DSP-2232 Multi-Mode Digital Signal Processors

Top of the Line Controller

This is the Cadillac and the Corvette of data controllers rolled into one. Work satellites, HF, VHF, even Gateway between HF and VHF. The DSP-2232 with two simultaneous ports, provides a new level of performance and versatility in data controllers.

Built for the Future

The great advantage of having Digital Signal Processors in your data controller is that new modems or modes only require new software. Unlike an analog modem which usually requires that new hardware be installed. In addition, DSPs provide filtering that analog machines just can't match.

All Proven Modes

PACTOR, VHF/HF Packet, AMTOR/SITOR, Baudot, ASCII, Morse, TDM, and NAVTEX. As new modes become available, all you need are replacement EPROMs. Satellite and all the modems that made the PK-232MBX a legend are included, plus the K9NG and G3RUH compatible 9600 bps modems. For specific modems included, see below.

Full MailDrop

You get the latest version of MailDrop with selective control of third party traffic and bulletin board system (BBS) compatibility so messages can be automatically forwarded.

True Gateway & Dual Ports

The DSP-2232 has the ability to create a gateway from packet-to-AMTOR, packet to PACTOR, and of course, packet-to-packet. Since you have dual simultaneous radio ports, the DSP-2232 allows cross-mode gateway operation. Packet users connecting to Port 2 have the ability to monitor and link to other AMTOR, PACTOR, or even

Features

- Dual Simultaneous Ports
- True Gateway between modes and radio ports
- 9600 & 1200 bps Packet
- Auto satellite correction
- Great modes, plus the satellites
- Hardware HDLC
- Digital Signal Processor
- All standard modes
- PSK modems
- Full MailDrop facility for Packet, PACTOR, and AMTOR
- SIAM™ signal identification
- Hardware Memory ARQ

Modes and Modems for the DSP-2232

Modes

packet stations using your HF radio on Port 1. The dual ports also offer simultaneous HF and VHF monitoring, or running two VHF packet radios at the same time. You can also listen to your local DX node while working AMTOR on an HF frequency.

LCD Readout

The unique LCD read-out on the DSP-2232 displays the mode and diagnostics for both radio ports, giving you information on connect and system status. On packet, the LCD displays the call sign of stations heard. On RTTY, AMTOR, and PACTOR, text received on the air is displayed. This is true for both radio ports of the DSP-2232

TDM Capability

As with all AEA multi-mode data controllers, these DSPs will decode Time Division Multiplex (TDM) signals. TDM is a mode resembling FEC AMTOR used in commercial applications. TDM uses one sub-carrier, but assigns separate data channels to different time slots.

A Satellite Workhorse

The satellite modems included make the DSP-2232 the premier satellite data controller on the market. The automatic Doppler correction keeps the signals coming in clear. Up/down Doppler shift for PSK modems and outputs for up/down frequency stepping to control the radio's frequency included. The onboard 9600 bps modem lets you bounce packets off satellites and communicate with terrestrial stations at a blazing rate. With the optional AEA WeFax 256, receive real-time, true grayscale images from either NOAA HF WeFax Service or the NOAA APT Satellite Service. Take a look at the Satellite modems available to you and you will see how AEA has engineered the DSP-2232 and DSP-1232 to be the best tool for working the satellites.

Specifications

Demodulator	Motorola 56001 Digital Signal Processor running at 24 MHz.
Modulator	Phase continuous sinewave, AFSK generator
Modulator output level	5-100 mV RMS side panel adjustable controls for each audio port
Processor system	Hitachi 64180
RAM	Battery-backed 64K
Send and receive	ASCII AMTOR (ARQ & FEC) Baudot Fax (2 color) Morse code Packet (AX.25 and KISS) PACTOR
Receive only	Signal Identification AMTOR ARQ Listen Bit-inverted Baudot RTTY NAVTEX TDM 250 gray shade fax PACTOR listen
Modems	
Port 1	**RTTY/TOR 170**: 2125/2295 **RTTY/TOR 170**: 1445/1275 **RTTY/TOR 425:** 2125/2250 **RTTY/TOR 850:** 2125/2975 **RTTY/TOR 200:** Pactor 2125/2310 **RTTY/TOR 200:** Pactor 1460/1260 Packet 300 bps HF 2110/2310 Packet 300 bps HF 1460/1260 Packet 1200 bps VHF Packet 1200

ROM	128K standard, expandable to 384K
Hardware HDLC	Zilog Z8530 SCC
Power Requirements	+12 to +16 Vdc @ 1.1 A

Input/Output Connections

Radio interference	Two 5-pin DIN connectors, Simultaneous operation
Direct FSK outputs	Normal/Reverse
CW keying output	+100 Vdc @ 100 mA max or -30 Vdc @ 20 mA max.
Terminal Interface	RS-232C DB-9S connector with hardware/software handshakes
Terminal data rates	Autobaud setting at 300, 600, 1200, 2400, 4800, 9600 bps; and 19,200 bps
Printer Interface	IBM compatible 25-pin bi-directional parallel port (DB-25)

Physical

Dimensions	12" (305 mm) W x 9.8" (249 mm) D x 2.9" (78 mm) H
Weight	3 lbs., 12 oz. (1.7 kg)

	bps PACSAT Packet 1200 PSK Packet 2400 V.26B Packet 4800 bps PACSAT Packet 4800 PSK Packet 9600 bps FSK K9NG/G3RUH Morse 750 Hz Analog Fax HF Analog Fax APT Analog SSTV DSP data 400 bps OSCAR- 13 RTTY/TOR 1200 bps ASCII OSCAR-11 DSP data spectrum Packet 1200 bps MSK Packet 2400 bps MSK
Port 2	Packet 200 bps HF 2110/2310 Packet 1200 bps VHF Packet 1200 bps PACSAT Packet 2400 bps V.26B Packet 9600 bps FSK K9NG/G3RUH DSP data 400 bps Oscar-13 Packet 1200 bps MSK Packet 2400 bps MSK
Dual	**RTTY/TOR**

Port	**170** 2125/2295, Packet 300 bps HF 2110/2310, Packet 1200 bps VHF, **RTTY/TOR 200,** PACTOR 2110/2310, Packet 300 bps HF 2110/2310, Packet 1200 bps VHF

May 7, 1997

PK-900 Digital DSP-2232
Command Summary

- **AMTOR - CMD: AM**

  CASedisp set to 2 will force UPPER CASE and save problems.
  If you do not use that, BE SURE to press the CAPS LOCK key.

  - **FEC Mode:** (non connected)
    - FEC (Enter) to XMIT
    - CTRL-D to Receive

  - **ARQ Mode:** (Connected)
    - ARQ [SELCAL] to CONnect
    - +? (Enter) to Receive
    - CTRL-D to DISConnect
    - AL (Enter) ARQ Listen mode

- **PACTOR - CMD: PT**

  Is NOT case sensitive.

  - **FEC Mode:**
    - PTS(end) to XMIT
    - CTRL-D to end Xmit
    - PTL to receive **Note:** When you go back to receive, if you have set the PTRound parameter to ON, the TNC will automaticly go to PTL and save having to enter the PTL at each receive. **However** the VHF access via Gateway will not function until you turn PTR off again.

  - **ARQ Mode:**
    - PTC [call] to connect
    - CTRL-Z Changeover Command
    - CTRL-D to disconnect
    - CTRL-C R Immediate Disconnect **NOTE: PTL(isten)** will monitor and TNC parameter PTR ON will automaticly return to PTL after CTRL-D.

- **RTTY - CMD: BA**
  - SETTINGS:
    - RBAUD 45
    - RXREV OFF
    - TXREV OFF
    - MODEM 1
    - QRTTY (Automaticly selects modem when starting with RTTY)
    - DIDdle OFF
  - X (Enter) to Xmit
  - CTRL-D to Receive

        - CTRL-C R END OF CONTACT

- **MAILDROP** Operation **TM(ail) ON**
- **GATEWAY** Operation
    - **PTR(ound) = OFF!**
    - XGateway = ON
    - OPMode = Packet, Amtor, Pactor
    - RADIO 1/2 (both ports active)
    - **GUsers 3**
    - MYCAL W0IPL-5/W0IPL-6
    - MYGate W0IPL-7
    - Connect via the gateway
        - Do connect to the TNC via mode above
        - Issue the "G" command (Gateway)
        - Connect to the destination node as if you were on that frequency (c w0ia - for the D-11 cluster, c marc-1 for the MARC cluster, etc.)

- **Function Keys**
    - **F2** - AMTOR on
    - **F3** - Gateway on
    - **F4** - PACTOR on
    - **F5** - Gateway off
    - **F9** - Reload Parms

OPERATING MANUAL

MODEL DSP-2232 DATA CONTROLLER

ADVANCED ELECTRONIC APPLICATIONS, INC.

ADVANCED ELECTRONIC APPLICATIONS, INC.

PREFACE TO THE DSP-2232 OPERATING MANUAL

Please read this preface in its entirety. It contains information about how to receive warranty service from AEA and AEA's software update policy.

RF Interference Information To User

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with AEA's instructions, may cause interference to radio and TV reception. 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 DSP-2232 on and off, the user is encouraged to try to correct the interference using one or more of the following measures:

- Re-orient the antenna of the device receiving interference.
- Relocate the DSP-2232 or computer with respect to this device.
- Plug the DSP-2232 into a different outlet so the DSP-2232 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.

To comply with Federal Communications Commission rules you must do the following:

- YOU MUST USE SHIELDED CABLE FOR ALL CONNECTIONS

- INTERNAL MODIFICATIONS TO THE DSP-2232 MAY INCREASE RF INTERFERENCE AND VOID THE USERS AUTHORITY TO OPERATE THE UNIT

This DSP-2232 has been certified under Part 15 of the FCC rules.
Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including that which may cause undesired operation.

As part of its continuing program of product improvement, AEA reserves the right to make changes in this product's specifications or documentation.

There may be inaccuracies or typographical errors in this document. Please address comments and corrections to AEA Incorporated, PO Box C2160, Lynnwood, WA 98036-0918. AEA reserves the right to incorporate and issue any information thus supplied in whatever manner it deems suitable without incurring any obligations whatsoever.

Welcome

Congratulations!! You've purchased another fine AEA product.
PLEASE, before we go any further, may we ask you to FILL OUT AND RETURN the Warranty Registration Card, which has been packed with your DSP-2232.

Product Update Policy

From time to time AEA may make available updates to the design of its products. We can only tell you about these updates if we have your warranty card on file. PLEASE SEND IT IN if you have not already done so.

In Case of Trouble

Application and troubleshooting assistance may be had by calling AEA during our 8:00-12:00, 1:00-4:30 working hours in Lynnwood WA. Ask for the Technical Support Department. The phone number is (206) 775-7373. Please have your DSP-2232's serial number and version date of the software available. The version date is on the first screen that comes up when you turn on the DSP-2232. We will also need to know the nature of any other equipment connected to the DSP-2232.

You may wish to attempt to solve problems locally, using other hams or an AEA dealer. A helpful Amateur with equipment similar to your own may literally be just around the corner. Substituting another DSP-2232 or Data Controller that you know is working properly for your questionable one is a diagnostic technique that will check out the rest of your station. You may also try running your DSP-2232 in another station if possible.

AEA provides Technical Support for its line of amateur radio equipment by way of your personal computer and modem on CompuServe's HamNet! If you are already a CompuServe member, just type GO HAMNET at any CompuServe prompt. For a free introductory CompuServe membership call 1-800-848-8199 and ask for representative 48.

If you call for assistance, please have your DSP-2232 up and running beside the phone. Our Support technician will likely ask you to perform certain keyboard routines to aid in diagnosis. If you have a voltmeter handy, you might have the DSP-2232 open so you can report measurements to the technician.

Many of the AEA products that are sent to us for repair are in perfectly good order when we receive them. There is a check-out charge for units returned to us in working order. Please perform whatever steps are applicable from the installation sections of this manual.

PLEASE DO NOT RETURN THE DSP-2232 TO US WITHOUT CONTACTING US FOR PERMISSION AND AN RMA NUMBER. WE WOULD LIKE THE OPPORTUNITY TO TROUBLESHOOT THE PROBLEM OVER THE PHONE FIRST, SAVING YOU BOTH TIME AND MONEY.

If the unit must be sent in, we will give you a Return to Manufacturer Authorization (RMA) number over the telephone. This number allows us to track your unit and provide you with its status. Please write this number on the outside of the box so we may process your unit as quickly as possible.

If you send us the DSP-2232 by UPS it must be sent to the street address - not the post office box number. The street address is:

AEA. Inc.
2006 196th St. S.W.
Lynnwood, WA 98036-7042 USA

Attn. Technical Support
RMA # S????????? (obtain by telephone from AEA)

We will need YOUR street address for UPS return - be sure to send it. Please include your daytime telephone number in case we need to contact you for further information.

UPS Surface (Brown Label) takes 5-6 days, Blue takes 2-3 days. Red is an overnight service and is expensive. Send the DSP-2232 in a way that it can be traced if we cannot verify receipt of shipment. We suggest UPS or insured postal shipment.

If the DSP-2232 is still under the original owner's warranty, AEA will pay the cost of the return shipment to you. The current policy is that it will be returned Brown, if received Brown or by US Mail; returned Blue, if received Blue or Red or by other overnight service; or returned as the owner states in his letter if he furnishes the return cost for the method he selects.

If the DSP-2232 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) If you designate billing to VISA or MASTERCARD, or 3) you prepay the service charges with a personal check, or 4) you specify some other method of return. We cannot accept American Express.

Typically, we will service the product in five to ten working days after it has arrived at AEA if we have all the facts. If we must call you, it may take longer. PLEASE include a letter stating the problem and where you can be reached by telephone. If you can be reached by phone in the evening on the East Coast, let us know the number. If your unit is out of warranty, we will give you a cost estimate for the repair when you call us for an RMA number. AEA is not responsible for damage such as caused by lightning, nonprofessional alterations, poor storage/handling, etc. We will make note of any shipping damage upon receipt. See the inside back cover for Warranty information.

Should your warranty card not be on file at AEA, you need to send the 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.

Gateway Upgrade

With the new Gateway firmware in your DSP-2232/1232, packet digipeating is a thing of the past. The Gateway firmware functions like <The-Net> or NET/ROM. Instead of users having to digipeat to connect to a distant station, they can now simply connect to your MYGATE call sign.

Once connected, your Gateway firmware supports local acknowledgment (*acks*) of packets just like a full service node. The node supports the following commands:

+++N7ML AEA Gateway. Type ? for help.
de N7ML-3 (B, C, D, J, L, N, S,)>

?	
B (ye)	**Log off Gateway**
C (connect) n	**Connect to station "n"**
C n STAY	**Stay connected to gateway when "n" disconnects**
D (isconnect)	**Cancel a connect attempt**
J (heard)	**Display stations heard**
L (isten)	**Toggle monitoring**
N (odes)	**Display nodes heard**
S (end)	**Broadcast unproto (call CQ)**

The Gateway firmware helps out fellow hams in your local area, by acting as a packet node.

Your DSP now has the capability never before offered in a multi-mode controller: the ability to "gateway" from packet-to-AMTOR, packet-to-PACTOR, and of course, packet-to-packet. Under your command, you can allow packet users connecting to port 2 the ability to monitor and link to other AMTOR, PACTOR, and even packet stations using your HF radio port.

The unique AEA Signal Identification Mode (SIAM) design now identifies all your favorite digital modes, including PACTOR.

Up/down Doppler shift for PSK modems, outputs for up.down frequency stepping to control the radio's frequency.

New Features & Enhancements

ALIST and PLIST have been enhanced to show AMTOR and PACTOR connect attempts.

ARXTOR enables automatic detection and switching between AMTOR and PACTOR.

CODE 7 allows for upper and lowercase letters in AMTOR using the protocol that APLINK stations, European mailboxes, the AMT-3, and B4BMK software use.

CODE 8 includes all features of CODE 7 and additionally codes new punctuation characters using NULL.

DAYTIME now allows for the Dallas Semiconductor "Smart Watch" chips to be used to hold the date and time when power is off.

EXPERT disables some of the less frequently used commands in the verbose mode.

GUSERS allows up to three stations to connect to the callsign of your MYGATE "Node" call.

MHEARD now identifies TCP/IP, NET/ROM and <The Net> stations.

MOPITT simplifies full bread-in (QSK), in CW operation.

MYALIAS allows an alternate callsign to be used by other stations to connect to your station.

MYGATE is the callsign of the Node function of your TNC.

REINIT allows you to get out of trouble by re-initializing most of your commands to their default settings.

SIAM now identifies PACTOR signals.

AEA WeFax 256

With this new Windows program, your DSP-2232/1232 can receive high resolution, true gray scale weather fax images.

Features include:

The ability to receive from NOAA HF WeFax service or the NOAA APT satellite service.

Two modes of resolution-500 or 250 pixels per line-which insure that AEA WeFax 256 will always work on your system. Incoming data is stored in a buffer so you can change the resolution later if you change your mind.

Supports BMP, GIF, PCX, TIF, and JPG image formats so you can share images with your friends, or use the images in other programs.

Includes complete image processor that gives you the ability to enhance received images. Enhancements include brightness control, contrast, gamma, sharpness, negative, blur, etc. It even includes a function that adds "false" color to the images you receive.

Requires: 386 PC compatible computer, Windows 3.1, 2 MB RAM, 5 MB free hard-disk space, and a 256-color VGA monitor and video card.

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CHAPTER 1

INTRODUCTION

1.1 Overview

The DSP-2232 was designed by AEA to provide you the Amateur the complete digital operating position when coupled with a Personal Computer or Computer Terminal. The DSP-2232 couples your HF or VHF/UHF (or both) voice transceivers to your computer or terminal so you can use its keyboard and display to "talk" to other Amateurs.

1.1.1 Capabilities

The DSP-2232 allows you to transmit and receive all legal Amateur digital modes that are popular on both HF and VHF. In addition you can send and receive black-and-white Weather FAX. The DSP-2232 can receive other modes such as TDM, NAVTEX and bit-inverted Baudot RTTY. These capabilities together with SIAM (Signal Identification and Acquisition Mode) make the DSP-2232 ideal for the digital Short Wave Listener as well.

The DSP-2232 with your Computer or Terminal allows you to transmit and receive the following modes:

o AX.25 Packet, both HF and VHF	(Chapter 4)
o Baudot and ASCII RTTY	(Chapter 6)
o AMTOR/SITOR CCIR Rec. 476 and 625	(Chapter 7)
o Morse Code	(Chapter 8)
o HF Weather FAX	(Chapter 9)
o Satellite Operation	(Chapter 11)
o PACTOR Operation	(Chapter 12)

In addition the DSP-2232 receives the following modes:

o NAVTEX marine broadcasts	(Chapter 7)
o TDM (Time Division Multiplex) signals	(Chapter 10)
o Bit-inverted Baudot RTTY	(Chapter 10)

The DSP-2232 also has the following special features:

o SIAM for SWLing	(Chapter 10)
o PakMail Maildrop for Automatic Packet Message Handling	(Chapter 5)
o AMTOR MailDrop Operation	(Chapter 7)
o KISS mode for TCP/IP and special Packet applications	(Appendix A)
o HOST mode for Host application programs	(DSP Technical Manual)

1.1.2 Included Components

Your DSP-2232 Data Controller package contains the following items:

- One DSP-2232 Data Controller
- DSP-2232 Operating Manual (this manual)
- Cables to connect your DSP-2232 to two separate radios
- Connector package to help setup your DSP-2232
- Radio Port "Loop-back" connector with jumper
- RS-232 Serial Cable with a DB-9 and a DB-25 connector

1.2 Computer or Computer Terminal Requirements

You will need a Computer or Computer Terminal to "talk to" or control your DSP-2232. If you are using a Computer, you will need a Communications Program or Terminal Program as it is sometimes called. The most popular computers are the IBM-PC and its compatibles, the Apple Macintosh and the Commodore-64/128. These, and most other computers can be made to work with the DSP-2232.

Although not required, AEA has program packages for the IBM-PC and the Macintosh computers that are customized for radio communications. These packages are PC-PAKRATT II with FAX for the IBM-PC and compatibles, and MACRATT with FAX for the Apple Macintosh. Details of how to connect each of these computers to the DSP-2232 can be found in Chapter 2 of this manual. You may use other computers than those mentioned above if the following technical requirements are met.

The Computer or Computer Terminal you plan to use must have an RS-232 Serial Communications port. You will also need a Communications Program that allows your computer to communicate over the RS-232 port using the ASCII character set. Details for connecting many computers can be found in Chapter 2 of this manual.

1.3 Station Requirements

We presume that you already have an operating radio transceiver or Short-Wave receiver to which you will connect your DSP-2232. In the Amateur bands most of the VHF activity occurs on the 2-meter FM band, while most of the HF activity occurs on the 20-meter band. An HF receiver or transceiver must be capable of SSB operation. While no specific brand of transceiver is required, we recommend that a modern transceiver (built in the last 20 years) capable of operation on one of the two frequency bands mentioned above be used. Specific transceiver connections are described in Chapter 3 of this manual.

1.3.1 System Transmitter-Receiver Performance Requirements

Most modern radio transceivers are capable of excellent performance in Morse, Baudot and ASCII RTTY, AMTOR and packet radio. Although AMTOR Mode A (ARQ) operation imposes more demanding switching speed requirements than the other operating modes, most radios will operate in both AMTOR modes without any modifications. Radio switching times are less critical in packet radio operation. See the AMTOR operating section for further details on timing requirements.

Your DSP-2232 provides software-controlled timing variations that permits operation with nearly all the HF and VHF/UHF radios in general use today.

1.4 DSP-2232 Specifications

As part of its program of product improvement, AEA reserves the right to make changes in this product's specifications. Changes may also be made to the information in this document and incorporated in revisions to this manual. Prices and specifications are subject to change without notice or obligation.

1.4.1 Modem Characteristics

Modulator/Demodulator:	Motorola 56001 Digital Signal Processor (DSP) running at 24 MHz
DSP RAM:	24 Kilobytes (May hold two user-uploaded modems)
DSP ROM:	Up to 128 Kilobytes of DSP modems may be stored and are loaded by the Z-180.
Analog to Digital Converter:	AD7870 12-bit ADC
Digital to Analog Converter:	AD767 12-bit DAC
Available ROM Modems:	300 bauds HF Packet FSK 2110/2310 Hz also 1260/1460 Hz 1200 bauds VHF Packet FSK 1200/2200 Hz 2400 bps Packet DPSK 1200 bps Satellite BPSK HF RTTY FSK 2125/2295 and 1445/1275 Hz also 2125/2550, 1275/2125, 2125/2975 Hz PACTOR 2110/2310, 1460/1260 Hz Morse 750 Hz center frequency Facsimile, FM and APT 256 gray levels FM SSTV compatible 256 level 9600 bps FSK K9NG Compatible 1200/4800 bps ASCII Satellite Dual Port 300/1200 and 1200/1200 Packet Dual Port RTTY-TOR/1200 baud Packet
Receive Band-pass:	Automatically switched by operating mode
VHF packet:	Center frequency 1700 Hz, bandwidth 2600 Hz
HF packet:	Center frequency 2210 Hz, bandwidth 450 Hz
CW:	Center frequency 750 Hz, bandwidth 200 Hz
Modulator:	Phase-continuous AFSK
Output Level:	5 to 100 millivolts RMS into 600 Ohms, adjustable for each channel by side-panel controls

1.4.2 Processor System

Protocol conversion:	Zilog Z-180 microprocessor
RAM:	64 Kilobytes
ROM:	Up to 384 Kilobytes of ROM may be used (128 Kilobytes are dedicated to DSP ROM Modems leaving 256 K for Z-180 programs)
Hardware HDLC:	Zilog 8530 SCC

1.4.3 Input/Output Connections

Radio Interface:	Two five-pin DIN connectors, simultaneous operation on the DSP-2232, software selectable on the DSP-1232
Input/Output Lines	Receive audio Transmit audio +/- Push-To-Talk (PTT) (+25 / - 40 VDC) External squelch input Ground
Direct FSK Outputs:	Normal and reverse for each radio port
CW keying Outputs:	Positive: +100 VDC max, at up to 100 mA Negative: -30 VDC max, at up to 20 mA For each radio port
Satellite UP/DOWN Outputs:	UP/DOWN Frequency control outputs for each port
Terminal Interface: Input/Output	RS-232-C 9-pin DB-9P connector RS-232-C with full handshake (hardware and software)
Terminal Data Rates	Autobaud selection of 110, 300, 600, 1200, 2400, 4800, 9600 and 19200 BPS. TBAUD adds 150, 200, 400 and 38400 BPS.
Parallel Printer Port	IBM compatible 25-pin bi-directional parallel port (DB-25 connector)

1.4.4 Controls and Indicators

Front Panel Indicators:	Ten-segment discriminator-type bargraph indicator for tuning of each radio port
Status Display	STATUS LCD Display showing Mode status
Power Indicator	Power LED (green)

LED Status indicators for each channel (DSP-2232):

DCD (Data Carrier Detect)
SEND (XMIT)
MULT (MULTiple packet connect)
STA (packet acknowledge STAtus)
CON (packet CONnect status)
TRANS (TRANSparent mode)
CONV (CONVerse mode)
CMD (CoMmanD mode)

1.4.5 General

Power Requirements:	+13 VDC (12 to 16 VDC) at 1100 mA
Mechanical:	Overall, 12" x 9.8" x 2.9" (305 mm X 249 mm X 74 mm) Weight 3 pounds 12 oz. (1.69 kilograms)

CHAPTER 2

COMPUTER INSTALLATION

2.1 Overview

In this chapter we will connect the DSP-2232 to the RS-232 Serial port of your Computer or Computer Terminal. After the Serial connection has been made we will perform a quick check of the internal software. Finally we will check the DSP-2232's modem by performing a Packet "loop-back" test. When you have completed this chapter, you will be ready to connect the DSP-2232 to your receiver or transceiver and begin using it on the air.

2.1.1 Equipment Required

You will need the following for this chapter:

- your DSP-2232 Data controller;
- a 13.6-volt DC, 1.5-amp (or greater) regulated power supply such as those sold by Radio Shack (or an AEA AC-4);
  (the power supply must be able to supply at least 12 VDC to the DSP-2232 while it is operating under load)
- the included DSP-2232 DC power cord unless the AC-4 is used;
- your Computer or Computer Terminal;
- a Communications or Terminal Emulation program for your computer;
  (not needed if a Computer Terminal is being used)
- the included RS-232 cable with 9-pin "D" connector on one end and a 25-pin "D" connector on the other end;
- one of the included 5-pin shielded "Radio cables";
  (note that the radio cables may arrive as a single 10-ft. cable which should be cut in half producing two 5-ft. cables.
- the 5-pin DIN connector with the jumper wire "Loop-back".
- wire cutters and strippers or a small pocket knife, a small straight-blade screwdriver and a medium Phillips-head screwdriver.

2.2 Unpacking the DSP-2232

Carefully remove the DSP-2232 from the box and its plastic bag. Inspect the unit for signs of damage that may have occurred in shipping. If there is visible damage, please contact the dealer or shipper. Do not attempt to install or use a damaged DSP-2232.

We will be discussing some of the Controls, Indicators and Connections in this installation so take a few moments to familiarize yourself with them. The figures on the next pages may help with their locations.

2.2.1 Connecting Power

MAKE SURE YOUR POWER SUPPLY IS OFF AND UNPLUGGED BEFORE WIRING

- Locate the DSP-2232 Power Cable in the accessory bag. Strip off just enough insulation from the ends to connect it to your 12-14 Volt DC regulated power supply.

- The Center pin of the coaxial power plug is POSITIVE. Connect the lead with the White stripe to the POSITIVE (+) lead on your power supply. Check this with an Ohm-meter if you have one.

- Connect the solid Black (GROUND) lead to the NEGATIVE (-) lead of your power supply. (The AEA AC-4 Wall Transformer is already wired correctly.)

- Connect the power plug to the 13 VDC Power Receptacle on the left rear of the DSP-2232. DO NOT CONNECT YOUR COMPUTER YET.

- Plug in your power supply or AC-4 and turn on power. Turn on the DSP-2232 by depressing the Power Switch on the rear of the unit. At power-on, the LCD STATUS display on the left should light and soon display the words "Press *". If this occurs, then switch OFF the DSP-2232 and move on to section 2.3.

If the STATUS display does not light, then re-check the above steps to insure that 12-14 VDC is available at the power plug and the center pin is POSITIVE.

If the STATUS display lights, but a message other than "Press *" is displayed, then the DSP-2232 has probably been initialized. If the DSP-2232 has been initialized it is ready to communicate with a computer or terminal at a specific baud rate (probably 300, 1200, 2400, 4800 or 9600 baud). If you know what this baud rate is then you should continue with the installation at section 2.3 keeping this in mind.

If you do not know what baud rate the DSP-2232 has been initialized to then you should reset the DSP-2232 by pressing the rear-panel RESET switch at the same time you turn on the power switch. After this is done, the "Press *" message should be observed on the LCD STATUS display.

If the above did not produce the "Press *" message, then contact AEA Technical Support Department as described in the front of this manual.

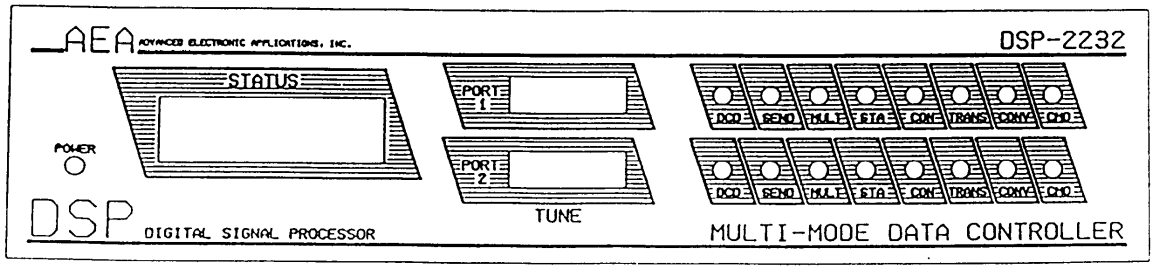


Figure 2-1 DSP-2232 Front Panel Controls and indicators

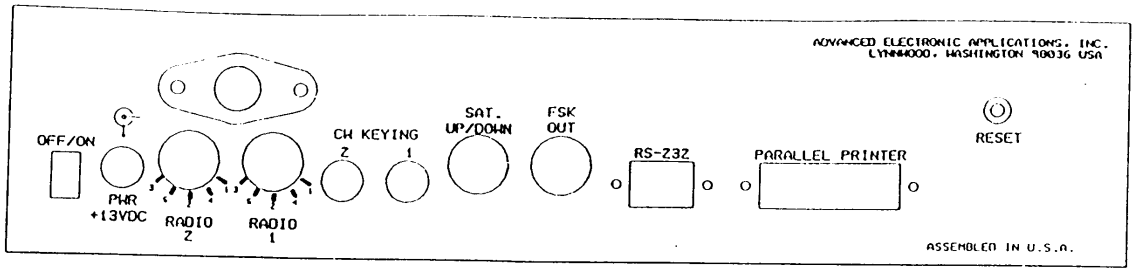


Figure 2-2 DSP-2232 Rear Panel Connections and Controls

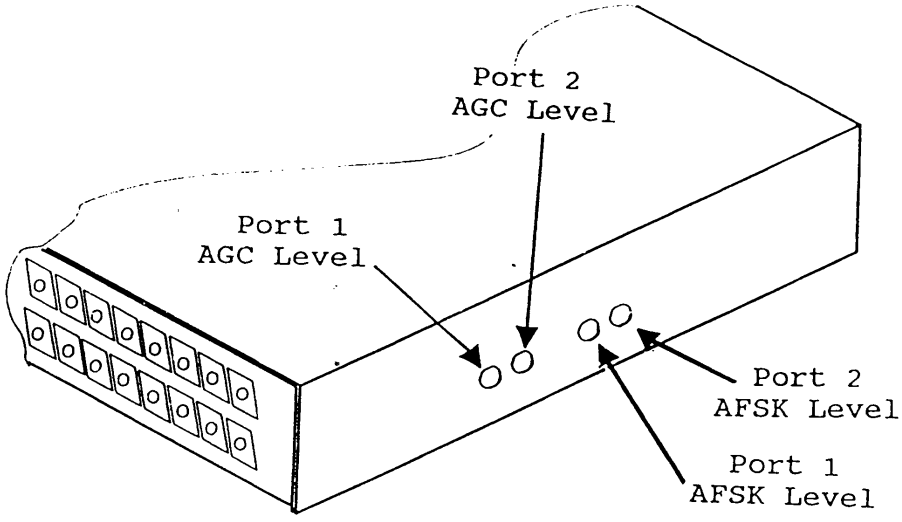


Figure 2-3 DSP-2232 Side Panel AFSK Controls

2.3 Connecting Your Computer or Computer Terminal

MAKE SURE THE DSP-2232 AND YOUR COMPUTER ARE SWITCHED OFF

- Locate the DSP-2232 Serial Cable. Connect the 9-pin Female connector to the RS-232 connector on the DSP-2232 rear panel.

- Connect the other end of this cable (Female DB-25) to the RS-232 Serial Port of your personal computer or Computer Terminal. Details on connecting to common machines are listed below.

NOTE: This cable was designed to connect directly to a 25-pin IBM-PC compatible RS-232 port. Many machines on the market today support this configuration. Some less-common machines are listed in section 2.6. Please be certain you have properly connected the DSP-2232 to your RS-232 computer or Terminal then proceed to section 2.4.

2.3.1 IBM-PC/XT/AT and Compatibles

IBM compatible 25-pin RS-232 serial ports should connect directly to the supplied serial cable. Some IBM compatible machines are equipped with a 9-pin serial port. For these machines a DB-9 to DB-25 adapter should be obtained from a Radio Shack store or a computer dealer.

2.3.2 Apple Macintosh Series of Computers

AEA presently sells the program MacRATT with FAX which contains the serial cable for the newer models of the Macintosh (models Mac + and later). If you intend to use another communications program with the DSP-2232 a Modem adapter cable must be purchased from your Apple dealer to connect the Mac to your DSP-2232. For the newer machines such as the Mac +, Mac SE and Mac II, a mini-8 to DB-25 adapter cable is required (included with the AEA MACRATT with FAX program). For the older Mac 128 and 512 machines, a DB-9 to DB-25 adapter cable from your Apple dealer is needed.

2.3.3 Commodore 64 and 128 Computers

The Commodore 64/128 computers do not have an RS-232 port as standard equipment. For these machines RS-232 adapters are available from manufacturers such as Commodore or OMNITRONIX. These may work with modem or terminal programs for your Commodore. Section 2.4 of this chapter deals more with programs for personal computers. The AEA Program COM-PAKRATT With FAX is NOT recommended for the DSP-2232.

2.3.4 Computer Terminal

If you have an RS-232 Computer Terminal, sometimes called a Dumb-Terminal, Smart-Terminal or ASCII-Terminal, you may need to change the gender of the cable provided with your DSP-2232. This can be accomplished with an inexpensive double-male RS-232 gender changing adapter available from Radio Shack and other computer dealers. The Radio Shack part number is 26-243.

2.4 Setting Up Your Communications or Terminal Software Program

If you will be using your DSP-2232 with a Computer, you will need to read parts of this section to set up your Communications or Terminal Software. If you will be using your DSP-2232 with a Terminal you will not need any software and may skip to section 2.5.

Setting up a Communications program for your DSP-2232 is very important. How your screen looks when you use your DSP-2232 depends completely on your Communications program. AEA currently makes available programs for the IBM-PC and compatibles and the Apple Macintosh computers. These products are customized for radio communications and are available at extra cost from your AEA dealer.

The DSP-2232 operates in much the same manner as a telephone modem and most modem Terminal Programs will control a DSP-2232 quite nicely. Some of these programs are "Public Domain" which means they are FREE. Other Terminal Programs are "Share-ware" which means you may get them from a friend and try them before you buy them. Whether you are using an AEA program or one of your own choosing, see the section below for the particular type of computer you plan to use.

2.4.1 Terminal Programs for IBM PCs and Compatibles

Although you can use almost any terminal program with your IBM PC or close compatible, AEA currently sells the PC-PAKRATT II w/FAX program which provides many features not available in "telephone modem" programs. See your AEA dealer for information on PC-PAKRATT II w/FAX.

If you already have the PC-PAKRATT II program, follow the program manual and install the software on your computer. You should also read through the PACKET OPERATION chapter of the PC-PAKRATT II manual. Familiarity with Packet operation of PC-PAKRATT will be necessary for performing a quick-check of the DSP-2232 in section 2.5 of THIS manual.

As we mentioned above, an AEA program is not required to use the DSP-2232. Many terminal programs can be found throughout the amateur radio community or can be downloaded from Compuserve, GEnie and from many telephone bulletin boards.

A partial list of PC programs tested with the DSP-2232 includes:

PROCOMM, CROSSTALK-XVI, SMARTCOMM, RELAY, BITCOM, QMODEM, PC-TALK, CTERM, HAMCOM, HAMPAC, YAPP and the terminal program included with Microsoft Windows 3.0 (tm).

Follow the installation directions that come with the Terminal program you wish to use. Once installed on the computer, you should start the program and set the communication parameters for the following:

Data Rate = 1200 bits per second (Bauds)
Data bits = 7
Parity = EVEN
Stop bits = 1

Once these settings have been achieved and the correct serial communications port chosen, you may proceed to section 2.5.

2.4.2 Terminal Programs for the Apple Macintosh

Although you can use almost any terminal program with your Macintosh, AEA presently sells the MACRATT with FAX program which provides many features not available in "telephone modem" programs. See your AEA dealer for information on MACRATT with FAX.

If you already have the MACRATT program, please follow the program manual and install the software on your Mac. You should also read through the PACKET OPERATION chapter of the MACRATT manual. Familiarity with Packet operation of MACRATT will be necessary for performing a quick check of the DSP-2232 in section 2.5 of THIS manual.

As we mentioned above, an AEA program is not required to use the DSP-2232. Many terminal programs can be found throughout the amateur radio community and can be downloaded from Compuserve, GEnie and from many telephone bulletin boards.

A partial list of Mac programs tested with the DSP-2232 includes:

MAC TERMINAL, RED RYDER, MICROPHONE, SMARTCOMM II and MOCK TERMINAL

Follow the installation directions that come with the Terminal program you wish to use. Once installed on the computer, you should start the program and set the communication parameters for the following:

COMPATIBILITY:
1200 bauds, 7 bits/character, even parity, Handshake XON/XOFF, FULL-DUPLEX, Modem connection, "telephone" port.

Once these settings have been achieved, proceed to section 2.5.

2.4.3 Terminal Programs for the Commodore 64, 64C and 128

Although AEA presently sells the COM-PAKRATT with FAX program package for the PK-232, this program cannot access all the features of the DSP-2232. AEA therefore cannot recommend using the COM-PAKRATT package with the DSP-2232. If you already have this package, it will certainly get you started with the DSP-2232 by using the "Dumb Terminal" mode. You may wish to find another program which provides more features than are available in the COM-PAKRATT program in the Dumb Terminal Mode. Other ideas for terminal programs for the Commodore-64 series of computers are listed below.

Many terminal programs can be found throughout the amateur community or can be downloaded from Compuserve and from many telephone bulletin boards. In addition a BASIC communications program is listed in the Programmer's Reference Guide published by Commodore. Use the program listing for "True ASCII". We suggest you operate your DSP-2232 at 300 bauds with these computers to avoid possible speed difficulties.

Follow the installation directions that come with the Terminal program you wish to use. Once installed on the computer, you should start the program and set the communication parameters for the following:

Data Rate = 300 bits per second (Bauds)
Data bits = 7
Parity = EVEN
Stop bits = 1

Once these settings have been achieved, proceed to section 2.5.

2.5 System Startup and Loop-back Test

Make sure that you have connected your DSP-2232 to a 12-14 Volt DC power source and to the RS-232 port of your computer or Terminal. If you are using a computer, you must also have a communications program and be familiar with its operation. You are now ready to begin the following DSP-2232 Startup and Loop-back test procedure.

1. Don't connect any cables to your radio yet!

2. Remove the 5-pin DIN "Loop-back" connector from the DSP-2232 accessory bag.

3. Plug this connector into the RADIO-1 connector on the DSP-2232's rear panel.

4. Set both AFSK levels on the right side of the DSP-2232 to 50% rotation (straight up and down) using a small screwdriver.

5. Turn on your computer. Load and run your communications program.

   If you are using an AEA PAKRATT program, follow the program instructions to enter the Packet mode, then skip to step 11.

   If you are using another Terminal Program or a Computer Terminal, Set your computer's terminal program to:

   - 1200 bauds (if available);
   - seven-bit word;
   - even parity;
   - one stop bit.

NOTE: You may use other terminal baud rates with the DSP-2232 - we recommend 1200 baud here to keep this procedure easy and consistent.

6. Press the DSP-2232's power switch to the ON position.

   At power-on, the LCD STATUS display on the left should light and soon display the words "Press *". If the STATUS display lights, but a message other than "Press *" is displayed, then the DSP-2232 has probably been initialized. If you know the terminal baud rate the DSP-2232 has been set to, you may proceed to step 11; otherwise you must reset the DSP-2232 as described below.

   To reset the DSP-2232, simply press the rear-panel RESET switch at the same time you turn on the power switch. After this is done, the "Press *" message should be observed on the LCD STATUS display.

   If your serial port is operating at 1200 bauds as we recommend, you'll see the "autobaud" message:

   Please type a star (*) for autobaud routine.

   If your serial port is operating at 300, 2400, 4800 or 9600 bauds, you may see some "garbage" characters.
   This is normal and you should proceed with step 10.

7. Type an asterisk (*). When the DSP-2232 has "recognized" your computer's data rate, the CMD LED will light. Your screen will then display the sign-on message:

```
DSP-2232 is using default values.

AEA DSP-2232 Data Controller
Copyright (C) 1986-1991 by
Advanced Electronic Applications, Inc.
Release DD.MMM.YY
cmd:
```

Make note of the Release date on the first page of this manual. This is important should you ever call AEA for technical support. It should match the firmware release sticker on the bottom of your DSP-2232

8. If you are using an AEA program, follow the instructions in the program manual to enter the packet callsign (MYCALL) of AAA into the DSP-2232. Even though this is not your callsign, please do this for this procedure. You must change it to YOUR OWN CALLSIGN after completing this procedure.

If you are using a Computer Terminal or a non-AEA terminal program the following will set your packet callsign to AAA:

Enter MYCALL by typing MY AAA <Enter> (or <RETURN>).
(<RETURN> or <Enter> means type the single key on your keyboard.)
Your monitor should display:

```
MYcall   was DSP/DSP
MYcall   now AAA/DSP
```

9. If you are using an AEA program follow the instructions to CONNECT in packet mode to AAA. Since you have just entered your callsign as AAA, you will connect to yourself.

If you are using a Computer Terminal or a non-AEA program, entering the following after the "cmd:" command mode prompt will cause the DSP-2232 to Connect to AAA:

C AAA <Enter>

After a few moments, your monitor should display:

```
*** CONNECTED to AAA
```

10. Type HELLO SELF <Enter>
After a few moments, your monitor should echo the same message.

If you have gotten this far then the digital section of the DSP-2232 and the VHF packet modem are both working.

11. We will now check the DSP-2232's HF modem. If you are using an AEA program, follow the instructions to select the HF modem by turning the VHF Parameter OFF; this will automatically set the radio baud rate HBAUD to 300 for HF packet work.

    If you are using a Computer Terminal or a non-AEA terminal program, the following sets the HF mode of the DSP-2232:

    Type <CONTROL-C>. (Type C while pressing the <Ctrl> key down.) Your monitor should respond with the command prompt:

    ```
    cmd:
    ```

    Then enter VHF OFF <Enter>
    Your monitor should respond with:

    ```
    Vhf     was ON/ON
    Vhf     now OFF/ON
    *** HBAUD now 300/0
    ```

12. If you are using an AEA program type HELLO SELF <Enter>
    Your monitor should soon echo the message you've just typed.

    If you are using a Computer Terminal or a non-AEA terminal program, you must first type CONV or K followed by a <Enter>. Now you may type a few characters. Your monitor should soon echo the characters you've just typed.

13. If you are using an AEA program, follow the instructions to DISCONNECT from a Packet station.

    If you are using a Computer Terminal or a non-AEA terminal program the following will cause the DSP-2232 to DISCONNECT:

    Enter <CONTROL-C>
    Your monitor should respond with the command prompt:

    ```
    cmd:
    ```

    Enter D <Enter>
    Your monitor should respond with:

    ```
    cmd:*** DISCONNECTED: AAA
    p1 AAA*>AAA (UA)
    ```

If all of the above steps were successful, you've completed the quick-check and are ready to proceed to Chapter 3. In Chapter 3 you will connect your DSP-2232 to your radio and begin using it "on the air".

If you have problems with the steps shown above, go back to Step 1 AFTER checking all cables and connectors. Read each step again carefully. The most common problems are trying to connect to a call different from AAA, not having the loop-back jumper connected, or not setting the AFSK level to 50% rotation.

If you still have problems, leave your DSP-2232 ON and contact AEA's Technical Support Department as suggested in the front of this manual.

2.6 Detailed RS-232 Connections for Other Computers

If the type of computer you plan to use with the DSP-2232 was not mentioned in the beginning of this chapter, you may find specific connection information in the sections below. You will also need a Communications program to use with your computer which AEA can not provide. See section 2.7 for information regarding Communication programs for many of these machines.

Some computers require a serial port adapter card that incorporates the necessary RS-232-C interface circuitry. The IBM-PC and Apple II series of computers are good examples of this.

Computers that do not have a serial port or do not permit use of a suitable adapter or level converter cannot be used with the DSP-2232.

2.6.1 Apple II Series

The Apple II, II+ and IIe computers require an RS-232 Serial card to connect to your DSP-2232. The most popular we know about is the Super-Serial Card which should be available from your Apple dealer.

2.6.2 Commodore C-64, C-128 and Vic 20

Commodore, OMNITRONIX and other manufacturers sell a signal level converter that is installed in the User Port Connector on the rear of the computer. The converter changes the computer's internal TTL voltage levels to the proper RS-232-C voltage levels and polarities.

2.6.3 IBM PCjr

The PCjr uses standard RS-232-C voltage levels; however, the connector is not standard and is hard to find. Pin-out information can be found in the IBM PCjr Technical Reference Manual. Some dealers sell a 'IBM PCjr Adapter Cable for Serial Devices' that converts the connector on the PCjr to standard RS-232-C. The cable attaches between the PCjr and the DSP-2232 Serial Cable.

2.6.4 Tandy Color Computer

The CoCo series (except for the Micro CoCo) uses a four-pin DIN connector for its serial interface. Wire a cable as shown below. All necessary parts should be available from your Radio Shack dealer.

CoCo	DSP-2232 (DB9S)
4	3
2	2
3	5

2.6.5 Tandy Model 100/102 and NEC 8201

The Model 100/102 and NEC 8201 have built-in standard RS-232 serial ports which are compatible with the DSP-2232. You'll need a DB-25 male-male gender changing adapter to use the supplied DSP-2232 Serial Cable.

2.6.6 Other Computers with RS-232-C Ports

If your computer has an RS-232 port, consult your computer manuals to see which pins are used for Transmit-Data, Received-Data and Signal-Ground. Read the manufacturer's recommendations for connecting the serial port to a modem and connect your DSP-2232 in the same way.

Your DSP-2232 is configured as Data Communications Equipment (DCE) which receives data on pin 3 of the 9-pin DB-9 connector or pin 2 of the 25 pin cable supplied with the unit. Most computers and terminals are configured as Data Terminal Equipment (DTE) transmitting data on pin 3 of a DB-9 or pin 2 of a DB-25 RS-232 connector.

- If your computer is configured as DTE:

  Use the supplied RS-232 cable with a Gender changing adapter if necessary. These are available from Radio Shack (Part # 26-243) and other computer stores.

- If your computer is configured as DCE:

  You may want to purchase a Null Modem adapter from Radio Shack (Part # 26-1496) or other computer store.

  You may also wire your own cable directly to the DSP-2232's DB-9 connector by wiring the Transmit Data (TXD), Receive Data (RXD), and the Signal Ground (GND) to a DB-9S (Female) connector as diagrammed below:

CoCo	DSP-2232 (DB9S)
TXD	3
RXD	2
GND	5

- As a default the DSP-2232 provides XON/XOFF software flow-control to the computer or terminal. The command XFLOW can be turned OFF to enable hardware handshake if your computer requires it. Hardware flow control is achieved with RTS/CTS (pins 7 and 8) of the 9-pin connector on the DSP-2232's rear panel.

2.6.7 Other Computers with Non-Standard Serial Ports

Computers with non-standard serial ports must meet the following conditions:

- The signal levels must be compatible with RS-232-C. The DSP-2232 requires the voltage levels from the computer be greater than +3 volts in the "asserted" state and 0 volts or less in the "non-asserted" state.

- The signal polarity must conform to the RS-232-C standard. The 0 or negative-voltage state must correspond to logical "1" and the positive-voltage state to logical "0."

- The computer must be able to correctly receive a signal that meets asynchronous RS-232-C specifications. The DSP-2232 supplies signals that meet this specification.

Make or buy a cable that provides the following connections:

- The computer's serial port signal ground or common pin must be connected to pin 5 of the DSP-2232's 9-pin connector.
- The pin on which the computer SENDS data must be connected to pin 3 of the DSP-2232's 9-pin serial connector.
- The pin on which the computer RECEIVES data must be connected to pin 2 of the DSP-2232's 9-pin serial connector.

If your computer requires any other signals, you must arrange to provide them. The DSP-2232 has the standard hardware handshake lines available. As a default the DSP-2232 provides XON/XOFF software flow control to the computer or terminal. The command XFLOW can be turned OFF disabling software flow control and enabling hardware handshake if your computer requires it. The documentation provided with your computer or serial card should clarify any special requirements.

2.7 Terminal (Modem) Software for Other Computers

Any communications program that enables your computer to emulate or act as an ASCII terminal with a telephone modem should work with your DSP-2232. If you have a familiar program you have used successfully, use it to communicate with your DSP-2232.

2.7.1 Terminal Programs for the Apple II, II+, IIe and IIC

The DSP-2232 operates well with the Apple II family of computers using both Apple-supplied or third-party serial interface cards. Terminal programs include Modem Manager, ASCII EXPRESS PRO, Hayes SMARTCOMM II, and DataCapture 4.0.

2.7.2 Terminal Programs for the Commodore Vic 20

A BASIC communications program is printed in the VIC 20 Programmer's Reference Guide published by Commodore. Use the program listing for "True ASCII"; Commodore computers internally use a modified ASCII format. We suggest you operate your DSP-2232 at 300 bauds with these computers to avoid possible data speed difficulties.

2.7.3 Terminal Program for the IBM PCjr

The PCjr's BASIC cartridge contains a terminal program. Start the program by typing TERM. Refer to the PCjr's BASIC manual for details on the program. For best results with the PCjr do not run the DSP-2232's serial port baud rate faster than 1200 bauds.

2.7.4 Terminal Programs for the Tandy Color Computer

Several terminal programs are available for the CoCo. We suggest that you use a commercial program rather than writing your own. The CoCo's "software UART" may be difficult to program in BASIC.

2.7.5 Terminal Program for the Tandy 100/102 and NEC 8201

The Model 100, 102 and NEC 8201 have built-in terminal programs in ROM which control the modem and the RS-232C port. Consult the computer documentation for instructions in their use. Make sure that you do not use the program to control the built-in telephone modem.

CHAPTER 3

RADIO INSTALLATION

3.1 Overview

This chapter describes how to connect the DSP-2232 to your radio receiver or transceiver. To receive digital transmissions you must connect the receiver audio and Ground to your DSP-2232. To transmit you will have to add connections to the microphone or low-level transmit audio and to the Push-To-Talk (PTT) circuit of your transceiver.

The most convenient way to connect your transceiver is through a rear panel ACCESSORY Connector (if your transceiver has one). You may also use the Mic connector if you prefer. MAKE SURE THAT YOU REMOVE POWER FROM THE DSP-2232 AND YOUR RADIO BEFORE MAKING ANY CONNECTIONS.

3.1.1 Equipment Required

You will need the following for complete transmit/receive connections:

- your DSP-2232 Data Controller, computer or Computer Terminal and software as discussed in Chapter 2 of this manual;
- AEA-supplied shielded cable for each radio you wish to connect;
- your radio and its power supply;
- microphone or accessory-plug connector(s) required by your radio;
- soldering iron and solder if the radio connectors require it;
- wire cutters and strippers and/or a small pocket knife;

3.2 Receive-Only Radio Connections

If you are a Short Wave Listener (SWL) or only interested in receiving signals, the connections to the DSP-2232 are simple. Even if you are planning on transmitting and receiving, you may initially want to just receive to become familiar with the DSP-2232. Taking a little time to tune in and "read the mail" is an excellent way to get acquainted with the various modes before going on the air.

For receive operation, only the audio from the receiver or transceiver (and Ground) needs to be connected to the DSP-2232. This can often be accomplished by simply soldering the included 3.5 mm audio plug to the GREEN and BROWN wires of a DSP-2232 Radio Cable as shown in figure 3-1 below. The audio plug can then be connected to the External Speaker/Earphone jack on the radio you will be using.

NOTE: Some Short Wave receivers come with low-level outputs designed for use with a tape recorder. These outputs typically do NOT have enough level to drive the DSP-2232.

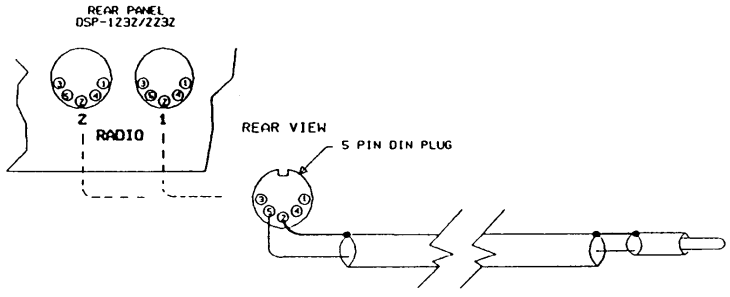


Figure 3-1 Receive audio connection to the DSP-2232.

If you are using an HF transceiver or Short-Wave receiver you should consult Chapter 10 for information on the Signal Identification mode. Chapters 4, 6, 7, 8 and 9 talk specifically about some of the modes you may encounter on the HF and Short-Wave bands.

If you are connecting to a VHF scanner or VHF/UHF transceiver you should look over Chapter 4 on Packet operation.

3.3 Transmit and Receive Radio Connections

To connect your DSP-2232 to a HF or VHF/UHF TRANSCEIVER you will need access to the Receive-Audio, Transmit-Audio (mic-audio), Push-To-Talk, Ground and optionally a Squelch input for shared voice/data channels. Most of these signals are typically available on the Mic connector and also often on a rear-panel Accessory connector of the transceiver. If you will be wiring the DSP-2232 to more than one radio, repeat the procedures in section 3.3.5 for each radio you will connect.

3.3.1 Transceiver's Microphone or Accessory Connector?

The most convenient way to connect your transceiver is through a rear panel Accessory connector if one is available. If the DSP-2232 is connected as an accessory, the microphone used for voice operation can sometimes be left connected to the transceiver. This makes changing between voice and data modes easier than if the microphone must be unplugged in order to connect the DSP-2232. On most HF radios however, the mic is "hot" and should be unplugged during data operation.

3.3.2 Connections for Specific Transceiver Models

APPENDIX E of this manual contains information and diagrams for connecting the DSP-2232 to many modern HF and VHF transceivers. Please turn to APPENDIX E and locate the transceiver model you will be connecting to your DSP-2232. If you do not find the exact model of your transceiver in APPENDIX E, then locate a model from the same manufacturer that has the same Accessory or Microphone connector as the unit you will be connecting.

3.3.3 Check Your Transceiver's Operating Manual

Locate the Operating Manual for your transceiver and turn to the page describing the connector to which you will attach your DSP-2232. Even if you found the exact model of your transceiver in APPENDIX E, it is a good idea to verify that your transceiver's manual agrees with the information in the appendix. If the information does not agree, or you could not find the exact transceiver model in APPENDIX E, then you should use the information contained in your transceiver's manual to connect the DSP-2232.

3.3.4 Specific Connection Points

Whether you are connecting an HF Single Side Band transceiver for RTTY/FAX operation, or a VHF/UHF transceiver exclusively for packet, the minimum connections to your transceiver will be almost identical. HF transceivers have a few optional connections that will be covered after the basic connections have been made.

The following table and figure will be helpful in identifying the proper basic connection points to the DSP-2232 radio cable.

Pin	Signal Name	Wire Color	Description
1	Microphone audio	White	AFSK from DSP-2232 to transceiver
2	Ground	Brown	Audio and PTT common return
3	Push-To-Talk	Red	DSP-2232 keys transmitter
4	Receive audio	Green	Audio from receiver to DSP-2232
5	Squelch Input	Black	Allows DSP-2232 to detect activity on a shared mode channel (optional)
	Shield/Drain Wire	Silver	Shield of cable / Microphone Ground

Table 3-1 J4 and J5 Radio Port and Cable Connections

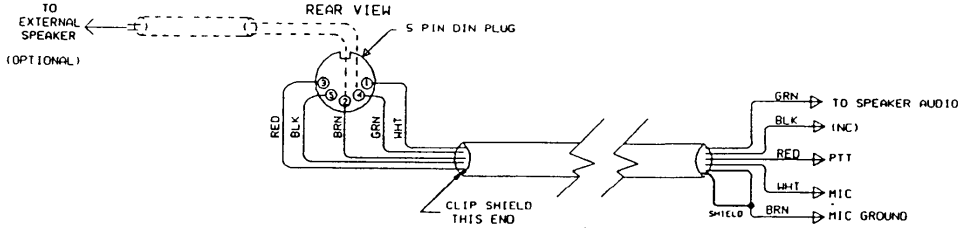


Figure 3-2 DSP-2232 to Radio Cable Connections

3.3.5 Begin Assembling your Radio Cable

Assemble the tools, DSP-2232 Radio cable and connectors you will need for each radio you wish to connect. You will probably also need a small soldering iron (20-40 watts) and solder at your work area.

3.3.5.1 Prepare the Radio Cable

1. Locate one of the 5 ft DSP-2232 radio cables included with your DSP-2232. Note that the Radio cables may have been shipped as a single 10 ft cable which should be cut in half before use.

2. Prepare the bare end of one of the radio cables by removing an appropriate amount of the jacket for the connector you will be attaching. Usually this is 1/2 to 3/4 inch.

3. Carefully remove the foil shield exposing the colored wires underneath. Be careful not to nick or cut the shield wire.

4. Strip back 1/8 inch of colored insulation from the GREEN, RED, WHITE and BROWN wires.

NOTE: The BLACK wire is the squelch input and normally not used. The black wire is only needed for Packet operation if the channel you plan to operate on is used for both voice and data. If you need this connection, strip away 1/8 inch of BLACK insulation as done with the other four wires. If this wire is not needed, then leave the insulation intact.

3.3.5.2 Verify the Connection Points with Your Manual

Look at the connector closely (with a magnifying glass if necessary) and locate pin 1. Compare this to the location of pin 1 on the connector drawing in your transceiver's manual and also in APPENDIX E. This is important as some diagrams show the connector from the inside of the transceiver, not the outside of the plug you are wiring. This will help insure that the plug is not wired backwards.

3.3.5.3 Prepare the Connector

Now that the cable is prepared, you are ready to prepare the connector for wiring. If the connector you are wiring has a shell, be sure that it is placed over the cable before any connections are made. If this is not done, an otherwise perfect wiring may have to be redone.

3.3.5.4 Wire the Connector

The following connections must be made for transmit and receive operation of the DSP-2232. Refer to table 3-1 and figure 3-2 as well as APPENDIX E and your transceiver's manual when making these connections.

HINT: When wiring a Connector, it is often easier to wire the inside or middle connections first and work your way to the outside pins. For this reason the following steps are not numbered and may be done in any convenient order.

- Connect the Shield/Drain wire (Silver wire with no insulation) to the Microphone GROUND connection if your transceiver has one. If your transceiver does not have a separate Microphone or Audio-in Ground connection, then this wire should connect to the single Ground along with the Brown wire. See the next step.

- Connect the BROWN wire to the main GROUND on the connector. This Ground is the one used for the PTT and receive audio. You should connect the Silver Shield/Drain wire to this GROUND only if there is not a separate Microphone Ground as described in the previous step.

- Connect the RED wire to the Push-To-Talk (PTT) terminal on the connector. At this time, check the manual to determine whether your transceiver uses positive (+) or negative (-) PTT. The DSP-2232 comes from the factory set for Positive PTT since most transceivers use this method of keying. This will be discussed in more detail in the Adjustment sections below. If you are connecting a Handheld transceiver to your DSP-2232, you will probably need a resistor and/or capacitor to isolate this connection from the AFSK audio. Check APPENDIX E.

- Connect the WHITE wire to the MICROPHONE AUDIO terminal on the connector. This connection carries the low level Audio Frequency Shift Keying (AFSK) to the transmitter's microphone audio section. If you are connecting a Handheld transceiver to your DSP-2232, you will probably need a resistor and/or capacitor to isolate this connection from the PTT. Check APPENDIX E.

- Connect the GREEN wire to the RECEIVER AUDIO terminal on the connector. For the DSP-2232 to operate properly, we recommend at least 200 mV RMS of receive audio be available. If you are connecting to an Accessory Jack, make sure the available level is at least 200 mV RMS. For CW work 400 mV may improve operation.

- If you will be using a Packet Radio channel that is shared with voice users then you should connect the BLACK wire to the SQUELCH status pin of the connector. This will prevent the DSP-2232 from transmitting when there is a received signal strong enough to open the Squelch. If you connect this pin you may have to change the setting of the SQUELCH command in the DSP-2232. Most VHF/UHF Packet channels are no longer shared with voice users so this connection will probably not be needed.

This completes the minimum necessary connections for transmit and receive operation with the DSP-2232. If you are interested in using the DSP-2232 to transmit Morse code (CW) or transmit RTTY using FSK inputs on your HF transceiver, the following three sections (3.3.6, 3.3.7, and 3.3.8) should be read.

If you will not be using any of the connections described in the following sections, then skip ahead to the Final Adjustment section 3.4 where you will set levels and prepare to go "On the Air".

3.3.6 Wiring Your HF Transceiver for Direct CW Keying

The DSP-2232 can directly key CW with HF and VHF multi-mode transceivers. This requires that a cable be wired from the CW KEY OUT jack on the DSP-2232's rear panel to your CW keying input of your transceiver on the correct Radio Port. Refer to the instructions below and Figure 3-3 to wire the DSP-2232 side of the cable.

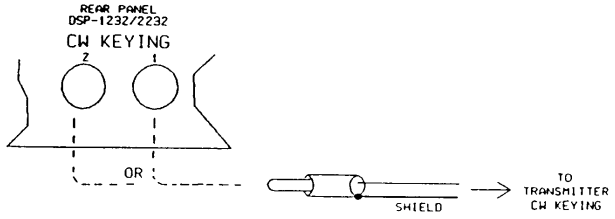


Figure 3-3: Direct CW Keying Cable diagram

1. Locate an RCA connector from the DSP-2232's accessory bag.

2. Locate some shielded audio cable from Radio Shack or other cable house and solder the RCA connector to the cable as shown above.

3. Locate the connector for the CW keying input to your transceiver. These are often supplied in your transceiver's accessory kit.

4. Wire the transceiver connector as per the instructions in your transceiver's manual for a "Straight key".

Consult your radio's instruction manual to determine if your radio uses negative (Grid Block) or positive keying polarity. Connect the shielded cable you just wired from the DSP-2232's positive or negative keying jacks to your radio's CW key input connector.
See the Specifications on page 1-3 for maximum limits.

3.3.7 Connections for Direct FSK Operation on RTTY

Some HF SSB radios provide direct FSK (Frequency-Shift Keying) for RTTY operation. Direct FSK can be an advantage when using RTTY and AMTOR and can sometimes help in HF packet operation. FSK operation may be helpful if your transceiver can switch in filters. Be cautious of narrow filters as they can limit your data rate. Direct FSK is not always recommended for data speeds above 110 bauds. Consult your transceiver's manual for further recommendations on direct FSK.

To install and operate your DSP-2232 and radio in the FSK mode:

1. Connect a shielded cable from the DSP-2232's J3 (DIN) receptacle, pins 1 or 4, to the radio's FSK input for radio port 1. Pins 3 or 5 are the FSK outputs for radio port 2.

NOTE: Polarity of the FSK signals is not standardized by the radio manufacturers. We have observed that Icom radios most often use FSKN (pins 1 and 3), while Kenwood radios most often use FSKR (pins 4 and 5). Consult your transceiver's manual to identify the proper polarity.

2. Connect the FSK lines from the DSP-2232 to your radio's FSK or RTTY input in accordance with your radio's requirements.

   See Figure 3-4 below.

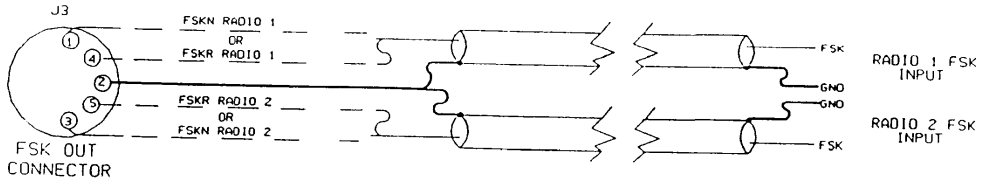


Figure 3-4 Connector J3 FSK Connections

NOTE: When using FSK, the same power and duty cycle limits apply as cited earlier for AFSK operation. Consult your radio's operating manual for any power or transmit time limits.

3.3.8 Connections for a Packet Satellite Receiver

If you will be operating Packet Radio through a satellite, you should connect the DSP-2232 to your receiver's UP/DOWN frequency control. To connect the DSP-2232 to your satellite receiver, do the following:

1. Connect a shielded cable from the DSP-2232's J7 (DIN) receptacle, to the UP and DOWN frequency control pins on the microphone jack or rear panel accessory connector of your satellite receiver.

   Pins 1 and 4 are UP and DOWN, to the radio's frequency control input for radio port 1. Pins 3 and 5 control UP/DOWN for radio port 2. See Figure 3-5 below.

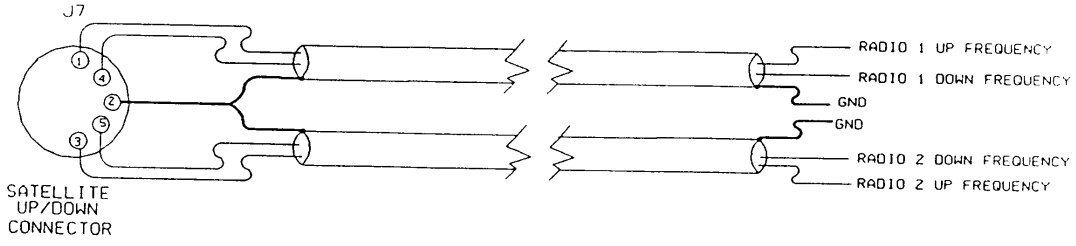


Figure 3-5 Connector J7 Satellite UP/DOWN Frequency Connections

3.4 DSP-2232 Configuration Jumpers and Connections

Before operating the DSP-2232, you must first make sure it is correctly configured for your radio's PTT. After this has been checked you should then connect the cables you constructed above.

3.4.1 Push-To-Talk (PTT) Configuration

Before you connect the Radio cable(s) you just made to the DSP-2232, consult your transceiver's manual for Push-To-Talk keying polarity. Most transmitters and transceivers made in the last 15 years use Positive PTT keying. However some gear, especially if it contains vacuum tubes, may use a negative PTT keying voltage.

The DSP-2232 is configured for positive PTT at the factory so it will operate with most equipment without changes. However, if necessary, you can change the polarity of the PTT configuration on either Port 1 or Port 2. Follow these steps:

- Remove four screws from the top and eight screws from the sides of the DSP-2232 chassis cover and lift off the cover.
- Locate Jumper posts JMP4 and JMP5 which are about 4 inches in from the right-rear corner of the PCB.
- JMP4 configures Port 1 and JMP5 configures Port 2.
- When the shorting jumpers are towards the fuse, the port is configured for Positive (+) PTT. When the shorting jumpers are towards the center, the port is configured for Negative (-) PTT.

Replace the cover and twelve screws when you are finished configuring the polarity of the DSP-2232 PTT circuit.

3.4.2 DSP-2232 Connections

Remove power from the DSP-2232, your transceiver and all accessories before making any connections.

Connect the Radio Cable(s) you constructed in section 3.3.5 between a Radio port on the DSP-2232 and your transceiver(s).

If you wired cables for CW keying or Direct FSK then connect these to the appropriate point on your equipment.

3.5 Transceiver Adjustments

This section is split into separate procedures for FM and SSB radios. You may adjust either port at any time without affecting the other.

3.5.1 FM Transceiver Final Adjustments

1. Turn on your computer and DSP-2232 and start your terminal program.

2. Connect the radio to a dummy load. Be prepared to monitor your transmissions with another nearby radio such as a handheld transceiver.

3. Verify that your DSP-2232 and FM radio are connected as shown in Figure 3-6 below.

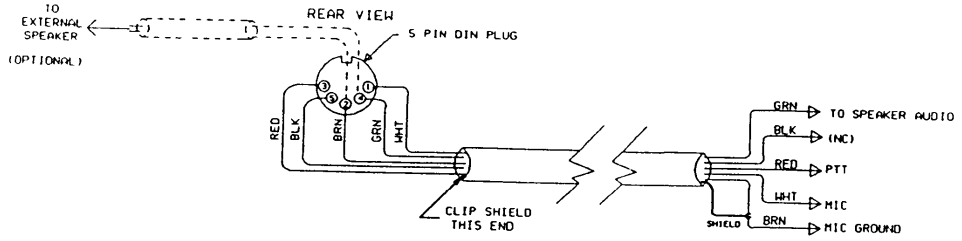


Figure 3-6 Radio-to-DSP-2232 Connections

4. If you are using an AEA program such as PC-PAKRATT II or MACRATT, you must enter the Dumb Terminal mode to access the CALIBRATE Mode as described below.

5. Enter the Calibrate mode by typing: "CAL <Enter>."

NOTE: In the Calibrate mode only, the "K" key toggles the transmitter PTT line on and off. The "SPACE BAR" toggles the DSP-2232's tone generator from "Mark" (the lower pitched tone) to "Space" (the higher pitched tone). The DSP-2232 has a transmit watchdog timer circuit that unkeys your transmitter automatically after sixty (60) seconds. As you perform the following adjustments, unkey periodically, then rekey the transmitter by typing "K."

6. Press the "K" key on the keyboard to key the transmitter. You should hear a continuous tone in the monitor receiver.

7. Tap the space bar several times until the higher pitched of the two tones ("space") is heard.

8. Refer to the figure below of the DSP-2232's side panel and locate the AFSK level potentiometer adjustment for the port you are calibrating. DO NOT ADJUST THE AGC CONTROLS, THEY ARE FACTORY SET.

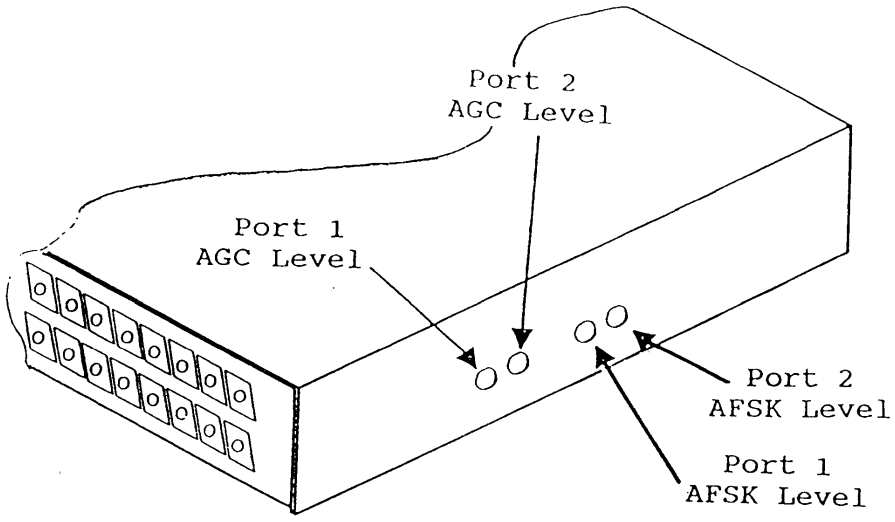


Figure 3-7 DSP-2232 Side Panel Controls

9. With the DSP-2232 keying the transmitter and sending the higher of the two tones, adjust the transmit audio level for the port you are calibrating as follows:

   - Listen to the monitor receiver; turn the DSP-2232's side-panel AFSK Output Level adjustment screw clockwise (CW) until you hear no increase in output level in the monitoring receiver.

   - Rotate the AFSK Output Level adjustment screw counterclockwise (CCW) until the audio signal on the monitoring receiver is slightly but noticeably reduced from the maximum level.

10. Type "K" to return to receive mode.

11. Type "Q" to "Quit" (exit) the calibration routine.

    You've now set your FM transmitter's deviation to an approximate level which will be adequate for initial operation.

12. With your radio in the receive mode, open the squelch control so that a steady hiss or noise is heard on a speaker.

13. Set the receiver's volume control so the DCD LED on your DSP-2232 just lights with the receiver unsquelched. This is the approximate proper level for best receive performance from your DSP-2232's modem.

14. Reset your receiver's squelch control for normal operation.

3.5.2 SSB Transceiver Final Adjustments

Digital modes with an SSB radio require some different settings of the radio's operating controls for proper AMTOR and packet operation. Be sure to observe the following setting precautions:

- Set VOX to OFF.
- Set speech compression to OFF.
- Set AGC to FAST (if available).
- Disconnect the ALC cables between your SSB radio and any external RF amplifier you wish to use in AMTOR or packet radio service.

Remember - Baudot and ASCII RTTY and Mode B (FEC) AMTOR are continuous key-down conditions - Your radio's duty cycle is 100% for the duration of each transmission. If your SSB radio isn't designed for continuous full-power operation, you must operate your radio at reduced output power. Consult the manufacturer's specifications for details on the operating duty cycle.

NOTE: Make all connections with all power off.

1. Connect your DSP-2232 and SSB radio as shown in Figure 3-6.

2. Turn on your DSP-2232 and your computer and start your terminal program.

3. Connect your SSB radio to a dummy load such as the AEA DL-1500.

4. If your SSB radio has a "monitor" facility, i.e., an audio output that lets you listen to the audio signals entering the microphone or phone patch jacks, turn that monitor circuit on.

5. Set the radio's MODE selector to LSB (lower sideband).

6. Set the radio's meter switch to the "ALC" position. If the radio doesn't have an "ALC" indication, set the meter switch to "Ip" or "Ic" to read plate/collector current. If a current reading isn't available, set the meter to indicate power output.

7. If you are using an AEA program such as PC-PAKRATT II, COM-PAKRATT or MACRATT, you must enter the Dumb-Terminal mode (see program manual) to access the CALIBRATE Mode described below.

8. Enter the Calibrate mode by typing: "CAL <Enter>."

NOTE: In the Calibrate mode only, the "K" key toggles the transmitter PTT line on and off. The "SPACE BAR" toggles the DSP-2232's tone generator from "Mark" (the lower pitched tone) to "Space" (the higher pitched tone). The DSP-2232 has a transmit watchdog timer circuit that unkeys your transmitter automatically after sixty (60) seconds. As you perform the following adjustments, unkey periodically, then rekey the transmitter by typing "K."

9. Adjust the transceiver's Microphone Gain control to its minimum setting.

10. Press the "K" key on the keyboard to key the transmitter. Increase the transceiver's microphone gain control until you hear a continuous tone in the radio's monitor output.

11. If you are able to hear the tones in radio's speaker, tap the space bar several times until you hear the lower pitched of the two tones ("mark").

12. With the DSP-2232 keying the transmitter and transmitting the lower of the two tones, adjust the transmit audio level as follows:

    I. Rotate the microphone gain control clockwise (CW) approximately in the one-quarter ON position.

    II. Turn the DSP-2232's side-panel AFSK Output Level adjustment screw clockwise (CW) until until the ALC meter shows a small deflection from the unmodulated reading. Check the radio's plate/collector current or output power indicators.

    III. Adjust the AFSK Output Level control until the radio's indicators show approximately thirty percent (30%) of the manufacturer's rated full-power reading.

    EXAMPLE: If the manufacturer's plate/collector current specification for CW operation is 200 mA, set the AFSK Output Level control and your microphone gain control so that the plate/collector current indicates approximately 75 mA.

13. Type "K" to return to receive mode.

14. Type "Q" to "Quit" (exit) the calibration routine.

You have now set the DSP-2232's transmit audio output level and your SSB radio's microphone gain control to an approximately correct level for all operating modes.

NOTE: For Mode A (ARQ) AMTOR and packet radio operation, the radio's microphone gain control can be adjusted to produce the full-power output plate current recommended by the radio manufacturer. These modes are "bursty" modes; the transmitter is keyed on and off automatically by the DSP-2232. The resulting duty cycle is much less than 100% and full-power operation is generally acceptable.

15. With your radio in receive mode, tune the receiver to a clear, unoccupied frequency.

16. Set the receiver's audio volume control (AF GAIN) to the position you would normally use for CW reception. This is the approximate receiver audio output level for best receive performance from your DSP-2232's modem.

CHAPTER 4

PACKET RADIO

4.1 Overview

In the last several years Packet has grown to become perhaps the most popular digital mode on the amateur bands. Although Packet can be found on HF (primarily on the 20 meter band) it is most popular on the VHF and UHF FM bands. This chapter will start with general Packet operation and then discuss VHF and UHF Packet. Packet on the HF bands requires some special considerations, so we will leave it until the end of this chapter.

Your DSP-2232 can operate HF or VHF Packet (on Radio port 2) and any other digital mode on Radio port 1 at the same time. This feature can come in handy allowing you to keep an "ear" on local packet activity while operating on any of the other digital modes normally found on HF. Sorting out the data from both Radio ports also requires some special considerations and will be discussed later in the chapter after HF Packet operation has been covered.

4.1.1 Getting Started

You can learn quite a bit about Packet operation with the DSP-2232 before even connecting it to a transceiver. For your first packet practice, the DSP-2232 will be connected in a "loopback" circuit as done in the "Quick Check" performed in Chapter 2. In this configuration, the DSP-2232 will "talk to itself" which allows you to become familiar with packet before actually going on the air.

4.1.2 Making the Loopback Connection

Make sure the DSP-2232 is turned OFF and power is removed before performing one of the following.

I Locate the 5-pin DIN plug with the WIRE "Loop-back" jumper and insert it into the RADIO-1 connector on the DSP-2232 rear panel.

II If you cannot locate the pre-made "Loop-back" jumper and have a spare Radio cable, you may construct the following:

1. Get the unused Radio Cable from Chapter 3.
2. Strip about 1/4 inch of insulation from the Green and White wires at the "radio" end of the cable.
3. Join the Green and White wires by twisting them together gently.
4. Insert the 5-pin DIN connector end of the cable into the "RADIO-1" connector on the DSP-2232's rear panel.
5. Go on to section 4.2.

4.2 Packet Introduction

You've now connected your DSP-2232's transmit audio output to its receive audio input. Your DSP-2232 can now "talk to itself" in packet.

1. Set the side-panel AFSK level control for RADIO-1 at 50% (straight up and down) for the following Packet introduction.

NOTE: If you have adjusted the RADIO-1 side-panel AFSK level control for a particular transceiver in chapter 3, then mark this setting with a pencil so it can be reset when finished.

2. Turn on your computer. Load and run your communications program.

   If you are using an AEA PAKRATT Program, follow the program manual to enter the Packet mode on Radio Port 1, and then skip to step 4.

   If you are using another Computer program or a Terminal, set the communication parameters as done in Chapters 2 and 3.

3. Press the DSP-2232's rear panel power switch to the ON position if you have not already done so.

   You should notice the sign-on message seen in chapter 2. The LCD STATUS display should indicate you are in the Packet mode.

4. After you have seen the sign-on message and/or entered the Packet mode, you must enter your own callsign (with the MYCALL Command) if you are to converse with any other Packet stations. If you try to connect to a station without entering your call sign, your DSP-2232 will send you the following message:

   ```
   ?need MYcall
   ```

   If you are a SWL and do not intend to transmit, you should enter "AAA" as a Callsign (MYCALL).

   If you are using an AEA PAKRATT program, follow the instructions in the Program Manual to enter your callsign. If you are using a terminal or terminal emulating program on your computer, you must use the MYCALL command to install your call sign.

   Note that since the DSP-2232 has two radio ports, you must enter a callsign for each port. The callsigns may be the same, or can be different to make life a little easier in the "two Ham" family. You must change the callsign from the default "DSP" on each radio port, or that port will not transmit packets. For example, if your Callsign is WX2BBB, enter the following:

   ```
   cmd:MYCALL WX2BBB/WX2BBB
   MYcall     was DSP/DSP
   MYcall     now WX2BBB/WX2BBB
   ```

Both Packet radio ports will now assume the callsign WX2BBB.

5. If you are using an AEA program follow the instructions in the Program manual to CONNECT in packet mode to your own callsign (the one you just entered in MYCALL).

   If you are using a Computer Terminal or a non-AEA program, entering the following after the "cmd:" command mode prompt will cause the DSP-2232 to Connect to yourself:

   CONNECT (your callsign) <Enter>

   After pressing <Enter>, you should observe the Port 1 SEND LED and DCD LED light, and the Port 1 TUNING bar graph spread. After a few moments, your monitor should display:

   *** CONNECTED to (your callsign)

   Notice that the front panel Port 1 Connect LED (CON) has lighted and the STATUS display indicates that the DSP-2232 is connected to a packet station. You may also notice that the Port 1 Converse LED (CONV) is lit indicating that the DSP-2232 is ready to CONVerse with the station (in this case it is yourself).

   This is how a packet connection is established. Whether you are "Connecting" to another Amateur, a Packet Bulletin Board System (PBBS) or a Networking Switch (more on this later) this initial procedure must be used to establish each and every Connection.

6. Type a few characters to yourself such as "Hello this is my first packet Connect. My name is ..." then press the <Enter> key.

   Shortly after pressing the <Enter> key, you should see the message you typed reappear on your screen. If you had connected to a distant station, they would have seen the message you typed appear at nearly the same time.

7. After you have typed a few lines (packets) to yourself, you will probably want to end the connection or "DISCONNECT".
   If you are using an AEA program, follow the instructions to DISCONNECT from the packet station you are talking to.

   If you are using a Computer Terminal or a non-AEA terminal program, the following will cause the DSP-2232 to DISCONNECT:

   Enter <CONTROL-C> (hold down the Ctrl and then type the letter C).
   Your monitor should respond with the command prompt:

   cmd:

   Enter D <Enter>.
   Your monitor should respond with:

   cmd:*** DISCONNECTED: (your callsign)
   pl (your call)*>(your call) (UA)

   Note that the front panel Connect LED (CON) should go out and the LCD STATUS display should indicate you are Disconnected.

8. You have just done the three things necessary in any Packet QSO.

   - o You started the QSO (with yourself) by CONNECTing. (Step 5)
   - o You sent some information (to yourself) and then received the information that you sent. (Step 6)
   - o You then ended the QSO by DISCONNEcting. (Step 7)

   Repeat steps 5, 6 and 7 above until you feel comfortable with Connecting, exchanging information and Disconnecting. These operations will be performed each time you use Packet so they should be second nature to you before going on the air.

   When you feel comfortable Connecting, sending information and Disconnecting, you are ready to start listening to VHF packet.

9. Turn OFF and remove power from the DSP-2232.

   - o Return the Port 1 side-panel AFSK level potentiometer to the setting you marked in Step 1.
   - o Remove the "Loop-back" jumper from the RADIO-1 port and reconnect your transceiver or receiver set-up in Chapter 3.

4.3 VHF/UHF Packet Operation

We will first listen to (and watch) some of the VHF or UHF Packet activity in your Local Area. This will allow you to become a little better acquainted with packet in your area before going "On The Air".

1. Construct a Radio Cable for the VHF/UHF transceiver you intend to use for Packet as described in Chapter 3 and connect your transceiver to the RADIO-1 connector on the DSP-2232 rear panel.

2. Load and run your communications program and enter the Packet Mode as done in the Packet Introduction section above.

3. Set Radio Port 1 for VHF Packet operation (default) as follows.

   If you are using an AEA program, follow the instructions to select the VHF modem on Port 1 by turning the VHF Parameter ON, this will automatically set the radio baud rate HBAUD to 1200.

   If you are using a Computer Terminal or a non-AEA terminal program, the following sets the VHF mode of the DSP-2232:

   Type <CONTROL-C>. (Type C while pressing the <Ctrl> key down.) Your monitor should respond with the command prompt:

```
cmd:
```

   Then enter VHF ON <Enter>
   Your monitor should respond with:

```
Vhf     was OFF/ON
Vhf     now ON/ON
*** HBAUD now 1200/0
```

Your DSP-2232 contains other Packet modems that may be selected with the MODEM command. If you wish to select a different DSP modem for Packet operation, simply type MODEM followed by a modem number from the list below:

```
10: p1 Packet 300 bps HF 2110/2310  (North America)
11: p1 Packet 300 bps HF 1460/1260  (European)
12: p1 Packet 1200 bps VHF
13: p1 Packet 1200 bps PACSAT
14: p1 Packet 1200 bps PSK
15: p1 Packet 2400 bps V.26B
16: p1 Packet 4800 bps PACSAT
17: p1 Packet 4800 bps PSK
18: p1 Packet 9600 bps FSK K9NG/G3RUH
50: p1 Packet 1200 bps MSK
51: p1 Packet 2400 bps MSK
52: p1 Packet 9600 bps G3RUH.UO22.eq
```

If you know the VHF activity in your area uses a modem from the above list other than the Bell 202 default, you may enter this modem number in the command QVPACKET. The modem in QVPACKET is automatically selected when the VHF parameter is ON and the Packet mode is entered.

4. Turn ON your VHF or UHF FM transceiver and tune to a known packet channel in your area. Most packet operation is on simplex, so the repeater offset on your transceiver should be disabled. If you know there is packet in your area, but do not know the frequency, you should try some of the following frequencies:

   2 meter (144 MHz) band:
   145.01 MHz, 145.03 MHz, 145.05 MHz, 145.07 MHz, 145.09 MHz
   144.99 MHz, 144.97 MHz, 144.95 MHz, 144.93 MHz, 144.91 MHz

   1-1/4 meter (220 MHz) band:
   223.40 MHz, 223.42 MHz, 223.44 MHz, 223.46 MHz, 223.48 MHz

   70 cm (440 MHz) band:
   440.975 MHz, 441.000 MHz, 441.050 MHz, 441.025 MHz, 441.075 MHz

   You know you've found a packet channel when you hear the characteristic "Braaaaaap" sound of packet transmissions.

5. Once you've found an active packet channel, you must make sure you have enough receive audio (volume) from your transceiver to light the DCD LED on the DSP-2232 when a packet is being received. If the DCD LED does not light when packets are received, you must increase the audio level from your transceiver. The DCD LED must light for the DSP-2232 to be able to receive packets.

   You must also make sure that the DCD LED goes out when no packet signals are present on the channel. If the DCD LED does not go out when the channel is clear, make sure the Squelch control on your transceiver is set high enough to silence the speaker. If the DCD LED stays on when the packet channel is quiet, your DSP-2232 will never send packets to other stations.

4.3.1 What You Should See

If all is operating properly, you should see some packets on your screen. Some typical packets you might "Monitor" are shown below:

```
pl N7ALW*>WA7GCI [C]
pl WA7GCI*>N7ALW (UA)

pl K6RFK>N7ALW*>N7GMF:
Goodnight John, its been nice talking to you.

pl N7ALW*>WA7GCI:
Hi Bob, how are you this evening?

pl KD7NM*>MAIL:
Mail for: K6RFK N7ML

pl N7HWD-8*>ID:
NET/ROM 1.3 (SEA)

pl SEA*>N7ML:
SEA:N7HWD-8> Connected to #SEA:N7HWD-7

pl K6RFK>N7ALW*>N7GMF [D]
N7GMF>N7ALW*>K6RFK (UA)
```

NOTE: You will probably see data (Packets) on the tuning bar-graph which do not print on the screen. This is normal and is a function of the MONITOR and the MPROTO commands.

4.3.2 What It Means

There are different types of packets that mean different things to the DSP-2232. Your DSP-2232 keeps track of and knows what to do with the packets so users need not be concerned with them most of the time. Since the DSP-2232 can "Monitor" all Packet activity on a channel, we'll briefly discuss the types of packets you will most often see. Skip to the next section if you do not plan on doing much monitoring.

Let's look at the first packet in the examples above and get acquainted with what it all means.

```
pl N7ALW*>WA7GCI [C]
```

The first two characters in monitored packets represents which radio port "heard" the packet and will be either "p1" or "p2". Every single packet you send will have your callsign (the one you just entered in MYCALL) as the first callsign of the packet. The callsign after the ">" is the next station the packet will go to. So the packet listed above originates from N7ALW and is being sent to WA7GCI. All packets will have at least these two callsign fields.

The "[C]" immediately following the two callsigns identifies this packet as a CONNECT Request. So we see that N7ALW is requesting a packet CONNECTION with WA7GCI.

The second packet in the above examples is a response to the first.

```
p1 WA7GCI*>N7ALW (UA)
```

In this case we see that WA7GCI is sending to N7ALW by the order of the callsigns. This packet acknowledges the Connect request as shown by the "(UA)" which stands for Un-numbered Acknowledge.

One benefit of packet radio is that packets can be relayed or "digipeated" by stations on the same frequency. In fact, packets can be relayed by up to eight stations to reach a distant station that cannot be heard directly. In practice, digipeating through many stations does not work very well, but you will often see packets digipeating through one or two stations to reach their destination. The packet shown below is an example of a digipeated packet.

```
p1 K6RFK>N7ALW*>N7GMF:
Goodnight John, its been nice talking to you.
```

This packet originated from K6RFK and is being sent to N7GMF but is "Digipeated" through the station N7ALW. We also see that this packet contains data by the text "Goodnight John...". Another thing that should be noticed in this packet is the asterisk (*) in the first line. The asterisk tells which station was actually heard sending the packet. In this case, we can see that we actually heard the digipeating radio station N7ALW. Without the asterisk, we could not tell whether the transmission came from radio station K6RFK or N7ALW. More will be discussed about digipeating later, but the above example is typical.

The following packet is a data packet from N7ALW to WA7GCI.

```
p1 N7ALW*>WA7GCI:
Hi Bob, how are you this evening?
```

Remember that in the first example we saw the two stations Connect. Now that they are connected, they may exchange data packets.

The following packet is a Beacon packet from KD7NM. Since we see the packet is addressed to "MAIL" we know KD7NM is probably a Packet Bulletin Board System (PBBS).

```
p1 KD7NM*>MAIL:
Mail for: K6RFK N7ML
```

The data section of this packet says "Mail for: K6RFK N7ML". This Beacon lets people know that K6RFK and N7ML have mail waiting on the KD7NM PBBS without having to connect.

The following Beacon packet is intended as identification for a NET/ROM level-3 packet networking switch.

```
p1 N7HWD-8*>ID:
NET/ROM 1.3 (SEA)
```

In this case, the Packet Switch is using the callsign N7HWD-8, but also uses the alias SEA as a callsign. There are many types of Packet Switches now in use, but NET/ROM is one of the most popular. We will briefly discuss using a NET/ROM switch later in this chapter since most switches operate in much the same way.

The packet below was sent by the network switch SEA to N7ML.

```
p1 SEA*>N7ML:
SEA:N7HWD-8> Connected to #SEA:N7HWD-7
```

The packet above from SEA contains the data "SEA:N7HWD-8> Connected to #SEA:N7HWD-7". This message tells N7ML that he is now connected to another port on the SEA Node named #SEA. Again, we will talk more about how and why N7ML might want to do this later in the chapter.

The following packet is again from K6RFK to N7GMF and is being digipeated through N7ALW. This packet indicates that K6RFK is finished talking to N7GMF and wants to Disconnect. Again we see that we are not hearing K6RFK, rather we are hearing N7ALW as indicated by the asterisk (*) after the callsign.

```
p1 K6RFK>N7ALW*>N7GMF [D]
```

The following packet is an acknowledgment (or simply called an ACK) that lets K6RFK know that N7GMF has acknowledged the Disconnect request sent above. K6RFK and N7GMF are no longer Connected.

```
p1 N7GMF>N7ALW*>K6RFK (UA)
```

As can be seen, all of the above examples were heard on radio port 1 of the DSP-2232. If a second radio was connected to radio port 2 and a dual port modem was loaded, we would have seen some monitored packets prefaced with a "p2" as well. See section 4.8 for more information on controlling both radio ports when you are ready.

NOTE: Some applications software such as PB and PG for Amateur Satellite use have problems with the port designators "p1" and "p2" in front of monitored packets. To disable the port designators "p1" and "p2" from appearing turn OFF User Bit 19 (UBIT 19) by typing "UBIT 19 OFF <Enter>" at the command prompt.

4.3.3 What Happens When You Connect

If you are working with a friend who is familiar with packet, you may want to skip to section 4.4. If you are on your own, the following three sections will help you learn what to expect on VHF/UHF packet.

There are three different kinds of packet stations you are likely to encounter in your first Connects: Standard TNCs, Mailbox Systems and Network Switches. The following sections discuss each station type.

4.3.3.1 Standard TNCs

When you first turn on your DSP-2232, it becomes a standard AX.25 packet TNC (Terminal Node Controller). All TNCs and Multimode controllers have this capability. When you Connect to a TNC, in most cases you will be connecting directly to someone's computer screen. If you see an automatic Connect Message (CMSG) similar to the one below, you know you have reached a TNC.

> Welcome to my packet station. If I don't respond, please leave a message and Disconnect.

If you get a message like this when you connect to another station, usually you would type something like "Are you there?". If you do not see a response from the other station in a minute or so, simply leave a message - just like a telephone answering machine.

The TNC at the other station should then hold your message until the operator returns to his computer. Later we will discuss how your DSP-2232 can do the same for messages it receives from others.

4.3.3.2 Mailbox Message Systems

Although Standard TNCs allow incoming messages to be saved, there is no way for the owner to leave a message for someone who will connect at a future time. The ability to both send and receive messages without the owner being present is accomplished by a Mailbox.

There are many different Packet Mailbox systems in use. Some systems are large and require the use of a dedicated computer. Other systems are small like the personal MailDrop built into your DSP-2232.

Large systems are often called Packet Bulletin Board Systems (PBBS) since they serve as electronic message centers for a local area. PBBS's are a source of information as well as a gateway for messages that can be sent to and received from other parts of the country or world. You will probably want to locate the local area PBBS nearest you and connect to it from time to time.

Mailbox systems are easy to use and most operate in much the same way. Most Mailboxes and other automatic systems usually have Help available by sending an "H" or "?". If you connect to a Mailbox such as a DSP-2232 MailDrop you will see something like the following:

```
*** CONNECTED to KD7NM
[AEA DSP-2232]  18480 free  (A,B,H,J,K,L,R,S,V,?) >
```

If you get something like this when you connect to another station, try typing an "H" or a "?" to get a help list as shown below:

```
A(bort)    Stop Read or List
B(ye)      Log off
H(elp)     Display this message
J(log)     Display stations heard
K(ill)     K n: Kill message number n
           KM : Kill messages you have read
L(ist)     L  : List message titles
           LM : List messages to you
R(ead)     R n: Read message number n
           RM : Read all your unread messages
S(end)     S  : Send a message to SYSOP
           S n: Send a message to station n
?          Same as H(elp)
[AEA DSP-2232]  18480 free  (A,B,H,J,K,L,R,S,V,?) >
```

There are quite a few options available on the MailDrop, but the most commonly used commands are L(ist), R(ead), S(end) and K(ill) message.

For example, you may first want to LIST all the messages that are available on a mailbox that you connect to. This is done by simply sending "L" or "LIST" command to the system you have just connected.

If you are interested in any of the message subjects that appear, you may then READ the messages that interest you. To read a message, simply send the command "R (message number)", where (message number) is the number of the message you are interested in.

After you are finished reading messages, you may want to SEND a message to the SYSOP (short for System Operator) or to another user. To send a message simply enter "S (callsign)" where (callsign) is the call of the station you are sending the message to.

When you are finished Listing, Reading and Sending messages, you will want to send the Bye command to log-off (disconnect) from the Mailbox.

Feel free to experiment with Mailboxes and other packet systems. Remember that most automatic systems will send you help on commands if you send an "H" or "?". For more information on setting up and using your own DSP-2232 Maildrop, see Chapter 5 on MailDrop Operation.

4.3.3.3 Packet Switches and "Nodes"

When Amateur Packet radio was first beginning there were not many stations on the air. Amateurs at that time "digipeated" through many stations (up to 8) to connect to others over long distances. As more users became active on packet, digipeating quickly proved to be an inefficient way of relaying packets through even a very few stations.

To solve this problem, Amateurs began working on more efficient "higher level" ways of routing packets over long distances. NET/ROM (tm), ROSE, TCP/IP and TEXNET are some of the higher level protocols that emerged and are currently in use around the world.

NET/ROM, developed by Software 2000, quickly became a standard that others imitated. Many networking "Nodes" today use a similar if not identical set of commands. We will discuss the typical NET/ROM commands you will likely encounter when connecting to a packet switch.

When you connect to a NET/ROM Node you will not initially get any prompt. Since NET/ROM commands are few and easily memorized, they did not see a need to clutter the channel with prompts. Like other automatic systems however, if you send an "H" or a "?" for Help you can expect to get a "Help" response similar to the following:

```
SEA:N7HWD-8> Invalid Command (CONNECT INFO NODES ROUTES USERS)
```

In our example, the line above is from the Seattle node, simply known as SEA. The callsign for the node is N7HWD-8. "Invalid Command" means that the node did not understand the command you sent, so it returned the above "help" line to remind the user of the commands it knows. These are CONNECT, INFO, NODES, ROUTES and USERS.

Most often you will use the nodes CONNECT command to connect to other stations. Once you have connected to the node, simply send the command "CONNECT (callsign)" or simply "C (callsign) where (callsign) is the call of the packet station you want to connect to that is in range of the node.

Not everyone you want to talk to is in range of your local Node. Fortunately, NET/ROM will learn about other nodes it can reach and allow you to connect to these nodes as well. To find out what other nodes your local station can reach, simply type the command "NODES" after you connect. This will display something like the following:

```
SEA:N7HWD-8> Nodes:
BALDY:WB6VAC-8     BOI:W7SC          BOISE:N7FYZ-8     COE:KK7X-4
ELN:N7HHU-8        EVT:KA7VEE-8      LSO:K7ZVV-8       MCW:WB7DOW-12
MSO:W7DVK-5        OLY:K7APT-8       PDT:N7ERT-5       PDX7:KA7AGH-8
PTN:K7TPN-8        RLIMB:W0RLI-2     SALEM:AF7S-1      SEAW:N8GNJ-8
SPOKN:WB7NNF-8     SVBBS:KA7RNX      TAC:W7DK-8        YKM:K3GPJ-8
```

When you connect to a node (either directly or through another node) you may want to know who else is using that particular node. Type the command "USERS" to find out who is using the system. You will see your own call in the list as well as anyone else who is using the node. An example is shown below:

```
SEA:N7HWD-8> NET/ROM Version 1.3 (662)
Uplink(W7MCU)                          <-->  Downlink(W7MCU-15 WA7ZUE)
Circuit(SEAW:N8GNJ-8 KA7RZK)
Uplink("your callsign")
```

The IDENT command simply sends you an identification packet from the node that may give its location and owner as shown below:

```
SEA:N7HWD-8> NORTHWEST AMATEUR PACKET RADIO ASSOCIATION
145.01 MHZ, USER LAN, GRASS MTN.
Local BBS is N7HFZ
```

The ROUTES command provides routing information about other nodes that can be reached.

A complete discussion of NET/ROM is beyond the scope of this manual, but we hope the above information will help get you started. Certainly the CONNECT, NODES and USERS commands will allow you to navigate through the network, and find new people to talk to.

4.3.4 Who Can I Talk To?

Now that you understand a little about the different packets and packet stations, you are ready to make your first real connection.

If you do not have a friend on Packet in your local area, then you will want to choose a station you can reach. Fortunately the DSP-2232 has a command called MHEARD that displays the list of the 18 most recently heard stations. Check this list in one of the following ways:

I If you are using an AEA PAKRATT program, follow the instructions in the program manual for checking the Packet MHEARD list.

II If you are using a Terminal or Terminal Program on your computer, then first type a <CTRL-C> to make sure you are in the DSP-2232 Command (cmd:) mode. Then type the command MHEARD as shown. You should then see a display similar to the one below.

```
cmd:MHeard
........  p1 N7GMF
........  p1 K6RFK
........  p1 SEA*
........  p1 N7HWD-8*
........  p1 KD7NM*
........  p1 N7ALW*
........  p1 WA7GCI*
cmd:
```

The callsigns in the list are the stations heard by your DSP-2232 with the most recently heard station at the top of the list. As in the Monitored packets, the asterisks (*) indicate that the station was heard directly by the DSP-2232. The callsigns without an asterisk were relayed by another station and so cannot be connected to directly. The "p1" means the station was heard on radio port 1.

4.3.5 Your First Real Connect

Choose one of the stations with an asterisk displayed in YOUR MHEARD list, or a friend that you know is "on the air" near to you.

If you are using an AEA PAKRATT program, follow the instructions to CONNECT in Packet mode to the callsign you chose above.

If you are using a Computer Terminal or a non-AEA program, entering the following after the "cmd:" command mode prompt will cause the DSP-2232 to Connect to the station (Callsign) chosen above:

CONNECT (Callsign) <Enter>

After pressing <Enter>, you should observe the SEND LED light. Your monitor should soon display:

*** CONNECTED to (Callsign)

If you see this, you have just Connected to your first packet station. Identify what type of station you have connected to, and respond appropriately. After you have connected to a few stations, you should skip to section 4.4 to learn more about the DSP-2232 packet features.

4.3.6 I'm Having Trouble Connecting

If the station you are trying to connect to is connected to someone else, you may see the following message:

*** BUSY from (Callsign) DISCONNECTED

If you see this, simply wait a few minutes and try again or try connecting to a different station from your MHEARD list.

If the distant station cannot hear you, you may see the following:

*** Retry count exceeded
*** DISCONNECTED:

A number of different things can cause this to occur. It may simply be that the station you are trying to connect to is out of your transmitter's range. It is possible however that something more serious is wrong, so you should check the following before proceeding:

- The Loopback Test in section 4.2 functions properly.
- Your DSP-2232's AFSK Output Level control, microphone gain, and deviation are set properly as discussed in Section 3.5.1.
- All cables and connectors are properly installed.
- Your radio's volume and squelch are set for local conditions.
- You are following the correct procedure for Connecting. Remember that this procedure is slightly different for AEA PAKRATT programs than it is for terminals or terminal-programs.
- The "VHF" command is "ON" for VHF/UHF operation.
- RESET the DSP-2232 with the RESET command or RESET switch and start over with section 4.2 of this chapter.

If none of the above correct the problem, ask one of your area's experienced packet operators to listen to your transmissions. Both you and your partner should set MONITOR and MCON to 6, and then send some packets. Each station should display packets sent by the other.

- If only one station is "hearing" packets, check the modulator and transmitter of that station and the demodulator and receiver of the other station.
- Experiment with the TXDELAY parameter for the sending TNC. Try setting TXDELAY 64 for a long delay. If this solves the problem, decrease TXDELAY to the smallest value that works all the time.

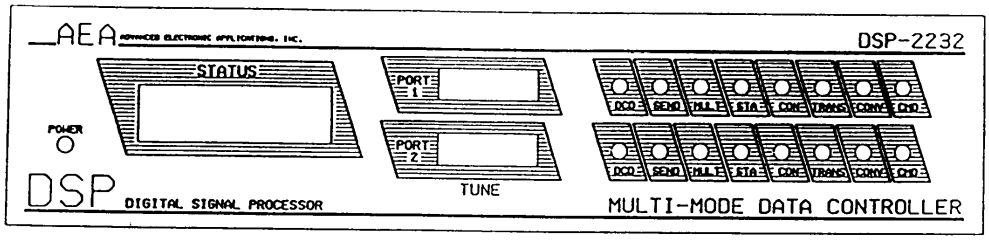
If you still cannot connect to other stations, then you should contact AEA Technical Support as outlined in the PREFACE of this manual.

4.4 More Packet Features

Now that you have worked a few packet stations, it is time to learn a little more about the other packet capabilities of the DSP-2232. Rather than explain all the features in detail, we will leave the specifics to the command descriptions in the Command Summary Appendix.

4.4.1 LCD Status and Mode Indicators

Your DSP-2232's front panel is broken into three parts as shown below:



DSP-2232's Front Panel Indicators.

On the left is the LCD STATUS indicator which displays the Status of Radio Port 1 on the top line, and Radio Port 2 on the second line.

In the middle of the front panel are the two LED bar-graph TUNING Indicators. The top indicator aids in tuning signals on Radio Port 1, and the bottom bar-graph is a Tuning aid for Radio Port 2.

On the right are the LED Status Indicators for both Radio Ports. The top row of eight LEDs indicates the Status for Radio Port 1 and the lower row indicates Status for Radio Port 2.

Your DSP-2232's front-panel LEDs show the Status of each Radio Port at a glance. Each LED is marked with an abbreviated name. The following describes the function of each of the front-panel LEDs.

NAME	DESCRIPTION	LED FUNCTION
DCD	Data Carrier Detect	Lit when data signals are received
SEND	Send	Lit when PTT line is active
MULT	Multiple	Lit when multiple connections exist Blinks when receive buffer is full
STA	Status	Lit when you have sent a packet that has not yet been acknowledged Blinks when you have MailDrop messages
TRANS	Transparent	Lit when in the Transparent Mode
CONV	Converse	Lit when in the Converse Mode
CON	Connected	Lit when a packet Connection exists
CMD	Command	Lit when in the Command Mode

4.4.2 Automatic Greetings

You can tell your DSP-2232 to send an automatic greeting (CTEXT) to any station that connects to you. This can be used to tell others that you are out of the shack and to leave you a message or for any other message you would like to send.

To enable the CTEXT message, set your Connect Text message using the CTEXT command. Then set CMSG ON to enable the Connect Message feature. Think of the CTEXT message as the message your telephone answering machine might give to a caller.

4.4.3 Beacon Operation

Your DSP-2232 can send an automatic "beacon" message at a specified time interval. A beacon can send special announcements, or let others know you are on the air. To enable beacon operation do the following:

- Set your beacon message with the BTEXT command.
- Set the beacon interval using the BEACON EVERY or AFTER command.
- A beacon frame is sent to the path given in the UNPROTO command.

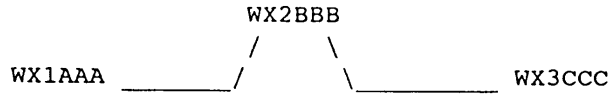
In the early days of packet, the beacon was useful to show your presence on the packet channel. With the growth of packet, many users feel that beacons have outlived their usefulness and interfere with traffic. Use your beacon with consideration for others.

As a reminder, if you set the BEACON timing at a value considered too small for busy channels (less than "90"), you'll see:

WARNING: BEACON too often

4.4.4 Digipeater Details

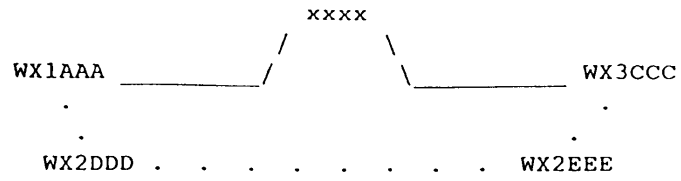
You may wish to connect to a packet station that is beyond your direct radio range. If a third packet station is on the air and both you and the station you want to talk to are in range of that third station, the third station can relay or "digipeat" your packets. You simply set the "digipeater" routing when you connect. Here's a sketch that shows how digipeating can solve problems:



You are station WX1AAA - you want to have a packet QSO with WX3CCC. There is a mountain between you and WX3CCC; you're out of simplex range of each other. However, you know that there's a packet station located on the ridge - WX2BBB - which is in range of you and WX3CCC.

Instruct your DSP-2232 to set up a connection to WX3CCC using WX2BBB as an intermediate digipeater. When you initiate the Connect, type: "CONNECT WX3CCC VIA WX2BBB".

If WX2BBB has turned off his station, you can still contact WX3CCC by going around the ridge through WX2DDD and WX2EEE as shown:



This time, type the connect command like this:

CONNECT WX3CCC VIA WX2DDD,WX2EEE

Type the digipeaters' call signs in the exact order of the intended path from your station to the station with which you wish to connect.

You can specify a routing list of up to eight intermediate stations. In practice this does not work very well, and Networking Switches such as NET/ROM have replaced digipeating for the most part. Still, it is sometimes necessary to digipeat through one or two stations.

4.4.4.1 Are You a Digipeater?

Your packet station can be a digipeater for other stations. You don't have to "do" anything - your DSP-2232 will digipeat other stations - unless you tell it not to! with the DFROM command.

If your transmitter is keyed when you're not using it, or during lulls in your own conversations, you're being used as a digipeater by some other stations. This won't bother your chat with your partner.

If you wish to monitor the other stations that are using you as a digipeater then set the command MDIGI ON.

4.4.5 Monitoring Other Stations

Use the MONITOR command to determine what kinds of packets you will see when you are NOT connected to another station. "MONITOR" takes a numerical value between "0" and "6." Each higher number adds more detail to your monitoring. The meanings of the MONITOR numbers are:

0 Monitoring is disabled.

1 Only unnumbered, "unconnected" frames are displayed. This setting will display Beacons, but not display connected stations.

2 Numbered (I) frames are also displayed. Use this setting to monitor connected conversations in progress on the channel.

3 Connect request ("C") frames and disconnect ("D") request packets in addition to the above are displayed.

4 This is your DSP-2232's default value. Unnumbered acknowledgment (UA) of connect and disconnect frames are also displayed.

5 Receiver Ready (RR), Receiver Not Ready (RN), Reject (RJ), and Frame Reject (FR) supervisory frames are also displayed.

6 Poll/Final bit and sequence numbers of monitored frames are shown.

Understanding all types of packet frames is not necessary to operate packet. Packet operators should however understand that there are many types of control frames that do not contain printable data.

Your DSP-2232 can display these frames, but most users only want to see frames with information. For this reason, the MONITOR command default (4) does not display all the packets that the DSP-2232 hears.

NOTE: If you will be leaving your DSP-2232 on to accept connects from others while your computer is off, set MONITOR to 0 (zero) and type a <CTRL-S> to hold the data.
If you are using an AEA program, you must set the MONITOR command to 0, but the our programs automatically perform the <CTRL-S> function for you.

4.4.5.1 Monitoring the Packet Networking Switches

There are other types of AX.25 frames used by networking switches that the DSP-2232 does not normally display. These other frames can be seen by turning the MPROTO command ON. Some of the packets monitored with MPROTO ON will contain information that may interfere with the screen on your terminal or computer causing it to look "funny". For this reason the MPROTO command default is OFF.

If you are hearing packets that sound strong but are not displayed, setting MONITOR to 6 and MPROTO ON should show them. If you are curious about the packets that do not print, you may find the command WHYNOT useful. When WHYNOT is turned ON, the DSP-2232 will give a reason why each packet was not displayed. If you are interested in exactly how the packets are represented, turn on the TRACE command. See the Command Summary for more information about WHYNOT and TRACE.

4.4.5.2 Monitoring Other Stations While Connected

When you are NOT connected to another station, the MONITOR command discussed above determines what packets are displayed. When you ARE connected, the MCON command determines what packets are shown.

The default of MCON is 0 which tells the DSP-2232 NOT to monitor any packets while you are connected. Most users like this so they are not disturbed with monitored channel data when they are communicating with another station. If it is desired to monitor channel activity while you are connected, then remember to set MCON to an appropriate Monitor number from the list above or the command summary.

4.4.5.3 Selective Monitoring

After you have monitored channel activity for a while, you may decide there are only a few stations you wish to display. The DSP-2232 will let you do this with the Monitor-TO (MTO) and Monitor-FROM (MFROM) commands. With the MBELL command, you can even be alerted when a certain station transmits on the frequency. These commands work in conjunction with MONITOR and MCON commands.

4.4.5.4 The MFILTER Command

Some terminals and computer programs are sensitive to certain characters that may appear in monitored packets. You will know this is happening if occasionally the cursor on your screen moves to strange places causing the copy to be garbled.

The DSP-2232 default for MFILTER is $80 which prevents most control characters from interfering with your display. If you find a terminal or printer is bothered by certain characters, see the Command Summary for more information on the MFILTER command.

4.4.5.5 Monitor Without Callsign Headers

Sometimes you may wish to monitor certain stations without wanting to look at the packet callsign headers. This can be useful when monitoring message traffic from a large Packet Bulletin Board System (PBBS). The MBX command allows you to choose the callsign of a station, or a pair of stations you wish to monitor without seeing the packet headers. See the Command Summary for details.

4.4.5.6 MSTAMP, The Monitor Time-Stamp Command

Monitored packets can be time-stamped if the real-time clock has been set with the DAYTIME command. To timestamp monitored packets, turn the MSTAMP command ON. Turning the DAYSTAMP command ON adds the date to the timestamp provided by the MSTAMP command.

4.4.6 Packet Connects

When you turn your DSP-2232 on and enter your callsign, anyone can Connect to you. If you are at your terminal or computer when this occurs you will see a message like the one shown below:

```
*** CONNECTED to N7GMF
```

When a packet connection occurs, the DSP-2232 automatically switches to the Converse mode so what you type on the keyboard will be sent to the connected station. The NEWMODE and NOMODE commands control when and how the DSP-2232 changes to and from Command mode in response to packet connects and disconnects. You will probably never need to change these settings.

4.4.6.1 Time-Stamping Connects

Sometimes it is useful to know what time someone connected to you - perhaps for logging. To time-stamp your connects and disconnects turn the command CONSTAMP ON. As discussed in the Monitoring section above, turning the command DAYSTAMP ON adds the date to this as well. The DAYTIME command must first be set for this to operate.

4.4.6.2 Connect Alarm

If you busy doing other things, you may want to be alerted when someone connects to you. Turning the command CBELL ON rings the bell on your terminal when a station connects to, or disconnects from you.

4.4.7 Packet Formatting and Editing

Some of your DSP-2232's command parameters affect how your packets are formatted - how your typing appears to the rest of the world. Other commands let you correct typing errors before your packet is sent, cancel lines or cancel packets if necessary.

4.4.7.1 Carriage Returns and Linefeeds in Packets

Most people use packet radio for sending and receiving messages or conversing with other Amateurs. The character used to send a packet is defined with the command SENDPAC which defaults to a Carriage Return ($0D). The SENDPAC character may be changed, but most will find the Carriage Return or Enter key to be a natural choice.

Similarly, your DSP-2232 will include a Carriage Return in the packet you send to other stations since this makes for a more natural conversation. The ACRPACK command (default ON) controls this feature, but most people never want to change this.

The DSP-2232 also has the capability of adding a linefeed character ($0A) automatically to packets that you send to others. If you encounter a station that says your packets are overprinting, you may want to turn the ALFPACK or the ILFPACK command ON temporarily.

4.4.7.2 Canceling Lines and Packets

Most of the time, the Backspace key (or the Delete key on some computers) is all that is needed to edit a line before it is sent. Occasionally it may be helpful to cancel the line, or the entire packet you are entering with one key stroke. The CANLINE character (default <CTRL-X>) will cancel the entire line you are typing. The CANPAC character (default <CTRL-Y>) will delete the entire packet you are entering. These commands can be helpful, but use them with care.

4.4.7.3 Redisplay

If you have erased and retyped many characters, you may want to see the sentence you are currently entering "redisplayed" by the DSP-2232, especially if BKONDEL is OFF. Your DSP-2232 will show the line you're entering when you type the REDISPLAY character (default <CTRL-R>). This will also allow you to display any packets you might have received while you were typing.

4.4.7.4 The PASS Character

If you are using a terminal or terminal program, the following may be useful. Sometimes you may want to include a special input character such as a Carriage Return (the SENDPAC character) in a packet. For example, to send several lines in the same packet, you must include <CR> at the end of each line. You can include any character in a packet (including all special characters) by prefixing that character with the PASS character (default <CTRL-V>):

```
I wasn't at the meeting.<CTRL-V><CR>
What happened?
```

Without the PASS character, this message would go out as two packets. By prefixing the first <CR> with <CTRL-V>, you send it all at once, while maintaining the <CR> as part of the text. The PASS character can be useful in formatting text Messages such as CTEXT as well.

4.4.8 Packet Transmit Timing

Your DSP-2232 has a number of built-in timers used to control the packet protocol and transmit timing. The default values have been set at the factory to provide reasonable performance, but the values may not be optimum for your local area. Most protocol parameters should be adjusted only after carefully reading about them later in the chapter. You SHOULD however adjust TXDELAY for your transmitter as indicated below.

4.4.8.1 TXDELAY and AUDELAY

Radios vary in the time it takes to switch from receive to transmit. If your DSP-2232 starts sending data before your transmitter is up to power, the packet will not be received properly at the distant end.

TXDELAY controls the delay between your transmitter's key-up and the moment when your DSP-2232 starts sending data. The default value of 30 corresponds to a time of 300 mSec and works with most VHF/UHF FM transceivers. With modern transceivers TXDELAY can often be reduced which will improve packet performance in your area. You should perform the following procedure to optimize TXDELAY for your station.

- Find another station who can reliably digipeat your signals.
- Set your UNPROTO path to TEST via the callsign of the station who can digipeat your signals.
- Set the MONITOR command to at least 1.
- Go to CONVERSE mode and send a few packets by pressing the <Enter> key. Note that you should see them on your own screen when they are digipeated by the other station.
- Start reducing TXDELAY by units of 5 each time making sure the other station is still digipeating ALL your UNPROTO packets. Eventually you will find a value where the other station can no longer copy your packets to digipeat them.
- When this happens, increase TXDELAY in units of one or two until the other station again digipeats ALL of your packets. This will be the optimum setting of TXDELAY.

After TXDELAY is adjusted as indicated above you may want to adjust the audio delay (AUDELAY) as indicated in the Command Summary.

The next sections of this chapter will discuss some of the more advanced packet features including Multiple Connects, Packet Timing and Protocol, and HF Packet Operation.

4.4.8.2 AXDELAY and AXHANG

Although it is not common, packet can be used through voice repeaters. When sending packets through an audio repeater you may require a longer key-up delay than is normally needed for direct communications. The AXDELAY command adds more key-up delay in your DSP-2232 so that the repeater can stabilize. The AXHANG command sets the time your DSP-2232 assumes is needed for the repeater to drop.

4.5 Packet Protocol Basics

Here we will talk a little about the AX.25 packet protocol. You do not need to know the protocol to use packet, but it helps in understanding the protocol parameters.

There are two modes of packet transmissions, Connected mode and Unconnected mode. Usually you will converse with another packet station in Connected mode. Still, the Unconnected or Unprotocol mode comes in handy for beacon transmissions and roundtable conversations.

All packets have basically the same construction. Packets contain source and destination callsigns (and any digipeaters if used), as well as information identifying the type of packet. This packet identification can be seen with the MONITOR command discussed earlier. All packets contain an error check code called the CRC. This virtually ensures that when a packet is received, it will not contain a single error. The command PASSALL can disable the CRC error check, but this should only be done for experimental purposes.

4.5.1 Unconnected Packets

In order to allow amateurs to send message beacons and to call CQ, the AX.25 protocol has the ability to send packets that are intended for more than one specific packet station to see. Since all packets must have a destination "callsign", the DSP-2232 sends Unprotocol packets TO the callsign of CQ. This can be changed with the UNPROTO command, but most people like this since it makes calling CQ easy.

4.5.2 Connected Packets

When you Connect to another station, the AX.25 packet protocol ensures that the station to whom you are connected receives all the packets that you send. Similarly, the protocol ensures you will receive all the packets that the other station sends to you. The following describes briefly how the protocol does this.

4.5.3 FRACK and RETRY

When the DSP-2232 sends a packet to a Connected station, it expects an acknowledgment (ACK) packet from the other station to confirm that the packet was received. The AX.25 packet protocol will automatically retransmit (Retry) packets when an acknowledgment is not received from the distant end of the link within a specified time.

The FRACK command (FRame ACKnowledge time) sets the time lapse allowed before the originating station retransmits (retries) the packet.

The RETRY command sets the maximum number of retransmissions before the sending station terminates the connection (DISCONNECTS). The TRIES counter keeps track of the retries that have occurred on the current packet.

4.5.4 PACLEN and MAXFRAME

Packets will be sent either when the <Enter> key is pressed or when the maximum packet size is exceeded. The maximum packet size is set by the PACLEN command which defaults to 128 characters. When large amounts of data need to be sent, this value can be increased to 256. When conditions are poor or the channel is crowded as on HF packet, this value should be reduced to 64 or less.

The packet protocol allows more than one frame to be sent in a single transmission. The default is set to 4 by the MAXFRAME command. When conditions are good up to 7 frames can be sent to speed data transfer. When conditions are poor or the channel is crowded, MAXFRAME should be reduced to only 1 frame.

4.5.5 Reducing Errors through Collision Avoidance

If every packet station could hear every other station, there would be very few "collisions" due to stations transmitting at the same time. Since packet operates over radio, there are often many stations on the same frequency that cannot hear each other. Digipeaters and network nodes allow these stations to communicate with each other, but this increases the chances of collisions.

The first attempt to avoid collisions was through the use of the DWAIT and RESPTIME timers. DWAIT forced the TNC to delay the transmission of any packet except for digipeated frames by the time selected. This fixed timer helped, but packet was still plagued by collisions. The RESPTIME was added to help with large file transfers. Still, more needed to be done to reduce collisions.

Another attempt to reduce collisions was the introduction of AX.25 version 2 protocol. On VHF packet, most everyone uses version 2 which is controlled by the AX25L2V2 command (default ON). On VHF this helps, but some users on HF packet are turning this command OFF.

An exponentially distributed random wait method was proposed by Phil Karn (KA9Q) called P-persistent CSMA. When the command PPERSIST is ON (default) the DSP-2232 uses the number set in PERSIST and the time value set by the SLOTTIME command to more randomly distribute the transmit wait time. This is more efficient than using the DWAIT time.

As a further attempt to improve packet performance, Eric Gustafson (N7CL) proposed giving priority to acknowledgment packets (ACKs). This protocol is controlled by the ACKPRIOR command which currently defaults OFF. Check with experienced packet users in your area and find out if they are using priority acknowledge or have changed any other packet parameters.

4.5.6 CHECK and RELINK

If someone connects to you and then turns his TNC off, you would probably not want to stay connected to the station forever. The CHECK timer determines the amount of time the DSP-2232 will wait before testing the link if no data has been sent or received.

The RELINK command sets what happens when the CHECK timer expires. If RELINK is OFF, the DSP-2232 changes to the Disconnected state. If ON, the DSP-2232 attempts to reconnect to the other station.

4.6 Multiple Connection Operation

Since packet radio allows many stations to share the same channel, many QSOs can be going on at the same time. Because packet has this channel sharing capability, there is no reason you cannot connect to more than one station at the same time. Being connected to multiple stations at once is a powerful feature of your DSP-2232.

4.6.1 Multiple Connection Description

The DSP-2232 offers 10 logical packet channels on Radio Port 1 and 26 logical packet channels when using Radio Port 2. Each logical channel can support a connection with another packet station. So with the DSP-2232, you may be connected to a total of 36 other packet stations simultaneously.

Multiple connect operation is much like a multi-line telephone with automatic hold. When you are connected to multiple stations you will automatically receive everything sent TO you. You must select the proper channel (in effect push the proper line button on the telephone) to send data to a particular station.

If you are using an AEA PAKRATT program, this is described in the program manual. If you are using a terminal, the rest of this section will describe how to set up the DSP-2232 for multiple connections.

4.6.2 The Channel Switching Character

The logical channels are selected with the CHSWITCH character. You must choose a CHSWITCH character that you do not normally type such as the vertical bar "|" (ASCII $7C), or the tilde "~" (ASCII $7E). Once this has been selected and entered into the DSP-2232, you may initiate multiple connections with others on your radio channel.

The ten logical channels on Radio Port 1 are numbered 0-9. The 26 logical channels on Radio Port 2 are labeled A-Z. After the CHSWITCH character has been selected, you can now initiate connects on any of the logical channels numbered zero through nine (0-9) on Port 1 or "A" through "Z" on Port 2.

To change logical channels on Radio Port 1, press the CHSWITCH character you just defined, and then a number from 0-9. Remember that the text that you type will only be sent out to the station connected to the logical channel your DSP-2232 is currently on.

This same procedure is used to select a logical channel on Radio Port 2, only instead of pressing a channel "number" from 0-9, a "letter" from A-Z is pressed. This is in fact the method used to switch back and forth between Radio Ports 1 and 2. Please see the section on switching between Radio Ports later in this chapter for a more complete description of this process.

4.6.3 Will You Accept Multiple Connects

Setting the CHSWITCH character only allows you to make outgoing multiple connects. For the DSP-2232 to allow multiple incoming connections, you must set the USERS parameter to more than one (1) for each Port that you wish to allow incoming multiple connections. The number you enter in the USERS command tells the DSP-2232 how many other users you will allow to connect to you at one time.

4.6.4 Display Multiple Connected Callsigns

Multiple Connection operation can be confusing - especially remembering who is connected on what channel. To help this, you may want to turn ON the CHCALL command to display the callsign of the station who is connected to you on a given channel.

4.6.5 Doubling Received CHSWITCH Characters

If you want to be able to tell the difference between the CHSWITCH characters you type, and characters from other stations that happen to be the same as your CHSWITCH character, then set CHDOUBLE ON.

4.6.6 Checking Your Connect Status with the CSTATUS Command

To check what channels your DSP-2232 is currently set to, as well as who is connected to you, you may find the CSTATUS command helpful. CSTATUS is an immediate command that shows you the status of all packet channels as well as the channel you are currently on.

4.6.7 The MULT LED

You will know you are connected to more than one packet station on each Radio Port when the MULT LED for that port on the front panel of the DSP-2232 lights.

NOTE: The MULT LED will blink if the DSP-2232's receive buffer is filled. This can happen if your computer is not connected to the DSP-2232 and the MONITOR command was left ON, or if for some reason, your communications program no longer can accept any further inbound data.

4.7 HF Packet Operation

HF Packet is much trickier than operating on VHF. In this section we will assume you have as completed section 4.2 of this chapter and at least read section 4.3 and the MONITORING sections of 4.4. If at all possible, get some experience with VHF packet before trying packet on HF. Although this is not absolutely required, the experience will help you make HF packet contacts.

4.7.1 Where to Operate HF Packet

Before you can operate HF Packet, you must first find the activity. Most HF packet operation is on the 20-meter amateur band starting at 14.103 MHz and every 2 kHz above that up to 14.111 MHz. Note that 14.103 MHz is the HF Packet calling frequency and a good place to start. The higher frequencies such as 14.109 and 14.111 are used mostly by HF PBBS systems and are not good places to look for a QSO.

4.7.2 DSP-2232 HF Packet Settings

Radio Port 1 on the DSP-2232 is intended for multi-mode operation so either a VHF or HF transceiver may be connected. The packet parameter defaults have been set for VHF Packet operation on both radio ports and should be changed for HF packet operation as shown below.

The table below shows the parameters that should be set differently for HF and VHF packet operation. If you will be operating HF Packet, you should make note of these parameters and change them accordingly.

Recommended 300 baud HF Packet		Port 1 & 2 Defaults 1200 baud VHF Packet	
SLOTTIME	12	SLOTTIME	30
PACLEN	64 or less	PACLEN	128
MAXFRAME	1	MAXFRAME	4
FRACK	8	FRACK	5
VHF	OFF	VHF	ON
HBAUD	300	HBAUD	1200
MODEM	10	MODEM	12

Note that the HF (VHF OFF) modem number is tied to the QHPACKET command and the VHF (VHF ON) modem number is tied to QVPACKET. The Radio Port baud rate HBAUD is tied to the Modem number selected. When HF Packet operation is selected by turning VHF OFF for the Radio Port in use, the Modem and baud rate (HBAUD) for that port are automatically selected as well. The modem selected for HF operation may be set with the QHPACKET command. This is handy since it allows both the modem and the HBAUD rate to be changed with a single command.

You should set MONITOR to 6 on the port used for HF Packet when tuning in your first HF Packet stations.

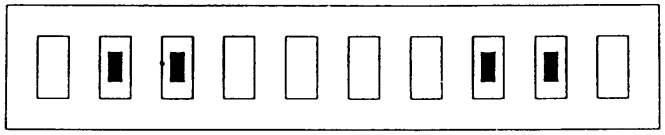
4.7.3 HF Receiver Settings

Set your HF receiver (or transceiver) to Lower Sideband (LSB) unless you connected your DSP-2232 through the direct FSK keying lines, in which case you should select the FSK or RTTY operating mode. Adjust the volume to a comfortable listening level.

4.7.4 Tuning in HF Packet Stations

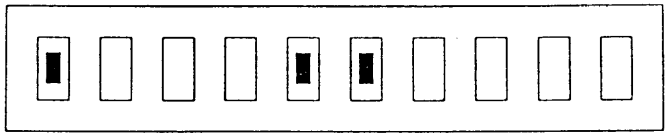
Perhaps the most difficult thing about HF Packet operation is making sure the station is tuned properly and stays tuned. Since HF packet uses 200 Hz Frequency Shift Keying to send data (2110/2310 Hz), tuning accuracy is very important. Being off frequency by only 20 Hz can make a noticeable difference in the DSP-2232's ability to copy packet stations. Follow the tuning procedure below carefully for the best results in tuning in HF packet stations.

- Make certain your HF receiver is either in LSB or FSK depending on your DSP-2232 set-up.
- Turn any IF-Shift and Passband-Tuning controls to the Center or OFF position.
- Tune your receiver to 14.103 MHz (or another frequency where you know there is HF packet activity) and listen to the packets.
- Slowly vary the tuning knob on your receiver and look for a display on the DSP-2232 tuning indicator like the one below.



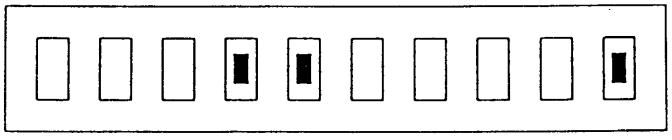
Tuned In

If the tuning indicator looks like the one below, the audio frequency from your speaker is too low for the DSP-2232 to copy packets. Slowly tune the VFO and make the frequency higher.



Frequency Too Low

If the tuning indicator looks like the one below, the audio frequency from your speaker is too high for the DSP-2232 to copy packets. Slowly tune the VFO and make the frequency lower.



Frequency Too High

- Adjust the volume on the receiver so that the DCD LED lights when a properly tuned packet is being received.
  You must also make certain that the DCD LED goes out when no packet signals are present on the frequency.

After you have a packet station tuned in, you should start seeing HF packet stations on your display.

4.7.5 Transmitter Adjustments

Make sure your DSP-2232 is adjusted for your SSB transmitter as described in section 3.5 and 3.5.2 of this manual before transmitting. These are very critical adjustments. If the AFSK level and transmitter microphone gain are not adjusted properly, other stations will not be able to copy your packets. Check your plate or collector current or the power output of your rig before going on the air.

4.7.6 Going On The Air

Make sure your transmitter and antenna are tuned and adjusted for the band and operating frequency you are using.

On HF there are two ways you can go about talking to another station.

- First, you can look at the packets you have just MONITORED (or in your MHEARD list) and choose one of them to connect to.
- You can also "Call CQ" by entering the CONVERSE mode and pressing the <Enter> key a few times.

Either way you decide to go on the air, remember that things happen much more slowly on HF packet than they do on VHF packet. HF packet requires patience and careful tuning in order to be used successfully.

If you are having problems connecting to other HF packet stations, try working with an experienced HF packet operator in your area and listen to each other's signals. See if you can copy each other's packet signals. If he cannot copy your signals, have him listen to your signal in the CALIBRATE mode to make sure you are transmitting a pure tone. As mentioned earlier, any distortion caused by overmodulation or RF feedback will make your signal difficult or impossible to copy.

4.8 Controlling the Radio Ports

If you are using an AEA PAKRATT program designed for the DSP-2232, switching between Radio Ports is described in the program manual. If you are using a computer terminal, terminal program or the "Dumb Terminal Mode" of an older PAKRATT program, this section will describe how to control and switch between the radio ports. The RADIO command allows either (or both) Radio Port(s) to be disabled.

Before the second radio port can be used for packet operation, a modem must be loaded that can access the second port. There are two types of modems available for radio port 2. The first type disables radio port 1 when in use and is designated "p2". These are listed below.

20: p2 Packet 300 bps HF 2110/2310	22: p2 Packet 1200 bps VHF
23: p2 Packet 1200 bps PACSAT	25: p2 Packet 2400 bps V.26B
28: p2 Packet 9600 bps FSK K9NG/G3RUH	
60: p2 Packet 1200 bps MSK	61: p2 Packet 2400 bps MSK

The second type of modem is "Dual Ported", that is allows for operation on radio port 1 and radio port 2 at the same time. The dual port modems available in the DSP-2232 are listed below.

30: RTTY/TOR 170: 2125/2295; p2 Packet 300 bps HF 2110/2310
31: RTTY/TOR 170: 2125/2295; p2 Packet 1200 bps VHF
33: p1 Packet 300 bps HF 2110/2310; p2 Packet 1200 bps VHF
35: p1 Packet 1200 bps VHF; p2 Packet 1200 bps VHF

4.8.1 Selecting and Loading Modems

The various modems available in the DSP-2232 can be seen with the DIRECT(ory) command. To display all the available modems simply enter the Command Mode of the DSP-2232 and then type DIR as shown.

DIR <Enter>

The DSP-2232 will respond with the following:

```
(920716)
 1: RTTY/TOR 170: 2125/2295          2: RTTY/TOR 170: 1445/1275
 3: RTTY/TOR 425: 2125/2550          4: RTTY/TOR 850: 2125/2975
10: p1 Packet 300 bps HF 2110/2310  11: p1 Packet 300 bps HF 1460/1260
12: p1 Packet 1200 bps VHF          13: p1 Packet 1200 bps PACSAT
14: p1 Packet 1200 bps PSK          15: p1 Packet 2400 bps V.26B
16: p1 Packet 4800 bps PACSAT       17: p1 Packet 4800 bps PSK
18: p1 Packet 9600 bps FSK K9NG/G3RUH
20: p2 Packet 300 bps HF 2110/2310
22: p2 Packet 1200 bps VHF          23: p2 Packet 1200 bps PACSAT
25: p2 Packet 2400 bps V.26B
28: p2 Packet 9600 bps FSK K9NG/G3RUH
30: RTTY/TOR 170: 2125/2295; p2 Packet 300 bps HF 2110/2310
31: RTTY/TOR 170: 2125/2295; p2 Packet 1200 bps VHF
33: p1 Packet 300 bps HF 2110/2310; p2 Packet 1200 bps VHF
35: p1 Packet 1200 bps VHF; p2 Packet 1200 bps VHF
40: Morse 750 Hz                    41: Analog FAX HF
42: Analog FAX APT                  43: Analog SSTV
44: DSP data 400 bps OSCAR-13       45: RTTY/TOR 1200 ASCII OSCAR-11
46: DSP data Spectrum               50: p1 Packet 1200 bps MSK
51: p1 Packet 2400 bps MSK          52: p1 Packet 9600 G3RUH UO22 eq
60: p2 Packet 1200 bps MSK          61: p2 Packet 2400 bps MSK
cmd:
```

Any modem from this list may be loaded with the MODEM command. For example, let's say that you want to operate 300 bps HF packet on radio port 1 and 1200 bps VHF packet on radio port 2. This operation is achieved with modem 33. To load modem 33, first enter the Command Mode of the DSP-2232 and then type MODEM 33 as shown below:

MODEM 33 <Enter>

The DSP-2232 will respond with the following:

```
MODem was  12
MODem now  33
cmd:*** HBaud now 300/1200
```

4.8.2 Displaying Received Data

When a port 2 only modem is loaded, radio port 1 is effectively disabled. This can be desirable when operating packet on radio port 2 and you do not want to be disturbed with any HF signals or noise that may be received on radio port 1.

When a Dual Port modem such as MODEM 33 is loaded in the DSP-2232, received data is displayed from both Radio Ports at the same time. This allows you to operate on HF and not miss any local Packet connects or information from DX spotting nets.

The DSP-2232 displays monitored packets by prefacing each packet with a port designator "p1" for radio port 1 and "p2" for radio port 2. For instance, let's say that dual port modem number 33 is loaded and you are monitoring HF packet activity on Radio Port 1, and VHF packet activity on Radio Port 2. You might see something like the following:

```
p1 WX1AAA*>CQ [UI]:                          { WX1AAA calling CQ on
                                               Radio Port 1 (HF) }
p1 WX1AAA*>CQ [UI]:

p2 WY7DDD*>WY7EEE [I,P;1,1]:                 { An Information Frame from
Hello Bob, how are you?                        WY7DDD to WY7EEE monitored
                                               on Radio Port 2 (VHF) }
p2 WY7EEE*>WY7DDD (RR,F;1)                   { Acknowledgment of the above
                                               I-Frame on Radio Port 2 }
p1 WX2BBB*>WX1AAA [C,P]                      { WX2BBB attempting to connect
                                               to WX1AAA on Radio Port 1 }
p1 WX1AAA*>WX2BBB (UA,F)                     { WX1AAA acknowledging the
                                               connect request }
p1 WX2BBB*>WX1AAA [I,P;0,0]:                 { An Information Frame from
Hello Bob, how are you?                        WX2BBB to WX1AAA monitored
                                               on Radio Port 1 (HF) }
```

The first packet shown above is an Unprotocol "CQ" packet from WX1AAA that was received on Radio Port 1. We know this was received on Port 1 because of the "p1" shown in front of the packet. Remember from the section on Multi-connect packet operation that (Packets received on Radio port 1 will be on one of the ten logical channels numbered 0-9.) The second packet is another "CQ" from WX1AAA. Again, there is a "p1" in front of it so we know it was also received on Radio Port 1.

The third packet is an Information-Frame, or simply an "I-Frame" that was monitored on Radio Port 2. We know this was received on Radio Port 2 because of the "p2" shown before the packet. Remember that Packets received on Radio port 2 will be on one of the 26 logical channels designated A-Z.

The fourth packet is an acknowledgment to the previous I-Frame received on Radio Port 2. Again, the "p2" in front of the packet tells us it was received on Radio Port 2.

The fifth packet is a Connect Request from WX2BBB to WX1AAA that was monitored on Radio Port 1. The "p1" in front tells us so. The sixth packet is an acknowledgment by WX1AAA to the connect request.

The seventh and last packet shown above, is the first I-Frame that WX2BBB is sending to WX1AAA after they have connected.

4.8.3 Controlling Your Transmitted Text

If you are using an AEA PAKRATT program designed for the DSP-2232, switching between Radio Ports is described in the program manual. If you are using a computer terminal, terminal program or the "Dumb Terminal Mode" of an older PAKRATT program, this section will describe how to control and switch between the radio ports.

4.8.3.1 Defining the Channel Switching Character CHSWITCH

Before you can switch between logical channels or Radio Ports you must define a Channel Switching character that you will use to signal the DSP-2232 that you want to redirect your transmitted text. This special character is defined with the CHSWITCH command and should be one that you do not normally type in conversational text such as the vertical bar "|" ($7C), or the tilde "~" ($7E). To enter the vertical bar "|" as the CHSWITCH character, first enter the Command Mode of the DSP-2232 and then type CHSWITCH $7C as shown below:

```
CHSWITCH $7C <Enter>
```

The DSP-2232 will respond with the following:

```
CHSWitch was  $00
CHSWitch now  $7C (|)
```

Once a CHSWITCH character has been entered, you may switch Radio Ports or Packet logical channels of the DSP-2232 at will.

4.8.3.2 Switching Between Radio Ports

The ten logical channels on Radio Port 1 are labeled 0-9. The 26 logical channels on Radio Port 2 are labeled A-Z. To select Radio Port 1, press the CHSWITCH character you just defined, followed by a number from 0-9. To select Radio Port 2, press the CHSWITCH character, followed by a letter from A-Z.

After you change Radio Ports or logical channels, the text you type in the CONVERSE mode will be sent to the port and channel selected. If you are connected to another packet station, the text you type will be sent to him or her. If the channel is not connected, the text will be sent in the Unprotocol or unconnected mode.

For example, let's say that you are operating HF Packet on Radio Port 1 and are also available for connects on the local VHF Packet channel on port 2. You connect to an HF packet station and are in the middle of a QSO when a station on VHF connects to you. The following shows how your screen would look and suggests how you might handle such an occurrence. The underlined text is the text that you have typed.

pl WX1AAA*>CQ [UI]:	{ WX1AAA calling CQ on Radio Port 1 (HF) }
pl WX1AAA*>CQ [UI]:	
cmd:C WX1AAA	{ You attempt to connect to station WX1AAA on HF }
*** CONNECTED to WX1AAA	{ You're connected to WX1AAA }
Hello, name here is Bob.	{ You send him your name }
Hi Bob, name here is Jim and the QTH is Boston Mass.	{ The other station responds with his name and location }
A:*** CONNECTED to WX7EEE	{ WX7EEE connects to you on VHF (Radio Port 2) }
Nice to meet you Jim, QTH here is Seattle, WA. You have a nice signal.	{ You send another packet to Jim on HF }
Hey Bob, I'm going to the hamfest this weekend if you want a ride..	{ Your friend on VHF packet wants to go to the hamfest }
|AHello Mike, I am on HF right now talking to a station in Boston.	{ You switch ports by typing |A and respond on VHF }
0:Thanks Bob, your signal is S-7 here. I am running 100 Watts into a tri-bander at 50 ft.	{ Jim on HF gives you a signal report. The "0:" shows you this was from Port 1 (HF) }
|0Thanks for the report Jim, you're S-8 and the antenna here is a quad.	{ You switch back to HF with the |0 and respond to Jim }
|AYes, I was planning to go Saturday. What time do you want to leave?	{ You switch to Port 2 with |A to say you want to go }
A:I'll pick you up at 8:00 Bob. I'm looking forward to it.	{ Your friend on VHF responds to you }
0:Well, it's getting late here and time to pull the plug Bob.	{ Jim on HF tells you he has shut down for the night }
Sounds good, I'll see you on Saturday morning.	{ You last sent data on Port 2 and do not need to send |A }
|0Take care Jim, and 73.	{ You say 73 to Jim on HF }
A:73 Bob.	{ Your friend on VHF says 73 }
|A<Ctrl-C>A:cmd:D <Enter>	{ You switch to Port 2 and Disconnect from WX7EEE }
*** DISCONNECTED: WX7EEE	{ You're now disconnected from WX7EEE on VHF }
0:*** DISCONNECTED: WX1AAA	{ WX1AAA disconnects from you on HF (Port 0 }

As you may have noticed, the above technique of communicating on more than one Port at the same time is almost identical to that used for single-port multiconnect packet operation. Let's discuss the sample QSOs above to see how the Port switching occurs.

The first packet frame, we see is a CQ from WX1AAA. This frame is preceded by a "p1" which shows it was received on Radio Port 1.

You have seen WX1AAA calling CQ and decide to connect to him on HF. You simply go to the Command mode (by typing <CTRL-C>) and issue the CONNECT command C WX1AAA as shown on the third line. The fourth line shows that you are now Connected to WX1AAA. Note that you did not have to type "|0" before sending the connect request since the DSP-2232 defaults to Port 1 until it has been changed to Port 2.

Now that you are connected to WX1AAA you greet him and send your name. WX1AAA then gives you his name (Jim) and location which is the way most QSOs begin. Remember in the above example, the underlined text is the text you would have typed.

You have just begun your QSO with WX1AAA when all of a sudden your friend WX7EEE connects to you. WX7EEE has connected on Radio Port 2 (VHF) which is shown by the "A:" before the connect message. Remember that the 26 channel designators for Radio Port 2 are A-Z.

Before you respond to WX7EEE on VHF, you send a packet to Jim on HF giving him your location. After sending this packet, you see WX7EEE on VHF has offered you a ride to the hamfest. We know this packet is from Radio Port 2 since the previous packet displayed by the DSP-2232 was the "A:*** CONNECTED" message from Port 2.

Now you want to let WX7EEE on VHF know that you are there, but that you are involved in another QSO on HF. This way he will understand that it may take you a little longer to respond to his packets. Before you can send data to Radio Port 2, you must switch to this Port with "|A" or the text you type will be sent to Radio Port 1.

You receive another packet from Jim on HF giving you a signal report and describing his antenna. Again, the "0:" in front of the text shows this was received on Port 1.

Now you want to give Jim a signal report so you must switch to Port 1 with |0 before your text or it will be sent to WX7EEE on Port 2.

After sending Jim a signal report, you tell your friend on VHF that you want to go to the hamfest with him. You must switch back to Port 2 by typing |A before sending to WX7EEE.

In the next received packet, we see that WX7EEE on VHF agrees to pick you up at 8:00 to go to the hamfest. The "A:" in front of the packet shows that this packet was received on Port 2.

Immediately following, you see a packet from Jim on HF saying it's time to shut down. The "0:" identifies this as a Port 1 packet.

The last packet you sent was to WX7EEE on VHF so you decide to reply to him first. This way you do not have to change Ports. After your reply to WX7EEE, you change to Port 1 with |0 and send your good-byes to Jim on HF.

Your friend WX7EEE on VHF says 73 and signs off with you. After two stations agree to sign off, one of them must initiate a Disconnect. You decide to disconnect from WX7EEE by first switching to Port 2 with |A and then entering Command mode with a <Ctrl-C>. Once you see the Command prompt (cmd:), enter the the Disconnect "D" command. Shortly after you do this you see the display "*** DISCONNECTED: WX7EEE" from the DSP-2232.

Jim on HF has decided to initiate the disconnect with you so the final packet you see is the "0:*** DISCONNECTED: WX1AAA" frame from Port 1.

4.8.3.3 More Thoughts on Port Switching

One problem of having more than one Radio Port is remembering which port you are currently using. In the dual port sample QSOs above, this was not a problem, but after it has been hours or days since you have used your DSP-2232, you may forget which port you last used.

With AEA Pakratt Software programs, the on-screen status will always show which port you are using so this is not a problem. With other programs, you will have to query the DSP-2232 with the CSTATUS SHORT command. The CSTATUS command displays the status of the logical channels of Port 1 and Port 2 of the DSP-2232. The CSTATUS SHORT command displays the status of the active channel and any other connected packet channels. After completing the sample QSOs above, the DSP-2232 would display the following.

```
cmd:CSTATUS S

Ch. A - IO DISCONNECTED
```

This reminds you that Channel A is your current I/O channel. Any text that you type in the Converse mode will be sent to channel A on Radio Port 2. If you had been connected to any other packet stations, the callsign and channel would have also shown in the display.

Sometimes you might not want to be bothered with anything from the Radio Port you are not using. For these times either Radio Port may be turned OFF with the RADIO command. For example, let's say that in the above example QSO you wanted to work HF packet and did not want to be interrupted with any VHF connects. Typing the following command would cause Radio Port 2 to be disabled.

```
cmd:RADIO /0
RAdio  was  1/2
RAdio  now  1/0
```

When a DSP-2232 Radio Port is disabled, the front panel LCD STATUS indicator for that port will be extinguished as a reminder.

4.9 Advanced Packet Operation

Your DSP-2232 has many commands and features that are not used for day-to-day connects conversations. Still, as you become more familiar with packet, some of these features may become important to you.

4.9.1 Transparent Mode

The TRANSPARENT mode allows any 8-bit binary character to be sent by your packet station. You usually must use the TRANSPARENT mode to transfer binary and program files to and from other stations.

You can enter the TRANSPARENT mode either by typing TRANS at the cmd: prompt after you connect, or by setting CONMODE to TRANS. Either way, once in the transparent mode, any character you type will be sent automatically after the PACTIME setting. This way the DSP-2232 can send any character. We recommend using HARDWARE flow control in transparent mode but SOFTWARE flow control is available with the TRFLOW and TXFLOW commands. To get back to Command mode after you are finished with transparent mode, you must type the COMMAND character (default <CTRL-C>) 3 times within the "Guard time" set by the CMDTIME command (default 1 second).

4.9.2 Gateway Operation

The DSP-2232 can allow packet stations on one radio port to communicate with stations on the other port. When the DSP-2232 bridges two packet frequencies in this manner, it is said to be a "Gateway." Gateway operation is a dual port feature and requires that one of the dual port packet modems be loaded. Once this has been done the gateway function is enabled by entering a callsign in MYGATE. The callsign must not be the same call sign and SSID as MYCALL or MYMAIL.

When another station digipeats via the callsign in MYGATE, your DSP-2232 will Gateway between Radio Port 1 and Radio Port 2. If provide this feature to users in your area, you may want to BEACON a message on both ports informing users that your gateway is available.

At this time however, unattended operation below 30 MHz is not legal for US amateurs unless they hold a Special Temporary Authorization (STA) from the FCC. This restriction may someday change, but until then US amateurs must always have control of their HF transmitters when an automatic device such as the DSP-2232 Gateway is in use.

4.9.3 Sending 8-bit Data in Converse Mode

Sometimes you may need to send a file that contains some 8-bit data, but not need all the features of the TRANSPARENT mode. In this case, you may find turning the command 8BITCONV ON is all that is needed.

4.9.4 The Packet QRA Feature

The DSP-2232 recognizes UI frames with a destination field of "QRA" and will respond by sending an ID packet. This is helpful for others new to your area that are looking for other packet stations to talk to. To disable this feature and remain anonymous, simply set User BIT 22 OFF (UBIT 22 OFF). The default is ON.

If you wish to see who is available in your local area, simply set your UNPROTO path to QRA and send a packet. Within 1 to 16 seconds other stations should respond to your QRA request by sending an ID packet of their own. This feature is compatible with TAPR's QRA feature introduced in the 1.1.8 firmware release.

4.9.5 The CFROM Command

If you ever want to exclude certain stations from connecting or only allow friends to connect, you may do so with the CFROM Command. See The Command Summary for details of its operation.

4.9.6 Operating in Full-Duplex

Most packet operation is carried on over Half-Duplex transceivers that can transmit and receive but not do both at the same time. When a separate transmitter and receiver is used such as in satellite operation, you may want to use the FULLDUP Command in the DSP-2232.

4.9.7 Identifying as a Digipeater

If your DSP-2232 is being used as the primary digipeater in a local area, you may want to enable the HID command. HID will automatically identify your station for others to see.

4.9.8 Digipeater Alias Callsign

If your packet station is being used as the primary digipeater in your local area, you may want to choose a simpler identifier for others to use with the MYALIAS Command.

4.9.9 Morse ID in Packet

In most countries packet is an accepted mode of identification so this command should be left OFF. In some countries however a Morse ID is required when packet is used and so the MID command should be enabled.

4.9.10 Sharing Packet Channels with Voice Operation

Although it is seldom needed, the DSP-2232 does have an input for SQUELCH information from a transceiver on the RADIO connectors. This input should be used and the SQUELCH command set if the packet channel is to be shared with voice operation.

4.9.11 Disabling Transmit Operation

Occasionally for test purposes it may be desired to disable the PTT circuit in the DSP-2232. This is done with the XMITOK Command.

4.10 Seldom Used Commands

The following commands operate in Packet, but are seldom needed. They are listed for reference and described in the Command Summary.

AFilter BBSmsgs CONPerm CPactime DCdconn Flow HEAderln
MDMon MRpt MXmit

4.11 Packet Lite HF Packet Protocol Extension

Amateur radio needs a better communications mode for HF operation. Baudot and ASCII have no provision for error detection. AMTOR FEC and ARQ are more resistant to errors, but do not carry the full ASCII character set. 300 baud AX.25 packet is undesirable because the long transmissions are prone to bit errors, any one of which invalidate the whole frame.

Packet Lite is, as its name suggests, an abbreviated form of packet. It is designed as a transparent extension to the AX.25 protocol that reduces the "overhead" of all HF packet frames without digipeaters. Packet Lite does not solve HF packet's problems, but it should provide some throughput improvement on HF where it is desperately needed.

AEA's engineering department is interested in hearing from Packet Lite users with any comments or suggestions on improving the protocol.

A Brief Description of the Packet Lite Protocol

The main feature of Packet Lite that reduces overhead is that it uses an address field of only 4 bytes. A standard AX.25 header without digipeaters uses 14 bytes of addressing. Shortening the packet frame header lessens the possibility of any given frame taking a hit.

Packet Lite reduces the length of an I-frame slightly, but its real strength is the shortening of the acknowledgment frames, resulting in fewer garbled acks and therefore fewer unnecessary retries. An ack (RR, RNR or REJ frame) in standard AX.25 consists of 19 consecutive bytes that must be copied with no hits; Packet Lite reduces the length to 9 bytes, or 47% of the standard ack length.

A couple of restrictions are necessary to accomplish this. First, Packet Lite works only between two stations connected directly, with no digipeating allowed. If digipeaters are introduced to the address field, the advantage of the reduced overhead disappears.

Second, all Packet Lite connections emulate AX.25 version 2.0 (RR polling instead of retrying I-frames). This is necessary for the 10-minute identification described below. Also, the main reason version 1 continues to be used on HF is that on a retry a [RR,P] polling frame is so long that one might as well just send the I-frame again. Packet Lite's polling and ack frames are so short that the AX.25 version 2.0 polling method is now worth doing.

4.11.1 Enabling Packet Lite

To begin using Packet Lite, first make sure you have made all the proper HF Packet settings discussed earlier in this chapter. Be careful to ensure VHF is OFF and a 300 bps Modem has been selected.

Once these settings have been made, to enable the Packet Lite protocol extensions, turn the command LITE ON for the appropriate Port. For example to enable Packet Lite on Port 1, type "LITE ON" at the command prompt. You must not be connected to any other stations on that Port or you will not be allowed to change the LITE command.

Initiating a Packet Lite Connection

Once all the above settings have been made, simply issue the standard CONNECT request as described earlier in the chapter.

If the station you are connecting to also has Packet Lite enabled, a Packet Lite connection will result and you and the distant station should enjoy a more reliable QSO than others on the same frequency.

4.11.2 Compatibility With Standard AX.25 Stations

If the station you connect to does not have the Packet LITE protocol extensions, there are three known possibilities that will occur.

1. WA1ABC>WB2XYZ [C,P] 01 3E 38 58 32 {Packet Lite attempt}
   WB2XYZ>WA1ABC (UA,F) {Standard ack}

In this case, the non-Lite station sees the [C,P] control byte but ignores the non-standard bytes following it. It replies with a standard UA frame, and the connection proceeds as standard AX.25.

2. WA1ABC>WB2XYZ [C,P] 01 3E 38 58 32 {Packet Lite attempt}
   WB2XYZ>WA1ABC (FR): 3F 00 03 {Frame Reject}
   WA1ABC>WB2XYZ [C,P] {Standard attempt}
   WB2XYZ>WA1ABC (UA,F) {Standard ack}

In this case, the non-Lite station notices the non-standard bytes following the control byte and issues a FRMR (Frame Reject) to signify that a protocol violation has taken place. The DSP-2232 receives the FRMR and automatically reverts to standard AX.25, sending the connect retries without the Lite PID and address bytes.

3. WA1ABC>WB2XYZ [C,P] 01 3E 38 58 32 {Packet Lite attempt}
   ... {No response}

In this case, the non-Lite station notices the non-standard bytes following the control byte but sends no response at all. If this occurs, you must turn the command LITE OFF and try to connect again to the distant station. No adverse effects are caused by this, but transparency with standard AX.25 is lost when the receiving station does not acknowledge a Packet Lite connect request in some manner.

We know that TCP/IP, NET-ROM and DRSI stations ignore Packet Lite Connect requests. These stations are normally found on VHF, but to be safe, the LITE command should be turned OFF when not in use.

4.11.3 Packet Lite Protocol Enhancement Summary

The following describes the Packet Lite protocol extension in depth for those interested in the technical details. It is not necessary to read or understand the following section to use the protocol.
Here is a summary of a Packet Lite exchange, where WA1ABC calls WB2XYZ:

Connect:

W B 2 X Y Z -0	W A 1 A B C -0	SABM	01	3E 38 58 32
destination	source	CTRL	PID	short address

The destination and the source are both 7 bytes long. Everything up to the CTRL byte (SABM) is standard AX.25 version 2.0. The "Protocol ID" of 01 hex is Packet Lite's reserved value, which provides a way of interpreting the following bytes. This leaves room for other extensions to AX.25 in the future. The short address bytes are the right-justified bytes of the address field that WA1ABC proposes to use in subsequent Packet Lite frames with WB2XYZ. In this case, the AEA implementation of the short address is illustrated. 3E38 is a compressed version of the destination WB2XYZ and 5832 is a compression of WA1ABC. However, any combination of 26 bits may be used (see "Technical Details" below).

Connect acknowledgment:

```
W  A  1  A  B  C  -0   W  B  2  X  Y  Z  -0    UA   01  58  32  3E  38
      destination     |      source          | CTRL PID | short address
```

WB2XYZ replies to WA1ABC. Again everything up to the CTRL byte (UA) is standard AX.25. The "PID" of 01 and the short address confirm that WB2XYZ has accepted the Packet Lite connection. The short address is again the right-justified representation of the address field that WB2XYZ will be using in subsequent Packet Lite transmissions. In this case WB2XYZ has accepted the short address field suggested by WA1ABC, and has shown his acceptance by echoing the address back in reverse order (5832 = WA1ABC and 3E38 = WB2XYZ). AEA products always accept the short address from the SABM frame; however, the Packet Lite protocol allows the sender of the UA frame to propose a different combination of 26 bits, to avoid conflicting with another Lite QSO. In either case, the sender of the original SABM must accept the 26 bits in the UA frame, reversing the address order for its own transmissions.

Transmission of data:

```
   7C F0          B0 65          10        F0   Test <CR>
3E38 shifted   5832 shifted   [I,P;0,0]
short dest.    short source     CTRL      PID   text
```

WA1ABC sends data to WB2XYZ in Packet Lite format. The address field consists of the short address from WB2XYZ's UA frame, reversed and left-shifted. The added bits come from AX.25 version 2.0's command and response bits, and the end-of-address bit.

Acknowledgment of data:

```
   B0 64          7C F1          31
5832 shifted   3E38 shifted   (RR,F;1)
short dest.    short source     CTRL
```

WB2XYZ acknowledges the data from WA1ABC. The address field is reversed. This is the shortest length frame possible in Packet Lite. 4 address bytes + 1 CTRL byte + 2 flags + 2 CRC bytes = 9 bytes.

Every 10 minutes the stations must identify using both long and short addresses:

```
W  B  2  X  Y  Z  -0   W  A  1  A  B  C  -0   [RR,P;0] 01  3E  38  58  32
     destination     |      source          |   CTRL  PID | short address

W  A  1  A  B  C  -0   W  B  2  X  Y  Z  -0   (RR,F;1) 01  58  32  3E  38
     destination     |      source          |   CTRL  PID | short address
```

Either station may initiate the ID exchange.

Disconnect:

```
W B 2 X Y Z -0   W A 1 A B C -0   DISC  01  3E  38  58  32
     destination |      source     | CTRL PID | short address
```

Disconnect acknowledgment:

```
W A 1 A B C -0   W B 2 X Y Z -0    UA   01  58  32  3E  38
     destination |      source     | CTRL PID | short address
```

At the end of the connection, the two stations must once again identify using both long and short addresses.

AEA firmware supporting Packet Lite also contains code that permits monitoring of Packet Lite and extended AX.25 frames.

Packet Lite Shortened Address Technical Details

The Packet Lite address field consists of 26 bits distributed over 4 bytes (or octets, as the AX.25 spec calls them). These bits are considered to be two groups of 13 bits each, roughly equivalent to a destination and a source ID. If we label the bits A-Z and show their use in the address field of a Lite frame, the bits are distributed as follows:

```
A B C D E F G 0   x H I J K L M 0   N O P Q R S T 0   y U V W X Y Z 1
```

The least significant bit of each byte is used to show whether or not the byte is the final byte in the address field, as in standard AX.25. The bits "x" and "y" (lower case) have the function of command and response, similar to the function of the standard AX.25 version 2.0 SSID byte C bits (see AX.25 Protocol version 2.0, section 2.4.1.2).

In the AEA implementation of Lite addressing, the standard callsigns are compressed to yield short addresses. The destination callsign is compressed into bits A-M, and the source into N-Z. These bits are used as the address field suggestion following the control byte in the Connect (SABM) frame. When the bits are used following the control byte as an ID suggestion or a real extended ID, the format is:

```
0 A B C D E F G   0 0 H I J K L M   0 N O P Q R S T   0 0 U V W X Y Z
```

If we label the 7 standard right-justified callsign bytes 1-6 and SSID, here is how we derive the first group of address bits A-M:

```
ABCDE  =  (byte 1  XOR  byte 4)                AND  $1F
 FGHI  =  (byte 2  XOR  byte 5)                AND  $0F
 JKLM  =  (byte 3  XOR  byte 6  XOR  SSID)     AND  $0F
```

AEA firmware derives the second group of bits N-Z the same way. Other implementations are free to select any combination of 26 bits when setting up the short address in either the initial SABM frame or its UA response.

4.12 Packet Meteor Scattor Extension

A new packet protocol extension has been added for meteor scatter work that allows a Master/Slave packet connection to be established. This is done to reduce the possibility of simultaneous transmissions by both sides of a packet connection over a long meteor scatter path.

This experimental protocol is activated by turning User BIT 18 ON (UBIT 18 ON). When UBIT 18 is ON (default OFF) the packet station who initiates a packet connect will become the Master station and the station who acknowledges the connect becomes the Slave.

After a Meteor Scatter connection has been established, the Master station will continually send either information frames (I-frames) or polling frames and await an acknowledgement from the slave. The Master station therefore sends packets constantly, even if all its I-frames have been acknowledged. The slave station sends nothing, not even I-frames, until it receives a polling frame from the master. The Slave station may only send an I-frame to the Master after a poll frame has been received.

The packet timing of the Master station is critical for proper Meteor Scatter operation. In a normal AX.25 packet connect, the FRACK timer counts down until it reaches zero and then a Retry of a poll frame is sent. The FRACK timer counts in units of seconds however and a finer timing resolution is desirable for Meteor Scatter work. A new timer called FRICK has been added which times in 10 mSec increments. The FRICK timer can be set from 0 (disabled) to 250 which corresponds to a time of up to 2.5 Seconds. See the Command Summary for a complete description of the FRICK timer.

The following settings are recommended for this method of Meteor Scatter work. Both packet stations should use these same settings.

```
UBIT 18 ON
RETRY 0
AX25L2V2 ON  (default)
MAXFRAME 1
(CHECK doesn't matter)
FRICK n, where n is large enough to allow the other station time
         to send the start of an acknowledgement frame
```

Note: Do not operate the unit with multiple packet connections while FRICK is active (1-250). In contrast to FRACK, which provides one retry timer per multi-connect channel, there is only one FRICK timer on each radio port of the DSP-2232. Each logical channel will try to use the same FRICK timer, causing interference to the operation of the other channels.

Digipeaters should not be used when in the Meteor Scatter mode. The FRICK timer (unlike FRACK) does not allow any extra time when digipeater stations are specified.

To return to normal AX.25 packet operation turn User BIT 18 OFF. Also, be sure to disable the FRICK timer (by setting FRICK to 0) when you are through operating in Meteor Scatter mode.

CHAPTER 5

MAILDROP OPERATION

5.1 Overview of MailDrop Operation

The DSP-2232's MailDrop is a personal mailbox that uses a subset of the well-known WORLI/WA7MBL packet BBS commands allowing messages to be automatically sent and received. The MailDrop operates in Packet, AMTOR and PACTOR modes and may be accessed from both Radio Ports, although not simultaneously. This allows message traffic to move from Packet to AMTOR or PACTOR and vice versa.

When your MailDrop is active, distant stations can connect (in Packet) or Link (in AMTOR) to your DSP-2232, leave messages for you or read messages from you. If you choose to allow it, any station may leave messages for any other station simply by turning the parameter 3RDPARTY ON.

The Maildrop also supports forwarding and reverse forwarding of Packet messages if properly coordinated with a local "full service" BBS. Hierarchical message addressing is supported to simplify the routing of both national and international traffic.

5.1.1 RAM Space for Message Storage

Approximately 18K bytes of RAM are available to your MailDrop. RAM space is dynamically allocated so that it is possible to store as many messages as you like until all the memory is filled. If all 18K of RAM is used, the MailDrop displays the message "*** No free memory".

5.1.2 System Commands

MailDrop operation is completely under your "SYSOP" control from your local terminal or computer keyboard. Only you can start and stop MailDrop service. The commands shown below provide MailDrop control.

5.1.3 Your MailDrop Callsign

When operating in Packet, your MailDrop can have its own callsign which you enter with the MYMAIL command. If you do not enter a callsign in MYMAIL, the MailDrop will use MYCALL when it is enabled. When operating the MailDrop in AMTOR, your 4 character MYSELCAL or 7 character MYIDENT is used and must be entered for remote users to access the MailDrop.

5.1.4 Start and Stop MailDrop Operation

Set MAILDROP to ON to start Packet MailDrop operation (default is OFF). This command activates or deactivates your Packet MailDrop. Set TMAIL ON to start AMTOR MailDrop operation. Again, the default is OFF.

5.2 Local Logon

Type MDCHECK to verify that you have local control of the MailDrop. You must not be connected or linked to any other stations to do this.

Once logged on to your MailDrop from your local keyboard, you are shown the MailDrop prompt as though you were the calling station:

```
[AEA DSP-2232]  18396 free  (B,E,K,L,R,S) >
```

You can now EDIT, KILL, LIST, READ or SEND messages.
The number "18396 free" is the RAM available for MailDrop messages.

While you're "logged on" to your MailDrop, a connect request from another station will cause the DSP-2232 to send the "BUSY" frame. In AMTOR, the DSP-2232 simply ignores ARQ link requests while you are logged on to your MailDrop. When you are finished using the MailDrop, type "B" (BYE) to "log off". This returns the DSP-2232 to normal operation and makes your MailDrop available to other stations.

In Packet mode, you must leave the MAILDROP command ON to make it available for others. No other stations can reach your MailDrop unless the MAILDROP command is turned ON. In AMTOR, TMAIL must be ON.

You have full control of your DSP-2232 while the MAILDROP is ON. You can connect to others and carry on normal QSOs using the call sign in MYCALL provided you have entered a separate MYMAIL MailDrop callsign.

5.2.1 Monitor MailDrop Operation

Set MDMON to ON to monitor other stations' use of your MailDrop. Set MDMON OFF (default) to cancel MailDrop monitoring. User bit 13 allows MailDrop connect and status messages to be disabled as well. See the UBIT command in the command summary for specifics.

The MDMON command permits you to monitor a station's activity on your MailDrop showing you both sides of the QSO. Packet headers are not shown while a caller is connected to your MailDrop. When a caller is connected to the MailDrop, MCON determines what packets are monitored. When your MailDrop is idle, MONITOR determines what packets are seen.

5.2.2 Caller Prompts

MTEXT is the MailDrop connect-message prompt sent to a packet station connecting to the MailDrop if MMSG is ON. The default message is:

```
"Welcome to my AEA DSP-2232 maildrop.
 Type H for help."
```

MDPROMPT is the Message prompt sent to a station by the MailDrop. This prompt is given to a station sending a message. You can enter any text with a maximum length of 80 bytes. The default prompt is:

```
"Subject:/Enter message, ^Z (CTRL-Z) or /EX to end"
```

You may wish to enter a CTEXT message announcing the presence of a mailbox and the call sign (MYMAIL) used to access your MailDrop.

5.3 SYSOP MailDrop Commands

While you have logged on to your MailDrop from your local keyboard with the MDCHECK command, the commands available to you are:

B, E, K, L, R, S.

These are the "standard" BBS commands available to the MailDrop SYSOP. Any other command sent by you is answered with the error message "*** What?". A brief description of each command follows. All the available commands are described in detail following the next section.

B	BYE	Log off the MailDrop
E	EDIT	Edit a MailDrop message
K	KILL	Kill or delete messages
L	LIST	List the message directory
R	READ	Read a specific message
S	SEND	Send a message

5.4 Remote User MailDrop Commands

When a remote user has logged on to your MailDrop the following commands will be available to the distant station:

A, B, H, J, K, L, R, S, V, ?.

A brief description of each command follows.
These MailDrop commands are described in detail in the next sections.

A	ABORT	Aborts the reading of a long message
B	BYE	Log off the MailDrop
H	HELP	Help for the MailDrop commands
J	JLOG	Sends the DSP-2232 MHeard list
K	KILL	Kill or delete messages
L	LIST	List the message directory
R	READ	Read a specific message
S	SEND	Send a message
V	VERSION	Sends the DSP-2232 sign-on message
?	HELP	Help for the MailDrop commands

5.4.1 A (ABORT) (Remote only)

The "A" command aborts the Listing or Reading of messages by a calling station. This is handy if the remote user decides not to continue reading a long message. The message "*** Done" followed by the MailDrop prompt will be sent after an Abort has been received. On the local terminal the SYSOP may type the CANLINE character (default <CTRL-X>) to abort a long screen dump.

5.4.2 B (BYE)

The "B" command (Host abbreviation B1) logs the calling station (and you) off the MailDrop. A calling station will be disconnected; you will see the standard DSP-2232 "cmd:" prompt. The calling station may also simply disconnect.

5.4.3 E (EDIT #) (SYSOP only command)

The Edit command (Host abbreviation E1) is a powerful tool for controlling the status of messages on your MailDrop. The SYSOP must access the MailDrop before typing this command. Here are all possible ways to use this command:

E	Shows the following short help file: E msg# E msg# B/T/P E msg# Y/N/F E msg# >/</@ callsign
E 12	Shows message 12's info line.
E 23 > W0RM	Sets "W0RM" as message 23's destination.
E 35 < WH1Z	Sets "WH1Z" as message 35's source.
E 48 @ N7ML	Sets "N7ML" as message 48's destination BBS.
E 49 @ N7ML.MT.NA	Sets "N7ML" as message 49's destination BBS. and adds the hierarchical forwarding information .MT.NA signifying that N7ML BBS is located in the state of Montana (MT) which is located in North America (NA).
E 58 @	Clears message 58's destination BBS field.
E 60 P	Sets message 60's status to Private.
E 61 B	Sets message 61's status to Bulletin.
E 62 T	Sets message 62's status to Traffic.
E 63 Y	Sets message 63's status to Has-Been-Read.
E 64 N	Sets message 64's status to Has-Not-Been-Read.
E 49 F	Sets message 49's status to Reverse Forward.

The command "E n F" sets the message status to enable Reverse Forwarding of a message number. To cancel forwarding, set the status to either "Y" or "N." Please read the section on Reverse Forwarding (below) if you are interested in this feature.

5.4.4 H (HELP) (Remote only command)

The "H" command sends the distant station a HELP list of all available MailDrop commands as shown below. The "?" will also cause the HELP file to be sent.

```
A(bort)    Stop Read or List
B(ye)      Log off
H(elp)     Display this message
J(log)     Display stations heard
K(ill)     K n: Kill message number n
           KM : Kill messages you have read
L(ist)     L  : List message titles
           LM : List messages to you
R(ead)     R n: Read message number n
           RM : Read all your unread messages
S(end)     S  : Send a message to SYSOP
           S n: Send a message to station n
V(ersion)  Display TNC firmware version
?          Same as H(elp)
```

5.4.5 J (JLOG) (Remote only command)

The "J" command sent by the distant station will cause your MailDrop to send the DSP-2232's MHEARD List to the station. This command is not available to you the SYSOP since you can simply enter MHEARD at the DSP-2232 command prompt.

5.4.6 K n (KILL n [Mine])

The "K n" command (Host abbreviation K1) deletes message number "n" from the MailDrop. As SYSOP, you can kill any message. A calling station can kill only messages addressed to or from that station. Messages are killed by number, not call sign. The remote user may enter the "KM" (Kill Mine) command to KILL all of his or her messages that have been read previously.

5.4.7 L (LIST [Mine])

The "L" command (Host abbreviation L1) shows you the SysOp a list of ALL active messages on the MailDrop. The list is preceded by the following column header:

Msg# Size To From @ BBS Date Time Title

All active messages are listed under this line with the most recent message first. DAYTIME must be set for the Date and Time to appear.

When a remote user types the LIST command, the MailDrop lists only the messages that user may read, including messages to "ALL" and "QST." Messages to other users are not displayed. The MailDrop accepts the LM (List Mine) command from the remote user. This command acts only on messages addressed to the remote user, not messages to "ALL" or "QST."

5.4.8 R n (READ n [Mine])

The "R n" command displays the header and text of message number "n". Messages are read by number, not call sign. As SYSOP, you can read all messages. A remote user may READ only messages addressed to his call sign, or to "ALL" or "QST". The MailDrop accepts the RM (Read Mine) command from remote users. This command acts only on messages addressed to the remote user, not messages to "ALL" or "QST." The RM command displays only messages that have not been read previously.

5.4.9 S callsign (SEND callsign)

The "S callsign" command notifies the MailDrop that either you as SYSOP or the calling station will now send text into a message.

If 3RDPARTY is ON, then the calling station can leave a message for a station other than the SYSOP. If the station attempts to leave third party traffic with 3RDPARTY OFF, then the calling station will see:

```
*** No 3rd party traffic.
[AEA DSP-2232]  18396 free  (A,B,H,J,K,L,R,S,V,?) >
```

If all 18K of the RAM is used, the MailDrop displays the message "*** No free memory". If there is room, the MailDrop displays the Subject request message prompt:

"Subject:"

Enter a short (up to 27 character) description of the subject of the message. The MailDrop will then send the message prompt:

"Enter message, ^Z (CTRL-Z) or /EX to end"

After entering the message there are two ways to end the message. Either the <CTRL-Z> may be entered followed by a carriage return, or the 3 characters "/EX" and a carriage-return on a line by itself will end the message being sent. After this the MailDrop prompt should appear indicating that the MailDrop is ready for another command.

After ending the message, if you or the calling party see the message "*** No free memory", this means that the message was too large for the available MailDrop memory and has been deleted. If this occurs, you must shorten the message to fit into available memory shown in the MailDrop prompt, and re-send the message.

When logged on from your local keyboard, if you use the "S" command without a call sign, you'll see the error message "*** Need callsign". However, a calling station may use the S command without a call sign; it is understood that the message is directed to the DSP-2232's SYSOP.

As soon as a calling station uses the S command to send you (the SYSOP) a message, the STA light starts blinking to show that a message has been left for you. When you log on to your MailDrop with the MDCHECK command the STA LED will stop blinking.

5.4.9.1 Sending Other Types of Messages with SEND

Each message in the DSP-2232 MailDrop has a flag to show whether it is Private, Traffic or a Bulletin. A "P," "T" or "B" after the message number shows the status of every message. A user sets this with the SP, ST and SB forms of the Send command. The SYSOP may set this with the Edit (E) command described above. If only S is used as the Send command, the MailDrop will assign the message a Private (P) status.

The DSP-2232 MailDrop also accepts SEND commands of the form "SP SYSOP < W1AW." The call sign after the "<" goes into the "From" field of the message header.

For example, your MailDrop accepts the following additional information in a Send command:

S N7ML @ K6RFK < N6IA

The above means you want to send a message to N7ML who uses the K6RFK Bulletin-Board and the message is from N6IA.

The DSP-2232 MailDrop accepts hierarchical forwarding information that is helpful in reverse forwarding to full service BBS stations. An example of this is shown below:

```
SP N7ML @ K6RFK.WA.NA
```

The above means that you want to send a message to N7ML who uses the K6RFK Bulletin-Board which is located WAshington which is located in North America.

The DSP-2232 MailDrop also supports BIDs (Bulletin IDs). This support is required for Reverse Forwarding (see below). The BID begins with a "$" character and is sent and received in the Send command line:

```
S N7ML @ K6RFK < N6IA $345_KB7B
```

With the DSP-2232 MailDrop you may also use just the "$" all by itself as shown in the two examples below:

```
S N7ML @ K6RFK < N6IA $
or   S ALL $
```

In this case, the DSP-2232 MailDrop will assign its own BID to these messages.

5.4.10 V (VERSION) (Remote only command)

The "V" command causes the DSP-2232 to send the sign-on message and firmware date to the remote user only.

5.4.11 ? (HELP) (Remote only command)

The "?" command sends the distant station a HELP list of all available MailDrop commands shown above under the "H" command. Both the "?" and the "H" cause this same file to be sent to the remote user.

5.5 Sample MailDrop Session - The Remote User's Point of View

Let's see what the MailDrop looks like to a calling station. Let's assume that your call is "WX1AAA", and that you wish to connect and log on to "WX2BBB's" MailDrop system. During your session on his MailDrop, you wish to list the messages to see if there is a message for you, read it if it exists, kill it after you're done reading it, send a return message to WX2BBB and finally log off or disconnect from his MailDrop.

5.5.1 Connect and Logon

From the cmd: prompt, type the usual connect request:

```
cmd:c wx2bbb                                          {Connect request}
*** CONNECTED to WX2BBB                          {DSP-2232 status line}
You have mail                                        {informs the user
                                                      mail is waiting}
[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) > {MailDrop's prompt}
```

5.5.2 LIST Messages

You're logged on and have gotten the MailDrop's prompt:

```
[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) > {MailDrop's prompt}
```

Now, type "L" to LIST all the messages in the MailDrop.

```
L                                                    {The LIST command}
                                                  {The MailDrop responds}
Msg#      Size To     From   @ BBS      Date        Time     Title
  6 PN     184 WX1AAA WX2BBB            01-Jun-90 20:15     Hello Joe
  5 BY     287 ALL    WX2BBB            01-Jun-90 18:42     Question
  4 BY     178 QST    WX2BBB            01-Jun-90 17:30     Mailbox
  1 BY      56 ALL    WX2BBB            01-Jun-90 10:22     APLINK
[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) > {MailDrop's prompt}
```

5.5.3 READ Messages

You've seen the list of messages and wish to READ yours. You've seen the MailDrop's prompt:

```
[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) > {MailDrop's prompt}
```

Now, type "R #" to READ the one message number to you in the MailDrop.

```
R 6                                                  {The READ 6 command}
                                                  {The MailDrop responds}
Msg#      Size To     From   @ BBS      Date        Time     Title
  6 PN     144 WX1AAA WX2BBB            01-Jun-90 20:15     Hello Joe
                                                  {The message header}
Hello Joe.  Did you get the notice                 {The message}
about next month's meeting of the
Radio Society at the Firehouse?
Will you be going? - I need a ride.
73.

[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) > {MailDrop's prompt}
```

5.5.4 KILL Messages

You've read the message addressed to you and wish to KILL it. Again you see the MailDrop's prompt:

```
[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) > {MailDrop's prompt}
```

Now, type "K #" to KILL one specific message in the MailDrop.

```
K 6                                                  {The KILL 6 command}
*** Done.                                           {MailDrop confirms}
[AEA DSP-2232]  16704 free  (A,B,H,J,K,L,R,S,V,?) > {MailDrop's prompt}
```

5.5.5 SEND Messages

You've killed the message and wish to SEND a reply to the MailDrop's operator, WX2BBB. Again you see the MailDrop's prompt. Remember the number after the right bracket "]" shows you how much memory space is available in the MailDrop. Always verify that the MailDrop has enough memory remaining for the length of message you intend to send.

```
[AEA DSP-2232]  16704 free  (A,B,H,J,K,L,R,S,V,?) > {MailDrop's prompt}
```

Now, type "S [callsign]" to SEND a message to the MailDrop's SYSOP. If you omit the call sign, the MailDrop will address the message to the MYMAIL or MYCALL call sign. Messages sent with the S command are considered Private unless they are sent to "ALL" or to "QST".

```
S WX2BBB                                    {The "SEND callsign" command}
Subject:                                    {MailDrop's Subject prompt}
I WILL BE GOING                             {Your subject entry}
Enter message, ^Z (CTRL-Z) or /EX to end    {MailDrop answers you}

YEAH, I GOT THE MAILING AND WILL            {Type your message to WX2BBB}
BE GLAD TO PICK YOU UP.  WHAT TIME
DO YOU WANT ME THERE?  IS MARY
GOING?  CUL. WX1AAA
/EX                                         {End the message with /EX}

[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) > {MailDrop's prompt}
```

NOTE: If the message was ended with the "/EX", the last line will contain a "/E" when the message is read. To avoid this, use the <CTRL-Z> to end messages.

5.5.6 Log Off and Disconnect

You're finished with this session. Time to log off the MailDrop.

```
[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) > {MailDrop's prompt}
```

Now, type "B" (for Bye) to LOG OFF the MailDrop.

```
B                                           {The Bye command}
```

The MailDrop issues an immediate disconnect command to your DSP-2232 and the connection is over.

```
*** DISCONNECTED                            {DSP-2232's status line}
```

5.6 Sample MailDrop Session - MailDrop SYSOP's Point of View

Here is a transcription of the entire session described in the previous section, exactly as it would appear to the MailDrop's operator (SYSOP). We're assuming that the MDMON command is set to ON.

When MDMON is ON, you have the ability to supervise the activities of any station logged on to your MailDrop and - if needed - take any corrective action.

```
WX1AAA>WX2BBB <C,P>
You have mail
[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) >
*** CONNECTED to WX1AAA (Maildrop)

L
Msg#      Size To     From   @ BBS      Date       Time     Title
  6 PN     184 WX1AAA WX2BBB            01-Jun-90 20:15     Hello Joe
  5 BY     287 ALL    WX2BBB            01-Jun-90 18:42     Question
  4 BY     178 QST    WX2BBB            01-Jun-90 17:30     Mailbox
  1 BY      56 ALL    WX2BBB            01-Jun-90 10:22     APLINK
[AEA DSP-2232]  16508 free  (A,B;H,J,K,L,R,S,V,?) >
R 6
Msg#      Size To     From   @ BBS      Date       Time     Title
  6 PN     184 WX1AAA WX2BBB            01-Jun-90 20:15     Hello Joe

Hello Joe.  Did you get the notice
about next month's meeting of the
Radio Society at the Firehouse?
Will you be going? - I need a ride.
73.

[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) >
K 6
*** Done.
[AEA DSP-2232]  16704 free  (A,B,H,J,K,L,R,S,V,?) >
S WX2BBB
Subject:
I WILL BE GOING
Enter message, ^Z (CTRL-Z) or /EX to end

YEAH, I GOT THE MAILING AND WILL
BE GLAD TO PICK YOU UP.  WHAT TIME
DO YOU WANT ME THERE?  IS MARY
GOING?  CUL. WX1AAA
/EX

[AEA DSP-2232]  16508 free  (A,B,H,J,K,L,R,S,V,?) >
B
*** DISCONNECTED
```

5.6.1 Message Numbers

Any message that is sent to the DSP-2232 MailDrop by a remote user or you, the SYSOP is given a message number. Message numbers start at 1 and over time work their way up to 999 and then wrap back around to 1 again. Sometime it is desirable to reset the message counter. This can be done with the LASTMSG command which is described in the Command summary.

5.7 Forwarding and Reverse Forwarding with the DSP-2232 MailDrop

Forwarding allows your large community Bulletin Board System (BBS) may automatically connect to your MailDrop and send messages to you. Similarly, Reverse Forwarding allows your community BBS to connect to your MailDrop and get messages you wish to send to others.

Forwarding and Reverse Forwarding (or simply Auto-Forwarding) can be an advantage in a local area. The community BBS can be set to connect to your MailDrop at times when local traffic is low, such as late at night. This can spread out the traffic volume on a packet frequency which can become quite heavy in the "prime time" early evening hours.

Auto-Forwarding is involved and requires the cooperation of both you and your community BBS Operator. Not all large BBSs will forward to individual users. Some packet frequencies are so busy forwarding to other BBSs that they can not forward to individuals. You must contact the community BBS SYSOP to determine the guidelines in your area.

5.7.1 MailDrop Settings for Auto-Forwarding

The following must all be set properly for Auto-Forwarding to operate.

- Enter your MYCALL. Enter your MYMAIL if you desire to use a separate call sign for the MailDrop.

- Make arrangements with your local BBS SYSOP to Auto-Forward to your MailDrop. Make sure you let the him know the MailDrop call sign you will use. The BBS SYSOP must program his system to connect to your MailDrop or Auto-Forwarding will not function.

- Enter the call sign of this community BBS in the HOMEBBS command.

- Leave your DSP-2232 and radio ON THE AIR so that your local BBS can connect to your MailDrop. If your packet station is not on when the local BBS tries to connect, the advantage of Auto-Forwarding is lost and the BBS SYSOP may drop you from the Forwarding list.

Once the above have been completed, you are ready to receive messages automatically from your local BBS. The next section describes how to prepare messages for Reverse Forwarding to the local BBS (HOMEBBS).

5.7.2 Entering a Message for Reverse Forwarding

To prepare a message for Reverse Forwarding to another station:

- Type MDCHECK to access your MailDrop from your terminal.

- Using the Send command, type the message you want forwarded. Use the "@" field to set the destination BBS where the addressee will pick up his mail. For example if you want to send a message to N6UND who you know uses the BBS N6IIU enter the following:

  S N6UND @ N6IIU.CA.NA

Note that the "@" call sign does not need to be the same as the HOMEBBS call sign. The "@" call sign can be typed as part of the Send command or as part of the Edit command described earlier.
The ".CA.NA" is optional "Hierarchical forwarding" information that in this case designates that N6IIU is located in the state of California.

- Enter the Subject and text of the message as described above in the Send command section. Don't forget to end your message with <CTRL-Z> or "/EX" on its own separate line also described above.

- Use the Edit command to set the Forwarding flag for each message that will be Reverse Forwarded to HOMEBBS. This is described in the Edit command section above. For example the following will mark message number 53 for Reverse Forwarding.

  E 53 F (Sets Reverse Forwarding for message 53.)

- Log off your MailDrop with the B (Bye) command.

- If you wish each message to disappear as it is Reverse Forwarded, leave KILONFWD ON. If you wish to keep each message after it has been Forwarded, turn KILONFWD OFF. After forwarding, the message flag will change from "F" to "Y" to show that it has been read.

Last page of Chapter 5 - Maildrop Operation

CHAPTER 6

BAUDOT AND ASCII RTTY OPERATION

6.1 Overview

Baudot (pronounced Bod-dough) has been around for many years. The five bit Baudot/Murray code was the basis of the Western Union Telex service and Baudot RTTY (Radio TeleTYpe) is still widely used on the HF amateur bands. The Baudot character set contains the upper-case letters, the numbers 0-9 and some common punctuation characters. Because Baudot has only five bits, it is less prone to errors than seven bit ASCII. Your DSP-2232 provides Baudot RTTY at all standard speeds in use today, including commercial speeds up to 300 bauds.

ASCII (pronounced Ask-kee), the American Standard Code for Information Interchange has been around for nearly 30 years. ASCII is a 7-bit code and was designed to overcome the limitations of the Baudot character set by including both upper and lower case letters, numbers, all punctuation as well as many computer control codes. ASCII is not so popular on the amateur bands, but its operation is almost identical to Baudot RTTY so we will describe them both in this chapter.

Baudot and ASCII may be operated on Radio Port 1 on the DSP-2232. Packet may be used on Radio Port 2 at the same time, so you won't miss any connects while operating Baudot or ASCII on HF.

6.2 Where to Operate Baudot and ASCII RTTY

Before you can operate Baudot or ASCII RTTY, you must first know where the activity is. Most RTTY operation occurs on the 20-meter amateur between 14.08 and 14.10 MHz. RTTY activity can be found on the other HF amateur bands as well and is most often located between 80 and 100 kHz up from the bottom of the band as it is on 20 meters.

6.2.1 DSP-2232 Baudot RTTY Parameter Settings

First you must enter the Baudot mode of the DSP-2232.
If you are using an AEA PAKRATT program, follow the instructions in the program manual to enter the Baudot mode.

If you are using a terminal, simply type "BAUDOT" or "BA" from the Command Mode followed by the <Enter> key to enter the Baudot mode. The DSP-2232 responds by displaying the previous mode:

```
Opmode   was PAcket
Opmode   now BAudot
```

Your DSP-2232's front panel STATUS display will show the Baudot operating mode on Radio Port 1 and the CMD LED will be lit. The Radio Baud rate (RBAUD) will also be shown on the STATUS display.

The following parameters are the most common settings for HF Baudot operation. Check the parameters and make sure they are set as follows:

RBAUD	45 (this is the most common amateur speed on HF)
RXREV	OFF
TXREV	OFF
MODEM	1

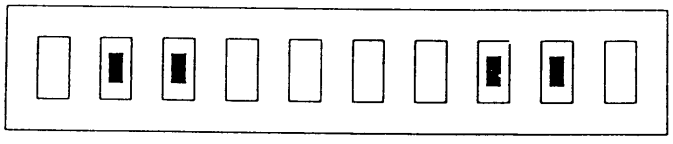
6.2.2 HF Receiver Settings

Set your HF receiver (or transceiver) to Lower Sideband (LSB) unless you connected your DSP-2232 through the direct FSK keying lines. In this case, you should select the FSK operating mode. Adjust the volume to a comfortable listening level.

6.2.3 Tuning in Baudot and ASCII Stations

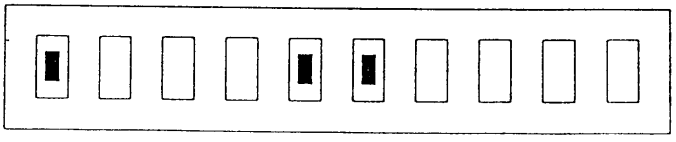
Tuning in Baudot and ASCII stations properly is critical to successful operation. Since HF Baudot and RTTY stations use either 170 Hz or 200 Hz Frequency Shift Keying to send data, tuning accuracy is very important. Follow the tuning procedure below carefully for the best results in tuning HF Baudot and ASCII stations.

- Make certain your HF receiver is either in LSB or FSK depending on your DSP-2232 set-up.
- Turn any IF-Shift and Passband-Tuning controls to the Center or OFF position.
- Tune your receiver carefully between 14.08 and 14.10 MHz (or another band where you know there is Baudot or ASCII activity) and listen for RTTY stations.
- When you find a station, slowly vary the VFO tuning knob on your receiver and look for a display on the DSP-2232 tuning indicator like the one shown below.



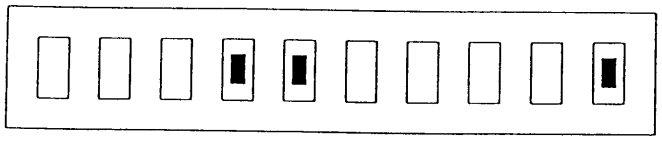
Tuned In

If the tuning indicator looks like the one below, the frequency from your speaker is too low for the DSP-2232 to copy the signal. Slowly tune the VFO and make the frequency higher.



Frequency Too Low

If the tuning indicator looks like the one below, the frequency from your speaker is too high for the DSP-2232 to copy the signal. Slowly tune the VFO and make the frequency lower.



Frequency Too High

- Adjust the receiver's volume control so the DSP-2232's DCD LED lights when a properly tuned RTTY station is being received.

HINT: If you adjust the volume control so the DCD LED goes out when no station is being received, you will prevent garbage characters generated by noise from printing on your screen.

After you have an ASCII or RTTY station tuned in, you should start seeing the copy printing on your screen.

NOTE: If the text you are receiving is garbled, you may be tuned to a transmission at a different baud rate. Either try tuning in a different station, or see Chapter 10 on SIGNAL IDENTIFICATION to let the DSP-2232 determine the kind of station you are listening to.

6.3 Transmitter Adjustments

Make sure your DSP-2232 is adjusted for your SSB transmitter as described in section 3.5 and 3.5.2 of this manual before transmitting. These are very critical adjustments. If your DSP-2232's AFSK level and transmitter microphone gain are not adjusted properly, other stations will not be able to copy your signals. Check your plate or collector current or the power output of your rig before transmitting.

6.3.1 Going On The Air

Make sure your transmitter and antenna are tuned and adjusted for the band and operating frequency you are using. If you are using an AEA PAKRATT program, see the program manual for the proper way to place the DSP-2232 into RTTY transmit mode.

If you are using a terminal or terminal program, the following will place your DSP-2232 and transceiver into the transmit mode.

- Make sure that you have selected your transmitted text to go to Port 1 by pressing the CHSWITCH character defined in Chapter 4 followed by the number 0.

- Type "X" for XMIT and then press the <Enter> key to key your transmitter and automatically enter the Converse mode.

As soon as you type the <Enter> key you will be transmitting. At this point you are also in the CONVERSE mode and anything you type will be sent in Baudot by your transmitter.

When you are finished transmitting, use one of the following methods to return to receive.

- Type <CTRL-D> (the RECEIVE character) to shut off your transmitter and return to the Command Mode.
- Type <CTRL-F> (the CWID character) to send a Morse ID and shut off your transmitter and return to Command Mode.
- Type <CTRL-C> (the COMMAND character) to return to the Command Mode and then type "R" to shut down your transmitter and end the contact.

See the following sections for a sample QSO as well as some Baudot operating hints.

6.4 A Typical Baudot RTTY Contact

As with most amateur operating modes, you can start a contact either by "calling CQ" or by answering a "CQ" call by another station.

6.4.1 Calling CQ

To call CQ first you must tell your DSP-2232 to start transmitting.

- Type "X" to key your transmitter and start the DSP-2232 sending.
- Type in your CQ message (use YOUR callsign) such as the one below:

```
CQ CQ CQ CQ CQ CQ CQ DE YOURCAL YOURCAL YOURCAL
CQ CQ CQ CQ CQ CQ CQ DE YOURCAL YOURCAL YOURCAL
CQ CQ CQ CQ CQ CQ CQ DE YOURCAL YOURCAL YOURCAL
CQ CQ CQ CQ CQ CQ CQ DE YOURCAL YOURCAL YOURCAL K
<CTRL-D>
```

- Type <CTRL-D> at the end of your CQ call. The <CTRL-D> puts both your radio and the DSP-2232 into the receive mode.
- Wait a bit to see if you get a response. If not, you can repeat the above procedure.

6.4.2 Answering a CQ

Let's assume you hear KZ7G calling CQ. To answer, do the following:

- Type "X" to key your transmitter and start the DSP-2232 sending.
- Call the other station by giving his call followed by your call, (KZ7G DE YOURCAL). Start the transmission with a line of RYs as a tuning signal for the distant station. Here's an example:

```
RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYR
KZ7G KZ7G KZ7G DE YOURCAL YOURCAL YOURCAL
KZ7G KZ7G KZ7G DE YOURCAL YOURCAL YOURCAL
KZ7G KZ7G KZ7G DE YOURCAL YOURCAL YOURCAL
<CTRL-D>
```

(If the other station can't copy these four lines of text, the chances are he won't copy any more than that. No need to waste time and bandwidth by typing 15 or 20 lines of the same thing.)

- Type <CTRL-D> at the end of your call. The <CTRL-D> puts both your radio and the DSP-2232 into the receive mode.

Always end every transmission with a carriage return to force the distant station's screen cursor or teleprinter back to the left margin on a new line. It's a good operating habit that keeps things neat.

- Wait a bit to see if you get a response. If not, you can repeat the above procedure.

6.5 Baudot RTTY Operating Tips

The DSP-2232 can automatically determine the speed of the received signals with the SIGNAL IDENTIFICATION (SIAM) mode. However, you can manually step through all the available RTTY receiving speeds with the RBAUD command.

The following "Function Keys" and immediate commands are included for Baudot RTTY operating convenience.

Immediate Commands from the Command Mode:

"L"	Forces LETTERS case in receive.
"N"	Forces FIGURES case in receive.
"R"	Switches system to receive mode, forces LETTERS case.
"X"	Switches system to transmit mode and forces immediate entry into Converse mode.
"K"	Go to CONVERSE Mode in order to load Transmit type ahead buffer.

"Function Key" characters embedded in transmitted text:

<CTRL-B>	Sends AAB string as a HEREIS message.
<CTRL-E>	Sends "Who Are You" request to distant station.
<CTRL-O>	Sends LETTERS shift character.
<CTRL-N>	Sends FIGURES shift character.
<CTRL-D>	Shuts off transmitter after sending character buffer.
<CTRL-F>	Sends call sign in Morse and shuts off transmitter.
<CTRL-T>	Sends the Time if the DAYTIME clock has been set.

6.5.1 Changing Speed

Assume you've been receiving at 45 bauds and wish to increase the baud rate in steps. From the Command mode, type RB U followed by an <Enter>. The DSP-2232 responds with:

```
RBaud   was 45
RBaud   now 50
```

The RBAUD command sets the Baudot RTTY speed. The most common speed is 45 bauds on HF, but other speeds including commercial speeds are supported. See the Command Summary for all the supported speeds.

6.5.2 Formatting Your Transmitted and Received Text

The default configuration of the DSP-2232 RTTY parameters are set for natural conversation and traffic. Sometimes it is desired to alter how your text looks on the screen of the station you are talking to. The commands ACRRTTY and ALFRTTY allow for customizing the Carriage Return and Linefeed characters in your transmitted text.

To allow for changing how received text is displayed on your screen or printer, see the ACRDISP and ALFDISP commands in the Command Summary.

MARS operators have some special requirements for RTTY operation and displaying text. To accommodate these, the CRADD and MARSDISP commands are included and should be reviewed in the Command Summary.

6.5.3 Sending a Synchronous Idle or DIDDLE

Some RTTY users like to send an idle signal when no data is being transmitted. To allow for this the DSP-2232 has the DIDDLE command. See the Command Summary for more information.

6.5.4 Echoing Transmitted Characters As Sent

Since Baudot RTTY at 45 baud is rather slow, some users like to know when the characters are actually being sent. The EAS command when ON echoes characters to the display only when they are sent over the air.

6.5.5 Sending Only Complete Words

Some RTTY users like to have their words sent out only when they are complete. This allows the word you are currently typing to be edited as long as you have not typed a <Space> character. Turning WORDOUT ON activates this feature. See the Command Summary for more information.

6.5.6 Operating on the Wrong Sideband

In RTTY operation it is important to operate on the correct sideband, otherwise other stations will not be able to copy your transmissions. If you find another station operating on the wrong sideband, you can reverse your receive sense with the RXREV command so you will not have to change sidebands yourself.

Similarly, if someone tells you that you are on the wrong sideband, you can correct your transmit signal sense with the TXREV command. See the Command summary for more information on these commands.

6.5.7 Framing errors

Baudot and ASCII RTTY operation traditionally do not check for errors and tend to be prone to receiving "garbage". The DSP-1232 has the ability to check for framing errors on received characters which can reduce the amount of "garbage" characters on the screen. To reduce the amount of erroneous characters printed on the screen, turn the command RFRAME ON (default OFF). See the Command Summary for a complete description of the RFRAME command.

6.5.8 Unshift-On-Space (USOS)

The Unshift-On-Space (USOS Command) automatically changes the received Baudot/Murray code characters to the LETTERS or lower case condition after any "space" character is received.

When operating Baudot RTTY under poor conditions, a received LETTERS-SHIFT character can be garbled, or another character can be wrongly interpreted as a FIGURES-SHIFT character. Turning USOS ON helps reduce reception errors under these conditions.

Some commercial, weather and utility RTTY services send groups of numbers separated by spaces. When receiving such non-amateur signals, USOS should be OFF to prevent displaying LETTERS-shifted characters when the originator may have intended the data to be FIGURES-shifted.

6.5.9 Operating at Commercial or VHF Wide RTTY Shifts

Most commercial stations found in the non amateur Short Wave bands operate with a wide Frequency Shift keying of either 425 or 850 Hz shift. To allow these stations to be received other modems are available in the DSP-2232 and can be selected with the MODEM command. The following modems are available for Baudot and ASCII operation:

```
MODEM  1  AFSK Modem, 170 Hz shift, Mark=2125 Hz, Space=2295 Hz
MODEM  2  AFSK Modem, 170 Hz shift, Mark=1445 Hz, Space=1275 Hz
MODEM  3  AFSK Modem, 425 Hz shift, Mark=2125 Hz, Space=2550 Hz
MODEM  4  AFSK Modem, 850 Hz shift, Mark=2125 Hz, Space=2975 Hz

                        (Dual Port Modems)
MODEM  30: RTTY/TOR 170 Hz: 2125/2295; p2 Packet 300 bps HF
MODEM  31: RTTY/TOR 170 Hz: 2125/2295; p2 Packet 1200 bps VHF
```

If your license permits, you can also transmit to these stations when the appropriate MODEM number and data rate is selected.

6.5.10 The CODE Command for International RTTY Compatibility

The CODE command allows the DSP-2232 to receive (and sometimes send) other RTTY character sets. Part 97.69 of the FCC rules specifies that the International Telegraph Alphabet Number 2 (ITA #2) must be used by U.S. stations when operating RTTY. This corresponds to the CODE 0 command (default), but you may want to see the CODE command for more information on the capabilities of your DSP-2232.

6.5.11 Copying Encoded RTTY Transmissions

In the Short Wave bands many RTTY stations can be found that are not transmitting in plain text. Most of these stations are using sophisticated encryption techniques that make receiving them almost impossible. There are a few stations however that use a relatively simple bit-inversion technique to make them hard to copy. For these stations, the DSP-2232 has included the BITINV command to allow the SWL to decode these simple forms of encoded RTTY stations.

6.6 ASCII RTTY Operation

ASCII RTTY operation is almost identical to Baudot operation but there are a few differences you must know. Because the ASCII code uses seven bits to define a character (instead of the five bits used in the Baudot/Murray code), the probability of receiving errors is somewhat higher. For these reasons, ASCII is not used widely on the HF amateur bands. However, some commercial and military HF stations as well as W1AW do use ASCII.

6.6.1 Starting ASCII Operation

First you must enter the ASCII mode of the DSP-2232.
If you are using an AEA PAKRATT program, follow the instructions in the program manual to enter the ASCII mode.

If you are using a terminal, simply type "ASCII" or "AS" from the Command Mode followed by the <Enter> key to enter the ASCII mode. The DSP-2232 responds by displaying the previous mode:

```
Opmode   was BAudot
Opmode   now AScii
```

Your DSP-2232's front panel STATUS display will show that you are in the ASCII mode on Radio Port 1 and the CMD LED will be lit.

The following parameters are the most common settings for HF ASCII operation. Check the parameters and make sure they are set as follows:

ABAUD	110 (or whatever speed you wish)
RXREV	OFF
TXREV	OFF
MODEM	1

Some VHF Bulletin Boards and MSOs use ASCII at 110 and 300 bauds, most commonly on two meters.

6.6.2 ASCII RTTY Operating Tips

Follow the general operating procedures shown in the sections above for Baudot RTTY. As in Baudot operation, you can step the system through all the available receiving speeds.

The following "Special Function Characters" and immediate commands are included for ASCII RTTY operating convenience.

Immediate Commands From the Command Mode:

"R"	Switches system to receive mode.
"X"	Switches system to transmit mode and forces immediate entry into Converse mode.
"K"	Go to CONVERSE Mode in order to load the Transmit type ahead buffer.

Special Function Characters embedded in transmitted text:

<CTRL-B> Sends AAB string as a HEREIS message.
<CTRL-D> Shuts off transmitter after sending character buffer.
<CTRL-E> Sends "Who Are You" request to distant station.
<CTRL-F> Sends call sign in Morse and shuts off the transmitter.
<CTRL-T> Sends the Time if the DAYTIME clock has been set.

6.6.3 Changing ASCII Baud Rates

Assume you've been receiving at 110 bauds and wish to increase the baud rate in steps. From the Command mode, type AB U followed by an <Enter>. The DSP-2232 responds with:

```
ABaud   was 110
ABaud   now 150
```

The ABAUD command sets the ASCII RTTY speed. The most common speed is 110 bauds on HF, but other speeds including commercial speeds are supported. See the Command Summary for all the supported speeds.

6.6.4 Operating at Commercial or VHF Wide ASCII RTTY Shifts

Most commercial stations found in the non amateur Short Wave bands operate with a wide Frequency Shift keying of either 425 or 850 Hz shift. To allow these stations to be received other modems are available in the DSP-2232 and can be selected with the MODEM command. The following modems are available for Baudot and ASCII operation:

```
MODEM  1  AFSK Modem, 170 Hz shift, Mark=2125 Hz, Space=2295 Hz
MODEM  2  AFSK Modem, 170 Hz shift, Mark=1445 Hz, Space=1275 Hz
MODEM  3  AFSK Modem, 425 Hz shift, Mark=2125 Hz, Space=2550 Hz
MODEM  4  AFSK Modem, 850 Hz shift, Mark=2125 Hz, Space=2975 Hz

                    (Dual Port Modems)
MODEM  30: RTTY/TOR 170 Hz: 2125/2295; p2 Packet 300 bps HF
MODEM  31: RTTY/TOR 170 Hz: 2125/2295; p2 Packet 1200 bps VHF
```

If your license permits, you can also transmit to these stations when the appropriate MODEM number and data rate is selected.

6.6.5 Other RTTY Commands for ASCII Operation

Many of the commands mentioned above in the Baudot Section also operate in the ASCII RTTY mode as well. They are listed below:

```
AAB       ACRDISP   ALFDISP   DIDDLE    EAS   RFRAME
RXREV     TXREV     WORDOUT   WRU
```

6.7 Simultaneous RTTY and Packet Operation

Your DSP-2232 can operate on Baudot or ASCII RTTY on Radio Port 1 and HF or VHF Packet on Radio Port 2 at the same time. With this feature you won't miss any local Packet activity while operating RTTY.

Before the second radio port can be used for packet operation, a modem must be loaded that can access the second port. There are two types of RTTY modems available. The first type is a single port modem which disables packet operation on radio port 2. These are listed below.

```
MODEM  1  AFSK Modem, 170 Hz shift, Mark=2125 Hz, Space=2295 Hz
MODEM  2  AFSK Modem, 170 Hz shift, Mark=1445 Hz, Space=1275 Hz
MODEM  3  AFSK Modem, 425 Hz shift, Mark=2125 Hz, Space=2550 Hz
MODEM  4  AFSK Modem, 850 Hz shift, Mark=2125 Hz, Space=2975 Hz
```

The second type of modem is "Dual Ported", that is allows for RTTY operation on radio port 1 and packet operation on radio port 2 at the same time. The dual port RTTY modems available in the DSP-2232 are listed below.

```
MODEM  30: RTTY/TOR 170 Hz: 2125/2295; p2 Packet 300 bps HF
MODEM  31: RTTY/TOR 170 Hz: 2125/2295; p2 Packet 1200 bps VHF
```

6.7.1 Selecting and Loading Modems

The various modems available in the DSP-2232 can be seen with the DIRECT(ory) command. To display all the available modems simply enter the Command Mode of the DSP-2232 and then type DIR as shown.

```
DIR <Enter>
```

The DSP-2232 will respond with the following:

```
(920716)
 1: RTTY/TOR 170: 2125/2295          2: RTTY/TOR 170: 1445/1275
 3: RTTY/TOR 425: 2125/2550          4: RTTY/TOR 850: 2125/2975
10: p1 Packet 300 bps HF 2110/2310  11: p1 Packet 300 bps HF 1460/1260
12: p1 Packet 1200 bps VHF          13: p1 Packet 1200 bps PACSAT
14: p1 Packet 1200 bps PSK          15: p1 Packet 2400 bps V.26B
16: p1 Packet 4800 bps PACSAT       17: p1 Packet 4800 bps PSK
18: p1 Packet 9600 FSK K9NG/G3RUH   20: p2 Packet 300 bps HF 2110/2310
22: p2 Packet 1200 bps VHF          23: p2 Packet 1200 bps PACSAT
25: p2 Packet 2400 bps V.26B        28: p2 Packet 9600 FSK K9NG/G3RUH
30: RTTY/TOR 170: 2125/2295; p2 Packet 300 bps HF 2110/2310
31: RTTY/TOR 170: 2125/2295; p2 Packet 1200 bps VHF
33: p1 Packet 300 bps HF 2110/2310; p2 Packet 1200 bps VHF
35: p1 Packet 1200 bps VHF; p2 Packet 1200 bps VHF
40: Morse 750 Hz                    41: Analog FAX HF
42: Analog FAX APT                  43: Analog SSTV
44: D SP data 400 bps OSCAR-13      45: RTTY/TOR 1200 ASCII OSCAR-11
46: DSP data Spectrum               50: p1 Packet 1200 bps MSK
51: p1 Packet 2400 bps MSK          52: p1 Packet 9600 G3RUH UO22 eq
60: p2 Packet 1200 bps MSK          61: p2 Packet 2400 bps MSK
cmd:
```

Any modem from the list may be loaded with the MODEM command, but only the RTTY/TOR modems listed will operate in Baudot or ASCII RTTY. For example, to operate 45 baud Baudot on radio port 1 and 1200 bps VHF packet on radio port 2 you must load modem 31. To load modem 31, first enter the Command Mode of the DSP-2232 and then type MODEM 31 as shown below:

```
MODEM 31 <Enter>
```

The DSP-2232 will respond with the following:

```
MODem was  1
MODem now  31
```

When starting Baudot RTTY operation, the DSP-2232 defaults to the modem number set in the QRTTY command. You may wish to change the number in QRTTY to the modem number you prefer to use in Baudot RTTY.

6.7.2 Displaying Received Data

When a port 1 only modem is loaded, port 2 packet operation is effectively disabled. This can be desirable when operating RTTY and you do not want to be disturbed with any packet signals that may be received on radio port 2.

When a Dual Port modem such as MODEM 31 is loaded in the DSP-2232, received data is displayed from both Radio Ports at the same time. This allows you to operate on HF and not miss any local Packet connects or information from DX spotting nets.

The DSP-2232 sorts and displays received data from each Radio Port using the same technique as multi-connect packet operation described in Chapter 4. That is, when operating on one port and the other port becomes active, the displayed data from the inactive port is shown prefaced by the "channel designator" followed by a colon (:). Recall that Radio Port 1 is designated by "logical" channels from 0-9 and that Port 2 is designated by "logical" channels A-Z. This is true whether a single port or a dual port modem is loaded.

6.7.3 Switching Between Ports

If you are using an AEA PAKRATT program, switching between Radio Ports is described in the program manual. If you are using a terminal program, this section describes how to direct your transmitted text.

Switching between RTTY on Port 1 and Packet on Port 2 is similar to switching between Packet and Packet. If you have not yet read through the Switching Between Radio Ports section of Chapter 4, please do so now and define a CHSWITCH character before reading the example below.

Recall from chapter 4 that the channels on Port 1 are labeled 0-9 and the channels on Port 2 are labeled A-Z. To select Radio Port 1 (RTTY) press the CHSWITCH character you defined, followed by the number 0. To select Radio Port 2 (Packet), press the CHSWITCH character, followed by a letter from A-Z.

For example, you are conversing with an HF RTTY station and are in the middle of a QSO when a station on VHF connects to you. The following shows how your screen would look and suggests how you might handle such an occurrence. The underlined text is the text that you type.

```
x <Enter>
Hello Jim, you are printing solid          { You send the RTTY station
here and have an S7 signal.<CTRL-D>          a signal report }
cmd:

THANKS BOB, YOUR ALSO A SOLID S7           { The other station responds
HERE AS WELL.                                with a signal report }

A:*** CONNECTED to WX7EEE                  { WX7EEE connects to you on
                                             VHF (Radio Port 2) }

<CTRL-C>cmd:x <Enter>
Thanks for the signal report Jim           { You make another transmission
only running 100 watts here.<CTRL-D>         to Jim on HF RTTY }
cmd:

Hey Bob, I'm going to the hamfest          { Your friend on VHF packet
this weekend if you want a ride.             wants to go to the hamfest }

k <<Enter>
|AHello Mike, I am on HF RTTY                { You switch to Port 2 by
talking to a station in Boston.            typing |A and respond on VHF }

0:WELL BOB, I HAD BETTER BE GOING TO       { Jim on HF RTTY signs off
BED.  WORK STARTS PRETTY EARLY 73.           with you. }

|0<CTRL-C>0:cmd:x
73 Jim, it was nice meting you.          { You switch back to HF with
WX1AAA de WX7BBB SK <CTRL-D>               the |0 and sign off with Jim }
```

As you may have noticed, communicating with different modes on the two Radio Ports at the same time is almost identical to the method used in chapter 4 for Packet and Packet operation. Let's discuss the sample QSOs above to see how the Port switching occurs.

The first text we see in the sample above is the signal report you are sending to Jim, the HF RTTY station you are communicating with. Notice that you must type an "x" followed by the Enter key on the keyboard to place Radio Port 1 of the DSP-2232 into RTTY Transmit mode. When you are through sending your signal report to Jim on HF RTTY, you tell the DSP-2232 to return to receive by sending a <CTRL-D>. The DSP-2232 then responds with the Command Prompt "cmd:".

The next text you see is your signal report received from Jim on RTTY.

You are in the middle of a QSO with Jim on HF RTTY and all of a sudden your friend WX7EEE connects to you. WX7EEE has connected on Radio Port 2 (VHF) which is shown by the "A:" before the connect message. Remember that the 26 channel designators for Radio Port 2 are A-Z.

Before you respond to WX7EEE on VHF, you send a transmission to Jim on HF RTTY telling him how much power your transmitter is running. In order to do this however you must first enter the command mode of the DSP-2232 by typing a <CTRL-C> and then giving the RTTY Transmit command "x" followed by the <Enter> key. When you are finished with your text, you command the DSP-2232 back to receive with a <CTRL-D>.

After making this transmission on HF RTTY, you see WX7EEE on VHF has offered you a ride to the hamfest. We know this text is from Radio Port 2 since the previous packet displayed by the DSP-2232 was the "A:*** CONNECTED" message from Port 2.

Now you want to let WX7EEE on VHF know that you are there, but that you are involved in another QSO on HF. This way he will understand that it may take you a little longer to respond to his packets. Before you can send data to Radio Port 2, you must enter Converse Mode with the "k" command and then switch to this Port with "|A" or the text you type will be sent to Radio Port 1 on RTTY the next time you enter the transmit command "x".

You receive a transmission from Jim on HF RTTY telling you he needs to sign off to go to bed. The "0:" in front of the text shows this was received on Radio Port 1.

Now you want to sign off with Jim on HF. Again, first you must switch to Radio Port 1 with the "|0" since your last transmission was directed to Port 2. After this you must enter the command mode of the DSP-2232 by sending a <CTRL-C> and then place Port 1 into RTTY transmit with the "x" command. Now you can make your final transmission to Jim ending with his callsign followed by your callsign. As before, when you are through typing your text, you send a <CTRL-D> to the DSP-2232 which returns Radio Port 1 to receive after the text has been sent.

6.7.4 More Thoughts on Port Switching

One problem of having more than one Radio Port is remembering which port you are currently using. In the dual port sample QSOs above, this was not a problem, but after it has been hours or days since you have used your DSP-2232, you may forget which port you last used.

With AEA Pakratt Software programs, the on-screen status will always show which port you are using so this is not a problem. With other programs, you will have to query the DSP-2232 with the CSTATUS SHORT command. The CSTATUS command displays the status of the logical channels of Port 1 and Port 2 of the DSP-2232. The CSTATUS SHORT command displays the status of the active channel and any packet channels that are connected. After completing the sample QSOs above, the DSP-2232 would display the following.

```
cmd:CSTATUS S

Ch. A - IO DISCONNECTED
```

This reminds you that Channel A is your current I/O channel. Any text that you type in the Converse mode will be sent to channel A on Radio Port 2. If you had been connected to any other packet stations, the callsign and channel would have also shown in the display.

Sometimes you might not want to be bothered with anything from the Radio Port you are not using. For these times either Radio Port may be turned OFF with the RADIO command. For example, let's say that in the above example QSO you wanted to work HF packet and did not want to be interrupted with any VHF connects. Typing the following command would cause Radio Port 2 to be disabled.

```
cmd:RADIO /0
RAdio  was  1/2
RAdio  now  1/0
```

When a DSP-2232 Radio Port is disabled, the front panel LEDs and STATUS indicator for that port will be extinguished as a reminder the port is disabled.

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CHAPTER 7

AMTOR AND NAVTEX OPERATION

7.1 Overview

The DSP-2232 provides AMTOR operation on Radio Port 1 in accordance with FCC Part 97.69 and CCIR Recommendations 476 and 625 for Mode A (ARQ) and Mode B (FEC). AMTOR is an adaptation of the SITOR system used in high-seas telex, which provides error detection and correction.

AMTOR has two basic modes of operation, Mode A (ARQ - Automatic ReQuest for Reception) and Mode B (FEC - Forward Error Correction).

- ARQ AMTOR is a handshaking protocol that allows only two stations to communicate in a near error free fashion. You will hear a "chirp chirp" sound when you find two stations conversing in ARQ. AMTOR Mode A (ARQ) is the perhaps the most error-free method of getting messages through on HF when conditions are poor.

- FEC AMTOR is similar to Baudot RTTY and is used to call CQ or to carry on "round table" contacts.

NAVTEX is a form of FEC AMTOR that is used to send Navigational bulletins and weather information primarily to ships at sea. Recently it has been adopted by the ARRL to send bulletins to amateurs.

7.2 Where to Operate AMTOR

Before you can operate AMTOR, you must first know where the activity is. Most AMTOR operation occurs on the 20-meter amateur between 14.065 and 14.085 MHz. AMTOR activity can be found on the other HF amateur bands as well and is most often located between 65 and 90 kHz up from the bottom of the band as it is on 20 meters.

7.2.1 DSP-2232 AMTOR Parameter Settings

AMTOR is a bit more complex than Baudot or ASCII operation. AMTOR operating modes require SELCALL (Selective Call) codes be entered before you can operate. There are two SELCALLs you should enter.

7.2.2 Entering Your SELective CALling Code (MYSELCAL)

This unique character sequence contains four alphabetic characters that are derived from your call sign. The DSP-2232 automatically does this for you just by entering your amateur callsign into the MYSELCAL command. If you are using an AEA PAKRATT program, follow the instructions in the program manual for entering the command MYSELCAL.

If you are using a terminal, then Type "MYSELCAL" to load your SELCALL into the DSP-2232 as shown below:

```
cmd:MYSELCAL N7ML
```

The DSP-2232 will tell you, MYSelcal now NNML

See the MYSELCAL command in the Command Summary if you are interested in more information on the translation process.

Because the same call sign sequences are assigned in ten US districts, it is possible that your SELCALL could be used by another station. If you think a station in another call district is also active on AMTOR and is using the same SELCALL, see the MYSELCAL command for information on how to change your Selcall.

7.2.3 Entering Your SELective CALling Code (MYIDENT)

At the present time, most of the AMTOR activity on the amateur bands is using the four-character SELCALL defined in CCIR 476 and described above. The seven-character SELCALL (MYIDENT) defined in CCIR 625 solves the problem of non-unique SELCALLs by providing many more possible SELCALLs than CCIR 476 does with only four characters.

To enter your seven-character SELCALL all you must do is enter your amateur callsign. The DSP-2232 will do the translation for you.

If you are using an AEA PAKRATT program, follow the instructions in the program manual for entering the command MYIDENT.

If you are using a terminal, then enter the following

```
cmd:MYIDENT N7ML
```

The DSP-2232 will tell you, MYIdent now VTMFFFF

See the MYIDENT command in the Command Summary if you are interested in more information on the translation process.

7.2.4 Enter the AMTOR Mode

Now that you have entered your personal MYSELCAL and MYIDENT Selective Calling codes, you are ready to enter the AMTOR mode.

If you are using an AEA PAKRATT program, follow the instructions in the program manual to enter the AMTOR mode.

If you are using a terminal, simply type "AMTOR" or "AM" from the Command Mode followed by the <Enter> key to enter the AMTOR mode. The DSP-2232 responds by displaying the previous mode:

```
Opmode   was PAcket
Opmode   now AMtor
```

Your DSP-2232's front panel STATUS display will show that you are in the AMTOR Standby mode on Radio Port 1, and the CMD LED will be lit.

7.2.5 HF Receiver Settings

Set your HF receiver (or transceiver) to Lower Sideband (LSB) unless you connected your DSP-2232 through the direct FSK keying lines. In this case, you should select the FSK or RTTY operating mode. Adjust the volume to a comfortable listening level.

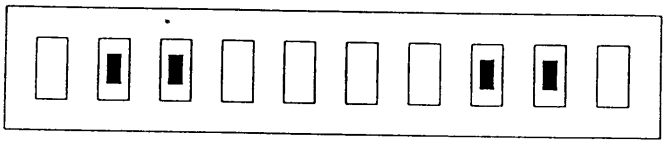
7.2.6 Tuning in AMTOR Stations

Tuning in AMTOR stations properly is critical to successful operation. Since HF AMTOR stations use either 170 Hz or 200 Hz Frequency Shift Keying to send data, tuning accuracy is very important. Follow the procedure below for the best results.

- Make certain your HF receiver is either in LSB or FSK depending on your DSP-2232 set-up.
- Turn any IF-Shift and Passband-Tuning controls to the Center or OFF position.
- Tune your receiver carefully between 14.065 and 14.085 MHz (or another band where you know there is AMTOR activity) and listen for the "chirp chirp" of ARQ or the steady data of FEC stations.

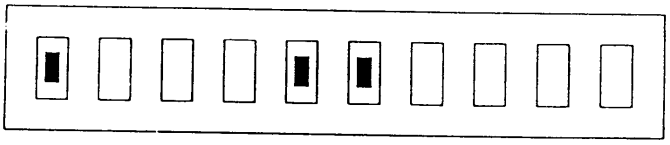
NOTE: When in the AMTOR Standby mode as you are now, you will not be able to print the "chirping" ARQ signals. To print these stations, you must be in the AMTOR Listen (ALIST) mode.

- When you find a station, slowly vary the VFO on your receiver and look for a display on the DSP-2232 tuning indicator as shown.



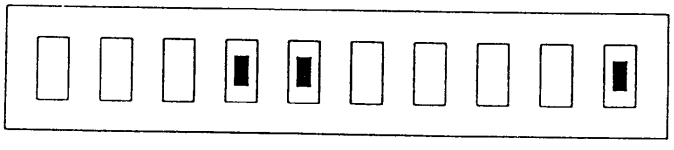
Tuned In

If the tuning indicator looks like the one below, the frequency from your speaker is too low for the DSP-2232 to copy the signal. Slowly tune the VFO and make the frequency higher.



Frequency Too Low

If the tuning indicator looks like the one below, the frequency from your speaker is too high for the DSP-2232 to copy the signal. Slowly tune the VFO and make the frequency lower.



Frequency Too High

- Adjust the volume of the received signal so that the DCD LED lights when a properly tuned FEC AMTOR station is being received.

After you have an FEC AMTOR station tuned in, you should start seeing the copy on your screen. If you have tuned in "chirping" ARQ AMTOR stations, you will not print anything until you enter the ALIST mode. If you just want to receive, see Chapter 10 on SIGNAL IDENTIFICATION.

7.3 Transmitter Adjustments

Make sure your DSP-2232 is adjusted for your SSB transmitter as described in section 3.5 and 3.5.2 of this manual before transmitting. These are very critical adjustments. If your DSP-2232's AFSK level and transmitter microphone gain are not adjusted properly, other stations will not be able to copy your signals. Check your plate or collector current or the power output of your rig before transmitting.

7.3.1 Going On The Air

Make sure your transmitter and antenna are tuned and adjusted for the band and operating frequency you are using. Before you transmit, you must decide if you are going to "call CQ" or answer someone's CQ call.

7.3.2 Calling CQ in FEC AMTOR

If you plan to make a CQ call, you must do so in the FEC AMTOR mode. This is required since an ARQ AMTOR transmission requires another station to "Link-up" with. If you are using an AEA PAKRATT program, see the program manual to place the DSP-2232 into FEC transmit.

If you are using a terminal or terminal program, the following will place your DSP-2232 and transceiver into the transmit mode.

- Make sure that you have selected your transmitted text to go to Port 1 by pressing the CHSWITCH character defined in Chapter 4 followed by a number from 0 through 9.

- Type "FEC" then press the <Enter> key to key your transmitter and automatically enter AMTOR FEC transmit mode.

As soon as you type the <Enter> key you will be transmitting! At this point you are also in the CONVERSE mode and anything you type will be sent in FEC by your transmitter.

- Type in your CQ message. Make sure you include YOUR Callsign, your four-character Selcall (MYSELCAL) as well as your seven-character Selcall (MYIDENT) so others can respond to your CQ call. An example is shown below:

```
CQ CQ CQ CQ CQ CQ CQ DE N7ML (NNML) (VTMFFFF)
CQ CQ CQ CQ CQ CQ CQ DE N7ML (NNML) (VTMFFFF)
CQ CQ CQ CQ CQ CQ CQ DE N7ML (NNML) (VTMFFFF)
CQ CQ CQ CQ CQ CQ CQ DE N7ML (NNML) (VTMFFFF)
SELCALL NNML (VTMFFFF) K
<CTRL-D>
```

- Type <CTRL-D> at the end of your CQ call. The <CTRL-D> puts both your radio and the DSP-2232 into the receive mode.

- Wait a bit to see if you get a response. If not, you can repeat the above procedure.

7.3.3 Answering an FEC AMTOR CQ

Normally when you see a station calling CQ in FEC AMTOR, you will want to answer him using ARQ AMTOR. Remember that ARQ AMTOR is the protocol that reduces the chance of transmission errors.

Let's assume you hear NNML calling CQ. To answer, do the following:

- o If you are using an AEA PAKRATT program, check the program manual for instructions on starting an ARQ AMTOR contact.

- o If you are using a terminal simply type "ARQ NNML<Enter>" to start a CCIR 476 ARQ contact, or "ARQ VTMFFFF<Enter>" to start a CCIR 625 ARQ contact.

After your DSP-2232 has locked or synchronized with the distant station, you may begin your conversation.

N7ML N7ML DE YOURCAL YOURCAL...etc

7.3.4 ARQ AMTOR Operating Fundamentals

When you finish typing your comments or traffic to the other station and wish the distant station to transmit to you Do Not type "KKK" or anything like that!

- o Do type a plus sign immediately followed by a question mark (+?).

"+?" is a software changeover command that switches your system from being the "Information Sending Station" (ISS) to the "Information Receiving Station" (IRS), and switches the distant system from being the IRS to being the ISS. When your distant partner sees the "+?" he knows he can begin typing comments or traffic.

NOTE: When discussing ARQ operation, we use the terms "Information Sending Station" (ISS) and "Information Receiving Station" (IRS) instead of "transmit" and "receive" since in ARQ, both stations are rapidly switching from transmit to receive.

- o Don't bother with multiple call signs and "over-to-you" routines or "KKK" used in Baudot and ASCII RTTY operation. The system does it all for you when you type the "+?".

The FCC requires station identification once every ten minutes. It's sufficient to begin with "QRA (mycall)" or end your transmission with "QRA (mycall)" before the "+?" changeover code, or use the <CTRL-B> "HERE-IS" to send your own Auto-AnswerBack message.

7.3.5 Ending an ARQ AMTOR Contact

When you've finished your "final finals" to the distant station and both stations are ready to end the Mode A (ARQ) contact, you can end the contact and terminate the link in several different ways:

- Type <CTRL-D> to stop sending when the transmit buffer is empty.

  <CTRL-D> breaks the link and returns your DSP-2232 to Command Mode.

- Type <CTRL-F> to break the link and send your Morse ID.

  Your DSP-2232 sends your call sign in Morse code, and then shuts off your transmitter.

- Type <CTRL-C> to return to Command Mode, then type "R" to break the link.

  The "R" command breaks the ARQ link immediately and returns your system to AMTOR Standby. This can be used as an "Emergency Shutdown" if you need to take your transmitter off the air.

7.3.6 LCD Status and Mode Indicator

The LCD STATUS indicator and the LEDs on the front of the DSP-2232 are there to help give you the unit's status at a glance. This is especially true in AMTOR operation. The following describe typical STATUS indications you will see.

Type "ARQ (SELCALL of distant station)." The STATUS changes to:

STATUS:	AMTOR ARQ Phase
LEDs:	SEND lit

This shows that your transmitter is in the SEND condition, in the "phasing" part of an ARQ selective call. Your transmitter will key on and off sending the distant station's SELCALL. As soon as your DSP-2232 is synchronized with the distant station, the STATUS changes to:

STATUS:	AMTOR ARQ Tfc
LEDs:	SEND lit

Verify the link by typing a few <Enter>s; watch the display. Your traffic will now begin to flow as you type characters. If EAS is set ON, your typed characters are displayed as they are acknowledged by the distant station. The STATUS will change back and forth from Idle and Tfc whenever your typing pauses.

If errors occur on the link and the distant station sends RQ (Request for Repeat), the STATUS will show:

STATUS:	AMTOR ARQ ERROR and/or RQ
LEDs:	SEND lit

ERROR: Your DSP-2232 has detected errors in the signals received from the distant station

RQ: Your DSP-2232 has received a "request for repeat" code from the distant station

If the link fails and you lose synchronization with the distant station your DSP-2232 automatically tries to re-establish synchronization with the distant station. The STATUS changes to show:

STATUS:	AMTOR ARQ Phase
LEDs:	SEND lit

After typing FEC, your DSP-2232 displays the system status:

STATUS:	AMTOR FEC Idle
LEDs:	SEND lit

As you send your traffic the STATUS will change back and forth from Idle to Tfc. Whenever you stop typing, the Idle status is displayed.

7.4 AMTOR Operating Tips

The following "Special Function Characters" and immediate commands are included for AMTOR operating convenience.

Immediate Commands from the Command Mode:

"ARQ <SELCALL>"	Starts Mode A selective call and forces Converse
"FEC"	Starts Mode B transmission and forces Converse
"SELFEC <SELCALL>"	Starts Selective Mode B transmission
"R"	Stops sending immediately, forces AMTOR Standby
"AM"	Stops transmission, forces AMTOR Standby
"AL"	Forces re-synchronization in ALIST (AMTOR Mode A Listen)
"L"	Forces LETTERS case in receive
"N"	Forces FIGURES case in receive

Special Function Characters embedded in transmitted text:

<CTRL-B>	Sends your AAB string as a HERE-IS message
<CTRL-D>	Stops sending when the transmit buffer is empty
<CTRL-E>	Sends a "Who Are You" request to the other station
<CTRL-F>	Sends call sign in Morse and shuts off transmitter
<CTRL-N>	Sends FIGURES character
<CTRL-O>	Sends LETTERS character
<CTRL-T>	Sends the TIME if the DAYTIME clock has been set

7.4.1 ARQ Break-In (ACHG Command)

In Mode A (ARQ), when you're the "Information Receiving Station," you can use the "ACHG" command to interrupt the distant station's comments.

As the "Information Receiving Station," you normally rely on the distant station to send the "+?" to "change-over" at the end of his comments. ACHG is a command that forces both systems to reverse the "Information Receiving" and "Information Sending" status of the link.

- Use the ACHG command only when really needed to interrupt the distant station.

7.4.2 Entering Your Auto-AnswerBack (AAB)

AMTOR allows you to request the identity of the station you are conversing with by sending your DSP-2232 a <CTRL-E>. This causes the DSP-2232 to send a FIGS-D request to the other station.

For this reason, you should set your own Auto-AnswerBack (AAB) message to "DE YOUR-CALL MYSELCAL MYIDENT". Your DSP-2232 will automatically send the AAB message when another station requests your identity, and then stop sending.

7.4.3 Operating AMTOR with Other Modem frequencies and Shifts

All Amateur (AMTOR) and commercial (SITOR) stations that we know of use either 170 or 200 Hz shift FSK modems. Modem 1 (default) is therefore the best choice for ARQ or FEC AMTOR use. The DSP-2232 allows other modems to be used in AMTOR should the need arise. The following other modems may be selected with the MODEM command.

```
MODEM  1  AFSK Modem, 170 Hz shift, Mark=2125 Hz, Space=2295 Hz
MODEM  2  AFSK Modem, 170 Hz shift, Mark=1445 Hz, Space=1275 Hz
MODEM  3  AFSK Modem, 425 Hz shift, Mark=2125 Hz, Space=2550 Hz
MODEM  4  AFSK Modem, 850 Hz shift, Mark=2125 Hz, Space=2975 Hz

                    (Dual Port Modems)
MODEM  30: RTTY/TOR 170 Hz: 2125/2295; p2 Packet 300 bps HF
MODEM  31: RTTY/TOR 170 Hz: 2125/2295; p2 Packet 1200 bps VHF
```

Note that Modems 3 and 4 are wideshift modems and are not recommended.

7.4.4 Speed Change Not Permitted

In accordance with FCC 97.69 and international regulations, AMTOR is operated at 100 bauds. The DSP-2232 does not permit other speeds.

7.4.5 Echoing Transmitted Characters As Sent (EAS)

EAS has special significance in ARQ AMTOR. If EAS is on, you will see characters echoed to your screen only after your partner in the AMTOR link, has validated them. With EAS ON, the characters appear on your screen three at a time.

- o If the data scrolls across your monitor at an even rate, you can assume that you have a good ARQ link.
- o If the data hesitates or scrolls in "jerky" intermittent fashion, that's generally a sign that the radio link is not too good.
- o If the characters stop appearing on your monitor, the link is failing or has failed. The STATUS display will tell you this.

7.4.6 Sending Only Complete Words (WORDOUT)

Some AMTOR users like to have their words sent out only when they are complete. This allows the word you are currently typing to be edited as long as you have not typed a <Space> character. Turning WORDOUT ON activates this feature. See the Command Summary for more information.

7.4.7 Operating on the Wrong Sideband

In AMTOR operation it is important to be operating on the correct sideband, otherwise other stations will not be able to copy you. If you find a station operating on the wrong sideband, you can reverse your receive sense with the RXREV command.

Similarly, if someone tells you that you are on the wrong sideband, you can correct your transmit signal sense with the TXREV command. See the Command summary for more information on these commands.

7.5 Monitoring ARQ AMTOR Contacts with ALIST

Use the "ALIST" command to monitor ARQ traffic flowing between two stations linked in an ARQ contact. Your DSP-2232 will try to synchronize with whichever of the two linked ARQ stations is the Information Sending Station at the moment.

Mode L Listen operation does not give you error detection or error correction; your DSP-2232 is not one of the two stations locked to each other. If the other two stations are enjoying a good link, you'll probably get good copy from that link.

Your DSP-2232 will not print a block of data if that block contains the same information as the previous block. If the "ISS" (Information Sending Station) is repeating the same block, you won't print it twice, unless you receive an error. If the stations you're monitoring are sending error and RQ codes and repeating blocks of characters across their link, you may see some repeated character blocks. If they're having link problems, the data on your screen can look very strange indeed, although the two synchronized stations are getting error-free copy.

7.6 AMTOR MailDrop Operation

The DSP-2232 allows AMTOR as well as Packet access to the MailDrop. Messages that originate in Packet can be accessed remotely in AMTOR and messages that originate from a remote AMTOR station can be accessed by Packet users of your MailDrop. This section of the manual talks about basic AMTOR mailbox operation. Section 7.7 will discuss how to pass message traffic from AMTOR to Packet and vice versa.

Make sure that you understand MailDrop Operation in Chapter 5 and the basic AMTOR operation described earlier in this chapter before putting your AMTOR MailDrop on the air.

7.6.1 Special Operating Considerations

The AMTOR MailDrop has been designed with a "Watchdog" safety feature so that it may perform safely without constant attention. If a remote station is linked with your AMTOR MailDrop and no traffic is passed for 5 minutes, the link will drop and your transmitter will shut off.

At this time however, unattended operation below 30 MHz is not legal for US amateurs unless they hold a Special Temporary Authorization (STA) from the FCC for this purpose. This restriction may someday change, but until then US amateurs must be sure to always have control of their HF transmitters when any automatic device such as the DSP-2232 MailDrop is in operation.

With this in mind, we have designed the AMTOR MailDrop so that it can be disabled and then re-enabled at any time during an ARQ link simply by turning the command TMAIL (TOR MAIL) OFF. This allows you the SYSOP to make your MailDrop available to other stations and still break in to chat with remote stations at any time. This could come in handy should you want to provide some help or information to a remote station using your AMTOR MailDrop.

7.6.2 Settings For AMTOR MailDrop Operation

Before a remote AMTOR user can access your MailDrop, be certain that MYCALL (on Port 1) is set to your Amateur callsign and MYSELCAL is set to your 4-character AMTOR SelCall. To allow CCIR 625 AMTOR access to your MailDrop, your 7-character MYIDENT must also be entered. Once these commands have been entered, you must then enter the AMTOR mode.

7.6.3 Starting AMTOR MailDrop Operation

Remote access to your AMTOR MailDrop is controlled by the command TMAIL which is short for TOR MAIL. The TMAIL command controls remote access to the AMTOR MailDrop in the same way that the MAILDROP command controls remote Packet access.

Turn the TMAIL command ON (default OFF) to allow remote stations to access your MailDrop in ARQ AMTOR. Turn TMAIL OFF to have normal ARQ QSOs with other stations in the AMTOR mode.

7.6.4 Local Logon to the MailDrop

To locally access your MailDrop use the MDCHECK command as described in chapter 5 of this manual on MailDrop operation.

7.6.4.1 Remote Logon to your AMTOR MailDrop

The AMTOR maildrop user interface is slightly different from the packet interface due to the differences between the two modes.

When CODE is set to 0 and the ITA#2 alphabet is used in AMTOR, only UPPER case characters are sent. If you the SYSOP set CODE to 2 enabling the Cyrillic extensions, both upper and lower case characters can be sent and received. See the CODE command for information and limitations of this feature.

When a station links with your AMTOR MailDrop, your DSP-2232 first identifies your station by sending your callsign and the amount of free MailDrop memory as shown below:

DE WX7AAA (AEA DSP-2232) 17528 FREE.

Since AMTOR transmissions do not self-identify, your MailDrop will force the remote user to identify in one of three possible ways.

The first way is automatic:
Your MailDrop will send "STAND BY" and then the WRU request to the remote user. Always be sure you have entered a proper Auto-Answerback (AAB) message consisting of "QRA YOURCALL YOUR_MYSELCAL YOUR_MYIDENT" as described earlier in this chapter.

The second way covers beginning AMTOR users:
AMTOR users who have not entered a proper Auto-AnswerBack response or for some reason have the WRU feature disabled cannot be automatically identified by your MailDrop. In this case, your MailDrop will ask the calling station to identify as follows:

After 10 seconds your MailDrop will ask the calling station to identify by sending "QRZ? DE "your callsign+?" to the calling station.

The calling station then has 3 minutes to respond with its callsign. The ID must contain either "QRA" or "DE" and must end with "+?". An Amateur with the call WX7BBB would send the following:

QRA WX7BBB +?

If no satisfactory ID occurs within 3 minutes from the establishment of the link, the link is automatically shut down.

The third way covers experienced users:
Experienced AMTOR users may want to save time by simply sending QRA followed by their callsign immediately after establishing the link. For example station WX7BBB may simply enter the following immediately after establishing the ARQ link.

QRA WX7BBB +?

The DSP-2232 then sends the user the MTEXT string if the MailDrop message command (MMSG) is ON. The default text is shown below:

WELCOME TO MY AEA DSP-2232 MAILDROP.
TYPE H FOR HELP.

7.6.5 Caller Prompts

The command prompt that the MailDrop sends the remote user in AMTOR is shortened from that used in the Packet mode and is shown below:

WX7BBB DE WX7AAA GA+?

TMPROMPT is the AMTOR MailDrop message prompt sent to a remote station by your MailDrop. The default prompt is:

GA subj/GA msg, '/EX' to end.

Text before the first slash is sent to the user as the subject prompt; text after the slash is sent as the message text prompt.

7.6.6 Monitor MailDrop Operation

The local user (SYSOP) can monitor the dialog by setting MDMON ON. The DSP-2232 stays in command mode during remote MailDrop access.

7.6.7 SYSOP MailDrop Commands

The MailDrop commands that you the SYSOP have access to are the same as those described in Chapter 5 of the manual on MailDrop Operation.

7.6.8 Remote User MailDrop Commands

When a remote user has logged onto your MailDrop the following commands are available to the distant station:

A, B, H, J, K, L, R, S, V, ?.

The remote user may end a command with either +? or a carriage return.

A brief description of each command follows in the next sections. The description is expanded where the command operation differs from the Packet Maildrop section found in Chapter 5.

7.6.8.1 A (ABORT) (Remote only)

The "A" command aborts the listing or reading of messages by the remote calling station as described in chapter 5. The difference in AMTOR is that the remote user must send the ACHG command first to reverse the direction of the link before he can issue the Abort command. The remote user also has the ability to abort a command that may have been mis-typed by typing "///" on the same line as the bad command.

7.6.8.2 B (BYE)

The "B" command logs the remote station off the MailDrop. In AMTOR the remote station may simply gracefully shut down the link with the RECEIVE character (<CTRL-D>) or the CWID character (<CTRL-F>).

7.6.8.3 H (HELP)

The "H" command sends the remote station a help list of the available commands shown in Chapter 5.

7.6.8.4 J (JLOG) (Remote only command)

The "J" command sent by the distant station will cause the MailDrop to send the list of stations who have logged in to your AMTOR MailDrop.

7.6.8.5 K n (KILL n [Mine])

The "K n" command deletes message number "n" from the MailDrop as described in Chapter 5.

7.6.8.6 L (LIST [Mine])

The "L" command shows the remote user only a list of the messages he or she may read as described in Chapter 5.

7.6.8.7 R n (READ n [Mine])

The "R n" command lets the remote user read any of the message numbers displayed in the LIST command. The command operates as described in Chapter 5 except that the column headers are not displayed.

7.6.8.8 S callsign (SEND callsign)

Due to the nature of AMTOR, character errors may occur at any time, so extra safeguards are built into the system. In AMTOR, the MailDrop echoes the actual SEND command, then asks for confirmation by sending "CFM YES/NO+?". If the remote user's reply is "N", the MailDrop cancels the SEND command and gives the "GA" command prompt instead. If the reply is "Y", the message can then be sent as shown below.

In the SEND command, the words "AT," "FROM" and "BID" must be used in place of the "@," "<" and "$" signs used in packet. Hierarchical addresses are also supported in AMTOR mode, but not forwarding. You the SYSOP may edit any message so it can be forwarded in Packet mode.

Since <CTRL-Z> is not available in the AMTOR character set, the "/EX" command or "+?" must be used to end all AMTOR MailDrop messages. After the "/EX" or "+?" has been detected, the MailDrop will confirm that the message has been sent by returning the message "FILED MSG n" to the remote user. An example of sending a message is shown below:

```
WX7BBB DE WX7AAA GA+?                          {MailDrop prompt}
s wx2zzz at wx2yyy                             {User's SEND command}

S WX2ZZZ AT WX2YYY                   {MailDrop echoes SEND command
18340 FREE.  CFM YES/NO +?            and awaits confirmation}
y                                    {User confirms}

GA SUBJ+?                                  {MailDrop Subject prompt}
Going to the Hamfest?                      {User enters Subject}
GA MSG, '/EX' TO END.+?                    {MailDrop Send prompt}
I haven't heard from you and wondered if             {Message text}
you are going to the Hamfest next month?             {Message text}
Hope to see you there. 73                            {Message text}
/ex                                        {User ends message}

WX7BBB DE WX7AAA FILED MSG 1 GA+?              {MailDrop prompt}
```

7.7 Simultaneous AMTOR and Packet Operation

Your DSP-2232 can operate AMTOR on Radio Port 1 and HF or VHF Packet on Radio Port 2 at the same time. With this feature you won't miss any local Packet activity while operating AMTOR.

Before the second radio port can be used for packet operation, a modem must be loaded that can access the second port. There are two types of RTTY/AMTOR modems available. The first type is a single port modem which disables packet operation on radio port 2. These are listed below.

```
MODEM  1  AFSK Modem, 170 Hz shift, Mark=2125 Hz, Space=2295 Hz
MODEM  2  AFSK Modem, 170 Hz shift, Mark=1445 Hz, Space=1275 Hz
MODEM  3  AFSK Modem, 425 Hz shift, Mark=2125 Hz, Space=2550 Hz
MODEM  4  AFSK Modem, 850 Hz shift, Mark=2125 Hz, Space=2975 Hz
```

The second type of modem is "Dual Ported", that is allows for RTTY/AMTOR operation on radio port 1 and packet operation on radio port 2 at the same time. The dual port RTTY modems available in the DSP-2232 are listed below.

```
MODEM  30: RTTY/TOR 170 Hz: 2125/2295; p2 Packet 300 bps HF
MODEM  31: RTTY/TOR 170 Hz: 2125/2295; p2 Packet 1200 bps VHF
```

7.7.1 Selecting and Loading Modems

The various modems available in the DSP-2232 can be seen with the DIRECT(ory) command. To display all the available modems simply enter the Command Mode of the DSP-2232 and then type DIR as shown.

```
DIR <Enter>
```

The DSP-2232 will respond with the following:

```
(920716)
 1: RTTY/TOR 170: 2125/2295          2: RTTY/TOR 170: 1445/1275
 3: RTTY/TOR 425: 2125/2550          4: RTTY/TOR 850: 2125/2975
10: p1 Packet 300 bps HF 2110/2310  11: p1 Packet 300 bps HF 1460/1260
12: p1 Packet 1200 bps VHF          13: p1 Packet 1200 bps PACSAT
14: p1 Packet 1200 bps PSK          15: p1 Packet 2400 bps V.26B
16: p1 Packet 4800 bps PACSAT       17: p1 Packet 4800 bps PSK
18: p1 Packet 9600 FSK K9NG/G3RUH   20: p2 Packet 300 bps HF 2110/2310
22: p2 Packet 1200 bps VHF          23: p2 Packet 1200 bps PACSAT
25: p2 Packet 2400 bps V.26B        28: p2 Packet 9600 FSK K9NG/G3RUH
30: RTTY/TOR 170: 2125/2295; p2 Packet 300 bps HF 2110/2310
31: RTTY/TOR 170: 2125/2295; p2 Packet 1200 bps VHF
33: p1 Packet 300 bps HF 2110/2310; p2 Packet 1200 bps VHF
35: p1 Packet 1200 bps VHF; p2 Packet 1200 bps VHF
40: Morse 750 Hz                    41: Analog FAX HF
42: Analog FAX APT                  43: Analog SSTV
44: DSP data 400 bps OSCAR-13       45: RTTY/TOR 1200 ASCII OSCAR-11
46: DSP data Spectrum               50: p1 Packet 1200 bps MSK
51: p1 Packet 2400 bps MSK          52: p1 Packet 9600 G3RUH UO22 eq
60: p2 Packet 1200 bps MSK          61: p2 Packet 2400 bps MSK
cmd:
```

Any modem from the list may be loaded with the MODEM command, but only the RTTY/TOR modems listed will operate in AMTOR. For example, to operate AMTOR on radio port 1 and 1200 bps VHF packet on radio port 2 you must load modem 31. To load modem 31, first enter the Command Mode of the DSP-2232 and then type MODEM 31 as shown below:

MODEM 31 <Enter>

The DSP-2232 will respond with the following:

MODem was 1
MODem now 31

7.7.2 Displaying Received Data

When a port 1 only modem is loaded, port 2 packet operation is effectively disabled. This can be desirable when operating AMTOR and you do not want to be disturbed with any packet signals that may be received on radio port 2.

When a Dual Port modem such as MODEM 31 is loaded in the DSP-2232, received data is displayed from both Radio Ports at the same time. This allows you to operate on HF and not miss any local Packet connects or information from DX spotting nets.

The DSP-2232 sorts and displays received data from each Radio Port using the same technique as multi-connect packet operation described in Chapter 4. That is, when operating on one port and the other port becomes active, the displayed data from the inactive port is shown prefaced by the "channel designator" followed by a colon (:). Recall that Radio Port 1 is designated by "logical" channels from 0-9 and that Port 2 is designated by "logical" channels A-Z. This is true whether a single port or a dual port modem is loaded.

7.7.3 Switching Between Ports

If you are using an AEA PAKRATT program, switching between Radio Ports is described in the program manual. If you are using a terminal program, this section describes how to direct your transmitted text.

Switching between AMTOR on Port 1 and Packet on Port 2 is similar to switching between Packet and Packet. If you have not yet read through the Switching Between Radio Ports section of Chapter 4, please do so now and define a CHSWITCH character before reading the example below.

Recall from chapter 4 that the channels on Port 1 are labeled 0-9 and the channels on Port 2 are labeled A-Z. To select Radio Port 1 (AMTOR) press the CHSWITCH character you defined, followed by the number 0. To select Radio Port 2 (Packet), press the CHSWITCH character, followed by a letter from A-Z.

For example, you are conversing with an AMTOR station and are in the middle of a QSO when a station on VHF connects to you. The following shows how your screen would look and suggests how you might handle such an occurrence. The underlined text is the text that you type.

Hello Jim, you are printing solid here and have an S7 signal.+?	{ You send the AMTOR station a signal report }
THANKS BOB, YOUR ALSO A SOLID S7 HERE AS WELL.+?	{ The other station responds with a signal report }
A:*** CONNECTED to WX7EEE	{ WX7EEE connects to you on VHF (Radio Port 2) }
Thanks for the signal report Jim only running 100 watts here.+?	{ You make another transmission to Jim on HF AMTOR }
Hey Bob, I'm going to the hamfest this weekend if you want a ride.	{ Your friend on VHF packet wants to go to the hamfest }
|AHello Mike, I am on HF AMTOR talking to a station in Boston.	{ You switch to Port 2 by typing |A to answer on VHF }
0:WELL BOB, I HAD BETTER BE GOING TO BED. WORK STARTS PRETTY EARLY 73.+?	{ Jim on HF AMTOR signs off with you. }
|073 Jim, it was nice meting you. WX1AAA de WX7BBB SK <CTRL-D>	{ You switch back to HF with |0 and sign off with Jim }

As you may have noticed, communicating with different modes on the two Radio Ports at the same time is almost identical to the method used in chapter 4 for Packet and Packet operation. Let's discuss the sample QSOs above to see how the Port switching occurs.

The first text we see in the sample above is the signal report you are sending to Jim, the HF AMTOR station you are communicating with. This example assumes you have already set up the ARQ AMTOR contact with the ARQ command discussed earlier in the chapter. When you are through sending your signal report to Jim on AMTOR, you turn the link over to become the IRS by sending the "+?". The DSP-2232 then responds by sending a blank line to the display to break up the received text.

The next text you see is your signal report received from Jim on AMTOR.

You are in the middle of a QSO with Jim on AMTOR and all of a sudden your friend WX7EEE connects to you. WX7EEE has connected on Radio Port 2 (VHF) which is shown by the "A:" before the connect message. Remember that the 26 channel designators for Radio Port 2 are A-Z.

Before you respond to WX7EEE on VHF, you send a transmission to Jim on AMTOR telling him how much power your transmitter is running. When you are finished with your text, you again command the DSP-2232 to be the IRS by sending a "+?".

After making this transmission on AMTOR, you see WX7EEE on VHF has offered you a ride to the hamfest. We know this text is from Radio Port 2 since the previous packet displayed by the DSP-2232 was the "A:*** CONNECTED" message from Port 2.

Now you want to let WX7EEE on VHF know that you are there, but that you are involved in another QSO on HF. This way he will understand that it may take you a little longer to respond to his packets. Before you can send data to Radio Port 2, you must switch to this Port with "|A" or the text you type will be sent to Radio Port 1 on AMTOR when Jim turns the link over to you again.

You receive a transmission from Jim on AMTOR telling you he needs to sign off to go to bed. The "0:" in front of the text shows this was received on Radio Port 1.

Now you want to sign off with Jim on HF. Again, first you must switch to Radio Port 1 with the "|0" since your last transmission was directed to Port 2. Now you can make your final transmission to Jim ending with his callsign followed by your callsign. This time when you are through typing your text, you send a <CTRL-D> to the DSP-2232 which breaks the ARQ link and returns Radio Port 1 to AMTOR Standby after the text has been sent.

7.7.4 More Thoughts on Port Switching

One problem of having more than one Radio Port is remembering which port you are currently using. In the dual port sample QSOs above, this was not a problem, but after it has been hours or days since you have used your DSP-2232, you may forget which port you last used.

With AEA Pakratt Software programs, the on-screen status will always show which port you are using so this is not a problem. With other programs, you will have to query the DSP-2232 with the CSTATUS SHORT command. The CSTATUS command displays the status of the logical channels of Port 1 and Port 2 of the DSP-2232. The CSTATUS SHORT command displays the status of the active channel and any packet channels that are connected. After completing the sample QSOs above, the DSP-2232 would display the following.

```
cmd:CSTATUS S

Ch. A - IO DISCONNECTED
```

This reminds you that Channel A is your current I/O channel. Any text that you type in the Converse mode will be sent to channel A on Radio Port 2. If you had been connected to any other packet stations, the callsign and channel would have also shown in the display.

Sometimes you might not want to be bothered with anything from the Radio Port you are not using. For these times either Radio Port may be turned OFF with the RADIO command. For example, let's say that in the above example QSO you wanted to work HF packet and did not want to be interrupted with any VHF connects. Typing the following command would cause Radio Port 2 to be disabled.

```
cmd:RADIO /0
RAdio  was  1/2
RAdio  now  1/0
```

When a DSP-2232 Radio Port is disabled, the front panel LCD STATUS indicator for that port will be extinguished as a reminder.

7.7.5 Dual Port AMTOR/Packet Maildrop Operation

Your DSP-2232 MailDrop will operate both on Packet and AMTOR and can be used to allow message traffic that originates on AMTOR to be reverse-forwarded into the Packet network. Similarly, traffic originating on Packet may be picked up by remote stations on AMTOR.

Before you begin dual port Packet/AMTOR MailDrop operation, be sure that you are familiar with the operation of Packet, AMTOR and the MailDrop as described in Chapters 4, 5 and 7 of this manual. Also be sure that a dual port modem such as MODEM 31 is loaded. The more experience you have with each of these modes will help when setting up a dual port MailDrop system.

7.7.5.1 Packet MailDrop Command Settings

First set up the packet side of the MailDrop (on Radio Port 2) by setting MYCALL and MYMAIL. You may also want to enter a custom MTEXT to let others know about the AMTOR feature. Be sure to set 3RDPARTY, MDMON, MDPROMPT, and MMSG, as desired. If you will be reverse forwarding to a full-service BBS, you must set HOMEBBS to the callsign of that BBS. Do not forget to turn MAILDROP ON. As a test you should connect to your own maildrop via a digipeater or network node to make sure the radio link is working properly and the user prompts are what you desire.

7.7.5.2 AMTOR MailDrop Command Settings

Once the Packet side is working properly, the AMTOR side of things on Radio Port 1 must be configured. First be sure that MYSELCAL and MYIDENT are entered properly. You may want to customize the AMTOR MailDrop prompt (TMPROMPT) or compose a message to ALL that tells remote users about your system. Finally, remember to turn TMAIL ON and enter the AMTOR mode of the DSP-2232 to start the AMTOR MailDrop.

7.7.5.3 Dual Port MailDrop Operation Notes

With the above parameters set, packet connections to the MYMAIL callsign on Radio Port 2 will be sent to your MailDrop if you or a remote AMTOR station is not using it. If you or any other station is using your MailDrop, the remote user attempting the packet connection will be sent a "*** Busy" message.

Similarly, a remote AMTOR station linking to you will be given access to your MailDrop provided no one else is using it. If you or a remote packet station is using your MailDrop, the AMTOR station may link to you, but will not be given access to your MailDrop. For this reason, you may wish to disable Radio Port 1 (by turning the RADIO parameter to 0/2) when logging into your own MailDrop for maintenance. This will prevent remote AMTOR stations from linking with you.

If you will be Reverse Forwarding messages into the Packet network, be sure to check your MailDrop often for new messages. Remember that you must use the Edit command in the MailDrop to select which messages will be Reverse Forwarded.

Note: At this time unattended operation below 30 MHz is not legal for US amateurs unless they hold a Special Temporary Authorization (STA) from the FCC. US amateurs must be sure to have control of their HF transmitters when any device such as the DSP-2232 AMTOR/Packet MailDrop is in operation.

7.8 AMTOR Switching-Time Considerations

For operation in AMTOR Mode A (ARQ), your transceiver or transmitter-receiver combination must be able to change between transmit and receive within 20 milliseconds. Most semiconductor-based radios can easily meet this specification. Many older tube-type radios that use electromechanical relays operate very well in AMTOR Mode A (ARQ).

If the changeover from transmit to receive is too long, the minimum working distance is 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. For this reason, you may be able to "Link with" stations across the country, but not across town.

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 the ADELAY command in the Command Summary to adjust the DSP-2232's AMTOR timing characteristics to compensate for this.

7.8.1 Suggested AMTOR Operating Settings

If you have trouble synchronizing with another AMTOR ARQ station, try some of the following operating tips before calling AEA or deciding that your radio equipment needs modifications:

- Try to work the distant station on Mode B (FEC) to establish that the other station's system is fully functional.
- Don't use VOX control - use the PTT line from your interface.
- Turn off the AGC circuit - use the RF gain control to prevent receiver blocking on stronger signals.
- Turn off all compression or other audio processing.
- Keep the AFSK audio input level to the microphone circuit as low as possible - avoid overdriving the audio input stages.
- Disable the ALC circuit or reduce excessive ALC action; use more effective RF antenna loading to adjust output power levels.

7.8.2 Possible Areas for AMTOR Performance Improvement

If switching-time problems persist, you may have to make changes in the radio to eliminate excessive time delays:

- Remove large decoupling capacitors from the Push-To-Talk line to allow faster PTT (transmitter) activation;
- Improve power supply decoupling, especially in audio stages.
- Do not use squelch.

In case you can't solve your radio's switching-time problems, please call AEA Technical Support Department (see the front of this manual).

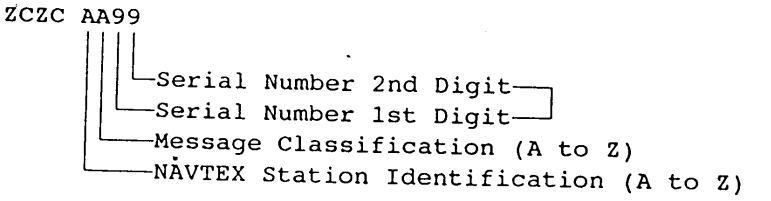
7.9 NAVTEX Operation

NAVTEX is an international system which stands for NAVIGATIONAL TELEX. It is a direct printing service designed to distribute navigational and meteorological warnings and other urgent information to ships. To enter the NAVTEX mode, simply type "NAVTEX" at the command prompt.

The ARRL has also adopted this format for transmitting bulletins. In amateur radio this same format is starting to be referred to as AMTEX. AMTEX transmissions can be found on ARRL bulletin frequencies.

NAVTEX is broadcast in Mode-B AMTOR (SITOR) on a frequency of 518 kHz. NAVTEX may be selectively monitored, so you will see only information of interest and never see the same message twice. It is this unique feature of NAVTEX that the DSP-2232 uses with the NAVSTN and NAVMSG commands to allow the user to monitor only messages of importance.

NAVTEX/AMTEX messages are prefaced by the characters "ZCZC" and then a four character Preamble as diagramed below.



The first character of the Preamble is a letter that identifies the NAVTEX transmitter. Transmitter Identification letters can be any of the characters A through Z. This limits the number of NAVTEX stations in an area to 26. The NAVSTN Command can be used to selectively monitor or reject certain NAVTEX transmitters.

The second character of the Preamble is the Message Classification. The NAVMSG command is used to selectively monitor or reject any of the NAVTEX message classes shown below:

A. Navigational Warnings
B. Meteorological Warnings (Storm Warnings)
C. Ice Reports
D. Search and Rescue Information
E. Weather Forecasts
F. Pilot Service Messages
G. DECCA System Information
H. LORAN-C System Information
I. Omega Systems Messages
J. SATNAV System Messages
K-Z. Reserved for future use

The exception to this is that message classes A, B and D CANNOT be excluded and will always be copied if the transmitting station is enabled by NAVSTN.

The last two numbers form a serial number from 00 through 99 that is different for each message. The DSP-2232 remembers the Preamble of the 200 most recent messages and will not re-print a message that has the same preamble if it has already been received without many errors.

CHAPTER 8

MORSE OPERATION

8.1 Overview

The DSP-2232 will both send and receive International Morse Code. The computer based Morse operator can use the DSP-2232 to send "perfect" code at much higher speeds than are typical of hand sent code.

As a rule, no machine can receive Morse as well as the FSK modes. Your DSP-2232 is no exception. A strong signal and a good "fist" are both required for the DSP-2232 to do a reasonable job of copying Morse code. Don't expect your DSP-2232 to do miracles and produce good copy from bad fists!

8.2 Where to Operate Morse

Before you can operate Morse, you must first know where the activity is. Morse operation is permitted on any amateur frequency, but most often occurs in the lower 100 to 250 kHz of a band.

8.2.1 Entering the Morse Mode

If you are using an AEA PAKRATT program, follow the instructions in the program manual to enter the Morse mode.

If you are using a terminal, simply type "MORSE" or "MO" from the Command Mode followed by the <Enter> key to enter the Morse mode on Radio Port 1. Packet operation on port 2 is dissabled when in the Morse mode. The DSP-2232 responds by displaying the previous mode:

```
Opmode   was PAcket
Opmode   now MOrse
```

8.2.2 HF Receiver Settings

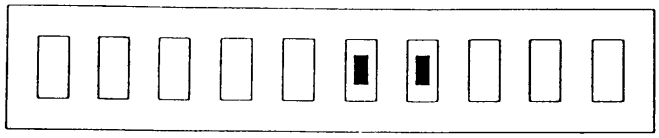
Set your HF receiver (or transceiver) to the CW mode. Adjust the volume to a comfortable listening level. Be certain that any IF-Shift and Passband Tuning controls are centered or set to the OFF position.

8.2.3 Tuning in Morse Stations

Tuning in Morse stations properly is critical to successful operation. Follow the procedure below for the best results in tuning in Morse stations.

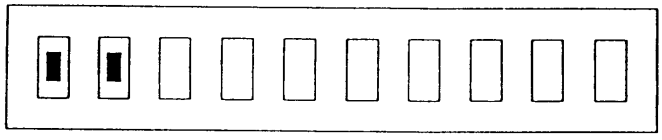
- Make certain your HF receiver is in the CW mode.
- Turn any IF-Shift and Passband-Tuning controls to the Center or OFF position.
- Tune your receiver carefully in the lower portion of your favorite amateur band and look for Morse signals.

- When you find a station, slowly vary the VFO on your receiver and look for a display on the DSP-2232 tuning indicator as shown below when the station is "keyed down".



Tuned In
(Key Down)

When the station is not "keyed down" or there is no station on frequency, the tuning indicator should look like the one below.



Frequency
Quiet

- Adjust the receiver volume so that the DCD LED lights when a properly tuned Morse station is being received.

When a Morse station is tuned in, you should see the copy on your screen. The DSP-2232 will track the speed of the received signal.

8.3 Going On The Air

Make sure that you have connected the DSP-2232 to your transmitter for direct CW keying as discussed in Section 3.3.6 of this manual. Although the DSP-2232 is capable of morse transmission using Audio Keying in the SSB mode of a transmitter, direct CW keying is preferred. Most modern transmitters and transceivers are designed for direct CW keying and often allow additional filtering to be switched in for improved Morse reception when operating in this mode.

Adjust your transmitter for Morse operation as described in your transmitter's manual. Make sure your antenna is tuned and adjusted for the band and operating frequency you are using.

If you are using a terminal or terminal program, the following will place your DSP-2232 and transceiver into the transmit mode.

- Make sure that you have selected your transmitted text to go to Port 1 by pressing the CHSWITCH character defined in Chapter 4 followed by a number from 0 through 9.

- Type "X" for XMIT and then press the <Enter> key to key your transmitter and automatically enter the Converse mode.

As soon as you type the <Enter> key you will be transmitting! At this point you are also in the CONVERSE mode and anything you type will be sent in Morse by your transmitter.

When you are finished transmitting, use one of the following methods to return to receive.

- Type <CTRL-D> to shut off your transmitter and return to the Command Mode.

- Type <CTRL-C> to return to the Command Mode and then type "R" to shut down your transmitter and end the contact.

See the following sections for some Morse operating hints.

8.3.1 A Typical Morse Contact

As with most amateur operating modes, you can start a contact either by "calling CQ" or by answering a "CQ" call by another station. To call CQ first you must tell your DSP-2232 to start sending.

- Make sure that you have selected your transmitted text to go to Port 1 by pressing the CHSWITCH character defined in Chapter 4 followed by the number 0.

- Type "X" to key your transmitter and start the unit sending.

- Type in your CQ message (use YOUR callsign) such as the one below:

  CQ CQ CQ CQ CQ CQ DE YOURCAL YOURCAL YOURCAL
  CQ CQ CQ CQ CQ CQ DE YOURCAL YOURCAL YOURCAL
  CQ CQ CQ CQ CQ CQ DE YOURCAL YOURCAL YOURCAL K <CTRL-D>

- Type <CTRL-D> at the end of your CQ call. The <CTRL-D> puts both your radio and the DSP-2232 into the receive mode after all the text you have entered into the Transmit Buffer has been sent.

- Wait a bit to see if you get a response. If not, you can repeat the above procedure.

8.4 Morse Operating Tips

The following "Special Function Characters" and immediate commands are included for Morse operating convenience.

Immediate Commands from the Command Mode:

"L"	Locks system to the speed of the incoming signal.
"R"	Switches system to receive mode, unlocks receive speed, forces receive speed to equal transmit speed
"X"	Switches system to transmit mode and forces immediate entry into Converse mode.
"K"	Loads the Transmit type ahead buffer
"MO"	Unlocks the Morse receive speed.

Special Function Characters embedded in transmitted text:

<CTRL-D>	Shuts off the transmitter and returns the DSP-2232 to the Command Mode after sending the contents of the transmit buffer.
<CTRL-T>	Sends the TIME if the DAYTIME clock has been set.

8.4.1 The DSP-2232 Morse Modem

The DSP-2232 uses a special modem (MODEM 40) for Morse (CW) operation. This modem has a center frequency of 750 Hz. A 750 Hz tone is also generated when Morse is transmitted and may be fed to a voice grade transmitter for Tone modulated CW operation. This is not the way most HF transceivers should be used, but VHF FM transceivers can use this for transmitting code practice sessions. At this time, this is the only Morse modem available in the DSP-2232.

8.4.2 Speed Change (MSPEED)

Use the MSPEED command to change Morse keying speed.

Type "MSPEED" followed by one or two digits from "5" to "99" and a <Enter>. The DSP-2232 responds with the previous Morse speed.

```
MSPeed   was 20
MSPeed   now xx (whatever new speed digits you typed)
```

The number you enter becomes the new transmit speed and replaces the value used previously. The slowest Morse speed is 5 words per minute.

8.4.3 Echoing Transmitted Characters As Sent (EAS)

Since Morse can be rather slow, some users like to know just when the characters are actually being sent. The EAS command when turned ON will Echo characters to the display only when they are transmitted.

8.4.4 Sending Only Complete Words (WORDOUT)

Some Morse users like to have their words sent out only when they are complete. This allows the word you are currently typing to be edited as long as you have not typed a <Space> character. Turning WORDOUT ON activates this feature. See the Command Summary for more information.

8.4.5 Speed Lock (LOCK)

The LOCK command locks the system to the speed of the received signal. This can help the reception of Morse code in the presence of noise.

To unlock the Morse speed and allow the DSP-2232 to track the received signal, type "R" or "MO" followed by an <Enter>.

8.5 Special Morse Characters

The DSP-2232's Morse program contains special keystrokes which 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:

Morse	Keystroke	Abbreviation	Meaning
...-.-	* or <	SK	End of QSO
.-...	&	AS	Wait
.-.-.	+	AR	End of message
-.--.	(	KN	Go only
-...-	=	BT	Break or pause
-.-.-	> or %	KA	Attention
...-.	!	SN	Understand
.-.-	[	AA	New line
---.	\	ö	Umlaut O
..--	^	ü	Umlaut U
.--.-	]	å	Swedish A
..-..	@	é	Swedish E

8.6 Morse Code Practice

Use your computer with your DSP-2232 to develop and improve your manual CW sending and receiving skills.

Set your DSP-2232 for Morse receive operation on Radio Port 1 and operate the hand key attached to your radio transceiver. In most installations your hand keying will be sent to the DSP-2232 and displayed on your monitor if your radio has an audio "input monitor" or "sidetone" output and you've turned on those monitor functions. The frequency of the monitor sidetone must be nearly 750 Hz or the DSP-2232 will not be able to copy it.

Send test words to familiarize yourself with the relationship between your hand-keying and the Morse appearing on your screen.

Practice keying at various speeds; observe how the system decodes your "fist". You may be a bit unhappy or surprised at the quality of your keying but after a few sessions you'll notice an improvement.

Last page of Chapter 8 - MORSE Operation

CHAPTER 9

FACSIMILE AND SSTV OPERATION

9.1 Overview

While facsimile and SSTV are not digital modes, the personal computer coupled with a high resolution monitor makes an excellent display for these images. The DSP-2232 contains modems that can receive both FM and APT facsimile signals as well amateur Slow Scan Television (SSTV).

The DSP-2232 filters and digitizes the received audio signal for processing by software running on your personal computer. Therefore this chapter only provides an overview of FAX and SSTV operation. The program used to display FAX and SSTV should provide operating instructions and detailed information about the modes it supports.

Note: The Analog mode is intended to replace the old black & white FAX mode originally developed for the PK-232. As of July 1992, there is no display software yet available for gray scale FAX or SSTV. The black & white FAX mode is retained only to support the PK-FAX and MACRATT with FAX programs while new display software is developed.

9.1.1 Facsimile

Facsimile is the term used to describe the transmission of black & white images. There are several different Facsimile standards in use. Over the telephone, either "Group-2" or "Group-3" transmission standards are used. Sending facsimile by radio has some special problems so different and incompatible transmission methods are used.

There are two basic types of facsimile signals transmitted over radio. Frequency Modulated (FM) facsimile is often found in the HF Short Wave bands, while an Amplitude Modulated (APT) system is used by satellites in the VHF and Microwave bands.

Weather Facsimile (FM WEFAX) is transmitted throughout the Short-Wave spectrum, primarily to provide information to ships at sea. Typical stations you may find broadcast maps with weather conditions and satellite photographs showing cloud cover over a large area. Not only weather information is transmitted, but also news photographs from the wire services (see the frequency list below).

With FM facsimile, the picture information is modulated in an audio tone between 1,500 Hz (Black) and 2,300 Hz (White). In between these two frequencies are shades of gray. The DSP-2232's MODEM 41 receives these signals and can discern 250 levels (shades of gray) between these two frequencies.

Facsimile signals can also be received directly from satellites that are found in the 137 MHz VHF band as well as the 1691 and 1694.5 MHz Microwave frequencies. These satellites broadcast images of the earth as seen from above. The satellites transmit an FM signal with a 2,400 Hz Amplitude Modulated sub-carrier. A 5% modulation of the sub-carrier corresponds to black, and an 80% modulation level corresponds to white. The DSP-2232's MODEM 42 receives 256 levels of modulation (shades of gray) for this type of facsimile signal.

9.1.2 Slow Scan Television

Slow Scan Television (SSTV) has been around for many years and is presently found primarily in the 20 meter amateur band. Over the years SSTV has evolved a great deal and many different formats now exist for both black & white as well as color image transmission.

SSTV uses a Frequency Modulation scheme similar to FM facsimile where the video information is usually transmitted by an audio tone between 1,500 Hz and 2,300 Hz. In SSTV however additional synchronizing information is often necessary and is typically sent with tones between 1,100 and 1,500 Hz. For this reason SSTV requires a different modem than is used in FM Facsimile. The DSP-2232's Modem 43 is optimized for these frequencies and is used for SSTV reception.

9.2 Finding FAX Frequencies

The following is a list of HF FM facsimile frequencies that seem to broadcast on a regular schedule. A few of these stations transmit 24-hours/day. We suggest you try the weather FAX frequencies listed below while you are becoming familiar with facsimile operation. After printing a few images, and you are accustomed to the sound of facsimile you will be able to tune the bands in search of other frequencies where perhaps different kinds of pictures may be found.

Weather: USB	3,357.0 kHz	4,268.0 kHz	4,975.0 kHz	6,946.0 kHz	
	10,865.0 kHz	12,125.0 kHz	20,015.0 kHz		
Photographs:	LSB	10,680.7 kHz	17,673.9 kHz	18,434.9 kHz	

The following HF facsimile frequencies were obtained from Popular Communications Magazine:

USB

4,271.0 kHz	9,890.0 kHz	13,510.0 kHz		Halifax, Canada
8,502.0 kHz	12,750.0 kHz			Boston, Mass
9,389.5 kHz	11,035.0 kHz			Brentwood, NY
4,793.5 kHz	10,185.0 kHz	12,201.0 kHz	14,671.5 kHz	Washington, DC
9,157.5 kHz	17,447.5 kHz			Mobile, Al
8,080.0 kHz	10,854.0 kHz	16,410.0 kHz		Norfolk, VA
4,802.5 kHz	9,440.0 kHz	13,862.5 kHz		Hawaii
7,770.0 kHz	11,090.0 kHz	13,627.5 kHz		Hawaii
8,459.0 kHz				Alaska
4,346.0 kHz	8,682.0 kHz	12,730.0 kHz	17,151.2 kHz	San Francisco
8,646.0 kHz	17,410.5 kHz			San Diego

VHF and Microwave APT Facsimile Satellite Frequencies

1691.0 MHz	GOES Geosynchronous Weather Satellite (USA)
1694.5 MHz	METEOSAT Geosynchronous Weather Satellite (ESA)

136.0-138.0 MHz Orbiting WEFAX APT Weather Satellites

Table 1: Facsimile Frequencies

9.2.1 Finding SSTV Frequencies

In the US, SSTV is presently most popular on the 20 meter HF amateur band. Most evenings an active group of SSTV enthusiasts can be found on 14.230 and 14.233 MHz. This is a good place to start looking for signals. Once you recognize the different sounds of common SSTV signals, you may find activity on other frequencies and bands especially as propagation changes.

9.3 FAX and SSTV Analog Signal Operation

To accommodate the characteristics of gray-scale FAX and SSTV analog signals, the DSP-2232 uses a special Analog mode. Software programs to display images should automatically set the DSP-2232 Analog parameters so most users need not concern themselves with the following information. If you are curious how the DSP-2232 works in this mode, or are interested in writing your own display software, this information may be helpful.

Note: The Analog mode requires special display software that has been written for each familly of personal computer be used. Software is necessary in order to handle the gray scale FAX and SSTV images. This software is not provided with the DSP-2232 because the unit operates with many different types of computers. Without display software, the Analog mode should not be used.

The Analog mode is designed to pass data for communications methods that require "gray scales" or color such as FAX and SSTV. In HF FAX and SSTV signals, the information is contained in an audio signal that varies from 1,500-2,300 Hz for FAX and 1,100-2,300 Hz for SSTV. In APT FAX signals, the information is contained in the amplitude of a 2,400 Hz audio carrier.

Modems 41, 42 and 43 filter and digitize these analog signals and convert the range of interest an 8 bit unsigned binary number. Low values (e.g. $00) correspond to low frequencies and amplitudes, while high values ($FF) correspond to high amplitudes and frequencies.

In order for the image information to have any meaning, it must be sampled at a periodic rate. This rate is set with the Analog SAMPLE (ANSAMPLE) command. ANSAMPLE allows the application program to choose the sample rate for the signal up to 2,222 times per second.

See the Command Summary Appendix for more detailed information on the Analog mode and the ANSAMPLE command if you are interested in programming a display application for the DSP-2232.

9.4 Black & White FAX Operation

This mode of black & white FAX operation will eventually be deleted from the DSP-2232 since the Analog mode has been created. Still, if you own an older AEA PAKRATT WITH FAX program, you should have the ability to display weather FAX on the screen of your PC. If you are using an AEA PAKRATT WITH FAX program, follow the program manual instructions to run the program with the DSP-2232.

To hook-up the DSP-2232 for facsimile operation the radio must be connected to Radio Port 1. If all you want is to receive FAX, you only need to connect the audio from your receiver. If you wish to transmit as well, follow the instructions in Chapter 3 of this manual for complete Radio Connections.

If you will be printing directly to a graphics printer with a parallel printer cable, an IBM printer cable must be attached to the parallel printer port on the rear on the DSP-2232. This port feeds a Centronics Parallel printer and supports many graphics standards. See the PRTYPE command in the command summary for a list of supported printer graphics formats.

NOTE: Facsimile transmissions contain such a large amount of data that the DSP-2232 can not support Packet operation on Radio Port 2 while in the Facsimile mode.

9.4.1 HF Receiver Settings

Set your HF receiver (or transceiver) to upper Sideband (USB) and disable any IF-Shift or Passband-tuning controls. Adjust the volume to a comfortable listening level.

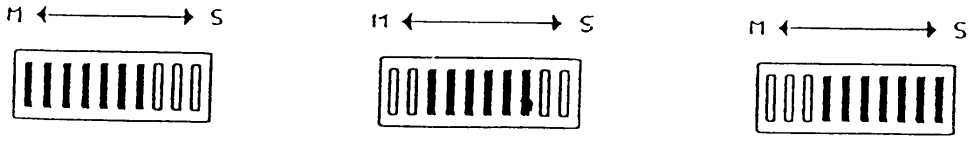
9.4.2 Tuning In HF Facsimile Stations

Facsimile is most often found on Upper Sideband and sounds similar to monitoring an AMTOR QSO with both stations being of equal strength. The most common facsimile signals are WEFAX, so we have set the DSP-2232 FAX default parameters to copy weather charts and many satellite photographs. We recommend starting start with one of the listed weather frequencies, or frequencies from Popular Communications in Table 1 when first receiving facsimile.

Upon tuning into a WEFAX signal, you will notice that the facsimile sound seems to repeat at the rate of twice a second. This is the horizontal scan frequency, and allows you to distinguish different facsimile services by speed. Common horizontal scan rates are 2 lines per second, which is typically used in weather facsimile broadcasts, 1 line per second for photographs, and 4 lines per second for some foreign facsimile stations. Listen for these repetition rates as you tune across the bands in search of new pictures.

The DSP-2232 uses a center frequency of 1.9 kHz for copying facsimile transmissions. As a result, you must tune 1.9 kHz lower than the frequencies listed in Table 1 when using Upper Sideband. Similarly, in Lower Sideband, one must tune 1.9 kHz higher than the frequencies listed in the table.

The DSP-2232 LED bar-graph should be tuned so that the facsimile signal is roughly centered in the display as shown in the middle of Figure 1 below. If the audio frequency is too low, the bar-graph will look something like the left-most display. If the audio frequency is too high, it will look something like the right-most display. Facsimile tuning is not especially critical when copying WEFAX, but a properly tuned signal is needed when printing facsimile photographs.



Frequency too low Tuned In Frequency too High

Figure 1: Facsimile tuning indicator conditions for FAX tuning

9.4.3 DSP-2232 Facsimile Parameter Settings

To start receiving WEFAX broadcasts on your computer screen, follow the setup instructions in your PAKRATT WITH FAX program manual.

To start receiving FAX on your graphics compatible printer, you first must tell the DSP-2232 that there is a parallel printer connected by issuing the command PRCON ON. The DSP-2232 will respond with:

```
PRCon was OFF
PRCon now ON
```

Now all that is necessary is to put the DSP-2232 into FAX mode by typing FAX. The DSP-2232 will respond with:

```
Opmode now FAx
```

9.5 Receiving Facsimile Broadcasts

The DSP-2232 is now in the Facsimile Standby-Receive mode which means it is waiting for a synchronization signal from a facsimile transmitter to begin a new picture. Verify this by entering the OPMODE command. The DSP-2232 should respond with:

```
Opmode FAX STBY RCVE
```

At this point make sure the receiver volume is high enough so that the DCD LED lights, otherwise the printer may not print. If you do not want to wait for the beginning of a new picture, you may type

```
Lock
```

This forces a synchronization-lock, and starts the printer printing regardless of what kind of signal is being monitored. Since this synchronization lock was not sent by the transmitting station, the picture will probably not be correctly positioned on the page. Rather, it will likely appear to be split in half with the left half of the picture on the right half of the page, and the right half of the picture on the left half of the page.

To correct for this, a justification command has been included that allows the user to shift the entire image to the left in 1/2 inch increments. For example if the left-edge of the picture appears roughly 4-1/2 inches away from the left edge of the paper, issuing the command JUSTIFY 9 will shift the left edge of the picture to the left 4-1/2 inches (9 X 0.5 inch) correcting its justification.

The DSP-2232 will respond with:

JUstify now 9

This procedure will not be necessary if the DSP-2232 synchronizes from the transmitted facsimile signal. This procedure is also not necessary if you are using an AEA PAKRATT with FAX program. AEA programs allow the image to be justified after it has been received.

To stop the printer, you may either exit the facsimile mode by changing to another mode or enter the RCVE command, which puts the DSP-2232 back into facsimile standby receive. Standby receive is the same as if you have just entered the FAX mode from another mode. The DSP-2232 will wait until it receives the synchronization signal from a facsimile station before beginning to print again.

9.6 Facsimile Operating Tips

The following section contains tips and information on FAX reception for those printing directly to a graphics printer. If you are using an AEA PAKRATT WITH FAX program, consult the program manual for more information and helpful hints.

9.6.1 Setting PRTYPE for Your Printer

Before FAX can be printed on the printer you have connected, you must choose the correct printer type with the PRTYPE Command. Most printers these days support either the Epson or the IBM 8-bit image graphics formats. For this reason the DSP-2232 defaults to the Epson format. See the PRTYPE command in the Command Summary if your printer supports a different graphics standard.

9.6.2 Printing Direction (LEFTRITE)

Weather FAX as well as most other facsimile prints from left to right, but occasionally you may find a station that is reversed. If you come across such a transmission, you may simply issue the command LEFTRITE OFF to correct this. The DSP-2232 will respond with:

LEftrite now OFF

9.6.3 Inverting Black and White (FAXNEG)

You may occasionally come across a station that appears to be inverted; that is printing black where you expect white, and leaving white where you expect black. In this case you may issue the command FAXNEG ON. The DSP-2232 will respond with:

```
FAXNeg  now ON
```

What was before printing black will now be white, and vice versa.

9.6.4 Printing Density (GRAPHICS)

How the graphics will look on your printer depends on the setting of the GRAPHICS command. There are 7 graphics commands providing horizontal dot densities from 480 dots to 1,920 dots horizontally across a page. The default setting is 960 which Epson compatible graphics printers can reproduce. See the GRAPHICS command description in the Command Summary for a complete description of this command.

9.7 Printing Other Services

Most of the weather services in the US use a facsimile scan speed of 2 lines per second, which corresponds to FSPEED 2 (Default). Facsimile photographs often use 1 line per second, which is FSPEED 1. Some foreign services use speeds of 4 lines per second, which is FSPEED 4. Speeds of 1.5 and 3 lines per second are also supported. See the command summary for more information on FSPEED.

When different horizontal scan speeds are used, the number of lines per vertical inch can also vary. If nothing is done to change the number of lines printed by the printer, the pictures may appear squashed or elongated. The ASPECT command resolves this by allowing from one to six lines to be printed out for every six lines received. The default setting is ASPECT 2 which means that 2 out of 6, or 1 out of every 3 horizontal lines is printed. This is the most common setting you will use for WEFAX, but other services may require using other values to print pictures without aspect ratio distortions.

9.7.1 The DSP-2232 FAX Modem

The DSP-2232 uses a special modem (MODEM 41) for HF WEFAX operation. This modem has a bandwidth of 800 Hz and a center frequency of 1900 Hz. The APT FAX modem (Modem 42) may also be selected for black & white Facsimile operation. To select this modem, set the default FAX modem to be modem 42. This is done from a terminal program of from the dumb terminal modem of the PC-PAKRATT program by setting the command QFAX to 42.

9.8 Transmitting FAX

The DSP-2232 does support FAX transmission, but attempting to do this without an AEA's PC-PAKRATT II WITH FAX program is difficult. We recommend you consider this program if FAX transmission is desired.

9.9 Adjusting the DSP-2232 4.0 MHz Oscillator

Note: The following only applies to the black & white FAX mode of the DSP-2232 and does not apply to the Analog mode.

If you ever observe the received FAX from a Commercial station does not print or display straight up and down the page, your 4.00 MHz oscillator inside the DSP-2232 has probably drifted off frequency. If you have a frequency counter with a high-impedance input, you may do the following:

Step 1: Open the DSP-2232 by removing the 12 screws that hold the gray top chassis in place and separate it from the bottom chassis.

Step 2: Reconnect the DSP-2232 to +13 VDC, then turn it on, and allow it to warm-up for 30 minutes.

Step 3: With the help of Figure 2 below, locate the variable capacitor C11 in the left-rear quadrant of the DSP-2232 circuit board. It is located near the parallel printer connector and the 64 pin processor.

Step 4: Place the probe of the frequency counter on pin-16 of IC U8, the Z8536 which will provide a strong square-wave clock signal.

Step 5: Adjust C11 until the counter reads 4.00000 MHz +/- 10 Hz.

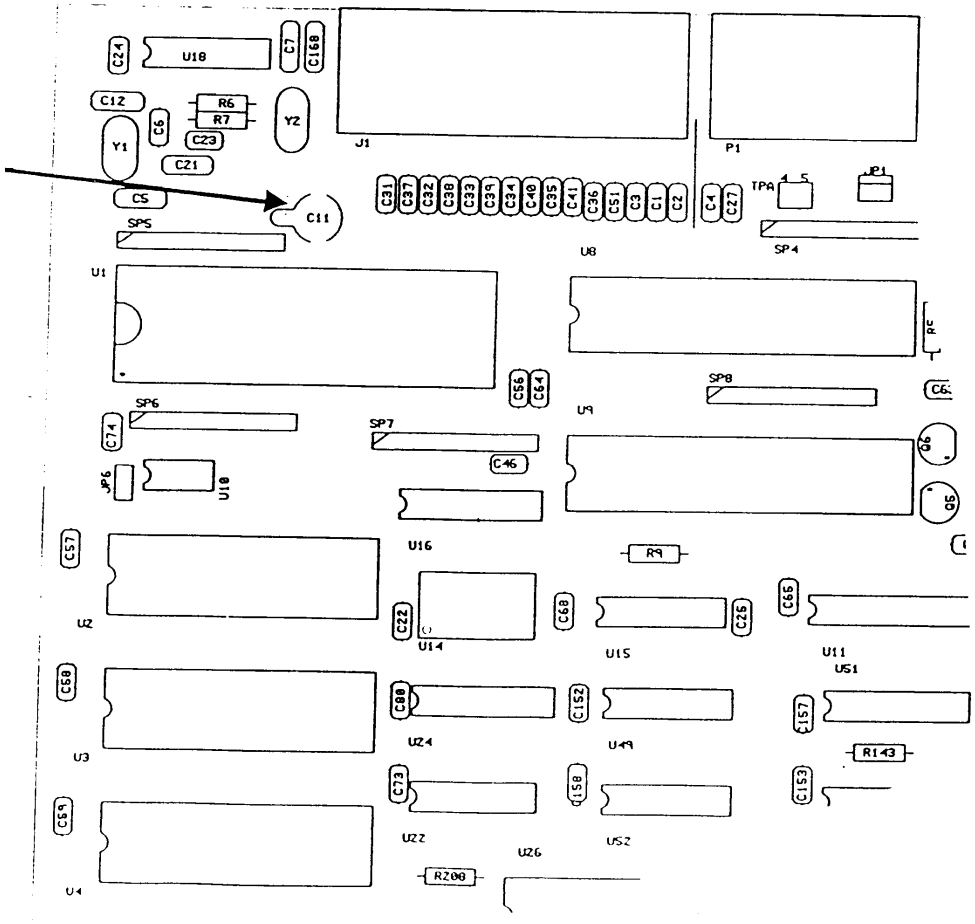


Figure 2: DSP-2232 circuit board layout showing the location of C11

CHAPTER 10

SIGNAL IDENTIFICATION AND TDM OPERATION

10.1 Overview

As you tune across the High-Frequency bands these days you find an ever increasing number of digital signals. These signals range from the simple Murray Baudot code to ASCII and even packetized data. With the large number of speeds, formats and shifts now in use, it is difficult to determine what kind of signal you are listening to. Even with a knowledge of digital communications, it is still time-consuming to set the communication parameters correctly.

SIAM stands for Signal Identification and Acquisition Mode, and allows a wide variety of digital signals to be automatically analyzed so they can be easily copied with the DSP-2232. SIAM will "listen" to a signal for a few seconds and then display the type of signal and its speed to the user. The user can then decide whether or not to copy the signal, or simply go on to the next signal.

SIAM makes the DSP-2232 more useful to the radio amateur and the Short-Wave Listener. Whether tuning across 20 meters, or searching the Short-Wave bands, when you find a signal SIAM will help you decide what it is, and tune it in without time-consuming trial and error.

NOTE: Outside the Amateur bands, many of the RTTY signals employ sophisticated encryption schemes and are not copyable by the DSP-2232.

10.2 SIAM Operation

Before entering the Signal Identification mode, set the default modem (QSIGNAL) to the number you wish to use from the list below.

```
 1: RTTY/TOR 170: 2125/2295              2: RTTY/TOR 170: 1445/1275
 3: RTTY/TOR 425: 2125/2550              4: RTTY/TOR 850: 2125/2975
30: RTTY/TOR 170: 2125/2295; p2 Packet 300 bps HF
31: RTTY/TOR 170: 2125/2295; p2 Packet 1200 bps VHF
```

If you are using an AEA PAKRATT program, follow the instructions in the program manual to enter the Signal mode.

If you are using a terminal, simply type "SIGNAL" or "SI" from the Command Mode followed by the <Enter> key to enter the SIAM mode on Radio Port 1. The DSP-2232 responds by displaying the previous mode:

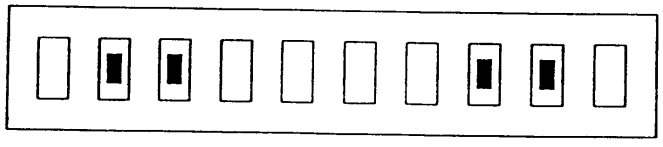
```
Opmode   was XXXXX
Opmode   now SIgnal
```

Now you are ready to tune in an unknown FSK signal.

10.2.1 Tuning in FSK Narrow and Wide Stations

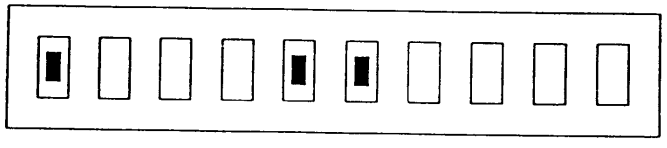
Tuning in the Frequency Shift Keying (FSK) signal properly is critical to successful SIAM operation. SIAM can only decode a signal properly if it is tuned correctly. Follow the tuning procedure below carefully for the best results in tuning HF FSK stations.

- Set the default Signal Identification modem (QSIGNAL) to the number you wish to use.
- Make certain your HF receiver is either in LSB or FSK depending on your DSP-2232 setup.
- Turn OFF any IF-Shift and Passband-Tuning controls.
- Tune your receiver carefully across the band looking for the distinctive two tone sound of an FSK signal.
- When you find a station, slowly vary the VFO tuning knob on your receiver and look for a display on the DSP-2232 tuning indicator like the one shown below.



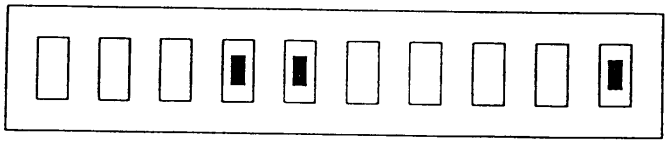
Tuned In

If the tuning indicator looks like the one below, the frequency from your speaker is too low for the DSP-2232 to copy the signal. Slowly tune the VFO and make the frequency higher.



Frequency Too Low

If the tuning indicator looks like the one below, the frequency from your speaker is too high for the DSP-2232 to copy the signal. Slowly tune the VFO and make the frequency lower.



Frequency Too High

- Adjust the receiver's volume control so that the DCD LED lights when a properly tuned RTTY station is being received.

HINT: If you adjust the volume control so the DCD LED goes out when no station is being received, you will prevent garbage characters generated by noise from printing on your screen.

10.3 Using the SIAM Mode

After tuning in a signal as described above, make sure the volume is adjusted so the DCD LED is lit. Then after about 10 seconds the DSP-2232 should respond with a baud rate indication and confidence factor similar to the one shown below.

```
0.47:    50  Baud,
```

After another 15 seconds or so, the DSP-2232 should respond with one of the following signal classes and tell whether or not the signal is reversed by giving the status of the command RXREV:

```
ASCII AMTOR ALIST Baudot Unknown noise 6-bit TDM
```

The complete information from the DSP-2232 signal analysis will look something like the following:

```
0.47    50  Baud,  Baudot,    RXREV  OFF
```

This means that the DSP-2232 has found the signal to be a 50-Baud Baudot signal that is not inverted (since RXREV is OFF). The 0.47 means that the DSP-2232 is 47% sure that the baud rate is correct.

SIAM can identify and copy ASCII, ARQ and FEC AMTOR, Baudot and TDM signals. To begin printing one of these signals, all that must be done is to type the command OK after the analysis has been completed. You should immediately begin to see text appear on your screen.

If the DSP-2232 determined the signal to be Unknown, 6-bit or noise which it cannot decode, typing OK will cause the response:

```
?bad
```

The SIGNAL routine will run repeatedly until the operating mode is changed either by typing OK, or forcing a change to another mode. If you tune to a different signal during an analysis, simply type SIGNAL again to restart the analysis routine.

10.3.1 Copying Encoded RTTY Transmissions

In the Short Wave bands many RTTY stations do not transmit in plain text. Most of these stations are using sophisticated encryption techniques that make receiving them almost impossible. There are a few stations that use a relatively simple bit-inversion technique. For these stations, the DSP-2232 has included the BITINV command.

If the text is not plain, but appears to be encoded, you can try different settings of BITINV. BITINV will Exclusive-OR a number from $00 to $1F with the received character of a Baudot signal thus inverting specific bits. By varying BITINV from 0 through 31, you will test all the different inversion possibilities that may encode a Baudot signal. If only simple bit-inversion is being used, one of the BITINV settings should cause the transmission to become readable. If none of the 32 possibilities reveal plain text, then the transmitting station is likely using a more sophisticated technique. Computer programmers may be interested in the 5BIT and 6BIT commands.

10.3.2 The CODE command for International RTTY Compatibility

The CODE command allows the DSP-2232 to receive (and sometimes send) other RTTY character sets. Look up the CODE command in the Command Summary Appendix for information on some of the other character sets you may encounter on the HF bands.

10.4 TDM Receive Operation

The SIAM mode described above will recognize and decode TDM signals for receive only. The TDM receive mode can be entered directly simply by typing TDM at the DSP-2232 command prompt.

TDM is an immediate command that places the DSP-2232 in the TDM receive mode. TDM stands for Time Division Multiplexing, also known as Moore code and is the implementation of CCIR Recommendation 342. The following describes the TDM mode and commands in detail.

10.4.1 TDM Parameters

If you are using an AEA PAKRATT program, follow the instructions in the program manual to enter the TDM mode.

If you are using a terminal, simply type "TDM" from the Command Mode followed by the <Enter> key to enter the TDM mode. The DSP-2232 responds by displaying the previous mode:

```
Opmode   was PAcket
Opmode   now TDm
```

10.4.2 Monitoring TDM Signals

The TDM command forces bit phasing; do this when changing frequency to another TDM signal. This is also useful when the DSP-2232 synchronizes on the wrong bit in the character stream, which is likely on a signal which is idling. TDM stations idle MOST of the time, so you may have to leave the DSP-2232 monitoring for an hour or two before any data is received.

TDM signals allow multiple data streams to share the same RF channel. The DSP-2232 can receive either 1, 2 or 4 channel TDM signals. When monitoring 2 or 4 channel TDM, the TDCHAN command allows you to select which channels will be displayed. The TDCHAN command takes an argument from 0 to 3 to allow any one of the four channels of a 4-channel TDM station to be monitored.

TDM signals operate at different data rates. The TDBAUD command allows any data rate from 0 to 200 baud to be selected, but only the values in the following list are valid.

```
1-channel:  48,  72,  96
2-channel:  86,  96, 100
4-channel: 171, 192, 200
```

10.4.3 Where to Find TDM Signals

We have heard TDM signals on the following frequencies which should be used as a starting point when looking for TDM signals.

9.125.9	LSB	11.246.5	USB	12.061.7	USB	14.623.3	USB
14.956.7	USB	18.983.6	USB	19.101.9	LSB	19.647.4	LSB

The above signals were using several different shifts.

CHAPTER 11

SATELLITE OPERATION

11.1 Overview

Amateurs have always been experimenters and innovators of communications technology. This has certainly been true in the area of satellite communications. The satellites amateurs have designed and built relay CW, SSB (voice) and now digital signals over large distances without the need of ionospheric propagation which is not always reliable.

The space program began for amateurs with the launch of the first satellite (OSCAR 1) in 1961. OSCAR, which stands for Orbital Satellite Carrying Amateur Radio is the general term used to refer to most amateur satellites once in orbit. Since that time some 20 satellites for amateur use have been launched and more are being planned.

The first satellites were beacons only and did not actually "relay" signals. By the mid 1960s however transponders capable of retransmitting CW and SSB signals were added to the satellites. Since that time digital modes have been added first for telemetry reception and then for two way communications use. In the most recent satellites digital transmissions have even been used to return pictures to earth.

The special problems of satellite communications including weak signals and Doppler shift make for some special modem requirements. Your DSP-2232 supports the 1200 bits/sec BPSK (Binary Phase Shift Keying) as well as the 9600 bits/sec FSK modems currently used in amateur satellite communications. In fact, the Digital Signal Processing technology used in the DSP-2232 is ideal for satellite use because new and experimental modems can be programmed in software.

11.2 Preparation

Satellite operation requires some specialized equipment and operating techniques that cannot possibly be covered in this single chapter. If you are new to this area of amateur radio, we strongly recommend obtaining a good introduction to satellite operation from the ARRL or other source. A guide such as this will discuss setting up a satellite station, where to find and how to track the satellites as well as the satellite operating practices you will need to know.

While an introductory reference guide will get you started with satellite operation, the most current information is obtained from AMSAT. AMSAT is the Radio Amateur Satellite Corporation and is made up of amateurs interested in designing, building, and using communication satellites. A membership in AMSAT helps support future amateur satellite efforts as well as provides you with the most current satellite and space communication information.

AMSAT bulletins are also distributed on the amateur packet network, Compuserve, and other computerized information sources. Satellite users should pay attention to these bulletins as they are both interesting and sometimes crucial to the life of the satellites.

11.3 Operation

Before you can communicate through the satellites with 1200 bits/sec BPSK, you must connect the DSP-2232 to your satellite transmitter and receiver as described in chapter 3.

Special Note for 9600 bits/sec Operation:

> For 9600 bits/sec operation, the AFSK output of the DSP-2232 must be connected directly to the Varactor modulator stage of the transmitter. Also note that the DSP-2232 receive audio must be taken directly from the discriminator section of the receiver.
>
> These special 9600 bits/sec connections must be located on the radio's schematic diagram by the user. Most often these connections are not available on any external connector and must be wired carefully inside the transceiver.

Most two-way digital satellite operation occurs in the Packet mode. Be sure that the DSP-2232 is set to Packet operation before selecting most satellite modems. Some satellite telemetry data is sent using ASCII RTTY. This telemetry mode is discussed later in the chapter.

Two way satellite operation generally requires that the transmitted signal be on a different amateur band than the received signal. This allows satellite QSOs to be in Full-Duplex. The digital satellites are no exception to this so remember to turn the command FULLDUP ON when operating through the satellites.

11.4 DSP-2232 Satellite Modems

The DSP-2232 contains many modems used in satellite communications. Presently the following satellite modems listed by number are available and can be listed with the DIRectory command.

```
12: p1 Packet 1200 bps VHF              13: p1 Packet 1200 bps PACSAT
14: p1 Packet 1200 bps PSK
16: p1 Packet 4800 bps PACSAT           17: p1 Packet 4800 bps PSK
18: p1 Packet 9600 bps FSK K9NG/G3RUH
22: p2 Packet 1200 bps VHF              23: p2 Packet 1200 bps PACSAT
28: p2 Packet 9600 bps FSK K9NG/G3RUH
44: DSP data 400 bps OSCAR-13
45: RTTY/TOR 1200 bps ASCII OSCAR-11
52: p1 Packet 9600 bps G3RUH.UO22.eq
```

11.5 1200 bits/sec BPSK Operation

The most widely used satellite modem is the 1200 bits/sec BPSK (Binary Phase Shift Keying) often referred to as simply the PSK modem. To select this modem enter the command MODEM 13 (or MODEM 23 for radio port 2) at the DSP-2232 command prompt. The DSP-2232 is now ready to receive a 1200 bits/sec BPSK PACSAT signal from a SSB receiver.

With this particular modem the transmit signal is exclusive ORed with a 1200 Hz clock which is called Manchester encoding. This allows the transmitted signal to be fed to an FM rather than an SSB transmitter. This is precisely the way the TAPR/JAS PSK modem works when in the Fuji-Oscar 12 satellite mode.

11.5.1 BPSK Transmitter and Receiver Settings

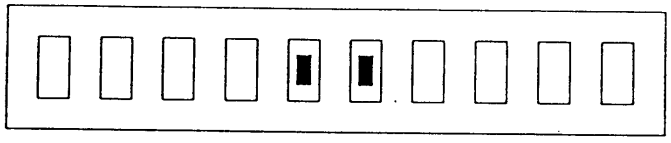
As indicated above, the satellite receiver should be set to either Upper or Lower Sideband. Due to the characteristics of the filter in your receiver, you may find that one sideband copies the satellites better than the other. You should use whichever sideband produces the best received copy.

The transmitter you use to access the satellite should be set in the FM mode. Since PSK is a linear mode, it is quite critical that the audio level has been properly set as described in Chapter 3. PSK is much more sensitive than FSK to over-driving of the transmitter. Be especially careful that your transmitted signal is no wider than 3.5 KHz which is approximately 70% of a full 5 KHz deviation.

11.5.2 Tuning in BPSK Satellite Stations

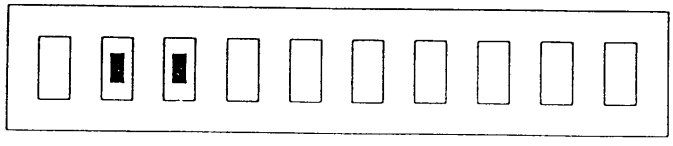
Tuning in BPSK satellite stations properly is critical to successful operation. Follow the procedure below for the best results.

- Make certain your satellite receiver is in the SSB mode.
- Turn any IF-Shift and Passband-Tuning controls to the Center or OFF position.
- Tune your receiver carefully to the BPSK satellite downlink frequency. Be sure that you have properly calculated the satellite's path and that it is one you can copy well with good signal strength. Do not forget that the signal may be a few KHz away from the exact downlink frequency due to Doppler shift.
- When you find a station, slowly vary the VFO on your receiver and look for a display on the DSP-2232 tuning indicator as shown.



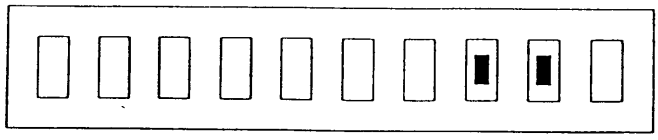
Tuned In

If the tuning indicator looks like the one below, the frequency from your speaker is too low for the DSP-2232 to copy the signal. Slowly tune the VFO and make the frequency higher.



Frequency Too Low

If the tuning indicator looks like the one below, the frequency from your speaker is too high for the DSP-2232 to copy the signal. Slowly tune the VFO and make the frequency lower.



Frequency Too High

- Adjust the volume of the received signal so that the DCD LED lights when a properly tuned BPSK signal is being received.

Note that the rear panel Satellite UP/DOWN Doppler shift compensation outputs are not yet functional with the 1200 bits/sec BPSK PACSAT modem. Satellites that use this mode include the following:

- AMSAT OSCAR 16
- DOVE OSCAR 17
- WEBER OSCAR 18
- LUSAT OSCAR 19
- FUJI OSCAR 20

11.6 9600 bits/sec Direct FSK Operation

A modem that has gained some popularity in Packet and Packet satellite use is the 9600 bits/sec FSK G3RUH and K9NG compatible modems. UoSAT OSCAR 14 uses this modem to both uplink and downlink data. This modem is number 18 in the DSP-2232 and is selected by entering the command MODEM 18 for radio port 1 or MODEM 28 for radio port 2 at the command prompt. Modem 52 has been optimized for 9600 bits/sec operation on UO-22. You may find this modem provides better performance when operating this satellite.

As mentioned above, this is modem is a direct FSK variety and must be connected directly to the modulator stage of an FM transmitter in order to transmit properly. Unfortunately most FM transmitters do not provide connections to this internal stage and so it must be found on the schematic and connected to internally by the user.

Similarly, the receive connection for this 9600 bits/sec modem must be made directly to the discriminator circuit of an FM receiver. A few manufacturers do provide external connections to discriminator audio but unfortunately for most receivers this connection must be determined from the schematic diagram.

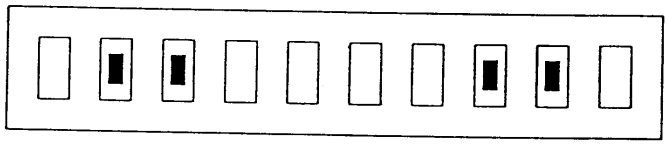
11.6.1 FSK Transmitter and Receiver Settings

As indicated above, the satellite transmitter and receiver should be set to the FM position.

11.6.2 Tuning in FSK Satellite Stations

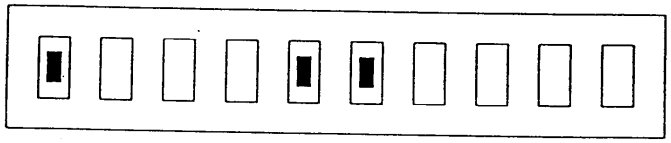
Tuning in 9600 bits/sec direct FSK satellite stations properly is critical to successful operation. Follow the procedure below for the best results.

- Make certain your satellite receiver is in the FM mode.
- Turn any IF-Shift and Passband-Tuning controls to the Center or OFF position.
- Tune your receiver carefully to the 9600 bits/sec satellite downlink frequency. Be sure that you have properly calculated the satellite's path and that it is one you can copy well with good signal strength. Do not forget that the signal may be a few KHz away from the exact downlink frequency due to Doppler shift.
- When you find a station, slowly vary the VFO on your receiver and look for a display on the DSP-2232 tuning indicator as shown.

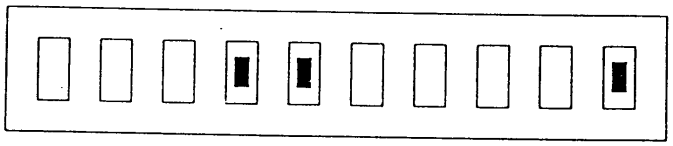


Tuned In

If the tuning indicator looks like the one below, adjust the frequency of your receiver to center the display as shown above.



If the tuning indicator looks like the one below, adjust the frequency of your receiver to center the display as shown above.



- Make sure that the output from the discriminator is high enough so that the DCD LED lights when a properly tuned FSK signal is being received.

Note that the rear panel Satellite UP/DOWN Doppler shift compensation outputs are not yet functional with the 9600 bits/sec FSK modem.

The UoSAT OSCAR 14 and 22 satellites currently use these modems.

11.6.3 Satellite Programs

To send and receive files on the PACSATs, you may wind up using the PB and PG programs available from AMSAT. These programs require some special parameter settings in the DSP-2232 which are listed below. The following configuration files have been used successfully with the PB and PG programs. Thanks to Bob McGwier (N4HY) for the files.

```
;PB configuration file example (PB.CFG)
; Comments start with ; and are ignored.
; Remove and add ; as appropriate to your setup.
;Set your callsign
mycall N4HY
;Set the satellite's callsign
bdcstcall uosat5-11
;Set a directory for the pb operations if you want to
;this is where all files will be stored
;pbpath C:\microsat\bbs\uosat
;And any other callsign or string that you are known by
;myaddr ALL
;COM Port and TNC settings
;port 1
port 2
speed 19200
restart_delay 60
txd 120
; Please use graball so the satellite is more useful for everyone
graball 1
; Up to 10 blockftype entries keep PB from saving the file types
; that you specify. e.g. blockftype 2 gets rid of BBS forwarding
; traffic.
blockftype 2
; These entries control frame logging
; directory broadcast frames
;logdbframes 1
; message broadcast frames
;logpbframes 1
; all other frames
;logothers 1
; How long to keep .act and .hol files
actdays 3
; How many bytes of pfhdir.pfh is max
maxpfhdirsize 250000
; How many bytes of pfhdir.pfh to leave after archiving
minpfhdirsize 25000
; How many minutes of no packets to exit after
;exitafter 0
; Turn off all automatic downloading THIS WAS 0
automode 1
; Turn on batch file builder
;makebat 1
; Bats1 and Bats2 allow you to customize what ends up in
; the batch file postpass.bat
; bats1 'call myproc'
; bats2 '.dl'
ndupesearch 200
select pb.eqn
```

The following is a sample PG program configuration file PG.CFG.

```
speed 19200
port 2
bbscall uosat5-12
bdcstcall uosat5-11
mycall n4hy-0
maxdupes 10
maxsel 50
restart_delay 36
break_delay 36
```

The DSP-2232 displays monitored packets with a port identifying "p1" or "p2" in front of the header to identify which port heard the packet. While helpful to the human user, computer programs can have problems with "extra" information such as this. To eliminate the "p1" and "p2" from monitored packets , the User BIT 19 command (UBIT 19) may be turned OFF. With the versions of PB and PG available in July of 1992, we recommend turning UBIT 19 OFF.

11.7 1200 and 4800 bits/sec ASCII Operation

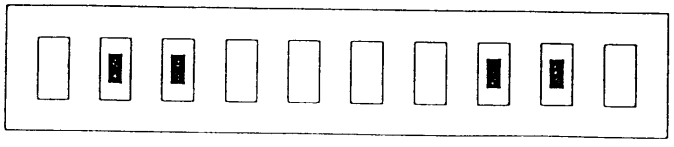
The UoSAT OSCAR 11 can transmit 1200 bits/sec FM AFSK ASCII signals which can be received by the DSP-2232 with MODEM 45. Place the DSP-2232 into the ASCII mode and then select MODEM 45. Finally select the desired ASCII baud rate (ABAUD) to 1200.
The satellite receiver should be set to the FM mode.

11.7.1 Tuning in ASCII Satellite Stations

Tuning in 1200 or 4800 bits/sec AFSK ASCII satellite stations properly is critical to successful operation. Follow the procedure below for the best results.

- Make certain your satellite receiver is in the FM mode.
- Turn any IF-Shift and Passband-Tuning controls to the Center or OFF position.
- Tune your receiver carefully to the 1200 or 4800 bits/sec satellite downlink frequency. Be sure that you have calculated the satellite's path and that it is one you can copy with good signal strength. Do not forget that the signal may be a few KHz away from the exact downlink frequency due to Doppler shift.

  If your FM receiver has discriminator metering, use this as a check to be sure you are exactly on the proper frequency. When the station is tuned, the you should see a display as shown below.



Tuned In

11.8 1200 bits/sec AFSK FM AX.25 Operation

The UoSAT OSCAR 14 and DOVE OSCAR 17 satellites can transmit 1200 bits/sec FM AFSK AX.25 standard VHF Packet signals. These signals are received in the Packet mode with MODEM 12 for Radio Port 1 and Modem 22 for Radio Port 2 as in normal VHF 1200 baud packet.

11.8.1 AFSK FM Receiver Settings

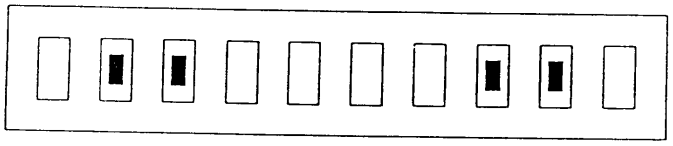
As indicated above, the satellite receiver should be set to the FM position.

11.8.2 Tuning in AFSK FM Satellite Stations

Tuning in 1200 bits/sec AFSK FM AX.25 packet satellite stations properly is critical to successful operation. Follow the procedure below for the best results.

- Make certain your satellite receiver is in the FM mode.
- Turn any IF-Shift and Passband-Tuning controls to the Center or OFF position.
- Tune your receiver carefully to the 1200 bits/sec satellite downlink frequency. Be sure that you have properly calculated the satellite's path and that it is one you can copy well with good signal strength. Do not forget that the signal may be a few KHz away from the exact downlink frequency due to Doppler shift.

  If your FM receiver has discriminator metering, use this as a check to be sure you are exactly on the proper frequency. When the station is tuned, the you should see a display on the DSP-2232 LED bar graph as shown below.



Tuned In

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CHAPTER 12

PACTOR OPERATION

12.1 Overview

PACTOR is a relatively new amateur data communications mode. It was developed in Germany by Hans-Peter Helfert, DL6MAA and Ulrich Strate, DF4KV. PACTOR combines some of the best features of both AMTOR and packet as well as providing a few new features. PACTOR operates at 100 bps or 200 bps depending on radio conditions. PACTOR also contains a 16 bit CRC to provide near error-free operation and can also selectively use a data compression scheme (Huffman encoding) to increase the throughput when transmitting text. PACTOR uses an 8-bit word, allowing the use of the full ASCII character set. You should use both upper and lower case in your PACTOR transmissions.

When data blocks are repeated in the case of an error, the receiving unit can often combine the information in the repeated blocks to provide a good block without the need of receiving a perfect block. This scheme is called memory ARQ.

Like AMTOR and packet, PACTOR has two basic modes of operation, an ARQ mode (Automatic ReQuest for reception) and a non-linked mode used for CQ calls and roundtable operation.

- ARQ PACTOR is a handshaking protocol that allows two stations to communicate in a near error-free fashion. A PACTOR ARQ exchange consists of a 0.96 second burst of data from the information sending station followed by a short burst from the data receiving station that is an acknowledge (ACK) or non-acknowledge (NAK). The NAK is sent by the receiving station when the CRC data test indicates an error in the data block. Like packet, PACTOR is mark-space polarity independent, although for different reasons. The PACTOR protocol alternates the data polarity with every transmission to reduce the effects of interference on the received signal.

- The unproto(col) mode of operation is a non-linked type of operation. It is used for roundtable operation or for calling CQ. The unproto mode repeats the data blocks a selectable number of times and can use either 100 or 200 bps. It also uses the CRC error check.

12.2 Where to Operate PACTOR

Before you can operate PACTOR, you must first know where the activity occurs. Most PACTOR operation occurs on the 20-meter amateur band between 14.065 and 14.085 MHz. PACTOR activity can be found on the other HF amateur bands as well and is most often located between 65 and 90 kHz up from the bottom of the band as it is on 20 meters. On 80 meters, most PACTOR will be found between 3660 and 3690 KHz. PACTOR is not sensitive to to the sideband used, but we recommend using LSB as in RTTY and AMTOR operating modes.

12.3 DSP-2232 PACTOR Parameter Settings

PACTOR is a bit more complex than Baudot or ASCII operation. PACTOR operation requires you to have MYPTCALL or MYCALL entered before you can operate. If you do not enter MYPTCALL, the call in MYCALL will be used as the default callsign. PACTOR stations can't use the SubStation IDentification number (SSID) in MYCALL.

12.3.1 Entering Your Callsign (MYPTCALL)

If you have not already done so, enter your callsign for PACTOR after the command prompt (cmd:) using the MYPTCALL command. For example, if your call is WX5FAP, you would type:

```
cmd:MYPTCALL WX5FAP <Enter>

The DSP-2232 will respond with:

MYPTCALL   was  DSP
MYPTCALL   now  WX5FAP
```

If you have not entered your call with the MYPTCALL command, the DSP-2232 will default to the call in MYCALL. MYCALL does not allow punctuation other than the dash and SSID. MYPTCALL does allow up to 8 characters and punctuation in the call. This allows you to properly identify when operating portable, e.g. ZL/K6RFK.

If you do not enter a call using MYPTCALL or MYCALL, the DSP-2232 will not allow transmission as the default call DSP is not a valid call. The error message "Need MYCALL" will be displayed if transmission is attempted.

12.3.2 Enter the PACTOR Mode

If you are using the AEA PAKRATT for WINDOWS program, follow the instructions in the program manual to enter the PACTOR mode. The current AEA PAKRATT for DOS does not support PACTOR except in the dumb terminal mode. AEA will have PC PAKRATT for DOS with PACTOR available in later in 1993.

If you are using a terminal or a computer with a terminal emulation program, simply type "PACTOR" or "PT" from the Command Mode followed by the <Enter> key to enter the PACTOR mode. The DSP-2232 responds by displaying the previous mode, for example packet:

```
Opmode   was PAcket
Opmode   now PACTOr
```

Your DSP-2232's front panel LCD status display will show that you are in the PACTOR Standby mode on RADIO port 1, and the COMMAND LED will be lit.

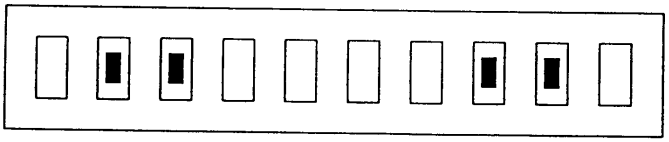
12.4 HF Receiver Settings

Set your HF receiver (or transceiver) to Lower Sideband (LSB) unless you connected your DSP-2232 through the direct FSK keying lines. If you are using a transceiver with a RTTY or Packet mode and you have the DSP-2232 connected for direct FSK, keep in mind that PACTOR uses 200 Hz shift. If your radio has 200 Hz shift FSK for packet use, you may use direct FSK. If your radio has only 170 Hz shift capability, you should use the TX audio from your DSP-2232 to drive the microphone input of your radio. Although you may use either USB or LSB, LSB is generally used to make mode changes easier and is recommended. Adjust the volume to a comfortable listening level.

12.5 Tuning in PACTOR Stations

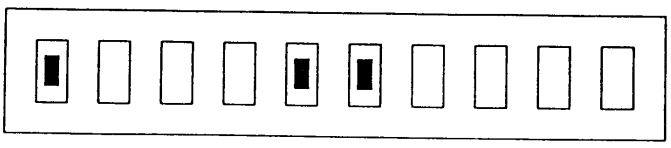
Tuning in PACTOR stations properly is critical to successful operation. Since PACTOR stations use 200 Hz Frequency Shift Keying (FSK) to send data, tuning accuracy is very important.

- Make certain your HF receiver is either in LSB or FSK/RTTY/Packet depending on your DSP-2232 set-up.
- Turn any IF-Shift and Passband-Tuning controls to the Center or OFF position.
- Enter the command "PTLIST" for PACTOR Listen to monitor both linked and unproto PACTOR data.
- Tune your receiver carefully between 14.065 and 14.085 MHz (or another band where you know there is PACTOR activity) and listen for the 1-second data burst of ARQ PACTOR or the steady data of the unproto mode stations. Be sure that the volume from the receiver is high enough to activate the DCD LED indicator during the PACTOR data burst.
- When you find a station, slowly vary the VFO on your receiver and look for a display on the DSP-2232 tuning indicator as shown.



Tuned In

If the tuning indicator looks like the one below, the frequency from your speaker is too low for the DSP-2232 to copy the signal. Slowly tune the VFO and make the frequency higher.



- When you finish typing your comments or traffic to the other station and wish to let the distant station transmit, you should type "KKK" or "BTU" to let the other station know that you are going to change the link direction.

- Then, type a <CTRL-Z> (Hold the "CTRL" key down while typing the Z) to turn the link over to the other station.

  <CTRL-Z> is the character defined by the PTOVER command that switches your system from being the Information Sending Station (ISS) to the Information Receiving Station (IRS) and switches the distant system from being the information receiving station to the information sending station.

The FCC requires station identification once every ten minutes. It's sufficient to begin with "QRA (mycall)" or end your transmission with "QRA (mycall)" before the <CTRL-Z> changeover code, or use the <CTRL-B> "HERE-IS" to send your own Auto-AnswerBack message. For the "HERE-IS" command to function, you must have your AAB text entered. See appendix A for the AAB command.

12.6.3.1 Ending an ARQ PACTOR Contact

When you've finished your "final finals" to the distant station and both stations are ready to end the PACTOR ARQ contact, you can end the contact and terminate the link in several different ways:

- Type <CTRL-D> to stop sending after the transmit buffer is empty. <CTRL-D> breaks the link and returns your DSP-2232 to Command Mode in PACTOR Standby. This is the best way to end a PACTOR contact.

- Type <CTRL-F> to stop sending after the transmit buffer is empty, send your Morse ID and return to PACTOR Standby and Command Mode.

  Your DSP-2232 sends your call sign (in MYCALL) in Morse code, and then shuts off your transmitter and returns to PACTOR Standby and Command Mode. This is the best way to end a contact if you want to identify your station in Morse code as well.

- Wait until all the text has been sent, then type <CTRL-C> to return to Command Mode, then type "R" to break the link. The DSP-2232 will go into the PACTOR Standby mode.

- Type <CTRL-C> to return to Command Mode, then type "R <Enter> R <Enter>" to break the link immediately! If there are characters left in the transmit buffer, they will not be sent. This method should only be used for an emergency shutdown as it does not send the control signal to the other station that informs it you are shutting down. As a result, the other station will continue to send until its internal timer turns it off.

12.6.4 Long Path Contacts

If the station you wish to contact is more than half way around the world, i.e. a long path station, a special connect command is used to lengthen the PACTOR timing. In this case, precede the station's call with the exclamation point:

PTCONN !N7ML <Enter>

If your station doesn't link within a period of time determined by the ARQTMO command (default 60 seconds), your station will stop transmitting.

12.6.5 LCD Status and Mode Indicators

The front panel LCD display provides mode and status information at a glance. This is especially useful in PACTOR operation. The following describes typical status indications you will see.

Type "PTCONN (CALLSIGN of distant station)." The status changes to:

LCD: PACTOR Phase,
LEDs: SEND

This shows that your transmitter is in the SEND condition, in the "connect" part of an ARQ connect call. Your transmitter will key on and off sending the distant station's connect request.

As soon as your DSP-2232 is synchronized with the distant station, the status changes to:

LCD: PACTOR Tfc,
LEDs: SEND and CONnected

Verify the link by typing <Enter> a few times and watch the display. Your traffic will now begin to flow as you type characters. If EAS (Echo As Sent) is set ON, your typed characters are displayed as they are sent. The status will change back and forth from IDLE and Tfc whenever your typing pauses and resumes.

When errors occur on the link and the distant station sends REQUEST (request for repeat), the status will show:

LCD: PACTOR Error and/or Rqst,
LEDs: SEND and CONnected

ERROR: Your DSP-2232 has detected errors in the signals received from the distant station.

REQUEST: Your DSP-2232 has received a "request for repeat" code from the distant station.

If the link fails and you lose synchronization with the distant station the DSP-2232 goes to standby and the status shows:

LCD: PACTOR, Stby

For the unproto mode:

After typing" PTSEND", to start an unproto transmission, your DSP-2232 displays the system status:

LCD: PACTOR IDLE,
LEDs: SEND

As you send your traffic the status will change back and forth from IDLE to Traffic. When you stop typing, the IDLE status is displayed.

12.7 PACTOR Operating Tips

The following "Special Function Characters" and immediate commands are included for PACTOR operating convenience.

Immediate Commands from the Command Mode:

"PT"	Selects the PACTOR mode
"PACTO"	Selects the PACTOR mode as above
"PTCONN <CALL>"	Starts a linked connect and forces Converse
"PTSEND"	Starts an unproto transmission and forces Converse
"R"	Stops sending immediately, forces PACTOR Standby
"PTLIST"	Allows reception of both unproto and linked transmissions
"PTHUFF <0-4>"	0 - prevents compression 1 - allows automatic use of Huffman compression
"PT200 <ON|OFF>"	Off - prevents 200 baud operation On - allows automatic speed selection
"PTOVER <$HH>"	Used to select the changeover character Defaults to <CTRL-Z> ($1A)

Special Function Characters embedded in transmitted text:

<CTRL-B>	Sends your AAB string as a HERE-IS message
<CTRL-D>	Stops sending after the transmit buffer is empty
<CTRL-E>	Sends a "Who Are You" request to the other station
<CTRL-F>	Same as <CTRL-D> but sends your callsign in Morse
<CTRL-T>	Sends the TIME if the DAYTIME clock has been set
<CTRL-Z>	Changes your DSP-2232 from send (ISS) to receive (IRS)

12.7.1 ARQ Break-In (ACHG Command)

In the linked or connected mode, (ARQ), when you're the "Information Receiving Station," you can use the "ACHG" command to interrupt the distant station's comments.

As the "Information Receiving Station," you normally rely on the distant station to send the <CTRL-Z> to "change-over" at the end of his comments. ACHG is a command that forces both systems to reverse the "Information Receiving" and "Information Sending" status of the link.

- Use the ACHG command only when really needed to interrupt the distant station.

12.7.2 Entering Your Auto-AnswerBack (AAB)

AEA PACTOR allows you to request the identity of the station you are conversing with by sending your DSP-2232 a <CTRL-E>. This causes the DSP-2232 to send an inquiry (WRU) request to the other station.

For this reason, you should set your own Auto-AnswerBack (AAB) message to "DE YOUR-CALL". Your DSP-2232 will automatically send the AAB message when another station requests your identity, and then stop sending.

12.7.3 PACTOR Modem Frequencies and Shifts

All PACTOR operation uses 200 Hz shift FSK modems. Modem 5, (default) 6, 32 or 34 are the best choices for PACTOR use. Modem 5 is a single port PACTOR modem using the standard 2110 Hz and 2310 Hz tones. Modem 6 allows the lower tone (1460 Hz and 1260 Hz) pair to be used. Modems 32 and 34 are dual port PACTOR/PACKET modems allowing simultaneous HF or VFH packet operation on radio port 2 while operating PACTOR on radio port 1.

MODEM 5 AFSK PACTOR Modem, 200 Hz shift, Mark=2110 Hz, Space=2310 Hz
MODEM 6 AFSK PACTOR Modem, 200 Hz shift, Mark=1460 Hz, Space-1260 Hz

(Dual Port modems)
MODEM 32: PACTOR 200: 2110/2310; p2 Packet 300 bps HF 2110/2310
MODEM 34: PACTOR 200: 2110/2310; p2 Packet 1200 bps VHF

12.7.4 Automatic Speed Change

If the command PT200 is set on, the linked PACTOR mode will automatically change the transmitted data rate from 100 bps to 200 bps if a certain number of error-free 100 bps packets are received in a row. If the error rate at 200 bps is excessive, the data rate will automatically revert to 100 bps. There may be some propagation conditions that will cause the system to vacillate between the two data rates. This may be prevented by setting PT200 to OFF, which will force 100 bps operation. See the UCMD command to control these thresholds.

12.7.5 Echoing Transmitted Characters As Sent (EAS)

EAS (Echo As Sent) operates the same as in ARQ AMTOR. If EAS is on, you will see characters echoed to your screen only the first time your DSP-2232 sends them. If the data is not acknowledged by the receiving station and is re-transmitted, the characters are not echoed again. An exception to this occurs when the speed shifts from 200 to 100 bauds. In this case, the block will be echoed again. With EAS OFF, characters are echoed to your screen as you type them. With EAS ON:

- If the data scrolls across your monitor at a fairly even rate, you can assume that you have a good ARQ PACTOR link.
- If the data hesitates for a few seconds at a time, that's generally a sign that the radio link is not very good.
- If the characters stop appearing on your monitor, the link is failing or has failed. The Status display will tell you this by showing ERROR or REQUEST nearly continuously.

12.7.6 Sending Only Complete Words (WORDOUT)

Some PACTOR users like to have their words sent out only when they are complete. This allows the word you are currently typing to be edited as long as you have not typed a <Space> character or punctuation. Turning WORDOUT ON activates this feature. See the Command Summary for more information.

12.7.7 Operating on the "Wrong Sideband"

PACTOR, like packet is mark-space polarity insensitive. Once linked the PACTOR protocol alternates the data polarity every transmission. A specific header synchronizes the system during non-linked operation. For this reason, there is no "wrong" sideband. You may operate on either LSB or USB.

If you are going to change to other modes, for example AMTOR, then LSB must be used. It is suggested that LSB be used to make mode changes simple as well as keeping the radio dial frequency reading consistent with other users.

If you are using a radio that has direct FSK inputs, keep in mind that PACTOR uses 200 Hz shift and most direct FSK capable radios are set for 170 Hz shift. If the 170 Hz shift can not be adjusted to 200 Hz, use the TX audio from the DSP-2232 to drive the microphone input in LSB.

12.7.8 Little Used PACTOR Commands

There are four seldom-used PACTOR commands that are accessible with the UCmd command. This command is of the form UCmd n x, where n is the UCmd number and x is the setting. Several examples are shown in the use of UCmd:

UCMD 2	Will show the current setting of command 2
UCMD 4 10	Will set command 4 to the value 10
UCMD 1 OFF	Will set the value of command 1 to zero
UCMD 3 ON	Will set the command 3 to its default value
UCMD	Will show the setting of the last UCMD entered

The PACTOR UCmd commands are:

UCMD 0: Default 3, maximum 30. This command sets the number of correct packets in a row that must be received before generating an automatic request to change from 100 to 200 baud. Also, see the command PT200 in 12.7.4.

UCMD 1: Default 6, maximum 30. This command sets the number of incorrect packets in a row that must be received before generating an automatic request to change from 200 to 100 baud. Also see the command PT200 in 12.7.4

UCMD 2: Default 2, maximum 9. This command sets the number of packets sent in a baud rate speed-up attempt.

UCMD 3: Default 5, maximum 60. This command sets the maximum number of Memory ARQ packets that are combined to form one good packet. When this number is exceeded, all stored packets are erased and Memory ARQ is re-initialized.

12.8 Monitoring ARQ PACTOR Contacts with PTLIST

Use the "PTLIST" command to monitor ARQ traffic flowing between two stations linked in a PACTOR ARQ contact. Your DSP-2232 will try to display the text of whichever of the two linked ARQ stations is the Information Sending Station at the moment.

Monitoring two linked PACTOR ARQ stations does not provide the error correction enjoyed by the linked stations. Since your DSP-2232 is not part of the "handshake" you do not generate the request for repeat. Your DSP-2232 will test for the correct CRC error check and will not display messages with errors. Data blocks with errors will be designated with four error symbols. The default error symbol is the underline (_). See the command summary for ERchr, the error symbol.

Your DSP-2232 will not print a block of data if that block contains the same sequence number as the previous block. If the "ISS" (Information Sending Station) is repeating the same block, you won't print it twice.

12.9 PACTOR MailDrop Operation

The DSP-2232 allows PACTOR as well as Packet and AMTOR access to the MailDrop. Messages that originate in Packet or AMTOR can be accessed remotely in PACTOR and messages that originate from a remote PACTOR station can be accessed by Packet and AMTOR users of your MailDrop. This section of the manual talks about basic PACTOR mailbox operation. Section 12.10 will discuss how to pass message traffic from PACTOR to Packet and vice versa.

Make sure that you understand MailDrop Operation in Chapter 5 and the basic PACTOR operation described earlier in this chapter before putting your PACTOR MailDrop on the air.

12.9.1 Special Operating Considerations

The PACTOR MailDrop has been designed with a "Watchdog" safety feature so that it may perform safely without constant attention. If a remote station is linked with your PACTOR MailDrop and no traffic is passed for 5 minutes, the link will drop and your transmitter will shut off.

At this writing however, unattended operation below 30 MHz is not legal for US amateurs unless they hold a Special Temporary Authorization (STA) from the FCC for this purpose. This restriction may soon change, but until then US amateurs must be sure to always have control of their HF transmitters when any automatic device such as the DSP-2232 MailDrop is in operation.

With this in mind, we have designed the PACTOR MailDrop so that it can be disabled at any time during an ARQ link simply by turning the command TMAIL (TOR MAIL) OFF. This allows you the SYSOP to make your MailDrop available to other stations and still break in to chat with remote stations at any time. This could come in handy should you want to provide some help or information to a remote station using your PACTOR MailDrop.

12.9.2 Settings For PACTOR MailDrop Operation

Before a remote PACTOR user can access your MailDrop, be certain that MYPTCALL and MYCALL (on Port 1) are set to your Amateur callsign.

12.9.3 Starting PACTOR MailDrop Operation

Remote access to your PACTOR MailDrop is controlled by the command TMAIL which is short for TOR MAIL. The TMAIL command controls remote access to the PACTOR and AMTOR MailDrop in the same way that the MAILDROP command controls remote Packet access.

Turn the TMAIL command ON (default OFF) to allow remote stations to access your MailDrop in ARQ PACTOR. Turn TMAIL OFF to have normal ARQ QSOs with other stations in the PACTOR mode.

12.9.4 Local Logon to the MailDrop

To locally access your MailDrop use the MDCHECK command as described in chapter 5 of this manual on MailDrop operation.

12.9.4.1 Remote Logon to Your PACTOR MailDrop

The PACTOR maildrop user interface is slightly different from the packet interface due to the differences between the two modes.

When a station links with your PACTOR MailDrop, your DSP-2232 first identifies your maildrop by sending the amount of free MailDrop memory as shown below:

```
Type H for help.
(AEA DSP-2232) 17528 FREE.
```

The DSP-2232 then sends the user the MTEXT string if the MailDrop Message command (MMSG) is ON. The Default text is shown below:

```
Welcome to my AEA DSP-2232 maildrop.
Type H for help.
```

12.9.5 Caller Prompts

The command prompt that the MailDrop sends the remote user in PACTOR is similar to that used in the Packet mode and is shown below:

```
WX7BBB DE WX7AAA (A,B,H,J,K,L,R,S,V,?) >
```

As in packet, MDPROMPT is the PACTOR MailDrop message prompt sent to a remote station by your MailDrop. The default prompt is:

```
Subject:/Enter Message,^Z (CTRL-Z) or /EX to End
```

Text before the first slash is sent to the user as the subject prompt; text after the first slash is sent as the message text prompt.

12.9.6 Monitor MailDrop Operation

The local user (SYSOP) can monitor the dialog by setting MDMON ON. The DSP-2232 stays in command mode during remote MailDrop access.

12.9.7 SYSOP MailDrop Commands

The MailDrop commands that you the SYSOP have access to are the same as those described in Chapter 5 of the manual on MailDrop Operation.

12.9.8 Remote User MailDrop Commands

When a remote user has logged onto your MailDrop the following commands are available to the distant station:

A, B, H, J, K, L, R, S, V, ?.

The remote user may end a command with either <CTRL-Z> or a carriage return.

A brief description of each command follows in the next sections. The description is expanded where the command operation differs from the Packet Maildrop section found in Chapter 5.

12.9.8.1 A (ABORT) (Remote only)

The "A" command aborts the listing or reading of messages by the remote calling station as described in chapter 5. The difference in PACTOR is that the remote user must send the ACHG command first to reverse the direction of the link before he can issue the Abort command.
The remote user also has the ability to abort a command that may have been mis-typed by typing "///" on the same line as the bad command.

12.9.8.2 B (BYE)

The "B" command logs the remote station off the MailDrop. In PACTOR the remote station may gracefully shut down the link with the RECEIVE character (<CTRL-D>) or the CWID character (<CTRL-F>).

12.9.8.3 H (HELP)

The "H" command sends the remote station a help list of the available commands shown in Chapter 5.

12.9.8.4 J (JLOG) (Remote only command)

The "J" command sent by the distant station will cause the MailDrop to send the list of stations who have logged in to your MailDrop.

12.9.8.5 K n (KILL n [Mine])

The "K n" command deletes message number "n" from the MailDrop as described in Chapter 5. The "KM" command will kill all of your messages that have been read.

12.9.8.6 L (LIST [Mine])

The "L" command shows the remote user only a list of the messages he or she may read as described in Chapter 5. The "LM" command lists only those messages addressed to the user.

12.9.8.7 R n (READ n [Mine])

The "R n" command lets the remote user read any of the message numbers displayed in the LIST command. The command operates as described in Chapter 5 except that the column headers are not displayed. The "RM" command displays messages addressed to the remote user that have not been read previously.

12.9.8.8 S callsign (SEND callsign)

Either a <CTRL-Z> or the "/EX" command must be used to end all PACTOR MailDrop messages. After the <CTRL-Z> or "/EX" has been detected, the MailDrop will confirm that the message has been sent by returning the message "Filed msg n" to the remote user. An example of sending a message is shown below:

```
WX7BBB DE WX7AAA (A,B,H,J,K,L,R,S,V,?) >          {MailDrop prompt}
s wx2zzz @ wx2yyy                              {User's SEND command}
Subject:                                    {MailDrop Subject prompt}
Going to the Hamfest?                          {User enters Subject}
Enter Message, ^Z (CTRL-Z) or /EX to End     {MailDrop Send prompt}
I haven't heard from you and wondered if               {Message text}
you are going to the Hamfest next month?               {Message text}
Hope to see you there. 73                              {Message text}
/ex                                                {User ends message}
WX7BBB DE WX7AAA Filed msg 1 (A,B,H,J,K,L,R,S,V,?) >{MailDrop prompt}
```

12.9.8.9 V (VERSION) (Remote only command)

The "V" command causes the DSP-2232 to send the sign-on message and firmware date to the remote user only.

12.9.8.10 ? (HELP) (Remote only command)

The "?" command sends the distant station a HELP list of all available MailDrop commands shown above under the "H" command. Both the "?" and the "H" cause this same file to be sent to the remote user.

12.10 Simultaneous PACTOR and Packet Operation

Your DSP-2232 can operate PACTOR on Radio Port 1 and HF or VHF Packet on Radio Port 2 at the same time. With this feature you won't miss any local Packet activity while operating PACTOR.

Before the second radio port can be used for packet operation, you must be sure the correct modem is selected to enable the second port. Use the MODem command to select either MODEM 32 or MODEM 34, to enable dual port operation.

For example, typing MODEM 34 enables dual port PACTOR operation on radio 1, and VHF Packet operation on radio port 2.

12.10.1 Selecting Modems

The various modems available in the DSP-2232 can be seen with the DIRECT(ory) command. To display all the available modems simply enter the Command Mode of the DSP-2232 and then type DIR as shown.

DIR <Enter>

The DSP-2232 will respond with the following:

```
(930315)
  1: RTTY/TOR 170: 2125/2295              2: RTTY/TOR 170: 1445/1275
  3: RTTY/TOR 425: 2125/2550              4: RTTY/TOR 850: 2125/2975
  5: RTTY/TOR 200: PACTOR 2110/2310       6: RTTY/TOR 200: PACTOR 1460/1260
 10: p1 Packet 300 bps HF 2110/2310      11: p1 Packet 300 bps HF 1460/1260
 12: p1 Packet 1200 bps VHF              13: p1 Packet 1200 bps PACSAT
 14: p1 Packet 1200 bps PSK              15: p1 Packet 2400 bps V.26B
 16: p1 Packet 4800 bps PACSAT           17: p1 Packet 4800 bps PSK
 18: p1 Packet 9600 bps FSK K9NG/G3RUH   20: p2 Packet 300 bps HF 2110/2310
 22: p2 Packet 1200 bps VHF              23: p2 Packet 1200 bps PACSAT
 25: p2 Packet 2400 bps V.26B            28: p2 Packet 9600 bps FSK K9NG/G3RUH
 30: RTTY/TOR 170: 2125/2295; p2 Packet 300 bps HF 2110/2310
 31: RTTY/TOR 170: 2125/2295; p2 Packet 1200 bps VHF
 32: RTTY/TOR 200:PACTOR 2110/2310; p2 Packet 300 bps HF 2110/2310
 33: p1 Packet 300 bps HF 2110/2310; p2 Packet 1200 bps VHF
 34: RTTY/TOR 200:PACTOR 2110/2310; p2 Packet 1200 bps VHF
 35: p1 Packet 1200 bps VHF; p2 Packet 1200 bps VHF
 40: Morse 750 Hz                        41: Analog FAX HF
 42: Analog FAX APT                      43: Analog SSTV
 44: DSP data 400 bps OSCAR-13           45: RTTY/TOR 1200 bps ASCII OSCAR-11
 46: DSP data Spectrum                   50: p1 Packet 1200 bps MSK
 51: p1 Packet 2400 bps MSK              60: p2 Packet 1200 bps MSK
 61: p2 Packet 2400 bps MSK
 cmd:
```

Any modem from the list may be loaded with the MODEM command, but only modems 5, 6, 32 and 34 will operate correctly in PACTOR. For example, to operate PACTOR on radio port 1 and 1200 bps VHF packet on radio port 2 you must select MODEM 34. First, enter the Command Mode of the DSP-2232 and then type MODEM 34 as shown below:

MODEM 34 <Enter>

The DSP-2232 will respond with the following:

```
MODem was  x (The previous modem)
MODem now  34
```

12.10.2 Selecting a Default PACTOR Modem

When you enter the PACTOR mode, the modem number stored in the QPTOR command is automatically loaded. QPTOR defaults to 5 which automatically loads the 2110/2310 single port PACTOR modem. If you wish to load the low-tone modem (MODEM 6), or one of the dual port PACTOR modems (MODEM 32 or 34), enter the corresponding modem number into QPTOR.

12.10.3 Displaying Received Data

The Radio command may be used to disable port 2. This may be desirable when operating PACTOR and you do not want to be disturbed with any packet signals that may be received on radio port 2. To disable port 2, enter:

RADIO ON/OFF <Enter> or RADIO 1/0 <Enter>

For dual port operation, type

RADIO ON/ON <Enter> or RADIO 1/2 <Enter>

The DSP-2232 sorts and displays received data from each Radio Port using the same technique as multi-connect packet operation described in Chapter 4. That is, when operating on one port and the other port becomes active, the displayed data from the inactive port is shown prefaced by the "channel designator" followed by a colon (:). Recall that Radio Port 1 is designated by "logical" channels from 0-9 and that Port 2 is designated by "logical" channels A-Z.

12.10.4 Switching Between Ports

If you are using an AEA PAKRATT program, switching between Radio Ports is described in the program manual. If you are using a terminal program, this section describes how to direct your transmitted text.

Switching between PACTOR on Port 1 and Packet on Port 2 is similar to switching between Packet and Packet. If you have not yet read through the Switching Between Radio Ports section of Chapter 4, please do so now and define a CHSWITCH character before reading the example below.

Recall from chapter 4 that the channels on Port 1 are labeled 0-9 and the channels on Port 2 are labeled A-Z. To select Radio Port 1 (PACTOR) press the CHSWITCH character you defined, followed by the number 0. To select Radio Port 2 (Packet), press the CHSWITCH character, followed by a letter from A-Z.

For example, you are conversing with an PACTOR station and are in the middle of a QSO when a station on VHF connects to you. The following shows how your screen would look and suggests how you might handle such an occurrence. The underlined text is the text that you type.

Hello Jim, you are printing solid here and have an S7 signal.<CTRL-Z>	{ You send the PACTOR station a signal report }
Thanks Bob, you're also a solid S7 here as well.	{ The other station responds with a signal report }
A:*** CONNECTED to WX7EEE	{ WX7EEE connects to you on VHF (Radio Port 2) }
Thanks for the signal report Jim only running 100 watts here.<CTRL-Z>	{ You make another transmission to Jim on HF PACTOR }
Hey Bob, I'm going to the hamfest this weekend if you want a ride.	{ Your friend on VHF packet wants to go to the hamfest }
|AHello Mike, I am on HF PACTOR talking to a station in Boston.	{ You switch to Port 2 by typing |A to answer on VHF }
0:Well Bob, I had better be going to bed. Work starts pretty early 73.	{ Jim on HF PACTOR signs off with you. }
|073 Jim, it was nice meeting you. WX1AAA de WX7BBB SK <CTRL-D>	{ You switch back to HF with |0 and sign off with Jim }

As you may have noticed, communicating with different modes on the two Radio Ports at the same time is almost identical to the method used in chapter 4 for Packet and Packet operation. Let's discuss the sample QSOs above to see how the Port switching occurs.

The first text we see in the sample above is the signal report you are sending to Jim, the HF PACTOR station you are communicating with.

This example assumes you have already set up the ARQ PACTOR contact with the ARQ command discussed earlier in the chapter. When you are through sending your signal report to Jim on PACTOR, you turn the link over to become the IRS by sending the <CTRL-Z>. The DSP-2232 then responds by sending a blank line to the display to break up the received text.

The next text you see is your signal report received from Jim on PACTOR.

You are in the middle of a QSO with Jim on PACTOR and all of a sudden your friend WX7EEE connects to you on Packet. WX7EEE has connected on Radio Port 2 (VHF) which is shown by the "A:" before the connect message. Remember that the 26 channel designators for Radio Port 2 are A-Z.

Before you respond to WX7EEE on VHF, you send a transmission to Jim on PACTOR telling him how much power your transmitter is running. When you are finished with your text, you again command the DSP-2232 to be the IRS by sending a <CTRL-Z>.

After making this transmission on PACTOR, you see WX7EEE on VHF has offered you a ride to the hamfest. We know this text is from Radio Port 2 since the previous packet displayed by the DSP-2232 was the "A:*** CONNECTED" message from Port 2.

Now you want to let WX7EEE on VHF know that you are there, but that you are involved in another QSO on HF. This way he will understand that it may take you a little longer to respond to his packets. Before you can send data to Radio Port 2, you must switch to this Port with "|A" or the text you type will be sent to Radio Port 1 on PACTOR when Jim turns the link over to you again.

You receive a transmission from Jim on PACTOR telling you he needs to sign off to go to bed. The "0:" in front of the text shows this was received on Radio Port 1.

Now you want to sign off with Jim on HF. Again, first you must switch to Radio Port 1 with the "|0" since your last transmission was directed to Port 2. Now you can make your final transmission to Jim ending with his callsign followed by your callsign. This time when you are through typing your text, you send a <CTRL-D> to the DSP-2232 which breaks the ARQ link and returns Radio Port 1 to PACTOR Standby after the text has been sent.

12.10.5 More Thoughts on Port Switching

One problem of having more than one Radio Port is remembering which port you are currently using. In the dual port sample QSOs above, this was not a problem, but after it has been hours or days since you have used your DSP-2232, you may forget which port you last used.

With AEA Pakratt Software programs, the on-screen status will always show which port you are using so this is not a problem. With other programs, you will have to query the DSP-2232 with the CSTATUS SHORT command. The CSTATUS command displays the status of the logical channels of Port 1 and Port 2 of the DSP-2232. The CSTATUS SHORT command displays the status of the active channel and any packet channels that are connected. After completing the sample QSOs above, the DSP-2232 would display the following.

```
cmd:CSTATUS S

Ch. A - IO DISCONNECTED
```

This reminds you that Channel A is your current I/O channel. Any text that you type in the Converse mode will be sent to channel A on Radio Port 2. If you had been connected to any other packet stations, the callsign and channel would have also shown in the display.

Sometimes you might not want to be bothered with anything from the Radio Port you are not using. For these times either Radio Port may be turned OFF with the RADIO command. For example, let's say that in the above example QSO you wanted to work HF packet and did not want to be interrupted with any VHF connects. Typing the following command would cause Radio Port 2 to be disabled.

```
cmd:RADIO /0
RAdio  was  1/2
RAdio  now  1/0
```

When a DSP-2232 Radio Port is disabled, the front panel LCD status indicator for that port will be extinguished as a reminder.

12.10.6 Dual Port PACTOR/Packet Maildrop Operation

Your DSP-2232 MailDrop will operate both on Packet and PACTOR and can be used to allow message traffic that originates on PACTOR to be reverse-forwarded into the Packet network. Similarly, traffic originating on Packet may be picked up by remote stations on PACTOR.

Before you begin dual port Packet/PACTOR MailDrop operation, be sure that you are familiar with the operation of Packet, PACTOR and the MailDrop as described in Chapters 4, 5 and 7 of this manual. Also be sure that appropriate modems are selected. The more experience you have with each of these modes will help when setting up a dual port MailDrop system.

12.10.6.1 Packet MailDrop Command Settings

First set up the packet side of the MailDrop (on Radio Port 2) by setting MYCALL and MYMAIL. You may also want to enter a custom MTEXT to let others know about the PACTOR feature. Be sure to set 3RDPARTY, MDMON, MDPROMPT and MMSG as desired. If you will be reverse forwarding to a full-service BBS, you must set HOMEBBS to the callsign of that BBS. Do not forget to turn MAILDROP ON. As a test you should connect to your own maildrop via a digipeater or network node to make sure the radio link is working properly and the user prompts are what you desire.

12.10.6.2 PACTOR MailDrop Command Settings

Once the Packet side is working properly, the PACTOR side of things on Radio Port 1 must be configured. First be sure that MYCALL is entered properly. You may want to customize the PACTOR MailDrop prompt (MDPROMPT) or compose a message to ALL that tells remote users about your system. Finally, remember to turn TMAIL ON and enter the PACTOR mode of the DSP-2232 to start the PACTOR MailDrop.

12.10.6.3 Dual Port MailDrop Operation Notes

With the above parameters set, packet connections to the MYMAIL callsign on Radio Port 2 will be sent to your MailDrop if you or a remote PACTOR station is not using it. If you or any other station is using your MailDrop, the remote user attempting the packet connection will be sent a "*** Busy" message.

Similarly, a remote PACTOR station linking to you will be given access to your MailDrop provided no one else is using it. If you or a remote packet station is using your MailDrop, the PACTOR station may link to you, but will not be given access to your MailDrop. For this reason, you may wish to disable Radio Port 1 (by turning the RADIO parameter to 0/2) when logging into your own MailDrop for maintenance. This will prevent remote PACTOR stations from linking with you.

If you will be Reverse Forwarding messages into the Packet network, be sure to check your MailDrop often for new messages. Remember that you must use the Edit command in the MailDrop to select which messages will be Reverse Forwarded.

Note: At this time unattended operation below 30 MHz is not legal for US amateurs unless they hold a Special Temporary Authorization (STA) from the FCC. Although this may soon change, US amateurs must be sure to have control of their HF transmitters when any device such as the DSP-2232 PACTOR/Packet MailDrop is in operation.

12.11 PACTOR Switching-Time Considerations

For operation in PACTOR ARQ, your transceiver or transmitter-receiver combination must be able to change between transmit and receive within 100 milliseconds. Most modern solid state radios can easily meet this specification. Many older tube-type radios that use electromechanical relays also operate very well in PACTOR ARQ.

If the changeover from transmit to receive is too long, the minimum working distance is 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. For this reason, you may be able to "Link with" stations across the country, but not across town.

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 the ADELAY command in the Command Summary to adjust the DSP-2232's PACTOR timing characteristics to compensate for this.

12.11.1 Suggested PACTOR Operating Settings

If you have trouble synchronizing with another PACTOR ARQ station, try some of the following operating tips before calling AEA or deciding that your radio equipment needs modifications:

- Try to work the distant station on the unproto mode to establish that the other station's system is fully functional.
- Don't use VOX control - use the PTT line from your interface.
- Turn off the AGC circuit - use the RF gain control to prevent receiver blocking on stronger signals.
- Turn off all compression or other audio processing.
- Keep the AFSK audio input level to the microphone circuit as low as possible - avoid over-driving the audio input stages.
- Disable the ALC circuit or reduce excessive ALC action; use more effective RF antenna loading to adjust output power levels.

12.11.2 Possible Areas for PACTOR Performance Improvement

If switching-time problems persist, you may have to make changes in the radio to eliminate excessive time delays:

- Remove large decoupling capacitors from the Push-To-Talk line to allow faster PTT (transmitter) activation;
- Improve power supply decoupling, especially in audio stages.
- Do not use the squelch control.

In case you can't solve your radio's switching-time problems, please call AEA's Customer Service Department (see the front of this manual).

This is the last page of Chapter 12 - PACTOR Operation