionally collects these holes

Hole Collection – See Hole. Process used to collect a specific range of data from a datalogger. Usually used to collect data to fill RTM strip charts or to collect data not collected with Data Advise.

Keyboard display – A hand-held display and keyboard used to access CR10T datalogger programming, and star mode (* mode) information directly. Model CR10KD.

Kick – When a transaction fails, it is usually retried until it succeeds. Retries are based on intervals specified by user. To "kick" a transaction is to force an immediate retry.

Link – Communication route between to devices, e.g., phone link between two phone modems.

MD9 – A mutidrop modem where several CR10T dataloggers (with MD9 modems) are attached to a single coaxial cable along with a MD9 at the computer. DlsMgr "dials" the base MD9 to access the remote dataloggers. The MD9 are individually addressed.

Named Pipe – See Acknowledged Named Pipe and Unacknowledged Named Pipe. Method provided by OS/2 for two programs or process to exchanged data. Used with RTMS to make datalogger data available to user-written programs. DBSelect provides an Acknowledged Named Pipe and an Unacknowledged Named Pipe.

Net Description – Description of dataloggers and communications devices that form the datalogger network. Entered as with NetAdmin and used by DlsMgr to communicate with the various dataloggers.

NetAdmin – Network Administration program, Used to: monitor network communication and health, edit network descriptions, set/check clocks, download datalogger programs, interact directly with dataloggers, and test RF links.

Network Health – Pertaining to DlsMgr ability to collect data and communicate with the datalogger in the datalogger network. Network Health indicators are displayed on the main NetAdmin screen.

Node – Part of the description of a datalogger network (Net Description). Represents a device that DlsMgr will directly communicate with or dial. Nodes are organized as a hierarchy with all nodes accessed by the same device (parent node) grouped as children nodes. A node can be both a parent and child node.

Packet – A unit of information sent between two devices that are communicating, can contain data, messages, programming, etc. Usually contains addressing and routing information.

Path – A list of modems or devices used to communicate with a remote site datalogger.

Pipe – See Named Pipe.

Polling – Process where a datalogger or other communication device is periodically checked for any packets it needs to send. DlsMgr polls dataloggers for most communication links. With radio (RF) the base RF232T or repeaters can poll datalogger sites.

Polling Interval – See Poll. The user-specified interval that determines when to poll a given device.

RAD Modems – Short haul modems for communicating with a CR10T datalogger over twisted pair wire connection. RAD is the trademark name for the modems manufactured by RAD Data Communictions, Inc.

Real-Time Monitoring Software – Collection of OS/2-based software for automated data acquisition, monitoring, and control of CR10T datalogger networks.

Remote Keyboard – A mode provided by NetAdmin that emulates the functionality available with a Keyboard display.

Remote site – Usually refers to the site where a datalogger is located at other end of communication link. Also can refer to site where a radio (RF) repeater is located.

Repeater – A radio (RF) site that relays packets of information to a remote site. Used to extend the range of radio transmissions. Any remote datalogger site with radio can act as a repeater.

Retries – When a transaction or communication between two devices or programs fail. The transaction or communication is usually repeated until it succeeds. These "retries" occur based on user entered parameters (in Net Description).

RF – Dealing with radio telemetry. Stands for Radio Frequency.

RF232T – A base station radio and modem. Contains radio, SC532, RF95T, and power supply in an enclosure.

RF95T – Modem for use with radio (RF) telemetry.

RTM – Real Time Monitor, Program to monitor datalogger data in "real-time" with various graphical displays and tables.

RTMS – See Real-Time Monitoring Software

SC12 cable – 9-pin cable (subminature D-type connectors) used to connect dataloggers and peripherals.

SC32A – A device for connecting a CR10T datalogger to an RS-232 serial port.

SC532 – Interface device to connect an MD9 modem or RF95T modem to an RS-232 serial port.

SC932 – Interface device for connecting RAD modems to datalogger.

SerLine – Dealing with the serial port or serial connection. Usually used in SWF messages.

SHADOW directory – DBSelect temporarily stores the data it receives in subdirectories under the SHADOW directory. The user should access or place files in these directories. DBSelect needs full rights to these directories.

Sibling Nodes – See Node, Child Node, and Parent Node. Two or more nodes accessed by the same parent node.

Signature – Number calculated to verify both sequence and validity of bytes within a packet.

Station number – DlsMgr assigns and uses station numbers for routing of packets. NetAdmin allows the user to specify these numbers but the defaults are usually adequate.

Status – Message relating to current network activity.

SWF logs – Messages indicating Status, Warnings, and Faults within the datalogger network. May be filtered and logged to disk.

Table Definitions – List of data available from a datalogger. Datalogger supplies this list on request. Based on the datalogger programming. Used by DlsMgr to form Data Advise.

Terminal Mode – See Remote keyboard.

TimeStamp – Date and time information for data or message.

Transaction – Exchange of data or information between two devices or programs. For example setting of the clock in a datalogger is a transaction between DlsMgr and the datalogger.

Unacknowledged Named Pipe – See Named Pipe. Exchange of data through named pipe where sending program (DBSelect) sends data regardless of whether receiving program (client) is ready to receive (or even present).

View – NetAdmin function that can be accessed and configured but runs even when not being accessed.

Warning – Message relating to network activity where a potential problem or error has been identified. Usually occasional warnings are not cause for alarm.