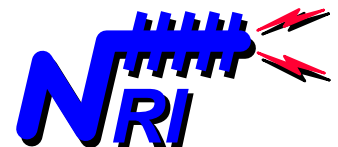


The RTU Operator Interface
Telemetry And Control System Engineering Series

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1 INTRODUCTION

In 1995, Navionics Research introduced the **WiSTAR** Network, an acronym derived from **W**ireless **S**ystem **T**elemetry **A**nd **R**emote-Control. This product was designed to solve the problems posed by the complex distributed control and monitoring requirements of the rural water and wastewater industries.

During the early design of the WiSTAR RTU, a relatively primitive interface was developed using one of the RTU's serial communication ports (COM1). At that time, the interface's main purpose was to assist Navionics Research service personnel: By interacting with the RTU and reading the self-diagnostic messages, problems could be detected and repairs and adjustments could be made. And the requisite terminal equipment was relatively simple: a notebook computer running basic terminal emulation software. However, operators soon saw the benefits of interaction with a self-diagnostic RTU; and requests were made to transform the "Service Interface" into an "Operator Interface". And so the "RTU Operator Interface" was born.

The look of today's RTU Operator Interface bears little resemblance to the austere, early versions. Today, the user is presented with a crisp, sleek interface. The menus are selectable by a single keystroke ("hotkeys"), and the operation is virtually self-explanatory at every step. In fact, no previous computer experience is required to work with the interface.

Another development that boosted the popularity of the RTU Interface was Hewlett Packard's introduction of the HP-200LX Palmtop PC. Featuring a compact size that fits in a coat pocket, a low price, and a long battery life, "the palmtop" has become one of the most popular telemetry system accessories among Navionics Research clients.

In addition to palmtop and notebook computers, additional compatible terminal devices have been introduced. For example, the RTU Operator Interface supports a standard UNIX/LINUX terminal. Featuring a large backlit display and a full-size keypad, UNIX/LINUX terminals have been placed into operation at select Water Plants and Pump Stations that require a permanent operator interface.

Also, with the recent addition of strong security measures, the RTU Operator Interface port can be connected to a modem and telephone line. This enables a remote operator to connect to the RTU, via modem-equipped computer, for telemetry monitoring purposes. Also, Navionics Research service personnel can connect to the RTU; and both troubleshooting and firmware upgrades can be performed remotely.

The purpose of this tutorial is to provide assistance to operators, engineers, and service personnel who wish to interact with a Navionics Research RTU. Each chapter focuses on a specific task, and detailed sequential procedures are given to accomplish this task. No previous computer experience is required of the reader.

2 TERMINAL SETTINGS

The communication settings for the RTU Operator Interface Port are:

Default Speed	19200 bps
Data Bits	8
Parity	None
Stop Bits	1
Terminal Emulation	ANSI or VT100
Hardware	RS-232C, DTE, 9-Pin D-Subminiature, Male

The settings for a connecting device, such as a palmtop/notebook/terminal, must match the above settings in order for communications to occur.

Also, the proper cable must be used. When connecting to another DTE serial port, a "NULL MODEM CABLE" must be used. For example, a notebook computer is usually equipped with a DTE serial port, and therefore a null modem cable is required.

When connecting to a DCE serial port, a "STRAIGHT-THRU SERIAL CABLE" is required. For example, an external modem is usually equipped with a DCE serial port, and therefore a straight-thru serial cable is required.

Color Versus Monochrome Displays

The images displayed in this tutorial are actual screen snapshots taken from a working system – Carlyle North Water Company. Some of the images display black text against a white background; and other images display color text against a black background. Color can be toggled ON/OFF by pressing the "C" key from any menu. The terminal or terminal emulation software should be checked for color compatibility.

3 GENERAL OVERVIEW OF THE EXAMPLE SYSTEM

This tutorial is based upon a system that is in operation in a rural, Southern Illinois community. The system consists of a single booster pump station and a single water tower. The pump station is located approximately 10 miles from the water tower. Before proceeding to the subsequent chapters, it will be useful to become acquainted with the operating logic for these two RTU's. This chapter gives a brief overview of the industrial equipment connected to the RTU's and the logic that governs the use of this equipment.

Site Addresses

Each RTU in a Telemetry Network has a unique network ID, or "address". In this example, the two RTU's have the following addresses:

Water Tower: **10**

Pump Station: **4**

Water Tower RTU

1. The Water Tower RTU monitors the 120VAC power source, the level of water in the tower via an electronic pressure transducer, and the RTU enclosure temperature (via a thermocouple). If the electronic pressure transducer should fail, then the RTU will report this failure to the operator and to the remote Booster Pump Station.
2. When the level of water in the tower drops below its "LEAD-PUMP-ON" setpoint, the tower RTU calls for the booster station's lead pump to turn ON. The lead pump remains ON until the level of water in the tower climbs above the "LEAD-PUMP-OFF" setpoint.
3. Also, if the level of water in the tower drops below its "LAG-PUMP-ON" setpoint, the tower RTU calls for the booster station's lag pump to turn ON. The lag pump remains ON until the level of water in the tower climbs above the "LAG-PUMP-OFF" setpoint.
4. The Water Tower RTU approximates the flow rate in (and out) of the tower, and presents this calculation in units of "feet per hour".
5. If the RTU enclosure temperature falls below the "HEATER_THERMOSTAT" setting (with a 10 degF deadband), the RTU will energize a 200 watt strip heater.
6. If the RTU enclosure temperature climbs above the "FAN_THERMOSTAT" setting (with a 10 degF deadband), the RTU will energize a cooling fan.

Pump Station RTU

1. The Pump Station RTU monitors the 120VAC power source, and the 3-Phase power source. It also monitors the feedback (auxiliary contacts) from the two (2) booster pumps. The station is underground, and therefore the RTU monitors a “flood detector” as well. There is an electronic-output water meter in the station, and both flow-rate (gallons per minute) and totalization (total gallons) are monitored. The discharge pressure (PSIG) and suction pressure (PSIG) are both monitored. The station temperature (degF) is also monitored.
2. The Pump Station RTU can operate using any of the following primary operating modes: Radio (Run pumps based upon the Water Tower’s commands.), Pressure (Run pumps based upon discharge pressure in the Pump Station.), Timer (Run pumps based upon timer settings.), or External (Run pumps based upon an external controller.)
3. If the Pump Station RTU is operating using “Radio” as its primary operating mode, and a communication failure to the Water Tower occurs for any reason (or if the pressure transducer at the Water Tower fails), then the Pump Station RTU will fail over automatically to an alternate (“failover”) operating mode. The available “failover” operating modes are: Pressure, Timer, or External.
4. The RTU operates based upon the following logic:
 - A. “Radio Mode” Lead Pump Control. The following control logic applies when the RTU is operating the pumps based upon “RADIO-MODE”: When the RTU at the water tower signals for the Lead pump to turn ON, then the pump station’s RTU turns the Lead pump ON. When the RTU at the water tower signals for the Lead pump to turn OFF, then the pump station’s RTU turns the Lead pump OFF.
 - B. “Radio Mode” Lag Pump Control. The following control logic applies when the RTU is operating the pumps based upon “RADIO-MODE”: When the RTU at the water tower signals for the Lag pump to turn ON, then the pump station’s RTU turns the Lag pump ON. When the RTU at the water tower signals for the Lag pump to turn OFF, then the pump station’s RTU turns the Lag pump OFF.
 - C. “Pressure-Mode” Lead Pump Control. The following control logic applies when the RTU is operating the pumps based upon “PRESSURE-MODE”: When the discharge pressure falls below the “LEAD-ON-PRESSURE-MODE” setpoint for a period of 20 minutes, then the RTU turns the Lead pump ON. The Lead pump then runs for a period of “RUNTIME-PRESSURE-MODE” (hours); and then turns OFF.
 - D. “Pressure-Mode” Lag Pump Control. The following control logic applies when the RTU is operating the pumps based upon “PRESSURE-MODE”: When the discharge pressure falls below the “LAG-ON-PRESSURE-MODE” setpoint for a period of 15 minutes, then the RTU turns the Lead AND the Lag pumps ON. The Lead and the Lag pumps then run for a period of “RUNTIME-PRESSURE-MODE” (hours); and then turn OFF.

E. Timer-Mode Lead Pump Control. The following control logic applies when the RTU is operating the pumps based upon "TIMER-MODE": The Lead pump turns ON when any of the following conditions apply:

- i. The time of day (hour) is greater than "TIMER-1-START-HOUR" and less than "TIMER-1-STOP-HOUR"
- ii. The time of day (hour) is greater than "TIMER-2-START-HOUR" and less than "TIMER-2-STOP-HOUR"
- iii. The time of day (hour) is greater than "TIMER-3-START-HOUR" and less than "TIMER-3-STOP-HOUR"

F. If the pumps are set in "ALTERNATION" mode, and a pump fails to turn ON when the RTU signals that pump to turn ON, then the RTU automatically attempts to start the other pump in its stead.

G. External-Mode Lead Pump Control. The following control logic applies when the RTU is operating the pumps based upon "EXTERNAL-MODE": The RTU turns all pumps OFF, and energizes a parallel electrical circuit which contains hard-wired control logic to control both pumps.

H. Radio-Mode Calculation. The RTU operates in "RADIO-MODE" when the operator has selected the "OPERATING-MODE" to "RADIO", and the following conditions apply:

- i. The RTU is NOT in a state of communication failure to the water tower
- ii. The RTU at the water tower is not reporting a transducer failure

I. Pressure-Mode Calculation. The RTU operates in "PRESSURE-MODE" when the operator has selected the "OPERATING-MODE" to "PRESSURE". Additionally, the RTU operates in "PRESSURE-MODE" when the operator has selected the "OPERATING-MODE" to "RADIO" and the "FAILOVER-MODE" to "PRESSURE", and one (or more) of the following conditions applies:

- i. The RTU is in a state of communication failure to the water tower
- ii. The RTU at the water tower is reporting a transducer failure

J. Timer-Mode Calculation. The RTU operates in "TIMER-MODE" when the operator has selected the "OPERATING-MODE" to "TIMER". Additionally, the RTU operates in "TIMER-MODE" when the operator has selected the "OPERATING-MODE" to "RADIO" and the "FAILOVER-MODE" to "TIMER", and one (or more) of the following conditions applies:

- i. The RTU is in a state of communication failure to the water tower
- ii. The RTU at the water tower is reporting a transducer failure

K. External-Mode Calculation. The RTU operates in “EXTERNAL-MODE” when the operator has selected the “OPERATING-MODE” to “EXTERNAL”. Additionally, the RTU operates in “EXTERNAL-MODE” when the operator has selected the “OPERATING-MODE” to “RADIO” and the “FAILOVER-MODE” to “EXTERNAL”, and one (or more) of the following conditions applies:

- i. The RTU is in a state of communication failure to the water tower
- ii. The RTU at the water tower is reporting a transducer failure

L. Power Fail Operations. The RTU supervises the 3-Phase Monitor and the 120VAC Single-Phase power of the control circuit. In the case of any power fault, the RTU asserts a “POWER-FAIL” FLAG, and the RTU does not clear this FLAG until power has been restored, uninterrupted, for a period of 10 minutes. The RTU does not allow the pump motors to run while the “POWER-FAIL” FLAG is asserted.

M. Low-Suction-Cutout. When the Suction Pressure falls below the “LOW-SUCTION-CUTOUT” threshold for a period of 20 seconds, then the RTU turns OFF all pumps and asserts the “LOW-SUCTION-CUTOUT” FLAG. The “LOW-SUCTION-CUTOUT” persists until the Suction Pressure climbs above the “LOW-SUCTION-CUTOUT” threshold for a period of “LOW-SUCTION-RELEASE-SECS” seconds.

N. Suction-Transducer-Fail. When the RTU detects an electrical failure of the Suction transducer, the RTU asserts a “SUCTION-TRANSDUCER-FAIL” FLAG.

O. Discharge-Transducer-Fail. When the RTU detects an electrical failure of the Discharge transducer, the RTU asserts a “DISCHARGE-TRANSDUCER-FAIL” FLAG.

P. Pump 1 Manual Operations. The #1 Pump turns OFF when the “PUMP-1-MODE” is set to “OFF”. The #1 Pump turns ON when the “PUMP-1-MODE” is set to “ON”. However, the pump does not run during a power failure, phase-fault, low-suction-cutout, or flood condition. When “PUMP-1-MODE” is set to “AUTO”, then the operating modes, setpoints, and conditions govern the operation of the #1 Pump.

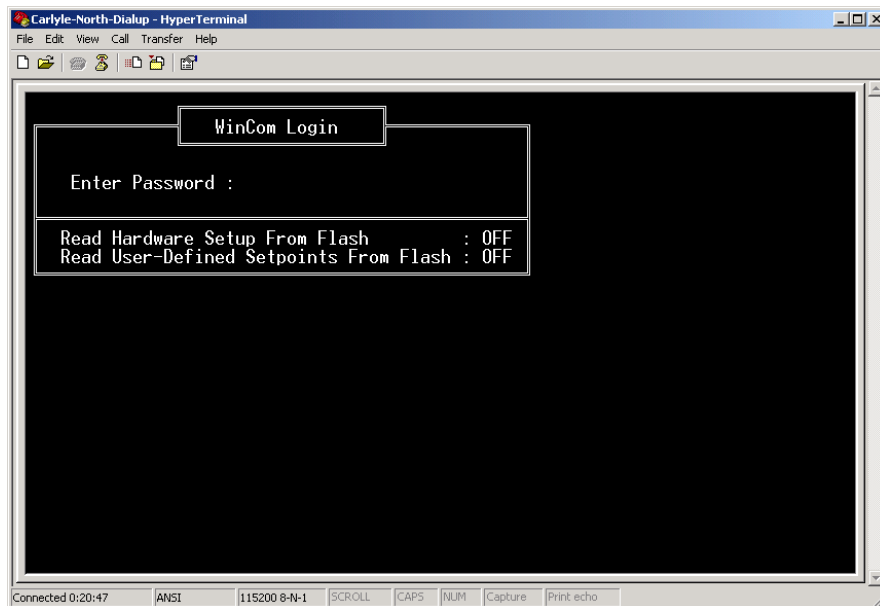
Q. Pump 2 Manual Operations. The #2 Pump turns OFF when the “PUMP-2-MODE” is set to “OFF”. The #2 Pump turns ON when the “PUMP-2-MODE” is set to “ON”. However, the pump does not run during a power failure, phase-fault, low-suction-cutout, or flood condition. When “PUMP-2-MODE” is set to “AUTO”, then the operating modes, setpoints, and conditions govern the operation of the #2 Pump.

R. Pump Alternation. If the “PUMP-ALTERNATION” setpoint is set to “ON”, then the RTU rotates the Lead Pump between Pump 1 and Pump 2. If “PUMP-ALTERNATION” is set to “OFF”, then the Lead Pump will always be the Pump that is selected in the “LEAD-PUMP” setpoint; and the Lag Pump will always be the Pump that is selected in the “LAG-PUMP” setpoint.

4 CONNECTING TO THE RTU WITH A PALMTOP

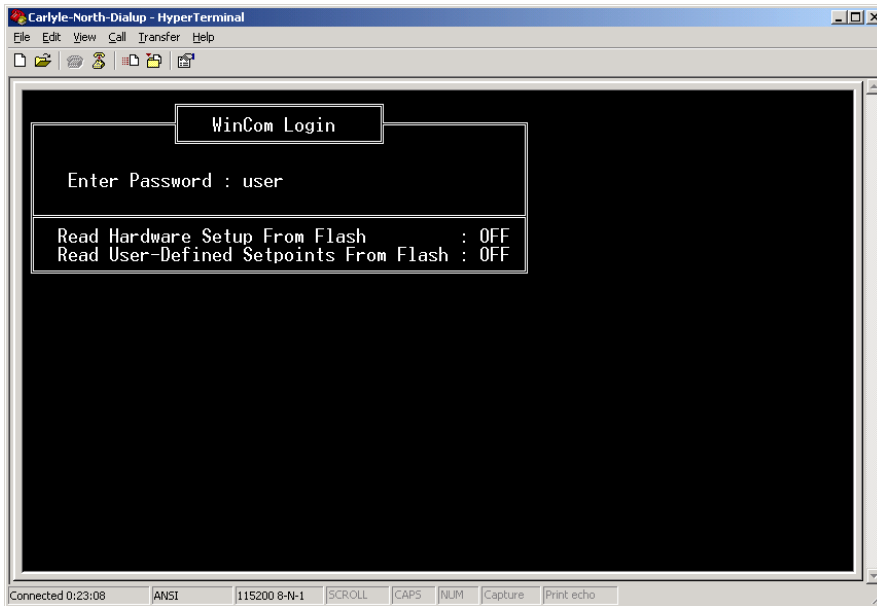
Using an HP-200LX or HP-100LX palmtop PC, the operator should perform the following steps:

1. Connect the 9-Pin Female D-Subminiature Connector of the “Communication Cable” (Null Modem Cable) to the RTU “Terminal Port”.
2. Connect the other end of the “Communication Cable” (Null Modem Cable) to the Palmtop PC.
3. Turn the Palmtop PC “ON”.
4. If the “DataCom” Terminal Program is running, skip to Step 7.
5. Press the “More” button the palmtop keypad to bring up the list of application program icons.
6. Press the <C> key to start the “DataCom” Terminal Program.
7. Press the <ENTER> key.
8. At this point, the login screen should appear:

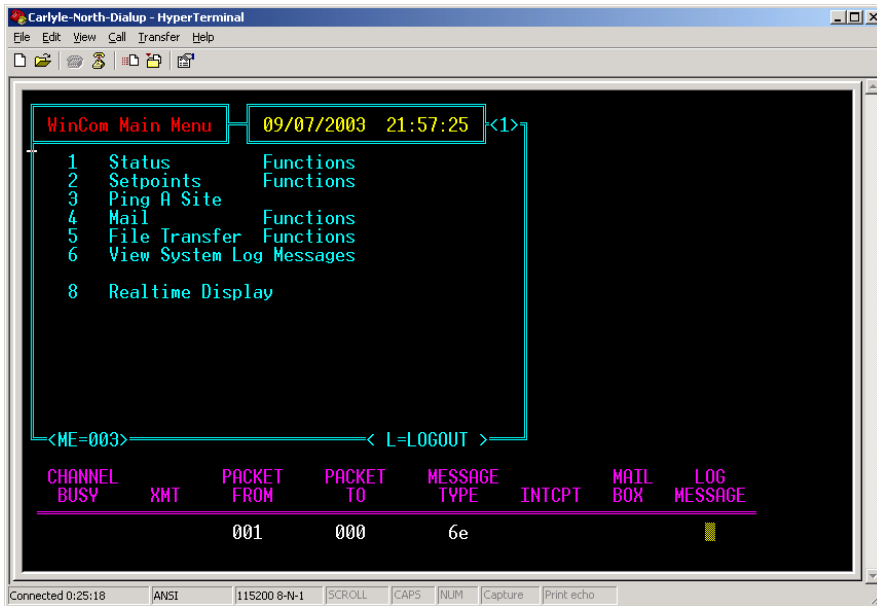


5 OPERATOR LOGIN

1. At the login prompt, the user should enter the default operator password: USER



2. Press the <ENTER> key.
The "Main Menu" should appear, as shown below:



6 ALTERNATE LOGIN LEVELS

1. The following default passwords are programmed into the each RTU:

GUEST
USER
ROOT
FACTORY
CONTROL

2. Each password enables and/or disables certain features of the RTU. The goal of a multi-level password system is to simplify the menus, as well as to lessen the possibility of problems caused by an errant keystroke.

3. The following table summarizes the capabilities enabled for each password:

	GUEST	USER	ROOT	FACTORY	CONTROL
View Local And Remote Status	X	X	X	X	
View Local And Remote History	X	X	X	X	
View Realtime Display	X	X	X	X	
View Enhanced Realtime Display (Control Logic View)				X	
View Local And Remote Setpoints	X	X	X	X	
Modify Local And Remote Setpoints		X	X	X	
View System Log		X	X	X	
Auto Logout Enabled	X	X			
Ability To Halt System Software				X	X
Ability To View Control Logic					X
Ability To Debug Control Logic					X
Ability To Edit Control Logic					X
View And Modify System Settings				X	
Increase Firmware Debugging Level				X	

7 THE MAIN SCREEN

1. The following image is a snapshot of the main screen, and the annotations (red) describe the various parts of this screen:

Hotkey Menu: These Hotkeys Define The Key Press Required For Activating The Various Menu Functions. For Example, <1> Is The Hotkey To Enter The "Status Menu".

Modem Status Bar: All Communication Activity Is Displayed Here In Real Time.

Day Of Week (1=Sun... 7=Sat)

Date And Time (Military)

<L> = Hotkey To Log Out

Lit When Another Network RTU Or Voice Radio Is Transmitting

Lit When This RTU Is Transmitting

The Network Address Of The Transmitter Of This Message

The Network Address Of The Receiver Of This Message

The Type Of Message Transmitted (See Table)

Lit When A Mail Message Is Waiting In This RTU's Mailbox

Lit When A Message Was Overheard (Intercepted) Before The Final Relay

Lit When A New (Not Previously Viewed) Message Is Contained Within The System Log

2. When viewing the "Main Screen", the "Modem Status Bar" will be actively displaying all transmitted and received communications. The "Modem Status Bar" is therefore a very useful tool for troubleshooting the communication process.

3. From the Main Screen, the **Status Functions** can be accessed by punching the <1> key on the keypad.

4. From the Main Screen, the **Setpoints Functions** can be accessed by punching the <2> key on the keypad.

5. From the Main Screen, the **Realtime Display** can be accessed by punching the <8> key on the keypad.

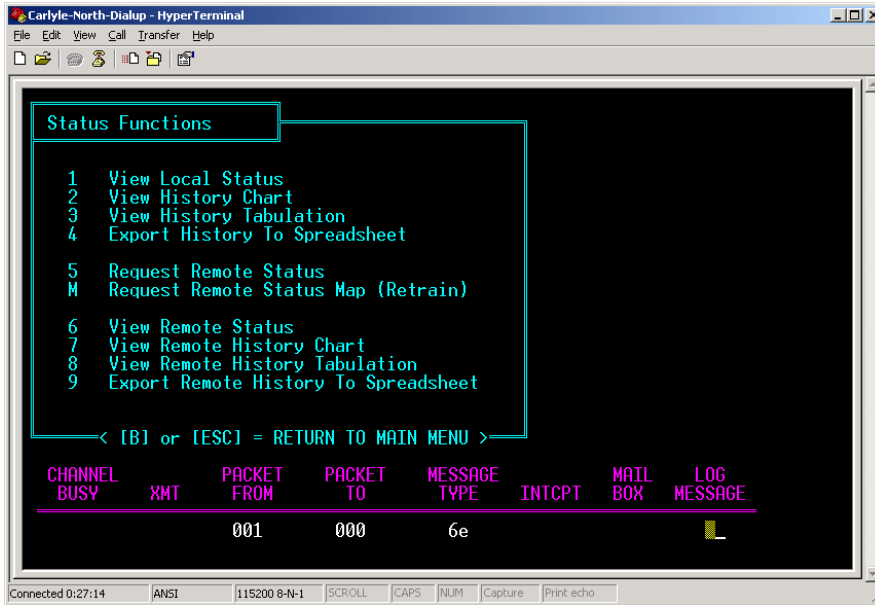
6. Message Types. Notice the “Message Types” field on the “Modem Status Bar”. Each transmitted or received message has a purpose, and that purpose is displayed in the “message type” field. The “message types” are displayed in Hexadecimal encoding.

The following table defines all of the “Message Types” used by the RTU, accompanied by the “Numeric Identifier (Hexadecimal and ASCII codes)” of each “Message Type”.

Hex Code	ASCII Code	Message Type	Hex Code	ASCII Code	Message Type
41	A	Request: Status	61	a	Reply w/ Status
42	B	Request: Setpoints	62	b	Reply w/ Setpoints
43	C	Request: Ping	63	c	Ack: Ping
44	D	Announce: Status	64	d	Ack: Status Announce
45	E	Announce: Setpoints	65	e	Ack: Setpoints Announce
46	F	Announce: RTU Restart	66	f	Ack: RTU Restart Received
47	G	Submit: New Setpoints	67	g	Ack: Setpoints Received
48	H	Request: General File	68	h	Reply w/ General File
49	I	Submit: General File	69	i	Ack: General File Received
4A	J	Submit: Email Message	6A	j	Ack: Email Received
4B	K	Request: Status Map	6B	k	Reply w/ Status Map
4C	L	Request: Setpoints Map	6C	l	Reply w/ Setpoints Map
4D	M	-Reserved-	6D	m	-Reserved-
4E	N	Request: Q-Status	6E	n	Reply w/ Q-Status
4F	O	Submit: Set Time/Date	6F	o	Ack: Set Time/Date
50	P	Request: System Log	70	p	Reply w/ System Log
51	Q	-Reserved-	71	q	-Reserved-
52	R	Submit: Reboot RTU	72	r	Ack: Reboot RTU
53	S	-Reserved-	73	s	-Reserved-
54	T	-Reserved-	74	t	-Reserved-

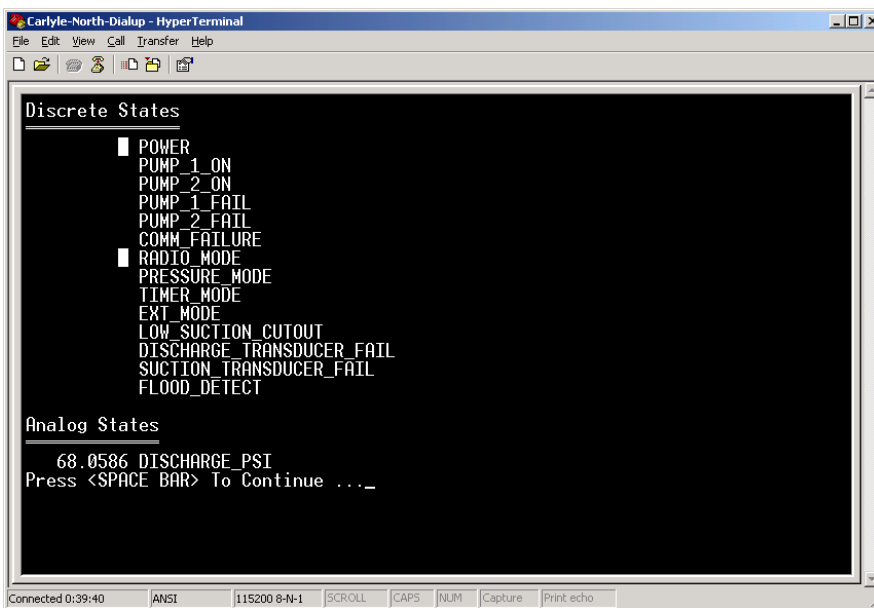
8 VIEW LOCAL STATUS

1. As mentioned in the Chapter 7, the “Status Functions” can be accessed from the “Main Menu” by pressing the <1> hotkey. After pressing the hotkey, the “Status Functions” screen will be displayed.



Within the “Status Functions” Menu, several new choices are now available. Note, however, that the modem bar remains at the bottom of the screen.

2. To view the local status, press the <1> hotkey; and the local status will be displayed:



3. Sometimes, the entire status cannot be displayed on a single screen; and thus the program will prompt the user with the message: "Press <SPACE BAR> To Continue". After pressing the <SPACE BAR>, the status is scrolled another 20 lines:

```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
PRESSURE_MODE
TIMER_MODE
EXT_MODE
LOW_SUCTION_CUTOUT
DISCHARGE_TRANSDUCER_FAIL
SUCTION_TRANSDUCER_FAIL
FLOOD_DETECT

Analog States
68.0586 DISCHARGE_PSI
58.5348 SUCTION_PSI
98.9323 RTU_TEMP_DEGF
-14.4976 FLOW_RATE_GPM

Counter States
379903062 METER_GAL
2798 PUMP_1_RUNTIME_MIN
3144 PUMP_2_RUNTIME_MIN
1 CURRENT_LEAD_PUMP
1713 UP_TIME_MIN

Press <SPACE BAR> To Continue ...

Connected 0:39:55 ANSI 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

4. Pressing the <SPACE BAR> returns the user back to the "Status Functions" Screen:

```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help

Status Functions
1 View Local Status
2 View History Chart
3 View History Tabulation
4 Export History To Spreadsheet
5 Request Remote Status
M Request Remote Status Map (Retrain)
6 View Remote Status
7 View Remote History Chart
8 View Remote History Tabulation
9 Export Remote History To Spreadsheet

< [B] or [ESC] = RETURN TO MAIN MENU >

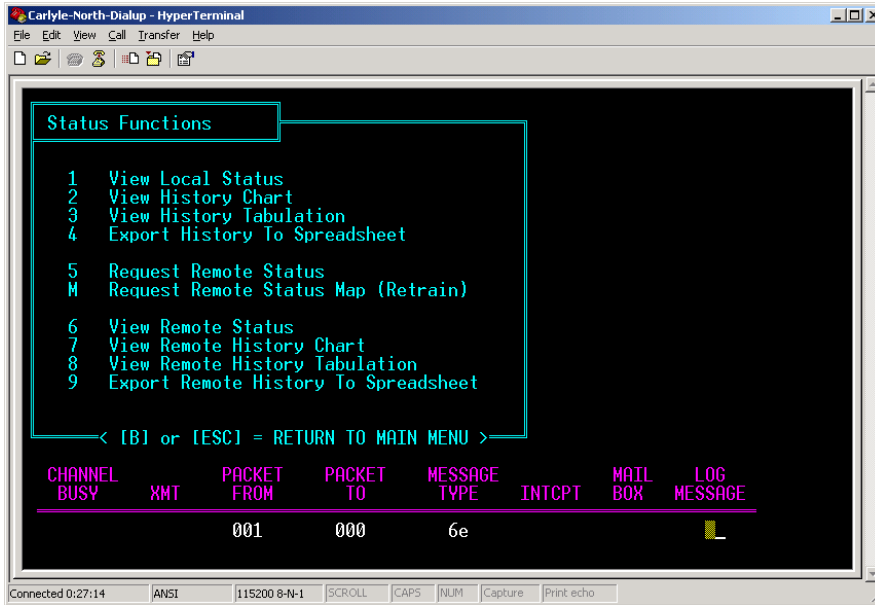
CHANNEL BUSY XMT PACKET FROM PACKET TO MESSAGE TYPE INTCP MAIL BOX LOG MESSAGE
-----
001 000 6e

Connected 0:27:14 ANSI 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

5. If the user wants to return to the "Main Menu" at this point, he should press the <ESC> key (or the key).

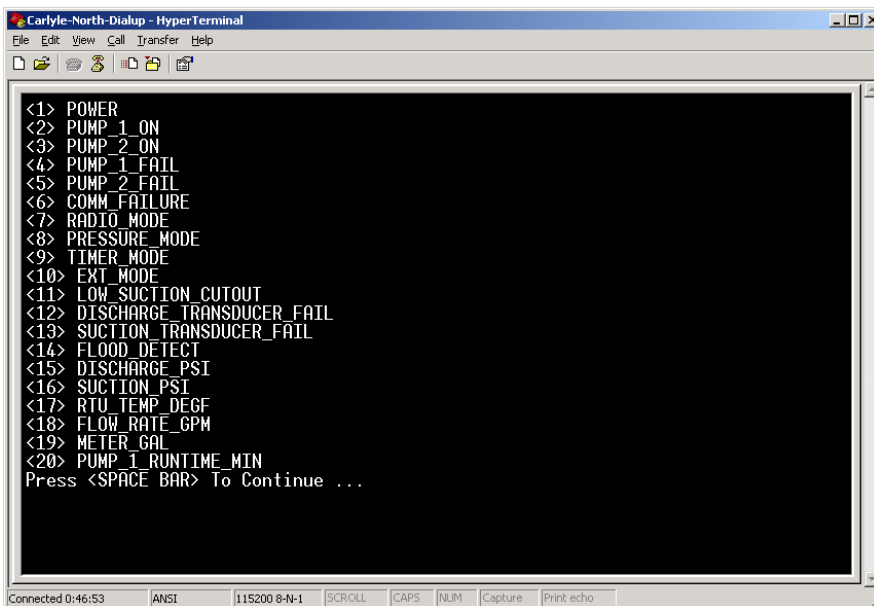
9 VIEW LOCAL HISTORY CHARTS

1. As mentioned in the Chapter 7, the “Status Functions” can be accessed from the “Main Menu” by pressing the <1> hotkey. After pressing the hotkey, the “Status Functions” screen will be displayed.



Within the “Status Functions” Menu, several new choices are now available. Note, however, that the modem bar remains at the bottom of the screen.

2. To view the Local Status history Charts, press the <2> hotkey; and the “Local Status History Charts Dialog” will begin:



Often times, the “Local Status History” dialog does not fit on a single screen, so the user is prompted to press the <SPACE BAR> to continue.

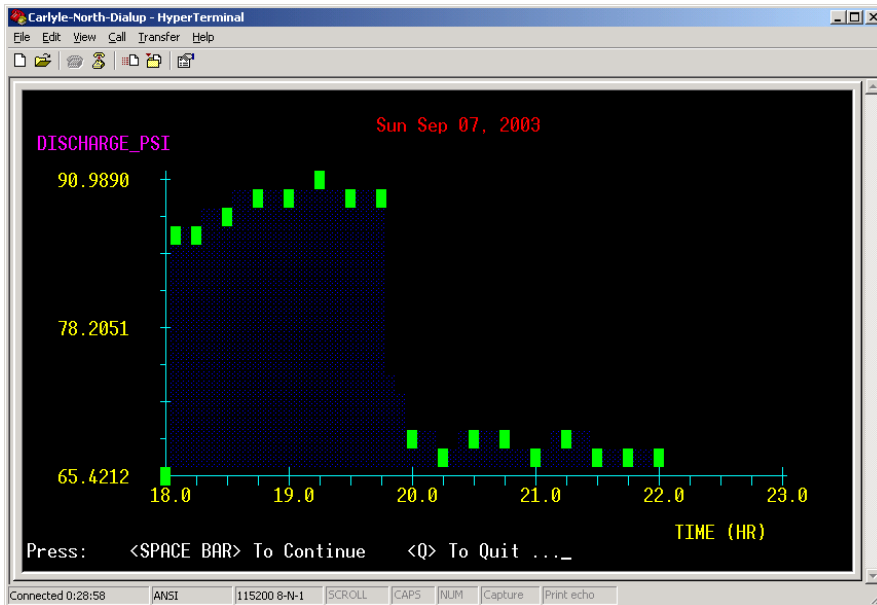
```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
<1> POWER
<2> PUMP_1_ON
<3> PUMP_2_ON
<4> PUMP_1_FAIL
<5> PUMP_2_FAIL
<6> COMM_FAILURE
<7> RADIO_MODE
<8> PRESSURE_MODE
<9> TIMER_MODE
<10> EXT_MODE
<11> LOW_SUCTION_CUTOUT
<12> DISCHARGE_TRANSDUCER_FAIL
<13> SUCTION_TRANSDUCER_FAIL
<14> FLOOD_DETECT
<15> DISCHARGE_PSI
<16> SUCTION_PSI
<17> RTU_TEMP_DEGF
<18> FLOW_RATE_GPM
<19> METER_GAL
<20> PUMP_1_RUNTIME_MIN
<21> PUMP_2_RUNTIME_MIN
<22> CURRENT_LEAD_PUMP
<23> UP_TIME_MIN
Which State To View ? (-1 To Cancel) : _
Connected 0:49:43 ANSI 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

3. At this point, the user should select to view the history of a flag. Usually, approximately 7 days of history is held in RTU memory.

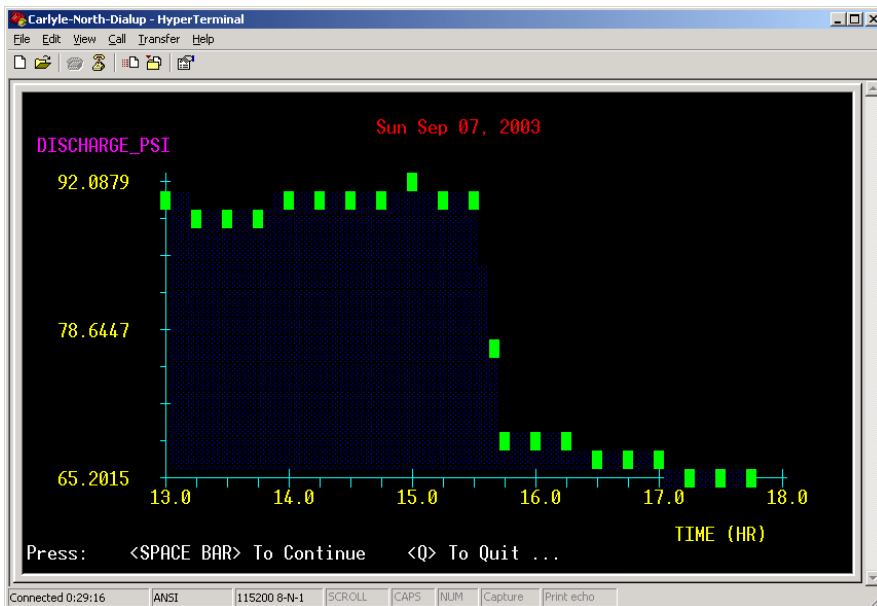
4. In this example, the user selects to view “DISCHARGE_PSI” history. In this example, it is denoted by the number “15”:

```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
<1> POWER
<2> PUMP_1_ON
<3> PUMP_2_ON
<4> PUMP_1_FAIL
<5> PUMP_2_FAIL
<6> COMM_FAILURE
<7> RADIO_MODE
<8> PRESSURE_MODE
<9> TIMER_MODE
<10> EXT_MODE
<11> LOW_SUCTION_CUTOUT
<12> DISCHARGE_TRANSDUCER_FAIL
<13> SUCTION_TRANSDUCER_FAIL
<14> FLOOD_DETECT
<15> DISCHARGE_PSI
<16> SUCTION_PSI
<17> RTU_TEMP_DEGF
<18> FLOW_RATE_GPM
<19> METER_GAL
<20> PUMP_1_RUNTIME_MIN
<21> PUMP_2_RUNTIME_MIN
<22> CURRENT_LEAD_PUMP
<23> UP_TIME_MIN
Which State To View ? (-1 To Cancel) : 15
Connected 0:54:56 ANSI 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

5. After the user presses the <ENTER> key, the DISCHARGE_PSI history chart is displayed, with the most recent history shown first. Notice the date stamp on the upper left of the screen:



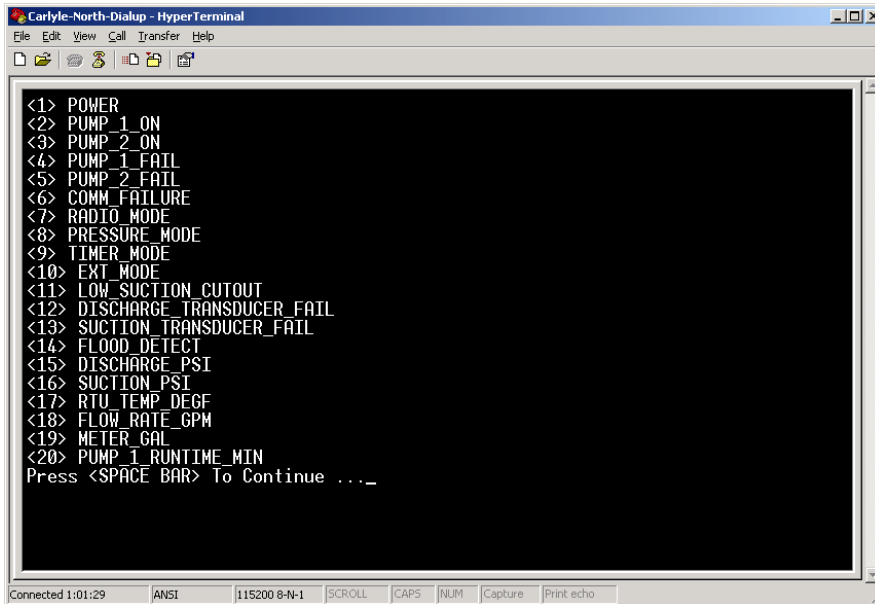
To view earlier history, the program prompts to user to press the <SPACE BAR> to continue:



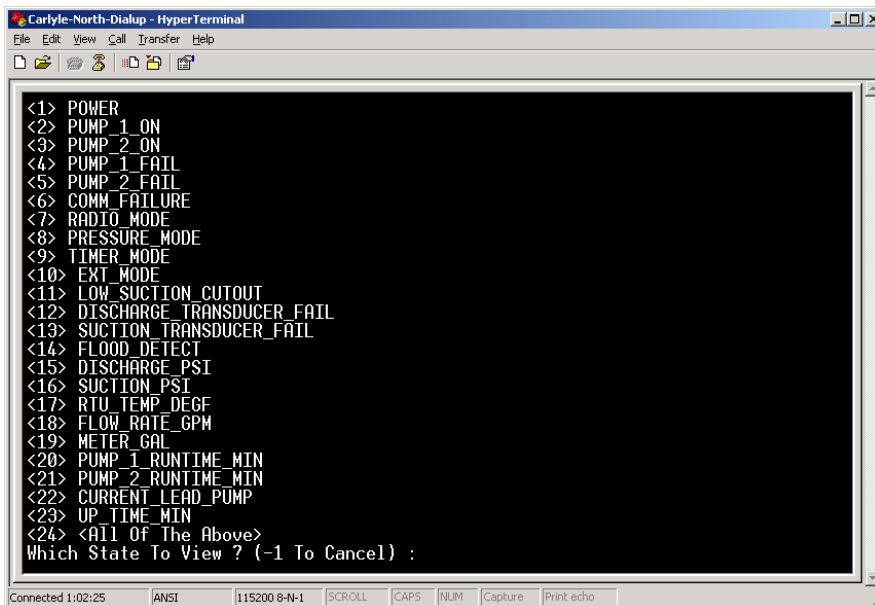
6. At this point, the user can press the <SPACE BAR> to continue on to earlier history; or he can press the <Q> hotkey to quit and return to the "Status Functions" Menu.

10 VIEW LOCAL HISTORY TABULATION

1. As mentioned in the Chapter 7, the “Status Functions” can be accessed from the “Main Menu” by pressing the <1> hotkey. After pressing the hotkey, the “Status 7. If the user wants to view the history of a single flag, then he should press the <3> hotkey to enter the “View Local History Tabulation” dialog.

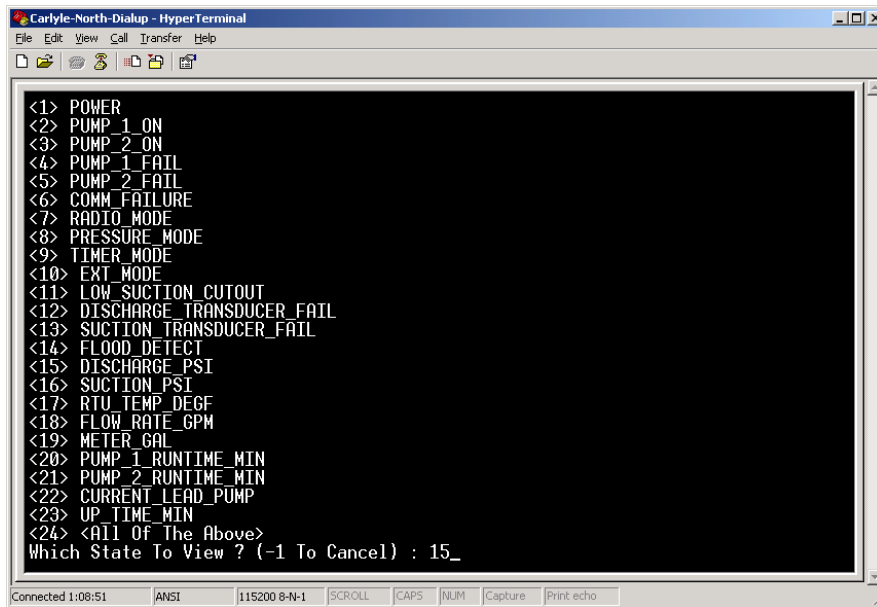


```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
<1> POWER
<2> PUMP_1_ON
<3> PUMP_2_ON
<4> PUMP_1_FAIL
<5> PUMP_2_FAIL
<6> COMM_FAILURE
<7> RADIO_MODE
<8> PRESSURE_MODE
<9> TIMER_MODE
<10> EXT_MODE
<11> LOW_SUCTION_CUTOUT
<12> DISCHARGE_TRANSDUCER_FAIL
<13> SUCTION_TRANSDUCER_FAIL
<14> FLOOD_DETECT
<15> DISCHARGE_PSI
<16> SUCTION_PSI
<17> RTU_TEMP_DEGF
<18> FLOW_RATE_GPM
<19> METER_GAL
<20> PUMP_1_RUNTIME_MIN
Press <SPACE BAR> To Continue ..._
Connected 1:01:29  ANSI  115200 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```



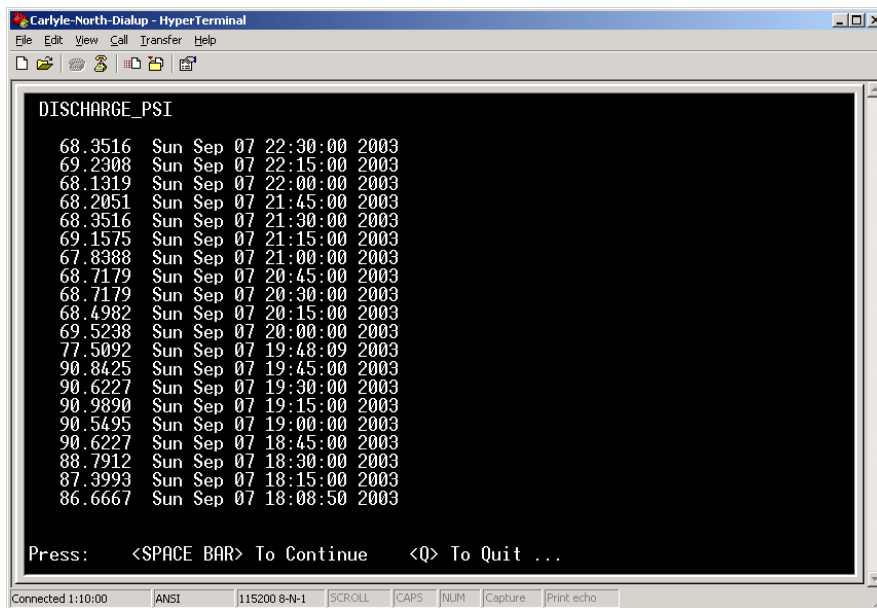
```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
<1> POWER
<2> PUMP_1_ON
<3> PUMP_2_ON
<4> PUMP_1_FAIL
<5> PUMP_2_FAIL
<6> COMM_FAILURE
<7> RADIO_MODE
<8> PRESSURE_MODE
<9> TIMER_MODE
<10> EXT_MODE
<11> LOW_SUCTION_CUTOUT
<12> DISCHARGE_TRANSDUCER_FAIL
<13> SUCTION_TRANSDUCER_FAIL
<14> FLOOD_DETECT
<15> DISCHARGE_PSI
<16> SUCTION_PSI
<17> RTU_TEMP_DEGF
<18> FLOW_RATE_GPM
<19> METER_GAL
<20> PUMP_1_RUNTIME_MIN
<21> PUMP_2_RUNTIME_MIN
<22> CURRENT_LEAD_PUMP
<23> UP_TIME_MIN
<24> <ALL Of The Above>
Which State To View ? (-1 To Cancel) :
Connected 1:02:25  ANSI  115200 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

2. As an example, if the user wants to view the history of the “DISCHARGE_PSI” flag, then he should type the number that corresponds to this flag. In this example, it is “15”:



```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
<1> POWER
<2> PUMP_1_ON
<3> PUMP_2_ON
<4> PUMP_1_FAIL
<5> PUMP_2_FAIL
<6> COMM_FAILURE
<7> RADIO_MODE
<8> PRESSURE_MODE
<9> TIMER_MODE
<10> EXT_MODE
<11> LOW_SUCTION_CUTOUT
<12> DISCHARGE_TRANSDUCER_FAIL
<13> SUCTION_TRANSDUCER_FAIL
<14> FLOOD_DETECT
<15> DISCHARGE_PSI
<16> SUCTION_PSI
<17> RTU_TEMP_DEGF
<18> FLOW_RATE_GPM
<19> METER_GAL
<20> PUMP_1_RUNTIME_MIN
<21> PUMP_2_RUNTIME_MIN
<22> CURRENT_LEAD_PUMP
<23> UP_TIME_MIN
<24> <ALL OF The Above>
Which State To View ? (-1 To Cancel) : 15_
Connected 1:08:51 ANSI 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

3. The user should press <ENTER>, and the “discharge pressure” history will be displayed, with the most recent displayed first:

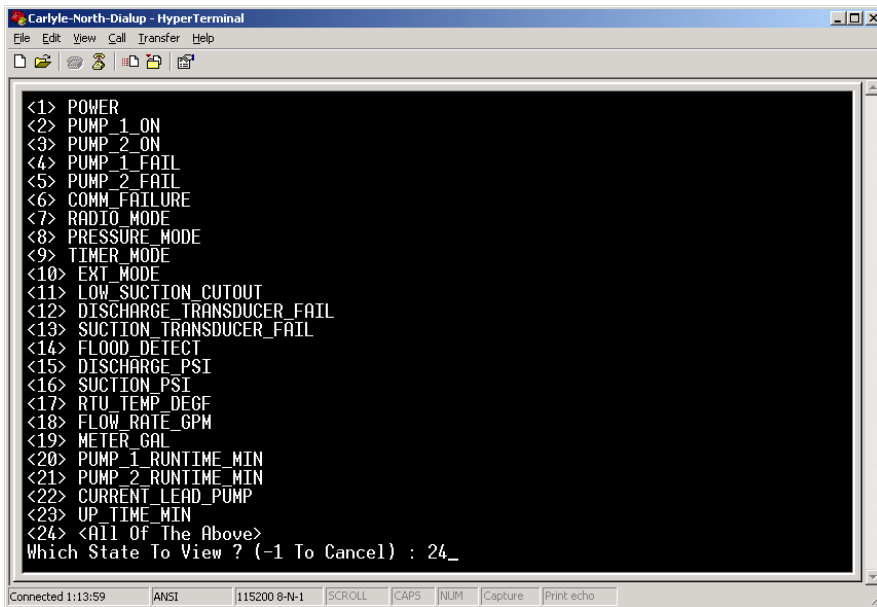


```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
DISCHARGE_PSI
68.3516 Sun Sep 07 22:30:00 2003
69.2308 Sun Sep 07 22:15:00 2003
68.1319 Sun Sep 07 22:00:00 2003
68.2051 Sun Sep 07 21:45:00 2003
68.3516 Sun Sep 07 21:30:00 2003
69.1575 Sun Sep 07 21:15:00 2003
67.8388 Sun Sep 07 21:00:00 2003
68.7179 Sun Sep 07 20:45:00 2003
68.7179 Sun Sep 07 20:30:00 2003
68.4982 Sun Sep 07 20:15:00 2003
69.5238 Sun Sep 07 20:00:00 2003
77.5092 Sun Sep 07 19:48:09 2003
90.8425 Sun Sep 07 19:45:00 2003
90.6227 Sun Sep 07 19:30:00 2003
90.9890 Sun Sep 07 19:15:00 2003
90.5495 Sun Sep 07 19:00:00 2003
90.6227 Sun Sep 07 18:45:00 2003
88.7912 Sun Sep 07 18:30:00 2003
87.3993 Sun Sep 07 18:15:00 2003
86.6667 Sun Sep 07 18:08:50 2003
Press: <SPACE BAR> To Continue <Q> To Quit ...
Connected 1:10:00 ANSI 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

4. At this point, the user can press the <SPACE BAR> to continue to view more (earlier) discharge pressure history; or he can press the <Q> hotkey to return to the “Status Functions” menu.

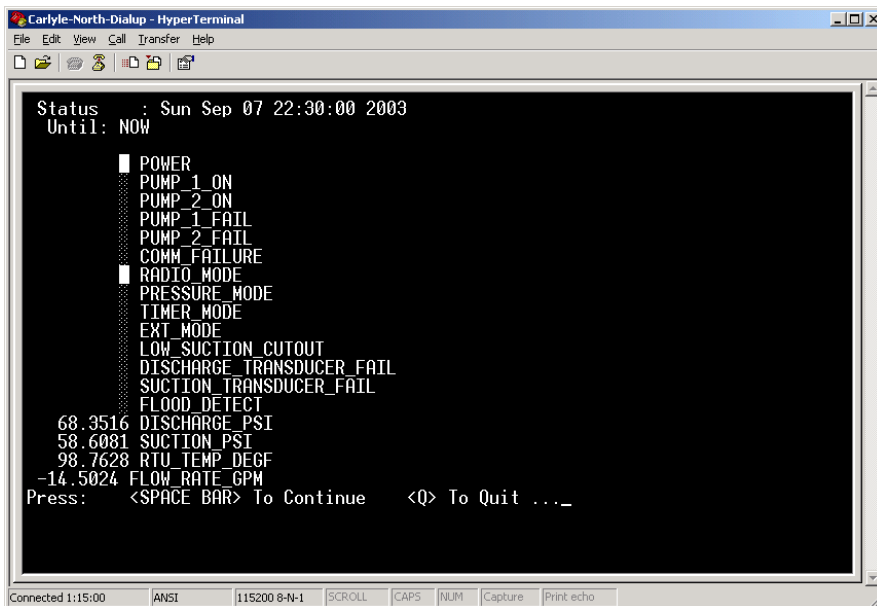
5. If the user wants to return to the “Main Menu” at this point, he should press the <ESC> key (or the key).

6. If the user wants to view “all flags”, then he should type the number that corresponds to “<All Of The Above>”. In this example, it is “24”:



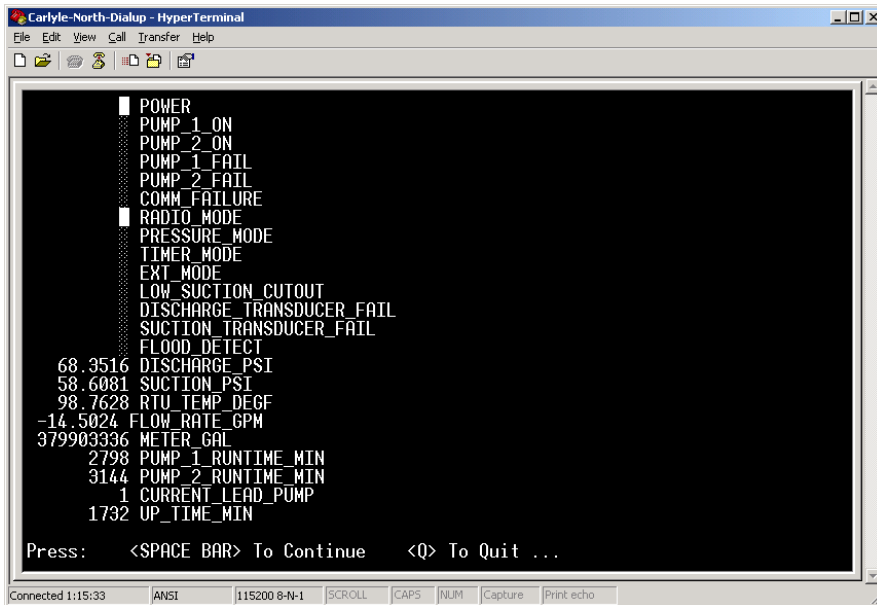
```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
<1> POWER
<2> PUMP_1_ON
<3> PUMP_2_ON
<4> PUMP_1_FAIL
<5> PUMP_2_FAIL
<6> COMM_FAILURE
<7> RADIO_MODE
<8> PRESSURE_MODE
<9> TIMER_MODE
<10> EXT_MODE
<11> LOW_SUCTION_CUTOUT
<12> DISCHARGE_TRANSDUCER_FAIL
<13> SUCTION_TRANSDUCER_FAIL
<14> FLOOD_DETECT
<15> DISCHARGE_PSI
<16> SUCTION_PSI
<17> RTU_TEMP_DEGF
<18> FLOW_RATE_GPM
<19> METER_GAL
<20> PUMP_1_RUNTIME_MIN
<21> PUMP_2_RUNTIME_MIN
<22> CURRENT_LEAD_PUMP
<23> UP_TIME_MIN
<24> <All Of The Above>
Which State To View ? (-1 To Cancel) : 24_
Connected 1:13:59 ANSI 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

7. After the user presses the <ENTER> key, all history flags are shown, with the most recent history snapshots shown first. Notice the time stamp on the upper two lines of the screen:



```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
Status : Sun Sep 07 22:30:00 2003
Until: NOW
POWER
PUMP_1_ON
PUMP_2_ON
PUMP_1_FAIL
PUMP_2_FAIL
COMM_FAILURE
RADIO_MODE
PRESSURE_MODE
TIMER_MODE
EXT_MODE
LOW_SUCTION_CUTOUT
DISCHARGE_TRANSDUCER_FAIL
SUCTION_TRANSDUCER_FAIL
FLOOD_DETECT
68.3516 DISCHARGE_PSI
58.6081 SUCTION_PSI
98.7628 RTU_TEMP_DEGF
-14.5024 FLOW_RATE_GPM
Press: <SPACE BAR> To Continue <Q> To Quit ..._
Connected 1:15:00 ANSI 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

Because the history snapshot in this example does not fit on one screen, the program prompts to user to press the <SPACE BAR> to view the remainder of this history snapshot:

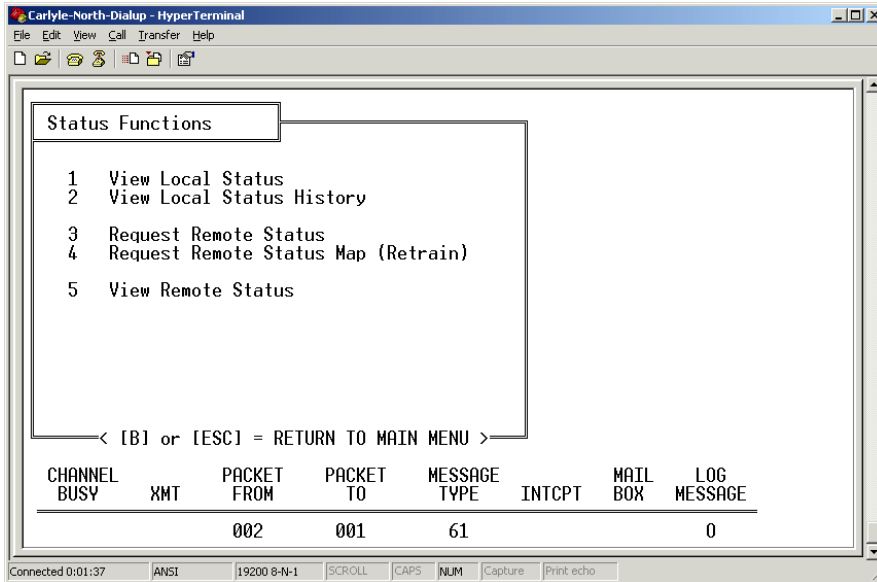


```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
POWER
PUMP_1_ON
PUMP_2_ON
PUMP_1_FAIL
PUMP_2_FAIL
COMM_FAILURE
RADIO_MODE
PRESSURE_MODE
TIMER_MODE
EXT_MODE
LOW_SUCTION_CUTOUT
DISCHARGE_TRANSDUCER_FAIL
SUCTION_TRANSDUCER_FAIL
FLOOD_DETECT
68.3516 DISCHARGE_PSI
58.6081 SUCTION_PSI
98.7628 RTU_TEMP_DEGF
-14.5024 FLOW_RATE_GPM
379903336 METER_GAL
2798 PUMP_1_RUNTIME_MIN
3144 PUMP_2_RUNTIME_MIN
1 CURRENT_LEAD_PUMP
1732 UP_TIME_MIN
Press: <SPACE BAR> To Continue <Q> To Quit ...
Connected 1:15:33 ANSI 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

8. At this point, the user can press the <SPACE BAR> to continue on to the previous history snapshot; or he can press the <Q> hotkey to quit and return to the “Status Functions” Menu.

11 VIEW REMOTE STATUS

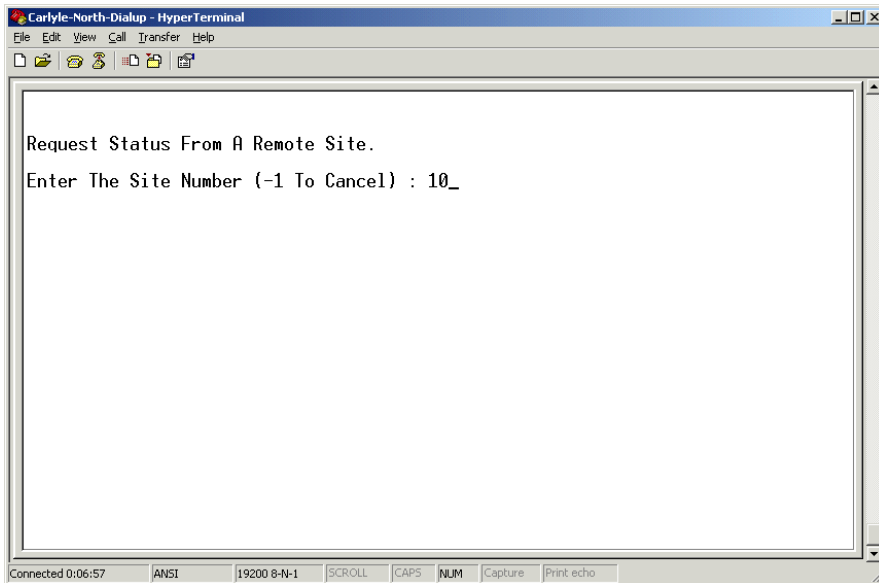
1. As mentioned in the Chapter 7, the “Status Functions” can be accessed from the “Main Menu” by pressing the <1> hotkey. After pressing the hotkey, the “Status Functions” screen will be displayed.



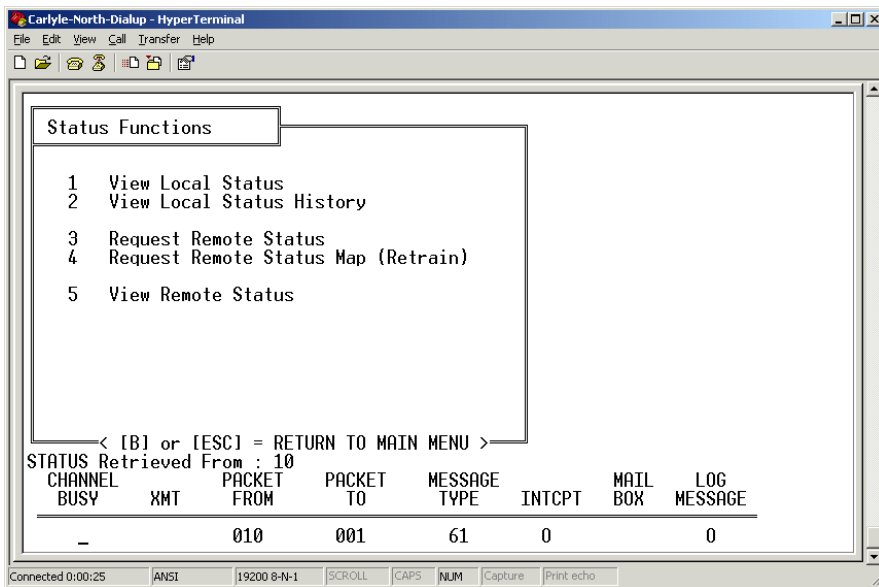
Within the “Status Functions” Menu, several new choices are now available. Note, however, that the modem bar remains at the bottom of the screen.

2. Before viewing the status of a remote RTU, it is advised that the user first request status from that RTU. Only by first performing this procedure can the user be assured that he is viewing an up-to-date copy of that RTU’s status.

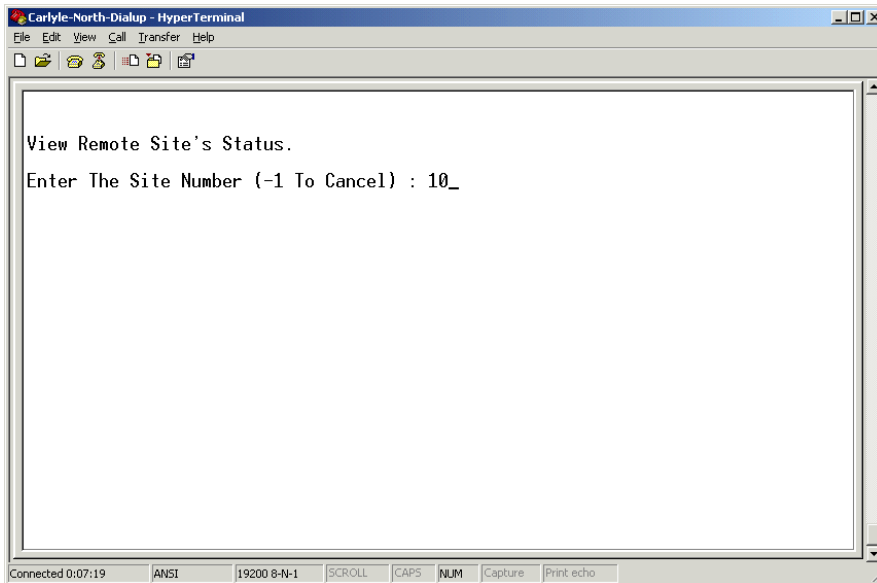
3. To request the status of a remote RTU, press the <3> hotkey. The program will prompt for the address of the remote RTU. Type the address of the remote RTU ("10", for example), and press the <ENTER> key.



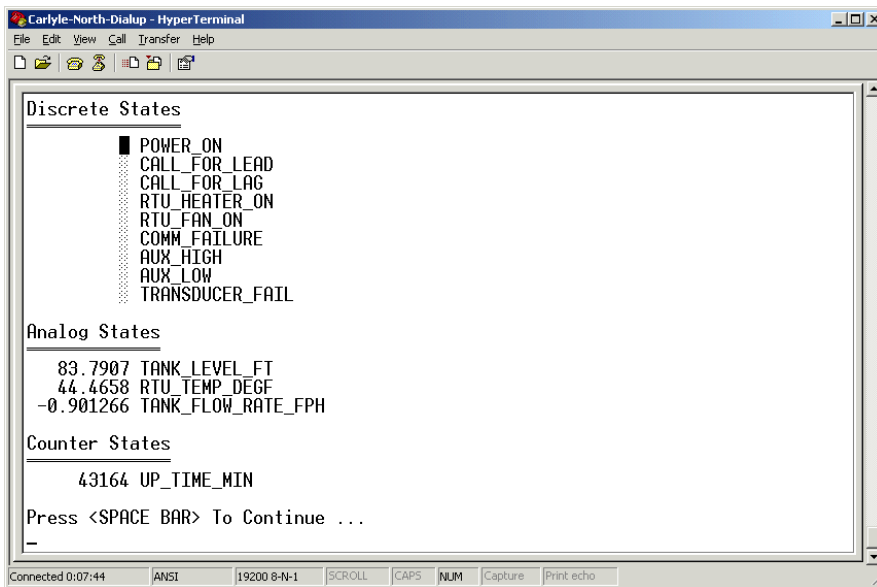
4. The program will transmit a request to the remote RTU for its status. When the status is received, the following message will be displayed in the "Comm Event Viewer": "STATUS Received from 10".



5. At this point, the user can view the remote status. Press the <5> hotkey to view the remote status. The program will prompt for the address of the remote RTU. Type the address of the remote RTU ("10", for example), and press the <ENTER> key.



6. Sometimes, the entire status cannot be displayed on a single screen; and thus the program will prompt the user with the message: "Press <SPACE BAR> To Continue". After pressing the <SPACE BAR>, the status is scrolled another 20 lines:

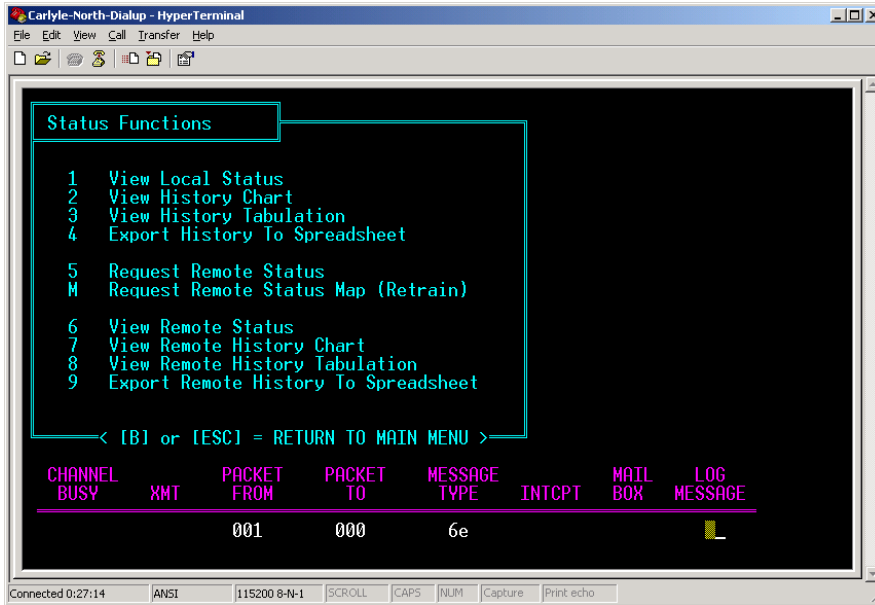


7. Pressing the <SPACE BAR> returns the user back to the "Status Functions" Screen:

8. If the user wants to return to the "Main Menu" at this point, he should press the <ESC> key (or the key).

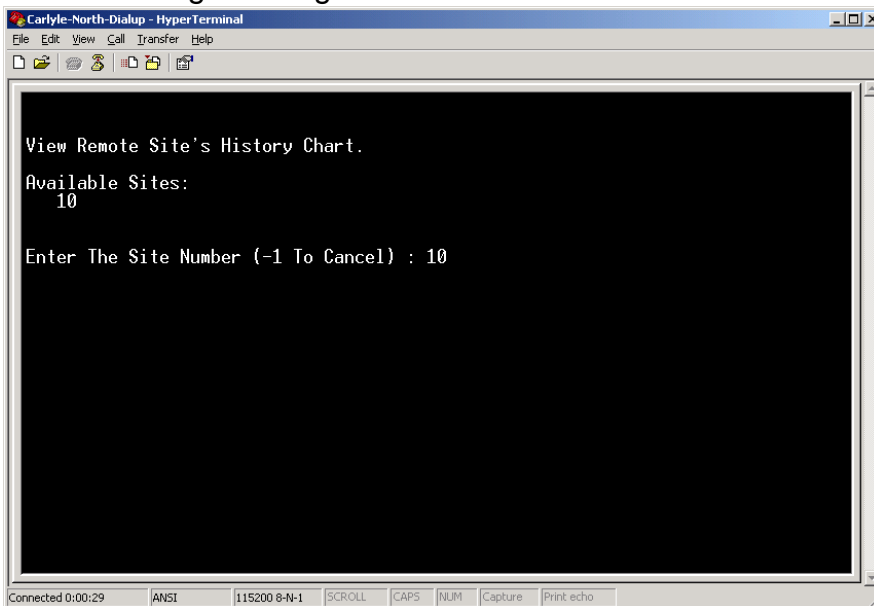
12 VIEW REMOTE HISTORY CHART

1. As mentioned in the Chapter 7, the “Status Functions” can be accessed from the “Main Menu” by pressing the <1> hotkey. After pressing the hotkey, the “Status Functions” screen will be displayed.



Within the “Status Functions” Menu, several new choices are now available. Note, however, that the modem bar remains at the bottom of the screen.

2. To view the Remote history Charts, press the <6> hotkey; and the “Remote History Charts Dialog” will begin:

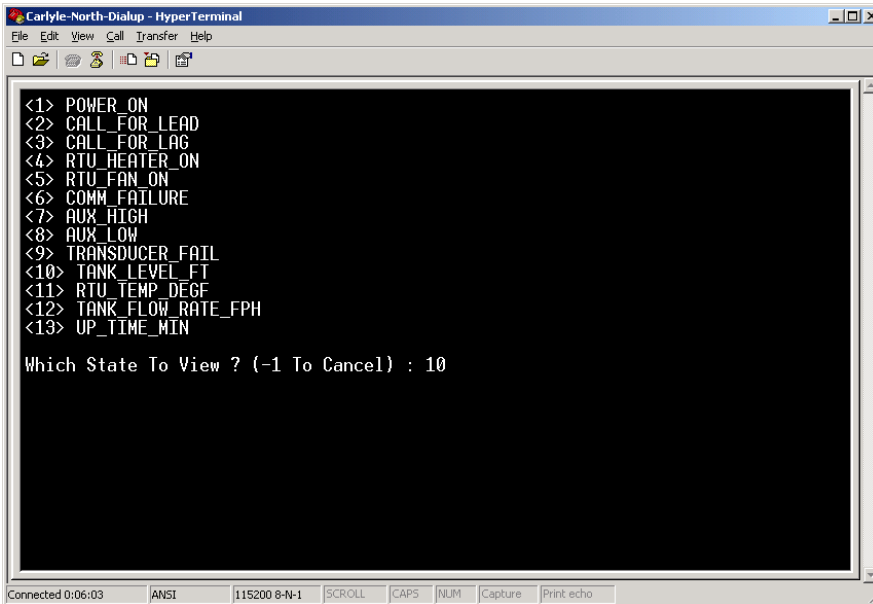


The Dialog presents a list of remote sites for which history charts are available. In this example, the history for site #10 is available. In this example, 10 is selected.

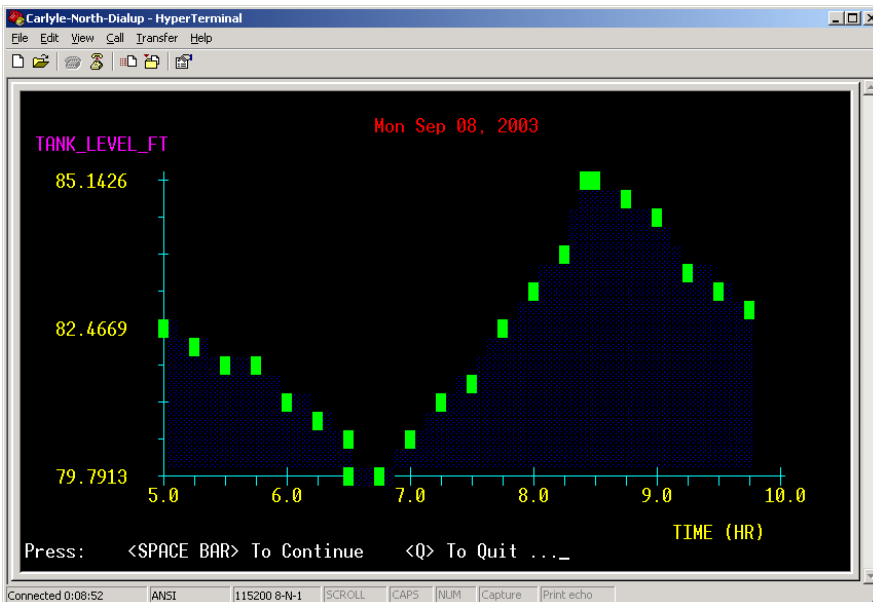
(Often times, the “Local Status History” dialog does not fit on a single screen, so the user may be prompted to press the <SPACE BAR> to continue.)

3. At this point, the user should select to view the history of a flag. Usually, approximately 7 days of history is held in RTU memory.

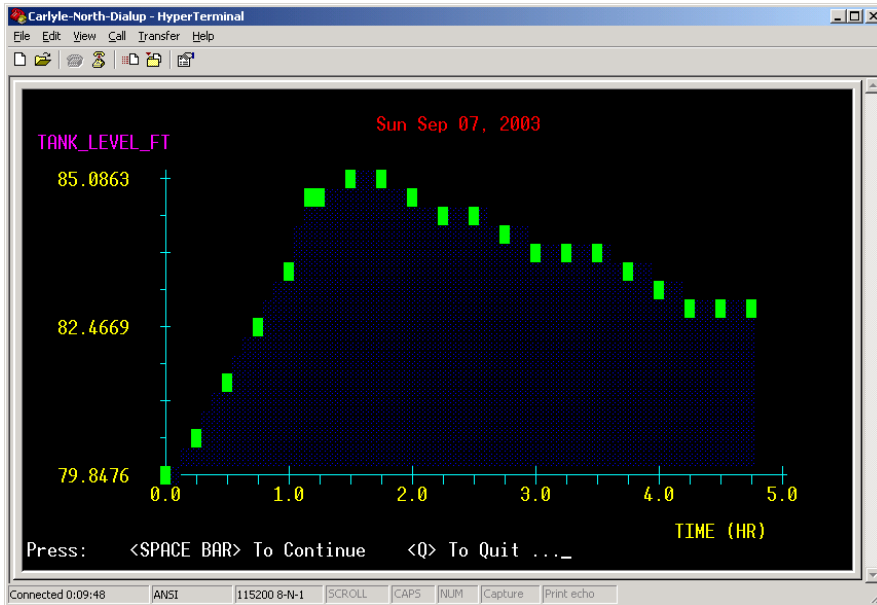
4. In this example, the user selects to view “TANK_LEVEL_FT” history. In this example, it is denoted by the number “10”:



5. After the user presses the <ENTER> key, the TANK_LEVEL_FT history chart is displayed, with the most recent history shown first. Notice the date stamp on the upper left of the screen:



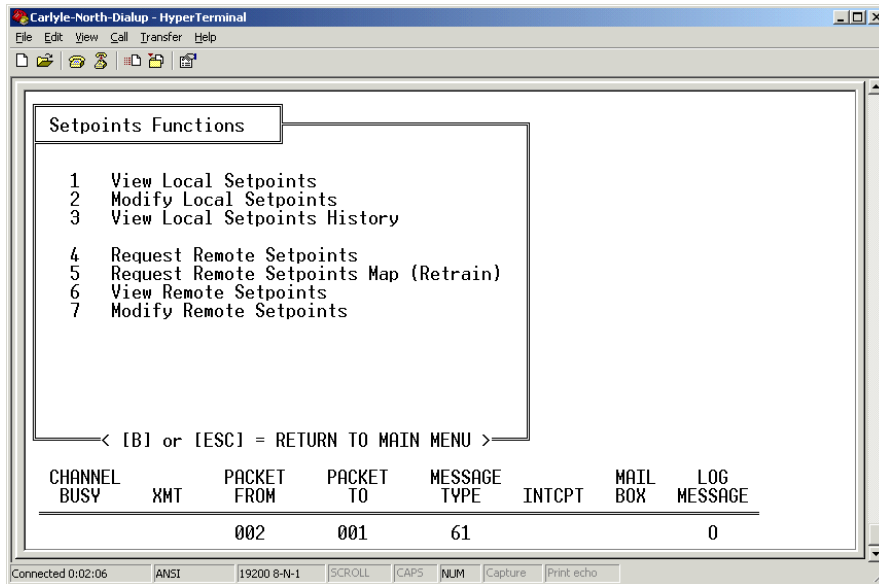
To view earlier history, the program prompts to user to press the <SPACE BAR> to continue:



6. At this point, the user can press the <SPACE BAR> to continue on to earlier history; or he can press the <Q> hotkey to quit and return to the "Status Functions" Menu.

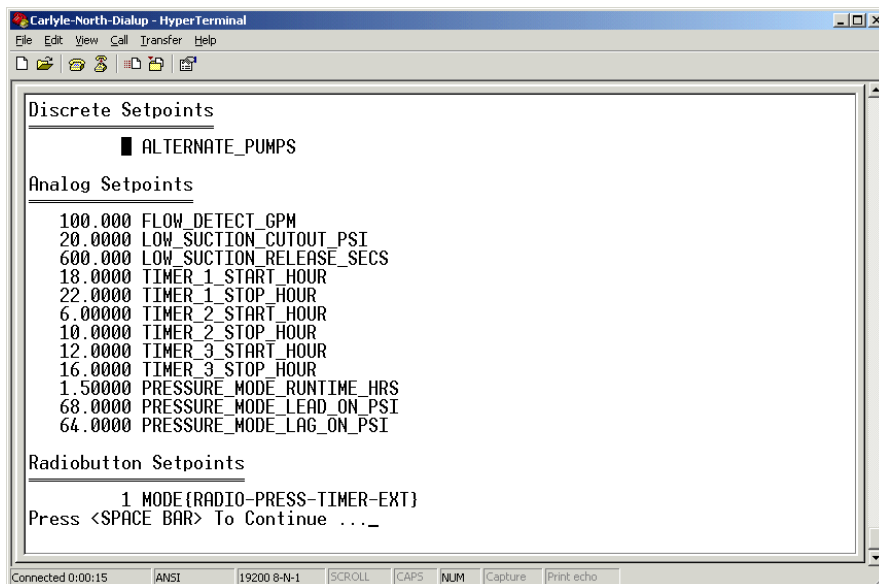
13 VIEW LOCAL SETPOINTS

1. As mentioned in the Chapter 7, the “Setpoints Functions” can be accessed from the “Main Menu” by pressing the <2> hotkey. After pressing the hotkey, the “Setpoints Functions” screen will be displayed.

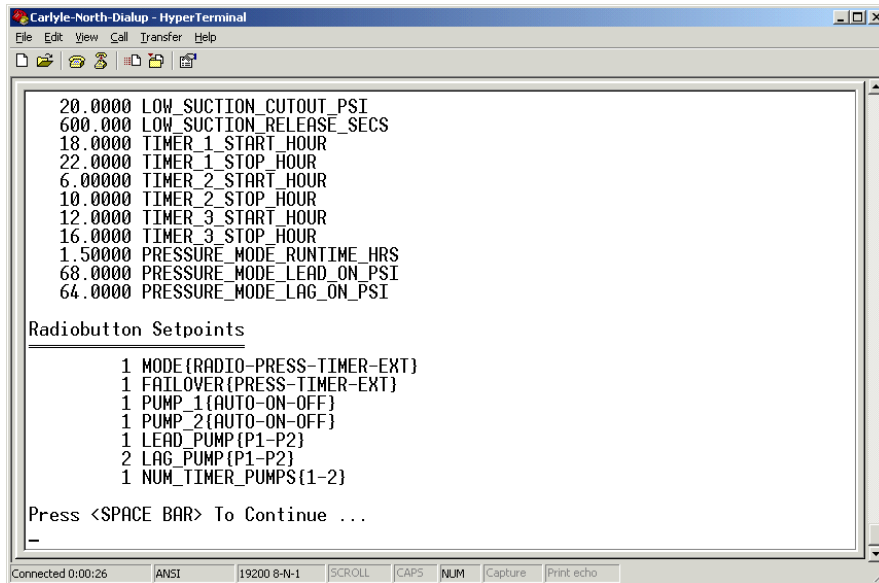


Within the “Setpoints Functions” Menu, several new choices are now available. Note, however, that the modem bar remains at the bottom of the screen.

2. To view the local setpoints, press the <1> hotkey:



3. Sometimes, the entire setpoints cannot be displayed on a single screen; and thus the program will prompt the user with the message: "Press <SPACE BAR> To Continue". After pressing the <SPACE BAR>, the status is scrolled another 20 lines:



```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
20.0000 LOW_SUCTION_CUTOUT_PSI
600.000 LOW_SUCTION_RELEASE_SECS
18.0000 TIMER_1_START_HOUR
22.0000 TIMER_1_STOP_HOUR
6.00000 TIMER_2_START_HOUR
10.0000 TIMER_2_STOP_HOUR
12.0000 TIMER_3_START_HOUR
16.0000 TIMER_3_STOP_HOUR
1.50000 PRESSURE_MODE_RUNTIME_HRS
68.0000 PRESSURE_MODE_LEAD_ON_PSI
64.0000 PRESSURE_MODE_LAG_ON_PSI

Radiobutton Setpoints
1 MODE{RADIO-PRESS-TIMER-EXT}
1 FAILOVER{PRESS-TIMER-EXT}
1 PUMP_1{AUTO-ON-OFF}
1 PUMP_2{AUTO-ON-OFF}
1 LEAD_PUMP{P1-P2}
2 LAG_PUMP{P1-P2}
1 NUM_TIMER_PUMPS{1-2}

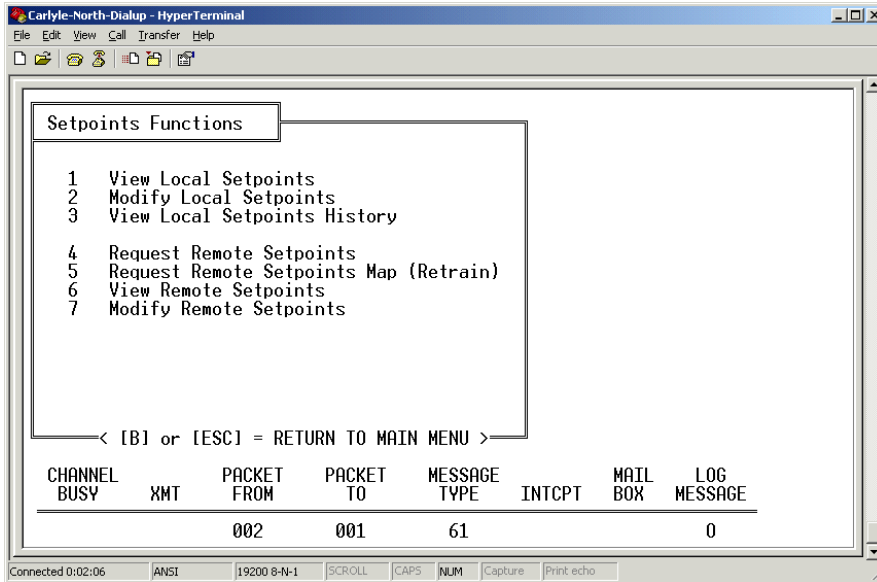
Press <SPACE BAR> To Continue ...
-
Connected 0:00:26 ANSI 19200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

4. Pressing the <SPACE BAR> returns the user back to the "Setpoints Functions" Screen:

5. If the user wants to return to the "Main Menu" at this point, he should press the <ESC> key (or the key).

14 VIEW REMOTE SETPOINTS

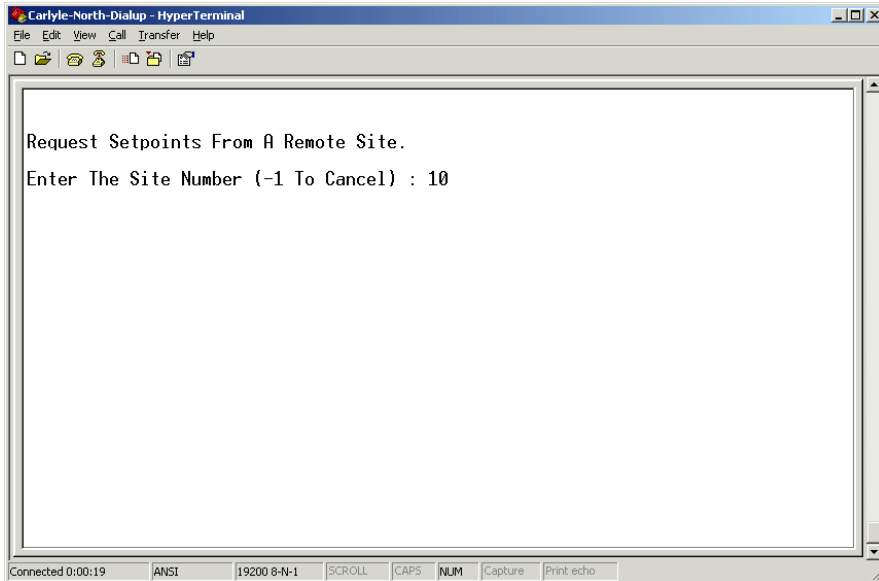
1. As mentioned in the Chapter 7, the “Setpoints Functions” can be accessed from the “Main Menu” by pressing the <2> hotkey. After pressing the hotkey, the “Setpoints Functions” screen will be displayed.



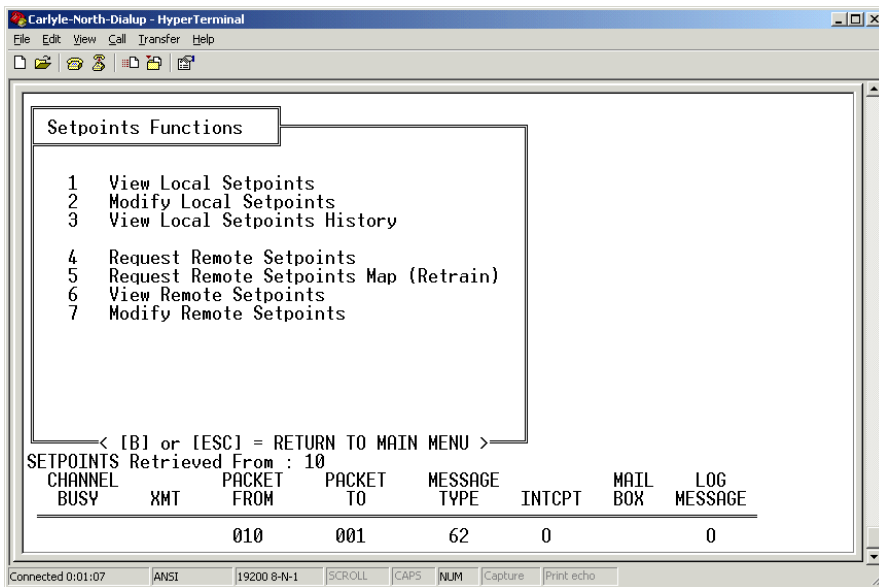
Within the “Setpoints Functions” Menu, several new choices are now available. Note, however, that the modem bar remains at the bottom of the screen.

2. Before viewing the setpoints of a remote RTU, it is advised that the user first request setpoints from that RTU. Only by first performing this procedure can the user be assured that he is viewing an up-to-date copy of that RTU’s setpoints.

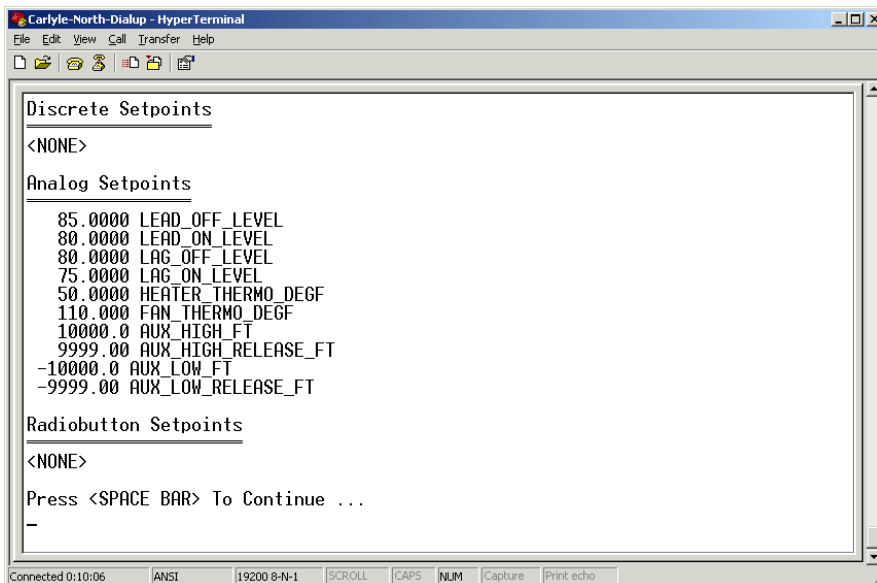
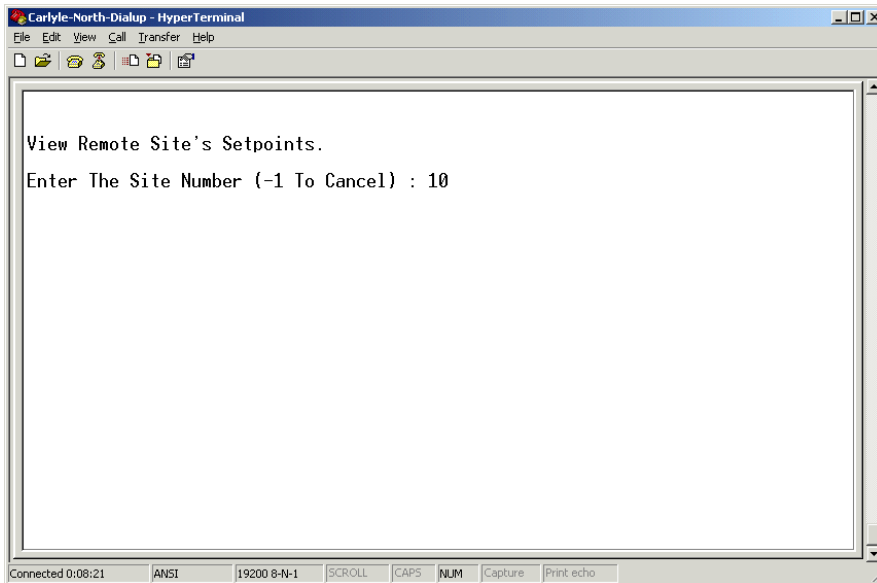
3. To request the setpoints of a remote RTU, press the <4> hotkey. The program will prompt for the address of the remote RTU. Type the address of the remote RTU ("10", for example), and press the <ENTER> key.



4. The program will transmit a request to the remote RTU for its setpoints. When the setpoints are received, the following message will be displayed in the "Comm Event Viewer": "SETPOINTS Received from 10".



5. At this point, the user can view the remote setpoints. Press the <6> hotkey to view the remote setpoints. The program will prompt for the address of the remote RTU. Type the address of the remote RTU ("10", for example), and press the <ENTER> key.



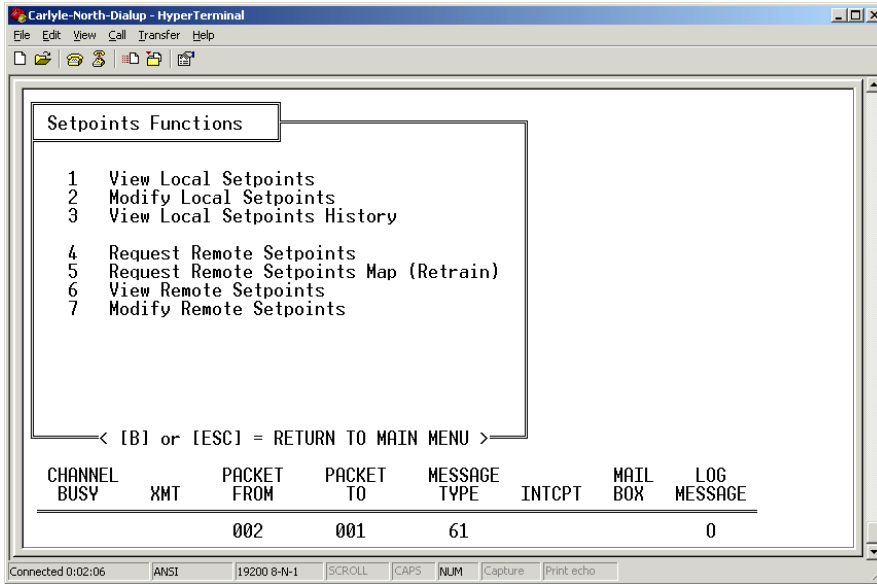
6. Sometimes, the entire setpoints cannot be displayed on a single screen; and thus the program will prompt the user with the message: "Press <SPACE BAR> To Continue". After pressing the <SPACE BAR>, the status is scrolled another 20 lines:

7. Pressing the <SPACE BAR> returns the user back to the "Setpoints Functions" Screen:

8. If the user wants to return to the "Main Menu" at this point, he should press the <ESC> key (or the key).

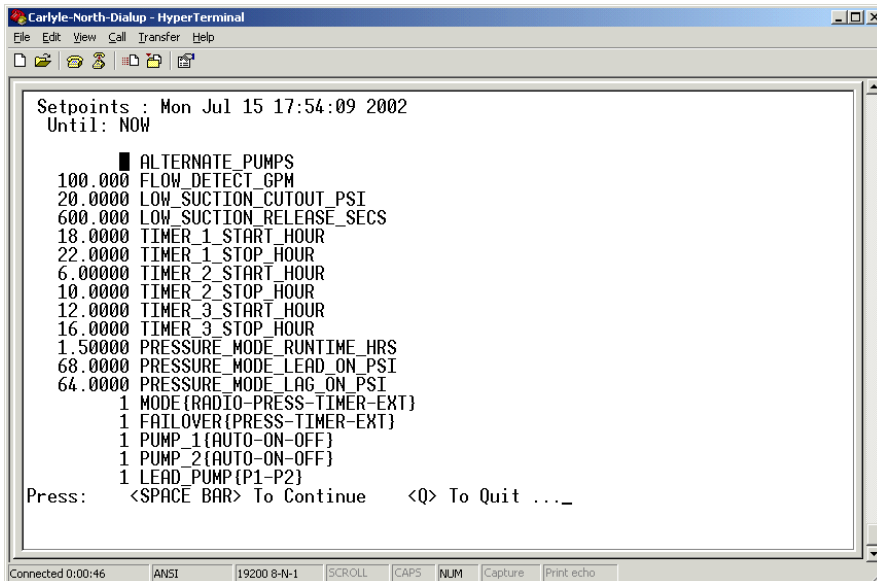
15 VIEW LOCAL SETPOINTS HISTORY

1. As mentioned in the Chapter 7, the “Setpoints Functions” can be accessed from the “Main Menu” by pressing the <2> hotkey. After pressing the hotkey, the “Setpoints Functions” screen will be displayed.



Within the “Setpoints Functions” Menu, several new choices are now available. Note, however, that the modem bar remains at the bottom of the screen.

2. To view the “Local Setpoints History”, press the <3> hotkey. The setpoints history of the RTU will be displayed, and each setpoint snapshot will be time-stamped. The most recent setpoints will be displayed first, and the oldest setpoints will be displayed last.



Sometimes, the entire setpoints cannot be displayed on a single screen; and thus the program will prompt the user with the message: “Press <SPACE BAR> To Continue”. After pressing the <SPACE BAR>, the status is scrolled another 20 lines:

```

Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
Until: NOW
■ ALTERNATE_PUMPS
100.000 FLOW_DETECT_GPM
20.0000 LOW_SUCTION_CUTOFF_PSI
600.000 LOW_SUCTION_RELEASE_SECS
18.0000 TIMER_1_START_HOUR
22.0000 TIMER_1_STOP_HOUR
6.000000 TIMER_2_START_HOUR
10.0000 TIMER_2_STOP_HOUR
12.0000 TIMER_3_START_HOUR
16.0000 TIMER_3_STOP_HOUR
1.50000 PRESSURE_MODE_RUNTIME_HRS
68.0000 PRESSURE_MODE_LEAD_ON_PSI
64.0000 PRESSURE_MODE_LAG_ON_PSI
1 MODE{RADIO-PRESS-TIMER-EXT}
1 FAILOVER{PRESS-TIMER-EXT}
1 PUMP_1{AUTO-ON-OFF}
1 PUMP_2{AUTO-ON-OFF}
1 LEAD_PUMP{P1-P2}
2 LAG_PUMP{P1-P2}
1 NUM_TIMER_PUMPS{1-2}
Press: <SPACE BAR> To Continue <Q> To Quit ...
Connected 0:00:59 ANSI 19200 8-N-1 SCROLL CAPS NUM Capture Print echo
  
```

4. Pressing the <SPACE BAR> will also proceed to the previous setpoint snapshot. Notice the time stamp on the top two lines of the screen:

```

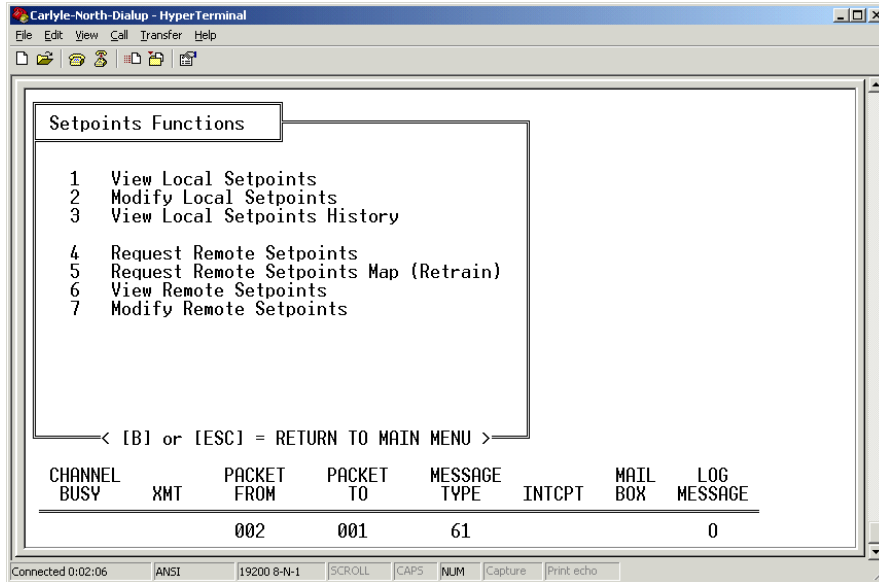
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
Setpoints : Mon Jul 15 17:54:05 2002
Until      : Mon Jul 15 17:54:09 2002
■ ALTERNATE_PUMPS
100.000 FLOW_DETECT_GPM
20.0000 LOW_SUCTION_CUTOFF_PSI
600.000 LOW_SUCTION_RELEASE_SECS
18.0000 TIMER_1_START_HOUR
22.0000 TIMER_1_STOP_HOUR
6.000000 TIMER_2_START_HOUR
10.0000 TIMER_2_STOP_HOUR
12.0000 TIMER_3_START_HOUR
16.0000 TIMER_3_STOP_HOUR
1.50000 PRESSURE_MODE_RUNTIME_HRS
68.0000 PRESSURE_MODE_LEAD_ON_PSI
64.0000 PRESSURE_MODE_LAG_ON_PSI
1 MODE{RADIO-PRESS-TIMER-EXT}
1 FAILOVER{PRESS-TIMER-EXT}
1 PUMP_1{AUTO-ON-OFF}
1 PUMP_2{AUTO-ON-OFF}
1 LEAD_PUMP{P1-P2}
2 LAG_PUMP{P1-P2}
Press: <SPACE BAR> To Continue <Q> To Quit ...
Connected 0:01:15 ANSI 19200 8-N-1 SCROLL CAPS NUM Capture Print echo
  
```

5. Pressing the <Q> hotkey returns the user back to the “Setpoints Functions” Screen:

6. If the user wants to return to the “Main Menu” at this point, he should press the <ESC> key (or the key).

16 MODIFY LOCAL SETPOINTS

1. As mentioned in the Chapter 7, the “Setpoints Functions” can be accessed from the “Main Menu” by pressing the <2> hotkey. After pressing the hotkey, the “Setpoints Functions” screen will be displayed.



Within the “Setpoints Functions” Menu, several new choices are now available. Note, however, that the modem bar remains at the bottom of the screen.

2. To modify the local setpoints, press the <2> hotkey:

3. The “Modify Local Setpoints” dialog will begin. Each setpoint will be displayed and followed with the question: Modify? <N>

4. If the user does not wish to modify a particular setpoint, he should press the <N> hotkey or the <ENTER> key. The dialog will then proceed to the next setpoint.

5. If the user does wish to modify a particular setpoint, he should press the <Y> hotkey.
 - A. For a discrete setpoint, the dialog will reply that the discrete setpoint was toggled to the opposite ON or OFF state.

```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
[Icons]
-----
Digital Setpoint States
-----
TRUE : ALTERNATE_PUMPS
Modify ? <n>
-----
Connected 0:15:55  ANSI  19200 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
[Icons]
-----
Digital Setpoint States
-----
TRUE : ALTERNATE_PUMPS
Modify ? <n>
State Changed To : FALSE
Analog Setpoint States
-----
100.000000 : FLOW_DETECT_GPM
Modify ? <n>_
-----
Connected 0:12:44  ANSI  19200 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

Notice that the program displayed a confirmation message:

“State Changed To : FALSE”

B. For an analog setpoint, the dialog will prompt for a new value. The new value should be typed, following by pressing the <ENTER> key.

```
Carlyle-North-DiMap - HyperTerminal
File Edit View Call Transfer Help
[Icons]
-----
Digital Setpoint States
=====
TRUE : ALTERNATE_PUMPS
Modify ? <n>
Analog Setpoint States
=====
100.000000 : FLOW_DETECT_GPM
Modify ? <n>
```

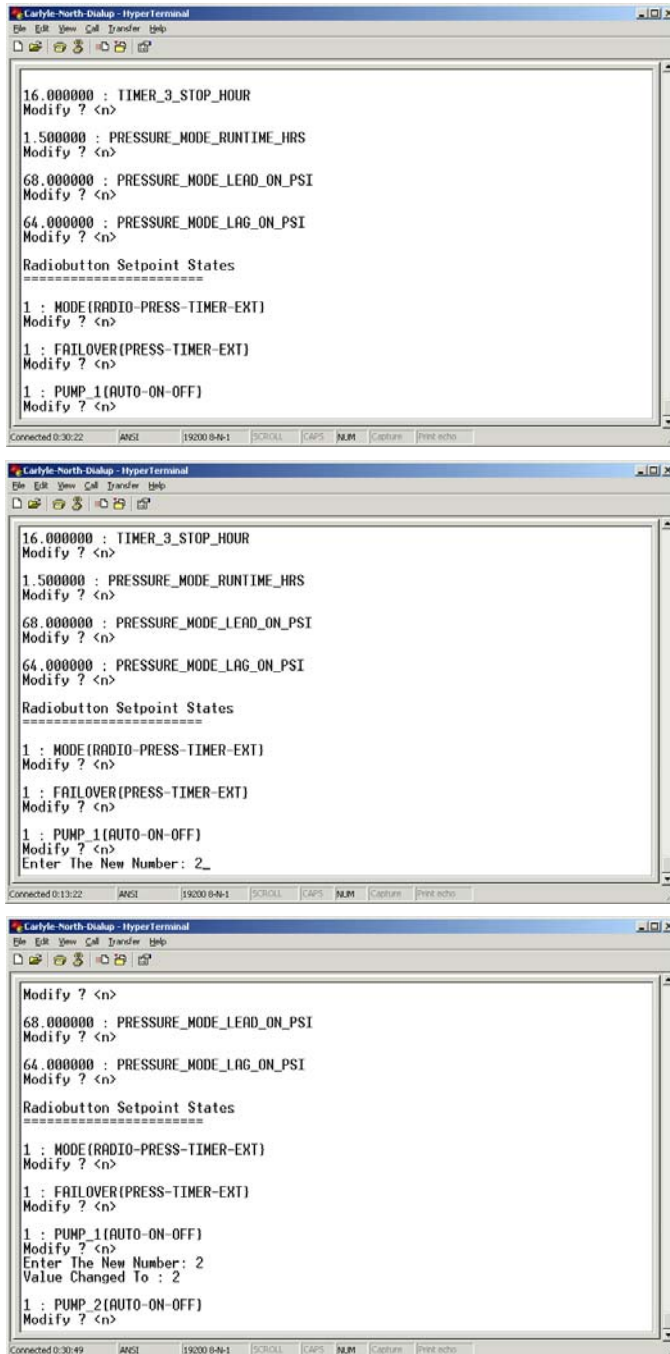
```
Carlyle-North-DiMap - HyperTerminal
File Edit View Call Transfer Help
[Icons]
-----
Digital Setpoint States
=====
TRUE : ALTERNATE_PUMPS
Modify ? <n>
Analog Setpoint States
=====
100.000000 : FLOW_DETECT_GPM
Modify ? <n>
Enter The New Number: 80.0_
```

```
Carlyle-North-DiMap - HyperTerminal
File Edit View Call Transfer Help
[Icons]
-----
Digital Setpoint States
=====
TRUE : ALTERNATE_PUMPS
Modify ? <n>
Analog Setpoint States
=====
100.000000 : FLOW_DETECT_GPM
Modify ? <n>
Enter The New Number: 80.0
Value Changed To : 80.000000
20.000000 : LOW_SUCTION_CUTOFF_PSI
Modify ? <n>_
```

Notice that the program displayed a confirmation message:

“Value Changed To : 80.000000”

C. For a radiobutton setpoint, the dialog will prompt for a new value. The new value should be typed, followed by pressing the <ENTER> key. Radiobutton setpoints are specified as integer selector items. For example, the radiobutton setting for a pump's mode can be expressed as: PUMP{AUTO-ON-OFF}. Using this notation, the AUTO setting is expressed as a "1"; the "ON" setting is expressed as a "2"; and the "OFF" setting is expressed as a "3".



Notice that the program displayed a confirmation message:

“Value Changed To : 2”

6. After all desired setpoint modifications have been performed, the program will prompt for confirmation:

“Do you wish to accept these changes (Y or N) ?”

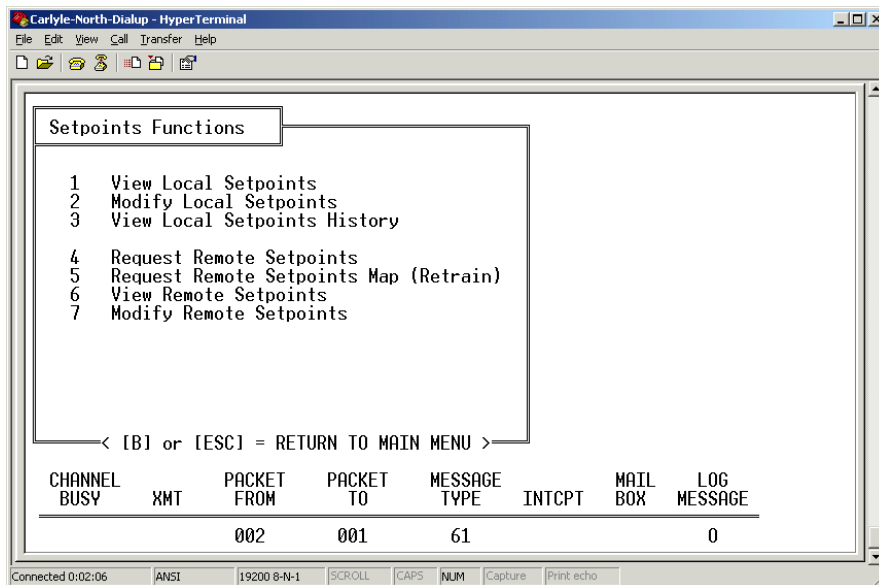
```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
1 : MODE {RADIO-PRESS-TIMER-EXT}
Modify ? <n>
1 : FAILOVER {PRESS-TIMER-EXT}
Modify ? <n>
1 : PUMP_1 {AUTO-ON-OFF}
Modify ? <n>
Enter The New Number: 2
Value Changed To : 2
1 : PUMP_2 {AUTO-ON-OFF}
Modify ? <n>
1 : LEAD_PUMP {P1-P2}
Modify ? <n>
2 : LAG_PUMP {P1-P2}
Modify ? <n>
1 : NUM_TIMER_PUMPS {1-2}
Modify ? <n>
Do You Wish To Accept These Changes (Y or N) ?
Connected 0:13:41  ANSI  19200 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

7. If a mistake was made, the user can simply press the <N> hotkey; and the changes will be discarded. If the changes were made correctly, then the user should press the <Y> hotkey; and the changes will take effect immediately. At this point, the “Setpoints Function” screen will be displayed again.

8. If the user wants to return to the “Main Menu” at this point, he should press the <ESC> key (or the key).

17 MODIFY REMOTE SETPOINTS

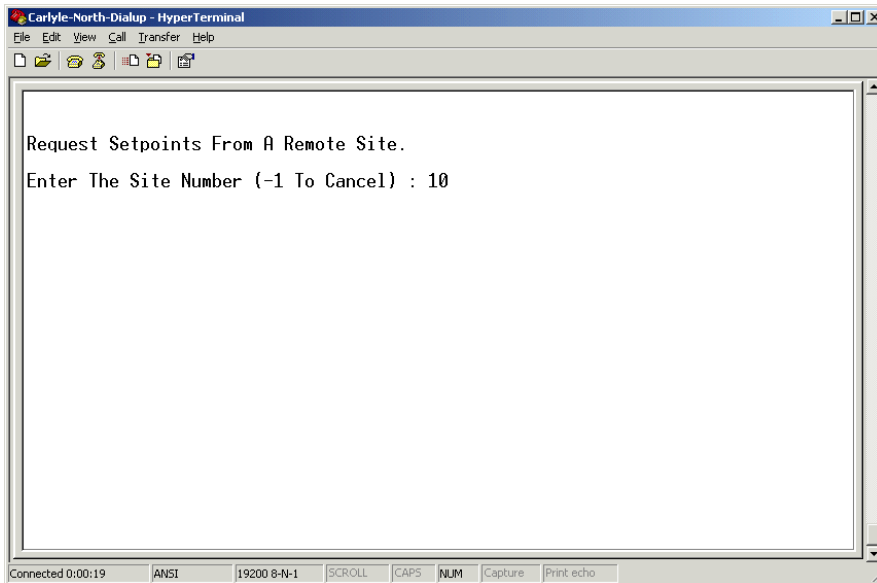
1. “Modify Remote Setpoints” is a very similar procedure to “Modify Local Setpoints”. It is advised that the user first read Chapter 14 (“Modify Local Setpoints”) before reading this Chapter.
2. As mentioned in the Chapter 7, the “Setpoints Functions” can be accessed from the “Main Menu” by pressing the <2> hotkey. After pressing the hotkey, the “Setpoints Functions” screen will be displayed.



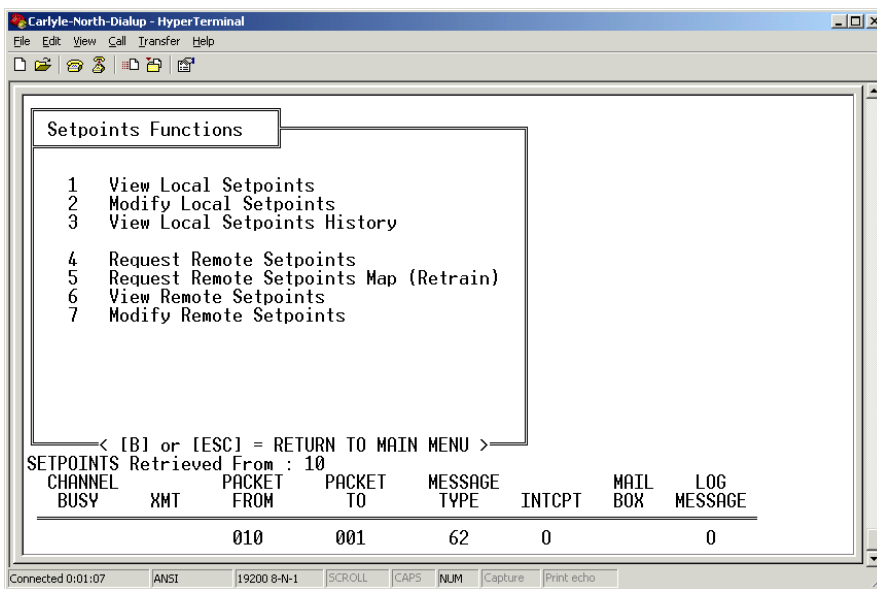
Within the “Setpoints Functions” Menu, several new choices are now available. Note, however, that the modem bar remains at the bottom of the screen.

3. Before modifying the setpoints of a remote RTU, it is advised that the user first request setpoints from that RTU. Only by first performing this procedure can the user be assured that he is modifying an up-to-date copy of that RTU’s setpoints.

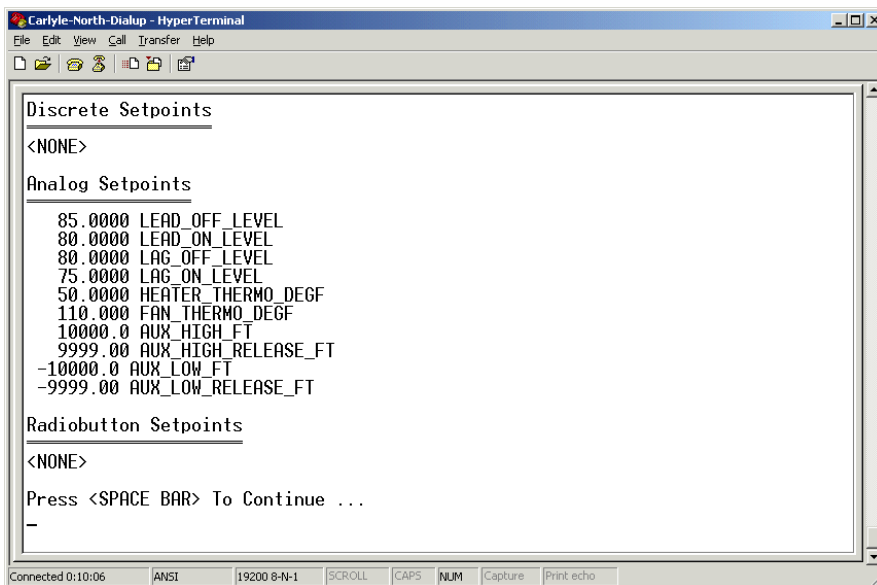
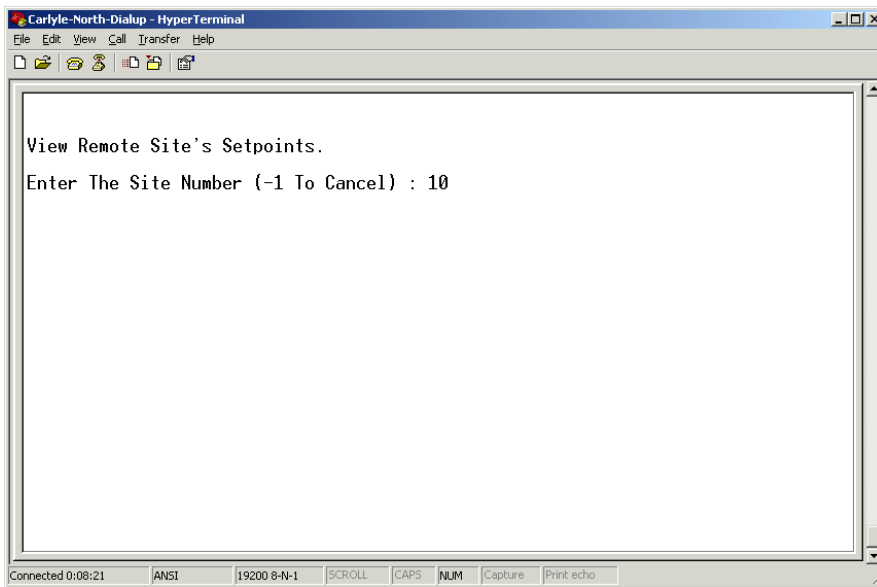
4. To request the setpoints of a remote RTU, press the <4> hotkey. The program will prompt for the address of the remote RTU. Type the address of the remote RTU ("10", for example), and press the <ENTER> key.



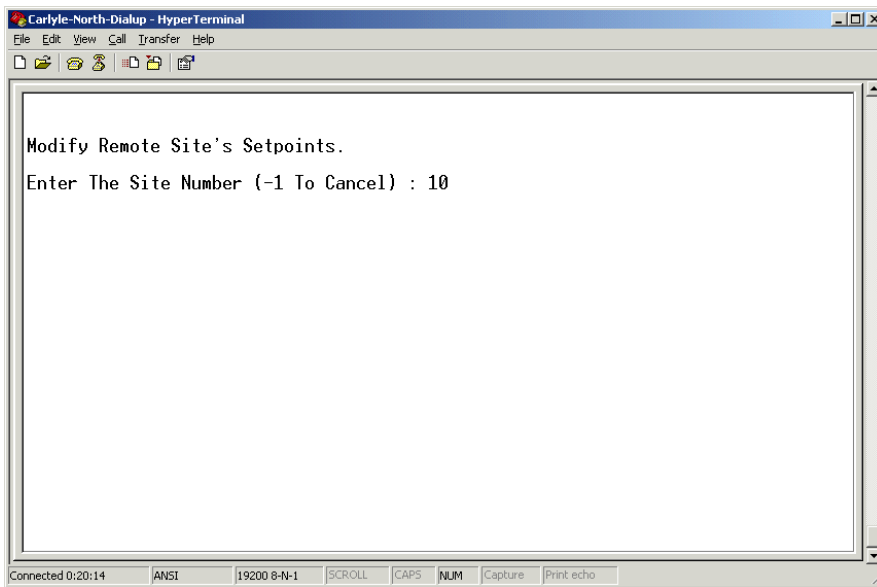
5. The program will transmit a request to the remote RTU for its setpoints. When the setpoints are received, the following message will be displayed in the "Comm Event Viewer": "SETPOINTS Received from 10".



6. At this point, the user can view and/or modify the remote setpoints. Usually, it is best to view the remote setpoints before attempting to modify. Press the <6> hotkey to view the remote setpoints. The program will prompt for the address of the remote RTU. Type the address of the remote RTU ("10", for example), and press the <ENTER> key.



7. After viewing the remote setpoints, the user can modify the remote setpoints. Press the <7> hotkey to modify the remote setpoints. The program will prompt for the address of the remote RTU. Type the address of the remote RTU ("10", for example), and press the <ENTER> key.



8. The "Modify Remote Setpoints" dialog will begin. (Please read Chapter 14, which contains a very detailed explanation of the setpoint modification procedure.) Each setpoint will be displayed and followed with the question: Modify? <N>

9. If the user does not wish to modify a particular setpoint, he should press the <N> hotkey or the <ENTER> key. The dialog will then proceed to the next setpoint.

10. If the user wishes to modify a particular setpoint, he should press the <Y> hotkey.
- A. For a discrete setpoint, the dialog will reply that the discrete setpoint was toggled to the ON or OFF state.
 - B. For an analog setpoint, the dialog will prompt for a new value. The new value should be typed, following by pressing the <ENTER> key.

```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
[Icons]
-----
Digital Setpoint States
=====
<NONE>
Analog Setpoint States
=====
85.000000 : LEAD_OFF_LEVEL
Modify ? <n>
```

Connected 0:52:05 ANSI [19200 8-N-1] SCROLL CAPS NUM Capture Print echo

```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
[Icons]
-----
Digital Setpoint States
=====
<NONE>
Analog Setpoint States
=====
85.000000 : LEAD_OFF_LEVEL
Modify ? <n>
Enter The New Number: 86.0_
```

Connected 0:52:43 ANSI [19200 8-N-1] SCROLL CAPS NUM Capture Print echo

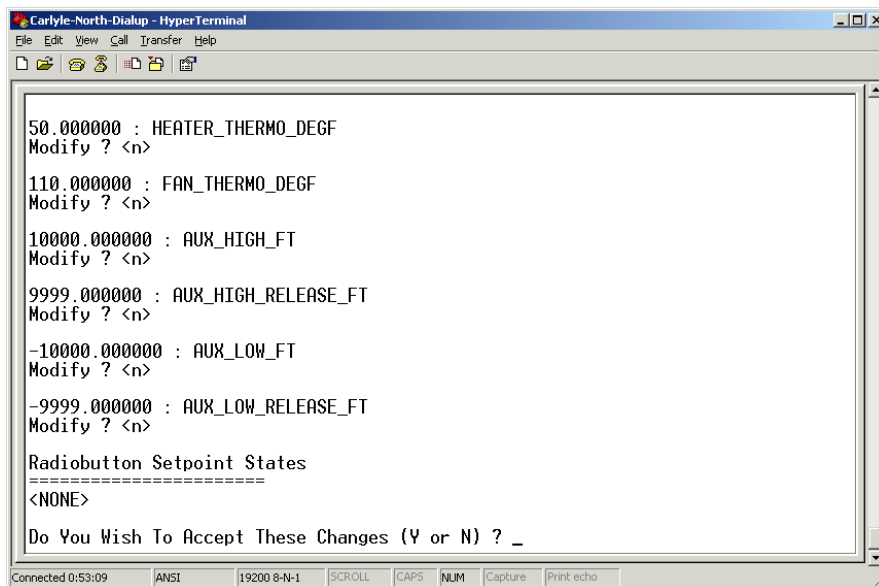
```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
[Icons]
-----
Digital Setpoint States
=====
<NONE>
Analog Setpoint States
=====
85.000000 : LEAD_OFF_LEVEL
Modify ? <n>
Enter The New Number: 86.0
Value Changed To : 86.000000
80.000000 : LEAD_ON_LEVEL
Modify ? <n>_
```

Connected 0:52:54 ANSI [19200 8-N-1] SCROLL CAPS NUM Capture Print echo

C. For a radiobutton setpoint, the dialog will prompt for a new value. The new value should be typed, followed by pressing the <ENTER> key. Radiobutton setpoints are specified as integer selector items. For example, the radiobutton setting for a pump's mode can be expressed as: PUMP{AUTO-ON-OFF}. Using this notation, the AUTO setting is expressed as a "1"; the "ON" setting is expressed as a "2"; and the "OFF" setting is expressed as a "3".

11. After all desired setpoint modifications have been performed, the program will prompt for confirmation:

"Do you wish to accept these changes (Y or N) ?"

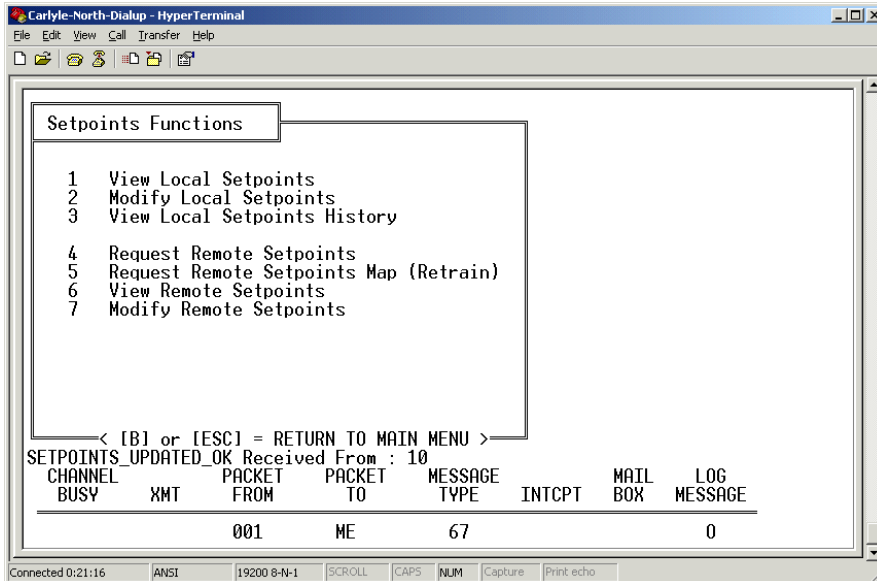


```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
[Icons]
50.000000 : HEATER_THERMO_DEGF
Modify ? <n>
110.000000 : FAN_THERMO_DEGF
Modify ? <n>
10000.000000 : AUX_HIGH_FT
Modify ? <n>
9999.000000 : AUX_HIGH_RELEASE_FT
Modify ? <n>
-10000.000000 : AUX_LOW_FT
Modify ? <n>
-9999.000000 : AUX_LOW_RELEASE_FT
Modify ? <n>
Radiobutton Setpoint States
=====
<NONE>
Do You Wish To Accept These Changes (Y or N) ? _
```

12. If a mistake was made, the user can simply press the <N> hotkey; and the changes will be discarded.

13. If the changes are correct, then the user should press the <Y> hotkey. At this point, the "Setpoints Function" screen will be displayed again. The user should watch the "Comm Event Viewer" closely for a confirmation. The user can be assured that the setpoints were received from the remote RTU when the following message is received:

"SETPOINTS_UPDATED_OK Received From 10"

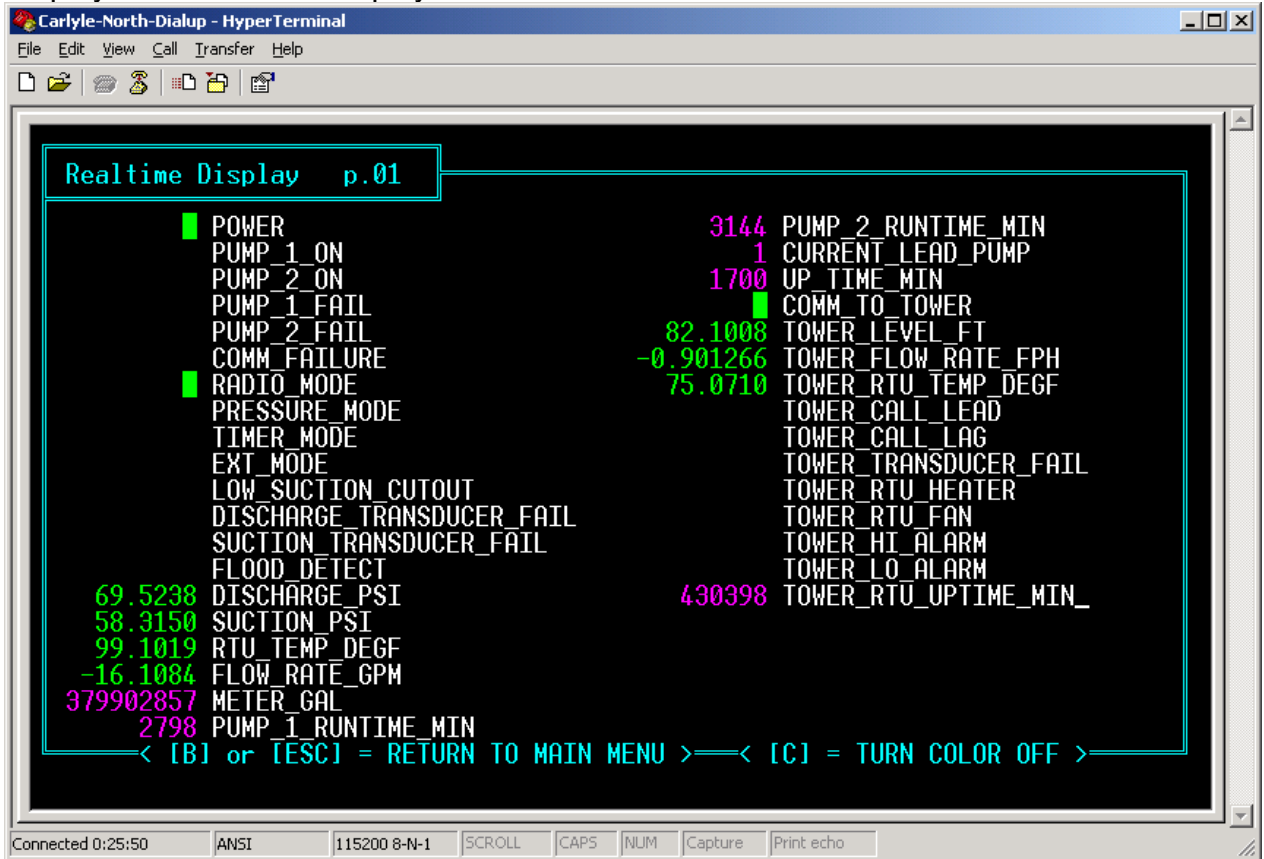


If the above confirmation is not received, then the user cannot be assured that the changes were received from the remote RTU. In this case, steps 7-13 should be repeated until the confirmation is received.

14. If the user wants to return to the "Main Menu" at this point, he should press the <ESC> key (or the key).

18 REALTIME DISPLAY

1. As mentioned in the Chapter 7, the “Realtime Display” can be accessed from the “Main Menu” by pressing the <8> hotkey. After pressing the hotkey, the “Realtime Display” screen will be displayed.



2. The “Realtime Display” will refresh all displayed values every 20 seconds. However, a single press of the <SPACE BAR> will immediately refresh all displayed values.

3. If the user wants to return to the “Main Menu” at any time, he should press the <ESC> key (or the key).

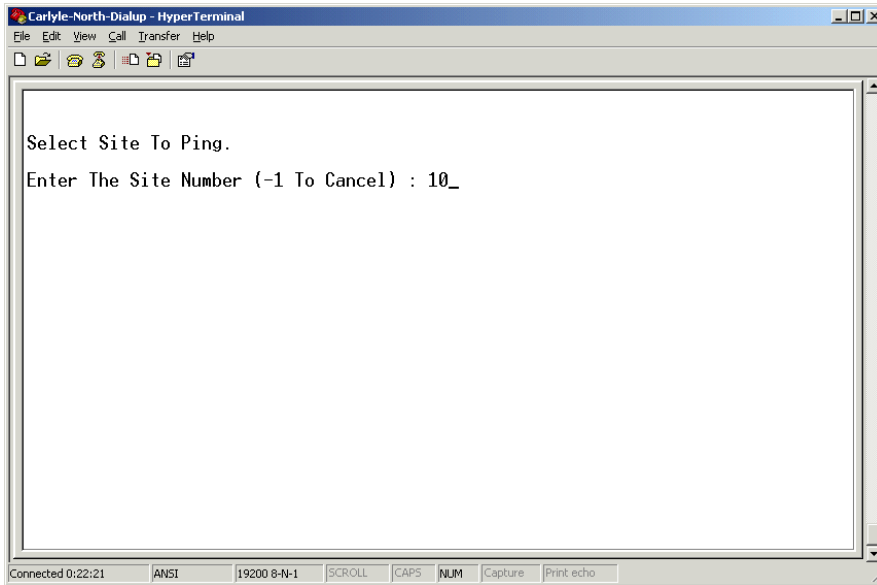
19 COMMUNICATION TROUBLESHOOTING

TESTING COMMUNICATIONS BETWEEN RTU'S... THE PING FUNCTION

1. The best method of troubleshooting communications is to use the “PING” function, which can be accessed via the “Main Menu”. The “PING” function was named after the “ping” of a sonar transmitter; and it behaves very similarly.
2. When troubleshooting communications between RTU's, the “PING” function should be used to test communications to nearby sites to determine which communication paths are working properly, and which are not.
3. Also, while performing communication troubleshooting, it is highly recommended that the user closely observe the activity on the “Modem Status Bar”.

```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
WinCom Main Menu 12/12/2002 21:52:00 <5>
1 Status Functions
2 Setpoints Functions
3 Ping A Site
4 Mail Functions
5 File Transfer Functions
6 View System Log Messages
7 Site Programming
8 Realtime Display
< X = EXIT , R = RESTART , L = LOGOUT >
CHANNEL BUSY XMT PACKET FROM PACKET TO MESSAGE TYPE INTCPT MAIL BOX LOG MESSAGE
001 000 6e 0
```

2. In order to invoke the “PING” function, press the <3> hotkey. The “PING” dialog will request the network address of the RTU to ping.
3. In this example, a “ping” will be demonstrated from this RTU (network address “4”) to the RTU with network address “10”. However, the #4 RTU and the #10 RTU in this example do not communicate “directly”. Rather, they communicate using another RTU as a relay (the #1 RTU) in order to boost the communication reliability.



4. The network address “10” is typed and the user presses the <ENTER> key.
5. The following 4 events are observed on the “Modem Status Bar”. Although these events occur very quickly, the user will acquire the ability to discern the communication sequence as it flashes across the screen. Also, the user’s observation task is substantially easier if he is anticipating the communication sequence. Essentially, the observation is best described as a “verification”.

6. Observe the communication events in sequence (ME to 1... and... 1 to 10) and then the return path (10 to 1... and... 1 to ME):

WinCom Main Menu 12/16/2002 19:18:11 <2>

```

1 Status      Functions
2 Setpoints  Functions
3 Ping A Site
4 Mail       Functions
5 File Transfer Functions
6 View System Log Messages
7 Site Programming
8 Realtime Display
  
```

< X = EXIT , R = RESTART , L = LOGOUT >

CHANNEL BUSY	XMT	PACKET FROM	PACKET TO	MESSAGE TYPE	INTCPT	MAIL BOX	LOG MESSAGE
	0	ME	001	43			0

Connected 0:24:31 ANSI 19200 8-N-1 SCROLL CAPS NUM Capture Print echo

Transmitting **From: ME** **To: 1** **PING**

WinCom Main Menu 12/16/2002 19:18:11 <2>

```

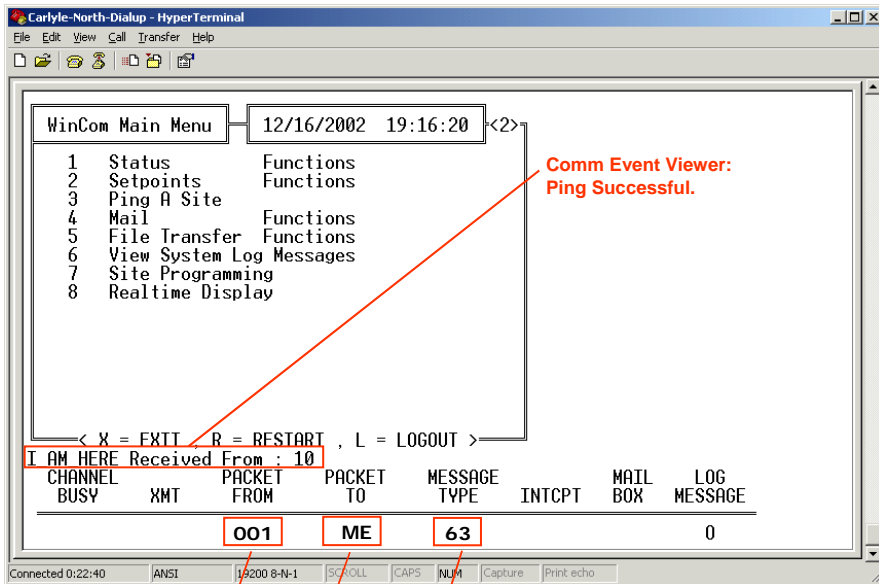
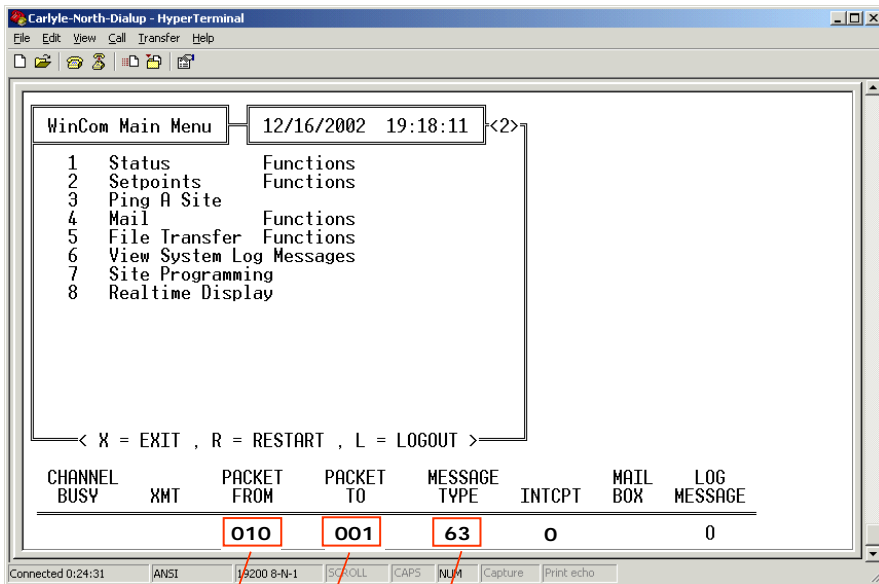
1 Status      Functions
2 Setpoints  Functions
3 Ping A Site
4 Mail       Functions
5 File Transfer Functions
6 View System Log Messages
7 Site Programming
8 Realtime Display
  
```

< X = EXIT , R = RESTART , L = LOGOUT >

CHANNEL BUSY	XMT	PACKET FROM	PACKET TO	MESSAGE TYPE	INTCPT	MAIL BOX	LOG MESSAGE
		001	010	43			0

Connected 0:24:31 ANSI 19200 8-N-1 SCROLL CAPS NUM Capture Print echo

From: 1 **To: 10** **PING**



7. In addition to observing “PING” communications, the user can observe ALL types of communications on the “Modem Status Bar”. Mastering this tool is a key skill for personnel who wish to troubleshoot communications between RTU’s.

IS THE RECEIVER WORKING?

1. By closely observing the “Modem Status Bar”, the user can usually determine easily whether the RTU is receiving messages from the network.
2. First, watch at the “PACKET FROM” indicator for several minutes. If, at any time, it displays a numerical address between 000 and 255 inclusive, then the receiver mechanism of the RTU is functional. (Each RTU has both a receiver and a transmitter.)
3. However, if the “PACKET FROM” indicator does not show a numerical address between 000 and 255 inclusive over the course of several minutes, this does not necessarily mean that the receiver mechanism of the RTU is not functional. If the RTU network contains only 2 RTU’s, it is possible that the other RTU is simply not transmitting.
4. In an RTU network which contains several or more RTU’s, it would be unusual for the “PACKET FROM” indicator to not display a numerical address between 000 and 255 inclusive unless the receiver mechanism was not functional.

IS THE TRANSMITTER WORKING?... **LISTEN FROM ANOTHER NEARBY RTU**

1. For example, the user wishes to determine whether the transmitter of the RTU with network address “4” is working properly. Interface to a nearby RTU (In this example, let’s say from network address “10”.) From this RTU, closely observe the “Modem Status Bar” on the “Main Menu” for several minutes. If at any time the user observes address “004” on the “PACKET FROM” indicator, then the transmitter at the 004 RTU should be assumed to be operational.

IS THE TRANSMITTER WORKING?... **TEST FOR FORWARD & REFLECTED POWER**

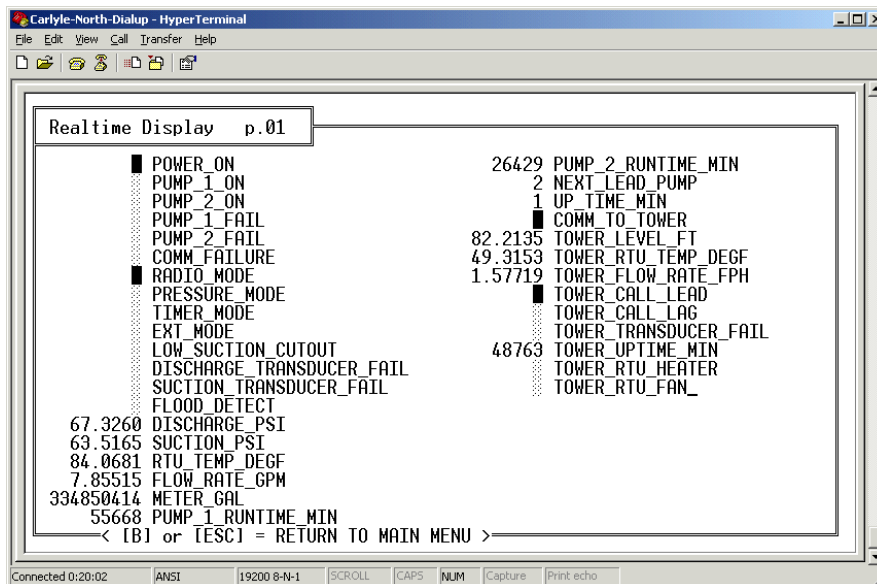
1. Place a BIRD Directional Wattmeter in the coaxial cable circuit (between the radio and the Polyphaser lightning arrestor) and “PING” a remote RTU. Observe both the transmitted and reflected power. The transmitted power should be approximately 5 Watts (for a Dataradio DL-34xx radio) or more if an inline amplifier is used. The reflected power should be very low (<10% of the forward power). If the reflected power is significantly high, then an open circuit should be suspected.
2. If the transmitted power is observed to be at the correct level, but the reflected power is high, then the next step is to determine the location of an open circuit in the coaxial cable / antenna circuit.

3. Test the Polyphaser for an open circuit. Note: A DC ohmmeter cannot be used for this test, as the Polyphaser blocks DC current. This test must be performed with a BIRD Directional Wattmeter. Place the BIRD Directional Wattmeter in the coaxial cable circuit (between the Polyphaser lightning arrestor and the antenna) and "PING" a remote RTU. Observe both the transmitted and reflected power. The transmitted power should be approximately 5 Watts (for a Dataradio DL-34xx radio) or more if an inline amplifier is used. If the reflected power is still significantly high, then an open circuit should be suspected further up the coaxial cable, and the Polyphaser should be assumed to be working properly. If no forward power is detected at this point, then the Polyphaser should be suspect. Replace the Polyphaser and repeat the test.

4. If an open circuit in the coaxial cable is suspected further up toward the antenna, the test in Step 3 can be repeated, except with the BIRD Directional Wattmeter placed beyond each device (or connection) which is suspected to be breaking the coaxial circuit.

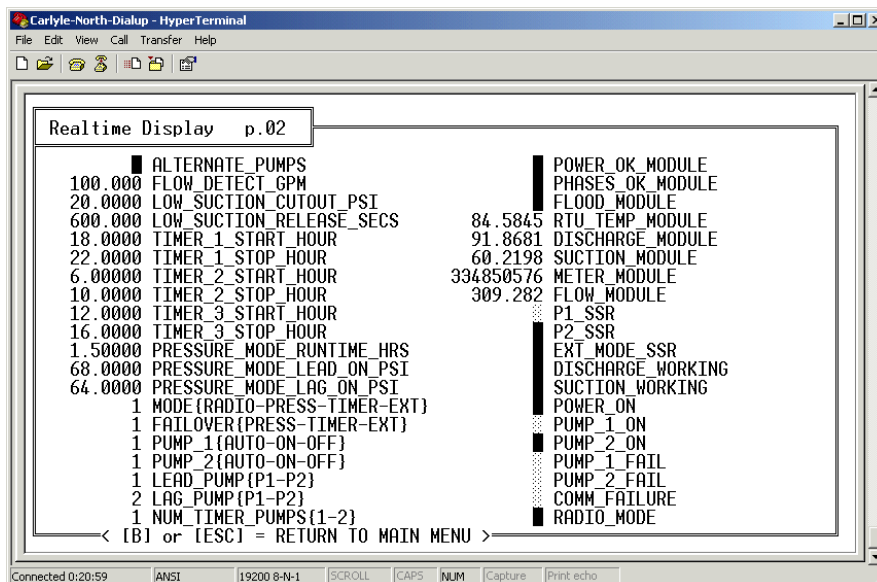
20 CONTROL LOGIC TROUBLESHOOTING

1. In addition to NDB, the NCL debugger which is documented in the NCL Manual, there exists another technique for debugging the control logic of an RTU. This alternative method uses an extended feature of the “Realtime Display”, and is only available to personnel who are logged into the RTU with the “factory”-level password.
2. While logged in at the “factory”-level, and from the “Main Menu”, press the <8> hotkey to enter the “Realtime Display”. The standard “Realtime Display” is shown:



```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
Realtime Display p.01
POWER_ON 26429 PUMP_2_RUNTIME_MIN
PUMP_1_ON 2 NEXT_LEAD_PUMP
PUMP_2_ON 1 UP_TIME_MIN
PUMP_1_FAIL COMM_TO_TOWER
PUMP_2_FAIL 82.2135 TOWER_LEVEL_FT
COMM_FAILURE 49.3153 TOWER_RTU_TEMP_DEGF
RADIO_MODE 1.57719 TOWER_FLOW_RATE_FPH
PRESSURE_MODE TOWER_CALL_LEAD
TIMER_MODE TOWER_CALL_LAG
EXT_MODE TOWER_TRANSUCER_FAIL
LOW_SUCTION_CUTOUT 48763 TOWER_UPTIME_MIN
DISCHARGE_TRANSUCER_FAIL TOWER_RTU_HEATER
SUCTION_TRANSUCER_FAIL TOWER_RTU_FAN_
FLOOD_DETECT
67.3260 DISCHARGE_PSI
63.5165 SUCTION_PSI
84.0681 RTU_TEMP_DEGF
7.85515 FLOW_RATE_GPM
334850414 METER_GAL
55668 PUMP_1_RUNTIME_MIN
< [B] or [ESC] = RETURN TO MAIN MENU >
Connected 0:20:02 ANSI 19200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

3. When the user presses the <TAB> key, a “Realtime Display” of internal control logic registers is shown. Notice that the page number is incremented to page #2:



```
Carlyle-North-Dialup - HyperTerminal
File Edit View Call Transfer Help
Realtime Display p.02
ALTERNATE_PUMPS
100.000 FLOW_DETECT_GPM
20.0000 LOW_SUCTION_CUTOUT_PSI
600.000 LOW_SUCTION_RELEASE_SECS
18.0000 TIMER_1_START_HOUR
22.0000 TIMER_1_STOP_HOUR
6.00000 TIMER_2_START_HOUR
10.0000 TIMER_2_STOP_HOUR
12.0000 TIMER_3_START_HOUR
16.0000 TIMER_3_STOP_HOUR
1.50000 PRESSURE_MODE_RUNTIME_HRS
68.0000 PRESSURE_MODE_LEAD_ON_PSI
64.0000 PRESSURE_MODE_LAG_ON_PSI
1 MODE{RADIO-PRESS-TIMER-EXT}
1 FAILOVER{PRESS-TIMER-EXT}
1 PUMP_1{AUTO-ON-OFF}
1 PUMP_2{AUTO-ON-OFF}
1 LEAD_PUMP{P1-P2}
2 LAG_PUMP{P1-P2}
1 NUM_TIMER_PUMPS{1-2}
POWER_OK_MODULE
PHASES_OK_MODULE
FLOOD_MODULE
84.5845 RTU_TEMP_MODULE
91.8681 DISCHARGE_MODULE
60.2198 SUCTION_MODULE
334850576 METER_MODULE
309.282 FLOW_MODULE
P1_SSR
P2_SSR
EXT_MODE_SSR
DISCHARGE_WORKING
SUCTION_WORKING
POWER_ON
PUMP_1_ON
PUMP_2_ON
PUMP_1_FAIL
PUMP_2_FAIL
COMM_FAILURE
RADIO_MODE
< [B] or [ESC] = RETURN TO MAIN MENU >
Connected 0:20:59 ANSI 19200 8-N-1 SCROLL CAPS NUM Capture Print echo
```


4. When the user presses the <TAB> key again, the more internal control logic registers are shown. For user reference, the page number of each screen is shown. Notice the “POWER_OK_TIMER” register, and those of similar type. These are “Time-Delay” Registers. The left block denotes the input signal; and the right block denotes the output signal. The left number denotes the “time since energized”; and the left number denotes the “timeout” of the timer.

```

Realtime Display p.03
-----
PRESSURE_MODE          TOWER_CALL_LEAD
TIMER_MODE             TOWER_CALL_LAG
EXT_MODE              TOWER_TRANSDUCER_FAIL
LOW_SUCTION_CUTOUT    48763 TOWER_UPTIME_MIN
DISCHARGE_TRANSDUCER_FAIL TOWER_RTU_HEATER
SUCTION_TRANSDUCER_FAIL TOWER_RTU_FAN
FLOOD_DETECT          █ 300/ 300 POWER_OK_TIMER
89.6703 DISCHARGE_PSI  - - - - / 300 P1_FAIL_TIMER
59.0476 SUCTION_PSI   - - - - / 300 P2_FAIL_TIMER
84.5845 RTU_TEMP_DEGF - - - - / 900 PRESSURE_LEAD_ON_TIMER
336.666 FLOW_RATE_GPM █ 5400/ 5400 PRESSURE_LEAD_OFF_TIMER
334850744 METER_GAL   - - - - / 600 PRESSURE_LAG_ON_TIMER
55668 PUMP_1_RUNTIME_MIN █ 5400/ 5400 PRESSURE_LAG_OFF_TIMER
26429 PUMP_2_RUNTIME_MIN - - - - / 20 P1_DELAY_TIMER
2 NEXT_LEAD_PUMP      █ 40/ 40 P2_DELAY_TIMER
3 UP_TIME_MIN         - - - - / 30 LS_TIMER
█ COMM_TO_TOWER      - - - - / 600 LS_RELEASE_TIMER
82.2135 TOWER_LEVEL_FT █ 300/ 300 FLOOD_OK_TIMER
49.3153 TOWER_RTU_TEMP_DEGF 3340095 P1_RUNTIME_SECS
1.57719 TOWER_FLOW_RATE_FPH 1585781 P2_RUNTIME_SECS_
< [B] or [ESC] = RETURN TO MAIN MENU >

```

5. When the user presses the <TAB> key again, the final page of internal control logic registers is shown:

```

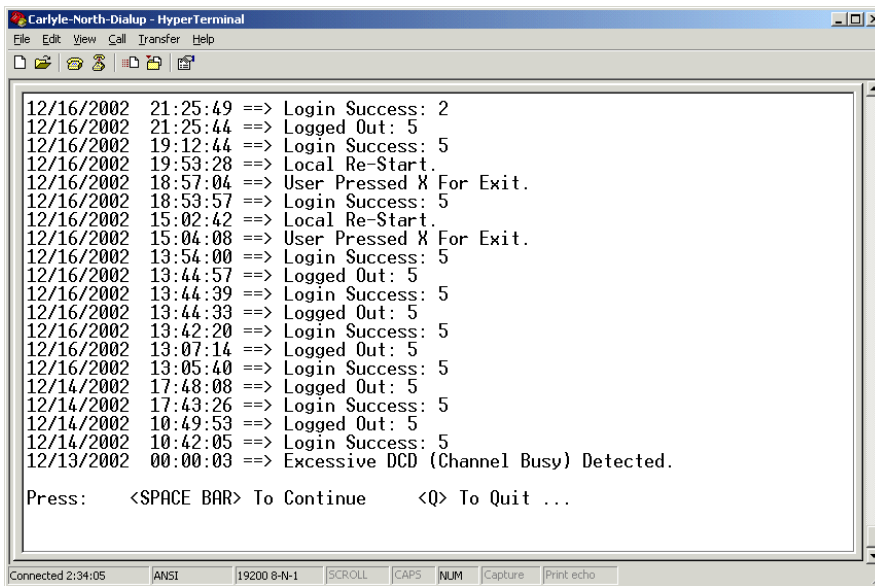
Realtime Display p.04
-----
2.00000 LEAD_PUMP_DEF          0.0 TRY_1_FAIL
1.00000 LAG_PUMP_DEF          0.0 TRY_2_FAIL
1040087717 LASTCALL_TIME      1.00000 AOK
5.00000 DELTA_TIME           2.00000 NUM_PUMPS
1.00000 TOWER_LEAD           1.00000 FLOW_DETECT
0.0 TOWER_LAG
0.0 PRESSURE_LEAD
0.0 PRESSURE_LAG
0.0 TIMER_LEAD
0.0 TIMER_LAG
1.00000 NEW_LEAD_STATE
0.0 LEAD_TURNING_ON
0.0 LEAD_TURNING_OFF
1.00000 LEAD_STATE
0.0 LAG_STATE
0.0 TRAIL_STATE
0.0 LOCAL_P1
1.00000 LOCAL_P2
0.0383333 LEAD_TIMER
2.00000 SEQUENCE_POINTER
< [B] or [ESC] = RETURN TO MAIN MENU >

```

6. If the user presses the <TAB> key again, the display will return to the standard “Realtime Display” page.

21 VIEWING THE SYSTEM LOG

1. When troubleshooting an RTU, it is advised that the user view the contents of the “System Log”. Often, the presence of certain error messages can assist the user in determining a problem. There are dozens of possible error messages. Some are rather self-explanatory, while others are somewhat cryptic.
2. In order to view the “System Log”, the user must be logged in at the “user”-level or above. Also, the user should be at the “Main Menu” screen.
3. Press the <6> hotkey to “View System Log Messages”:



The screenshot shows a HyperTerminal window titled "Carlyle-North-Dialup - Hyper Terminal". The window contains a list of system log messages with timestamps and descriptions. The messages include login success, local re-start, and excessive DCD (Channel Busy) detected. At the bottom of the log, there is a prompt: "Press: <SPACE BAR> To Continue <Q> To Quit ...". The status bar at the bottom of the window shows "Connected 2:34:05", "ANSI", "19200 8-N-1", "SCROLL", "CAPS", "NUM", "Capture", and "Print echo".

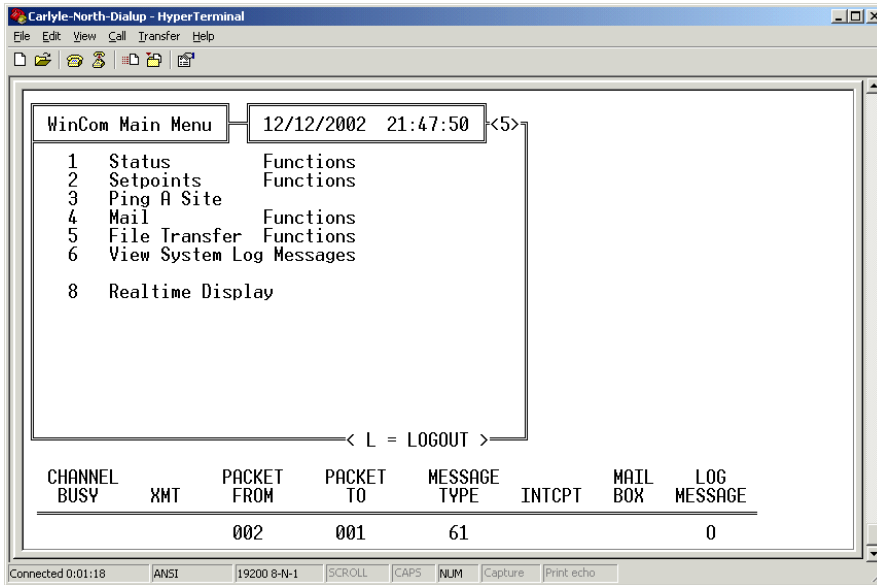
```
12/16/2002 21:25:49 ==> Login Success: 2
12/16/2002 21:25:44 ==> Logged Out: 5
12/16/2002 19:12:44 ==> Login Success: 5
12/16/2002 19:59:28 ==> Local Re-Start.
12/16/2002 18:57:04 ==> User Pressed X For Exit.
12/16/2002 18:53:57 ==> Login Success: 5
12/16/2002 15:02:42 ==> Local Re-Start.
12/16/2002 15:04:08 ==> User Pressed X For Exit.
12/16/2002 13:54:00 ==> Login Success: 5
12/16/2002 13:44:57 ==> Logged Out: 5
12/16/2002 13:44:39 ==> Login Success: 5
12/16/2002 13:44:33 ==> Logged Out: 5
12/16/2002 13:42:20 ==> Login Success: 5
12/16/2002 13:07:14 ==> Logged Out: 5
12/16/2002 13:05:40 ==> Login Success: 5
12/14/2002 17:48:08 ==> Logged Out: 5
12/14/2002 17:43:26 ==> Login Success: 5
12/14/2002 10:49:53 ==> Logged Out: 5
12/14/2002 10:42:05 ==> Login Success: 5
12/13/2002 00:00:03 ==> Excessive DCD (Channel Busy) Detected.

Press: <SPACE BAR> To Continue <Q> To Quit ...
```

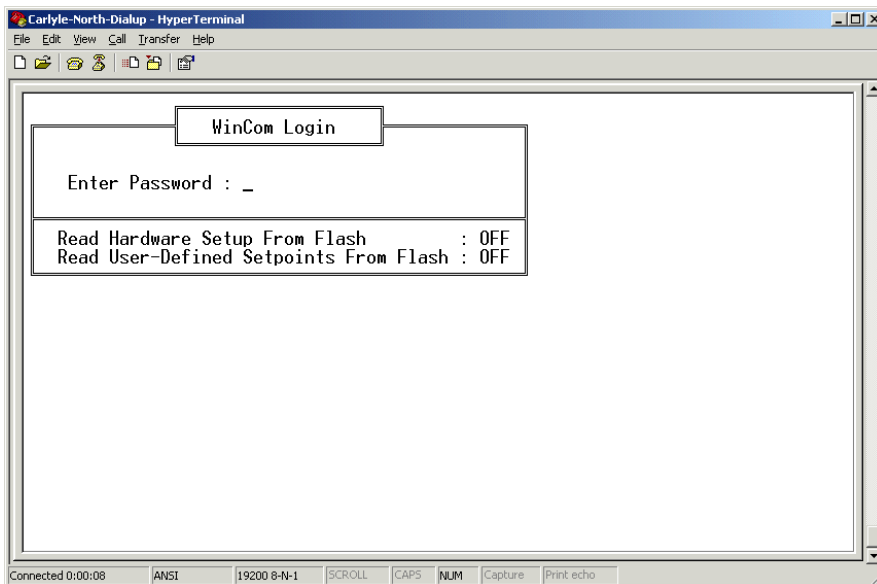
4. RTU's are configured to store the latest 50-150 error messages.

22 LOGGING OUT

1. After using a palmtop (or notebook) to interact with an RTU, it is recommended that the user “log out” of the RTU before disconnecting. Logging out tells the RTU that it can pause the “User Interface” functions until the next user logs in. However, the communication and control processes will continue to operate normally.
2. In order to “Logout”, the user must be at the “Main Menu” screen:



3. Press the <L> hotkey from the “Main Menu”. The “Main Menu” will disappear, and it will be replaced by the “Login Screen”:



4. At this point, the user can disconnect the palmtop (or notebook) computer from the Operator Interface Port.

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