SUPPORT
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ADVANCED ELECTRONIC APPLICATIONS, INC.

PAKRATT™

MODEL PK-64

MULTIMODE DATA CONTROLLER

AND

MODEL HFM-64

ENHANCED HIGH FREQUENCY MODEM

OPERATING MANUAL

SYS 33333

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OPERATING MANUAL

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RF INTERFERENCE INFORMATION TO USER*

This equipment generates and uses radio frequency energy, and if not used and installed properly, that is in strict accordance with AEA's instructions, may cause interference to radio and TV reception. It has been type-tested and has beeen found to comply with the limits of a Class B computing device in accordance with the specifications in Subpart J of Part 15 of the FCC Rules, which are designed to provide a 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 TV reception, which can be determined by turning the PK-64 on and off, the user is encouraged to try and correct the interferece using one or more of the following measures:

Reorient the antenna of the device receiving interference.

Relocate the computer with respect to this device.

Plug the computer into a differet outlet so the computer and the device are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/TV technician for additional suggestions. The user may find "How to Identify and Resolve Radio-TV Interference Problems", a booklet prepared by the FCC, helpful.

* This notice is effective if the product bears a certification number containing the AEA Model Number, the FCC Model and Manufacturer ID number and reading:

Certified to comply with the limits of a Class B computing device pursuant to Subpart J of Part 15 of FCC rules. See instructions if interference to radio is suspected.

This manual is AEA Part Number 040-029. October 1985. /jmpg

CHAPTER 1

INTRODUCTION

MODEL PK-64 PAKRATT DATA CONTROLLER

PRODUCT DESCRIPTION

Congratulations !! You have purchased another fine AEA product.

PLEASE, before we go any further, may we ask you to FILL OUT AND RETURN the Product Support Agreement/License/Warrantee contained in the Appendix to this manual.

WE WILL NOT BE ABLE TO FURNISH YOU ANY UPDATES TO THE SOFTWARE FOR THE PAKRATT IF YOU DO NOT RETURN THE ABOVE DOCUMENT. AS NEW FEATURES ARE DEVELOPED, WE ARE SURE YOU WILL WANT TO BE ABLE TO OBTAIN THEM.

We will ask for the support number from it if you call for any kind of customer assistance. Because of the numerous situations where our product software is used by an unauthorized third party, we MUST verify that you are the licensed user. We may choose to call you at the phone number listed in our records to verify your identity. THANK YOU for your patience.

The Packratt works with the Commodore C-64, SX-64, and C-128 (in its C-64 emulation mode). The Pakratt is powered by an included AEA AC-1 (or equivilant) power supply. It allows you to transmit and receive Morse, Baudot, ASCII, AMTOR, and AX.25 V2.0 or below amateur packet. (You will not be able to receive Morse unless you purchase the HFM-64 described below). Packet operation on VHF and UHF FM will be entirely satisfactory without the HFM-64. Packet, RTTY, and AMTOR operation on HF without the HFM-64 is possible, but it will be less satisfactory for signals mixed with a lot of noise; operation on packet will be at least as good as the AEA Model PKT-1 however.

If you plan to operate on HF, you should consider purchasing the AEA HFM-64 HF Modem which includes an LED bargraph tuning indicator and which will allow you to operate Morse, and will SIGNIFICANTLY enhance your ability to copy all five modes compared to operation with the PK-64 alone. You will be able to copy signals you can barely hear. The technology in the HFM-64 is based upon the well known AEA CP-1 Computer Patch. The HFM-64 mounts inside the PK-64 using two screws and a ribbon cable connection. It replaces the PLL (Phase Locked Loop) portion of the PK-64 with vastly superior modem circuitry. Operation of the HFM is controlled by software commands present in all PK-64 ROMs. A front panel THRESHOLD control is added to enhance HF operation, as well as an LED bargraph tuning indicator which supplements the on-screen tuning indicator. If you have already purchased the HFM-64, you should refer to the HFM-64 OPERATION chapter included in this manual.

COMMODORE ACCESSORIES - PRINTERS/DISK AND CASSETTE DRIVES

AEA has had a problem in years past where the customer has tried to use non Commodore accessory devices with AEA products. In many cases these products were introduced AFTER the AEA product and AEA was not able to check compatability of design with the "foreign" product. We encourage the dealer to inform you of compatability considerations prior to your purchase of the AEA product, and we hope you thought to ask him. Either you or the dealer are free to call us at AEA. We are usually unable to provide software changes after the fact that will allow a compatability problem to be rectified.

The PK-64 will support use of the following Commodore accessories:

Printers - Centronics compatable, when used with a Xetec or Cardco +G serial-to Centronics-parallel adapter.
- Commodore serial printers (1525, 1526, and some MPS801s).

Disk Drives - Commodore Model 1541

Cassette Drives - Commodore, or most other companies.

Other products are not guaranteed to work, and you should (have) check(ed) with your dealer or AEA prior to purchase of the PK-64.

Do NOT use an expansion port extender card with the PK-64 or any other plug in device for the C-64 expansion port.

HOW TO USE THIS MANUAL AND OPERATE MORSE, BAUDOT, ASCII, or AMTOR

The portion of the PK-64 software that allows you to operate Morse, Baudot, ASCII RTTY and AMTOR was written earlier than the packet portion and has been sold by AEA, Inc. under the name "MBA-TOR" for some time. The operating manual for MBA-TOR has been modified as necessary and is included as a chapter of this manual.

When you wish to operate one of these modes, please turn to the chapter called MORSE, RTTY, AND AMTOR OPERATION. If you have used MBATOR in the past you will find it almost exactly the same. The only change of note is that the "AUTOCALL" feature has not been included.

The screens for MBA-TOR are as you found them in the free-standing product. The only exception is the parameter (OPTION) menu previously accessed from the Main Menu screen. It is found on the first Packet Parameters screen, which is accessed from the Packet screen. Set your parameters on this screen and then exit the Packet mode to the Opening Menu using the [RUN/STOP] key and re-enter the MBA-TOR mode you wish to use.

HOW TO USE THIS MANUAL AND OPERATE PACKET

This operating manual is furnished with the AEA PK-64 Pakratt Data Controller. It is designed to give you an introductory idea of what Packet Radio is all about. It is not intended to give a comprehensive treatment of the subject - there is a reading bibliography of many fine articles and books in the appendix to this manual.

You will learn in the remainder of this introduction a little bit about what packet radio is, what some of the terms are (there is a glossary in the appendix), what happens in a typical QSO and what appears on the screen.

You will be anxious to get on the air in a hurry if you are an average ham. You probably won't want to spend any time reading the manual before doing so. You may not have even gotten this far. If you have, be advised that the chapter titled "Quick Check and Sneak Packet Preview" will give you the thrill of a very quick way to get some of the local packet activity to print on your screen.

The chapter titled "Installation" will get you installed so you may transmit. You will find connection information to specific radios in the appendix. THE ONLY PURCHASE AND INSTALLATION YOU WILL HAVE TO MAKE TO GET ON THE AIR IS OF A MICROPHONE CONNECTOR FOR YOUR SPECIFIC RADIO. (For non USA models, AEA supplies no DC power adapter - you will need to supply 13 VDC power).

At this point you should sit back in your chair, watch what is happening on the local packet frequency, and read on, while trying out what you are learning.

JOIN A PACKET CLUB - SUBSCRIBE TO NEWSLETTERS - JOIN A VOICE NET

You should join a packet radio club - they exist in all states as of this writing. You should subscribe to the ARRL publication "Gateway", which is aimed at describing all the goings-on in packet radio, and to the TAPR "Packet Status Register", which describes the technically interesting happenings in the movement. There are many voice nets on VHF and HF and they usually meet weekly. Break in on your local packet frequency (usually 145.01) using voice and inquire. They are usually dedicated to making the newcomer feel at home. JOIN THE PACKET RADIO REVOLUTION.

IN CASE OF TROUBLE

Application and troubleshooting assistance may be had by calling AEA during our 8-12, 1-4:30 working hours in Seattle WA. Ask for the customer service department. The phone is 206-775-7373. Please have your product serial number, the software support number and the release date of the software available. The release date is on the first screen that comes up when you turn on the PK-64. The software support number should be recorded on the Software Support Agreement in the appendix of this manual. If it is not, the number will be the serial number of your PK-64. We will also need to know the nature of any other equipment connected to the PK-64.

Please attempt to solve most problems locally, using other hams or an AEA dealer. Substituting a known-good PK-64 or other TNC for your questionable one is a diagnostic technique that will check out the rest of your station. Also try running your PK-64 in another station, or at the dealer's - where you can use his computer. Commodore computers do not have a good reliablility record, so you should check yours, especially the power pack. A frequent failure is the expansion port chip, so try and run some other device in that port to verify the port is OK.

Many of the AEA products that are sent to us for repair are perfectly in order when received at AEA. To avoid this, we ask you, PLEASE, to run the Quick Check from Chapter 3, and be prepared to tell us what step it failed. If you call without doing so, we are likely to ask you to call us back with the results of that exercise. Please also run the SELF CHECK section of the CALIBRATION chapter. This proceedure isolates the PK-64 from other station components and tells us whether the problem is a systems problem outside of the PK-64.

If you call for assistance, please have your PK-64 up and running beside the phone. Our service technician will likely ask you to perform certain keyboard routines to aid in diagnosis. If you have a voltmeter handy, you might have the PK-64 open so you can report measurements to the serviceman.

PLEASE DO NOT RETURN THE PK-64 TO US WITHOUT CONTACTING US FOR PERMISSION FIRST. WE WOULD LIKE THE OPPORTUNITY TO TROUBLE SHOOT THE PROBLEM OVER THE PHONE FIRST, SAVING YOU BOTH TIME AND COST.

If you send us the PK-64 UPS, it must be sent to the street address - not the PO Box. The street address is:

AEA, Inc.
2006 196th St. SW
Lynnwood, WA 98036, USA

We will need YOUR street address for UPS return - be sure and send it.

UPS Surface (Brown Label) takes 4-5 days, Blue is 2-3 days, and Red is presently available on the West Coast only and is an overnight service and is expensive. Send the PK-64 in a way that it may be traced if we cannot verify receipt of shipment. We suggest UPS or insured postal shipment.

If the PK-64 is still under the original owners warranty, AEA will pay the cost of the return shipment. The current policy is that it will be returned Brown if received Brown or by US Mail, returned Blue if received Blue or by overnight service, or returned as the owner states in his letter if he furnishes the return cost for the method he selects.

If the PK-64 is out of warranty, it will be returned by UPS Brown COD unless 1) it was received UPS Blue/Red in which case it will go back UPS Blue COD or 2) or if you designate billing to VISA or MASTERCARD or 3) you enclose a BLANK personal check endorsed "not to exceed .. $" or 4)you specify some other method of return.

We will typically service the product in two or three days if we have all the facts. If we must call you, it may take longer. PLEASE, if you send it in, include a letter stating the problem and where you can be reached. If you can be reached by phone in the evening on the East coast, let us know where. Our current rate for non-warranty service is $40/hour with a 1/2 hour minimum. Parts and shipping are extra. AEA is not responsible for damage such as caused by lightning, nonprofessional alterations, poor storage/handling etc.

Should your warranty card not be on file at AEA, you need to send proof of purchase date to receive warranty service. Typically a copy of your bill of sale from an AEA dealer will suffice.

The warranty is for the original owner only and is not transferable.

NOW YOU ARE A PART OF PACKET RADIO!

Your PK-64 represents a major milestone in the pioneering of the exciting new hobby of PACKET RADIO, and now you are a part of it, too! No longer are you on the outside looking in as a few HAMS experiment with a new technology. Instead, you are one of them!

AEA, INC. has for the first time integrated a complete packet controller and the terminal software needed to operate an advanced amateur packet radio station with MBA-TOR software and packaged it in one package. Plug one end into your computer and the other into your transceiver and you are on the air.

We hope you will look forward to the excitement of controlling your computer and the computers of others in your local area packet network. Expect to feel moments of great satisfaction and occasionaly some frustration as you expand your own horizons: learn more and more about your computer and how packet networks are built and work. Not only do you now have a fine piece of equipment to help you do this, but it is hoped that the information in this manual will help you understand PACKET RADIO and how it works.

A NEW SET OF TERMS TO LEARN

When you first became interested in the hobby of amateur radio, you found that there was a new set of terms to learn. Words that seemed very confusing to others started making sense to you. They quickly became part of your vocabulary. The same will be true of PACKET RADIO. To help you understand this manual and make it easier to learn about your new hobby we have included a glossary in the final pages. To get things started though, we will introduce a few terms here.

NETWORK refers to the linking together of computers and other equipment. One of the biggest advantages to networking is that it allows for the sharing of resources. For example, in an office word processors may be linked together in a network. This means that a few printers can serve several people.

Networks are made up of NODES. You might think of a system of freeways within a state. The places where you stop and get off the freeway to do what ever you must do are the NODES. Your home town, or the place where you work, the destination of your travels might be called TERMINAL NODES. Rest stops, gas stations, and restaurants along the way provide you with services that you need when you travel. These might be called SERVER NODES. Other SERVER NODES might be packet stations that provide bridges or gateways to other packet frequencies such as VHF to HF or to amateur satellites.

In Packet Radio, the TERMINAL NODE is your own station. It is where messages to you terminate and from you originate. Sometimes you will want to leave a message for someone who does not have their packet station on the air. This can be done if someone within your packet network leaves a computer on the air running as an electronic bulletin board or mailbox. Such a station is called a SERVER NODE.

Often you will want to communicate with another packet station that is too far away to reach with your ordinary transciever and antenna. You can link several packet stations together so that your messages are passed from one to another until they reach their destination. This is called DIGIPEATING. Any PK-64 may be used as a DIGIPEATER.

Within a given geographic area, HAMS operating on the same frequency, capable of communicating with each other, form a network of packet stations called a LAN. LAN is an acronymn for Local Area Network.

The generic name for the packet portion of the PK-64 is TERMINAL NODE CONTROLLER or TNC. It is a sophisticated, dedicated computer with its own microprocessors designed to interface your computer with your transceiver. It assembles and disassembles

the packets.

PACKETS are created by taking the data you wish to transmit and packaging it together with special information that will tell all TNCs that might hear it who it is sent to, who it is sent from, who should DIGIPEAT it and all the other information needed to detect whether or not it has been received correctly and in the order that it was sent. Although the PACKETS are of variable length, they are longer than the actual data being sent, as they contain control information also.

When you have linked your packet station with another, either directly or with the aid of DIGIPEATERS, it is said that you are CONNECTED. When two stations are CONNECTED data can be sent from either the keyboard, the disk, or cassette tape quickly and accurately. You may be sending computer programs, sharing articles that have been created with your word processors or just chatting back and forth. When you are finished and the link between your two computers is no longer in effect, you are DISCONNECTED.

The term PATH refers to how you link your computers. It may be a DIRECT PATH, meaning your TNC is communicating directly with the other TNC. Otherwise, the PATH would refer to the stations that you are using as DIGIPEATERS to reach the destination.

WHAT IS PACKET RADIO?

One of the newest forms of communication, Amateur Packet Radio, has been developed by HAMS in North America. It represents a major improvement in the reliablity of text communication.

In earlier years, Morse code provided HAMS with the first opportunity to send messages over great distances via radio. The accuracy of this communication was dependent on the conditions of the band, and the ability of the operators sending and receiving the code.

Later, radio teletype became available and HAMS were relieved of the responsiblity of decoding the tones. Instead, mechanical equipment translated them and printed the text onto paper. With the development of the personal computer, video display terminals replaced the noisy mechanical printers. Reliablity and accuracy was handled by the equipment, but it was still vulnerable to band conditions which often lead to missing or incorrect characters.

Packet Radio solves this problem. Using a system of error checking, the packet controller provides the receiving station with information that can insure that the text it receives is 100% accurate. And because it is the nature of Packet Radio to transmit in short bursts of data, it is possible for more than one packet QSO to occur at the same time on the same frequency.

To accomplish this a TERMINAL NODE CONTROLLER (TNC) is needed. Its task is formidable. It must take the text that you choose to send and package it with additional information specifically related to how it will get to the destination and be received in sequence with other data that has been sent. At the same time the TNC is "listening" to packets sent by other stations, checking to see if they are intended for you or if someone else is sharing the frequency and using your TNC as a DIGIPEATER. Amazingly enough, this is all "transparent" to you. You will see only the text you send and receive.

To accomplish this task your PK-64 contains a special microprocessor. It is a sophisticated chip known as an HLDC (highlevel link data controller) that takes on the burden of assembling and disassembling the actual packets.

A typical packet QSO begins when you command your TNC to send out a special packet to another TNC called a "connect request." You do this by typing:

C <CALLSIGN>

and pressing [RETURN], where <CALLSIGN> is the call sign of the other station.

Almost immediately the other TNC will automatically respond and you will either see the

message:

*** CONNECTED to <CALLSIGN>

or the message:

<CALLSIGN> busy
*** DISCONNECTED

If you are connected, anything that you type onto your keyboard will appear, as you have typed it, on the screen at the destination station.

Most operators have borrowed abbreviations that date back to the early days of CW communications. Sending "K" at the end of your comments is an invitation to transmit. Words that are received will appear at the top of the screen and the text that you are sending will appear at the bottom.

To end a packet QSO you will probably send the letters "SK" and wait for the other station to initiate a "disconnect". You should not initiate the disconnect yourself because he or she may have one last comment to make. When you receive a message that ends with "SK" you should either disconnect or send your final comment followed by "SK" and wait for the other station to disconnect.

When you are disconnected the following message will appear on your screen:

*** DISCONNECTED

All the time that you are connected to a station the only information that you will receive is text that is being sent to you. Packets sent by others who may be sharing the frequency will not appear on your screen. However, if someone else attempts to connect to you while you are engaged with another station, the following message will appear on your screen:

*** connect request:<CALLSIGN>

One advantage to Packet Radio communication is the fact that your station does not need to be attended in order for you to receive messages. The PK-64 can be set up to automatically answer any time someone connects and send a message asking that they leave a note. You can later find their message in your computer's buffer. Similarly, you may leave messages in your friend's computers that they will read later.

Sometimes you may be aware of your transmitter sending packets when you haven't asked it to. There are several situations where this will occur. Whenever your TNC receives packets that it will accept, that is they are addressed to you and they are error free, it will send a short packet called an ACK to the other TNC. This is to acknowledge receipt of it. Also, should packets arrive addressed to you that fail the error checking a short packet, this time called a NACK, is sent. If you have sent a packet and the TNC at the other end sends your TNC a NACK or for whatever reason no ACK is returned, you will notice that after a short pause your transmitter will go on. Your TNC is retransmitting your packet. This is called a RETRY.

There are many different types of TNCs being used on Packet Radio today. With the exception of a few in some parts of Canada, all of them are capable of communicating with each other. This is possible because they all follow a set of very specific rules called PROTOCOL.

In 1982, AMSAT hosted a meeting of the major packet radio interest groups in order to decide upon a single mutually agreeable protocol for the AMICON channel on the then upcoming Phase III B satellite. Such agreement was reached, and the presently accepted protocol is known as AX.25, named after the international commercial protocol X.25, upon which it is based. AX.25 is currently the most widely used protocol in Amateur Packet Radio. The current revision number accepted by the ARRL is Version 2.0. Your PK-64 will send and receive using this protocol as well as earlier protocols used by earlier TNCs.

CHAPTER 2

INSTALLATION

CONTROLS AND INDICATORS

The PK-64 front panel contains:

PTT — LED indicator - shows when the PK-64 is keying the radio

DCD — LED indicator - Data Carrier Detect indicator - shows when valid signal is present at the output of the internal modem. The signal next goes to the Commodore 64 for processing.

TUNE — Window - when the HFM-64 High Frequency Modem is installed, its tuning indicator display shows through this window.

THRESHOLD — Snap-in hole cover - when the HFM-64 is installed, the THRESHOLD control is mounted in this hole.

The PK-64 rear panel contains:

POWER — Coaxial power connector - the +13VDC at 300 ma from the included AC-1 (or equivilant) 120 VAC adaptor is connected here.

TO RADIO — 5-pin connector - carries the audio signals to and from the radio MIC and SPEAKER jacks and the PTT signal to the PTT pin of the radio MIC connector. Optionally carries the radio squelch output to the PK-64. A 5 foot cable with the mating 5-pin connector is furnished by AEA. The customer is expected to purchase the appropriate connector and install them at the radio end of the cable.

AUDIO IN — An "Audio In" 3.5mm jack - allows connecting the radio speaker output to this PK-64 input. It is an alternative way to connect what would otherwise go to pin 1 of the "To Radio" connector. You need only one or the other - not both.

EXT SPKR — A "External Speaker" 3.5mm jack - allows you to connect a monitor speaker in the event plugging a lead into your radio speaker jack has muted your radio speaker.

The PK-64 left side contains:

A shielded ribbon cable that plugs into the Commodore Expansion Port (the connector at the right rear of the computer). The cable is shielded and a friction contact on the plug-board carries the shield through to the internal Commodore shield.

The PK-64 right side contains:

A hole through which the AFSK amplitude to the radio MIC connector may be set (R35). This in turn will determine the deviation on an FM radio. It is set at the factory to produce appropriate deviation for the average FM transceiver. See the section on "Radio and PK-64 Audio Level Adjustments" in this chapter.

RADIO HOOKUP

The PK-64 should work with nearly any radio. Study the manufacturer's manual carefully. Most connections can be made to the mic pin on the MIC connector and to the speaker jack. Some transceivers are equipped with an accessory jack that includes both and provides room for additional lines. See APPENDIX-R:SPECIFIC RADIO HOOKUPS, for information on a particular transceiver.

In general, the easiest transceivers to interface will have all return lines to

negative ground, separate microphone and PTT input lines and clean audio sections with no spurious audio tones or audio harmonic distortion. Due to the wide variety of audio input and output connectors in common amateur radio use, AEA cannot provide a prewired cable for mating to your particular radio.

The five pin in-line "To Radio" connector provided is normally the only one you need to connect to your transceiver. Among other signals, the audio and AFSK lines are present at this connector. If you have interference problems, you may wish to use the separate connector for the audio line also present on the rear panel and use shielded cable.

The pinout of the "To Radio" connector and the color coding of the cable provided with your PK-64 are as follows:

Pin 1	Green	Audio (speaker) input from the radio
Pin 2	White	AFSK output from the PK-64 to the radio MIC input
Pin 3	Black	Squelch information from the radio (may be left open)
Pin 4	Brown	Ground/Shield to the radio ground/MIC ground
Pin 5	Red	Positive voltage PTT (push to talk) line to the radio
	Shield	Connected to the brown wire at the radio.

AUDIO INPUT (PIN 1)

This lead brings the audio from the radio to the PK-64. It is normally connected to the headphone or speaker audio output of the receiver. An optimum signal level would be about 50mv RMS. This pin is connected to the Audio In and Ext. Spkr. jacks.

TRANSMITTER AFSK AUDIO (PIN 2)

This lead provides an audio signal to the radio microphone input. The PK-64 has been designed to work with almost any microphone impedance where it is high or low. An adequate audio level to most radios would be about 20 mv RMS. ICOM radios with preamplified mics require about 200 mv.

SQUELCH INHIBIT CONNECTION (PIN 3) (optional)

The PK-64 uses a feature called Carrier Sense Multiple Access (CSMA). Its purpose is to monitor the incoming audio for the presence of tones and inhibit the transmission of packets at any time someone else is using the frequency. The PK-64 will check to see if a tone is received by the modem. This works well if all stations on the channel are sending tones such as with PACKET, ASCII, or RTTY. Unmodulated carriers or voice transmissions might not be detected and the PK-64 may attempt to transmit a packet when they are present.

An optional squelch connection is provided with the PK-64 to improve this situation. Pin 3 of the "To Radio" connector is normally designed to read a voltage from the radio which varies between a low having a range of 0-0.4 volts and a high of 2.5-12 volts. The voltage should come from a point in the radio which is low when there is an RF carrier on the channel and is high when there is not. The radio take-off point will be driving a 20K ohm resistor internal to the PK-64, the other end of which is connected to the base of a grounded NPN transistor.

NOTE THAT IT IS NOT NECESSARY TO CONNECT THE RADIO SQUELCH TO THE PK-64 FOR IT TO OPERATE PROPERLY.

You can probably locate a point in your radio in the "channel busy" LED circuit which will behave as required. If not, some radios have a chip pin which provides a gate voltage to the audio muting circuit which you may be able to use. If the radio has no point which can provide the drive current to pin 3, you may want to use a small relay. AEA would be happy to advise you if you can send a copy of your radio schematic to us.

A special command is provided with the PK-64 to take into account that fact that some squelch circuits will produce lows and highs opposite to those described above. Please refer to the SQUELCH command in the Parameter Set.

COMMON (PIN 4)

This pin is tied directly to the negative return bus on the PK-64 and should be connected to the negative return bus on the radio. This common serves as a return for tramsit control. NOTE: Some Japanese handhelds, such as the Yaesu FT-208R, use their positive supply bus as audio return. DO NOT connect this positive audio return to the PK-64 common! Instead, the handheld's negative common should be connected to the PK-64. This should not cause any problems, as the radio power supply should be adequately bypassed for audio.

TRANSMIT KEY LINE (PTT) (PIN 5)

This lead is designed to connect to the PTT or other transmitter activation line on the transceiver. It will move to about the voltage of the PK-64 common, or "ground" when the PK-64 attempts to key the transmitter.

This line is rated at 30 volts DC (plus or minus keying) open circuit maximum. It can safely sink up to 250 ma in the closed (transmitter keyed) condition. If the above ratings of the transmitter key line are exceeded, damage may occur to your PK-64. If your radio fails to meet the above criteria, a relay or other means of keying should be used. To determine what keying your radio has, you may use a multimeter. Measure the voltage present on the radio PTT pin in unkeyed operation. Then switch to the ammeter mode on the meter and connect between the PTT pin and ground and measure the keying current. The ammeter input resistance is low and will cause the radio to key so you can read the current. If the unkeyed voltage is less than 30 volts DC and if the current is less than 250 ma, you will be able to use the PK-64 keying circuit as is.

To operate a radio which uses negative voltage PTT, open the PK-64 and move jumper JP-3 to the front position. It comes from AEA set for positive keying (jumper in the rear position).

<<<KNOW YOUR RADIO PTT CHARACTERISTICS BEFORE CONNECTING THE PK-64!!! >>>

RADIO AND PK-64 AUDIO LEVEL ADJUSTMENTS

Before connecting a radio to the PK-64 be sure you have proceeded through step 12 of the chapter called "Quick Check".

Connect the five pin connector to the PK-64; the connector should plug in so that the cable exits downwards from the connector. Connect the other end to your radio and tune it to a band where you expect to find packet activity. If the audio from your radio is muted by the connector, you can hook an external speaker or headphone to the EXT SPEAKER jack on the rear panel of the PK-64. In most areas this might be 145.01 MHz. Whenever you hear the raspy packet signal, the red LED labeled "DCD" should light. Back off on the radio volume until the LED no longer lights when a packet is heard. Then increase it slightly beyond the point where it begins to operate again.

The AFSK audio signal level to the transmitter is set by the control accessible through the right side of the PK-64 cabinet. Typically it should be about 20 mV RMS at the microphone connector. Generally, on-the-air monitoring of your packet transmissions by other stations will prove adequate. For further details, consult the Calibration Chapter.

A rough-cut technique of setting the AFSK audio level to an FM radio is to monitor the channel with another radio and increase the drive to the MIC pin by adjusting the control on the side of the PK-64 clockwise. Cause the PK-64 to send packets UNPROTO by entering the command CONV after a CMD: prompt. Now each time you press [ENTER], a packet containing only a CR will be sent. When you no longer hear the monitored packet increase in volume, stop the CW rotation and go CCW until volume just starts to decrease. You have set to roughly 3 KHz deviation which is better than to run 5KHz. Packet Radio is susceptable to distortion - keep the deviation low and keep the audio output of the radio as low as you can to still do the job.

CHAPTER 3

QUICK CHECK AND SNEAK PACKET PREVIEW

We know you are anxious to monitor some packet transmissions and maybe even transmit before you read this manual. These short instructions allow you to do so.

Follow these steps. Whenever an instruction refers to a specific key on the keyboard of your computer it will be surrounded by square brackets such as, [RETURN] or [f5]. Be sure that you simply touch that key and don't attempt to spell the letters out.

Preliminaries

STEP 1 ...
Set up your COMMODORE-64 computer following the directions provided in your user's guide. Turn on the computer with the PK-64 NOT ATTACHED. Observe that the video display is normal and that everything is working correctly. Try the keyboard. We receive many calls at AEA from people who say their equipment doesn't work when, in fact, the difficulty is within their computer, not our product.

STEP 2 ...
Turn your computer off and wait about five seconds. Be sure that you have not hooked the AC-1 power supply to the PK-64.

<<<<<<<<<<WARNING! CAUTION!! LOOKOUT!!!>>>>>>>>>>>>>

DO NOT EVER ATTEMPT TO CONNECT OR DISCONNECT THE PK-64 AND YOUR COMPUTER WHILE POWER IS ON IN EITHER DEVICE

STEP 3 ...
Carefully examine the card edge connector on the PK-64. Note how it attaches to the computer with the grounding surface upwards. Press it firmly into the cartridge slot. Be sure that it is secure and that the ground plate is in contact with the metal housing of the Commodore connector.

STEP 4 ...
Repeat STEP 1, this time with the PK-64 attached to the computer but still WITHOUT power to the PK-64. Then go on to STEP 5.

STEP 5 ...
Plug the included AEA AC-1 power supply (or equivilant) into an ordinary electrical outlet and plug the coaxial plug into the round jack on the PK-64 labeled: "POWER". For export models, furnish 13 VDC to the center pin of the jack (the outer connector is ground).

STEP 6 ...
Repeat STEP 1 again, this time with power to both devices.

STEP 7 ...
After the READY prompt from the Commodore, type: SYS 33333 [RETURN] (this will select colors BLL from the SET COLOR command). If you are using a color TV or monitor, type SYS 33330 instead (this will give you colors OGG from the SET COLOR command (see the Opening Menu chapter for a description of this command.

You should see displayed on the screen the date "00-JAN-00",a clock, a copyright notice, and a list of selections. If you do, go on to STEP 8.

If instead you see the word "READY.", or if your screen appears to go black, check to be sure that power is indeed getting to the PK-64. Turn the computer off and repeat STEPS 6 and 7.

One other possible display at this point results from a software check of some of the PK-64 digital hardware. If you see "TTL" or "HDLC" followed by a single letter, check your connections and start again at step 6.

STEP 8 ...
Touch the letter [P] on your keyboard.

The screen should clear. You will see a line near the top. Above it you will see :

```
PACKET-64              00-JAN-00 00:00:00
CMD   DISCONNECTED                XBF 512
                            CH.0  QBF 2xxx
```

At the bottom corner of the screen you should see just the letters:

```
cmd:
```

Note: In the top right hand corner of your screen is a time of day clock; the numbers should be changing each second.

STEP 9 ...
Now type: MY <CALLSIGN> [RETURN]

Be sure to put your callsign in where the word <CALLSIGN> appears. There should be a space after "MY".

As you type, a second line will suddenly appear on the screen. The "cmd:" will appear above it and what you type will appear at the bottom. When you press [RETURN] a reverse ":" will be displayed and all that you have typed will reappear above the line. A second "cmd:" will appear.

STEP 10 ...
Now type: C XYZ [RETURN]

The "C" stands for "CONNECT" and the "XYZ" is just a dummy callsign for the purpose of this quick check.

The reverse ":" will always appear when you press [RETURN]. In the upper part of the screen the word "DISCONNECTED" will be replaced by the words: "CONN in prog". Also note that the red PTT light on the PK-64 blinks on and off. It will do this about 10 times until "Retry count exceeded" appears along with a message displaying the date and time followed by "*** DISCONNECTED".

STEP 11 ...
Now touch the [f5] function key on the right of your computer.

A lengthy list of commands and options should appear. You might note that your call should be displayed in the second column.

Touch the [f5] function key a second time. More information is displayed on the screen including "BTEXT" and "CTEXT". These will be explained later.

STEP 12 ...
Touch the [f5] key again. The packet screen should reappear with the "cmd:" displayed many times as it was before.

Touch the [RUN/STOP] key and you should see the opening screen with the copyright.

Monitoring - Receive off the air

At this point you may be anxious to see how your PK-64 is going to work with real packet off the radio. If you want to spend some time watching what is going on out there before you actually keyup your own transmitter here are some things that you can do to get a "sneak-preview" of Packet Radio in your area.

STEP 13 ...
Locate packet activity on your receiver. You might try 145.01 MHz or check with other packeteers in your area for a frequency to monitor. Listen for

the unmistakeable "braaaap" of packet activity. This can best be described as a raspy burst of noise that rarely lasts for more than two seconds.

STEP 14 ...
Using the 3.5 mm miniature phono jack shielded audio cable (included), insert one end into your radio's speaker jack and the other into the audio jack on the back of of the PK-64.

STEP 15 ...
Adjust the radio volume for comfortable listening. In general the less volume the better as the radio has a tendency to distort at higher volumes, which will make any reception difficult.

STEP 16 ...
Set up the PK-64 in the PACKET SCREEN MODE. (See steps 7 and 8 above.)

STEP 17 ...
Now when clear packets are heard you will see their contents displayed on the screen. What you will see is a header telling you first the originating station and then the destination station. After that you will see the message that is being sent.

It should be pointed out that monitoring packets can be confusing. More than one Packet QSO may be going on at the same time. Some stations will need to retransmit some packets so you may see the same messages appear more than once.

On The Air (at last)

Now you are ready to go on the air with packets. You must be sure that you have connected your PK-64 to the radio in the manner described in the Installation chapter.

STEP 18 ...
Type:

MY <URCALL> [RETURN]

Type in your callsign for the expression <URCALL>. As you type, a line will appear near the bottom of the screen with the "cmd:" above it. The characters you type appear below the line. If you need to correct an error as you type use the backup arrow on the top left corner of your keyboard. The characters you have typed will be echoed above the line when you press [RETURN].

STEP 19 ...
Determine the call sign of another station that should be close enough for you to connect. This can be best done by asking local packeteers for assistance. If you know of none, try monitoring the frequency for a while. Call signs will appear on your screen when packets are heard.

Type:

C <URCALL> VIA <CALLSIGN> [RETURN]

Again type your own callsign for <URCALL> but also type the other call for <CALLSIGN>. You see the phrase "CONN in prog" at the top of the screen and your transmitter should key up as the PTT light lights on the PK-64. This will change to a message indicating that you are connected to yourself when the connection is complete. If the PK-64 is unable to make this connection it will try again and again about ten times. It will then display: "Retry count exceeded *** DISCONNECTED". You will then need to repeat the procedure using the call of another station.

STEP 20 ...
When your screen tells you that you are connected type a short test message, such as:

HELLO SELF, TEST TEST TEST [RETURN]

Again the message is echoed, your PTT light lights, and your transceiver keys up.

(Note it should key up more than one time). Soon the test message will appear a second time on the screen.

If the message does not appear a second time, the transmitter will try again and again to send it. These are called retries. The PK-64 will retry ten times (11 times total) to connect before it quits and displays: "Retry count exceeded *** DISCONNECTED". If you have a way of monitoring the frequency you should hear the sound of a packet being transmitted from the other station soon after your radio stops sending. If you do not hear this, you may need to choose another station for this test.

STEP 21 ...

To disconnect this test link with yourself, touch the [f7] function key. You will see the letters "cmd:" appear at both the bottom of the screen and the top where the letters "CONV" had been. Now type:

D [RETURN]

The phrase "DISC in prog" will appear near the top of the screen and soon you will see "*** DISCONNECTED".

STEP 22 ...

By first connecting to yourself, you have determined that you have a workable path to the other station. You can now connect to that station directly or use it as a digipeater to connect to others. To connect directily to that station simply type:

C <CALLSIGN> [RETURN]

To use it as a digipeater to connect to another type:

C <CALLSIGN2> VIA <CALLSIGN1> [RETURN]

These steps should help you make your first contacts on packet radio. In later chapters you will find the many details of packet radio with the PK-64 fully described.

CHAPTER 4

OPENING MENU

If you are already in the PAKRATT-64 program, reach the Opening Menu by pressing the [RUN/STOP] key. (If you are in BASIC type: SYS 33333 or SYS 33330 [RETURN]. The 33330 is for a color monitor - see the turn-on section in the chapter called "Quick Check

P. PACKET
A. AMTOR
R. RTTY
I. ASCII
W. MORSE
K. CALIBRATE
L. LOAD
B. BROWSE
E. EDIT
M. MOVE
S. SAVE
T. SET TIME
C. SET COLOR
D. DISK
[B] BACK TO BASIC

To select one of these options simply press the key indicated in front of the selection. To return to BASIC touch [B] while holding the [CTRL] key down.

A description of each option follows. Remember characters or phrases contained in square brackets indicate keys that you should press on your computer. You do not spell these out.

P. PACKET

Press the [P] to go to the packet screen. From this screen you can communicate with the PK-64 and with other packet stations if you are connected to a transceiver. For a complete description, see the chapter titled Packet Screen.

A. AMTOR
R. RTTY
I. ASCII
W. MORSE

Press the appropriate key. The descriptions of the screens and how to operate are contained in Chapter 10.

K. CALIBRATE

Use this command to adjust the AFSK transmit tone frequencies. See the description in the chapter titled "Calibration".

L. LOAD

Press the [L] to go to the "Load Menu". You will find three choices:

Q. QSO BUFFER
M. MESSAGE BUFFERS
P. PACKET PARAMETERS

When selecting either [Q] or [M] you will be asked to enter a file name. It is important

that you understand your computer's filing system. If you are using a cassette system, the file name should be preceded by the letter C and a colon. Quotation marks are not needed. Example:

C:MESSAGE [RETURN]

This will load a file called "MESSAGE" from your tape into the buffer you have specified. The computer will prompt you to "PRESS PLAY ON TAPE". When you do, the screen will go blank and the tape will advance until your file is found. The computer will not load the buffer until you press the [C=] (Commodore logo) key on the lower left corner of your keyboard. If another message is found first, the computer will continue to search for the one you requested. If it is found, it will be loaded into your buffer.

If you are using a disk system, the file name should be preceded by the letter D and a colon. Quotation marks are not needed. Example:

D:MINUTES [RETURN]

This will load a file called "MINUTES" from your tape into the buffer you have specified.

The ten message buffers are loaded and saved as a group, not separately.

NOTE: If you enter the file name and forget to precede it with either the C for cassette or the D for disk, your file name will simply disappear and the prompt: ENTER FILE NAME will indicate that you can try again.

CAUTION: Whenever loading a message into any of the buffers, the contents of those buffers will be lost. Be sure that any data you wish to keep has been SAVED before you LOAD. You may, however, load the MESSAGE BUFFERS without losing data in the QSO buffer or vice versa.

You may store the parameters (including the text parameters like MF, MTO, BT, etc) from the parameter screens for easy recall. To load them, simply specify which set of parameters you choose to use. You may have up to ten different sets (0-9). It is handy to have a separate set for HF and VHF activities. Different people using the station may keep different sets. Notice that upon turn-on of the PK-64, the parameters loaded are those contained in location 0. If there is no file on disk, the default parameters from the ROMs in the PK-64 are used. The parameters may be saved to Disk ONLY; Cassette storage is not available for parameter storage.

B. BROWSE

The browse option on the PK-64 allows you to view the contents of your QSO buffer. When you press [B] the first "page" of your QSO buffer will be displayed. You can move to the next page by touching the [f3] function key. Each time you press this key you will move from page to page through the buffer until you come to a portion of the buffer that is empty. To move backward through the buffer press the [f1] function key. Press [RUN/STOP] to return to the opening menu.

E. EDIT

When you press the [E] you will see an edit menu listing all the buffers. To edit a buffer touch the [0] or any of the numbers from [0] to [9]. The contents of that buffer, if there are any, will be displayed on the screen. In the top left corner you will see either a 0 or the number of the buffer you are editing. Also displayed at the top is a number indicating how much memory is available to you in this buffer.

If the buffer is empty, you can insert text into it for transmitting later. Or the text you enter may be a command for the TNC in command mode (such as a connect message to a station you call frequently). The message may be stored on disk or tape if you choose.

If you wish to clear a buffer, you may use the MOVE command to move another buffer you know to be empty into it, or you may use the [INST/DEL] key as described below.

When you are in the edit mode, text will be displayed continuously across the screen. Control characters like carriage returns are marked with inverse video. (CTRL-M is the equivalent to a carriage return).

The two [CRSR] keys can be used to move the blinking cursor. (Hold the [SHIFT] down at the same time if you wish to move up or left.) The cursor keys repeat if they are held down. The cursor may be quickly moved to the bottom of the 23 line page by pressing the [f3] function key. Pressing [f1] puts it at the top of the page. The text will scroll up or down the screen as the cursor reaches the top or bottom of the screen. The [HOME] key brings the cursor to the first character in the buffer

You can write over characters that are on the screen to correct the spelling of words or change the text when necessary. Characters can be deleted by pressing the [INST/DEL] key. The entire text will be moved back one space, over-writing the character where the cursor sits. Characters can be inserted into the text by pressing the same key while holding the [SHIFT] key down. This shifted [INST/DEL] key toggles you in and out of an insert mode. When you are in the insert mode the letters "INS" appear at the top of your screen. Then when you type, the text will be moved forward character by character allowing you to make additions in front of the cursor.

You may hold the [CTRL] key and press the DEL key to delete one line (40 characters) starting from the cursor position.

You may use the [<---] left arrow key to backspace over characters without deleting them, except at the end of the buffer where the key functions as a destructive backspace key.

Large sections of text may be deleted using the [CLR/HOME] key. If you press [CLR/HOME] while holding the [SHIFT] key down all of the text from the cursor on to the end of the file will be deleted. If you press [CLR/HOME] while holding the [CTRL] key down all the text up to, but not including, the cursor will be deleted.

NOTE: To delete all of the text in a buffer place the cursor at the very beginning (use [f1], if you like) and then press [CLR/HOME] while holding the [SHIFT] key down.

Holding the [CTRL] key while pressing the [pound sterling] key deletes all characters from the cursor to the next carriage return (inverse video M). If the HEADERLIN parameter was on, this will allow editing out callsign headers, leaving just the text.

HINT: It is very easy to get confused and press the wrong key when editing text. We recommend that you use the MOVE option from the OPENING MENU to place a copy of your text into another buffer where you then do the editing. If you make a serious error you can clear that buffer and start again. The original buffer is not lost.

You may hold [SHIFT] and press the [Commodore] key at the lower left of the keyboard to toggle the keyboard between upper and lower case.

HINT: It is difficult in EDIT mode to actually see what your text is going to look like when it is received by the other station. If you use the MOVE option in the OPENING MENU to place your edited text in the QSO buffer you can then use BROWSE to view it as it will appear when sent, as the BROWSE mode acts upon the control characters in the file, whereas the EDIT mode does not.

Finally, the [RUN/STOP] key will store the results and move you back to the Main Menu.

M. MOVE

When you press [M] for MOVE, the words: "REPLACE" and "APPEND" will appear. If you choose the first, the material you move will replace all material in the source buffer. The second choice adds it to the material already there, starting at the end of the existing destination-buffer material.

"MOVE FROM:" will appear next at the top of your screen followed by a list of buffers. You may copy the contents of one buffer into another with this option. (The MOVE command really should be called COPY, as it leaves the original material intact

in the source buffer). Touch a key representing the buffer you want copied. It can be [Q] for the QSO buffer or any of the numbers from [0] to [9].

When you make your selection, the words "MOVE TO:" will appear. Do the same thing to designate in which buffer you want the text copied. You will then see another prompt appear that says: "MOVE ALL? Y/N:"

If you intend to copy the entire buffer touch the [Y]. If you have marked a portion of the text to copy touch [N]. (Marking this block will be described in a later paragraph.) When the text has been copied the OPENING MENU appears again on your screen.

It is also possible to move a buffer that is empty to a buffer that contains some text. This is a quick way of deleting the entire buffer. Alternative ways are to use some of the editing commands contained within the EDIT command.

IT IS IMPORTANT TO NOTE, THAT MOVING TEXT FROM ONE BUFFER TO ANOTHER IS ACTUALLY A COPYING PROCESS. IN OTHER WORDS, THE ORIGINAL BUFFER IS NOT CHANGED. IF YOU MOVE THE QSO BUFFER INTO MESSAGE BUFFER NUMBER 5, WHEN YOU ARE DONE, BOTH BUFFERS WILL CONTAIN IDENTICAL INFORMATION.

It is possible to mark a portion of text to move from one buffer into another. This is done by placing CTRL-S and CTRL-Q into the text before you instruct the computer to make the MOVE. To do so, enter the buffer from which the text will be selected using the EDIT mode, go into INST and position the cursor at the beginning of the text to be marked. Insert a CTRL Q at this location by holding the [CTRL] key and pressing lower or upper case [Q] key. You will see a reverse video control character show up. Insert a CTRL S at the end of the text to be marked. Make sure there are no other unwanted CTRL S or CTRL Q characters in the buffer.

There is an implied CTRL Q at the beginning of the buffer. This means it is there but non-visible. Place a CTRL S there, unless you wish to move material starting at the beginning of the buffer.

Think of CTRL S,Q as flow control characters - that is the Q is a transfer-on toggle and the S is a transfer-off toggle. The transfer will take place character by character from the beginning of the buffer, except as modified by the flow control characters.

S. SAVE

You may save the contents of the QSO or Message buffers to the disk drive, or cassette. Additionally you may save the contents of the QSO buffer to the printer. You may save the operating parameters to the disk drive.

Touch the [S] key. You will see the word "SAVE" in the upper corner of the screen and three options:

Q. QSO BUFFER
M. MESSAGE BUFFERS
P. PACKET PARAMETERS

(Be sure that you understand how your computer stores files on disk or tape. Refer to your computer manuals).

To save the QSO or Message buffers to cassette or disk, press either [Q] or [M]. The ten message buffers are saved as a group, not separately. It makes no sense to respond with "M3" to this choice.

You will then see the prompt: "ENTER FILE NAME" at the top of the screen. If you are using a tape system type the letter C followed by a colon followed by the name you wish to give the file. No quotation marks are needed. For example if you wish to call the file "FRIDAY" simply type:

C:FRIDAY [RETURN]

You will then see the prompt: "PRESS RECORD & PLAY ON TAPE". Be sure that you have positioned the tape correctly then press these two buttons. The screen will go blank during the file saving procedure. If the file is long you may see some text flash on and off the screen, but don't be concerned about it.

When the computer is finished with the task it will return you to the OPENING MENU. Press the <STOP> button on the tape machine.

To save the QSO or Message buffers to a file on a disk, enter the file name with a D and a colon preceding it. No quotation marks are needed. For example if you wish to call the file "AUTOKEYS" simply type:

D:AUTOKEYS [RETURN]

NOTE: If you enter the file name and forget to precede it with either the C for cassette or the D for disk, your file name will simply disappear and the prompt: ENTER FILE NAME will indicate that you can try again.

To save the QSO buffer to the printer, enter (after selecting the QSO buffer choice) ONLY the letter P and a colon.

P:

If you wish to save the full or partial contents of one of the Message buffers to the printer, use the MOVE command to place it in the QSO buffer first. If you have difficulty with getting your printer to operate in this mode, see the section in the Introduction chapter called Commodore Accessories, the description of the PRNCMD command in the Parameters chapter, and the last paragraph of the D. DISK command in this chapter. In most cases, you will be able to get the printer to operate in the SAVE mode; real-time operation using the [f8] key may be more difficult (see the description in the Packet Function Keys chapter under [f8]).

You may save parameters (including the text parameters like MF, MTO, BT, etc). To save them, simply specify which set of parameters you want. You may store only a few of the up-to-ten possible sets (0-9). It is handy to have a separate set for HF and VHF activities. Different people using the station may keep different sets. Notice that upon turn-on of the PK-64, the parameters loaded are those contained in location 0. If there is no file on disk, the default parameters from the ROMs in the PK-64 are used. The parameters may be saved to Disk ONLY; Cassette storage is not available for parameter storage.

T. SET TIME

The time and date appears at the top right corner of your screen when you are working with the PK-64. You can also set up commands that will "stamp" the date and time on messages that you receive when you leave the station running on its own. Press the [T] to set the date and time.

You will see the prompt: "ENTER TIME" on the screen. Notice also that there is a solid, non-blinking cursor on the line under the time display. First enter the hour. The clock is in 24 hour time. You must enter two digits so if it is, for example, 8:24 in the morning, you must touch: [0] then [8]. Next enter the minutes and the seconds in the same way. The new time will appear under the old.

When you enter the last digit a prompt will appear on the screen asking that you enter the month. This MUST be entered as a two digit number. For example if it is February you should touch first [0] and then [2]. When the second digit has been entered, you will be prompted for the date. Again two digits are required. Enter the year in the same way. When you have entered the last digit, the computer will automatically return to the OPENING MENU.

At any place on the screen, you may press [RETURN] to advance to the next field without changing the field you were on or you can press [RUN/STOP] to get back to the Main Menu.

The date will roll over at midnight and leap years are taken into account.

C. SET COLOR

If you are using the PK-64 with a color monitor, you have the option of selecting the colors that appear on the screen. When you touch the letter [C] a list of sixteen colors will appear. First select the color of your choice for the characters. You will then see a list of logical color suggestion for the screen. You may pick colors other than indicated with the risk that the contrast between the characters and the screen may be poor. Make your selection in the same way. After that choose one for the border.

If you are using a mono-chrome display screen you may want to experiment with color combinations that provide a contrast of light and dark tones that appeal to you.

See the "Quick Check and ..." chapter for the colors choosen at boot up for a monochome monitor or TV vs. a color one.

D. DISK

It is possible to have complete access to your disk operating system while using the PK-64. Pressing [D] will provide you with a short menu giving you the option to enter a DOS command or see your directory. Press either [C] after which you will enter one of the commands below, or [D], which will cause the directory to scroll up the screen. (You may use the [f1] HOLD key to cause the scroll to pause).

Refer to your disk user's guide for more information on the disk commands.

Disk operations other than LOAD and SAVE can be performed from within the PK-64 program. In BASIC, a disk command is issued in this format:

```
OPEN 15,8,15
PRINT#15,"XXXX"
CLOSE 15
```

where xxxx is the actual command. If you selected C above, the next thing to type is the command (WITHOUT the quotes please).

Some examples of commands:

N0:name,id	format new disk
N0:name	clear directory
C0:newfile=0:oldfile	copy files
R0:newname=oldname	rename file
S0:name	delete file
I	initialize, clear error
V	validate
UI+	set C-64 speed

for the N,S commands you be asked to verify that you want to do the operation as it destroys files. Do not confuse the zeros above (0) with the capital letter (O); they are all zeros above - no capital "oh"s.

For more information on these commands, see the Model 1541 disk drive instruction manual.

After the command is executed, the file directory will be displayed. You may use the [f1] hold key to start and stop its scrolling. Press [RUN/STOP] to return to the Main Menu.

When using the printer in real time (when it is printing AS the copy appears on the screen) you may change the secondary command in the OPEN statement using the the PRNCMD parameter on the parameter screen. The number changed is the third (z) number in the OPEN statement (OPEN x,y,z). You may need to experiment with this secondary command to make your Centronics compatable printer work. See the description in the Parameters chapter.

[B] BACK TO BASIC

It is possible to return to BASIC without having to turn the computer off. To do this touch the [B] while holding the [CTRL] key down. The contents of all buffers are lost if you revert to BASIC.

CHAPTER 5

PACKET MODE FUNCTION KEYS

The PK-64 makes use of the function keys on your computer to allow you to perform specific functions with ease. To help you remember the purpose of these keys special templates or overlays have been provided for different modes of operation. You may cut out the centers of these templates and place them over your function keys.

The function keys are numbered [f1],[f3],[f5], and [f7]. To use functions 2,4,6, and 8 touch the same keys while holding down either of the [SHIFT] keys.

The keys have different uses in different modes. The following descriptions are valid only in the PACKET mode. The uses of the function keys in Morse, Baudot, ASCII and AMTOR are described in the chapter titled such.

[CTRL] [f1] TOGGLE QSO BUFFER RECORDING

All text that appears in the received text area of the the screen may be saved to the QSO buffer when you press and hold the [CONTROL] key while pressing the [f1] key. A star appears in the status panel and the number of free bytes in the buffer starts to decrement as indicated by the QBF number. At zero, new text will wrap around and start recording over the oldest text. Another toggle will turn off the QSO buffer record feature. Note that if CONMSG is on, the QSO buffer will be triggered ON for the duration of the contact, regardless of its previous state (which should be OFF for CONMSG operation).

[f1] HOLD

This key toggles a HOLD feature that freezes the screen so that incoming data can be read before it is scrolled off the top of the receive window. Data that is received while the screen is frozen will not be lost. An H will appear in the status window. If you leave the HOLD on too long, the internal buffer (which is about 1000 bytes long) will fill, the H in the status panel will be displayed in reverse video and a "Device Busy" condition will occur. This in turn, will cause Receiver Not Ready (RNR) frames to be sent to the other station, causing it to retry. An alternative is to turn on the QSO buffer using CONTROL f1, and go back later and use BROWSE to see what came in. If you are using the HOLD to stop the scroll of text after you change channels in the Multi Connection mode, you may find that there is too much text for the buffer size, and that you loose data. Read the section in the Packet Screen chapter about multiple connections for some solutions to the problem. To release the hold feature and turn off the status panel H, touch [f1] a second time.

The letter H will appear in the upper status window when the receive window is being held with the [f1] key.

[f1] VIEW PRECEDING PAGE

If you are using the BROWSE mode the [f1] key is used to page back a page of viewed text.

[f2] CLEAR QSO BUFFER

The QSO buffer may be quickly and completely cleared by touching [f2]. You will notice that the space available counter in the status window will return to its original count when you clear this buffer. This control operates only from the receive screen.

[f3] VIEW NEXT PAGE

This key only functions when you are in BROWSE mode. It allows you to move forward one page at a time through the QSO buffer. [f1] moves you backwards.

[F3] SELECT CONNECTION CHANNEL

This key allows you to choose which of 11 channels will be viewed on screen in the Multiple Connections mode. See the description in the Packet Screen chapter of Multiple Connections.

Pressing [f3], (assuming you have no unacknowledged frames causing a "Ux" indication under the connect mode location in the Packet screen status window) will cause a blinking cursor in the status window after the "CH." indication. Press a digit key from 0-9 or A to select the channel you wish to move to.

[f4] CLEAR KEYBOARD BUFFER

Text that you are preparing to send appears in the KEYBOARD WINDOW at the bottom of your screen. It is not usually transmitted until you press the [RETURN] key. You may clear this text and start over by touching [f4]. Doing so causes the whole keyboard window to disappear, leaving you more room to view incoming text - in fact, exisitng on-screen text will scroll down a bit allowing you to see some data that previouly went off-screen at the top of the receive window. Or you may use the left arrow key at the top left of the keyboard as a destructive backspace.

If you are sending a long file, and wish to abort the transfer, use this control to clear the display and the transmit buffer.

[f5] PARAMETER SCREENS

When touching [f5] from the PACKET SCREEN once or twice, you will move to one of two lists of parameters that may be changed while operating the PK-64. Continued pressing of the key toggles between the two parameter screens and the Packet screen. For a detailed description see the chapter titled Parameters. While you are in this screen, the PK-64 is still receiving and sending packets. When you return to the Packet screen, the new incoming text will be posted. If it moves past you too fast, be prepared to use the [f1] hold key. See [f1] above.

[f6]

This key has no function in the Packet mode at present.

[f7] RETURN TO CMD MODE

At anytime you wish to exit CONVERSE or TRANSPARENT MODE you may do so by touching [f7]. You would do this, for example, before you intiate a disconnect.

[f8] TOGGLE PRINTER

If you have a printer attached to the C-64, you may toggle the printer on and off with the [f8] function key. When the printer is on the letter P will be displayed in the status window. The printer will operate "real time" - that is it will print without having to first store in the QSO buffer and then print the contents of the QSO buffer.

Please read the section of the INTRODUCTION chapter called Commodore Accessories. There are many different printers, and not all of them will work in this mode. Try also the parameters called PRINTER and PRNCMD. See the description in the PARAMETERS chapter. See also the last paragraph under the D. DISK section of the Opening Menu chapter.

[CTRL][f7] RESET PACKET

If you lose track of what is going on and want to reset to a known point of reference, entering this sequence of keystrokes will unilaterally place you in a DISCONNECTED state and clear the receive screen. Reconnect to the other station at this point so as to not confuse him.

MESSAGE BUFFER KEYS

In addition to these regular funtion keys, the [0] through [1] keys on your C-64 keyboard may also be used to move data or commands. Their purpose is to automatically send data
from any of the numbered message buffers to the PK-64 for

transmission or action.

It is possible, for example, to have stored in different message buffers the commands needed to connect to friends or mailboxes. You may automatically connect to the station you desire; If you have text (such as a connect command) prepared and stored in one of the buffers, (see the Message Buffers section), simply press the numbered key while holding down the [CTRL] key. If you are on the Packet screen, and in CMD mode, when you press [RETURN] that message will be sent to the program for execution.

If you are in a data tranmission mode (e.g. CONVERSE) and the text is a message rather than a command, it will be sent to whomever you are connected to.

PLEASE NOTE THAT MESSAGE BUFFERS USAGE SUBTRACTS DIRECTLY FROM THE QSO BUFFER AVAILABLE SIZE.

CHAPTER 6

THE PACKET SCREEN

NOTE

Do not be alarmed if the screen goes BLANK after about 20 minutes of no activity from the keyboard or no incoming data. There is a timer that causes this and makes things a bit easier for the CRT in your monitor (allows longer cathode life). Press any key to restore the screen (e.g. space bar, f7, f1 etc.). If an incoming message occurs after the screen blanks, it will reactivate the screen and, if you have the QSO buffer open, it will be recorded.

SCREEN DESCRIPTION

STATUS WINDOW

The PACKET SCREEN is divided into three windows. A status window is located on the top few lines. The information displayed in this window will tell you if you are connected or disconnected, and to whom, as well as whether the connect or disconnect is in progress, or whether there is a "frame reject recovery" (FRMR) in progress. It will tell you which mode (CMD, CONV, TRAN) you are in. The time and date are indicated here as well. The space available (in bytes) in the QSO (QBF) and transmit (XBF) buffers is listed after the letters. (The XBF numbers will not change in Packet mode - they have meaning in Morse Baudot and ASCII operation). If an asterisk (*) appears in front of the QBF letters, the buffer is open and anything that appears on the receive window will be stored. This buffer is toggled on and off by pressing the [f1] key while holding [CTRL] down at the same time. The buffers may be cleared by pressing [f2] (QBF) and [f4] (XBF) using the [SHIFT]) key.

The status window also contains several other pieces of information. Depending on the settings of the MONITOR command, you will see (for example) a "U1" under the CMD location which indicates the number of unacknowledged frames you have in your transmit buffer. To the left of the DISCONNECTED you may see a "+" indicating that you are operating in the version 2.0 AX.25 mode. Below the DISCONNECTED you may see "S02" indicating one of the link status states. To the right of that you may see a "T1" indicating that the FRACK timer is on, or a "T3" indicating the CHECK timer is on. T2 indicates the timer associated with the RESPTIME parameter described in the chapter on Parameters.

And above the DISCONNECTED you will see alternately, a vertical or horizontal bar indicating the zeros and ones of the receive data stream from the PK-64 modem into the C-64. When seen in rapid succesion, they will look like a + and -. They should be of comfort to you as they indicate that the data is making it from the other station through your modem to the computer. The indication appears only when the modem has a valid Data Carrier Detect (DCD). You may use this indication for tuning in HF operation. A QRL means you are using the optional squelch input of the PK-64 and it shows the channel is busy meaning you can't transmit just yet.

There is also an "H" above the DISCONNECTED when the [f1] key has been used to hold a scrolling display, and it goes into reverse video when the 1000 byte buffer associated with the mode fills up. And a "P" appears there also when the printer has been activated with an [f8]. An "S" appears intermittantly in the same area, and is indicative of the fact that the transmit text characters are being echoed to the screen (which causes the incoming data to be held back temporarily).

Also the multiple connect "CH.n" appears to the left of the QBF indication and tells which of the multiple connections you have going is being observed on the receive screen. In the dividing line between the Status window and the Receive screen, you will find one or more single digits ranging from 0-9 indicating what multiple connect channels are connected to another station. If one blinks, it is because data has come in on that channel and can be viewed by entering [f3] and that channel number.

RECEIVE WINDOW

The large window is the Receive window. In addition to all text received from other stations, messages from the PK-64 appear here as well. If you have selected the ECHO ON option, text that you send will be displayed in this window as it is being transmitted. Note: if you have the QSO buffer open (so that messages will be saved) your own text will not be saved unless you have selected the ECHO ON option.

KEYBOARD (OR TRANSMIT BUFFER) WINDOW

At the bottom of the screen is a four line keyboard window. The window will not appear until you begin typing at the keyboard. It will disappear if you use the [f2] clear key, thereby allowing more room for incoming text display. Characters that you type on the keyboard will appear in this window. You may backspace using either the [<--] key in top left corner or the [INST/DEL] key in the top right corner. The [CRSR] keys have no effect when you are at the PACKET SCREEN. When you press the [RETURN] key the text you prepare will be sent to the PK-64. (A reverse video ":" will show up in the keyboard window). If you are in CMD MODE, it will attempt to follow your instructions. If you are in either converse or transparent mode (CONV or TRAN) the PK-64 will transmit your text. You may send the contents of a message buffer by pressing CTRL n, where n is 0 to 9. You may also enter a carriage return without terminating the packet if you enter it as "CTRL M" - this is called imbedding a control character in the text.

MONITOR AUDIO

If you have a video monitor with audio capability or a TV set as a monitor, you can hear a received BELL character ($07) as a short beep. You can also hear a 3 second whooping connect alarm that sounds whenever some other station connects to you. If the volume is up enough, you'll have the spouse and kids in the shack, wondering what's up.

UPPER CASE

A shifted Commodore key toggles between upper and lower case input from the keyboard. The Commodore key is the lower left keyboard key. Entering the Packet Screen from the Main Menu using P defaults you to lower case entry.

OPERATING MODES

Whenever you are at the PACKET SCREEN, the PK-64 will display in the upper left corner the name PACKET and the current operating mode. This will be indicated by either the letters:

CMD, CONV, or TRAN.

CMD, command mode, is used to enter commands to the PK-64. CONV, converse mode, and TRANS, transparent mode are both data modes.

TRANSPARENT mode is the mode used in most telephone modems and allows passage of all characters to the other station without the PK-64 interpreting some of the characters (typically control characters) as instructions to it. This mode is typically used in transmitting files such as a BASIC program which might contain such (control) characters. There is a special escape sequence (back into command mode) in telephone modems; in the PK-64, you may revert from either CONV or TRANS to Command mode using the [f7] key. Additionally, the TRANSPARENT mode does not echo to the screen at the sending station end, and has a timed packet-send feature. Nor do the status messages such as ***CONNECTED: appear as the idea behind TRANSPARENT mode is to put on-screen only what has been sent from the other station.

CONVERSE mode is most often used and is what transparent mode is not - it allows certain characters to be interpreted by the PK-64 and acted upon.

All three modes and the commands that are used within them are further described.

CMD (COMMAND) MODE

The PK-64 will automatically place you in the CMD MODE whenever you turn it on. If you are in either TRANSPARENT or CONVERSE MODE and wish to enter CMD MODE simply touch the large [f7] function key.

Data that you enter at the keyboard will be interpreted and the PK-64 will attempt to follow your instructons when you press [RETURN]. If you make a mistake you may back up with the [<---] key at the top left corner of the keyboard. In the event that it does not understand an instruction entered in CMD MODE the error message: "SAY WHAT?" will be displayed. You may then re-enter the instruction. If you accidently provide more information than is necessary the message: "Input ignored" will be displayed. In this case if the first part of your instruction was correct, it will be executed. Otherwise, you will need to re-enter the command.

The following is a list of commands that may be entered from the CMD mode from the Packet screen. Another group of commands which are really better called parameters are discussed in the next chapter, and appear on the two Parameter screens. They are changed from the Parameter screen.

The status of some of the commands (below) are indicated on the Parameter screens. The commands with a @ indicator are called direct or immediate commands in that they cause an immediate change in the operation of the PK-64. Commands may be entered as abbreviated for quicker operation.

	* BTEXT	BT or B
@	* CONNECT	CON or C
@	CONVERSE	CONV
	* CTEXT	CT
@	* DISCONNECT	DIS or D
	* MFROM	MF
	* MTO	MT
	+ MYCALL	MY
@	TRANSPARENT	TRAN or T
	* UNPROTO	U
	* VIA	V (used within the C command)

\+ Status of these commands shown on first option screen
* Status of these commands shown on second option screen.
@ Direct or immediate commands. Status also shown on Packet screen Status field

To enter any of these commands into your PK-64 you must be sure you are at the PACKET SCREEN and the letters "CMD" appear at the top left corner of your monitor. A special prompt, "cmd:" will also appear at the bottom of the large receive window. If ECHO is ON your command will be redisplayed following the prompt after you press [RETURN]. If ECHO is OFF the command will not be redisplayed, but in either case another prompt will appear after the command has been executed. (Two exceptions to this are the commands CONVERSE and TRANSPARENT).

The use of the direct commands accessed from the Packet screen is described below. The descriptions of the indirect commands may be found in the next chapter, along with the Parameter descriptions.

NOTE: Words or phrases surrounded by square brackets refer to specific keys on the keyboard. Be sure that you press these keys when directed. Do not type out the words.

CONNECT
Connect

This command is used when you wish to connect to another station. In CMD MODE type C followed by the station you are calling. Example:

C W7RXS [RETURN]

The message "CONN in prog" will appear at the top of the screen and the PK-64 will key up your transmitter. When the connection is successful you will automatically move into either CONV or TRAN MODE depending on the setting of the CONMODE parameter. The VIA command is an extension of the CONNECT command and may be used with the CONNECT command - never alone. See VIA below.

If you have intiated a connect and wish to abort it you may do so by typing:

D [RETURN]

Related commands: CONMODE,XMITOK,DISCONNECT,VIA

CONVERSE
Enter converse or conversation mode

To enter converse mode simply type:

CONV [RETURN]

The letters: "CONV" will appear at the top of the screen. Anything that you type at the keyboard will be transmitted when you press [RETURN]. See the description in this chapter for a detailed explanation of CONV MODE.

Related commands: TRANSPARENT,CONMODE

DISCONNECT
Disconnect

This command is used when you wish to break the link between you and another station. You must first be sure that you are in CMD MODE. You will probably need to press the [f7] function key to get there. Then type:

D [RETURN]

You will see the message "DISC in prog" appear at the top of the screen and after your TNC has sent one or more disconnect packets, the words: "*** DISCONNECTED" will be displayed when the path is broken. This leaves the same message on the other station screen.

If you wish to abort the disconnect process and get to the DISCONNECTED state immediately, enter a second D [RETURN]. This will bring to a halt any disconnect retries and put you in the DISCONNECTED mode. Doing this will probably leave the other station in the CONNECTED mode and unavailable for connection to another station. You have just done a "unilateral" disconnect. If the other station is a PK-64, it can recover from this automatically using the CHECK parameter (see the description in the next chapter).

Related commands: CONNECT, CHECK

TRANSPARENT
Enter Transparent Mode

To enter transparent mode simply type:

T [RETURN]

The letters TRAN will appear at the top of the screen.

Related commands:CONVERSE,CONMODE

CONV (CONVERSE or CONVERSATION) MODE

Unless you have specified otherwise with the command CONMODE, your PK-64 will automatically enter CONV MODE when a connection is established. When you are in CONV MODE the PK-64 will attempt to transmit anything that you type to the station at the other end. This data will go out in packets when you press the [RETURN] key or sooner if you have typed as many characters as is set by the command PACLEN. You may backspace using the arrow at the top left corner of the screen to correct spelling or change words if you do this before you press the [RETURN] key. It is not possible to make changes after [RETURN] has been pressed. If you wish to enter a carriage return in the text WITHOUT sending a packet, enter:

[CTRL][M]

A reverse video indication of M will be imbedded in the text.

If the PK-64 cannot successfully send your packets to the other station after trying the number of times specified by RETRY, the message: "Retry count exceded *** DISCONNECTED" will be displayed and you will return to CMD MODE.

If the other station chooses to break the link, you will simply see: "*** DISCONNECTED" appear on the screen, and you will return to CMD MODE.

If you wish to break the link, you must first enter CMD MODE. Do this by touching the [f7] function key and then type:

D [RETURN]

The PK-64 will send information to the other station indicating that a disconnect is in progress and will display "*** DISCONNECTED" on your screen when it is acknowledged.

VIA
digipeater routing

NOTE: VIA is NEVER used alone. Always use via within the CONNECT command described above.

AX.25 version 1 and version 2 protocols allow you to route your packets through up to eight intermediate stations in order to reach their final destination. This is called DIGIPEATING. When connecting to another station you may use the command VIA (or just V if you like) to designate which digipeater(s) should relay your packets. The VIA command is an extension of the CONNECT command and must always be used with the CONNECT command. Examples:

C W7ABC V N7XYZ [RETURN]
C W7RXS VIA AK7S,WN7ANK-5 [RETURN]

In the first example only one digipeater is specified, N7XYZ. Your packets will be routed through his station to W7ABC. The command VIA has been abbreviated in this example. In the second example, two stations are being called upon to relay your packets. First AK7S digipeats, then WN7ANK-5 digipeats.

A special case useful for testing or demoing digipeating to another individual in your shack is to connect to yourself via one or more digipeating stations. To do this you must specify the path out and back - for example:

C <URCALL> V AK7S,WN7ANK-5,AK7S

Note that ANK-5 probably wasn't close enough for you to use directly as a digipeater and that you had to reach it via AK7S. Note further that you had to specify AK7S a second time in order to get the packet from ANK-5 back to where AK7S could digipeat it back to your station.

It is possible to observe the fact that other stations are using digipeaters on

the air if you have MONITOR set to a value greater than 1 and have MRPT set ON. The paths of the packets will then be displayed in the header line. The asterisk (*) will indicate which transmitter you actually copied.

NOTE: When the connection is established all packets returning to you from the other station will be digipeated through the same path in reverse order.

NOTE: If you leave the command DIGIPEAT set ON, other stations may specify you as part of their digipeating path. You will be aware of this by the fact that the PK-64 keys up your transmitter at times that you would not expect. This may even occur when you are quite some distance from your keyboard. At first this may make you feel uneasy, but consider the satisfaction you are providing for another station that may not otherwise be able to work into the network.

TRANSPARENT MODE

Transparent mode is very similar to CONV MODE. You may enter transparent mode after you have connected to another station by first going to CMD MODE (touch [f7]) and then typing:

T [RETURN]

It is also possible to set CONMODE to TRAN so that you will automatically enter transparent mode when the connection is established.

Transparent mode differs from converse mode in several ways.

Transparent mode (the mode used in most telephone modems) allows passage of all characters to the other station without the PK-64 interpreting some of the characters (typically control characters) as instructions to it. This mode is typically used in transmitting files such as a BASIC program which might contain such (control) characters. There is a special escape sequence (back into command mode) in telephone modems; in the PK-64, you may revert from either CONV or TRANS to Command mode using the [f7] key. Additionally, the TRANSPARENT mode does not echo to the screen at the sending station end, and has a timed packet-send feature. Nor do the status messages such as ***CONNECTED: appear as the idea behind TRANSPARENT mode is to put on-screen only what has been sent from the other station. In a computer program, for example, you would not want additional data to appear in the middle that would make the program useless.

Another difference is that the [RETURN] key no longer "sends" the packets. It is instead treated as any other character. The PK-64 uses the parameter PACTIME to determine when packets should be sent.

Transparent mode is frequently used for sending assembly language programs or data files. In this type of application many of the bits sent are not interpretable as ASCII characters. They would show up on screen as gibberish. Binary files are usually structured using 8 data bits and no parity. The PK-64 will transmit binary data in Transparent mode.

MULTIPLE CONNECTION OPERATION

As you have probably noticed, the Status Window of the Packet Receive screen contains information that you are using CH.0. You may establish individual connections with up to 10 stations simultaneously using CH.0-9. Additionally, another channel (channel A) is available for UNPROTO monitoring and tranmission.

The multiple connect mode is useful in a roundtable discussion where for example you have 4 stations. Each station would establish connections using 3 channels with the other three stations. All packets between stations would be in the CONNECTED mode as opposed to the UNPROTO mode, and would have the benefit of error checking and retries using the usual station to station acknowledge packet techniques. This network configuration is called a "mesh" as opposed to the next to be described, called a "star".

A "star" configuation is another example - imagine that you are net control for the group, and that each other station has connected to you only - they have a single connection and

you have a triple. You are the center of the "star". There are also "ring" and "tree" connections - we will stay away from them here.

You select the channel you want to use by starting in the Packet screen, disconnected, and in command mode. Press [f3] and notice the status panel displays CH._ with a blinking cursor. Enter, for example, 5. Now connect to another station. As you enter the connect command, you will notice a "5" appear in the midst of the dividing line between the status and receive portions of the screen. It indicates that channel 5 is active and being used. Wait until the connection is established - wait for the ***CONNECTED:. Tell the station hello and QRX, and now you will establish a second connection.

Use [f3] again and enter 6, for example. Establish a connection with a second station, as you did with channel 5. Tell him hello and QRX also, and use [f3] to establish a third connection on channel 7.

You notice that the CH._ status indicator tells you what channel you are sending on and observing reception on. The 5 6 7 in the dividing line tells you what channels have calling, connected, or disconnecting activity with your station.

By now, channel 5 is impatient, and has sent you "what's going on?". You are still on channel 7, so you don't see the message. But you notice that the 5 in the dividing line is blinking - meaning incoming text is waiting for you to read. Use [f3] and enter 5 on the blinking cursor. You are now looking at channel 5; and the text for you to read may be only a few lines or it may be many lines and some of it starts scrolling off screen. Use the [f1] scroll-hold key to stop it while you read it. You may even want to have the QSO buffer open (use [CTRL] [f1] to open it) so you can go back later and BROWSE the buffer. You may send a message to the other station on channel 5 at this point. And you may notice channel 6 is blinkng - and you can use [f3] to go there and talk to him.

The only other case to cover is when a new station calls you in the midst of all this. He will come in on the lowest unnassigned channel - channel 0 in this situation. Notice the 0 appear, and start blinking (if he has sent text). You may use [f3] again and go talk to him now.

Notice that in this usage, the status panel information describes the state of the connect on the channel you are looking at. You may see (all in one place and at any time) what channels are active and to whom you are connected (with routings) on the second Parameter screen.

Channel A will allow you to send UNPROTO packets and monitor. If all other channels are deactivated by the CONMAX command or are really busy, someone trying to connect to you will get a busy message, and if you are viewing channel A, you will see a ***CONNECT REQUEST: message on screen

The CONMAX parameter on the first parameter screen affects multiple user operation also. You may set a value from 0-10 for CONMAX governing how many of your channels may be connected to from other stations. If you have it set to 4, and you have channels 0,1,2 active (connections initiated either by you or the other station), only one more outside station may connect to you (he will appear on channel 3). Any more stations trying a connect to you will receive a <URCALL BUSY> on their screen. However, you may initiate connects totalling more than 4. The case where CONMAX is set to 0 says all stations trying you will find you busy, and if set to 1, will allow one station at a time to connect to you (this might be a good place to set CONMAX if you are a novice at all this - doing so will lock you out of any multiple connect operation).

When leaving multiple connection operation, use [f3] and set up channel 0 as the channel to be monitored. This is a good habit to get into, as if you enable CONMSG (set it ON), it will not work unless the channel you expect connects to come in on is the same one being monitored.

ERROR AND STATUS MESSAGES

In the Receive screen, as a part of normal operation, you will see several messages. Their significance is:

CMD:
If cmd: is the last thing on screen, it indicates that the PK-64 is ready to receive a command - it is in "command mode".

***CONNECTED:....CH.0
Indicates you are connected to the station whose call follows, through the digipeaters indicated, and that Channel 0 is the active channel for this connect.

***DISCONNECTED CH.0
Same as CONNECTED: but indicates you have disconnected or have been disconnected.

SAY WHAT?
An indication the PK-64 has looked for the command you gave it, and can't find it - you probably gave an invalid command or mispelled or mistyped it.

can't CONNECT
You probably are already connected to someone or in the process of doing so and the PK-64 won't accept a new connect command until you disconnect (unless you are reconnecting to the other station for the purpose of establishing a different digipeat path).

can't DISCONNECT
You are probably already disconnected or in the process of doing so.

Retry Count Exceeded
May be followed by the date/time and means that you have timed out - that you sent a number of calling packets (which may or may not have caused a ***CONNECTED: message on the other station's screen) and you didn't receive a decipherable acknowledge packet from him. You will also receive this message if you enter "d" twice in a row in the command mode - the first "d" being an instruction to the PK-64 to initiate a disconnect with the other station and the second "d" telling the PK-64 that you (further) want to abort the disconnect attempt and unilaterally manually disconnect.

Connect Request:
You are connected to someone and another station has tried to connect to you. He receives a message on his screen saying <URCALL> BUSY - if he has a PK-64 or similar TNC.

Input Ignored
You are in command mode and have entered a command that the PK-64 recognizes but you have mistated the "argument" - (a command can consist of a "verb" followed by an "argument" - e.g "CONNECT N7BTI-17" - where "CONNECT" is the verb and the balance is the argument. In this example, "17" is out of range.

Date and or Time
You have turned ON the CONSTAMP, MONSTAMP, DAYSTAMP commands in some combination.

HINTS ABOUT OPERATING

Some of the worthwhile ideas that have come out of the Seattle operating group might be of use to you. They may seem obvious to some, but useful to others.

Setting LCOK OFF will put all your incoming text in upper case where it is easily

distinguishable from the resulting lower case outgoing text.

You will soon learn to make a record of the best path to use to connect to someone with the least hops. If someone has connected to you and is marginally connected, the path he has chosen will display on the second parameter screen. Without disconnecting, you may go back to command mode and enter a connect command using a better path.

If you are sending files, and many retries are occuring, set PACL to 64 or even 32 to make the packets shorter and minimize the chance of them getting "hit".

If you wish to maximize the throughput of a file transfer, set the PACL parameter to 256, and MAXFRAME to 7. Use a duplex voice-style repeater instead of a store and forward digipeater. Do bear in mind though, that the maximum transmit buffer length is 3 frames times 256 bytes (or 768 bytes), so you may not see the full 7 frames go out unless the information in each frame is short.

Lengthening your TXD from 4 to 7 to 10 or more may give the other station's radio AGC a chance to stabilize in a weak signal situation before the data bytes come to his radio.

Your beacon may be useful for telling all listeners when you'll return, or that your buffer is on and they can leave a message, or that the best path to you is...., or telling your name and QTH, or, if used in the "beacon after n" mode, leaving a message for a specific caller you expect to try and call you (the beacon message can be made to transmit a short time after he sends you his calling packet). Don't upset your fellow stations by clogging their screens and buffers with your beacons though.

Don't forget that you can beacon or transmit UNPROTO in Converse mode THROUGH ONE OR MORE DIGIPEATERS so that you can get the transmission to the geographical center of those you want to hear it, as well as to all those within earshot of the digipeaters.

If there is an (unattended) packet station at a high place operating as a digipeater, remember that your station may not be able to hear non-digipeated traffic originating near the destination station. The collisions at the digipeater between your input packets to the digipeater and the remote packets may cause you to retry and time out. Encourage all local packet users to always use the repeater when on that frequency, and to limit non-repeater QSOs to another frequency.

Be considerate of any voice traffic on your chosen frequency. Use the Squelch Input feature of the PK-64, as the audio carrier detect CSMA system is not reliable in inhibiting transmission on a voice channel. The voice traffic probably has been using the channel for many years and feels more "ownership" of it than they feel you, the noisy newcomer" may have. How good a diplomat are you? The best solution sometimes is to get your packet traffic off the voice frequency. Take your own voice traffic off onto another frequency, and your fellow packeteers will love you. There is nothing more frustrating than having to abandon packet for an hour-long rambling voice QSO.

CHAPTER 7

PARAMETER SCREENS

In order to provide complete flexibility when operating your packet station, the PK-64 comes with an extensive list of settable parameters. At first this may seem a bit overwhelming. But to be sure your first packet experiences are successful, we have preset each parameter to a default value that should be close to what you will actually want.

As you experiment with your PK-64 you will find that you may want to change a few of these parameters. The changes you make can be saved on disk (not cassette) and reused later (see the description of the SAVE command). You may choose to use different values for different types of operation, such as one set for VHF and another for HF.

Most of the parameters are selected from a menu. Some of the parameters are entered from the keyboard while in the PACKET SCREEN. To get to the PARAMETERS MENU from the PACKET SCREEN simply press the large [f5] key on the right of your computer. The following list of selections without the "sec" and "range" columns will appear (please note that the descriptions of BTEXT, CTEXT, CONNECT, CONVERSE, DISCONNECT, MFROM, MTO, MYCALL, TRANSPARENT, UNPROTO, and VIA appear in the chapter called The Packet Screen):

Name	sec	range	Name	sec	range	Name	sec	range
AUTOCR-T 0		0-255	MAXFRAME 4		1-7	RTTY:		
AUTOCR-R 80		0-255	MFILT $0000		$0-7F	AUTO-CR ON		
AUTOLF-T OFF			MFILT $0000		$0-7F	AUTO-LF ON		
AUTOLF-R OFF			MONITOR 2		0-6	ARQTMO 45	1	1-255
AX25L2V2 OFF			MONCON OFF			SELCAL		
AXDELAY 0	.12	0-15	MONDIGI OFF			USOS ON		
AXHANG 0	.12	0-15	MONREJ OFF			WIDESHIFT OFF		
BAND VHF			MONRPT OFF			WORDOUT ON		
BEACON EV 0	10	0-255	MFROM ALL			XMITREV OFF		
CHECK 30	10	0-255	MTO NONE					
CONMSG OFF			MONSTAMP OFF					
CONMODE CONV			MYCALL PK64					
CONMAX 10		0-10	PACLEN 128		0-255			
CONSTAMP OFF			PACTIM AF 4	.25	0-15			
CPACTIME OFF			PASSALL OFF					
DAYSTAMP OFF			PRINTER 1		1-2			
DIGIPEAT ON			PRNCMD 0		0-255			
DWAIT 2	.04	0-15	RESPTIME 12	.10	0-255			
ECHO ON			RETRY 10		0-15			
FRACK 3	1	1-16	SQUELCH NEG					
FULLDUP OFF			TXDELAY 4	.04	1-16			
HARDTIME ON			UNPROTO CQ					
HEADERLN ON			WRAP ON					
LCOK ON			XMITOK ON					

Notice that some are followed by the word ON or OFF, some are followed by numbers, and still others are followed by unique notations such as CQ. Looking at the screen, notice also that one of the parameters is listed in reverse video. This highlighting lets you know which parameter the computer is prepared to change. Touch one of the keys in the lower right hand corner of your keyboard labeled: "CRSR".

As you tap the key again and again, notice that the highlighting moves from parameter to parameter, but occasionally skips one or more of the items listed on your screen. You will discover that if you hold the [SHIFT] key down at the same time you tap the [CRSR] key the reverse video cursor moves in the opposite direction. You may move it from column to column by using the left-right [CURSOR] key and the [SHIFT] key.

For the purpose of this tutorial, move the cursor to the parameter "ECHO". Now tap the large [RETURN] key again and again. Because the computer switches back and forth between ON and OFF, we call this a toggle parameter. There are several toggle parameters in the group. The purpose of these will be explained later.

Now move the cursor to the word: "RETRY". This time, if you press the [RETURN] key, nothing happens. But if you type the number "7" it replaces the 10 that was on your screen. You may type in any number here that you choose. Valid numbers for this parameter are from 0 to 15. If you type in an invalid number, the computer will switch back to the old value when you press the [CRSR] key or [RETURN].

You will notice that you cannot move the cursor to some of the parameters. For example, MYC is skipped every time you attempt to highlight it. This parameter is really a parameter that must be set while you are at the PACKET SCREEN. For convenience we have chosen to display it here along with these parameters. We can change your call from PK64 to your own amateur call by first touching the [f5] key twice to get to the main packet screen. At the bottom of your screen you should see the letters "cmd:". (If you don't see these letters touch the [f7] key). Touch the letter "M" and the screen jumps up to display two windows. The cmd appears in the upper receive window and the "M" in the lower keyboard window. Touch the letter "Y" so that the word "MY" appears. Then touch the [SPACE BAR] and type your call. Use the backup arrow if you have to make any changes, and press [RETURN] when it is finished. (Note: whenever you press the [RETURN] key you will see a reverse colon on the screen. Now if you touch [f5] again and return to the OPTIONS MENU you should see that your call is listed on the screen. Other parameters that must be entered from the PACKET SCREEN will be discussed later.

Take a moment or two to experiment with the keyboard while in this menu. After you have a good feel for moving around the screen and changing parameters, try pressing the [f5] key again. If you find that you have returned to the PACKET SCREEN, press [f5] twice. You should find a display of your current parameters:

```
BTEXT: AEA PK-64 Answering System active
CTEXT: AEA PK-64 Auto-Answer -- Please le
ave message, then disconnect.
0  DISCONNECTED
UNPROTO:     CQ
MON FROM:     ALL
MON TO:      NONE
```

These parameters are displayed here, but they cannot be changed unless you return to the PACKET SCREEN by pressing [f5] once as we did earlier with your call. Notice that tapping [f5] again and again "toggles" you back and forth between the two parameter screens and the main packet screen.

The following pages contain a detailed list of the packet parameters:

FIRST PARAMETER SCREEN

The following is a listing of all the parameters available to you with the PK-64. The values shown here are the default values that will be in effect whenever you turn the PK-64 on. Unless otherwise stated, these can be changed from the PARAMETERS MENU which is found by touching the large [f5] function key on the right side of your computer. Use either of the [CRSR] keys and the [SHIFT] KEY to select the parameter you wish to change. Toggle the OFF/ON parameters using the [RETURN] key; enter the number and then move from the numeric options to effect the change. See the SAVE command from the Opening Menu for information on saving your parameters to disk. The parameters here are listed in alphabetical order; on-screen order is slightly different.

AUTOCR-T 0
Auto carriage return on transmit disabled

May be (0-255)

Carriage returns will automatically be sent for you after a given number of characters from the last carriage return. This may prove to be useful if you know the width of the screen of the other station. If 0 is selected, no carriage returns will be added. For a value of 80, the return is inserted at the first space after character 76 or at column 80, whichever comes first.

Related parameters: AUTOCR-R,AUTOLF-R,AUTOLF-T

AUTOCR-R 80
Auto carriage return on receive after 80 characters.

May be (0-255)

Carriage returns will automatically be added to text you receive after a given number of characters since the last return. If 0 is selected, no carriage returns will be added.

Related parameters: AUTOCR-T,AUTOLF-R,AUTOLF-T

AUTOLF-T OFF
Auto line feed on transmit

Toggles: ON/OFF

If AUTOLF-T ON is selected a line feed will automatically be added each time a carriage return is sent. It has been generally accepted that if line feeds are needed it is the responsibility of the receiving station to insert them.

Related parameters: AUTOCR-T,AUTOLF-R,AUTOLF-T

AUTOLF-R OFF
Auto line feed on receive

Toggles: ON/OFF

IF AUTOLF-R ON is selected line feeds will automatically be added each time a carriage return is received. This may be needed when some printers are used with your packet station. If the other station is sending line feeds and your station has this parameter set ON, double spacing will appear on your screen.

Related parameters: AUTOCR-R,AUTOLF-T

AX25L2V2 OFF
AX.25 Level 2 Version 2

Toggles: ON/OFF

Version 2 of the AX.25 Packet Radio Protocol is presently the most current protocol used for packet radio. It includes many enhancements not found in version 1. If set OFF, the TNC acts as an original TAPR TNC-1, with pre-2.0 protocol. Version 1 packets are always sent, regardless of the received packet type. If ON, the TNC acts as a TAPR TNC 2 and uses version 2.0 protocol to initiate connects. If the remote TNC responds using version 1 packets. the PK-64 will revert to version 1 mode for the duration of the connect, even though the parameter screen still says version 2. Keep in mind, that as of this writing, most version 1 digipeaters will not repeat version 2 packets. The PK-64 will digipeat version 2 packets, regardless of the state of the parameter screen indication. The indication that the PK-64 is operating in version 2 is the "+" sign to the left of the CONNECECTED word in the status window of the packet screen.

In monitor mode, version 1 packets are shown with the packet type in angle <> brackets; version 2.0 packets have the type shown in square [] brackets.

AXDELAY 0
Auxiliary delay

may be (0-15), representing units of 120 ms

For voice repeater use, this value specifies how much extra time (in addition to the normal delay set by TXDELAY) the TNC will wait after keying up the transmitter before

data is sent. This is handy if your transmitter needs extra time to stabilize its frequency or if you are using a conventional voice repeater using a slow mechanical relay. It should be used when the related parameter, TXDELAY cannot provide an adequate time interval. TXD will usually be enough for TNC to TNC communication - AXD is intended for other devices and is usually left at "0".

The TNC will send flag characters for the duration of AXD. You will hear them on air as a uniform "buzz" followed by a change to the raspy data in the packet frame itself.

Related parameters: AXHANG,TXDELAY

AXHANG 0
Auxiliary hang time

may be (0-15), representing units of 120 ms

This value can be used to increase channel utilization when an audio repeater with a hang time greater than 120 ms is used. If the repeater squelch tail is equal to the hang time set by this command, the TNC will not invoke the AXDELAY time for packets to be sent before the tail has dropped.
Related parameters: AXDELAY

BAND VHF
Band parameters for packet

Toggles: VHF/HF

VHF sets the mark and space tones to 1200 Hz and 2200 Hz and the transmitting baud rate to 1200. These are the common VHF settings.

HF: sets the mark and space tones to 2110 Hz and 2310 Hz and the transmitting baud rate to 300 with the HFM-64 installed. This 200 Hz shift is the common shift for HF. The tone pair is placed within the filter bandwidth of the HFM-64; the same filters are used for the RTTY tones (2125 and 2295). If the HFM-64 is not installed, the command sets the tones to 1600 and 1800 Hz, and the PLL detector on the main PK-64 board is used. The command WIDESHIFT sets the mark and space tones for Amtor, Baudot and ASCII.

Related parameters: WIDESHIFT

BEACON EV 0
Beacon interval

may be (0-255), representing units of 10 seconds
may be EVERY/AFTER

The message stored as BTEXT will be transmitted UNPROTO (via whatever digipeat path is specified in the UNPROTO command) as often as the time interval specifies. If the interval is zero no beacons are transmitted. If EVERY is specified, the beacon will be transmitted no matter what the link state is (whether connected or disconnected).

If AFTER is specified, the beacon will transmit only once after the specified interval with no link activity. The frame (in either case) is addressed to BEACON. The AFTER mode is useful to keep from cluttering the frequency and the other station screens, as it sends the beacon only when there is someone on frequency to hear it. Note if you are beaconing using a digipeated path, the command will interpret the digipeater packet as "channel activity" and will reset the timer causing another beacon after the specified time interval.

To select the "AFTER" parameter touch the <A> key and the letters "AF" will appear next

to the word "BEACON". To select the "EVERY" parameter touch the <E> key and the letters "EV" will appear. If you wish to change just the number, enter it only.

Commonly used Beacon intervals and their settings (divide the setting by 6 and get minutes):

```
  6 =  1 min.
 18 =  3 min.
 30 =  5 min.
180 = 30 min.
```

To set BTEXT see the description of the command.

Related parameters: BTEXT,UNPROTO

BTEXT
Beacon Text

may be any text up to 128 characters

Beacon Text is a short message that you want transmitted automatically at some time interval set by the command BEACON. The default message: "AEA PK-64 Answering System active." will be transmitted at that interval unless you have changed the text.

To change the beacon text, after "cmd:" type "BT" followed by the new beacon and [RETURN]. For example:

BT TEST TEST TEST TEST TEST [RETURN]

This will change the beacon to the message: "TEST TEST TEST TEST TEST"

BEACONS ARE TRANSMITTED USING YOUR UNPROTO PATH.

Related commands: BEACON,CTEXT,UNPROTO

CHECK 30
Automatic Time-Out

may be (0-255) representing units of 10 sec.

If a value of 0 is selected, CHECK is totally inactive.

If the station you are connected to "disappears", an older TNC could remain in the connected state forever, refusing any new connect attempts. In order to prevent this kind of lockup, the PK-64 will try to clean up the link after a specified time interval.

If a value greater than 0 is selected, the PK-64 will wait for the specified time interval (which is called the T3 interval) for the other station to send some data. (The T3 timer status is shown in Monitor mode 6 in the status panel of the Packet screen). If no data is received the PK-64 will (for a version 1 link) try to restablish the link by sending SABM (connect) frames. If the link is a version 2.0 link, the PK-64 will test the link by sending RR frames with the Poll bit set. After doing this RETRY times with no response, it will start sending SABM (connect request) frames. If this is unsuccesful in the case of either version 1 or 2, the RETRY number will be exceeded and your station will time out and be available for a new connection. Always set the CHECK interval to a value greater than FRACK times 17 (the max FRACK interval). A message will display after a successfull CHECK showing the link state (***CONNECTED TO XXX V YYY).

Note:CHECK will not work if you try to test this with a connect to yourself.

Note: If the PK-64 disconnects you because of a time out, it will be a unilateral disconnect, that is no attempt is made to disconnect the other end. If the other station is pre-version 2, he may be left hanging and be "BUSY" for a connect from someone else. Be a good neighbor and don't do this to him.

Related parameters: CONMSG,CTEXT

CONMSG OFF
Auto Connect Message

Toggles: ON/OFF

When CONMSG is ON, the message stored as CTEXT is automatically sent when another station connects to your PK-64. If CONMSG is OFF the text is not sent.

Note: If you initiate the connect, the automatic CTEXT message will not be sent, but the timer is still active.

Note: If the monitored multiple connect channel described in the Packet Screen chapter is not left at CH.0, and CH.0 receives an incoming connect, the CTEXT message will not be sent, and the buffer will not record the other station's message.

Note: If MONCON is ON while the QSO buffer is recording the other station's message, any other packet traffic on the radio channel will be monitored and stored in the QSO buffer in addition to the message.

CONMODE CONV
Connect Mode

toggles CONV/TRANS

CONV: Connects to your station will automatically cause the PK-64 to go into the Converse Mode.

TRANS: Connects to your station will automatically cause the PK-64 to go into the Transparent Mode.

The connect may result either from a connect request received from another station or by one initiated by yourself. If the PK-64 is already in Coverse or Transparent Mode when the connection is completed the mode will not be changed.
Related parameters: CPACTIME,PACTIME

CONMAX 10
Maximum number of connections

values: 0-10

0: No stations may connect to your PK-64; those trying will receive a "busy" report.

1 through 10: Stations requesting to connect may do so, until the cumulative number connected equals the value set. Additional stations trying to connect will receive a "busy" report.

Occasionally you may not want anyone to connect to your station. This parameter will allow you to leave your station on the air so that it can be used for digipeating and/or your beacon can be transmitted but connects will not occur.

If CONMAX is 0 or if the max number of channels is active, you may still initiate a connect yourself on an additional channel. After you have finished your packet QSO the PK-64 will refuse connects in excess of the number set.

If a station is refused a connect to you, O, the message:

*** connect request: <CALLSIGN>

will be displayed on your screen, where <CALLSIGN> is the call of the station requesting the connect. You may then intiate the connect yourself. CAUTION: occasionally a station may need a specific path in order to connect to you. No indication of that path will be displayed for you to use in connecting to him.

Related parameters: XMITOK

CONNECT

This direct command is described in the Packet Screen chapter.

CONSTAMP OFF
Date and Time Stamp Connects and Disconnects

When CONSTAMP is ON, the date and time are displayed on the screen as a part of the connect and disconnect messages. If the QSO buffer is open, this information is included there for later reference. If CONSTAMP is OFF, this information is not displayed.

Related parameters: MONSTAMP, DAYSTAMP

CONVERSE

This direct command is described in the Packet Screen chapter.

CPACTIME OFF
Converse Packet Timer

toggles: ON/OFF

ON: PACTIME is used in Converse Mode.

OFF: PACTIME is not used on Coverse Mode.

When CPACTIME is ON, the PACTIME parameter is used in Converse Mode as well as in Transparent Mode. This mode is normally used when a near Transparent Mode is desired. In this mode, characters are sent periodically as in Transparent Mode, but the features of Converse Mode are still available.

AUTOCR-T should normally be OFF in this mode, since otherwise carriage returns will appear at random intervals as the input is packetized by the timer.

Related parameters: PACTIME

CTEXT
Connect Text

may be up to 128 characters

Whenever the command CONMSG is ON, the CTEXT message will automatically be sent when another station connects to your PK-64.

To change the CTEXT message, from command mode simply type CT followed by the text. For example:

CT HEY SAILOR!!

In this case, the message: "HEY SAILOR!!" will automatically be sent whenever another station connects to your PK-64.

You may also imbed carriage returns in the text by typing CTRL-M.

Related commands: BTEXT

DAYSTAMP OFF
Enables date in CONSTAMP and MONSTAMP

Toggles: ON/OFF

When ON, includes the date in CONSTAMP and MONSTAMP. When OFF, only the time is printed, saving QSO buffer space (such as would be the case if you were out of the house for the afternoon).

Related parameters: CONSTAMP, MONSTAMP

DIGIPEAT ON
Enable Digipeater

Toggles: ON/OFF

When this parameter is turned on, any packets received that have your station's call in the digipeat section of its address field will be retransmitted. This will not interfere with any other packet operation the PK-64 is performing at the time. If the parameter is turned off, digipeating will not occur. As a courtesy to others, DIGIPEAT is usually left on (as well as your station).

Related parameters: XMITOK

DISCONNECT

This direct command is described in the Packet Screen chapter.

DWAIT 2
Digipeat Wait

may be (0-15) representing units of 40 ms.

This value is used to avoid collisions with digipeated packets. The PK-64 will wait the specified time interval after last hearing data on the channel before it transmits. The best value will be determined by experimentation; you should take into consideration the TXDELAY of the slowest station in the network. Ask what other users in your network are using.

This feature is made available to help alleviate the drastic reduction of throughput that occurs on a channel when digipeated packets suffer collisions. It is necessary because currently, digipeated packets are not retried by the digipeater, but must be restarted by the originating station. Digipeaters do not wait DWAIT but transmit immediately. If all other stations operate with DWAIT, the digipeater will capture the frequency everytime it has data to send and your network will operate more smoothly.

Related Commands: FRACK

ECHO ON
Keyboard echo

Toggles: ON/OFF

ON: text sent to the PK-64 will be echoed in the upper receive window and added to the QSO buffer.

OFF: text sent to the PK-64 is displayed in the lower keyboard window only. It is still transmitted normally, but will not appear in the QSO buffer. This feature is very handy when downloading text files from your local mailbox to your QSO buffer. Commands and instructions that you send to the mailbox will not appear in the QSO buffer.

Related parameters: none

FRACK 3
Frame Retry - Acknowledgement

may be (1-16), representing units of 1 second

After transmitting a packet requiring acknowledgment, the PK-64 will wait the specified number of seconds before incrementing the retry counter and sending it again. If the retry count specified by RETRY is exceeded, the current operation is aborted. If the packet address includes digipeat requests, the time between retries will be adjusted using the following formula:

Retry interval = FRACK * (2*m + 1)

where m is the number of intermediate relay stations.

When the retried packet is sent, a random wait time is added to any other wait times in use. This is to avoid lockups where two stations repeatedly collide with each other.

Related parameters: DWAIT

FULLDUP OFF
Fullduplex

Toggles: ON/OFF

ON: Full duplex mode is enabled.

OFF: Full duplex mode is disabled.

When FULLDUP is OFF the PK-64 uses the carrier-detect signal from within its modem to avoid collisions, and acknowledges packets with a single acknowledgment. When FULLDUP is ON, the PK-64 ignores the carrier-detect signal and acknowledges packets individually. FULLDUP ON is useful for full-duplex radio operation, such as through OSCAR 10. The SQUELCH command is overridden in the ON mode.

Related parameters: SQUELCH
HARDTIME ON
Hardware clock

Toggles: ON/OFF

Most users will want to use the hardware clock in the C-64, but a few will find that the clocks on their computer runs too fast (the C-64 is noted for this problem). If this is the case, select the software clock by setting HARDTIME OFF. Note: the software clock will lose some time during disk I/O.

Related parameters: none

HEADERLN ON
Line feed after header lines

Toggles: ON/OFF

When monitoring packets, a header telling the origin and destination as well as possibly other information, may be displayed. If HEADERLN is ON, a line feed and carriage return is used at the end of the header so the text of the packet appears on a new line. If HEADERLN is OFF, the text will appear on the same line as the header.

Related parameters: MONITOR,MONCON

LCOK ON
Lower case okay

Toggles: ON/OFF

ON: lower-case characters received by the PK-64 are displayed as such.

OFF: lower-case characters are displayed as upper-case characters.

This parameter has no effect on characters received in TRANSPARENT mode. Input characters and echoed characters are not case translated.

Your computer or terminal may not accept lower case characters; in this event, the command is useful. Also you may wish to have all incoming text off the air display as upper case in order to more easily distinguish it from your outgoing lower case on the screen.

Related parameters: none

MAXFRAME 4
Maximum outstanding frames

may be (1-7), specifying the number of packet frames

MAXFRAME sets a limit on the number of frames that the PK-64 may have outstanding (unacknowledged) at any one time. It is also the maximum number of contiguous frames the PK-64 may send in a single packet. If some but not all of the outstanding frames are acknowledged, a smaller number may be transmitted the next time, or new frames may be included in the retransmission, so that the total unacknowledged frames will not exceed MAXFRAME.

NOTE: If you find that conditions result in frequent "retries",you may find that you can improve the throughput by lowering this parameter. The maximum packet receive buffer space of the other station may be exceeded if you set your outgoing packet size too large.

For file transfers, you may find that setting to 7, and setting PACLEN to 255 will give you the maximaum throughput on a good empty VHF channel. The PK-64 transmit buffer is 3*256 bytes long and you may never achieve 7 frames to a packet (if the individual frames are smaller than 256 bytes, you may see 7 frames max).

Related parameters: PACLEN

MFILT $0000
Filters out selected incoming characters

may be up to four hex($) representations of ASCII characters ranging between $0-$7F

You may choose up to four characters to filter out of the text of incoming packets before

they are printed onscreen or in a buffer. For example, to filter out the bell character type in a 7 such that the display would read $7. To filter out carriage returns ($0D), line feeds ($0A), and bells ($07), set the two MFILT lines to $070A and $0D. The $ character should not be typed in.

You may wish to use this feature if the other station (for example) is sending a CR and a LF after 40 characters because that is the width of his computer screen. In general, you should send text that is unformatted and let the other station do his own formatting.

MFROM ALL
Monitor packets from

A list of callsigns for stations you wish to monitor (OR REJECT) may be entered in the COMMAND MODE. To do this you must be at the PACKET SCREEN in CMD MODE with a "cmd:" on the screen.

For example type: MFROM WB7FHC,N7BTI-2,W7RXS [RETURN]

Note that the calls are separated with commas. The list may contain up to 10 calls. In this example packets sent by those stations listed will be displayed on your screen. In addition, packets sent by others directed to stations listed in your MTO list wil also be displayed.

MFROM ALL and MFROM NONE are permissible. When MFROM ALL is chosen, all packets will be monitored. When MFROM NONE is chosen only those packets directed to stations listed in your MTO list will be displayed.

Examples:

```
MF ALL
MF WB7XYZ,WA7ABC,N7TTL-3
```

The MF and MT lists are displayed on the second parameter screen.

If the option, MONREJ is ON, the function of this command is reversed. Instead of monitoring packets originating from stations in this list, those packets are rejected by the PK-64, and all others are monitored. This command has no effect on the digipeating capabilities of your station.

If you have the MONRPT command on, and are displaying packets originating from digipeaters, you will not see a digipeated packet from that digipeater just because the digipeater call is in your MF list; the MF and MT parameters only monitor calls that are in the "to" and "from" sections of the address field in the frame.

Note: MONITOR must be set higher than 0 for MFROM to have any effect.

Related parameters: MONITOR,MONALL,MONCON,MONRPT,MONREJ,MTO

MONCON OFF
Monitor while connected

ON: enable monitor mode while state is CONNECTED

OFF: disable monitor mode while state is CONNECTED

If MONCON is ON, the PK-64 will display the packet activity on your frequency in addition to packets sent to you while you are CONNECTED. This is handy if you notice that other stations have come up on the air while you are chatting and want to know who they are. All of the related "monitor" parameters are effective while MONCON is ON.

Packets to you will display with a To/From header, unlike the situation with MONCON OFF.

Note: If MONITOR is 0, MONCON will have no effect.

Related parameters: MONITOR,MONALL,MONRPT,MONREJ,MFROM,MTO

MONDIGI OFF
Monitor when you are a digipeater

OFF: Normal monitoring as determined by the various monitor commands

ON: I and UI frames with <URCALL> as the next digipeater in the digipeater field are displayed whether you are connected or disconnected.

If MONDIGI is OFF and your monitor modes are set to set to monitor frames that include you as one of the digipeaters in the routing, you will see these frames. If your monitor commands are set such that you will not see these frames, turning MONDIGI ON will cause them to be monitored. The command is useful if you are wondering why your transmitter is more active than you would expect.

Related Parameters:MONITOR,MONCON,MREJ,MRPT,MFROM,MTO

MONITOR 2

may be (0-6)

0 No packets are monitored.

1 Only un-numbered information (UI) frames are displayed. These are frames resulting from an unconnected transmission. This is handy for an unproto, round-table type QSOs. If other stations are connected and using the frequency their packets are not displayed.

2 As in 1 but numbered information (I) frames also are displayed. These are frames, numbered in order of generation, resulting from a connected transmission.

3 As in 2, but connect request frames (SABM) and disconnect frames (DISC) are displayed with a header and either the characters: <C> or <D>.

4 As in 3, but un-numbered acknowledgement of connect and disconnect state frames are displayed with a header and either the characters: <UA> or <DM>

5 As in 4, but receive ready, receive not ready, reject, and frame reject are displayed. This will appear as the characters: <RR>, <RNR>, <RJ>, and <FRMR>. I-frame sequence numbers are also displayed.

6 Shows internal states of the link and the three timers.

7-15 Duplicates 6

The sequence numbers of RR, RNR, and REJ frames appears as <RR;3>. This means the remote station expects the next received I frame to be numbered 3.

The sequence numbers of I frames appears as <I;2,5>. This means the transmitted I frame is numbered 5, and the next received I frame is expected to be numbered 2.

Poll and Final bits are indicated as ",P" and ",F" respectively.

The PID byte, if different from F0 (no layer 3 implemented), is shown after the frame type, as in "[1;2,5]DF:"

The angle brackets <> indicate the monitored frame is a pre-version 2.0 frame. Version 2.0 frames are shown in [] brackets. Also remember that the Packet screen status section carrys a "+" indication that you have set AX.25L2V2 ON.

In MONITOR level 6, the internal link state is shown in the Packet screen status panel and is numbered according to the ARRL AX.25 Level 2.0 spec as follows:

S01 Disconnected
S02 Link setup
S03 Frame reject
S04 Disconnect request
S05 Information transfer
S06 REJ frame sent
S07 Waiting acknowledge
S08 Device busy
S09 Remote device busy
S10 Both devices busy
S11 = 7 and 8
S12 = 7 and 9
S13 = 7 and 10
S14 = 6 and 8
S15 = 6 and 9
S16 = 6 and 10

The timer states are shown in the Packet screen status panel in MONITOR level 6. T1 is the FRACK timer; T2 is RESPTIME/10 seconds, and T3 is CHECK*10 seconds. If they are displayed, they are active.

Related parameters: MONALL,MONCON,MONRPT,MONREJ,MFROM,MTO

MONSTAMP OFF
Monitor Time Stamp

When MONSTAMP is ON the time and date (if DAYSTAMP is ON) are displayed with headers. This allows you to determine when messages were monitored when you view them later in your buffer. When MONSTAMP is OFF, the date and time do not appear with the headers. MONSTAMP is fully independent of the related parameter CONSTAMP.

Related parameters: CONSTAMP,DAYSTAMP

MONREJ OFF
Monitor Reject

Toggles: ON/OFF

This parameter simultaneously reverses the function of both MTO and MFROM. When MONREJ is OFF these two parameters perform normally, specifying which packets will be displayed on your screen. When MONREJ is ON, the packets whose address are listed in MTO and MFROM are rejected and not displayed.

If, for example, you would like to monitor all the activity on the frequency, but not have your buffer filled with data sent from two local mailboxes (say WORLI,W5XO), you would set up the PK-64 as follows:

```
MONITOR 2
MONREJ  ON
MFROM WORLI,W5XO
MTO  NONE
```

NOTE: In the above example it is important that MTO is set at NONE. That means that none of the "TO" packets are filtered out, as the functional opposite of NONE is ALL. Only packets "FROM" WORLI and W5XO are filtered out. If you had MTO set at ALL, all packets would be rejected and you would not be able to monitor any packet activity. Note that this

command allows selective rejection or monitoring of packets whose source or destination calls match the MFROM and MTO calls listed. It does not allow monitoring or rejection of a packet from a station whose call is in the digipeat (VIA) portion of the frame.

Related parameters: MONITOR,MONCON,MFROM,MTO

MONRPT OFF
Monitor with Repeat Path Shown

Toggles: ON/OFF

Digipeater paths of monitored packets are displayed. The call of the actual digipeater to transmit the particular packet is displayed with an asterisk (*). For example, W1ABC>W1DEF*>W1HGI>W1JKH will indicate the monitored packet is from W1DEF and that the source station is ABC and the destination station is JKH.

OFF: Only the source and destination callsigns are displayed.

Note: This parameter has no effect unless MONITOR is set to a non-zero value.

Related parameters: MONITOR,MONALL,MONCON,MONREJ,MFROM,MTO

MTO NONE
Monitor packets to

A list of callsigns for stations you wish to monitor (or reject) may be entered in the COMMAND MODE. To do this you must be at the PACKET SCREEN in CMD MODE with a "cmd:" on the screen.

For example type: MTO WB7FHC,N7BTI-2,W7RXS [RETURN]

Note that the calls are separated with commas. The list may contain up to 10 calls. In this example packets sent to those stations listed will be displayed on your screen. MTO ALL and MTO NONE are permissible. When MTO ALL is chosen, all packets will be monitored. When MTO NONE is chosen only those packets directed to stations listed in your MFROM list will be displayed.

It is usually desirable to exclude monitoring of packets whose "TO" field contains "calls" such as "CQ, BEACON, QST" and other repetitive, screen-clogging types.

Note: MONITOR must be set higher than 0 for MTO to have any effect.

Related parameters: MONITOR,MONALL,MONCON,MONRPT,MONREJ,MFROM

MYCALL PK64
My call is ...

n may be 0-15 (CALL-n)

May be any combination of up to six letters or numbers (but must contain an alpha character in one or more of the the first three locations). This call will be placed in the FROM address field of all packets originating from your PK-64. Your PK-64 will accept packets with this call in the TO field of the frames in the packet and will relay frames with this call in the digipeat field. The default callsign (PK-64) must be changed for proper operation, and there must not be more than one station with the this callsign (including SSID) on the air at one time. You may use different SSID numbers (see the GLOSSARY for a definition) to distinguish between stations with the same amateur call. For example, W7ABC-1,N7PKT-2,ZL2NYS-15 or WB7FHC-0 are all valid calls for packet stations. The extension: -0 is not required, the calls WB7FHC and WB7FHC-0 are considered the same. SSIDs may be from 0 to 15.

Calls must be entered in the CMD MODE from the PACKET SCREEN. Type: "MY" followed by a

space and your call, and then touch the large [RETURN] key.

Example 1: MY N7PKT [RETURN]
Example 2: MY K7ABC-2 [RETURN]

Related parameters: none

PACLEN 128
Maximum Packet Length

may be (0-255) representing the maximum length of the data portion of a packet.

The PK-64 will automatically transmit a packet when the number of bytes input for a packet reaches the length you specify. This value is used in both Converse and Transparent Modes.

NOTE: If you find that you are experiencing frequent "retries" you may improve the likelihood of a packet being received without error by reducing PACLEN. See the discussion under the MAXFRAME command as it relates to this problem and to maximizing file transfer speed.

Related parameters: MAXFRAME, AUTOCR-T

PACTIM AF 4
Packet Time

May be (0-15) representing units of 1/4 second
May be EVERY/AFTER

This parameter is used in Transparent Mode. It may also be used in Converse Mode if CPACTIME is ON.

If EVERY is specified, packets are automatically transmitted at intervals of PACTIM from when the first byte is input. If no data has been input, no packet will be transmitted.

If AFTER is specified, packets are automatically transmitted after a period of time equal to PACTIM has passed with no additional data being input to the PK-64 (for example, you stop typing). If no data has been input, no packet will be transmitted.

If PACLEN is reached while data is being input, a packet will be transmitted.

To specify EVERY touch [E] when PACTIM is highlighted in your Parameters MENU. To specify AFTER touch [A]. Input the number only, if you don't want to change EVERY/AFTER.

Related parameters: CPACTIME,PACLEN,AUTOCR-T

PASSALL OFF
Pass all Packets

Normally everytime a packet is received your PK-64 checks it using the FCS (CRC) to be sure that the data has been received correctly. Only those packets that pass this sophisticated test are displayed on your screen. It is possible, however to see packets even though they do not pass the test by setting the parameter PASSALL to ON. Because packets with errors are also displayed you may notice strange characters on the screen. You might use this capability to test a marginal path or some such application.

Related parameters: MONITOR,MONCON,MONREJ,MFROM,MTO

PRINTER 1
Printer type select

maybe (1 or 2)

Because there are so many different kinds of printers available for your computer, you may find that printing with the [F8] function key does not work. More than one printer routine is provided with the PK-64 in the hopes that you will find one that is compatible with your printer. A list of known compatable equipment is included in the Introduction chapter.

If you are having difficulty with your printer try switching from the default value of 1 to type 2. Although we have made an attempt to make the PK-64 compatable with most printers, sometimes changes are made by the other manufacturers that we could not anticipate.
Related parameters: PRNCMD

PRNCMD 0
Printer Command

values: 0-255

The value is the value you would use in a BASIC statement for "x":

```
OPEN 4,4,x
```

PRNCMD is a secondary command. For the Cardco A interface, the value could be 0 or 7. See your printer manual for more detail.

Related parameters: PRINTER

RESPTIME 12
Acknowledge packet delay time (0-255)

This command sets a minimum delay that is imposed on acknowledgement packets. The delay May run concurrently with the default wait set by DWAIT.

The delay (in units of 1/10 sec) can be used to increase throughput during file transfers when you have usually set MAXFRAME and PACLEN to larger numbers to maximize speed. If the PK-64 doesn't have a packet ready in time, transmission will stop temporarily. The acknowledgement from earlier frames will start, and the final packet of the series may be sent and will collide with it. If the receiving station sets RESPTIME to a longer value, its acknowledge will be held off to prevent this problem.

related parameters:MAXFRAME,PACLEN

RETRY 10
Retry count

May be (0-15) representing number of tries

Retry count determines the number of times the PK-64 will attempt to send an unacknowledged frame before timing out and disconnecting your station. It also specifies the number of times it will send a connect (SABM) frame to connect to a station for you. If a retry count of 0 is specified, the PK-64 will try continuously until you initiate a disconnect yourself. In any event, a message is displayed, showing that you exceeded RETRY and were disconnected.

Note: A high retry count may be needed if there is a lot of activity on your frequency. If you find that the retry count is being exceeded and you are disconnected often, consider changes to MAXFRAME and/or PACLEN. It may also be

possible to make your connection through an alternate path using one or more digipeaters.

Related parameters: MAXFRAME,PACLEN

SQUELCH NEG
Squelch type

Toggles: NEG/POS

Normally the PK-64 CSMA (carrier sense multiple access) system senses the audio packet mark/space tones coming from the transceiver in order to know when the channel is clear and it may transmit. CSMA might more appropriately be called TSMA in this mode. In the event there are other signals beside packet on the channel (e.g. voice), you may find that the PK-64 is not as polite as it normally is and will double with the signal. To provide for true RF carrier CSMA, the PK-64 optionally allows you to run a line from the tranceiver's squelch circuit. This line may be easily connected to the "busy" light on the receiver's display panel or other locations that indicate when an RF signal is present on the frequency. Because the signal in the transceiver may be active-low or active-high (depending on the transceiver) you may set your PK-64 to conform. If you find that when you hook up the squelch line to the PK-64 it no longer transmits, change this parameter. If you are not using the SQUELCH input, keep the command at NEG. QRL appears on the status panel of the Packet screen if you are a) set to POS and have no connection to pin 3 of the TO RADIO jack on the back of the PK-64 or have one and the line is being held positive by the transceiver or if b) you are set to NEG and a line is connected and is being held low. Appropriate voltage levels to drive the pin are 0 and +5 volts (low and high, neg and pos).

If you are operating fullduplex, you will have input at the same time you have output to/from the radio.

Related parameters: FULLDUP

TRANSPARENT

This direct command is described in the Packet Screen chapter.

TXDELAY 4
Transmitter delay

may be (1-16) representing units of 40 ms.

TXDELAY tells the PK-64 how long after PTT to send flag characters before switching to data. Null tones may be recognized on the air as a uniform buzz at the beginning of the packet. Different transmitters require different amounts of start time to put a signal on the air and stabalize the frequency. In general, crystal rigs with diode antenna switching need only a little time, synthesized rigs need time for PLL lockup, and radios with mechanical relays need more time. The correct value for your equipment should be determined by experimentation. To increase throughput, it should be set as low as possible, but still allow for consistant flow of data. If you are having trouble being printed by another station, set TXD to 16 for the moment to rule out a short setting as the problem. In general, set TXD for the slowest station in the network.

Related parameters: AXDELAY

UNPROTO CQ
Unprotocol transmission paths

When in Converse or Transparent Mode it is useful to send packets even though you are not connected to another station (meaning your packet will print on his screen but will not elicit an acknowledge packet. It is entirely analogous to a QST voice "broadcast" where no one replies to you. UNPROTO packets are sent as unsequenced I frames. The TO and DIGIPEAT fields of the frame may be specified. UNPROTO is handy for round-table type QSOs or for situations where the full round-trip required of a connected packet and its

acknowledge packet leave too large a time window for a possible "hit" by some interference.

It is possible to route these UNPROTO packets through one or more digipeaters for wider area coverage if you wish. UNPROTO is set in the CMD MODE while at the PACKET SCREEN. Type: U CQ VIA <CALLSIGN> [RETURN] where <CALLSIGN> is the call sign of the station you wish to use as a digipeater.

Examples: U SEZ VIA WN7ANK-5
U QST VIA N7BTI,WN7ANK-5
U SAYS VIA W7AEA
U N7BTI

The first example will cause a packet (if sent from the DISCONNECTED and CONVERSE modes and including a "hello" typed on-screen before sending the packet) that will show up on the screen of a monitoring station as:

MYCALL>SEZ:hello

The SEZ may be used in the TO field of the packet instead of the alternative of an actual call as you are addressing no one in particular. You may use any call or word which meets the 6 character criteria stated in the MYCALL parameter.

The fourth example would monitor as:

MYCALL>N7BTI:hello

and could be used to allow only packets addressed to N7BTI to show up on the screens of a round-table net. The net members would all set UNPROTO as described and would set MFROM to NONE and MTO to N7BTI. They would be unbothered by any other packets printing onscreen.

UNPROTO, since there are no acknowledgements and therefore no retries, counts on getting the data to the other screen on the first try. If you wish to send the same information over again UNPROTO, you may send it more easily from a message buffer where you have it stored. Some data or packets may be lost. It is not as robust a mode as CONNECTED.

UNPROTO also specifies the path that your beacons will take if you have directed the PK-64 to send them.

Related parameters: BEACON,BTEXT

WRAP ON
Word Wrap

Toggles: ON/OFF

ON: Word wrap enabled

OFF: Word wrap disabled

If WRAP is ON, a new line is started if there is a space in the last five character positions on a line. This parameter prevents words being split between lines.

Related parameters: none

XMITOK ON
Okay to Transmit

Toggles: ON/OFF

ON: Transmitter enabled

OFF: Transmitter disabled

If XMITOK is ON, your PK-64 will behave normally. It can key your transmitter through the cable and the 5 pin inline connector. If, however, XMITOK is OFF the PTT line will not be activated and your transmitter can not be keyed by the PK-64. All other functions of the PK-64 remain the same.

Related parameters: CONMAX

MORSE, BAUDOT, ASCII, AND AMTOR PARAMETERS

The following parameters are not used in Packet, but have uses in Morse, Baudot, ASCII, and AMTOR. They are described in the chapter titled MORSE BAUDOT ASCII AND AMTOR OPERATION.

AUTO-CR:

AUTO-LF:

ARQTMO:

SELCAL:

USOS:

WIDESHIFT:

WORDOUT:

XMITREV:

SECOND PARAMETER SCREEN

This screen is reached by pressing [f5] from the first parameter screen. It contains status and message information only. No commands or parameter changes may be made from this screen. There is no movable cursor on this screen. The screen looks like:

```
                                                00-JAN-00 00:00:00
BTEXT: AEA PK-64 Answering System Active. !M!
CTEXT: AEA PK-64 Auto-Answer - - !M! Please le
ave message, then disconnect.!M!
0 DISCONNECTED

UNPROTO: CQ
MON FROM: ALL
MON TO: NONE
```

NOTE:the !M! designation indicates a reverse-video presentation and is a CTRL-M.

The first line contains the date and time and is set from the TIME choice on the Opening Menu. The second and third lines show the current text of the BTEXT,CTEXT messages. These are entered from the main packet screen. Note that you may imbed carriage returns as above. The "0 DISCONNECTED" line shows the connect and path status of all active channels in the multiple connect system. See the section on Multiple Connections in the chapter called The Packet Screen. The last three lines show the current status of those three parameters. They may all be changed from the packet screen - see the command descriptions.

You may exit this screen only to the main packet screen; use [f5] to do so.

When you are in either of the parameter screens, your station will behave as it would were you in the packet screen - that is, whatever activity your station is carrying out (calling, receiving, storing to buffer, etc) will continue; the only thing different is that you will not see text that is received during your abscence from the packet screen (unless you were storing it and will view it later from the QSO buffer).

CHAPTER 8

MODEL HFM-64 ENHANCED HIGH FREQUENCY MODEM OPERATION

WHERE YOU CAN OPERATE WITH OR WITHOUT THE HFM-64

Operation with the PK-64 alone (without the piggyback HFM-64 High Frequency Modem board) will give entirely satisfactory results on VHF or UHF FM where you wish to run RTTY or Packet.

You will be able to run RTTY (Baudot or ASCII), CW, and AMTOR without the HFM-64 on HF with reasonable performance. We strongly recommend the use of the HFM-64 on HF. The PK-64, without the HFM-64 installed, uses a Phase Locked Loop (PLL) demodulator which is more prone to lock-up on spurious signals than the modulator in the HFM-64. The PLL demodulator is the approach used in most of the packet TNCs in the marketplace now, and is the demodulator in the AEA PKT-1.

THE MODEL HFM-64 HF MODEM

Congratulations on your purchase of the HFM-64. This accessory for the PK-64 will allow you to operate CW and will greatly enhance operation on the HF bands in other modes.

The HFM-64 contains separate 4-pole bandpass filters for mark and space tones. It contains an AM demodulator with an automatic threshold detector and true Data Carrier Detect (DCD) output to the PK-64. The filters are set for 200 Hz shift at 2110 and 2310 Hz, suitable for HF RTTY, AMTOR, and Packet. It also contains a 10 segment LED bar-graph tuning display which allows about 25 Hz tuning resolution. A THRESHOLD control on the front panel is used to set the demodulator threshold such that extraneous characters do not print. Installation may be done by the customer by opening the PK-64 case, removing the front panel hole-plug, cutting two jumpers on the PK-64 board, placing the HFM-64 board in place, installing two screws to hold it, and plugging in both ends of a short supplied cable to connect the two boards. Calibration steps are not necessary; the HFM-64 is precalibrated at the factory. However you will need to follow the instructions in the CALIBRATION chapter and reset the PK-64 1600/1800 HF transmit tones to 2110/2310.

INSTALLATION

To install the HFM-64 board, open the PK-64 cabinet by undoing the 5 sheet metal screws. Remove the hole plug from the PK-64 front panel. Check that two hexagonal aluminum standoffs are installed on the PK board. If not, remove the PK-64 board from the case by undoing the aluminum screws holding it down (4 places) and installing the two 5/8" standoffs provided using the screw holes located on the PK-64 board about 2 1/4 inches back from the front edge of the board.

Cut two jumpers on the PK-64 board (JP-4 and JP-5). These were necessary to allow the PK-64 to operate without the HFM-64.

Position the HFM-64 board with the component side up such that the pot bushing is through the PK-64 front panel hole provided for it. Position the backing nut on the pot bushing so that it is against the back side of the front panel when the two HFM-64 board mounting holes are located in line with the previously installed standoffs. Secure the board with the two screws provided.

Install the short grey ribbon cable. Be very careful to avoid bending under the plug pins when inserting the plugs. One end of the cable plugs into J6 on the PK-64 board and is oriented so that the cable exits the plug towards the outside edge of the PK-64 board. Dress the cable so it is bent back over the J6 plug you just installed and the other end is in the vicinity of J1 on the -64 board. Now bend the cable close to the free-end plug so the plug is underneath the cable with the pins pointing down. Plug this plug into J1 on the HFM-64 board. If you have installed the cable correctly, the cable will exit J6 and head towards the right hand outside edge of the PK-64 board. It will then bend up and head back to the left towards the J1 plug. As it gets to the J1 location, it will pass over J1 and then bend under and enter the J1 plug from the left hand outside edge of the PK-64.

Install the provided lockwasher and nut over the pot bushing. Before tightening, check again that the backing nut on the pot bushing has been run up to where it is snug against the back of the PK-64 panel. Install the knob on the pot shaft - with the shaft CCW, the index will be at the "H" in THRESHOLD.

Now proceed to the CALIBRATION chapter and re-set the 1600/1800 Hz outbound AFSK tones to 2110/2310. Use the proceedure involving R24 and R28.

HF OPERATION

The HFM-64 allows you to operate on HF with very good sensititvity on Morse, RTTY Baudot and RTTY ASCII, AMTOR, and Packet.

To enable the HFM-64 board, proceed from the Main Menu to the mode you wish to operate. For example, press <P> to get to Packet operation. Then press <f5> to get to the Options screen. Move the cursor down the first column until you get to BAND. Press <RETURN> to toggle operation to [HF] from [VHF]. You should see the front panel DCD light turn on if the THRESHOLD control was fully CW. Return to the Packet screen using the <RUN/STOP> key.

The BAND parameter is used for packet; for all other modes use the WIDESHIFT parameter in the third column.

THRESHOLD CONTROL

Now rotate the <THRESHOLD> front panel control counterclockwise to just blank the <DCD> front panel light in the presence of radio noise. Under normal conditions, and with proper adjustment of the radio tuning knob, the DCD light should come on solidly in the presence of signal.

When you switch back to VHF operation using the [BAND] toggle on the Options Screen, PLEASE DO NOT FORGET TO ROTATE THE THRESHOLD CONTROL BACK AGAIN TO ITS FULL CLOCKWISE POSITION. The VHF signal will not cause the DCD light to light unless you do.

TUNING PACKET STATIONS

To tune an average HF packet signal, you may use your radio RTTY, LSB or USB operating mode. You may want to use the radio IF SHIFT control to knock out any lower audio frequency signal components leaving just the 2110/2310 frequencies. Tune using the criteria outlined in the Tuning Indicator section. Use as little audio signal as possible consistant with being able to hear the signal in the speaker, and to keep a solid DCD light on during the presence of the packet burst. Tuning will be tricky, as you must tune while the packet is present or tune after it has gone, and wait for the next packet in order to see if you tuned correctly.

Signals which sound mushy due to path distortion are going to be difficult to impossible to tune.

There are many Bulletin Board systems on HF and they usually are all beaconing. Also many of them are on slightly different frequencies due to radio drift. And many amateurs like to play the "BBS DX" game - a distant BBS takes several hops to get to and the connection, if acheived, isn't sustainable. Clogging the frequency is NOT good amateur practice - don't be guilty of it.

As of this printing, packet may be received on VHF 145.01 MHz, and HF 14.103, 10.147, 7.097, and 3.607 MHz.

TUNING INDICATOR - PACKET RECEPTION

As you enable the HFM-64 as described above, you will notice with no signal, that there are one or two segments in the center that are lit. With a properly tuned packet station, when a packet is present that causes the DCD light to light, the lit portion will separate into two lit areas that will be centered on the bargraph display. Experiment with radio tuning - as you tune to one side or the other of the proper point, this centered display

will move to the left or right. If you continue to tune away from the proper point, the display will revert to the original condition where one or two center segments are lit.

The separation of the lit areas will increase with more volume from the radio up to a point. As you increase the volume of the signal, you will also notice that the segments on the outside of the lit areas become brighter. These end segments correspond to the mark amd space tones coming from the radio (2110 and 2310 Hz).

It may be instructive for you to turn on the marker/calibrator of the radio and tune it. There is now only one tone involved instead of two as in a packet signal and you will see the lit segment move from center to one end as you approach the tone. It will then move through center to the other end, and from there back to center again as you lose the tone. When it was at the two ends it was at 2110 and 2310 Hz respectively. As it passed through center, it was halfway between the two frequencies (at 2210 Hz).

The on-screen tuning indicator in the Packet status window uses a vertical bar and horizontal bar to indicate the reception of mark and space. This indicator should flash with both if you have used the HFM-64 tuning indicator properly.

TUNING INDICATOR - OTHER MODES

To operate RTTY, ASCII, CW or AMTOR, refer to the chapter called MORSE, BAUDOT, ASCII, AMTOR OPERATION.

The directions for tuning (for other than Morse) will essentially be the same as those above for packet, as you are dealing again with an AFSK two-tone signal.

CW OPERATION

To operate CW, you will need to use your radio in the SSB mode as CW is generated as the upper AFSK tone (2310 Hz) and is fed to the radio through the MIC connector - the CW key input on you radio is unused. Appropos of the discussion above on tuning, you will see the 2310 Hz tone displayed as the left-ahnd bright bar on the tuning display. Tune for this display.

CHAPTER 9

CALIBRATION

CALIBRATION OF THE PK-64

AFSK GENERATOR CALIBRATION

1. With the Main Menu displayed, connect a scope to the end of R38 closest to the front panel.

2. Calibration of the transmit tone frequencies:

The transmitted tone frequencies may be read directly off the screen, as there is a counter contained in the software. Press "K" for KALIBRATE. Use the [f1] and [f3] keys to have the counter measure what you are adjusting. Adjust the indicated pot on the right side of the PK-64 board. You may want to mentally average the numerical readings as they jump around a bit; the transmitted frequencies are stable, the counter has a little jitter. Adjust within +,- 5 Hz.

Band	Tone	Adjust	Frequency
VHF	Mark	R30	1200 Hz
	Space	R26	2200
HF	Mark	R28	1600 *
	Space	R24	1800 *
HF	Mark	R28	2110 +
	Space	R24	2310 +

* without the HFM-64 installed
\+ with the HFM-64 installed

You may wish to transmit one of these single tones over the air to help another ham judge whether he is receiving both tones well. Or you may wish to measure FM deviation. The AFSK generator in the PK-64 runs at one of the two selected frequencies all the time; a tone is always present at the MIC pin of the MIC commector on your radio. Whether the tone is transmitted is determined by whether the PTT line is activated (grounded) by the PK-64. You may cause this tone to be transmitted by using a clip lead to ground the middle pin of JP-3 in the PK-64. You may temporarily remove the JP-3 jumper to allow easier access to the middle pin. Use the [f1] and [f3] keys to change between the two frequencies.

CALIBRATION OF THE PHASE LOCKED LOOP

1. Return to the Kalibrate screen from the Main Menu, and select VHF/SPACE. Adjust R26 for 1685 Hz.

2a. If the HFM-64 board IS installed, connect pins 1 and 2 of the "TO RADIO" connector together and set R35 fully CW. Adjust R42 so that the two center bars of the tuning display are lit.

2b. If the HFM-64 board IS NOT installed, connect the scope to the right end of R61 and adjust R42 so that transitions between 0 and +5 volts are observed. Alternatively, adjust to a position between the appearance of the vertical and horizontal bars in the Packet Screen status window.

3. Reset R26 for 2200 Hz.

SELF CHECK OF THE PK-64

To determine whether the PK-64 has a problem, please perform the following check and record the results prior to calling AEA for help.

1 - Remove the 5-pin "To Radio" connector from the back panel and use a jumper to connect pin 2 to pin 1.

2 - Set the AFSK level control (R35) to 2/3 CW rotation.

3 - Boot up the program by turning on the C-64 computer and entering SYS33333 in response to the "READY" prompt. Proceed to the Packet Screen, enter your callsign, and attempt a connect to yourself (c <URCALL>). You should see both the front panel PTT and DCD LEDs light, and the message "***CONNECTED:<URCALL><URCALL>" display on the front panel.

CALIBRATION OF THE HFM-64

Using an Oscilloscope:

1. Connect pins 1,2 of the "TO RADIO" connector together.
2. Set counter on the Kalibrate screen for HF/Mark measurement.
3. Remove JP1 and JP2 from the HFM-64 board.
4. Connect the scope to the rear pin of JP2.
5. Adjust R24 and R32 for peak amplitude.
6. Adjust amplitude with R35 on the PK-64 board to prevent clipping of the signal.
7. Move scope to rear pin of JP1.
8. Select HF/Space and adjust R6 and R14 for peak.
9. Use R35 if necessary to prevent clipping.
10. Remove scope and install jumpers on JP1, JP2.

Without the Oscilloscope:

1. Connect pins 1,2 of the "TO RADIO" connector together.
2. Set Kalibrate screen for HF/Mark measurement.
3. Remove jumpers from JP1, JP2.
4. Adjust R35 on the PK-64 board so the second and third bars from the left end of the tuning indicator are lit. If this is not presently possible, set R35 to midrange.
5. Adjust R24 and R32 for maximum leftward deflection. It may be necessary to reduce the input level by adjusting R35.
6. Now set R35 so that the second and third bars are lit.
7. Readjust R24 and R32 on the HFM-64 board for a maximum on the second bar. The third bar may go out.
8. Repeat this process on the space tone using R6 and R14 and adjust for maximum deflection to the right, using the second and third bars from the right end.
9. Replace the jumpers on JP1 and JP2.

CHAPTER 10

MORSE, BAUDOT, ASCII, AMTOR OPERATION

Aside from Packet operation, the Morse, Baudot, ASCII and AMTOR modes are very similar to the well-known AEA software package for the Commodore C-64 and VIC-20 computers called MBA-TOR.

Much of the PK-64 operation in these "extra" modes is covered in the preceding chapters dealing primarily with Packet operations. For example, the message and text editing is all done the same for all modes. Also, the printer, disk, and cassette operations are all essentially the same, with some of the exceptions noted in this chapter.

The purpose of this chapter is to familarize the operator with those operating practices that are different from Packet. Remember that if something does not make perfect sense, do not be afraid to put your receiver into a low power position, connect to a dummy load and start experimenting!

SPECIAL PARAMETER OPTIONS

The special parameter options for Morse, Baudot, ASCII, and AMTOR operation are found in the third column of the main parameter menu (which is accessed by entering the Packet screen and pressing [F5]). The third column appears as follows:

```
RTTY:
AUTO-CR      ON
AUTO-LF      ON
ARQTMO       45
SELCALL
USOS         ON
WIDESHFT     OFF
WORDOUT      ON
XMITREV      OFF
```

```
AUTO-CR      ON
AUTOMATIC CARRIAGE RETURN
TOGGLE       ON/OFF WITH <RETURN>
```

When transmitting Baudot or ASCII RTTY, if this option is toggled "ON", a carriage return (C/R) character is automatically sent at the first space after 65 characters, or after 71 characters. After the carriage return is sent, the character counter starts at 0 again. Use this option when you are hand-typing text into the transmit buffer and do not want the bother of watching the screen to see when you come to the end of a line.

There are several cases in which you should not use this option:

When retransmitting text received from another station: for example, ARRL RTTY bulletins. The received text will already contain the needed carriage return characters. If this option is enabled, your transmission will have double, or perhaps even triple line feeds and look very strange at the distant station. Many stations using the older electromechanical teleprinter and Teletype machines habitually send a traditional line-ending sequence consisting of CR CR LF LTRS, which was needed to allow the old, slow machines to return to the left margin. The double "CR" routine will produce a double line feed if this option is selected "ON".

```
AUTO-LF      ON
AUTOMATIC LINE FEED
TOGGLES ON/OFF
```

When transmitting Baudot or ASCII RTTY, if this option is toggled to the "ON" state, a line feed character is automatically sent after a "RETURN" keystroke. Use this option when you are hand-typing text into the transmit buffer and do not want the bother of watching

the screen to see when you come to the end of a line. The same restrictions apply to this option as to the automatic carriage return option described above.

This option has no effect in AMTOR; a line feed is automatically sent after every carriage return.

If AUTO-LF is toggled OFF, the operator can send LF characters by pressing the [CRS R] cursor key or a CTRL-J (press J while holding the control key down at the same time).

In addition, the [CRSR] cursor key will generate the LTRS character which is useful for MARS and other traffic handling operations. CTRL-N will gerate the FIGS (figures) character and CTRL-M will generate a carriage return with NO line feed.

ARQTMO 45
ARQ TIMEOUT
RANGE: 01 TO 99 SECONDS

This option permits you to set the automatic timeout in AMTOR mode. The "timeout" refers to the length of time or number of seconds that the program will continue to process a data stream containing errors, phasing signals, and requests for repeats.

When the "timeout" period expires, the program will stop trying to reacquire synchronization with the distant station and will then revert to AMTOR standby. The timeout is set by default to 45 seconds when the program is intialized. You can enter any two-digit number between 01 and 99.

SELCALL

AMTOR operating modes require a SELCALL (selective sequential calling) code. This unique character sequence must contain four alphabetic characters and is normally derived from your callsign.

The convention originated by the early European AMTOR pioneers, and later adopted by amateurs around the world, was broadly based on the then most-common "one-by-three" call signs, and used the first and the last three letters of the callsign. However, with the recent changes and expansions of the call sign systems in many countries, some comment and explanation may by in order here.

First, some of the call sign groupings now in use:

Group	Call	Selcall
1 by 2	W1XX	WWXX
1 by 3	W1XXX	WXXX
2 by 1	AA1X	AAAX
2 by 2	AA1XX	AAXX
2 by 3	KA1XXX	KXXX

For "1 by 2" call signs, the first letter is doubled, e.g., N7ML becomes NNML. For most cases this is acceptable; the SELCALL automatically generated after entering "my call" in the Packet screen would be fine.

However, if you become aware that a station in another call district or zone is also active on AMTOR and may be using the same SELCALL you can derive your own unique SELCALL by substituting a letter for your call district number. Use the letter corresponding to the call district number as it appears on the keys of a standard typewriter or Baudot RTTY keyboard.

Let's assume that your call sign is N7ML. You discover that there is another station with the call sign N?ML. Change your SELCALL to NUML, according to the following table:

1=Q	4=R	7=U	0=P
2=W	5=T	8=I	
3=E	6=Y	9=O	

To use this SELCALL option, enter your call sign from the Packet screen. Press F7 to be in the command mode and type SELCALL----<return>. (Type your four chosen letters where the four dashes appear). The letters will now appear beside the SELCALL in the options menu. Use of this unique SELCALL option will not affect your normal call sign entered earlier with the MY CALL command in Packet mode.

USOS ON
UNSHIFT ON SPACE
TOGGLES ON/OFF

Unshift-on-Space automatically changes the Baudot RTTY receive program to the LETTERS or "lower case" condition after the character "space" is received.

When operating Baudot RTTY under poor HF receiving conditions, a received LETTERS-SHIFT character can be garbled or another character can be wrongly interpreted as a FIGURES-SHIFT character. Many otherwise good characters received after this point would be interpreted as "upper case", as numbers and punctuations, rather than the lower-case letters typed by the originating station.

USOS helps reduce errors in reception in these conditions. However, be aware that some commercial, weather and utility RTTY services send consecutive groups of numbers separated by spaces. In these cases, the use of USOS will produce unacceptable results by returning the system to lower-case characters when the originator may have intended the data to be upper-case characters.

WIDESHFT OFF
WIDE SHIFT
TOGGLES ON/OFF

Selection of any of the Morse, Baudot, ASCII or AMTOR modes, will normally select the narrow shift PLL modem or the HFM option modem if it is installed. In the event you want to operate wide shift for VHF RTTY or ASCII, you can set WIDESHFT to ~~OFF~~ ON?.

WORDOUT ON
WORD OUTPUT MODE
TOGGLES ON/OFF

This option permits you to toggle between two different ways of outputting your hand-typed characters. The "WORD" option permits a limited form of editing of your typing errors.

1. If you select WORDOUT OFF (CHARACTER mode), each character you type will be transmitted immediately as you type it and as it is entered into the XMIT Buffer. Each character typed by you will appear in the lower screen area (the transmit buffer page), and at the same time, scroll from right to left across the "Times Square" transmitted output strip as it keys your transmitter.

2. If you select WORDOUT ON nothing will be transmitted until you type a "SPACE" character (space bar), a "RETURN", or any punctuation mark, including parentheses, plus sign, asterisk, etc. This gives you the opportunity to correct your spelling or even change words before the XMIT Buffer contents are transmitted (even though the transmit buffer has been emptied).

Use the LEFT ARROW key at the upper left-hand corner of your keyboard to backspace. This is a "destructive" backspace key, and will erase the characters from the screen and from the XMIT Buffer as well. The DEL key will also work as a destructive backspace key.

XMIT REV
TRANSMIT REVERSE
TOGGLES ON/OFF

Toggling this option ON reverses the normal MARK and SPACE tone frequencies in transmit modes other than Morse Code. This option can be useful in the event that you have to use USB mode on your transceiver.

FUNCTION KEYS IN MBA-TOR

On-the-air operation is controlled by the function keys marked "f1" through "f8" at the right side of the Commodore 64 keyboard.

Keys "f1", "f3", "f5", and "f7" are accessed directly by pressing the keys.

Keys "f2", "f4", "f6" and "f8" are accessed by holding down either one of the "SHIFT" keys, while pressing the desired function key.

The "CNTL-f1" command is operated by pressing and holding the "CTRL" key, while pressing the "f1" key.

f1 - RECEIVE

In the Morse, RTTY and ASCII modes, function key "f1" puts the program into the receive mode.

Each time "f1" is pressed, a carriage return and a line feed character are sent to the QSO Buffer and the printer, if these functions are enabled. Text can be typed into the XMIT Buffer while receiving, but that text will not be sent until function key "f3", the transmit key is pressed.

In the Morse receive mode, function key "f1" resets the CW receive algorithm by forcing the temporary receive speed to start again at the transmit speed.

In the Baudot RTTY and AMTOR receive modes, function key "f1" forces the text into LTRS (Baudot lower case) if the system is thrown into the FIGURES case by noise or other errors.

In the AMTOR mode, function key "f1" LOCKS the XMIT Buffer.

f2 - CLEAR QSO BUFFER

This key clears the QSO Buffer, returning it to its empty QBF setting.

f3 - TRANSMIT

In the Morse, Baudot and ASCII RTTY modes, function key "f3" puts the system into the transmit mode. Text previously entered and stored in the XMIT Buffer will be transmitted.

In the AMTOR mode, function key "f3" OPENS the XMIT Buffer, releasing characters if the system is in XMIT.

f4 - CLEAR TRANSMIT BUFFER

This key clears the XMIT Buffer, returning it to its empty XBF status.

f5 - CHANGE SPEED

In the Morse mode, the screen prompts you to "ENTER 2 DIGITS". The number you enter becomes the new transmit speed and replaces whatever value was previously displayed in the screen status panel.

The slowest available Morse speed is 5 words per minute. If you enter numbers lower than 5, the program will set in 5 words per minute.

For speeds from 5 to 14 words per minute, the transmitted code is sent in Farnsworth spacing; the characters are sent at 15 words per minute while the spaces between characters are lengthened to yield an overall code transmission rate of 5 to 14 words per minute.

In the Baudot RTTY mode, function key "f5" cycles the program through all of the available speed options: 60, 67, 75, 100, or 132 words per minute. The speed selected and shown on the screen status panel becomes the new transmit and receive speed.

NOTE: The term "words per minute" is no longer used in commercial telegraphy. All data rates or speeds are now generally specified by baud rates. The Baudot "WPM" speeds relate to modern terminology as follows:

Words per Minute	Baud Rate
60	45.45 bauds
67	50 bauds
75	56 bauds
100	74.28 bauds
132	100 bauds

In the ASCII RTTY mode, function key "f5" cycles the program through all of the available speed options: 100, 150 and 300 bauds.

f6 - INVERT

Function key "f6" reverses mark and space (stop and start) polarity in Baudot and ASCII RTTY and AMTOR reception. When "Invert" is active, the letter I appears in the first line of the screen status panel. Successive pressing of f6 toggles between Invert and Non-inverted operation. Character transmission polarity is not affected.

Set the "Invert" mode while in AMTOR mode to provide inversion for received AMTOR signals. To invert the transmitted tone polarities in the parameters option menu, toggle the XMIT REV function to ON.

f7 - SPEED LOCK/GUESS

In Morse Code, function key "f7" locks the system to the speed of the received signal. An asterisk (*) will appear next to the "RCVE" indicator in the status panel; for example, RCVE* 23 WPM. Reception of Morse Code in the presence of noise can be enchanced this way. To unlock the speed, press function key "f7" again.

In the Baudot and ASCII RTTY mode, function key "f7" causes the program to attempt to estimate the speed or data rate of the received signal. Identification of the speed of a signal by its sound alone is difficult. The computer's speed estimate will appear in the RCVE portion of the status panel in "BAUDS" for ASCII and in WPM (BAUDS in international versions of the Commodore 64) for Baudot RTTY. Press and hold the "f7" key, allowing it to repeat. Read the estimates and note the average value of the estimates. Ignore the fact that the characters are not being received properly on your screen. The program is concentrating all its attention on the speed estimate. This "Speed Lock/Guess" routine does not affect the transmit speed. Change your transmit speed if necessary with the "f5" function key.

In AMTOR, f7 causes immediate return to standby (receive).

f8 - TOGGLE PRINTER ON-OFF

Function key "f8" toggles your printer on and off.

When toggled "on", the printer prints characters while they are being stored in the QSO Buffer. If you have a printer connected, the letter "P" appears on the first line of the status panel.

QSO Buffer recording is also turned on automatically. The printer will print upper case only. Some printers will not copy in "real time", but only out of the QSO buffer. For those printers that do copy in real time, they will print only after their internal line buffer has been filled. Thus, you will not have to hear each character print as it is being received.

CONTROL-FUNCTION KEYS

The following routines are actually a combination of two key presses, in sequence. Press and hold the "CTRL" key and then press the indicated function key.

CTRL-F1- Toggle QSO Buffer Recording On/Off

CTRL-f1 toggles the QSO Buffer recording mode. Buffer recording is disabled at startup. When CTRL-f1 is pressed, the status panel shows an asterisk (*) next to the QBF display (*QBF). This indicates that the received data is being recorded and stored in the QSO Buffer.

Press CTRL-f1 again to disable QSO Buffer recording and delete the asterisk (*).

NOTE: Record only the traffic or data that you really need. You have the ability to record more than 20,000 characters (in the C-64). When many characters have been recorded, the "Edit" mode commands respond more slowly.

CTRL-f3- Break-in Buffer

Pressing the CTRL-f3 key switches the system into the transmit mode and provides a separate "break-in" buffer. The normal "XMIT" Buffer is bypassed for short, immediate or break-in transmissions. The contents of the other buffers in the system are not affected. Upon return to receive, the original text in the transmit buffer will reappear at the bottom of the screen.

CTRL-f5- Set CTRL-X Keyword

CTRL-f5 memorizes the call sign of the distant station as a "keyword" in a special "CTRL-X" or "CALLSIGN-X" buffer. The "CTRL-X" buffer can store up to 12 characters.

CTRL-f5 lets you set the contents of the CTRL-X buffer. If you imbed or insert a "CTRL-X" character in a message buffer or type "CTRL-X" in the "XMIT" buffer, you can send the distant station's call sign automatically. Use this function with a message buffer to avoid typing the other station's call each time you want to send it. This is useful,for example, at the beginning and end of each transmission cycle.

Assume that Message Buffer 01 contains:

"(CTRL-X) DE N7ML K"

You are working N6IA and you press "CTRL-f5". The XMIT buffer is now cleared temporarily, waiting for you to install a call sign.

Now type "N6IA" followed by a carriage return [RETURN]. Your original XMIT buffer is returned. If you press CTRL-1 [RETURN] and then function key "f3" to turn on your

transmitter, you will transmit:

"N6IA DE N7ML K"

Each time you type "CTRL-X" from now on, "N6IA" will be sent.

When you make you next contact, press "CTRL-f5" again to install a different call sign in the "CTRL-X" buffer.

CTRL-(0 THROUGH 9) Transmit Message Buffer (Number)

This combined keypress function is used to transmit previously stored contents of a message buffer or port, either as a stand-alone transmission, or inserted into a text that you are typing into the XMIT buffer. To load these buffers, enter the EDIT mode from the main menu.

CTRL-A and CTRL-B

See AMTOR operation below

CTRL-D- Return to AMTOR Standby

In the AMTOR Mode A (ARQ), this function when imbedded in transmit text, terminates the ARQ link and returns your system to AMTOR Standby. Your system is returned to the condition in which it can be accessed by the distant station's transmission of the SELCALL you have stored. For immediate return to standby, press the <f7> key.

In the AMTOR FEC Mode (Mode B), this function terminates your transmission.

This is the ASCII "EOT" (End of Transmission) character, ASCII value 4 ($04).

CTRL-E- Return to Receive Mode

You can insert this command in a pre-typed message in one of your message buffers or "XMIT" buffer. This avoids having to press the "f1" function key at the end of your transmission. In AMTOR, the CTRL-E locks the buffer, but does not stop transmission. See CTRL-D above.

CTRL-E is the ASCII "ENQ" (Enquiry or Request Answerback) character, ASCII value 5 ($05).

CTRL-J- Linefeed

The CTRL-J function is part of the C-64's "RETURN" key operation and is normally sent with a carriage return (see CTRL-M below).

You can insert "CTRL-J" in any text where you need an isolated linefeed function without an associated carriage return. This is known as an "index" function in word processing, and can be useful when formatting text files in your buffers.

This is the ASCII "LF" (Line Feed) character, ASCII value 10 ($0A).

CTRL-L- Baudot RTTY and AMTOR "LETTERS" Shift

The CTRL-L function sends a Baudot RTTY or AMTOR "Letters-Shift" (LTRS) character. The "LTRS" character is not shown on the XMIT line or in the QSO Buffer as having been sent.

In text transmission, the program sends the LTRS character for you automatically.

This is the ASCII "FF" (Form Feed) character, ASCII value 12 ($0C).

CTRL-M- Carriage Return

The CTRL-M function is part of the C-64's "RETURN" key operation and is normally transmitted together with a line feed.

You can insert "CTRL-M" in any text where you need an isolated carriage return function without an associated linefeed. This is also known as a "zero-index carriage return (ZICR)" function in word processing and can be useful when formatting text files in your message buffers.

This is the ASCII "CR" (Carriage Return) character, ASCII value 13 ($0D).

CTRL-N- Baudot RTTY and AMTOR " FIGURES" Shift

The CTRL-N function sends a Baudot RTTY or AMTOR "Figures-Shift" (FIGS) character. The " FIGS" character is not shown on the XMIT line or in the QSO Buffer as having been sent. In text transmission, the program sends the FIGS character for you automatically.

This is the ASCII "SO" (Shift Out) character, ASCII value 14 ($0E).

CTRL-U- Transmit File from Cassette or Disk

The CTRL-U function permits you to send files from tape or disk when operating in the Morse, Baudot and ASCII RTTY modes. The command has no effect in AMTOR or Packet. You can use this function while sending live, or imbed the control code in a pre-stored file.

You must insert CTRL-U before and after the file name. For example, a disk file named "TRAFFIC" would be embedded in the transmitted data as follows:

YOUR TEXT...[CTRL-U]D:TRAFFIC[CTRL-U]...MORE TEXT.....

Your system will automatically access the file from your disk drive and transmit the file directly without further action on your part. After the disk file has been transmitted, your text typing continues normally.

This is the ASCII "NAK" (Negative Acknowledgement) character, ASCII value 21 ($15).

CTRL-X- Send Contents of CTRL-X Buffer

The CTRL-X function transmits the contents of the CTRL-X buffer, in which you would generally store the distant station's callsign.

In the automatic AMTOR modes, the distant station's callsign is stored in the CTRL-X buffer automatically upon starting the QSO.

Use CTRL-f5 in the Morse, Baudot and ASCII RTTY and AMTOR (not Packet) modes to install the callsign or other desired data.

This is the ASCII "CAN" (Cancel) character, ASCII value 24 ($18).

CTRL-+ CTRL-Minus- AMTOR Clock Adjustment

The CTRL-+ and CTRL-Minus Sign (-) functions adjust the C-64's internal system clock for most effective AMTOR operation when required. In most cases, the accuracy of the computer's internal clock frequency is adequate. However, if needed, you can adjust the clock's frequency up to plus or minus 200 parts per million.

Indications that Adjustment is Required

Symptoms of period error are regular loss of phasing, as evidenced by re-phase cycles in the middle of ARQ contacts. This will occur in spite of strong signals and low QRM levels. Be sure it is not the fault of the other station before you become concerned.

Adjustment Method

1. Connect a period-averaging frequency counter (capable of averaging to 104 cycles) to pin "L" on the back of the edge card cable connector at the left rear of the Commodore 64.

2. Connect the counter's ground wire to pin "N"- the ground pin.

3. Set the counter trigger to respond on the signal's negative edge.

4. Set the PK-64 for normal AMTOR operation.

5. Press and hold the CTRL key while pressing the + or - keys (in AMTOR mode) to bring the period of the signal as close as possible to 1 millisecond.

6. Note the setting shown at the top of the AMTOR status panel for use each time you reboot the program. From now on you will not need the counter any more.

Effects

Because the ARQ mode allows 170 milliseconds for the signal to travel to the other station and back, increasing the transmit delay will reduce the maximum working distance.

At 300 kilometers per millisecond, the maximum range is 25,500 kilometers. Using some of that time in transmit delay leaves less time for the signal propagation. Thus, the maximum distance available is restricted- the signal cannot cover as much distance.

NOTE: These speed and distance restrictions do not apply in FEC mode.

The PK-64 normally allows 20 milliseconds from the time the push-to-talk (PTT) signal appears until the ARQ data begins flowing. To lengthen this delay, you can press <+> while at the same time holding down the <SHIFT> key. Each time you do so will increment the delay by 10 milliseconds. You may decrement the delay amount by 10 milliseconds each time you press <SHIFT> <MINUS>. The status panel will show 1 to 9 indicating a setting of 10 to 90 milliseconds.

TUNING INDICATORS

The standard PK-64, without the enhanced H.F. modem option, comes with a special on-screen tuning indicator that works in all modes. A special FM discriminator-style hardware tuning indicator comes with the enhanced H.F. modem option . This bar graph tuning indicator offers more precise tuning for H.F. applications.

The on-screen tuning indicator shows up as a square block when in the Morse Code mode and a signal is present. In all other modes a horizontal bar appears when a signal (tone) is present at the Mark filter frequency. A vertical bar appears when a signal is present at the Space filter frequency.

When tuning across a RTTY, AMTOR, or PACKET signal you will learn to tune in the middle of the extreme edges of the signal where the Mark or Space indications start to disappear. With practice, you will feel quite comfortable with the on-screen tuning indicator, though it is not as easy to use as the bar graph indicator that comes with the HFM-64 option.

The bar graph tuning indicator (part of the HFM-64 option) is enabled only when H.F. band operation is selected. When no signal is present (receive volume reduced to zero) there will be only one bar graph segment lit in the middle of the display. If all segments are lit at this point, you are probably in V.H.F. mode.

If you turn the receiver volume up and tune across a single carrier signal, you will be able to note how the bar graph display moves from left to right as the tone frequency is increased. In Morse operation, you simply tune a signal for a maximum left side deflection as the signal is present.

For all other modes, tune for even deflection to the right and left as you tune across a two tone signal. Do not overdrive the PK-64 with receiver audio, you should try to achieve about 2/3 deflection from center in both directions.

Be sure to adjust your receiver passband (or I.F. shift) tuning for maximum deflection after you have tuned the main frequency dial to the proper position. Then back off the audio gain one more time for 2/3 deflection.

THRESHOLD CONTROL OPERATION

Although the PK-64 is not recommended for Morse receive without the HFM-64 option, with practice you will find it is possible to get reasonable performance ON medium to slow speed Morse by tuning signals that are free of QRM and QRN using the on-screen tuning indicator and the DCD LED at the same time. Simply tune your receiver until the two indicators blink on and off in unison with the Morse signal. Be sure to back off on the volume level until the DCD is only lit when the Morse signal is present.

With the HFM-64 option active , you must adjust the threshold control clockwise until the DCD light just lights. Then back off (counter-clockwise) until the light just goes out. You are now adjusted for maximum sensitivity on all modes (except AMTOR ARQ). For more immunity to noise, but less sensitivity, back off even more in the counter-clockwise direction.

For AMTOR ARQ mode, turn the threshold control full clockwise (DCD fully lit).

MORSE CODE OPERATION

Morse Code operation requires no special explanation. All amateurs are familiar with CW operation; there are few differences between manual and automatic Morse operation. As a general rule, stronger CW signals will provide the lowest number of errors (error rate) in the automatic decoding of the received Morse text.

Computer hardware and software are not forgiving or tolerant of a "bad fist"! Trying to decode poorly sent Morse Code with any computer system is a function of the "GIGO" rule- Garbage In, Garbage Out! The most sophisticated computeers in the world will output garbled characters to the screen or printer when attempting to decipher CW in which the dot-dash lengths, intervals and ratios, inter-character and inter-word spacing are substantially wrong.

Do not expect your Commodore computer and the PK-64 (or any other computer-software combination) to produce miracle copy from bad fists!

NOTE: The PK-64 will operate on Morse as a transmitting keyboard without the enhanced HF modem option (HFM-64). However, the HFM-64 is required for Morse receive operation in the presence of QRM or QRN. Heavy QRN will make Morse Code difficult if not impossible for any computer to decode.

MORSE DISPLAY

The Morse receive mode screens are shown below. Only the status panel area will show information until incoming data characters are received.

```
MORSE                    DATE  00:00:00
XMIT 20 WPM              XBF 512
RCVE 20 WPM              QBF 20000
```

- "RCVE" is in inverse video to show that the system is in the receive mode;
- The mode, "MORSE", is shown in the upper left-hand corner;
- The time of day is shown at the upper right-hand corner, next to the date;
- "XMIT" (transmit) speed is shown as 20 WPM;
- "RCVE" (receive) speed is shown as 20 WPM;
- "XBF" shows the amount of transmit buffer space set aside;
- "QBF" shows the amount of QSO buffer space available;
- [] (reverse video block) Tuning indicator shows when signal is present

The receive and transmit speeds and buffer sizes are the "default" values assigned automatically by the program.

The Morse transmit mode screens for both computers are shown below as they appear after pressing any of the keys on the keyboard, other than f3.

```
MORSE  20 WPM            DATE  00:00:00
XMIT   20 WPM            XBF 512
RCVE   20 WPM            QBF 20000

12 LINES OF RECEIVED TEXT

1 LINE OF TEXT BEING TRANSMITTED

5 LINES OF TEXT TO BE TRANSMITTED
```

Notice the changes in the display:

- "RCVE" is still in inverse video to show that the system is still in the receive mode;
- Horizontal lines have appeared on the screen, dividing the area under the status line in three parts;
- The upper area shows the received characters as they will be stored in the QSO buffer;
- The middle area consists of a single line "transmit action" strip that shows the transmitted characters as they are being transmitted. The strip scrolls the data from right to left;
- The bottom area consists of text showing the latest characters typed into the XMIT buffer, waiting to be transmitted.

As you type more characters into the buffer, the lowers area of the display will scroll up one line at a time.

Press function key f3 to begin transmission. Note the changes in the upper-left area of the status panel:

```
                COMMODORE 64

    MORSE                   DATE  00:00:00
    XMIT 20 WPM             XBF 512
    RCVE 20 WPM             QBF 20000

       12 LINES OF RECEIVED TEXT

       1 LINE OF TEXT BEING TRANSMITTED

       5 LINES OF TEXT TO BE TRANSMITTED
```

- "XMIT" changes to inverse video to show that the system is in the transmit mode;
- "RCVE" changes to normal display;
- The data characters typed into the XMIT buffer begin to scroll from right to left across the "transmit action" strip;
- Your transmitter will be keyed according to the characters you typed;

The "transmit action" strip will continue to display the outbound data characters as they are being transmitted. "XBF" will decrease with every character typed, and will increase with every character transmitted.

When the "f1" function key is pressed to return the system to the receive mode, the screen splits will continue in effect. To cancel the split-screen format, press the "RUN/STOP key and select the operating mode again.

For further explanations of Morse operation, see the preceding section of this chapter covering all the applicable control functions.

SPECIAL MORSE CHARACTERS

The PK-64 program provides easy, efficient keyboard-generated Morse operation. The program contains a series of dedicated special keystrokes that you can use to make transmission easier, faster and more enjoyable.

The most frequently used Morse "prosigns" are coded into the keyboard with keys that have no direct representation in standard Morse. These special "reserved" keys are listed below:

Keystroke	Abbreviation	Meaning
+	SK	End of QSO
@	AS	Wait
*	AR	End of Message
Up-Arrow	KN	Go only
=	BT	Break or pause
Pound sign	AA	New line
!	SN	Understand
%	KA	Attention

TRANSMIT MODE DISPLAYS

When you first enter the Morse, RTTY, ASCII and AMTOR transmit modes, before any keys are pressed, the screen displays are identical to the receive mode displays.

When you press function key f3, the "return" key, the space bar, or any letter, number or other character key, the screen splits into three sections. The upper part of the screen continues as a status panel. F3 puts you in transmit condition for either mode.

f1 or CTRL-E will return you to receive condition in either mode.

BAUDOT RTTY OPERATION

The Baudot or Murray Code, also known as International Telegraph Alphabet Number 2, is a five-bit asynchronous text transmission code used for text or message transmission, when the user does not need the more sophisticated character set found in ASCII. The Baudot/Murray code is the RTTY code most widely used in the amateur radio service.

The PK-64 provides RTTY operation in the Baudot/Murray code at 45, 50, 57, 75 and 100 bauds, corresponding to approximately 60, 67, 75, 100 and 132 words per minute (WPM).

BAUDOT RTTY DISPLAY

```
RTTY              +    DATE 00:00:00
XMIT  60 WPM             XBF 512
RCVE  60 WPM             QBF 20000
```

ASCII RTTY OPERATION

The ASCII (American Standard Code for Information Interchange) code is also known as International Telegraph Alphabet Number 5. ASCII is a seven-bit asynchronous transmission code used to send text or data traffic that requires a more complete character set than that provided by the older, less-sophisticated Baudot code.

The PK-64 provides RTTY operation in the ASCII code at 110, 150 and 300 bauds, corresponding to approximately 1001, 150 and 300 words per minute (WPM).

ASCII RTTY DISPLAY

```
ASCII             +   DATE 00:00:00
XMIT 110 BAUD             XBF 512
RCVE 110 BAUD             QBF 20000
```

BAUDOT AND ASCII RTTY MAILDROPS

One of the most interesting forms of Baudot and ASCII RTTY available to day with computer-based systems is the RTTY Maildrop.

A "maildrop" is a limited form of the "electronic mailbox" system. The PK-64 provides software routines that equip you with a unique form of RTTY maildrop in the Baudot and ASCII codes.

To use the RTTY"maildrop" function, set up a WRU (Who aRe yoU) keyword and its response in Message buffer 7. Each time the program receives "(YOURCALL) DE", your system can reply with a personalized message such as:

"DE (YOURCALL) AUTO 0142 UTC- PLEASE TURN ON MY PRINTER BY SENDING PRINTERON AND TURN IT OFF BY SENDING PRINTEROFF KKK"

NOTE: Do not type parentheses- they are shown here for clarity only!

Set this up by typing the following text into Message Buffer 7:

+YOURCALL DE+ DE (YOURCALL) AUTO (CTRL-T) UTC-PLEASE TURN ON MY PRINTER BY SENDING PRINTERON AND TURN IT OFF BY SENDING PRINTEROFF KKK (CTRL-E)

The "+" signs are required by the program to distinguish the contents from some ordinary message, and to separate the keyword from the response.

If you want to use Message Buffer 7 for a normal message, such as a "brag tape", omit the "+" signs.

The CTRL-E at the end of the "WRU" response is necessary to switch from XMIT to RCVE (see CTRL-E below); if you leave it out, the WRU keyword will not work.

The rest of the maildrop function is installed by setting up keywords to turn your printer on and off. These keywords are set up in Message Buffer 8, as follows:

+PRINTERON+PRINTEROFF+

Again, the + signs are necessary as delimiters and to distinguish the keywords from a normal message in Message Buffer 8. QSO recording must be kept ON (*QBF) in order for the printer on/off keywords to operate properly.

Use your own keywords for the WRU, printer-on and printer-off keywords. Each keyword may be from 1 to 12 characters long.

AMTOR OPERATION

AMTOR an adaptation of the internationally-standardized SITOR system, uses a unique seven-bit synchronous text transmission code which provides built-in error-detection and error-correction capabilities. AMTOR has been widely used overseas since 1977 and is growing rapidly among US amateurs who wish to obtain almost error-free RTTY under the worst-case conditions typically found in HF radio.

The PK-64 provides CCIR-compatible AMTOR ARQ and FEC operation. Although the AMTOR Mode A (ARQ) operating system imposes more exacting switching speed requirements than the older operating modes, most radios will operate in either AMTOR mode without any modifications.

NOTE: AMTOR Mode B (FEC) operation is similar to conventional RTTY; the transmitter operates continuously without the on-off switching characteristic of AMTOR Mode A (ARQ).

SWITCHING TIME CONSIDERATIONS

For proper AMTOR MODE A (ARQ) operation, the transmitter-receiver combination, or transceiver, must be able to change between transmit and receive within 20 milliseconds. Most semiconductor-based radios can easily meet this specification. In fact, many older tube-type radios with electromechanical relays operate very well in AMTOR Mode A (ARQ)!

If the changeover from transmit to receive is too long, the minimum working distance will be extended; the signal to the distant station will arrive before the station has switched back to receive. However, if the transmitting station is further away, the transmission

time over the propagation path will delay the arrival of the signal until after the station has switched to receive.

If the receiving station's changeover from transmit to receive is too slow, the transmitting station delay between "PTT" and "data send" can be extended. See: Shift Plus, Shift Minus above for detailed instructions on adjusting the program's timing characteristics to attempt compensation for this effect.

POSSIBLE AREAS FOR PERFORMANCE IMPROVEMENT

Should modifications be needed in the radio, changes will usually be required in one or more of the following performance characteristics:

1. Faster AGC operating speeds;
2. Faster enabling of the push-to-talk line;
3. Improved power supply decoupling, especially in audio stages;
4. Reduction or elimination of ALC action;
5. Elimination of audio compression or other processing;
6. Elimination of VOX operation.

SUGGESTED TRIAL OPERATING TECHNIQUES

If you are having trouble synchronizing with another station in Mode A (ARQ), before deciding that your radio equipment needs modifications, try some of the following operating tips:

1. Attempt to work the distant station on Mode B (FEC) to establish that the other station's system is fully functional;

2. Do not use VOX control-use the PTT line from your interface

3. Turn off the AGC circuit-use the RF gain control to prevent receiver blocking on stronger signals;

4. Turn off all compression or other audio processing;

5. Keep the AFSK audio input level to the microphone circuit as low as possible-avoid overdriving the audio input stages;

6. Reduce excessive ALC action- Use more effective RF antenna loading to adjust output power levels;

Before considering any modifciations to your equipment, please contact AEA's Customer Service Department for a list of radio changes and for technical assistance over the phone.

SELECTED READING

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by J. Peter Martinez, G3PLX, QST Magazine, June 1981

"An Introduction to AMTOR"
by Paul Newland, AD7I, QST Magazine, July 183

"AMTOR-A Hands on Primer"
by Mike Lamb, N7ML, CQ Magazine, November 1983

"AMTOR How-To"
by J. Peter Martinez, G3PLX, with Norm Sternberg, W2JUP
73 Magazine, August 1984

AMTOR DISPLAYS, MODE B (FEC)

Some of these status panels and indicator codes are similar to the Morse, RTTY, and ASCII displays. The main differences are the AMTOR status and OPEN/LOCK displays. The AMTOR status always consists of two letters.

AMTOR system operators enjoy the benefits of being able to watch the processing of their signals and generally having a greater amount of detailed information available to them. Therefore, the screen displays in the AMTOR modes are necessarily more comprehensive and more complex.

The correct transmission mode for calling CQ and initiating a general or broadcast transmission is AMTOR Mode B (FEC, Forward Error Correction). For this reason, Mode B screens are shown first. Here are the displays as they appear before starting the Mode B transmission.

```
AMTOR                          +     DATE 00:00:00
RCVE S S                               XBF 512
LOCK                                   QBF 20000
```

- "RCVE" indicates that the system is in the "receive" state;

- The first "S" indicates "standby" mode;

- The second "S" indicates that the system is in the "standby" status

After pressing CTRL-B to begin a Mode B transmission, either for CQ or during an ongoing Mode B QSO, the transmitter will be turned on and invisible synchronous idle control characters will be transmitted in a continuous stream. The screens will split into the same three areas described earlier and further change as follows:

```
AMTOR                          DATE  00:00:00
XMIT B I                             XBF 458
LOCK                                 QBF 20000
```

HERE ARE THE CHARACTERS YOU HAVE TYPED INTO THE TRANSMIT BUFFER.

"XMIT" shows that t6he transmitter is on the air;

"B" indicates Mode B operation;

"I" indicates the "idle" condition of the data.

At this point, function key "f3" is pressed to "open" the transmit buffer and start the transmission of the actual data characters. The screen status panel area will change again and the data will now begin to scroll from right to left across the "transmit action" strip and appear as validated characters scrolling from left to right in the "received signal" upper-screen segment.

COMMODORE 64

```
AMTOR                    00:00:00
XMIT  B  T               XBF 1024
OPEN                     QBF 29419
```

HERE ARE THE CHARACTERS YOU HAVE TYPED INTO THE TRANSMIT BUFFER.

- "XMIT" shows that the transmitter is still on the air;

- "B" indicates Mode B operation;

- "T" indicates "traffic"; data is flowing.

Let's look at the difference between RCVE/XMIT and OPEN/LOCK.

In the Baudot and ASCII RTTY modes, when we are in RCVE, no characters are sent from the XMIT Buffer. When we are in XMIT, characters are sent from the buffer and are seen on the XMIT line as they are sent.

In the AMTOR mode, the XMIT buffer is isolated from the transmitter. The "RCVE/XMIT" function, (who is sending data and who is receiving data) is controlled automatically by typing the "+?" characters at the end of each transmission sequence, the AMTOR equivalent of "KKK" or "over to you".

The "PLUS-SIGN/QUESTION MARK" (+?) character sequence is a software command that affects the sending station and the receiving station.

These two characters make it possible for the XMIT buffer to be OPEN (releasing characters) in RCVE or XMIT. In XMIT the characters are sent; in RCVE the character transmission is held automatically until the "+?" sequence is received- then the stored characters are sent.

The XMIT buffer can also be LOCKed (no characters released) in RCVE or XMIT. The characters are held in any mode. You can compose messages in the XMIT buffer with full type-ahead editing capability.

As a general rule when operating AMTOR, use the "OPEN/LOCK" function to control your type-ahead capability. If you do not need type-ahead, use the "f3" function key to OPEN the XMIT buffer and leave it OPEN for the whole contact.

AMTOR DISPLAYS MODE A (ARQ)

Mode A (ARQ, Automatic Request for Repetition) is the transmission mode used to reply to another station's CQ call sent in Mode B (FEC), or after the initial contact has been established in Mode B.

Mode A presents additional, valuable data with which the system operator can observe the processing of the AMTOR protocols, watch the flow of the data, see the "good" or "bad" data, and accurately estimate the "throughput" rate. The operator can evaluate the relative merit or acceptability of the path, the circuit link and band conditions.

Here are the screen status panels as they appear before starting the Mode A transmission.

```
AMTOR                    DATE    00:00:00
RCVE S S                         XBF 512
LOCK                             QBF 20000
```

- "RCVE" indicates that the system is in the "receive" state;
- The first "S" indicates that the system is in "standby" mode;
- The second "S" indicates that the system is in the "standby" status;

To answer a Mode B (FEC) CQ call from the distant station, start the AMTOR SELCALL (selective calling sequence) by pressing CTRL-A.

A solid block in inverse video will appear after the word "LOCK".

```
AMTOR                    DATE  00:00:00
RCVE S S                       XBF 512
LOCK [  ]                      QBF 20000
```

As you type in each letter of the distant station's SELCALL, the letters will appear to the right of "LOCK", each letter progressively clearing the inverse video. When the fourth letter (a valid SELCALL must have four characters)has been entered, the inverse video block will be gone and your transmitter will be keyed on and off in the typical ARQ three-character burst sequence. The system status line will change to show the transmitter active state and the keying progress.

```
AMTOR                    DATE  00:00:00
XMIT A P                       XBF 512
LOCK NNML                      QBF 20000
```

Your transmitter will continue keying on and off as it sends the ARQ-coded selective calling sequence carrying the distant station's SELCALL.

If your system does not achieve successful synchronization and lock with the distant station wihtin the time-out period, set in "timeout" in your "OPTIONS" menu. Your system will time out and stop keying. Your screen display will revert to the status shown in the beginning of this section.

If your system successfully synchronizes with the distant station, the screen display will change as follows:

```
AMTOR                          00:00:00
XMIT A I                       XBF 512
LOCK NNML                      QBF 20000
```

"XMIT A P", the phasing condition, has now changed to "XMIT A I "the synchronized idle-traffic condition.

Press function key "f3" to "OPEN" the transmit buffer. Your traffic will now begin to flow as you type characters.

"XMIT A I" will change to "XMIT A T" as characters are sent and validated by the distant station. These indications will change back and forth when you pause in your typing.

```
AMTOR                          00:00:00
XMIT A T                       XBF 512
OPEN NNML                      QBF 20000
```

Depending on the band conditions and the status of your link to the distant station, the "XMIT A T" and "XMIT A I" indications of a valid link may change as follows:

"XMIT A E" Your system has detected errors in the signals received from the distant station.

"XMIT A R" Your system has receivced a "request for repeat" code from the distant station.

SUMMARY OF AMTOR DISPLAY STATUS CODES

AMTOR status indications always consist of two letters. The first letter following "RCVE" or "XMIT" indicates the present mode:

S Standby, (system available for SELCALL access);
A Mode A, ARQ (Automatic Request for Correction);
B Mode B, FEC (Forward Error Correction);
L Mode L, ARQ Listen (monitor two linked stations);

The second letter following "RCVE" or "XMIT" indicates present link status:

S Standby state;
P Phasing (synchronizing try) in ARQ, ARQ Listen, or FEC;
T Traffic is flowing;
I Idle, no traffic flowing (times out after one minute);
C ARQ change over or close down;
R Request for repeat received from distant station;
E Data errors in signal received from distant station.

A BRIEF GLOSSARY

TOR	Teleprinting over radio
AMTOR	Amateur teleprinting over radio
ARQ	Automatic Request (Mode A)
FEC	Forward Error Correcting (Mode B)
RQ	Request for Repetition signal
SELCALL	SELective CALL
+?	The signal sent for "over" (also "?)
MASTER	Station that starts an ARQ contact by sending the SELCALL
SLAVE	Station that responds to the ARQ SELCALL

AMTOR CONTROL KEY FUNCTIONS

The following Control (CTRL) keys are used in AMTOR operation:

CTRL-A- Starting a Mode A (ARQ) Call

Type CTRL-A and obseve the appearance of a solid inverse-video block under the "RCVE" status. The program is waiting for you to type in the SELCALL of the distant station (four alphabetic characters, no numerals, no punctuations, no spaces!)

Type in the four characters of the station you wish to contact.

As soon as you type the last of the four characters of the distant station's SELCALL, your transmitter will begin keying on and off. Your system will be sending the other station's selective code mixed with certain control signals and attempting to acquire synchronization with the distant station, if the other station's system responds to the SELCALL. Your screen display will show ARQ status "A P" (AMTOR Mode A Phasing).

If a valid, synchronized link is established, contact is made and your system will be sending synchronous idle signals. The screen display will show "A I" (AMTOR Mode A Idle).

This "idle" signal is really a series of AMTOR control codes sent by your system under software control. Do not confuse these "idle" signals with "diddle" or "RTTY sync". The idle signals are required by your system and the distant system in order to achieve link synchronization.

THE MODE A (ARQ) CONVERSATION

You can now "OPEN" the XMIT buffer by pressing function key "f3" (see below) and begin sending your text to the distant station. Verify that you have a good link to the other station by typing a few carriage returns [RETURN] and observing the response on your screen.

It is a normal characteristic of Mode A (ARQ) systems that the characters you type into your XMIT buffer will not show on your screen until they have been validated as good data received by the distant station with whom you are linked. The delay between your typing and the appearance of your typed characters on the screen is a function of the quality of the radio link and indicates the state of the link quite accurately. The better the link between you and the distant station, the faster your typed characters will scroll across your screen.

If your typing does not appear on your screen, the distant station is not receiving valid data from you and the automatic error-detection and error-correction features of the AMTOR ARQ mode will now go into effect. Study the AMTOR status on the screen panels.

When you finish typing your comments or traffic to the other station and wish the distant station to transmit to you now, type a plus sign immedately followed by a question mark

(+?). This combination of "+?" is a software changeover command; it switches your system from the transmit mode to the receive mode and vice-versa at the distant end. The other station will receive the "+?" and now begin sending his remarks or traffic.

There is no need for either station to exchange the usual long-winded, wordy "multiple-repeat call signs and over-to-you" routines typical of conventional Baudot and ASCII RTTY operation. You do not need to type "KKK" at the end of your turn; the system does it all for you when you type the "+?".

You also do not need the extensive strings of your call sign and the other station's call sign repeated three or four times. Many countries now require station identification only at limited intervals (once every ten minutes in the USA). Generally, it is sufficient to begin your transmission with a simple "QRA N7ML" and end it with something brief like "BTU" for "back to you".

The whole point of AMTOR is to achieve the best, most efficient, most accurate transmission of text traffic and messages from one point to another. Many veteran AMTOR operators take a dim view of the "fancy screen doodles" and "poor-man's graphics" frequently seen on conventional Baudot and ASCII RTTY operations, such as names and locations surrounded by parentheses, apostrophes, quotation marks, slant bars, hyphens, dollar signs, etc. In some cases, when the AMTOR channels are busy, excess use of inappropriate operating technique can cause the sudden failure of the link with the distant station "disappearing" into the background noise.

At times, the sending of "fancy screen stuff" and other unnecessary transitions from LTRS to FIGS will result in funny things happening to the AMTOR protocols and the data being lost to those who cannot read a line of text inadvertently left in FIGS case.

ENDING THE MODE A (ARQ) CONVERSATION

When you are ready to end your Mode A (ARQ) contact and are finished sending your "final finals" to the distant station, break the link by ending your XMIT buffer text with CTRL-D or press f7 to go to standby immediately.

The link can also be broken by pressing the "RUN/STOP" key or typing CTRL-A. However, the distant station's system will keep on looking for your codes and continue transmitting, trying to maintain the link until it times out. This is considered tacky, poor operating practice and will not win you any popularity contests.

CTRL-B- STARTING A MODE B (FEC) CALL

Mode B (FEC) is the preferred, correct method of calling an AMTOR CQ. The use of Mode A (ARQ) for CQs is not only questionable, such operation gives the distant stations no clue as to who you are or what your SELCALL might be. To say the least, CQ in ARQ is not very productive.

Remember, you are using a transmission method that carries an effective built-in forward error correction protocol for the station receiving your CQ call. There is no need or justification for sending long CQ calls with many lines of repeated call signs over and over again. The error correction inherent in AMTOR Mode B eliminates the need for excessivley long CQ calls.

Type CTRL-B to begin a Mode B (FEC) transmission. Your transmitter will be keyed on continuously sending synchronous idle control characters.

IMPORTANT NOTE

> Wait a moment (three to five seconds) before sending your traffic or data. The distant station must receive several seconds of synchronous idle control characters with which to establish synchronization with your system. The distant station cannot sync to data characters. Do not start a Mode B transmission with "RYs" as you might do in Baudot or ASCII RTTY. The distant station will not be able to synchronize with the RY characters. The synchronous idle control signals are mark- to-space tone shifts and can be used for tuning by the distant station.

Until you "OPEN" the buffer, your typed data characters will not be transmitted.

Press the "f3" function key to OPEN the XMIT buffer and the system will start sending your typed characters.

To return to the receive mode, press either the "f1" function key (LOCK) or CTRL-D (STANDBY), or "f7".

Except for the short delay in starting before sending your traffic, in general you can operate AMTOR Mode B (FEC) using the same typing and receiving techniques as in CW or conventional Baudot and ASCII RTTY. Mode B (FEC) does not have interaction or handshaking between you station and the distant station.

CTRL-C - MODE A (ARQ) BREAK-IN OR INTERRUPTION

The CTRL-C command is used by the receiving station to interrupt the sending station's transmissions. This software command forces changeover from receive to transmit if needed to interrupt the distant station's sending. As the receiving station, you normally rely on the distant station to send the "+?" command to do the changeover, but in Mode A (ARQ), you can break the sending station's tranmission with CTRL-C.

CTRL-D - RETURN TO STANDBY

The CTRL-D command is used by the sending station to cancel ARQ, ARQ Listen, and FEC transmit. This is the preferred way to end an ARQ contact if you are the sending station. This control character may be placed in traffic or text stored in your message buffers or the XMIT buffer. Use f7 to return to standby immediately, regardless of how much of the XMIT buffer has been sent.

CTRL-F-ARQ LISTEN MODE

The CTRL-F command is used when you wish to monitor traffic flowing between two other stations linked in a ARQ contact. This command forces your system to attempt to synchronize with whichever of the other two stations is sending at the moment. There is no error detection or error correction in your system when you enter this mode.

"ARQ Listen" does not permit your system to take part in the synchronizing ARQ "handshake" between the other two stations locked to each other. If the other two stations are enjoying a good link, you will get good copy from that link. If the stations to which you are listening are exchanging error codes and RQ codes and repeating blocks of characters between themselves, you will generally display the repeated chartacter blocks. If they are experiencing link problems, the traffic on your screen can look vey strange indeed, although the two synchronized stations are getting error-free copy.

APPENDIX A

AEA PRODUCT SUPPORT AGREEMENT/LICENSE/WARRANTEE

You must sign this document and return it to AEA in order to initiate the product support agreement for the product described below. AEA will limit product software and/or hardware updates to those who have returned the warranty card and this product support agreement. AEA will ask you for the support number if you contact us for assistance and may ask to write or call you back at the address/phone you list below in order to verify your support eligibility. AEA will provide warranty support to the original purchaser only. If you wish to change your listed address or phone, AEA will need the request in writing, including a copy of this page and your signature for crosscheck purposes. AEA hopes to be better able to handle support request by limiting assistance to those who have purchased our product.

This AEA product is furnished to a user for use on a single processor only. The program or documentation may be modified or copied only with the inclusion of the AEA copyright notice, for use only by the purchaser on that CPU. The customer shall not provide, assign or make available the program or documentation to a third party without prior approval of AEA. Title to ownership of the product/documentation shall remain with AEA. AEA disclaims all implied warranties with regard to this product, including those of merchantability and fitness, and any stated express warranties are in lieu of all obligations or liabilities on the part of AEA for damages. The product is warranted to be in good working order for a period as stated in the sales literature from the period of original purchase from an authorized AEA dealer or AEA. Replaced parts and products become the property of AEA. The warrantee does not extend to a defect AEA determines is caused by improper maintenance or repair, misuse, neglect, improper installation, accidental or intentional damage. AEA is not responsible for damage to other equipment or property or incidental damage of any kind, whether based on contract, negligence, or strict liability. Maximum liability in any case shall not exceed the purchase price of the product. Some state laws do differ, so some of the above limitations may not apply to you. This warrantee gives specific legal rights. You may have other rights which vary from state to state.

Name_____ Date 11/12/85

Street_____ Phone_____

City_____State_____ Zip_____

Product PK-64 Purchase Date 11/08/85 (Date Shipped)

Purchased from EGE, Inc Suppt # SN 45217 Sec No 217

Signature: _____ For AEA by:_____

APPENDIX B

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"Understanding Data Communications" Texas Instuments Learning Center - sold by Radio Shack $3.95

ARRL Amateur Radio Computer Networking Conference, vols 1,2, October 16-17, 1981

Fourth ARRL Amateur Radio Computer Networking Conference, March 30 1985

"The Packet Radio Revolution", Dec 1978, pp 192-3, 73 Magazine, by VE2PY

"Bulletin Boards in Space",May 1984, John Markhoff, BYTE Magazine

"Packet Radio ", June, Aug, Oct, 1983 by WB9FLW, Micro Cornucopia magazine

GATEWAY, an ARRL publication devoted to packet radio. Available from the ARRL, Newington CT - biweekly

"Packet Radio Combines Computer, RF Technologies", by John Gates, N7BTI. Mobile Radio Technology magazine, Aug and Sept 1985

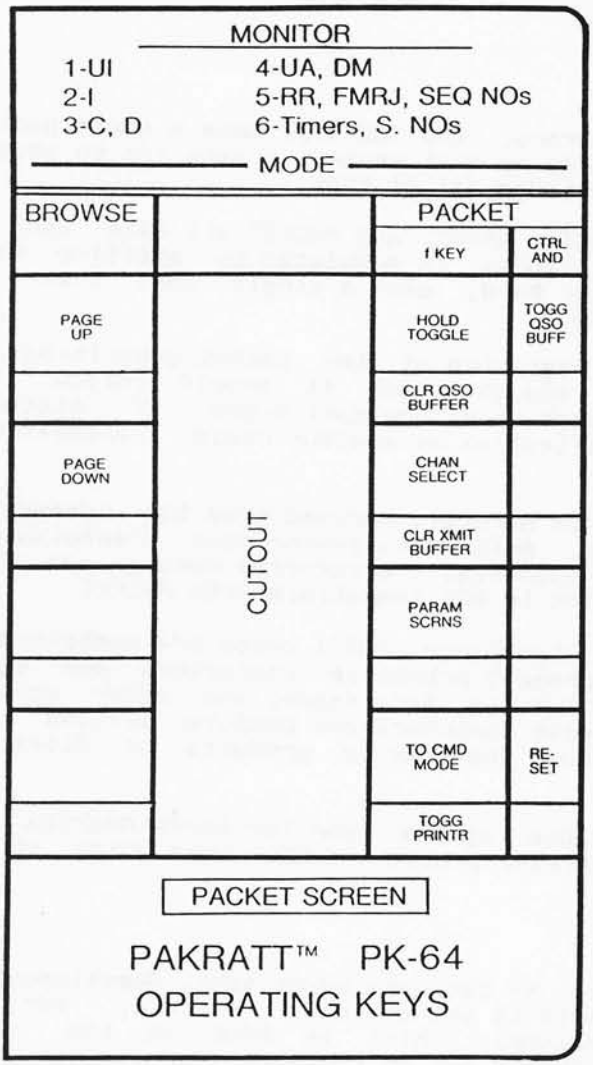
APPENDIX C

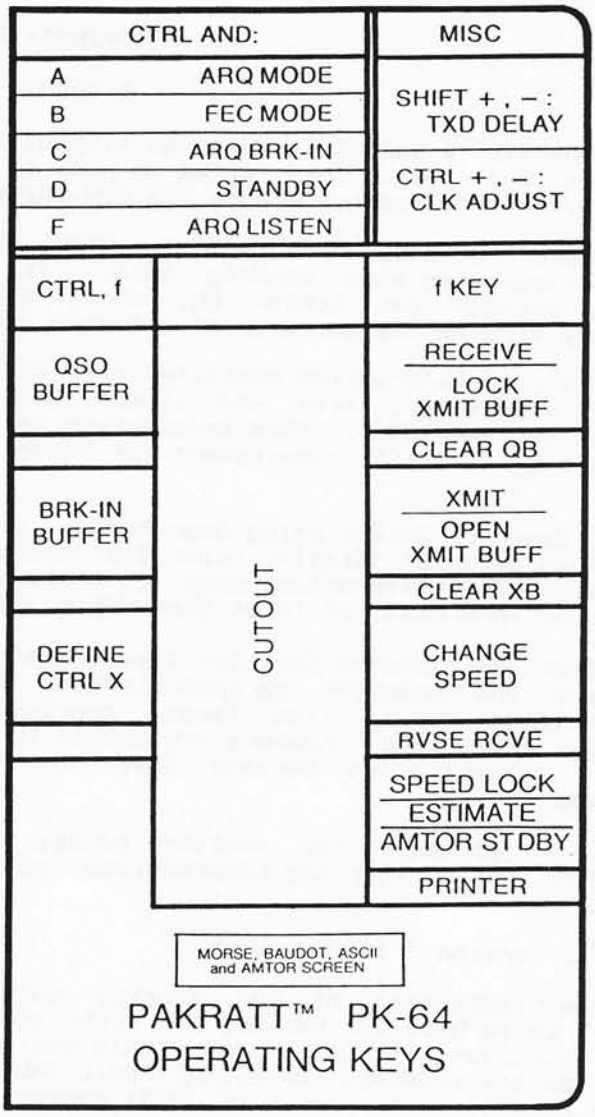
CONNECTORS

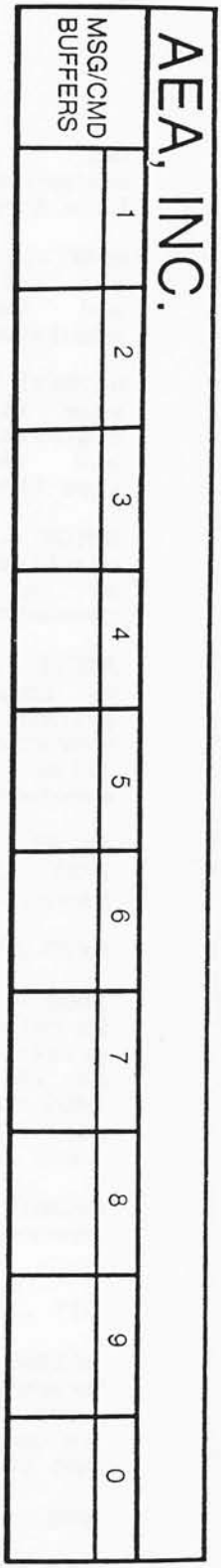
FIVE PIN "To Radio" CONNECTOR

The pinout of the "To Radio" connector and the color coding of the cable provided with your PK-64 are as follows:

Pin 1	Green	Audio (speaker) input from the radio
Pin 2	White	AFSK output from the PK-64 to the radio MIC input
Pin 3	Black	Squelch information from the radio
Pin 4	Brown	Ground/Shield to the radio ground/MIC ground
Pin 5	Red	Positive voltage PTT (push to talk) line to the radio
	Shield	Connected to Brown at radio end of cable







040-984

COMMODORE COMPUTER OVERLAYS

MORSE	
$\overline{SK}$	+
$\overline{AS}$	@
$\overline{AR}$	*
$\overline{KN}$	↑
$\overline{BT}$	=
$\overline{AA}$	£
$\overline{SN}$	!
$\overline{KA}$	%

EDIT COMMANDS	
CSR KEYS	MOVE CSR
f3	CSR TO PGE BOTTOM
f1	CSR TO PGE TOP
HOME	CSR TO FILE START
DEL	DELETE CHAR
INST	INSERT TOGGLE
CTRL DEL	DELETE LINE
←	BACKSPACE
CLR	DEL CSR TO FILE END
CTRL CLR	DEL CSR TO FILE START
CTRL £	DEL CSR TO CTRL M
RUN/STOP	RETRN TO OPENING MENU
C=SHIFT	CASE TOGGLE

CTRL AND:	
0-9	MSG PORT
E	RECEIVE
J	LINE FEED
L	LETTERS
M	CR
N	FIGURES
T	TIME
U	XMIT FILE
X	CTRL X BUFF
CSR	LTR/FIG

APPENDIX G

GLOSSARY

ACK ... Whenever a packet is received without errors, the TNC will send a short packet acknowledging the fact. This called an ACK. It may be that several frames (up to seven) have arrived. In this case, a single ACK can acknowledge all of them.

AFSK ... Audio Frequency Shift Keying. RTTY, ASCII, AMTOR, and PACKET all make use of two audio frequencies when sending data. The signal is modulated by shifting back and forth between two tones. CW, on the other hand, uses a single tone that is modulated by varying the duration of a single tone.

ADDRESS FIELD ... information contained near the beginning of the packet describing to whom it is addressed, from who it was sent, and the path it should follow (if digipeating is requested). This information is made up of the call signs of stations and satisfies the FCC requirement for indentification of amateur radio transmitters. (see FRAME)

AMTOR ... Amateur Teleprinting Over Radio. It is directly derived from the commercial practice known as SITOR (Simplex Telex Over Radio). AMTOR uses synchronous transmissions of a seven-bit information code to achieve essentially error-free message and text communications in blocks of three characters. AMTOR is NOT compatible with PACKET.

ASCII ... American Standard Code for Information Interchange. ASCII codes are numbers sent by computers and computer peripherals that represent printable characters and other printer functions such as line feeds, carriage returns, form feeds, and other control characters. These code numbers are common to most computers and computer devices and allow for communication between them even though they may be products of different manufactures.

AX.25 ... a protocol for amateur packet radio agreed upon for North America in 1982. It is named after the international commercial protocol X.25, upon which it is based.

AX25L2V2 ... version 2 of the above.

BAUD ... an indication of how quickly pulses of data are being sent. Sometimes BAUD is referred to as bits per second, and although this is not entirely correct, for all practical purposes it is a reasonable explanation. Think of BAUD as the speed at which you are sending. On packet radio BAUD should not be compared too closely with BAUD rates used in other forms of ASCII communication. Because packets contain so much more information over and above the actual text you wish to transmit, the throughput is lower. (see THROUGHPUT)

BAUDOT ... the name for the five bit binary (mark/space) code used with teletype equipment.

BIT ... short for "binary-digit". May be either a binary 1 or 0.

BRIDGE ... a server node that takes information from a network on one frequency and transfers it to a network on another. For example, messages may be allowed to easily move from a 2 meter network (LAN) onto the 220 MHz band. Quite often the term GATEWAY is used as if it were synonimous with BRIDGE. The fact that you digipeat through but do not connect to a BRIDGE distinguishes it from a GATEWAY.

BBS ... Bulletin Board Service (see MAILBOX)

BEACON ... It is possible to automatically send a short prepared message on a given time interval. This beacon may be used as a CQ or simply announce your presence on the air. When in MONITOR MODE you will be able to see the beacons of other packeteers. Their call will be automatically displayed with their beacon. the PK-64 can be instructed to direct your beacon through one or seveal digipeaters.

BIT STUFFING ...Whenever a frame is being transmitted, all fields except for the flags, will be checked to be sure that no more than 5 contiguous one bits exist. Any time that five ones occur in a row, the TNC will add a zero after the fifth bit. This added zero

bit will be detected at the receive end of the link and automatically removed.

BUFFER ... space in the computer's memory reseved for storing data on a temporary or semi-perminent basis. Sections of RAM are allocated for variou biffer space. Data sent to the TNC is stored in a buffer while it is prepared for transmitting.

BULLETIN BOARD ... (see MAILBOX)

CMD MODE ... Command mode. When the PK-64 is in CMD MODE you may enter commands from the keyboard. These include commands to connect, disconnect, set beacon text, etc. (see page xx)

COLLISION ... This occurs when two packet stations transmit at the same time. Data sent by both is usually destroyed. This might occur when neither station can hear the other, but they are using the same high elevation digipeater. Both stations will wait a random period of time and then retry.

COMMAND MODE ... (see CMD MODE)

CONNECTED ... This is when two terminal stations are linked together either directly or with the aid of digipeaters. Transmissions sent by other stations on the network will not appear on the screens of connected stations unless a special monitor while connected option is selected. (see DISCONNECTED, MONITOR MODE)

CONTROL FIELD ... information telling the stations in the network what type of frame is being sent. Some frames contain only supervisory information, such as an ACK or a request to disconnect. Others contain
data that should be passed on to the user. The control field also
contains a sequence number that is used to insure that the frames
are receioved in order. (see FRAME)

CONVERSE MODE ... All information entered from the keyboard, cassette, or disk will go directily to the PK-64 for transmitting whenever a carriage return occurs. If the link state is connected, this data will be sent directly to the receiving station. If the link state is disconnected, this data will be transmitted UPROTO. (see UNPROTO,TRANSPARENT MODE, page XX)

<CR> ... carriage return. On the Commodore-64 this is the large key marked "RETURN" on some computers the carriage return is marked "ENTER".

CSMA ... Carrier Sense Multiple Access. The sharing of a channel by listening to see that it is clear. If a carrier is detected transmission of data is delayed until the carrier goes away.

DATE/TIME STAMP ... the idea that the date and time of an event will be included with the data. The PK-64 can be programmed to DATE/TIME STAMP all connects and disconnects.

DEFAULT VALUES ... there are many parameters used in operating the PK-64. When you first power up your packet station these vaules are automatcally set for you. The selections are refered to as DEFAULT VALUES. They are the displayed values that appear in the chapter called The Packet Screen.

DISCONNECTED ... This is when your station is not linked to any other station in the network. It is possible to view packets being sent by other stations in your network if your are disconnected and in the MONITOR MODE. (see CONNECTED, MONITOR MODE)

DIGIPEATER ... a packet station that relays packets from one station on to another. It is possible to link up to eight packet stations between the sending and receiving terminal nodes to provide a path for the data. Any TNC may be used as a digipeater. Often the term DIGIPEATER may refer to a specific packet station within a network, usually located at a high elevation for the sole purpose of providing a path for linking stations within that network. Its function is similar to that of a local VHF-FM repeater.

DIGIPEATING ... sending packets from one station to another with the aid of other TNCs that retransmit the packets so that they can be received error free at the destination. This is a store and forward approach, the data is regenerated and sent seconds after it is received. When using a single digipeater the throughput is cut

in half, because everything is sent twice. Even if you are connected to another station and sending your own packets back and forth, your station may digipeat packets for others on the network. The retransmission of packets will be transparent to you. They will not appear on your screen.

DOS ... DISK OPERATING SYSTEM ... instructions that allow you to perform specific tasks with your disk drive.

ELECTRONIC BULLETIN BOARD ... (see MAILBOX)

ELECTRONIC MAILBOX ... (see MAILBOX)

ERROR CHECKING ... (see FRAME CHECK SEQUENCE)

EPROM ... erasable programable read only memory. Chips that store computer software. With proper equipment an EPROM can be reprogrammed.

FCS ... (see FRAME CHECK SEQUENCE)

FIELD ... (see FRAME)

FILE ... You can store data, which might be text from a word processor or a program for your computer, onto either the disk or the cassette. That stored data is called a file.

FLAG FIELD ... all FRAMES begin and end with a flag, which is defined as one 0 followed by six 1s and another 0 (01111110). If more than one frame is being sent only one FLAG is needed between FRAMES. (see FRAME)

FRAME ... Frames include the text or data that you wish to send to another station. Additional information is packaged around your text. Each addition is called a FIELD. Your text is called the INFORMATION FIELD. Other fields that are added are called: FLAG FIELD, ADDRESS FIELD, CONTROL FIELD, PID FIELD, and FCS FIELD. The resulting group of fields are called the FRAME. Quite a bit of control or overhead information is being sent over and above your text. The word PACKET is often used when the word FRAME would be more correct. A packet is made up of one or more frames separated by flag fields. The MAXFRAME parameter determines how many frmaes may be in a packet. A good reference for a better understanding of protocol subjects such as this is referneced in the bibliography: Terry Fox, "AX.25 Level 2 Protocol".

FRAME CHECK SEQUENCE ... using a sophisticated mathematical formula a number is calculated and sent along with each frame. When the frame is received the calculation is performed again and if the two calculations are the same the data received can safely be assumed to be correct. This is how the TNC performs its error checking.

GATEWAY ... a true gateway is a server node that takes information created in a network using one protocol and transfers it so that it can be used in another network using another protocol. More often the term GATEWAY is being defined as a server node that takes information from a network on one frequency and moves it to a network on another. This would better be called a BRIDGE.

HDLC ... High level Data Link Controller. A highly sophisticated microprocessor that performs several useful functions for the PK-64. It helps format data received from the computer into packets for transmission. It generates and checks the Frame Check Sequence (FCS) which is used for error detection. It processes formatted packets received from the air to check for errors and sends the required data to the computer for further processing. This chip performs a major portion of the work involved in implementing the lower layers of the AX.25 protocol from the computer, and thus allows the computer to spend its time implementing the higher levels of the protocol.

HEADERS ... Information displayed in monitor mode telling you the origin and destination of packets being sent. It is possible with the PK-64 to also display the path within the header. (see PATH)

HUNG-UP ... being left in the connected state. (see UNILATERAL CONNECT)

I/O ... Input Output

INFORMATION FIELD ... this is the part of the frame that contains the actual data you wish to transmit. It may be up to 128 bytes in length. Bit stuffing has been added to insure that nothing is sent that would look like a FLAG. Some frames do not have information fields. These would be packets used to request a connect or ACK a received packet. (see FRAME)

KEYBOARD WINDOW ... (see WINDOWS)

LAN ... (see LOCAL AREA NETWORK)

LINK STATE ... whether or not your packet station is currently connected to another or disconnected.

LOCAL AREA NETWORK ... Within a given geographic area, HAMS operating on the same frequency, capable of communication with each other either directly or with the aid of a common digipeater form a network of packet stations called a local area network (LAN).

MAILBOX ... a computer and TNC, usually left on the air 24 hours a day, where messages and bulletins may be stored and retrieved. When you connect to a mailbox, you will usually automatically receive a menu of commands that you can send it to obtain a multitude of information and services. You can leave messages for others who will find them later and might find messages left for yourself. Some mailboxes will automatically pass or forward your messages to other mailboxes so that traffic moves from one network to another.

MODEM ... short for Modulator-Demodulator. The modulator part converts the serial binary data from the HDLC to two tones which are used to modulate the radio carrier when the packet is actually sent out over the air. The demodulator converts the audio tones received off the air to serial binary data for the HDLC.

MONITOR MODE ... often when you are not connected to another station you might like to monitor the activity in your network. Packets and beacons sent by others will appear on your screen. Each packet will be preceeded by the call signs of the originating and destination stations. Only packets which pass the error checking test at your TNC will be displayed.

This may mean that omissions may occur. Packets that are digipeated or resent as retries may appear more than once on your screen. If more than one QSO is going on at the same time, packets from both will be interspersed. Monitoring packet radio may seem quite confusing because only the sending and receiving stations see straight clean text. (see BEACONS)

NACK ... the idea that if a frame fails its error checking a special packet is sent requesting that it be resent. In actuality, amateur packet radio does not send NACKs. Instead, the lack of an ACK is interpreted as a NACK.

NETWORK ... all packet stations within a geographical location operating on the same frequency such that they can be linked together either directly or by digipeating through a common digipeater.

NODES ... individual stations within a network. (see TERMINAL NODE, SERVER NODE)

NRZI ... Non Return to Zero Inverted ... A way of encoding bits so that the logic level transition is guaranteed to occur at least every 5 bit times. This allows two stations to synchronize themselves when data is transmitted. In ASCII RADIO COMMUNICATIONS a binary one is represented by one tone and a zero by another. In NRZI, which is used by PACKET, a zero is represented by shifting from one tone to the other. This may be either high to low or low to high. A one is represented by no shift in tones.

PBBS ... Packet Bulletin Board Service. (see MAILBOX)

NOVRAM ... non-volatile RAM. This specialized memory chip is used in the TAPR type TNCs to store the command parameters. It will recall data stored in it even if the power has been turned off. You can store the same parameters on disk or cassette with the PK-64.

PACKET ... The word PACKET is often used when the word FRAME would be more correct. A packet is made up of one or more frames. It is what is sent in a single transmission. (see FRAME)

PACKETEER ... one who runs a packet station. Rumors have it that some packeteers in parts of the country wear funny hats with big ears, but we have yet to see one.

PROTOCOL ... a set of specific rules used to insure that all stations operating within the packet network will be able to function together. The protocol used in the PK-64 is called AX.25.

RAM ... Random Access Memory. This is the user memory in your computer. It is volital, meaning data is lost if the power is interupted for even a very short period of time.

RECEIVE WINDOWS ... (see WINDOWS)

RETRY .. Occasionally your TNC will send a frame to another station and not copy an acknowledgement or ACK indicating that it was received. When this occurs it will retransmit the frame. This is called a RETRY. Many times you will be sending a cluster of several frames all at one time. If the error checking fails in one of those frames the TNC will retransmit the one that failed and all those after it. In this case, new frames may be added to the cluster as well.

ROM ... Read Only Memory ... This is memory pre-programmed and provided by the manufacturer of your computer equipment. If the power fails data stored in ROM chips is not lost.

RTTY ... radio teletype

SECONDARY STATION ID ... (SSID) ... Packet stations are typically identified by the amateur call sign of the licensed operator. This call sign is used in the address field of frames sent. Because one amateur may be operating more than one packet station, provisions have been made to add an extension to the call to insure that each station will have a unique identifier, for example: W7AEA, W7AEA-1, and W7AEA-2. Although it is not displayed as such the first is actually transmitted as W7AEA-0. You may have up to 16 different SSIDs (0-15).

SERVER NODE ... a packet station operating within a network that provides some service for others. This service may be in the form of an electronic MAILBOX or as a GATEWAY.

SPLIT SCREEN ... (see WINDOWS)

SUPERVISORY PACKETS ... These frames do not contain any of the user's data. They provide a means to allow two TNCs to exchange link level information. Packets requesting a connect, a disconnect, or acknowledging receipt of other packets are supervisory packets.

SSID ... (see Secondary Station ID)

STORE AND FORWARD ... the act of capturing information, holding it for a portion of a second and then regenerating the information. Consider for a moment that a conventional VHF-FM REPEATER rebroadcasts your voice on one frequency at the exact same time it receives it on an other. A DIGIPEATER receives your packets and then rebroadcasts them on the same frequency after you have finished transmitting.

TERMINAL ... a device capable of displaying and generating the text you send and receive on packet radio, usually a computer.

TERMINAL NODE ... an individual packet station, one that operates for the sole purpose of its owner (not counting digipeating). (see SERVER NODE)

THROUGHPUT ... this term refers to the ability of a network to move data from one station to another. Throughput is effected by the number of stations that are active on the channel, the number of digipeaters you have linked between yourself and the other station, the baud rate selected for the network, and the number of retries experienced.

TRANSPARENT MODE ... In this mode all characters, including control characters, are sent out with the packets. Full binary files can be sent and received. No system messages will appear. Packets are sent automatically according to either their size or a time interval. Transparent mode is very effective when sending computer programs by packet radio. (see page xx)

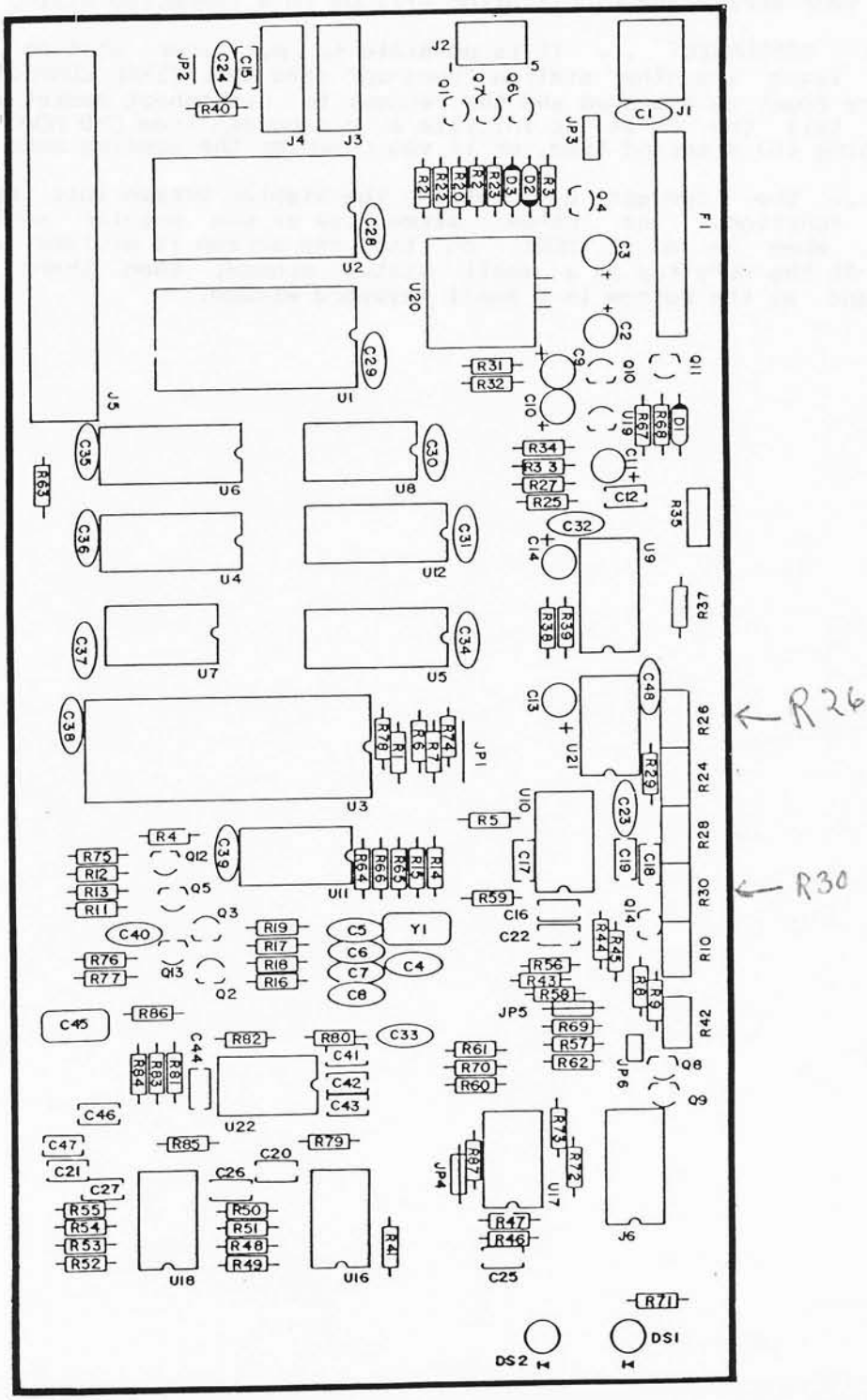
UNILATERAL CONNECT ... If another station sends a packet requesting a connect to you, the PK-64 will attempt to acknowledge that request. A connected message will appear on your screen and your station will be in a connected state.

UNILATERAL DISCONNECT ... It is possible to put your station into a disconnected state and leave the other station "hung-up" (see UNILATERAL CONNECT). This may occur if your retry count is exceeded and the request to disconnect packet is never acknowledged, if you tell the PK-64 to initiate a disconnect from CMD MODE by touching <D> and then touching <D> a second time, or if you re-enter the opening menu on the PK-64.

WINDOWS ... the concept of dividing the display screen into sections each with a different function. The PK-64 makes use of the popular notion of split screen operation. When in AX.25 MODE on the the screen is divided into three different windows. At the very top is a small status window, then there is a large receive window, and at the bottom is a small keyboard window.

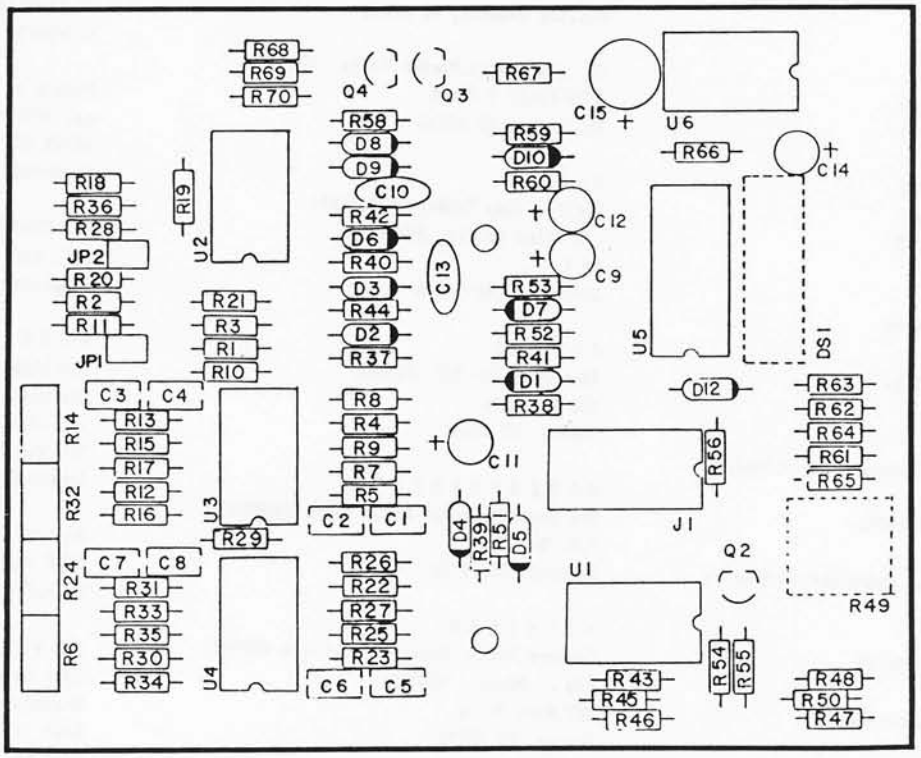
APPENDIX L

PK-64 BOARD LAYOUT



APPENDIX L

HFM-64 BOARD LAYOUT



This list contains the names of organizations on national, local, and regional levels that are active in the furtherance of amateur packet radio. Also shown are individuals that are actively interested in organizing groups in their respective areas.

N A T I O N A L
AMRAD
P.O. Drawer 6148
McLean, VA 22106-6148

AMSAT
850 Sligo #601
Silver Spring MD 20910
301-589-6062

TAPR
Tucson Amateur Packet Radio
P.O. Box 22888
Tucson, AZ 85734-22888

A L A B A M A
Frank Emens, W4HFU
3714 Lakewood Circle
Huntsville, AL 35811

Henry Wingate, K4HAL
104 Von Dale Drive
Birmingham, AL 35215

A R K A N A S A S
Elmer Wingfield, W5FD
26 Belmont Drive
Little Rock, AR 72204

C A L I F O R N I A
Los Angeles Area Packet Group (LAPG)
P.O. Box 6026
Mission Hills, CA 91345

So. Calif. Digital Coordination Council
SCDCC
P.O. Box 6026
Mission Hills, CA 91345

Pacific Packet Radio Society
P.O. Box 51562
Palo Alto, CA 94303

San Diego Packet Group (SDPG)
c/o Mike Brock WB6HHV
10230 Mayor Circle
San Diego, CA 92126

C O L O R A D O
Rocky Mountain Packet Radio Association
RMPRA
c/o Andy Freeborn, N0CCZ, Secretary
5222 Borrego Drive
Colorado Springs, CO
(303) 598-8373

F L O R I D A
Florida Amateur Digital Communications Assoc.
FADCA
812 Childers Loop, Brandon, FL 33511
(813) 689-3355

G E O R G I A
Georgia Radio Amateur Packet Enthusiast Society
GRAPES
P.O. Box 1354
Conyers, GA 30207

Southern Amateur Packet Society (SAPS)
c/o Wayne Harrell, WD4LYV
RT 1 Box 185
Sycamore, GA 31790

I L L I N O I S
Chicago Amateur Packet Radio Assn. (CAPRA)
P.O. Box 8251
Rolling Meadows, IL 60008

St. Louis Area Packet Radio (SLAPR)
9926 Lewis & Clark
St. Louis, MO 63136

I O W A
Central Iowa Technical Society
c/o Ralph Wallio, W0RPK
RR 4
Indianola, IA 50125

K A N S A S
John Anderson III, WB0SKL
305 Brittany
Olathe, KS 66061

M A S S A C H U S E T T S
New England Packet Radio Assn. (NEPRA)
P.O. Box 15
Bedford, MA 01730

M I C H I G A N
Eastern Packet Radio Of Michigan (EPROM)
c/o J. Nugent, WB8TKL
307 Ross Drive
Monroe, MI 48161

M I N N E S O T A
Minnesota Amateur Packet Radio (MAPR)
c/o Pat Snyder, WA0TTW
565 Redwood Lane
New Brighton, MN 55112

N E W H A M P S H I R E & V E R M O N T
Mt. Ascutney Amateur Packet Radio Assoc.
c/o Carl Breuning, N1CB
54 Myrtle Street
Newport, NH 03773

N E W J E R S E Y
The Radio Amateur Telecommunications Society
RATS-NORTH
c/o J. Gordon Beattie, Jr. N2DSY
206 North Vivyen St.
Bergenfield, NJ 07621
201-387-8896

The Radio Amateur Telecommunications Soiety
RATS-SOUTH
c/o Brian B. Riley, KA2BQE
RD 2 Burnt House Rd.
Indian Mills, NJ 08088

Cherryville Repeater Association
Box 308
Quakertown, NJ 08868

N E W Y O R K
Rockester Packet Group
c/o Fred Cupp, W2DUC
27 Crescent Rd.
Fairport, NY 14450

Packet of New York (PONY)
c/o Bill Schimoler
42-15 172 Street
Flushing, NY 11358

Mt. Beacon Amateur Radio Club
P.O. Box 841
Wappingers Falls, NY 12590

O H I O
Cincinnati Amateur Packet Radio
Experimenters Society (CAPRES)
c/o John Schroer IV, KA8GRH
984 Halesworth Drive
Forest Park, OH 45240

Maynard Weston, W8MW
4564 Park Edge Drive
Fairview Park, OH 44126

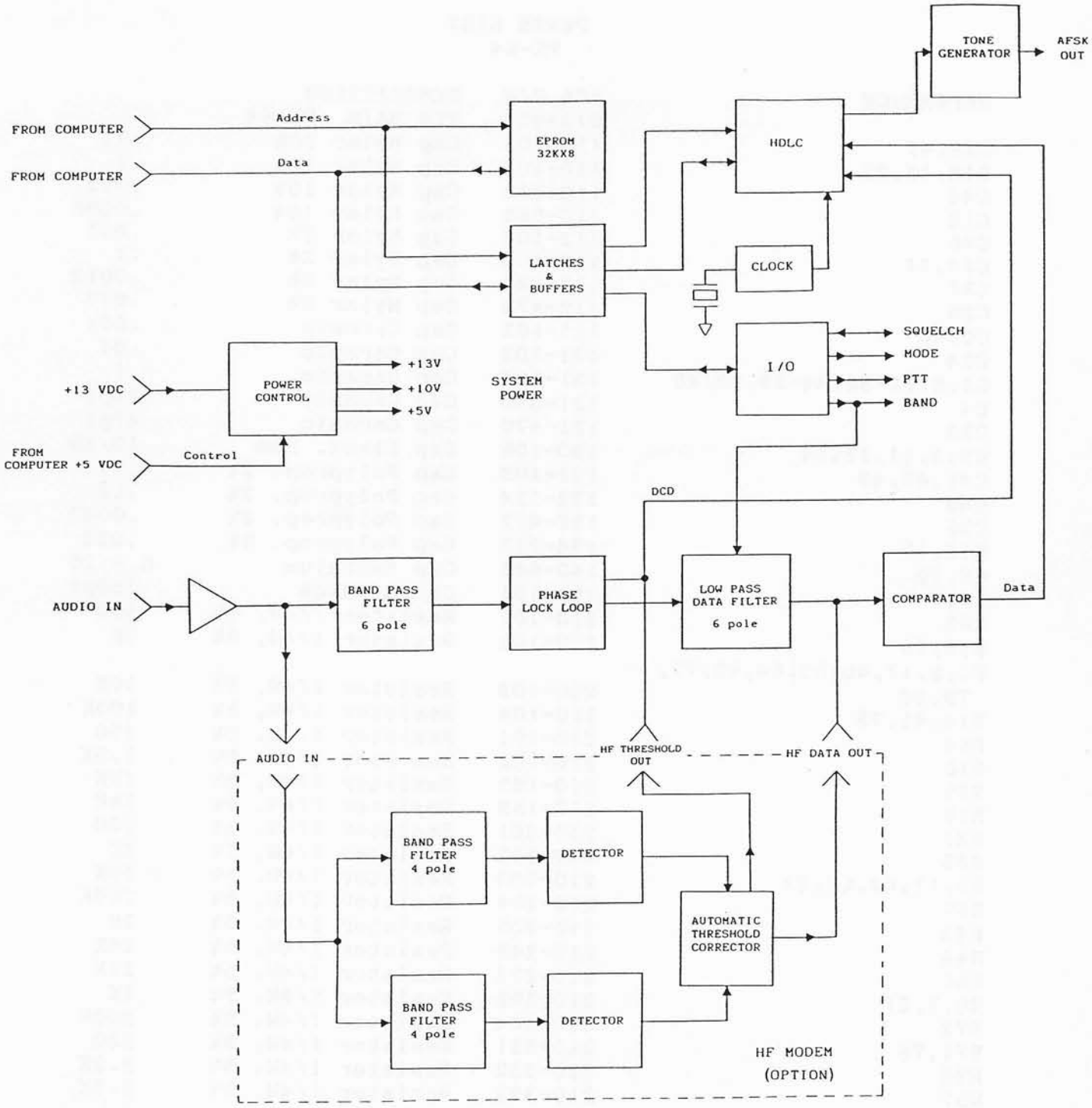
T E N N E S S E E
John Burningham, WB8PUF
Memphis State University
Dept. of Engineering, Technology
Memphis,TN 38152

T E X A S
Dave Cheek, WA5MWD
1510 Treavis St.
Garland, TX 75042

U T A H
Utah Packet Radio Association (UPRA)
4382 Cherryview Drive
West Valley City, UT 84120

W A S H I N G T O N
Northwest Amateur Packet Radio Assoc.
(NAPRA)
c/o John Gates, N7BTI
750 Northstream Ln.
Edmonds, WA 98020

Source: GATEWAY #16



BLOCK DIAGRAM PK-64

PARTS LIST
PK-64

REFERENCE	AEA P/N	DESCRIPTION	
	013-057	PCB MAIN PK-64	
C16,47	110-103	Cap Mylar 10%	.01
C15,18,22	110-104	Cap Mylar 10%	.1
C44	110-223	Cap Mylar 10%	.022
C19	110-562	Cap Mylar 10%	.0056
C46	112-102	Cap Mylar 2%	.001
C20,21	112-104	Cap Mylar 2%	.1
C27	112-122	Cap Mylar 2%	.0012
C25	112-473	Cap Mylar 2%	.047
C8,40	121-102	Cap Ceramic	.001
C24	121-103	Cap Ceramic	.01
C1,5,28-32,34-39,23,48	121-104	Cap Ceramic	.1
C4	121-330	Cap Ceramic	33pf
C33	121-470	Cap Ceramic	47pf
C2,3,11,13,14	130-106	Cap Elect. Rad	10/25
C41,42,43	132-103	Cap Polyprop. 2%	.01
C45	132-124	Cap Polyprop. 2%	.12
C26	132-472	Cap Polyprop. 2%	.0047
C12,17	134-223	Cap Polyprop. 5%	.022
C9,10	140-685	Cap Tantalum	6.8/25
C6,7	150-151	Cap SilMica	150pf
R63	210-101	Resistor 1/4W, 5%	100
R18,19	210-102	Resistor 1/4W, 5%	1K
R1,5,17,40,59,64,65,77, 79,80	210-103	Resistor 1/4W, 5%	10K
R14,41,73	210-104	Resistor 1/4W, 5%	100k
R68	210-151	Resistor 1/4W, 5%	150
R16	210-152	Resistor 1/4W, 5%	1.5K
R29	210-153	Resistor 1/4W, 5%	15K
R25	210-183	Resistor 1/4W, 5%	18K
R37	210-201	Resistor 1/4W, 5%	200
R23	210-202	Resistor 1/4W, 5%	2K
R3,12,62,69,27	210-203	Resistor 1/4W, 5%	20K
R87	210-204	Resistor 1/4W, 5%	200K
R43	210-205	Resistor 1/4W, 5%	2M
R44	210-243	Resistor 1/4W, 5%	24K
R66	210-273	Resistor 1/4W, 5%	27K
R6,7,21	210-302	Resistor 1/4W, 5%	3K
R72	210-304	Resistor 1/4W, 5%	300K
R71,76	210-331	Resistor 1/4W, 5%	330
R38	210-332	Resistor 1/4W, 5%	3.3K
R57	210-392	Resistor 1/4W, 5%	3.9K
R2,4,11,13,20,60, 61,70,74	210-472	Resistor 1/4W, 5%	4.7K
R15,45	210-473	Resistor 1/4W, 5%	47K
R56	210-474	Resistor 1/4W, 5%	470K
R33,34,75	210-512	Resistor 1/4W, 5%	5.1K
R58	210-514	Resistor 1/4W, 5%	510K
R78	210-622	Resistor 1/4W, 5%	6.2K
R22,39	210-681	Resistor 1/4W, 5%	680
R67	210-910	Resistor 1/4W, 5%	91

REFERENCE	AEA P/N	DESCRIPTION	
R52,54	211-113	Resistor 1/4W, 1%	11.0K
R31	211-161	Resistor 1/4W, 1%	1.69K
R8,9	211-202	Resistor 1/4W 1%	2.00K
R82	211-233	Resistor 1/4W, 1%	23.7K
R46,48,50	211-243	Resistor 1/4W, 1%	24.3K
R32	211-241	Resistor 1/4W, 1%	243
R53,55	211-333	Resistor 1/4W, 1%	33.2K
R81,84,85,86	211-472	Resistor 1/4W, 1%	4.75K
R83	211-594	Resistor 1/4W, 1%	590K
R47,49,51	211-802	Resistor 1/4W, 1%	8.06K
R10	251-101	Trim Pot	100
R24,26,28,30,42	251-103	Trim Pot	10K
R35	251-253	Trim Pot	25K
D4	311-001	Diode Signal	1N4148
D1,2,3	311-003	Diode Power	1N4003
DS1,2	314-001	Diode LED (Red)	MV5025
Q1-5,8,9,12-14	320-001	Transistor NPN	2N3904
Q6	320-501	Transistor PNP	2N3906
Q7,10	320-012	Transistor NPN	MPS6561
Q11	320-510	Transistor PNP	MPSU51
U20	330-001	Voltage Reg.	LM7805
U19	330-008	Voltage Reg.	LM317L
U16,22	330-015	I.C. Quad Op Amp	4136
U9	330-034	I.C.	EXAR2206
U10	330-046	I.C.	EXAR2211
U11	331-123	I.C. M/vibrator	74LS123
U8	331-138	I.C. Decoder	74HTC138
U7	331-174	I.C. Flip/Flop	74HTC174
U12	331-240	I.C. Oct. Invert.	74HCT240
U6	331-247	I.C. Oct. Buff.	74HCT244
U4,5	331-374	I.C. Flip/Flop	74HCT374
U1	332-801	I.C. Prog. E-Prom(Hi)	27128-3
U2	332-802	I.C. Prog. E-Prom(Lo)	27128-3
U3	333-018	I.C. SCC	Z8530
U17,18,21	334-066	I.C.	CD4066B
J2	410-005	HDR .10 R/A	5 pos
JP6	410-102	HDR .10 STR.	2 pos
JP3	410-103	HDR .10 STR.	3 pos
J1	420-001	CONN POWER	2.1mm
J3,4	420-002	CONN PHONE	3.5mm
Y1	650-245	Crystal	2.4576 MHz
U20	750-070	Heatsink	5070B
U20	750-071	Heatsink	5071B
F1	763-001	Fuse	1 Amp
JP3,6	779-001	Shorting Jack	
	740-041	Stand-off, nylon	3/4"
	769-001	Cable Assy Phone/Phone	
	769-016	Cable Assy (To Radio)	5 pos
	090-019	AC-1 Power Supply	
	011-063	Pk-64 Transition Cable	
	060-053	Chassis Top PK-64	
	060-054	Chassis Bottom PK-64	
	040-029	PK-64 MANUAL	
	040-984	PK-64 OVERLAY	

PARTS LIST
HF MODEM FOR THE PK-64

RERERENCE	AEA P/N	DESCRIPTION	
	013-061	PCB HF MODEM/PK-64	
C10,13	110-104	Capacitor Mylar 10%	.1
C9,11,12,14	130-106	Capacitor Elect. Rad	10/25
C15	130-486	Capacitor Elect. Rad	47/25
C1-8	132-103	Capacitor Polyprop.	.01
R64,66	210-102	Resistor 1/4W, 5%	1K
R42,47,60,67,69,45	210-103	Resistor 1/4W, 5%	10K
R50	210-123	Resistor 1/4W, 5%	1.2K
R4,12	210-152	Resistor 1/4W, 5%	1.5K
R38,39,40,51,52,59	210-201	Resistor 1/4W, 5%	200
R55,22,30	210-202	Resistor 1/4W, 5%	2K
R41,43,53	210-203	Resistor 1/4W, 5%	20K
R63	210-332	Resistor 1/4W, 5%	3.3K
R56,68,70	210-472	Resistor 1/4W, 5%	4.7K
R44	210-473	Resistor 1/4W, 5%	47K
R54	210-512	Resistor 1/4W, 5%	5.1K
R46	210-514	Resistor 1/4W, 5%	510K
R48	210-821	Resistor 1/4W, 5%	820
R18,36,37,58	211-104	Resistor 1/4W, 1%	10.0K
R3,10,21,29	211-104	Resistor 1/4W, 1%	100.0K
R65	211-202	Resistor 1/4W, 1%	2.00K
R7,8,15,16,25,26, 33,34	211-203	Resistor 1/4W, 1%	20.0K
R9,17,27,35	211-263	Resistor 1/4W, 1%	26.1K
R2,5,28,11,13,20, 23,31	211-273	Resistor 1/4W, 1%	27.4K
R61,62	211-302	Resistor 1/4W, 1%	3.09K
R1,19	211-492	Resistor 1/4W, 1%	4.99K
R49	250-102	Potentiometer PNL (PCB)	1K
R6,14,24,32	251-112	Potentiometer Trim	1K
D1-10,12	310-001	Diode Signal	1N4448
DS1	314-010	Bargraph 10 Segment	
Q2,3,4	320-001	Transistor	2N3904
U1-4	330-015	I.C. Quad Op Amp	4136
U5	330-050	I.C.	LM3914
U6	334-066	I.C.	CD4066B
JP1,2	410-102	HDR .10 STR	2 pos
(2)To mount Board	700-127	Screw, Phillips	6-32X1/4
(2) R49	710-037	Nut	3/8"
(1) R49	719-038	Flat Washer	3/8"
(1) R49	760-003	Knob, BLK w/Set Screw	
	769-501	Cable Assy, ribbon	16 pos
JP1,2	779-001	Shorting Jack	

APPENDIX R

SPECIFIC RADIO INSTALLATION

The following information is furnished courtesy of the TAPR Company.

This appendix contains interfacing information for the IC-2AT and the FT-208R, along with a table listing hookup information for several commonly used Amateur transceivers. All the data in the table is derived from information received from participants in the TAPR Beta Test. While we hope there are no errors in this information, we urge caution in making use of it, in view of the potentially grave results some errors might produce. Please DO NOT use this information without independently checking its accuracy!

Each entry includes the source being quoted, the connector type, as described by that source, and the pin-out for the various functions. We also list the PTT open-circuit voltage as well as the current measured while keyed. In some cases more than one source described the same transceiver and we've tried to include all variations reported. In the case of reported variations we have simply listed them as described. They may be due to the use of alternative connectors where more than one exists on the unit.

Simple electrical tests with a VOM should be enough to determine the accuracy of the information listed. The primary situations to watch out for are accidently connecting the radio positive supply to the TNC's PTT line or audio input line (the latter is bad only if a polarized capacitor is used or the capacitor rating is exceeded.)

Interfacing the IC-2AT

The IC-2AT keys the transmitter by completing the ground connection on the microphone. The cleanest way to interface to this combination is to use an audio transformer, connecting the primary side to the TNC audio out and return lines (pins 5 and 6-9, respectively), and connecting one side of the secondary to the microphone input of the IC-2AT and the other to the PTT line on the TNC (pin 4). Almost any transformer should work, provided the turns ratio is not too great.

Interfacing the Yaesu FT-208R

The FT-208R must be interfaced carefully (presumably these peculiarities exist in other Yaesu equipment) in order to avoid damaging either the TNC or the radio. Using Yaesu's numbering of pins on the external connector, attach radio pin 1 to TNC pin 5, radio pin 2 to TNC pin 3, radio pin 3 to TNC pin 4 and radio pin 4 to TNC pins 6-9. On no account connect radio pin 6 to any pins on the TNC radio connector! The radio pins mentioned are the four closest to the FRONT panel of the HT, with pin 1 to the left as you hold it normally.

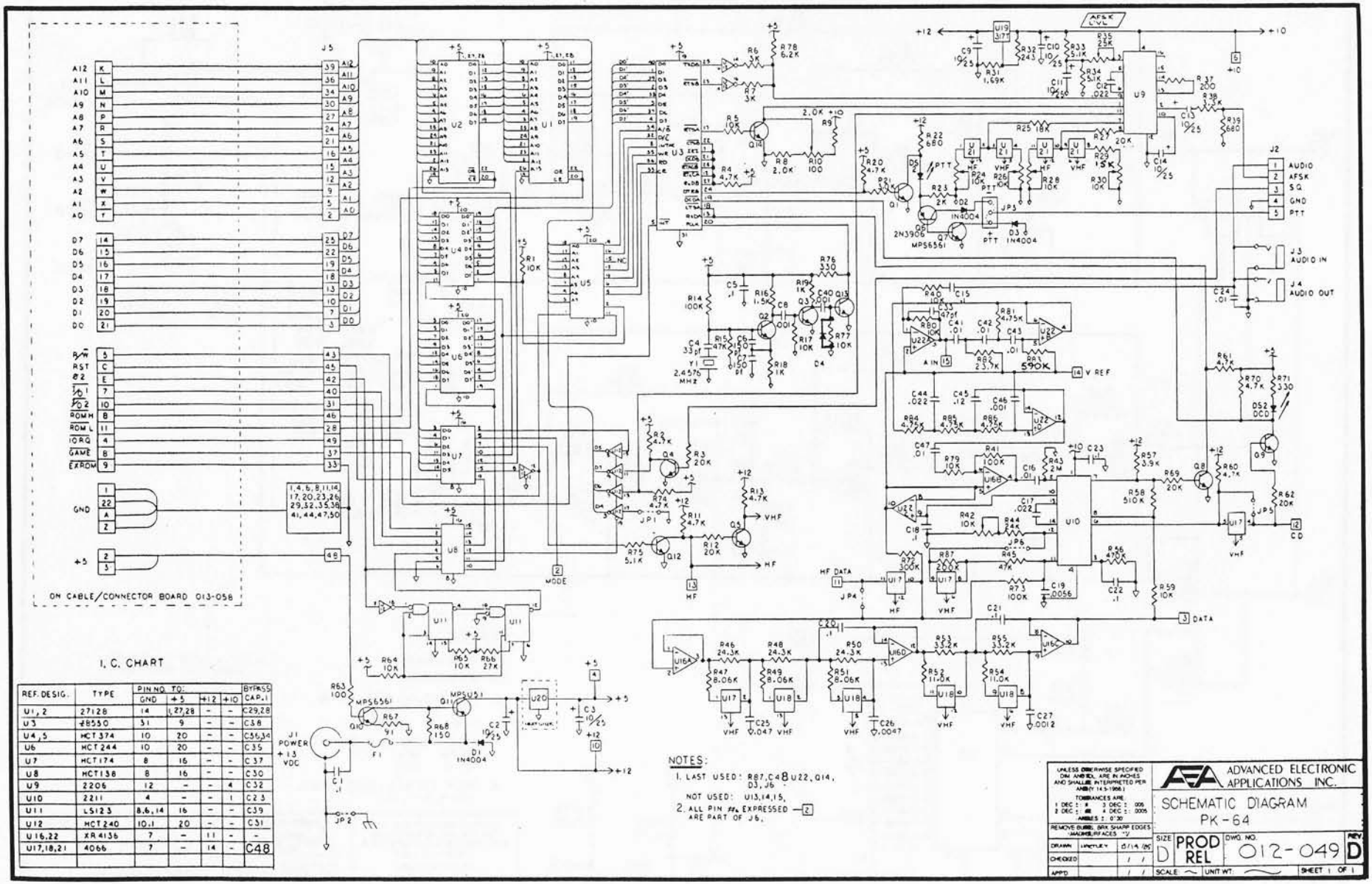
TAPR wishes to thank all those participants in Beta Test who submitted radio interface data and returned software questionnaires. Along with Amateurs mentioned above, we thank W3VS, W6LLE, N9ATM, WB9BWN, WB9CNE, W9TD, WA9WXC, WA9YKK, NOCCZ, KONN, and WOQKA for their radio interface information.

APPENDIX R

SPECIFIC RADIO INSTALLATION

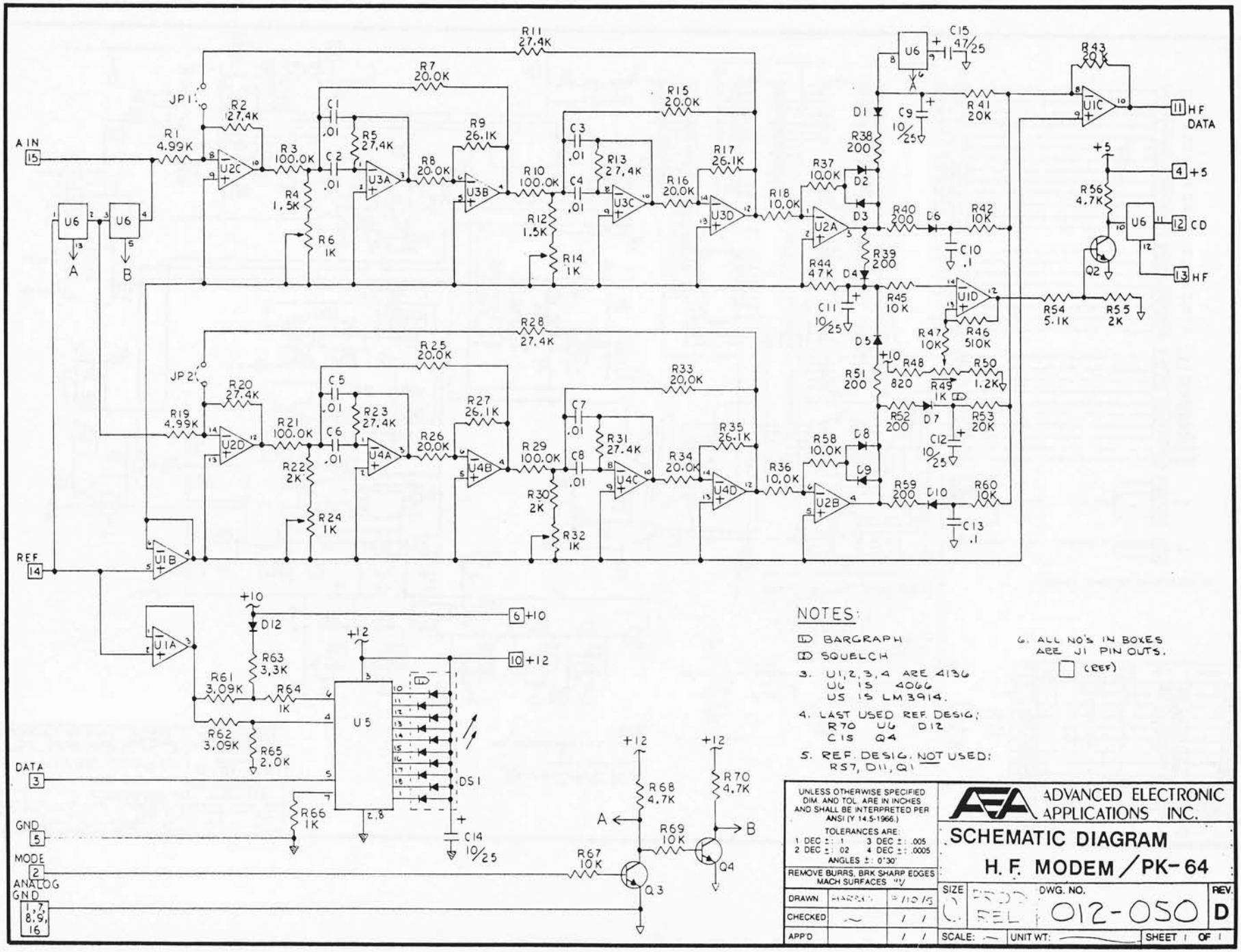
Note: Unless described to the contrary, all model numbers beginning with "TR" or "TS" in the table refer to transceivers made by Kenwood.

SOURCE	RADIO	CONNECTOR TYPE	SP AUD PIN	PTT PIN	MIC AUD PIN	COMMON PIN	PTT OCV/ CURR.
KF4LG	TR-7600	5-pin 1/8" phone	tip	2	1	4,5 sleeve	4.39V/30mA
N6MA	GENAVE GTX-100	1/4" phone 1/4" phone	tip	tip	ring	sleeve sleeve	12V/22mA
W4CQI	KDK FM-2025A/E Mark II	4-pin mini-phone	tip	2	4	3 sleeve	13V/1.0mA
WB9HBH	KDK FM-2025 (NOTE: this arrangement via rear connector, J2)	5-pin	1	5	2	case	12V/40 mA
W1BEL	TS-700A (Note: W1BEL used rear aux. conn., tied pins 8 and 9 together)	9-pin	1	6	3	2,4	17.3V/0.4mA
W1BEL	AZDEN PCS-3000	EC-80 mini phone	tip	9	12	2,11 sleeve	9V/16mA
WB0IBZ	TR-9130	6-pin	?	2	1	6	8.6V/49mA
W6SZX	ICOM 22-S (NOTE: W5FD used pin 2 as PTT)	4-pin mike small audio	tip	3	1	4 sleeve	13.8V/60mA
WB6HHV	Drake UV-3	Molex, under chassis. Added speaker audio to an unused pin, others per Drake. Changed R35 to 2.2k to help with p.s. "noise."					11.6V/30mA
WD6FPY	FT-227R	5-pin	1	3	2	case	?
WA6CFM	FT-230R	7-pin	5	3	2	1	4V/40mA
N6TE	ICOM 211	24-pin Molex Waldom 1625-24P	4	3	5	8	?
WB6UUT	ICOM 22U (Note: WB9SVM used pin 6 instead of 7 for common)	Amphenol CBC-8 mini phone	tip	5	1	7 sleeve	9.5V/25mA
WD9DBJ	WILSON MARK II	WILSON P1016	J3-2	J3-3	J3-1	J3-4	12V/?
W7KB	TR 7950	6-pin mini phone	tip	2	1	6 sleeve	9.5V/16mA
N8ANJ	HW-2036	RS 274-204/205 phono	tip	1	2	4 sleeve	0.8V/2.2mA
N0DVS	TR 7400 A (NOTE: KB7XP measured 12V/70mA)	4-pin mini phone	tip	2	1	3,4 sleeve	?
W8KOX	TR 2200 (*NOTE: pin 3 was rewired as speaker out rather than ground)	4-pin	3*	2	1	4	?V/*<10mA
WB9HBH	Drake TR-7 (*Note: audio out from speaker line)	4-pin	*	2	4	3	5V/1.0mA
N0ENN	WILSON WE800	?	4	3	5	1	12.7V/50mA
AI6C	TR 9000 (NOTE: TouchTone jack was used for mike/PTT)	6-pin mini phone	tip	2	1	6 sleeve	8V/26mA
K0HOA	TR 7800	6-pin mini phone	tip	2	1	6 sleeve	0.1V/8.2mA
WD0FHG	ICOM 290A (NOTE: pin 7 was connected to ext. speaker jack, pin 9 to tone input pin 1)	9-pin	7	2	9	4	13.4V/13mA



I. C. CHART

REF. DESIG.	TYPE	PIN NO. TO: GND	+5	+12	+10	BYPASS CAP.
U1, 2	27128	14	1, 27, 28	-	-	C29, 28
U3	8530	31	9	-	-	C38
U4, 5	HCT 374	10	20	-	-	C36, 34
U6	HCT 244	10	20	-	-	C35
U7	HCT 174	8	16	-	-	C37
U8	HCT 138	8	16	-	-	C30
U9	2206	12	-	-	4	C32
U10	2211	4	-	-	1	C23
U11	LS123	8, 6, 14	16	-	-	C39
U12	HCT 240	10, 1	20	-	-	C31
U16, 22	XR 4136	7	-	11	-	-
U17, 18, 21	4066	7	-	14	-	C48



NOTES:

1. ▭ BARGRAPH
2. ▭ SQUELCH
3. U1,2,3,4 ARE 4136
   U6 IS 4066
   U5 IS LM3914.
4. LAST USED REF. DESIG:
   R70 U6 D12
   C15 Q4
5. REF. DESIG. NOT USED:
   R57, D11, Q1
6. ALL NO'S IN BOXES ARE J1 PIN OUTS.
   ▭ (REF)

UNLESS OTHERWISE SPECIFIED DIM. AND TOL. ARE IN INCHES AND SHALL BE INTERPRETED PER ANSI (Y 14.5-1966.)

TOLERANCES ARE:
1 DEC ±: 1 3 DEC ±: .005
2 DEC ±: 02 4 DEC ±: .0005
ANGLES ±: 0°30'

REMOVE BURRS, BRK SHARP EDGES MACH SURFACES "V"

DRAWN	HARRIS	9/10/85
CHECKED		/ /
APP'D		/ /

ADVANCED ELECTRONIC APPLICATIONS INC.

SCHEMATIC DIAGRAM
H.F. MODEM / PK-64

SIZE	DWG. NO.	REV.
C	REL 012-050	D

SCALE: — UNIT WT: — SHEET 1 OF 1