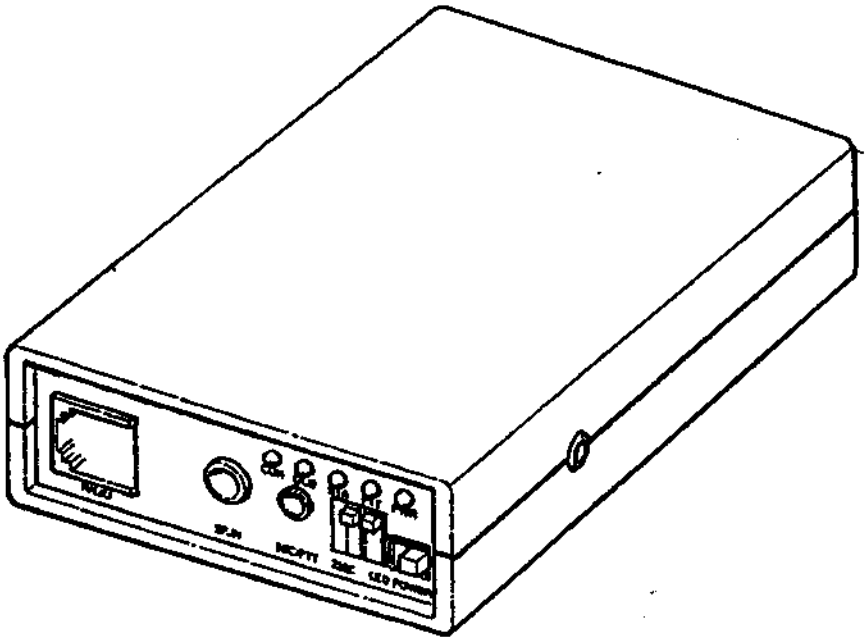
MODEL AR-21

TERMINAL NODE CONTROLLER



OPERATING INSTRUCTIONS

AOR, Ltd.

Radio Communication Products & Systems

This equipment uses radio frequency energy for its operation and if not installed and used properly, that is, in strict accordance with the Manual, may cause interference to radio and television reception. It has been tested and found to comply with the RF emission limits for a Class B computing device, which is intended to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which you can determine by turning the equipment off and on, try to correct the interference by one or more of the following measures:

- Move the computing device away from the receiver being interfered with.
- Relocate the computing device with respect to the receiver.
- Reorient the receiving antenna.
- Plug the computing device into a different AC outlet so that the computing device and receiver are on different branch circuits.
- Disconnect and remove any I/O cables that are not being used. (Unterminated I/O cables are a potential source of high RF emission levels.)

If you need additional help, consult your dealer or ask for assistance from the manufacturer.

TABLE OF CONTENTS

INTRODUCTION

The AR-21 is designed to link your amateur radio station and a data terminal or personal computer. This terminal node controller (TNC) allows you to operate using the exciting computer based communications mode - packet radio. You will find the AR-21 convenient and easy to use.

The most unique and important feature of the packet radio transmissions, unlike RTTY, is that they are virtually error-free. Information that you intend to transmit is first made into digital groups, or packets. Confirmation of correct reception of these packets is then returned to the originating station by the destination station. If the originating station does not receive confirmation, however, it automatically resends the packets until the correct information is confirmed, or the contact is terminated.

A modem (modulator/demodulator) that can operate at very high baud rates is included in the unit. This results in very short transmissions by each station, and allows several stations to use the frequency at the same time. Also, due to the choice of operating parameters, you are not even aware of the presence of other stations on the frequency.

The unit also functions as an automatic repeater. You may use it as an unattended repeater, a beacon, or a "mailbox" with the appropriate computer and software. You may also use it with an FSK or AFSK FM station on the VHF and UHF bands.

NOTE: In addition to your regular amateur radio equipment, you will need either an ASCII data terminal or a personal computer that has an RS-232C output and uses a terminal emulator program. Such programs are widely available for connecting your computer to a modem; they are often used to access Compuserve or other computer telephone services.

You may also need connectors to fit your equipment and an RS-232C serial cable.

SPECIFICATIONS

Processor	Z80A, soft-compatible ASIC (Applications Specific Integrated Circuit).
Memory	32K ROM, 32K RAM.
Memory Backup	Lithium battery.
Serial Port	RS-232C interface to terminal or computer. Baud rates: 300, 600, 1200, 2400, 4800, and 9600 (auto baud). The default, or reset, baud rate is 9600.
Commands	TAPR TNC-2 up-load compatible.
Modem Port	1200 baud FSK.
Protocol	AX.25 Level 2, Version 1, 1, 4 TJ.
Power Requirements	External 10 to 13.8 VDC at 40 mA. (29 mA from internal 4.8-volt, 120 mAh NICAD® battery.)
Input Level	20 mV to 2 V peak-to-peak, 18Ω.
Output Level	0 to 300 mV (variable).
Push-To-Talk	30 V maximum at 100 mA.
Overall Dimensions	2-1/2" W x 1" H x 4-1/4" L (6.4 x 2.5 x 10.8 cm).
Net Weight	4.6 oz. (130 g).

INSTALLATION

Before you can perform the "Operational Tests and Alignment", which follows this section, you will have to properly connect your controller to a terminal or a computer, and run the proper terminal emulation program if you are using a computer. In addition, you will have to connect the controller to your radio equipment. Read and comply with the following information that pertains to your situation under "Computer Connections", "Software Requirements", and "Radio Connections".

If you use a computer you will need a terminal emulator, or a communications program ... NOTE: Since these programs allow a computer to operate like a terminal, the following information will use the term "computer" to refer to a computer or a terminal.

The controller communicates with your computer through a serial port using signals that correspond to the RS-232C standard. Most computers that are available today either incorporate an RS-232C-style serial port, or have one available as an accessory. If you have already been using your computer with an RS-232C modem, you can use this controller the same way.

COMPUTER CONNECTIONS

Table 1-1 shows the minimum connections that are required between the RS-232 I/O connector on the rear of the controller and your computer. These minimum connections do not permit hardware flow control. DO NOT connect any wires other than pins 1 through 8 and 20. Pins 17 through 19 and 21 through 25 are reserved for future use. Using a full 25-wire cable will cause your controller to operate improperly. You may find that one of the ready-made cables that is available

IMPORTANT: Whether you purchase a ready-made cable or make your own, make sure it is a SHIELDED cable.

Table 1-1

Pin	Signal Name	Description
2	Transmit Data-	Serial data from the computer to the Controller.
3	Receive Data	Serial data from the Controller to the computer.
7	Signal Ground	Common ground for both data lines.

It is beyond the scope of this Manual to show you how to connect your controller to every brand and model of computer. It does, however, provide you with information for several common computers. If your particular computer is not listed, you can probably adapt the information that is presented to suit your needs.

ZENITH

Table 1-2 shows the proper cable connections for Zenith series 89, 90, 130, 140, 150, 160, 170 and 180 Computers.

Table 1-2

Computer 25-pin connector		Controller 25-pin connector
1*	Chassis Ground	1*
2	Transmit Data	2
3	Receive Data	3
4	Request To Send	4
5	Clear To Send	5
6	Data Set Ready	6
7	Signal Ground	7
8	Carrier Detect	8
20	Data Terminal Ready	20

* Connect this drain wire to the connector shells.

Table 1-3 shows the proper cable connections for the Zenith 200-series Computers.

Table 1-3

Computer 9-pin connector		Controller 25-pin connector
1	Carrier Detect	8
2	Receive Data	3
3	Transmit Data	2
4	Data Terminal Ready	20
5*	Ground	1,7*
6	Data Set Ready	6
7	Request To Send	4
8	Clear to Send	5

* Connect the drain wire to the connector shells.

APPLE MACINTOSH™

Table 1-4 shows the proper cable connections for an Apple Macintosh computer. NOTE: This computer uses an RS-422 serial port, but it will operate properly with your controller.

Table 1-4

Computer 9-pin connector		Controller 25-pin connector
1*	Chassis Ground	1*
5	Transmit Data	2
9	Receive Data	3
3	Signal Ground	7
7	Carrier Detect	8
6	Data Terminal Ready	20

* Connect this drain wire to the connector shells. NOTE: Pin 1 is not connected inside the computer. We recommend, however, that you connect pin 1 to the main ground of the computer.

COMMODORE

Commodore (as well as other manufacturers) sells a voltage converter device that installs in the User Port connector on the rear of their computers. This adapter converts the internal TTL- level voltages of the computer to the proper RS-232C levels and polarities. Unless you are very familiar with the inner workings of your computer, you should obtain the necessary converter instead of trying to "do it yourself."

IBM

Refer to Table 1-2 for the proper cable connections for an IBM PC computer.

Refer to Table 1-3 for the proper cable connections for an IBM AT-series computer.

The IBM PCjr TM computer uses standard RS-232C voltage levels for its interface. The connector required, however, is nonstandard and is not readily available from electronic supply dealers. Refer to the IBM PCjr Technical Reference Manual for the proper cable connections.

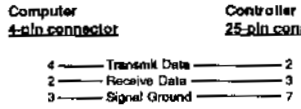
IBM sells an adapter cable for serial devices which allows you to convert the connector on the PCjr to a standard RS-232C connector. Since this cable is only 3" long, you will have to obtain a standard male-to-female RS-232C extension cable to reach between this adapter cable and your controller.

RADIO SHACK COLOR COMPUTER

The Radio Shack Color Computer series (except the Micro Color Computer) uses a 4-pin DIN-style connec-

tor for its serial interface. Table 1-5 shows the proper cable connections for a Radio Shack computer that has a 4-pin DIN connector.

Table 1-5



The Radio Shack Model 100/102 has a built-in standard RS-232C serial port that is compatible with the controller. Use a standard male- to-male RS-232C extension cable to connect this computer to your controller.

NEC

The NEC Model 8201 has a built-in standard RS-232C serial port that is compatible with the controller. Use a standard male-to-male RS-232C extension cable to connect this computer to your controller.

OTHER COMPUTERS WITH 25-PIN RS-232C PORTS

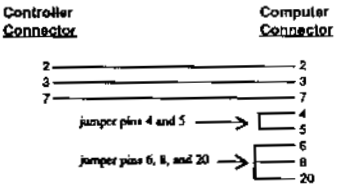
If your computer has a 25-pin RS-232C port, refer to its manuals to determine the transmit data, receive data, and signal ground pins. Follow the manufacturer's recommendations for connecting the serial port to a modem.

Your controller is configured as Data Communications Equipment (DCE), while most computers are configured as Data Terminal Equipment (DTE). If this is true of your particular computer, you can probably connect pins 2, 3, and 7 of your controller to the same number pin of your computer's RS-232C port. Standard 3-wire male-to-female and male-to-male RS-232C extension cables are readily available for this purpose.

If your computer is configured as DCE, you will have to cross the wires between pins 2 and 3 of the controller and the computer. In other words, connect pin 2 of the controller to pin 3 of the computer and pin 3 of the controller to pin 2 of the computer. The signal ground is still pin 7 on both ends.

Some computers may require that you connect pin 5 of the serial port connector to an appropriate signal. Others may require connections to pins 8 and 20. You can use the computer's output signals on pins 4 and 6 for this purpose as shown in Table 1-6.

Table 1-6



OTHER COMPUTERS WITH NONSTANDARD SERIAL PORTS

Computers with nonstandard serial ports must meet the following conditions:

1. The signal levels should be RS-232C compatible. The controller requires that the voltage levels that come from the computer be greater than about +3 volts in one state and less than 0 volts in the other state.

2. The polarity of the signals must conform to the RS-232C standard. A lower voltage state must correspond to a logical "1" and the higher voltage state to a logical "0".

3. The computer must be able to correctly receive a signal which meets the RS-232C specification. The controller supplies signals that meet this specification.

Make or purchase a cable that provides the necessary connections. The serial port common pin must be connected to the controller's serial port connector at pin 7. The data line that sends data FROM the computer must be connected to the controller's connector at pin 2. The line that your computer uses to RECEIVE data must be connected to the controller's connector at pin 3.

If your computer requires any other signals, you must find ways of providing them. The documentation provided with your computer or its accessory serial port should specify any special requirements of your particular port.

SOFTWARE REQUIREMENTS

Any software package that enables your computer to act as an ASCII terminal with an ordinary telephone modem should work with your controller. If you have a program that you have successfully used with a telephone modem, and you are familiar with its operation, use that same program to communicate with the controller.

ZENITH

Several acceptable terminal emulator software packages, such as CPS-86 and CPS-150 are available. The package you need depends upon your particular model of computer. Load the program and set the options as follows. NOTE: Be sure to run the system configure program to properly set up the computer's serial port, etc.

Baud Rate ——— 1200
Word Length ——— 7 bits
Parity ——— Even
Stop Bits ——— 1

APPLE MACINTOSH

The MACTERM program will work properly with your controller. Load this program and set the options as follows:

Compatibility	Terminal
1200 baud	VT100
7 bits/character	ANSI
Even parity	UNDERLINE
Handshake Xon/Xoff	US
Modem connection	80 Columns
"Telephone" port	ON LINE
	AUTOREPEAT

COMMODORE

The Programmer's Reference Guide published by Commodore contains a BASIC communications program. This program converts Commodore's modified ASCII format to "true ASCII." Since Commodore's computers do not send too well at data rates greater than 300, we recommend that you operate the controller at 300 baud.

IBM PCjr

The IBM PCjr has a built-in terminal program in the BASIC cartridge. Type TERM to start this program. Then refer to your PCjr's BASIC manual for details about it. For best results from your PCjr, do not operate the controllers serial port at greater than 1200 baud.

RADIO SHACK COLOR COMPUTER

There are several terminal programs available for the Color Computer. You will probably want to use a commercially available program rather than writing your own, because the Color Computer has a "software UART" that is difficult to program in BASIC.

The Radio Shack Model 100 has a built-in terminal program in ROM. Refer to your computer's documentation for information about its use.

NEC

The NEC Model 8201 has a built-in terminal program in ROM. Refer to your computer's documentation for information about its use.

Refer to Figure 1-4 and connect and solder the free ends of the remaining cables as shown. NOTE: Cut off the shields of these cables; do not connet them together.

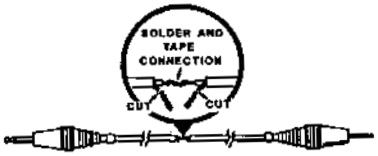


Figure 1-4

Connect the smaller plug on one end of this prepared cable to the MIC/PTT socket on the controller. Connect the other end of this cable to the microphone socket on the radio.

SPECIAL CASES

Yaesu models FT-270, FT-270OR, and FT-770 require a 10 kΩ resistor in series with the PTT line as shown in Figure 1-5.

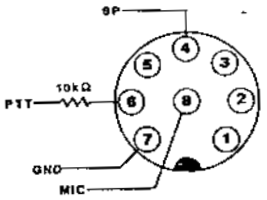


Figure 1-5

Yaesu models FT-3700, FT-3800, and FT-3900 require two type IS1588 (or equivalent) diodes in series with the PTT line as shown in Figure 1-6.

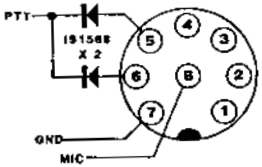


Figure 1-6

POWER SOURCE

To power your AR-21 you will need either the internally fitted battery pack (option), or an external power supply. The external power supply must be capable of providing 10 to 13.8 volts dc at 40 mA. If the battery option has been fitted and you wish to charge it from your external supply, the supply must be capable of delivering 100 mA.

Refer to Figure 1-7 while you perform the following steps, which show you how to install the power plug on the free end of your external power supply wires.

( ) Prepare the ends of your power cable as shown in the inset drawing. The longer lead must come from the positive (+) terminal of your power supply.

( ) Remove the cap from the power plug. Then slide the cap over the end of the power supply cable with the threaded end as shown.

( ) Solder the long and short wires to the indicated lugs on the power plug. Make sure the longer lead goes to lug 1 and the shorter lead goes to lug 2. NOTE: You may find it easier to clamp the power plug in a small vice to hold it steady while you solder the connections.

( ) After the connections cool, crimp the indicated lugs around the cable as shown. Then reinstall the cap on the power plug.

RADIO CONNECTIONS

Refer to Figure 1-1 while you read the following information.

Depending upon your particular radio, you can either use the RADIO socket or the SP IN and MIC/PTT sockets. In general, the RADIO socket is for connection to a base or mobile station and the SP IN and MIC/PTT sockets are for connection to a hand-held radio. NOTE: The MIC/PTT socket is for hand-held transceivers that use a combined audio and PTT cable.

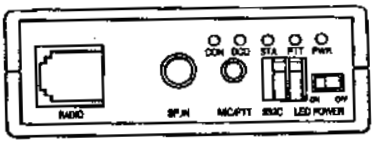


Figure 1-1

Figure 1-2 shows the connections for the RADIO socket. A cable that has a matching connector on one end to fit this socket is provided. You will have to adapt the other end of the cable to fit your particular radio.

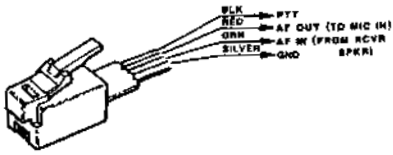


Figure 1-2

Two cables are provided for use with hand-held radios. One of these cables (for the SP. IN socket) has miniature phone plugs on each end and the other cable (for the MIC/PTT socket) has subminiature sockets on each end. These cables should interface properly with many of the popular hand-held radios that are currently available.

Information about some specific hand-held radios is included below.

ICOM, & YEASU

The two shielded cables provided should work properly with the following radios with no special modification:

Icom IC-2A, IC-2AT, IC-02AT, IC-μ2A, IC-μ2AT, IC-3AT, IC-03AT, IC-4AT, IC-04AT, IC-μ4AT, IC-12AT, and others
Yaesu FT-703, FT-709, and FT-73

Connect the cable that has miniature phone plugs (the larger plugs) between the SP IN socket on the controller and the speaker output socket on your transceiver.

Connect the cable that has subminiature phone plugs (the smaller plugs) between the MIC/PTT socket on the controller and the microphone/push-to-talk socket on your transceiver.

KENWOOD

To use the controller with a Kenwood TR-3500 (and others), you will have to modify the cables.

Cut the two shielded cables in half. Then refer to Figure 1-3 and connect and solder the free end of a cable that has a miniature plug (the larger plug) to the free end of a cable that has a subminiature plug (the smaller plug) as shown.

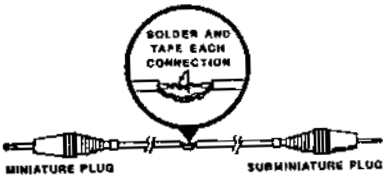


Figure 1-3

Connect the larger plug on one end of this prepared cable to the SP IN socket on the controller. Connect the other end of this cable to the speaker socket on the radio.

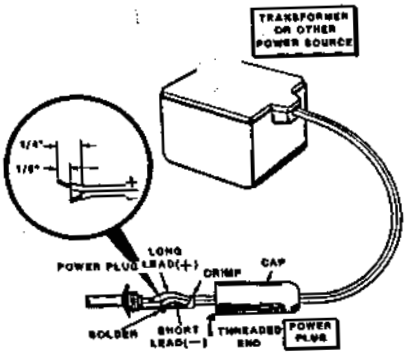


Figure 1-7

BATTERY ACCESSORY

The following steps show you how to install the optional Battery Accessory

( ) Turn the controller off and disconnect any external power supply.

( ) Refer to Figure 1-8 and remove the screw from the bottom of the unit. Then carefully remove the cabinet halves.

( ) Refer again to Figure 1-8 and remove the two indicated screws that hold the circuit boards together.

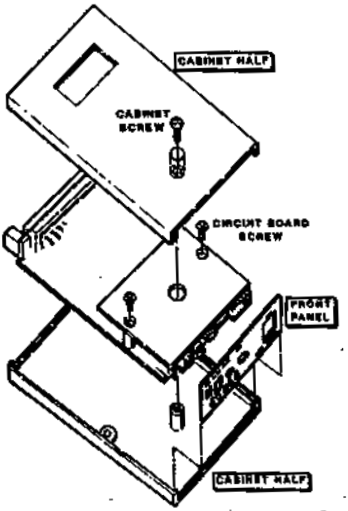


Figure 1-8

( ) Carefully position the smaller circuit board beside the larger circuit board as shown in Figure 1-9. Do not flex the interconnecting ribbon cable any more than necessary.

( ) Plug the socket coming from the Battery Accessory onto the indicated plug on the smaller circuit board. The socket is keyed to fit only one way.

( ) Reposition the smaller circuit board on top of the larger circuit board and use the two screws removed earlier to secure the assembly.

( ) Carefully peel the backing paper from one side of the double-stick tape. Then refer again to Figure 1-9 and press the tape onto the larger circuit board in the area shown.

( ) Carefully peel the remaining backing paper from the double-stick tape. Then press the battery onto the tape as shown.

( ) Use the screw you removed earlier to reinstall the cabinet halves.

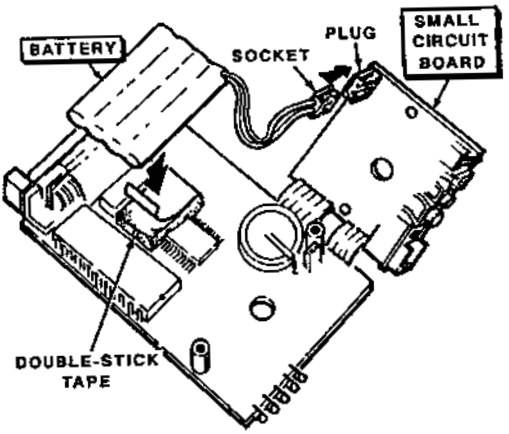


Figure 1-9

OPERATIONAL TESTS AND ADJUSTMENT

This section of the Manual describes some operational tests you can perform to make sure your controller is connected and operating properly.

PRELIMINARY TESTS

Make sure you have the controller connected to a suitable power source. Also make sure you have the controller connected to your computer as described in the "Installation" section of this Manual.

1. Turn the computer on and boot up any necessary terminal emulation program.

2. Make sure the 232C and LED switches on the controller are on (toward the top of the controller).

3. Push the POWER switch to ON. The PWR LED should light. NOTE: Some of the other LEDs may light briefly and then extinguish.

If your computer's data rate is set to 9600 baud, you will see the following message:

Please type a star (*) for the auto-baud routine.

NOTE: If your Computer's baud rate is set to something other than 9600 baud, you will see meaningless characters on the screen. If this happens, go ahead and perform the next step anyway.

4. Type four or five asterisks (*), at one second intervals, until you see the sign-on message:

AOR Packet Radio AR-21
AX.25 Level 2 Version 2.0
Release 1.1.4TE 12/10/87 - 32K RAM
message board Ver 1.17
Checksum $11
cmd:

The above procedure performed an auto-baud routine that determines the rate at which data is transferred between the controller and your computer or video terminal.

IMPORTANT: This data rate is stored in the controller's memory. If you later change your terminal emulation program's data baud rate and then attempt to communicate with the controller, no intelligent information will be transferred (because the two units will no longer be compatible).

SOLUTION: To correct the above compatibility problem, reset your computer or terminal to the original baud rate that is held in the controller's memory and type "ABAUD xxxx" (xxxx = the new baud rate). Now turn off the controller, reset the computer or terminal to the new ABAUD rate, and turn the controller back on. The auto-baud routine will now place the new data rate in memory. This method allows you to select a faster or slower start-up data rate. We strongly suggest that you write your initial baud rate in the space provided below for future reference.

ABAUD RATE _____

ADJUSTMENTS

The following steps check the basic operation of the controller.

1. Make sure your radio is connected to the controller as described in the "Operation" section of this Manual.

2. Type "MY K8TMK" followed by a <RETURN>, substituting your call sign in place of the one shown. Your monitor should reply with:

   ```
   was
   now (your call sign)
   ```

3. If your radio had a squelch control, unsquelch your receiver.

4. Advance the receiver's volume control until the DCD LED on the controller just lights when no signals are present. This is the proper initial setting of the receiver's volume control.

5. Turn the radio's squelch control until the DCD LED just extinguishes.

6. Listen for packet activity and readjust the receiver's volume control as necessary until you receive packets properly.

NOTE: The output level from the controller has been factory set at 150 mV peak-to-peak, which should be satisfactory for most radios. If, however, you find that this is not correct for your radio, perform the following steps:

1. Remove the screw from the bottom of the controller. Then carefully remove the cabinet bottom.

2. Refer to Figure 2-1 and locate control VR3, on the smaller circuit board close to the optional internal battery plug. Then adjust this control as necessary for the proper output level.

3. Reinstall the cabinet bottom on the controller.

NOTE: If during the operation of your controller you find that the TNC does not operate your radio's PTT circuits, carefully remove the cabinet top. Then refer to Figure 2-2 and cut the tiny foil that is connected between the two indicated solder pads on the smaller circuit board. Reinstall the cabinet top.

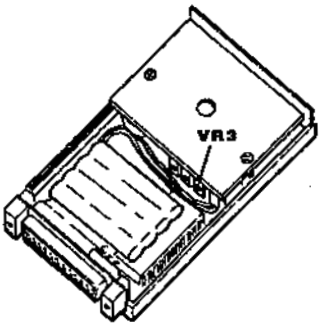


Figure 2-1

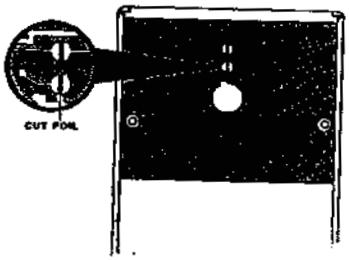


Figure 2-2

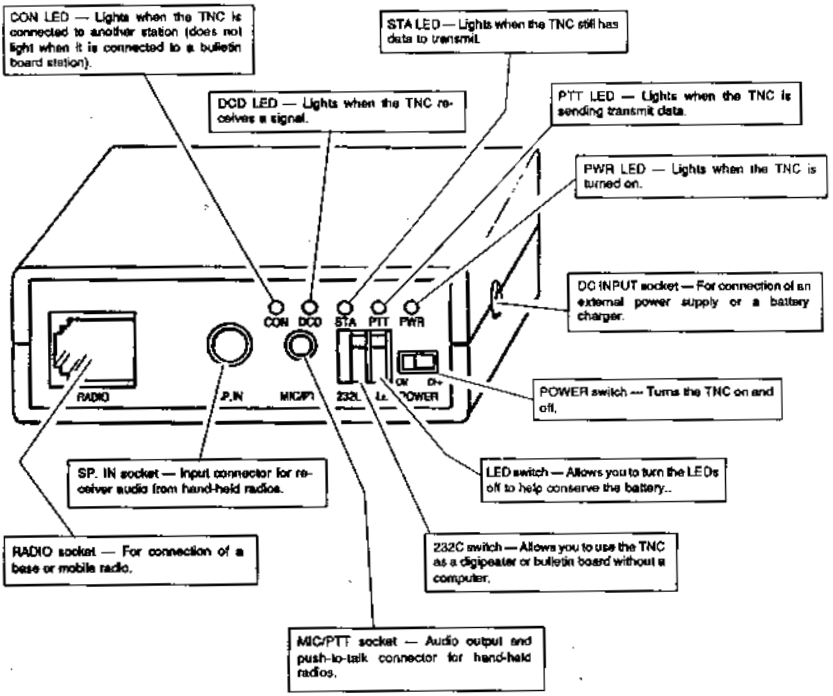


Figure 3-1

AOR, LTD.
TOKYO, JAPAN

OPERATION

Figure 3-1 shows the front panel of your AR-21 TNC and briefly describes each control and connector. The following pages describe the operation of the unit, and how to use the TNC to receive and transmit "packets".

Before you attempt to use the TNC, be sure you are thoroughly familiar with your communications equipment and its operation. This equipment should either be crystal-controlled or synthesized to ensure excellent frequency stability, which is important for packet radio operation. Be sure the transmitter you use has the ability to handle "key down" operation (continuous transmission of a CW carrier). Also, be sure you are familiar with your computer terminal or computer (used in the terminal mode) and its operation.

NOTES:

1. After the TNC types a sign-on message on your terminal, you are ready to operate.

2. You can use your computer to emulate a terminal by running a terminal emulator program. A terminal emulator program makes the RS-232C port on your computer appear as a terminal input to the TNC.

GENERAL

Your TNC uses AX.25 software (built into ROM) and has the following operating modes:

Command Mode — In this mode, everything you type is interpreted as instructions for the TNC. These instructions are in the form of command lines that are terminated by a RETURN. The commands allow you to change the TNC operating parameters, perform special functions, or change modes. If your TNC receives packets while it is in the Command Mode, you will see them printed on the display screen. To send packets, you must direct the TNC to enter a data mode.

Data Modes — Two data modes are available; the Converse Mode and the Transparent Mode. In these modes, the information you type to the TNC is assembled into packets and transmitted on the radio.

The remainder of this section first decribes the terminal you will use. It then explains how to use the commands to configure the TNC to suit you and your station, and how to get started talking to other hams on packet radio. This is not intended to be an exhaustive description of every command, but rather a discussion about how the various commands are related and how you may use them. An alphabetical catalog of commands that describes the formal and parameters of each is provided in the "Commands and Messages" section of this Manual.

TERMINAL CHARACTERISTICS

Baud Rate Selection — Most terminals use serial communications. In this mode, each bit of a 7- or 8-bit character is sent in sequence over the same wire. Serial data must be transmitted at a predetermined bit-per-second rate called baud rate. There are many standard baud rates. Unless the TNC and the terminal use the same baud rate, they will not be able to communicate. This TNC supports the following standard baud rates: 300, 600, 1200, 2400, 4800, and 9600.

Word Length/Parity/Stop Bits — In addition to the data rate, there are three other characterists of serial data which should be the same for the TNC and the terminal. These are word length, parity, and number of stop bits. Use the commands AWLEN and PARITY to set these characteristics. Serial data may represent ASCII data, which has seven data bits per character, or binary data, which has eight data bits per byte. Unless you operate in the Transparent Mode, the TNC will ignore the extra bit if you use 8-bit characters. This means that the eighth bit is set to 0 before data is assembled into a packet.

If you change any of these configurations, the new values do not take effect until you perform a reset by turning the power off, or type RESET.

If you start the TNC in the default-parameter mode, the serial port is initialized at 9600 baud, even parity, 7-bit characters, and one stop bit. A message is then typed at 9600 baud. If you enter an asterisk (*) before the message completes, the TNC will sign on at 9600 baud. If you do not enter an asterisk before the message completes, press the asterisk key at 1-second intervals until the message reappears. Then, before it completes, type another asterisk. The TNC will now sign on at the baud rate you have your software or hardware terminal set to.

GETTING STARTED

After you have your TNC and terminal set up properly, you should see the TNC sign on with a message, followed by the command prompt:

```
cmd:
```

When you see this prompt, first set your call sign. To do this, type MY and your call sign as shown below:

```
cmd:MY G4LOW <RETURN>
```

A lithium battery inside the TNC enables it to remember any changes you make in the default parameters.

Once you set your call sign, you are ready to send a packet. First type the command CONVERS and press <RETURN> to enter the converse mode. Then type a message you wish to transmit as a packet:

```
HELLO WORLD!
```

Press the RETURN key to end your message. If you watch the LEDs on the front of the TNC when you do this, you should observe the following:

1. The PTT light will light, indicating that the transmitter is being keyed. The STA LED may also light briefly at the beginning of the transmission.
2. When the transmission stops, the PTT LED will extinguish.

The message you just transmitted was sent to the address speified by the UNPROTO command. This address is set to CQ when you first turn the TNC on or type RESET.

To find out which stations in your area use packet radio, make sure the monitor function is turned on. To do this, first type CTRL-C (press and hold down the control key while you press the C key) to return to the command mode, if this has not already been done. Then type each of the following commands:

```
cmd: M ON <RETURN>

cmd: MA ON <RETURN>
```

NOTE: Refer to "Commands and Messages" beginning on Page 4-1 for information about these commands.

Any packet that your TNC receives should now appear on your screen.

To make full use of the TNC's capabilities for reliable data communications, you should establish a connection with another station. This causes everything you type in the Converse Mode to be automatically addressed to the other station.

and packets sent between your station and the other station will be automatically acknowledged by the recipient. The sending station will continue to retransmit the message a preset number of times until it has been received properly. To connect to G4LOW for example, type CTRL-C followed by a <RETURN> to return to the command mode. Then type:-

```
cmd:C G4LOW<RETURN>
```

If G4LOW is on the air, tuned to your frequency, and within range of your transmissions, you should see a message coming back to your TNC. If you have a speaker connected to your radio as well as the TNC you will hear the packets, and speaker or not, you should see the DCD LED light with each incoming packet. When your connect request is acknowledged, the TNC will display the following message:-

```
***CONNECTED TO G4LOW
```

The TNC will then switch to the converse mode. If you now type a message, it will be formed into a packet and stored in memory until you press the RETURN key. At that moment it is sent to G4LOW.

After you complete the conversation, either you or the operator of the other station may initiate a disconnect. To do this, return to the Command Mode (by typing CTRL-C) and type the following command:

```
cmd: D <RETURN>
```

After an exchange of packets, you will see the message:

```
*** DISCONNECTED
```

This message indicates that your disconnect request packet was acknowledged by the station you were connected to. NOTE: You must send a disconnect request to the station you are communicating with before you can connect to other stations or hear them (if your monitor functions are set to off). When you become familiar with packet radio, you can learn how to use the STREAMSW command to connect to more than one station at a time.

If you are ready to receive messages from other packet radio stations and you wish to let them know that you are active on packet radio, you can use the TNC as an automatic repeater (or beacon) to transmit this fact at preset intervals. You must first decide how often you wish your station to send the desired message, and then store it in RAM inside you TNC. If, for example, you wish to send it every 30 minutes (or every 1800 seconds), type the following after the command prompt:

```
cmd: B E 180 <RETURN>
```

NOTE: You must divide the number of seconds by 10 before you enter the desired time.

The TNC will respond with a message similar to:

```
was EVERY 0
```

if no number was previously entered in RAM, or the number that corresponds to the number you may have entered earlier.

Then type BT followed by the message you wish to send.

Example:

```
cmd:BT G6LOW PACKET RADIO STATION
          BLOGSVILLE WESTERSHIRE<RETURN>
```

The TNC will respond with a message similar to:

```
was
```

NOTE: In this case, no text message was previously entered. If a message was previously entered, it would follow the word "was."

If G4LOW, for example "hears" your beacon and wishes to connect to you, he will type;

```
C G6LOW<RETURN>.
```

When your TNC acknowledges his connect request, it will display the following message:-

```
***CONNECTED TO G4LOW
```

Your TNC will then switch to the converse mode. If you now type a message, it will be formed into a packet and sent to G4LOW

Since you have now succeeded in getting your packet radio station on the air, read the following pages which describe the TNC operation in more detail. The remainder of this section will help you get the most out of your TNC. Also refer to the alphabetical list of commands in the "Commands and Messages" section of this Manual.

OPERATING MODES

COMMAND MODE

Use the Command Mode to enter commands that alter the TNC's operating parameters. You must enter all other modes from the Command Mode. When the TNC is in the Command Mode, "cmd:" appears on the screen at the beginning of each input line. This indicates that the TNC is waiting for instructions.

The TNC is always in the Command Mode after a reset or power-up. You can perform a reset by disconnecting power from the TNC for several seconds or by issuing a RESET command. After a reset operation, all operating parameters of the TNC are reinitialized by the resident software.

You can store the value of most parameters in a permanent but easily changed form in memory. Each time you change a parameter, it is stored in memory until you change the parameter again or issue a RESET command.

There are several ways you can get from the Command Mode to one of the data modes. You can type the command CONVERS or TRANS, depending upon the data mode you desire. This causes an immediate mode change. If you issue a CONNECT command to initiate a conversation with another station, or if your TNC receives a connect request packet, the TNC will automatically change to a data mode after the connection is established. The setting of the CONMODE parameter determines whether the TNC will enter the Converse or Transparent Mode. If you specify the data mode in the CONNECT command, however, that mode will be used without altering the setting of CONMODE.

DATA MODES

Converse Mode

The Converse Mode is the data mode that you will probably use most for ordinary contacts. In this mode, the information you type is assembled by the TNC into packets and transmitted over the radio. A packet is terminated whenever you type the send-packet character, which is set by the SENDPAC command, and may optionally be included in the packet. There are nine characters that have special meanings to the TNC. These characters allow you to correct typing errors in your messages and return to the Command Mode, but are not normally included in the packet. These include input editing characters, which are discussed in a later section. NOTE: To return to the Command Mode from the Converse Mode, just type CTRL-C.

Transparent Mode

Packet radio is very well suited for transferring large amounts of data between computers. For some types of data tranfer operations, the Converse Mode will work very well. You may want to send special information, however, such as ready-to-run programs to another amateur operator. A .COM file on a CP/M system or even a BASIC program may contain many strange characters which could be confused with special characters in the Converse Mode. For this application, you will want to use the Transparent Mode (a data mode like the Converse Mode, except there are no special characters). Everything you type, or everything your computer sends to the TNC, is sent over the radio exactly as it appears to the TNC. Packets are sent at regular time intervals or when a full packet of information is ready. You may use the PACTIME command to change the time intervals at which data is put into packet form.

The display characteristics of the TNC are also modified in the Transparent Mode. Data is sent from the TNC to the terminal exactly as it is received over the radio channel, including all eight bits of each byte received. All features such as LINE FEED and RETURN insertion, ESCAPE translation, and case conversion are disabled. None of the parameters which control these features in the Converse Mode are changed when you enter the Transparent Mode, and all display features are re-enabled when you return the TNC to the Command Mode. Most of the informative messages that appear in the Converse Mode as the TNC moves between the disconnected and connected states are also disabled.

If you wish to escape from the Transparent Mode to the Command Mode, you must use the following special procedure. NOTE: After a time equal to PACTIME has elapsed, the last data you typed will have been put into packet form for transmission (although it may not have been transmitted yet).

1. Wait for PACTIME to elapse. Then wait an additional time, which is set by the CMDTIME command.

2. Type CTRL-C three times within an interval CMDTIME of each other.

After a final CMDTIME interval in which you did not type any characters, you will see the "cmd:" prompt. If you type any character in this interval, even if they are more command characters, the escape will be aborted and the three command characters will be sent as packet data. If you set CMDTIME or PACTIME to 0, you will not be able to escape from the Transparent Mode except by performing a hard reset (power-down reset).

FLOW CONTROL

Whenever you transfer data to computers, there is a chance that the data will be received faster that the computer can handle it. To prevent loss of data, the computer must be able to make whatever is sending data stop sending, and later tell it to resume sending. If you are a home computer user, you are probably already familiar with one type of flow control, which allows you to stop the output from the computer while you read it and restart it when you have finished.

There are two methods of providing flow control that are supported by the TNC. XON/XOFF flow control, sometimes called "software flow control," is accomplished by sending a special character (usually a CTRL-S) to request that the output stop and another special character (usually a CTRL-Q) to restart the output. Hardware flow control may be used if both computers use the RTS (Request To Send) and CTS (Clear To Send) lines of the RS-232C interface.

Many terminal programs and file transfer programs for home computers do not implant flow control in software, and many so-called RS-232C ports do not support hardware flow control. Even if the RTS and CTS lines appear at the connector, software that directly reads the CTS line may be required in order for flow control to be implemented. If you find that the TNCs seem to lose data during file tranfers, immediately suspect a flow control problem.

XON/XOFF FLOW CONTROL

If you are using a terminal rather that a computer, or if your computer does not support RTS/CTS flow control, you can use the XON/XOFF flow control. You can enable this method by setting XFLOW ON. The special flow control characters are set to CTRL-S and CTRL-Q by default.

In the Command Mode, the TNC input buffer may fill up if you try to type too long a command. In the data mode, the buffer may fill up if you are using your computer to transfer data at a rate that is faster than the data rate for radio transmission, if radio data transmission has slowed down due to noise or other users on the channel, or if the operator or computer at the other end has stopped the output from his TNC. The TNC will send the terminal an XOFF character when there is room remaining for about ten characters in the buffer. If you continue sending data until there are only five spaces left, the TNC will send an XOFF character after each character received. When the buffer fills up completely, data will be lost. When the buffer empties out, the TNC will send a single XON character to the terminal.

If you disable XON and XOFF by setting them to 0, the TNC will automatically use the RTS/CTS flow control to stop input from the terminal.

XON/XOFF flow control is normally disabled in the Transparent Mode. This is done because characters are treated as data; therefore, the XON and XOFF characters will not be recognized. If you cannot use RTS/CTS flow control, you may enable the XON and XOFF characters (the commands from the TNC to the terminal) by setting TXFLOW ON and XFLOW ON. START and STOP characters (the commands to the TNC from the terminal), however, will still be treated as data.

HARDWARE FLOW CONTROL

This method of flow control is preferred, since it usually does not depend on the programming of a particular communications program.

DISPLAY OPTIONS

Several parameters control the way output is formatted for display on your terminal. Most of these are parameters that are determined by the display capabilities of your terminal and would be changed only if you change terminals.

In the Converse Mode, it is natural to choose a line-termination character such as a <CR> or <LF> to terminate packets. For some applications, however, you may want to use an "invisible" command character to force the TNC to transmit a packet. In the first case, the send-packet character is interpreted as part of the input as well as a command; in the second case, it is a command only. You can choose either option with the CR command. If CR is ON, the send-packet character is data, and is echoed to the terminal and included in the packet. You should disable CR if you are using packet timeout (CPACTIME ON) in the Converse Mode.

A common occurrence when two stations are exchanging packets is for incoming packets to arrive when the operator is in the middle of typing a line. In order to prevent the new line from disrupting the screen display, you can enable FLOW. In this mode, output to the screen is disabled as soon as you begin to type, and is enabled when a packet is completed. If you want to see the incoming packet before you transmit your line, you can type the redisplay-line character, which is set by the REDISPLA command (default CTRL-R). This will display the incoming packet and then retype your partially completed line. If FLOW is OFF and an incoming packet disrupts your typing, you can also use this character to redisplay your input line.

The SCREENLN parameter sets the width of the terminal screen or page. Whenever this number of characters has been sent to the terminal without an intervening <CR>, a <CR> is inserted in the output. A <CR> is also echoed if you type a line that exceeds the width of your screen; the extra <CR>, however, is not included in the packet. If your terminal performs automatic line-wrap, you should disable this feature by setting the SCREENLN parameter to 0. The TNC does not carefully distinguish between printing and nonprinting characters and it does not correct its line count for horizontal tab characters; backspace characters, however, are counted correctly.

For normal display, a <CR><LF> is the new line sequence. You terminate a line, however, by typing with a single character, usually a <CR> (called RETURN or ENTER on some terminals). If only a <CR> is displayed, the next line will be typed over the previous one instead of appearing below it. Some terminals automatically display an <LF> following each <CR>, but most do not. If auto line feed is enabled by AUTOLF, the TNC will add a <LF> after every <CR> displayed or echoed.

The conventional response to character deletion on display terminals is to feed a backspace-space-backspace sequence to the terminal. This removes the character from the screen and leaves the cursor ready to type a new character in its place. On a hardcopy terminal, however, this results in unreadable text. If backspace display is disabled with BKONDEL OFF, a backslash symbol (\) will be displayed for each character deleted. You can use the redisplay-line character to see the corrected line.

The <ESCAPE> character (ASCII code 27 or hexidecimal $1B) is used by many terminals to control cursor movement and special display modes. (NOTE: Throughout this Manual, the dollar sign symbol, $, prefaces all hexidecimal numbers.) If you do not want this effect, enable the <ESCAPE> translation with ESCAPE OFF. This will cause all <ESCAPE> characters to be sent to the terminal as the dollar sign symbol. This does not affect <ESCAPE> characters that are transmitted as packets.

Some terminals echo characters typed in locally, before the character is transmitted to the I/O port. Also, some terminal programs on computers may perform local echoing. If the TNC also echoes characters, you will see two of every character. You can disable the echo mode by setting ECHO to OFF.

A few terminals require particularly long times to respond to <CR>s or <LF>. Some hardcopy terminals require time to move the print head to the beginning of the line following a <CR>. Some display terminals require long times to scroll their screens following a <LF> character. If characters are sent to such a terminal before it is ready, the characters will be lost. If your terminal always loses a few characters at the beginning of a line, you need to enable null insertion. A null is character with ASCII code 0; and the TNC does not actually transmit nulls in this mode, since they are misinterpreted by some computer's terminal programs as a BREAK signal. The number of null intervals is set by the command NULLS, and null insertion after <CR>s and <LF>s is separately enabled by NUCR and NULF.

EDITING COMMANDS

Several characters are used to correct mistakes in the text typed into the TNC. Except in the Transparent Mode or if times packets are in effect in the Converse Mode, no text characters are interpreted by the TNC until it receives a <CR> or the send-packet (in the Converse Mode). Until then, you can delete and retype characters or cancel the line completely.

Control characters are normally chosen as editing characters. You can disable editing functions by setting the character used for the function to $00. This prevents any character (even a null) from being matched to that function.

The key usually used to remove the last character typed on a line may be either a <DELETE> character (hexadecimal $7F) or a back space (hexadecimal $08 or CTRL-H). The character used is determined by the DELETE command, which has options ON (<delete>) and OFF (back space). The key used for rub out on your terminal may be labeled "back space", "delete", "rub out", or simply "<—". You may have to experiment to find out if it produces a back space or a <DELETE> character.

Attempts to delete past the beginning of a line, or past the beginning of a packet in the Converse Mode, have no effect. You cannot delete a <CR> or any of the special characters not inserted into the text, such as the send-packet character or flow-control characters. These characters cause actions which take place immediately. Some home computers allow you to fix errors in input lines by backing the cursor up to the mistake, retyping the incorrect characters, and then spacing forward with an arrow key. The TNC does not have this kind of input editing feature; therefore, you must delete all of the characters back to the ones you want to change and then retype the rest of the line.

If you wish to cancel an entire line, you can delete text back to the last-occurring <CR> by typing the character specified by the CANLINE command (default CTRL-X). In the Converse Mode, this character functions like the cancel-packet character to something other than <CR>.

In the Converse Mode, you can delete text back to the last-occurring send-packet character by typing the character specified by the CANPAC command (default CTRL-Y). This will delete any intervening <CR>s. You cannot cancel packets which have already been placed in the outgoing packet buffer.

The cancel character has a special function in the Command Mode. Typing this character causes the terminal output buffer to be flushed and all output to be diverted to the write-only memory. You can resume normal output by typing another cancel-packet character or by changing modes; that is, going into the Converse Mode. Echoing of input is not affected by this command. This feature makes it possible to get rid of any unwanted output which may occur.

You may occasionally wish to transmit one of the characters that you have assigned to a special function. The pass character is intended to increase the flexibility of the Converse Mode by providing this capability. To insert such a character into the input buffer, precede it with the character specified by the PASS command (default CTRL-V). You can send any character this way, including nonspecial characters and the pass character. Since the pass character is kept in the buffer until a packet is formed, two <DELETE>s are required to remove both the quoted character and the pass character. Note that the PASS character will cause only one special character to be inserted; therefore, you must type it again for each such character.

You can use the pass character in the Command Mode in order to include <CR>s in the beacon text.

SPECIAL OPERATING CONFIGURATIONS

The primary function of the TNC is to enable you to communicate with other amateurs via packet radio. The AR-21 TNC implements the AX.25 protocol (set of rules). This protocol is designed primarily for point-to-point, two-party communications. You can also use it, however, to simulate the common amateur net or round-table type of contact. You can specify the AX.25 protocol level 2 version by setting it ON (Level 2, Version 2) or OFF (Level, Version 1).

Earlier in this section, you learned how to set your call sign and issue the CONNECT command to talk to a specific station. These commands are the beginning of packet operation, which you will now learn more about.

To establish a two-way connection, the TNC must know your station address and the address of the party you wish to talk to. To prepare your TNC for amateur operation, first establish your call sign as the station address by using the MYCALL (or just MY) command. This sets the string that is used to identify packets transmitted by your station (the protocol will not work if there is more than one station on the air with a given address). If you have more than one station operating using your call sign, you can give them different addresses using the substation ID (SSID) extension, a number between 0 and 15. This number is appended with a dash like this:

```
MYCALL G4LOW-3
```

If you do not specify the SSID extension, it will be 0. The extension does not affect the Morse code ID of your station.

The call sign specified by MYCALL is ordinarily used by the TNC for Morse code identification. This call sign is sent automatically every 9-1/2 minutes if you have sent a packet in the previous 9-1/2 minutes (or as soon thereafter as the channel is available). In many locations, the address string included in the packets may be considered adequate identification for legal purposes. Automatic Morse code identification is initially off, but you can turn it on by setting ID to ON. You can make the TNC send your call sign at any time by typing ID.

You already learned about the CONNECT command, which causes your packets to be sent to a specific station. If the station you wish to talk to is a little too far away for you to connect directly, you can use the digipeating feature of the TNC. A digipeater accomplishes much the same task as an ordinary repeater in extending the range over which you can communicate. The difference is that your messages are copied and relayed by the digipeating packet station. This results in better quality of the signal received at the destination at the expense of some delay while the intermediate message is received and retransmitted.

To request digipeating under the AX.25 protocol, you must specify the intermediate packet station or stations which you want to relay your messages. You can do this as part of the CONNECT command by using the VIA subcommand:

```
CONNECT G6LOW VIA G7XYZ-2, G4ABC
```

You must list the intermediate stations in the order in which you want them to relay the packets as they go from your station to the destination station. In this example your connect message to G6LOW will be repeated by G7XYZ-2 and then by G4ABC. Reply packets will come via G4ABC then G7XYZ-2.

You can specify as many as eight intermediate stations; however, keep in mind that using more than one digipeater is an extension to AX.25 and may not be compatible with other implementations of this protokol. The delay between your transmission and the receipt of a reply will naturally increase as more intermediate relays are used. Also, the possibility of losing information due to interference or noise on the channel increases.

You can specify intermediate digipeaters to be used for unconnected packets by using the UNPROTO command with the same format as the CONNECT command:

```
UNPROTO QST VIA G6LOW
```

This causes packets sent when you are not connected to another station to be sent to QST(rather than the default CQ) digipeated by G6LOW.

For special applications, you can disable the TNC's ability to connect or to transmit. If you leave your TNC running to monitor channel activity in your absence, but you wish to inhibit it from transmitting, set XMITOK to OFF. The TNC will perform normal operations in this condition, including formatting and "sending" packets; however, it will not key the transmitter. You may also wish to specify CONOK OFF. This prevents the TNC from accepting connect requests from other stations (although it does not stop you from initiating a connect request of your own).

If a connect request is received when CONOK is OFF, the TNC will send a "station busy" packet to the requesting station and display a message such as:

```
***connect request; G9ABC
```

to identify the requesting station. If the TNC receives a "station busy" message in response to a connect request, it will display a message such as:-

```
***G9ABC station busy
```

to show the call sign of the station you tried to connect to. These messages are also used if a TNC is connected to another station when a request is received.

In addition to transmitting information typed in from a data mode, you can command the TNC to send a specific message at regular intervals. This message is called a "beacon." You can use this function to send announcements to allow other packet users to test their equipment. To set the beacon text to your message, type the command:

```
BTEXT
```

Everything you enter on the command line following the space after BTEXT will be entered into your message string.

Use the BEACON EVERY command to set the inteval between your beacon messages. If you wish the beacon to transmit at 30-minute intervals, for example, give the command:

```
BEACON EVERY 180
```

You can specify any value between 0 and 255 for n in the BEACON EVERY n command, where n specifies 10-second time intervals. A value of 0 is the default value and turns the beacon off, while 255 specifies 2550 seconds (or 42.5 minutes). If local activity is high on your operating frequency, it is wise to send regular beacon messages at 30-minute or longer intervals.

The beacon function also has a transmit-after mode, in which a beacon packet is only transmitted after activity is heard on the channel. You can use this feature to leave a message for other packet users. If someone initiates a connection (or sends anything, for that matter) on an otherwise idle channel, a beacon can be sent a short time later with a message such as "I'll be back on the air on packet after dinner — call me then." If the station is monitoring beacon packets (refer to the description of the monitor mode on Page 4-33), the operator will see this message. No beacons are sent in this mode if there is a lot of packet activity on the channel, since the required period of quiet will not occur.

PACKET TIMING FUNCTIONS

Five adjustable timing parameters are provided so you can configure the TNC to your particular radio environment. Some other parameters related to the timing parameters are also described.

The time delays that are required when the TNC switches from receive to transmit and from transmit to receive vary greatly among various amateur radio equipment. When two stations send packets back and forth, these delays must be allowed for. If data is sent before the transmitter is operating, the packet will not be transmitted properly. Similarly, if the receiving station has not had sufficient time since it stopped transmitting for the receiver to become active, data will be lost. The delay between transmitter keyup and the beginning of data transmission is controlled by the TXDELAY command. Ordinarily, this parameter should be set to the same value by all members of a local packet group, and it should be determined by the slowest pair of stations in the group.

If you transmit packets through an audio repeater, you may require a considerably longer keyup delay than that required for direct communications. The AXDELAY command allows you to specify an additional keyup delay to allow the repeater receiver and transmitter to lock up. If the repeater has a long "hang time" and stays up for a while after the other station has stopped transmitting, you can make use of this time with the AXHANG command. If the TNC has detected channel activity recently enough that the repeater should still be "up," it will wait only a time that equals the TXDELAY before it sends data, rather than adding an AXDELAY time as well.

The parameters set by TXDELAY, AXDELAY, and AXHANG are all specified as numbers between 0 and 15. The actual delay in milliseconds is a multiple of the input parameter, 40 ms per count for TXDELAY and 120 ms per count for AXDELAY and AXHANG. During the time the TNC is keying the transmitter but not sending data, it will transmit a synchronizing signal (flags). Thus, the total keyup delay will only be:

```
Keyup delay = (TXDELAY x 40) + (AXDELAY x 120)
```

in milliseconds. If channel activity has been heard more recently than AXHANG x 120 ms ago, the keyup delay will be:

Keyup delay = TXDELAY x 40

in milliseconds. If it takes your radio an exceptionally long time to keyup, you can use AXDELAY to augment the maximum delay available with TXDELAY by setting AXHANG to 0.

The AX.25 protocol provides for retransmitting packets if no acknowledgement is heard from the connected station within a certain period of time. A packet may not be acknowledged due to channel noise or "collision" with another packet transmission. Since there may be other stations on the channel, the receiving staiton may not be able to acknowledge the received packet immediately. The time lapse before the originating station retransmits the packet is set by the FRACK (frame acknowledge time) command. The maximum number of retransmissions before the originating station terminates the connection is set by the RETRY command. The maximum number of transmissions of a packet is RETRY + 1, since the initial transmission does not count as a retransmission.

The frame-acknowledge time is automatically corrected for the additional time required for digipeating. An extra time delay is added for each transmission, which must be made after origination of the packet in order to deliver the packet and receive the acknowledgement. The time interval before the TNC retransmits an unacknowledged packet is therefore:

Retry interval = FRACK x (2 x n+1)

in seconds, where n is the number of calls in the digipeat field of the address.

The AX.25 protocol specifies that acknowledgments of digipeated packets be made from end to end. This means that intermediate digipeaters do not acknowledge the packets they digipeat. When the destination station receives the packet, it generates an acknowledgment which is sent through the reverse route used by the original packet. If there are several intermediate relays, the chance of either the original packet or the acknowledgment being lost increases drastically. To help alleviate this problem, an automatic wait time can be imposed on any station not transmitting a digipeated packet. Any station ready to transmit a packet immediately after the carrier drops is required to wait for this time interval unless it will be transmitting one or more digipeated packets. This means that the chance of a collision involving a digipeated packet is reduced since, once a transmission begins, other stations will wait for a clear channel. The digipeat wait time is set by the DWAIT command, which specifies 40 ms intervals. If no digipeating is being done by anyone in the local area, you can set this parameter to 0. In any event, however, it should be set to the same value by all members of a local packet group.

To avoid unnecessary packet retries with associated channel load, the TNC implements a collision-avoidance strategy which applies to all packets except those being relayed. On the second and subsequent transmission of a particular packet, the TNC waits an additional random time after detecting a clear channel before beginning transmissiion. This strategy is based on the assumption that packets not acknowledged suffered collisions with transmissions from other stations. If the random waiting time is spent, repeated collisions of transmissions by the same two stations can be prevented, since eventually they will wait different time periods and one station will capture the frequency. The random time is a multiple (0 to 15) of the TXDELAY time. This occurs because TXDELAY represents the interval during which a transmiutted may have been keyed but cannot yet be detected by other staitons. The interval, in milliseconds, between the TNC detecting carrier drop and beginning to transmit is:

Wait time = DWAIT x 40

for the first transmission of a packet. For subsequent transmissions of the same packet, the interval is:

Wait time = (DWAIT + r x TXDELAY) x 40

where r is a random number from 0 to 15.

The AX.25 protocol allows multiple packets to be transmitted before waiting for an acknowledgment. This permits more efficient channel use when large amounts of data are being transferred. The maximum number of packets that the TNC will send before waiting for acknowledgment is specified by MAXFRAME. Of course, the TNC will not wait until MAXFRAME packets have been entered before transmitting — this parameter is only used to limit the transmission if more than one packet is ready when the TNC begins to transmit. MAXFRAME, in combination with PACLEN, determines how much information can be sent in a single transmission. The best combination for efficient data transfer is determined partly by the channel quality and partly by the rate at which the terminal can process data. For a 1200 baud terminal data rate, you should start with a combination that produces about 300 characters outstanding at one time.

The radio data transmission rate is set by the HBAUD command. This command selects a baud rate from a table of standard rates similar to the ABAUD command for terminal baud rate. Note that there is no relationship between terminal baud rate and radio baud rate. Also, be aware that the baud rate table is different for HBAUD and ABAUD. A 400 baud option for radio baud rate is included for AMSAT operations, and only rates through 4800 baud are supported (9600 with high-

speed clock option). To communicate with another packet station, you must use the same radio baud rates. The length of time required to send a given amount of information depends inversely upon the baud rate, so that it takes four times as long to send a line at 300 baud as at 1200 baud. If you use slow radio baud rates, you should either limit the length of transmissions determined by MAXFRAME and PACLEN so that the hardware watchdog timer does not disrupt your transmissions, or disable or modify the watchdog. The Bell-202 compatible modem is the optimum design only for 1200 baud radio data rate. The modem is not useful at rates higher than 1200 baud, although the TNC will provide data signals at up to 4800 baud with the standard clock; an external modem is required for such operation.

MONITOR FUNCTIONS

Although the AX.25 protocol is primarily oriented toward setting up "circuits" between two stations, this is not the way many amateurs operate. The TNC can also operate in a mode more suitable for a "net" or 'round-table" discussion with several participants, although reliable reception of your transmissions by every station cannot be guaranteed. This is done by enabling the monitor functions.

Monitoring is enabled by setting the MONITOR command to ON, and separate monitor functions are individually enabled. This set of functions allows you to see displayed packets from selected stations or classes of stations. You can list up to eight call signs of stations to monitor or discard with the LCALLS and BUDLIST commands. Packets are displayed if any of the call signs specified by LCALLS appear in the "yes" field of the packet address, or if any call signs specified by BUDLIST appear. If you specify ALL in place of an LCALLS list, you will see all of the packets your TNC receives. NOTE: Since the LCALLS and BUDLIST commands interact, refer to their descriptions in the "Commands and Messages" section of this Manual for additional information.

Monitored packet display is somewhat different from the display of connected packets. Each packet is displayed with the source and destination stations identified:

```
G4LOW>G9ABC: go ahead with file transfer.
```

If a connected packet QSO is taking place on the frequency of your group conversation, you may wish to ignore all connected packets while your group operates in an unconnected mode. The MALL OFF command causes connected packets to be ignored. If you want to be able to monitor packet activity when your station is not connected but have the feature automatically disabled when you connect to someone, you should set the MCON command to OFF. If you have MALL ON and MCON ON, and you are monitoring the station you are connected to, packets from that station will be displayed only in the monitor format and not in the usual manner with no station identification.

You can operate a group conversation with some data integrity by having the stations connect in pairs and set MALL ON and MCON ON. This does not insure that every packet is received at every station, but it does insure that a packet involved in a collision will be retried. You may occasionally see duplicate copies of packets in this mode if the acknowledgment packet is lost. If you have an odd number of stations participating in this sort of conversation, one station can connect to itself via another station as a digipeater. This station will have the disadvantage of seeing its own packets redisplayed. For example if G4LOW, G8LOW, G8RNU, G3UBO, and G3MME wish to carry on a group conversation, the following connections are made to ensure reliability:-

```
G4LOW connects to G3UBO
G8RNU connects to G3MME
G8LOW connects to G8LOW via G3UBO
```

If each station specifies MCON ON, MALL ON, and MTO ALL, each station will see the packets sent by all of the others.

NOTE: The STREAMSW command allows you to actually connect to more than one station at the same time. Since this feature is confusing to inexperienced packet operators, we recommend that you wait until you know how to use the basic TNC commands before you attempt to use this command. You can find more information about the STREAMSW command in the "Commands and Messages" section of this Manual.

USING THE BULLETIN BOARD (BBS) FEATURE

Unlike most packet radio TNCs that are currently available, your Pocket Packet has a bulletin board feature built in. This feature allows other stations to retrieve and store messages to and from them at any time in your system, which acts as a "mailbox."

Assume you want to send a message to a specific station that you know is on packet radio, but that station is not on the air when you are. A bulletin board enables you to leave a message for that station with a bulletin-board-equipped station that is always on the air. Now, when the station you left the message for comes on the air, he can contact the third station and read your message. If he wishes, he can then leave a message for you to retrieve when you return to the air.

The special commands that pertain to bulletin board operation are shown in Table 3-1 on the next page.

To set up your station as a BBS, perform the following steps:

1. From the Command Mode, type "MB ON" followed by a <RETURN> to turn the BBS on.

   ```
   cmd: MB ON <CR>
   MBOD was OFF
   ```

2. Set MYMCALL to your call sign, if this has not already been done. NOTE: Many stations use an SSID after their call sign to distinguish the BBS from their main station. If you use the same call sign as you do for MYCALL, the BBS will have priority, and any station that connects to you will actually be connected to your BBS.

   ```
   cmd:MYM G6LOW-1<CR>
   MYMCALL was
   ```

3. Set DAYTIME, if this has not already been done. NOTE: If you do not set DAYTIME, messages will not be time and date stamped.

   ```
   cmd: DA YYMMDDHHmm
   ```

   Example:

   ```
   cmd: DA 8709151210
   ```

   (year=87, month=September, date=15, hours=12, and minutes=10)

If G3MME now connects to your BBS for example, he will see the following message while your controller waits for a command:

```
WELCOME TO G6LOW's MESSAGE BOARD
AOR SYSTEM VER 1.17
CMD )F/K/M/R/W/B/H?)
```

NOTE: The letters in parentheses correspond to the mnemonics of the commands listed in Table 3-1.

If your computer or terminal is turned on, it will display:

```
K:***CONNECTED TO G3MME
```

Table 3-1

COMMAND*	MNEMONIC	PARAMETER	DEFAULT	PURPOSE
DAYTIME	DA	YYMMDDHHmm	Blank	Time and date stamps messages stored on the BBS.
MYMCALL	MYM	CALL (-n)	Blank	Your BBS call sign.
MBOD	MB	ON/OFF	OFF	Turns BBS on and off.
BYE	B	None	None	Terminates BBS operation.
MINE	MI	None	None	Prints messages left by you or to you on your terminal or computer.
FILE	FI	None	None	Prints a BBS file on your terminal or computer.
HELP	H	None	None	Displays a help message.
KILL	KI	"n"	None	Deletes nth message from the BBS. NOTE: You can kill only those messages that were sent to or from yourself.
		% or &	None	Deletes the 10 oldest messages from the BBS.
READ	R	"n"	None	Reads the nth message from the BBS.
WRITE	W	Call sign	None	Writes a message in the BBS with attention to call sign. If you do not specify a call sign, the BBS writes the message to ALL.
?	?	None	None	Same as HELP

*The SYSOP (System Operator) can also use any of these commands, except BYE and HELP, from the command mode.

COMMANDS AND MESSAGES

COMMAND SYNTAX

The TNC uses many variable **parameters**, such as your call sign, terminal type, display preferences, and the characteristics of your radio in its operation. In addition, you can command the TNC to perform several tasks, such as connecting to another station to start a conversation, disconnecting at the end of the QSO, or displaying information about itself. You can change parameters and issue instructions to the TNC by typing **commands** comprised of English-like words or word abbreviations called **keywords**, or by typing **variables** that consist of numbers or strings of characters you select. You will probably never change some of these parameters; the TNC, however, is designed to provide you with maximum flexibility so you can adapt it to your particular environment.

In the following paragraphs, all commands are listed alphabetically. If a command has parameters, each parameter is described and the default value is given. The defaults are the EPROM's stored values, which you may load by typing the RESET command. Each parameter is described and the possible values are given. Refer to the "Operation" section for a more detailed discussion of many of the commands and their interrelationships. Enter the command in the TNC by typing it when you see the command-mode prompt:

cmd:

The command keywords and parameters are separated by spaces, and the TNC takes action after you press the RETURN key. You may enter keywords in upper- or lowercase. Except for the beacon, ID text, and CTEXT, everything you enter in the command mode is translated to uppercase before it is examined. You may abbreviate all commands and alphabetic parameters to the shortest unique string. These minimum abbreviations are shown to the left of each command's full name.

There are several types of parameters. A parameter denoted as "n" is a number, and can be given either in decimal or in hexadecimal (base 16). When the TNC shows some of these parameters (those which set special characters), they are given in hexadecimal. A hexadecimal number is distinguished from a decimal number by the "$" prefix that precedes it. The 'digits" of a hexadecimal number represents powers of 16, analogous to the powers of 10 represented by a decimal number. The numbers 10 through 15 are denoted by the hexadecimal digits A through F. For example:

$1B = 1 * 16 + 11 = 27
$120 = 1 * 16 * 16 + 2 * 16 = 288

The TRACE command parameter is given as a bitcode. This means that several related values are simultaneously set by this command, and the parameter is formed by adding together the numbers that correspond to each desired value. You may find it convenient to think of this number in hexadecimal.

Many parameters are "flags", meaning that they have two possible values, ON and OFF, or YES and NO. All of the commands descriptions show ON and OFF as the options; you may, however, type YES and NO instead. A few parameters are really flags, but rather than indicating that something is "on" or "off", they select one of two ways of performing a task. Some of these parameters have the values EVERY or AFTER, indicating how a time interval for a repeated action is to be treated. Others are CONVERS or TRANS, indicating operating modes for data transmission.

Several commands require call signs as parameters. While these parameters are normally amateur radio call signs, they may actually be any collection of numbers and at least one letter (up to six characters). Call signs or other similar desig-

nations (called aliases) are used to identify stations sending and receiving packets. A call sign may additionally include an "extension", a decimal number between 0 and 15 that is used to distinguish between two or more stations on the air with the same call sign (such as a base station and a repeater). You enter the call sign and extension, which are then displayed as call-ext; that is, W8XYZ-3. If you do not enter the extension, it is set to —0. Extensions of —0 are not displayed by the TNC.

Several parameters are numerical codes for characters which perform special functions. The code is simply the ASCII character code for the desired character. These characters have control characters as default values. You enter a control character by holding down a special control key on the keyboard while you press the indicated key.

There are two commands, BTEXT and ID, which have a text string as parameters. These strings can be any combination of letters, numbers, punctuations, or spaces up to 128 characters. You can even put characters with special meanings, such as RETURNs, into the string by preceding them with the "pass" character. The string ends when you type a (non-passed) RETURN.

In the following command descriptions, the keywords are shown in uppercase. User-supplied values are shown in lowercase. If you must choose a parameter from one or two values, the choices are separated by a vertical bar. Optional parameters are shown in square brackets. For example:

KEYWORD var A/B [C/D]

This means that the command KEYWORD requires a user-supplied variable "var" and either A or B. In addition, you can optionally specify C or D.

You can examine the value of any parameter by typing the command which sets this parameter followed by a RETURN. A special command, DISPLAY, allows you to see the values of all parameters or groups of related parameters.

USER COMMANDS

The following alphabetic list contains detailed descriptions about the meaning, use, effects of, parameters, default values, and arguments of each command. Examples of command usage are also included.

8B 8BITCONV ON/OFF

Default: OFF

Parameters:

ON The high-order bit IS NOT stripped in the Converse Mode.

OFF The high-order bit IS stripped in the Converse Mode.

8BITCONV permits packet transmission of eight-bit data in the Converse Mode.

If 8BITCONV is OFF, the high-order bit (bit seven) of characters received from the terminal is removed before the characters are transmitted in a packet.

The standard ASCII character set requires only seven bits. The eighth or final bit is used as a parity bit or ignored.

NOTE: Setting bit seven in text characters transmitted over the air may cause confusion at the other end.

If you need to transmit eight-bit data but do not want all of the features of the Transparent Mode, set 8BITCONV ON and AWLEN to 8. This may be desirable if you are using a special non-ASCII character set.

Since commands require only the standard seven-bit ASCII character set, bit seven is always removed in the Command Mode.

AB ABAUD "n" *Default: 9600 baud*

Parameter:

"n" Specifies the data rate or signaling speed, in baud, on the serial I/O terminal port.

ABAUD displays the baud rate set by the auto-baud routine when you first apply power to the Controller, or after you type "RESET".

Use ABAUD to specify a terminal baud rate that will become active at the next power-up or RESTART. A warning message reminds you of this.

If you plan to change terminals but want to retain all of the RAM parameter values, set ABAUD, AWLEN, and PARITY to the new terminal's characteristics while you are still connected to the old terminal. Then turn off the TNC, change the terminal, and turn the TNC on again.

AU AUTOLF ON/OFF *Default: ON*

Parameters:

ON A <LF> character IS added to outgoing packets following each <CR> transmitted in the packet.

OFF A <LF> IS NOT added to outgoing packets.

AUTOLF is included to maintain compatibility with other packet radio controllers.

NOTE: If the station you are talking to reports overprinting of packets from your station, set AUTOLF ON. Character insertion is disabled in the Transparent Mode.

AW AWLEN "n" *Default: 7*

Parameter:

"n" 7 or 8 specifies the number of data bits per word.

The parameter value defines the digital word length used by the serial input/output (IO) terminal port and your computer or terminal program.

NOTE: Set AWLEN to 7 for most packet operations, such as conversation, bulletin board operation, and transmission of ASCII files.

If eight-bit words are sent to the Controller in the Command or Converse Modes, the eighth bit is normally removed, leaving a standard ASCII character, regardless of the setting of AWLEN.

All eight data bits of each character must be retained to send executable files or other special data.

NOTE: Set AWLEN to 8 and use the Transparent Mode.

You can also use the Converse Mode and set AWLEN to 8 and 8BITCONV ON. You must, however, precede the Converse Mode special characters with the PASS character in the data you send.

A AX25L2V2 ON/OFF

Default: ON

Parameters:

ON The Controller uses AX.25 Level 2 Version 2.0 protocol.

OFF The Controller uses AX.25 Level 2 Version 1.0 protocol.

Some implementations of the earlier version of AX.25 protocol will not properly digipeat Version 2.0 AX.25 packets. This command exists to provide compatibility with these other TNCs until their software has been updated.

AXD AXDELAY "n"

Default: 0 (00 msec.)

Parameter:

"n" 0 to 180 specifies a key-up delay for voice repeater operation in ten-millisecond intervals.

AXDELAY specifies the period of time the controller will wait, in addition to the normal delay set by TXDELAY, after keying the transmitter and before data is sent.

Packet groups using a standard "voice" repeater to extend the range of the local area network may need to use this feature.

Repeaters with slow electromechanical relays, split sites, auxiliary links, or other circuits which delay transmission for some time after the RF carrier is present, require some amount of time to get RF on the air.

If you are using a repeater that has not previously been used for packet operations, try various values to find the best value for "n".

If other packet stations have been using the repeater, check with them for the proper setting.

AXDELAY acts in conjunction with AXHANG.

AXH AXHANG "n"

Default: 0 (000 msec.)

Parameter:

"n" 0 to 20 specifies the voice repeater hang time in 100-millisecond intervals.

The numeric value can be used to increase channel efficiency when an audio repeater has a hang time greater than 100 milliseconds. For a repeater with a long hang time, it is not necessary to wait for the repeater key-up delay after keying the transsmitter if the repeater is still transmitting.

When the controller has heard a packet sent within the hang period, it does not add the repeater key-up delay (AXDELAY) to the keyuop time.

If you use a repeater that has not previously been used for packet operations, try various values to find the best value for "n".

If other packet stations have been using the repeater, check with them for the proper setting.

B BEACON EVERY/AFTER "n"

Default: EVERY 0

Parameters:

EVERY Send the beacon at regular intervals.

AFTER Send the beacon once after the specified time interval of no packet activity.

"n" 0 to 250 specifies beacon timing in 10-second intervals.

0 (zero) Turns off the beacon.

The BEACON command sets the conditions under which your packet beacon will be transmitted.

NOTES:

1. A beacon frame contains the text that you have typed into the BTEXT message in a packet addressed to "CQ" or other UNPROTO address.

2. A beacon frame may be sent directly, or sent via the digipeat addresses specified by the UNPROTO command.

When the keyword EVERY is specified, a beacon packet is sent every n times 10 seconds. This mode can be used to transmit packets for testing purposes.

When AFTER is specified, a beacon is sent after n times 10 seconds have passed with no packet activity.

NOTE: The beacon is sent only once until further activity is detected.

You can use this mode to send announcements or test messages only when packet stations are on the air.

NOTE: Proper choice of "n" avoids cluttering a busy channel with lots of unnecessary transmissions.

You can monitor beacon frames from other packet stations by setting MONITOR in the range 1-6.

BK BKONDEL ON/OFF *Default: ON*

Parameters:

ON — The sequence <BACKSPACE><SPACE><BACKSPACE> is echoed when a character is deleted from the input line.

OFF — The <BACKSLASH> character <\> is echoed when a character is deleted.

BKONDEL determines how character deletion is displayed in the Command or Converse Modes.

The <BACKSPACE><SPACE><BACKSPACE> sequence updates the video display screen.

NOTE: Set BKONDEL ON if you are using a video display terminal or computer.

On a printing terminal the <BACKSPACE><SPACE><BACKSPACE> sequence will result in overtyped text.

NOTE: Set BKONDEL OFF if you have a paper-output display, or if your terminal does not respond to the <BACKSPACE> character <CTRL-H>.

The Controller displays a <BACKSLASH> for each character you delete. You can get a display of the corrected input by typing the redisplay- line character that you can set with the REDISPLAY command.

BT BTEXT text *Default: Empty (Null String)*

Parameter:

text — Any combination of characters and spaces, up to a maximum length of 120 characters.

BTEXT is the content of the data portion of a beacon packet. The default text is an empty string (no message).

NOTE: Beacon packets are discussed in more detail under the BEACON command.

You can send multiple-line messages in your beacon by including <CR> characters in the text. To insert <CR>, type the PASS character (CTRL-V) before the <CR>.

NOTE: The PASS character is set by the PASS command.

If you enter a text string longer than 120 characters, the command is ignored and the following error message appears:

```
?too long
```

A packet bulletin board (PBBS) program may set the beacon text to a message like this, updating the text after each connection:

```
MAIL for: G4LOW G3MME G8RNU G8ABC
```

NOTE: Use a "%", "&", "N", "NO", "NONE", or OFF as the first characters in the text to clear the BTEXT text without issuing the RESET command.

Although the subject of beacons is controversial in packet circles, the following four suggestions will help you use the feature intelligently and benefit the packet community:

1. Do not type your call sign in BTEXT. The normal packet header shows it for you.
2. Do not fill your BTEXT with screen graphics such as asterisks, parentheses, colons and semicolons, etc. Use BTEXT for some significant information.
3. Do not use BTEXT to tell the world that your "DIGIPEAT IS ON" and "BUFFER SAVE TO DISK IS ENABLED". Put this information in your CTEXT message so that it is seen by any station that connects to you – the only one who can make use of the information.
4. After you have beaconed for a week or two and the packet community has learned who and where you are, follow the practice used by more experienced packeteers: SET BEACON EVERY 0!

BU BUDLIST ON/OFF *Default: OFF*

Parameters:

ON	Causes the TNC to ignore frames from stations that are NOT in the LCALLS list.
OFF	Causes the TNC to ignore frames from stations that ARE in the LCALLS list.

BUDLIST works together with the LCALLS command, which allows you to set up a call sign list. These commands determine which packets are displayed when you set MONITOR to ON. BUDLIST allows you to specify whether the call signs in the list are those you wish to ignore, or if they are the ones you want displayed.

If you want your TNC to display packets only from a limited list, use LCALLS to enter the list of call signs, and then set BUDLIST to ON. This feature enables you to have the TNC watch for a particular station while you converse with another station.

If you want your TNC to ignore packets from a limited list, use LCALLS to enter the list of call signs, and then set BUDLIST to OFF. This is handy when you want to ignore a bulletin board on the frequency, for example, while you monitor other conversations.

CAN CANLINE "n" *Default: $18 <CTRL-X>*

Parameter:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code.

CANLINE changes the CANCEL-LINE input editing command character.

The parameter "n" is the ASCII code for the character you want to use to cancel an input line.

The following examples show how to enter the code in hex and decimal:

CANLINE $15 (hex)

CANLINE 21 (decimal)

Either method sets the cancel-line character to <CTRL- U>.

When you use the CANLINE character to cancel an input line in the Command Mode, the line is terminated with a <BACKSLASH> character and new prompt (cmd:) appears.

When you cancel a line in the Converse Mode, only the <BACKSLASH> and a new line appear.

NOTES:

1. You can cancel only the line you are currently typing.
2. Once you type a <CR>, you cannot use the cancel-line character to cancel an input line.
3. Use the CANPAC character to cancel the entire packet.
4. If your send-packet character is not <CR>, the cancel-line character cancels only the last line of a multi-line packet.

Like all other input editing features, line cancellation is disabled in the Transparent Mode.

CANP CANPAC "n" *Default: $19 <CTRL-Y>*

Parameter:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code.

CANPAC changes the CANCEL-PACKET input editing command character.

The parameter "n" is the ASCII code for the character you want to type in order to cancel an input packet.

NOTE: You can enter the code in either hex or decimal.

When you cancel a packet in the Converse Mode, the line is terminated with a <BACK-SLASH> character and a new line.

NOTE: You can only cancel the packet that you are currently entering.

Once you have typed the send-packet character, or waited PACTIME (if CPACTIME is enabled), the packet cannot be canceled even if it has not been transmitted.

Like other input editing features, packet cancellation is disabled in the Transparent Mode.

The CANCEL-PACKET character also cancels the display output in the Command Mode. If the Controller is in the Command Mode and you type the CANCEL-PACKET character, any characters that would be typed on the screen (except those echoed) are "discarded" by the Controller.

NOTES:

1. Typing the cancel-output character a second time restores normal output.
2. To see how this works, type DISPLAY followed by a <CTRL-Y>.

The command list display will stop and you will not see any response from the Controller to commands.

To verify that the display is back to normal, type <CTRL-Y>, and then type DISPLAY again.

Use the CANCEL-DISPLAY feature if you inadvertently do something that causes the Controller to generate large amounts of output to the terminal, such as entering the DISPLAY command or setting TRACE ON.

NOTE: If the Controller is in the Converse or Transparent Mode and you want to cancel display output, you must exit to the Command Mode before you type the CANCEL-PACKET character.

CB CBELL ON/OFF *Default: OFF*

Parameters:

ON	Three BELL characters <CTRL-G> ($07) are sent to your terminal with the "*** CONNECTED to (call sign)" message.
OFF	BELLS are NOT sent with the CONNECTED message.

NOTES:

1. Set CBELL ON if you want to be notified audibly whenever someone connects to your station.

2. If CBELL is ON and MFILTER contains the character ($07), you can be sure that whenever your terminal beeps there is a connection for you. At no other time will you hear a beep while the Controller is in the Packet Mode.

CH CHECK "n" *Default: 30 (300 sec.)*

Parameters:

"n"	0 to 250 specifies the check time in ten-second intervals.
0 (Zero)	disables this feature.

CHECK sets a timeout value for a packet connection, and depends upon the setting of AX25L2V2.

Without the CHECK feature, if your Controller was linked or "connected" to another station and the other station seemed to "disappear", your Controller would remain in the connected state indefinitely, refusing connections from other stations. This might happen if propagation changes unexpectedly or an intermediate digipeater station fails or is shut down while you and the other station are connected "via" that digipeater.

Your Controller tries to prevent this sort of "lockup" from occurring by sending a new connect request packet when the specified time elapses without any packets being received from the other TNC.

If a pre-Version 2 link is inactive for CHECK times ten seconds, your Controller tries to save the link by starting a reconnect sequence. The Controller enters the "connect in progress" state and sends SABM (Connect Request) frames. In addition, the Controller adds a random time of up to 30 seconds each time CHECK is used.

NOTE: If AX25L2V2 is ON and packets have not been received from the other station for "n" times 10 seconds, your Controller sends a "check packet" to test if the link still exists to the other station.

The "check" packet frame contains no information, but is interpreted by the other station's TNC to see if it is still connected. If the other station's TNC is still connected, it sends an appropriate response packet.

If your Controller initiates the "check" and does not obtain an answer after RETRY+1 attempts, your Controller starts a reconnect sequence just as if you had typed the CONNECT command.

NOTE: If AX25L2V2 is OFF and the other station has not been received for "n" times 10 seconds, your Controller does not test the link to the other station. Instead, your Controller sends a reconnect packet just as if you had typed the CONNECT command.

CLK CLKADJ "n" *Default: 8 (zero)*

"n" 0 to 65535 specifies a correction factor that us applied to the real-time clock routine.

CLKADJ provides you with a limited ability to correct your TNC's real-time clock. A value of 0 (zero) causes no correction to be applied. If the value of CLKADJ is anything other than zero, the correction factor is calculated as:

relative clock speed in % = 100 - (9.16667 x 1/n)

The real-time clock routine keeps track of year, month, day, hour, minute, and second as specified in the DAYTIME command.

NOTE: The real-time clock is not intended to serve as your ham shack reference clock. It is useful for approximate time-stamping information during packet operation.

CM CMDTIME "n" *Default: 1 (1 msec.)*

Parameter:

"n" 0 to 250 specifies timeout value in 100-millisecond intervals while the Controller is in the Transparent Mode.

If "n" is 0 (zero), you will have to send the BREAK signal or interrupt power to the Controller to exit from the Transparent Mode.

CMDTIME sets the timeout value in the Transparent Mode. A guard time of "n" seconds allows escape to the Command Mode from the Transparent Mode, while permitting any character to be sent as data.

The same Command Mode entry character (default <CTRL-C>) that is used to exit from the Converse Mode is also used to exit the Transparent Mode, although the procedure is different.

NOTES:

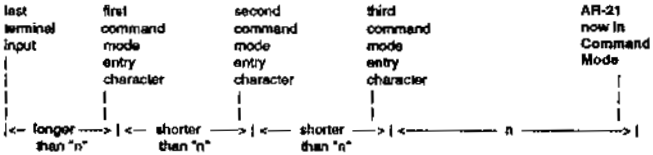
1. The Command Mode entry character is set by COMMAND.
2. Three Command Mode entry characters must be entered less than "n" seconds apart, with no intervening characters, after a delay of "n" seconds following the last characters you typed.

3. After a final delay of "n" seconds, the Controller exits the Transparent Mode and enters the Command Mode.

4. You will then see the normal Command Mode prompt:

   cmd:

The following diagram illustrates this timing:



CMS CMSG ON/OFF *Default: OFF*

Parameters:

ON The recorded CTEXT message is sent as the first packet after a connection is established by a connect request from another station.

OFF The text message is not sent at all.

CMSG enables or disables automatic transmission of the CTEXT message when your Controller accepts a connect request from another station.

NOTES:

1. Set CMSG ON to tell callers that you are not available to answer calls manually when they connect to your Controller.

2. Set CMSG OFF when you are available to operate or answer calls manually.

CMSGD CMSGDISC ON/OFF *Default: OFF*

Parameters:

ON Causes an automatic disconnect upon completion of the CTEXT message.

OFF The TNC will remain connected after it sends the CTEXT message.

Normally, you will want to set CMSGDIS to ON. If CMSGDIS is set to OFF and another station connects to you, your station will remain in a connected state until either you or the other station issues a DISCONNECT.

This feature helps prevent your station from being hung up by a distant station that connects you, but for some reason cannot disconnect, such as fading band conditions.

COM COMMAND "n" *Default $03 <CTRL-C>*

Parameter:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code.

COMMAND is used to change the Command Mode entry character. You can enter the code in either hex or decimal.

Type the COMMAND character to enter the Command Mode from the Converse Mode. You will not see a response if you type the Command Mode entry character while the Controller is already in the Command Mode.

To enter the Converse Mode type: CONVERSE

Now, all characters typed on the keyboard and characters sent from a disk or tape files are transmitted as packet data.

To return to the Command Mode, type <CTRL-C>. The Command Mode prompt appears to indicate a successful exit to the Command Mode. The display might look like this:

```
cmd:CONVERSE
Hello World! I'm on the air on packet radio! [type <CTRL-C>]
cmd:
```

CONM CONMODE CONVERS/TRANS *Default: CONVERS*

Parameters:

CONVERSE Your Controller automatically enters the Converse Mode when a connection is established.

TRANS Your Controller automatically enters the Transparent Mode when a connection is established.

CONMODE selects the mode your Controller uses after entering the CONNECTED state.

The connection may result either from a connect request received from another station, or a connection initiated by a CONNECT command that you have typed.

NOTES:

1. Set CONMODE to CONVERS for most packet operations.
2. Set CONMODE to TRANS if you are using the Transparent Mode for a bulletin board program, so that the correct mode will be entered when your bulletin board receives a connect request.
3. If the Controller is already in the Converse or Transparent Mode when the connection is completed, the mode will not be changed.

C CONNECT call1 [VIA call2[,call3...,call9]] *Immediate Command*

Parameters:

call1	Call sign of the other station to which you wish to be connected.
call2	Optional call sign(s) of up to eight digipeaters via which you want to be repeated to reach the other station.

CONNECT sends a connect request to station "call1," directly or via one or more digipeaters. Each call sign can include an optional SSID "n", immediately after the call sign.

The part of the command line shown below in brackets is optional. The double-bracketed text ",call3...,call9" is also optional and is used only when "VIA call2" is used, that is, when you are connecting through one or more digipeaters. (The brackets and quotation marks are used in this text only for clarity. Do not type them!)

VIA call2[, call3...,call9]

NOTE: Type the digipeater fields in the exact sequence you wish to use to route your packets to the destination station "call1."

If you type CONNECT while your Controller is already connected, or trying to connect to or disconnect from another station, your monitor will display:

```
Link state is: CONNECT in progress
```

If the other station does not "ack" your connect request after the number of tries specified by RETRY, the CONNECT command is canceled and your monitor displays:

```
cmd:*** Retry count exceeded
*** DISCONNECTED: (call sign)
```

To connect directly to G6LOW, you would type:-

```
CONNECT G6LOW (or C G6LOW)
```

To connect to G6LOW via G3UBO (with whom you can easily connect) and G3MME (who is near G6LOW) as digipeaters, type:-

```
CONNECT G6LOW VIA G3UBO,G3MME
```

Type CONNECT or "C" without arguments to see the link status and the number of unacknowledged, outstanding packets.

CONO CONOK ON/OFF *Default: ON*

Parameters:

ON	Connect requests from other stations ARE accepted.
OFF	Connect requests from other stations ARE NOT accepted.

The CONOK command determines the action that the TNC will take when it receives a

connect request from another station. If CONOK is set to ON, the request is acknowledged, the normal connect message is displayed, and the TNC will enter either the Converse or the Transparent Mode (depending upon how you have CONMODE set).

If CONOK is set to OFF and the TNC is not in the Transparent Mode, it will display a connect request message:

Connect request: <callsign>

The TNC also issues a DM packet, like a "busy signal", to the requesting station. If you wish, you can then issue your own connect command. When your TNC receives a DM packet in response to a connect request, it will display:

***** <call> station busy**

If, for example, you wish to leave your station on as a digipeater, you could set CONOK to OFF until you are ready to communicate with another station. When another station attempts to connect to your TNC, it will be able to see that your station is not available for a connection, but can still be used as a digipeater.

CONP CONPERM ON/OFF *Default: OFF*

Parameters:

ON The current connection on the current channel is not allowed to enter the disconnected state.

OFF The current channel can be connected to and disconnected from other stations.

When it is ON, CONPERM forces the Controller to maintain the current connection, even when frames to the other station exceed RETRY attempts for an acknowledgment. RESTART and power off/on cycling do not affect this connected state.

CONPERM works only when a connection is established. It functions on a channel-by-channel basis when multiple connections are allowed.

CONPERM allows connections on other channels to operate normally. For example, automatic disconnect based on RETRY, when it is used under conditions such as:

Certain networking applications.

Meteor scatter.

Other noisy, less reliable links.

CONPERM ON may be advantageous when you use full-duplex continuous mail forwarding or traffic links.

CONS CONSTAMP ON/OFF

Default: OFF

Parameters:

ON Connect status messages ARE time stamped.

OFF Connect status messages are NOT time stamped.

CONSTAMP activates time stamping of *** CONNECTED status messages.

If CONSTAMP is ON and DAYTIME (the Controller's internal clock) is set, date and time information generated in the Controller is available for bulletin board programs or other host computer applications.

Date and time must be set initially by the DAYTIME command before time stamping will occur. For example, if CONSTAMP is ON and the date and time have been set in the Controller, a connect and disconnect sequence appears as follows:

```
cmd:connect G6LOW
cmd:10:56:23 ***CONNECTED to G6LOW
cmd:disconnect
cmd:10:55:29 ***DISCONNECTED:G6LOW
```

The CONNECT and DISCONNECT commands can be abbreviated as shown below:-

```
cmd:c G6LOW
cmd:10:56:22 ***CONNECTED to G6LOW
cmd:d
cmd:10:56:32 ***DISCONNECTED:G6LOW
```

CONV CONVERSE

Immediate Command

CONVERSE is an immediate command that causes the Controller to change from the Command Mode to the Converse Mode.

NOTE: Link connections are not affected.

Once the controller is in the Converse Mode, all characters typed from the keyboard or sent from a disk file are processed and transmitted by your radio.

NOTE: To return the Controller to the Command Mode from the Converse Mode, type the Command Mode entry character (default is <CTRL-C>).

CP CPACTIME ON/OFF

Default: OFF

Parameters:

ON Packet transmit timer IS used in the Converse Mode.

OFF Packet transmit timer IS NOT used in the Converse Mode.

CPACTIME activates automatic, periodic transmission of packets while the Controller is in the Converse Mode.

CPACTIME may be used for several types of computer communications such as bulletin board or host computer operation when you do not want the full Transparent Mode features.

NOTES:

1. When CPACTIME is ON, characters are packetized and transmitted periodically like they are in the Transparent Mode. Local keyboard editing and display features of the Converse Mode are available; software flow control can be used.

2. Refer to the PACTIME command, (which controls the rate and mode of packet assembly) for a discussion of how periodic packetizing works.

3. Set ACRPACK OFF in this mode. When ACRPACK is ON, the send-packet character is inserted in the data being packetized even though it was not typed.

4. To include <CR> characters in transmitted packets, set SENDPAC to a character not normally used (e.g., <CTRL-P>); the Controller then treats a <CR> as an ordinary character.

5. Set CPACTIME ON for a mode of operation similar to full break-in CW.

Setting CPACTIME ON transmits your text soon after you type it, in short bursts of a few characters. The other station may break in at will. Some operators find it easier to chat in this mode; long delays are eliminated while long packets are being typed.

CR CR ON/OFF *Default: ON*

Parameters:

ON The send-packet character (normally <CR>) IS appended to all packets that are sent in the Converse Mode..

OFF The send-packet character IS NOT appended to packets.

When CR is set to ON, all packets that are sent in the Converse Mode will include, as the last character of the packet, the send-packet character, This character causes the packet to be sent. If CR is set to OFF, the send-packet character is interpreted only as a command to the TNC, and is not included in the packet. In addition, it will not be echoed to the terminal.

Set CR ON and SENDPAC to $0D for a natural conversation mode. Each line is sent whenever you enter a <CR>, and arrives at the other station with a <CR> at the end of the line.

NOTE: If the other station reports overprinting of lines on his display, you can either set LFRADD to ON or the other station can set AUTOLF to ON.

CS CSTATUS *Immediate Command*

CSTATUS is an immediate command that is used during multiple connections. When you type CSTATUS, your monitor displays:

The number of each logical channel.

The link state of all ten logical channels.

The current input/output channel - the one you are using.

Whether each channel connection is "permanent." (Refer to CONPERM.)

Depending upon your use of multiple connections and the USERS command, CSTATUS will display the following:

NOT CONNECTED TO ANY STATION

```
cmd:CS
A stream - IO Link state is: DISCONNECTED
B stream -    Link state is: DISCONNECTED
C stream -    Link state is: DISCONNECTED
D stream -    Link state is: DISCONNECTED
E stream -    Link state is: DISCONNECTED
F stream -    Link state is: DISCONNECTED
G stream -    Link state is: DISCONNECTED
H stream -    Link state is: DISCONNECTED
I stream -    Link state is: DISCONNECTED
J stream -    Link state is: DISCONNECTED
K stream -    Link state is: DISCONNECTED
```

CONNECTED TO ONLY 1 STATION

```
cmd:CS
A stream - IO Link state is: CONNECTED to WX1AAA
B stream -    Link state is: DISCONNECTED
C stream -    Link state is: DISCONNECTED
D stream -    Link state is: DISCONNECTED
E stream -    Link state is: DISCONNECTED
F stream -    Link state is: DISCONNECTED
G stream -    Link state is: DISCONNECTED
H stream -    Link state is: DISCONNECTED
I stream -    Link state is: DISCONNECTED
J stream -    Link state is: DISCONNECTED
K stream -    Link state is: DISCONNECTED
```

If you are connected to several stations, the CSTATUS command shows your connect status as follows:

CONNECTED TO SEVERAL STATIONS

```
cmd:CS
A stream - IO Link state is: CONNECTED to WX1AAA
B stream -    Link state is: CONNECTED to WX2BBB P
C stream -    Link state is: CONNECTED to WX3CCC
D stream -    Link state is: CONNECTED to WX4DDD
E stream -    Link state is: CONNECT in progress
F stream -    Link state is: DISCONNECTED
G stream -    Link state is: DISCONNECTED
H stream -    Link state is: CONNECTED to WX5EEE via WX6FFF
I stream -    Link state is: DISCONNECTED
J stream -    Link state is: DISCONNECTED
K stream -    Link state is: DISCONNECTED
```

This sample display shows that:

CHANNEL 0 has the input and output channels — you are using it!

CHANNEL 1 is connected to WX2BBB "permanently."

All other channels' states are shown as they might appear with multiple connections.

CT CTEXT text

Default: Empty

Parameter:

text Any combination of characters and spaces up to a maximum of 120 characters.

CTEXT is the "automatic answer" text you type into a special section in the Controller's memory.

If CMSG is set to ON, the CTEXT message is sent as soon as another station connects to your station.

To type multiple-line CTEXT messages and include a carriage return (<CR>) character in your text, use the PASS character (<CTRL-V> is the default value) immediately preceding the carriage return (refer to the PASS command).

A typical CTEXT message might be:

```
"I'm not available right now <CTRL-V> <CR>
Please leave your message, then disconnect <CR>
```

NOTE: If you enter a text string longer than 120 characters, the following error message appears and the command is ignored:

```
?too long
cmd:
```

Use a percent sign (%), an ampersand (&), "N", "NO", "NONE", or "OFF" as the first characters in the CTEXT message to clear the previous message without having to type a RESET command.

DA DAYTIME date & time

Default: clock not set

Parameters:

date&time Current DATE and TIME to set.

DAYTIME sets the Controller's internal clock current date and time. The date&time parameter is used in the Packet Mode by the commands CONSTAMP and MSTAMP to "time stamp" received and monitored messages.

Entries in the "heard" (displayed by MHEARD) are also time stamped if date&time has been set. The Controller time updates continuously, as long as power is applied.

The clock is not set when the Controller is first turned on, and the DAYTIME command will display the following error message:

```
cmd:day
?clock not set
```

NOTE: You must reset date and time each time you turn on the Controller. Otherwise CONSTAMP and MSTAMP will not "stamp" the time.

If you type DAYTIME without a parameter, the Controller displays current date and time information. The format of the display is:

```
dd-mm-yy hh:mm:ss
cmd:day
DAYTIME 09-Mar-87 06:57:33
```

The format for entering the date&time is:

```
yymmddhhmm
cmd:daytime 8703090659
```

where:

yy is the last two digits of the year.
mm is the two-digit month code (01-12).
dd is date (01-31).
hh is the hour (00-23).
mm is the minutes after the hour (00-59).

Enter the numbers 0-9 with leading zeros; all codes must be exactly two digits. Delimiters such as <SPACE>, "/", ":", and ";" can be used. The Controller will echo the new setting to confirm a successful entry.

Pay particular attention to the month when you set the date. The Controller does not check for the correct number of days in a month.

DAYU DAYUSA ON/OFF

Default: ON

Parameters:

ON	The date is displayed in a mm-dd-yy format.
OFF	The date is displayed in a dd-mm-yy format.

The DAYUSA command allows you to determine the format of the TNC's date display. If DAYUSA is set to ON, the standard United States format is used. If DAYUSA is set to OFF, the standard European format is used. The command affects the format of the date display that is used in "time stamps". It also affects the display when you enter a DAYTIME command without paramemters. The format you use for entering the time with the DAYTIME command is not affected.

If DAYUSA is set to ON, December 14, 1987 and 8:35:45 AM would be displayed as:

```
cmd: DAYTIME
12/14/87 8:35:45
```

If DAYUSA is set to OFF, the same date and time would be displayed as:

```
cmd: DAYTIME
14/12/87 8:35:45
```

DEL DELETE ON/OFF *Default: OFF*

Parameters:

ON The <DELETE> ($7F) key is used for editing your typing.

OFF The <BACKSPACE> ($08) key is used for editing your typing.

Use the DELETE command to select the key to use for deleting while editing.

Type the selected DEL key to delete the last character from the input line.

You cannot use the DEL key to delete text before the beginning of a line. Use the PASS character to delete <CR> characters that have been typed into the text.

The BKONDEL command controls how the Controller indicates deletion.

To see a corrected display of the current line after deleting characters, type the redisplay-line character, which is set by the REDISPLAY command.

DIG DIGIPEAT ON/OFF *Default: ON*

Parameters:

ON The TNC will digipeat packets, if another station requests it.

OFF The TNC will not digipeat packets.

When this parameter is set to ON, any packet that is received with your TNC's call sign (including any SSID) in the digipeat list of its address field will be retransmitted. Each station that is included in the digipeat list relays the packet, in turn, and will mark the packet so that it will not accidentally relay it twice (unless it is requested to do so). In addition, all stations will relay the packet in the correct order. Digipeating takes place concurrently with other TNC operations and does not interfere with normal operation of a packet station.

Many stations set DIGIPEAT to ON most of the time. You may wish to set it to OFF if you are not at home, or if your transmit/receive relay makes enough noise to wake you up at night.

THE HID command enables automatic retransmission of identification packets when your station acts as a digipeater.

D DISCONNECT *Immediate Command*

DISCONNECT is an immediate command that initiates a disconnect request to the other station to which you are connected.

If your disconnect command is successful, your monitor will display:

*** DISCONNECTED: (call sign)

Other commands can be entered while a disconnect is in progress. New connections are not allowed until the disconnect is completed.

NOTES:

1. If the retry count is exceeded while you are waiting for the other station to acknowledge your disconnect command, your Controller automatically switches to the disconnected state.

2. If another disconnect command is entered while your Controller is trying to disconnect, the retry count is immediately set to the maximum number. In either case, your monitor displays:

```
*** Retry count exceeded
*** DISCONNECTED: (call sign)
```

Disconnect messages are not displayed when your Controller is in the Transparent Mode.

DISP DISPLAY [class] *Immediate Command*

Parameters:

class Optional parameter identifier, one of the following:

(A)sync	display asynchronous port parameters.
(C)haracter	display special characters.
(I)d	display ID parameters.
(L)ink	display link parameters.
(M)onitor	display monitor parameters.
(T)iming	display timing parameters.

DISPLAY is an immediate command.

If you type DISPLAY without a class parameter, all control parameters and their current values are displayed. You can specify the optional parameter class to display subgroups of related parameters. To display an individual parameter, enter the parameter name without an option.

DW DWAIT "n" *Default: 32 (320 msec.)*

Parameter:

"n" 0 to 250 specifies default wait time in ten-millisecond intervals.

DWAIT helps avoid collisions with digipeated packets.

Unless the Controller is waiting to transmit digipeated packets, DWAIT forces it to pause after last receiving data on the channel for the duration of the DWAIT (Default Wait) time, before it begins its transmitter key-up sequence.

Wherever possible, the value of DWAIT should be agreed upon by all stations in a local area when digipeaters are used in the area. The best value will be determined by experimenting.

DWAIT is a function of the key-up time (TXDELAY) of the digipeater stations and helps alleviate the drastic reduction of throughput that occurs on a channel when digipeated packets suffer collisions.

DWAIT is necessary because digipeated packets are not retried by the digipeater, but are always restarted by the originating station. When all stations specify a default wait time, and the right value of "n" is chosen, the digipeater captures the frequency every time it has data to send — digipeated packets are sent without this delay.
Recommended settings of DWAIT for different types of packet station operation are:

TYPE OF OPERATION	TIME (in msec)	DWAIT VALUE
Digipeaters	0	0
Local keyboards	160	16 (default)
PBBSs, Hosts	320	32
File transfers	480	48

E ECHO ON/OFF

Default: ON

Parameters:

ON Characters received from the computer or terminal ARE echoed by the Controller.

OFF Characters ARE NOT echoed.

The ECHO command controls local echoing by the Controller when it is in the Command or Converse Mode. Local echoing is disabled in the Transparent Mode.

Set ECHO ON if you do not see your typing appear on your display.

Set ECHO OFF if you see each character you type doubled.

ECHO is set correctly when you see the characters you type displayed correctly.

ES ESCAPE ON/OFF

Default: OFF

Parameters:

ON The <ESCAPE> character ($1B) is output as "$" ($24).

OFF The <ESCAPE> character is output as <ESCAPE> ($1B).

The ESCAPE command selects the character to be output when an <ESCAPE> character is to be sent to the terminal. The <ESCAPE> translation is disabled in Transparent Mode.

The ESCAPE character selection is provided because some computers and terminal emulators interpret the <ESCAPE> character as a special command prefix. Such terminals may alter their displays depending upon the characters following the <ESCAPE>.

Set ESCAPE ON if you have such a terminal to avoid unexpected text strings from other packeteers.

Refer to the MFILTER command for information about character stripping (rather than character translation) in monitored packets.

F FLOW ON/OFF

Default: ON

Parameters:

ON Type-in flow control IS active.

OFF Type-in flow control IS NOT active.

When FLOW is ON, type-in flow control is active. Any character typed on your keyboard causes the output from the Controller to the terminal to stop until any of the following conditions exist:

A packet is forced (in the Converse Mode).

A line is completed (in the Command Mode).

The packet length (See PACLEN) is exceeded.

The terminal output buffer fills up.

Canceling the current command or packet or typing the redisplay-line character also causes output to resume. Type-in flow control is not used in the Transparent Mode.

Setting FLOW ON prevents inbound or received data from interfering with your keyboard data entry. If you (and the person you are talking to) normally wait for a packet from the other end before starting to respond, you can set FLOW OFF.

Some packet bulletin board programs (PBBS) may work best with FLOW set to OFF.

Some computers with "software UARTs" may be unable to send and receive data at the same time. If you are using that type of computer, set FLOW to ON.

FR FRACK "n"

Default: 3 (3 sec.)

Parameter:

"n" 1 to 15, specifying frame acknowledgment time-out in one-second intervals.

FRACK is the FRame ACKnowledgment time in seconds that your Controller will wait for acknowledgment of the last-sent protocol frame before resending or "retrying" that frame.

After sending a packet requiring acknowledgment, the Controller waits for FRACK seconds timeout before incrementing the retry counter and sending the frame again. If the packet address includes digipeat instructions, the time between retries is adjusted to:

Retry interval = "n" x (2 x m + 1)
where m is the number of intermediate relay stations.

When a packet is retried, a random wait time is added to any other wait times in use. This avoids lockups in which two packet stations repeatedly send packets which collide with each other.

FU FULLDUP ON/OFF *Default: OFF*

Parameters:

ON Full duplex mode is ENABLED.

OFF Full duplex mode is DISABLED.

When full-duplex mode is disabled, the Controller makes use of the DCD (Data Carrier Detect) signal from its modem to avoid collisions; the Controller acknowledges multiple packets in a single transmission with a single acknowledgment.

When full-duplex mode is enabled, the Controller ignores the DCD signal and acknowledges packets individually.

Full-duplex operation is useful for full-duplex radio operation, such as through OSCAR 10. It should not be used unless both your station and the other station can operate in full-duplex.

You may also find full-duplex mode useful for some testing operations, such as analog- or digital-loopback tests.

HB HBAUD "n"

Default: 1200 baud

Parameter:

"n" Values specifying the rate or signaling speed in bauds from the Controller to the radio.

HBAUD sets the radio ("on-air") baud rate only in the packet operating mode. HBAUD has no relationship to your computer terminal program's baud rate.

You must use the same radio data rate as the other station. NOTE: Always set HBAUD to 1200. The TNC will accept other numbers, but the TNC's modem port is not capable of using anything other than 1200 baud.

Example: HBAUD 1200

NOTE: Modern commercial and amateur terminology no longer always refer to the speeds or data rates in "WPM". The term "bauds" is now accepted for FSK and AFSK operations using mono-bit data. In these cases, the terms "bauds" and "bits-per-second" mean the same thing. Either term may be used.

HE HEADERLN ON/OFF

Default: OFF

Parameters:

ON The header for a monitored packet is printed on a separate line from the packet text.

OFF The header and packet text of monitored packets are printed on the same line.

HEADERLN affects the display of monitored packets. When HEADERLN is OFF, the address information is shown on the same line as the packet text:

```
WX1AAA>WX2BBB: Go ahead and transfer the file.
```

When HEADERLN is ON, the address is shown, followed by a <CR><LF> that puts the packet text on a separate line:

```
WX1AAA>WX2BBB:
Go ahead and transfer the file.
```

If MRPT or MSTAMP are ON, set HEADERLN ON; long headers may extend across your screen or page when these functions are active.

HEAL HEALLED ON/OFF *Default: OFF*

Parameters:

ON Automatically runs diagnostic tests on the microprocessor when you turn the unit on. If all checks are satisfactory, it alternately lights the CON and STA LEDs.

OFF Does not run diagnostic tests and no LEDs will light.

Allows you to make a quick check of the Controller's operation. If you set HEALLED to ON and the LEDs do not alternately flash, check for proper power supply or battery voltage and connections. If the LEDs do not flash, the software has failed.

HI HID ON/OFF *Default: OFF*

Parameter:

ON Your Controller sends HDLC identification as a digipeater.

OFF Your Controller does not send HDLC identification.

The HID command activates or disables your Controller's automatic periodic transmission of identification packets when it is operating as a digipeater. This identification consists of an unsequenced I- Frame with your station identification (MYCALL) and MYALIAS in the data field.

Set HID ON to force your Controller to send an ID packet every 9.5 minutes when it is being used as a digipeater.

Set HID OFF to stop your Controller from sending any ID packets.

The HID identification packet is addressed to the "CQ" address set by the UNPROTO command.

Your station identification is the call sign you have set with the MYCALL command, with "digipeater" appended.

NOTE: You cannot change the 9.5-minute automatic interval timing.

I ID *Immediate Command*

ID is an immediate command that sends a special identification packet. The ID command allows you to send a final identification packet when you are taking your station off the air. Note that HID must be set to ON. ID forces a final identification packet to be sent when a digipeater station is being taken off the air. The identification consists of an unnumbered I-Frame, with its data field containing your MYALIAS (if any) and your MYCALL station identification and the word "digipeater".

The ID identification packet is sent only if the digipeater has transmitted since the last automatic identification.

The ID identification packet is addressed to "ID."

Your station identification is the call sign you have set with the MYCALL command, with your MYALIAS, your main call sign and the word "digipeater" appended. The following example is shown as seen with and without a MYALIAS, with MONITOR set to 6.

```
W2XYZ-9*>ID <UI>      W2XYZ-9*>ID <UI>
W2XYZ digipeater      BHTC, W2XYZ digipeater
```

LCA LCALLS all, none, yes/no call1[,call2..] *Default: Empty*

Parameter:

Call — All, none, YES list, NO list. The list can contain up to eight call signs, separated by commas.

LCALLS uses arguments to determine how your Controller monitors the packet channels an displays information — which stations' packets will be displayed and which stations' packets will be masked or hidden. LCALLS is set to 'all" when you start your Controller for the first time.

Type LCALLS to display the ALL/NONE/YES list/NO list status of station call signs whose packets will or will not be displayed. You can use the abbreviated command form or mnemonic:

```
cmd:lcalls
LCALLS all
cmd:lca
LCALLS yes WX1AAA,WX2BBB, WX3CCC,WX4DDD
```

To stop any packets from being displayed, type LCALLS NONE.

To display packets from one or more specific stations type LCALLS YES (followed by a list of call signs). Packets will be displayed only from staitons whose call signs are listed after YES.

To hide or mask packets from one or more specific stations, type LCALLS NO (followed by a list of call signs). Packets from stations whose call signs are listed after NO will not be displayed.

You can include optional SSIDs specified as "-n" after the call sign. IF LCALLS is set to "no N6ABC" or "yes N6ABC", any combination N6ABC, N6ABC-1,...N6ABC-15 will be matched and processed.

When LCALLS and BUDLIST contain different types of arguments, to avoid any possible conflict, the arguments take the following priority:

1. ALL
2. No list
3. YES list
4. NONE

Clear LCALLS with "%", "&", or "OFF" as the argument.

LC LCOK ON/OFF

Default: ON

Parameters:

ON Causes the TNC to send lowercase characters to the computer or terminal.

OFF Causes the TNC to translate lowercase characters to uppercase.

If LCOK is set to OFF, lowercase characters are translated to uppercase before they are sent to the terminal. Input characters and echoes are not translated. NOTE: Case translation is disabled in the Transparent Mode.

If your computer or terminal does not accept lowercase characters, it may react strangely when the TNC sends them to it. The LCOK command allows you to translate all lower case characters that are received in packets, as well as messages from the TNC, to upper case.

Since echoes of the characters you type are not translated to uppercase, you can use this command to make your display easier to read when you converse in a connected mode. If you and the other station set LCOK to OFF, you can each type your own messages in lowercase, and the other station's incoming packets will be displayed in uppercase. This makes it easier to distinguish between incoming and outgoing packets.

LCS LCSTREAM ON/OFF

Default: ON

Parameters:

ON Causes the character that immediately follows the STREAMSWITCH character to be changed to uppercase, before it is acted upon.

OFF Causes the character that immediately follows the STREAMSWITCH character to be acted upon normally.

When LCSTREAM is set to ON, the character that immediately follows the STREAMSWITCH character is changed to uppercase before it is acted upon as a parameter to that command. Since you can specify the stream you desire with either an upper case or a lowercase letter, the LCSTREAM command simplifies management of multiple connections.

When LCSTREAM is set to OFF, the case of the character that immediately follows the STREAMSWITCH character is important. NOTE: A lowercase letter will result in an error message.

LF LFADD ON/OFF

Default: OFF

Parameters:

ON A line feed <LF> character is added to outgoing packets following each carriage return <CR> that is transmitted in the packet.

OFF No line feed character is added to outgoing packets.

LFADD is similar to AUTOLF, except the line feed characters are added to outgoing packets instead of to the display text. This feature helps make your TNC compatible with other packet radio TNCs.

Set LFADD to ON if the station you are communicating with reports that your packets are being overprinted. NOTE: This character insertion is disabled in the Transparent Mode.

LFI LFINGORE *Default: OFF*

Parameters:

ON Causes the Controller to ignore any line feed characters it receives from another station.

OFF Causes the Controller to print any line feed characters it receives.

Set LFIGNORE to ON if you feel you are receiving too many line feeds from another station. NOTE: This command has no effect in the Transparent Mode.

MA MALL ON/OFF *Default: ON*

Parameters:

ON Both connected and nonconnected packets are monitored.

OFF Only nonconnected packets are monitored.

The MALL command determines the class of monitored packets. When MALL is set to OFF, only packets from unconnected stations determined by BUDLIST and LCALLS are displayed. This is the normal setting when you are communicating to a group of unconnected stations.

When MALL is set to ON, all eligible frames are displayed, including those that are sent between two other connected stations.

The MALL command is handy for diagnostic purposes or for general monitoring.

MAX MAXFRAME "n" *Default: 2*

Parameters:

"n" 1 to 7 signifies a number of packet frames.

MAXFRAME sets an upper limit on the unacknowledged packets your Controller permits on the radio link at any one time. MAXFRAME also sets the maximum number of contiguous packets your Controller will send during any given transmission.

If some but not all of the outstanding packets are acknowledged, a smaller number may be transmitted the next time, or new frames may be included in the retransmission so that the total number of unacknowledged packet frames does not exceed "n."

The "best" value of MAXFRAME depends upon your local channel conditions. In most cases of keyboard-to-keyboard direct or local operation (links that do not require going through digipeaters), you can use the default value MAXFRAME 4.

When the amount of packet traffic, the path in use, the digipeaters involved, or other variables not under your control make packet operation difficult (as shown by lots of retries!), you can actually improve your throughput by reducing MAXFRAME.

If packet traffic is heavy or the path is poor, reduce MAXFRAME to 3 or 2.

If you are sharing the channel with several PBBSs and digipeaters, or when you are working a PBBSs or other types of host computers, reduce MAXFRAME to 1.

If the radio link is good, an optimal relationship exists between the parameters set by these commands, so that the maximum number of characters outstanding does not exceed the receive buffer space of the TNC receiving the data.

MB MBOD ON/OFF

Default: OFF

Parameters:

ON Turns the message (bulletin) board on.

OFF Turns the message (bulletin) board off.

This Controller has built-in bulletin board capability. To use this feature, you must set MBOD to ON. Before you do this, however, make sure that you have entered an exclusive call sign in MYMCALL.

NOTE: To use the bulletin board feature, you must enter a call sign into MYMCALL.

MCOM MCOM ON/OFF

Default: OFF

Parameters:

ON Connected, disconnected, information, UA (Unnumbered Acknowledgment), and DM (busy signal) frames are monitored.

OFF Only information frames are monitored.

When MCOM is set to ON, both connected and disconnected frames are displayed, if MONITOR is also set to ON. Connected, disconnected, information, UA, and DM frames are indicated by <C>, <D>, <I>, <UA>, and <DM>, respectively. Like other monitor commands, stations that are monitored are determined by BUDLIST and LCALLS.

Set MCOM to OFF to display only I frames (packets that contain user information).

MC MCON ON/OFF *Default: OFF*

Parameters:

ON Monitors packets from all other stations while your TNC is connected to another station.

OFF Only monitors packets from the station you are connected to.

Turn MCON ON to monitor other stations on the frequency while your TNC is connected to another station.

MF MFILTER n1[,n2[,n3[,n4]]] *Default: $00*

Parameter:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code. Up to four characters may be specified.

Use MFILTER to select characters to be "filtered," or excluded from monitored packets. Parameters "n1", "n2", etc., are the ASCII codes for the characters you want to filter. You can enter up to four characters in either hex or decimal.

1. To prevent a <CTRL-L> character from clearing your screen, set MFILTER 12.
2. To eliminate <CTRL-Z> characters, which some computers interpret as end-of-file markers, set MFILTER 26.
3. To eliminate <CTRL-G> characters, which beep your computer or terminal, set MFILTER 7.

MHC MHCLEAR *Immediate Command*

The MHCLEAR command clears the list of stations heard. You can use this command together with the MHEARD command to keep track of any stations heard over a particular period of time, such as an evening or a week. Be sure to clear the list of stations heard when you first begin to monitor packet activity.

MH MHEARD *Immediate Command*

MHEARD is an immediate command that displays a list of stations heard since the last time the MHEARD buffer was cleared.

Use the MHC command to clear the MHEARD buffer.

The maximum number of heard stations that can be logged is 18. If more stations are heard, earlier entries are discarded.

NOTES:

1. Stations that are heard directly are marked with a * in the heard log.

2. Stations that have been repeated by a digipeater are not marked.

3. If you clear the list of stations heard at the beginning of a session, you can use this command to keep track of the stations that are active during that period.

4. Logging of stations heard is disabled when PASSALL is ON.

When DAYTIME has been used to set the date and time, entries in the heard log are time-stamped. When DAYSTAMP is ON, the date is shown before the time. An actual sample of the MHEARD function with the clock set is shown below:

DAYSTAMP ON

```
cmd:mh
05-Jul-86 21:42:27 WA1AAA
05-Jul-86 21:42:24 WA1BBB*
05-Jul-86 21:32:18 K2AAA-5
05-Jul-86 21:27:57 W2ABC-4*
05-Jul-86 21:26:41 K2AAA-4
05-Jul-86 21:26:38 W2XYZ-9
05-Jul-86 21:21:24 KA1CCC*
05-Jul-86 21:21:23 W2XYZ-4*
05-Jul-86 21:05:07 KB1DDD
05-Jul-86 20:58:40 WA1EEE
05-Jul-86 14:45:57 WA2XXX-1
05-Jul-86 14:45:53 KV1FFF
05-Jul-86 14:45:47 W6ABC
05-Jul-86 14:28:16 KB2WXY
05-Jul-86 14:23:32 WB2BBB
05-Jul-86 14:23:19 WB2CCC
05-Jul-86 13:55:26 N2DDD
05-Jul-86 13:50:28 W1HHH-1*
cmd:
```

DAYSTAMP OFF

```
cmd:mh
21:42:27 WA1AAA
21:42:24 WA1BBB*
21:32:18 K2AAA-5
21:27:57 W2ABC-4*
21:26:41 K2AAA-4
21:26:38 W2XYZ-9
21:21:24 KA1CCC*
21:21:23 W2XYZ-4*
21:05:07 KB1DDD
20:58:40 WA1EEE
14:45:57 WA2XXX-1
14:45:53 KV1FFF
14:45:47 W6ABC
14:28:16 KB2WXY
14:23:32 WB2BBB
14:23:19 WB2CCC
13:55:26 N2DDD
13:50:28 W1HHH-1*
cmd:
```

M MONITOR ON/OFF

Default: ON

Parameters:

ON — Packet activity is monitored.

OFF — Packet activity is not monitored.

If MONITOR is set to ON and the Controller is not in the Transparent Mode, packets not adressed to you are displayed. The addresses in the packet are displayed along with the data portion of the packet. For example:

```
N2XYZ>W5ABC-3: I am ready to transfer the file.
```

The call signs are separated by a ">" and the substation ID field (SSID) is displayed if it is other than 0. The MALL, BUDLIST, and LCALLS commands determine which packets are to be monitored. The MCON command controls the action of the monitor mode when the Controller is in a connected state. All monitor functions are disabled in the Transparent Mode.

HEADERLN controls the format of the monitor display. If you wish to see the station addresses on a separate line from the text, set HEADERLN ON: MRPT enables monitoring of the digipeater routing as well as source and destination addresses for each packet.

MSTAMP included a time stamp with the addresses if you have set DAYTIME.

MR MRPT ON/OFF

Default: ON

Parameters:

ON — Show digipeaters in the header; stations heard directly are marked with an asterisk.

OFF — Show packets only from originating and destination stations.

MRPT affects the way monitored packets are displayed. When MRPT is OFF, only packets from the originating station and the destination are displayed:

```
W2XYZ-4*>W1AW-4 <I;0,3>:
```

In addition, while MRPT is OFF, the Controller will remove all indications of digipeater paths in connect requests, and all connect and disconnect stamps.

When MRPT is ON, the call signs of all stations in the entire digipeat path are displayed. The call sign of the stations received directly are flagged with an asterisk (*):

```
W2XYZ-4*>WA1ABC>W1AW-5>W1AW-4 <I;0,3>:
```

MS MSTAMP ON/OFF

Default: OFF

Parameters:

ON — Monitored frames ARE time stamped.

OFF — Monitored frames ARE NOT time stamped.

The MSTAMP command activates or disables time stamping of monitored packets. When your Controller's internal software clock is set, date and time information is available for automatic logging of packet activity or other applications.

When MSTAMP is OFF, the packet header display looks like this:

```
W2XYZ-4*>KA2ABC-1>AI2X <I;2,2>:
```

When MSTAMP is ON and DAYSTAMP is OFF, the display looks like this:

```
22:51:33  W2XYZ-4*>KA2ABC-1>AI2X <I;1,7>:
```

When both MSTAMP and DAYSTAMP are ON, the display looks like this:

```
10-Jul-88  22:54:25  W2XYZ-4*>KA2ABC-1>AI2X <I;2,2>:
```

Set the date and time with the DAYTIME command.

Setting MSTAMP ON increases the length of the address display.

Set HEADERLN ON to display this information on a separate line.

MYA MYALIAS call[-n] *Default: none*

Parameters:

call	Alternate identity of your Controller.
"n"	0 to 15, an optional substation ID (SSID).

MYALIAS specifies an alternate call sign (in addition to the call sign specified in MYCALL) for use as a digipeater only. NOTE: The controller will not allow other stations to connect to your MYALIAS call sign.

MYALIAS permits both normal HID identification and an alias alternate, repeater-only "call sign."

Wide-coverage digipeater operators in some areas change their call sign to a shorter and (usually) easier to remember identifier.

Identifiers used include International Civil Aviation Organization (ICAO) airport IDs, sometimes combined with telephone area codes.

MY MYCALL call[-"n"] *Default: No call*

Parameters:

call	Your call sign.
"n"	0 to 15, indicating an optional substation ID (SSID).

Use the MYCALL command to load your call sign into your Controller's RAM. Your call sign is inserted automatically in the FROM address field for all packets originated by your Controller. MYCALL is also used for identification packets (see HID and ID).

Your Controller accepts connect request frames with your MYCALL in the TO field and repeats frames with this call sign in the digipeat field.

The AR-21 default call sign is present in your Controller's RAM when the system is manufactured. The initial call must be changed for proper operation of the packet protocol.

Two or more stations cannot use the same call sign (including SSID) on the air at the same time.

Use the SSID to distinguish between two stations with the same amateur call.

The SSID will be zero (0) unless explicitly set to another value.

Although there is no standardization of SSIDs at present, most packet operators use SSID 0 (zero) for manual or local keyboard operation of their main station, and an SSID of (-1) or (-2) for a secondary station or dedicated digipeater under their responsibility.

Local area networks operated or maintained by a packet group or club may use the same call sign for several stations in their network, each node or unit being identified with a different SSID.

As packet networks grow and become more complex, with multiport and gateway systems and frequency translation between bands, SSIDs become especially significant. For example look at the hypothetical case:

```
W2ABC-4>K2AAA-5>W2XYZ-1>W2XYZ-2>W2XYZ-4
145.07     145.07     221.11     221.11     145.07
```

In this example, PBBS (Packet Bulletin Board System) W2ABC-4 is linked to PBBS W2XYZ-4 via three digipeaters, each having a distinctive SSID.

NOTE: Your Controller will not operate in the Packet Mode until you have inserted your own call sign in place of "AR-21"

MYM MYMCALL call[-n] *Default: empty*

Parameters:

call Exclusive call sign for your bulletin board.

-n 0 to 15, an optional substation ID (SSID).

NOTE: If you set both MYMCALL and MYCALL to the same call sign, MYMCALL has priority.

NE NEWMODE ON/OFF *Default: OFF*

Parameters:

ON The Controller automatically returns to the Command Mode at disconnect.

OFF The Controller does not return to the Command Mode at disconnect.

NEWMODE determines how your Controller behaves when the link is broken.

Your Controller always switches to a data transfer mode at the time of connection, unless NOMODE is ON.

Set NEWMODE for the type of operation most suitable to your needs.

If NEWMODE is OFF and the link is disconnected, your Controller remains in the Converse or Transparent Mode unless you have forced it to return to the Command Mode.

When NEWMODE is ON and the link is disconnected, or if the connect attempt fails, your Controller returns to the Command Mode.

Bulletin Board or other host computer programs designed to operate with earlier TNC systems may require you to set NEWMODE to OFF.

NO NOMODE ON/OFF *Default: OFF*

Parameters:

ON — The Controller switches modes (Command, Converse, Transparent) only upon an explicit command. The NEWMODE function is ignored.

OFF — The Controller changes modes according to NEWMODE.

When NOMODE is ON, your Controller never switches from the Converse or Transparent Mode to the Command Mode (or vice versa) by itself. Only specific commands (CONVERSE, TRANS, or <CTRL-C> typed by you can change the operating mode.

When NOMODE is OFF, your Controller switches modes automatically according to the way NEWMODE is set.

Some applications programs may require NOMODE to be ON. WA7MBL's PBBS Version 3-12 program is one such example.

NU NUCR ON/OFF *Default: OFF*

Parameters:

ON — <NULL> characters ARE sent to the terminal following <CR> characters.

OFF — <NULL> characters ARE NOT sent to the terminal following <CR> characters.

Some of the older electromechanical terminals (Teletype machines) and printer-terminals require some extra time for the printing head to do a line feed and return to the left margin. NUCR ON solves this problem by making your Controller send <NULL> characters (ASCII code $00) to your computer or terminal. This introduces any necessary delay after any <CR> sent to the terminal.

The NULLS command sets the number of individual <NULL> characters that are to be sent when NUCR is ON.

NOTE: Set NUCR ON if your terminal or printer misses one or more characters after responding to a <CR>. If this is the case, you will sometimes see overtyped lines.

NUL NULF ON/OFF *Default: OFF*

Parameters:

ON — <NULL> characters are sent to the terminal following <LF> characters.

OFF — <NULL> characters are not sent to the terminal following <LF> characters.

Some of the older electromechanical terminals (Teletype machines) and printer terminals require some extra time for the printing head to do a line feed and return to the left margin. NUCR ON solves this problem by making your Controller send <NULL> characters (ASCII code $00) to your computer or terminal. This introduces any necessary delay after any <LF> sent to the terminal.

The NULLS command sets the number of individual <NULL> characters that are to be sent when NULF is ON.

Set NULF ON if your terminal or printer misses one or more characters at the beginning of a new line after responding to a <LF>.

NULL NULLS "n"

Default: 0 (zero)

Parameters:

"n"	0 to 30 specifies the number of <NULL> characters to be sent to your computer or terminal after <CR> or <LF> when NUCR or NULF are set ON.

NULLS specifies the number of <NULL> characters (ASCII code $00) to be sent to the terminal after a <CR> or <LF> is sent.

NUCR and/or NULF must be set to indicate whether nulls are to be sent after <CR>, <LF>, or both.

Devices requiring nulls after <CR> are typically hard-copy devices requiring time for carriage movement. Devices that require nulls after <LF> are typically CRTs that scroll slowly.

The null characters are sent from your Controller to your computer only in the Converse and Command Modes.

P PACLEN "n"

Default: 96

Parameter:

"n"	0 to 255 specifies the maximum length of the data portion of a packet.
0	Zero is equivalent to 256.

PACLEN sets the maximum number of user data bytes to be carried in each packet's "information field." "User data" means the characters you actually type at your keyboard (or send from a stored file).

Your Controller automatically transmits a packet when the number of characters you type (or send from disk) for a packet equals "n." This value is used in both the Converse and Transparent Modes.

Most keyboard-to-keyboard operators use the default value of 128 bytes for routine VHF/UHF packet services.

Experiment with different values for MAXFRAME and PACLEN to find the combination best suited to your operating conditions, especially if you are transferring files.

The lower the value of PACLEN, the greater the probability of getting packets though the link without "hits" or retries.

Increase PACLEN to 256 if you are transferring files to a nearby station over a high quality path.

Reduce PACLEN to 64, or even 32, when you are working "difficult" or maginal radio paths.

If the radio link is good, an optimal relationship will exist between the parameters set by these commands. Set PACLEN so that the maximum number of characters outstanding does not exceed the receive buffer space of the TNC receiving the data.

NOTE: It is not necessary that two TNCs be set to the same PACLEN value to exchange data; some TNCs, however, may not be compatible when frames contain more than 128 data characters.

PACT PACTIME EVERY/AFTER "n" *Default: AFTER 10 (1000 msec.)*

Parameters:

"n"	0 to 250 specifies 100-millisecond intervals.
EVERY	Packet timeout occurs every "n" times 100 milliseconds.
AFTER	Packet timeout occurs when "n" times 100 milliseconds elapsewithout input from the computer or terminal.

A PACTIME parameter is always used in the Transparent Mode. PACTIME is also used in the Converse Mode if CPACTIME is ON.

When EVERY is specified, the characters you type or send from disk are packetized and queued for transmission every "n" times 100 milliseconds.

When AFTER is specified, the characters you type or send from disk are packetized when input from the terminal stops for "n" times 100 milliseconds.

A zero-length packet will never be produced. The timer is not started until the first character or byte is entered.

A value of 0 (zero) for "n" is allowed; zero means packets are sent with no wait time.

PAR PARITY "n" *Default: 3 (even)*

Parameter:

"n"	0 to 3 selects a parity option from the table below.

PARITY sets the Controller's data parity for terminal or computer data transfer

according to the following table:

0 = no parity
1 = odd parity
2 = no parity
3 = even parity

The parity bit, if present, is stripped automatically on input, and is not checked in the Command and Converse Modes.

In the Transparent Mode all eight bits (including parity) are transmitted in packets. When "no parity" is set and AWLEN is 7, the eighth bit is set to 0 (zero).

PAS PASS "n" *Default: $16 <CTRL-V>*

Parameter:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code.

PASS selects the ASCII character used for the "pass" input editing command.

The parameter "n" is the numeric ASCII code for the character you will use to signal that the character immediately following it is to be included in a packet or text string.

NOTE: You can enter the code in either hex or decimal.

Use the PASS character (default is <CTRL-V>) to send characters that usually have special functions.

A common use for the pass character is to allow <CR> to be included in the BTEXT and CTEXT messages so that the transmitted information appears on several short lines rather than a single longer line.

Use the PASS character to insert <CRs> at the end of a short line:

```
BT Notice:<CTRL-V><CTRL-M>
Meeting at the Firehouse tonight <CTRL-V><CTRL-M>
at 8:00 PM. All welcome! <CR>
```

The other station's monitor shows:

```
Notice:
Meeting at the Firehouse tonight
at 8:00 PM. All welcome!
```

Without the PASS character, the message would probably look like this:

```
Notice: Meeting at the Firehouse tonight
at 8:00 PM. All welcome!
```

In like manner, you can include <CR> in text when you are in the Converse Mode to send multi-line packets. (The default send-packet character is <CR>.)

PASSA PASSALL ON/OFF

Default: OFF

Parameters:

ON Your Controller will accept packets with invalid CRCs (Cyclic Redundancy Checks).

OFF Your Controller will only accept packets with valid CRCs.

PASSALL permits the Controller to display packets received with invalid CRC fields; the error-detecting mechanism is turned off.

Packets are accepted for display despite CRC errors if they consist of an even multiple of eight bits and are up to 330 bytes. The Controller attempts to decode the address field and displays the call sign(s) in the standard monitor format, followed by the text of the packet.

PASSALL is normally turned off; therefore, the protocol ensures that received packet data is error-free by rejecting packets with invalid CRC fields.

PASSALL (sometimes called "Garbage Mode") may be useful for testing a marginal RF link or during operation under other unusual conditions or circumstances.

When you set PASSALL ON while monitoring a moderately noisy channel, "packets" are displayed periodically because there is no basis for distinguishing between actual packets and random noise.

NOTE: When PASSALL is ON, logging of stations heard (for display by MHEARD) is disabled; the call signs detected may be incorrect.

PE PERSIST "n"

Default: 127

Perameters:

"n" 0 to 255 specifies the threshold value for a random-number attempt to transmit.

"0" Signifies a 1/256th chance of transmitting every SLOTTIME.

"256" Causes the Controller to transmit right away without delay.

The PERSIST command works with the SLOTTIME command to achieve true p-persistent CMSA (Carrier-Sense Multiple Access) in the KISS TNC mode and in AX.25 operation. No real advantage, however, is obtained in AX.25 operation unless the other stations on the channel are also using PERSIST and SLOTTIME.

When the host (your computer) has queued data for transmission, the Controller monitors the DCD (Data Carrier Detect) signal from its internal modem. The Controller waits indefinately for DCD to go inactive.

When the Channel is clear, the Controller generates a random number between 0 and 255. If this number is less than or equal to "P", the Controller keys the radio's PTT line, waits .01 x TXDELAY seconds, and transmits all frames in queue. The Controller then unkeys the PTT line and returns to the idle state.

If the random number is greater than "P", the Controller waits .01 x SLOTTIME seconds and repeats the procedure. If the DCD signal has gone active during this wait time, the Controller again waits for DCD to clear before it continues.

The Controller waits an exponentially-distributed random interval, after it senses that the channel is clear, before it tries to transmit. When PERSIST and SLOTTIME are carefully set, several stations sending traffic are much less likely to collide with each other when they simultaneously detect that the channel is clear.

NOTE: P = 255 directs the Controller to transmit as soon as possible, regardless of the random number.

PP PPERSIST ON/OFF *Default: OFF*

Parameters:

ON The Controller uses PERSIST and SLOTTIME parameters when it executes p-persistent CMSA (Carrier-Sense multiple Access).

OFF The Controller uses DWAIT for TAPR-type 1 persistent CMSA.

When PPERSIST is set to ON, the Controller uses the PERSIST and SLOTTIME parameters for p-persistent CMSA instead of normal TAPR-type DWAIT procedure to achieve CMSA operation. PPERSIST may be used in both KISS TNC and normal AX.25 operation.

RECO RECONNECT call1 [VIA call2[,call3...,call9] *Immediate Command*

Parameters:

call1 This is the call sign of the station you are trying to reconnect to.

call2 Optional call sign(s) of station(s) you are attempting to digipeat through. You can use up to eight digipeat stations.

The RECONNECT command allows you to change the path you are using to communicate with another station. NOTE: This command works only when you are already connected to the station you are attempting to reconnect to.

When you use this command, any frames that may be in process between your station and the station you are reconnecting to may be lost.

Refer to the CONNECT command for more information about the parameter list.

RED REDISPLA "n" *Default: $12 <CTRL-R>*

Parameter:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code.

REDISPLA changes the redisplay-line input editing character.

Parameter "n" is the numeric ASCII code for the character you will use when you want to redisplay the current input line.

NOTE: You can enter the code in either hex or decimal.

Type the REDISPLA character to redisplay a line you have just typed. The following things will happen:

1. Type-in flow control is temporarily turned off (if it had been active). Any incoming packets that are pending are displayed.

2. A <BACKSLASH> is appended to the line you just typed and the line is shown below it. Only the final form of the line is shown if you have deleted or changed any characters.

3. You can now continue typing where you left off.

Use the redisplay-line character to see a "clean" copy of your input if you are using a printing terminal and you have deleted characters.

If BKONDEL is set OFF, deletions are designated with <BACKSLASH> characters, rather than by trying to correct the input line display. The redisplayed line is the corrected text.

Use the REDISPLA character if a packet is received while you are typing a message in Converse Mode. You can see the incoming message before you send your packet without canceling your input.

RESET RESET *Immediate Command*

RESET is an immediate command that resets all parameters to the Controller's PROM default settings and reinitializes the Controller.

WARNING: All parameter customizing and monitor lists are lost.

To reinitialize the Controller using the parameter values in bbRAM, turn the Controller OFF then ON, or use the RESTART command.

RES RESPTIME "n" *Default: 5 (500 msec.)*

Parameter:

"n" 0 to 250 specifies 100-millisecond intervals.

RESPTIME adds a minimum delay before your Controller sends acknowledgment packets. This delay may run concurrently with the default wait time set by DWAIT and any random wait in effect.

Use RESPTIME delay to increase throughput during operations such as file transfer when the sending TNC usually sends the maximum number of full-length packets.

Occasionally, the sending TNC may not have a packet ready in time to prevent transmission from being stopped temporarily, with the result that the acknowledgment of earlier packets collides with the final packet of the series.

These collisions can be avoided if the receiving TNC sets RESPTIME to 10.

RE RETRY "n" *Default: 10*

Parameter:

"n" 0 to 15 specifies the maximum number of packet retries.

The AX.25 protocol uses retries — retransmission of frames that have not been acknowledged. Frames are retransmitted "n" times before the link is disconnected.

The time between retries is specified by the command FRACK. A value of 0 for "n" specifies an infinite number of retries. Also refer to the FRACK command.

RX RXBLOCK ON/OFF *Default: OFF*

Parameters:

ON Directs the Controller to place a $FF mark in front of received packets before they are printed on your terminal.

OFF Does not place a $FF mark in front of received packets.

The $FF mark makes it easier to identify incoming packets.

When RXBLOCK is ON, your Controller automatically places a $FF mark in front of all incoming packets. The order of identity is:

$FF, LH, LL, PID, DATA UNIT

where:

$FF is the header identify block (1 byte)

LH is the block length high byte (1 byte, high 4 bit, 111 fixed)

LL is the block length low byte (1 byte)

PID is the protocol indent of the control field of the received packet

DATA UNIT is the contents of the received packet

S SCREENLN "n" *Default: 0*

Parameter:

"n" 0 to 255 specifies the screen or platen width, in characters, of the terminal.

The SCREENLN command allows you to properly format your terminal's output. A carriage return, line feed (<CR><LF>) sequence is sent to the terminal at the end of a line in the Command and Converse modes after n characters have been printed. An n value of zero inhibits this function.

NOTE: If your computer automatically formats output lines, set SCREENLN to 0 to avoid a conflict between the two line formats.

SE SENDPAC "n" *Default: $0D <CTRL-M>*

Parameter:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code.

Use the SENDPAC command to select the character used to force a packet to be sent in the Converse Mode. The parameter "n" is the numeric ASCII code for the character you want to use to force your input to be packetized and queued for transmission. You can enter the code in either hexadecimal or decimal numbers.

Use default SENDPAC value $0D for ordinary conversation with CR ON to send packets at natural intervals with <CRs> included in the packet.

When you are setting CPACTIME ON, set SENDPAC to some value not ordinarily used (say, <CTRL-A>), with CR OFF). This setting forces packets to be sent without extra <CR> characters being sent in the text.

SL SLOTTIME "n" *Default: 1 (10 msec.)*

Parameter:

"n" 0 to 250 specifies the time interval during which the Controller waits between generating random numbers to see if it can transmit.

The SLOTTIME command works with the PERSIST command to achieve true p-persistent CSMA (Carrier-Sense Multiple Access) in KISS TNC and normal AX.25 operation. No real advantage, however, is obtained during AX.25 operation unless other stations on the channel also use PERSIST and SLOTTIME.

STA START "n" *Default: $11 <CTRL-Q>*

Parameter:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code.

Use the START command to choose the User Start character you want to use to restart output from the Controller to the terminal after you have halted it by typing the User Stop character.

NOTES:

1. The User Stop character is set by the STOP command.
2. You can enter the value in either hex or decimal.

If the User Start and User Stop characters are set to $00, software flow control to the Controller is disabled; the Controller will only respond to hardware flow control (CTS).

If the same character is used for both the User Start and User Stop characters, the Controller alternately starts and stops transmission on receipt of the character ("toggles").

STO STOP "n" *Default: $13 <CTRL-S>*

Parameter:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code.

Use the STOP command to select the User Stop character you want to use to stop output from the Controller to the terminal. Type this character to halt the Controller's output to your monitor so that you can read the received text before it scrolls off your screen display.

NOTES:

1. Output is restarted with the User Start character.
2. The User Start character is set by the START command.
3. You can enter the value in either hex or decimal.

If the User Start and User Stop characters are set to $00, software flow control to the Controller is disabled; it will only respond to hardware flow control (CTS).

If the same character is used for both the User Start and User Stop characters, the Controller alternately starts and stops transmission upon receipt of the character ("toggles").

STREAMC STREAMCA ON/OFF

Default: OFF

Parameters:

ON Call sign of the other station IS displayed in multiple connection operation.

OFF Call sign of the other station IS NOT displayed.

STREAMCA displays the call sign of the "connected-to" station after the channel identifier.

Set STREAMCA ON if you intend to operate multiple connections (as opposed to having your "host" computer operate multiple connections).

STREAMCA is especially useful when you are operating with multiple connections. Using STREAMCA is similar to using MRPT to show digipeat paths when you are monitoring the channel.

EXAMPLES:

1. When STREAMCA is OFF, the monitored activity looks like this:

```
:0hi howie
hello ted how goes it?
:1***CONNECTED TO WA7XYZ
:1 must be a dx record. ge lyle
:01 unreal ted! fi-az no digis!
:1 big band opening...ge
```

2. When STREAMCA is ON, the same activity looks like the following. The additional information shown as a result of setting STREAMCA ON is underlined.

```
:0:K4NTA: hi howie
hello ted how goes it?
:1:WA7XYZ:***CONNECTED to WA7XYZ
:1 must be a dx record. ge lyle
:01 unreal ted! fi-az no digis!
:1:WA7XYZ:big band opening...ge
```

With STREAMCA ON, ":1" becomes ":1:<call sign>:"

NOTE: To switch channels during your multiconnect conversations, type STREAMSW characters ":0" and ":1" without a ":" after them.

STREAMD STREAMDB ON/OFF *Default: OFF*

Parameters:

ON Received STREAMSW characters appear twice (doubled).

OFF Received STREAMSW characters appear once (not doubled).

STREAMDB displays received STREAMSW characters as doubled characters.

In the following example, STREAMDB is ON and STREAMSW is set to "|":

```
|| this is a test.
```

The sending station actually transmitted:

```
|this is a test.
```

The same frame received with STREAMDB OFF would be displayed as:

```
|this is a test.
```

NOTE: Set STREAMDB ON when you operate with multiple connections so you can tell the difference between STREAMSW characters received from other stations and STREAMSW characters generated by your Controller.

NOTE: STREAMSW characters must not be one of the channel numbers (A through J) for this command to function properly.

STR STREAMSW "n" *Default: $7C (|)*

Parameter:

"n" 0 to $FF (0 to 255 decimal) specifies an ASCII character code.

STREAMSW selects the characters used by both the Controller and the user to show that a new connection channel is being addressed.

The character can be PASSed in the Converse Mode. This character is always ignored as a user-initiated channel switch in the Transparent Mode; it just flows through as data.

NOTES:

1. You cannot change the outgoing channel while the Controller is active or "on-line" in the Transparent Mode.
2. To switch channels, ESCAPE to the Command Mode. Then enter the Converse Mode to use the STREAMSW command.
3. If you use your Controller as the TNC for a PBBS (Packet Bulletin Board System), change the STREAMSW character to $00 to avoid possible conflict or problems with characters that are frequently found in packet network maps.

Refer to STREAMCA for further use of STREAMSW.

TRAC TRACE ON/OFF *Default: OFF*

Parameters:

ON Trace function is activated

OFF Trace function is disabled.

The TRACE command activates the AX.25 protocol display. If TRACE is ON, all received frames are displayed in their entirety, including all header information.

NOTE: Be careful when you use the mnemonic — do not use "TRA"! TRA causes the Controller to change to the Transparent Mode!

The TRACE display is shown as it appears on an 80-column display. The following monitored frame is a sample:

```
W2XYZ*>TESTER <UI>:
This is a test message packet.

Byte    Hex                                      Shifted ASCII     ASCII

000:  A88AA6A8 8AA460AE 6494AAA0 406103F0 TESTER0W2XYZ 0.x   ....`.d...@a..
010:  54686973 20697320 61207465 7374206D  *449.49.0.:29:.6   This is a test m
020:  65737361 67652070 61636B65 742E0D    299032.80152:..    essage packet
```

The byte column shows the offset into the packet of the beginning byte of the line.

The hex display column shows the next 16 bytes of the packet, exactly as received, in standard hex format. The shifted ASCII column decodes the high-order seven bits of each byte as an ASCII character code.

The ASCII column decodes the low-order seven bits of each byte as an ASCII character code.

In a standard AX.25 packet:

1. The call sign address field is displayed correctly in the ASCII column.
2. A text message is displayed correctly in the ASCII column.
3. Nonprinting characters and control characters are displayed in both ASCII fields as a period (".").

You can examine the hex display field to see the contents of the SSID byte and the control bytes used by the protocol.

T TRANS *Immediate Command*

TRANS is an immediate command that switches the Controller from the Command Mode to the Transparent Mode. The current state of the radio link is not affected.

The Transparent Mode is primarily useful for computer communications. In the Transparent Mode, "human interface" features such as input editing, echoing of input characters, and type-in flow control are disabled.

Use the Transparent Mode when you need to transfer binary or other nontext files.

TRF TRFLOW ON/OFF *Default: OFF*

Parameters:

ON — Software flow control for the computer or terminal can be activated in the Transparent Mode.

OFF — Software flow control for the computer or terminal is disabled in the Transparent Mode.

If TRFLOW is ON, the type of flow control used in the Transparent Mode is determines by the way START and STOP are set.

If TRFLOW is OFF, only "hardware" flow control (CTS, RTS) is available to the computer and all characters received by the Controller are transmitted as data.

If START and STOP are set to $00, the User Stop and User Start characters are disabled; hardware flow control must be used by the computer.

If TRFLOW is ON, and START and STOP are set to values other than zero, and software flow control is enabled for the user's computer or terminal. The Controller responds to the User Start and User Stop characters (set by START and STOP) while remaining transparent to all other characters from the terminal.

Unless TXFLOW is also ON, only hardware flow control is available to the Controller to control output from the terminal.

TRI TRIES "n" *Default: 0*

Parameter:

"n" — 0 to 15 specifies the current RETRY level on the selected input channel.

TRIES retrieves (or forces) the count of "tries" on the data channel presently selected.

If you type TRIES without an argument, the Controller returns the current number of tries if an outstanding unacknowledged frame exists. If no outstanding unacknowledged frame exists, the Controller returns the number of tries required to get an ACK for the previous frame.

If RETRY is set to zero (0), the TRIES command always returns zero (0).

Use TRIES for gathering statistics on a given path or channel. TRIES is especially useful for computer-operated stations (such as automatic message-forwarding stations) using less-than-optimal, noisy paths.

Using TRIES under these conditions automatically optimizes the PACLEN and MAXFRAME parameters.

If you type TRIES with an argument, the "tries" counter is forced to the entered value. Using this command to force a new count of tries is not recommended.

TX TXDELAY "n" *Default: 30 (300 msec.)*

Parameter:

"n" 0 to 120 specifies ten-millisecond intervals.

The TXDELAY command tells your Controller how long to wait before sending packet frame data after keying your transmitter's PTT line.

All transmitters need some amount of start-up time to put a signal on the air; some need more, some need less.

Some general rules apply to these radios:

1. Crystal-controlled radios with diode antenna-switching do not need much time.
2. Synthesized radios need time for their phase-lock-loops (PLLs) to lock up.
3. Radios with mechanical transmit/receive relays need time for the physical movement of the relays.
4. External amplifiers that use RF-driven relay switching usually require you to increase TXDELAY to allow for the additional delays.

Experiment to determine the best TXDELAY value for a specific radio.

TXDELAY can also compensate for certain characteristics of the radio used by the station which you are communicating with.

If the other station's radio has slow AGC recovery or squelch release times when it is switching from transmit to receive, increasing your TXDELAY may reduce retries and improve throughput by retarding the start of your data until the other receiver has reached full sensitivity.

TXF TXFLOW ON/OFF *Default: OFF*

Parameters:

ON Software flow control for the Controller can be activated in the Transparent Mode.

OFF Software flow control for the Controller is disabled in the Transparent Mode.

When TXFLOW is ON, the setting of TXFLOW determines the type of flow control used in the Transparent Mode.

When TXFLOW is OFF, the Controller uses only hardware flow control; all data sent to the terminal remains fully transparent.

When TXFLOW and XFLOW are both ON, the Controller uses the Start and Stop characters (set by XON and XOFF) to control the input from the terminal.

Unless TRFLOW is also ON, only hardware flow control is available to the computer or terminal to control output from the Controller.

If the Controller Start and Stop characters are set to $00, hardware flow control will always be selected regardless of the setting of TXFLOW.

U UNPROTO call1 [VIA call2[,call3...,call9]] *Default: CQ*

Parameters:

call1 Call sign to be placed in the TO address field.

call2-9 Optional digipeater call list, up to eight calls.

UNPROTO sets the digipeat and destination address fields of packets sent in the unconnected (unprotocol) mode.

Unconnected packets are sent as unsequenced I-frames with the destination and digipeat fields taken from "call1" through "call9" options. When a destination is not specified, unconnected packets are sent to "CQ".

You can monitor unconnected packets sent from other packet stations by setting MONITOR to a value greater than "1" and setting MFROM to ALL.

You can also use the digipeater list for beacon packets.

To send your beacon message through one or more digipeaters, type:

UNPROTO BEACON VIA WX1AAA,WX2BBB,WX3CCC

Your beacon is routed to and repeated by each of the digipeaters in the order listed.

Some PBBSs and other types of host computer systems may use this form of UNPROTO addressing to disseminate their traffic or mail lists over the channel to a wider audience.

To address a PBBS mail list through one or more digipeaters, type:

UNPROTO MAIL VIA WX1AAA,WX2BBB,WX3CCC

The resulting "unproto" beacon may look like this:

W2XYZ-4> WX1AAA>WX2BBB>WX3CCC>MAIL:
QTC (list of call signs with mail waiting in the PBBS)

US USERS "n" *Default: 1*

Parameter:

"n" 0 to 10 specifies the number of active simultaneous connections that can be established with your Controller.

USERS only affects the way that incoming connect requests are handled. It does not affect the number of connections you initiate with your Controller. For example:

USERS 0 Allows incoming connections on any free logical channel.

USERS 1 Allows incoming connections on logical channel 0 only.

USERS 2 Allows incoming connections on logical channels 0 and 1.

USERS 3 Allows incoming connections on logical channels 0, 1 and 2, and so on, through USERS 10.

X XFLOW ON/OFF *Default: ON*

Parameters:

ON XON/XOFF (software) flow control is activated.

OFF XON/XOFF flow control is disabled and hardware flow control is enabled.

When XFLOW is ON, software flow control is in effect; it is assumed that the computer or terminal will respond to the Controller's Start and Stop characters defined by the XON and XOFF commands.

When XFLOW is OFF, the Controller sends hardware flow control commands via the RTS line.

For full hardware control in both directions, set START, STOP, XON, and XOFF all to $00.

XM XMITOK ON/OFF *Default: ON*

Parameters:

ON Transmit functions (PTT line) are active.

OFF Transmit functions (PTT line) are disabled.

When XMITOK is OFF, the PTT line to your transmitter is disabled; the transmit function is inhibited. All other Controller functions remain the same. Your Controller generates and sends packets as requested, but does not key the radio's PTT line.

Use the XMITOK command at any time to ensure that your Controller does not transmit.

Set XMITOK OFF if you are absent and wish to leave your Controller on as a channel activity monitor.

Set XMITOK OFF for testing in loopback or direct wire connections when PTT operation is not required.

XO XOFF "n" *Default: $13 <CTRL-S>*

Parameters:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code.

Use XOFF to select the Stop character to be used to stop input from the computer or terminal.

NOTE: You can enter the code in either hex or decimal.

The Stop character default value is <CTRL-S> for computer data transfers.

If you are operating in the Converse Mode and there is a chance that activity might fill the Controller's buffers, you can define the Stop character as <CTRL-G> ($07), which "beeps" many terminals.

XON XON "n" *Default: $11 <CTRL-Q>*

Parameter:

"n" 0 to $7F (0 to 127 decimal) specifies an ASCII character code.

XON selects the Controller Start character that is sent to the computer or terminal to restart input from that device.

NOTE: You can enter the code in either hex or decimal.

The Start character default value is <CTRL-Q> for computer data transfers.

If you are operating in the Converse Mode and there is a chance that activity might fill the Controller's buffers, you can define the Stop character as <CTRL-G> ($07), which "beeps" many terminals.

SYSTEM COUNTERS

Your AR-21 can display the contents of the following system counters in much the same way as commands. You may type the counter name or its mnemonic. Since these are system commands, however, do not attempt to change their contents. Each counter is 16 bits wide and is always initialised to 00000 at power-up or RESTART.

AS **ASYRXOVR** *Default: 0*

This value of this counter increases when the software does not communicate with the asynchronous receiver fast enough. This condition indicates that some or all of the data you are entering is being dropped before it reaches the TNC. This counter should always be zero when you use one of the data rates that are supported by the TNC.

BB **BBFAILED** *Default: 0*

This counter stores the number of times the bbRAM checksum is in error.

DIGIS **DIGISENT** *Default: 0*

This counter increments each time the controller digipeats a frame.

HO **HOVRERR** *Default: 0*

This counter increments when the HDLC receiver does not obtain data fast enough, and results in lost data. This counter should never increment when you use one of the data rates that are supported by the TNC.

HU **HUNDRERR** *Default: 0*

This counter increments when the HDLC transmitter does not obtain data fast enough, and frames are aborted. This counter should always be zero when you use one of the data rates that are supported by the TNC.

RCVDF **RCVDFRMR** *Default: 0*

This counter increments when the TNC receives frame reject frames from a connected station.

RCVDI **RCVDIFRA** *Default: 0*

This counter increments each time the TNC receives an I-frame from a connected station.

RCVDR **RCVDREJ** *Default: 0*

This counter increments each time the TNC receives a reject frame from a connected station.

RCVDS **RCVDSABM** *Default: 0*

This counter increments each time the TNC receives an SABM frame that is addressed to it.

RXC **RXCOUNT** *Default: 0*

This counter increments when the TNC receives a frame that has a good CRC (Cyclic Redundancy Check).

RXE **RXERRORS** *Default: 0*

This counter increments each time the TNC discards a frame that is too short, contains overruns, or has a bad CRC (if CRC checking is enabled). This counter often increments when noise is present.

SENTF **SENTFRMR** *Default: 0*

This counter increments each time the TNC transmits a frame reject frame.

SENTI **SENTIFRA** *Default: 0*

This counter increments each time the TNC sends an I-frame.

SENTR **SENTREJ** *Default: 0*

This counter increments each time the TNC transmits a Reject frame.

TXC **TXCOUNT** *Default: 0*

This counter increments each time the TNC correctly transmits a frame.

TXQ **TXQOVFLW** *Default: 0*

This counter increments each time a frame is discarded when the outgoing frame queue is too small.

IN CASE OF DIFFICULTY

Your Pocket Packet was thoroughly checked at the factory to make sure it operates properly prior to shipment. In most cases, any problem you experience with the unit will be external (wiring, computer or terminal configuration, etc.). The following "Troubleshooting Chart" should help you determine the cause of several common problems.

Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE
PWR LED does not light when you turn the unit on.	1. External power supply not turned on. 2. External power supply not properly connected to the unit. 3. LED switch not set to ON (upward). 4. Optional internal battery needs to be charged.
Unit will not communicate with the terminal or computer.	1. Improper cable connections between the unit and the terminal or computer. 2. 232C switch not set to ON (upward). 3. Wrong configuration (baud rate, etc.)
Does not receive packets from other stations.	1. Improper connections between the unit and your radio. 2. Radio's volume control not set properly. 3. HBAUD setting does not match other station's setting (normally 1200 baud for VHF).
Cannot transmit packets.	1. MYCALL not set. 2. Improper connections between the unit and your radio. 3. Improper setting of control VR3 (refer to "Tests and Adjustments" section).

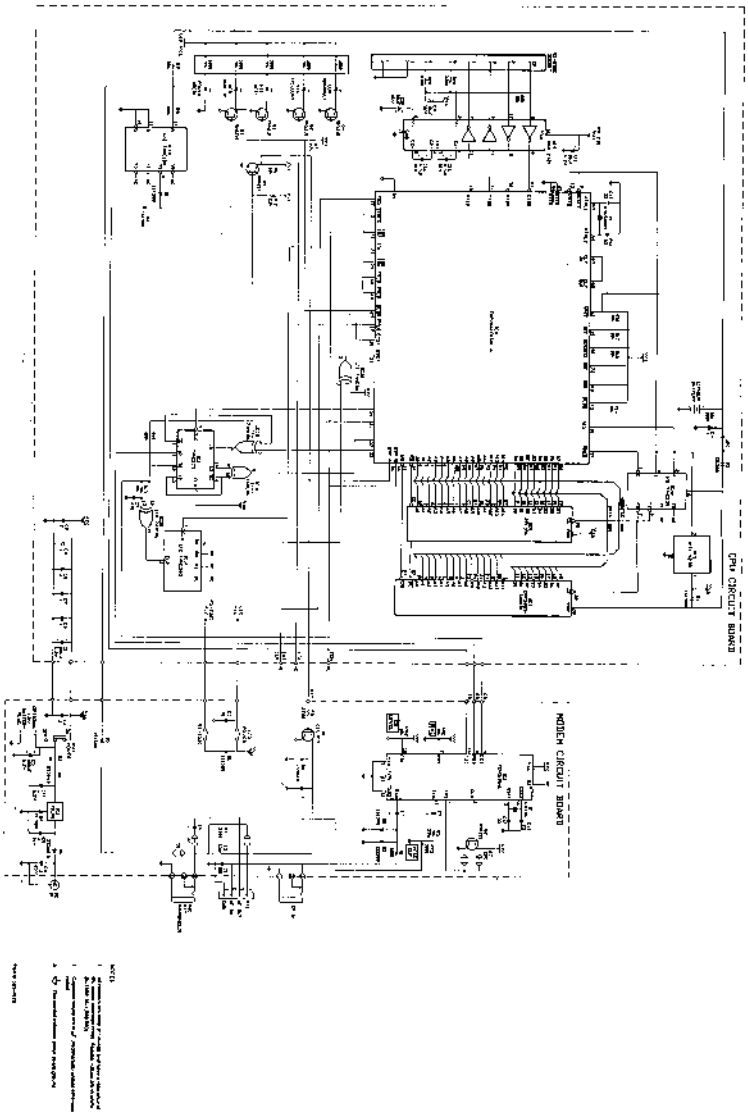
APPENDIX

LIST OF DEFAULTS

COMMAND	MNEMONIC	DEFAULT
8BITCONV	8B	OFF
AX25L2V2	A	ON
ABAUD	AB	1200
ASYRXOVR	AS	0
AUTOLF	AU	ON
AWLEN	AW	7
AXDELAY	AXD	0
AXHANG	AXH	0
BBFAILED	BB	0
BEACON	B	EVERY 0
BKONDEL	BK	ON
BTEXT	BT	(null string)
BUDLIST	BU	OFF
CANLINE	CAN	$18
CANPAC	CANP	$19
CBELL	CB	OFF
CHECK	CH	30
CLKADJ	CLK	8
CMDTIME	CM	1
CMSG		CMS OFF
CMSGDISC	CMSGD	OFF
COMMAND	COM	$03
CONMODE	CONM	CONVERSE
CONNECT	C	Immediate Command
CONOK	CONO	ON
CONPERM	CONP	OFF
CONSTAMP	CONS	OFF
CONVERSE	CONV	Immediate Command
CPACTIME	CP	OFF

COMMAND	MNEMONIC	DEFAULT
CR	CR	ON
CSTATUS	CS	Immediate Command
CTEXT	CT	(empty)
DAYTIME	DA	Clock not set
DAYUSA	DAYU	ON
DELETE	DEL	OFF
DIGIPEAT	DIG	ON
DIGISENT	DIGIS	0
DISCONNECT	D	Immediate Command
DISPLAY	DISP	Immediate Command
DWAIT	DW	32
ECHO	E	ON
ESCAPE	ES	OFF
FLOW	F	ON
FRACK	FR	3
FULLDUP	FU	OFF
HBAUD	HB	1200
HEADERLN	HE	OFF
HEALLED	HEAL	OFF
HID	HI	OFF
HOVRERR	HO	0
HUNDRERR	HU	0
ID	I	Immediate Command
LCALLS	LCA	(empty)
LCOK	LC	ON
LCSTREAM	LCS	ON
LFADD	LF	OFF
LFIGNORE	LFI	OFF
MALL	MA	ON
MAXFRAME	MAX	2
MBOD	MB	OFF
MCOM	MCOM	OFF
MFILTER	MF	$00
MHCLEAR	MHC	Immediate Command
MHEARD	MH	Immediate Command
MONITOR	M	ON
MRPT	MR	ON
MSTAMP	MS	OFF
MYALIAS	MYA	None
MYCALL	MY	No call
MYMCALL	MYM	(empty)
NEWMODE	NE	OFF
MOMODE	NO	OFF
NUCR	NU	OFF
NULF	NUL	OFF
NULLS	NULL	0
PACLEN	P	96
PACTIME	PACT	AFTER 10
PARITY	PAR	3
PASS	PASS	$16

COMMAND	MNEMONIC	DEFAULT
PASSALL	PASSA	OFF
PERSIST	PE	127
PPERSIST	PP	OFF
RCVDFRMR	RCVDF	0
RCVDIFRA	RCVDI	0
RCVDREJ	RCVDR	0
RCVDSABM	RCVDS	0
RECONNECT	RECO	Immediate Command
REDISPLA	RED	$12
RESET	RESET	Immediate Command
RESPTIME	RES	5
RETRY	RE	10
RXBLOCK	RX	OFF
RXCOUNT	RXC	0
RXERRORS	RXE	0
SCREENLN	S	0
SENDPAC	SE	$00
SENTFRA	SENTI	0
SENTFRMR	SENTF	0
SENTREJ	SENTR	0
SLOTTIME	SL	1
START	STA	$11
STOP	STO	$13
STREAMCA	STREAMC	OFF
STREAMDB	STREAMD	OFF
STREAMSW	STR	$7C
TRACE	TRAC	OFF
TRANS	T	Immediate Command
TRFLOW	TRF	OFF
TRIES	TRI	0
TXCOUNT	TXC	0
TXDELAY	TX	30
TXFLOW	TXF	OFF
TXQOVFLW	TRQ	0
UNPROTO	U	CQ
USERS	US	1
XFLOW	X	ON
XMITOK	XM	ON
XOFF	XO	$13
XON	XON	$11


CPU CIRCUIT BOARD
MODEM CIRCUIT BOARD

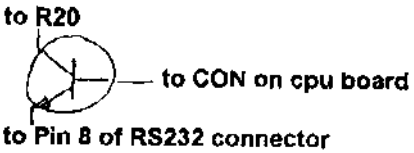
Mod to provide active DCD line on the RS232 port.

Cut top of R20

Connect wire of R20 to Emitter of BC184L

Connect R20 top to Colector of BC184L

Connect base of BC184L to CON point on CPU board adj. Lithium batt.



AR - 21

The AR-21 is designed as a link between a simple data terminal or personal computer, and a radio transceiver. The terminal node controller(TNC) allows you to operate a virtually error free computer based packet radio communications link.

The most important feature of packet radio transmissions, unlike RTTY, is that they are virtually error-free. Information that you intend to transmit is first formed into digital groups, or packets. Confirmation of correct reception of these packets is then returned to the originating station by the destination station. If the originating station does not receive confirmation, it automatically re-sends the packets until the correct information is confirmed, or the contact is terminated.

A modem (modulator/demodulator) that can operate at very high data rates is included in the TNC. The high data rate results in very short transmissions by each station, and allows several stations to use the same radio frequency at the same time. Also, due to the choice of operating parameters you are not even aware of the presence of other stations on the same frequency.

The TNC also functions as an automatic repeater. You can use it as an unattended repeater, as a beacon, or as a "mailbox" with the appropriate computer and suitable software. You can also use it with an FSK or AFSK FM station on the VHF and UHF bands.

You should bear in mind that in addition to your normal amateur radio station, you will need either an ASCII data terminal or a personal computer which has an RS232C data port and can support a simple terminal emulator programme. Such software is widely available for most modern personal computers, and often used for accessing computer telephone services.

You may also need connectors to fit your equipment and an RS232C serial cable.

With its low current drain, the battery operated AR-21 is ideal for data collection in remote sites, using a combination of NiCd rechargeable batteries and solar cell chargers.

Features

Small size (fits into the palm of the hand)

Recessed controls for protection against damage.

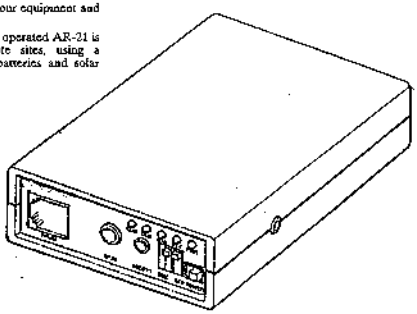
Low power consumption for long life battery operation. (NiCd batteries optional).

Mailbox facility is fitted so messages can be left when unattended.

The AR-21 is TAPR TNC-2 compatible.

Specification

Processor	Z80 software compatible.
Memory	32K ROM, 32K RAM.
Memory backup	Lithium battery.
Serial port	RS-232C interface to terminal or computer.
Baud rates	300, 600, 1200, 2400, 4800, and 9600(auto baud).
Commands	TAPR TNC-2 compatible.
Modem port	1200 bps.
Protocol	AX.25 Level 2.
Power	External 10-13.8 VDC at 40mA. (29mA from optional internally fitted NiCd).
Input level	20mV to 2V peak to peak, 18 ohms.
Output level	0 to 500mV (adjustable).
PTT	30Vdc maximum, at 100mA
Size	64 x 25 x 108mm.
Weight	130g (excluding battery).



AOR®

AOR Ltd

2-6-4 Misuji, Taito-ku, Tokyo 111-0055, Japan.
Tel: +81 3 3865 1695 Fax: +81 3 3865 1697
post@aorja.com www.aorja.com

AOR (UK) Ltd

4E East Mill, Bridgefoot, Belper, Derbys DE56 2UA, England
Tel: +44 1773 880788 Fax: +44 1773 880780
info@aoruk.com www.aoruk.com

AOR USA, INC.

20655 S. Western Avenue, Suite # 112
Torrance, CA. 90501, USA
Tel: (310) 787 8615 Fax: (310) 787 8619
info@aorusa.com www.aorusa.com