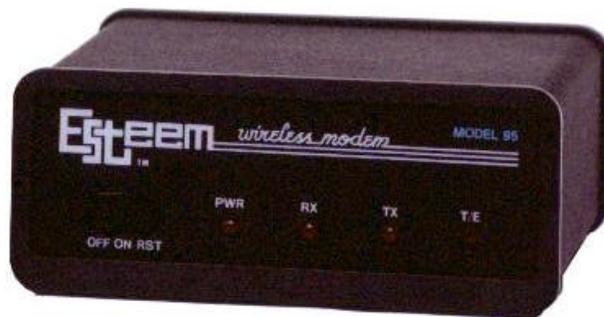


ESTEEM

Wireless Modems

ESTeem MODELS 85, 95, 96, & 98 USER'S MANUAL

Firmware Versions 4.18 and above.
February 1997



Electronic Systems Technology, Inc.



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CHAPTER 1

STARTING OUT

BEFORE YOU START

ESTEEM UTILITY

Installing ESTeem Utility Software - DOS

Installing ESTeem Utility Software - Windows

Running The Program

STARTING OUT

BASIC ESTEEM PROGRAMMING

HELP Functions

Saving A Program

Restoring Factory Defaults

CHAPTER 1 STARTING OUT

BEFORE YOU START

Congratulations on your purchase of the ESTeem Wireless Modem! This section of the manual will describe the basic functioning and programming of the ESTeem to get your wireless network up as soon as possible. It is recommended that any first time user of the ESTeem and those that are unfamiliar with its operation complete all steps in this section before proceeding.

Take a few minutes to inventory your equipment before you proceed. Report any missing or damaged items to Customer Support as soon as possible. We at Electronic Systems Technology, Inc. (EST) are constantly trying to improve our products and support system so if you have any comments or suggestions on improvement of this manual, please contact us at (509) 735-9092.

The completion of this section requires loading the ESTeem Utility program on your computer. The following section will describe the installation and use of this valuable utility program.

ESTEEM UTILITY

The ESTeem Utility is designed to assist the ESTeem user in programming and troubleshooting. The Utility covers basic operation, programming, PLC applications, and diagnostics of the ESTeem.

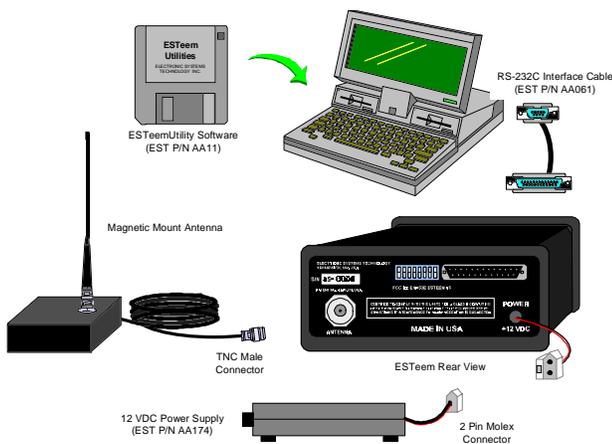


Figure 1: Installation Diagram

Installing ESTeem Utility Software-DOS

1. Boot-up the computer using DOS.
2. Insert the 3.5 inch ESTeem Utility Program into drive A. Reference Figure 1.
3. Select drive A from DOS by typing A: and press RETURN.
4. Type INSTALL followed by pressing RETURN.
5. The ESTeem Utility and Diagnostic Programs will be loaded on to your computer's hard drive.

Installing ESTeem Utility Software-WINDOWS

1. Insert the ESTeem Utilities Disk in drive A, or type the appropriate drive for your system.
2. Select RUN from the File menu.
3. Type A:\install on the RUN line.
4. Follow the procedures in the installation program.
5. Remove the ESTeem Utility Program from drive A and store in a safe place.

Running The Program

1. To run the program, type EST-U followed by a RETURN. Figure 2 shows an example of the menu of the ESTeem Utility program. If you see this menu, you have successfully completed the installation of the ESTeem Utility software.

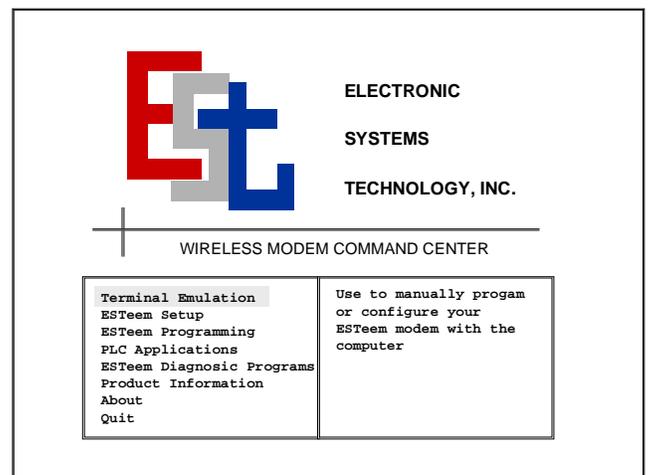


Figure 2: ESTeem Utility Main Menu

CHAPTER 1 STARTING OUT

STARTING OUT

This section covers the basics of operating the ESTeem wireless modem. If this is your first experience with the ESTeem wireless modems or you are unclear on how to set the frequency, squelch, or test communication, the [ESTeem Setup](#) section will guide you through the basics of wireless communication.

1. Select [ESTeem Setup](#) from the main menu. A window like the one in Figure 3 will be displayed. This window is a check sheet for setting all

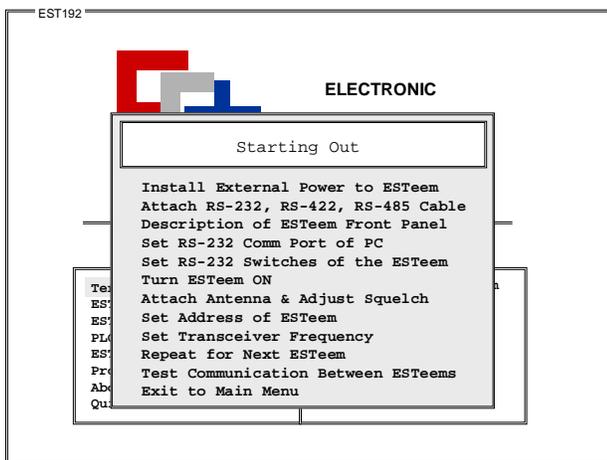


Figure 3: Starting Out Menu

operating parameters of the ESTeem. As you complete each section, a check mark will be displayed next to the item you finished. This will allow you to verify that all steps were taken in programming the ESTeems to communicate. Proceed to step 2.

2. Select [Install External Power to ESTeem](#) from the menu. You are instructed to plug the power converter into the power source and the ESTeem modem. The voltage and current specifications are displayed. The ESTeem model AA174 power supply can be used with all ESTeem products. Press any key to proceed.
3. Select [Attach RS-232, RS-422, RS-485 Cable](#) from the main menu. All the cable configurations for the ESTeem serial port are listed. Press ENTER to scroll through the pin-outs. Press the ESC key when finished. Attach a serial cable to the computer and ESTeem modem.

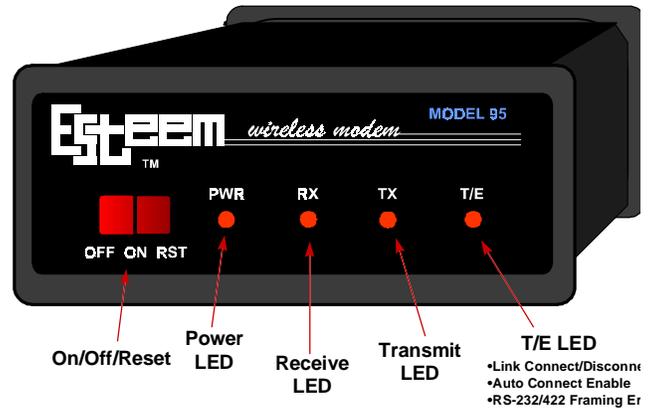


Figure 4: ESTeem Front Panel

Note: A standard 9-Pin serial port on a computer to ESTeem interface cable is the ESTeem AA061 (Figure 1).

4. The [Description of ESTeem Front Panel](#) section will show the location and description of the four lights on the front of all ESTeem modems (Figure 4). For example, place the cursor dot over the PWR location and press ENTER. A small dialog on the meaning of the PWR light indicator will be displayed. Familiarize yourself with the meaning of all the display lights on the ESTeem and press ESC to continue.
5. Select [Set RS-232 Comm Port of PC](#) and press ENTER. This section will configure the communications port on your computer to operate

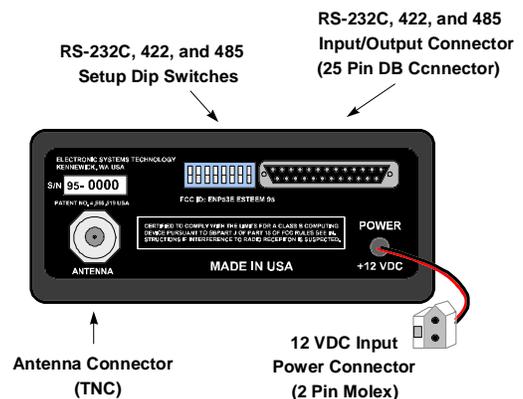


Figure 5: ESTeem Rear Panel Diagram

CHAPTER 1

STARTING OUT

with the ESTeem modem. Select the operating parameters you wish or leave at the default of 9600,N,8,1. Press the control key and the enter key at the same time (CTRL-Enter) to select your choice.

6. This next section is titled Set RS-232 Switches of the ESTeem. Press ENTER and the window will display how the RS-232 switches on the rear of the ESTeem (Figure 5) need to be set to match the configuration of the computer's communication port that we set in step 5. Configure the switches on the ESTeem to match those listed in the window and press any key to continue.
7. Select Turn ESTeem ON. If your power cord and serial interface cable are installed correctly, the ESTeem welcome message will be displayed. This will confirm communications between computer and the ESTeem. If you do not see the welcome message or the computer displays an error in communication, follow the on-line troubleshooting procedure that will be displayed.
8. Select Attach Antenna & Adjust Squelch from the menu. This section will give you instructions on antenna placement and installation. Install antenna and press the ENTER key to set the squelch. Proceed to step 9.
9. This section of the utility will set the receiver squelch on the ESTeem. The ESTeem's radio communication protocol will not allow the modem to transmit if the ESTeem has a solid receive light due to outside interference. Look on the front of the modem and adjust the squelch to as high a level as possible that will keep the receive light out when other ESTeems are not transmitting. Press ESC to leave this section.
10. Press Set Address of ESTeem. You must give each ESTeem a unique address in the system. Type in the address number and press ENTER to continue.
11. Select Set Transceiver Frequency. This will allow you to configure the ESTeem's operating frequency. Set all ESTeems on the same frequency for operation within this section. Press CTRL-Enter to continue.
12. You have just configured all operating parameters within the ESTeem. If this is your first ESTeem you have programmed for testing, press the Repeat for next ESTeem and all check marks will be erased. Proceed to step 2 and complete all items for the next ESTeem. If you have at least two ESTeems programmed and wish to test communication, proceed to step 13.

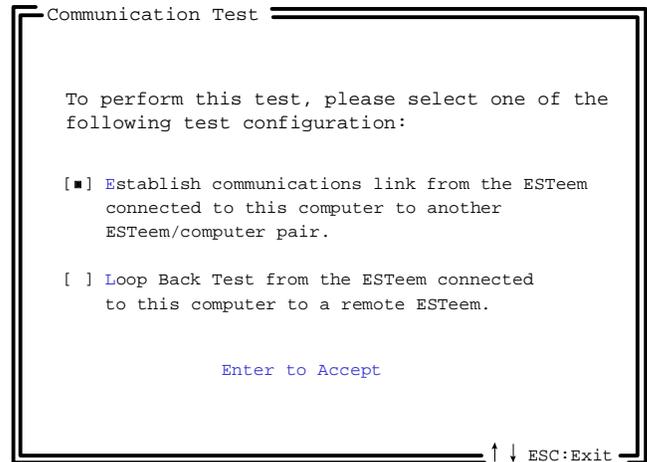


Figure 6: Communications Test Window

13. Press Test Communication Between ESTeems. This section will allow you to test the radio frequency (RF) communications between two or more ESTeems. Two types of tests are listed in this window (Figure 6). If you have a computer attached to both ESTeems proceed to step 14 and if you only have one computer to test both ESTeems proceed to step 15.
14. The first test will be used if you have a computer attached to both ESTeems. Select the first of two items and press ENTER. Follow the instructions on the screen to establish a communication link between modems.
15. This second test will allow you to use the remote ESTeem as a digi-repeater for your local modem. This procedure is explained in the window and can test communication with only one computer.
16. You now have completed the basic programming and setup of your ESTeem modems. You have tested their operation with each other and are now ready to proceed in programming them for your application. Press Exit to Main Menu and continue with the programming of the ESTeem for your application.

BASIC ESTEEM PROGRAMMING

Most of the ESTeem commands outlined in this section have been automatically input to the modem by the ESTeem Utility program. A few of the commands used most often in troubleshooting and programming are covered here. These commands can be programmed to the modem directly by the Terminal Emulation section of the utility or by any other terminal software package.

CHAPTER 1

STARTING OUT

HELP Functions

The ESTeem has over a hundred software commands to aid the user in their application. The HELP command allow the user to list the various software commands and their respective values.

From the COMMAND mode, type HELP<cr>. Your display should list the following:

Help switches are:

ALL (Lists all settings).
CHANGE (List settings changed from factory default).
CONTROL (List settings dealing with control).
PLC (List settings for PLCs).
RADIO (List settings for ESTeem radio).
RS232 (List settings for RS-232/422/485)
SETUP (List settings for control).
SYSTEM (List settings for system).

These are the different software categories.

Example: HELP SETUP<cr> , will list all the programmable variables and their settings for the SETUP category.

You can interrogate a discrete software command by just typing the command followed by a <cr>.

Example: ADD<cr> , will list the current address saved in the connected ESTeem.

Note *Appendix E of this manual will have the complete listing of software commands and categories for the factory default of the ESTeem.*

Saving A Program

A program is saved by typing in the SAVE command at the CMD: prompt. The programming variables that have been changed will be written to the non-volatile memory.

The programming parameters will be loaded each time the modem is powered up or reset.

Restoring Factory Defaults

The ESTeem has a very simple procedure to restore the program variables in the unit to the factory default setting. When the FA<cr> command is entered from the command mode the ESTeem will be configured from a variable table located in its EPROM. It is a good practice to restore the ESTeem to a factory defaults before any programming of the unit.

To ensure the modem is in the COMMAND MODE to set it back to the factory default perform the following:

1. Set Bit 8 on the RS-232 setup switches to the OFF position.
2. Reset the ESTeem.
3. Type FA<cr> and the ESTeem welcome message should be displayed. The characters may not be echoed on the screen.
4. Type SA<cr> to save the factory default table.

CHAPTER 2

MODES OF OPERATION

COMMAND MODE

CONVERSE MODE

TRANSPARENT MODE

HARDWARE MODE CONTROL

CONDITIONAL TRANSPARENT MODE

SEMI-TRANSPARENT MODE

HAYES EMULATION MODE

CHAPTER 2

MODES OF OPERATION

The ESTeem has three major modes of operation, Command, Converse, and Transparent. This chapter of the manual describes each one of these modes.

COMMAND MODE

The COMMAND Mode (CMD: prompt) is the default mode that the ESTeem initially enters on power-up or after a hardware or software reset. From this mode the user can command or program the ESTeem. In this mode the user may access the various program commands to configure the ESTeem for the specific application. These values can be stored in nonvolatile memory within the ESTeem by the use of the SAVE command. The ESTeem reads these setup parameters stored in memory on power-up or RESET.

When programming in the COMMAND Mode, the user need only enter enough characters to uniquely identify the respective command.

Example: CMD:ADD 15 <cr>

This enters the source address of the ESTeem to the decimal value of 15. The first three letters ADD were enough for the ESTeem to uniquely identify the command for ADDRESS. The number of characters that need to be typed varies depending upon the command being entered. In some cases, four or even more letters may have to be entered in order for the identification to be uniquely determined. Up to ten commands can be written on the same line if separated by a colon.

Example: CMD:ADD 15:SETC 2:SAVE <cr>

CONVERSE MODE

This mode allows bi-directional communication from the input/output device attached to the ESTeem to a destination ESTeem and its respective input/output device. The ESTeem will automatically switch to the CONVERSE Mode after the initial CONNECT has been made.

When the ESTeem is in the CONVERSE Mode the * prompt will be displayed. The ESTeem will remain in the CONVERSE Mode until the radio link has been broken or by typing a control character defined by the user with the COMMAND variable.

The factory default for the COMMAND variable is CTRL C. You can return to the CONVERSE Mode from the COMMAND Mode by typing CONV <cr>.

When you are in the CONVERSE Mode the echoing of the character comes from the ESTeem if ECHO = ON (factory default) has been programmed in the ESTeem.

Transmitting Data

The ESTeem will transmit data from the CONVERSE Mode if one or more of the following conditions have been met.

1. The ESTeem transmit buffer has been filled. The size of the transmit buffer is defined in the ESTeem by the PACKLEN variable. This variable is programmable from 1 to 1010 bytes. Factory default is 1010.
2. The ESTeem receives a SENDPAC (send packet) character from the RS-232C input data stream. The SENDPAC variable can be defined from 0 to 255 by the user. Factory default is 13 (carriage return). The SENDPAC character is also transmitted by the ESTeem. In file dump applications the SENDPAC character can be programmed to be the EOF (end of file) character transmitted from the sending device (ie; CTRL Z, CTRL G, etc.).
3. Termination control timer. The termination control timer is enabled by the TERMC (on/off) command. When enabled, the termination timer starts from the time the last transmit buffer has been updated in the RS-232C port. If the termination timer expires before another character is received or transmitted, the contents of the ESTeem transmit buffer will be transmitted. The waiting time of the timer is defined by the TERMT variable (termination time). The programming range of the TERMT variable is 1-255 (one unit equals 16.67 ms.). Factory default values are TERMC = OFF and TERMT = 10. It is noted that when the termination timer is used, the SENDPAC variable is usually programmed to be a character that is non occurring in your data stream (ie; SENDPAC = 255) so that premature transmission is not caused.

CHAPTER 2

MODES OF OPERATION

TRANSPARENT MODE

The TRANSPARENT Mode allows the ESTeem to pass all data characters (O-255 or 0-FF hex) using 8 data bits.

To program the ESTeem in the TRANSPARENT mode the SETMODE (on/off) and SETTRANS (on/off) commands must be enabled (SETMODE = ON and SETTRANS = ON) and switch Bit 8 to ON (RS-232C Setup Switch). The SETMOD command will defeat the SENDPAC and COMMAND variables and will put the ESTeem in the transparent mode when Bit 8 is ON.

The SETTRANS command when enabled will program the following discrete commands:

```
AUTOLF   = OFF  ECHO = OFF   EDIT = OFF
PROMPT   = OFF  TYP5 = OFF
```

PLEASE NOTE: When SETTRANS is enabled the screen will go blank because ECHO has been disabled, therefore this should be the last variable programmed before the SAVE command.

The transmission of the data packets can only be accomplished by enabling the termination control commands (TERMC and TERMT) or the PACKLEN buffer being filled. The value of TERMT should be slightly longer than the maximum delay encountered during RS-232C transmission. If this time is set to short, the ESTeem will truncate your data stream improperly.

When using the TRANSPARENT Mode, data flow control is by hardware handshaking only. Hardware handshaking is initiated by enabling hardware flow control (XHF = ON) or the Request to Send/Clear to Send lines (RTS_CTS = ON) and disabling software flow control (XSF = OFF) in the ESTeem.

The SETCON (Set Connect) or ALTERO (Alternate Route) commands must be used to define the node that you want to communicate with because while in the TRANSPARENT Mode you can not communicate to the ESTeem in the COMMAND Mode unless you use the Hardware Mode Control line (see explanation this chapter).

To remove the ESTeem from the TRANSPARENT Mode the user must perform the following:

1. Switch Bit 8, Off on the RS-232C Setup Switch.
2. Reset the ESTeem from the front panel switch.
3. Type FA <cr>. The characters FA will not be echoed on your CRT because the ECHO command in the ESTeem is disabled.

HARDWARE MODE CONTROL

The MODECON (Mode Control) command is provided in the ESTeem to change the mode of the ESTeem modem from COMMAND Mode to CONVERSE or TRANSPARENT Mode via a hardware control line. The hardware line is located on pin 19 of the RS-232C connector. If MODEC = HARDWARE, a "low or 0" on pin 19 (-3 to -15 vdc) will put the ESTeem in the COMMAND Mode and a "high or one" on pin 19 (3 to 15 vdc) will put the ESTeem in the CONVERSE or TRANSPARENT Mode. The factory default is SOFTWARE.

Pin 6 on the ESTeem RS-232C connector provides a feedback status to the user when MODECON is set to HARDWARE. A "high or 1" condition on pin 6 indicates the ESTeem modem is in the COMMAND mode. A "low or 0" condition on pin 6 indicates the ESTeem modem is in the CONVERSE or TRANSPARENT mode.

CONDITIONAL TRANSPARENT MODE

This mode is a special version of the TRANSPARENT Mode. This mode is entered by typing the following from the COMMAND Mode:

```
TRANS X <cr>
```

The "X" specifies the number of packets to be sent before returning to the COMMAND Mode. If the argument is set to zero or not entered, then the original form of the Transparent Mode will be executed. When using this command the ">" prompt will be displayed on your CRT.

SEMI-TRANSPARENT MODE

This mode should be utilized when sending a non-ASCII file and there is a possibility that the SENDPAC character could be contained in the transmitted data set.

CHAPTER 2

MODES OF OPERATION

Perform the following prior to programming the ESTeem to initialize the unit to factory default settings:

1. Turn Bit 8, OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters may or may not be echoed by the CRT.

ESTeem

```
-----  
ADD      xxx    xxx = your address  
SETC     yyy    yyy = destination address  
TERMC    ON  
TERMT    1  
SENDP    255  
EDIT     OFF  
SAVE
```

If EDIT is off, and SENDPAC = 255, the SENDPAC character is disabled. This character when received will not cause packet transmission and will be passed as normal data. The TERMC and TERMT commands are used to transmit the contents of the ESTeem transmit buffer.

Software flow control in this example is still enabled (factory default XSF = ON) therefore the ESTeem will pass all characters except the data flow control characters for Xon/Xoff.

HAYES MODE EMULATION

The ESTeem modem is placed in the Hayes Emulation Mode by setting the HAYES (on/off) software command to ON.

When the HAYES command is enabled (HAYES = ON) the ESTeem will respond to certain Hayes modem commands from the RS-232C port.

The HAYESTIM (x) command (Hayes protocol termination sequence delay) is used to define the delay which terminates the Hayes protocol sequence. Listed below are standard values for "x".

11 = 4800 b/s 22 = 2400 b/s 44 = 1200 b/s
45 = 1173 b/s 88 = 600 b/s

Factory default for HAYES = OFF and HAYESTIM = 45.

Appendix D lists the Hayes Modem Messages and Command Tables.

CHAPTER 3

PROGRAMMING ESTEEM FEATURES

GLOBAL BROADCAST FEATURE

DIGI-REPEATING FEATURE

AUTO TRANSMIT FEATURE

AUTO CONNECT FEATURE

AUTO CALL BACK FEATURE

ALTERNATE ROUTING FEATURE

CALL WAITING FEATURE

MULTI-CONNECT FEATURE

REMOTE PROGRAMMING FEATURE

SECURITY FEATURE

HARDWARE RING LINE FEATURE

PACKET MONITOR FEATURE

RADIO SELF-TEST FEATURE

CHAPTER 3

PROGRAMMING ESTEEM FEATURES

Listed in this chapter are the major ESTEem features and programming examples on how to use them. These features are individual building blocks to solve your application needs. Remember your particular application may require one or more of these features enabled.

DIGI-REPEATING

The Repeater feature allows an ESTEem to relay its respective transmission or packet through a maximum of three ESTEems to increase the operating range of the unit. Any ESTEem in your radio network can function as a repeater for any other ESTEem independent of the fact that the ESTEem being used as a repeater is linked or connected to another node. Therefore an ESTEem can function as a repeater, operational node, or both at the same time. The data that is digi-repeated through an ESTEem will not be output through its respective RS-232C port.

To specify one or more ESTEems as repeaters, the CONNECT command has been expanded to accept up to three added addresses as follows:

```
CONN r1,r2,r3,da
```

r1 = Address (0 to 253) of first repeater.
r2 = Address (0 to 253) of second repeater.
r3 = Address (0 to 253) of third repeater.
da = Address (0 to 255) of destination ESTEem.

Note: Address 254 is used for self test and address 255 is used for Global.

When transmitting packets through other ESTEems, the source ESTEem will automatically adjust its FRACK time to allow additional time for the packet to reach its destination and for the returned acknowledgment. Frack time takes into account the packet size and the number of repeaters specified. The ACK still comes from the destination ESTEem, not the first repeater.

For testing purposes you can answer back to yourself if you place your source address in the destination address of the repeater string.

REMEMBER, you can use a repeater address string in any command that requires a specific address in this manual.

Example: SETC r1,r2,r3,da

GLOBAL BROADCAST

Global broadcast is the ability of one ESTEem to transmit its message to more than one ESTEem at once. All ESTEems within radio range will receive the message whether or not they are connected to another ESTEem or in command or converse mode. The global message will have the highest priority over all other traffic on the receiving ESTEem.

You can put your ESTEem in Global by connecting to address 255. Address 255 is a non assignable unit address and is used by the ESTEem CPU to put the modem in this special mode. When an ESTEem is in Global the standard ACK protocol from the receiving ESTEem is disabled, but the 16 bit CRC error checking on the received ESTEem is still operational. When you perform CONN 255 <cr> from the COMMAND MODE the ESTEem will immediately go to the CONVERSE MODE (* is displayed). All messages sent will be transmitted globally to all ESTEems in radio range.

In your ESTEem you have a GLOBAL (on/off) command. When GLOBAL = On, you will receive Global transmissions. If GLOBAL = Off you will not display Global transmissions from other ESTEems. Factory default is ON.

By using the repeater function, you can go Global from another ESTEem.

Example:

CONN 10,20,30,255 <cr>. By performing this connect string you can route from unit 10 to 20, 20 to 30, and go Global at unit 30.

You can also enable global in more than one ESTEem in your network and have all units talk to all other units at the same time.

AUTO TRANSMIT

The Auto Transmit feature of the ESTEem allows the user to transmit a data packet without filling up the PACKLEN (packet length) buffer or defining a special control character using the SENDPAC (send packet)

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variable. The Auto Transmit feature is a timer that is enabled in the ESTeem that monitors traffic in and out of the RS-232C port. If there are characters in the RS-232C buffer, the termination control timer starts from the time the last receive or transmitted character is updated in the buffer. If the termination time expires before another character is received or transmitted, the received characters are transmitted.

To enable this feature perform the following from the COMMAND MODE:

TERMC (on/off) = On. Enable termination control.

TERMT (1-255) = One unit number equals 16.67 ms. (i.e. 60 units equal 1 second).

TERMC stands for termination control. TERMT stands for termination time. Factory default for TERMC = Off and TERMT = 10.

AUTO CONNECT

The Auto Connect or Auto Dial Up feature allows the user to program the ESTeem to perform a CONNECT to another ESTeem when data is sensed in its' respective RS-232C communications port.

To enable this feature perform the following from the COMMAND MODE:

SETCON (0-255) = Address of destination ESTeem.

NOTE: You can use the Repeater routing (r1,r2,r3,da) to put the ESTeem in Global (address 255). SETCON stands for set connect.

SA SAVE command. This is to save the SETC variable to the non volatile memory so that it will not be lost when the ESTeem is RESET.

Bit 8 (on/off) = On. Bit 8 is located on the RS-232C SETUP SWITCH on the rear of the ESTeem. Remember the ESTeem must be RESET after the Bit has been changed to be read by the ESTeem CPU.

RESET ESTeem RESET is located on the front panel OFF/ON switch. The T/E light on the

front panel of the ESTeem should now flash at a twice per second rate.

AUTO DISCONNECT

The Auto Disconnect feature allows the user to program the ESTeem to automatically disconnect the radio link if there is no data being received or transmitted through its respective RS-232C port for the time frame defined by IDLET (idle port timer).

To enable this feature perform the following from the COMMAND MODE:

IDLEC (on/off) = On. Enables idle port disconnect.

IDLET (1-255) = One unit number equals one second if IDLEF = Off. One unit equals one millisecond if IDLEF = On.

IDLEF (on/off) = Changes the scale of IDLET above.

IDLEF stands for idle port timer fine control.

Factory default for IDLEC = Off, IDLET = 30, and IDLEF = Off.

AUTO CALL BACK

The Auto Call Back feature allows the ESTeem to automatically call back a destination ESTeem if that ESTeem is connected to another node.

To enable this feature perform the following from the COMMAND MODE:

RECONN (on/off) = On. Enables reconnect feature.

RECONR (1-255) = One unit number stands for the number of retries that will be made if the destination address is connected to another node. RECONR stands for reconnect retry.

RECONT (1-255) = One unit number stands for the time (in seconds) between retries. RECONT stands for reconnect time.

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Factory default for RECONN = Off, RECONR = 10, and RECONT = 1.

ALTERNATE ROUTING

The Alternate Routing feature allows the user to define up to four communication routes for the ESTeem. The communication routes or paths are changed when the ESTeem is unable to perform a CONNECT or the DESTINATION CONNECTED TO ANOTHER NODE message is encountered. The ALTERRETRY variable defines the number of connect attempts before switching to the next route. The ESTeem will start with the route defined in ROUTE 1 or the last route used in its table. To enable this feature perform the following from the COMMAND MODE:

ALTERO (on/off) = On. Alternate Routing is enabled. When this feature is enabled the user will be prompted to enter Route 1, Route 2, Route 3, and Route 4. If all four routes are not needed for your application then enter a <cr> for the last route entered.

Remember, the Route can include up to three repeaters in its connect string. Factory default = OFF.

ROUTE 1: r1,r2,r3,da r1 = Repeater 1.

ROUTE 2: r1,r2,r3,da r2 = Repeater 2.

ROUTE 3: r1,r2,r3,da r3 = Repeater 3.

ROUTE 4: r1,r2,r3,da da = Destination address.

ALTERE (1-255) One unit number equals the number of retries before the ESTeem switches to the next route. ALTERE stands for Alternate route retry. Factory default = 2.

SETCON (r1,r2,r3,da) The Setconnect command should be defined the same as Route 1.

To use this feature with Auto Connect all you have to do is turn Bit 8 = ON (RS-232C Setup Switch) and RESET the ESTeem.

The ESTeem RETRY variable determines the number of times that you will go through the ALTERNATE ROUTE table before a "LINK IS DOWN" message will appear.

CALL WAITING

The Call Waiting feature will tell the addresses of the first five ESTeems that attempted to connect to you when you were connected to another node. If a connect attempt has been made from another ESTeem the following message will be displayed when you return to the COMMAND MODE from the CONVERSE MODE.

* NODE CONNECT ATTEMPTS WERE

The NODES command will display the addresses of the first five callers.

Example: CMD:NODES <cr>

The ESTeem will output the addresses in the following format:

NODES = [address 1], [address 2], [address 3],
 [address 4], [address 5]

If a "*" precedes the address then one or more repeaters were used to reach you. To determine the repeater routing path the NODES PATH command must be used. To use this command type NODES PATH(x) where x = the number of the caller (x can be 1, 2, 3, 4, or 5).

The NODES CLEAR command is used to clear the nodes buffer. The nodes buffer is automatically cleared when a connect is made.

When you are connected to another node you can momentarily return to the COMMAND MODE to check the nodes buffer and return back to the CONVERSE MODE with out breaking your communications link.

MULTI-CONNECT

The Multi-Connect feature when enabled allows an ESTeem to perform a direct connect to more than one ESTeem at a time. The maximum number is 255. This feature changes the usual ESTeem point to point protocol to a point to multi-point protocol. The main use of this feature is in a polled or contention applications where

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many remotes are sending data to a common point. The standard CONNECT (transmission plus ACK) and DISCONNECT (transmission plus ACK) are eliminated. This feature will also allow REPORT BY EXCEPTION (a remote can communicate with a central point even though it is not being polled or addressed by the central point).

To enable this feature perform the following from the COMMAND MODE:

MULTCON (on/off) = On.

Multi-Connect is enabled. Factory default = OFF.

The actual polling of the ESTeem must originate from the host device connected to the ESTeem by using the CONNECT command (to originate the initial connect) and the COMMAND character, to return from the CONVERSE mode to the COMMAND mode. The first time around the poll a CONNECT data packet (rf transmission) will be initiated. When a link is established it will be remembered internally in the ESTeem connect table. The next time around the poll to the same address, the link status will be checked in the ESTeem table. If the address indicates a link has already been established, then only data and its corresponding ACK will be transmitted to that node. This greatly increases polling time by eliminating the usual CONNECT/DISCONNECT sequence each time except when the initial communication is established.

Two other software features have been added to support the MULTI-CONNECT command; The MULT-ID command and the MULTDEL command.

The MULTID command allows the user to send data from the CONVERSE Mode by specifying the address routing before the data packet. This feature will also display the address of sending ESTeem on any received data.

Example Of Transmitted Data:

[001]DATA Routes data to an ESTeem addressed 1.

[100,200,250,1]DATA Routes data to an ESTeem addressed 1 via ESTeems addressed 100, 200, and 250.

This replaces using the CONNECT command from the COMMAND Mode. The brackets [and] are defined using the MULTDEL command.

Received data packets will have the address of the ESTeem that sent the data at the beginning of the data packet.

Example Of Received Data:

[004]RECEIVED DATA Data received from an ESTeem addressed 4.

[030,100,244,004] Data received from an ESTeem addressed 4 via ESTeems addressed 30, 100, and 244.

MULTID (on/off) = On Enables this feature. Factory default = OFF.

MULTDEL (0-255,0-255) Defines the delimiters used to bracket the MULTID address when enabled. Factory default = 91,93.

REMOTE PROGRAMMING

The Remote Programming feature allows the user to remotely program ESTeems in his network. When a connection has been made with the remote ESTeem the RPG: prompt will be displayed showing that you are now in the COMMAND mode of that remote ESTeem.

To enable this feature perform the following from the COMMAND MODE:

PROG (0-254) = Address of destination ESTeem.

Remember, you can also use the Repeater routing (r1,r2,r3,da) to reach the destination ESTeem.

Note: r1 = address of first repeater,
r2 = address of second repeater, etc.
da = destination address.

To end remote programming type DISC (Disconnect) and you will return to the COMMAND prompt of your ESTeem. There is a Watch Dog Timer that will

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automatically disconnect you from remote programming if there is no activity for thirty seconds.

The REMPROG (on/off) feature is used to defeat the ability of your ESTeem from being remotely programmed. If REMPROG = OFF, another ESTeem cannot remotely program your unit. Factory default = ON.

SECURITY

The Security feature allows the user to lock out programming of the ESTeem.

CAUTION: STORE YOUR CODE NUMBER IN A SAFE PLACE.

To enable this feature perform the following from the COMMAND MODE:

SECURITY (on/off) = On. Enables the security feature. The following prompt will appear to enter your security value.

ENTER SECURITY VALUE: (0-65535)

SAVE To enter the security code permanently into the ESTeem memory.

To disable the security feature perform the following from the COMMAND mode.

SECURITY (on/off) = Off. Disables the security feature.

The following prompt will appear to enter your security value.

ENTER SECURITY VALUE: (0-65535)

SAVE To remove the security code permanently from the ESTeem memory.

HARDWARE RING LINE

When the ESTeem establishes a CONNECT or link with another ESTeem (T/E Light on solid), pin 22 at the ESTeem RS-232C will change from a -15 vdc voltage state to a +15 vdc voltage state. The RING software command allows the user to change the output from a

latched state to a pulsed state. To change the state of this line program the following from the COMMAND mode. Factory default = LATCH.

RING =Latch. Pin 22 is high when the ESTeem T/E light is on solid.

RING =Pulse. Pin 22 is pulsed (positive 250 ms.) when the ESTeem T/E light is on solid.

PACKET MONITOR

The PACKM [ON/OFF] command places the ESTeem in a special packet monitor mode. When this feature is enabled the ESTeem is placed in a receive only mode and will not function as a normal ESTeem. The ESTeem will monitor and report the status of all message traffic within the network in the following format, the actual packet message will not be output.

XXX-DA, XXX-SA, TYPE, XXX-E1, XXX-R1, XXX-E2, XXX-R2, XXX-E3, XXX-RS, BYTE COUNT (including 7 bytes overhead)

XXX MODEM ADDRESS
DA DESTINATION MODEM ADDRESS
SA SOURCE MODEM ADDRESS

TYPE CODES

I = INFORMATION
DISC = DISCONNECTED
RR = RECEIVE READY
UA = UNNUMBERED ACKNOWLEDGE
RNR = RECEIVE NOT READY
FRMR = FRAME REJECT
REJ = REJECT
DM = DISCONNECTED MODE
UI = UNNUMBERED INFORMATION
SABM = SET ASYNC. BALANCE MODE

E1 XXX = EXTENDER BYTE OF FIRST REPEATER

R1 XXX = ADDRESS OF FIRST REPEATER

E2 XXX = EXTENDER BYTE OF SECOND REPEATER

R2 XXX = ADDRESS OF SECOND REPEATER

E3 XXX = EXTENDER BYTE OF THIRD REPEATER

R3 XXX = ADDRESS OF THIRD REPEATER

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RADIO SELF TEST

The Radio Self Test feature is used to test the radio conductivity of a given geographical area without the use of external hardware attached to the ESTeem (i.e. terminal, computer, etc.) by performing a GO or NO GO test by visually looking at the ESTeem T/E light. If after resetting the ESTeem the T/E light changes from a twice per second flash rate to solid ON light the radio path has been tested. This test is usually done by attaching a 12 VDC battery pack to the remote ESTeem and walking a given area and pushing the reset switch to test the radio path at various points of interest relative to a fixed reference point. This test is used to give the user a rough test of the radio operating range but does not give signal strength, back ground noise levels, or sources of co-channel interference.

To perform a radio self test requires two ESTeems. Address 254 is a special address used for the self-test feature and is assigned to the remote ESTeem. After addressing the remote ESTeem to 254 it is then programmed to auto connect to the reference ESTeem. Address 254 is a special command that allows the ESTeem to perform the AUTO CONNECT upon reset, not when the unit senses data through it's RS-232C port.

When the remote ESTeem is reset by the front panel switch it will initiate a CONNECT to the reference ESTeem (T/E Light on solid) and send the message TEST PACKET if the ESTeem is within radio range of the reference ESTeem. It is noted that repeater address strings can be assigned to the remote ESTeem SETC address.

Perform the following prior to programming the ESTeem(s) to initialize the units to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters may not be echoed by the crt.

<u>ESTeem - Remote Unit</u>	<u>ESTeem - Reference Unit</u>
ADD 254	ADD yyy
SETC yyy	
SAVE	SAVE
BIT 8 ON	
RESET ESTEEM	

NOTE: yyy = reference unit address.

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TRANSPARENT AUTO CONNECT

TRANSPARENT AUTO CONNECT GLOBAL

IBM AND COMPATIBLE PERSONAL COMPUTERS

DATA GENERAL EQUIPMENT

DEC EQUIPMENT

HP 3000 EQUIPMENT

NCR EQUIPMENT

INTERACTIVE TERMINAL APPLICATIONS

PHONE MODEM INTERFACING

CROSSTALK XVI INTERFACING

PC-TALK INTERFACING

PROGRAMMABLE LOGIC CONTROLLERS

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ESTEEM APPLICATION PROGRAMS

Listed below are different application programs to aid the user in programming the ESTeem.

TRANSPARENT AUTO-CONNECT

This mode is used for a dedicated point to point application. The ESTeem will initiate the radio link when data is received by the RS-232/422 port.

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

ESTeem A		ESTeem B	
-----		-----	
ADD	xxx	ADD	yyy
SETC	yy	SETC	xxx
TERMC	ON	TERMC	ON
TERMT	1	TERMT	1
XSF	OFF	XSF	OFF
XHF	ON *	XHF	ON *
RTS_CTS	ON *	RTS_CTS	ON *
DISACK	ON*	DISACK	ON *
SETMODE	ON	SETMODE	ON
SETTRANS	ON:SAVE	SETTRANS	ON:SAVE
BIT 8	ON (RS-232 SWITCH)	BIT 8	ON
RESET ESTEEM		RESET ESTEEM	

- Turn DISACK ON only if you want to defeat the acknowledge packet.
- Hardware or software flow control can be used in this mode. Select either XHF, XSF, or RTS_CTS for your application. NOTE: If you are sending binary files then do not use software flow control (XSF).
- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

TRANSPARENT AUTO-CONNECT GLOBAL

This mode is usually used for a point to multi-point applications when a customer's device includes their own addressing protocol to communicate between devices. The ESTeem packet addressing and acknowledge protocol is defeated. All ESTeems will receive the data transmission. The 16 bit CRC error checking on received data is still enabled. This program is used in all ESTeems, the only difference is the unit addresses.

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

ESTeem A

```
ADD      xxx (xxx = ESTeem address)
SETCON   255
TERMC    ON
TERMT    1
XSF      OFF
XHF      ON *
RTS_CTS  ON *
SETMODE  ON
SETTRANS ON:SAVE
BIT 8    ON (RS-232 SWITCH)
RESET ESTEEM
```

- Only hardware flow control can be used in this mode. Select either XHF or RTS_CTS for your application.

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IBM AND COMPATIBLE COMPUTERS

This is a typical program for sending data between two personal computers using a standard communications package (i.e. PC-TALK, CROSSTALK XVI, PROCOM, etc.)

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

ESTeem A	ESTeem B
ADD xxx	ADD yyy
SETC yyy	SETC xxx
TERMC ON	TERMC ON
TERMT 10	TERMT 10
SENDP 255	SENDP 255
SAVE	SAVE
BIT 8 ON (RS-232 SWITCH)	BIT 8 ON
RESET ESTEEM	RESET ESTEEM

- Software flow control is used in this example. The units have been configured for AUTO-CONNECT (Bit 8 - ON). If this feature is not desired then set Bit 8 - OFF.
- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

DATA GENERAL EQUIPMENT

This program is used to connect a Data General mainframe to a remote terminal. This setup is a typical point to point configuration with the AUTO-CONNECT feature enabled.

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

ESTeem At Mainframe	ESTeem At Terminal
ADD xxx	ADD yyy
SETC yyy	SETC xxx
TERMC ON	TERMC ON
TERMT 80	TERMT 1
DISACK ON *	DISACK ON *
SENDP 255	SENDP 10
	PASSWORD ON
SETTRANS ON:SAVE	SETTRANS ON:SAVE
BIT 8 ON (RS-232 SWITCH)	BIT 8 ON
RESET ESTEEM	RESET ESTEEM

- Turn DISACK ON only if you want to defeat the acknowledge packet.
- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

DEC EQUIPMENT

This program is used to connect a DEC 11-780 mainframe to a remote terminal. This setup is a typical point to point configuration with the AUTO-CONNECT feature enabled.

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

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ESTeem At Mainframe

```
-----
ADD      xxx
SETC     yyy
TERMC    ON
TERMT    1
DISACK   ON *
SENDP    255
SETTRANS ON:SAVE
BIT 8 ON (RS-232 SWITCH)
RESET ESTEEM
```

ESTeem At Terminal

```
-----
ADD      yyy
SETC     xxx
TERMC    ON
TERMT    10
DISACK   ON *
SENDP    255
SETTRANS ON:SAVE
BIT 8 ON
RESET ESTEEM
```

- Turn DISACK ON only if you want to defeat the acknowledge packet.
- You will probably have to connect a NULL Modem adapter (reverse pins 2 & 3) between the DEC 11-780 and the ESTeem.
- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

HP-3000 EQUIPMENT

This program is used to connect a HP-3000 mainframe to a HP-2392A terminal. This setup is a typical point to point configuration with the AUTO-CONNECT feature enabled.

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

ESTeem At Mainframe

```
-----
ADD      xxx
SETC     yyy
TERMC    ON
TERMT    1
PROTOD   ON
DISACK   ON *
SENDP    255
SETTRANS ON:SAVE
BIT 8 ON (RS-232 SWITCH)
RESET ESTEEM
```

ESTeem At Terminal

```
-----
ADD      yyy
SETC     xxx
TERMC    ON
TERMT    10
DISACK   ON *
SENDP    255
SETTRANS ON:SAVE
BIT 8 ON
RESET ESTEEM
```

- Turn DISACK ON only if you want to defeat the acknowledge packet.
- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

NCR EQUIPMENT

This program is used to connect a NCR 3450 mainframe to a NCR 4940 terminal. This setup is a typical point to point configuration with the AUTO-CONNECT feature enabled.

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

ESTeem At Mainframe

```
-----
ADD      xxx
SETC     yyy
TERMC    ON
TERMT    1
DISACK   ON *
SENDP    255
SETTRANS ON:SAVE
BIT 8 ON (RS-232 SWITCH)
RESET ESTEEM
```

ESTeem At Terminal

```
-----
ADD      yyy
SETC     xxx
TERMC    ON
TERMT    5
DISACK   ON *
SENDP    255
SETTRANS ON:SAVE
BIT 8 ON
RESET ESTEEM
```

- Turn DISACK ON only if you want to defeat the acknowledge packet.

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- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

INTERACTIVE TERMINAL APPLICATION

This program is used to connect a mainframe to a remote terminal. This setup is a typical point to point configuration with the AUTO-CONNECT feature enabled.

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

ESTeem At Mainframe	ESTeem At Terminal
ADD xxx	ADD yyy
SETC yyy	SETC xxx
TERMC ON	TERMC ON
TERMT 1	TERMT 10
XSF OFF	XSF OFF
XHF ON *	XHF ON *
DISACK ON *	DISACK ON *
SETMODE ON	SETMODE ON
SETTRANS ON:SAVE	SETTRANS ON:SAVE
BIT 8 ON (RS-232 SWITCH)	BIT 8 ON
RESET ESTEEM	RESET ESTEEM

- Turn DISACK ON only if you want to defeat the acknowledge packet.
- Only hardware flow control can be used in this mode.
- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

PHONE MODEM INTERFACING

This application program is for interfacing the ESTeem to a Black Box 1200+ phone modem which is bell 212 compatible. The configuration is used to have a remote terminal access to a phone line.

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

ESTeem At Phone Modem	ESTeem At Terminal
ADD xxx	ADD yyy
SETC yyy	SETC xxx
TERMC ON	AUTO OFF
TERMT 50	PROMPT OFF
SENDP 255	SAVE
SETTRANS ON:SAVE	
BIT 8 ON *(RS-232 SWITCH)	BIT 8 ON *
RESET ESTEEM	RESET ESTEEM

- Enable Bit 8 ON only if you want the AUTO-CONNECT feature.
- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

A NULL connector must be connected between the phone modem and the ESTeem because both devices are DCE equipment. Use normal procedures to CONNECT to the ESTeem interfaced to the phone modem. After a CONNECTED TO MESSAGE appears, the normal dial up commands can be used.

Listed below is a second application program for interfacing an ESTeem to a Hayes phone modem. Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.

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3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

ESTeem At Ph. Modem	ESTeem At Terminal
ADD xxx	ADD yyy
SETC yyy	SETC xxx
XSF OFF	XSF OFF
TERMC ON	TERMC ON
TERMT 1	TERMT 1
DISACK ON	DISACK ON
RTS_CTS ON	RTS_CTS ON
DTR ON	DTR ON
SETTRANS ON:SAVE	SETTRANS ON:SAVE
SAVE	SAVE
BIT 8 ON (RS-232 SWITCH)	BIT 8 ON
RESET ESTEEM	RESET ESTEEM

- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

Listed below is the RS-232 cable pin out:

<u>ESTeem Hayes</u>	<u>ESTeem Laptop</u>
1 ---- 1	2 ---- 3
2 ---- 3	3 ---- 2
3 ---- 2	4 ---- 7
20 ---- 6	5 ---- 8
22 ---- 20	6 ---- 6
7 ---- 7	7 ---- 5
	8 ---- 1
25P TO 25P	20 ---- 4
	22 ---- 9
	25P TO 9P

CROSSTALK XVI INTERFACING

This application program is for an ESTeem interfaced to a personal computer using CROSSTALK XVI. An alternate to this application is using the Hayes emulation mode in the ESTeem described in Chapter 2.

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters my not be echoed by the crt.

ESTeem At PC 1	ESTeem At PC 2
ADD xxx	ADD yyy
SETC yyy	SETC xxx
TERMC ON	TERMC ON
TERMT 60	TERMT 60
SENDP 255	SENDP 255
PROMPT OFF *	PROMPT OFF *
SAVE	SAVE
BIT 8 ON *(RS-232 SWITCH)	BIT 8 ON *
RESET ESTEEM	RESET ESTEEM

- Enable Bit 8 ON only if you want the AUTO-CONNECT feature.
- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

NOTES:

1. In the CROSSTALK program set IN/OUT FILTERS = OFF.
2. Type GO LOCAL at command.
3. Type SEND A: "file name".

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PC-TALK III INTERFACING

This application program is for an ESTeem interfaced to a personal computer using PC-TALK III. This program was used for both ASCII and Binary file transfers.

Perform the following prior to programming the ESTeem(s) to initialize the unit to factory default settings:

1. Turn Bit 8 OFF on the RS-232C Setup Switch.
2. Reset the ESTeem.
3. TYPE FA <cr>. Please note the characters may not be echoed by the crt.

ESTeem At PC 1	ESTeem At PC 2
-----	-----
ADD xxx	ADD yyy
SETC yyy	SETC xxx
TERMC ON	TERMC ON
TERMT 5	TERMT 5
SETMODE ON	SETMODE ON
XSF OFF	XSF OFF
DISACK ON *	DISACK ON *
SETTRANS ON:SAVE	SETTRANS ON:SAVE
BIT 8 ON* (RS-232 SWITCH)	BIT 8 ON *
RESET ESTEEM	RESET ESTEEM

- Enable Bit 8 ON only if you want the AUTO-CONNECT feature.
- DISACK is enabled only if you want to defeat the ESTeem ACKNOWLEDGE protocol.
- xxx and yyy represent an ESTeem address which is user definable from 0 to 253.

Notes:

1. Send files using XMODEM file transfer option. All error checking is done by PC-TALK. Use ALT ^R and define a file name to receive a program and ALT ^T and define a file name to transfer a program.

PROGRAMMABLE LOGIC CONTROLLERS

EST has available complete Engineering Reports for each PLC manufacturer make which will be provided at no charge by calling EST Customer Support on 509-735-9092 or visit our web site www.esteem.com.

CHAPTER 5

RS-232C/422/485 INTERFACING

DTE VS DCE

FLOW CONTROL

MEMORY BUFFERS

REQUEST TO SEND/CLEAR TO SEND

DATA TERMINAL READY

RS-422/485 CONFIGURATION

RS-232/422/485 CONFIGURATION TABLES

RS-232/422/485 PORT PINOUT TABLE

CHAPTER 5

RS-232C/422/485 INTERFACING

DTE vs. DCE

The ESTeem is configured as a Data Communication Equipment (DCE) device. The following signals available at the RS-232C connector located at the rear of the unit.

	Pin		Description
	1	FG	Shield Ground
	2	TXD	Transmit Data (Input)
	3	RXD	Receive Data (Output)
DCE	4	RTS	Request To Send (Input)
	5	CTS	Clear to Send (Output)
	7	SG	Signal Ground
	8	DCD	Data Carrier Detect (Output)
	12	RTS	Request To Send (Output)
	20	DTR	Data Terminal Ready (Input)
	22	Ring	Ring Indicator (Output)

The important thing to remember is that for the ESTeem to communicate with an external device, the data output from pin 3 of the ESTeem RS-232C connector must be connected to the data input of the device you are connected to; otherwise, the ESTeem won't work. Likewise, the data input to pin 2 of the ESTeem must be connected to the data output of the device you are connected to. Normally, if the equipment you are connecting to looks like a terminal or computer (DTE), its input, Receive Data (RXD), will be on pin 3 its output, Transmit Data (TXD), will be on pin 2. Therefore, the ESTeem can be directly connected.

If the device you are connecting to is configured as a modem (DCE), its output will be on pin 3. If this configuration is connected to the ESTeem, damage may result to the ESTeem or the connecting device. In this case, you can purchase a null connector that internally reverses pins 2 and 3.

Whatever your situation may be, it is always best to check the manual on your particular device and connect accordingly.

Purchase or fabricate a RS-232C shielded cable for your ESTeem. The ESTeem requires a standard male 25 pin D connector on one end of the cable for proper connection.

Remember to install the small retaining screws on either side of the cable connector. Tightening these screws

keeps you from accidentally losing connection with your ESTeem.

Notes:

- *The ESTeem requires a shielded RS-232 cable. This is to prevent unwanted electrical noise from entering the ESTeem and also to prevent any electrical noise from getting out of the ESTeem.*
- *Remember -- always use a shielded RS-232C cable.*
- *Pins 9, 10, 14, & 16 are used for RS-422/485 interfacing and should be left open if not used.*

FLOW CONTROL

The ESTeem can be enabled to support SOFTWARE or HARDWARE flow control.

Software Flow Control

Software flow control is enabled by the XSFLOW (on/off) command in the ESTeem. When XSFLOW is ON the ESTeem will respond to <XOFF>, (stop) and <XON>, (off) commands from the RS-232 port. The factory default setting is ON. The default value for START is 17 (CTRL Q) and for STOP is 19 (CTRL S).

Hardware Flow Control

Hardware flow control is enabled by the XHFLOW (on/off) command in the ESTeem. The factory default value is OFF.

When XHFLOW is enabled (on) the control signal lines, Request To Send (RTS, pin 4), Data Carrier Detect (DCD, pin 8), and Clear To Send (CTS, pin 5) are available to the user at the RS-232C connector. The CTS and RTS signals are used to control the flow of data into and out of the ESTeem.

The CTS signal on pin 5 is used to control the data into the ESTeem. When CTS is set (high on pin 5) the modem is ready to receive data. When CTS is reset (low on pin 5) the ESTeem is not ready to receive data.

The RTS signal is used to control data out of the ESTeem. RTS is set (high on pin 4), by the user to indicate to the ESTeem that the user is ready to receive data. When reset, the user is not ready to receive data. (NOTE: Low = On, High = Off).

CHAPTER 5

RS-232C/422/485 INTERFACING

MEMORY BUFFERS

The ESTeem has a 2020 byte buffer on the TRANSMIT SIDE (outgoing data) and a 2020 byte buffer on the RECEIVE SIDE (incoming data).

Transmit Buffer

The Outgoing data buffer will hold two data blocks before the ESTeem will enable its RS-232C hardware/software control on data coming into the modem if the network is busy. A data block in this example is a block of data that is defined by the PACKLENGTH or SENDPAC character which ever occurs first.

Therefore, if PACKLENGTH = 10 the modem will accept a maximum of 20 bytes before it enables its hardware/software handshake line (two 10 byte packets). In another example, if PACKLENGTH = 1010 but the data block is terminated by the SENDPAC character before the input buffer reaches the full 1010 bytes, the buffer will still hold only two data blocks if the network is busy.

In order to utilize the 2020 bytes storage for small data packets (bar code readers, etc.), program the modem using the following guidelines:

PACKLENGTH = 1010	SENDPAC = 255
TERMC = ON	TERMT = 10

Note: *Set the TERMT time greater than the pause between data bursts.*

By programming the above parameters the ESTeem will buffer the incoming data packets and automatically transmit the data when the 1010 byte buffer is filled or the TERMT time limit is met. This will allow the customer to use two blocks of 1010 or 2020 bytes before the modem enables the respect hardware/software control.

Receive Buffer

If the device that the receiving ESTeem is outputting data to, enables its respective hardware or software control, the modem will store 2020 bytes of data before flow controlling off the transmitting ESTeem.

REQUEST TO SEND/CLEAR TO SEND

A software switch, RTS_CTS (on/off), is provided in the ESTeem for operation of the Request to Send (RTS) pin 4 and Clear to Send (CTS) pin 5 when Hardware Flow control is not necessary or available, but the RTS/CTS lines are required. When the users device raises the RTS line (Pin 4) the ESTeem will assert the CTS (Pin 5) in response. This feature is used to have the ESTeem emulate a standard phone modem, but can NOT be used a method of flow control.

When the RTS_CTS software switch is ON, HARDWARE FLOW CONTROL can NOT be enabled in the ESTeem.

The factory default setting for this switch is OFF.

DATA TERMINAL READY (DTR)

A software switch, DTR_ENAB (ON/OFF) is provided in the ESTeem for monitoring the status of a device connected to pin 20 of the RS-232C connector. The factory default setting is OFF. When this command is enabled the ESTeem will monitor the DTR signal on pin 20. If the DTR line being supplied to the ESTeem, from the user, is at a SPACE (high) condition then the ESTeem is enabled. If the DTR line is at a MARK (low) condition then the ESTeem is disabled.

This signal is normally used by the ESTeem modem as an indication that connection is made to a device that is on line and ready to transmit/receive data.

Also note that if DTR command is enabled, and the line is disabled then the ESTeem will perform a "Disconnect" if connected. DTR enabled also turns on Carrier Detect (pin 8) if the ESTeem is "Connected" to another ESTeem, Carrier Detect will go off if the ESTeem is "Disconnected".

CHAPTER 5

RS-232C/422/485 INTERFACING

Additional RS-232 Software Commands

- AUTOLF (on/off) Enables an auto line after each transmitted carriage return. Factory default value is ON.

- BKONDEL (on/off) The backspace, space, backspace, delete is echoed to the terminal when the DELETE character is entered. Factory default is ON.

- DATA_GEN (on/off) Enables the Data General protocol. Factory default is OFF.

- ECHO (on/off) Characters received from the ESTeem input device are echoed to the input device. Factory default is ON.

- NUCR (on/off) ESTeem will send nulls to the terminal after a carriage return <CR>. Factory default is OFF.

- NULF (on/off) ESTeem will send nulls after a line feed <LF>. Factory default is OFF.

- NULLS (0-255) Defines the number of nulls sent after a carriage return <CR> or line feed <LF>. Factory default is 0.

- PROTOCOL (on/off) Enables the ENQ/ACK type of protocol. The ENQ/ACK characters are defined using PROTORX and PROTOTX commands. Factory default is OFF.

- PROTORX (0-255) Defines the inquiry character received by the ESTeem. This character when received is used to signal the ESTeem to transmit the PROTOTX character. Factory default is 5.

- PROTOTX (0-255) Defines the ACK character transmitted by the ESTeem when the PROTORX character is received. Factory default is 6.

RS-422/485 CONFIGURATION

The ESTeem will support the requirements of the EIA Standard RS-422/485. This is a four (4) wire interface consisting of the TRANSMIT DATA (-), TRANSMIT DATA (+), RECEIVE DATA (-), AND RECEIVE DATA (+). These signals are available at the 25 pin RS-232C connector on the modem.

	Pin		Description
	9	BTR (-)	TRANSMIT DATA (-)
	10	BTR (+)	TRANSMIT DATA (+)
DCE	14	BRX (+)	RECEIVE DATA (+)
	16	BRX (-)	RECEIVE DATA (-)

This interface is designed to provide unipolar differential drive to twisted pair or parallel wire transmission lines.

Note: *The ESTeem can be factory configured for 2-wire RS-485 interfacing. Call EST Customer Support on 509-735-9092.*

CHAPTER 5

RS-232C/422/485 INTERFACING

RS-232C/422/485 CONFIGURATION TABLES

On the rear end plate of the ESTeem is an eight position switch labeled RS-232 Setup. The switch positions are defined as follows:

Switch	1	2	3	Baud	
	On	Off	Off	9,600	
	Off	On	Off	4,800	
	On	On	Off	2,400	
	Off	Off	On	1,200	RS_Baud
	On	Off	On	600	Command
	Off	On	On	300	
	On	On	On	150	150
	On	On	On	110	110
	On	On	On	75	75
	On	On	On	50	50

* Special Baud Rates, you must program the RS_BAUD (150, 110, 75, 50) Command in addition to the switch settings. Factory default is 110.

RS-232C Parity Select Table

Switch	4	5	Parity
	Off	Off	None
	Off	On	None
	On	Off	Odd
	On	On	Even

Data Bit Select Table

Switch	6	7	Data Bit
	Off	Off	5
	Off	On	6
	On	Off	7
	On	On	8

Selecting RS-232C Stop Bits

The RS_STOP (1, 1.5, 2) command is used to change the number of stop bits used in the data stream to be interpreted by the ESTeem. Factory default value is 1.

ESTeem RS-232C/422/485 Port Pin-Out Table

Pin No.	Function
1	Shield Ground
2	Transmit Data (TxD)
3	Receive Data (RxD)
4	Request To Send (RTS Input)
5	Clear To Send (CTS)
6	Data Set Ready (DSR)
7	Signal Ground
8	Data Carrier Detect (DCD)
12	Request To Send (RTS Output)
19	Mode Control
20	Data Terminal Ready (DTR)
9	RS-422/485 Transmit Data (-)
10	RS-422/485 Transmit Data (+)
14	RS-422/485 Receive Data (+)
16	RS-422/485 Receive Data (-)
22	Ring Indicator (RI)
15 & 17	Internal Clock Output
24	External Clock Input

COAXIAL CABLES

WEATHER PROOFING COAXIAL CONNECTORS

GROUNDING

LIGHTNING ARRESTORS

REFERENCE MATERIAL

**MODEL 95 OUTDOOR FIXED BASE ANTENNA SETUP
DIAGRAM**

MODEL 95 INDOOR ANTENNA SETUP DIAGRAM

**MODEL 96 OUTDOOR FIXED BASE ANTENNA SETUP
DIAGRAM**

**MODEL 96 OUTDOOR FIXED BASE ANTENNA SETUP
DIAGRAM WITH EXTERNAL LINEAR AMPLIFIER**

**MODEL 96 OUTDOOR FIXED BASE ANTENNA SETUP
DIAGRAM USING BANDPASS FILTER**

MODEL 96 MOBILE ANTENNA SETUP DIAGRAM

SWR MEASUREMENT BLOCK DIAGRAM

CHAPTER 6

ANTENNAS

EST offers different types of antennas ranging from 1/4 wave to 5/8 wave in physical size. The user choice is dependent on the application.

Communications in the VHF and UHF bands are normally over "**Line of Sight (LOS)**". Looking from the antenna of one wireless modem you must be able to see the antenna of the wireless modem you wish to communicate with. If a large object obstructs the line of sight view it is unlikely that satisfactory communications will result. This means you must relocate the antennas or use the REPEATER FEATURE and a second modem to go over or around the object.

The United States Federal Communications Commission (FCC) specifies that the antenna type used on the ESTeem Model 95 be limited to one-half wave vertically polarized omni-direction in design. This limits the overall gain of the antenna to a maximum of approximately 3 dB.

The Model 96 products are allowed by the FCC to use high gain directional antennas.

It is noted that a 1/4 wave antenna that does not have ground plane radials requires a ground plane to operate at maximum efficiency. This can simply be a conducting surface under the antenna that is a 1/4 wave length in diameter. For the Model 95 this is approximately 42 inches. A conducting surface can be anything from the roof top of an automobile to a file cabinet.

COAXIAL CABLES

To minimize signal loss, the overall length of the coaxial cable should be as short as possible. To avoid corrosion select coaxial cable manufacturers with tinned copper braid, where possible. Listed below are representative cable losses in db/100ft at the VHF and UHF frequencies:

Frequency (MHz)	RG-58u	RG-8	½" Helix
72-79	- 3.8	- 1.5	- 0.6
402-420	-10.0	- 4.2	- 1.5
450-470	-10.8	- 4.4	- 1.5

In a severe noise environment it may be desirable to use a double shield type of coax cable such as RG-214/U.

Notes:

1. *Pre-made coax cables can be purchased from the factory. A -3 dB loss means you have lost 1/2 of your signal. A +3 dB gain means you have doubled (x2) your signal.*
2. *Keep the antenna feedline as short as possible to minimize losses.*
3. *Extreme care must be taken when attaching coax connectors to the antenna feedlines. If there is any error in making this connection the output of the transmitter will be greatly reduced.*

WEATHER PROOFING COAX CONNECTIONS

1. Coat the threads of the connectors with silicone lubricant prior to assembly (See Note 1) and hand tighten. Care should be taken **not** to get any lubricant on the center conductor.
2. Wrap the connector assembly with a vapor barrier patch for weather proofing (See Note 2), ensuring to overlap onto the coax cable approximately 1 1/2 inches.
3. Apply an electrical coating (sealing agent) over the vapor barrier patch for added protection (See Note 3).

Notes:

1. *Dow Corning RTV-3140 or equivalent.*
2. *Suggested vendors:*

VAPOR-WRAP
Decibel Products
3184 Quebec St.
Dallas, TX 75356
214-631-0310

VYNIL-MASTIC, P/N 2200
3-M Company
Customer Service
512-984-1800

3. *SCOTCHKOTE, 3-M Company, or equivalent.*

CHAPTER 6

ANTENNAS

GROUNDING

All building mount antennas require attachment to a good earth ground for optimum efficiency. Contact a reputable local communications shop for procedures in your area.

LIGHTNING ARRESTORS

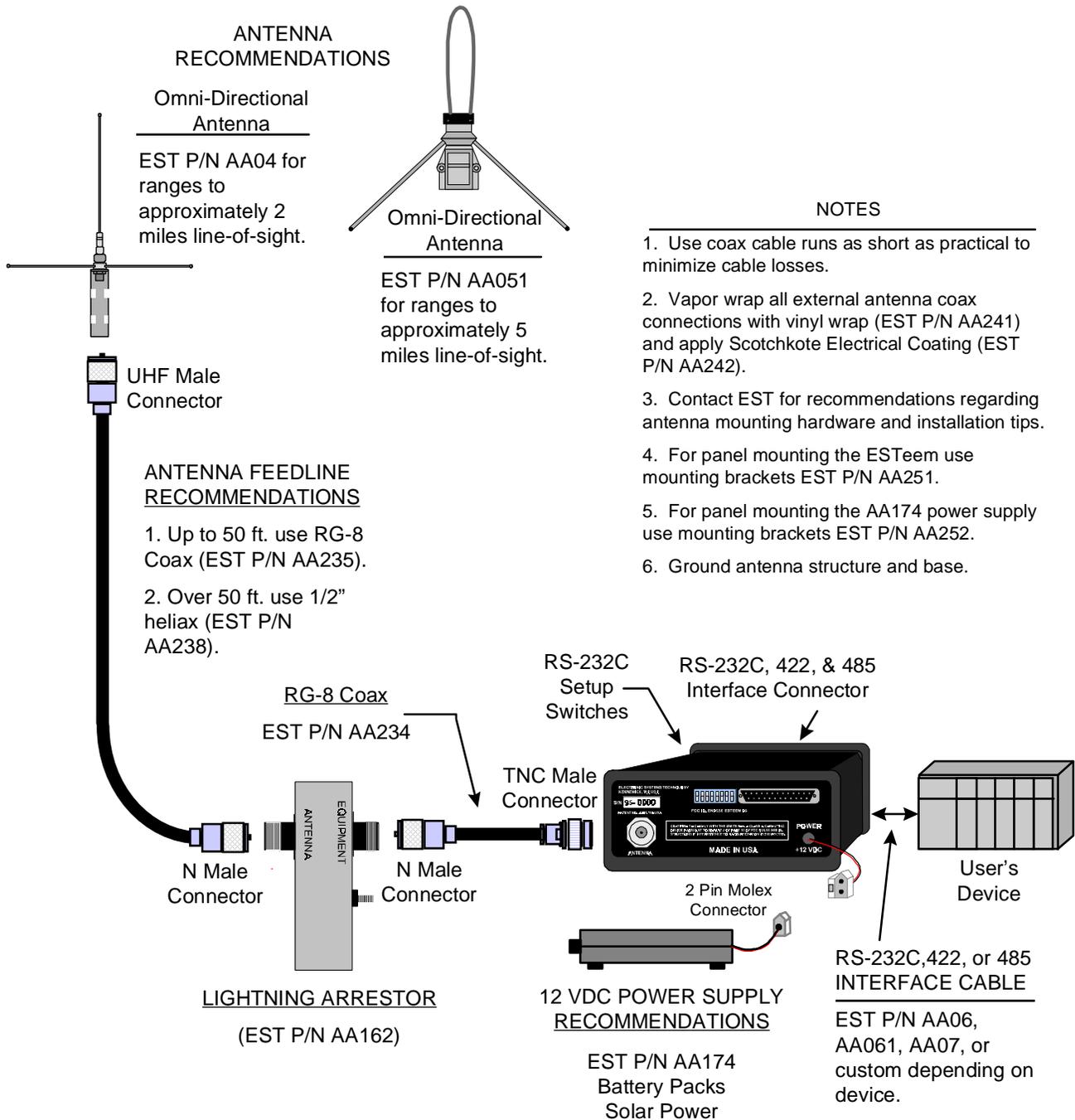
Lightning arrestors should be used on all external building mount antennas for personal protection and to minimize damage to the transceiver during lightning storms. The units should be installed as per manufacturers instructions provided with the device.

REFERENCE MATERIAL

The ideal reference book for antennas and transmission lines is the “**The Radio Amateur's Handbook**”, by the Headquarters Staff of the American Radio Relay League.

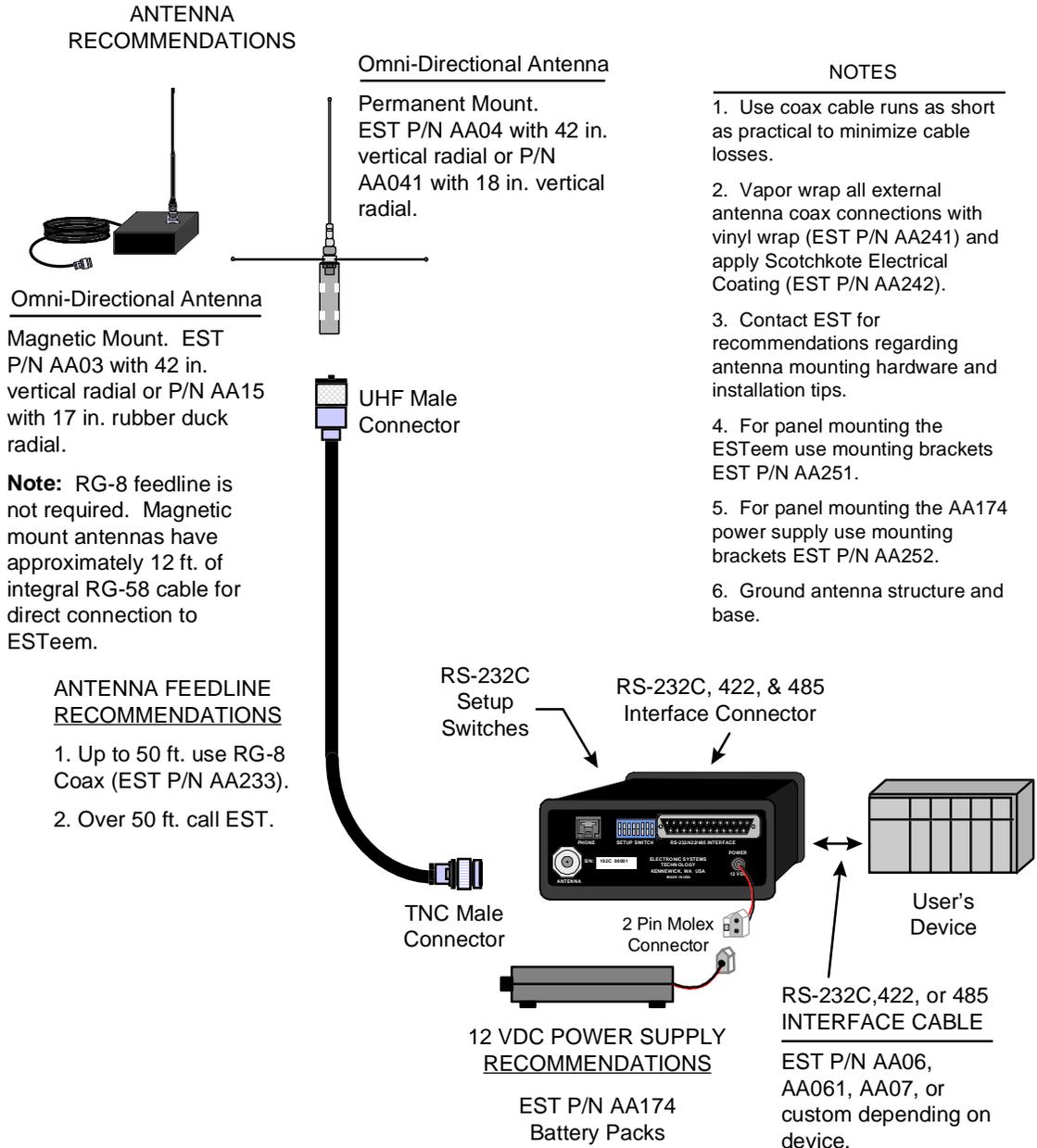
CHAPTER 6 ANTENNAS

Model 95 Outdoor Fixed Base Antenna Setup Diagram



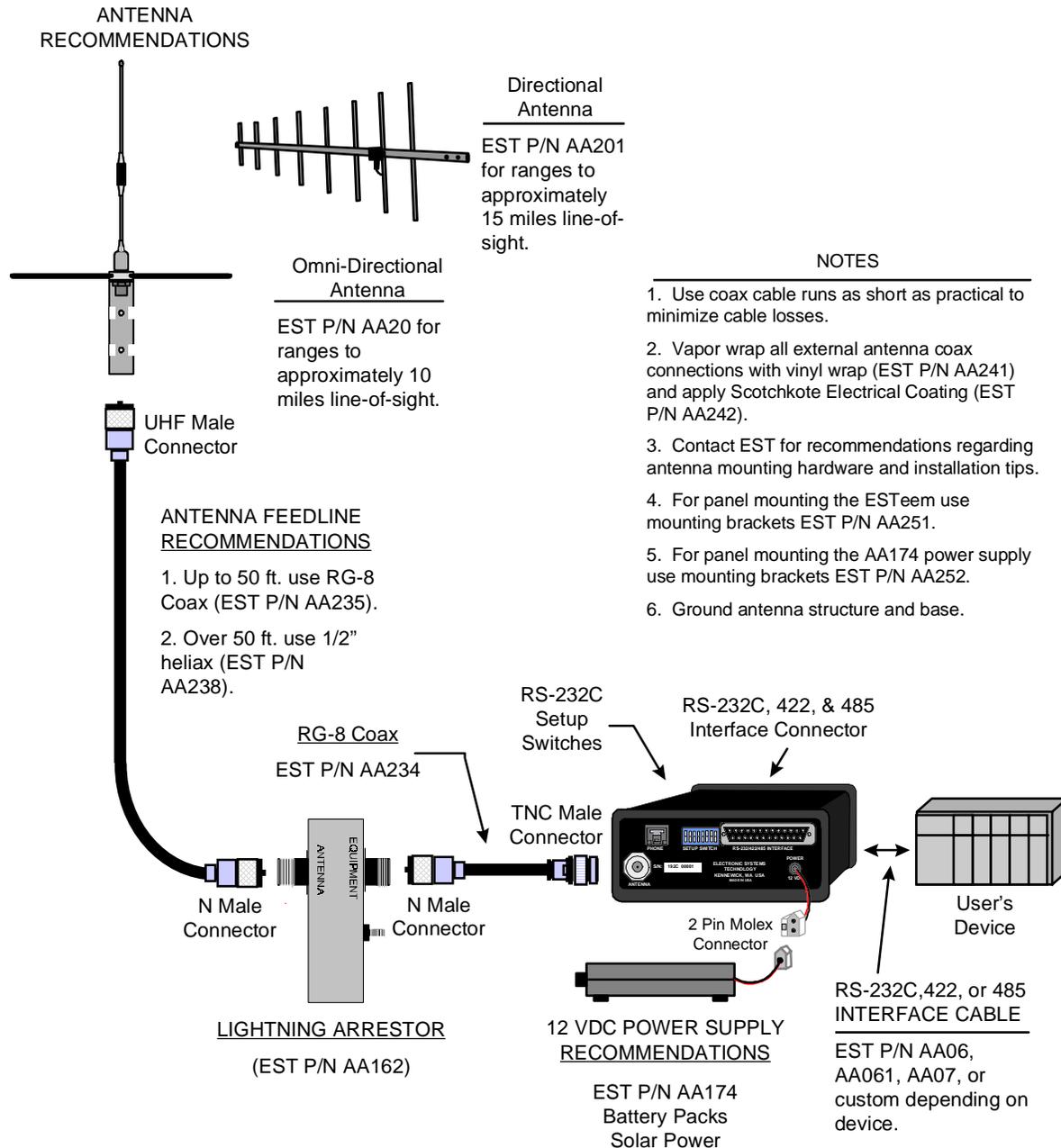
CHAPTER 6 ANTENNAS

Model 95 Indoor Antenna Setup Diagram



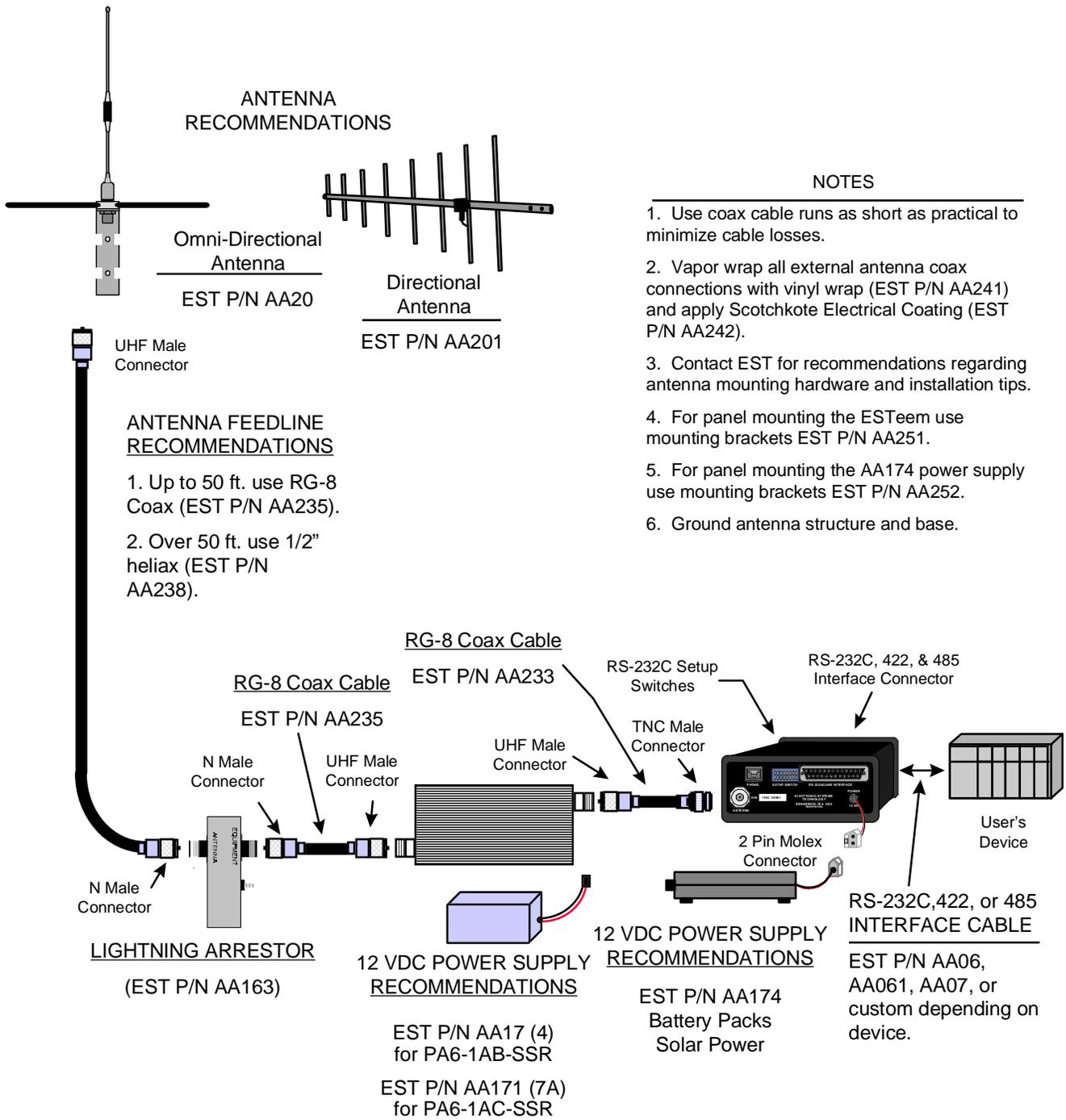
CHAPTER 6 ANTENNAS

Model 96 Outdoor Fixed Base Antenna Setup Diagram



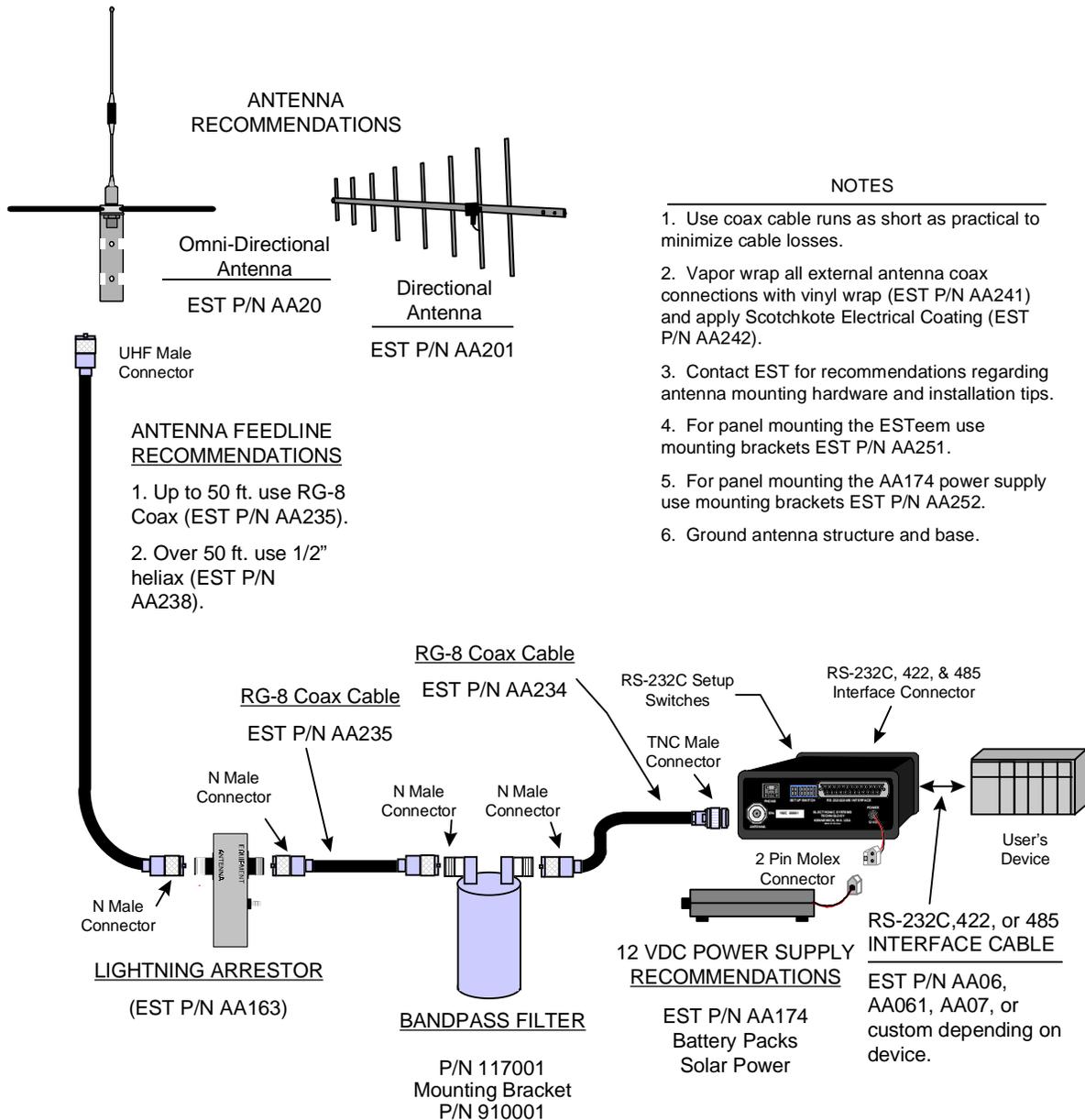
CHAPTER 6 ANTENNAS

Model 96 Outdoor Fixed Base Antenna Setup Diagram With External Linear Amplifier



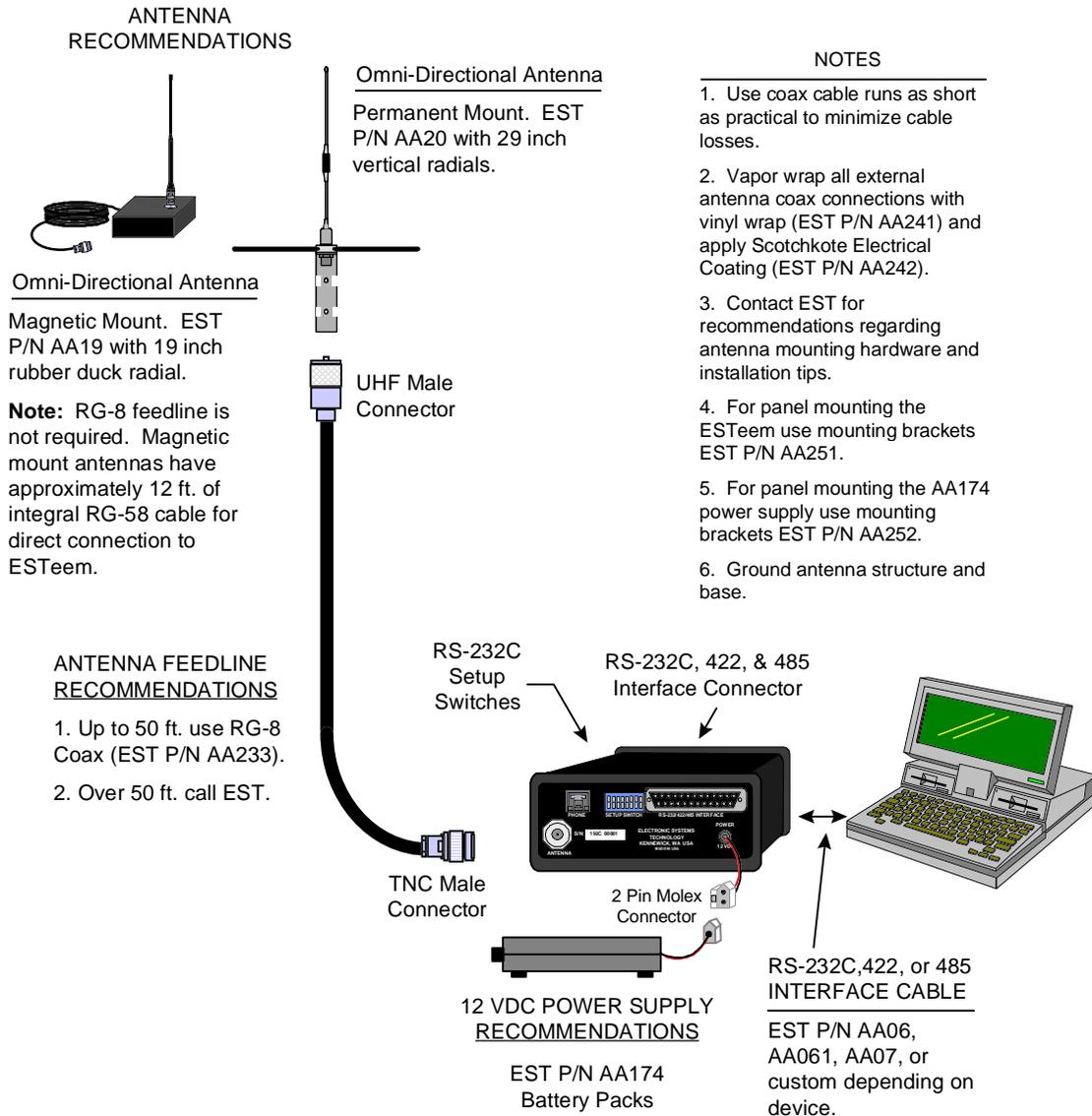
CHAPTER 6 ANTENNAS

Model 96 Outdoor Fixed Base Antenna Setup Diagram Using Bandpass Filter



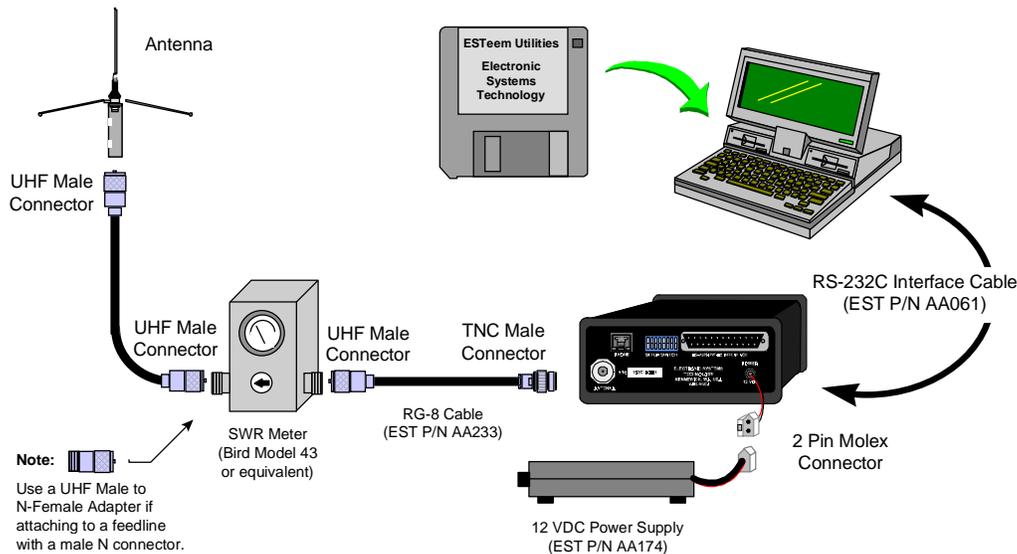
CHAPTER 6 ANTENNAS

Model 96 Mobile Antenna Setup Diagram



CHAPTER 6 ANTENNAS

ESTeem SWR Measurement Block Diagram



Programming The ESTeem For SWR Measurements

1. Configure the hardware as per the above diagram.
2. Turn Switch 8 on the RS-232 Setup Switch (located on the rear of the ESTeem) to the OFF position.
3. Reset the ESTeem (front panel switch).
4. Install the ESTeem Utility on the PC hard drive as per instructions with the software.
5. From Utility Main Menu (Figure 1) select the Terminal Emulation Mode.
6. In the Terminal Emulation Mode type the following commands followed by a RETURN.

FA Return This returns the unit to factory default parameters.

RAD ON Return Enable the RADIO ON command. The transmitter will alternate ON for 10 seconds and OFF for 3 seconds.

7. When the testing is completed, type the following:

RAD OFF Return This disables the RADIO ON command.



**Electronic
Systems
Technology Inc.**

WIRELESS MODEM COMMAND CENTER

Terminal Emulation
ESTeem/Setup Programming
PLC Applications
ESTeem Diagnostic Programs
Product Information
Site Survey Information
About
Quit

Use to manually program or communicate to your ESTeem modem with this computer.

CHAPTER 7

THEORY OF OPERATION

INTRODUCTION

ESTEEM HOW IT WORKS

SPECTRUM UTILIZATION

PACKET PROTOCOLS

FLOW CONTROL

DATA PRIVACY

EFFECTIVE BAUD RATE

CHAPTER 7

THEORY OF OPERATION

INTRODUCTION

ESTeem wireless modem products provide a "Wireless Solution" by eliminating conventional hardwiring of leased phone lines.

All of the ESTeem models come with the industry standard RS-232C, RS-422, and RS-485 asynchronous communications ports to give the user a new dimension to "Local Area Networking".

Our packet burst, frequency agile VHF and UHF communications products allow the user to create a "Radio Area Network" of up to 254 users on a single frequency. The packet burst communications using Synchronous Data Link Control (SDLC) technique was chosen to give the system very high data integrity in high noise industrial environments. The ESTeem incorporates a method of error checking that provides received data accuracy of greater than one part in 100 million.

Internal Digi-Repeater features allow the user to increase operating range by relaying transmission through a maximum of three ESTeems to reach the destination ESTeem. An ESTeem can operate as an operating node, a repeater node, or both simultaneously for added flexibility.

"Private Data Communications" is provided by the use of the ESTeem firmware SDLC, bit compression, and Manchester encoding techniques. The user can define over four different security code and communications parameter groups that allow communication access to the "Radio Area Network". If higher security is required, the ESTeem is compatible with asynchronous Data Encryption Standard (DES) encryption devices.

The ESTeem has over a 100 programmable software commands to allow the user to easily configure the unit for any application or mission. The ESTeem setup parameters are saved in its own non-volatile memory.

When you buy ESTeem products you are getting equipment designed by the company that holds the United States and Canadian patent for the wireless modem. We are proud to say that we design, develop and manufacture our products in the United States. Each ESTeem is subjected to a rigorous quality control bench test before shipping to insure our customers have out-of-the-package reliability. We also have a dedicated Customer Support Staff, Field Engineering Services and Factory Training classes to make sure that your application problem are solved.

ESTEEM HOW IT WORKS

Now, as you can probably guess, the ESTeem is a sophisticated piece of technology, however the concept is easy to comprehend if you understand packet radio.

All packet systems, whether hardwired or radio, share the same principle of operation; data is taken from your standard RS-232C asynchronous port and is transmitted in "Blocks". Think of this block as an "Electronic Envelope" that we call a packet. The size of the packet can be defined by the user from 1 to 1010 bytes of information. Reducing the size of the packet allows the ESTeem to operate better in high EMF noise environments, because by reducing the packet size you reduce transmission exposure time on the radio waves thereby increasing your probability of a successful transmission.

Once this packet of data is formed, its transmitted in a "burst," one ESTeem to another, hence the term "packet burst communications". Now, if more than one packet is required to send the data then the ESTeem goes into full automatic mode and transmits additional packets.

Before an ESTeem transmits its packet it listens to ensure that the air waves are clear before transmitting. This listen before transmit scheme is called "carrier sensed multiple access," or CSMA.

When a "packet" has been transmitted, every modem in radio range on the same frequency hears it. To design a modem to communicate with a network of modems it has to be "address specific" so only the modem you want to talk to accepts your information. It's like yelling into a crowd of 255 people but you want only the persons name you called to acknowledge (ACK). Well, very simply, that's how the ESTeem works. Once the address you're calling receives your packet, it's checked for accuracy.

Accuracy is probably the single most important part of any communication device. The ESTeem uses a 16 bit Cyclic Redundancy Check (CRC) which is a very sophisticated method of checking the data integrity of the packet once its been received. The CRC insures data integrity greater than one part in one hundred million. Once the CRC is completed on the received packet, the data is outputted to the user and a positive acknowledgment (ACK) is transmitted back to the sender.

CHAPTER 7

THEORY OF OPERATION

It's safe to assume that the data you receive is good data or you get nothing at all using the CRC technique. If no ACK is returned after a given delay, the sender assumes the packet was not received and "retries" the transmission. The number of retries are user definable from 1 to 255, allowing the unit to automatically retry sending the packet.

SPECTRUM UTILIZATION

The ESTeem uses a "listen before transmit" or Carrier Sensed Multiple Access (CSMA) scheme. This means only one unit in a network is allowed to transmit at a time. By fixing each user's communication window and allowing the computer in the ESTeem to be the Air Traffic Controller, many individual users can share one frequency. The ESTeem firmware can support up to 253 ESTeems on a single channel or frequency. For example in the United States there are over 50 frequencies available in the VHF spectrum and 1600 frequencies in UHF, giving a network density of greater than 16,830 users in a given cell or geographical area. Once you are out of radio range, you can construct another cell of users.

The CSMA technique is a very efficient way to manage your network of ESTeems and prevent communication bottlenecks. In addition, an anti-collision software scheme is used to recover data if two or more units transmit at exactly the same time. When this feature is added the technical term for this technique is now called CSMA-CD (collision detection).

By using this communications technique only one frequency channel is needed with a very narrow bandwidth (this is called narrow bank FM modulation) thereby saving valuable radio spectrum space.

PACKET PROTOCOLS

By using CSMA no polling station or token is required in the ESTeem network. When an ESTeem has information to send it will check to see if the channel is clear before transmitting its packet and await an (ACK). The ESTeem is a Master/Master system, meaning any ESTeem can communicate with any other ESTeem.

FLOW CONTROL

The ESTeem supports hardware and software flow control, which allow different devices on the network to communicate at different baud rates. In addition to flow control the ESTeem also has a 2020 byte data buffer on both the receive and transmit buffers in the modem.

DATA PRIVACY

Data privacy in the ESTeem is provided by three levels of data encoding in the firmware and by the user being able to define over four security and communications parameters (Unit Address, Network ID, Operating Frequency, and HDLC Communications Baud Rate) that allow communications access to the modem giving over 200 million combinations. If higher security is required, the units are compatible with asynchronous Data Encryption Standard (DES) encryption peripherals.

EFFECTIVE BAUD RATE

The maximum input RS-232C baud rate to the modem is 9600 baud, asynchronous, full duplex, but this is misleading since the ESTeems actually communicate to each other half duplex, synchronous, at 4800 b/s. The effective baud rate is a function of the above items plus the packet length variable in the ESTeem (definable from 1 to 1010 baud). If the packlength variable is set to 1010 baud the effective baud rate is approximately 4484 baud but the effective baud rate will degrade as the packlength variable is reduced.

Another item that must be understood is transmission turn around time. Remember, the ESTeem sends a data packet and waits for an (ACK) from the destination modem before another packet is transmitted. All radio transmitters have a fixed delay time, which is the amount of time it takes the transmitter to stabilize once it is energized before it can send data. In the ESTeem the delay is approximately 45 milliseconds one way which includes transmitter turn-on time and packet frame overhead or a total turn around time accounting for the (ACK) of 90 milliseconds. Therefore total time to send a data packet is 90 milliseconds plus the time required to send the data (ie. number of bits sent/4800 b/s). There are tables in Appendix D that give the user greater detail on this subject.

APPENDIX “A” FCC INFORMATION (USA Only)

APPENDIX “B” SPECIFICATIONS

- ESTeem General Specifications**
- Model 85/95 Transceiver Specifications**
- Models 96/98 Transceiver Specifications**
- Model 85/95 Antenna Specifications**
- Model 96/98 Antenna Specifications**

APPENDIX “C” TABLES/DIAGRAMS

- ESTeem Effective Baud Rate Table**
- ESTeem Timing Diagram**
- ESTeem Command Error Message Table**
- ESTeem System Status Message Table**
- ESTeem Communication Error Message Table**
- Hayes Modem Message Table**
- Hayes Modem Command Table**

APPENDIX “D” ESTEEM SOFTWARE COMMANDS

- Factory Default Settings**
- Definitions**

APPENDIX A

FCC LICENSING

INFORMATION TO USERS

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

To insure compliance to FCC non-interference regulations, peripherals attached to this modem require shielded I/O cables.

If this equipment does cause interference to radio or television, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Re-orient the radio/TV receiving antenna.
2. Re-orient the modem antenna.
3. Relocate the modem with respect to the radio/TV receiving antenna.
4. Plug the power supply for the modem into a different outlet so that the modem and radio/TV receiver are on different branch circuits.
5. Verify that the modem chassis is connected to an earth ground.
6. Attach a split bead (FAIR-RITE PN 2643164251) to the RS-232 cable.

If necessary, the user should consult the dealer or an experienced radio/TV technician for additional suggestions. The user may find the following booklet prepared by the FCC helpful.

"How to Identify and Resolve Radio-TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402 - Stock No. 004-000-00245-4.

Application forms for the license are available from the nearest office of the FCC.

Electronic Systems Technology maintains a list of consultants that provide professional services at a reasonable cost to assist the users in licensing.

APPENDIX A FCC LICENSING

FEDERAL COMMUNICATIONS COMMISSION FIELD OFFICES

ALASKA

1011 E. Tudor Rd.
Rm 240 Box 2955
Anchorage, AK 99510

CALIFORNIA

7840 El Cajon Blvd.
Suite 405
La Mesa, CA 92041

3711 Long Beach Blvd.
Suite 501
Long Beach, CA 90807

323A Battery St.
San Francisco, CA 94111

COLORADO

Executive Tower
1405 Curtis St.
Suite 2925
Denver, CO 80202

FLORIDA

919 Federal Bldg
51 SE First Ave.
Miami, FL 33130

1211 N. Westshore
Suite 601
A.D. P. Building
Tampa, FL 33607

GEORGIA

Massell Bldg. 440
1365 Peachtree NE
Atlanta, GA 30309

HAWAII

7304 Prince Kuhi
Federal Building
Honolulu, HI

HAWAII

300 Almoana Blvd.
P.O. Box 50023
Honolulu, HI

ILLINOIS

3935 Federal Bldg
230 S. Dearborn
Chicago, IL 60604

LOUISIANA

1009 Edw Hebert Bldg.
600 South Street
New Orleans, LA 70130

MARYLAND

1017 Geo. Fallon
Building 31
Hopkins Plaza
Baltimore, MD

MASSACHUSETTS

1600 Customhouse
165 State Street
Boston, MA 02109

MICHIGAN

1054 Federal Building
231 W LaFayette
Detroit, MI 48225

MINNESOTA

691 Federal Building
316 N Robert St.
St. Paul, MN

MISSOURI

Brywood Office Tower
6800 E. 63rd Street
Kansas City, MO

NEW YORK

1307 Federal Building
111 W. Huron
Buffalo, N.Y. 14202

201 Varick Street
New York, N.Y. 10014

OREGON

1782 Federal Building
1220 SW 3rd Avenue
Portland, OR 97204

PENNSYLVANIA

Room 404
2300 E. Lincoln H
Langhorne, PA

PUERTO RICO

747 Federal Building
Carlo Chardon Ave.
Hato Rey, P.R. 00918

TEXAS

Cabeli Building
1100 Commerce
Dallas, TX 75242

5636 Federal Building
515 Rusk Avenue
Houston, TX 77002

VIRGINIA

Military Circle
870 N. Military Hwy.
Norfolk, VA 23502

WASHINGTON

3256 Federal Building
915 Second Avenue
Seattle, WA 98174

APPENDIX B

SPECIFICATIONS

ESTeem General Specifications

SWITCHES:

- Off/On/Reset
- RS-232C/422/485 Setup

LED INDICATORS:

- Power On
- Receiver Carrier Detect
- Transmitter Enable
- Link Connect/Disconnect
- Auto Connect Enabled
- RS-232C/422/485 Framing Error.

I/O - CONNECTORS:

- Asynchronous Full Duplex, RS-232C, RS-422 and RS 485 with 25 Pin Sub D Connector.
- Antenna Output - TNC connector
- Input Power - 2 pin molex

ADDRESSING RANGE:

- 0 to 255

DATA INPUTS:

- Selectable 50 to 9,600 baud
- 7 to 8 data bits
- Even, odd, or no parity
- One or two stop bits

DATA BUFFERS:

- Transmit 2020 bytes
- Receive 2020 bytes

FLOW CONTROL:

- Hardware or Software

DATA TRANSMISSION PROTOCOL:

- Carrier Sensed Multiple Access with Collision Detection (CSMA-CD)

ERROR CHECKING:

16 Bit Cyclic Redundancy Check (CRC) with packet acknowledge and retry

MINIMUM RADIO TURN AROUND TIME:

- < 90 MS + Data (W/O ACK)
- < 180 MS + Data (W/ACK)

ENVIRONMENT:

- -20 TO 50 ° C.
- 95% non-condensing

WARRANTY:

- 1 Year

APPENDIX B SPECIFICATIONS

ESTEEM MODEL 85/95

TRANSMITTER

FREQUENCY RANGE:	72 to 73 MHz (Standard) 66 to 72 & 73 to 79 MHz (Custom 95 only)
CHANNEL SPACING:	20 KHz (standard) 12.5 KHz (Custom 95 only)
NO. OF CHANNELS:	650 Digitally Synthesized
FREQUENCY STABILITY:	± 2 PPM
RF POWER OUTPUT	1 Watt ±10%
DUTY CYCLE:	100%
RF OUTPUT IMPEDANCE:	50 Ohms
RF OUTPUT CONNECTOR:	TNC Female
SPURIOUS and HARMONICS:	> 60 dB Down From Carrier
TRANSMIT RISE TIME:	3 msec
DATA RATE:	9600 bps
DEVIATION :	± 5 KHz

RECEIVER

FREQUENCY RANGE:	72 to 73 MHz (Standard) 66 to 72 & 73 to 79 MHz (Custom 95 only)
CHANNEL SPACING:	20 KHz (Standard) 12.5 KHz (Custom 95 only)
NO. OF CHANNELS:	650 Digitally Synthesized
OUTPUT:	Digital
FREQUENCY STABILITY:	± 2 PPM
SENSITIVITY:	< 3µv Useable
SPURIOUS & IMAGE REJECTION:	> 60 dB
NOISE SQUELCH SENSITIVITY:	Four Levels; 85 Dip Switch
ADJACENT CHANNEL REJECTION:	> 60 dB

GENERAL

POWER SUPPLY VOLTAGE:	11 to 15 VDC
POWER SUPPLY CURRENT @ 12 VDC :	200 mA Receive 700 mA Transmit
INPUT POWER CONNECTOR:	2 Pin Molex
TEMPERATURE RANGE:	-20 TO +50 Degrees C
SIZE:	2-1/4 in. x 5-1/4 in. x 7 in.
WEIGHT:	2.2 lbs.
RADIO EQUIPMENT CERTIFICATES:	
Model 85	ENP53EESTEEM85-1(USA) B9093 (Canada)
Model 95	ENP53EESTEEM95
EMISSION TYPE:	16KOF2D

ESTEEM MODELS 96/96/98

TRANSMITTER

FREQUENCY RANGE:	96F & 98F: 402 to 420 MHz 96C: 450 to 470 MHz
CHANNEL SPACING:	12.5 KHz
NO. OF CHANNELS:	1600 Digitally Synthesized/Software
FREQUENCY STABILITY:	±2 PPM
RF POWER OUTPUT:	2W (Standard), 4W (Optional)
DUTY CYCLE:	100%
RF OUTPUT IMPEDANCE:	50 Ohms
RF OUTPUT CONNECTOR:	TNC Female
SPURIOUS and HARMONICS:	> 55 dB Down From Carrier
TRANSMIT RISE TIME:	2 msec
INPUT LEVEL:	Direct Digital
DATA RATE:	9600 bps

RECEIVER

FREQUENCY RANGE:	96F & 98F: 402 to 420 MHz 96C: 450 to 470 MHz
CHANNEL SPACING:	12.5 KHz
NO. OF CHANNELS:	1600 Digitally Synthesized/Software
OUTPUT:	Digital
FREQUENCY STABILITY:	±2 PPM
SENSITIVITY:	< 3µv Useable
SPURIOUS & IMAGE REJECTION:	> 50 dB
NOISE SQUELCH SENSITIVITY:	Adjustable-Software Four Levels
ADJACENT CHANNEL REJECTION:	> 60 dB @ 25 KHz Channel Spacing

GENERAL

POWER SUPPLY VOLTAGE:	12 TO 15 VDC
POWER SUPPLY CURRENT @ 12 VDC:	600 mA Receive ; 2A Transmit (2W) 3A Transmit (4W)
INPUT POWER CONNECTOR:	2 Pin Molex
TEMPERATURE RANGE:	-20 TO +50 Degrees C
SIZE:	2-1/4 in. x 5-1/4 in. x 10-1/4 in.
WEIGHT:	3.2 lbs.
RADIO EQUIPMENT CERTIFICATES:	
Model 96C:	ENP53 EESTEEM96 (USA) 2163 194 224 (Canada) TA91-RM-27 (Singapore) RPELE9407-256 (Mexico)
Model 98F:	2163 194 291A (Canada)
EMISSION TYPE:	16KOF2D

APPENDIX B SPECIFICATIONS

MODEL 85/95 ANTENNAS

MODEL AA02

ANTENNA TYPE: Omni-Directional, 1/4 Wave
POLARIZATION: Vertical
IMPEDANCE: 50 ohms
GAIN: < Unity
SWR: n/a
FRONT TO BACK RATIO: n/a
HORIZONTAL BEAMWIDTH: n/a
VERTICAL BEAMWIDTH: n/a
ANTENNA MATERIAL: Rubber Duck Whip
MOUNTING HARDWARE: n/a
ANTENNA CONNECTOR: TNC with right angle adapter
FREQUENCY RANGE: 66 to 79 MHz
ANTENNA ENVELOPE: 17" length
WEIGHT: 4 oz.
APPLICATION: Direct attachment to the ESTeem Model 95

MODEL AA03

ANTENNA TYPE: Omni-Directional, 1/4 Wave
POLARIZATION: Vertical
IMPEDANCE: 50 ohms
GAIN: Unity with ground plane
SWR: < 2 to 1
FRONT TO BACK RATIO: n/a
HORIZONTAL BEAMWIDTH: n/a
VERTICAL BEAMWIDTH: n/a
ANTENNA MATERIAL: Stainless steel whip with magnetic base.
MOUNTING HARDWARE: Magnetic base
ANTENNA CONNECTOR: TNC connector with 12 ft. of integral
RG-58 cable
FREQUENCY RANGE: 66 to 79 MHz
ANTENNA ENVELOPE: 44" length Base 3.5" L X 2.5" W x 1" H
WEIGHT: 1 lb. 5 oz.
APPLICATION: Mobile mount

MODEL AA04

ANTENNA TYPE: Omni-Directional, 1/4 Wave
POLARIZATION: Vertical
IMPEDANCE: 50 ohms
GAIN: Unity
SWR: < 1.5 to 1
FRONT TO BACK RATIO: n/a
HORIZONTAL BEAMWIDTH: n/a
VERTICAL BEAMWIDTH: n/a
ANTENNA MATERIAL: Stainless steel whip and ground plane
radials
MOUNTING HARDWARE: Heavy Duty U-Bolts for mounting up to
1 5/8" pipe
ANTENNA CONNECTOR: SO-239
FREQUENCY RANGE: 66 to 79 MHz
ANTENNA ENVELOPE: 52" length with four perpendicular
42" ground plane radials
WEIGHT: 2 lbs.
APPLICATION: Fixed Base, Building Mount

MODEL AA051

ANTENNA TYPE: Omni-Directional, DC Grounded
POLARIZATION: Vertical
IMPEDANCE: 50 ohms
GAIN: Unity
SWR: < 1.5 to 1
FRONT TO BACK RATIO: n/a
HORIZONTAL BEAMWIDTH: n/a
VERTICAL BEAMWIDTH: n/a
ANTENNA MATERIAL: Stainless steel radiator, fiberglass radials,
anodized aluminum base
MOUNTING HARDWARE: Mast mounting to 25/32 in. to 1 1/8 in.
pole by means of a mounting kit (supplied)
ANTENNA CONNECTOR: SO-239
FREQUENCY RANGE: 72 to 76 MHz
ANTENNA ENVELOPE: 63 in. L x 55 in. W with ground plane
radials
WEIGHT: 4 lbs.
APPLICATION: Fixed Base, Building Mount

MODEL AA15

ANTENNA TYPE: Omni-Directional, 1/4 Wave
POLARIZATION: Vertical
IMPEDANCE: 50 ohms
GAIN: -3db
SWR: < 2 to 1
FRONT TO BACK RATIO: n/a
HORIZONTAL BEAMWIDTH: n/a
VERTICAL BEAMWIDTH: n/a
ANTENNA MATERIAL: Rubber Duck Whip
MOUNTING HARDWARE: n/a
ANTENNA CONNECTOR: TNC with 12 ft. integral RG 58 cable
FREQUENCY RANGE: 66 to 79 MHz
ANTENNA ENVELOPE: 17" length. Magnetic base 3 1/2 in. L x
3 in. W x 1 in. H.
WEIGHT: 1 lb. 5 oz.
APPLICATION: Mobile mount

Specifications subject to change without notice.

APPENDIX B SPECIFICATIONS

MODEL 96/98 ANTENNAS

MODEL AA19

ANTENNA TYPE: Omni-Directional, 1/2 Wave
POLARIZATION: Vertical
IMPEDANCE: 50 ohms
GAIN: 2 db
SWR: < 2 to 1
FRONT TO BACK RATIO: n/a
HORIZONTAL BEAMWIDTH: n/a
VERTICAL BEAMWIDTH: n/a
ANTENNA MATERIAL: Rubber Duck Whip.
MOUNTING HARDWARE: Magnetic base.
ANTENNA CONNECTOR: TNC connector with 12 ft. of integral
RG-58 cable
FREQUENCY RANGE: 450 to 470 MHz - Model AA19C
400 to 420 MHz - Model AA19F
ANTENNA ENVELOPE: 16" length Magnetic base 3.5" L x 3" W x
1 in. H
WEIGHT: 1 lb. 5 oz.
APPLICATION: Mobile Mount

MODEL AA20

ANTENNA TYPE: Omni-Directional
POLARIZATION: Vertical
IMPEDANCE: 50 ohms
GAIN: 4.5 db
SWR: < 1.5 to 1
FRONT TO BACK RATIO: n/a
HORIZONTAL BEAMWIDTH: n/a
VERTICAL BEAMWIDTH: n/a
ANTENNA MATERIAL: Stainless steel whip and ground plane
radials all other hardware anodized
MOUNTING HARDWARE: Attaches directly to any 3/4" to 1 1/2"
pipe
ANTENNA CONNECTOR: SO-239
FREQUENCY RANGE: 450 to 470 MHz - Model AA20C
400 to 420 MHz - Model AA20F
ANTENNA ENVELOPE: 37 1/2" H by 16" W with ground plane
radials
WEIGHT: 2 lbs.
APPLICATION: Fixed Base, Building Mount

MODEL AA201

ANTENNA TYPE: Directional, 8 Element Yagi, Direct Ground
POLARIZATION: Vertical
IMPEDANCE: 50 ohms
GAIN: 11 dB
SWR: < 1.5 to 1
FRONT TO BACK RATIO: 23 dB
HORIZONTAL BEAMWIDTH: 42 degrees
VERTICAL BEAMWIDTH: 50 degrees
ANTENNA MATERIAL: High strength aluminum painted black
MOUNTING HARDWARE: Heavy duty U bolts for mounting to 3/4
in. to 1 1/2 in. pipe with right angle mount or direct panel mount
ANTENNA CONNECTOR: SO-239
FREQUENCY RANGE: 450 to 470 MHz - Model AA201C
400 to 420 MHz - Model AA201F
ANTENNA ENVELOPE: 60" L by 15" W
WEIGHT: 2.5 lbs.
APPLICATION: Fixed Base, Building Mount

APPENDIX C

TABLES/DIAGRAMS

EFFECTIVE BAUD RATE TABLE

:# of Repeaters	None	One	Two	Three
	1010	4398	2191	1455
	504	4056	2016	1333
Pack-	250	3503	1735	1140
length	100	2492	1225	797
(Bytes)	50	1688	821	531
	25	1020	496	318
	1	51	25	16

NOTE: These times are used for "BLOCK TRANSFER" applications and assumes the RS-232C Input/Output Baud Rate is 9600 for all devices used and the radio transfer rate is the factory default setting of 4800 b/s. These calculations are accurate for binary transfer applications; actual times for ASCII files will be slightly higher.

TOTAL PACKET OVERHEAD (POH)

No repeater : POH = 84 ms.
 One repeater : POH = 87 ms.
 Two repeaters : POH = 91 ms.
 Three repeaters : POH = 94 ms.

CALCULATING TOTAL TRANSMISSION TIME (TTT)

$$TTT = [2(n+1) * POH] + [(n+1) * (Data/4800)]$$

n = Number of Repeaters.

Data = Total number of Data Bits transmitted per packet or frame.

EFFECTIVE BAUD RATE

EBR = Data/TTT = BAUD RATE (when using a 8 bit word).

ESTEEM TIMING DIAGRAM

TXDATA DELAY	TXFLAY DELAY	PACKET Over- head	DATA	TXEND DELAY	CARBSY DELAY
--------------	--------------	-------------------	------	-------------	--------------

Data Packet from Sending Modem

TXDATA DELAY	TXFLAG DELAY	PACKET Over- head	TXEND DELAY	CARBSY DELAY
--------------	--------------	-------------------	-------------	--------------

Acknowledge Packet from Receiving Modem

NOTE: Data field can vary from 1 to 1010 bytes (8 to 8080 bits) depending on setup.

Listed below are the factory preset delay times for the following modems for comparison (no repeaters).

MODEL 85/96		
	TICKS	TIME
TXDATA	35	35 ms.
TXFLAG	4	4 ms.
PACKET OH		18 ms.
TXEND	10	10 ms.
CARBSY	1	17 ms.

TOTAL PACKET OVERHEAD 84 ms.

TOTAL PACKET TURN AROUND TIME
(No Repeaters)

O.H.	Transmitted Data	ACK Frame
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NOTES: The factory settings for Models 85 and 86 have been optimized for the transmitter and should not be changed.

APPENDIX C

TABLES/DIAGRAMS

ESTEEM COMMAND ERROR MESSAGE TABLE

Listed below are the ESTeem Command Error Messages and their definitions. To receive these messages, TYPESYSTEM must be ON (See Appendix E, Definitions). All System Status Messages have a bell (O7H or CTRL G) preceding the message except when Messform is ON. If MESSFORM = OFF Line A will be displayed. If MESSFORM = ON Line B will be displayed.

1. A "TOO MANY CHARACTERS FOR COMMAND"
B EMO1

This message will be displayed if more than the allocated number of characters are typed for a command. This is because some commands are truncated at a length of 8 characters.

2. A "AMBIGUOUS COMMAND"
B EMO2

This is the case of not enough characters being entered to uniquely identify a command.

3. A "INVALID COMMAND"
B EMO3

This message will be displayed if the entered characters are not defined in the command table.

4. A "TOO MANY CHARACTERS FOR THE SWITCH"
B EMO4

This message will be displayed if more than the allocated number of characters are typed for a switch (similar for error message #1, but applies to a switch). A switch in this system is defined as an off or on input.

5. A "AMBIGUOUS SWITCH"
B EMO5

Same as error message #2, only applies to switch.

6. A "INVALID SWITCH"
B EMO6

Same as error message #3, only applies to switch.

7. A "COMMAND LOCKED!"
B EMO7

This message will be displayed if an attempt is made to modify a Command Switch or Value while Security is enabled.

8. A "RADIX ALREADY DEFINED"
B EMO8

This message will be displayed if two different radices are entered for the same value.

9. A "INVALID CHARACTER FOR CURRENT RADIX"
B EMO9

This message will be displayed if: a) you are in decimal mode and enter a digit greater than 9, or enter a letter between A-F; b) you are in octal mode and enter a digit greater than 7, or a letter between A-F.

10. A "ARGUMENT OVERFLOW"
B EM10

This message is displayed if the value given to a command exceeds its maximum limit.

11. A "INVALID ARGUMENT"
B EM11

This is displayed when a non valid value is given to a Command. Example; a value of O cannot be given to FRACK because the only valid values are 1-255.

12. A "TOO MANY ARGUMENTS!"
B EM12

This message is displayed if there were too many arguments entered for the selected command.

APPENDIX C

TABLES/DIAGRAMS

ESTEEM SYSTEM STATUS MESSAGE TABLE

Listed below are the ESTEem System Status Messages and their definitions. To receive these messages, TYPSSYSTEM must be ON (See APPENDIX E, DEFINITIONS). All System Status Messages have a bell (O7H or CTRL G) preceding the message except when Messform is ON. If Messform = OFF Line A will be displayed. If Messform = ON Line B will be displayed.

- | | |
|---|---|
| <p>1. A "CONNECTED TO XX"
B SSO1-xx</p> <p>This message is caused by either receiving a reply from a Log On Packet, receiving a Log On Packet, or by typing LINK when connected and in the COMMAND MODE. XX is the address of the modem connected to.</p> | <p>7. A "LINK DOWN"
B SSO7</p> <p>This message occurs after sending the last retry data packet and receiving no response from the destination node. This message usually indicates a hard failure -i.e. destination node not energized, wrong baud rate, (not compatible between units) improper transmit/receive frequency between nodes, etc.</p> |
| <p>2. A "DISCONNECTED FROM XX"
B SSO2-xx</p> <p>Tells that you have been disconnected from the device you were originally connected to (xx is unit address).</p> | <p>8. A "ADDRESS USED AS SOURCE!"
B SSO8</p> <p>The Connect Address you gave is the same as your Unit Address.</p> |
| <p>3. A "DESTINATION CONNECTED TO ANOTHERNODE"
B SSO3</p> <p>This message occurs while trying to log to a node that is already logged to another node. The destination node sends a Node Busy Packet which, when received, causes this message to be displayed. The ESTEem remains in the COMMAND mode.</p> | <p>9. A "CURRENTLY NOT CONNECTED!"
B SSO9</p> <p>The Disconnect was issued while the modem was not connected to another modem or when LINK is typed in the COMMAND MODE when you are not connected.</p> |
| <p>4. A "LINK BUSY"
B SSO4</p> <p>This message is caused by receiving a Node Busy Packet from the destination node. Any further packet transmission is disabled until a Node Ready Packet is received from the destination node.</p> | <p>10. A "ECHO IS ALREADY Disabled"
B SS10</p> <p>This message is displayed if ECHO is disabled while enabling PASSWORD.</p> |
| <p>5. A "PACKET REJECTED"
B SSO5</p> <p>This message is caused by an invalid sequence number between transmit and receive. This could happen if the data somehow was modified during transmission. The normal recovery from this message is to reconnect. This will synchronize the sequence numbers between the transmit and sending ESTEems. This message usually indicates a soft failure in the link.</p> | <p>11. A "PASSWORD IS ENABLED"
B SS11</p> <p>This message is displayed if PASSWORD is enabled while disabling ECHO. All System Status Messages have a bell (O7H/CNTLG) preceding the message except when Messform is ON.</p> |
| <p>6. A "DESTINATION NODE RESET"
B SSO6</p> <p>This message is caused by the destination node being reset (power up, down, etc.), and the other node continues to send data. The normal recovery from this message is to reconnect. This will synchronize the sequence numbers between the transmit and sending ESTEems. This message usually indicates a soft failure in the link.</p> | <p>12. A "SECURITY IS ALREADY ENABLED!"
B SS12</p> <p>Security ON command was issued while security was currently enabled.</p> |
| | <p>13. A "SECURITY IS ALREADY DISABLED"
B SS13</p> <p>Security OFF command was issued while security was currently Disabled.</p> |
| | <p>14. A "ENTER SECURITY VALUE"
B SS14</p> <p>The ESTEem will prompt for a security value after Security On is issued. The value may be O-65535.</p> |

APPENDIX C

TABLES/DIAGRAMS

ESTEEM SYSTEM STATUS MESSAGE TABLE (continued)

15. A "ENABLING SECURITY!" B SS15	24. A "NODE CONNECT ATTEMPTS WERE "XX" B SS24
This is displayed for a correct entry to Enter Security value from the command Security On.	This message will tell the user the number of attempts to connect to your unit when you are connected to another modem. The buffer will hold a maximum of five (5) addresses. If more than five attempts are made a "CONNECT ATTEMPTS BUFFER OVERFLOW" will be printed after the number of attempts. This message will be displayed when you return to the COMMAND MODE. See NODES in the COMMAND TABLE.
16. A "DISABLING SECURITY!" B SS16	25. A "CONNECT ATTEMPTS BUFFER OVERFLOW" B SS25
This response is displayed when a correct security value is entered from the command Security Off.	This message will be displayed if more than five attempts were made to connect to your unit. See Item 24.
17. A "INVALID SECURITY VALUE!" B SS17	26. A "NO NODES ATTEMPTED CONNECT!" B SS26
This is displayed when a value other than the one used to enable the security is used to disable the feature.	This message will appear if NODES is executed from COMMAND MODE and no addresses are in the memory buffer. See NODES in the COMMAND TABLE.
18. A "EDIT IS ALREADY ENABLED" B SS18	27. A "FAILED TO CONNECT!" B SS27
This message is displayed when Block Mode is enabled and the Edit Function is already turned off.	This message occurs if the modem fails to connect.
19. A "TERMCONT IS ALREADY ENABLED" B SS19	28. A "FAILED TO DISCONNECT!" B SS28
This message is displayed when Block Mode is enabled and the TERMCONT timer is already enabled.	This message occurs if the modems are connected and are unable to disconnect.
20. A "MODEM CONFIGURED AS A PACKET MONITOR" B SS20	29. A "ENTER ROUTE #" B SS29
This message is displayed when the modem is configured in the monitor mode.	This prompt is enabled when the ALTEROUT command is ON and asks the user for up to four different routes.
21. A "ADDRESS USED AS DESTINATION" B SS21	30. A "ENTER POLE ADDRESS #" B SS30
This message is displayed when operator tries to set the unit address of the modem equal to the destination address.	This prompt is enabled when the A_BADD command is on and asks the user for the address of the device connected to the ESTeem. Reference Allen-Bradley Engineering Report 90-023.
22. A "PACKET RESPONSE BUFFER OVERFLOW" B SS22	31. A "INVALID POLE ADDRESS!" B SS31
An internal buffer has been added to hold up to seven pending packet responses. If the modem is unable to clear its buffer before the eight message is received then following message will be displayed.	This message is displayed when an invalid pole address is entered.
23. A "INVALID REPEATER ADDRESS" B SS23	
This message is displayed when trying to use ADDRESS 255 as a repeater address.	

APPENDIX C

TABLES/DIAGRAMS

ESTEEM SYSTEM STATUS MESSAGE TABLE (continued)

32. A "USING FACTORY DEFAULTS"
B SS32

This command states when factory defaults have been enabled.

33. A "NEW SOFTWARE VERSION"
B SS33

This message will appear when new EPROM version has been installed in the modem.

34. A "NOVRAM CURRENTLY IS BLANK!"
B SS34

This command states when the modem has tried to boot from blank novram.

35. A "ANOTHER PLC COMMAND ALREADY ENABLED"
B SS35

This message is displayed when one of the PLC commands (Square D, Westinghouse, or Johnson Controls) is enabled and one of the other PLC commands is requested.

36. A "DISABLED DUE TO MODECNTL COMMAND"
B SS36

This message is displayed when the MODECNTL command is enabled, and the CONVERSE command is issued from the keyboard.

37. A "HAYES PROTOCOL NOT ENABLED"
B SS37

This message is displayed when any HAYES command is invoked and HAYES is OFF.

38. A "DISABLED DUE TO RTS CTS COMMAND"
B SS38

This message is displayed when the RTS CTS command is enabled and the XHFLOW command is invoked.

39. A "DISABLED DUE TO XHFLOW COMMAND"
B SS39

This message is displayed when the XHFLOW command is enabled and the RTS CTS command is invoked.

40. A "REMOTE PROGRAMMING"
B SS40

This message is displayed when the ESTeem has been placed in the remote programming mode.

41. A "REMOTE PROGRAMMING REJECTED!"
B SS41

This message is displayed when an ESTeem is unable to remote program another unit.

APPENDIX C

TABLES/DIAGRAMS

ESTEEM COMMUNICATION ERROR MESSAGE TABLE

Listed below are the ESTEem Communication Error Messages and their definitions. To receive these messages, TYPESYSTEM must be ON (See APPENDIX E, DEFINITIONS). All System Status Messages have a bell (O7H or CTRL G) preceding the message except when Messform is ON. If Messform = OFF Line A will be displayed. If Messform = ON Line B will be displayed.

1. A "RS-232 RX PARITY ERROR"
B ECO1

This message is displayed when there is a mismatch between the received characters' parity and what the ESTEem's parity is set for.

2. A "RS-232 RX OVERRUN ERROR"
B ECO2

This message is displayed when the ESTEem's central processor unit fails to read an RS-232 character from the data buffer while more than three characters have been received. The third character is lost due to the fourth character being stored in its place.

3. A "RS-232 RX FRAMING ERROR"
B ECO3

This error message has been deleted. See Section 6, T/E LED.

4. A "HDLC RECEIVE OVERRUN ERROR"
B ECO4

This message is displayed when CPU does not service an incoming packet fast enough and information is lost. This error message should not occur under normal situations unless internal processor has a failure.

5. A "HDLC RECEIVE CRC ERROR"
B ECO5

This message is displayed when the Cyclic Redundancy Check (CRC) byte does not coincide between transmitting and receiving ESTEems. This can be caused by the integrity of the data being compromised during transmission.

6. A "HDLC RECEIVE RESTV SEQUENCE ERROR"
B ECO6

This message is displayed when the internal received sequence number does not match the received packet received sequence number.

7. A "HDLC RECEIVE SESTV SEQUENCE ERROR"
B ECO7

This message is displayed when the internal send sequence number does not match the received packet send sequence number.

8. A "NOVRAM FAILED TO VERIFY"
B ECO8

This message is displayed when a SAVE command is invoked and the verify read on the NOVRAM fails.

9. A "NOVRAM FAILED"
B ECO9

If this response is received after a save, save 1 or a save 2, there is a hardware problem with the ESTEem's NOVRAM CIRCUITRY.

10. A "HDLC MISSING SYNC BYTE"
B EC10

This message is displayed when a version 2.0 software is trying to communicate with a version other than 2.0.

11. A "SYSTEM CLOCK FAILURE"
B EC11

This message is displayed upon failure of the ESTEem internal clock.

12. A "INVALID MANCHESTER DATA"
B EC12

This message is displayed upon receipt of invalid manchester data.

13. A "HDLC RECEIVE ABORT SEQUENCE!"
B EC13

This message is displayed upon receipt of a HDLC abort sequence.

APPENDIX C

TABLES/DIAGRAMS

HAYES MODEM MESSAGES TABLE

Listed below are the Hayes Modem Messages and their definitions. To receive these messages, TYPESYSTEM must be ON (See Appendix E, Definitions). All Hayes Modem Messages have a bell (07H or CTRL G) preceding the message except when MESSFORM is ON. If MESSFORM = OFF line A will be displayed. If MESSFORM = ON line B will be displayed.

1. A "OK"
B 0

This message is displayed when the ESTeem recognizes the "AT" <cr> followed by a carriage return.

2. A "CONNECT"
B 1

This message is displayed when the ESTeem has completed a valid link.

3. A "RING"
B 2

This message is not applicable in regards to the ESTeem modem operation.

4. A "NO CARRIER"
B 3

This message is displayed when the ESTeem has lost a valid link (failed to connect).

5. A "ERROR"
B 4

This message is not applicable in regards to the ESTeem modem operation.

6. A "Connect 1200"
B 5

This message is displayed when the link has been established, the baud rate select switch of the ESTeem has been read and is verified to be set at 1200, and the AT command has been received where X>0.

7. A "NO DIAL TONE"
B 6

This message is not applicable in regards to the ESTeem modem operation.

8. A "BUSY"
B 7

This message is displayed when the ATX command has been received by the ESTeem bs X>2.

9. A "NO ANSWER"
B 8

This message is displayed when the ATX command has been received by the ESTeem and X>2.

10. A "RESERVED"
B 9

This message is not applicable in regards to the ESTeem modem operation.

11. A "CONNECT 2400"
B 10

This message is displayed when the link has been established, the baud rate select switch of the ESTeem has been read and is verified to be set at 2400, and the ATx command has been received where X>0.

12. A "RINGING"
B 11

This message is not applicable in regards to the ESTeem modem operation.

13. A "VOICE"
B 12

This message is not applicable in regards to the ESTeem modem operation.

APPENDIX C

TABLES/DIAGRAMS

HAYES MODEM COMMAND TABLE

Listed Below are the definitions of the Hayes Modem Commands in alphabetical order:

AT

Hayes command for checking the status of the modem. It will return the "OK" prompt if HAYES ON software switch is enabled.

AT&H (0-3)

Hayes command that defines the flow control as follows:

- 0 = Disables both XHFLOW and XSFLOW.
- 1 = Enables XHFLOW and disables XSFLOW.
- 2 = Enables XSFLOW and disables XHFLOW.
- 3 = Enables XHFLOW and XSFLOW.

ATD (0-255)

Hayes command to initiate a connect packet to a destination node. A value from 0 to 255 can be assigned. Factory default is 2.

ATDP (0-255)

Hayes command to initiate a connect packet to a destination node. A value from 0 to 255 can be assigned. Factory default is 2.

ATDT (0-255)

Hayes command to initiate a connect packet to a destination node. A value from 0 to 255 can be assigned. Factory default is 2.

ATE (0-1)

Hayes command with a range of 0 to 1 that defines the ECHO parameter as follows:

- 0 = Disables ECHO.
- 1 = Enables ECHO.

ATQ (0-1)

Hayes command with a range of 0 to 1 that defines the TYPSTYPE parameter as follows:

- 0 = Enables TYPSTSTE.
- 1 = Disables TYPSTSTE.

ATS (r,n)

Hayes command for configuring its internal registers. ESTEem only supports register 2 which defines the escape character value. (r = n).

- r = Hayes specified register value.
- n = Hayes register value range of 0 to 255 that defines the Escape character value.

ATV (0-1)

Hayes command with a range of 0 to 1 that defines the MESSFORM parameter.

- 0 = Enables MESSFORM.
- 1 = Disables MESSFORM.

ATX (0-6)

Hayes command with a range of 0 to 6 that defines the Extended set variable. Factory default is 0.

ATZ

Hayes command to execute a RESTORE command.

APPENDIX D

SOFTWARE COMMANDS

FACTORY DEFAULT SETTINGS

Listed below is a listing of the ESTeem software commands and their factory default values:

HELP CONTROL

CONNECT
CONVERS
COPYRIGHT
DISCONN
FACTDEFT
HARDCONF
HELP
LINKSTAT
MODEL
NODES
PACKMON = OFF
PROGRAM
RADIO = OFF
REMPROG = ON
RESET
RESTORE
SAVE
TRANS
VERSION = 4.13

HELP SETUP

ADDRESS
COMMAND = 3
EDIT = ON
MESSFORM = OFF
NETWORK = 37
PACKLENG = 1010
PREFIX = 0
PROMPT = ON
RETRY = 6
SENDPAC = 13
SETMODE = OFF
SETTRANS = OFF
TERMCONT = OFF
TERMTIME = 10
TYPERROR = OFF
TYPSTYPE = ON

HELP PLC

A_BADD = OFF
A_BCTRL = OFF
A_BPOLET = 30
GE_CTRL = OFF
GROUPDES = OFF
JOHNCTRL = OFF
MODCTRL = OFF
PLC_MAST = OFF
REPECONF = 255,0,0
REPELIST
SQDADD = 0
SQDCTRL = OFF
WESTCTRL = OFF

HELP RS-232

AUTOLF = ON
BKONDEL = ON
DTR_ENAB = OFF
ECHO = ON
MODECONT = SOFT
NUCR = OFF
NULF = OFF
NULLS = 0
PROTOCOL = OFF
PROTORX = 5
PROTOTX = 6
RING = LATCH
RS_BAUD = 110
RS_STOP = 1.0
RTS_CTS = OFF
START = 17
STOP = 19
XHFLOW = OFF
XSFLOW = ON

HELP SYSTEM

ALTERETR = 2
ALTEROUT = OFF
DISACK = OFF
GLOBAL = ON
HAYES = OFF
HAYESTIM = 45
IDLECONT = OFF
IDLEFINE = OFF
IDLETIME = 30
MULTCONN = OFF
MULTDELI = 91,93
MULTID = OFF
POLLED = OFF
RECONNEC = OFF
RECONRET = 10
RECONTIM = 1
SECURITY = OFF
SETCON = 10

HELP RADIO

CARBSY = 1
FRACK = 15
HDLCAUD = 11 (85 & 95); 13 (96)
LATFREQ
SEL/A1 = (95 & 96 only)
SEL/A2 = (95 & 96 only)
SEL/A3 = (96 only)
SEL/N1 = (95 & 96 only)
SEL/N2 = (95 & 96 only)
SEL/N3 = (96 only)
SEL_SW1 = (96 only)
SEL_SW2 = (95)
TXDATA = 35
TXEND = 10
TXFLAG = 4
TXSTAT

APPENDIX D

SOFTWARE COMMANDS

DEFINITIONS

Listed below are the definitions of the ESTeem software commands listed in alphabetical order:

A_BADD (ON/OFF)

This function enables an addressing table for Allen Bradley half duplex equipment. For further details reference the EST Engineering Report on Allen Bradley controller interfacing. Factory default = OFF.

A_BCTRL

This function enables the Allen Bradley controller protocol. For further details reference the EST Engineering Report on Allen Bradley controller interfacing. Factory default = OFF.

A_BPOLET (1-255)

This command defines the rate at which the ESTeem modem sends Allen Bradley half duplex poll messages. For further details reference the EST Engineering Report on Allen Bradley controller interfacing.
Factory default = 30.

ADDRESS (0-255)

The command defines the ESTeem source address. The default value is whatever address has been stored in nonvolatile memory. Addresses 0 to 254 are usable for unit addressing. Address 254 is used for Self Test. Address 255 is used for GLOBAL.

ALTERETR (0-255)

This command specifies the number of retries to establish a link under the ALTERROUT command. This command is independent to the RETRY command.
Factory default = 2. NOTE: When ALTERROUT = ON, the RETRY variable determines how many times the ESTeem will cycle through the ALTERROUT table before displaying the "Link Is Down" message.

ALTEROUT (on/off)

This command allows the user to define four alternate routes. When this software switch is enabled the ESTeem will prompt the user for four addition modem addresses or destinations. It is noted that a destination using repeater paths can be used. If the modem is unable to connect to the specific unit addressed or "DESTINATION CONNECTED TO ANOTHER NODE" is encountered the modem will try to connect using an alternate route. The modem will start route selection with the last route used or the SETCONN variable. The ALTERETR command will determine the number of tries the ESTeem will attempt to connect before it switches to the next route defined in the table. Factory default = OFF.

AUtoLf (on/off)

This command enables the auto line feed sent to the terminal after each carriage return. Factory default = ON.

BKONdel (on/off)

This command when enabled echoes to the terminal the [backspace - space - backspace -delete] sequence when the DELETE character is entered. When disabled the [] is echoed to the terminal when the DELETE character is entered. Factory default = ON.

CARBsy (1-255)

This command defines the carrier busy delay in TICS. One TIC equals 16.67 milliseconds.

COMMANd (0-255)

This command specifies the value in decimal specifying an ASCII character used to return the ESTeem to COMMAND MODE. If the COMMAND variable is sent when in the COMMAND MODE any pending radio transmissions are terminated and the RS-232C receive buffers are cleared. Factory default = \$O3 (Hex) or CTRL-C.

CONNect (r1,r2,r3,da)

This command performs the CONNECT to a destination ESTeem. This function supports a direct connect or a connect through a maximum of three repeater nodes. The default value is whatever address has been stored by the SETCONN COMMAND.

r1 = ESTeem address (0 to 253) of repeater 1.
r2 = ESTeem address (0 to 253) of repeater 2.
r3 = ESTeem address (0 to 253) of repeater 3.
da = Destination address (0 to 255).

CONVers

The execution of this command causes an immediate exit from COMMAND MODE into CONVERSE MODE.

COPright

The execution of this command causes the copyright information to be printed.

DISACK (on/off)

This command when enabled instructs the modem to disable the acknowledgement request on the information packet. This is used when the designation device will respond with its own acknowledgement.
Factory default = OFF.

APPENDIX D

SOFTWARE COMMANDS

DISCONnect

The disconnect command. The execution of this command immediately initiates a disconnect request with the currently connected node.

DTAr-enab (on/off)

The DTR enable command. This command, when enabled, allows the ESTeem modem to monitor pin 20 of the RS-232C connector in regards to the status of an external device connected to it.

ON: Enables monitoring the DTR signal on pin 20 of the RS-232C connector. If DTR is at a space condition, then the modem is enabled. If DTR is at a mark condition, then the ESTeem modem will be disabled. The normal operation of this line is for the ESTeem modem to have status on the external device, outputting to pin 20. This line can act as a status to the ESTeem when the external device is ready to transmit or receive data.

Factory default = OFF.

If the DTR command is enabled and the line is disabled then the ESTeem will perform a "Disconnect" if connected. DTR enabled also turns on Carrier Detect (pin 8) if the ESTeem is "Connected" to another ESTeem, Carrier Detect will go off if the ESTeem is "Disconnected".

ECHO (on/off)

This command enables the ESTeem to echo characters received from the input device back to the input device. to the terminal by the ESTeem.

Factory default =ON.

EDit (on/off)

This command enables the EDIT functions from the CONVERSE Mode. Factory default = ON.

FActdeft

The factory default command. The execution of this command causes the ESTeem to restore the command table values from factory values that are stored permanently in UVPRM. This is to allow the user the ability to configure the ESTeem to factory conditions during testing or set-up.

FRACK (1-255)

This command programs the frame acknowledge delay in tics. This value is used as a minimum time before decrementing the retry count and retransmitting a packet if the retry count is not zero. 1 TIC = 16.67 ms.

GE_CTRL

This command enables the General Electric controller protocol. For further information please reference the EST Engineering Report on General Electric controller interfacing. Factory default = OFF.

GLOBAL (on/off)

The Global command when enabled will allow the user to receive GLOBAL messages from other ESTeems.
Factory default = ON.

GROUPDES (on/off)

This command works in conjunction with the REPECONF command to allow multiple PLC addresses with one destination ESTeem address. This function is described in detail in the PLC engineering reports. Factory default = OFF.

HARDCONF

This command prints out the current hardware configuration. Listed below is an example of the display format:

Hardware Configuration

```
CPU      MODEL 85
RS-232  ASYNCHRONOUS
NOVRAM  4 * 64 bytes
MEMORY  4 *16384 bytes
ROM SIZE 24049 bytes
RAM SIZE 8192 bytes
```

HAYES (on/off)

The Hayes modem command. This command allows the ESTeem modem to respond to certain Hayes modem commands via the RS-232C. Factory default = OFF.

HAYESTim (1-255)

The Hayes protocol termination sequence delay command. This is an eight bit variable used to define the delay which terminates the Hayes protocol sequence.

6,600 b/s = HDLC 8	4,800 b/s = HDLC 11
5,867 b/s = HDLC 9	2,400 b/s = HDLC 22
1,200 b/s = HDLC 44	1,100 b/s = HDLC 48
694 b/s = HDLC 76	600 b/s = HDLC 88

Call the factory for custom baud rate settings.

Factory default = 45.

HDLC (0-255)

This command defines the HDLC data rate for the data transmission over the radio transmitter. Contact factory for details. Factory default = 11 (Model 85 & 95) = 13 (Model 96C & 96F).

APPENDIX D

SOFTWARE COMMANDS

HELP

HELP switches are:

HELP	Displays this Help menu.
HELP ALL	Displays All commands switches and arguments.
HELP CHANGE	Displays only the commands that were change on the last SAVE.
HELP CONTROL	Displays Control commands switches and arguments.
HELP PLC	Displays PLC commands switches and arguments.
HELP RADIO	Displays Radio commands switches and arguments.
HELP RS-232	Displays RS232 commands switches and arguments.
HELP SETUP	Displays Setup commands switches and arguments.
HELP SYSTEM	Displays System commands switches and arguments.

IDLECont (on/off)

This command enables the idle port disconnect timer. This means that if enabled the idle port will be disconnected from the CONVERSE or TRANSPARENT MODE and returned to COMMAND MODE if the RS-232 port is not active for the length of time defined by IDLETime command. Factory default = OFF.

IDLEFine (on/off)

Sets the IDLETime unit time intervals.

ON: IDLETime units = tics (1 tic = 16.7ms).
OFF: IDLETime unit = 1 sec.

Factory default = OFF.

IDLETime (1-255)

This command sets the time limit for the idle port disconnect timer. Factory default = 30.

JOHNctrl (on/off)

This function enables the Johnson controller protocol. For further detail Reference the EST Engineering Report on Johnson controller interfacing.
Factory default = OFF.

LAtfreq (1-2)

This command is only supported on the Model 96. This allows selection of the desired serial frequency synthesizer on the Tx/Rx card. A one (1) or two (2) specifies the desired synthesizer to latch the corresponding divide by "N", divide "A", and the two bit switch settings.

LINKStat

This command displays the current link status.

MESSForm (on/off)

When enabled all of the system status and error messages will be in a formatted form.

"xx" indicates what error or message (See Error Messages and System Status Messages).

nEMxx <CR>	[ESTeem Error Messages]
nECxx <CR>	[Communication Error Messages]
nSSxx <CR>	[System Status Messages]
nSSxx-xxxx <CR>	[System Status Message W/Returned Value]

n is the User Definable Prefix character (See Prefix).

Factory default = OFF.

MOdecontr (Hardware/Software)

HARDWARE: The mode of the ESTeem modem is controlled by pin 19 of the RS-232C connector. A low (0) directs the ESTeem into the COMMAND mode. A high (1) directs the ESTeem into CONVERSE/TRANSPARENT mode.

SOFTWARE: The mode of the ESTeem modem is controlled by ASCII character.

Factory default = SOFTWARE

MODEL (xx)

Displays the product model of default firmware that is installed. Model should be the same as product being used.

MODCTRL (on/off)

This command enables the Modicon controller protocol. For further detail Reference the EST Engineering Report on Modicon controller interfacing.

Factory default = OFF.

APPENDIX D

SOFTWARE COMMANDS

MULTCONN (on/off)

The MULTICONNECT command.

ON: When enabled, the ESTeem modem can connect to more than one ESTeem (node) at a time. When a link is established it will be remembered in a link status table stored internally in the ESTeem. The maximum number of multiple connect nodes that the modem can connect to is 255. This feature is used for CONTENTION and POLLED systems eliminate the radio transmissions occurring during the normal CONNECT/DISCONNECT protocol sequence. Reference MULTID and MULTDELI commands.

Factory default = OFF.

MULTDELI (1-255,1-255)

This command defines the delimiter that will be used when the MULTID is enabled.

Factory default = 91, 93.

MULTID (on/off)

This command when enabled allows the ESTeem User to send data to another ESTeem from the CONVERSE MODE by specifying the routing address before the data.

Factory default = OFF.

EXAMPLE OF TRANSMITTED DATA:

[001]DATA Routes data to an ESTeem addressed 1.
[100,200,250,1]DATA Routes data to an ESTeem addressed 1 via ESTeems addressed 100, 200, and 250.

This replaces using the CONNECT command from the COMMAND Mode. The brackets [and] are defined using the MULTDELI command. Received data packets will have the address of the ESTeem that sent the data at the beginning of the data packet.

EXAMPLE OF RECEIVED DATA:

[004]RECEIVED DATA Data received from an ESTeem addressed 4.
[030,100,244,004] Data received from an ESTeem addressed 4 via ESTeems addressed 30, 100, and 244.

NETWORK (0-255)

Network identification code. This is used to program a common code for all modems in the customers network so that another facility on your frequency using the same addresses will not interfere with your equipment. Factory default = 37.

NODES

This command will tell the user the address of modems (nodes) that attempted to connect to you when you were connected to another node. The maximum buffer capacity is five addresses. Listed below is the output format.

"NODES = [1st Address], [2nd Address], [5th Address]

If a "*" precedes an address then one or more repeaters were used. To determine the routing direction the following PATH commands must be used:

1st Address = PATH1
2nd Address = PATH2
3th Address = PATH3
4th Address = PATH4
5th Address = PATH5

EXAMPLE: "NODES = 11, *10, 16, 30, *55

If the above was displayed after the NODE command was executed from COMMAND MODE, the following would be known:

1st modem address = 11 - called direct.
2nd modem address = 10 - used one or more repeaters.
3rd modem address = 16 - called direct.
4th modem address = 30 - called direct.
5th modem address = 55 - used one or more repeaters.

To determine the repeater path for modems 2 and 5 do the following from COMMAND MODE:

CMD: NODE PATH2 <cr>

The modem will reply with the following:

"NODES PATH2 = [Address of 1st Repeater], [Address of 2nd Repeater], [Address of 3th Repeater], [Address of Modem].

NOTE: This is in proper order for the CONNECT command.

Repeat the above procedure for PATH5.

NODES CLEAR

This command will reset the NODES buffer. The buffer will be cleared when the modem is connects to another node.

NUCr (on/off)

This command enables the nulls command after carriage return. Factory default = OFF.

NULf (on/off)

This command enables the nulls command after line feeds. Factory default = OFF.

APPENDIX D

SOFTWARE COMMANDS

NULLS (0-255)

The nulls command, where n is equal to the number of nulls to send after either a carriage return <CR> or a line feed <LF>. Factory default = 0.

PACKleng (1-1010)

This command defines the length of the data packet in bytes. Factory default = 1010.

PACKMON (on/off)

Places the ESTeem in the packet monitor mode. Factory default = OFF.

PLC_MAST (on/off)

The programmable logic controller (PLC) command.

ON: When enabled, the ESTeem modem will identify the desired route from the master PLC message. The ESTeem modem will only identify the PLC master route if the master command is enabled in the PLC.

OFF: The ESTeem modem will be configured as to interface to a slave PLC.

Factory default = OFF.

POLLed (on/off)

When enabled the ESTeem will only transmit the contents of its internal transmit buffer when it receives an ENQ (hex 5) from a polling ESTeem. During non polled times the ESTeem transmit buffer will be continuously updated from data being received by the

RS-232C/422 port. This software feature was developed for interfacing the ESTeem to output devices without flow control that are to be polled from a master device.

ON: Enabled will transmit the contents of its transmit buffer when a ENQ (hex 5) is received.

OFF: Disabled.

Factory default = OFF.

PREfix (1-255)

This is the character that precedes the formatted message (See Messform). It may be given any value from 1-255. If a 0 is used, then there will be no prefix value. This character is generally used to flag the users software that an ESTeem message follows. Factory default = 0.

PROGRAM (0-254,0-254,0-254,0-255)

This command is used to remote program another ESTeem unit. Example PROG: 10 (Unit 10 is the address of the remote unit). When a connection has been made with the remote ESTeem the RPG: prompt will appear. Showing you are now in the command prompt of the remote modem. See REMPROG.

PRompt (on/off)

The prompt enable command.

ON: The prompt responses are enabled. These are the prompts for Converse or Trans Mode that are normally output from the RS-232C serial port by the ESTeem.

Factory default = ON.

PROTOCol (on/off)

The protocol command when interfacing the ESTeem to a mainframe computer. This command allows the ESTeem to be connected to computers using the ENQ/ACK type of protocol. The ENQ/ACK characters are user definable by the PROTORX and PROTOTX commands.

Factory default = OFF.

PROTORx (0-255)

The enquiry character received by the ESTeem when connected to a mainframe computer. The value in decimal specifies an ASCII character used to signal the ESTeem when to send the- PROTOTx ASCII character.

Factory default = 5.

PROTOTx (0-255)

The ACK character transmitted by the ESTeem when connected to a mainframe computer, after receiving the PROTORx inquiry ASCII character from the mainframe. The value in decimal specifies an ASCII character used to signal the mainframe, or acknowledge the mainframe, that the ESTeem has received a PROTORx ASCII character. Factory default = 6.

RADio (on/off)

The radio transmitter enable command. The ESTeem radio transmitter will cycle on and off when enabled for tuning and adjusting procedures. The factory default value is OFF.

APPENDIX D

SOFTWARE COMMANDS

RECONNEC (on/off)

The RECONNEC command when enabled will automatically repeat the connect attempt when "DESTINATION CONNECTED TO ANOTHER NODE" (SS03) is displayed. The number of attempts is determined by the RECONRET command. The time between attempts is determined by the RECONTIm command. If the modem is unable to connect after the retry number is met, the unit will return to the COMMAND MODE.

NOTE: The modem will not be able to receive a connect from an outside node during the reconnect process, but the NODE command will reveal the addresses of any attempts to contact you.

Factory default = OFF.

RECONRet (1-255)

The RECONRET command is used with the RECONNEC command to determine the number retry attempts before the Reconnect is aborted. Factory default = 10.

RECONTIm (1-255)

The RECONTIM command is used with the RECONNEC command to set the time in seconds between the RECONNEC attempts. Factory default = 1.

REMPROG (on/off)

This command will enabled will disable your ESTeem from being remotely programmed from another ESTeem. Factory default = 0.

REPECONF (1-255,1-255,1-255)

This command extends the usual point to point routing protocol in a PLC to include routing data through a series of ESTeem repeaters. This command is explained in detail in the PLC Engineering Reports. See REPELIST command.

REPELIST

This command is used to display REPECONF Table. This command is used in PLC interfacing. Its actual use is defined in the specific PLC engineering reports.

RESet

The software reset command for the ESTeem. The execution of this command resets the internal electronics in the ESTeem.

REStore (1-2)

The restore command. The execution of this command restores the ESTeem command variables and switches from one of two different configurations stored in nonvolatile memory. Factory default value is REST (1).

RETry (1-255)

The retry command number. This is the number specifying the number of retries, retransmission of frames, that are not acknowledged. Frames are retransmitted RETRY times before operation is aborted. Factory default = 6.

RING (latch/pulse)

This command is used to program the ring output line on pin 22 of the RS-232C connector.

RING LATCH: Pin 22 is high (space) when unit is connected.

RING PULSE: Pin 22 is pulsed (positive 250 ms.) when unit is connected.

Factory default = LATCH.

RS Baud (110,150,75,50)

This command allows the user to extend the ESTeem RS-232C 110 baud rate switch setting to the following non-standard values of 150, 75, and 50 baud. The RS-232C SETUP SWITCH on the ESTeem must be set to the 110 baud switch setting for these settings to be enabled. Factory default is 110.

RS-stop (2.0,1.5,1.0)

This command allows software selection of the number of stop bits in the data stream to be interpreted by the ESTeem modem via the RS-232C. Factory default = 1.0.

RTs-cts (on/off)

This command enables the standard RS-232C handshake protocol.

ON: When enabled, this switch will allow the ESTeem modem to respond to the RTS (Request to Send pin 4) and reply with the CTS (Clear to Send pin 5) commands according to the standard RS-232C specifications,

OFF: The ESTeem modem activates the RTS (pin 4) and CTS (pin 5) according to XHFLOW (Hardware flow control specifications). XHFLOW must be enabled. An error message will be generated if an attempt is made to enable RTS and XHFLOW simultaneously.

Factory default = OFF.

RXS (on/off)

This command when enabled will display the approximate received RF signal strength of an emitter. Listed below is the output reading an approximate microvolt (uV) conversation.

OUTPUT uV Level:

0 to 2	<10
3 to 9	>10 but <20 uV
10 to 19	>20 but <35 uV
20 to 34	>35 but <50 uV

APPENDIX D

SOFTWARE COMMANDS

SAve (1-2)

The save command. The execution of this command stores the current command values and switches to one of two different nonvolatile memories. The commands are SAVE (1 = default value) and SAVE 2. NOTE: Please wait approximately two seconds after executing the SAVE command before turning off power to the ESTeem.

SDLC (on/off)

The Synchronous Data Link Control (SDLC) command.

ON: When enabled, this switch configures the ESTeem modem RS-232C port for transparent SDLC mode. This mode will be executed when the SDLC command has been invoked, SAVED, bit 8 of the RS-232C switched ON, and the modem hardware reset.

OFF: The ESTeem modem RS-232C port is configured as an asynchronous character port.

Factory default = OFF.

SECURity (on/off)

The security command: When enabled you can input a security code from 0 to 65535.

ON: Prevents protected commands from being modified.

Factory default = OFF.

SENDPAC (0-255)

The send packet command. The value specifies an ASCII character used to signal when to send the packet. The send packet factory default value is 13 (Carriage Return <cr>).

SETCon (r1,r2,r3,da)

This command defines the destination address for the ESTeem to perform a connect using the Auto Connect feature. This function supports a direct connect or a connect through a maximum of three repeaters.

r1 = ESTeem address (0 to 253) of repeater 1.
r2 = ESTeem address (0 to 253) of repeater 2.
r3 = ESTeem address (0 to 253) of repeater 3.
da = Destination address (0 to 255).

SETMode (on/off)

The TRANSPARENT mode set command.

ON: When switch #8 of the RS-232C Set-up switch on the rear of the ESTeem is set ON, the SET Mode is ON, and the ESTeem is reset (a reset reads in the position of the switch #8 after it was changed), the ESTeem will enter Auto-Connect TRANSPARENT mode. COMMAND and SENDP character are defeated.

OFF: When switch #8 of the RS-232C Set-up switch on the rear of the ESTeem is set OFF. The modem will no longer auto-connect in the transparent mode on receipt of data.

Factory default = OFF.

SETTrans (on/off)

This command is used to enable/disable the following commands for TRANSPARENT MODE using one input command:

ON: AUTOLF = OFF PROMPT = OFF
 ECHO = OFF TYPSTYPE = OFF
 EDIT = OFF

OFF: AUTOLF = ON PROMPT = ON
 ECHO = ON TYPSTYPE = ON
 EDIT = ON

Factory default = OFF.

SQDCTRL (on/off)

This function enables the Square D controller protocol. For further detail Reference the EST Engineering Report on Square D controller interfacing.
Factory default = OFF.

SQDADD (0-255)

This function is used with the SQDCTRL command to control the address fence when using SQ-D Network Interface Modules. For further details reference the EST Engineering Report on the SQ-D controller. Factory default = 0.

STArt (0-255)

The start command for flow control. The value specifies the ASCII character used to start XSFLOW.
Factory default = 17 [CTRL Q].

STOp (on/off)

The stop command for flow control. The value specifies the ASCII character used to stop XSFLOW.
Factory default = 19 [CTRL S].

APPENDIX D

SOFTWARE COMMANDS

TERMCont (on/off)

The RS-232 receive termination timer.

ON: If there are characters in the RS-232 buffer and the modem is in Converse Mode, the termination timer starts from the time the last receive character is updated in the buffer. If the termination time expires before another character is received, the characters are transmitted.

Factory default = OFF.

TERMTime (1-255)

The RS-232 receive termination timer value. This value can be 1 to 255 tick intervals (1 tic = 16.67 ms.). This value time out is enabled by TERMCONT.

Factory default = 10.

TRans (0-255)

The transparent mode command. The execution of this command causes an immediate exit by the ESTeem unit COMMAND mode to TRANSPARENT mode and cannot be saved by the SAVE command. This mode allows the ESTeem link to be completely transparent to the communicating RS-232 devices. When in transparent mode, and prompts are enabled, a ">" is displayed on the terminal. If a variable is specified with this command the ESTeem will return to the COMMAND Mode after the number of transmissions equal the number specified.

EXAMPLE: CMD: TRANS <cr>

The ESTeem would immediately be placed in the TRANSPARENT Mode (> prompt would be displayed) and remain in that mode until the ESTeem was hardware reset.

EXAMPLE: CMD: TRANS 5 <cr>

The ESTeem would immediately be placed in the TRANSPARENT Mode and would return to the COMMAND Mode after five transmissions.

TXDATA (1-255)

This command defines the transmit data delay in milliseconds.

TXEnd (1-255)

This command defines the transmit end delay in milliseconds.

TXFlag (1-255)

This command defines the transmit flag delay in milliseconds.

TXSTAT (clear/high/low)

This command prints the total number of rf transmissions vs. the total number of retries.

CLEAR: Initiation of this command causes the total transmit and retry count to be zeroed.

HIGH: Initiation of this command displays the upper 16 bit value of the total transmit count and the total retry count.

LOW: Initiation of this command displays the lower 16 bit value of the total transmit count and the total retry count.

TYPerr (on/off)

This command enables the Communication Error Messages. Factory default = OFF.

TYPSysteme (on/off)

This command enables the System and Error Message Commands. Factory default = ON.

VERSION

This command will display the current software version being used by the ESTeem.

WESTCTRL (on/off)

This function enables the Westinghouse controller protocol. For further detail Reference the EST Engineering Report on Westinghouse controller interfacing. Factory default = OFF.

XHflow (on/off)

This command enables hardware flow control. Factory default = OFF.

XSflow (on/off)

This command enables software flow control. Factory default = ON.

APPENDIX E

MODEL 85 TRANSCEIVER

TRANSCEIVER FREQUENCY SELECTION TABLE

The Transceiver Select Switches located on the rear of the ESTeem select the operating frequency for both the transmitter and receiver simultaneously. The Model 85 cannot be configured to transmit and receive on different frequencies. Listed below is the published frequency table for the 72 to 73 MHz spectrum, for frequencies outside of that spectrum call the factory.

FREQ (MHz)	SWITCH BIT								
	1	2	3	4	5	6	7	8	9
72.020	ON	OFF	ON	ON	OFF	OFF	ON	ON	OFF
72.040	ON	OFF	ON	ON	OFF	OFF	OFF	ON	OFF
72.060	ON	OFF	ON	OFF	ON	ON	ON	ON	OFF
72.080	ON	OFF	ON	OFF	ON	ON	OFF	ON	OFF
72.100	ON	OFF	OFF	ON	ON	ON	ON	ON	OFF
72.120	ON	OFF	OFF	ON	ON	ON	OFF	ON	OFF
72.140	ON	OFF	OFF	ON	ON	OFF	ON	ON	OFF
72.160	ON	OFF	OFF	ON	ON	OFF	OFF	ON	OFF
72.180	ON	OFF	OFF	ON	OFF	ON	ON	ON	OFF
72.200	ON	OFF	OFF	ON	OFF	ON	OFF	ON	OFF
72.220	ON	OFF	OFF	ON	OFF	OFF	ON	ON	OFF
72.240	ON	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
72.260	ON	OFF	OFF	OFF	ON	ON	ON	ON	OFF
72.280	ON	OFF	OFF	OFF	ON	ON	OFF	ON	OFF
72.300	OFF	ON	ON	ON	ON	ON	ON	ON	OFF
72.320	OFF	ON	ON	ON	ON	ON	OFF	ON	OFF
72.340	OFF	ON	ON	ON	ON	OFF	ON	ON	OFF
72.360	OFF	ON	ON	ON	ON	OFF	OFF	ON	OFF
72.380	OFF	ON	ON	ON	OFF	ON	ON	ON	OFF
72.400	OFF	ON	ON	ON	OFF	ON	OFF	ON	OFF
72.420	OFF	ON	ON	ON	OFF	OFF	OFF	ON	OFF
72.440	OFF	ON	ON	ON	OFF	OFF	OFF	ON	OFF
72.460	OFF	ON	ON	OFF	ON	ON	ON	ON	OFF

FREQ (MHz)	SWITCH BIT								
	1	2	3	4	5	6	7	8	9
72.500	OFF	ON	OFF	ON	ON	ON	ON	ON	OFF
72.540	OFF	ON	OFF	ON	ON	OFF	ON	ON	OFF
72.580	OFF	ON	OFF	ON	OFF	ON	ON	ON	OFF
72.600	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
72.620	OFF	ON	OFF	ON	OFF	OFF	ON	ON	OFF
72.640	OFF	ON	OFF	ON	OFF	OFF	OFF	ON	OFF
72.660	OFF	ON	OFF	OFF	ON	ON	ON	ON	OFF
72.680	OFF	ON	OFF	OFF	ON	ON	OFF	ON	OFF
72.700	OFF	OFF	ON	ON	ON	ON	ON	ON	OFF
72.720	OFF	OFF	ON	ON	ON	ON	OFF	ON	OFF
72.740	OFF	OFF	ON	ON	ON	OFF	ON	ON	OFF
72.760	OFF	OFF	ON	ON	ON	OFF	OFF	ON	OFF
72.780	OFF	OFF	ON	ON	OFF	ON	ON	ON	OFF
72.800	OFF	OFF	ON	ON	OFF	ON	OFF	ON	OFF
72.820	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
72.840	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	OFF
72.860	OFF	OFF	ON	OFF	ON	ON	ON	ON	OFF
72.880	OFF	OFF	ON	OFF	ON	ON	OFF	ON	OFF
72.900	OFF	OFF	OFF	ON	ON	ON	ON	ON	OFF
72.920	OFF	OFF	OFF	ON	ON	ON	OFF	ON	OFF
72.940	OFF	OFF	OFF	ON	ON	OFF	ON	ON	OFF
72.960	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	OFF
72.980	OFF	OFF	OFF	ON	OFF	ON	ON	ON	OFF

NOTE: Model 85 units that are shipped to Canada are not allowed to have the frequency and receiver gain switches accessible from the outside of the unit. The rear plate must be removed to gain access to these switches to prevent frequency changes by unauthorized users.

RECEIVER SQUELCH SELECTION

An application may arise where environmental noise triggers the carrier detect circuitry and inhibits operation of the ESTeem. The user has the option to increase receiver squelch above the noise. Increasing the receiver squelch allows operation of the ESTeem in the users' high noise environment.

REMEMBER, an increase in receiver squelch causes a corresponding decrease in range.

Receiver squelch switches are provided on the rear of the ESTeem to allow the user to select different values of receiver sensitivity.

The last two bits (11 & 12) on the Frequency Select Switch located on the rear panel of the ESTeem are used to adjust the receiver carrier detect threshold. Four ranges are provided for the user. Listed below are the switch settings.

SWITCH BIT		TYPICAL RECEIVER SQUELCH THRESHOLDS	
11	12		
OFF	OFF	LOW	40 μ v
OFF	ON	MEDIUM LOW	27 μ v
ON	OFF	MEDIUM HIGH	10 μ v
ON	ON	HIGH	2.5 μ v

Receive squelch values are approximate due to production variations.

NOTE: Model 85 units that are shipped to Canada are not allowed to have the frequency and receiver gain switches accessible from the outside of the unit. The rear plate must be removed to gain access to these switches to prevent frequency changes by unauthorized users.

APPENDIX F

MODEL 95/96/98 TRANSCEIVER

TRANSCEIVER FREQUENCY SELECTION

ESTeem Models 95, 96, and 98 transceiver frequency and receiver squelch settings are adjustable via software control from the RS-232/422 communications port. The frequencies can be programmed easily through the use of the ESTEEM UTILITY PROGRAM (see instructions included with the disk) provided with the equipment or it can be performed manually using the procedure listed below.

On the Model 96 and 98 only, the transmitter and receiver frequencies can be programmed to different operating frequencies if desired.

To change the Model 95, 96, or 98 operating frequency manually perform the following:

1. Call the factory to obtain the frequency select codes for your operating frequency(s) or use the ESTeem Utility Program to calculate the select codes.
2. Enter the ESTeem Command Mode and perform the following:

CMD: Help Radio <cr> This will list the radio parameters.

The following commands and their settings will be displayed:

CARBSY	=	Set at the factory.
FRACK	=	Set at the factory.
HDLC	=	Set at the factory.
LATFREQ	=	This command causes the frequency select settings below to be latched into the transceiver digital synthesizer.
SEL/A1	=	Transmitter frequency select code.
SEL/A2	=	Receiver frequency select code.
SEL/A3	=	Receiver frequency select code (96 or 98 only).
SEL/N1	=	Transmitter frequency select code.
SEL/N2	=	Receiver frequency select code.
SEL/N3	=	Receiver frequency select code (96 or 98 only).
SEL_SW1	=	Receiver sensitivity select (0,1,2, or 3 level settings. 0 = highest gain). NOTE: Model 96, or 98 only.
SEL_SW2	=	Receiver sensitivity select (0,1,2, or 3 level settings. 0 = highest gain). NOTE: Model 95 only.
TXDATA	=	Set at the factory.
TXFLAG	=	Set at the factory.
TXSTAT	=	Set at the factory.

3. Enter in your respective SEL Codes followed by a carriage return.

Example: CMD: SEL/A1 = 22 <cr>

4. CMD: save <cr> To save the commands after you have finished.
5. RESET the ESTeem to latch the frequencies or manually from the Command Mode by performing the following:

CMD: LAT 1 <cr>

CMD: LAT 2 <cr>

CMD: LAT 3 <cr>

RECEIVER SQUELCH SELECTION

An application may arise where environmental noise triggers the carrier detect circuitry and inhibits operation of the ESTeem. The user has the option to increase receiver squelch above the noise. Increasing the receiver squelch allows operation of the ESTeem in the users' high noise environment.

REMEMBER, an increase in receiver squelch causes a corresponding decrease in range.

The Model 95 receiver squelch is selectable via software from the command mode. To change the receiver gain use the SEL_SW2 (0,1,2,3) command. 0 = highest gain setting.

The Model 96 receiver squelch is selectable via software from the command mode. To change the receiver gain use the SEL_SW1 (0,1,2,3) command. 0 = highest gain setting.