GORDON KAPES INC.

Technical Practice

Issue 4, October, 1989

Model 115

Contents
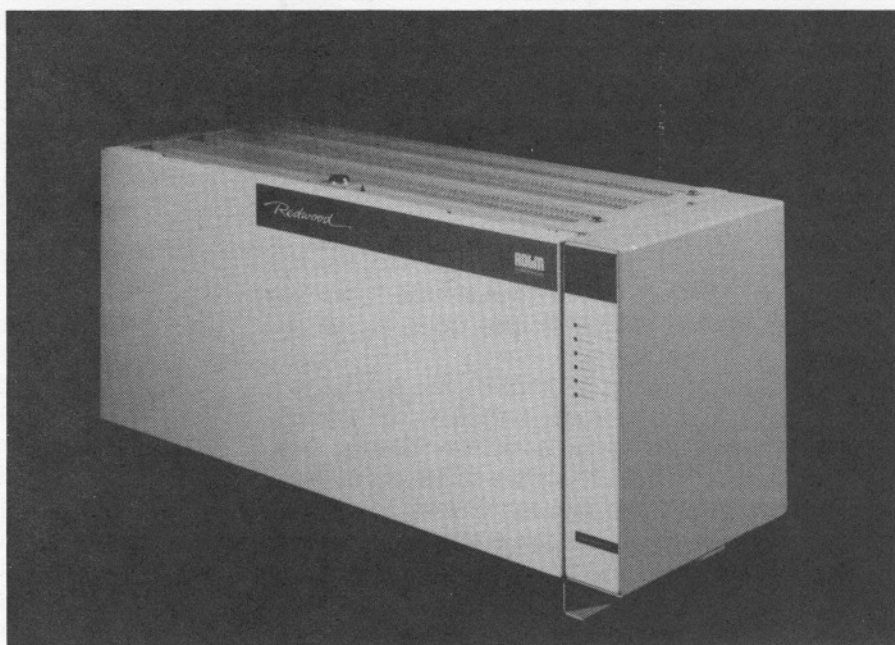
1. General Description

1.1 NEW PRACTICE ISSUE   Issue 4 of this practice applies to Model 115 units with software version 1.02 or higher. The Model 115's menu system displays the software version number in the upper right corner of all screens. This software implements several operational changes and improvements. The data rate of the Main and RW ports are now selectable, in tandem, for 1200, 2400, or 4800 bits per seconds. Improved handling of CDR, alarm, and configuration report data has been implemented. The secondary BLF function is no longer implemented.

1.2 PRODUCT OVERVIEW   The Model 115 is designed to provide expanded capabilities to the ROLM Redwood® Digital Telephone System. Redwood, when equipped with an accessory card, contains one serial communications port from which a variety of information is sent and received. This information includes system configuration, Busy Lamp Field (BLF), Call Detail Recording (CDR), and system alarms. The Model 115 provides enhanced utilization of these resources by electronically "expanding" the one serial port into three separate communication paths.

1.3 MULTIPLE DATA PATHS   Using a combination of microprocessor-based hardware and software, the Model 115 provides two serial ports for on-site use and an integral modem for remote access. One serial port, called the Main port, is intended for use by a local serial communications device, such as a WYSE 50 or IBM 3151 with WYSE 50 emulation cartridge. This device is generally used for Redwood configuration and BLF. The second Model 115 serial port, called the Auxiliary port, provides a dedicated CDR and/or alarm output port. The Auxiliary port is intended to connect to a printer or data collection device. The integral modem conforms to Bell 212A standards (1200/300 bits per second) and is intended to give service personnel 24-hour access to Redwood.

1.4 INTELLIGENT ROUTING   The real power of the Model 115 is in its ability to intelligently control, store, and route signals between Redwood and the three communication paths. The Main port and the modem are each, with minimal interference to the other, able to communicate with Redwood. The Auxiliary port, unaffected by Main port or modem operation, can be configured to be a truly dedicated

CDR and/or alarm port. The remote user, primarily field support personnel, have immediate access to Redwood via the modem. During a modem session, the local user is informed that they have been temporarily logged off. When the modem session is over, another message indicates that Redwood login can again proceed. If the local terminal was in Redwood's BLF mode when the modem was accessed, it will be temporarily logged off from Redwood, then automatically returned to BLF when the modem session is completed. The Auxiliary port will continuously output CDR and/or alarm records, even during modem access.

1.5 FUTURE SOFTWARE VERSIONS (VAPORWARE) As a software controlled product, features can be added as need dictates. Gordon Kapes, Inc. has several ideas for Model 115 enhancements, including automatic alarm reporting. An automatic status reporting system would alert service personnel to changes in the operating status of Redwood. Alarm records sent out via Redwood's serial port would be stored in the Model 115's memory, compared to an installer defined priority list, and, as required, cause a service request to be generated. This service request would cause the Model 115's integral modem to automatically dial a service center and leave a status message. In this way, unattended 24-hour monitoring of Redwood would be implemented. The addition of this, or other features is dependent on customer demand. Contact Gordon Kapes, Inc. for details.

1.6 COMPATIBILITY WITH REDWOOD The Model 115's software was written in a manner that allows compatibility with different versions of Redwood system software. The Model 115 uses algorithms to identify differences in Redwood system software, and then automatically adjusts for them. As of the release date of this practice (October, 1989), the Model 115 is compatible with all versions of Redwood software, including Release 3.

1.7 SIMPLE INSTALLATION Installing the Model 115 is fast and simple. Two screws hold the unit onto the right side of the Redwood cabinet. A dedicated cable with a 25-pin plug exits the rear panel and mates with Redwood's serial port. Two 25-pin connectors provide access to the Main and Auxiliary ports. A modular jack provides access to the modem. A power cord that exits the rear panel and connects to a standard 120Vac outlet. There are no configuration switches to set; operating parameters are menu selectable locally via the Main port or remotely using the modem. The finish and coloring of the Model 115 cabinet make the completed installation a complementary addition to Redwood.

1.8 FCC REGISTRATION The Model 115 FCC Part 68 Registration Number is EPR5ZC-10447-MD-E. The ringer equivalence is 0.9B.

1.9 SAFETY COMPLIANCE The Model 115 is Underwriters Laboratories, Inc., Listed Telephone Equipment.

2. Applications

2.1 PRIMARY APPLICATION The Model 115 is intended only for use with the Redwood Digital Telephone System. If you can figure out another use for it, let us know! A generalized, on-site, PBX monitoring system that incorporates many of the Model 115's features is available. It is

the Model 125 and information is available by contacting Gordon Kapes, Inc. The Model 125 will work great with many communications systems, including the ROLM 9751 and CBX series telephone systems.

3. Installation

3.1 WORDS OF CAUTION As with any product, installing the Model 115 requires a safety first approach.
Warning: Never install telephone wiring during a lightening storm. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations. Never touch non-insulated telephone wires or terminals unless the telephone line has been disconnected at the network interface. Use caution when installing or modifying telephone lines.

3.2 ELECTROMAGNETIC INTERFERENCE As with most devices in use today, the Model 115 contains circuitry that produces energy in the radio frequency bands. To keep these wonderful digital gremlins from escaping into "thin air", use only shielded cable between the Model 115 and other equipment. This will avoid interference and maintain compliance with Part 15 of the FCC rules.

3.3 REDWOOD ACCESSORY CARD The Redwood system that the Model 115 is intended to connect to must contain an accessory card. The accessory card contains the circuitry to implement the serial communications port. Purchase and installation of the accessory card is a prerequisite for using the Model 115.

3.4 CHECKING FOR DAMAGE The Model 115 should be inspected for damage immediately upon receipt. A claim should be filed with the shipper if damage is found. A replacement should be ordered if necessary.

3.5 INSTALLATION MATERIALS Included in each Model 115 shipping carton is an installation kit. Each kit contains two 10-32 x 5/8 pan head mounting screws. Other installation materials provided are modular cable and approximately nine inches of adhesive backed Velcro® tape.

3.6 MOUNTING The Model 115 is attached to the right side of the Redwood cabinet using two 10-32 x 5/8 pan head screws, and one piece of Velcro tape. The two screws provide the strength to hold the Model 115 onto the Redwood cabinet, and the Velcro keeps the bottom of the Model 115 steady. On the top of all Redwood cabinets are four threaded inserts, two on each side, that are used to secure an additional Redwood cabinet. In a one cabinet system, these inserts are not used. In a multi-cabinet system, the inserts on the top cabinet are always available, i.e., in the case of a multi-cabinet Redwood system, the Model 115 attaches to the top Redwood cabinet. Start the installation by removing the protective coating from the back of the Velcro tape. Attach the tape along the very lower edge of the right side panel of Redwood. In a moment, this Velcro will "mate" with the piece already attached to the Model 115. Now use the two screws to loosely, but safely, attach the Model 115 to the threaded inserts on the right side of Redwood. Position the Model 115 so that the Velcro strips align with each other -- you may have to do a bit of juggling to get the unit positioned just right -- then tighten the mounting screws.

3.7 CONFIGURING REDWOOD   For correct operation, the baud rate on the Redwood serial port must be set to match that of the Model 115. The default rate on the Model 115 is 1200, and can be changed to 2400 or 4800. For the present time, set the baud rate on the Redwood serial port to 1200. Later, if required, the rate can be changed. If you want the Model 115's Auxiliary port to output CDRs and/or alarms, set Redwood to Start CDRs and/or Start Alarms. Later, you'll configure the Model 115's Auxiliary port.

3.8 MODEL 115 SERIAL PORTS   The Model 115 contains two serial ports, Main and Auxiliary, to which a variety of serial communications devices can be connected. These ports are electrically identical to the Redwood serial port. With the Main and Auxiliary ports, as well as with the Redwood serial port, if nothing is connected to pin 20, it is internally pulled up to the high state, enabling data flow. This can be a problem if a printer or CDR collection device normally attached to the Auxiliary port accidently gets disconnected. Since pin 20 is automatically pulled high, CDR and/or alarm data, if configured to do so, is still sent out the port, even though the device is disconnected.

3.9 CABLING   The Main and Auxiliary ports are wired as Data Communications Equipment (DCE). Most terminals, such as the WYSE 50 and IBM 3151, and personal computers, such as an IBM PC® running Configuration Processor (CP) software, are Data Terminal Equipment (DTE).

If the equipment you connect to is DTE: you need a straight-through cable. As a general rule, if your straight-through cable connects pins 1 to 1, 2 to 2, 3 to 3, 6 to 6, 7 to 7, and 20 to 20, it will link the Model 115's ports to your device.

If the equipment you connect to is DCE: you need a special cable, often referred to as a null modem, modem eliminator, or crossover cable. This cable connects pins 1 to 1, 2 to 3, 3 to 2, 6 to 20, 7 to 7, and 20 to 6.

Refer to Figure 1 at the end of this technical practice for the exact Model 115 serial port implementation.

3.10 MAIN PORT DEVICE   Select the device that will connect to the Main port. It will most likely be a WYSE 50, IBM 3151 with WYSE 50 emulation cartridge, or personal computer running CP software. As a reference, Appendix A provides a sample IBM 3151 configuration; Appendix B applies to the WYSE 50. The required basic configuration for the device is 1200 baud, 7 data bits, 1 stop bit, even parity. Later, if required, the data rate can be changed to 2400 or 4800. Character stop/start control can be implemented via the software XON/XOFF, or hardware DTE Ready (DTR) protocols. If hardware flow control is desired, be certain your cable connects pin 20 on the Main port to the DTE Ready line on your device. Connect the device directly to the serial port on Redwood with the cable. Do not cheat by using a short "test" cable; use the actual cable, even if it runs many feet to a reception area, etc.

Test the device by logging into Redwood and performing some basic functions. After you are certain the device and cable are working correctly, disconnect the plug from Redwood and connect it to the Main port on the Model 115. Be sure to tighten the two screws to secure the plug into the connector. Do not over tighten the screws!

3.11 ATTACHING A PRINTER TO THE MAIN PORT DEVICE   A printer with a serial port can be connected to the device connected to the Main port. On a WYSE 50, the Aux. port is used to connect to a printer. Follow the technical manuals provided with your terminal and printer for connection details. You'll also have to configure the terminal and printer for the correct baud rate, number of data bits, etc.

3.12 AUXILIARY PORT DEVICE   A number of devices can be connected to the Auxiliary port, including printers with serial interfaces and CDR collection devices.

Remember: The Auxiliary port only sends data out. No incoming data, except XON/XOFF control characters, are recognized by the port.

Configure the device for 1200 baud, 7 data bits, 1 stop bit, even parity. Character stop/start control can be implemented via the software XON/XOFF, or hardware DTE Ready (DTR) protocols. If hardware flow control is desired, be certain your cable connects pin 20 on the Auxiliary port to the DTE Ready line on your device. Connect the device directly to the serial port on Redwood with the cable. Do not cheat by using a short "test" cable; use the actual cable.

Test the device by generating CDRs or alarm records. This is based on the assumption that the Redwood system is set to output CDRs and/or alarms. If not, you'll have to enable the Start CDRs and/or Start Alarms function(s) on Redwood. Once you are correctly receiving your test CDRs and/or alarms, disconnect the serial cable from Redwood and connect it to the Auxiliary port on the Model 115. Be sure that you tighten the two screws to secure the plug into the connector. Do not over tighten the screws!

3.13 MODEM TELEPHONE LINE   The telephone line that is to be connected to the Model 115's modem should be terminated on an RJ-11C jack. Once a telephone line is connected to a modem, it is quite difficult to determine if the line is working correctly, i.e., providing dial tone, ringing, etc.

Test the phone line: Obtain an industry standard single-line telephone. Using the modular cable included with the Model 115, connect the RJ-11C to the telephone. Take the telephone off-hook and ensure that you get a clean dial tone. If you do not get dial tone, check the RJ-11C wiring, and confirm that the line is set for loop start. Often in a PBX setting a line will be set for ground start by default. Make sure the line is set for ground start by keeping the telephone off-hook, and using a piece of cross-connect wire to momentarily earth ground the ring lead. If after earth ground you get a dial tone, then the line is set for ground start.

Test the line for outgoing calls: If the line was set for touch tone dialing, make certain you test with touch tones. Current versions of Model 115 software will not dial out, but later versions, which your site might be upgraded to, may require a properly configured outgoing line.

Test the line for incoming calls: This will confirm the telephone number, and ensure that ringing is coming in. Disconnect the telephone and connect the modular cord to the jack labeled TELCO on the back of the Model 115.

3.14 CONNECTING TO THE REDWOOD SERIAL PORT   A cable exits the rear panel of the Model 115, and connects to the Redwood serial port. The cable, labeled RW, is con-

nected to J53 on the Redwood master cabinet. In a multi-cabinet system, be sure to connect to J53 on the master cabinet. The cable is long enough to be placed under the metal covers that protect and shield the back of the cabinet(s). Be certain that you secure the plug to the connector using the two screws on the plug. Do not over tighten the screws.

3.15 CONNECTING TO POWER   Plug the power cord into a standard 120Vac, grounded outlet. If possible, plug into an outlet that is on the same electrical circuit as the associated Redwood system. There is no power switch on the Model 115; so, as soon as you plug in the power cord, the Model 115 will start operating. The top LED, labeled POWER, on the front of the Model 115 should be steadily lit. The status of the other LEDs is not important at this time. This completes the hardware part of the installation.

4. Menu System

4.1 GENERAL   The Model 115 contains an internal operating system that allows the configuration of a number of Model 115 operating parameters. The menu system can be accessed locally, using a device connected to the Main port, or remotely via the modem. In homage to Dennis Hayes, the Model 115 user types "###" as the access sequence.

4.2 MAIN PORT ACCESS TO THE MENU SYSTEM   The Main port user can access the menu system using ### anytime that the modem is not in use. After typing ###, the user will automatically log off from Redwood and connect to the Model 115's menu system. If the modem has accessed Redwood or the Model 115's menu system, the Main port user typing ### will receive an "access denied" message. Once the modem has disconnected, ### will again access the menu system.

4.3 MODEM ACCESS TO THE MENU SYSTEM   If the modem user is connected to Redwood, typing ### will log off from Redwood and access the Model 115's menu system. However, the modem user does not have to login to Redwood prior to accessing the menu system. The remote user should dial the modem number. After the modem answers, do not press the enter key or the space bar; simply type ###. This will bring up the menu system. If the Main port is accessing the menu system when the modem number is dialed, the modem will answer and immediately return a message that says "Busy". After five seconds, the modem will disconnect. This prevents conflicts and minimizes the chance of an error. Once the Main port user has left the menu system, the modem will again allow normal operation, giving the remote user direct access to Redwood or the menu system.

4.4 MAIN MENU FOR THE MAIN PORT USER   Once the menu system has been accessed, the main menu will appear. The main menu gives a number choices, including, but not limited to, Aux Port Configuration, Baud Rate Select, Exit to Telephone System, and Modem Disable Menu. Some of the choices lead to other menus. Selecting Exit to Telephone System will cause the menu system to be exited and the Redwood log in message to be brought up. If Exit is selected by accident, ### will again bring up the main menu.

4.5 MAIN MENU FOR THE MODEM USER   The modem user sees a slightly different main menu from that seen by the Main port user. No Modem Disable Menu selection is present. An additional selection, Hang up, causes the Model 115's modem to immediately disconnect. This command allows a fast, clean disconnect from the menu system and the Model 115.

4.6 CHANGING THE RW AND MAIN PORT BAUD RATES   At this point the Model 115 should be communicating at 1200 baud with Redwood and the device(s) connected to the Main and/or Auxiliary ports. In some installations, it may be desirable to increase the RW and Main port baud rate to give faster BLF and configuration response.

Technical Reminder: The RW port provides the link between the Model 115 and Redwood.

The Model 115 menu system allows the baud rates of the RW and Main ports to be changed from the default rate of 1200; to 2400 or 4800. The baud rates change together, i.e., both can be 1200, 2400, or 4800. (The Auxiliary port is always 1200 baud, and the modem automatically adjusts to 1200 or 300. These rates cannot be changed.)

Baud Rate Change via the Main Port: Access Redwood's menu system via the device connected to the Main port. Go to Redwood's baud rate selection function and change the rate to 2400 or 4800. Immediately after the rate has been changed, the Model 115 will stop correctly communicating with Redwood. The screen may display "garbage" characters. Type ### to access the Model 115 menu system. Use the menu selections to change the RW and Main port baud rates to match the new Redwood baud rate. Messages will be displayed on the device connected to the Main port, instructing you when to change the baud rate of the device connected to the Main port. Paying close attention to these instructions will keep you out of baud rate "never, never land!" Exit the menu system and login to Redwood. If login is not successful, i.e., you get garbled data, momentarily access the main menu of the Model 115 menu system, then again try to login to Redwood. You should now be able to access Redwood without a hitch.

Baud Rate Change via the Modem: The Model 115 RW and Main port baud rates can be changed via the modem, however, this IS NOT the preferred method. This modem accessed menu selection was implemented primarily to allow remote service personnel to examine the baud rate, rather than to change it. If there is an on-site device connected to the Main port, its baud rate must also be changed; a change that cannot be made via the modem.

Please Note: Continue only if no device is currently connected to the Main port, or if you are certain that someone is currently on-site to change the baud rate.

Start by accessing Redwood's menu system via the Model 115's modem. Go to Redwood's baud rate selection function and, WITH GREAT CAUTION, change the rate to 2400 or 4800. If you accidently select a baud rate not supported by the Model 115, such as 300, you're a dead duck. The Model 115 will no longer be able to talk to Redwood, and your modem access will be history. Only connecting a terminal directly to Redwood and selecting a compatible baud rate will get things straightened out.

Immediately after Redwood's baud rate has been changed, the Model 115 will stop correctly communicating with Redwood. Your screen may display "garbage" characters, and the modem may disconnect.

If the modem has not disconnected, type ### to access the Model 115 menu system. If the modem has disconnected, re-dial the modem and, immediately after it answers, type ### to get to the menu system.

Use the Model 115's menu selections to change the RW and Main port baud rates to match the new Redwood baud rate. Exit the menu system and attempt to login to Redwood. If login is not successful, i.e., you get garbled data, use the Model 115 menu system's Hang Up command to disconnect you from the Model 115's modem. Once again dial the Model 115's modem; you now should be able to access Redwood without a hitch. HOLD YOUR HORSES! If a WYSE 50 or compatible terminal is connected to the Main port, it must now be set to match the new baud rate. Once the terminal's baud rate has been changed, ensure that it once again works correctly with the Model 115 and Redwood.

4.7 AUXILIARY PORT CONFIGURATION MENU   The Auxiliary port can be configured to operate in one of four modes. Besides controlling what comes out of the Auxiliary port, the operating mode also dictates what information is sent via the Main port and modem; information that goes out via the Auxiliary port cannot exit via the Main port or modem. The Aux Port Configuration Menu displays the current mode, and allows the mode to be changed. The ESC key is used to return to the main menu.

Port OFF: In this mode, no information is sent out of the Auxiliary port; CDR and alarm information is accessible via the Main port or the modem. Redwood should be configured not to output CDR and alarm records if a printer or storage device is not connected to the device connected to the Main port. When a modem user wants to receive CDR and/or alarm information stored in Redwood's memory, the dump command from the Redwood menu should be used.

Send CDRs Only: In this mode, only CDR records sent by Redwood will be sent out the Auxiliary port; alarm information is accessible via the Main port or the modem. Redwood should be configured not to output alarm records if a printer or storage device is not connected to the device connected to the Main port. When a modem user wants to receive alarm information stored in Redwood's memory, the dump alarms command from the Redwood menu should be used.

Send Alarms Only: In this mode, only alarm information sent by Redwood will be sent out the Auxiliary port; CDR records are accessible via the Main port or the modem. Redwood should be configured not to output CDR records if a printer or storage device is not connected to the device connected to the Main port. When a modem user wants to receive CDR information stored in Redwood's memory, the dump CDRs command from the Redwood menu should be used.

Send CDRs and Alarms: In this mode, all CDR and alarm records sent by Redwood will be sent out the Auxiliary port.

No CDR or alarm information will be sent out via the Main port or the modem.

4.8 MODEM DISABLE MENU   In special circumstances, it may be desirable for the Main port user to disable modem access to Redwood and the Model 115 Menu System. In the disabled mode, a call to the modem will result in the modem answering, a message that says "Busy" being returned to the remote modem, and after a five second pause, the modem hanging up. This disable feature may be useful when diagnostic work is being done on the Redwood data base, where an interruption of data transmission between the Main port and Redwood would be a problem.

Remember: When not disabled, the modem has priority over the Main port in accessing Redwood; a remote user could interrupt important work in process.

The Modem Disable Menu gives two choices: Disable Modem Access and Restore Modem Access. The ESC key is used to return to the main menu.

Disable Modem Access: This selection disables modem access to Redwood or the Model 115's menu system for 30 minutes after the last keystroke is pressed on the device connected to the Main port. This time-out ensures that modem access will always reset; forgetful technicians, we're looking out for you! The modem will stay disabled while data is being sent to the Main port, but will always reset 30 minutes after it stops.

Restore Modem Access: This selection terminates the disable mode and immediately allows the modem to access Redwood and the Model 115 Menu System.

4.9 AUXILIARY PORT WARNING MESSAGE   A warning message may display at the bottom of the Aux Port Configuration Menu:

"Device connected to Aux Port is NOT READY!"
This is provided as a diagnostic tool for use during installation and maintenance. The message appears when pin 20, DTE Ready, of the Auxiliary port is held in the low state longer than 10 seconds. It is useful as it will indicate when the connected device, e.g., a printer or CDR collection device, is not providing correct hardware handshaking, or when the serial connecting cable has not been wired correctly. By adding a 10-second delay, normal, short duration hardware flow control signals on pin 20 will not activate the warning message.

4.10 MENU SYSTEM NO ACTIVITY TIME-OUT   When the Main port user is in the Model 115's menu system, a remote user is prevented from accessing Redwood or the Model 115's menu system; the modem answers, returns a "Busy" message, and then disconnects. To prevent the Main port user from "locking up" the modem, a 15 minute time-out function is always active. If the menu system is accessed via the Main port, and no keystroke is sent by the Main port user for 15 minutes, the menu system is exited, the Redwood log in screen is brought up, and the modem is again able to access the menu system and Redwood.

5. Technical Notes

5.1 AUXILIARY PORT   The Model 115 does not interact with Redwood to start or stop the outputting of CDR and alarm records. Redwood must be configured, using its menu system, to start or stop CDR and alarm output. The

configuration of the Model 115's Auxiliary port simply determines what will happen to data sent out by Redwood. If the Model 115's Auxiliary port is configured to output CDR records, but Redwood is not configured to do the same, no CDR records will come out. Be careful with your setup!

5.2 WHERE CDR AND ALARM INFORMATION CAN BE ROUTED CDR and alarm records that exit the Redwood serial port can be routed to the Auxiliary port, or to the Main port with remote access allowed via the modem. The Model 115 menu system is used to select the path for the CDR and alarm records. For example, CDR records can be sent either to the Auxiliary port OR to the Main port and modem. Alarm records are routed in the same way.

5.3 CDR AND ALARM RECORD FILTERING It is important to understand that all CDR and alarm records are separated from the data that exits Redwood. Once separated, they can exit the Model 115 either via the Auxiliary port OR the Main port and the modem. This routing was implemented so that CDR records, and to a lesser extent alarm records, are never sent out in duplicate, thereby preventing a record tracking nightmare.

5.4 CONFIGURATION RETENTION The Model 115's menu system allows the installer to configure several operating parameters. This configuration data is stored in battery backed memory. A loss of power to the Model 115 will not cause the operating configuration to be lost. The battery is designed to provide memory retention for up to ten years. A more detailed explanation of battery life is given in Section 6 - Circuit Description of this technical practice.

5.5 MEMORY ERROR INDICATION A data integrity check of the Model 115's static random access memory (SRAM) is performed each time 120Vac power is applied. This ensures that the operating parameters stored in SRAM did not get corrupted during the power loss. If it is determined data was corrupted, a warning message will display over the device connected to the Main port. The operating parameters, such as the Auxiliary port operating mode, then revert to the factory default. Use the Model 115's menu system to re-configure the system to the desired operating modes.

5.6 MODEM TELEPHONE LINE SELECTION The Model 115's modem will operate correctly with any loop start telephone line. It is recommended that a dedicated CO loop start line be provided. In this way, the modem can always be accessed by service personnel. An OPS port from the associated Redwood can be used, but is far from ideal. If Redwood has a serious problem, the Model 115's modem may not have access to a working telephone line. Also, direct access to the modem would require that the Redwood system have DID or DISA capability, otherwise 24-hour modem access would not be possible. Are these enough reasons to get a dedicated line?

5.7 DATA FLOW CONTROL The Main and Auxiliary ports, and the modem accept software data flow control. In addition, the Main and Auxiliary ports also accept hardware data flow control. Data flow control allows a communications device, such as printer or terminal, to implement a data transmission stop or start procedure.

Software flow control often uses what is called the XON/XOFF protocol. A device will send the XOFF control character (a non-printable character) to say "stop sending me data". The XON character is sent when it is again ready to receive information.

Hardware flow control uses a separate wire in the serial cable to give an electrical ready/busy indication. Like the Redwood serial port, the Main and Auxiliary ports give the option for pin 20, DTE Ready, to be connected to the hardware flow control connection on the associated communications device (printer, terminal, etc.).

To enable data flow for installations where hardware flow control is not desired, Pin 20 on both the Main and Auxiliary port are automatically held in the high state. Although this is not standard, in order to be consistent, the Model 115 matches the operating characteristics of the Redwood serial port.

5.8 AUXILIARY PORT FLOW CONTROL BUFFER The Auxiliary port operates somewhat differently than the Main port and the modem. The Main port and modem have only enough temporary storage to facilitate flow control. It is anticipated that the devices connected to these two communications paths will not go "off-line". The Auxiliary port is implemented with a data buffer of approximately 4K bytes to allow for the device connected to the Auxiliary port to be temporarily in the "not ready" state. This buffer is added so that a temporary software or hardware flow control stop command will not cause CDR and/or alarm records to be lost. Short duration flow control commands certainly do not require a buffer this size, but situations can arise that require a larger buffer, such as if a printer is attached to the Auxiliary port.

For example: If the printer runs out of paper, a software or hardware stop sending data command is sent to the Model 115. Several minutes might elapse while the paper is being changed. The buffer allows CDR and/or alarm records that are arriving from Redwood to be temporarily stored while the printer is being placed back on-line.

The buffer operates in a first-in first-out mode. Once 4K bytes of data are stored in the buffer, further CDR and alarm records are simply discarded. When the device connected to the Auxiliary port is again placed on-line, the 4K bytes of records are sent, and if new records are received from Redwood, they are stored in the free space of the buffer, awaiting their turn to get sent to the printer. This buffer is not intended to store CDR records for later access via the modem.

5.9 AUTOMATIC RETURN TO BLF A nifty Model 115 function is its ability to return the Main port user to the BLF mode after the modem user has completed accessing Redwood. The Model 115 operating software is able to "learn" Redwood's password, and use it to log into Redwood and return to the BLF mode.

In most cases, a change in the password will be recognized by the Model 115, and return to BLF will work correctly. In rare cases, such as after a new installation or when the battery is changed, the Model 115 will not have the correct password, and will not be able to return to BLF. If the Model 115 is not able to return to BLF, a message on the Main port user's screen will ask the user to log into Red-

wood again. The correct password will be recognized, and the next automatic return to BLF will be successful. The Model 115 accepts defeat gracefully and tries again!

5.10 DUMPING REPORTS FROM REDWOOD The Redwood menu system allows various configuration reports to be sent out the Redwood serial port. The Model 115 will route this data either to the main port or the modem. Redwood has a nasty habit of inserting CDR and alarm records in the middle of the report data. These CDR and/or alarm records are not preceded, or followed by carriage return and line feed control characters. The absence of the normal control characters prevents the Model 115 from separating these CDRs and alarms from the report. Thus a CDR record that should be sent out the Model 115's Auxiliary port is left in the middle of a report. If you want to guarantee a "clean" report, use the Redwood menu system to stop outputting CDRs and alarms, print the report, then again enable outputting of CDRs and alarms. Life is full of compromises...

6. Circuit Description

6.1 GENERAL DESCRIPTION The circuit description is intended to familiarize you with the Model 115 for engineering, applications, and recreational purposes.

6.2 POWER SUPPLY The power supply section produces the five voltages required by the analog and digital circuitry. Nominal 120Vac enters the Model 115 via a three-conductor line cord. This voltage then connects via a fuse to the primary of a step down transformer. The secondary of the transformer is rectified and filtered to provide unregulated ±12Vdc. The unregulated +12Vdc is used by the modem off-hook relay, and connects to three sections of voltage regulator circuitry. The unregulated -12Vdc connects to two sections of voltage regulator circuitry. A linear regulator integrated circuit creates the +5Vdc required by the digital circuitry. Two other linear regulator ICs create the ±5Vdc required by the modem's analog circuitry. Separate +5Vdc power supplies are utilized to isolate the digital and analog circuitry from each other, thus improving modem performance. The remaining two linear regulator ICs create the ±8Vdc used by the EIA-232-D driver-receiver ICs.

6.3 POWER MONITORING/BATTERY/WATCHDOG CIRCUITRY The Model 115's circuitry is greatly simplified through use of a wonderful integrated circuit. This IC implements under voltage sensing, battery backup, and hardware watchdog functions -- functions that previously would have been created using a proverbial boatload of analog and digital components.

This IC monitors the unregulated +12Vdc for an imminent power failure condition. When the unregulated +12Vdc falls below a threshold voltage, a "power failure" signal is sent to the microprocessor, which then starts a power down sequence. Upon power up, the microprocessor is able to perform a "clean" start.

The IC also monitors the +5Vdc used by the SRAM. If this voltage falls below that of the 3V lithium battery, the battery is connected to the SRAM memory.

This same integrated circuit implements a hardware watchdog function, preventing the microprocessor from locking up due to a power or software "glitch". The microprocessor sends a continuous stream of logic pulses

to the watchdog input; if the pulses stop, a reset signal is returned.

6.4 BATTERY LIFE The Model 115 utilizes a 3V lithium battery to maintain SRAM data during the time when 120Vac power is not provided, i.e., during a power failure or physical relocation of the unit. The battery was selected to provided memory backup for 10 years, with a 30% operating duty cycle. This means that the SRAM will be backed up for a cumulative time of 3 years over a 10 year period. This is an extremely generous amount. You could disconnect the Model 115 for months at a time and not have a SRAM data problem. Once this cumulative 3 year time period has been exceeded, the battery must be replaced. Most manufacturers give some silly, meaningless figure about battery life. Without listing the maximum length of battery shelf life (in our case 10 years) and rated duty cycle, you really have no clue what the listed battery backup figure means.

A lithium battery starts with a finite amount of energy in it; it does not recharge. Once that is gone, that's all folks! The Model 115 does not have an automatic means of identifying a lithium battery that needs to be replaced. Any cost-effective circuit that measures battery strength will drain the battery too fast; the test itself is worse than not testing at all! The Model 115's serial number label lists a replace battery date. To be conservative, the date shown is eight years from the year of manufacture.

6.5 MICROPROCESSOR The "heart" of the Model 115 is an HD64180 microprocessor. Really more of a microcomputer, the 64180 is an advanced version of the Z80® microprocessor, combining the industry standard Z80 instruction set with a high level of hardware integration. The 64180 combines in one package: clock, interrupt, memory and I/O port addressing, and two serial communication ports. This greatly reduces the parts count required from that of a usual Z80 implementation.

For those who think the Z80 is outdated: It is estimated that as of 1989 the Z80 family is the volume leader in the 8-bit microprocessor market. It is projected that the Z80 will stay popular through the end of the century!

6.6 MEMORY The Model 115 utilizes 32K X 8 (256K bit) memory integrated circuits. One read only memory (ROM) chip stores the program code. One static random access memory (SRAM) chip is used to store user defined parameters, as well as to provide general purpose memory for the program. If future requirements demand it, six more SRAM chips can be added at the factory. SRAM was selected because of its ability to be battery backed using simple support circuitry.

6.7 SERIAL COMMUNICATIONS PORTS AND DRIVERS The Model 115 contains three serial communication ports, identified as RW, Main, and Auxiliary. Two of the ports are part of the microprocessor's resources, the third is implemented using a universal asynchronous receiver-transmitter (UART) integrated circuit. The data rate of the two microprocessor-based serial ports, Main and RW, is software configured for 1200, 2400, or 4800 baud, with the default at 1200.

The UART chip, which implements the Auxiliary port, has been hardware configured for 1200 baud and cannot be changed. All transmit, receive, and data flow control lines are buffered using integrated circuits that meet the EIA-232-D specifications. No out-of-date RS-232-C for us! The logic level transmit data is converted to ±8Vdc; input bipolar signals are converted to logic level.

The RW port is configured as Data Terminal Equipment (DTE), which interfaces with the Data Communications Equipment (DCE) serial port on Redwood. The Main and Auxiliary ports are implemented as DCE. They do not match the EIA specifications exactly, as they have pull-up resistors on pin 20, DTE Ready. This is done to match the implementation of Redwood's serial port.

Although the Auxiliary port is a fully implemented bidirectional port, the Model 115's software configures the port strictly to transmit data, i.e., the Auxiliary port is an output port only -- only XON/XOFF flow control characters are acknowledged.

Figures 1 and 2, located at the end of this practice, give a detailed electrical description of the ports.

6.8 LED INDICATORS   Six light emitting diodes (LEDs) act as operating status indicators. The POWER LED is connected to the microprocessor reset circuitry. During normal operation it lights steadily. If the hardware watchdog circuit requests a system reset, it flashes once per second. The four DATA LEDs are controlled by the microprocessor. They are lit for a short period of time whenever data is transmitted or received over their respective communication paths. These LEDs give a simplified representation of the data flow over the serial ports and the modem. Unlike the transmit and receive LEDs on a standard modem, they do not indicate the direction of the data. The MODEM OH LED indicates the status of the telephone line off-hook relay.

6.9 MODEM   A Bell standard 212A modem is implemented using two integrated circuits and a data access arrangement (DAA) circuit. These ICs utilize VLSI to cram a lot of circuitry into a very small volume. The DAA is used to link the ICs with the telephone line. A sealed, bifurcated contact relay controls the connection of the telephone line to the coupling transformer. Protection components prevent excessive signal levels from reaching the ICs. An optical coupler-based ring voltage detection circuit provides the telephone line ringing logic signal. The DAA does not provide A/A1 control as it was deemed this was not necessary.

7. Specifications

General Parameters

COMPATIBILITY
All versions of Redwood operating software, including Release 3, as of October, 1989

SAFETY COMPLIANCE
Underwriters Laboratories, Inc., Listed Telephone Equipment

FCC REGISTRATION
Registration Number: EPR5ZC-10447-MD-E
Ringer Equivalence: 0.9B

RELIABILITY
MTBF 20.3 years, per Method I of Bellcore TS-TSY-000332, Issue 2, July 1988

RADIATED NOISE COMPLIANCE
The Model 115 has been tested with a Class A computing device and has been found to comply with Part 15 of the FCC Rules.

POWER REQUIREMENT
120Vac, 0.25 Amps, 50/60 Hz

FUSE
1/4A, 3AG type, not field replaceable

LED INDICATORS
6 LEDs display power and modem off-hook status, and represent data transmission activity on the four data paths

CONFIGURATION SWITCHES
No internal or external switches contained on Model 115

CONFIGURATION
Software selectable locally via the Main port, or remotely via the modem

ENVIRONMENT
0 to 50 degrees C, humidity to 95% (no condensation)

DIMENSIONS
12.3 inches high (31.2cm)
 2.5 inches wide (6.4cm)
10.5 inches deep (26.7cm)

Integral mounting bracket adds:
0.1 inches high (0.3cm)
1.1 inches wide (2.8cm)

WEIGHT
8.6 pounds (3.9kg)
Shipping Weight: 10.0 pounds (4.5kg)

MOUNTING
Two #8 screws, and one length of Velcro® fastening material, included in Model 115 shipping carton

RW Port (Link to Redwood) Parameters

PORT TYPE
Data Terminal Equipment (DTE)

DATA FORMAT
Asynchronous, 7 Data Bits, 1 Stop Bit, Even Parity

DATA RATE
1200, 2400, or 4800 baud; selectable in tandem with Main port; default is 1200

FLOW CONTROL
XON/XOFF, DCE Ready (DSR), and DTE Ready (DTR)

Main Port Parameters

PORT TYPE
Data Communications Equipment (DCE)

DATA FORMAT
Asynchronous, 7 Data Bits, 1 Stop Bit, Even Parity

DATA RATE
1200, 2400, or 4800 Baud; selectable in tandem with
RW port; default 1200

FLOW CONTROL
XON/XOFF and DTE Ready (DTR)

Auxiliary Port Parameters

PORT TYPE
Data Communications Equipment (DCE)

DATA FORMAT
Asynchronous, 7 Data Bits, 1 Stop Bit, Even Parity

DATA RATE
1200 Baud; not changeable

FLOW CONTROL
XON/XOFF and DTE Ready (DTR)

TRANSMITTER BUFFER
Approximately 4K bytes; first-in/first-out. CDR and alarm
data from Redwood discarded when buffer is full. Buffer
does not store records for access via modem.

Modem Parameters

COMPATIBILITY
Bell 212A, CCITT V.22

DATA FORMAT
Asynchronous, 7 Data Bits, 1 Stop Bit, Even Parity

DATA RATE
1200 or 0-300 bits per second, auto-selected

FLOW CONTROL
XON/XOFF

NUMBER OF RINGS TO ANSWER
3 Rings

MODEM TELEPHONE LINE REQUIREMENTS
2-wire, loop start, bridged ringing 15-68 Hz, 40 to 150 Vac

MODEM TELEPHONE LINE CONNECTION
Mates with USOC RJ-11C
Modular cable included in Model 115 shipping carton

AUDIBLE MONITORING
None

8. Incorrect Operation

8.1 REVIEW PRACTICE Should problems arise in the
operation of the Model 115, please review Section 3 - Instal-
lation and Section 4 - Menu System of this practice.

8.2 CHECK CONFIGURATION - REDWOOD Be certain that
Redwood has been set for the same baud rate as the Model
115. If CDRs and/or alarms are configured in the Model
115's menu system to be sent from the Model 115's
Auxiliary port, be certain that Redwood has been configured
to output CDRs and/or Alarms.

8.3 CHECK CONFIGURATION - SERIAL DEVICES Be sure
that the device connected to the Main port is set to the
same baud rate as the Model 115. In addition, the device
must be set for 7 data bits, 1 stop bit, even parity. Check
that the device connected to the Auxiliary port is set for
1200 baud, 7 data bits, 1 stop bit, even parity.

8.4 CHECK CONFIGURATION - MODEL 115 MENU SYSTEM
Double check that the required operating parameters are
selected using the Model 115's menu system. Is the
desired baud rate selected? Is Redwood set to match this?
Is the Auxiliary port configured to send out what you want?
The default selection is to send nothing.

8.5 CABLES Take time to carefully check your serial
cables. Don't assume that a pre-made cable implements the
pin-out you require. Relish the thought that the person who
designed the dreadful DB-25 connector, along with the per-
son who selected it for the RS-232 standard, are now play-
ing cards together in connector hell!

8.6 CONFIGURATION LOSS In rare cases, upon Model
115 power up, an error message may display on the device
connected to the Main port. The message will state that due
to servicing or loss of battery backup power, the configura-
tion stored in memory has been lost, and that the defaults
have been restored. The message informs you to use the
Model 115 menu to re-configure your operating parameters.
If this message appears, check the third line of the serial
number label for the battery replacement date. If the date
has been reached or exceeded, the Model 115 should be
returned to Gordon Kapes, Inc. for battery replacement. If
the date has not been reached, the desired configuration
should be reset, and a simple test performed. Once the
menu system has been used to reset the configuration, un-
plug the unit. Wait at least 10 minutes, then plug the unit
back in. If the error message again appears, the battery
may be dead, or a problem exists in Model 115 circuitry.
Return the Model 115 to Gordon Kapes, Inc. for service. If
no error message appears, the unit is ready for operation.
The first error message may have been caused by a power
glitch or other aberration.

8.7 FUSE The Model 115 contains a 1/4 Amp, 3AG type
fuse. Only a serious failure of Model 115 circuitry will
cause the fuse to blow. Evidence that the fuse has blown is
the failure of any of the six LEDs to light upon plugging the
power cord into a working 120Vac outlet. If this is the
case, the unit should be returned to Gordon Kapes, Inc. for
service.

Warning: Opening the Model 115's cabinet will expose you
to potentially lethal voltages. DO NOT OPEN THE CABINET!
The fuse is located inside the cabinet, connected via the
power cord to potentially lethal voltages, and is not intended
to be changed by installation or field service personnel.

8.8 SAVE TIME You are encouraged to call Gordon
Kapes, Inc. for technical support. We much prefer a

telephone call BEFORE you tear your hair out! We do not have a problem "walking" you through an installation, or performing a verbal review with you prior to you actually getting started. Please have these items with you: a copy of this technical practice, Redwood documentation, documentation for the serial device(s) you will be installing, and adequate tools. In addition, it is very helpful to have a good digital VOM, such as the wonderful Fluke 70 or 80 series, a 2500-type telephone or linepersons handset, and an RS-232 LED monitor box. (For those rare cases, it's not a bad idea to have some aspirin and the telephone number of a ribs joint that delivers!)

9. Maintenance

9.1 NO NORMAL MAINTENANCE The Model 115 requires no normal maintenance.

9.2 LITHIUM BATTERY REPLACEMENT One coin-type, socketed, lithium battery is used to protect the contents of memory during momentary power outages. The battery is expected to last 10 years under normal conditions. On the rear panel of the Model 115 is the serial number label. The third line of this label indicates the battery replacement date. This date is 8 years after the Model 115 was manufactured. There is a 2 year grace period before the battery, theoretically, loses its energy. Use this date as a guide for when the battery should be replaced. Because of the potential danger in removing the Model 115's cover, battery replacement should ONLY be performed by Gordon Kapes, Inc.

Please Note: If, in a dire emergency, the battery does have to be replaced in the field -- BE CERTAIN THAT THE MODEL 115 IS DISCONNECTED FROM THE 120VAC AND THE TELEPHONE LINE.

Failure to do this will expose you to potentially _lethal_ voltages. After the power cord and telephone line are disconnected, the cover can be removed, and the battery exchanged with an exact replacement. Ensure that the new battery is installed with the "+" terminal facing up; you should be able to read "+" after the battery is installed.

10. Repair and Replacement

10.1 NOT SO FAST Statistically, most equipment returned to Gordon Kapes, Inc. for repair actually has nothing wrong with it. A telephone call to Gordon Kapes, Inc. technical support can often help to get the equipment operating correctly. We don't mind spending time with our customers getting a site up and running.

10.2 SEND IT BACK If you determine that the Model 115 is defective, return for repair or replacement according to the Gordon Kapes, Inc. Warranty/Repair and Return policy.

10.3 ONLY WE FIX IT In the event repairs are ever needed on your Model 115, they should only be performed by Gordon Kapes, Inc. or an authorized representative. For further information, contact Gordon Kapes, Inc.

11. FCC Requirements

11.1 TYPE OF SERVICE Your Model 115 is designed to be used on standard device telephone lines. The Model 115 connects to the telephone line by means of a standard jack called the USOC RJ-11C. Connection to telephone company-provided coin service (central office implemented systems) is prohibited. Connection to party line service is subject to state tariffs. We are certain you'll want to connect the Model 115 to a party line, but check it out with your state first. Party, party, party!

11.2 TELEPHONE COMPANY PROCEDURES The goal of the telephone company is to provide you with the best service it can, within the constraints of receiving a good return on shareholder equity. In order to do this, it may occasionally be necessary for them to make changes in their equipment, operations, or procedures. If these changes might affect your service or the operation of your equipment, the telephone company will give you notice, in writing, possibly in advance, to allow you to make any changes necessary to maintain uninterrupted service.

If you have any questions about your telephone line, such as how many pieces of equipment you can connect to it, the telephone company will provide this information upon request.

In certain circumstances, it may be necessary for the telephone company to request information from you concerning the equipment which you have connected to your telephone line. Upon request of the telephone company, provide the FCC registration number and the ringer equivalence number (REN) of the equipment which is connected to your line; both of these items are listed on the equipment label. The sum of all of the RENs on your telephone line should be less than five in order to assure proper service from the telephone company. In some cases, a sum of five may not be usable on a given line.

11.3 IF PROBLEMS ARISE If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When practical, they will notify you in advance of this disconnection. If advance notice is not feasible, you will be notified as soon as possible. When you are notified, you will be given an opportunity to correct the problem and be informed of your right to file a complaint with the FCC. You have the right to remain silent, if you waive your right to remain silent...

Specifications and information contained in this technical practice subject to change without notice.

Figure 1 Main and Auxiliary Ports Connection Diagram

Configured as modified EIA-232-D DCE.
Connector Type: 25-pin Connector (female)

Plug Pin	Direction	Description
2	To Model 115	Transmitted Data
3	From Model 115	Received Data
5	From Model 115	Clear to Send
6	From Model 115	DCE Ready
7	NA	Signal Ground
20	To Model 115	DTE Ready

Notes

NA: Not Applicable

Clear to Send is held high and does not change state.

DTE Ready can be used by the connected device for hardware character stop and start control.
It is internally pulled to the high state, enabling data flow if DTE Ready is not connected.

Plug pin 1, shield, is not connected on DCE equipment.
Cable shield wire will pick up shield via Plug pin 1 of connector on DTE device.

Figure 2 RW Port (Link to Redwood) Connection Diagram

Configured as EIA-232-D DTE.
Connector Type: 25-pin Plug (male)

Plug Pin	Direction	Description
1	NA	Shield
2	From Model 115	Transmitted Data
3	To Model 115	Received Data
6	To Model 115	DCE Ready
7	NA	Signal Ground
20	From Model 115	DTE Ready

Notes

NA: Not Applicable

Shield connected to Signal Ground via 0.1uf capacitor

Appendix A   IBM 3151 - Suggested Setup

IBM 3151 must have WYSE 50 emulation cartridge installed.

General	Communication	Printer	Function

Machine Mode	=	WYSE 50/50+
Enhance Mode	=	Off
Screen	=	Normal
Row and Column	=	24 x 80
Scroll	=	Jump
Auto LF	=	Off
CRT Saver	=	Off
Line Wrap	=	On
Attribute	=	Screen
Return/Enter	=	CR/CR
Word Processing	=	Off
Protect	=	Normal

General	**Communication**	Printer	Function

Operating Mode	=	Echo
Line Speed (bbs)	=	1200
Word Length (bits)	=	7
Parity	=	Even
Stop Bit	=	1
Parity Check	=	Off
Line Control	=	IPRTS
Pacing	=	On
Block End	=	US/CR
Edit Mode	=	Local
Key Board Lock	=	Disable

General	Communication	**Printer**	Function

Line Speed	=	1200
Word Length	=	7
Parity	=	Even
Stop Bit	=	1

General	Communication	Printer	**Function**

Recall	=	Save (Default)
Reset Terminal Clear Status	=	Mode Adjust

Appendix B   WYSE 50 - Suggested Setup

HANDSHAKE = XONXOFF	SCREEN = 80	CURSOR = BLOCK	BLINK? = ON	MODE = FDX

DATA BIT = 7	STOP BIT = 1	PARITY BIT = EVEN	MODEM PORT BAUD RATE = 1200

BLK END = US / CR	AUTO NL = ON	CR = CR	AUTO SCRL = ON	AUX BAUD R = 1200

SCRL = JUMP	STATUS = ON	S. SAVER = OFF	PROT = DIM	TEST = OFF

KEYS? = US/UK	RET/ENTER = CR / CR	COMPATIBLE MODE = WY50	ENHANCE = OFF