MFJ MULTI-MODE DATA CONTROLLER
With Multi-Gray Level Modem

MODEL MFJ-1278/MFJ-1278T
INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

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MFJ ENTERPRISES, INC.

Model MFJ-1278

Multi-Mode Data Controller
Revision 9

SYSTEM MANUAL

Third Edition
1990

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******* Important Notice: Please Read ******

This MFJ-1278 System Instruction Manual (Third Edition) is
for MFJ-1278 with Revision 9 and later mother board.

If you have the MFJ-1278 with Revision 8 or earlier mother
board and your MFJ-1278 has not been upgraded, please be
aware that some features and information mentioned in this
Instruction Manual may not apply to your MFJ-1278.

Pre-revision 9 MFJ-1278 owners may contact MFJ Enterprises,
Inc. for upgrade information. Some new features may not be
installable on certain board revisions.

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INTRODUCTION

Welcome to the exciting world of Amateur Digital
Communications. By choosing the MFJ-1278, you have chosen
the most versatile and powerful Multi-mode Data Controller
manufactured for the Amateur Radio Service.

The MFJ-1278 interfaces your radio with any personal
computer that has an RS-232 or TTL level Serial Port and a
terminal program. While most communications programs will
work, MFJ recommends the use of MFJ Starter Pack for those
who have IBM or compatible, Macintosh or Commodore C64/128
computers. With an IBM or compatible computer, the MFJXFER
terminal program gives you a new Packet Picture Transfer
mode that lets you transmit and receive EGA and CGA
pictures.

This compact versatile controller employs the **genuine** TAPR
TNC 2 AX.25 protocol packet firmware plus many added fea-
tures to receive and transmit VHF packet, HF packet, AMTOR,
CW, ASCII, RTTY, Facsimile, and SSTV. The new SSTV multi-
level board gives you the ability to receive and transmit
multi-gray level FAX and SSTV pictures. In addition, MFJ-
1278 lets you monitor the new and growing NAVTEX system.
MFJ-1278 also has a Contest Memory Keyer mode.

The MFJ-1278 also gives you the new Easy Mail Personal
Mailbox. This mailbox has soft-partitioned memory so
messages are not limited to a certain number of characters.

You also get MFJ's 20-segment, 10 Hz Precision Tuning
Indicator that makes tuning for HF Packet and other modes
that require precise tuning easy. This unique tuning
indicator also provides a uniform tuning method for all
modes of operation, so you don't have to remember different
tuning methods for different modes.

In addition, the advanced new DCD circuit in the MFJ-1278
has been optimized for HF packet. It can be adjusted to
ignore background noise while still being able to respond to
a valid data carrier. New "packet collision prevention"
features -- Prioritized Acknowledgments and Slottime are
installed. This new technology helps prevent many packet
collisions inherent in the current packet protocol.

A new IC socket type I/O Port lets you add peripherals such
as the new MFJ Picture Perfect Digitizer -- even if the
device is not designed specifically for your type computer.

You also get a Key Paddle jack so you can use your MFJ-1278 as an Iambic Keyer or Memory Keyer. Ten user-programmable memory buffers are provided for the contest memory keyer function. In addition you also get contest serial numbering and a random code generator.

A speaker jack lets you plug in a speaker and monitor transmit and receive audio and CW side tone as it is received and transmitted by your MFJ-1278. Speaker output also provides packet connect signal alarm.

A Centronics compatible parallel printer port (DB-25) lets you directly interface your printer to the MFJ-1278 for printing received text, Packet, FAX and SSTV pictures.

Dual Radio Ports for HF and VHF let you connect 2 radios at once in any combination. Independent transmit audio output adjustment is provided for each radio port.

You also get a Threshold control for optimizing your demodulator filter for different modes of operation.

The MFJ-1278T has a 2400 modem installed. If your MFJ-1278 does not have the 2400 modem installed, it can be purchased separately (MFJ-2400) and installed by the user. With the 2400 modem installed, your MFJ-1278 can operate 300, 1200 and 2400 packet. The only difference between the MFJ-1278 and the MFJ-1278T is that the MFJ-1278T has the 2400 modem installed.

Your MFJ-1278 package includes the following items:

1. One MFJ-1278 Multi-Mode Data Controller

2. One AC adapter Power Supply for 110V AC.

3. Two Radio Port cables with 5-pin DIN male connectors.

4. One 8-pin connector the TTL port.

5. One MFJ-1278 Instruction Manual.

6. One MFJ-1278 Fast-Start Manual.

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Bob Slomka, WD4MNT, whose software innovations establish the packet picture standard and make operation of every digital mode in the MFJ-1278 more powerful and easier than ever.

Also to countless unnamed others for their various contributions to the development of the MFJ-1278.

Finally, to you, the user, for putting another MFJ-1278 on the air and furthering the cause of digital communication in ham radio. Our greatest thanks go to you!

COMPUTER INTERFACING

You are now ready to attach your MFJ-1278 to your station computer or terminal. Throughout this manual we will use the term "computer" to refer to the computer or terminal you use to communicate with your MFJ-1278.

The MFJ-1278 communicates with your computer through a serial port using signals corresponding to a standard called RS-232C. Why an RS-232C interface? Nearly every computer in production today either incorporates an RS-232C style serial port as a standard feature, or has one available as an optional accessory, either from the computer manufacturer or from a manufacturer of computer accessories. In addition to the RS-232C port, the MFJ-1278 has a built-in TTL port to allow interfacing with computers which need TTL signals such as the Commodore C-64, C-128 or the VIC-20.

In order to use the MFJ-1278 with your computer, the computer must have an RS-232C serial port, or a TTL serial port and a program to support the serial or TTL port. The program will typically be called a modem, terminal emulator, or communications program.

Since there are so many computers on the market today, it is impractical for this chapter to provide detailed instructions for each computer. Detailed information is given for some of the popular models available in the United States. Also provided is general computer interfacing information.

MFJ Starter Packs

MFJ Enterprises, Inc. offers a Starter Pack for some of the most popular computers. These Starter Packs contain a terminal program and a cable for connecting the MFJ-1278 to your computer. The Starter Packs available are as follows:

MFJ-1282: Commodore VIC-20, C64, C128 in 5-1/4" diskette.

MFJ-1283: Commodore VIC-20, C64 in tape.

MFJ-1284: IBM PC/XT/AT & clones in 5-1/4" diskette.

MFJ-1284M: IBM PC/XT/AT & clones in 3-1/2" diskette.

MFJ-1287: Apple Macintosh, in 3-1/2" diskette.

Computer Interface with MFJ Starter Pack

If you are using one of the MFJ Starter Pack, you should use the cable provided to connect the MFJ-1278 and your computer. Follow the instruction manual provided with the Starter Pack to operate the terminal program and to connect the MFJ-1278 to your computer. After connecting the MFJ-1278 to your computer you can then proceed to the "Computer Baud Rate" section in this chapter to continue installing the MFJ-1278.

Computer Interface without MFJ Starter Pack

If you are not using one of the MFJ Starter Packs then you should follow the following instruction in this chapter for computer interfacing.

Serial Port Signals

The serial port connector on your MFJ-1278 is on the rear panel and is marked "SERIAL." There are several signals available at this connector. You won't need all of them for standard normal operation. For some special applications, such as binary file transfer or some Bulletin Board operations, you may want to use more of them. In that case, see MFJ-1278 Serial Port Pin Functions in this chapter.

The pins on the serial port connector of the MFJ-1278 that must be connected are shown in Table 2-1. Note that the MFJ-1278 connects to a computer exactly as if the MFJ-1278

were a standard RS-232C modem.   If you have successfully
used your computer with a telephone modem, hook it up to the
MFJ-1278 in the same way.   Use whatever program you
ordinarily use to communicate with the modem.

   Table 2-1. Serial port signals required by MFJ-1278.

   Pin   Signal Name   Description

   2   Transmit Data   Serial   data   _from_   your
                                 computer _to_ the MFJ-1278.
   3   Receive Data   Serial data _from_ the MFJ-1278
                                 _to_ your computer.
   7   Signal Ground   The common ground for both
                                 data lines.

If your computer is listed in Table 2-2, refer to the speci-
fic information in the following sections to connect your
MFJ-1278 to your computer.

              Table 2-2. Computers with specific serial
                       interfacing instructions.

        Manufacturer   Model

        Apple   Macintosh (tm)
                                Apple II,II+,IIe,II-gs(tm)
        Commodore   VIC-20 (tm)
                                C-64 (tm)
                                C-128 (tm)
        IBM   PCjr, PC-XT, PC-AT (tm)
                                most compatibles and clones
        Radio Shack   Color Computer (tm)
                                1000, 1000HD, 1000EX, 1000SX,
                                1200, 2000, 3000HL, 3000
                                Model 100/102
        NEC   8201

Many computers require a serial port adapter card.   These
cards incorporate the circuitry necessary to add an RS-232C
port to the computer.   Some popular models in this category
are the Apple II series, the IBM Personal Computer, many
Radio Shack computers, and the Sanyo MBC-55X series. If you
have one of these computers with an "add-in" serial port, or
if you have another computer we haven't mentioned, you
should skip to one of the sections on "other computers." If
your computer has a 25-pin RS-232C serial port, refer to the
section on _Other Computers with 25-pin RS-232C Ports_.
Otherwise refer to the section _Other Computers with Nonstan-
dard Serial Ports_.

Some computers have no serial port and no adapter is commer-
cially available.   Such computers are not suitable for use
with the MFJ-1278.

Computer with Specific Serial Interfaces

Apple Macintosh

The Macintosh serial port is an RS-422 compatible port, but
it will work fine with the RS-232C serial port on your MFJ-
1278.

MFJ Enterprises, Inc. offers an optional Starter Pack for
the Macintosh. It can be purchased from MFJ Enterprises,
Inc. or any MFJ dealer. The Starter Pack includes an
interface cable for connecting the MFJ-1278 to the Macintosh
and a terminal program. The Starter Pack for Macintosh is
MFJ-1287. If you wish to use your own cable, you will need
a cable wired as shown in Fig. 2-1.

Macintosh 8 pin	MFJ-1278 DB-25P		Macintosh DB-9P	MFJ-1278 DB-25P
1 (HSKO) -------- 4			1 --------- 1	
2 (HSKI) -------- 6			5 --------- 2	
3 (TXD-) -------- 2			9 --------- 3	
4 (GND) -------- 7			3 --------- 7	
5 (RXD-) -------- 3			7 --------- 8	
6 (TXD+) -------- N/C			6 --------- 4	
7 (GPi) -------- N/C				

Fig. 2-1. Serial port wiring for Apple Macintosh.

Note that pin 1 of the DP-9P connector is not connected
inside the Macintosh or the MFJ-1278. If you use a shielded
serial cable, which we recommend, connect both pin 1s to the
shield and connect pin 1 of the MFJ-1278 serial connector to
digital ground on the MFJ-1278 circuit board.   A printed
circuit board pad is provided for this purpose near pin 1 of
the serial connector.

Commodore C64, C128 and VIC-20

The MFJ-1278 has a built-in TTL-level port for interfacing
with the Commodore C64, C128 or the VIC-20 computers.   You
do not need a RS-232C converter to interface with the MFJ-
1278.

An optional Starter Pack for the C-64, C-128 or the VIC-20
can be purchased from MFJ Enterprises, Inc. or from any

MFJ   dealer.   The Starter Pack includes an interface cable
from   the   MFJ-1278   TTL port to the user I/O port   on   the
Commodore   computer.   A terminal program is also included.
To order,   specify MFJ-1282 for software on disk or MFJ-1283
for software on tape.

If you wish to construct your own cable, the information is
as follows:

MFJ-1278 J-5,Pin#	Mnemonic	Name	C-64/128*, VIC-20 Pin#
1	RXD	Receive Data	B,C
2	DCD	Data Carrier Detected	H
3	GND	Ground (Frame and Signal)	N
4	RTS	Ready To Send	E**
5	TXD	Transmit Data	M
6	DSR	Data Set Ready	L
7	CTS	Clear to Send	K

  *C-128 is used in the C-64 mode for these connections.
  **Pin E is not needed when using terminal program
referred   to in this chapter for the Commodore computers.

Fig. 2-2A TTL port wiring for VIC-20, C64 and C128

The pin connections for the TTL port (J-5) are numbered from
left to right as you look at the back of the MFJ-1278.   All
of these connections are not necessarily used by your
terminal program.   The MFJ-1278 needs RXD, TXD and GND
connected. Programs which utilize file transfer and printer
routines will probably use RTS and CTS as well.   Consult
your software documentation.

IBM PCjr

The PCjr uses standard RS-232C voltage levels for its serial
interface; however, the connector used is non-standard and
not readily available from electronic supply dealers.   Pin-
out information for this connector is given in the IBM PCjr
Technical Reference Manual.

IBM dealers sell the "IBM PCjr Adapter Cable for Serial
Devices" for converting the connector on PCjr to a standard
RS-232C terminal connector.   This cable attaches directly
between the MFJ-1278 and the PCjr.   It is only about 3
inches long, however, so you may want to obtain a male-to-
female RS-232C extension cable, which should be readily
available.

Radio Shack Color Computer

The Color Computer series (except for the Micro Color Computer) uses a 4-pin DIN-style connector for its serial interface. Wire a cable as shown in Fig. 2-2 to interface your MFJ-1278 to a Color Computer. All necessary parts should be available from Radio Shack dealers.

                    Color Computer   DB-25P

                    4 ------------------ 2
                    2 ------------------ 3
                    3 ------------------ 7
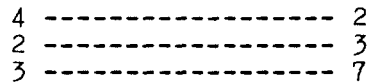
             Fig. 2-2. Serial port wiring for Radio Shack
                         Color Computers.

Radio Shack Model 100/102 and NEC 8201

These computers have built-in standard RS-232C serial ports that are compatible with the MFJ-1278. You will need a standard male-to-male RS-232C extension cable to connect the computer to the MFJ-1278.

IBM PC/XT/AT and compatibles Computer
"Include other computers with 25-pin RS-232 Ports"

If your computer is a IBM PC/XT/AT or a compatible or clone, you should have a serial port with standard DB-25 pin connector. You may used a standard IBM PC/XT/AT **serial modem cable** with the correct gender on each end of the cable.

MFJ Enterprises, Inc. offers optional Starter Pack (MFJ-1284) for the IBM PC/XT/AT or compatible computers. The Starter Pack is supplied with the computer connecting cable for connecting your MFJ-1278.

For other computers with a 25-pin RS-232C port, you should consult your computer manual or accessory manual to see which pins it uses to send and receive data on, as well as which pin is used for signal common. Follow the computer manufacturer's recommendations for connecting the serial port to a modem. You may also find the technical information in this section useful.

Your MFJ-1278 is configured as Data Communications Equipment (DCE), the technical term for an RS-232C modem. Most computers are configured as Data Terminal Equipment (DTE). If this is the case for your computer, you will probably be able to simply wire pin 2 of the MFJ-1278 connector to pin 2

of your computer's RS-232C port, pin 3 to pin 3 and pin 7 to
pin 7. You can provide these connections with a standard 3-
wire male-to-female or male-to-male RS-232C extension cable,
depending on whether your computer has a DB25S or DB25P
connector.

If your computer is configured as DCE, you will have to wire
pin 2 of your MFJ-1278 to pin 3 of the computer connector,
and pin 2 of the computer connector to pin 3 of your MFJ-
1278. Pin 7 of the computer connector will still connect to
pin 7 of your MFJ-1278 serial port. Some computers may
require that pin 5 of the computer serial port connector be
connected to an appropriate signal. Others may require
connections for pin 8 and pin 20. You can use the
computer's output signals on pins 4 and 6 as shown in Fig.
2-3.


```
        MFJ-1278 RS-232c        Computer


              2 -------------- 2
              3 ------------- 3
              7 ------------- 7
                         |---- 4
                         |---- 5
                      |--------- 6
                      |--------- 8
                      |--------- 4
```
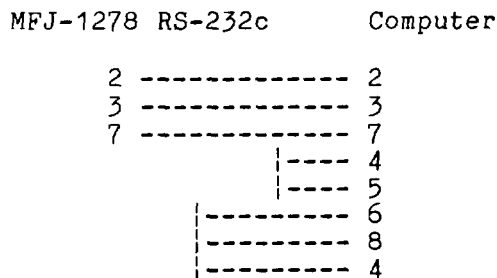
Fig. 2-3. Serial port wiring with jumpers for
auxiliary signals.

Other Computers with Nonstandard Serial Ports

Computers with nonstandard serial ports must meet the fol-
lowing conditions.

First, the signal levels should be RS-232C compatible. The
MFJ-1278 requires that the voltage levels sent from the
computer be greater than about +3 volts in one state and
less than about +1 volt in the other state.

Second, the polarity of the signals must conform to the RS-
232C standard. This means that the low voltage state must
correspond to a logical "1" and the high voltage state to a
logical "0".

Third, the computer must be able to correctly receive a
signal which meets the RS-232C specification. The MFJ-1278
supplies signals that meet this specification.

Make or buy a cable that provides the following connections. The computer serial port common pin must be tied to the MFJ-1278 serial port connector pin 7.   The data line that sends data _from_ the computer must be tied to the MFJ-1278 connector pin 2.   The pin on which your computer _receives_ data on must be tied to the MFJ-1278 connector pin 3.

If your computer requires any other signals, you must arrange to provide them. The documentation provided with your computer or its accessory serial port should clarify any special requirements of your port.

Terminal Software Requirements

Any software package that enables your computer to act as an ASCII terminal with an ordinary telephone modem should work with your MFJ-1278.   If you have a program that you have used successfully with a telephone modem and that you are familiar with, use that program to communicate with your MFJ-1278.

If you are using a terminal program provided by the MFJ Starter Pack, proceed to the "Computer Baud Rate" section in this chapter. Follow the instruction provided by the program.

If you are not using a MFJ terminal program, then proceed with the instruction for your type of computer.

Note: Some terminal programs (such as the Apple II+ Super Serial Card) requires DCD to be asserted before they receive any characters.   If this is the case, place a jumper across pin 1 and 2 of JMP 1.   The DCD LED on the front panel will function normally indicating received packets.

Apple Macintosh

MFJ Starter Pack for the Macintosh (MFJ-1287) includes a terminal program and a cable to connect the MFJ-1278 to the Macintosh.   If you should want to use a terminal program such as MacTerm set the options according to Table 2-3.

Table 2-3. MacTerm option settings for operation
with MFJ-1278

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

Apple II, II+, IIe, IIc

For the Apple II family of computers with Apple or third-
party serial interface cards, you may use ASCII Express
Pro, Hayes Smartcom IIe and DataCapture 4.0 for the MFJ-
1278. There are others which may be compatible with the
MFJ-1278, but have not been tested.

Commodore C64, C128 and VIC-20

The optional Starter Pack for the C-64, C-128 and VIC-20 can
be purchased from MFJ Enterprises, Inc. or from any MFJ
dealer. Starter Pack includes an interface cable from the
MFJ-1278 TTL port to the user I/O port on the commodore
computer. A terminal program is also included. To order,
specify MFJ-1282 for software on disk or MFJ-1283 for
software on tape.

If you do not have the MFJ Starter Pack then you may use the
BASIC communications program is given in the Programmer's
Reference Guide published by Commodore. Use the program
listing for "true ASCII," as these computers use a modified
ASCII format internally. You will probably want to run your
MFJ-1278 at 300 baud on the serial port with these
computers.

NOTE: When using the above program, you must first use the
"COMMODORE" key to shift to lower case before using this
program. Also line 200 should read For J=0 to
64:T%(J)=J:NEXT.

When making the connecting cable from TTL port of the MFJ-
1278 to the I/O port of the Commodore computer you may use
the wiring information given on page 2-3 in this chapter.
However, do not use pin E connection for this program.

IBM PCjr

The IBM PCjr has a built-in terminal program in the BASIC cartridge.   Start this program by typing **TERM**.   Refer to your PCjr BASIC manual for details on this program.   For best results with PCjr, do not run the MFJ-1278 serial port faster than 1200 baud.

IBM PC/XT/AT and Compatibles

The optional Starter Pack (MFJ-1284) for the IBM PC/XT/AT, the compatibles and clones can be purchased from MFJ Enter-prises, Inc. or from any MFJ dealer.   This Starter Pack includes a graphics terminal program, and a connecting cable for connecting the MFJ-1278 to your computer.   MFJ-1284 program allows you to receive FAX or SSTV pictures and display on the screen.   It will also store the pictures on disk for later viewing.   You may also print any pictures stored on disk to an EPSON or IBM graphics compatible printers.

You may also use many commercial, "shareware" and public-domain terminal programs for the IBM PC/XT/AT, compatible and clone computers.   Special program written for packet radio and packet bulletin board service can also be used with the MFJ-1278.   Note that these type of programs will not support printing of graphics to the computer screen.

Radio Shack Color Computer

There are several terminal programs available for the Color Computer.   You will probably want to use a commercial pro-gram (rather than writing your own) since the Color Computer has a "software UART" that is difficult to program in BASIC.

Some of the terminal programs available are COLORCOM 64, AUTOTERM and RICKEYTERM (for Coco III).   Others are WIZ and XTERM for OS-9.

Radio Shack Model 100/102 and NEC 8201

These computers have built-in terminal programs in ROM. Consult your computer's documentation for instructions in their use.

MFJ-1278 Serial Port Pin Functions

This section describes the pins used on the MFJ-1278   RS-232C serial port connector.   It is intended for users   with special   applications requiring hardware handshaking.   This information should not be needed by most users.

Table 2-4. RS-232C Pin Designations

Pin #	Mnemonic	Name
1	FG	Frame Ground
2	TXD	Transmit Data
3	RXD	Receive Data
4	RTS	Request To Send
5	CTS	Clear To Send
6	DSR	Data Set Ready
7	SG	Signal Ground
8	DCD	Data Carrier Detect
9	---	+ 12V unregulated reference
10	---	- 12V unregulated reference

Frame Ground is provided for attachment to the chassis of the   MFJ-1278 and the chassis of the attached device (computer or terminal).   This pin is brought out to a feedthrough on the MFJ-1278 PC board near pin 1 of the serial connector. It is not electrically connected anywhere else on the MFJ-1278 circuit board.
Transmit Data is an <u>input</u> line to the MFJ-1278 on which the attached device sends data.

Receive Data is an <u>output</u> line from the MFJ-1278 on which the attached device receives data.

Request To Send is an <u>input</u> line to the MFJ-1278 which the attached device requesting clearance to transmit.

Clear To Send is an <u>output</u> from the MFJ-1278 signaling the attached device to send or refrain from sending data to the MFJ-1278. This line is used for hardware flow control.

Data Set Ready is an <u>output</u> from the MFJ-1278 telling the attached device that the MFJ-1278 is operational.

Signal Ground is the common, or return, path for all signals between the MFJ-1278 and the attached device.

Data Carrier Detect is an output from the MFJ-1278.   As
normally configured, DCD reflects the status of the CON LED:
It is true when an AX.25 connection exists between your MFJ-
1278 and another station; it is false when no connection
exists. This configuration is useful when the MFJ-1278 is
used with a telephone style Bulletin Board system, since the
AX.25 connection, analogous to a modem signal on the
telephone, indicates the presence of a user. Shorting pin 1
and 2 of JMP1 on the MFJ-1278 board will cause this output
to always be true.

Computer Baud Rate

Autobaud

The **AUTOBAUD** command routine installed in the MFJ-1278 is
executed upon each power on of the MFJ-1278.   **AUTOBAUD**
command is user selectable.   AUTOBAUD is defaulted to ON.
When AUTOBAUD is ON, MFJ-1278 will attempt to synchronize
with the user's terminal baud rate. Upon power on MFJ-1278
will wait until it detects a carriage return from the
keyboard. User should repeatedly strike the carriage return
key on initial power up until the MFJ-1278 recognizes and
sets its baud rate to match the terminal baud rate of your
computer before signing on.

Once the MFJ-1278 has signed on, user may set **AUTOBAUD** OFF.
If AUTOBAUD is set to OFF, MFJ-1278 will store the terminal
baud rate which it signed on to last, so MFJ-1278 will sign
on without you having to strike the return key.   In setting
AUTOBAUD to OFF, you should remember that if the terminal
baud rate is changed, then MFJ-1278 will no longer be able
to match the new baud rate.   You must change the baud rate
of your terminal program to match the baud rate you set for
the MFJ-1278 or you may remove JMP 5 on the MFJ-1278 board
to reset the battery back-up RAM.   Once reset, the MFJ-1278
will restore all parameters to the default values. AUTOBAUD
will also be reset to ON. When MFJ-1278 is powered on after
reset, it will attempt to match the new baud rate and sign
on after receiving the striking of the return key by the
user.

Changing Terminal Baud Rate

After the MFJ-1278 is signed on, you can change the MFJ-1278
terminal baud rate by using the SET MENU. To do this, type:
SET, upon display of the CMD: command prompt. MFJ-1278 will
display the SET MENU. A baud rate of 300, 1200, 2400, 4800
or 9600 can be selected from the SET menu.

If you change the terminal baud rate of the MFJ-1278, you

must also set the terminal program baud rate to match the
MFJ-1278 baud rate. Otherwise, upon each sign-on thru the
AUTOBAUD routine,   the MFJ-1278 will change its terminal
baud rate back to whatever the terminal baud rate is set to
on your terminal program. We suggest that once you select a
terminal baud rate which you wish to operate your MFJ-1278
on, you should set AUTOBAUD command to OFF. Once AUTOBAUD
is turned OFF, the MFJ-1278 will automatically sign-on
without you having to press the "Return" key.   This is
important if power outage occurs, the MFJ-1278 will sign-on
when power is on again. One important thing to remember is
that if the AUTOBAUD is OFF. And terminal program baud
rate does not match the MFJ-1278 computer baud rate,   then
once the MFJ-1278 is turned off, it will not sign on again
until you reset the MFJ-1278 or the terminal program baud
rate. Once reset, the MFJ-1278 will default AUTOBAUD to ON
and it will sign on upon power up and with a few strikes of
the return key. The MFJ-1278 can be reset by removing JMP 5
on the main PC board of the MFJ-1278.

Verifying Serial Port Operation

Now that you have a terminal program and the hook-up cable
for connecting the MFJ-1278 to your computer, you are ready
to verify that MFJ-1278 will communicate with your computer.

1.   Turn on your computer.   Load and run the terminal
program.

2.   Set the parameter of the terminal program as follow:

     o word length: 8 bits
     o duplex: full
     o parity: none
     o stop bit: 1
     o baud rate: 300, 1200, 2400, 4800 or 9600

3.   Turn on your MFJ-1278. Note that PWR, STA and CON LEDs
will be lit.

4. If the MFJ-1278 terminal parameters match your terminal
program parameter, the MFJ-1278 will sign on and the STA and
CON LEDs will extinguish. If not, you will see an asterik
(*) or other meaningless characters on the screen at this
time.   This is because the MFJ-1278 has not been set to
match the parameter of your terminal program. You will need
to execute the AUTOBAUD routine.

5. Execute the **AUTOBAUD** routine by pressing the **RETURN** key few times in succession on your computer. The MFJ-1278 will execute the AUTOBAUD routine and set itself to the terminal program parameter. Your computer screen will display the sign-on message:


```
*:J
bbRAM:LOAD WITH DEFAULTS
  |A
MFJ ENTERPRISES, INC.
MODEL MFJ-1278
AX.25 LEVEL 2 VERSION 2.0
RELEASE XXXXX  (date) - 32K RAM
CHECKSUM  XXX
cmd:
```


After sign-on the **STA** and **CON** on the MFJ-1278 will extinguish.

If the sign-on message fails to appear, you should check the connecting cable between and the computer and the MFJ-1278.

When you have successfully read the sign-on message from the MFJ-1278, type:

   DISPLAY

followed by a carriage return. You should see a lengthy list of items on your screen. This verifies the ability of the MFJ-1278 to accept and respond to input from your computer. Your serial interface is now working.

Printer Port Connection

The parallel printer port is located on the left side of the MFJ-1278. The printer port is configured for a Centronics compatible parallel port. A cable with male DB-25 on one end and a 36 pin Centronics male connector for the printer end should be used. You may use a standard IBM parallel printer cable instead of trying to wire your own. A Printer cable for connection from the MFJ-1278 printer port to a Centronics compatible printer is available from MFJ Enterprises, Inc. Model No. is MFJ-12.

If you are using a terminal program which supports graphic printing from the computer to the printer, then you should connect the printer to the computer printer port and not to

the MFJ-1278 printer port.

If your terminal program does not support graphic printing to the computer screen and you want to print graphic: Packet, SSTV or FAX pictures, then you should connect the printer to the MFJ-1278 printer port. In this case the printer must be either EPSON or IBM graphic compatible in order to insure successful graphic receiving to the printer.

Table 2-5   Parallel Printer Port Pin Functions

MFJ-1278 DB-25 Printer Port Pin #	Name
1	Strobe
2	Data Bit 1
3	Data Bit 2
4	Date Bit 3
5	Data Bit 4
6	Data Bit 5
7	Data Bit 6
8	Data Bit 7
9	Data Bit 8
10	Acknowledge
11	Busy
12 thru 17	No connection
18 thru 25	Ground

Printer Consideration

The MFJ-1278 printer port will work with any printer that is compatible with EPSON, IBM graphics. Printers which are not EPSON or IBM graphics compatible may not be used to print FAX or SSTV pictures. The following are some of the EPSON or IBM graphics compatible printers which will allow the MFJ-1278 to print FAX and SSTV pictures.

    o Canon PW-1156A
    o Citizen MPS-25
    o Epson FX-80, FX-85, LQ-800, MXIII, RX-80, FX-86e
    o Printer Plus NLQ
    o Seikosha 1000A, 1200AI
    o Star Micronics- Gemeni 10X, NX-10, NX-1000
    o other printer: C. Itoh 8510P/NEC 8023A and compatible

If your printer is EPSON or IBM graphics compatible and is not listed, you may just try it to see if it will work. Some printers have both EPSON and IBM graphics mode. If your

printer has both EPSON and IBM graphics mode, you should try
both modes to see which mode give you the best results.

In addition to being able to print weather FAX, FAX and SSTV
pictures, the printer connected to the MFJ-1278 printer port
can also print incoming text in all modes as it is received
on the screen.   This means that you can keep a log of all
your QSOs.   To   print   text to the printer,   you will
need   to connect an IBM compatible parallel printer   to
the   MFJ-1278 printer   port.   Printers without Epson
compatible   graphics will not be able to print Weather FAX,
FAX or SSTV.

Printer Port Test

After properly connecting your printer to the MFJ-1278, you
may verify its compatibility as follows:

1.   Turn on your computer. Load and run the terminal prog-
      ram.

2.   Turn on the MFJ-1278. The MFJ-1278 should sign-on with
      the cmd: prompt sign.

3.   Type: PRINTTES <CR>

      If   the   printer   is connected   correctly   and   is
      compatible,   it   will   print   a string of   223
      characters.   Again this only shows that the printer
      connected can print text.   It does not   necessarily
      indicate   that your printer   can   print graphics
      unless it is Epson or IBM graphics compatible.

4.   If   the   printer   is connected   correctly   and   is
      compatible,   then   it   should   print a string of 223
      characters. Printing will start with   ASCII SPACE
      (value 32 decimal) and end with the value 255 decimal
      which is not an ASCII character but may be a graphics
      character.

5.   Once the printer has completed the printing, the MFJ-
      1278 will return to cmd: prompt sign.

This completes the printer test.   If the printer test was
satisfactory,   proceed to connect your radios to the MFJ-
1278.

The above test is only valid if your printer is connected to
the MFJ-1278 parallel port.   This test can not be performed
if the printer is connected to the computer.

RADIO INTERFACING

Computer interfacing, covered in the previous chapter, is
only half the interfacing task.   The other half is connect-
ing your MFJ-1278 to your radios.

MFJ-1278 Radio Ports

Interfacing the MFJ-1278 to your radios involves connecting
the following signals at Radio Port 1 and Radio Port 2. The
pin outs of Radio Port 1 and Radio Port 2 are shown in Fig.
3-1.

Pin 1   Microphone audio, from the MFJ-1278 to your
.   transmitter.

Pin 2   Ground, audio and PTT common.

Pin 3   Push-to-talk, to allow the MFJ-1278 to key your
         transmitter.

Pin 4   Receive audio, from your receiver to the MFJ-
         1278.

Pin 5   Squelch input (optional) to allow the MFJ-1278
         to detect activity on a shared-mode channel.
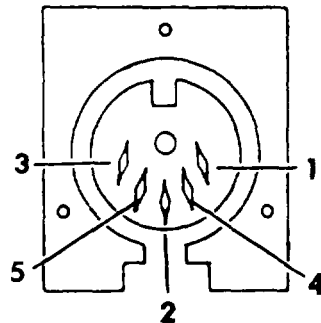
Fig.3-1 Radio Port 1 and Radio Port 2 Connector

This chapter describes how to connect these signals between your MFJ-1278 and your radio and how to adjust the receive and transmit audio levels appropriately. The inter-connection should be planned so as to minimize pickup of stray audio and RF noise by the lines. If possible, you should set up your station with monitor speaker and be able to operate on voice without disconnecting the MFJ-1278.

Radio Ports Connection

The two radio ports on the MFJ-1278 allow both an FM radio and as HF radio to be connected at all times. You can also connect two HF radios or two VHF radios to the radio ports. Pin designation for Radio port 1 and Radio port 2 are the same. See Fig. 3-1. Switching of the radio ports on the MFJ-1278 is done by using the RADio command. We will discuss radio port switching in the next chapter.

Use Fig. 3-2 to wire a microphone connector (not provided) to the 5 pin DIN cable provided. You will need to wire two radio cables if two radios are to be hooked up to the MFJ-1278.

You may obtain the specific microphone connector pin designation for your radio from the your radio's manual. Appendix A at the end of this Instruction Manual lists pin assignments for some of the most popular radios. The accuracy of this information is not guaranteed. You should verify this information with your radio manual.

1-MIC. AUDIO
2-GND
3-PTT
4-REC. AUDIO
5-SQUELCH INPUT

TO RADIO

5 PIN DIN
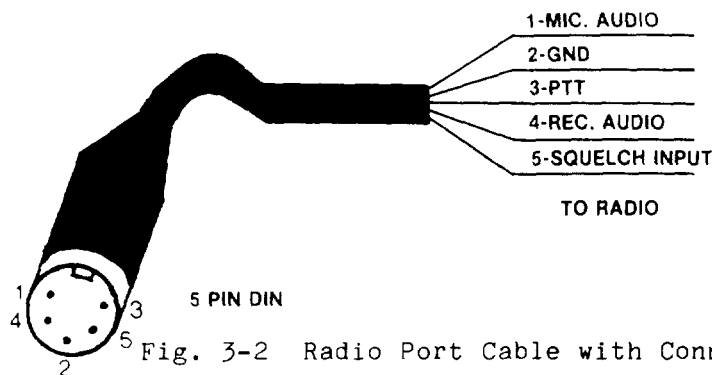
Fig. 3-2 Radio Port Cable with Connector

Two 5-pin male DIN connector cables are provided with the MFJ-1278 for wiring to the microphone connector for your radio.

CHECK THIS CABLE WITH AN OHM METER TO IDENTIFY EACH WIRE BEFORE WIRING IT TO THE MIC CONNECTOR THAT FITS YOUR RADIOS.

Handheld Radio Connection

Some HTs key the transmitter by drawing a small amount of
current from the microphone input pin (see Fig. 3-3 below).
Radios with this type of special keying circuit are ICOM-2AT
(tm) and Yaesu FT-x09, FT-x3, FT-727 (tm) and others.

Appendix A at the end of this instruction manual provided
pin designation for some of the radios. Also consult the
instruction manual of your radio.

If your HT has this type of microphone input, you can wire
the microphone like the one shown in Fig. 3-3 or you can
remove the cover of the MFJ-1278 and install a shorting
jumper at JMP L for Radio Port 1 or JMP K for Radio Port 2.
Installing JMP K or JMP L will eliminating the need of
soldering "Cx" and "Rx" to the microphone cable. "Cx" and
Rx" are installed on the MFJ-1278 mother board. Fig. 3-4
shows the location of JMP L and JMP K connectors. On the
MFJ-1278 mother board, the "Rx" resistor for Radio Port 1 is
R140 and the "Rx" resistor for Radio Port 2 is R107. If you
find the your radio still would not key properly after
installing JMP L or JMP K, it may be necessary for you to
change the value of R140 or R107 to a smaller value.

Be sure to remove JMP K or JMP L when connecting the MFJ-
1278 to another type of radio.
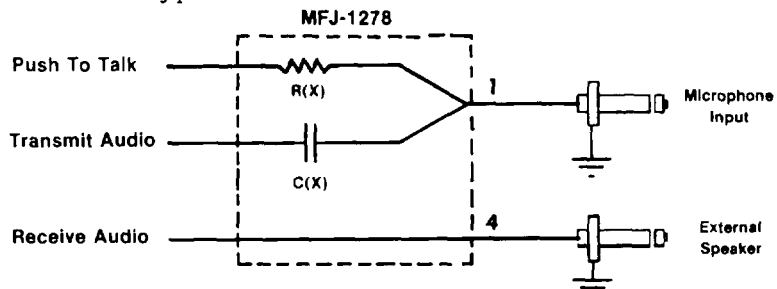
FIG. 3-3   HT Special Keying Circuit
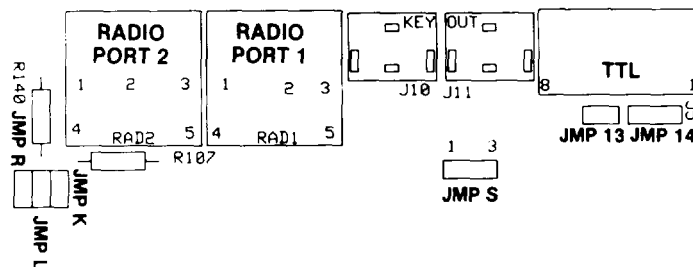
FIG. 3-4   MFJ-1278 JMP L and JMP K Location

RADIO INTERFACING METHODS

The MFJ-1278 was designed to allow hook-up without any
modifications to the radio or any signal level balancing
devices in the cables. Two interfacing methods are
presented.

Method 1: Direct Connection to Microphone and Speaker

For Method 1, shown in Fig. 3-5, the MFJ-1278's audio will
be fed directly into the microphone connector or similarly
connected auxiliary jack, and the output of the MFJ-1278
will be adjusted to give a proper modulation level. The
receiver audio will be taken from an earphone plug or
speaker jack and fed directly to the MFJ-1278. A monitor
speaker can be connected to the SPEAKER jack of the MFJ-
1278. This allows you to monitor the channel.
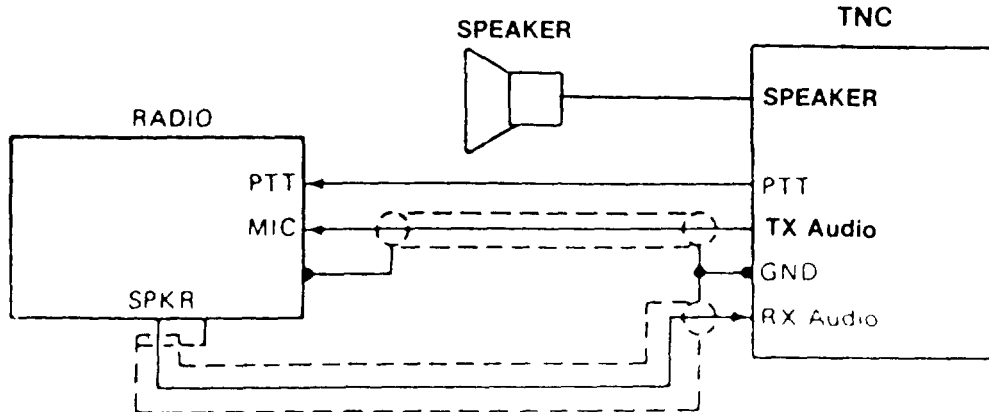
Fig. 3-5   Method One Interconnect.

The transmit audio levels for both radio ports are factory
pre-set at 250 mV p-p to be compatible with the mic input of
most radios. However, if the transmit audio is too low
or distorted, adjustment may be needed. Use the following
procedure to calibrate:

Chapter 3 Page 4

Transmit Audio Level Adjustment for Method I Interface

1.   Connect your MFJ-1278 and radio as shown in Fig. 3-5.
      Turn on the MFJ-1278 and computer and start your
      terminal program.   Connect the radio to a dummy load
      and listen to the transmission with another nearby
      radio.

2.   Enter the modem calibration procedure by typing

          CALIBRA

      and a carriage return.   Press the K key on your key-
      board to key the transmitter, then tap the space bar
      until the higher of the two tones is heard.   Pressing
      the K key again will unkey the transmitter.   After the
      transmitter has been keyed for a few seconds, it will
      be shut off automatically by the transmit watch-dog
      circuit.   As you perform the adjustments below, you
      will have to periodically unkey then re-key the trans-
      mitter by typing the K key.   If you wish to defeat the
      watch-dog timer, install a shorting jumper at JMP4.

3.   With   the   MFJ-1278   keying the   transmitter   and
      transmitting the higher of the two tones, adjust the
      transmit audio level as follows.   With a small
      screwdriver, adjust trimpot (R157 for radio 1 or R158
      for radio 2) while you listen to the monitoring receiv-
      er.   Turn the adjustment on the trimpot clockwise (CW)
      until no increase in output level is heard at the
      monitoring receiver.

4.   Rotate the adjustment on the trimpot counter-clockwise
      until the audio signal on the monitoring receiver is
      reduced by half of the maximum level.   This can be
      estimated by ear or accurately by measuring the output
      voltage at the transmitting audio pin of the radio port
      with an oscilloscope or A.C. voltmeter.

5.   Press the K key to return to receive mode and type Q to
      exit the calibration routine.   Be sure to remove JMP4
      if you placed it to defeat the watch-dog timer.   You
      have now set your transmitter deviation to approxi-
      mately the correct level.

If you notice a significant hum level in the monitored audio
in Step 3, take measures to remove it.   This may require
shielded wire (recommended in any event) in your microphone
audio circuit. If your transmitter has an adjustable micro-
phone gain control, try reducing the sensitivity of the
transmitter microphone circuit and increasing the signal
level from the MFJ-1278 to minimize hum or other noise
problems.

Setting the Receiver Audio Input Level

The modem in your MFJ-1278 is equipped with an advanced
phase coherence type data carrier detector (DCD) with
threshold control and a sensitive tuning indicator. These
can be used in combination to set the correct receive audio
level for the modem and to optimize the DCD characteristics
for the various methods of operation.

With your radio in the receive mode, open the squelch
control so that a steady hiss is heard on a speaker. Set
the volume control to the minimum volume position. The
tuning indicator on the MFJ-1278 should drift off to one
side of the display and become stationary. It may drift
enough to disappear off the end of the display. Slowly
advance the audio output level with the volume control until
the tuning indicator "springs to life" and dances around a
point near the middle of the display. This is the absolute
minimum audio level for marginal copy. Continue to advance
the volume control until there is approximately twice as
much audio present at the receiver output. This can be
estimated by ear or measured with an oscilloscope or A.C.
voltmeter. This will be near the correct amount of audio
for NBFM operation. Levels higher than this will not
degrade the modem performance as long as the receiver audio
amplifier is capable of producing the chosen output level
without distortion (clipping).

While still listening to unsquelched receiver noise, rotate
the DCD threshold control on the front panel of your MFJ-
1278 clockwise until the DCD LED just flickers with false
data carrier indications. This control should be set to
produce approximately a 10% duty cycle of false DCD activity
when receiving unsquelched NBFM receiver noise.

The modem sensitivity to false DCD will be affected by the
bandwidth of the audio coming out of the receiver. some
receivers produce wideband audio which will NOT produce any
false DCD activity regardless of the threshold control
setting. In this case, set the DCD threshold control to its
maximum clockwise rotation. Modem performance will not be
affected.

Method 2: Accessory Jack or Interface Box Connection

If your radio has an accessory jack with PTT, transmit audio, and receive audio signals, the interface can be done through this jack (shown in Fig. 3-6).

RADIO   TNC

Accessory   J2
Jack

MIC   R(s)   Mic Audio
Input

RCVR   RX Audio

PTT SW   PTT

                       GROUND
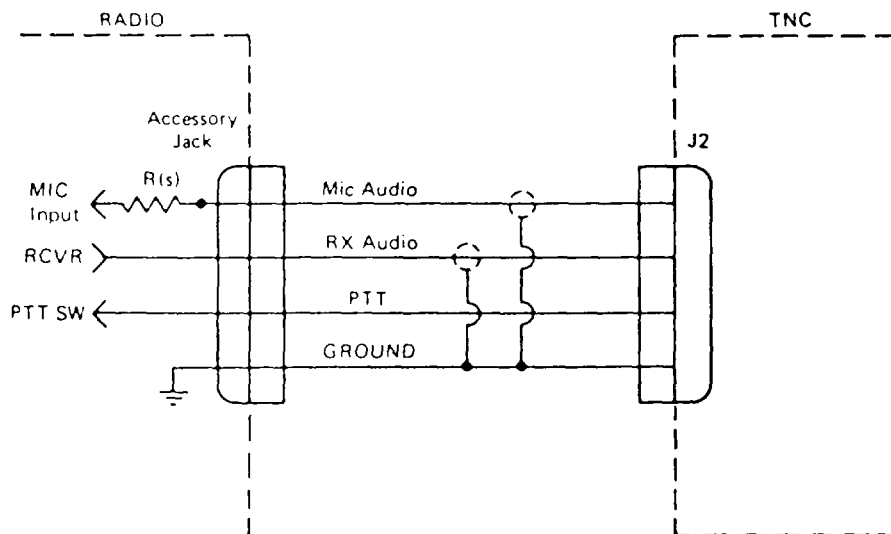
Fig. 3-6   Accessory Jack Interface.

If your radio does not have an accessory jack and you don't wish to add a connector to your radio, you may construct a separate external interface box. This box will permit simultaneous connection of your MFJ-1278 and a microphone. A schematic of an external interface box is shown in Fig. 3-7.

An interface box similar to the one shown in Fig. 3-7 is available from MFJ Enterprises, Inc. Model No. is MFJ-1272.

Regardless of whether you use an accessory jack or an external interface box, you should use shielded wire for all signal-carrying leads. The connector types and pinouts will be determined by the connector jacks on your radio.
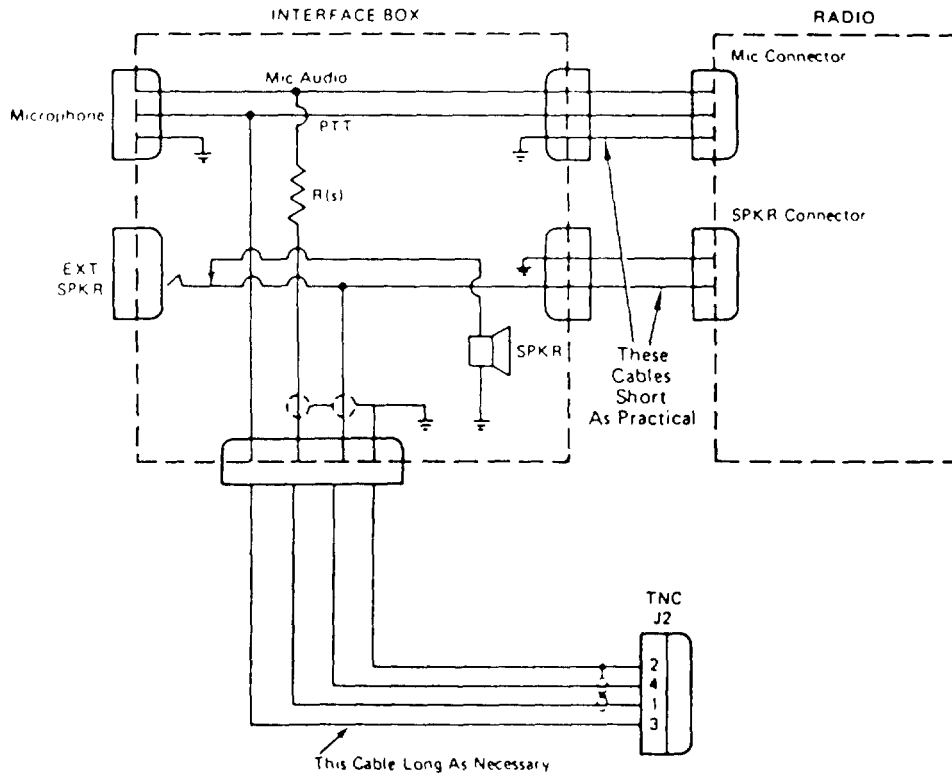
Fig. 3-7   External Interface Box

If you built the external interface box as in Fig.3-7,   then
follow this procedure to adjust R(s).

1.   Install JMP J on the MFJ-1278 PC board.

2.   Temporarily solder a variable resistor' in place of R(s)
      Fig. 3-7. The maximum value of this resistor must be
      determined by experiment, but 500K should handle most
      cases. Connect your MFJ-1278 to the radio. Connect the
      microphone to the radio, or to the interface box if one
      is being used. Connect the radio to a dummy load and
      listen to the transmission with another nearby radio.
      Adjust R(s) for proper modulation as follow:

Transmit Audio Level Adjustment for Interface Method II

1. Turn on the MFJ-1278 and computer and start your
    terminal program. Enter the modem calibration procedure
    by typing

        CALIBRA

    Press the K key to key the transmitter, then tap the
    space bar until the higher of the two tones is heard.
    Pressing the K key again will unkey the transmitter.
    After the transmitter has been keyed for a few seconds,
    it will be shut off automatically by the transmit watch-
    dog circuit.   As you perform the adjustments below, you
    will   have to periodically unkey then re-key   the
    transmitter by typing the K key.   If you wish to defeat
    the watch-dog timer, place a shorting jumper at JMP4.

2. With   the   MFJ-1278   keying   the   transmitter   and
    transmitting the higher of the two tones, adjust the
    transmit audio level as follows.

3.   Adjust R(s) the variable resistor installed for proper
     modulation level (typically between 3.0 and 4.5 kHz
     deviatio. for Amateur FM). If FM test equipment is not
     available, adjust R(S) until the audio signal on the
     monitoring receiver is reduced by half of the maximum
     level.   This can be estimated by ear or accurately
     determined by measuring the output voltage across the
     speaker with an oscilloscope or A.C. voltmeter.   If
     there is not adequate audio level from the MFJ-1278 to
     make adjustment of R(s), then you can increase the
     output level of the MFJ-1278 by adjusting R157   for
     radio port 1 or R158 for radio port 2. The transmitting
     audio output of both radio ports is factory set at 250
     mV p-p.

4. Press the **K** key to return to receive mode and type **Q** to
    exit the calibration routine.   You have now set your
    transmitter   deviation to approximately the correct
    level. Remove JMP4 if you placed it in Step 4.

5. Carefully remove the variable resistor and measure its
    value.   This is the proper value of R(S) for your
    particular radio.

6. Select the nearest standard value fixed resistor (1/4
    watt is fine) and permanently install this resistor as
    R(S) in the interface circuit.

7. If you have access to FM test equipment, check to see
    that the modulation level is still within the limits of
    3 to 4.5 kHz deviation.   If it is not, make a final
    adjustment   with the MFJ-1278 transmit audio level
    controls, R157 for Radio 1 or R158 of Radio 2.

Receiver Audio Setting

The modem in your MFJ-1278 is equipped with an advanced
phase coherence type data carrier detector (DCD) with
threshold control and a sensitive tuning indicator.   These
can be used in combination to set the correct receive audio
level for the modem and to optimize the DCD characteristics
for the various methods of operation.

With your radio in the receive mode, open the squelch
control so that a steady hiss is heard on a speaker.   Set
the volume control to the minimum volume position.   The
tuning indicator on the MFJ-1278 should drift off to one
side of the display and become stationary.   It may drift
enough to disappear off the end of the display.   Slowly
advance the audio output level with the volume control until
the tuning indicator "springs to life" and dances around a
point near the middle of the display.   This is the absolute
minimum audio level for marginal copy.   Continue to advance
the volume control until there is approximately twice as
much audio present at the receiver output.   This can be
estimated by ear or measured with an oscilloscope or A.C.
voltmeter.   This will be near the correct amount of audio
for NBFM operation.   Levels higher than this will not
degrade the modem performance solong as the receiver audio
amplifier is capable of producing the chosen output level
without distortion (clipping).

While still listening to unsquelched receiver noise, rotate
the DCD threshold control on the front panel of your MFJ-
1278 clockwise until the DCD LED just flickers with false
data carrier indications.   This control should be set to

produce approximately a 10% duty cycle of false DCD activity
when receiving unsquelched NBFM receiver noise.

The modem sensitivity to false DCD will be affected by the
bandwidth of the audio coming out of the receiver. some
receivers produce wideband audio which will NOT produce any
false DCD activity regardless of the threshold control
setting. In this case, set the DCD threshold control to its
maximum clockwise rotation. Modem performance will not be
affected.

IMPORTANT NOTE: Harmonics Interference

If you experience interference from one of the harmonics of
the crystal oscillator in the MFJ-1278, trimmer capacitor,
C47 (near the crystal) can be adjusted to move the frequency
of the harmonic.

Monitor Speaker Connection

MFJ-1278 has a built audio amplifier to provide audio for an
external monitor speaker. Monitor speaker such as the MFJ-
280 can be can be connected to the **SPEAKER** jack on the MFJ-
1278. Only one speaker is needed for RADIO 1 and RADIO 2.
MFJ-1278 will automatically switch monitor speaker to the
radio port in used.

If wiring of a speaker plug is necessary, use a 3.5 mm
(1/8") mono or stereo plug for this connection. Wire the
plug so that the **tip** of the plug is connected to the speaker
and the sleeve is connected to ground. Note that only one
speaker is needed for both radio ports. MFJ-1278 will
automatically switch the speaker to the correct radio port
in use.

The speaker jack on the MFJ-1278 is for monitoring of
received and transmitted audio including CW side tone. It is
also used to provide a signal to the operator when a packet
connection is made. A small audio amplifier is built in the
MFJ-1278 to drive the external speaker. Volume of the
monitor speaker can be adjusted by R160 on the MFJ-1278 main
board. If the internal amplifier of the MFJ-1278 does not
provide adequate volume you may use an external audio
amplifier.

You can disable received audio, transmitted audio or the
packet connect tone from the speaker monitor jack by cutting
a trace between the pins of the following jumpers. See
Appendix G for the locations and functions of JMP jumpers.

        JMP X : Transmitting Audio
        JMP Y : Receiving Audio
        JMP Z : Packet Connect Tone.

For example, if you like to have the packet connect tone but
do not wish to hear the racket of packet, then you should
disconnect JMP X to disable the transmitted audio and
disconnect JMP Y for received audio.

CW Installation

Besides being able to send and receive CW by using your
computer, the MFJ-1278 expands CW operating fun by allowing
you to connect an iambic paddle to the **KEY** input jack of the
MFJ-1278 so you can use the MFJ-1278 as a keyer to send CW.
Connect the MFJ-1278 for CW operation as follow:

DC Keying Connection

Connect a two conductor shielded cable from the **GRID BLOCK**
or **DIRECT** jack of the MFJ-1278 to the keying input of your
radio.   The keying jacks of the MFJ-1278 accept a standard
RCA phono plug.   Solid state radios should use the **DIRECT**
keying output and tube type radios should used the **GRID
BLOCK** keying output.   If you are unsure of which output to
use, try both outputs.   The keyout outputs of the MFJ-1278
are protected. If the wrong output is used you will notice a
constant key down effect on the transmitter.

Key Paddle Connection

The KEY paddle input jack of the MFJ-1278 accepts a 3.5mm
(1/8") **stereo** plug. (Radio Shack Part No. 274-284). **DO NOT
USE A MONO plug, IT WILL SHORT OUT THE KEY INPUT.** A two
conductor fully shielded cable should be used.   Wire the
tip of the plug for the dash contact and the ring of the
plug for the dot contact.   Be sure to use the shield of the
cable for the paddle ground contact.

GETTING STARTED

This chapter will guide you through the basic operation on
all the modes of the MFJ-1278. It contains the basic
information required to operate Packet, RTTY, ASCII, CW,
AMTOR, NAVTEX, FAX, SSTV and CW Memory Keyer.

First Steps

1.   Make sure that your computer is connected to the RS-
232C port or the TTL port on the MFJ-1278 according to
Chapter 2.

2. Make sure that your radios are connected to the MFJ-1278
according to Chapter 3.

3. Turn on your computer. Load and run the terminal prog-
ram.

4.   Turn on the MFJ-1278. The MFJ-1278 will sign on with
"cmd:" prompt sign. If the MFJ-1278 fails to sign-on, press
the return key on your computer a few times in succession,
the MFJ-1278 will sign-on as as follow:

```
          *:J
          bbRAM:LOADED WITH DEFAULTS
             |A
          MFJ ENTERPRISES, INC.
          MODEL MFJ-1278
          AX.25 Level 2 Version 2.0
          Release XXXXX  (date) - 32K RAM
          Checksum XXX
          cmd:
```

Note: The "|A" may display as a vertical-bar and any capi-
tal letter from "A" through "J".

The first five lines are the sign-on message, which you will
normally see only when you power up the MFJ-1278.   The
Command Mode prompt **cmd:** will appear when the MFJ-1278 is in
Command Mode and is ready to accept your instructions. Upon
sign-on the MFJ-1278 is defaulted to the VHF packet mode.
Before the MFJ-1278 can be fully operational, some of the
basic parameters must be set.

Basic Parameters Setup

With the MFJ-1278 sign-on and default to the VHF packet
mode, you are now ready to start setting up the parameters
you will use. You may be satisfied with most of the
defaults for now, but a few parameters will have to be
changed! Let's try entering your call sign. Type:

        cmd:MYCALL K5FLU
        MYCALL was   NOCALL
        cmd:

Type the text, **MYCALL K5FLU**, following the command mode
prompt. Of course, you should substitute your own call sign
for K5FLU. Don't forget the <CR> at the end of the line.
Your call sign will be used by the MFJ-1278 as its
"address." The MFJ-1278 responds by telling you the
previous value of the MYCALL parameter, and gives you a new
Command Mode prompt.

Now try typing just the command by itself:

        cmd:**MYCALL**

MFJ-1278 will respond with:

        MYCALL   K5FLU

You can see the current value of most parameters by typing
the command that sets the parameter followed by just a <CR>.
This verifies that the MFJ-1278 accepted your call sign.

The next section describes the commands you will use to
configure the MFJ-1278 for proper text display for your
particular computer. You may not use these commands again
unless you change computers or terminal programs.

Serial Port Configuration

This section describes the commands you will use to set up
the MFJ-1278 to work best with your computer.

Parity and Word Length

If you are using one of the optional starter packs by MFJ Enterprises, Inc. then you should follow the instructions given by the terminal program documentation with the starter pack. If you are not using the MFJ starter pack then you should use the following instructions to set the parity and word length for the MFJ-1278.

If messages from the MFJ-1278 appear garbled, with incorrectly displayed characters, you may need to change the MFJ-1278's serial port parity and word length. (We assume that you have set the baud rate correctly. See Chapter 2 if the baud rate needs to be changed.) The MFJ-1278's default value is 8 bits and no parity. If your computer receives 8 bits as data, you may have to set space parity, since text may otherwise be interpreted as graphics or other special characters. To set 8 bits, space parity, use the following combination:

        AWLEN 8   (8-bit words)
        PARITY 0   (no parity bit)

For wordlength of 7 bits, even parity, set

        AWLEN 7   (7-bit words)
        PARITY 3   (even parity)

One of these combinations will satisfy most computers. You are more likely to require a different setting if you have a terminal rather than a computer, or if you have configured your terminal port for some special application.

If your computer requires odd parity, set PARITY 1. If your computer detects framing errors, try setting

        AWLEN 7   (7-bit words)
        PARITY 0   (no parity bit)

for shorter characters. For longer characters, set:

        AWLEN 8   (8-bit words)
        PARITY 1 or PARITY 3

Echos

You may see two characters on your screen for every character you type, for example:

        cmd:RREESSEETT

Your computer is echoing the characters you type, and the

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MFJ-1278 is also echoing them.   In this case, set duplex to
FULL on your terminal to stop the terminal from echoing
characters to your screen.

New Lines and Line Wrapping

If everything displayed appears to be double-spaced, your
computer is adding an extra linefeed (<LF>) whenever it
displays a carriage return (<CR>).   Set **AUTOLF OFF** to keep
the MFJ-1278 from also adding an <LF>.   If you change
equipment you may have to set **AUTOLF ON** to restore the MFJ-
1278's automatic linefeeds.

The screen-width parameter is set by default to 80, the
width of many CRT displays. The MFJ-1278 will send an extra
<CR> (or <CR> <LF> if **AUTOLF** is **ON**) when 80 characters have
been displayed on a line. If your computer does not automa-
tically break long lines, you will need to set the screen
width to the width of your display.   For example, for a
computer using a TV set for a display, you would set
SCREENLN 40. If your computer does automatically break long
lines, you should set **SCREENLN 0** to disable this feature on
the MFJ-1278.   Otherwise, you will get two <CR>s when the
line wraps around.

A few computers will frequently lose the first characters of
a line when several lines are typed in rapid succession, for
example, in the sign-on message. You can give the computer
more time between lines by setting **NUCR ON** (delay after
<CR>), or **NULF ON** (delay after <LF>). The delay is adjusted
by **NULLS**, which sets a number of character-times for the
delay.

With the basic parameters set up which enable the MFJ-1278
to be able to communicate with your computer, we can now
discuss some basic functions and features of the MFJ-1278.

The MFJ-1278 Multi-Mode Modem

The MFJ-1278 modem has five sets of pre-set modem
components. These allows   the MFJ-1278 to be used in its
various modes of operation.   These modes of operation
include VHF Packet, HF Packet, AMTOR, VHF RTTY, HF RTTY, VHF
ASCII, HF ASCII, CW, Modulated CW, CW Memory Keyer, FAX
(including Weather FAX), SSTV with gray   scales   and
monitoring of NAVTEX.

Each set of modem components is independently calibrated for
each mode of operation. Modem re-calibration is not required
for receiving or transmitting when switching among any of
the modes listed.

The modes used with each modem are shown in Table 4-1. The
tones and shifts produced by each modem are shown in Table
4-2.

Table 4-1: MFJ-1278 Modem and Operation Modes

MODEM	OPERATION MODES
P	VHF Packet, 2 levels FAX
H	HF Packet, HF Baudot RTTY, HF ASCII, AMTOR, NAVTEX
V	VHF RTTY, VHF ASCII
C	CW, Memory Keyer, Modulated CW
M	Multi-level FAX, Multi-level SSTV

Table 4-2: Tones & Shifts Produced by the MFJ-1278 Modems.

MODEM	Fu(Hz)	Fl(Hz)	SHIFT(Hz)
P	2100	1300	800
H	2310	2110	200
V	2975	2125	850
C	850	----	----
M	1550	thru 2250 in 50 Hz step	

Operation Mode

Verifying Operation Status

Upon power up, the MFJ-1278 is defaulted to VHF Packet mode
and the radio baud rate is defaulted to 1200 baud.   Radio
port connection is defaulted to radio 1. You can verify the
operating status of the MFJ-1278 at any time by using the
command MODE after the display of the CMD: prompt. To check
operation mode, type:

MODE <CR>

The MFJ-1278 will respond with modem status display lines
followed with the cmd: prompt.

Mode Switching With the MODE Command

Since the MFJ-1278 is a multi-mode controller, you will need
to familialize yourself with the commands for changing from
one operating mode to another.

The MFJ-1278 provides an easily used command to change the
mode of operation. The MODE command allows you to enter any
operation mode and select a desired radio baud rate and
modem to be used.   Table 4-3 lists the valid codes which
can be used by the MODE command.   The format for the MODE
command is:

MODE xx,bbbb,m <CR>

Where xx is a 2 letter operation mode code as listed in
Table 4-3, bbbb is the desired baud rate or speed, and m is
the desired modem as listed in Table 4-1.   If no modem is
specified then MFJ-1278 will select the default modem for
the selected mode using the modem as listed in Table 4-1.
Most of the time, the defaults will be sufficient so the
baud rate and modem need not be specified.   So in order to
specify HF RTTY operation at the default baud rate of 45
baud and using the default narrow shift modem, for example,
you would type:

MODE HB <CR>

Any of the three parameters may be changed without affecting
the other two.   for example, to change the baud rate to 110
baud while using RTTY with the same modem, you would type:

MODE HB,110   <CR>

Similarly, to select the wide shift modem without changing either the operating mode or the baud rate you would type:

MODE HB,110,V   <CR>

If you select an invalid code or baud rate, MFJ-1278 will respond with an error message:

? BAD
cmd:

Note that with the error message, the MFJ-1278 has changed to default settings.

On CW, MCW and Memory Keyer operation modes, instead of selecting a baud rate you will select CW sending speed by entering a number from 5 thru 99. If you do not select a speed, the last selection will be used. The default value is 20 WPM.

Table 4-3: MODE Command Codes and Baud Rates.

MODE CODE	OPERATION MODE	DEFAULT BAUD RATE	SELECTABLE BAUD RATE/SPEED/FORMAT
VP	VHF Packet	1200	300, 1200
HP	HF Packet	300	300
VB	VHF Baudot RTTY	45	45, 50, 57, 75, 100, 110, 150, 200, 300
HB	HF Baudot RTTY	45	45, 50, 57, 75, 100, 110, 150, 200, 300
VA	VHF ASCII RTTY	110	45, 50, 57, 75, 100, 110, 150, 200, 300
HA	HF ASCII RTTY	110	45, 50, 57, 75, 100, 110, 150, 200, 300
FX	FAX	3(120L/M)	60, 90, 120, 180, 240, 360, 480 (Lines/Min.)
CW	CW/ Mem. Keyer	20	5 WPM thru 99 WPM
MC	Modulated CW	20	5 WPM thru 99 WPM
TV	SSTV	1 (8.5S)	8.5, 12, 17, 24, 36 (seconds)
AM	AMTOR/NAVTEX	100	100

Radio Port Switching

MFJ-1278 provides two independent radio ports (Radio 1 and Radio 2). Upon power up MFJ-1278 will default to Radio port 1. Upon the cmd: command prompt, you can select radio port by typing "RAD 1" or "RAD 2" then press "Return".

MFJ-1278 will display a new operation status and end with cmd: prompt.

Memory Buffers

The MFJ-1278 gives you ten user programmable memory buffers. Memory buffer numbers are from 0 thru 9. Memory buffers are accessible by the command BUF. Each memory buffer is capable of storing up to 120 characters. All ten memory buffers can be chained together in any order. Memory buffers can be used for RTTY, ASCII, CW, MCW and Memory Keyer modes.

Loading the Memory Buffers

There are ten memory buffers provided by the MFJ-1278. Memory buffer 0 can be repeated. Time between repeats for memory buffer 0 is set by BUFTIME.

To load the memory buffer, under the CMD: command prompt, type:

CMD:BUF# XXXXXXXXXXXXXXX......XXXXX <CR>

Where # is the memory buffer number, from 0 thru 9. XXXXXXXXX......XXXX is the buffer message of up to 120 characters.

Note: Notice that there is NO space between "BUF" and "#" but remember to put a space between the buffer number and the buffer message.

Memory buffers Transmitting

Memory buffers can be transmitted by using the BUFKEY command. If BUFKEY is left with the default value of "9" (TAB key), user can transmit any buffer (0-9) by pressing the "TAB" key followed with a buffer number (0 thru 9). Once the buffer message is transmitted, MFJ-1278 will revert to receive mode. User do not have to type "CTRL-R" to go back to receive.

BUFKEY can only be used in the CW/MCW mode. It is not valid
for RTTY or ASCII modes.   For RTTY and ASCII modes you will
press a "CTRL-T" and a buffer number to initiate a buffer
transmit and you will press a "CTRL-R" to revert the MFJ-
1278 to the receive mode.

If you are using the MFJ-1278 with MFJCOM, IBM terminal
program, you must change the BUFKEY value of "TAB" (9) key
to "\" ($5C) key.

Buffer Serial Number

If the memory buffer text includes a # sign,   the MFJ-1278
will replace   the   #   with a number each   time   that
buffer is transmitted.   The number is the current value of
the serial number counter,   SERIALNO.   Once used,   this
serial   number counter value is incremented by one up to
a maximum of 65535, where the counter rolls over to zero.

If for any reason the serial number must be changed, you may
return to the CMD: command prompt and enter the new serial
number by typing:

CMD:SERIALNO ##### <CR>

    Where   ##### is   the   desired   serial   number from 0
    to 65535.

Memory Repeat and Buffer Repeat Time

The buffer 0 repeat time is set by using the command BUFTIME
followed by a number from 0 to 65535 seconds. BUFTIME of 0
seconds represents no repeat after Buffer 0 is transmitted.
BUFTIME is usable in CW, MCW and Memory Keyer modes.
BUFTIME is not effective for memory buffers 1 thru 9.

BUFTIME is the TOTAL time for one cycle of Buffer 0 message.
This means that if your buffer message is 10 seconds long,
then you must set the BUFTIME longer than ten seconds.   For
example, if you want a 5 second delay between the end of the
message and the beginning of message to be repeated, then
add 5 seconds to the total message time. If your message is
10 seconds, then you must set BUFTIME for 15 seconds for a 5
second delay.

If your buffer 0 message is 10 seconds long, and you want
Memory Buffer 0 to repeat every 5 seconds, under CMD:
command prompt, type:

CMD:BUFTIME 15 <CR>

Memory buffer 0 will repeat every 5 seconds. To stop
memory buffer 0 from repeating, set BUFTIME TO 0.

If BUFTIME is set to a nonzero value, the MFJ-1278
will automatically release the PTT line and revert to the
receive mode between repeats. This allows you to
monitor the frequency. If the MFJ-1278 is not interrupted
during the pre-set delay time, it will continuously
repeat until buffer 0 is interrupted.

Chaining the Memory Buffers

All ten memory buffers may be chained together in any order
while being transmitted. For example, you may transmit
memory buffer 0, memory buffer 2 and memory buffer 5
together in one transmission. To achieve this, you should
program the message in memory buffers as follows:

From CMD: command prompt, type:

CMD:BUF0 XXXXXXXXXXX....XXXXX CTRL-T 2 <CR>
CMD:BUF2 XXXXXXXXXXX....XXXXX CTRL-T 5 <CR>
CMD:BUF5 XXXXXXXXXXX....XXXXX <CR>

    Where XXXX is the desired text you wish to
    program into the memory buffers.

In the example shown above, whenever Buffer 0 is
transmitted, the MFJ-1278 will also transmit Buffer 2,
then Buffer 5. If you want the MFJ-1278 to transmit Buffer
0, Buffer 2 and Buffer 5 repeatedly, then add a "CTRL-T 0"
to the end of the Buffer 5 content.

Note: If BUFTIME is a non-zero value, MFJ-1278 will
automatically release the PTT line and revert to the receive
mode between repeats. This allows you to monitor the
frequency. If the MFJ-1278 is not interrupted during the
pre-set delay time, it will continuously repeat until buffer
0 is interrupted.

Tuning Indicator

Your MFJ-1278 is equipped with a tuning indicator which
is sensitive, very accurate and extremely useful not only
for tuning to signals for optimum reception but also for
filter alignment and audio level indication.

The   position of the tuning indicator LED is only meaningful
for   tuning a   signal under the following conditions:

1.   The station is transmitting data (both tones NOT just
     a single carrier).

2.   The DCD LED is lit indicating that the signal is
     within the capture range of the PLL demodulator.

3.   There is sufficient audio output from the receiver
     for proper operation of the demodulator.

Assuming   that   the conditions above are met,   tuning   in   a
station with the tuning indicator is quite simple.   Just set
the   receiver frequency so that the tuning indicator LED is
centered   in the display.   Actually there are 2 LEDs which
represent   the center of the display.   Either or both may
be used.

The   use   of the tuning indicator will be further   discussed
later in each mode of operation.

OPERATION: PACKET

VHF Packet

If you are not familiar with packet operation, then you can
learn quite a bit about it with the MFJ-1278 without
actually transmitting anything. For your first experiments,
the MFJ-1278 will be "talking to itself," allowing you to
become familiar with it before you go on the air.

If you are already familiar with the packet operation, then
you may not want to perform this exercise. In this case go
the other modes of operation in this chapter.

Disconnect your radio from the MFJ-1278 and turn off the
MFJ-1278.   Install the digital loopback jumper, JMP10. The
analog loopback jumper, JMP7, should not be installed.
Connect your computer to the MFJ-1278 with your serial
cable.   Turn on the computer and start your terminal
program.

A Connecting and Disconnecting Exercise

Packet radio QSOs are started by a connect process, which
sets up the "handshaking" between the two stations that
insures error-free communications. QSOs are terminated by a
disconnect process, which leaves both stations free to start
new QSOs.   Packet QSOs can also make use of digipeaters,
other packet stations which can automatically relay packets
from one station to the other over a specified route.

To see how this works, you can have the MFJ-1278 connect to
itself.   Since you have set the MFJ-1278 up for digital
loop-back, it will receive all packets that it sends.   Try
the following:

        cmd:FULLDUP ON
        cmd:CONNECT K5FLU
        *** CONNECTED to K5FLU

replacing K5FLU with your own call sign.   The MFJ-1278
generates packets initiating and confirming the connection.
The packets aren't actually converted to audio signals and
transmitted over the radio, but they are otherwise just like
packets you will be transmitting later on.

The *** CONNECTED to message tells you that the connection
was successful. You should also notice that the CON LED has
lit up and that you do not see a new cmd: prompt on the next
line. You are now in Converse Mode, ready to start talking.
Try it. Type your message, ending the line with a <CR>.

                    Hello, there.
                    Hello, there.

The <CR> causes your message to be put into a packet, or
"packetized," and transmitted. (We explain in the next
chapter how you can use a different character to send pack-
ets.) The underlined text is a message that the MFJ-1278
received in a packet and displayed. Whenever you are in
Converse Mode anything you type will be assembled into a
packet addressed to the station you are talking to and
transmitted. If there isn't a QSO (connection) in progress,
the packet will be sent to the address CQ.

In the example above, the MFJ-1278 entered Converse Mode
automatically after the connect took place.   You can also
command the MFJ-1278 to move back and forth between Command
Mode and Converse Mode.

To return to Command Mode, you must enter a special charac-
ter, Control-C (abbreviated <CTRL-C>), or else send a BREAK
signal. "Control" characters are usually entered by holding
down a special control key and then typing another key
without releasing the control key. If your keyboard doesn't
have a key marked CTRL or something similar, consult the
documentation for your computer or terminal program to see
how to enter control characters.   A BREAK signal is a spe-
cial transmission (not an ASCII character) which your compu-
ter may be able to produce.

        NOTE: If <CTRL-C> will cause your computer to do
        something to interfere with packet operations,
        such as halting the terminal program, and you
        can't send BREAK signals, you will have to change
        the character that returns you to Command Mode.
        See the section on "Special Input Characters,"
        below.

Now type a <CTRL-C>.   The MFJ-1278 doesn't echo the <CTRL-
C>, but you should immediately see a Command Mode prompt.
To return to Converse Mode, enter the command CONVERS:

        <CTRL-C>
        cmd:CONVERS
        Whatever I type in Converse Mode is transmitted.
        Whatever I type in Converse Mode is transmitted.
        <CTRL-C>
        cmd:

To terminate the QSO, you must end the connect by giving the
DISCONNE command.   The MFJ-1278 will transmit packets
terminating the conversation and notify you when the

disconnect is complete:

>   cmd:**DISCONNE**
>   *** DISCONNECTED

An actual QSO might be terminated by the other station, of
course.   In that case, you would see the ***** DISCONNECTED**
message without having issued the command.

You have just performed the basic operations of any packet
QSO.   You established a connection with the desired station
to begin the QSO, sent and received some messages, and
disconnected from the station at the end of the QSO.

Digipeating

You may wish to have a QSO with another packet station that
is beyond your direct radio range.   If a third packet sta-
tion is on the air and both you and the station you want to
talk to are in range of this third station, that station can
relay your packets.   You set up the packet routing when you
initiate the connection. The MFJ-1278 will then automati-
cally include the routing information in the packets it
sends.

The diagram below shows an example situation in which digi-
peating is useful.

```
                          AD7I
                         /    \
          N2WX _____/      _____ K5FLU
```
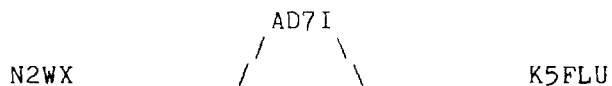
You are station K5FLU, and you want to have a packet QSO
with N2WX.   There is a mountain in the way and you are not
in simplex range of each other.   However there is a station
located on the ridge, AD7I, which is in range of both you
and N2WX.

You direct the MFJ-1278 to set up a connection to N2WX using
AD7I as an intermediate digipeater as follows:

>   cmd:**CONNECT N2WX VIA AD7I**

You can specify a routing list of up to eight intermediate
stations.   For example, consider a modification of the exam-
ple above:

```
                           / ‾‾‾ \
    N2WX _____/         _____  K5FLU
         .                         .
              .              .
            KV7D . . . NK6K
```
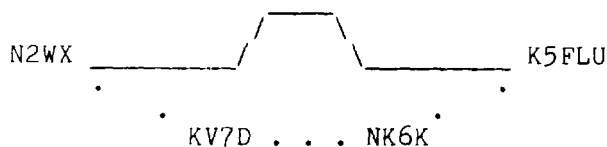
AD7I has turned off his station, but you can contact N2WX by
going around the mountain through NK6K and KV7D.   This time
you issue the connect command like this:

cmd:CONNECT N2WX VIA NK6K, KV7D

You specify the digipeaters in the order you would encounter
them going from your station to the station to which you
wish to connect.

Your station can also act as a digipeater for other sta-
tions.   This doesn't require any special actions on your
part -- the MFJ-1278 will do everything automatically.   If
your station is digipeating, you may occasionally notice
your   transmitter   keying   during lulls in your   own
conversations.

Unsuccessful Connections

Sometimes you will initiate a connect sequence that can't be
completed. The station may not be on the air, or it may not
be within range of your station.   You may have even mis-
typed the other call sign.   If the MFJ-1278 does not get a
response to its first connect packet, it will   try again.
You can control the number of attempts the MFJ-1278 will
make with the command **RETRY**.   The default number of retry
attempts is 10.   If the MFJ-1278 doesn't get an answer after
this number of transmissions, it will give up and display
the message

         *** retry count exceeded
         *** DISCONNECTED

The retry count is also used once the QSO has started. Each
transmission sent to the other station is "acknowledged," or
ACKed by the other station, and vice versa.   The ACK means
that the packet was received and that the CRC checksum
indicated that it was received without errors.   This is the
means by which packet radio can ensure error-free communica-
tions.   Sometimes a packet won't be received correctly by
the other station, either because of accidental interference
from another packet station (a collision), or because of
other channel noise.   If the MFJ-1278 doesn't get an ACK
soon enough, it retransmits the packet and increments the
retry count.   If the count set by RETRY is exceeded, the

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MFJ-1278   will automatically disconnect and display the same
message:

                *** retry count exceeded
                *** DISCONNECTED

The   automatic   disconnect   feature keeps   a   MFJ-1278   from
indefinitely retransmitting a packet and tying up the chan-
nel under hopeless conditions. For example, an intermediate
digipeater   might   have been shut down,   or the RF channel
might have deteriorated to the point of being unusable. The
other   operator   might   have even turned off   his   station
without disconnecting.   If you are operating under special
conditions, such as a marginal HF channel, you can set **RETRY**
O   to disable all automatic disconnects (the retry limit   is
never reached).

Monitoring Channel Activity

In   addition to displaying messages from the station you are
connected to,   the MFJ-1278 can allow you to monitor other
packet   activity on the channel.   You can "read the mail,"
displaying   packets between other   stations.   The   MFJ-1278
will   also   keep track of stations heard during a   session.
This section will describe some of the monitor functions.

Monitoring   is   enabled or disabled by the **MONITOR**   command.
You can try this out in digital loop-back mode while discon-
nected. Type:

                cmd:**MONITOR ON**
                cmd:**CONVERS**
                This is a test packet.
                K5FLU>CQ:This is a test packet.

Since   you aren't connected to another station your   packets
are sent to the address "CQ," i.e.,   anyone. The packet you
sent was "heard" by the MFJ-1278 and displayed,   along with
the sending station and the destination.

If you also want to see any intermediate digipeater stations
being used, you can set MRPT ON.   This feature would be
useful if you later want to connect to one of the   stations
you are monitoring and will need a digipeater route in order
to   reach it.   For example,   you might see   the   following
display:

                WB6YMH>WDOETZ,KV7B:Hello, Bill!

This packet was sent from WB6YMH via KV7B to WDOETZ.

If there are several digipeaters, or if the message lines are long, the display may be difficult to read. You can put the address header on a separate line from the text by setting HEADERLN ON:

WB6YMH>WDOETZ,KV7B:
Hello, Bill!

Ordinarily, the MFJ-1278 will stop displaying monitored packets if you connect to another station, permitting you to converse without interruption. If you want to monitor activity while connected to a packet station, set MCON ON.

To display a list of stations heard since the last time your MFJ-1278 was powered up, type

        cmd:MHEARD
        AD7I
        WA7GXD
        N2WX
        NK6K
        KV7B*

The last several stations whose packets were heard by your MFJ-1278 are displayed. The entry "KV7B*" means that KV7B was heard digipeating a packet rather than sending one of his own. You can clear the "heard log" with the command MHCLEAR.

You can see the settings of the monitor parameters described above, as well as several others, by typing DISPLAY MONITOR.

Your First Packet QSO

Although there are still a number of features you should be familiar with for comfortable packet operation, you are probably eager to get on the air and try out the MFJ-1278. Arrange to have another packet operator get on the air to help you get started. Make sure that your friend will be close enough to ensure solid copy, with no FM "popcorn" noise. It's best if you can get an experienced packet operator to help you get started. If you are both begin- ners, try to have both stations in the same room and operate on low power or into dummy loads.

Remove the digital loopback jumper, JMP10. Connect your radio to the MFJ-1278. Turn on your computer, the MFJ-1278, and your radio. Be sure you have adjusted the MFJ-1278 and radio according to one of the methods described in Chapter 3. When the other station transmits, the DCD LED on the

MFJ-1278 should glow steadily for the duration of the
transmission. You can work through the remainder of the
examples in this chapter while you try out the MFJ-1278 on
the air.

Starting the QSO

You are ready to initiate a connect. For the sake of exam-
ple, we will continue to use K5FLU in place of your call
sign, and we will use WB0QRP for your friend's call. Make
sure you are in Command Mode, and type

        cmd:CONNECT WB0QRP

After a moment you should see the message

        *** CONNECTED to WB0QRP

and you will be in Converse Mode. Your friend will see the
message

        *** CONNECTED to K5FLU

and he will also be in Converse Mode. You have begun your
first QSO.

If you have trouble connecting, make sure your microphone
drive level is set properly, as described in Chapter 3. It
may be helpful to have an experienced packet operator listen
to your transmissions and monitor with his TNC. You can
also try the following procedure. Both you and your friend
should set MONITOR ON, enter Converse Mode and send some
packets. Each station should display packets sent by the
other. If only one station is "hearing" properly, you can
concentrate on the modulator and transmitter of that station
and the demodulator and receiver of the other station. You
can try experimenting with the TXDELAY timing parameter for
the sending TNC. Set TXDELAY 64 for a long delay. If this
solves the problem, you can back off to the smallest value
that works consistently.

Exchange several messages to get a feel for this new mode.
If you monitor the radio transmit indicators and listen to
the speaker audio from the two rigs, you will have a better
idea of what is happening. You radio will be inactive most
of the time, even while you are actually typing. When you
get to the end of a line and type a <CR>, your radio will be
keyed briefly and your friend will hear a "brrrraaaap" on
his speaker. As your message is displayed on his computer,
his radio will be keyed for an even shorter time and you
will hear a "brraap" on your speaker. This is the ACK, or
packet acknowledgment coming back. The MFJ-1278 takes note

that the packet was received correctly, but nothing is displayed on your screen.

Digipeating

Now that you are on the air, you and your friend can try out the MFJ-1278's digipeating capabilities. This is actually more interesting if you have at least three stations participating, but you can get the feel for it with two stations.

Return to Command Mode and disconnect from the other station:

```
<CTRL-C>
cmd:DISCONNE
*** DISCONNECTED
```

Now issue the following command.

```
cmd:CONNECT K5FLU VIA WB0QRP
```

As before, substitute your call for K5FLU and your friend's call for WB0QRP. You are requesting a connect to yourself, as you did before in digital loop-back mode, but this time you are using a sort of RF loop-back. You transmit packets to your friend's TNC, which relays them back to you. When the connection is established you will see

```
*** CONNECTED to K5FLU VIA WB0QRP
```

and you will be in Converse Mode. Your friend won't see anything displayed on his computer and his TNC's state won't be affected at all by your QSO. In fact, your friend could issue this connect request,

```
cmd:CONNECT WB0QRP VIA K5FLU
```

and you can carry on two separate conversations completely independently. Monitor the radio transmit indicators and listen to the speaker audio. See if you can follow the packets and the acknowledgments back and forth.

Monitoring on the Air

This is a good time to try out the MFJ-1278's monitor functions. While you and your friend are separately connected, type

```
<CTRL-C>
cmd:MONITOR ON
cmd:MCON ON
cmd:CONVERS
```

You will be able to see both your "conversation" and your friend's conversation. Also try **HEADERLN ON** and **MHEARD**.

Special Input Characters

The MFJ-1278 has a number of special characters that can be used to control its actions. Many of these special characters can be used to "edit" commands and packet text as they are entered. These features can all be customized to suit you and your computer. Most of the special input characters we will describe are active in both Command Mode and Converse Mode; the exceptions will be noted.

The character used to return to Command Mode from Converse Mode is by default a <CTRL-C>. (Sending a BREAK signal also works.) This character does nothing in Command Mode, so if you accidentally enter it twice you won't mess up the next command line. You can change the Command Mode entry charac- ter with the command **COMMAND**. This is one of several com- mands that set special character functions. You can choose any character for this function, by entering the ASCII character code for the key. For example, you can use a <CTRL-E> to enter Command Mode by setting

```
cmd:COMMAND 5
was        $03
```

The MFJ-1278 displays the previous value in hex, and you can also enter character codes in hex if you prefer. All of the special characters described below can be changed in the same way as **COMMAND**.

We have already mentioned that you can erase mis-typed characters by typing the <BACKSPACE> character. You can change this character with the command **DELETE**. If you set **DELETE ON**, you can erase characters by typing the <DELETE> character; setting **DELETE OFF** returns to using <BACKSPACE>. You will probably want to use the same key that your compu- ter normally uses to rub out characters. <BACKSPACE> is more commonly used than <DELETE> by personal computers. If you aren't sure whether your rubout key produces <DELETE> or <BACKSPACE> characters, you can try both settings of the **DELETE** command and see which works.

When you rub out a mis-typed character, the MFJ-1278 will attempt to correct the screen display. This will work for most computers as well as display-type terminals. It won't

work for hardcopy-type terminals or possibly with a few
computers. If your display doesn't look right after you rub
out a character, try setting **BKONDEL OFF**. The MFJ-1278 will
not try to correct the display but will indicate the rubout
with a "\" character (<BACKSLASH>). You can restore display
correction by setting BKONDEL ON.

If you make several mistakes in a line, or if you change
your mind, you may want to cancel the whole line rather than
rubbing out the characters one at a time. You can cancel
the line by typing <CTRL-X>. The MFJ-1278 will display a
<BACKSLASH> followed by <CR>. If you are in Command Mode,
you will see a new prompt:

     cmd:**Hi, John, how are you?<CTRL-X>**\
   [You started typing text while in Command Mode.]
     cmd:CONVERSE
     Hi, John, how are you?

The cancel-line character can be changed to any ASCII char-
acter by the command **CANLINE**.

If you have changed your input by rubbing out and retyping
characters, you may want to see a "fresh" copy of your
input, especially if you have set **BKONDEL OFF**. The MFJ-1278
will retype the line you are entering when you type <CTRL-
R>:

     cmd:**CONNECT KB7****WA7<CTRL-R>**\
   [You mis-typed the call sign.]
     cmd:CONNECT WA7GXD

Here the user mis-typed the first three characters of the
call sign and rubbed them out. The MFJ-1278 displayed "\"
for each character rubbed out. The user then retyped the
characters correctly and redisplayed the line. He finished
typing the call sign on the new line. The redisplay-line
character can be changed to any ASCII character by the
command **REDISPLA**.

If the MFJ-1278 displays information faster than you can
read it before it scrolls off the screen, you can halt the
display by typing <CTRL-S>. To resume output from the MFJ-
1278 to your computer, enter <CTRL-Q>. These characters can
be changed to any ASCII character by the commands **STOP** and
START, respectively.

You may occasionally want to include one of the special
input characters in a packet. For example, to send several
lines at once in the same packet, you would have to include
<CR> in the packet at the end of each line, bypassing its

"send-packet" function except at the actual end of the
packet. You can include any character in a packet including
all special characters by prefixing it with the pass char-
acter, <CTRL-V>. For example,

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

Ordinarily, this message would be sent as two packets. By
prefixing the first <CR> with <CTRL-V>, the operator sends
it all at once, but maintains the <CR> in the text. The
pass character can be changed to any ASCII character by the
command **PASS**.

We will discuss operation of packet in more detail in the
next chapter. For now let us discuss the operation of other
modes which the MFJ-1278 is capable of operation.

HF Packet Basic Operation

The requirements for optimum performance with a typical HF
or OSCAR 10 path are very different compared to local VHF FM
environment. Lower signal to noise ratios require lower baud
rates, noise spikes and fades require shorter packet
lengths, and a higher rate of false carrier detects lowers
the total usable dynamic range in the audio input. The MFJ-
1278 hardware and software are configured to improve throu-
ghput in these environments. The MFJ-1278s settings of
MAXFRAME and PACLEN provide the possibility of several
continuous frames of long data length. For HF operation at
300 baud, we recommend setting MAXFRAME to 1.

The MFJ-1278 detects a busy channel by monitoring the lock-
detect signal from the demodulator. The presence of a lock-
detect signal is indicated by the Data Carrier Detect (DCD)
LED. Each time DCD goes off the MFJ-1278 will start a DWAIT
interval which must elapse before the channel is considered
to be available.   On a noisy channel spurious lock-detect
signals may be generated.   For HF and OSCAR operation you
should set DWAIT to 0.   The random wait before retry trans-
missions can be disabled by setting TXDELAY 0 and using
AXDELAY to set the required keyup delay.   Of course, AXHANG
should be 0 for this application.

If you are operating a full-duplex radio station
(simultaneous transmit and receive) such as an OSCAR 10
station,   you should set FULLDUP ON.   The MFJ-1278   is
always electrically capable of full duplex operation, but
this parameter causes the protocol to behave differently in
acknowledging packets. In addition, the MFJ-1278 will ignore
the state of the DCD line.

Although intuition tells you that lower baud rates will
reduce the number of packet retries, there is usually a
small range between "too fast" and "too slow."   A slower
packet takes longer to transmit and is therefore a larger
target for fades and static crashes. The entire packet must
be received correctly in order to be accepted.   Data rates
of 1200 baud have been used on both HF and through OSCAR 10.

HF activity may generally be found on 7.093 or 14.107 MHz.
Use LSB or USB - it really doesn't matter (although most
stations use LSB when referring to the suppressed carrier
frequency).

Tune through a few packet signals. Tune slowly! You will
find a point at which the display becomes bright. As you
continue tuning, you will see the moving bar display slide
across your tuning indicator.   When one of the center LEDs

is illuminated, you are tuned in and you should be able to copy the packets.

Each bar on the tuning indicator represents about 10 Hz. Thus, if a packet comes through and you are 4 bars off, re-tune your transceiver 40 Hz in the indicated direction. The direction depends on the sideband you selected and the manner in which you have the tuning indicator oriented. One or two tries will quickly tell you which way to go! Bars to the left of center indicate you should tune higher, while the other side of center means to tune lower.

Many BBS station forward traffic on HF at the above frequencies. Call CQ a couple KHz away from such channels. If you can't raise anyone, call CQ on one of the above frequencies, but **QSY immediately afte2 establishing contact!** Be careful on 20 meters especially that you don't operate +/- 2KHz around 14.100 MHz (you will cause interference to propagation beacons and give packet a bad name...)

Other HF Operation Hints:

1. Try to keep all packets below 80 characters in length.
2. Set **MAXFRAME** to 1. This will minimize transmission time.
3. Avoid multiple connections and digipeated packet operation.
4. Qsy away from the standard calling frequencies as soon as possible.
5. Set **FRACK** to a sensible long value.

More detail on HF packet operation is discussed in the next chapter in this instruction manual.

OPERATION: CW

The MFJ-1278 provides many unique features in the CW mode
that are not found in other multi-mode controllers.

The MFJ-1278 can be used to directly key your CW transceiver
for normal CW operation. The MFJ-1278 can accommodate either
positive (direct) or negative (grid block) keying voltages.
The MFJ-1278 can also be used for code practice on VHF FM
radios in the modulated CW (MCW) mode. This mode holds the
radio PTT line down and feeds keyed audio into   the
microphone input.

Morse code can be sent by using the computer keyboard or by
using a key paddle connected to the "CW Key-In" of the
MFJ-1278.   When keying with the key paddle, the MFJ-
1278 is transformed   into a full fledged Memory Keyer.
Ten memory buffers are provided in the MFJ-1278 to allow
you to   program your own messages.   In addition to the
buffer memory,   MFJ-1278 provides   automatic   serial
numbering. Dot/space weight ratio can be set by using the
WEIGHT command. This   is   to allow compensation   for
leading or trailing edge delays in many transceiver keying
circuits.   The built in random code generator allows   CW
code practice. A TUNE command is also built in for radio
tuning.

MFJ-1278 supports all Alpha and Numeric characters.   It
also will transmit and receive punctuations and major
prosigns as listed in Table 4-4 below:

Table 4-4: CW Prosigns and Punctuations

PROSIGNS	ASCII CHARACTER Keyboard Symbol	PROCEDURE
SK	*	End of Work
AS	&	Wait
AR	+	End of Message
BT	=	Break
SN	!	Understood
KA	%	Signal Starting
K	K	Invitation to Transmit
DN	/	
KN	(	Response from Contacted Call Only

PUNCTUATIONS	
, COMMA	: COLON
. PERIOD	; SEMI-COLON
? QUESTION MARK	' APOSTROPHE
$ DOLLAR SIGN	– HYPHEN
(LEFT PARENTHESIS	" QUOTATION
) RIGHT PARENTHESIS	

Receiving CW

The MFJ-1278 receives international Morse Code from 1 to 89 WPM.

From command mode, put the MFJ-1278 in the CW Mode by typing:

MODE CW,xx   <CR>,   where "xx" is the CW transmit speed.

The MFJ-1278 will respond with the mode status lines, and end with the command prompt. Note that if no transmit speed is selected, MFJ-1278 will default its CW transmit speed to 20 WPM.

Enter CONVERSE mode by typing:

K <CR>

The MFJ-1278 is now ready to receive Morse code.

CW tuning is done with the aid of the tuning indicator and the DCD LED on the front panel of the MFJ-1278. Tune your receiver to approximately center the tuning indicator when there is a CW audio tone actually present. Note that between code elements (dots and dashes), the tuning indicator will indicate randomly. Once the signal is approximately tuned in by the tuning indicator, further CAREFUL tuning should reveal a spot where the DCD LED flashes in synchronism with the incoming code. If the DCD LED does not light, then you must rotate the THRESHOLD control on the MFJ-1278 clockwise until the DCD LED flashes with the CW signal. If the DCD LED is lit, but is not flashing with the CW signal, then you must rotate the THRESHOLD control counter clockwise until the DCD LED flashes with the CW signal.

The demodulator is an extremely narrow filter. It is much narrower than the 500 Hz CW filter in your radio (if you have such a filter in the radio). This means that very careful tuning will be required for proper CW demodulation. You should attempt to tune for the center of the range where the DCD flashes with the incoming CW tone. Once tuned to that spot, the THRESHOLD control setting should be reduced (counter clockwise) to a point just above where the DCD LED stops flashing with the incoming CW tone. This is a critical adjustment and should be set based on your judgment of best copy. Once the optimum setting is found it can be pre-set and all remaining tuning done with the receiver frequency control.

Once the incoming signal is properly tuned, the **AUTOTRAC**
feature of the MFJ-1278 will automatically LOCK and TRACK
the speed of the signal. AUTOTRAC is defaulted to ON for the
MFJ-1278. If the speed of the received signal changes
greatly, the MFJ-1278 will automatically initiate a LOCK to
the new speed and continue tracking the signal. Note that
only a large change of speed will cause the MFJ-1278 to
initiate a LOCK. The MFJ-1278 will simply track the speed if
the change is small. If the **CWSPEEDMatch** is ON when a LOCK
takes place , then the newly locked speed also becomes your
new transmit speed. See CWSPEEDMatch command for further
details.

If the **AUTOTRAC** is OFF, before the MFJ-1278 can copy the
tuned-in CW signal, it must be locked to the speed of the
received signal. Type a "Ctrl-U" to start the locking
process. The MFJ-1278 will respond with "locking...",
and proceed to copy the code. Once the speed has been
"locked" in, the MFJ-1278 will respond with
"Locking...xxwpm". "xx" is the speed of the received CW
speed from 1 thru 89. You shouldn't have to re-lock unless
the station you're listening to changes its CW sending
speed.

Transmitting CW

The MFJ-1278 will transmit International Morse code from 5
to 99 WPM.

The CW transmitting speed defaults to 20 WPM. Transmit
speed can be set by using the MSPeed command. If a speed of
15 WPM or less is selected, and FARnswor is ON, the MFJ-
1278 uses 15 WPM characters but spaces the characters so
that text is sent at the slower speed. To set the MFJ-1278
to 15 WPM, type:

MSPeed 15 <CR>

or

MODE CW,15   <CR>

Be sure the MFJ-1278 is in command mode when issuing the
MSPeed or MODE command.

Since it is always a good idea to match your transmit CW
speed to the person you are talking to, the MFJ-1278
provides another way to set the CW transmit by using the
CWSPEEDM command. The CW speed matching feature causes
your MFJ-1278 to adopt the speed of the received CW
signal as it's transmit CW speed. This is the same CW
speed that was last locked in through **AUTOTrac** or by the
use of CW lock command, CONTROL-U.

The CWSEndch (nnn) command provides user more flexibility in controlling how CW/MCW will be transmitted from keyboard or by using the key paddle. **CWSEndch** is only effective for CW and MCW modes.

To have more control over when pending transmit characters are sent, enter it as the new **CWSEndch** value. For example, setting nnn to $02 will cause the MFJ-1278 to buffer CW characters for transmission until a CTRL-B (or CTRL-R which always transmits the buffer) character is typed.

If nnn is left at the default value of 255,   the MFJ-1278 will transmit everything right away, without waiting for a space or CARRIAGE-RETURN.   Note: If you are using a terminal program such as "PROCOMM" for IBM PC/XI/AT that buffers the transmit data, then a CARRIAGE-RETURN will be needed to transmit.

The   MFJ-1278   employs   full   CW   break-in   in   CW/MCW transmitting.   Users do not have to press Ctrl-R to force the MFJ-1278 to receive or to press Ctrl-T to force the MFJ-1278 to transmit. MFJ-1278 will always go back to receiving mode at the end of each transmission. CW break-in is effective for both CW and MCW mode.

Transmitting from Memory Buffers

The BUFKEY (nnn) command is installed to allow the user to program a single key to transmit a memory buffer. BUFKEY is defaulted to the "TAB" key (9).   Wherever memory buffer feature is used in CW or MCW mode, user can transmit any buffer (0-9) by pressing the "TAB" key followed with a buffer number (0 thru 9).   In CW/MCW mode, once the buffer message is transmitted, MFJ-1278 will revert to receive mode automatically without a "CTRL-R" been issued. In RTTY and ASCII modes a "CTRL-R" is needed at the end of the buffer transmission to revert back to receive. Also a "CTRL-T" must precede BUFKEY to transmit.

Note: If you are using MFJCOM terminal program, you will not be able to use the "TAB" key as the BUFKEY.   Change BUFKEY to another key on the keyboard. See BUFKEY command in Chapter 6 for more detail.

CW Weighting

The MFJ-1278 allows you to increase or decrease the weight of code elements generated by the keyboard or key paddle.   Weight is set by using the WEIGHT command. Default of the weight factor is set for a dot to space ratio of 1:1.   The value of weight is represented by a number between 0 thru 255.   The default weight ratio of 1:1 is

equal to a weight factor of 0 (WEIGHT 0). Select a number
from 1 to 127 to INCREASE the dot/space ratio.   Select a
number from 128 to 255 to DECREASE the dot/space ratio
(weight). To change the weight, you would type:

WEIGHT ### <CR>

Where ### is a number from 1 to 127 to increase weight, or
from 128 to 255 to decrease weight.

Radio Tune

The   MFJ-1278   lets you tune your radio with the   TUNE
command.   TUNE command must be issued from command mode.
The   TUNE command can be used in any MFJ-1278 operating
mode.

TUNE command activates the PTT line for 30 seconds.   After
30   seconds MFJ-1278 will automatically return to command
mode.   To abort tuning before 30 seconds, press any key on
the keyboard.

Random Code Generator

If you want to improve your CW proficiency, you will find
the CW Random Code Generator helpful. The CW Random Code
Generator can be invoked by using the RANDOMCW command.
Pseudo   random code can be generated by the MFJ-1278 in
two formats.   Normal CW and Farnsworth CW.   The MFJ-1278
uses the setting of the FARnswor command to   determine
which format to send when RANDOMCW is turned on.   To end CW
random code generation, type:

CONTROL-C

to return to command mode and then type:

RANDOMCW OFF <CR>.

CW random code speed is set by using the MSPEED command
described above.

Many find training for CW tests with a FARNSWORTH method of
code   generation   more valuable.   It   teaches   letter
recognition at   a   speed fast enough to   avoid   the
common   learning "plateau".   Some people have trouble
passing the plateau as they increase their code speed
because as the CW speed is increased, they must relearn the
sound of the letters.

To   select   the Farnsworth method of random   code

generation, set the FARNSWOR command to ON before entering
the RANDOMCW mode. When FARNSWOR is ON the MFJ-1278
transmits CW characters generated by random code generator,
keyboard and the contest keyer using 15 words per minute
timing for code elements (dots and dashes) but increases
the inter-character spaces to cause the text to be sent at
the slower selected rate.

When FARNSWOR is turned OFF, all code elements are sent at
the selected speed.

Setting Up the MFJ-1278 for Code Practice

You can monitor the random code sent by the MFJ-1278 without
a radio connected. This can be done by attaching a small
speaker to the "SPEAKER" jack in the back of the MFJ-1278.

Note: If a radio is connected and you do not wish to
transmit the random code, the radio should be turned OFF.
MFJ-1278 will key PTT line and the keying output is active
while RANDOMCW is ON.

Under the cmd: command prompt, type:

MODE MC,##   <CR> (## is the desired code speed)

The MFJ-1278 will respond with the "Modem Status" display,
verifying the operation mode, and cmd: prompt will appear.
Next type:

RANDOMCW ON <CR>,

type:

K   <CR>,

then type:

Ctrl-T.

MFJ-1278 will generate 5 letter groups and display them on
the computer screen. If you do not wish to see the
characters as are sent, you can turn off your computer
screen. You can then turn on the computer screen once you
finish copying the code and compare the result.

To stop the random code sending, type:

Ctrl-R.

To start the random code again, type:

Ctrl-T.

To exit random code practice, type:

Ctrl-C

MFJ-1278 will return to cmd: command prompt.   Turn off
random code by typing: RANDOMCW OFF <CR>.

OPERATION: CW CONTEST MEMORY KEYER

For CW enthusiasts who like to use a key paddle to send CW,
the MFJ-1278 provides an input for an iambic key paddle.
See CW KEY PADDLE INSTALLATION in chapter 3 in this
MFJ-1278 manual for installation of your iambic key
paddle.

Sending CW with External Key Paddle

Key paddle generated CW can be sent from 5 WPM to 99 WPM.

The key paddle transmission speed defaults to 20 WPM.
Transmit speed can be set by using MSPEED.   To set the MFJ-
1278 to 15 WPM, you would type:

MSPEED 15 <CR>

Be sure you are in command mode when issuing the MSPEED
command.

Since it is always a good idea to match your transmit CW
speed   to the person you are talking to,   the MFJ-1278
provides another way to set the CW transmit speed,   the
CWSPEEDM command.   The CW speed matching feature causes
your MFJ-1278 to adopt the speed of the received CW at it's
transmit speed.   This is the same CW speed that was last
locked in   through **AUTOTrac** or the use of the CW lock
command, CONTROL-U.

The **CWSEndch** (nnn) command provides user more flexibility in
controlling how CW/MCW will be transmitted from the key
paddle. CWSEndch is only effective for CW and MCW modes.

When sending CW with key paddle **CWSEndch** should be left at
the default value of 255. MFJ-1278 will transmit everything
right away. Once the CW transmission is completed, MFJ-1278
will revert to receive mode automatically.

Buffer transmission in the Memory Keyer Mode is the same as
in the CW mode.   Weighting can also be set by the WEIGHT
command as described above in the CW mode section.

OPERATION: MODULATED CW (MCW)

The MFJ-1278 allows the transmission of CW code practice
over   a VHF   FM radio by means of Modulated CW (MCW).
When   using Modulated CW,   the MFJ-1278 will key the PTT
line of the Radio port and send a keyed audio tone to the
microphone input of your radio.   Radio port 1 or 2 may
be used for MCW operation.

You do not have to rewire the Radio cable when operating
Modulated CW.   You can use the same cable that you use for
the other modes of operation.

To enter MCW mode type:

MODE MC <CR>

The MFJ-1278 will respond with a mode status line,   then
the command prompt will display.

Operation of MCW is the same as in standard CW.   Please
refer to "CW OPERATION" for further details.

OPERATION: BAUDOT RTTY & ASCII

The MFJ-1278 modems can be configured with the mode command
to copy all shifts including 170, 425 and 850 Hz shift. The
MFJ-1278 will transmit and receive RTTY at speeds of 45, 50,
57, 75, 100, 110, 150, 200 and 300 baud. In ASCII mode, the
MFJ-1278 will transceive at speeds of 45, 50, 57, 75, 100,
110, 150, 200 and 300 baud.

The MFJ-1278 transmits both wide shift for VHF RTTY/ASCII
and narrow shift for HF RTTY/ASCII.   Wide   shift VHF
RTTY/ASCII is a standard 850 Hz shift with mark and space
tones of 2125 Hz and 2975 Hz respectively.   Narrow shift HF
RTTY/ASCII is 200 Hz shift with mark and space tones of 2110
Hz and 2310 Hz respectively.

In RTTY mode, the MFJ-1278 will receive and transmit both
the   American   Western Union and   the   internationally
recognized CCITT character set. In ASCII mode MFJ-1278 will
transmit and receive 7 bit ASCII code.

The **RXINVERT** and **TXINVERT** commands allow the MFJ-1278 to
transmit or receive RTTY/ASCII in the standard MARK for HIGH
tone or in the inverted, MARK for LOW tone mode.

The MFJ-1278 also allows you to transmit from any one of the
ten memory buffers when in one of the asynchronous modes.
Memory buffer programming and use are the same as for CW
operation.

Setting Up for ASCII and RTTY Operation

From command mode, you can set the MFJ-1278 into the desired
RTTY or ASCII mode by using the **MODE** command. Type:

MODE ## <CR>

Where ## is the two letter code for the desired RTTY or
ASCII mode.

Code designations for RTTY and ASCII modes are as follow:

```
    VHF   RTTY   =   VB
     HF   RTTY   =   HB
    VHF   ASCII  =   VA
     HF   ASCII  =   HA
```

When no baud rate for RTTY or ASCII mode is specified, the
MFJ-1278 will select the default rate of 45 baud for all
RTTY and 110 baud for ASCII modes. You can select a desired

speed by typing the baud rate after the two character code.
For example, to enter 110 baud VHF Baudot RTTY, you would
type:

MODE VB,110 <CR>

Note: The only baud rates that you can select are those the
MFJ-1278 is capable of receiving and transmitting.
Selecting an illegal baud rate will cause the MFJ-1278 to
respond with an error message, such as:

bad?

In this case the MFJ-1278 will change to default settings
and return to the command mode.

RTTY and ASCII Receiving

After properly setting the MFJ-1278 to the desired RTTY or
ASCII mode, type "K" on the computer keyboard to enter
CONVerse mode.   The STA LED on the MFJ-1278 will light.
MFJ-1278 is ready to receive RTTY or ASCII signals tuned in
by your radio.

Set the volume of your radio for normal listening level and
then tune the radio until you hear a desired signal to be
decoded. Fine tune your receiver until the tuning indicator
is centered.   If the signal is tuned properly, the DCD LED
will light and MFJ-1278 will start to decode the signals.

If the displayed text appears to be garbled, your receive
speed may be incorrectly set or the receiving signal could
be encrypted. If you suspect that the receiving signal   is
encrypted, you can use the RBITMASK command to match the
inversion pattern of the signal.

If the speed of the receiving signal does not match the
speed you set on the MFJ-1278, you can change speed by
using the MODE command.

RTTY and ASCII Transmitting

While the MFJ-1278 is in RTTY or the ASCII mode and it is in
command mode, you can initiate RTTY or ASCII transmission by
typing:

K <CR> , then type:

CONTROL-T

The MFJ-1278 is now ready to transmit. Type your message on the keyboard. The MFJ-1278 will transmit your message as it is received from your computer.

Messages stored in memory buffers 0 thru 9 can be transmitted when in RTTY or ASCII mode. To transmit from buffer, when already in transmit mode, type:

Ctrl-T   then, type a number from 0 thru 9.

The MFJ-1278 will transmit the message stored in the buffer selected.

Note: If the MFJ-1278 is not in transmit mode (i.e. in receive mode), then in order to initiate transmission from a buffer, you must type CONTROL-T twice then enter a number for the buffer. You can tell if the MFJ-1278 is in transmit mode, by observing the PTT LED on the front panel. If PTT LED is lit, MFJ-1278 is in transmit mode.

Once transmission is completed, press CONTROL-R to return MFJ-1278 to receiving mode. Note that the PTT LED is extinguished and STA LED is lit when MFJ-1278 is in receiving mode.

For some terminal programs, the CONTROL-T and CONTROL-R keys may not be used as the transmit and receive switch characters for the MFJ-1278. If the CONTROL-T and CONTROL-R do not function in RTTY or ASCII mode, you will need to re-assign the ASENDCHAR and the ARCVCHAR commands of the MFJ-1278 to other keys. See Chapter 6 of this manual for detail on the ASENDCHAR and ARCVCHAR commands.

Note: When operating RTTY or ASCII it is recommended that you operate at about 50% of full power. This is to prevent damage to the finals of your radio. Some modern radios allow operation of RTTY and ASCII at full power. You should consult the owner's manual of your radio to see what is the acceptable power level at which your radio should operate.

OPERATION: AMTOR

AMTOR (AMateur Teletype Over Radio), an error correcting protocol suite, is fully supported by the MFJ-1278. Two modes are available with AMTOR. These are mode A and mode B.

From command mode, AMTOR mode is entered by typing:

MODE   AM   <CR>,

Note that the MFJ-1278 displays an "a_cmd:" once the AMTOR mode has been entered. This "a_cmd:" command prompt lets you know that you are in AMTOR mode and only AMTOR commands are recognized by the MFJ-1278. To issue other non AMTOR commands you will have to return to the normal command mode ("cmd:" command prompt) by typing "CTRL-C".

Operation of the Tuning Indicator in the AMTOR mode is the same as all other modes. Simply tune the signal so that the center LED segment of the Tuning Indicator is lit with each burst of AMTOR signal received.

Mode A "ARQ"

Automatic request for re-transmission mode, known as "Mode A", is similar to packet radio in a number of ways.

The calling station must know exactly the ID of the called station in order for communications to occur.

The "ARQ" command causes a link attempt. This is similar to a packet CONNECT command.

This is a one-on-one protocol meaning that it is used for QSOs and is not appropriate for broadcast (see FEC and SELCALL for more on broadcasts).

ARQ Mode A introduces a few new terms. "Information Sending Station" (ISS) and "Information Receiving Station" (IRS). In ARQ, a station must be either the ISS or the IRS, and the station that is transmitting data is called the ISS.

One becomes an ISS either by issuing a successful AMTOR call (with the ARQ), or when the ISS relinquishes control of the link (through +?), or finally, if an IRS link CHANGE (see CHANGE) is requested.

Mode A "ARQ": Setup

First you should decide upon a selective call identifier and
enter it as your MYSELCALL.   A selective call is formed by
taking the suffix of your callsign and adding to the front
of it, the first letter of your callsign. If there are less
than four characters, then add the first letter TWICE to the
front of the call ID string.

Examples are:
                     N2WX   is NNWX
                     WB2SPE is WSPE

AMTOR depends on everyone having a unique selective call.
If you find there is already a station using the same call
that you would use then you may need to base your ID upon
the call district that you're in. Select a letter based upon
the table below:

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

Example:

     N2WX   becomes NWWX (using zone 2)

When MYSELCALL is set the MFJ-1278 is ready to receive and
respond to AMTOR calls.

Mode A "ARQ": Operating

To start the ARQ call, type "ARQ <selcall>" and a carriage
return. The <selcall> must be four characters long. The MFJ-
1278 CON and STA leds will light and your transmitter will
start keying on and off repetitively. If the other
station responds, you can start sending data (see below) or
you can abort the call by typing QRT or R.

When CON or STA extinguishes, a link is established. You
may now type CONVERSE or K to enter the data mode and start
transmitting data. CON and STA will be lighting and
extinguishing at various times depending on how much data
you transmit and how good the link is.

When you are through transmitting, always use the AMTOR
ending signal "+?". NEVER use a "K" (like 'over to you KK')
since this will not relinquish the ISS function and the
station you're working will be unable to transmit until the
information sender sends a "+?".

If you wish to end the contact, go back to AMTOR command
mode with a CTRL-C and type "QRT".

While you are the current receiving station, you can't send
any new data to the other station.   Should you wish to
break in for some reason before the other station sends
"+?", and you want to become the transmitter, go to AMTOR
command mode with CTRL-C and type CHANGE. This forces the
remote ISS to revert to the IRS.   Then you can start
transmitting data.

If you encounter a loss of sync (rephasing) problem during
"ARQ" mode, it could be caused by the CPU oscillator of the
MFJ-1278 not being set properly. The CPU oscillator is
factory set at 4.91520 MHz. If adjustment is necessary,
remove the cover of the MFJ-1278 and adjust C47 on the
mother board for proper CPU oscillator frequency.   A
frequency counter or oscilloscope is needed to make this
adjustment.

Mode A "ARQ": Monitoring

The **LISTEN** command is useful for monitoring other people's
ARQ contacts. To use, tune in a mode A signal and type
LISTEN.   Both CON and STA will light until the station is
synchronized, at which time the MFJ-1278 will start to
receive.

Since ARQ monitoring is not error protected you may see
occasional errors or garbage characters. This depends on
how well or poorly you hear both sides of the QSO.   The
LISTEN mode is most useful for allowing amateurs   to
continue to self police their bands.

Mode B "FEC":

Mode B FEC is a "One transmitter, many receivers" mode.
Unlike packet or ARQ, FEC does not have a one-on-one link
setup, nor does it have a re-transmission feature.

Mode B "FEC": Setup

Setup for mode B FEC is the same as ARQ, although a
selective call is not required

Mode B "FEC": Operating

To receive mode B FEC, tune in the FEC signal.   When the
MFJ-1278 detects the synchronization pattern either the CON
or the STA LED will light (which depends on the exact point

in the   transmission that you tune to) and received   data
will begin to appear on the terminal.

Use mode B FEC for calling (or finding other's) CQs,
operating in round tables, and for transmitting bulletins
to more than one station at a time.   To transmit MODE B
FEC type FEC and a carriage return.   Your transmitter will
key up.   Now type CONVERSE or K to enter the data   mode
and you're on the air with FEC.   Anything you type now will
be broadcast.

When you're done transmitting,   return to AMTOR command mode
with CTRL-C and   type R or QRT and a carriage return to
release the transmitter.   At this point again the MFJ-1278
will automatically attempt to synchronize to any mode B
signal it hears.

Mode S "SELCALL":

Mode S is exactly like Mode B,   EXCEPT that the broadcasting
station can select one or a group of stations to receive the
transmission. By turning the AMTOR SRXALL command OFF to
enable the ID matching,   you specify that you'll only print
messages from mode S broadcasts addressed to your MYSELCAL
address.

AMTOR Status LED Indicators

The CON and STA LEDs have special meanings in AMTOR modes.

STA=OFF CON=OFF

    This is the standby mode.   The MFJ-1278 is ready to
    respond   to mode A "ARQ" calls, print mode B "FEC", and
    (according   to SRXALL and MYSELCAL) print mode S
    "SELCAL" broadcasts.

STA=OFF   CON=ON

    This is the idle mode.   If in a receive mode,   the MFJ-
    1278 is   receiving an AMTOR "idle" signal.   The other
    station is   still being received ok,   though he is not
    transmitting   any text.

    In mode A this signal could also mean that a send-receive
    CHANGE is pending or that the sender is repeating a
    block.

STA=ON   CON=OFF

    This is the traffic mode.   The MFJ-1278 is currently
sending   or receiving text.

STA=ON   CON=ON

    This is the phasing error mode.   If in a mode A contact,
this means   that   the MFJ-1278 is either trying   to   re-
establish   a link or is sending indication of a receive
error.

    If   the   MFJ-1278 is in mode L "LISTEN"   then   STA=ON
CON=ON   means   the   hunt for a synchronization to   the
signal is   active.

OPERATION: NAVTEX

Navtex is a new direct printing service operating on 518
KHz.

NAVTEX stands for Navigational Telex. It broadcasts urgent
weather, navigational and other information that is intended
for ships.

Navtex Stations and Frequencies

Navtex Stations currently cover most coastal areas of Europe
and the Eastern United States.   West Coast Stations for the
United States are in various phases of planning or construc-
tion, and will begin transmitting within a few years.

Currently operational Navtex stations in the United States
include locations in Portsmouth, Virginia, Boston, Miami,
and New Orleans.   A station in Sydney, Nova Scotia can also
be received in many parts of the United States.

Several Navtex stations are planned or already under con-
struction on the West coast, including locations in San
Francisco, Astoria, Oregon, Adak and Kodiak, Alaska, Long
Beach, California and Honolulu.

The system is fully installed in Europe, and is well on its
way to becoming an international standard for navigational
information.

A partial list of stations and their broadcasting time is
listed in Table 4-5 below:

Table 4-5 Navtex Station & Frequencies

Station QTH	Station ID	Broadcast Time (UTC)
Miami	O	0000, 0600, 1200, 1800
Portsmouth	M	0130, 0730, 1330, 1930
New Orleans	G	0300, 0900, 1500, 2100
San Juan	R	0415, 1015, 1615, 2215
Bermuda*	B	0100, 0700, 1300, 1900

*Bermuda station is not yet on line.

Navtex Operation

Navtex is part of the Mode B (FEC) AMTOR mode.   Each Navtex
transmission is prefaced by the characters ZCZC followed by
a four character code of two letters that identify the
station and type of message followed by a number code from
00 to 99 that identifies the particular   message.   This
prevents your MFJ-1278 from receiving messages that have
already been received.   In addition, you can use the MFJ-
1278 commands NAVMSG and NAVSTN to prevent your MFJ-1278
from receiving certain types of Navtex messages and/or
certain Navtex stations you don't want to receive.

The first two characters consist of two letters (from A to
Z).   The first letters identify the station within a
particular area. (Each receiving area is limited to 26
stations).   The second letter identifies the type of
message. Refer to the following explanation of the NAVMSG
command for the different types of messages that are identi-
fied by this second letter.

The NAVMSG and NAVSTN commands allow you to choose both the
types of messages you receive and the stations you receive.
The other command that applies is the NAVTEX command.

To enter NAVTEX mode, you must first enter AMTOR mode   by
typing:

MODE AM <CR>

then type:

NAVTEX ON   <CR>

MFJ-1278   will   display   "n_cmd:"   Navtex   command   prompt
indicating that it is ready to monitor any Navtex messages.
Tune your radio to 518 KHz.

To receive NAVTEX, MFJ-1278 must first receive the ZCZC
start message, followed by the four character preamble
described above.   If this is not received intact, the
message will not be received.   At the end of the message,
NNNN will be received and the MFJ-1278 will stop receiving
the Navtex message.

MFJ-1278 will remember the last 200 four character preambles
received with less than 1/8 of its characters received in
error. MFJ-1278 will not reprint any of these messages when
they are re-transmitted from that Navtex station.   If you
exit the "a_cmd:" command prompt, the preamble memory is
erased.

Emergency messages are numbered 00 and will always be

printed   regardless   of   whether   they   have   already   been
received.

To   prevent   your   MFJ-1278 from   receiving   certain   Navtex
stations,   just type "NAVSTN XXXXXXXXXXXX"   where each X is
the   identifying letter of the station you want to   receive.
Your   list   of   stations   to receive may contain   up   to   26
letters, each representing a station.

For example,   if you want to receive only stations A,   C and
P,   then   you type "NAVSTN ACP".   Only signals   from   these
three stations will be received by your MFJ-1278.

If you want to prevent certain stations from being received,
leave then off the list.   Then,   those stations will not be
received while others within the receiving area will.

You   may   also   type   "NAVSTN ALL" (the   Default   value)   to
receive all Navtex stations.

NAVMSG   works like the NAVSTN command with the ALL parameter
used to exclude all,   or to specify the type of messages   to
receive.

The types of Navtex messages currently are:

        A: Navigational warnings
        B: Storm Warnings
        C: Reports of Ice
        D: Search/Rescue Information
        E: Weather forecasts
        F: Pilot Service Messages
        G: DECCA System
        H: LORAN-C
        I: Omega Systems
        J: SATNAV Systems

K thru-Z are not in use at this time.   They are reserved for
future use.

To exit NAVTEX mode, type:

NAVTEX OFF

MFJ-1278   will   return   to   **a_cmd:**   command   mode.   Issuing
another   Control-C   to enter the "cmd:" command   prompt   for
non-amtor operation.

NAVTEX   commands   are explained in the COMMANDS   chapter   in
this instruction manual.

OPERATION: FAX

The MFJ-1278 provides an independent modem to transmit and receive FAX with multi-level of grays. FAX modes supported by the MFJ-1278 are listed in Table 4-6. These include Weather FAX (FAXMODE 3) and wire photographs (FAXMODE 1). However, the built-in printer port of the MFJ-1278 will support 2 levels FAX. In order to support more than 2 levels in FAX, you must have the specific terminal program for your computer to support multi-gray levels.

FAX operation of the MFJ-1278 does not require any special computer or software to receive FAX pictures on your Epson graphics compatible printer. However, to print a FAX picture to your computer screen or to save FAX pictures to disk, you need software that allows these operations. MFJ Enterprises, Inc. offers terminal software for some computers to support this operation. This software allows you to print FAX pictures to screen in near real time and to save FAX pictures to disk. FAX pictures saved on disk can be re-transmitted, sent to your printer, or recalled to screen at any time.

MFJ Terminal programs which support on screen 2-levels FAX operation are as follows:

1. MFJ-1284 for IBM PC/XT/AT and compatibles in 5-1/4"disk.

2. MFJ-1284M. Same as above but in 3-1/2" disk.

3. MFJ-1287 for Apple Macintosh computer in 3-1/2" disk.

4. MFJ-1282 for Commodore C-64 and C-128 in 5-1/4"disk.

FAX Formats

The MFJ-1278 lets you receive and transmit FAX. The modulator and demodulator of the MFJ-1278 are pre-set to allow FAX operation without any recalibration. The MFJ-1278 will support FAX formats listed in Table 4-6.

Table 4-6: MFJ-1278 FAX Formats

FAXMODE (n)	Lines per Minute	Lines per Second	Type of Service
1	60 line/min.	1 line/sec.	Wire Photographs
2	90 line/min.	1.5 line/sec.	
3	120 line/min.	2 line/sec.	Weather FAX
4	240 line/min.	4 line/sec.	Satellite Weather FAX
5	360 line/min.	6 line/sec.	
6	480 line/min.	8 line/sec.	
7	180 line/min.	3 line/sec.	

You may change the format with the FAXMODE command. From command mode, type:

FAXMODE n <CR>

Where n is a number from 1 thru 7 as listed in the Table 4-6.

For example, if you want to change to FAX format 1 (60 lines per minute), type:

FAXMODE 1 <CR>

The MFJ-1278 will be set to receive or transmit FAX format 1.

FAX Frequency

FAX transmitting stations are usually found on the HF bands. Weather FAX stations are generally upper sideband. Some of these stations maintain a regular schedule. Table 4-7 lists the frequencies of some FAX stations.

Table 4-7: FAX STATION FREQUENCIES

Service	Band	Frequency (KHz)
Weather	USB	3,357.00 4,268.00 4,975.00 6,946.00 10,865.00 12,125.00 20,015
Photographs	LSB	10,680.70 17,673.90 18,434.90, 20,738.00

Other FAX Frequencies

The following frequencies were obtained from Popular Communication Magazine:

FREQUENCIES (KHz, USB)	LOCATIONS
4,2710.00 9,890.00 13,510.00	Halifax, Canada
8,502.00 12,750.00	Boston, MA
9,389.50 11,035.00	Brentwood, NY
4,793.50 10,185.00 12,201.00 14,671.50	Washington, DC
9,157.50 17,447.50	Mobile, AL
8,080.00 10854.00 16,410.00	Norfolk, VA
4,802.50 9,440.00 13,862.50	Hawaii
7,770.00 11,090.00 13,627.50	Hawaii
8,459.00	Alaska
4,346.00 8,682.00 12,730.00 17,151.20	San Francisco, CA
8,646.00 17,410.50	San Diego, CA

FAX Operation Installation

Radio interface for FAX operation is the same as for other modes of operation. Radio connection of the MFJ-1278 to your radio is described in Chapter 3 of the MFJ-1278 manual.

Printer Connection

If you have a terminal program which supports FAX printing to the computer screen, then you should attach your printer to your computer printer port and not to the MFJ-1278. In this case turn the **PRINTGRA** command OFF. If you intend to receive the FAX picture and send it to the printer that is attached to the MFJ-1278 parallel port then turn the **PRINTGRA** command ON.

To insure successful FAX pictures printed to your printer, you must make sure that your printer is properly set. Make sure that your printer is set to "EPSON" , "IBM" or compatible graphics mode. This is usually selected by DIP switches on the printer. Select "EPSON" graphics mode first. If "EPSON" graphics mode does not work, then you should set your printer to "IBM" graphics mode and try again.

Receiving FAX

From command mode, the MFJ-1278 can be set to FAX mode by typing:

MODE FX <CR>

Select the desired FAX mode by typing:

FAXMODE n <CR>

n is the FAX format as indicated by FAX Format Table 4-6. For HF weather FAX, select FAXMODE 3. The default FAX mode for MFJ-1278 is FAXMODE 3 (120 lines per minute format). This is the format used by most weather FAX stations. For other FAX format use other n value as listed in Table 4-6.

Set the **PRINTGRA** command to ON if you are printing the FAX picture to the printer attached to the MFJ-1278 parallel printer port. Set the **PRINTGRA** command to OFF if you are printing the FAX picture to the computer screen. Note that to print FAX picture to the computer screen requires a terminal program which will perform this function.

Set the audio output of your radio to normal volume.   Tune
your   radio   to   a   desired   frequency.   If   you   are   not
familiar   with   recognizing FAX signals,   you   may   want   to
select   one   of the   weather   FAX frequencies   listed   above.
Weather   FAX   is   usually   transmitted   at   120   lines   per
minute.   This   is   a horizontal   scanning   rate   of   2
lines per   second.   So by listening to the scanning   rate,
you can determine what format you should set the MFJ-1278 on
to receive the signal.

After tuning in the desired FAX frequency, set the THRESHOLD
control to maximum clockwise rotation.   Tune the radio so
that   the   DCD LED remains lit.   Now observe   the   TUNING
INDICATOR   of the MFJ-1278 while fine tuning your   radio.
You   will   notice   that with each scan the tuning   indicator
will   move toward the center.   Tune the radio so   that   the
tuning   indicator is centered at the end of each   FAX   scan.
Once you achieve this,   the FAX signal is tuned in and   the
MFJ-1278 is ready to decode the FAX signal.

FAX Printing to Printer

This   section   applies   if you have your   "EPSON"   or   "IBM"
graphics compatible printer attached to the parallel port of
the MFJ-1278.

Most   commands that affect FAX printing default to   a   value
which   will   allow   successful   printing.   However,
before printing,   make sure the commands   EPSON and PRINTGRA
are ON.   Printing   a   FAX image directly to a printer   will
not function unless EPSON and PRINTGRA are ON.

After   selecting   the   desired FAX mode,   type   K   to   leave
command mode and enter the CONVERSE mode.   Once in CONVERSE
mode   the MFJ-1278 is in standby-receive mode.   This means
that   the   MFJ-1278   is   listening to the radio   for   the
distinctive   "tic-tic"   that indicates   the   synchronization
period   at   the beginning   of   a picture.   If the MFJ-1278
hears the   "tic-tic" well   enough,   it will establish a lock
onto the signal   and start   printing to the printer.   The
printer   will   print upon each scan of the FAX picture.

The   MFJ-1278's   built-in   LOCK detects the   beginning   of
each   picture before starting to print.   This insures   each
picture   will   be   printed from top to   bottom.   If   you
want   the   printer to start to print in the middle   of   the
picture,   you   may   force   a lock on the picture   and   the
printer   will   begin to print upon the   "force   lock".   To
force a lock,   you simply type   the letter "L" while in   the
FAX standby-receive   mode.

The LOCK detect feature on the MFJ-1278 is effective for FAXMODE 3. For other FAXMODEs, you will want to force a LOCK at the beginning of the picture to insure proper printing.

If the FAX picture appears to be printed shifted to the right, you can type the "<" key to shift the picture to the left. Each repetition of the "<" key will shift the picture 1/10" to the left. To shift the picture to the right, use the ">" key. Each repetition of the ">" key will shift the picture to the right 1/10". For example, if you needed to shift the picture to the left 1 inch, you would press the "<" key ten times. The picture can be shifted to the right or left at any time during printing.

If your picture is elongated horizontally or vertically, you can correct this by setting the ASPECT ratio. ASPECT is used to establish a reasonable aspect ratio between horizontal and vertical presentation of FAX graphics. ASPECT ratio can be set between 2 thru 8, with 2 being the optimum aspect ratio for weather FAX. The default ASPECT ratio of the MFJ-1278 is 2. The ASPECT ratio can be set by using the command ASPECT followed by a number from 2 thru 8. If you find that your picture seems to be elongated horizontally, you should decrease the value of aspect. If the picture is elongated vertical,y, you should increase the aspect value.

If you notice spaces in the printed picture, you should set GRAPHLF to OFF. The GRAPHLF command determines whether the MFJ-1278 will issue a line feed before the carriage return on every line of graphics. GRAPHLF defaults to OFF. For most printers GRAPHLF should be set to ON.

If the printed picture appears to be slanted to the left or to the right, this indicates that the master CPU clock on the MFJ-1278 may not be in frequency with the transmitting signal. To correct this problem, you will need to remove the cover of the MFJ-1278 and adjust the white capacitor trimmer, C47. This adjustment does not require any special equipment. Simply adjust C47 1/8 rotation at a time and let the printer print a few lines of the FAX picture. If the picture seems to be getting worse, rotate the trimmer in the opposite direction. Repeat this procedure until the picture is straight vertically.

Display FAX Picture on Computer Screen & Save it to Disk

The MFJ-1278 firmware does not support printing to your computer screen or allow you to save FAX pictures in disk files. You need special software for your particular computer that provides these features.

For IBM PC/XT/AT or compatibles, Macintosh and Commodore C64/128 users, MFJ offers an optional Starter Pack which will allow you to receive SSTV/FAX in near real time to the screen. SSTV/FAX pictures can also be saved on disk with software supplied with the Starter Pack. Pictures saved on disk may be re-transmitted, recalled to print to the screen or sent to the printer at any time. Order MFJ-1284 for IBM PC/XT/AT or compatibles, MFJ-1287 for Macintosh computer and MFJ-1282 for Commodore C64/C128.

If you are using one of the above terminal program you should first turn PRINTGRA OFF. Follow the instructions given in the software documentation to receive FAX pictures on the screen or to save the pictures to disk files.

For those who wish to write special software to handle FAX graphics and display it on screen, the following information may be useful for you.

When the PRINTGRA command of the MFJ-1278 is ON, FAX pictures received will be sent to the graphics printer attached to the MFJ-1278 printer port. If PRINTGRA is OFF, the MFJ-1278 will direct the picture graphics to your terminal thru the RS-232C port of the MFJ-1278. This FAX format thru the RS-232 port will be in either 2 levels (MULTIFAX OFF) or multi-level raw data format (MULTIFAX ON). The default is the 2 levels data format. To save to disk or display on your computer screen, the terminal program you used must be compatible with the multi-level raw data format or it must be compatible with the 2 levels "FAX frame" format:

Two Levels FAX Pictures Format

The FAX frame sent to the user's terminal contains carriage control information, graphics setup information and "nnn" columns of 6-row high dot graphics.

LF, CR, ESC x x, ESC x x x, <<nnn character of graphics>>

Special note: in order to allow the FAX frames to pass through without special handling, each character in the frame is biased upward with the value $30 (Hex), so only characters of ASCII value $30 through $7F are sent to the terminal.

A few side effects of the special handling:

1. FAX frames and pictures may be transmitted in PACKET or ASCII or logged to disk without concern for binary

transfers.

2. The "x" values in the FAX header are not useful for determining the format of the FAX picture (since 2 bits of the 8 bit lengths are lost). This is not serious provided you are aware of which format a FAX picture was copied under.

The number of graphics characters, "nnn", following a FAX frame header, depends on the FAXMODE. See horizontal density under the FAXMODE command for more information.

Multi-level FAX Picture Raw Data Format

In FAX mode the MFJ-1278 can provide data thru the RS-232 port in raw data format. With special terminal software which can support this data format, you can display and save multi-gray levels pictures. The number of gray levels which the raw date format provided thru the RS-232 port is determined by the command TVBREAK. Current TVBREAK is set to 8 levels of gray.

To invoke multi-level FAX receiving, under the cmd: prompt, type:

MULTIFAX ON   <CR>

then, make sure that you are in the FAX mode by typing:

MODE FX   <CR>

Type K to enter CONVERSE mode, then type L to start receiving raw FAX data. Note that with MULTIFAX turned On, you must type L to start receiving data. Unlike the 2 levels format which the MFJ-1278 firmware detects the beginning of a FAX picture and also signal the end of the FAX picture, in multi-level FAX the terminal program will establish synchronization and decide when to start and when to finish printing picture to the screen.

Note that when MULTIFAX is turned ON, PRINTGRA command will be ignored. This means that in FAX mode and with MULTIFAX turned ON, MFJ-1278 will start to send raw data to the terminal regardless of the setting of PRINTGRA command.

For those who wishes to write program to support this multi-level raw data format, the following information will be useful to you:

Upon typing the L character, MFJ-1278 will start to send the raw-data stream. Terminal program should look for the distinctive sync pattern at this time to detect the

beginning of the picture. Raw-data stream will continue to
be   sent   thru   the RS-232 port until   the   end   of   picture
pattern is detected or a "CTRL-C" is received.   Therefore
for multi-level FAX the terminal program is responsible for
attaining synchronization to begin a picture and to detect
the end-of-picture to stop printing.

Raw multi-level data are packed three pixels-per-byte and
biased with +30H (similar to the 2 level format in this
respect).   The leftmost 2-bit pixel, in bits 5 and 4 ("a")
in the below example, come first in time with respect to "b"
and "c" pixels.

Each pixel reflects the sampling of the received audio at a
366.66 uS interval.   Every data byte of three pixels
represents a 2.5 mS "snapshot" of the receiver.

There are three exceptions. If the actual data byte (before
unbiasing) is "p", "q", or "r", then the 1200 Hz SYNC tone
is being received.   "p" means it was received in the first
time position, "q" the second, and "r" the third.

Example: Date byte decoded

bit #   7 6 5 4 3 2 1 0
data   x x a a b b c c
             x = don't care
             a,b,c = first,   second,   and third pixel
                       groups.

Terminating FAX Printing

Printing of a FAX picture can be terminated at any time
during the printing.   You must type a "ESC", CTRL-C in
order to terminate FAX printing.   The MFJ-1278 will return
to command mode, and printing will stop.

Transmitting FAX

The MFJ-1278 is capable of transmitting 2 levels or multi-
gray levels pictures in the FAX mode.

Two Levels FAX Transmitting

In 2 levels FAX, pictures to be transmitted by the MFJ-1278
in FAX mode must be stored on disk and must be of the format
required by the MFJ-1278. How a file is recalled and
transmitted will depend on the terminal program used. Refer
to the instruction manual of your terminal program.

Enter the FAX mode by using the MODE command.   Type:

MODE FX <CR>

The   MFJ-1278 defaults to FAXMODE 3 (120 lines per minute
or 2 lines per second). Set MULTIFAX to OFF (default).

The FAX format can be changed by using the FAXMODE command.
The MFJ-1278 supports receive or transmit of all FAX formats
listed in Table 4-6 in both transmit and receive.

In 2 levels FAX, pictures saved under one format may NOT be
transmitted under a different format. For instance, you can
NOT receive and save a FAX picture under FAX format 3, then
re-transmit it under FAX format 2 or another FAX format as
listed in Table 4-6.

After entering the FAX mode and selecting the desired FAX
format to transmit, enter the CONVERSE mode by typing:

K

then, type:

CTRL-T.

The MFJ-1278 is now ready to transmit a picture and respond
with: "Send PIX Now". In FAX transmit mode MFJ-1278   will
not key the   transmitter until   it   has   been   given
around 1,500 characters of FAX graphics.   User should
follow the   normal   "File Upload" procedure given by the
terminal program.

In 2 levels FAX, when the MFJ-1278 keys the transmitter it
sends (5* (ASPECT+1)) rows of synchronization pulses before
starting to transmit the picture.

The MFJ-1278 determines that it is finished transmitting
by looking at its input buffer: If the buffer is   empty,
the transmission is assumed complete, and the MFJ-1278 then
sends an IDLE   signal   for   approximately 15   to   18
seconds.   This signals the end of the transmission.

NOTE: If your computer does not transmit the data to the
MFJ-1278 rapidly enough,   partial picture transmission
will result.   Also if your computer does not support
flow control, incorrect operation may result.

Multi-level FAX Transmitting

The MFJ-1278 is capable of transmitting multi-gray levels
pictures.   To achieve this you must use a terminal program

which supports the multi-level data format required by the
MFJ-1278.   Each level of gray is represented by a tone
produced by the MFJ-1278 modem.   The 16 tones which can be
produced by the MFJ-1278 FAX/SSTV modem (in Hz) are:

1500, 1550, 1600, 1650, 1700, 1750, 1800, 1850, 1900,   1950,
2000, 2050, 2100, 2150, 2200, and 2250.

The   tone being transmitted determines the shade of gray in
the   picture.   The higher the tone the   lighter   the   gray.
1500 Hz is for the sync, 1550 Hz is black and 2250   Hz   is
white.   The   other tones determine the shades   between   the
black and the white areas.

The   command PIXTONES is used to set the   multi-gray   levels
FAX   and   SSTV   pictures   being   transmitted.   The   current
PIXTONES is set to 8 gray levels. PIXTONES defines the   gray
levels of   the SSTV & FAX transmitted by the MFJ-1278.   To
achieve this you must use a terminal program which   supports
the multi-gray levels SSTV & FAX transmitting.

PIXTONES is defined as follows:

PIXTONES aaa,bbb,ccc,ddd,eee,fff,ggg,hhh

     where,

     aaa   is the value which determines the "white" area of
     the transmitted picture.

     hhh   is the value which determines the "black" area of
     the transmitted picture.

     The values between aaa and hhh defines the gray areas
     of the transmitted pictures.

The default PIXTONES values are:

PIXTONES $89,$8A,$88,$98,$88,$B0,$90,$A0

Note that if 4 gray-levels of SSTV or FAX transmission, MFJ-
1278 will automatically select only four of the PIXTONES
values you have chosen. PIXTONES does not affect 2   levels
FAX transmitting.

If the picture transmitted does not seem to have the right
contrast, try and   reset the PIXTONES values.   The   HEX
values which represent the PIXTONES for the pictures to be
transmitted is listed in Table 4-9 below.

In SSTV and MULTIFAX mode, MFJ-1278 automatically transmit
the sync tone.   Therefore, sync tone does not need to be
selected for PIXTONES parameters.

Table 4-8: FAX/SSTV Multi-Gray PIXTONES

PIXTONES Values (HEX)	FAX/SSTV Transmit Tones (Hz)
(not selectable)	1500 (sync)
$00	1550
$A0	1600
$90	1650
$B0	1700
$88	1750
$A8	1800
$98	1850
$B8	1900
$BC	1950
$BA	2000
$BE	2050
$B9	2100
$BD	2150
$BB	2200
$BF	2250

Creating FAX Pictures for Transmitting

FAX pictures captured by the MFJ-1278 and saved on disk can
be re-transmitted. However, it must be transmitted with the
same format with which it was saved.

MFJ Starter Packs for the IBM PC/XT/AT or compatible
computers can be used in conjunction with other graphics
generating programs available to create your own drawings
and graphics.

MFJ-1292 "Picture Perfect" Video Digitizer for the IBM
and compatible computers allows you to digitized a picture
with a Camcorder or video camera.   The digitized picture is
stored to disk and can be transmitted by the MFJ-1278 in any
of the FAX formats.

Contact   us or your MFJ dealer for more   information
concerning the MFJ-1292 Video Digitizer and other graphics
generating programs for use with the MFJ-1278.

OPERATION: SLOW SCAN TELEVISION (SSTV)

The MFJ-1278 lets you receive black and white SSTV
pictures with the built-in printer port in 4 levels of gray.
However, with additional software for your computer, it can
receive and transmit multi-gray levels pictures above the 4
levels provided by the MFJ-1278 firmware. If you are using
a standard terminal program with does not support screen
printing of SSTV pictures, you must attach a "EPSON" or
"IBM" graphics compatible printer to the MFJ-1278's parallel
port in order to allow printing of SSTV pictures.

If you are using the MFJ-1278's parallel printer port, then
SSTV pictures with 4 levels of gray will be supported.
Pictures received with more than 4 levels of gray will be
printed on the printer with 4 levels of gray.

The MFJ-1278 will receive all SSTV formats listed in Table
4-9. It will receive color and black and white SSTV
pictures and print black and white on any "EPSON" or "IBM"
graphics compatible printer.

To use the SSTV mode of the MFJ-1278 a special computer and
program are not required. However, if you intend to print
pictures to screen or save to disk, you will need a program
that allows this operation.

SSTV Formats

MFJ-1278 provides a dedicated modem for SSTV operation. The
modulator and demodulator frequencies of the MFJ-1278 are
pre-set to allow SSTV operation **without** any recalibration.
The MFJ-1278 supports all SSTV formats listed in Table 4-9.

Table 4-9: MFJ-1278 SSTV Formats

TVMODE(n)	Formats
1	8.5 seconds
2	12 seconds
3	17 seconds
4	24 seconds
5	36 seconds

The SSTV format can be changed by using the **TVMODE (n)**
command. n is a number from 1 thru 5 as listed in the Table
4-9.   For example, to set MFJ-1278 to 12 seconds SSTV
format, you would type:

TVMODE 2 <CR>

The MFJ-1278 would be set to receive or transmit SSTV in the
12 seconds format.

SSTV Installation

Installation of MFJ-1278 for SSTV operation is the same as
the other modes of operation. Installation of MFJ-1278 to
your radio is described in Chapter 3 of this manual. Either
Radio port can be used to connect to your radio for SSTV
operation.

Printer Connection

If you have a terminal program which supports SSTV picture
printing to the computer screen, then you should attach your
printer to your computer printer port and not to the MFJ-
1278.   In this case turn the **PRINTGRA** command OFF. IF you
intend to receive the SSTV picture and send it to the

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printer that is attached to the MFJ-1278 parallel port, then you should turn **PRINTGRA** command ON.

To insure successful SSTV picture printing to your printer, you must make sure that your printer is properly set. Make sure that your printer is set to "EPSON" , "IBM" or compatible graphics mode. This is usually selected by DIP switches on the printer. Select "EPSON" graphics mode first. If "EPSON" graphics mode does not work, then you should set your printer to "IBM" graphics mode and try again.

Receiving SSTV Pictures

From command mode, the MFJ-1278 can be set to SSTV mode by typing:

MODE TV <CR>

Select the desired SSTV formats by using the **TVMODE** command. Type:

TVMODE n   <CR>

n is the TV format 1 thru 5 as listed in SSTV Format Table 4-9. For example for 8.5 Second TV format, you will type: TVMODE 1.

The default SSTV mode for MFJ-1278 is **TVMODE 1** (8.5 seconds format).

After tuning to the desired SSTV frequency, observe the **TUNING INDICATOR** of the MFJ-1278 while fine tuning the radio. You will notice that with each scan the tuning indicator will move toward the center. Tune the radio so that the 10th LED segment from left is lit at the end of each SSTV line scan. Once you achieve this, the SSTV signal is tuned in. The DCD LED should light. If DCD LED on the MFJ-1278 is not lit, rotate the **THRESHOLD** control until it is lit.

SSTV Printing to Printer

At this point you will want to ensure that your printer is properly set. Make sure that your printer to set to "EPSON GRAPHICS" or IBM graphic mode. This is usually selected by DIP switches on the printer. "IBM GRAPHICS" mode is not the same as "EPSON GRAPHIC" mode. If you are using an EPSON graphics printer, you should turn the **IBM GRAPHICS** mode off and set your printer to EPSON GRAPHICS mode.

Although most commands of the MFJ-1278 that affect SSTV
printing are defaulted to allow successful printing, you
should check these commands before printing any SSTV
picture. You should insure that the commands **EPSON** and
PRINTGRA are ON. The default values of these commands are
ON.   SSTV printing to the printer will not function unless
these commands are turned on.

Note that **PRINTGRA** should be turned ON only if you are
printing pictures through the MFJ-1278 printer port. If you
are sending pictures to the computer screen with terminal
program which is capable of performing this function, then
PRINTGRA must be turn OFF.

After entering the SSTV mode and you have properly selected
the correct TV format, type:

K

to leave command mode and enter the CONVERSE mode. Once in
CONVERSE mode the MFJ-1278 is in standby-receive mode.   This
means that the MFJ-1278 is listening to the radio for the
synchronization signal at the beginning of each SSTV
picture. If the MFJ-1278 hears the synchronization signal
well enough, it will establish a lock onto the signal. Once
the signal is locked in MFJ-1278 will display a "!". A "!"
indicates that a lock on the signal is established and MFJ-
1278 begins to decode the signal.   Once decoding is
completed, the printer attached to the MFJ-1278 will begin
to print the captured SSTV picture.

The MFJ-1278 detects the beginning of each picture before
starting to print.   This insures each picture will be
printed from top to bottom.   If you want the printer to
start to print in the middle of the picture, you may force
printing to begin at any time by typing the letter "L" while
in the SSTV standby-receive mode.

If you notice spaces in the printed picture, you should set
GRAPHLF to OFF.   The GRAPHLF command determines whether the
MFJ-1278 will issue a line feed before the carriage return
on each line of graphics.   The default for GRAPHLF is OFF.
For most printers GRAPHLF should be turned ON.

If the picture printed appears to be distorted in large
black areas, you should make sure that the command TVHSYNC
is set to OFF. The default for TVHSYNC is OFF.   For most
SSTV receiving TVHSYNC should be turned OFF.

The 4 levels SSTV picture received by the MFJ-1278 thru the
built-in parallel printer port can be adjusted for
brightness and contrast by using the TVBREAK command.

TVBREAK controls the brightness and contrast of the SSTV
received on the MFJ-1278 printer port as well as when SSTV
picture is printed to the screen. SSTV pictures sent to the
MFJ-1278 printer port is set at 4 gray-levels. With terminal
software which supports multi-gray levels SSTV you can
receive SSTV pictures with up to 8 levels of gray.

TVBREAK command is arranged in the following format:

TVBREAK sss,aaa,bbb,ccc,ddd,eee,fff,ggg

    where,

    sss is the sync. The default value is $42.

    aaa is the black area, the default value is $28.

    ggg is the white area, the default value is $30.

    bbb thru fff are gray areas between the black area and
    the white area.

The default TVBREAK values are:

TVBREAK $42,$27,$28,$2A,$2B,$2D,$2F,$30

Note that the values for TVBREAK are in HEX.   The smaller
values represent the darker shade of gray. $30 is the
lightest gray and $27 is black. All other TVBREAK values in
between $27 and $30 define the other gray levels of the
picture being received. Sync is the first value at HEX $42.
Sync value can not be changed when resetting the TVBREAK
values.

If the picture you are receiving does not seem to have the
right contrast, reset the TVBREAK values.

Selection of TVBREAK values which is meaningful are as
follows:

$25-$26-$27-$28-$29-$2A-$2B-$2C-$2D-$2E-$2F-$30-$31-$32-$33
Black<--------Dark Gray<---------Light Gray<--------White-<

Note that if you select to operate only 4 level SSTV such as
printing to the MFJ-1278 printer port, the MFJ-1278 will
automatically select 4 TVBREAK values from the eight TVBREAK
values which you have selected.

SSTV Printing to the Screen

The MFJ-1278 does not support printing graphics to the
computer screen without specific terminal software designed
for your particular computer. MFJ offers an optional
Starter Pack which will allow you to receive SSTV in near
real time to the screen. SSTV pictures can also be saved on
disk with software supplied with the Starter Pack. Pictures
saved on disk may be re-transmitted, recalled to print to
the screen or sent to the printer at any time. For the
terminal software which support this operation, contact MFJ
Enterprises, Inc.

When using a terminal program which allows printing of SSTV
pictures to the computer screen, the command PRINTGRA must
be turned OFF. MFJ-1278 will send pictures to the computer
screen through the RS-232 port instead of the built-in
printer port.

For those who wish to write their own software to handle
SSTV printing to the computer screen, the following
information may be useful for you.

When the PRINTGRA is turned OFF, TVX is ON and MFJ-1278 will
send free running raw data thru the RS-232 port. Note that
this is not the 4 levels data which is used for printing to
the printer port of the MFJ-1278. Raw data format is
provided so that user can use special terminal program to
achieve more than the 4 levels of gray provided by the MFJ-
1278 firmware. This raw data graphic format is the same for
SSTV mode and FAX mode.

Upon hearing the sync tone for SSTV, raw-data stream is sent
to the RS-232 port until a "CTRL-C" is received. For multi-
level SSTV and FAX modes, the terminal program is
responsible for attaining synchronization and end-of-picture
detection of pictures.

Raw multi-level data are packed three pixels-per-byte and
biased with +30H (similar to the 2 level format in this
respect). The leftmost 2-bit pixel, in bits 5 and 4 ("a")
in the below example, come first in time with respect to "b"
and "c" pixels.

Each pixel reflects the sampling of the received audio at a
866.66 uS interval. Every data byte of three pixels
represents a 2.5 mS "snapshot" of the receiver.

There are three exceptions. If the actual data byte (before
unbiasing) is "p", "q", or "r", then the 1200 Hz SYNC tone
is being received. "p" means it was received in the first
time position, "q" the second, and "r" the third.

There are three exceptions. If the actual data byte (before
unbiasing) is "p",   "q",   or "r", then the 1200 Hz SYNC tone
is being received.   "p" means it was received in the first
time position, "q" the second, and "r" the third.

Example: Date byte decoded

bit #   7 6 5 4 3 2 1 0
data   x x a a b b c c
             x = don't care
             a,b,c = first,   second,   and third pixel
                       groups.

Saving SSTV Pictures

When the **PRINTGRA** command of the MFJ-1278 is ON, SSTV
pictures received will be sent to the graphics printer
attached to the printer port.   If PRINTGRA is OFF, the   MFJ-
1278 will direct the picture graphics (in raw data format)
to the user's terminal thru the RS-232C port of the MFJ-
1278. If your terminal program allows you to save a file to
disk, then you can save the picture on disk and re-transmit
it later.

Terminating SSTV Printing

Printing of an SSTV picture can be terminated at any time
during the printing.   User will type "ESC" then CTRL-C.
Printing will stop and the MFJ-1278 will return to command
mode.

Transmitting SSTV Pictures

The MFJ-1278 is capable of transmitting multi-gray levels
SSTV pictures.   To achieve this you must use a terminal
program which support the multi-level SSTV data format
required by the MFJ-1278.

Each level of gray is represented by a tone produced by the
MFJ-1278 modem.   The 16 tones which can be produced by the
MFJ-1278 FAX/SSTV modem (in Hz) are:

1500, 1550, 1600, 1650, 1700, 1750, 1800, 1850, 1900,   1950,
2000, 2050, 2100, 2150, 2200, and 2250.

The tone being transmitted determines the shade of gray in
the picture.   The higher the tone the lighter the gray.
1500 Hz is for the sync, 1550 Hz is black and 2250 Hz is

SSTV & FAX transmitting.

PIXTONES is defined as follows:

PIXTONES aaa,bbb,ccc,ddd,eee,fff,ggg,hhh

    where,

       aaa is the value which determines the "white" area of
       the transmitted picture.

       hhh is the value which determines the "black" area of
       the transmitted picture.

       The values between aaa and hhh defines the gray areas
       of the transmitted pictures.

The default PIXTONES values are:

PIXTONES $B9,$BA,$B8,$98,$88,$B0,$90,$A0

Note that if 4 gray-levels of SSTV or FAX transmission, MFJ-
1278 will automatically select only four of the PIXTONES
values you have chosen.

If the picture transmitted does not seem to have the right
contrast, try and rset the PIXTONES values. the HEX
values which represent the PIXTONES for the pictures to be
transmitted is listed in Table 4-8 in the "Multi-level FAX
Transmitting" section in this chapter.

Note that sync tone of 1500 Hz is automatically transmitted
when MFJ-1278 enters SSTV transmitting. Sync tone can not
be changed.

SSTV pictures received by the MFJ-1278 and stored on disk
can be retransmitted under the same SSTV format. How a file
is recalled and transmitted will depend on the terminal
program used. Refer to the instruction manual of your
terminal program.

To enter the SSTV transmit mode, first Type:

MODE TV   <CR>

Select the desired SSTV format with the TVMode command.   If
you are using a terminal program which support multi-level
SSTV transmitting, you should follow the transmitting
procedure given by the program manual.

After entering the SSTV mode, and selected the desired TV

Note that under multi-level SSTV, selection of TVMODE for transmitting is not required.

After entering the SSTV mode, enter the CONVERSE mode by typing:

K.

Then, switch to transmit mode by typing:

CTRL-T.

Terminal program will sends raw data stream to the MFJ-1278 thru the RS-232 port. Transmit to receive switching is automatic and occurs when the data stream has been exausted. Note that TVMODE setting is NOT required for multi-level transmitting. Follow the normal "File Upload" procedure given by the terminal program.

CAUTION: If your terminal program is not fast enough to support 480 cps sustained then you will be unable to transmit multi-level SSTV or multi-level FAX transmitting.

Creating SSTV Pictures for Transmitting

SSTV pictures captured by the MFJ-1278 and saved on disk can be re-transmitted. However, it must be transmitted with the same format with which it was saved.

In order to enjoy the exciting world of SSTV, you must have ways to create your own graphics. MFJ Starter Packs for the IBM PC/XT/AT or compatible computers can be used in conjunction with other graphics generating programs available to create your own drawings and graphics.

MFJ-1292 "Picture Perfect" Video Digitizer for the IBM and compatible computers allows you to digitized a picture with a Camcorder or video camera. The digitized picture is stored to disk and can be transmitted by the MFJ-1278 in any of the SSTV formats.

Contact us or your MFJ dealer for more information concerning the MFJ-1292 Video Digitizer and other graphics generating programs for use with the MFJ-1278.

ADVANCED PACKET OPERATION

This chapter describes some aspects of packet operation that you don't need to be concerned with for everyday conversational operation. You will want to consult this chapter if you are using your station for special applications such as a Packet Personal Mailbox, Bulletin Board, binary file transfers, Packet picture transfers or running a "host" program. This chapter also discuss use of the newly developed packet anti-collision feature. HF and OSCAR packet operation is also discuss in detail in this chapter.

We will use the term "computer" to refer to computers or terminals. In the command examples, the MFJ-1278's prompts and other messages are shown in ordinary type, your responses are shown in **bold face**, and received packets are shown <u>underlined</u>. Commands and other special keywords are shown in upper case; other text entered to the MFJ-1278 is shown in upper and lower case.

Special Characters

The MFJ-1278 recognizes a number of special characters for input editing, flow control, and other control functions. You can change any of these special characters to customize the MFJ-1278 to suit your applications, your computer, or your whim. Most of the characters are set by commands which specify the ASCII character code for the desired character. You can disable any special character feature by setting the character value to 0. Input editing characters may be disabled with no serious effects. You should use caution in disabling the flow-control or Command Mode entry characters. Also be careful not to set two special characters to the same value.

Special characters are normally set to various control characters. Control characters are entered by holding down a special control key while typing another key. For example, control-C, or <CTRL-C> is entered by holding down the control key while typing C. If your computer doesn't have a special control key, you will have to consult your computer's documentation to see how to enter these characters. If you will have difficulty entering control characters, you can change the special characters to, for example, seldom-used punctuation.

The action of each special character is described in detail
under the entry in Chapter 6 for the command that sets that
character.

You can enter the code for a character in either hex (base
16) or decimal notation. The MFJ-1278 displays character
codes in hex.   A number in hex notation is indicated by
beginning the number with a $. The "digits" of a hex number
represent multiples of powers of 16.   The values 10 through
15 are represented by the letters A through F, which may be
upper or lower case.   For example,

$$\$1B = 1 \times 16 + 11 = 27.$$

Tables of ASCII character codes are available in most compu-
ter manuals.   A table of ASCII codes for control characters
follows.

Table 5-1.   ASCII Codes for Control Characters.

Dec	Hex	Control	Mnemonic	Dec	Hex	Control	Mnemonic
0	$00	<CTRL-@>	NUL	16	$10	<CTRL-P>	DLE
1	$01	<CTRL-A>	SOH	17	$11	<CTRL-Q>	DC1
2	$02	<CTRL-B>	STX	18	$12	<CTRL-R>	DC2
3	$03	<CTRL-C>	ETX	19	$13	<CTRL-S>	DC3
4	$04	<CTRL-D>	EOT	20	$14	<CTRL-T>	DC4
5	$05	<CTRL-E>	ENQ	21	$15	<CTRL-U>	NAK
6	$06	<CTRL-F>	ACK	22	$16	<CTRL-V>	SYN
7	$07	<CTRL-G>	BEL	23	$17	<CTRL-W>	ETB
8	$08	<CTRL-H>	BS	24	$18	<CTRL-X>	CAN
9	$09	<CTRL-I>	HT	25	$19	<CTRL-Y>	EM
10	$0A	<CTRL-J>	LF	26	$1A	<CTRL-Z>	SUB
11	$0B	<CTRL-K>	VT	27	$1B	<CTRL-[>	ESC
12	$0C	<CTRL-L>	FF	28	$1C	<CTRL-\>	FS
13	$0D	<CTRL-M>	CR	29	$1D	<CTRL-]>	GS
14	$0E	<CTRL-N>	SO	30	$1E	<CTRL-^>	RS
15	$0F	<CTRL-O>	SI	31	$1F	<CTRL-_>	US
				127	$7F	<DELETE>	

Packet Operating Modes

In Chapter 4 we discussed two of the packet operation modes,
Command Mode and Converse Mode.   Packet also can operate in
the third mode, Transparent Mode which is a data-transfer
mode like Converse Mode but is intended primarily for
computer data interchange rather than human conversation.
We describe all three of these modes below.

Command Mode

Command Mode is used to enter commands which alter the MFJ-1278's operating parameters. The other modes are entered from Command Mode.   When the MFJ-1278 is in Command Mode, the Command Mode prompt,

          cmd:

is printed at the beginning of each input line.   Note, however, that if the MFJ-1278 has received and displayed packets, the prompt may have scrolled off the screen.

The MFJ-1278 will be in Command Mode after a reset or power-up.   After a power-off, power-on sequence, all operating parameters of the MFJ-1278 are re-initialized to the parameter stored in battery backed-up RAM (bbRAM) by the resident software.   After the **RESET** command is issued <u>all</u> <u>operating</u> <u>parameters</u> are reset to the default values stored in EPROM.   The values of most parameters are stored in a permanent but easily changed form in the bbRAM memory.

The following commands set special characters which are active in Command Mode.   Refer to the discussions of these commands in Chapter 6 for details on the operation of the characters in Command Mode.   Also see the section on special input characters in Chapter 4.

CANLINE	Cancel current line
CANPAC	Cancel output (Command Mode function only)
DELETE	Character deletion
PASS	Insert following special character
REDISPLA	Re-display current line
START, STOP	User's flow control characters (sent to MFJ-1278)
XOFF, XON	MFJ-1278 flow control characters (sent to terminal)

The following commands enable display features which are active in Command Mode.   Refer to the discussions of these commands in Chapter 6 for details on the operation of these characters in Command Mode.   Also see the section on terminal configuration in Chapter 4.

AUTOLF	Add <LF> after <CR> in data sent to terminal
BKONDEL	Echo after character deletion
ECHO	Automatic echo of serial port input
FLOW	Type-in flow control
LCOK	Lower case translation
NUCR	Nulls after <CR>
NULF	Nulls after <LF>
NULLS	Null count
SCREENLN	Automatic <CR> insertion

Entering Data-Transfer Modes

There are several ways to enter a data-transfer mode from Command Mode. You can type the command CONVERS or K to enter Converse Mode or the command TRANS or T to enter Transparent Mode, and the MFJ-1278 will immediately enter the specified mode. The MFJ-1278 will automatically enter a data-transfer mode if you are in Command Mode when a connection is completed. You can specify the data-transfer mode for automatic entry with the command CONMODE:

cmd:CONMODE TRANS

will specify Transparent Mode, and

cmd:CONMODE CONVERS

will return to the default choice of Converse Mode.

The timing of the automatic entry into data-transfer mode depends on whether you or the other station initiated the connection. If you receive a connect request which your MFJ-1278 accepts, you will enter data-transfer mode when the MFJ-1278 sends the connect acknowledgment (ACK) and types the message *** CONNECTED TO <callsign>.

If you initiate the connection with the CONNECT command, you can control the timing of the mode change with the command NEWMODE. If NEWMODE is OFF, the mode will change when the connect ACK is received and the *** CONNECTED TO: <callsign> message is typed. If NEWMODE is ON, you will enter data-transfer mode immediately, without waiting for a successful connection. Any text sent to the MFJ-1278 at this point will be queued up in packets which will wait for a successful connection before being sent. If the connect attempt fails, you will be returned to Command Mode. You will also be returned automatically to Command Mode when either station disconnects and ends the QSO.

Converse Mode

The data mode used most often for ordinary QSOs is Converse
Mode. In Converse Mode, the information you type is assem-
bled by the MFJ-1278 into packets and transmitted over the
radio. The send-packet character causes the input to be
packetized for transmission. If you type a full packet-
length of characters without typing the send-packet
character, your input will be packetized and transmitted
anyway.

The default send-packet character is <CR>, but you can
specify any character with the command SENDPAC.   You may
also choose to have the send-packet character transmitted in
the packet or not.   If the send-packet character is <CR> it
is natural to include it in the packet as part of the text
as well as interpreting it as a command.   This is accom-
plished by setting CR ON.   If you use some other character
to force packet transmission, you may want to set CR OFF and
inhibit transmission of the send-packet character.   If you
set the send-packet character to something other than <CR>,
you can cancel packets of more than one line with the
cancel-packet character, which is set with the command
CANPAC. Single-line packets can be canceled with either the
cancel-line character or the cancel-packet character.

To   return to Command Mode from Converse Mode you must type
the Command Mode entry character, or send a BREAK signal
over the serial port.   A BREAK is not a regular ASCII char-
acter, but it can frequently be transmitted by typing a
special key on the keyboard.

A BREAK signal is a continuous space (or 0) signal on the
serial port Transmit Data line lasting approximately 0.2
second.   In fact, the timing of the signal is not very
important, and most serial ports will recognize a BREAK if
the space signal lasts significantly longer than the time
required for a character transmission.   Because of the sim-
ple nature of this signal, it is easily possible to generate
a BREAK with circuitry external to the computer, thus guar-
anteeing entry to Command Mode in automatic station opera-
tion.

The following commands set special characters which are
active in Converse Mode.   Refer to the discussions of these
commands for details on the operation of the characters in
Converse Mode.

CANLINE	cancel current line
CANPAC	cancel current packet
COMMAND	Command Mode entry
DELETE	character deletion
MFILTER	characters to be filtered in monitored packets
PASS	insert following special character
REDISPLA	re-display current line
SENDPAC	send current packet
START, STOP	user's flow control characters (sent to MFJ-1278)
XOFF, XON	MFJ-1278 flow control characters (sent to terminal)

The following commands enable display features which are
active in Converse Mode.   Refer to the discussions of these
commands for details on the operation of these characters in
Converse Mode.

8BITCONV	Retain high-order bit from serial port in converse mode
AUTOLF	Add <LF> after <CR>
BKONDEL	Echo after character deletion
ECHO	Automatic echo of serial input
ESCAPE	<ESCAPE> translation
FLOW	Type-in flow control
LCOK	Lower case translation
NUCR	Null characters after <CR>
NULF	Null characters after <LF>
NULLS	Null count
SCREENLN	Automatic <CR> insertion

Transparent Mode

Packet radio is very well suited to the transfer of data
between computers. In some cases Converse Mode will work
well for computer data transfer. However, files such as a
processor text file, may contain characters which conflict
with special characters in Converse Mode. Some of these
files may utilize all eight bits of each byte rather than
the seven bits required by ASCII codes. If you transfer
such files you will have to use Transparent Mode.

Transparent Mode is a data-transfer mode like Converse Mode.
In this mode there are no special characters -- everything
you type (or everything your computer sends to the MFJ-
1278) is sent over the radio exactly as it was received by
the MFJ-1278. There are no input editing features and there
is no send-packet character.   Packets are sent at regular
time intervals or when a full packet of information is
ready. The time interval at which data is packetized is set
by the PACTIME command.

The display characteristics of the MFJ-1278 are also modi-
fied in Transparent Mode.   Data is sent to the computer
exactly as it is received over the radio, including all 8
bits of each byte received.   Features such as auto-linefeed
insertion and screen wrap are disabled, and echoing of input
characters is disabled.   The parameters that control these
features in Command Mode and Converse Mode are not changed
by entering Transparent Mode, and all display features are
re-enabled when the MFJ-1278 is returned to Command Mode.
Most of the link status messages that appear as the MFJ-1278
moves between disconnected and connected states are also
disabled in Transparent Mode.

In   order   to permit the Command Mode entry character to be
transmitted freely in Transparent Mode, the escape to Com-
mand Mode from Transparent Mode has been made a little more
complicated. You can still return to Command mode by trans-
mitting a BREAK signal, just as in Converse Mode.   You can
also utilize the Command Mode entry character in the follow-
ing way.

You must wait for a time period after typing the last char-
acter to be sent.   This time is set by the command CMDTIME.
Following this wait, you must type three Command Mode entry
characters (default <CTRL-C>) within an interval CMDTIME of
each other.   After a final CMDTIME interval in which no
characters are typed, you will see the

        cmd:

prompt.   If any characters are typed during this interval
(even Command Mode entry characters) the escape will be
aborted and all the Command Mode entry characters that have
been typed will be sent as packet data.   If you set CMDTIME
to zero you will not be able to escape from Transparent Mode
using this second procedure.

Flow Control

Whenever data is transferred to computers (home computers or
TNCs), there is a chance that the data will be received
faster than the computer can handle it.   Some programs try
to deal with this by providing data buffers for storing
incoming data until the program is ready for it.   However,
this merely postpones the problem, since there is a limited
amount of room in any buffer.   In order to prevent loss of
data the computer must be able to make whatever is sending
data stop sending, and later tell it to resume sending. If
you are a home computer user, you are probably already
familiar with one type of flow control, which allows you to
stop the output from the computer while you read it and
restart it when you are ready for more.

The MFJ-1278's input buffer may fill up in Command Mode   if
you try to type too long a command.   In Converse Mode the
buffer may fill up for any of several reasons: you may be
using a faster serial port baud rate than the radio data
rate;   radio data transmission may have slowed down because
of noise or other users on the channel; the person or
computer at the other end may have stopped output from that
MFJ-1278. The MFJ-1278 will signal the computer to stop
sending data when there is room remaining for about 80
characters in the buffer.   When the buffer fills   up
entirely, data will be lost.   When the buffer empties   so
that there is room for at least 270 characters, the MFJ-1278
will signal the computer to start sending data again.

A computer file transfer program may be unable to process
data fast enough to keep up with output from the MFJ-1278.
In order to be sure of reading every character, a computer
must respond to interrupts from its I/O devices.   Some
simple programs may poll the input register for new data.
If the polling is not done often enough, data may be lost.
Some computers disable interrupts during disk accesses.   If
the program enters a routine which will not allow it to
check for data or respond to it, it should signal the MFJ-
1278 to stop sending data.

There are two methods of providing flow control which are
supported by the MFJ-1278. XON/XOFF flow control, sometimes
called "software flow control," is accomplished by sending a
special character (usually <CTRL-S>) to request that the
output stop and another special character (usually <CTRL-Q>)
to restart output.   Hardware flow control may be used if
both computers use the C,ear To Send (CTS) and Data Terminal
Ready (DTR) lines of the RS-232C standard. Data is also
halted if you press the space bar while in command mode.
Press <CR> to resume.

Some commonly used terminal programs and file transfer pro-
grams for home computers do not implement flow control in
software, and many serial ports do not support hardware flow
control.   Although the DTR and CTS lines appear at the con-
nector, they may not be used on some computers unless the
software reads the state of the CTS line.   If you find that
the MFJ-1278 seems to lose data during file transfers, you
should immediately suspect a flow control problem.

XON/XOFF Flow Control

If you are using a terminal (rather than a computer) or if
your computer does not support DTR/CTS flow control, you
should use XON/XOFF flow control, which is enabled by set-

ting **XFLOW ON.**   The special flow control characters are set
to <CTRL-S> and <CTRL-Q> by default, but they may be chan-
ged.   The commands **XON** and **XOFF** set the characters which
will be sent to the terminal by the MFJ-1278, and the
commands **START** and **STOP** set the characters to be sent to the
MFJ-1278 by the terminal. Your computer may receive as many
as 4 characters from the MFJ-1278 after sending a STOP
character, since some characters may already be "in route"
through serial I/O chips.

If you send a STOP (START) character to the MFJ-1278 when it
is already stopped (started), the character will be ignored.
If the STOP and START character are the same character, this
character will "toggle" the output, turning it off if it is
on, and on if it is off.

You can disable XON/XOFF flow control in one direction only
by setting the appropriate flow control characters to 0. If
you do this, the MFJ-1278 will automatically use CTS flow
control to stop input from the terminal.   XON/XOFF flow
control is normally disabled in Transparent Mode, since all
characters are treated as data.   If you cannot use DTR/CTS
flow control, you may enable the XON and XOFF characters
(the commands from the MFJ-1278 to the terminal) by setting
TXFLOW ON and **XFLOW ON.**   The START and STOP characters (the
commands to the MFJ-1278 from the terminal) can be enabled
in Transparent Mode by setting **TRFLOW ON.**   Note that the
mode is no longer truly transparent when these features are
enabled.

Hardware Flow Control

Hardware flow control is less likely to depend on the pro-
gramming of a particular communications program.   DTR and
CTS are normally used for flow control signals in Transpa-
rent Mode.   The command **XFLOW OFF** enables hardware flow
control in Converse Mode and Command Mode.   Your computer
may receive as many as 2 characters after it signals the
MFJ-1278 to stop sending, since some characters may already
be "in route" through serial I/O chips. Refer to Chapter 7,
Hardware for details on the interface required for hardware
flow control.

Type-in Flow Control

Type-in flow control, enabled with the command **FLOW,** is
really a display feature.   It can keep the MFJ-1278 from
interrupting you with incoming packets when you are in the
middle of typing a command line or an outgoing packet.   As
soon as you type the first character of a line, the MFJ-1278
will put a "hold" on all output (except for echoing your

input).   The "hold" remains in effect until you type a <CR>
to end the command line, or a send-packet character to mark
the end of a packet, or until you erase or re-display the
line you have started.

Some computers have difficulty simultaneously sending and
receiving characters over the serial port.   This is most
commonly the case for computers with "software UARTs."
Type-in flow control will improve the operation of such
computers with the MFJ-1278.

Detail VHF Packet Operation

The previous chapter's discussion of "Basic Operation" con-
tains enough information for most packet operation.   This
section describes a few other aspects of packet operation.

Station Identification

Your station identification (call sign) is set with the
command MYCALL, as described in the previous chapter.   If
you will have more than one station on the air operating
with the same call sign, they must be distinguished -- no
two stations can have identical station identifications, or
the packet protocol will fail.   You can distinguish addi-
tional stations by setting the "secondary station ID", or
SSID.   This is a number from 0 to 15, appended to the call
sign with a dash:

        cmd:MYCALL W3IWI-3

If you don't specify the SSID extension, it will be 0, and
the MFJ-1278 won't explicitly show SSIDs that are 0. If you
want to connect to a station with a SSID other than 0, or
use such a station as a digipeater, you must specify the
SSID:

        cmd:CONNECT AD7I-2
    or
        cmd:CONNECT WA7GXD VIA N7CL-5

The MFJ-1278 can send an automatic identification packet
every 9-1/2 minutes when your station is operating as a
digipeater.   You can enable this feature with the command
HID ON.   An ID packet is displayed as follows by a
monitoring station:

        W3IWI-3>ID:W3IWI/R

You can request a final identification as you take your
station off the air with the command ID.   The MFJ-1278 will

only send identification packets if it has been digipeating.

Automatic Operations

Normally, any packet station can be used by other stations for relaying, or digipeating, packets to a more remote destination. If you don't want your station digipeating packets, you can give the command DIGIPEAT OFF. Unless there are special circumstances, such as a station operating on emergency power, most packet operators set DIGIPEAT ON in the spirit of Amateur cooperation.

Your station will normally accept a connect request from another station if it isn't already connected. You can disable this capability by setting CONOK OFF. If you re- ceive a connect request when CONOK is OFF, the MFJ-1278 will display the message

   *** connect request: <callsign>

and send a "busy signal" rejection packet to the other station. If you receive a rejection packet from a station you try to connect to, your MFJ-1278 will display

   *** <callsign> busy
   *** DISCONNECTED

If you want to have a special message sent automatically to stations connecting to you, you can specify the message with the command CTEXT. This message can consist of any text string up to 120 characters, and you may include <CR>s by prefixing them with the pass character:

      cmd:CTEXT Sorry, I can't talk right now.<CTRL-V><CR>
      I'll be on the air again after 8 PM.<CTRL-V><CR>
         Joe

In order for this message to be sent to stations connecting to you, you must set CONOK ON so that t(e connection takes place (default), and enables the automatic message with CMSG ON.

If you want to leave your station on but inhibit transmit- ting, you can set XMITOK OFF. If you do this, you would normally set CONOK OFF as well.

You can have your station periodically send an automatic message by enabling "beacons." A beacon can be used to make general-interest announcements, provide packets for other stations to use to test their ability to receive, or an- nounce the presence of a bulletin-board operation. The beacon message is set with the command BTEXT, which works

the same way as the CTEXT command. You enable beacon trans-
mission and set the frequency at which beacons are sent with
the command BEACON.   To transmit the beacon at 10-second
intervals, for example, give the command

        cmd:BEACON EVERY 1

The beacon function also has a transmit-after mode, enabled
by using the keyword AFTER in place of EVERY, in which a
beacon packet is only transmitted after activity is heard on
the channel.   This feature might be used to leave an an-
nouncement for other packet users.   If someone transmits on
an otherwise idle channel, a beacon can be sent a short time
later.   No beacons are sent in this mode if there is a lot
of packet activity on the channel, since the required period
of quiet will not occur.

Unattended Operations

Individuals who want to leave their MFJ-1278 on overnight
can monitor packets even with the terminal or computer off.
Just type CTRL-S then turn the terminal or computer off.
The next morning turn the computer on, then type CTRL-Q.
The MFJ-1278 will dump everything monitored during the night
limited only by the amount of available RAM.

The MFJ-1278 can operate unattended for extended periods of
time.   If you would like to have the MFJ-1278 operate as a
digipeater but not connect with a station, be sure to set
DIGIPEAT ON and CONOK OFF.   This is probably most useful
when setting up a dedicated digipeater in a remote location.

Packet Formatting

The maximum length of a packet is determined by the command
PACLEN. If you type more than the maximum number of charac-
ters without entering a send-packet character, the MFJ-1278
will transmit a maximum-length packet. In Transparent Mode,
a packet will be sent if the maximum number of characters is
entered before the delay conditions set by PACTIME force a
packet to be sent. Some MFJ-1278s may not be able to accept
packets longer than 128 characters.

If you have set the send-packet character to <CR>, you
probably want the <CR> to be included in the packet for
display at the other end.   If you set the send-packet char-
acter to a special non-printing character, you probably want
the character to be treated as a command only.   The command
CR controls whether the send-packet character is to be
echoed and included in the packet.

You can add a <LF> after each <CR> included in your packets by setting LFADD ON. If the other station reports that lines are overprinted on his display, and he can't remedy the situation at his end, you can enable this function.

Commands Affecting Protocol

This section describes some of the commands that affect the operation of the packet protocol.   Details of the protocol are given in Chapter 9.

The MFJ-1278 implements AX.25 Level 2 protocol, a set of rules for formatting messages to other TNCs. The version of AX.25 Level 2 protocol used by the MFJ-1278 can be set to Version 2.0 with the command **AX25L2V2 ON**, or to Version 1.0 with the command **AX25L2V2 OFF**.   Digipeating may not be successful if some MFJ-1278s are running Version 1.0 and some are running Version 2.0.   In addition, the command **CHECK** controls a timing function that depends on the proto- col version selected.

You can specify the "address" to be used for unconnected packets, as well as intermediate digipeaters with the **UNPROTO** command.   The format is similar to that of the **CONNECT** command:

cmd:UNPROTO QST VIA NK6K

The default address for unconnected packets is **CQ**.

The following functions may be useful for tracking down protocol problems.   They are seldom useful for ordinary packet operations.   The error-checking function of the pro- tocol is disabled for monitored packets with the command **PASSALL**.   If you set **PASSALL ON**, any "packet" will be dis- played if it meets the following conditions: It must start with a flag sequence; and it must contain an integral number of 8-bit bytes.   The **TRACE** command enables the display of the address and control fields of packets, as well as the text.   The trace function displays all bytes in hex as well as ASCII equivalents.

Packet Timing Functions

Transmit Timing

Amateur radio equipment varies greatly in the time delays required in switching from receive to transmit and from transmit to receive.   If the MFJ-1278 starts sending data before the transmitter is operating or before the receiver has had time to switch from transmitting and lock up on the

incoming signal, the packet will not be received properly.
The delay between transmitter keyup and the beginning of
data transmission is controlled by the command TXDELAY.
During the time the MFJ-1278 is keying the transmitter but
not sending data, it will transmit a synchronizing signal
(flags).

If you are transmitting packets through an audio repeater,
you may require a considerably greater keyup delay than is
required for direct communications. Furthermore, the extra
keyup delay is not required if the repeater has not had time
to "drop" since the last transmission. The command AXDELAY
allows you to specify an additional keyup delay to allow the
repeater receiver and transmitter to lock up. The command
AXHANG sets the time the MFJ-1278 will assume is required
for the repeater to drop. If the MFJ-1278 has detected
channel activity recently enough that the repeater
transmitter should still be on, it will wait only the
TXDELAY time before sending data, rather than adding an
AXDELAY time as well.

The commands **TXDELAY**, **AXDELAY**, and **AXHANG** all set times in
units of 10 ms.   If **AXDELAY** is in effect the total keyup
delay will be

        Keyup delay = (TXDELAY + AXDELAY) * 10

in milliseconds.   If channel activity has been heard more
recently than AXHANG*10 ms ago, the keyup delay will only be

        Keyup delay = TXDELAY*10

in milliseconds.

Packet Timing

The AX.25 protocol provides for re-transmitting packets if
no acknowledgment is heard from the intended destination
station within a certain period of time. A packet might not
be acknowledged due to channel noise or "collision" with an-
other packet transmission, and since there may be other
stations on the channel, the receiving station may not be
able to acknowledge the received packet immediately.   The
time lapse before the originating station re-transmits the
packet is set by the command **FRACK** (frame acknowledge time).
The maximum number of re-transmissions before the
originating station terminates the connection is set by the
command **RETRY**.   The maximum number of transmissions of a
packet is RETRY+1, since the initial transmission does not
count as a re-transmission. Setting **RETRY** to 0 specifies an
infinite number of retries.

The frame-acknowledge time is automatically corrected for the additional time required for digipeating. The time interval before MFJ-1278 re-transmits an unacknowledged packet is

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

in seconds, where n is the number of digipeaters in use for this connection.

Acknowledgments of digipeated packets are made from end to end, and digipeaters do not acknowledge the packets they relay. If there are several intermediate relays, the chance of either the original packet or the acknowledgment to be lost increases drastically. To reduce this problem, an automatic wait time can be imposed on any station not trans- mitting a digipeated packet. Stations waiting for a clear channel to transmit packets wait for this time interval after the channel clears before transmitting. This wait does not apply if the station will be transmitting one or more digipeated packets. This usually gives the digipeater a clear chance at the channel.

The wait time is set by the command **DWAIT**, which specifies 40 ms intervals. If no digipeating is being done by anyone in the local area, this parameter can be set to 0, but in any event it should be set to the same value by all members of a local packet group.

In order to avoid unnecessary packet retries, the MFJ-1278 implements a collision-avoidance strategy which applies to all packets except those being digipeated. On the second and subsequent transmissions of a particular packet, the MFJ-1278 waits an additional random time after detecting a clear channel before beginning transmission. This prevents repeated collisions of transmissions by the same two stations. The random time is a multiple (0-15) of the TXDELAY time.

The interval, in milliseconds, between the MFJ-1278 detecting carrier-drop and beginning to transmit is

    Wait time = DWAIT * 10

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

    Wait time = DWAIT * 10 + (r * TXDELAY) * 10

where r is a random number from 0 to 15. Thus, if your MFJ- 1278 is forced to re-transmit packets, you will occasionally hear a fairly long delay before transmission begins.

Multiple packets may be transmitted before waiting for an acknowledgment. This permits more efficient channel use when large amounts of data are being transferred. The maximum number of packets which the MFJ-1278 will send before waiting for acknowledgment is specified by the command MAXFRAME. This does not mean that the MFJ-1278 will wait until several packets have been entered before transmitting. MAXFRAME in combination with the command PACLEN, which sets the maximum number of characters in a packet, determines how much information can be sent in a single transmission. The best combination for efficient data transfer is determined partly by the channel quality and partly by the rate at which the terminal can process data. For a 1200 baud terminal data rate, you should start with a combination that produces about 300 characters outstanding at one time.

Radio Baud Rate

The radio data transmission rate is software selectable for 300 baud and 1200 baud. External modem (if installed) can also be selected thru software command.

Note that there is no relationship between terminal baud rate and radio baud rate. In order to communicate with another packet station you must use the same radio baud rates. The length of time required to send a given amount of information increases as the baud rate decreases. For example, it takes four times as long to send data at 300 baud as at 1200 baud. If you use slow radio baud rates, you should limit the length of transmissions by setting MAXFRAME to 1 and choosing PACLEN so that the hardware watchdog timer does not disrupt your transmissions and channel traffic is broken up frequently.

The Bell-202 compatible modem is optimized for a 1200 baud radio data rate. The on-board modem is not useful at rates higher than 1200 baud. The MFJ-1278 can provide data signals up to 9600 baud, but an external modem is required for operation above 1200 baud. A optional 2400 bps PSK modem board is available from MFJ Enterprises, Inc. This 2400 bps PSK modem board can be installed inside the MFJ-1278. Radio data rate of 2400/9600 is selectable with software command by the MFJ-1278. When an external modem is installed and when it is in selected to operate the TURBO LED on the front panel of the MFJ-1278 will light. Contact MFJ Enterprises, Inc. for more detail. For installation of an external modem, see APPENDIX F in this manual for more detail.

Special Protocol Times

You can set up a connection time-out with the command **CHECK**, which specifies a time in multiples of 10-second intervals. This function prevents the MFJ-1278 from getting stuck in a connection when the other station disappears for longer than the specified time. The MFJ-1278 uses this time somewhat differently depending on the setting of AX25L2V2.

The command RESPTIME sets a delay between the receipt of a packet and the transmission of the acknowledgment packet. This delay is used to prevent collisions between an acknowledgment and another packet from the sending station. This is primarily necessary during file transfers; otherwise the delay is best set to 0. During file transfers the stations receiving the file should set RESPTIME to 10 or 12 (default).

The timing of packet transmission in Transparent Mode is determined by the command **PACTIME**. You can choose the way packet transmission is timed. If you are typing input to a remote computer it is usually best to have packets transmitted at regular intervals. If your computer is operating a remote-host or bulletin board program you should send packets after an interval with no further input from the computer. You can enable the use of **PACTIME** in Converse Mode with the command CPACTIME.

Monitor Functions

The MFJ-1278's protocol is designed for setting up "circuits" between two stations. However it can also operate in a mode more suitable for a "net" or "round-table" discussion with several participants, although reliable reception of all transmissions by every station cannot be guaranteed. This is done by enabling the monitor functions. Most of the monitor functions are described in Chapter 4.

Monitoring is enabled by the command MONITOR ON, and separate monitor functions are individually enabled.

If connected packet QSOs are taking place on the frequency of your group conversation, you may wish to ignore all connected packets while your group operates in unconnected mode. The command MALL OFF causes the MFJ-1278 to ignore connected packets.

If you want to be able to monitor packet activity when your station is not connected, but have all monitoring automatically cease when you connect to someone, set MCON OFF.

If you want to monitor stations selectively, you can set up

a list of up to eight callsigns with the command **LCALLS.**
The callsigns in this list are regarded as "buddies," i.e.,
the only stations you want to listen to if BUDLIST is **ON.**
Otherwise, the stations in the list will be ignored, and all
other stations will be monitored.

You can operate a group conversation with some data integri-
ty by having the stations connect in pairs and setting **MALL
ON** and **MCON ON.**   This does not insure that every packet is
received at every station, but it does insure that a packet
involved in a collision will be retried. If you have an odd
number of stations participating in this sort of conversa-
tion, one station can connect to himself via another station
as digipeater.

For example, WB6YMH, WDOETZ, WAOTTW, W1BEL, and K9NG wish to
carry on a group conversation. In order to make all the
transmissions as reliable as possible, the following connec-
tions are made.

        WB6YMH connects to W1BEL
        WAOTTW connects to K9NG
        WDOETZ connects to WDOETZ via W1BEL

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

Ordinarily, only text packets are displayed. If you want to
see some of the protocol packets, you can set MCOM **ON** and
connect, disconnect, disconnect acknowledgments, and DM
(connect-request rejection) packets will be displayed.   For
example,

        WB9FLW>N7CL <C>
        KV7B>N2WX <D>

indicate connect and disconnect packets. Disconnect ac-
knowledgments are designated <UA>, and DM packets are <DM>.

You can cause the MFJ-1278 to "filter" certain characters
from monitored packets with the command **MFILTER.**   This
allows you to remove, for example, form-feeds, bell
characters, or extra <LF>s that may be necessary to the
stations involved in a connection, but which may interfere
with your display. You can specify up to four characters by
giving the ASCII character codes in hex or decimal.

Real-Time Clock and Time Stamping

You can enable the MFJ-1278's real-time clock by setting the
date and time with the command DAYTIME.   Once you have set
the clock, you can request the time by entering DAYTIME with

no   parameters.   The   format of date and   time   display   is
controlled   by   the   command DAYUSA.   If   the   MFJ-1278   is
powered off, DAYTIME will have to be reset.

Monitored   packets   can be time-stamped if DAYTIME has   been
set.   To enable this function, set MSTAMP ON.   You can also
time-stamp connect and disconnect messages with the   command
CONSTAMP ON.

Multi-Connect Guide

Multiple   connection capability is a very powerful   addition
to   the   MFJ-1278   It   is   very   useful   for   traffic   net
operation,   multi-user bulletin boards, path checking and so
forth.

Multiple   connection operation is not the same as   multi-way
operation.   With multiple connect, you may establish several
point-to-point   "links" with various   stations.   Multi-way,
which is not available, would enable multiple stations to be
simultaneously interconnected to each other, with each   sta-
tion   seeing all data passed from any station in the   group,
error free.

Multiple connection operation is another step on the road to
proper   networking,   and networking should eventually   allow
multi-way operation.

Setting the MFJ-1278 to Normal Operation

The MFJ-1278 defaults the multi-connection-related   commands
to the following parameters:

        CONPERM   OFF
        STREAMCALL   OFF
        STREAMDouBLe   OFF
        STREAMSWitch |
        USERS   1

This   sets up the MFJ-1278   to act just like a "normal"   TNC
does, that doesn't support multiple connections.   The key to
obtaining this traditional operation is to set USERS 1.

How to Invoke Multi-Connect?

If   USERS   is not 1,   you are telling the MFJ-1278 to   allow
multiple   connections to your stations from other   stations.
In addition,   TRANSPARENT mode will operate differently,   in
that   incoming   data   will   be   prefixed   with   the   current
STREAMSWitch character and identifier (such as "|A").   Thus,
truly   transparent   operation   is   not   possible   with   this

software release supporting multiple-connections.

The **STREAMSWitch** character, defaulted to "¦", should be set
to a character you won't normally use.   Note that this
character may be set to a hex value between $0   and $FF.
This may allow you to use 8-bit characters (**AWLEN** 8) if your
terminal or computer is capable of generating such "charac-
ters."   This could help prevent confusion in interpreting
incoming data from other stations if they happen to send
data that includes your selected **STREAMSWitch** character.

Although not fool proof, enabling **STREAMDBL** may also help in
sorting out **STREAMSWitch** characters included in the received
data from a valid stream switch generated by the MFJ-1278.

STREAMCAll should be especially helpful when manually ope-
rating a station in which you allow multiple connections.

When in **CONVERSE** mode, you may switch streams by entering
the **STREAMSWitch** character (default "¦"), followed by a
stream identifier ("A" through "J"), followed by the data
you wish to send to the station on that stream.   See the
example in the description of **STREAMCAll** for an illustration
of this.

If all this seems a bit confusing, don't worry, it is! The
only way to really understand multiple connect operation is
to try it!   Tested and on-the-air, Once you have gained
confidence in "normal" packet operation, try setting **USERS** 2
and get a couple of friends to connect to you.   Play with
the commands (you can't hurt the MFJ-1278 by issuing
commands to it!) and see their effects.

Easy-Mail Mailbox

The Easy-Mail mailbox feature is only valid for the VHF
packet mode. The operation of the Easy-Mail mailbox is
quite simple. Once the MAILBOX command of your MFJ-1278 is
turned on, anyone who operates AX.25 packet can access your
mailbox by establishing a connection to your station by
using the standard packet CONNECT command. Once the
connection is made, he can send a message, obtain a list of
the messages in your mailbox, read the messages or kill any
messages addressed to him.

The Easy-Mail mailbox in the MFJ-1278 provides approximately
3,000 bytes of memory for message storage. Maximum number
of message slots is 30.

With the MAILBOX turned ON, you can access the mailbox by
typing the command, SYsop, all commands available to the
remote users are available to you as the system operator.

When MAILBOX is ON, user should be aware of the following
conditions:

1. MFJ-1278 continues to monitor the channel according to
the setting of the MONITOR parameter when the mailbox is
idle. However, once a user connects, or while the system
operator is using the mailbox, the MFJ-1278 will not display
monitored packets, regardless of the setting of MONITOR.
This restriction does not apply to TRACE dumps.

2. MFJ-1278 answers as "busy" to incoming connect requests
if the system operator is on-line when the mailbox is turned
on.

3. MFJ-1278 mailbox messages are fully battery backed-up.
Messages left in the mailbox will not be lost when the MFJ-
1278 is powered down. DAYTIME is not retained by the backup
battery. User must re-enter correct time upon each power
up. Messages entered without DAYTIME will not be shown.

Set up your Easy-Mail Mailbox

The MFJ Easy-Mail mailbox is a single-user device. There-
fore, before the MAILBOX is turned on you must set up the
parameters as described in the following procedure. Make
certain that there is no connection active on the MFJ-1278.

1. Under cmd: command prompt, type:

   CSTATUS <CR>

Verify that all the streams are disconnected.

2. Type:

    USERS 1   <CR>.

3. Type:

    |A   <CR>, to force stream "A"

    If you have changed the default **STREAMSWitch** character
    from $7C then you will have to use that character in-
    stead of "|".

    Note: For the Commodore C64/128 or VIC-20 computers
    which do not have the "|" key. You can use the "£" key
    to replace the "|" key. To do this you will type:

    STREAMSWitch 92   <CR>

    £A   <CR> to force stream "A".

4. If you want your message time and date stamped, set
    DAYTIME with the current information.

5. Type:

    MAILBOX ON   <CR>

Your MFJ-1278 is now ready for mailbox operation.   You can
access your mailbox operation by typing:

SYSOP   <CR>

MFJ-1278 will respond with:

Mailbox (B, H(elp), K, L, R, S)>

Now you are ready to operate your mailbox. The functions of
(B, H(elp), K, L, R, S) are as follows:

o K   -- Kill all messages addressed to you.

o K ## -- Kill the message in slot nn. Remote users may
           only   kill message addressed   to   them   or
           originated   by   them.   the   local   SYSOP,
           however, can kill all messages.

o   L   -- List the slot number, originator, destination,
           and subject field of currently used slots.

o R   -- Read all of the messages addressed to you.

o   R ## -- Read the message in slot nn.

o   S call--Send a message to the callsign. "Call" must be
        a callsign valid under the same format as the
        MYCALL, CONNECT and other callsign commands.

o   SP call--Send a personal message to the callsign. This
        is a private message. Only the person the
        message is addressed to or the system operator
        can read this message.

o   B   --Logout: Initiates a disconnect sequence from
        the mailbox.

o   H(Help)--Display the mailbox command list, with a brief
        description of commands available to the user.

Mailbox Operation

1.   Establish connection to the mailbox station.

2.   If the connection station's mailbox is ON, then it will
     answer with the mailbox prompt:

     Mailbox Ready
     Mailbox (B,H(elp),K,L,R,S)>

     You may then type K to kill a message, L to list the
     messages, R to read the messages or S to send a
     message, B to logout and disconnect or H for the HELP
     menu.

3i. To send a message:

     Type:

     S Callsign   <CR>

     or

     SP Callsign   <CR>, if this is a private message.

     b. Mailbox responds with:

         Title:

         —

     c. Enter message subject (title) at the cursor prompt
         then press the "RETURN" key.

     d. Mailbox responds with:

```
Send Msg; Control-Z to end:
(Cursor)_
```

e. Enter message at cursor prompt.   At the end of the
    message type:

Control-Z <CR>

The message will be sent.   The screen will blank and
the cursor will be at the top of the page, with the
mailbox commands.

f. Your message will be seen on the mailbox station
    screen.   Mailbox will respond with the mailbox
    prompt:

    Mailbox (B,H(elp),K,L,R,S) >

3ii. To kill a message:
   a. Type:

K ##   <CR>,   ## is the slot number from 1 thru 30
to be killed.

b. mailbox will respond with:

    Message #_ deleted;
    Mailbox ($\overline{B}$, H(elp),K,L,R,S)>

Note that remote may only kill the messages that are
addressed   to him. System operator can kill all messages.
Message originator may also kill the message.

3iii. To list messages:

   a. Type:

     L <CR>

   b. Mailbox will respond with a list of currently
   used slots in the following format:

     Slot ##, To: , From: , Subject
     Mailbox (B,H(elp),K,L,R,S)>

3iv. To read messages:

   a. Type:

     R ##   <CR>   ## is the slot number of the message you
             wish to read.

b. Mailbox will respond with the message from the slot specified.

c. If you wish to read all the messages addressed to you, then you will want to type: R without the slot number.   The mailbox will respond with messages only addressed to you.

4. If you wish to disconnect from the mailbox, then you can type:

B   <CR>

to logout and disconnect from the mailbox.

If you access your MAILBOX by using the SYsop command, you must exit it by typing Control-C to return to command mode. This will allow remote users access to the MAILBOX.

5. Mail waiting is indicated by the flashing of the STA/MAIL LED on the front of the MFJ-1278.

The STA/MAIL LED of the MFJ-1278 serves two functions. It lights when unacknowledged packets are pending during a packet connection. If the MAILBOX is ON and you have mail waiting, the STA/MAIL LED will flash on and off if the MFJ-1278 is not connected to another packet station.

The "mail-waiting" LED function can be disabled by using the MAILLED command. MAILLED is defaulted to ON.   When MAILLED is OFF or when MFJ-1278 is in a connected state, STA/MAIL LED will not flash.

Mailbox Messages

? Not while mail server enabled

This message occurs when you are trying to access the mailbox when the system operator is using his mailbox. Also when SYSOP tries to initiate a connect while he is the SYSOP.

You have mail!

Upon access to a mailbox, this message will appear if there are messages addressed to you.

?EH

This message occurs when a command issued is not understood by the mailbox. This could be out of range slot number, missing slot number where one is required, or bad command.

Cannot, not yours

This message occurs when a remote user attempts to kill a message which is not his, or he tries to read personal message by or for someone else.

?Mailbox full

This message occurs when either all of the available slots (30) are full, or the actual message space (3000 bytes) is full. Messages must be killed to recover from this error.

Not found

This message occurs when one attempts to read or kill a non-existent message from an empty slot.

None found

A parameterless Kill or Read command did not find any messages addressed to the user.

No mail

A parameterless read command did not find any mail addressed to user or due to mailbox being empty.

Slotting and Acknowledgment Priority

The SLOTTING AND ACKNOWLEDGMENT PRIORITY feature is installed in the MFJ-1278 in an attempt to prevent or minimize packet collisions in a busy channel.

Use of the optional SLOTTING and ACKNOWLEDGMENT PRIORITY procedures now in the MFJ-1278 firmware significantly improve the reliability of packet radio connections on shared channels. The greatest improvement is yielded when all stations in a network are so equipped and configured with the appropriate, matching parameters.

SLOTTING improves channel efficiency by requiring each TNC to "flip" a many sided die whenever the channel goes from busy to not-busy. The result of the "flip" is the number of 10ms DEADTIME intervals the TNC waits before transmitting.

SLOTTING solves most of the problems that occur when there are two or more stations waiting to transmit when a third is already transmitting. Before slotting, the first two stations are definitely going to transmit at the same time, guaranteeing a collision. With slotting, the first station will probably choose a "slot" different from the second. If everyone is hearing everyone else, collisions are very unlikely.

In conjunction with slotting, the ACKNOWLEDGMENT PRIORITY feature helps improve channel utilization by assigning priority to acknowledgments (AX.25 frame types "S"), i.e. acknowledgments are never delayed by slotting.

The reason this works is because each TNC recognizes when another is transmitting. It also recognizes the destination of each packet it hears. If a TNC hears a packet not addressed to it, it can assume that somewhere another TNC will send an acknowledgment. Therefore, on hearing packets for others, a TNC will always wait at least one slot time in case the addressed TNC acknowledges. And it will never delay it's own acknowledgments.

Description

The idea behind the prioritized acknowledgment (ACK) protocol is quite simple. The idea is to give ACKs priority access to the channel so that time is not wasted retrying packets that have already been correctly copied but for whatever reason, the ACK is not received within the time limit defined by the FRACK timer.

The present protocol does not handle a simplex LAN with
hidden terminals as well as it possibly could. This is
primarily because, the present protocol is more likely to
synchronize collisions with acknowledgment packets than with
any other type of packet.

To this collision synchronization mechanism the current
version of AX.25 adds a propensity to cause ev%n ACKs which
are not from hidden terminals (& therefore less susceptible
to collision) to be delayed beyond even generous FRACK timer
settings when the channel gets busy.

Once the FRACK timer times out, even if the ACK finally
makes it through before the retry is sent, the original
packet is retried anyway. This obviously wastes a lot of
time which could be better used clearing the channel of some
of the legitimate offered load.

It is this feature of the current AX.25 protocol that
accounts for most of the abysmally poor performance of the
currently popular NETROM and THENET nodes when they are used
as omnidirectional single channel (or even multichannel if
there is more than a single other node on each channel)
systems. It should be noted that these node chips CAN
handle point to point links to a single other node perfectly
adequately.

The prioritized ACK protocol avoids the above problems by
giving ACKs priority access to the channel. It does this in
such a way that even ACKs coming from hidden terminals are
protected from collision.

The current protocol gives a limited version of this
priority access only to digipeated frames. Although it will
be possible to support digipeating in a compatible (with the
new protocol) fashion, compatible digipeating support was
not an objective that was addressed in this release.

Ack prioritization works with slotted channel access in the
following way:

1.   Response frames (ACKs) are always sent immediately with
      no time delays unrelated to hardware limitations
      applied. Ultimately, not even DCD will be checked for
      sending an ACK. However, in this release DCD will
      still hold an ACK off the channel.

2.   Stations queued up to access the channel but waiting
      for a channel busy condition (DCD true) to clear, will
      start a slotted access procedure only AFTER enough time
      for a response frame to clear the channel has
      transpired (weather or not the response frame is
      detectable by the queued up station).

3.   Slot time windows are selected to be large enough that
      the local TNC will be able to unambiguously determine
      whether any other detectable station has selected any
      slot, preceding the slot selected by the local TNC.

      This is to prevent two TNCs which have selected
      adjacent slots from colliding.

      As you can see, under this protocol there will never be
      a condition where an ACK is delayed from being sent
      beyond the FRACK timer limitation.   In fact, the FRACK
      timer becomes relatively meaningless in this context.
      However, in the current firmware release, The FRACK
      timer is still active and must be set to a value that
      is long enough to allow time for PACLEN + ACKWAIT to
      expire before FRACK does. This time will depend on the
      radio baud rate in use. The TNC knows that if it
      doesn't see the ACK immediately when expected, it is
      never going to see it.   See discussion of new
      parameters below for definition of ACKWAIT.

      Enforcing a channel access delay for all stations on
      the channel for whom the packet that caused the queue
      was not intended (& who therefore aren't going to ACK
      it) allows even ACKs from hidden terminals to get back
      to the expecting station.   This clears that traffic
      from the offered load list.   If the packet was indeed
      copied and ACKed, further retrys of the same
      information will not be necessary.

New Parameters

There are several new parameters that relate to this
modification of the protocol. They are as follows:

ACKPRIOR   ON¦OFF

This enables prioritized acknowledgments if turned on.

If ACKprior is turned off and SLots (see below) is set to 0,
this modification of the AX.25 protocol is effectively
disabled.   The MFJ-1278 will behave like normal AX.25
protocol.

Prioritized acknowledgments and slotted channel access can
be enabled or disabled independently of one another. So you
could if you wished run normal AX.25 with slotted channel
access or the new protocol without slotted channel access.

DEADTIME   0 - 250   (each increment   represents   10
                       milliseconds)

This is the time between when a remote TNC has pressed PTT
and when the local TNC can reasonably be expected to detect
this fact.

This must be set to a value that accounts for the slowest
acceptable station on the channel.   It includes the time
required for the remote station's radio to come on the air
properly after assertion of PTT (TXDelay) and the time
required for the local station's squelch (if used) and TNC
DCD circuits to allow generation of a "DCD true" signal in
the local TNC.   Ideally, once the proper value for this
timer is ascertained, all stations on the channel will use
the same value.

Very preliminary testing done here on VHF indicates that
measurements of the above delay times should be multiplied
by 1.5 for use as the DEAdtime parameter.   We had carefully
measured the times for all stations participating in our
tests.   This gave us a worst case delay total of 210
milliseconds.   When we ran the test, we were still getting
about a 5 percent collision rate on the acknowledgements.
We were required to increase the DEAdtime parameter to 30
(300 milliseconds) to completely eliminate collisions with
ACKs.

The current default for this parameter is a   ridiculously
short 30 milliseconds. This represents only the worst case
delay for the TNC's DCD circuit and completely ignores the
radio delays.

A much more reasonable value for th)s timer on VHF NBFM 1200
baud AFSK is 300 milliseconds (DEAdtime 3et to 30).   This
represents a relatively safe time for a radio that is
usable for serious packet work.

Some HTs and every Azden PCS-2000s that I have ever seen are
incapable of operating in a LAN which is using a 300
millisecond setting for this parameter.

Most HF linear mode radios are MUCH faster than   VHF FM
radio. A reasonable setting for HF work is 120 milliseconds
(DEAdtime set to 12). This should work fine with virtually
any HF radio stable enough to consider using on HF packet.

ACKTIME   0 - 250   (also 10 millisecond increments)

This represents the time required to send a response frame (with no I field appended) at the baud rate being used on the radio port.

The current 100 millisecond default is close but should be adjusted for 1200 baud work to 130 milliseconds (ACKTime set to 13).

For 300 baud HF work this parameter should be set to 520 milliseconds (ACKTime set to 52).

SLOTS n   0<=n<=127

This parameter determines how many sides are on the slot time dice. SLOTS represents an n+1 sided dice the MFJ-1278 "throws" before transmitting. The SLOTS command allows any number of slots from 1 thru 127 to be defined.

SLOTS (n)	REMARKS
1	Disables Slotting
2	
4	This should be the default setting
8	Use only if the channel is VERY busy.
16	VERY VERY VERY busy !
32	You get the idea.
64	
128	Might as well print it out & send it in the mail.

The value used on a particular channel should be agreed   on
by the channel users.   Access to the channel will be
equitably distributed among all users if everybody is using
the same value for the SLotmask and DEAdtime parameters.

The idea is to pick a value large enough that the
probability of two queued up stations picking the same value
is relatively small.   On the other hand, the value chosen
should be small enough that most of the time, ONE of the
queued up stations will have a significant probability of
picking the first available slot.   In this way, the channel
is reliably arbitrated and at the same time the overhead
required for the arbitration is minimized so that overall
throughput on the channel is maintained.

The actual value used will depend on the average number of
queued up stations there are on the channel during busy
periods.

ACKWAIT   (not directly user settable)

This timer actually consists of the sum of the 2 user
settable parameters ACKTime and DEAdtime.   It represents the
time the queued up TNC will wait before transmitting if it
has selected slot 0.   This allows time for a completely
inaudible (to this TNC) ACK to have been sent on the channel
without molestation.   It was split into two timers because
it has two unrelated components. One is related only to the
baud rate being used on the channel.   The other is related
only to the absolute times the hardware requires   to
transport carrier information from one station to another on
the channel.

Other Related Parameters

Several of the existing TNC parameters will affect the
operation of the modified protocol.   Most of these are
parameters in TNCs on the channel which AREN'T using the new
channel access procedure.   One, FRACK, must be set correctly
in any TNC which IS using prioritized ACK protocol.

FRACK should be set to a value which allows time for the TNC
to send its packet AND receive the ACK.   This value will
depend on the settings being used for PAClen and the radio
port baud rate.   This is because, for some reason which I
can't even begin to understand, the FRACK timer starts at
the BEGINNING of the packet rather than at the end.   For
this reason, it is probably best to set FRACK to its worst
case value for whatever baud rate you are using on the radio
port.   This way you can make adjustments to PAClen without

having to worry about interaction with the setting of FRACK.
The FRACK settings that should be used (at least initially
for BETA testing) are as follows:

BAUD RATE	FRACK (SECONDS)
1200	3
300	8

Note that these settings apply when everyone on the channel
is running the new protocol. This assumes that all stations
on the channel have both DWait and RESPtime set to 0.

If you are running the new protocol on a channel where some
of the stations have long RESPtime delays, those stations
will not be able to successfully communicate with you after
connecting.   If you wish to communicate with these stations
you will have to set your FRACK timer to a number which is
longer than the other stations RESPtime delay.

Both DWait and RESPtime are meaningless in the context of
the new protocol.   However, in this release both timers are
still active and should be set to 0 when using the new
protocol.

Initial Parameter Settings Summary

The settings for use at 1200 baud on a VHF FM channel are:

                ACKprior ON
                SLots   3
                DEAdtime 33
                ACKTime 13
                RESPtime 0   (If you require a nonzero value for
                               this parameter in order to prevent
                               ACKing   individual packets in   a
                               MAXframe greater than 1 blast, your
                               DCD circuit is not working.   Please
                               get it fixed.)
                DWait   0   (DWait   should be set to 0   even if
                               there   are   digipeaters   on   the
                               channel.   The new system will not
                               degrade   the   performance   of
                               digipeaters on the channel because
                               the ACKWAIT can be used by the
                               DIGI.)
                MAXframe 1 - 7 depending on channel quality
                FRACK   3

The settings to use for 300 baud work on a linear mode HF
channel are:

        ACKprior   ON
        SLots   3
        DEAdtime   12
        ACKTime   52
        DWait   0
        RESPtime   0
        MAXframe   1
        FRACK   8

What to Expect

This modification to the protocol is compatible with
stations using the current protocol in the   following
respect.   A station using the new protocol will not degrade
the channel for users of the current protocol.   So there is
nothing wrong with firing up the new stuff on a channel
where the majority of the users aren't yet using it.   You
will be able to communicate with users of the other system
without difficulties.

However, if the users of the old channel access procedures
have DWait and RESPtime set to 0, they will tend to hog the
channel from users of the newer, more polite access system.

Therefore, for purposes of testing the effect of the new
system on channel throughput, if there are stations on
channel which are NOT using the new system, they should set
their DWait value to one that is compatible with the new
system users.   A reasonable DWait setting for 1200 baud use
would be 73. For 300 baud work, it would be 76.

While these settings seem extremely long, they will assure
that the stations NOT using the new protocol always get a
shot at slot #1.   With these settings, the users of the NEW
protocol will occasionally capture the channel.

Settings of 43 for 1200 baud and 64 for 300 baud could be
used to assure that stations NOT using the new protocol
always have a shot at slot #0. This will result in users of
the new protocol almost never being able to capture the
channel unless all traffic from users of the old protocol
has been cleared.   This should NOT be done unless ALL
stations are using some type of slotted channel access
procedure with compatible numbers of slots and compatible
slot times.

Remember that the objective of the new channel access procedures is to increase aggregate throughput for the CHANNEL, not necessarily for an individual user (not even you!). It may seem to you at first when you get on a very busy channel where you are the only station that is using the new system, that you aren't getting to transmit very frequently. This is because you aren't getting to transmit very frequently. However, the OTHER users on the channel will see an incremental increase in the overall amount of data that the channel can pass per unit time because you are being such a nice guy. Remember that transmitting isn't necessarily communicating.

There is ONE benefit that you should be able to see even under the above circumstances. If you are communicating with another station who is also running the new system, the channel should appear more reliable to you even if quite slow. You should not be getting retried out waiting for his ACK to come back & have to keep reconnecting.

As a higher and higher percentage of the users on the channel begin using the new system, the performance of the channel should increase quite a bit. However, we all must remember that if a channel is mathematically capable of transferring (for example) 1000 characters per unit time, the very best it can possibly do (if CSMA is working right) is reliably pass about 620 characters per unit time. If it is offered more than this to handle, performance falls off sharply with increased offered load. Currently the typical AX.25 simplex channels observed on the HAM bands tend to hover around 10 to as high as 18 percent throughput. This is far below the 62 percent that is possible when the protocol is working right.

Packet Picture Transfer

The MFJ-1278 gives you the unique ability to transmit and receive Packet Pictures. Unlike the binary file transfer ability common to all packet controllers that lets you transmit and receive picture files, MFJ-1278 lets you transmit and receive actual packet pictures directly. You can also transmit and receive FAX, SSTV and other graphics formats pictures with the MFJ-1278 in the VHF packet mode. Packet pictrues received are directed to and printed on the built-in printer port on the MFJ-1278. Any EPSON (tm) or IBM (tm) graphics compatible printer may be used. Packet pictures can also be sent to the computer screen if special software, such as the MFJ-1284, is used.

Receiving Packet Pictures on Printer

Packet pictures data transmitted from the connecting packet station are received and data is sent directly to the printer attached to the MFJ-1278, without any intervening modification. Therefore, all data MUST use the same printer control codes that your printer uses. Typically **EPSON** format codes will be used.

The **PKTPIX** command provides a method for the MFJ-1278 to print packet pictures other graphics-format data transmitted by another station in the VHF packet mode. When you set PKTPIX, your MFJ-1278 becomes ready to print graphics data.

Using **PKTPIX**

Packet picture printing to the MFJ-1278 printer port requires you to first establish a packet connection with the station who is going to send the picture. Note that you won't be able to call up PKTPIX until the connection is made. You must have the printer powered and selected before MFJ-1278 will let you use the PKTPIX command.

Once these conditions are met, all data received over the packet link are sent directly to the printer. You can exit PKTPIX by using the escape-to-cmd: mode sequence for TRANSPARENT connections. Use CTRL-C three times (default), or asynchronous BREAK.

Packet pictures transfer to the computer screen

Packet pictures can also be received and displayed on the computer screen in real time. To achieve this special terminal program must be used. The MFJ Starter Pack for IBM

and compatibles (MFJ-1284) includes a program (MFJXFER) that allows you to transmit and receive CGA or EGA pictures in real time and display them on the screen. MFJXFER can transfer binary files in additional to picture files. It also allow you to set up your personal packet pictures bulletin board. Graphics that you create with certain "paint" software, such as QSL cards, drawings and pictures can be saved and transmitted to the connecting packet station with MFJXFER. Also, pictures created with digitizers, such as the MFJ-1292 "Picture Perfect" Video digitizer, can be transmitted and received using MFJXFER. Digitized pictures may also be "enhanced" with drawing or "paint" software.

Detail HF Packet Operation

Radio Setup for HF Packet Operation

Setting up your Radio interface will follow exactly the same procedure as for VHF NBFM operation with the exception that you will probably not need to set the modem output level. This is because linear mode radios typically have a transmit audio level control on the front panel and an indicator which tells you when you have set the level correctly. You will adjust the audio level just as you would for SSB operation.

If you are using the auxiliary audio input connector (other than microphone input), you MAY need to adjust the transmit audio level from the MFJ-1278 modulator. This is because many auxiliary audio inputs are intended for phone patch audio. These levels are typically much higher than microphone levels. If you do adjust the output level of the MFJ-1278 to a relatively high value for this type of application, do not operate the MFJ-1278 with a VHF NBFM radio unless you take steps to assure that the audio level for the FM radio will not produce excessive deviation. If both radios are to remain connected to the MFJ-1278, you can set the audio level for each radio independently by using the audio output level adjustments, R157 & R158, on the left side of the MFJ-1278 with a small screw driver.

The modem center frequency used by the MFJ-1278 for all of the narrow shift AFSK modes including HF packet operation is 2200 Hz (2110 and 2310 Hz tones). Most frequencies listed for packet operations in the HF bands were established using a modem center frequency of 1700 Hz (1600 and 1800 Hz tones) in lower sideband mode. This is a 520 Hz offset (2220-1700) between the two modem standards. So a listed frequency of 7093, for example, will cause you to have a frequency display on your radio of 520 Hz PLUS the listed frequency (IF you are also using lower sideband mode). Thus you should find the 7093 KHz packet activity centered around 7093.52 KHz.

Your tuning indicator, when properly centered, is easily capable of 10 Hz alignment accuracy. It should be used as the tuning reference on any individual signal regardless of the frequency indicated on the radio dial.

NOTE: The signal actually transmitted by your SSB transceiver (F(emission)) when using the MFJ-1278 for AFSK HF packet operation using lower sideband will cover a band of frequencies approximately 400 Hz wide and centered at the transmitter indicated carrier frequency (F(ind)) minus the modem center frequency (Fc).

So you would use:

$$F(emission) = [\ F(ind) - Fc \ ]$$

to determine the actual operating frequency for band edge or netting purposes. Remember to consider that you will be occupying a few hundred Hz on either side of F(emission).

NOTE: Regardless of the type of modem, whether or not the modem has audio filtering built in, 300 baud AFSK modem performance on a High Frequency linear mode (SSB as opposed to NBFM) radio channel will NOT be optimum UNLESS a filter of approximately 500 Hz bandwidth is used in the radio IF strip.

There are two reasons why this is the case. First, for the filtering to be fully effective, it has to precede the first hard limiter in the system. This limiter is typically located in the first stage of the demodulator. Second, no filter at audio can prevent an off channel interfering signal from capturing the receiver AGC system and causing wide variation in the level of the audio presented to the demodulator. All demodulators are affected by audio level variations.

If a narrow (approximately 500 Hz) filter is to be used in the radio for HF packet and RTTY operation (and this is STRONGLY recommended), it may be necessary to use a tone pair centered on the radio's filter rather than the "standard" 2110/2310 or 1600/1800 Hz pair. If the radio lacks IF shift capability, this will almost certainly be necessary. If this is the case, it will be necessary to determine the center frequency of the audio spectrum output from the receiver when the narrow filter is selected and the radio is in the LSB mode.

Most radios which provide for direct FSK RTTY operation use the radio's narrow CW filter if one is installed. The Kenwood TS-820 is one example. Packet operation using direct FSK is a viable mode but extreme caution should be exercised to make sure TX and RX frequencies are identical and that the transmitted frequency pair is centered in the radio's 500 Hz filter passband. Once the required modem center frequency for the particula2 radio's FSK mode has been determined, the modem alignment procedure presented in the trouble shooting / calibration section of the owners manual may (should) be used to align the modem for this mode. Since there is no standardization among the various radio manufacturers in this regard, a method for making the determination of transmitter FSK output frequencies and

their relation to the LSB carrier oscillator and center of
the 500 Hz filter is NOT presented here.   Contact the
manufacturer of the radio to obtain this information.

Radios which have provision for an auxiliary "narrow SSB"
filter can have the 500 Hz bandwidth filter installed
instead of the approximately 1.8 KHz wide "narrow" SSB
filter.   This will allow direct selection of the narrow
filter for AFSK work when in SSB mode.   If the filter is
also desired for CW operation and you don't want to invest
in 2 identical fi,ters, it is usually a relati6ely simple
modification to cause the radio to also select this filter
when in CW mode.   In the TS-430, for example, this requires
moving one end of one diode on the IF board.   The 270 Hz
filter can then be installed in the "normal" narrow CW
filter position making two bandwidths of narrow filter
available for CW operation with all filters selectable from
the front panel.

Some of the newer HF radios (and many older ones) allow
selection of filter independent of mode.   the TS-440 by
Kenwood is an example of a recent design with this feature.
For these radios it is a simple matter to select the
required mode and the optimum filter independently of one
another.

If the HF radio is to be dedicated to packet use, the 500 Hz
filter can be installed in place of the SSB filter. This is
possible on ANY radio designed for SSB and CW use.

It is important to use lower sideband rather than upper
sideband if you are going to use a CW filter in the radio
for packet operations.   The reason for this is simple. The
filter designed for CW operation is usually centered
approximately 800 Hz away from the upper sideband
suppressed carrier. This is the carrier oscillator which is
normally used as the BFO on CW.   This means that if the two
carrier oscillators are 3 KHz apart, the CW filter center
will be near 2200 Hz below the lower sideband carrier. This
is the reason 2220 Hz was selected for the center frequency
of the modem.

If you are going to use a narrow filter, and serious HF
operation is NOT recommended without one, it will be
necessary to take steps to be certain that the filter
passband is centered over the modem center frequency.   If
your radio has IF shift, this is a simple matter.   The
tuning indicator and DCD LED are used to give you an
indication of filter centering. The following discussion
assumes that your radio has provision for IF shift.

To center your radio passband over the modem, use the

following procedure:

1. Set your radio for maximum RF gain.

2. Set the radio for lower sideband operation.

3. Make sure the MFJ-1278 is in HF Packet mode and that the HF Packet modem has been selected.

4. Set the audio output level so that the tuning indicator is responding to the background noise coming through the filter. This can be verified by observing whether or not the tuning indicator "follows" the noise as the IF shift control is rotated.

5. Tune to a frequency which has ABSOLUTELY NO signals in the passband. It is very important that only noise is coming through the filter. If you have access to a RX noise bridge, an alternative is to use the bridge as a noise source for the receiver. No antenna is required in this case.

6. Adjust the IF shift control on the radio so that the tuning indicator on the MFJ-1278 is centered in its display area.

7. Adjust the DCD threshold control on the front panel of the MFJ-1278 so that the DCD LED is flickering with false DCD indications. Make the adjustment so that the DCD duty cycle is more than 10 but less than 50 percent.

8. Carefully adjust the IF shift control on the radio to produce maximum DCD activity. This is the optimum point for the filter center frequency. Note the position of the IF shift control for future reference. This is the position you will want to use for all of the narrowband FSK modes.

If your radio has no provision for IF shift, you will have to determine the center frequency of the audio which is passe$ through the filter and realign the modem to the center frequency of the filtered audio. If you are lucky, this may turn out not to be necessary. The tuning indicator and DCD LED can be used to give you an indication when the modem is aligned with the filter similar to the indications described above. If the tuning indicator hovers around the center of the display when the modem is listening to noise being passed through the narrow filter as described above, realignment of the modem is unnecessary.

If you have determined that it is necessary to realign the

If you have determined that it is necessary to realign the modem center frequency to the radio filter center frequency, You should refer to **Appendix D** at the end of this instruction manual for the alignment procedure.

HF Packet Operation

Much has been said and written about the relative merits of HF versus VHF packet operation. HF packet operation is made to appear more difficult than VHF NBFM packet operation by several factors. Some of these are:

1.   HF propagation is much more time variable and is more prone to produce intersymbol errors than is VHF propagation.

2.   On the "published HF packet frequencies" many more stations are trying to use a single channel simultaneously than is the usual case on VHF.

3.   Due to the wide area propagation characteristic of HF radio waves (sometimes nonreciprocal) with relatively dead "skipped" zones , the carrier sense multiple access (CSMA) feature of packet radio is a less than perfect arbitrator for time sharing the channel between users.

4.   Many of the commercially available Terminal Node Controllers (TNC) for use on HF packet have data carrier detect (DCD) circuits which are of limited use or no use at all on a HF packet channel. This further degrades the effectiveness of CSMA.

      The DCD circuit in the MFJ-1278 has been optimized for the HF packet mode. It can be adjusted to ignore background noise while still being able to promptly respond to a valid data carrier. It has a "hang time" feature that prevents DCD dropouts when short multipath hits occur or collisions put phase discontinuities in the received data carrier. Thus, most multipath conditions will not cause the MFJ-1278 to begin transmitting before the other station is in a listening mode. The DCD hang time also prevents the MFJ-1278 from "piling on" a collision between 2 other stations on the channel. The DCD circuit in the MFJ-1278 is NOT affected by the fact that there is a large amplitude difference between different signals on the same channel. So it will not allow you to collide with a relatively weak station which is transmitting immediately after a relatively strong station has finished.

indicator at all and many others have an indicator that is only marginally useful. Unlike VHF FM operation, frequency error between transmitter and receiver cause frequency errors in the modem tones. This is the reason that a good tuning indicator is absolutely essential for HF packet operation. The tuning indicator makes it possible for the operator to reduce the modem to modem frequency error to near zero. Reliable HF packet operation requires tuning errors of +\- 30 Hz or less.

6.   Many of the stations currently operating HF packet do not have their radio bandwidth matched to the characteristics of a 300 baud 200 Hz shift FSK signal. This causes a severe degradation in modem performance resulting in unnecessarily increased numbers of retries and drastic reduction in data throughput for the SHARED channel.

Serious HF packet operation should not be considered without a 500 Hz filter in the receiver IF. An audio filter is NOT an acceptable substitute.

"Squeezing" the edges of SSB filters together with so called variable bandwidth tuning (VBT or PBT) to produce a 500 Hz bandpass is difficult to properly align and results in operation near the edges of the filters where the phase response and group delay characteristics are particularly poor. So while this offers some marginal improvement over wide filters, it is not a good substitute for a real 500 Hz filter.

In spite of the above factors, HF packet communications can be a reliable and enjoyable mode. The trick is to operate in a manner that allows you to avoid the problems mentioned above. Your purchase of an MFJ-1278 has already helped you avoid the DCD and tuning indicator difficulties. Configuring your radio bandwidth to match the spectral characteristics of the HF packet FSK signal will allow you to avoid the modem performance degradation that results from excessive radio bandwidth. However, you will still be affected by other station's problems in these areas when operating on a crowded packet channel.

If you do have your radio configured for the proper bandwidth, you will notice that many stations you connect to will seem to not be able to copy you as well as you copy them. Don't worry, your transmitter output isn't low, you are just observing the difference between a good demodulator behind the correct radio bandwidth and any kind of demodulator behind a radio which has far too much bandwidth for the mode.

The actual mechanics of operating the MFJ-1278 in the HF packet mode are the same as for the VHF packet mode. The main differences that will be apparent to you will be the slower baud rates, the higher incidence of propagation related effects and QRM, and the requirement for accurate tuning. It will take some practice before you can rapidly acquire another station's signal and initiate a contact.

The MFJ-1278 has a "threshold" adjustment for the DCD circuit. It will be necessary for you to set this adjustment correctly for the mode of operation and the bandwidth of the radio being used.

The adjustment is very easy to perform. Simply tune the radio to a channel which has only noise (no signals whatsoever), then adjust the threshold control so that the DCD LED just flickers occasionally. Set it so that the DCD duty cycle is between 10 and 20 percent. DO NOT set the threshold control so that the DCD LED never comes on even when receiving a signal!

If your radio has a bandwidth which is wide compared to the packet signal spectrum, the DCD LED may not flicker at ANY setting of the threshold control when monitoring only noise. In this case, set the threshold control to its maximum clockwise rotation. The data carrier detector will function normally when monitoring a signal in this case.

Tuning in a signal is relatively easy to do once you get the hang of it. You must wait until the other station is sending a packet, and then tune the transceiver so that the tuning indicator LED is centered. If the DCD LED is not lit, the tuning indicator information is NOT valid.

Each bar on the tuning indicator represents about 10 Hz. Thus, if a packet comes through and you are 4 bars off, re-tune your transceiver 40 Hz in the indicated direction. The direction depends on the sideband you selected and the manner in which you have the tuning indicator oriented. One or two tries will quickly tell you which way to go! Bars to the left of center indicate you should tune higher, while the other side of center means to tune lower.

Once you have the other station tuned in, you may initiate a connect request just as you would on VHF.

Many BBS stations forward traffic on HF at the above frequencies. Call CQ a couple KHz away from such channels. If you can't raise anyone, call CQ on one of the above frequencies, but QSY immediately after establishing contact! Be careful on 20 meters especially that you don't operate

propagation beacons and give packet a bad name...)

Calling CQ on HF is a bit different than on VHF.   One
technique which has proven effective when NOT operating on
one of the congested calling frequencies is to do the
following:

1. Find a clear frequency and monitor it for long enough to
    make sure it really is clear.

2. Set "UNProto" to CQ if it isn't already.   This is the
    default field for this parameter.

3. Command the MFJ-1278 into converse mode by typing either:

    K <CR>

    or

    CONV <CR>

4. Rapidly type a string of 15 to 20 carriage returns <CR>.
    This will cause the MFJ-1278 to send a continuous string
    of unconnected information (UI) frames. Since this will
    be a relatively long burst of packet transmission, the
    potential receiving station will have plenty of time to
    tune your signal in. To a receiving station this will
    appear on his screen as:

    YOURCALL > CQ:

    YOURCALL > CQ:

    YOURCALL > CQ:

    YOURCALL > CQ:

    YOURCALL > CQ:
      .
      .
      .
      .

    One for each carriage return you typed.

    Even a station which has no tuning indicator can
    eventually get you tuned in using this type of signal as
    he can tune around and watch his screen to see where
    printing is effective.

    If you are meeting a friend on a schedule, you just set
    the "UNProto" field to "HISCALL" and do the same thing.

the "UNProto" field to "HISCALL" and do the same thing.
When your friend finds you, this will appear on his
screen as:

YOURCALL > HISCALL:

YOURCALL > HISCALL:

YOURCALL > HISCALL:

    .
    .
    .

For as many <CR>s as you typed. Your friend will have
little trouble finding you and tuning you in for the
QSO.

5.   After the MFJ-1278 finishes sending the string of CQ
     packets, listen for 5 to 10 seconds to allow a station
     to attempt to connect with you.   If you don't get any
     nibbles, send another string of CQ packets.

The above method of calling CQ is NOT appropriate for use on
one of the crowded calling frequencies.   There, everyone is
already tuned more or less to the same frequency.   To call
CQ on one of the calling frequencies do the following:

1.   Find the "center" of the channel by tuning the radio so
     that the tuning indicator is centered on most of the
     signals.

2.   Make sure your "UNProto" field is set to CQ.

3.   Enter converse mode.

4.   Occasionally strike a <CR> (2 a minute or so if DCD lets
     your packets clear the channel that fast) and wait for
     the MFJ-1278 to get an opportunity to squeeze the packet
     into the activity on the channel. Allow some time after
     your packet has been sent for someone to attempt a
     connect with you and then send another CQ packet by
     typing a <CR>.

5.   If (when) someone connects, immediately negotiate a QSY
     to a clear channel.   Then call him on the new frequency
     as outlined above (in the clear channel CQ procedure)
     for a scheduled contact.

     Please use care in selecting the QSO frequency so as to
     avoid   unnecessary   interference to   other   amateur
     services.   As in all amateur communication modes, it is

polite to listen before you transmit!

Monitoring a propagation beacon frequency will not necessarily be sufficient to reveal this activity to you. It is best to make a note of which INDICATED frequencies you should avoid so that your radiated packet spectrum (from F(emission) above) will not get within several hundred Hz of a propagation beacon.

HF packet operation is fundamentally different than other modes of operation in 1 major respect. If you are on a clear channel, talking to only 1 other station, there will be long periods of silence. People using other modes and tuning around looking for a clear frequency to use may be fooled by the silence. Don't assume that an interfering station who shows up considerably after you have begun using the frequency is interfering on purpose, he may honestly not have been aware of your QSO in progress. For this reason, it is a good idea to keep the flow of the conversation going so that the lapses aren't too long. It can also be advantageous to have more than one packet QSO on the channel but if more than a very few get on the same channel, the throughput falls off very fast as the likelihood that all stations are properly configured and have working DCD circuits is small.

Here are a few simple suggestions for operating HF packet which should help to get you started.

1. Do NOT try to hold a QSO on one of the calling
    frequencies.   Use   the calling frequency only   to
    establish contact and then MOVE OFF TO A CLEAR FREQUENCY
    to carry on the QSO. Remember to be aware of the
    frequencies   your   station is actually transmitting so
    you can avoid interference to other services such as
    propagation beacons etc.

2. Configure your station so that you can hear the activity
    on the channel. This will allow you to easily avoid
    interfering with other stations and also to quickly
    diagnose the problem when throughput suddenly falls off
    for some reason (usually propagation or interference).

3. If possible, use the highest frequency band possible to
    communicate with any specific station. The closer you
    are to the maximum usable frequency (MUF) the less
    intersymbol interference you will have from multipath
    effects. If you have a schedule with another station,
    arrange your times and frequencies accordingly.

4. Set the following parameters off unless you have some

DIGIPEAT   (off . . . there is NO reason good enough
                    to enable this function on HF)

DWAIT   = 0 (off)

AX25V2   (off)

CHECK   = 0 (off)

CMSG   (off)

RETRY   = 0 (try forever . . but NOT if unattended
                operation. This allows YOU to be the one to
                decide when or whether to give up rather
                than the MFJ-1278. Typically you know more
                than the MFJ-1278 does about whether the
                other station is still trying or is likely
                to recover from the latest fade.)

MAXFRAME = 1 (multiple frames off)

RESPTIME = 0 (some stations may have trouble copying
                your ACKnowledgements (ACKs) when you
                respond this fast. This is due to the fact
                that some radios pump up the AGC voltage
                during transmit and if the AGC time
                constant is long, they are essentially deaf
                for a while after transmitting. You will
                want to experiment with this value.   In
                general, you will want to use the minimum
                usable amount.)

5. Set FRACK to at least 8.   10 or 12 may be better on a
    very busy channel.

6. Restrict your use of beacon transmissions as much as
    possible.   If you MUST use a beacon, keep it short and
    keep the repetition rate as low as possible.   More than
    once a minute is definitely too frequent. once or twice
    in 10 minutes is more polite. Do not allow your beacons
    to continue if you are not in attendance.   Nobody wants
    to connect to you just to be ignored.

7. If your radio allows you to select the AGC time constant
    (fast or slow AGC), set it to the fastest setting
    available to you.

    If you cannot select fast AGC, it may be advantageous
    under some circumstances to partially defeat the AGC
    function by reducing RF gain and increasing AF gain.
    The demodulator in the MFJ-1278 is extremely insensitive
    to absolute audio level. It will function properly with

input levels from the low hundreds of millivolts up to
many tens of volts.   Thus, the variation in audio level
produced by partially defeating the AGC system will   not
degrade the modem's ability to copy.   The limiting
factor on the high end is usually the ability of the
receiver output stage to produce the voltage without
clipping.   The limiting factor on the low end is the
hundred millivolts or so required to exceed the MFJ-
1278's digital system noise seen at the demodulator
input.

MFJ-1278 HOST MODE & TNC-2 MODE

One unique feature offered by the MFJ-1278 is that it can be
switched into host mode to run programs such as TCP/IP, or
it can be converted into a "like-TNC 2" controller.   Once
MFJ-1278 is converted, it can run any firmware written for
the TNC 2, such as NET/ROM (tm), THE NET (tm) and other
firmwares for the TNC 2 & clones. The procedure to convert
the MFJ-1278 into a "like-TNC 2" is described in **Appendix E**
in the instruction manual.

KISS Interface for TCP/IP

The KISS interface is installed in firmware of the MFJ-1278.
Additional modification or replacement of firmware is not
necessary.

KISS enables the MFJ-1278 to act as a modem for a host
computer.   Turning   KISS on allows the MFJ-1278 to run
programs such as TCP/IP and other programs which use
the Serial   Link Interface Protocal (SLIP).

Before enabling KISS, make sure radio baud rate and terminal
baud   rate are set to the desired values.   The terminal
baud rate that's determined at sign on is the same that will
be used for KISS.

Once the operating parameters have been selected, set KISS
ON and then issue a RESTART command.   The CON and STA LEDs
will blink on and off three times to indicate that the MFJ-
1278 has entered the KISS mode.   Now you may call up a
TCP/IP, or another host program that can use KISS or "SLIP".

If you are using the TCP/IP program and wish to switch to
the AX.25 mode of operation, you can issue the command:
param ax0 255, then press "RETURN".   This command must be
issued under TCP/IP "net>" prompt and in lower case letters.

Once the MFJ-1278 receives the "param ax0 255" command, it
turns KISS off and will revert back to ordinary AX.25 mode
of operation.   When the MFJ-1278 is powered on again, it
will sign on to the AX.25 operation mode.

For details of operation the TCP/IP user should consult
documentation provided with the TCP/IP program.

OPERATION COMMANDS

This chapter serves as a complete reference to all MFJ-1278 commands. Commands are used to control the many variable values which affect the MFJ-1278's operation, as well as causing it to perform specific actions, such as connecting to another station to start a QSO. You can enter a command to the MFJ-1278 whenever you see the command-mode prompt:

        cmd:

You will change parameters and issue instructions to the MFJ-1278 by typing commands composed of English-like words or word abbreviations, which are called keywords, and variables which are numbers or strings of characters chosen by the user. You will probably never change some of these parameters; however, one of MFJ's goals is to allow each user maximum flexibility to adapt the MFJ-1278 to his environment.

Entering Commands

You may use either upper case (capital letters) or lower case (small letters) when you enter commands. In order to have the MFJ-1278 accept a command line, you must finish the line with a <CR>, or carriage return character. This won't be mentioned explicitly in the examples below. Before you type the final <CR> of your command, you can correct typing mistakes or cancel the line completely. See Chapter 4 for a discussion of input line editing.

This chapter will use UPPER CASE for commands and lower case for explanatory text. In examples showing input typed by the user together with the responses of the MFJ-1278, the user's input will be shown in **bold face**.

Whenever the MFJ-1278 accepts a command which changes a value, it will display the previous value. For example, if you type

        XFLOW OFF

you might see the display

        XFLOW was ON

This reminds you of what you have done, and indicates that the value has been successfully changed.

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If you type something the MFJ-1278 can't understand you will
get an error message.   If you type an unrecognized command,
you will see the message ?EH.   If you get a command name
correct, but the arguments are wrong, you will see the
message ?BAD.   A complete list of error messages appears at
the end of this chapter. For example,

        cmd:ASDFASDF   ¦¦ This isn't a command.
        ?EH
        cmd:BEACON E   ¦¦ A parameter was left out.
        ?BAD

Command List

The commands are listed alphabetically, and each command
entry contains several sections, as follows.

COMMAND NAME

The boldface command name at the top of the entry is the
word you will type in order to have the MFJ-1278 execute
this command. The command name is printed with some letters
underlined.   These letters form the minimum abbreviation
that you may use and still have the MFJ-1278 understand your
command.   Of course, you may type out the entire command
word, or any abbreviation longer than the minimum abbrevia-
tion, if you like.

For example, the command MYCALL may be specified by simply
typing MY.   The abbreviation M is not sufficient (and will
be interpreted as a different command), but MY, MYC, MYCA,
MYCAL or MYCALL are all acceptable.

If the command requires parameters, they will be indicated
after the command name.

Default

For commands that set values, the MFJ-1278 assumes a "most
often used" or default condition.   The defaults are the
values stored in EPROM which are loaded into RAM when the
system is first powered up, or when you give the RESET
command.   Immediate commands perform actions rather than
setting values, and don't have defaults.

Parameters

There are several types of parameters.   Some parameters can
have one of only two values, such as ON and OFF or EVERY and
AFTER.   If a parameter must be one of two values, the
choices are shown separated by a vertical bar.   You may use
YES instead of ON and NO instead of OFF.

A parameter designated as **n** is a numeric value. These values may be entered as ordinary decimal numbers, or as hexadecimal, or "hex", numbers by preceding the number with a $ symbol. When the MFJ-1278 shows some of these numeric parameters (those which set special characters), they will be given in hex. The "digits" of a hex number represent powers of 16, analogous to the powers of 10 represented by a decimal number. The numbers 10 through 15 are denoted by the hex digits A through F. For example,

    $1B = 1*16 + 11 = 27
    $120 = 1*16*16 + 2*16 + 0 = 288

A parameter designated as **text**, such as the argument to **CTEXT**, may be entered in upper or lower case, and may include numbers, spaces, and punctuation. The text is accepted exactly as typed by the user.

Several commands require **callsign**s as parameters. While these parameters are normally Amateur call signs, they may actually be any collection of numbers and at least one letter up to six characters; they are used to identify stations sending and receiving packets. A **callsign** may additionally include sub-station ID (SSID), which is a decimal number from 0 to 15 used to distinguish two or more stations on the air with the same Amateur call (such as a base station and a repeater). The call sign and SSID are entered and displayed as call-n, e.g., KOPFX-3. If the SSID is not entered, it is set to 0, and SSIDs of 0 are not displayed by the MFJ-1278.

Some commands have parameters which are actually lists of items. For example, you may specify as many as eight callsigns to be selectively monitored with the command **LCALLS**. The second and later items in the list are optional, and you may separate the list items with blank spaces or with commas.

These examples may help you to understand the explanations above.

   <u>B</u>EACON <u>E</u>VERY│<u>A</u>FTER n

means that the command **BEACON** requires an argument which must be either **EVERY** or **AFTER** (abbreviated to E or A), and an argument n which the user may choose from a range of values. An acceptable command might be BEACON E 2.

   <u>C</u>ONNECT call1 [<u>V</u>IA call2[,call3...,call9]]

means that the command **CONNECT** <u>requires</u> a callsign argument **call1**. You may <u>optionally</u> include the keyword VIA, followed by a list of one to eight **callsigns**, call2 through **call9**.

The **callsigns** in the list, if included, must be separated by
commas (as shown), or by blank spaces.   An acceptable com-
mand might be C N2WX V AD7I WB9FLW.

You can see the current value of the command's arguments by
typing the command name by itself, without any arguments.
For example,

    cmd:**CONOK** Y | | Sets the value to **YES** (**ON**).
    CONOK was OFF | | Displays previous value.
    cmd:**CONOK** | | Command with no arguments
    CONOK ON | | displays present value.

A special command, **DISPLAY**, allows you to see the values of
all parameters or groups of related parameters.

Remarks

This section describes the command's action and the meaning
of each argument. Examples may be included of situations in
which the command might be used.

8BITCONV ON|OFF   Mode: Packet   Default: OFF

Parameters:

   ON   The high-order bit is not stripped in Converse Mode.

   OFF   The high-order bit is stripped in Converse Mode.

This command enables transmission of 8-bit data in Converse
Mode.   If 8BITCONV is OFF, the high-order bit (bit 7) of
characters received from the terminal is removed before the
characters are transmitted in a packet.   The standard ASCII
character set requires only 7 bits, and the final bit is
used as a parity bit or ignored.   Setting bit 7 in text
characters transmitted over the air may cause confusion at
the other end.

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

Bit 7 is always removed in Command Mode, since commands
require only the standard 7-bit ASCII character set.

8LEVELS ON|OFF   Mode: FAX/SSTV   Default: OFF

Parameters:

      ON   The MFJ-1278 will transmit   and   receive
                  FAX and SSTV in 8 gray levels

      OFF   The MFJ-1278 will transmit and receive FAX
                  and SSTV in 4 gray levels

In FAX and SSTV modes, if 8LEVELS is also ON, MFJ-1278 will
receive and transmit FAX and SSTV data in 8 levels of gray.
8LEVELS is effective only when MULTIFAX and TVX are turned
ON.   If MULTIFAX and TVX are set to OFF, MFJ-1278 is set to
transmit and receive 2 levels of FAX and 4 levels of SSTV
regardless of the setting of 8LEVELS (ON or OFF).   8 gray
levels data are not supported by the built-in printer ports
of the MFJ-1278. Special terminal program must be used to
decode and display multi-level FAX and SSTV.

When 8LEVELS is set to OFF, MFJ-1278 will receive and
transmit FAX and SSTV data in 4 levels of gray.   MFJ-1278
built-in printer port will support 4 level SSTV and 2 level
FAX printing.

To send FAX and SSTV printing to the MFJ-1278 printer port,
simply set PRINTGRA to ON. See PRINTGRA command for more
information.

AALT ON¦OFF   Mode: AMTOR   Default: OFF

AALT controls whether the alternate SELCALL set by the
ALTCALL command (below) is used in mode A ARQ.

ACKPRIORITY   ON¦OFF   Mode: Packet   Default: ON

ACKPRIORITY permits an acknowledging TNC to transmit without
regard to the slotting delay. Turning ACKPRIORIyty ON to
enable prioritized acknowledgement.

If ACKprior is turned off and SLots (see SLots) is set to 0,
the modified AX.25 protocol is effectively disabled.   The
MFJ-1278 will behave like normal AX.25 protocol.

Prioritized acknowledgments and slotted channel access can
be enabled or disabled independently of one another. So you
could if you wished run normal AX.25 with slotted channel
access or the new protocol without slotted channel access.

ACKTIME   nnnn   Mode: Packet   Default: 30 (300 ms)

Parameters:

    nnnn   0 - 250, in 10 ms intervals.

The ACKTIME parameter controls a delay that occurs whenever
any packets have been received by the MFJ-1278 that are not
addressed to the MFJ-1278.

ACKTIME should be calculated by the radio channel baud rate,
and by the keyup and keydown (TXDELAY and fixed timer, in
TNC) delays.   It should reflect the time it takes for an
acknowledging TNC on the channel to keyup, send it's
acknowledgement, and release the PTT. This represents the
time required to send a response frame (with no I field
appended) at the baud rate being used on the radio port.

The current 100 millisecond default is close but should be
adjusted for 1200 baud work to 130 milliseconds (ACKTime set
to 13).

For 300 baud HF work this parameter should be set to 520
milliseconds (ACKTime set to 52).

ALOCKCHAR nn   Mode: CW/MCW   Default: $15 (^U)

This command controls which character is used to force the
MFJ-1278 to lock its CW receive speed to the incoming
signal. See CW operating instructions for more detail
information when using **alockchar.**

ALTCALL "ssss"   Mode: AMTOR   Default: blank

Parameter:

    ssss   A set of four letter SELCALL for mode A amtor

ALTCALL is used to set up an alternate SELCALL that the MFJ-
1278 responds to in mode A. "ssss" is a four letter
SELCALL.

ANSBSTR   "cccc"   Mode: AMTOR   Default: blank

ANSBSTR will enable the MFJ-1278's response to a "Who Are
You?" WRU mode A AMTOR signal. The text "cccc" may be up to
15 characters.

The response to the WRU in a mode A ARQ contact is the
automatic transmission of the ANSBSTR text.

ARCVCHAR   nn   Mode: RTTY/ASCII/CW   Default: $12 (^R)

ARCVCHAR specifies the character used in RTTY/ASCII/CW modes
to return to receive mode after transmitting

ARQ   "ssss"   Mode: AMTOR   Default: (command)

The ARQ command initiates a mode A "ARQ" connection. "ssss"
is the SELCAL of the station you wish to connect with.

When ARQ is first issued, the MFJ-1278 begins to key the
transmitter in attempt to establish the link.   Both CON and
STA LEDs immediately light to indicate the 'phasing'
condition.

If the remote station answers, the STA LED extinguishes but
CON remains lit. An IDLE (ready) state is indicated by this
combination. The MFJ-1278 is now ready to accept text for
transmission.   Type K or CONV to get into text transmit
mode.

ASENDCHA   nn   Mode: RTTY/ASCII/CW   Default: $14 (^T)

ASENDCHA specifies the character that initiates transmit
while in RTTY/ASCII/CW.   Note that other   events,
particularly in CW mode, may cause entry to the transmit
state.

ASPECT n   n = 2 thru 8   Mode: FAX   Default: 2

ASPECT is used to establish a reasonable aspect ratio
between   horizontal and vertical presentation   of   FAX
graphics.   It is necessary to have an ASPECT control because
the vertical density a dot matrix printer can represent is
much less than the representable horizontal density.

The ASPECT setting is a ratio of printed: non-printed rows
of FAX graphics.   The default of 2 means that for every 1
printed FAX row, two rows are discarded.   This is the
optimum aspect ratio for HF weather FAX.

If your pictures seem to be elongated horizontally, you
should decrease the value of aspect.   The reverse (vertical
elongation) is corrected by an increased aspect value.

AUTOBAUD   **ON:OFF**   Mode: All   Default: ON

When **AUTOBAUD** is ON,   the MFJ-1278 will attempt to
synchronize with   the   user's terminal baud rate.   When
powered   up,   the MFJ-1278 will wait until it detects a
carriage return from the keyboard.   You should repeatedly
strike the carriage return key on initial power up until
the MFJ-1278 recognizes and sets its baud rate to match
the terminal baud rate of your computer before signing
on.

Once the MFJ-1278 has signed on, you may turn AUTOBAUD OFF.
If AUTOBAUD is turned OFF,   the MFJ-1278 will store the
terminal baud rate which it signed on to last.   Therefore,
each time the MFJ-1278 is powered up,   it will sign on
without   executing the autobaud routine.   You should
remember that if you turn AUTOBAUD OFF, if the terminal baud
rate is changed, the MFJ-1278 will no longer be able to
automatically reset to the new baud rate.   AUTOBAUD must
be turned ON, before the MFJ-1278 will automatically seek a
new terminal baud rate.

If you must force the MFJ-1278 to autobaud after   AUTOBAUD
has been turned off and the terminal baud rate no longer
matches the MFJ-1278 serial port baud rate,   you will need
to remove JMP 5 on the MFJ-1278 circuit board and remove
power from the MFJ-1278 for several tens of seconds to
reset the RAM which stores the non volatile operating
parameters.   Once reset in this manner, the MFJ-1278 will
restore all parameters to the default values. AUTOBAUD will
now be at its default of ON. The next time the MFJ-1278 is
powered up after such a reset, it will attempt to match
the   new baud rate and sign on after detecting several
carriage returns input to the serial port.

AUTOLF ON¦OFF   Mode: Packet   Default: ON

Parameters:

    ON   A linefeed character (<LF>) is sent to the
                terminal after each carriage return character
                (<CR>).

    OFF   A <LF> is not sent to the terminal after each
                <CR>.

AUTOLF controls the display of carriage return characters
received in packets as well as echoing those that are typed
in.

If the MFJ-1278's sign-on message lines appear to be typed
over each other, you should set AUTOLF ON.   If the MFJ-
1278's sign-on message appears to be double-spaced, you
should set AUTOLF OFF.   If the MFJ-1278's sign-on message
appears to be single-spaced, you have AUTOLF set correctly.

This command only affects what is displayed, not the data
sent in packets.   If you want to add linefeed characters to
outgoing packets, use the command LFADD.

AUTOTRAC   ON:OFF   Mode: CW   Default:ON

When   **AUTOTrac** is set ON,   the MFJ-1278 attempts   to
continuously track the CW speed changes of a station that is
being received.

When the last reception speed greatly differs from the speed
being now, the MFJ-1278 will automatically initiate a LOCK
just as if you had requested one with "Control-U".   If
CWSPEEDMatch is on when this automatic locking takes place,
then the newly locked speed also becomes your new transmit
speed.

Small received speed changes do not cause your transmit
speed to change.

AUTOTrac feature is useful for listening while roaming the
bauds or for net operation.

AWLEN n   Mode: All   Default: 8

Parameters:

  n   7 - 8, specifying the number of data bits per
      word.

This value defines the word length used by the serial IO
terminal port.

For most packet operations, including conversation, bulletin
board operation, and transmission of ASCII files, you should
set **AWLEN 7.** If 8 bit words are transmitted to the MFJ-1278
in Command Mode or Converse Mode, the eighth bit is normally
removed, leaving a standard ASCII character, regardless of
the setting of **AWLEN.**

To transmit and receive packets retaining all 8 data bits of
each character, as you need to do if you send executable
files or other special data, you should use Transparent Mode
and set **AWLEN 8.** Alternatively, you can use Converse Mode
and set **AWLEN 8** and **8BITCONV ON** (however, the data you then
send must handle the Converse Mode special characters with
the **PASS** prefix).

AX25L2V2 ON|OFF   Mode: Packet   Default: ON

Parameters:

     ON   The MFJ-1278 will use AX.25 Level 2 Version 2.0 protocol.

     OFF   The MFJ-1278 will use AX.25 Level 2 Version 1.0 protocol.

Some implementations of the earlier version of AX.25 protocol (e.g., TAPR's TNC 1) won't properly digipeat version 2.0 AX.25 packets. This command exists to provide compatibility with these other TNCs until their software has been updated.

During the protocol transition period, you should set **AX25L2V2 OFF**.

After your local area TNCs are updated to the newer protocol version, you should set **AX25L2V2 ON**.

When **AX25L2V2** is ON, the MFJ-1278 answers L2 UI frames with P and C set with either: RR if connected (regardless of rcvr flow control state), or DM if not connected.

If retry limit is exceeded, or the MFJ-1278 receives a "disconnected" response to a poll, the connection is ended.

AXDELAY n   Mode: Packet   Default: 0

Parameters:

    n   0 - 180, specifying the voice repeater keyup
               delay in 10 ms intervals.

AXDELAY specifies a period of time the MFJ-1278 is to wait,
in addition to the normal delay set by **TXDELAY**, after keying
the transmitter and before data is sent.   This feature will
be used by groups using a standard "voice" repeater to
extend the range of the local area network.   Repeaters with
slow mechanical relays, split sites, or other circuits which
delay transmission for some time after the RF carrier is
present require some amount of time to get RF on the air.

If you are using a repeater that hasn't been used for packet
operations before, you will have to experiment to find the
best value for **n**.   If other packet stations have been using
the repeater, check with them for the proper setting. Note
that this command acts in conjunction with **AXHANG**.

Note that the TAPR TNC 1 and other TNCs using the same
version 3.x firmware interpret **n** in 120 ms intervals.   The
value set by **AXDELAY** on MFJ-1278 will thus be 12 times the
value used by a TNC 1 user to give the same delay time.

AXHANG n   Mode: Packet   Default: 0

Parameters:

    n   0 - 20, specifying the voice repeater hang
           time in 100 ms intervals.

This value can be used to increase channel efficiency when
an audio repeater with a hang time greater than 100 ms is
used.   For a repeater with a long hang time, it is not
necessary to wait for the repeater keyup delay after keying
the transmitter if the repeater is still transmitting.   If
the TNC has heard a packet sent within the hang period, it
will not add the repeater keyup delay (AXDELAY) to the keyup
time.

If you are using a repeater that hasn't been used for packet
operations before, you will have to experiment to find the
best value for n.   If other packet stations have been using
the repeater, check with them for the proper setting.

Note that the TAPR TNC 1 and other TNCs using the same
version 3.x firmware interpret n in 120 ms intervals.   The
value you set on MFJ-1278 for AXHANG will thus be 6/5 the
value used by a TNC 1 user for the same hang time (when
converting, round down to the nearest integer).

BBSMSGS <u>ON</u>|<u>OFF</u>   Mode: Packet   Default: OFF

This command controls how the MFJ-1278 displays certain
messages in command and CONVERSE modes.   The messages
affected are described below:

        <u>MESSAGE</u>   <u>EFFECT</u> <u>WHEN</u> <u>BBSMSGS</u> <u>ON</u>

CONNECTED to xxxx   -A newline is added just before""

***DISCONNECTED   -   "   "

***retry limit exceeded-   "   "

***xxxx Busy   -   "   "

***FRMR sent   -   "   "

***FRMR rcvd   -   "   "

***Connect request:xxxx-This message is omitted.

The BBSMSGS command is primarily useful for host operation.
Primarily with WORLI and like bulletin board systems that
require link status messages to begin in the first output
column.

The connect request message is omitted during BBSMSGS mode.
This should be most useful for preventing corruption of
messages when forwarding with small frames.

BEACON EVERY|AFTER n   Mode: Packet   Default: EVERY 0

Parameters:

    EVERY   Send beacon at regular intervals.

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

    n   0 - 250, specifying beacon timing in 10 sec-
               ond intervals. A value of 0 disables the
               beacon.

This command enables beacon sending and causes the first
beacon frame to be transmitted. A beacon frame consists of
the text specified by BTEXT in a packet addressed to
"BEACON" and sent via the digipeat addresses specified by
the UNPROTO command, if any.

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

If AFTER is specified, a beacon is sent only after n*10
seconds have passed with no packet activity. In this case,
the beacon is sent only once until further activity is
detected. This mode can be used to send announcements or
test messages only when packet stations are on the air. If
you choose n properly you can avoid cluttering a busy chan-
nel with unnecessary transmissions.

Beacon frames from other TNCs can be monitored by setting
MONITOR ON.

NOTE: BEACONS will not be sent if BTEXT is null.

BKONDEL ON|OFF   Mode: Packet   Default: ON

Parameters:

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

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

This command determines the way the display is updated to
reflect a character deletion in Command Mode or Converse
Mode.

The <BACKSPACE> <SPACE> <BACKSPACE> sequence will properly
update the screen of a video display. If you have a video
display terminal or computer, you should set BKONDEL ON.

The <BACKSPACE> <SPACE> <BACKSPACE> sequence on a printing
terminal would result in overtyped text. If you have a
paper-output display, or if your terminal does not respond
to the <BACKSPACE> character (<CTRL-H>), you should set
BKONDEL OFF.   The MFJ-1278 will type a <BACKSLASH> for each
character you delete.   You can display the corrected input
line by typing the redisplay-line character, which is set by
the command REDISPLA.

BTEXT text   Mode: Packet   Default: ""

Parameters:

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

BTEXT specifies the content of the data portion of a beacon
packet.   The default text is an empty string, i.e., no
message.   Beacon packets are discussed in more detail under
the BEACON command.

NOTE: BEACONS will not be sent if BTEXT is null.

You can send multiple-line messages in your beacon by in-
cluding carriage return (<CR>) characters in the text.   The
<CR> character can be included by preceding it with the pass
character.   The pass character is set by the PASS command.
If you enter a text string longer than 120 characters, an
error message will appear and the command will be ignored.

For example, a Bulletin Board program might set the beacon
text to a message like this, updating the text after each
connection:

    Mailbox on line. Messages for WB9FLW, AD7I, K9NG.

To clear the BTEXT text without issuing the RESET command,
use a % or & character as the first character in the text.

BUDLIST ON¦OFF   Mode: Packet   Default: OFF

Parameters:

    ON   Ignore frames from stations which are <u>not</u> in
               the **LCALLS** list.

    OFF   Ignore frame from stations which <u>are</u> in the
               LCALLS list.

BUDLIST works in conjunction with the command **LCALLS,** which
sets up a **callsign** list.   These commands determine which
packets will be displayed when you have set **MONITOR ON.**
BUDLIST specifies whether the **callsigns** in the list are the
ones you want to ignore or, alternatively, are the only ones
you want to listen to.

If you want to listen only for packets from a limited list,
you should enter this list with **LCALLS** and set BUDLIST **ON.**
You can use this feature, for example, to have your TNC
"keep an ear out" for a particular station while you con-
verse with someone else.

If you want to ignore packets from a limited list, you
should list the **callsign**s to ignore in LCALLS and set
BUDLIST OFF.   For example, if there is a bulletin board on
frequency, you can ignore it while monitoring other conver-
sations.

BUFn   n = 0 thru 9   Mode: CW/RTTY/ASCII   Default: empty

You may load up to ten buffers for use in CW/RTTY/ASCII
modes.   Maximum buffer text for each buffer is   120
characters. Note that when loading buffer text, there is no
space between the word "BUF" and the buffer number selected.

Buffers may be transmitted by setting up for the appropriate
mode, and typing the "ASENDCHAR" character (Ctrl-T).   This
causes   the MFJ-1278 to enter transmit mode.   Another
ASENDCHAR (Ctrl-T) causes the MFJ-1278 to wait for a buffer
number.   At this point, enter a digit zero through nine
and the buffer will be sent.

A special case occurs when the character "#" (pound sign)
occurs in the buffer text.   In this case, the MFJ-1278
replaces the "#" with the current value of the   SERIALNO
counter. Once used, this value is incremented by one up to
a maximum of 65535, where the counter rolls over to zero.

Also see: BUFTIME and SERIALNO commands.

BUFKEY nnn   Mode: CW/RTTY/ASCII   Default: 9

BUFKEY allows user to transmit memory buffers without having
to type "Ctrl-T".   Default of BUFKEY nnn is the "TAB" key
(9).   To transmit a buffer, user will press the "TAB" key
then follow by a memory buffer number (0-9).   For example,
to transmit memory buffer 0, press the "TAB" key then type
the "0" key.   MFJ-1278 will transmit the content of memory
buffer 0 then revert to receive at the end of the buffer
transmission. BUFKEY is useful for CW, MCW, RTTY or ASCII.

BUFTIME n n= 0 thru 65535   Mode: CW   Default: 0

When a nonzero **BUFTIME** is specified, the MFJ-1278 will transmit Buffer 0 at a repetition rate specified by BUFTIME. BUFTIME is effective only in CW mode. If the transmitter is not keyed, the buffer timer will key it, send the buffer, then release it. This is useful for beaconing, calling CQ, etc. BUFTIME can be turned off by setting it to 0.

BWNL   ON¦OFF   Mode: AMTOR   Default: OFF

BWNL controls whether the MFJ-1278 in mode B FEC waits for you to send a newline character (<CR>) before it starts transmitting the data.

If **BWNL** is OFF then every character you transmit in mode B will be sent as soon as possible.

If it is ON, the MFJ-1278 will buffer the entire line sending it only when you have completed it and struck the RETURN key, allowing you to fix typing mistakes before transmission.

CALIRA   Mode: All

CALIBRA is an immediate command, and is used to transfer
control to the modem calibration routine.   Calibration may
be performed at any time without altering the current link
state.

Briefly, the commands available in the calibration routine
are:

          `<SPACE>` Switch the transmit audio to the other tone.
             D   Alternate between the two transmit tones at a
                   rate determined by the radio baud rate.
             K   Toggle PTT line on/off.
             Q   Quit calibration routine.

CALSET n   Mode: All   Default: NONE

Parameters:

      n 0 - 65535, specifying the count setting for
                  use by the calibration routine.

The   number   to be specified by **CALSET** is determined by the
frequency **f** to be calibrated as follows.

          n = (525,000 / **f**) + 1   (modulator tones)
          n = (262,500 / **f**) + 1   (demodulator tones)

Round **n** to the nearest integer.   To calibrate   the   modem
tones, you will   set **n** for the   desired   frequency   using
CALSET.

CANLINE n   Mode: Packet   Default: $18 <CTRL-X>

Parameters:

    n   0 - $7F, specifying an ASCII character code.

This command is used to change the cancel-line input editing
command character. The parameter n is the ASCII code for
the character you want to type in order to cancel an input
line. You can enter the code in either hex or decimal.

For example, to change the cancel-line character to <CTRL-
U>, you would set CANLINE $15 or CANLINE 21.

If you cancel an input line in Command Mode, the line will
be terminated with a <BACKSLASH> character, and you will see
a new cmd: prompt. If you cancel a line in Converse Mode,
you will see only the <BACKSLASH> and a new line. You can
cancel only the line you are currently typing. Once a <CR>
has been entered, you can not cancel an input line using the
cancel-line character. Note that if your send-packet char-
acter is not <CR>, the cancel-line character will cancel
only the last line of a multi-line packet. To cancel the
entire packet, use the CANPAC character.

Line cancellation, like all other input editing features, is
disabled in Transparent Mode.

CANPAC n   Mode: Packet   Default: $19 <CTRL-Y>

Parameters:

   n   0 - $7F, specifying an ASCII character code.

CANPAC is used to change the cancel-packet input editing command character. The parameter **n** is the ASCII code for the character you want to type in order to cancel an input packet. You can enter the code in either hex or decimal.

If you cancel a packet in Converse Mode, the line will be terminated with a <BACKSLASH> character and a new line. You can only cancel the packet that is currently being entered. Once you have typed the send-packet character, or waited **PACTIME** (if **CPACTIME** enabled), the packet can not be canceled even if it has not been transmitted.

Packet cancellation, like other input editing features, is disabled in Transparent Mode.

Cancel Display Output

The cancel-packet character also functions to cancel display output in Command Mode. If you are in Command Mode and type the cancel-packet character, any characters that would be typed on the screen (except echoed characters) are "thrown away" by the MFJ-1278. Typing the cancel-output character a second time restores normal output. To see how this works, try typing DISPLAY, then type a <CTRL-Y>. The command list display will stop. You won't see any response from the MFJ-1278 to commands. Now type another <CTRL-Y>, and type **DISPLAY** again to see that the display is back to normal.

You can use the cancel-display feature if you inadvertently do something that causes the MFJ-1278 to generate large amounts of output to the terminal, such as giving the **DISPLAY** command or setting **TRACE ON**. If you are in Converse Mode or Transparent Mode and want to cancel display output, you must exit to Command Mode and then type the cancel-packet character.

CBELL ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   Connect bell enabled

    OFF   Connect bell disabled

This command is used to control whether an ASCII $07 (BELL)
character is sent as part of the connected message.

When set ON, the bell character immediately procedes the
asterisk portion of the connected message, e.g.:

    <BELL>*** Connected to: <callsign>

When CBELL is ON a tone will also be heard on the external
speaker. A speaker must be connected to the SPEAKER jack in
the rear panel of the MFJ-1278.

CCITT   ON|OFF   Mode: RTTY   Default: ON

The CCITT parameter selects either an internationally
recognized character set (CCITT) or the "U.S. TTY" standard.
The latter is used by many older, surplus mechanical
teletypes that have been taken out of commercial service and
placed into amateur use. This parameter is only significant
when in Baudot RTTY mode.

While the standards are nearly identical, stations in in the
United States are advised that the FCC requires (part
96.69(a)) stations in Baudot RTTY service utilize
International Telegraph Alphabet Number 2 (ITA No. 2) as
specified by the International Telegraph and Telephone
Consultative Committee (CCITT).

Note that when CCITT is ON, Baudot RTTY codes received but
not assigned in the ITA No. 2 standard are printed as they
would have been had the "U.S. TTY" standard been selected.

CHECK n   Mode: Packet   Default: 30

Parameters:

    n   0 - 250, specifying the check time in 10 second
           intervals. A value of 0 disables this feature.

This command sets a connection timeout. If a link connec-
tion exists between the MFJ-1278 and another station, and
the other station "disappears," your MFJ-1278 could remain
in the connected state indefinitely, refusing connections
from other stations. This might happen if propagation
changes unexpectedly or an intermediate digipeater station
is turned off. In order to prevent this sort of lockup, the
MFJ-1278 will try to clean up the link if the specified time
elapses without any packets being heard from the other TNC.
The operation of this feature depends on the setting of
AX25L2V2.

If AX25L2V2 is ON, the MFJ-1278 will send a "check packet"
to verify the presence of the other station if no packets
have been heard from it for n*10 seconds. This frame con-
tains no information, but is interpreted by the receiving
station's TNC as an inquiry as to whether it is still
connected. If the receiving TNC is still connected, it
sends an appropriate response packet. If the TNC initiating
the inquiry does not hear a response after RETRY+1 attempts,
it commences a disconnect sequence, as if the DISCONNE
command had been given.

If AX25L2V2 is OFF and the other station has not been heard
for n*10 seconds, the MFJ-1278 will not attempt an inquiry,
but will send a disconnect packet, just as if you had typed
the command DISCONNE.

CHECKV1   ON|OFF   Mode: Packet   Default: OFF

The CHECKV1 parameter enables the automatic idle-link-
disconnect feature for AX.25 Level 2 Version 1 connections.
The idle time before disconnecting will be equivalent to the
AX.25 CHECK parameter (see CHECK command).

CHANGE   Mode: AMTOR   Default: (command)

The CHANGE command causes your station to switch from being
the mode A "ARQ" receiver to being the transmitter. CHANGE
forces the direction of the link to switch without using the
"+?" over signal. It is valid only during a mode A
connection when you are the receiver.

CLKADJ n   Mode: Packet   Default: 0

Parameters:

    n   0 - 65535, specifying the correction factor
           to be applied to the real-time clock routine.

A value of "0" is a special case and means no correction
factor will be applied. If the value of CLKADJ is non-zero,
then the correction factor is calculated as:

$$\text{relative clock speed in \%} = 100 - \left(9.16667 * \frac{1}{n} \right)$$

The real-time clock routine is used to keep track of year,
month, day, hour, minute and second as specified in the
DAYTIME command. It should be noted that the real-time
clock is not intended to be your ham-shack reference clock,
but is useful for approximate time stamping information.

CONPERM ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   The current connection on the current stream will
           not be allowed to enter the disconnected state.

    OFF   The current stream may be connected to and discon-
           nected from other stations.

This command, when switched ON, forces the MFJ-1278 to
always maintain the current connection, even when frames to
the other station exceed RETRY attempts to get an acknowled-
gment. RESTART and power off/on cycling will not affect
this connected state.

This command only takes effect when a connection is establi-
shed. It functions on a stream-by-stream basis when multip-
le connections are allowed.

It is useful for certain networking applications, meteor
scatter and other noisy, less-reliable links, while still
allowing connections on other streams to operate normally
(automatic disconnect based on RETRY, etc.).

CMDTIME n   Mode: Packet   Default: 1

Parameters:

    n   0 - 250, specifying Transparent Mode timeout
               value in 1 second intervals. If n is zero,
               the only exit from Transparent Mode is to
               send a BREAK signal or interrupt power to the
               MFJ-1278.

This command sets the Transparent Mode timeout value. In
order to allow escape to Command Mode from Transparent Mode
while permitting any character to be sent as data, a guard
time of n seconds is set up.

The   same Command Mode entry character used for exit from
Converse Mode is used to exit Transparent Mode, but the
procedure is different.   (The Command Mode entry character
is set by COMMAND.) Three Command Mode entry characters
must be entered less than n seconds apart, with no inter-
vening characters, after a delay of n seconds since the last
characters were typed.   After a final delay of n seconds,
the MFJ-1278 will exit Transparent Mode and enter Command
Mode. You should then see the prompt

    cmd:

The diagram below illustrates this timing.

```
last                first           second          third           TNC
terminal            command         command         command         now in
input               mode            mode            mode            Command
¦                   entry           entry           entry           Mode
¦                   character       character       character       ¦
¦                            ¦               ¦               ¦       ¦
¦                            ¦               ¦               ¦       ¦
¦<---longer--->¦<-shorter->¦<-shorter->¦<-----n----->¦
      than n           than n          than n
```
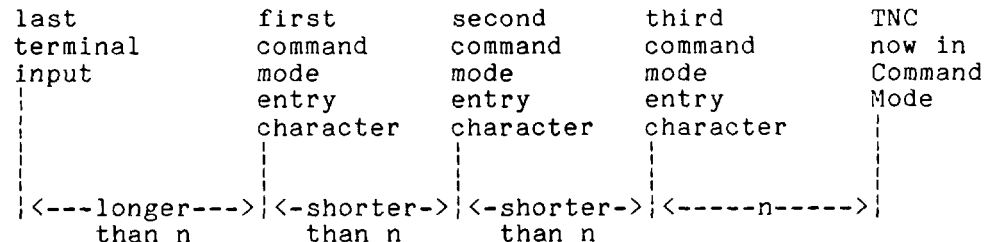
CMSG ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   A text message is sent as the first packet
              after a connection is established.

    OFF   The text message is not sent.

CMSG enables automatic sending of the message set by **CTEXT** whenever your MFJ-1278 accepts a connect request from another TNC.

For example, if you have left your station running even though you don't want to operate just now, you might want to set **CMSG ON** to let people know that you can't talk when they connect to your MFJ-1278. When you are ready to operate, you would set **CMSG OFF.**

CMSGDISC ON:OFF   Mode: Packet   Default: OFF

Parameters:

    ON   Automatic disconnect enabled

    OFF   Automatic disconnect disabled

This command controls whether the MFJ-1278 will initiate a disconnect sequence after it is connected to.

If **CMSG** is OFF, or **CTEXT** has no connected text, the MFJ-1278 initiates a disconnect immediately upon receiving information or acknowledgement frames from the other station.

If **CMSG** is ON end **CTEXT** contains some text information, the MFJ-1278 initiates a disconnect after the packet containing connect text (CTEXT) is acknowledged.

This command may be usef51 to bulletin board operators or others with a need to send a short message, confirm its receipt, and disconnect.

NOTE: Use this command with care - If you find you're
           able to receive connects, yet never get data, it's
           possible CMSGDisc has been left on. It's also
           possible is that RS-232 DCD is holding the
           terminal off -- see Chapter 5 for details on
           hardware flow control.

COMMAND n   Mode: All   Default: $03 <CTRL-C>

Parameters:

     n   0 - $7F, specifying an ASCII character code.

This command is used to change the Command Mode entry char-
acter. You can enter the code in either hex or decimal.

Command Mode is entered from Converse Mode when this charac-
ter is typed.   If you type the Command Mode entry character
while you are already in Command Mode, nothing will happen.
To see how this works, enter Converse Mode by typing
CONVERS.   Anything you type will become packet data.   Now
type a <CTRL-C>.   You will see the Command Mode prompt,
indicating successful exit to Command Mode.   The display
might look like this:

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

See the entry under **CMDTIME** or the discussion of Transparent
Mode in Chapter 5 for information on how the Command Mode
entry character is used for escape from Transparent Mode.

CONMODE CONVERS|TRANS   Mode: Packet   Default: CONVERS

Parameters:

    CONVERS   Sets automatic entry to Converse Mode when a
                connection is established.

    TRANS   Sets automatic entry to Transparent Mode when
                a connection is established.

CONMODE controls which mode the MFJ-1278 will be placed in
after a connection. The connection may result either from a
connect request received over the air or a connect initiated
by a **CONNECT** command that you issue.   For most operations,
you would set **CONMODE** to **CONVERS**.   However, if you are using
Transparent Mode for a bulletin board program, for example,
you would set **CONMODE** to **TRANS** so that the correct mode will
be entered when your bulletin board receives a connect
request.

If you initiate a connection with the **CONNECT** command, the
timing of the entry into Converse or Transparent Mode is
determined by **NEWMODE**.

If the MFJ-1278 is already in Converse or Transparent Mode
when the connection is completed, the mode will not be
changed.   If you have typed part of a command line when the
connection is completed, the mode change will not take place
until you complete the command or cancel the line.   This
prevents the last part of your command from inadvertently
being sent as a packet.

CONNECT call1 [VIA call2[,call3...,call9]]   Mode: Packet

Parameters:

    call1   Callsign of TNC to be connected to.

    call2   Optional **callsign** of MFJ-1278 to be
               digipeated through. As many as eight
               digipeat addresses can be specified.

The part of the command line in brackets, **VIA** call2[,
call3...,call9] is optional. The double-bracketed text,
,call3...,call9, is also optional, but would only be used if
VIA call2 is present. The brackets are not typed.

Each **callsign** may include an optional sub-station ID speci-
fied as -n immediately following the **callsign**. The digipeat
fields are specified in the order in which you want them to
relay the packets to the destination, call1.

CONNECT is an immediate command. It initiates a connect
request to MFJ-1278 **call1**, optionally through digipeaters.
If NEWMODE is ON, the MFJ-1278 will immediately enter
Converse Mode or Transparent Mode, as specified by the
command CONMODE. If NEWMODE is OFF, the MFJ-1278 will enter
Converse Mode or Transparent Mode when the connection is
successfully completed.

An error message is returned if the MFJ-1278 is in a
connected state, or is already attempting to connect or
disconnect. If no response to the connect request occurs
after the number of attempts specified by RETRY, the command
is aborted and a message is typed. The MFJ-1278 returns to
Command Mode if NEWMODE is ON. If NEWMODE is OFF, the mode
does not change, i.e. the MFJ-1278 remains in Command Mode.

For example, to connect to WA7GXD using NOADI-1 (who is near
your QTH) and WD0ETZ (who is near GXD's QTH) as digipeaters,
you would type

     CONNECT WA7GXD VIA NOADI-1,WD0ETZ

Packets coming back from WA7GXD access the digipeaters in
the opposite order. Thus, packets from WA7GXD will first be
repeated by WD0ETZ, then by NOADI-1.

CONOK ON|OFF   Mode: Packet   Default: ON

Parameters:

    ON   Connect requests from other TNCs will be
                accepted.

    OFF   Connect requests from other TNCs will be
                rejected.

This command determines the action taken by the MFJ-1278
when a connect request for it is received though the radio.
If CONOK is ON, the request will be acknowledged, the
standard connect message will be typed and either Converse
or Transparent Mode will be entered, depending on the
setting of CONMODE.

If CONOK is OFF and the MFJ-1278 is not in Transparent Mode,
the TNC will notify you of the connect attempt with the
following message.

    connect request: <call>

The callsign of the station trying to connect will replace
<call>.

All connect requests from stations with totally blank
callsigns are rejected with a busy response.

The MFJ-1278 will also issue a DM packet, or "busy signal"
to the requesting station. The user may then issue his own
connect command. If the MFJ-1278 receives a DM packet in
response to a connect request, it will type the message

    *** <call> station busy

with the callsign of the station that sent the DM packet in
place of <call>.

For example, if you want to leave your station running as a
digipeater you might set CONOK OFF until you are ready for a
conversation. If you get a connect request in the meantime,
you can change your mind. Stations attempting to connect to
your MFJ-1278 will be able to see that the station is up but
not available for connection (it might still be useful as a
digipeater).

CONSTAMP ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   Connect and disconnect status messages are
                time stamped.

    OFF   Connect status messages are not time stamped.

This command enables time stamping of *** CONNECTED status
messages. The date and time information is then available
for use by Bulletin Board programs or other computer appli-
cations. The date and time must be set initially by the
DAYTIME command before time stamping will occur. The date
format is determined by the DAYUSA command.

For example, if CONSTAMP is ON, DAYUSA is ON, and the date
and time have been set, a connect message might appear as
follows.

    *** CONNECTED to N2WX [05/28/85 16:28:31]

CONVERS   Mode: All

CONVERS is an immediate command, and will cause the MFJ-1278
to exit from Command Mode into Converse Mode. Any link
connections are not affected. Once in Converse Mode,
everything you type is packetized and transmitted over the
radio. Typing the Command Mode entry character returns the
MFJ-1278 to Command Mode. See the discussions of Converse
Mode in Chapter 4 and Chapter 5.

CONVERSE   Mode: AMTOR   Default: (command)

Switches from AMTOR command mode ("a_cmd:" prompt) to the
text transmission mode. Use CONVERSE after a connection or
FEC/SELCALL broadcast is begun to start exchanging data.

CPACTIME ON|OFF   Mode: Packet   Default: OFF

Parameters:

        ON   Packet timeout is used in Converse Mode.

        OFF   Packet timeout is not used in Converse Mode.

This command enables the periodic automatic sending of pack-
ets in Converse Mode. This feature may be used for computer
communications, such as Bulletin Board operation, when the
full Transparent Mode features are not desired.

If **CPACTIME** is **ON**, characters are packetized and transmitted
periodically as they are in Transparent Mode, but local
editing and display features of Converse Mode are enabled,
and software flow control may be used.   For a discussion of
how periodic packetizing works, see the command **PACTIME**,
which controls the rate and mode of packet assembly.

You   should   set **CR OFF** in this mode, since otherwise the
send-packet character will be inserted in the data being
packetized even though it was not typed.   In order to in-
clude <CR> characters in transmitted packets, set SENDPAC to
a normally unused character (e.g., <CTRL-P>), at which point
the TNC will treat <CR> as an ordinary character.

You   can set **CPACTIME ON** for a mode of operation similar to
full   break-in CW,   in which your text is transmitted   soon
after you type it,   but in short bursts of a few characters,
and the other station may break in at will.   Some operators
find it   easier   to carry on a conversation in   this   mode,
since it eliminates the delays while long packets are   being
typed.

CR ON|OFF   Mode: Packet   Default: ON

Parameters:

    ON   The send-packet character, normally <CR>, is
                        appended to all packets sent in Converse
                        Mode.

    OFF   The send-packet character is not appended to
                        packets.

When CR is ON, all packets sent in Converse Mode will in-
clude, as the last character of the packet, the send-packet
character which forces the packet to be sent. If CR is OFF,
the send-packet character is interpreted solely as a command
to the MFJ-1278, not as data to be included in the packet,
and furthermore, it will not be echoed to the terminal.

Setting CR ON and SENDPAC $0D results in a natural   conver-
sation mode. Each line is sent when a <CR> is entered, and
arrives at its destination with a <CR> at the end of the
line.   If the station at the other end reports overprinting
of lines on his display, you can set LFADD ON, or the other
station can set AUTOLF ON.

CTEXT text   Mode: Packet   Default: ""
Parameters:

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

CTEXT specifies the text of the packet to be sent after a
connection is made, if CMSG is **ON**.   The default **text** is an
empty string, i.e., no message.

You can send multiple-line messages by including carriage
return (<CR>) characters in the text.   The <CR> character
can be included by using the pass character immediately
preceding it (see the **PASS** command).   If you enter a **text**
string longer than 120 characters, an error message will
appear and the command will be ignored.

For example, you might set your **CTEXT** message to

    I'm not here right now, but you may leave a message.

To clear the **CTEXT text** without issuing a **RESET** command, use
a % or & as the first character in the message.

You cannot connect to yourself and see your CTEXT.   CMSG
only takes effect if you are connected to by another TNC.
CSTATUS   Mode: Packet

CSTATUS   Mode: Packet

CSTATUS is an immediate command which shows the stream
identifier and link state of all ten streams (links), the
current input and output streams, and whether or not each
stream is "permanent" (see CONPERM).

An example of a display resulting from issuing a CSTATUS
command is:

```
cmd:CS
A stream - IO Link state is: CONNECTED to 305MLB
B stream -    Link state is: CONNECTED to AD7I P
C stream -    Link state is: DISCONNECTED
D stream -    Link state is: CONNECTED to NOADI
              via K9NG-2


...


I stream -    Link state is: CONNECT in progress
J stream -    Link state is: CONNECTED to KV7B
              via NK6K-1
```

The example above shows the A stream is assigned both the
input and output streams. The B stream is connected to AD7I
"permanently." All other streams' states are shown as they
might normally appear with multiple connections.

CWCALL   "ssss"   Mode: AMTOR   Default: blank

Where "ssss" are 15 characters sent as CW when you issue the
ID character. The "ssss" text is sent following the QRA
("The name of my station is _____") signal.

CWSENDCH nnn   Mode: CW   Default:000

This controls when the MFJ-1278 transmits the pending text
in the CW buffer.   It is only effective for CW and MCW
modes.

If this is left at the default of 000, the characters to be
transmitted are left buffered and unsent until such time as
either a SPACE, CARRIAGE-RETURN, or other control character
is sent.

To have more control over when pending transmit characters
are sent, enter it as the new **CWSEndch** value. For example,
setting **CWSEndch** to $02 will cause the MFJ-1278 to buffer CW
characters for transmission until a CTRL-B (or CTRL-R which
always transmits the buffer) character is typed.

To enable immediate transmission, enter **CWSEndch** 255. This
tells the MFJ-1278 to send everything right away, without
delaying for a space or CARRIAGE-RETURN like **CWSEndch** 000
would.

CWSPEEDM ON¦OFF   Mode: CW   Default: OFF

When the **CWSPEEDM** command is ON, the MFJ-1278 will adopt
the CW speed that was last locked in through the CW "Lock"
command as its transmit speed.

When CWSPEEDM is OFF, the MFJ-1278 transmit speed will be
the speed set by the user with the MSPEED command.

The default value of CWSPEEDM is OFF.

DAYTIME date&time   Mode: Packet   No default

Parameters:

     date&time Current date and time to set.

This command allows you to set the current date and time for
the MFJ-1278. The format for entering the **date&time** is

     yymmddhhmm

where **yy** is the last two digits of the year, **mm** is the two-
digit month code (01-12), **dd** is date (01-31), **hh** is the hour
(00-23), and **mm** is the minutes after the hour (00-59). All
these codes must be exactly two digits, so that numbers from
0 to 9 must be entered with leading zeros.   The MFJ-1278
does not check thoroughly for the correct number of days in
a month, so you should use some judgment when you set the
date.

The **date&time** parameter is used by the commands **CONSTAMP** and
MSTAMP to "time stamp" received and monitored messages.
Entries in the "heard" (displayed by MHEARD) are also time
stamped if **date&time** has been set. The MFJ-1278's time is
updated continuously as long as it is powered up.   You must
reset the date and time each time you turn on the MFJ-1278.
If you don't do this, the commands CONSTAMP and MSTAMP will
not enable time stamping.

If you type DAYTIME without a parameter, the MFJ-1278 will
display the current date and time.   The format of the
display is **dd-mm-yy hh:mm** if DAYUSA is OFF, and **mm/dd/yy
hh:mm** if DAYUSA is ON. The format for _entering_ date&time is
not affected. For example,

     cmd:DAYTIME 8402291530

sets the date and time to February 29, 1984 at 3:30 PM. The
display of the date and time, with DAYUSA ON would be:

     cmd:DAYTIME
     02/29/84 15:30:26

DAYUSA ON|OFF   Mode: Packet   Default: ON

Parameters:

    ON   Date is displayed in the format **mm/dd/yy**.

    OFF   Date is displayed in the format **dd-mm-yy**.

This command determines the format for the MFJ-1278's display of the date. If DAYUSA is ON, the standard U.S. format is used; if DAYUSA is OFF, the standard European format is used. This command affects the format of the date display used in "time stamps" as well as the display when DAYTIME is entered without parameters. The format for entering the time using DAYTIME is not affected.

For example, if DAYUSA is **ON**, then July 2, 1984 at 9:28:44 AM would be displayed as

    cmd:DAYTIME
    07/02/84 9:28:44

If **DAYUSA** is **OFF** the same date and time would appear as

    cmd:DAYTIME
    02-07-84 9:28:44

DEADTIME nnn   Mode: Packet   Default: 33 (330 ms)

Parameter:

    nnn   0 thru 250 in 10ms

The DEADTIME parameter selects the basic time interval used
by the slotting procedures.   A delay of length = (random
multiple of DEADTIME) will be applied to the all outgoing
packets that are not acknowledgmented.

DEADTIME must be set to a value that accounts for the
slowest acceptable station on the channel.   It includes the
time required for the remote station's radio to come on the
air properly after assertion of PTT (TXDelay) and the time
required for the local station's squelch (if used) and TNC
DCD circuits to allow generation of a "DCD true" signal in
the local TNC. Ideally, once the proper value for this
timer is ascertained, all stations on the channel will use
the same value.

The current default for this parameter is a short 30
milliseconds. This represents only the worst case delay for
the TNC's DCD circuit and completely ignores the radio
delays.

Most HF linear mode radios are MUCH faster than VHF FM
radio. A reasonable setting for HF work is 120 milliseconds
(DEAdtime set to 12). This should work fine with virtually
any HF radio stable enough to consider using on HF packet.

DELAY "nn"   Mode: AMTOR   Default: 20 (msec)

The **DELAY** command establishes the interval that the MFJ-1278 delays between keying the transmitter and transmitting AMTOR.

AMTOR mode A ARQ demands a transceiver that switches from receive to transmit, and back to receive, quickly. Some rigs are faster than others. When you install the MFJ-1278 for the first time on a particular radio, it's a good idea to experiment with various DELAY times, working towards the minimum delay.

Note that if you're completely unable to work anyone in MODE A, but you can work people in modes B and S, it is possible that you are not using enough DELAY. Try increasing it until MODE A works reliably.

DELCHR n   Mode: CW/RTTY/ASCII   Default: Ctrl-X

The **DELCHR** command is effective for erasing the contents of the CW/RTTY/ASCII buffers during transmission. The DELCHR default is a "Control-X".

DELETE ON¦OFF   Mode: Packet   Default: OFF

Parameters:

    ON   The delete character input editing character
                is <DELETE> ($7F).

    OFF   The delete character input editing character
                is <BACKSPACE> ($08).

This command is used to change the input editing command for
character deletion.   When this character is typed, the last
character from the input line is deleted.   How the TNC
indicates the deletion is controlled by the BKONDEL command.

You can not use this character to delete past the beginning
of a line, although you can delete <CR> characters that have
been entered in the text with the pass character.

To see a corrected display of the current line after you
have deleted characters, type the redisplay-line character,
which is set by the **REDISPLA** command.

DIDDLE ON¦OFF   Mode: ASCII/RTTY   Default: ON

During   ASCII/RTTY transmit,   the MFJ-1278 sends a   non-
printing synchronization character, DIDDLE, whenever the
transmitter is keyed but not sending anything else.

The DIDDLE characters for ASCII and RTTY are NUL and LTRS,
respectively.

Diddling while the transmitter is keyed makes it much easier
for persons receiving to tune and remain tuned to your
transmitted signal.

Some stations running mechanical teletype equipment may ask
you not to "Diddle" while you are talking to them since it
may cause their older equipment to make a lot of noise (but
do nothing).   It should be noted that NO damage can   occur
should mechanical teletypes receive "Diddles", and it is not
considered   bad practice to leave it ON unless asked
otherwise by the other station in the QSO.

DIGIPEAT ON|OFF   Mode: Packet   Default: ON

Parameters:

    ON   The MFJ-1278 will digipeat packets if re-
                quested.

    OFF   The MFJ-1278 will not digipeat packets.

When this parameter is ON, any packet received that has your
TNC's callsign (including SSID) in the digipeat list of its
address field will be retransmitted.   Each station included
in the digipeat list relays the packet in its turn, marking
the packet so that it will not accidentally relay it twice
(unless so requested), and so that the stations will relay
the packet in the correct order.   Digipeating takes place
concurrently with other 'IFJ-1278 operations and does not
interfere with normal operation of a packet station.

In the spirit of cooperation typical of Amateur operation,
you will probably want to set DIGIPEAT ON most of the time.
However, you might want to disable digipeating if you're not
home, or if your transmit relay makes enough noise to wake
you up at night.

The command HID enables automatic transmission of identifi-
cation packets if your station is acting as a digipeater.

DISCONNE   Mode: Packet

DISCONNE is an immediate command.   It will initiate a dis-
connect request with the currently connected station.   A
successful disconnect results in the display of:

    *** DISCONNECTED

Other commands may be entered while the disconnect is taking
place, although connects are disallowed until the disconnect
is completed.   If the retry count is exceeded while waiting
for the other side to acknowledge, the MFJ-1278 moves to the
disconnected state.   If a disconnect command is entered
while the MFJ-1278 is disconnecting, the retry count is
immediately set to the maximum number.   In either case, the
disconnect message is

    *** retry count exceeded
    *** DISCONNECTED

Disconnect messages are not displayed when the MFJ-1278 is
in Transparent Mode.

DISPLAY [class]   Mode: All

Parameters:

    class   Optional parameter-class identifier, one of
                the following:

        ASYNC   display asynchronous port parameters
        CHARACTE   display special characters
        ID   display ID parameters
        LINK   display link parameters
        MONITOR   display monitor parameters
        TIMING   display timing parameters
        S   display a group of parameters such
                    as memory buffer contents, CW
                    parameters and parameters which
                    affect the printing of graphics to
                    the printer and to the computer
                    screen.
        HEALTH   display 25 counters*

*The twenty five counters in the MFJ-1278 are 16 bits wide,
and are ALWAYS initialized to 0000 on power up or "RESTART".

    o- ASYFRERR: This is a health counter reflecting the
                    number of hardware-detected asynchronous
                    framing errors. Framing errors are not
                    fatal. They merely indicate that the
                    terminal attached to your MFJ-1278 is
                    not configured correctly with regard to
                    AWLEN/PARITY.

    o- ASYQOVER: Records the number of times received-
                    connected packets have been rejected due
                    to insufficient space in the buffer
                    holding the data going to the terminal.
                    No actual data loss occurs, provided the
                    connection remains intact. ASYQOVER
                    counts can be avoided by increasing the
                    speed of the attached RS-232 terminal
                    and/or printer. (SEE also SENTRNR)

    o- ASYRXOVR: Increases when the software does not
                    service the asynchronous receiver in
                    time. Indicates data from the user to
                    the MFJ-1278 is being dropped. This
                    error counter should never become non-
                    zero under supported data rates.

    o- BBFAILED: Counts number of times bbRAM checksum
                    was in error.

o- DIGISEN1:   Each frame digipeated by the MFJ-1278 causes the counter to increase.

o- HOVRERR: Increases when HDLC receiver is not serviced rapidly enough and data is lost. This counter should never increment at any supported data rate.

o- HUNDRERR: Increases when the HDLC transmitter is not serviced rapidly enough and frames are aborted. This counter should never be non-zero at any supported data rate.

o- RCVDFRMR: Increases when Frame reject frames are received from a connected station.

o- RCVDIFRA: Increases for each reception of an I frame from a connectee.

o- RCVDREJ: Increases for each reception of an REJect frame from a connectee.

o- RCVDRNR: Counts the number of AX.25 L2 receiver-not-ready frames received since power-up and during connections. The count may be useful in gauging system throughput.

o- RCVDSABM: Each received SABM frame addressed to the MFJ-1278 causes this counter to be increased by one.

o- RXABORT: RXABORT is a count of the number of hardware-detected HDLC abort events. A large number of counts is perfectly normal and should not cause concern.

o- RXCOUNT: Increases when any frame is received with good CRC (or any CRC if HGARBAGE is turned on).

o- RXERRORS: Increments each time a received frame is thrown out due to it being too short, suffering overrun(s), or it having a bad CRC. Latter occurs only when CRC checking is enabled (i.e. HGARBAGE is OFF). This counter will often increment in the presence of noise.

o- RXLENERR: RXLENERR counts the number of too-short frames received. The counts are of diagnostic use only and here again, non-zero counts are not a matter of concern.

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o- RXRESYNC: RXRESYNC is a diagnostic health counter recording the number of receiver resynchronizations handled internally to the MFJ-1278. Non-zero counts indicate the attached radio may be either turned off or squelched. Note that in almost every situation your radio must to have its squelch fully opened!

o- SENTFRMR: Increments each time a Frame reject frame is transmitted.

o- SENTIFRA: Increases by one each time an I frame is sent.

o- SENTREJ: Whenever a REJect frame is transmitted, this counter is incremented.

O- SENTRNR: This health counter tracks the number of times your MFJ-1278 has had to send Receiver-Not-Ready (RNR) frames. Non-zero counts may be an indication that the RS-232 terminal or baud rate is too slow.

o- TXCOUNT: Incremented whenever a frame is correctly transmitted.

o- TXQOVFLW: Counts how many times frames were disconnected because the outgoing frame queue was too small.

o- TXTMO: This register may accumulate counts as the MFJ-1278 successfully recovers from HDLC transmitter timeouts. This is not a useful command for the majority of the users. Default is 0.

The counters just described, and the setting of HEALLED are displayed in response to the health inquiry.

DISPLAY is an immediate command, and with no **class** parameter will cause all control parameters and their current values to be displayed. Sub-groups of related parameters can be displayed by specifying the optional parameter-class. Individual parameters can be displayed by entering the parameter name with no options.

DISPLAY   Mode: AMTOR   Default: (command)

To display all of the current AMTOR parameters, type DISPLAY
at the "a_cmd:" prompt.

DWAIT n   Mode: Packet   Default: 33

Parameters:

        n   0 - 250, specifying default wait time in 10
                     ms intervals.

This value is used to avoid collisions with digipeated
packets. The MFJ-1278 will wait the default wait time after
last hearing data on the channel before it begins its own
keyup sequence, unless the MFJ-1278 is waiting to transmit
digipeated packets.   This value should be agreed on by all
members of a local area when digipeaters are used in the
area.   The best value will be determined by experimentation,
but will be a function of the keyup time (TXDELAY) of the
digipeater stations.

This feature is intended to help alleviate the drastic
reduction of throughput that occurs on a channel when digi-
peated packets suffer collisions.   It is necessary because
digipeated packets are not retried by the digipeater, but
must be restarted by the originating station.   If all sta-
tions specify a default wait time, and the right value of n
is chosen, the digipeater will capture the frequency every
time it has data to send, since digipeated packets are sent
without this delay.

The DWAIT timer is defeated (superseded) when the command
ACKPRIORITY is ON.

EASIN   **ON|OFF**   Mode: AMTOR   Default: OFF

EASIN controls whether the MFJ-1278 echos text that you have
sent it for transmission at the instant it is sent.
Normally the MFJ-1278 is configured to echo as you type,
this is the default (OFF) state of this parameter.

Setting **EASIN** ON is useful for monitoring channel quality.
If you type a few characters and they quickly echo, it
usually means the link is quite good. On the other hand if
it is taking a long time before the characters echo then the
link is not that good.

ECHO   **ON|OFF**   Mode: AMTOR   Default: ON

In the "a_cmd:" amtor command, **ECHO** sets whether the MFJ-
1278 transmits back to you everything that you type. **ECHO**
works independently of EASIN.

ECHO ON|OFF   Mode: All   Default: ON

Parameters:

    ON   Characters received from the computer or
            terminal are echoed by the MFJ-1278.

    OFF   Characters are not echoed.

This command controls local echoing by the MFJ-1278 when it
is in Command or Converse Mode.   Local echoing is disabled
in Transparent Mode.

If you don't see your input on the display, you should set
ECHO ON. If you see two copies of every character you type,
you should set **ECHO OFF**. If you see the characters you type
displayed correctly, you have **ECHO** set correctly.

EPSON   ON|OFF   Mode: All   Default: ON

This parameter specifies whether there is an EPSON (tm)
compatible or C. Itoh 8510-P printer attached to the printer
port.   If the printer connected to the MFJ-1278 is not an
EPSON or C.IToh 8510-P you should set EPSON to OFF.

ERUS   ON¦OFF   Mode: AMTOR   Default: ON

AMTOR monitoring is protected to some extent from errors,
but not fully. If **ERUS** is ON, at times when the MFJ-1278 is
receiving and detects the reception of errors, the ASCII
underscore character (_) is output to the terminal.

Receive errors are likely in mode "L", which is the mode A
monitoring mode if you can't hear both sides of the contact
very well.   Less likely, reception errors can occur while
receiving mode B or S.   They are extremely unlikely
(although still possible) in mode A because this mode is
more protected from receive errors.

ESCAPE ON¦OFF   Mode: Packet   Default: OFF

Parameters:

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

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

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

This command is provided because some terminals, and compu-
ter programs that emulate such terminals, interpret the
<ESCAPE> character as a special command pre&ix.   Such term-
inals may alter their displays depending on the characters
following the <ESCAPE>.   If you have such a terminal, you
can protect yourself from unexpected text sequences and from
other packeteers by setting **ESCAPE ON.**

See also the **MFILTER** command, which allows general character
stripping (rather than character translation) in monitored
packets.

FARNSWOR   **ON|OFF**   Mode: CW   Default: ON

Many find training for CW tests with a FARNSWORTH method of
code generation more valuable because it teaches letter
recognition at a speed fast enough to avoid the common
learning "plateau".   Some people have trouble passing this
plateau as they increase their code speed.

When   **FARNSWOR** is ON the MFJ-1278 transmits CW   characters
from keyboard or the Memory Keyer using 15 WPM equivalent
letters and elements.

Setting FARNSWOR to OFF causes CW text to be sent at normal
timing at the selected speed.

FAXEOP ON|OFF   Mode: FAX   Default: ON

When FAXEOP is ON, the MFJ-1278 detects the end-of-picture
for received FAX by looking for a long period of idle tone.
Setting it OFF disables all FAX end-of-picture detect, and
the user must manually terminate reception by returning to
command mode.

FAXMODE n   n= 1 thru 7   Mode: FAX   Default: 3

The FAXMODE command of the MFJ-1278 specifies the FAX
format, in terms of speed.   FAXMODE (n) and speed are
shown in the Table below.

FAXMODE(n)	Speed	Horizontal DENSITY (Dots)
1	60 lines/min. or 1 line/sec.	600
2	90 " or 1.5 "	600
3	120 " or 2 "	900/600
4	240 " or 4 "	480
5	360 " or 6 "	720
6	480 " or 8 "	480
7	180 " or 3 "	400

FAXMODE is effective only when operating 2 levels FAX
format, i.e. when MULTIFAX command is OFF. When MULTIFAX is
ON FAXMODE is irrelevant.

FAXNEG ON¦OFF   Mode: FAX   Default: OFF

Setting FAXNEG ON causes the MFJ-1278 to print the white
areas of FAX pictures black, and black areas, white.

FAXREV ON¦OFF   Mode: FAX   Default: OFF

When FAXREV is turned ON. The MFJ-1278 will invert all
received FAX data including synchronization bars. It is
analogous to RXINVERT as used by RTTY/ASCII modes.

FEC   Mode: AMTOR   Default: (command)

FEC immediately causes the MFJ-1278 to start broadcasting
with the AMTOR mode B forward error correcting (FEC)
protocol.

When FEC is issued the MFJ-1278 keys the transmitter and is
immediately ready to accept text to transmit.   Type K or
CONV to enter the text transmit mode.   When you're done
transmitting,   enter CTL-C and type R to release the
transmitter and return the MFJ-1278 to standby/receive.

FIRMRNR   ON¦OFF   Mode: Packet   Default: OFF

FIRMRNR controls the handling of busy states by the MFJ-
1278.   Setting FIRMRNR ON improves channel efficiency, but
is incompatible with earlier TNC-2 releases.   The
incompatibility   is   a   result   of   vague   protocol
specifications.

FIRMRNR should be always be set ON when conversing with
network nodes, for example, NET/ROM. In other cases, it is
recommended that FIRMRNR be left OFF unless you can be
assured the other TNC you are connected to supports FIRMRNR.

FLOW ON|OFF   Mode: Packet   Default: ON

Parameters:

    ON   Type-in flow control is active.

    OFF   Type-in flow control is disabled.

When type-in flow control is enabled, any character entered
from the terminal will halt output to the terminal until:
(1) a packet is forced (in Converse Mode); (2) a line is
completed (in Command Mode); (3) the packet length is ex-
ceeded; or (3) the terminal output buffer fills   up.
Canceling the current command or packet or typing the
redisplay-line character will also cause output to resume.
Type-in flow control is not used in Transparent Mode.

Setting FLOW ON will keep received data from interfering
with data entry. If you (and the person you are talking to)
wait for a packet from the other end before starting to
respond, you can set FLOW OFF.   Some Bulletin Board programs
may work best with FLOW OFF.   Some computers with "software
UARTs" may be unable to send and receive data at the same
time; users of such computers should set FLOW ON.

FRACK n   Mode: Packet   Default: 3

Parameters:

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

After transmitting a packet requiring acknowledgment, the
MFJ-1278 will wait for the frame acknowledgment timeout
before incrementing the retry counter and sending the frame
again.   If the packet address includes relay requests, the
time between retries will be adjusted to

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

where m is the number of intermediate relay stations.

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

FULLDUP ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   Full duplex mode is enabled.

    OFF   Full duplex mode is disabled.

When full duplex mode is disabled, the MFJ-1278 makes use of the Data Carrier Detect signal from the modem to avoid collisions, and acknowledges multiple packets in a single transmission with a single acknowledgment. When full duplex mode is enabled, the MFJ-1278 ignores the DCD signal and acknowledges packets individually. The latter mode is useful for full-duplex radio operation, such as through OSCAR 10. It should not be used unless both your station and the station you are communicating with are full-duplex stations.

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

FULLDUP should be ON during analog and digital loopback tests.

GRAPHLF   ON|OFF   Mode: FAX/SSTV   Default: OFF

For FAX and SSTV receive modes, the **GRAPHLF** setting determines whether the MFJ-1278 will issue a line feed (ASCII value 10 decimal) character before the carriage return on every line of graphics.

For most printers, GRAPHLF should be set to ON. Set GRAPHLF to OFF if you notice spaces in the printed pictures.

HEADERLN ON|OFF   Mode: Packet   Default: OFF

Parameters:

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

OFF   The header and packet text of monitored pack-
            ets are printed on the same line.

This command affects the display format for monitored pack-
ets.   If HEADERLN is OFF, the address information is dis-
played with the packet:

    KV7D>N2WX: Go ahead and transfer the file.

If HEADERLN is ON, the address information is displayed,
followed by the packet text on a separate line:

    N2WX>KV7D:
    Sorry, I'm not quite ready yet.

If you have set MRPT ON or enabled MSTAMP, you may wish to
set HEADERLN ON, as the packet header quickly becomes long
enough to fill a screen when these functions are active.

HEALLED ON|OFF   Mode: Packet   Default: OFF

Parameters:

ON   The MFJ-1278 will "dither" the CON and STA
            LEDs.

OFF   The MFJ-1278 will control the CON and STA
            LEDs in normal fashion.

This command allows the user to redefine the functions of
the two CPU controllable LEDs (i.e. the STAtus and CONnect
LEDs).

When HEALLED is set ON, the two LEDs flash in a seeming
random fashion. At a glance, the user may make a judgment
on whether the software has crashed, since the LEDs will
probably not flash if the software fails catastrophically.

With HEALLED set OFF, the LEDs function as before.

HID ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   Enables HDLC identification by a digipeater.

    OFF   Disables HDLC identification.

This command is used to enable or disable the sending of
identification packets by the MFJ-1278. If HID is OFF, the
MFJ-1278 will never send an identification packet. If HID
is ON, the MFJ-1278 will send an identification packet every
9.5 minutes if the station is digipeating packets. The ID
command allows the operator to send a final identification
packet if the station is being taken off the air.

An identification consists of an unsequenced I frame whose
data field is your station identification. The identifica-
tion packet is addressed to the "CQ" address set by the
UNPROTO command. Your station identification is your call-
sign as set by **MYCALL**, with "/R" appended.

ID   Mode: AMTOR   Default: (command)

When issued under the "a_cmd:" amtor command, the ID command
causes a keyed modulated CW identification of your station
to be sent immediately. The identification sent consists of
the letters QRA followed by the callsign entered in CWCALL
(see CWCALL)

ID   Mode: Packet

ID is an immediate command.   It will send a special identi-
fication packet.   ID can be used to force a final identifi-
cation packet to be sent as a digipeater station is being
taken off the air.   The identification packet will be sent
only if the digipeater has transmitted since the last auto-
matic identification.

An identification consists of an unsequenced I frame whose
data field is your station identification.   The identifica-
tion packet is addressed to the "CQ" address set by the
UNPROTO command.   Your station identification is your call-
sign as set by MYCALL, with "/R" appended.

KISS   ON|OFF   Mode: Packet   Default: OFF

The KISS interface is installed in firmware of the MFJ-1278.
KISS enables the MFJ-1278 to act as a modem for a host
computer.   Turning KISS on allows the MFJ-1278 to   run
programs such as TCP/IP and other programs   which   use
the Serial Link Interface Protocol (SLIP).

Before enabling KISS, make sure radio baud rate and terminal
baud rate are set to the desired values.   The terminal's
baud rate that's determined at sign on is the same that will
be used for KISS.
 Once the operating parameters have been selected, set KISS
ON and then issue a RESTART command.   The CON and STA LEDs
will blink on and off three times to indicate that the MFJ-
1278 has entered the KISS mode.   Now you may call up a
TCP/IP, or another host program that can use KISS or "SLIP".

If you are using the TCP/IP program and wish to switch to
the AX.25 mode of operation, you can issue the command:
param ax0 255,   then press "RETURN".   This command must be
issued under TCP/IP "net>" prompt and in lower case letters.

Once the MFJ-1278 receives the "param ax0 255" command, it
turns KISS off and will revert back to ordinary AX.25 mode
of operation.   When the MFJ-1278 is powered on again, it
will sign on to the AX.25 operation mode.

LCALLS call1[,call2...,call8]   Mode: Packet   Default: ""

Parameters:

    call   Callsign list.   Up to 8 calls,   separated by
                commas.

Each callsign may include an optional sub-station ID speci-
fied as -n immediately following the call.   This command
works in conjunction with BUDLIST and allows selective moni-
toring of other packet stations. These two commands deter-
mine which packets will be displayed when you have set
MONITOR ON. BUDLIST specifies whether the callsigns in the
list are the ones you want to ignore or, alternatively, are
the only ones you want to listen to.

If you want to listen only for packets from a limited list,
you should enter your selected list with LCALLS and set
BUDLIST ON.

If you want to ignore packets from a limited list, you
should list the callsigns to ignore in LCALLS and set
BUDLIST OFF.

"%" and "&" may now be used to clear the LCALLS list.

LCSTREAM ON┊OFF   Mode: Packet   Default: ON

Parameters:

    ON   The MFJ-1278 will translate   the character
                immediately   following   the   STREAMSWITCH
                character to upper case before processing it.

    OFF   The MFJ-1278 will process the character imme-
                diately following the STREAMSWITCH character
                as it is entered.

When operating multi-connect, the user must enter a stream
identifier (default A through J) after the STREAMSWITCH
character (default ┊) to select a new logical stream to send
data.   Normally, the stream identifier must be in upper
case, or an error message will result.

When LCSTREAM is ON, the character immediately following the
streamswitch character is converted to upper case before
being acted upon.   Thus, the case (upper or lower) becomes
insignificant.   Use of LCSTREAM is useful if you are typing
in lower case and don't want to be bothered with remembering
to switch to upper case when changing streams.

LCOK ON|OFF   Mode: Packet   Default: ON

Parameters:

    ON   The MFJ-1278 will send lower case characters
                to the computer or terminal.

    OFF   The MFJ-1278 will translate lower case
                characters to upper case.

If LCOK is OFF, lower case characters will be translated to
upper case before being output to the terminal. This case
translation is disabled in Transparent Mode. Input charac-
ters and echoes are not case translated.

If your computer or terminal does not accept lower case
characters it may react badly if the MFJ-1278 sends such
characters to it. This command allows you to translate all
lower case characters received in packets, as well as
messages from the MFJ-1278, to upper case.

Since echoes of the characters you type are not translated
to upper case, you can use this command to make your display
easier to read when you are conversing in connected mode.
If you and the other station's operator set LCOK OFF, you
can each type your own messages in lower case and see incom-
ing packets displayed in upper case. It will then be easy
to distinguish incoming and outgoing lines.

LFADD ON|OFF   Mode: ASCII/Packet   Default: OFF

When **LFADD** is ON and the ASCII or Packet mode is selected,
1278 will append an ASCII line feed character, $0A, to the
transmission immediately after a carriage return is sent.

LFADD should usually be switched OFF as the vast majority of
TNCs   (including   the   MFJ-1278)   are   configured   to
automatically go to a new line whenever a carriage return is
printed.

Also see: AUTOLF parameter

LFADDALT   ON|OFF   Mode: RTTY   Default: ON

LFADDALT is very similar to the LFADD command above.
However this command applies ONLY to Baudot RTTY mode.

Baudot RTTY operation almost always requires that a line
feed be sent along with a carriage return.   When   LFADDALT
is   ON the MFJ-1278 will automatically insert the   Baudot
line feed whenever the user sends a carriage return.

There   is   one   case   where   line   feeds   should   not   be
automatically transmitted, that is when sending complex
radio teletype pictures.

Also see: AUTOLF parameter

LFIGNORE ON│OFF   Mode: Packet   Default: OFF

Parameters:

    ON   MFJ-1278 will ignore <LF> characters.

    OFF   MFJ-1278 will respond to <LF> characters.

This command controls whether MFJ-1278 responds to ASCII Lind Feed (<LF> $0A) characters or ignores them in command and converse modes.

When turned on, line feeds are totally ignored except in transparent mode.

LISTEN   Mode: AMTOR   Default: (command)

LISTEN is used to begin monitoring someone else's mode A connection. You'll need to enter LISTEN to tell the MFJ-1278 to start synchronizing to the desired signal.

LISTENing to mode A connections can be irritating if conditions are poor because there is no error correction afforded to stations which are not active participants in the QSO. (also see ERUS)

MAILBOX   ON|OFF   Mode: Packet   Default: OFF

When **MAILBOX** command is set to ON the mailbox functions are
active.   Note that the **MAILBOX** is a single-user device;
therefore, if you wish to use the **MAILBOX** it is necessary
for you to set USER 1 and select stream A.   Note that these
are the default settings and selections, respectively.

If you wish to have messages time and date stamped, make
sure that DAYTIME is set with the correct time or else each
message entered without DAYTIME will not be shown.

The mailbox has the following basic commands:

o K   -- Kill all messages addressed to you.

o K ##   -- Kill the message in slot nn. Remote users may
               only   kill message addressed to them   or
               originated   by   them.   the   local   SYSOP,
               however, can kill all messages.

o L   -- List the slot number, originator, destination,
               and subject field of currently used slots.

o R   -- Read all of the messages addressed to you.

o R ##   -- Read the message in slot nn.

o S call -- Send a message to the callsign. "Call" must
               be a callsign valid under the same format as
               the MYCALL, CONNECT and other callsign
               commands.

o SP call -- Send a personal message to the callsign. This
               is a private message which can only be read by
               the originating station, the station addressed
               and the mailbox SYSOP.

o B   -- Logout: Initiates a disconnect sequence from
               the mailbox.

o H(elp) -- Displays the mailbox command list, with a
               brief description of commands, available to
               the user.

MAILLED ON¦OFF   Mode: Packet   Default: ON

When MAILLED is ON, the MFJ-1278's STA LED will flash on and
off while not connected to indicate the presence of mail in
the MFJ-1278's mailbox. The STA LED reverts to its normal
function, lit when unacknowledged packets are pending, if
the MFJ-1278 is in a CONNECTED state, or if MAILLED is OFF.

MALL ON¦OFF   Mode: Packet   Default: ON

Parameters:

     ON   Monitored packets include both "connected"
                packets and "unconnected" packets.

     OFF   Monitored packets include only "unconnected"
                packets.

This command determines the class of packets which are
monitored.   If MALL is OFF, only otherwise eligible packets
(as determined by the BUDLIST and LCALLS commands) sent by
other TNCs in the unconnected mode are displayed.   This is
the normal manner of operation when this MFJ-1278 is being
used   to   talk to a group of TNCs all of which are
unconnected.

If MALL is ON, all otherwise eligible frames are displayed,
including those sent between two other connected TNCs. This
mode may be enabled for diagnostic purposes or for "reading
the mail."

MATCH   ON|OFF   Mode: AMTOR   Default: ON

MATCH is used for selectively monitoring portions of mode B
FEC transmissions.   If MATCH is ON, the MFJ-1278 will   not
start printing a mode B signal until the string set in
MBEGIN   is matched.   Likewise,   the search for   the
terminating string in the MEND parameter begins when the
MFJ-1278 starts printing.   When this ending string is
matched the TNC stops printing and goes back to waiting
until the next MBEGIN sequence is received.

MAXFRAME n   Mode: Packet   Default: 4

Parameters:

    n   1 - 7, signifying a number of packets.

MAXFRAME sets an upper limit on the number of unacknowledged
packets which the MFJ-1278 can have outstanding at any one
time.   This is also the maximum number of contiguous packets
which can be sent during any given transmission.   If some
but not all of the outstanding packets are acknowledged, a
smaller number may be transmitted the next time, or new
frames may be included in the retransmission, so that the
total unacknowledged does not exceed n.

If you perform file transfers, you should experiment with
MAXFRAME and PACLEN.   If the link is good, there is an
optimum relationship between the parameters set by these
commands so that the maximum number of characters outstand-
ing does not exceed the packet receive buffer space of the
MFJ-1278 receiving the data.

MBEGIN cccc   Mode: AMTOR   Default: <<>>

The **MBEGIN** parameter, which can be up to 15 characters long,
is effective when MATCH is ON and a mode B signal is being
received. When MATCH is ON, the MFJ-1278 will not print a
mode B transmission until the string in MBEGIN is matched.

MEND cccc   Mode: AMTOR   Default: nnnn

The **MEND** parameter, which may also be up to 15 characters
long, is effective when MATCH is ON and a mode B signal has
set off the matching function. The MFJ-1278 will print all
of a mode B transmission received after text matching
MBegin is received until text matching the **MEND** string is
received, or the transmission physically ends.

MCOM ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   Connect, disconnect, UA, and DM frames are
                monitored.

    OFF   Only information frames are monitored.

This command enables monitoring of connect and disconnect
frames when MONITOR is ON.

When MCOM is OFF, only I frames (packets containing user
information) will be displayed. When MCOM is ON four proto-
col packets will also be displayed.   Connect, disconnect,
UA, and DM packets that are monitored are indicated by <C>,
<D>, <UA>, and <DM>, respectively. As with other monitor
commands, the stations monitored are determined by BUDLIST
and LCALLS.

Path for SABM received while in link-setup state is not
checked.

MCON ON|OFF   Mode: Packet   Default: ON

Parameters:

    ON   Monitor mode remains active when MFJ-1278 is
                connected.

    OFF   Monitor mode is off while the MFJ-1278 is
                connected.

If MCON is ON, the MONITOR command will enable monitoring
while your MFJ-1278 is connected to another TNC. If MCON is
OFF, the display of monitored packets is suspended when a
connect occurs, and is resumed when the TNC is disconnected.

If you want to see all packets displayed when you are not
connected but have such display suppressed when you connect
to another station, you should set MCON OFF.

MFILTER n1,[n2],[n3],[n4]   Mode: Packet   Default: none

Parameters:

    n   0 - $7F, specifying an ASCII character code.
                    Up to 4 characters may be specified.

This command allows you to specify characters to be "filtered," or eliminated from monitored packets. The parameters n1, n2, etc., are the ASCII codes for the characters you want to filter. You can enter the code in either hex or decimal.

For example, if a <CTRL-L> character causes your screen to be cleared, and you don't want this to happen, you can set MFILTER 12. If you also want to eliminate <CTRL-Z> characters, which some computers interpret as end-of-file markers, you can set MFILTER 12,26.

MHCLEAR   Mode: Packet

MHCLEAR is an immediate command. It causes the list of stations heard to be cleared. You can use this command in conjunction with MHEARD to keep track of the stations on the air over a given period of time, such as an evening or a week. Clear the list of stations heard when you first begin to monitor the packet activity.

MHEARD   Mode: Packet

MHEARD is an immediate command.   It causes the MFJ-1278 to
display the list of stations that have been heard since the
last time the command **MHCLEAR** was given.   Stations that are
heard through digipeaters are marked with a * in the heard
log.   If you clear the list of stations heard at the begin-
ning of a session, you can use this command to easily keep
track of the stations that are active during that period.
The maximum number of heard stations that can be logged is
18.   If more stations are heard, earlier entries are discar-
ded.   Logging of stations heard is disabled when **PASSALL** is
ON.

If the **DAYTIME** command has been used to set the date and
time, entries in the heard log will be time   stamped.   For
example,

        cmd:MHEARD
        K4NTA*   06/09/85   21:08:19
        WA4ITD*   06/09/85   21:08:17
        W1BEL-2*   06/09/85   21:06:18
        K4NTA-2*   06/09/85   20:57:35
        N2WX
        cmd:

Note that no daytime string is displayed next to N2WX.   This
indicates that when N2WX was last heard the clock had not
been set.

MODE   Mode: All

MODE is a immediate command.   The **MODE** command select which
mode the MFJ-1278 will be operating.   **MODE** command is
followed by two characters which denote the mode selected.
See Chapter 4 for more detail discussion of **MODE** command.

MNONAX25   ON|OFF   Mode: Packet   Default: OFF

MNonax25 is defaulted to OFF. When **MNonax25** is OFF the
display of non-AX.25 packets is inhibited. MFJ-1278 will
display only AX.25 packets. Setting **MNonax25** ON will cause
MFJ-1278 to also monitor non-AX.25 packets, for example
those associated with TCP/IP and NET/ROM or THENET links.
Display of non-AX.25 packets may not be understandable to
the user.

MONITOR ON|OFF   Mode: Packet   Default: ON

Parameters:

    ON   Monitoring of packet activity is enabled.

    OFF   Monitoring of packet activity is disabled.

If MONITOR is ON and the MFJ-1278 is not in Transparent
Mode, packets not addressed to your MFJ-1278 may be
displayed. The addresses in the packet are displayed along
with the data portion of the packet, e.g.:

    N2WX>W5FD-3: I'm ready to transfer the file now.

The calls are separated by a ">" and the sub-station ID
field (SSID) is displayed if it is other than 0. The **MALL**,
BUDLIST, and **LCALLS** commands determine which packets are to
be monitored. The **MCON** command controls the action of
monitor mode when the MFJ-1278 is connected. All monitor
functions are disabled in Transparent Mode.

The format of the monitor display is controlled by **HEADERLN**.
If you want to see the station addresses on a separate line
from the text, you can set **HEADERLN ON**. **MRPT** enables moni-
toring of the digipeater route as well as source and desti-
nation addresses for each packet. **MSTAMP** includes a time
stamp with the addresses if **DAYTIME** has been set.

MRPT ON|OFF   Mode: Packet   Default: ON

Parameters:

    ON   Display the stations in the digipeat path for
                monitored packets.

    OFF   Display only the source and destination sta-
                tions for monitored packets.

This command affects the way monitored packets are dis-
played.   If MRPT is OFF, only the originating station and
the destination are displayed for monitored packets.   If
MRPT is ON, the entire digipeat list is displayed for moni-
tored packets, and stations that have already relayed the
packet are indicated with an asterisk.

For example,

    WB9FLW>AD7I,K9NG*,N2WX-7:Hi Paul.

This packet, sent from WB9FLW to AD7I, has been relayed by
K9NG but not by N2WX-7.   With MRPT OFF, the same packet
would be displayed as

    WB9FLW>AD7I:Hi Paul.

Setting MRPT ON increases the length of the address display,
and you may wish to set HEADERLN ON as well to display this
information on a separate line.

MSPEED n n=5 to 99   Mode: CW/MCW   Default: 20

The value of the **MSPEED** setting controls the speed of CW sent by the MFJ-1278. Values below 5 WPM automatically cause a 5 WPM speed to be selected.

When MSPEED is less than 15 WPM, and FARnswor is ON, the MFJ-1278 uses the "Farnsworth" method of transmission, where the element (dot and dash) times are equivalent to 15 WPM but the character spacing of the slower speed is used.

MSTAMP ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   Monitored frames are time stamped.

    OFF   Monitored frames are not time stamped.

This command enables time stamping of monitored packets. The date and time information is then available for use for automatic logging of packet activity or other computer applications. The date and time are set initially by the **DAYTIME** command, and the date format is determined by the **DAYUSA** command.

Setting MSTAMP ON increases the length of the address display, and you may wish to set HEADERLN ON as well to display this information on a separate line.

MULTIFAX ON|OFF   Mode: FAX   Default: OFF

Parameters:

    ON   MFJ-1278 is set to transmit and receive FAX
                picture in raw data format.

    OFF   MFJ-1278 is set to transmit and receive FAX
                picture in 2 levels format.

When **MULTIFAX** is turned ON, MFJ-1278 is set to transmit and
receive multi-level FAX pictures. FAX Raw data format is
sent to the RS-232 port during receiving and raw data is
also expected from the terminal program for MFJ-1278 to
transmit multi-level FAX picture. Also see **PIXTONES**.
Multi-level FAX printing to the MFJ-1278 printer port or
printing to the computer screen is not supported by the MFJ-
1278 firmware. Special terminal program must be used for
this operation. for those who wish to write terminal
program to support MULTIFAX, more information is provided in
the "FAX Operation" section of this manual.

When **MULTIFAX** is OFF, the default setting, MFJ-1278 will
operate in standard 2 levels FAX mode. FAX data format is
sent to the MFJ-1278 printer port when **PRINTGRA** is OFF. IF
PRINTGRA is ON MFJ-1278 will sent 2 levels data the the RS-
232 port.

Note that when **MULTIFAX** is turned ON, **PRINTGRA** command will
be ignored. This means that under FAX mode with MULTIFAX
turned ON, MFJ-1278 will start to send raw data to the
terminal regardless of the setting of PRINTGRA command.

MYCALL call[-n]   Mode: Packet   Default: NOCALL-0

Parameters:

    call   **Callsign** of your MFJ-1278.

    n   0 - 15, an optionally specified sub-station
            ID (SSID).

This command tells the MFJ-1278 what its **callsign** is.   This
callsign will be placed in the FROM address field for all
packets originated by your MFJ-1278. It will accept frames
with this **callsign** in the TO field and relay frames with
this **callsign** in the digipeat field.   MYCALL will also be
used for identification packets (see HID and ID).

The default **callsign** must be changed for proper operation of
the protocols.   There should never be more than one station
with the same **callsign** (including SSID) on the air at once.
The SSID can be used to distinguish two stations with the
same Amateur call. The SSID will be 0 unless explicitly set
to another value.

MYALIAS call[-n]   Mode: Packet   Default: <blank>

Parameters:

      call   Alternate identity of your MFJ-1278.

      n   0-15, an optionally specified sub-station ID
                  (SSID).

This command specifies an alternate callsign (in addition to
the callsign specified in **MYCALL**) for use as a digipeater
only.

In some areas, wide coverage digipeaters operators have
changed the callsign of their machine to a shorter and
(usually) easier to remember identifier. International
Civil Aviation Organization (ICAO) airport identifiers,
sometimes combined with telephone area codes, have been
used.

Use of this command permits **HID** to identify normally with
the **MYCALL**-specified callsign yet permit an alternate
(alias) repeat-only "callsign."

MYSELCAL "ssss"   Mode: AMTOR   Default: blank

MYSELCAL tells the MFJ-1278 what SELCAL you're station
should respond to. See section "Mode A: Setup" for
information on selecting a SELCAL for your station, based on
your amateur callsign.

Note that your MFJ-1278 will not respond to mode A "ARQ"
calls unless MYSELCAL is set up.

NAVTEX   Mode: Navtex   Default:OFF

NAVTEX is a immediate command.   NAVTEX must be issued under
the "a_cmd:" amtor command prompt.   Under the "a_cmd:"
command prompt, type NAVTEX to put your MFJ-1278 ready to
receive NAVTEX signals on 518 KHz.   Tune your radio to 518
KHz.

To receive NAVTEX, MFJ-1278 must first receive the ZCZC
start message, followed by the four character preamble
described above.   If this is not received intact, the
message will not be received.   At the end of the message,
NNNN will be received and the MFJ-1278 will stop receiving
the Navtex message.

MFJ-1278 will remember the last 200 four character preambles
received with less than 1/8 of its characters received in
error.   MFJ-1278 will not reprint any of these messages when
they are re-transmitted from that Navtex station.   If you
exit the "a-cmd:" command prompt, the preamble memory is
erased.

Emergency messages are numbered 00 and will always be
printed regardless of whether they have already been
received.

NAVSTN   Mode: Navtex   Default: ALL

To prevent your MFJ-1278 from receiving certain Navtex
stations,   just type "NAVSTN XXXXXXXXXXXXX" where each X is
the identifying letter of the station you want to receive.
Your list of stations to receive may contain up to 26
letters, each representing a station.

For example, if you want to receive only stations A,   C and
P, then you type "NAVSTN ACP".   Only signals from these
three stations will be received by your MFJ-1278.

If you want to prevent certain stations from being received,
leave then off the list.   Then,   those stations will not be
received while others within the receiving area will.

You may also type "NAVSTN ALL" (the Default value) to
receive all Navtex stations.

NAVMSG   Mode: Navtex   Default: ALL

NAVMSG works like the NAVSTN command with the ALL parameter used to exclude all, or to specify the type of messages to receive.

The types of Navtex messages currently are:

        A: Navigational warnings
        B: Storm Warnings
        C: Reports of Ice
        D: Search/Rescue Information
        E: Weather forecasts
        F: Pilot Service Messages
        G: DECCA System
        H: LORAN-C
        I: Omega Systems
        J: SATNAV Systems

K thru-Z are not in use at this time. They are reserved for future use.

NEWMODE ON|OFF   Mode: Packet   Default: OFF

Parameters:

ON   Switching to data transfer mode occurs at the
            time of the CONNECT command and return to
            command mode is automatic at the time of
            disconnection.

OFF   Switching to data transfer mode occurs at
            time of connection and no return to command
            mode occurs at disconnection.

The NEWMODE command may be used to select the way the MFJ-1278 behaves when connections are made and broken.

If NEWMODE is OFF, the MFJ-1278 will remain in Command Mode after you issue a CONNECT command until a connection is actually established. When the connection is established, the MFJ-1278 will enter Converse Mode or Transparent Mode, depending on the setting of CONMODE. When the connection is terminated, the MFJ-1278 remains in Converse or Transparent Mode unless you have forced it to return to Command Mode. This is the same as the behavior of TNC 1 (running version 3.x software) under these conditions.

If NEWMODE is ON, the MFJ-1278 will enter Converse Mode or Transparent Mode as soon as you issue a CONNECT command, without waiting for the connection to be established. Anything you type will be packetized to be transmitted once the connection is complete. When the connection is broken, or if the connect attempt fails, the MFJ-1278 will return to Command Mode.

If you have a Bulletin Board program designed to work with TNC 1 you should set NEWMODE OFF if the program relies on the sequence of actions used by TNC 1. Otherwise, you should choose the setting for NEWMODE that seems most convenient to you.

NOMODE ON¦OFF   Mode: Packet   Default: OFF

Parameters:

    ON   The MFJ-1278 will only switch modes (command,
                converse or transparent) upon explicit com-
                mand.

    OFF   The MFJ-1278 will switch modes in accordance
                with the setting of NEWMODE.

When NOMODE is ON, the MFJ-1278 will never change between
CONVERSE or TRANSPARENT mode to COMMAND mode (or vice-versa)
on its own.   Only user commands (CONV, TRANS, or ^C) may
change the type in mode.

If NOMODE is OFF, then automatic mode switching is handled
according to the setting of the NEWMODE command.

NUCR ON¦OFF   Mode: Packet   Default: OFF

Parameters:

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

    OFF   <NULL> characters are not sent to the termi-
                nal following <CR> characters.

This command causes transmission of <NULL> characters (ASCII
code $00), producing an effective delay following any <CR>
sent to the terminal.   The number of <NULL> characters is
determined by the command NULLS.   This delay is required by
some hardcopy terminals.   You need to set NUCR ON if your
terminal misses one or more characters after responding to a
<CR>.   If this is the case, you will sometimes see overtyped
lines.

NULF ON|OFF   Mode: Packet   Default: OFF

Parameters:

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

    OFF   <NULL> characters are not sent to the termi-
            nal following <LF> characters.

This command causes transmission of <NULL> characters (ASCII
code $00), producing an effective delay following any <LF>
sent to the terminal. The number of <NULL> characters is
determined by the command NULLS. This delay is required by
some display terminals. You need to set NULF ON if your
terminal sometimes misses characters at the beginning of the
line.

NULLS n   Mode: Packet   Default: 0

Parameters:

    n   0 - 30, specifying the number of <NULL> char-
            acters to send after <CR> or <LF>.

This command specifies the number of <NULL> characters
(ASCII code $00) to send to the terminal after a <CR> or
<LF> is sent. In addition to setting this parameter value,
NUCR and/or NULF must be set to indicate whether nulls are
to be sent after <CR>, <LF>, or both. Devices requiring
nulls after <CR> are typically hard-copy devices requiring
time for carriage movement. Devices requiring nulls after
<LF> are typically CRTs which scroll slowly. Extra null
characters are sent only in Converse and Command Modes.

OMLC   ON|OFF   Mode: AMTOR   Default: OFF

Output   map to lower case (OMLC) when ON instructs the MFJ-
1278 to convert all letter characters, except those echoed,
to their lower case equivalent.

PACLEN n   Mode: Packet   Default: 128

Parameters:

     n   0 - 255, specifying the maximum length of the
                  data portion of a packet. The value 0 is
                  equivalent to 256.

The MFJ-1278 will automatically transmit a packet when the
number of input bytes for a packet reaches n. This value is
used in both Converse and Transparent Modes.

If you perform file transfers, you should experiment with
both MAXFRAME and PACLEN.   If the link is good, there is an
optimum relationship between the parameters set by these
commands so that the maximum number of characters outstand-
ing does not exceed the packet receive buffer space of the
MFJ-1278 receiving the data.

     NOTE: Although there is no requirement for two
     TNCs exchanging data to have the same PACLEN
     value,   allowing more than 128 characters of data
     in a packet may be incompatible with some varie-
     ties of TNCs.

PACTIME EVERY¦AFTER n   Mode: Packet   Default: AFTER 10

Parameters:

    n   0 - 250, specifying 100 ms intervals.

    EVERY   Packet timeout occurs every n*100 milli-
                 seconds.

    AFTER   Packet timeout occurs when n*100 milliseconds
                 elapse with no input from the computer or
                 terminal.

This parameter is always used in Transparent Mode, and will
also be used in Converse Mode if CPACTIME is ON.   When EVERY
is specified, input bytes are packaged and queued for trans-
mission every n*100 ms.   When AFTER is specified, bytes are
packaged when input from the terminal stops for n*100 ms.
In no case will a zero length packet be produced, and the
timer is not started until the first byte is entered.   A
value of 0 for n is allowed, and causes packets to be gene-
rated with no wait time.

PARITY n   Mode: All   Default: 0 (none)

Parameters:

    n   0 - 3, selecting a parity option from the
               table below.

This command sets the parity mode for terminal or computer
data transfer according to the following table:

               n   Parity
               ----
               0   no parity
               1   odd parity
               2   no parity
               3   even parity

The parity bit, if present, is automatically stripped on
input and not checked in Command Mode and Converse Mode. In
Transparent Mode, all eight bits, including parity if any,
are transmitted in packets. If "no parity" is set and AWLEN
is 7, the eighth bit will be set to 0 in Transparent Mode.

PASS n   Mode: Packet   Default: $16 <CTRL-V>

Parameter:

        n   0 - $7F, specifying an ASCII character code.

This command selects the ASCII character used for the "pass"
input editing command.   The parameter n is the ASCII code
for the character you want to type in order to include the
following character in a packet or text string.   You can
enter the code in either hex or decimal.

You can use this character to send any character in packets,
even though that character may have some special function.
For example, suppose you have set COMMAND 3, specifying that
<CTRL-C> is your Command Mode entry character. If you use a
Bulletin Board program that requires a <CTRL-C> to escape
from some operation, you will type

        <CTRL-V> <CTRL-C>

to insert a <CTRL-C> character in your packet.   Of course,
if you do this frequently you would be better off to change
your Command Mode entry character.

A common use for the pass character is to allow <CR> to be
included in the BTEXT and CTEXT messages.   Similarly, you
can include <CR> in text when you are in Converse Mode, to
send multi-line packets. (The default send-packet character
is <CR>.)

PASSALL ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   MFJ-1278 will accept packets with invalid
                CRCs.

    OFF   MFJ-1278 will only accept packets with valid
                CRCs.

This command causes the MFJ-1278 to display packets received
with invalid CRC fields.   Packets are accepted for display
despite CRC errors if they consist of an even multiple of 8
bits and up to 339 bytes.   The MFJ-1278 will attempt to
decode the address field and display the callsign(s) in the
standard monitor format, followed by the text of the packet.

This mode is not normally enabled, since rejection of any
packet with an invalid CRC field is what insures that re-
ceived packet data is error-free.   This mode might be ena-
bled for testing a marginal RF link or during operation
under other unusual circumstances.

If you set PASSALL ON and monitor a moderately noisy channel
you will periodically see "packets" displayed in this mode,
since there is no basis for distinguishing actual packets
received with errors from random noise.

Logging of stations heard (for display by MHEARD) is disab-
led whenever PASSALL is ON, since the callsigns detected may
be incorrect.

PIXTONES n   Mode: FAX/SSTV   Default: (see below)

                n = aaa,bbb,ccc,ddd

PIXTONES is arranged in the following format:

PIXTONES aaa,bbb,ccc,ddd,eee,fff,ggg,hhh

    where,

    aaa is the value which determines the "white" area of
    the transmitted picture.

    hhh is the value which determines the "black" area of
    tne transmitted picture.

    The values between aaa and hhh define the gray areas
    of the transmitted pictures.

The default PIXTONES values are:

PIXTONES $B9,$BA,$B8,$98,$88,$B0,$90,$A0

Note that in 4 gray-levels of SSTV or FAX transmission
(command 8LEVELS is OFF), MFJ-1278 will automatically select
only four of the PIXTONES values you have chosen. PIXTONES
does not affect 2 levels FAX transmitting.

PIXTONES determine the number of gray levels on a picture
which the MFJ-1278 is capable of transmitting.   Current
PIXTONES command is set to 8 levels of gray. Each level of
gray is represented by a tone produced by the MFJ-1278
multi-gray level modem.

To use PIXTONES the terminal program which support your
computer must be able to support the raw data format
required by the MFJ-1278. See Chapter 4 in this manual under
"Multi-level FAX/SSTV Transmitting" for more detail about
the raw data format.

The 16 tones which can be produced by the MFJ-1278 FAX/SSTV
modem (in Hz) are:

1500, 1550, 1600, 1650, 1700, 1750, 1800, 1850, 1900, 1950,
2000, 2050, 2100, 2150, 2200, and 2250.

The tone being transmitted determines the shade of gray in
the picture. The higher the tone the lighter the gray.
1500 Hz is for the sync, 1550 Hz is black and 2250 Hz is
white.   The other tones determine the shades between the
black and the white areas.

PIXTONES values are in HEX. The higher the tone the lighter
shade of gray. If the picture transmitted does not seem to
have the right contrast, try and reset the PIXTONES values.

The HEX values which represent the PIXTONES for the pictures
to be transmitted are listed in Table below:

PIXTONES Values (HEX) | FAX/SSTV Transmit Tones (Hz)
───

sync (not selectable)	1500	
$00	1550	White
$A0	1600	^
$90	1650	^
$B0	1700	^
$88	1750	^
$A8	1800	Light Gray
$98	1850	^
$B8	1900	^
$8C	1950	^
$8A	2000	Dark Gray
$8E	2050	^
$89	2100	^
$8D	2150	^
$8B	2200	^
$8F	2250	Black

───

PKTPIX ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   MFJ-1278 sends packet data to the printer port

    OFF   MFJ-1278 sends packet data to the RS-232 port

The PKTPIX command provides a method for the MFJ-1278 to
print packet pictures and other graphics-format data
transmitted by another station in the VHF packet mode. When
PKTPIX is turned ON, the MFJ-1278 becomes ready to print
graphics data.

Packet pictures data transmitted from the connecting packet
station are received and data is sent directly to the
printer attached to the MFJ-1278, without any intervening
modification. Therefore, all data MUST use the same printer
control codes that your printer uses.   Typically EPSON
format codes will be used.

Packet picture printing to the MFJ-1278 printer   port
requires you to first establish a packet connection with the
station who is going to send the picture. Note that you
won't be able to call up PKTPIX until the connection is
made. You must have the printer powered and selected before
MFJ-1278 will let you use the PKTPIX command.

Once these conditions are met, all data received over the
packet link are sent directly to the printer.

Exit PKTPIX by using the escape-to-cmd: mode sequence for
TRANSPARENT connections. Use CTRL-C three times (default),
or asynchronous BREAK.

PRINTGRA   ON¦OFF   Mode: FAX/SSTV   Default: ON

For FAX   and SSTV modes, the   setting   of   PRINTGRA
determines what the MFJ-1278 will do with demodulated
graphics. In multi-level FAX mode when MULTIFAX command is
turned ON,   the setting PRINTGRA (ON or OFF) will not be
useful.

Under 2 level FAX/SSTV format, when PRINTGRA is ON, the MFJ-
1278 expects and prints to the Epson graphics printer
attached to the printer port.   When OFF, graphics are sent
to the user's terminal in format:

 LF, CR, ESC x x, ESC x x x , <<nnn characters of graphics>>

The FAX/SSTV frame sent to the user's terminal contains
carriage control information, graphics setup information
and "nnn" columns of 6-row high dot graphics.

Special note: in order to allow the FAX/SSTV frames to pass
through without special handling, each character in the
frame is biased upward with the value 30Hex, so only
characters of ASCII value 30H through 7FH are sent to the
terminal.

A few side effects of the special handling:

1. FAX/SSTV frames and pictures may be transmitted in PACKET
or ASCII or logged to disk without concern for binary
transfers

2. The "x" values in the FAX/SSTV header are not useful for
determining the format of the FAX/SSTV picture (since 2
bits of the 8 bit lengths are lost).   This is not serious
provided you are aware of which format a   FAX/SSTV
picture was copied under.

The number of graphics characters, "nnn", following a
FAX/SSTV frame header, depends on the FAXMODE/TVMODE.   See
horizontal density under the FAXMODE/TVMODE command for more
information.

PRINTER   ON¦OFF   Mode: All   Default: OFF

PRINTER turns the parallel printer port ON and OFF.

PRINTTES   Mode: ALL   Default: off

PRINTTES is a command used to test the printer connected to
the   parallel port of the MFJ-1278.   When PRINTTES is
executed from command mode,   the MFJ-1278 will   send 223
characters to the printer,   starting   at ASCII SPACE (value
32   decimal) and ending with the value 255 decimal which
is   not   an   ASCII character   but may be a graphics
character.   This test does NOT   format with any   carriage
return/line   feed   sequences, therefore the printer attached
MUST be configured for "Auto Newline" or "Line Wrap ON"
in order to print all the characters.

<u>QRT</u>   Mode: AMTOR   Default: (command)

QRT is used to:

1. End a mode A "ARQ" connection

When the contact is completed and you are ready to break the
link, issue QRT to break it and return the MFJ-1278 to
standby/receive mode.

2. Stop a broadcast in mode B (FEC) and mode S (SELCALL)

When you're broadcast is complete type QRT to return the
MFJ-1278 to standby / receive mode.

(see also R)

<u>R</u>   Mode: AMTOR   Default: (command)

R is equivalent to QRT.   The R command returns the MFJ-1278
to standby / receive mode.

(see QRT)

RADIO n   Mode: All   Default: 1

Parameters:

    n   1 - 2, Specifying the radio port to be
                         used.

RADIO command allows user to select the radio ports of the
MFJ-1278.   From command mode, typing RADIO 1 will cause the
MFJ-1278 to select radio port 1 as the active radio port.
Typing Radio   2 will cause the MFJ-1278 to select radio
port 2 as the active radio port.   When initially powered
up, the MFJ-1278 defaults to radio port it was set to when
last powered down.

RANDOMCW   ON¦OFF   Mode: CW   Default: OFF

Pseudo random CW is sent when in CW mode and RANDOMCW is
turned ON.   To terminate sending random CW, type "CTL-C" and
set RANDOMCW to OFF again.

RBITMASK $xx   Mode: RTTY/ASCII   Default: 0

        xx   0 - $7F, specifying the bit inversion
                        during receiving.

RBITMASK   command controls the bit inversion applied to
received ASCII and RTTY. Bit inversion is a simple means of
encryption.   RBITMASK should be selected to match the
inversion pattern of the station you are receiving.

RECONNECT call1 [VIA call2[,call3...,call9]] Mode: Packet

Parameters:

    call1   **Callsign** of TNC to be reconnected to.

    call2   Optional **callsign**(s) of TNC(s) to be digipeated through. As many as eight digipeat addresses can be specified.

RECONNECT is an immediate command. It may be used to change the path through which you are currently connected to a station. It may only be used when your MFJ-1278 is connected on the current stream to the station you wish to RECONNECT to.

Integrity of frames in flight between your station and the RECONNECTed station at the time of RECONNECT is not assured.

RESTART   Mode: All

RESTART is an immediate command. It re-initializes the MFJ-1278 using the defaults stored in bbRAM. The effect of this command is the same as turning the MFJ-1278 OFF then ON again.

RESTART does not cause a reset of the parameters in bbRAM. See also the **RESET** command.

REDISPLA n   Mode: All   Default: $12 <CTRL-R>

Parameters:

     n   0 - $7F, specifying an ASCII character code.

This command is used to change the redisplay-line input
editing character. The parameter n is the ASCII code for
the character you want to type in order to redisplay the
current input line. You can enter the code in either hex or
decimal.

You can type this character to cause the MFJ-1278 to retype
a line you have begun. When you type the redisplay-line
character, the following things happen: First, type-in flow
control is temporarily released (if it was enabled). This
displays any incoming packets that are pending. Then a
<BACKSLASH> character is typed, and the line you have begun
is retyped on the next line. If you have deleted and re-
typed any characters, only the final form of the line will
be shown. You are now ready to continue typing where you
left off.

You can use the redisplay-line character to see a "clean"
copy of your input if you are using a printing terminal and
you have dele4ed characters. If you have set **BKONDEL OFF**,
deletions are designated with <BACKSLASH> characters, rather
than by trying to correct the input line display. The
redisplayed line will show the corrected text.

You can also use this character if you are typing a message
in Converse Mode and a packet comes in. You can see the
incoming message before you send your packet, without
canceling your input.

RESET   Mode: All

This is an immediate command.   It resets all parameters to
their default settings and re-initializes the MFJ-1278.

     WARNING: All parameter customizing and monitor
     lists are lost.

If   you want to re-initialize the MFJ-1278 using the
parameter values in battery backed-up RAM, you should turn
the MFJ-1278 off then on again rather than using this
command.

RESPTIME n   Mode: Packet   Default: 5

Parameters:

     n   0 - 250, specifying 100 ms intervals.

This command sets a minimum delay that is imposed on acknow-
ledgment packets.   This delay may run concurrently with
default wait set by **DWAIT** and any random wait in effect.

This delay can be used to increase throughput during opera-
tions   such as file transfer when the sending TNC usually
sends the maximum number of full-length packets.   Occasion-
ally, the sending TNC may not have a packet ready in time to
prevent transmission from being stopped temporarily, with
the result that the acknowledgment of earlier packets col-
lides with the final packet of the series. If the receiving
TNC sets RESPTIME to 10, say, these collisions will be
avoided.

RESTORE   Mode: AMTOR   Default: (command)

RESTORE returns the MFJ-1278 AMTOR code converter to "LTRS"
case, and it flushes the transmit buffer. For an
explanation on "LTRS" and "FIGS", see any text describing
the Murray / Baudot code.

RETRY n   Mode: Packet   Default: 10

Parameter:

    n   0 - 15, specifying the maximum number of
                packet retries.

The protocol allows for retries, i.e., retransmission of
frames that are not acknowledged. Frames are re-transmitted
n times before the operation is aborted. The time between
retries is specified by the command **FRACK**. A value of 0 for
n specifies an infinite number of retries. If the number of
retries is exceeded, the MFJ-1278 goes to the disconnected
state (with an informative message if not in Transparent
Mode). See also the **FRACK** command.

RFE   <u>ON</u>¦<u>OFF</u>   Mode: AMTOR   Default: OFF

RFE is the Retry ForEver parameter.   When ON a mode A call
will continue until successful or a "QRT" or "R" command is
issued.

RINV   <u>ON</u>¦<u>OFF</u>   Mode: AMTOR   Default: OFF

RINV controls whether the incoming received signal is
inverted before detection/processing.   It is similar to
RXINVERT in RTTY/ASCII mode.

RXBLOCK ON|OFF   Mode: Packet   Default: OFF

Parameters:

    ON   The MFJ-1278 will send data to the terminal
                in RXBLOCK format.

    OFF   The MFJ-1278 will send data to the terminal
                in standard format.

RXBLOCK is designed for automated operations, such as packet
bulletin board stations. It is intended to help such sys-
tems discriminate between data received from the connected
station and MFJ-1278-generated messages.

Correct operation of **RXBLOCK** is dependent on the **AWLEN**
parameter getting set to **8** (bits) since the character FF hex
marks the beginning of a received data unit header.

When **RXBLOCK** is on, data from other stations will be sent
from the MFJ-1278 in the following format:

```
 ---------------------------------------------------------
|  $FF  |  LO  |  L1  |  PID  |        DATA             |
 ---------------------------------------------------------

 ( prefix )(  length   ) ( pid ) (        data          )
```

The fields above are defined as follows:

prefix $FF ::= A character with all 8 bits set
length   LO   ::= The high order length of the data,
                   length, and pid fields logically ORed
                   with the value $F0
         L1   ::= The low order length of the data,
                   length, and pid fields
pid   PID ::= The Protocol IDentifier byte received
                   for the following data field
data   DATA ::= [Optional], variable length data

For best operation it is suggested that parameters like
AUTOLF, **MFILTER** etc. be set OFF in order to prevent
uncertainties in the size of the data field.

RXCAL   Mode: All

RXCAL is an immediate command. When invoked, the MFJ-1278 generates test signals (based on CALSET -- see below) that are used by the internal tuning software to align the demodulator components.

To use the RXCAL feature,

1) Align the modulator components as described in the owners manual.

2) Use the MODE command to select the demodulator to be tuned. Make sure JMP8, JMP7 and JMP 4 are installed.

3) Compute:

$$n = \frac{9600}{\text{bit-rate}}$$

Where "bit-rate" is the same as 1/2 the baud rate in packet modes and the baud rate in all other modes. See CALSET Adjustment & Location Map for "n" value.

4) Type the command "CALSET n". Use the 'n' from step 3

5) Type the RXCAL command.

7) Tune the appropriate trimpot (R79, R113, R114, or R115) until the DCD light is lit fully.

8) Continue tuning this trimpot until the CON and STA LEDs flash either alternately every half second, and/or both light up

9) return to step 2 until all the demodulators are tuned.

NOTE: RXCAL is not effective for alignment of the CW demodulator.

CALSET Adjustment & Location Map
This is a map of the physical locations of the adjustment
potentiometers on the MFJ-1278 circuit board. They are
shown as they appear when looking down on top of the board
with the board oriented so that the rear panel connectors
are to the left. Information in the boxes is organized as
shown below.

```
+---------------------+        +----------------------+----------------------+
|                     |        |                      |                      |
| PART    MODE        |        | PART MODE H/L         | PART MODE H/L         |
|                     |        |                      |                      |
| CALSET    #         |        | FREQ / CALSET         | FREQ / CALSET         |
|                     |        |                      |                      |
+---------------------+        +----------------------+----------------------+
       DEMODULATOR                           MODULATOR

+---------------------+        +----------------------+----------------------+
|                     |        |                      |                      |
| R113      HP        |        | R106     HP L         | R77      VP H         |
|                     |        |                      |                      |
| CALSET   32         |        | 2110     250          | 2100     250          |
|                     |        |                      |                      |
+---------------------+        +----------------------+----------------------+
|                     |        |                      |                      |
| R114      VB        |        | R122     VB L         | R105     HP H         |
|                     |        |                      |                      |
| CALSET   32         |        | 2125     248          | 2310     228          |
|                     |        |                      |                      |
+---------------------+        +----------------------+----------------------+
|                     |        |                      |                      |
| R79       VP        |        | R78      VP L         | R119     VB H         |
|                     |        |                      |                      |
| CALSET    8         |        | 1300     404          | 2975     177          |
|                     |        |                      |                      |
+---------------------+        +----------------------+----------------------+
|                     |        |                      |                      |
| R115     CW         |        | R138 SSTV H           | R129     MCW          |
|                     |        |                      |                      |
| NO CALSET           |        | 1500     351          | 850      618          |
| SEE NOTE            |        |                      | SEE NOTE              |
+---------------------+        +----------------------+----------------------+
```

NOTE! Separate procedure required to do alignment of CW
       demodulator center frequency.
NOTE! MCW modulator tone is also used for SSTV
       transmission. However, CW receive through a narrow
       filter for HF CW operation will require the CW
       demodulator center frequency to be selected to
       align with the radio's filter passband. MCW
       operation on VHF FM will require that both stations
       have both the modulator tone and demodulator center
       frequency to the same frequency. Depending on the
       mode you feel is most important to you, a choice
       will have to be made that can adversely affect
       operation on the other modes (SSTV, MCW, or CW).

RXINVERT   ON¦OFF   Mode: RTTY/ASCII   Default: OFF

Setting   RXINVERT ON causes the MFJ-1278 to change   its
decoding   of Baudot RTTY and ASCII signals from the standard
high tone used for MARK to the inverted low tone   used   for
MARK.

At times,   stations you work may inadvertently be in   the
wrong sideband mode.   If he is printing you but you're   not
printing him, try turning this ON.

SCREENLN n   Mode: All   Default: 80

Parameters:

     n   0 - 255, specifying the screen or platen
                  width, in characters, of the terminal.

This   value is used to properly format terminal output. A
<CR> <LF> sequence is sent to the terminal at the end of a
line in Command and Converse Modes when n characters have
been printed. A value of zero inhibits this action.

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

SELCALL ssss   Mode: AMTOR   Default: (command)

The SELCALL command initiates a mode L "SELCALL" broadcast.
"ssss" is the four character SELCAL address the broadcast is
being sent too.

When SELCALL is issued the MFJ-1278 keys the transmitter and
is immediately ready to accept text to transmit. Type K or
CONV to enter the text transmit mode. When you're done
transmitting, enter CTL-C and type R to release the
transmitter and return the MFJ-1278 to standby / receive.

Also see SRXALL

SENDPAC n   Mode: Packet   Default: $0D <CR>

Parameters:

      n   0 - $7F, specifying an ASCII character code.

This command selects the character that will force a packet
to be sent in Converse Mode. The parameter n is the ASCII
code for the character you want to type in order to force
your input to be packetized and queued for transmission.
You can enter the code in either hex or decimal.

For ordinary conversation, you will probably set SENDPAC $0D
and CR ON. This causes packets to be set at natural inter-
vals, and causes the <CR> to be included in the packet.

If you have set CPACTIME ON, you will probably set SENDPAC
to some value not ordinarily used (say, <CTRL-A>), and set
CR OFF. This will allow you to force packets to be sent,
but will not result in extra <CR> characters being transmit-
ted in the text.

SERIALNO n n=0-65535   Mode: CW   Default: 0

SERIALNO is   useful as a contest QSO   number   counter.
When transmitting a buffer, the MFJ-1278 scans the buffer
text to see if there are any pound sign "#" characters
and   if it encounters any then the current value   of
the   SERIALNO counter inserted in the buffer text being
sent.   After   this value is loaded,   SERIALNO is
incremented by one until it reaches 65535, where it rolls
over to zero.

If for some reason the serial number must be changed during
the contest, merely escape to command mode and enter the new
serial number by using the SERIALNO command.

SETUP   MODE: ALL   Default: see table below

All possible baud rates and modem configurations are
displayed on the SETUP menu. The selected baud rates and
modem configurations are also shown.

Anytime the MFJ-1278 default values are loaded the baud rate
and modem default profile is loaded as well. The defaults
are:

Modem	Mode	Default Baud Rate/ Speed/ Format
P	VHF Packet	1200
H	HF Packet	300
V	VHF BAUDOT RTTY	45
H	HF BAUDOT RTTY	45
V	VHF ASCII RTTY	110
H	HF ASCII RTTY	110
C	CW	20 WPM
C	Memory Keyer	20 WPM
C	Modulator CW	20 WPM
P	WeeFAX/ FAX	3 (120 Lines Per Min.)
P	SSTV	1 (8.5 Sec. Format)
H	AMTOR/Navtex	100
M	Multi-level FAX/SSTV	all formats

Terminal baud rate and modem configurations may be changed
by using SETUP command.

SFNL   ON|OFF   Mode: AMTOR   Default: OFF

SFNL controls whether the MFJ-1278 adds a new line character
to "+?" and WRU.

SLOTS nnn   Mode: Packet   Default: 3

Parameter:

        nn   0 - 127, specified the number of sides on
                    the slot time dice.

This parameter determines how many sides are on the slot
time dice. SLOTS represents an n+1 sided dice the TNC
"throws" before transmitting. The SLOTS command allows any
number of slots from 1 thru 127 to be defined.

        SLOTS (n)   REMARKS

          1   Disables Slotting

          2

          4   This should be the
                               default setting

          8   Use only if the
                               channel is VERY
                               busy.

         16   VERY VERY VERY busy !

         32   You get the idea.

         64

        128   Might as well print
                               it out & send it in
                               the mail.

The value used on a particular channel should be agreed on
by the channel users. Access to the channel will be
equitably distributed among all users if everybody is using
the same value for the SLots and DEAdtime parameters.

The idea is to pick a value large enough that the
probability of two queued up stations picking the same value
is relatively small.   On the other hand, the value chosen
should be small enough that most of the time, ONE of the
queued up stations will have a significant probability of
picking the first available slot.   In this way, the channel
is reliably arbitrated and at the same time the overhead
required for the arbitration is minimized so that overall
throughput on the channel is maintained. The actual value
used will depend on the average number of queued up stations
there are on the channel during busy periods.

SOLF   ON|OFF   Mode: AMTOR   Default: ON

SOLF determines whether only LINEFEED characters from the
AMTOR receiver are sensed as newline characters. If SOLF is
OFF then carriage return and linefeed characters are passed
directly through to the terminal, otherwise every received
linefeed   character will generate a <CR>,<LF>   newline
sequence.

SRXALL   ON|OFF   Mode: AMTOR   Default: ON

The MFJ-1278 will print all receivable mode S transmissions
when SRXALL is on.

Taking advantage of the ability to receive an addressed mode
S transmission requires SRXALL ON and a match between the
address being sent and your MYSELCAL.

If SRXALL is OFF and MYSELCAL does not match the address in
the received mode S transmission, the MFJ-1278 ignores the
transmission.

START n   Mode: All   Default: $11 <CTRL-Q>

Parameters:

    n   0 - $7F, specifying an ASCII character code.

This command selects the User Restart character, which is
used to restart output from the MFJ-1278 to the terminal
after it has been halted by typing the User Stop character.
You can enter the code in either hex or decimal.

The User Stop character is set by the STOP command.

If the User Restart and User Stop characters are set to $00,
software flow control to the MFJ-1278 is disabled, and the
MFJ-1278 will only respond to hardware flow control (CIS).

If the same character is used for both the User Restart and
User Stop characters the MFJ-1278 will alternately start and
stop transmission upon receipt of the character.

STATUS   Mode: AMTOR   Default: (command)

STATUS returns diagnostic information useful for helping us
help you with your problems. Please note the STATUS value
when writing to us about any problems you encounter with
AMTOR mode.

STOP n   Mode: All   Default: $13 <CTRL-S>

Parameters:

    n   0 - $7F, specifying an ASCII character code.

This command selects the User Stop character, which is used
to stop output from the MFJ-1278 to the terminal. You can
enter the code in either hex or decimal. This is the
character you will type to halt the MFJ-1278's typing so
that you can read text before it scrolls off your display.

Output is restarted with the User Restart character, which
is set by the START command.

If the User Restart and User Stop characters are set to $00,
software flow control to the MFJ-1278 is disabled, and the
MFJ-1278 will only respond to hardware flow control (CTS).

If the same character is used for both the User Restart and
User Stop characters the MFJ-1278 will alternately start and
stop transmission upon receipt of the character.

STREAMCA ON|OFF   Mode: Packet   Default: OFF

Parameters:

     ON   Callsign of other station displayed.

     OFF   Callsign of other station not displayed.

This command is used to enable the display of the connected-
to station after the stream identifier. This is particular-
ly useful when operating with multiple connections allowed.
It is somewhat analogous to the use of MRPT to show digipeat
paths when monitoring.

In the example below, the charaters inserted by enabling
STREAMCAll are shown in **bold face** type.

     |A:K4NTA:hi howie
     hello ted how goes it?
     |B:WA7GXD:*** CONNECTED to WA7GXD
     |Bmust be a dx record. ge lyle
     |Aunreal ted! fl-az no digis!
     |B:WA7GXD:big band opening...ge

etc.

The same sequence with **STREAMCALL OFF** would look like the
following:

     |Ani howie
     hello ted how goes it?
     |B*** CONNECTED to WA7GXD
     |Bmust be a dx record. ge lyle
     |Aunreal ted! fl-az no digis!
     |Bbig band opening...ge

etc.

Thus, what would have looked like "|B" now appears as
"|B:<callsign>:". This option is very useful for human
operators trying to operate multiple simultaneous connec-
tions. It is probably less useful for "host" operations.

Note that, in the first example, the STREAMSWitch characters
"|A" and "|B" with no ":" after them were entered by the
operator of the TNC to switch streams for his multiple-
connect QSO(s). If you intend to operate multiple connec-
tions (as opposed to having your "host" computer operate
multiple connections), use of this option is recommended.

STREAMDB <u>ON</u>|<u>OFF</u>   Mode: Packet   Default: OFF

Parameters:

   ON   Double all received STREAMSWitch characters.

   OFF   Do not "double" received STREAMSWitch characters.

This command is used to display received STREAMSWitch
characters by "doubling" them. The example below illus-
trates this action.

With STREAMDB on, and STREAMSWitch set to "|", the following
might be displayed from your MFJ-1278:

   || this is a test.

In this case the sending station actually transmitted

   | this is a test.

The same frame received with STREAMDBL OFF would be dis-
played as:

   | this is a test.

When operating with multiple connections, this is useful for
differentiating between STREAMSWitch characters received
from other stations and STREAMSWitch characters internally
generated by your MFJ-1278.

NOTE: The STREAMSWitch character must NOT be one of the
        stream letters (A - J) for this command to function
        properly.

STREAMSW n   Mode: Packet   Default: $7C < ¦ >

Parameters:

    n   0 - $FF, usually specifying an ASCII
                 character code.

This command selects the character used by both the MFJ-1278
and the user that a new "stream" (connection channel) is
being addressed.

The character can be PASSed in CONVERS mode.   It is always
ignored as a user-initiated stream switch in TRANSPARENT
mode, and flows through as data.   This means that the out-
going stream can not be changed while "on line" in TRANSPA-
RENT mode (you must escape to COMMAND mode to switch
streams).

For further usage of this character, see the STREAMDBL and
STREAMCA commands.

SYSOP   Mode: Packet   immediate command

When MAILBOX is ON, the local user can access the mailbox by
typing the immediate command, SYSOP. All commands are
available to the SYSOP. When the SYSOP has completed
operating the MAILBOX, he must return to command mode with
"Control-C" (or the current COMMAND character) to allow
remote users access to the MAILBOX.

TBITMASK $xx   Mode: RTTY/ASCII   Default: O

      xx   O - $7F, specifying the bit inversion
                  during transmitting.

TBITMASK command controls the bit inversion applied to
transmitted ASCII and RTTY. Bit inversion is a simple means
of encryption. TBITMASK can be set to a desired inversion
pattern during transmitting.

Note that encryption of transmitted data is illegal for
amateur application.

TINV   ON¦OFF   Mode: AMTOR   Default: OFF

TINV controls whether the MFJ-1278 inverts the transmitted
AMTOR signals. It is similar to TXINVERT in RTTY/ASCII
modes.

TRACE **ON**|**OFF**   Mode: Packet   Default: OFF

Parameters:

    ON   Trace mode is enabled.

    OFF   Trace mode is disabled.

This command is used to enable the protocol debugging func-
tion.   When **TRACE** is **ON**, all received frames will be dis-
played in their entirety, including all header information.
In normal operation you will probably never need this func-
tion; however, if you need to report an apparent software
bug, we may ask you to provide trace information if possi-
ble.

A trace display will appear in four columns on an 80-column
display. Following is an example trace display. For compa-
rison, the frame shown in the trace example would be moni-
tored as follows:

    KV7B>CQ,KF7B*:this is a test message

The trace display would look like this:

```
byte   ------------hex display------------ -shifted ASCII-- -----ASCII------
000:   86A24040 40406096 AC6E8440 4060963C CQ    OKV7B  OKF  ..###`..n.##`..
010:   6E844040 E103F074 53697320 69732061 7B  P.x:449.49.0  n.##...this is a
020:   20746573 74206D55 73756167 650D        .:29:.6299032.    test message.
```

The **byte** column shows the offset into the packet of the
beginning byte of the line. The **hex display** column shows
the next 16 bytes of the packet, exactly as received, in
standard hex format.   The **shifted ASCII** column attempts to
decode the <u>high order</u> seven bits of each byte as an ASCII
character code. The ASCII column attempts to decode the <u>low</u>
<u>order</u> seven bits of each byte as an ASCII character code.
In a standard AX.25 packet, the **callsign** address field will
be displayed correctly in the **shifted** ASCII column.   A text
message will be displayed correctly in the ASCII column.
Non-printing characters and control characters are displayed
in both ASCII fields as ".".   You can examine the hex dis-
play field to see the contents of the sub-station ID byte
and the control bytes used by the protocol.   Protocol de-
tails are discussed in Chapter 9.

TRANS   Mode: Packet   Immediate Command

This is an immediate command. It causes the MFJ-1278 to
exit from Command Mode into Transparent Mode. The current
link state is not affected.

Transparent Mode is primarily useful for computer communica-
tions. In this mode, the "human interface" features such as
input editing capability, echoing of input characters, and
type-in flow control are disabled. You may find Transparent
Mode useful for computer Bulletin Board operations or for
transferring non-text files. See the discussion of Transpa-
rent Mode in Chapter 5.

TRFLOW ON|OFF   Mode:Packet   Default: OFF

Parameters:

    ON   Software flow control can be enabled for the
               computer or terminal in Transparent Mode.

    OFF   Software flow control is disabled for the
               computer or terminal in Transparent Mode.

If TRFLOW is ON, the settings of START and STOP are used to
determine the type of flow control used in Transparent Mode.
If TRFLOW is OFF, only hardware flow control is available to
the computer and all characters received by the MFJ-1278 are
transmitted as data.   If START and STOP are set to $00,
disabling the User Stop and User Restart characters, hard-
ware flow control must always be used by the computer.

If TRFLOW is ON, and START and STOP are non-zero, software
flow control is enabled for the user's computer or terminal.
The MFJ-1278 will respond to the User's Restart and User's
Stop characters (set by START and STOP) while remaining
transparent to all other characters from the terminal.
Unless TXFLOW is also ON, only hardware flow control is
available to the MFJ-1278 to control output from the
terminal.

TRIES n   Mode: Packet   Default: NONE

Parameters:

    n   0 -15, specifying the current RETRY level on
                the currently selected input stream.

This command is used to retrieve (or force) the count of
"tries" on the currently selected input stream.

When used with no argument: if the MFJ-1278 has an
outstanding unacknowledged frame, it will retune the current
number of tries;   if the MFJ-1278 has no outstanding
unacknowledged frames, it will return the number of tries
required to obtain an acknowledgment for the previous frame.

If RETRY is set to 0, the value returned by issuing a TRIES
command will always be 0.

This command is useful for obtaining statistics on the
performance of a given path or channel.   It should be espe-
cially useful for automatic optimizing so such parameters as
PACLEN and MAXFRAME by computer-operated stations, such as
automatic message forwarding stations using less-than-opti-
mum paths (noisy HF or satellite channels, for example).

When used with an argument, TRIES will force the "tries"
counter to the entered value.   Use of this command to force
a new count of tries is NOT recommended.

TUNE   Mode: All   Immediate Command

The TUNE command keys the PTT and low tone for the current
modem for 30 seconds or until you strike a key on your
computer keyboard.

TUNEPROC   Mode: All   Immediate Command

TUNEPROC is a immediate command.   It is used to calibrate
the MFJ-1278 modulators and demodulators.   See APPENDIX B
under "Modulator and De-Modulator Calibration" for the use
of TUNEPROC.

TVHSYNC   ON¦OFF   Mode: SSTV   Default: OFF

When receiving SSTV pictures, your MFJ-1278 will usually
maintain correct synchronization with the picture as long as
the transmitting station is keeping accurate time.   However
some stations may attempt to use tape recorder or other
unstable picture sources.   In case the received picture is
skewed or very unstable, setting TVHSYNC ON may help.

When TVHSYNC is ON it causes your MFJ-1278 to look for
horizontal sync by looking for dark areas that indicate sync
around the picture's edges.   Note well that TVHSYNC ON may
be fooled by pictures that have a lot of dark areas in the
actual picture data.

TVMODE   n   Mode: SSTV   Immediate Command

The   TVMODE command selects the formats under the SSTV   mode
for   the MFJ-1278.   The MFJ-1278 supports all SSTV   formats
listed in table below.

        TVMODE(n) ¦   Formats
        ----

           1   ¦   8.5 seconds

           2   ¦   12   seconds

           3   ¦   17   seconds

           4   ¦   24   seconds

           5   ¦   36   seconds

The   SSTV   format   can be changed by using   the   TVMODE   (n)
command.   n is a number from 1 thru 5 as listed in the above
table.   For   example,   to   set MFJ-1278 to   12   seconds   SSTV
format,   you would type: TVMODE 2 <CR>.

TVMODE is ineffective when the command TVX is turned ON.

TVBREAK   n   Mode: SSTV   Default: (see below)

        n = sss,aaa,bbb,ccc,ddd,eee,fff,ggg

TVBREAK command is arranged in the following format:

TVBREAK sss,aaa,bbb,ccc,ddd,eee,fff,ggg-

    where,

    sss is the sync. The default value is $42.

    aaa is the black area, the default value is $28.

    ggg is the white area, the default value is $30.

    bbb thru fff are gray areas between the black area and
    the white area.

The default TVBREAK values are:

TVBREAK $42,$27,$28,$2A,$2B,$2D,$2F,$30

Note that the values for TVBREAK are in HEX.   The   smaller
values represent the darker shade of gray. $30 is the
lightest gray and $27 is black. All other TVBREAK values in
between $27 and $30 define the other gray levels of the
picture being received. Sync is the first value at HEX $42.
Sync value can not be changed when resetting the TVBREAK
values.

TVBREAK controls the brightness and contrast of the SSTV
received on the MFJ-1278 printer port as well as when SSTV
picture is printed to the screen. SSTV pictures sent to the
MFJ-1278 printer port is set at 4 gray-levels. With terminal
software which supports multi-gray levels SSTV, such as the
MFJ-1284 starter pack, you can receive SSTV pictures with up
to 8 levels of gray.

If the picture you are receiving does not seem to have the
right contrast, reset the TVBREAK values.

Selection of TVBREAK values which is meaningful are as
follows:

$25-$26-$27-$28-$29-$2A-$2B-$2C-$2D-$2E-$2F-$30-$31-$32-$33
Black<--------Dark Gray<--------Light Gray<---------White-<

Note that if you select to operate only 4 level SSTV such as
printing to the MFJ-1278 printer port, the MFJ-1278 will
automatically select 4 TVBREAK values from the eight TVBREAK
values which you have selected.

TVX   ON|OFF   Mode: SSTV   Default: OFF

   Parameters:

        ON   Multi-level SSTV raw data is sent to the
                    terminal without preset SSTV format.

        OFF   Multi-level SSTV raw data is sent to the
                    terminal   in   format   set   by   the
                    TVMODE command

TVX   command   sets the format which the MFJ-1278   sends   the
SSTV pictures to the terminal. When TVX is turned ON,   SSTV
picture format is not preset. The terminal program must be
responsible to detect the end of the SSTV picture. MFJ-1278
does not detect the end of the picture no matter what TVMODE
is set. This means that MFJ-1278 can receive any format of
SSTV picture. It is not limited by TVMODE. Picture lengths
longer than 36 seconds are possible as long as the terminal
program can detect the end of the picture when the picture
is being received.

When TVX is turned OFF, SSTV picture format is determined by
the setting of TVMODE. For example, if TVMODE is set to 5
(36 seconds format), the picture sent to the terminal will
end at 36 seconds. Which means that if you set the TVMODE
too short, you may not receive the whole picture.

TVX is automatically turned OFF when PRINTGRA is turned ON;
this sends SSTV picture being received to the built-in
printer port. SSTV pictures are sent to the printer port in
4 gray levels when PRINTGRA is set to ON.

TXDELAY n   Mode: Packet   Default: 30

Parameters:

     n   0 - 120, specifying 10 ms intervals.

This value tells the MFJ-1278 how long to wait after keying
up the transmitter before sending data. Some startup time
is required by all transmitters to put a signal on the air;
some need more, some need less. In general, crystal con-
trolled rigs with diode antenna switching don't need much
time, synthesized rigs need time for PLL lockup, and rigs
with mechanical T/R relays will need time for physical relay
movement. The correct value for a particular rig should be
determined by experimentation. The proper setting of this
value may also be affected by the requirements of the sta-
tion you are communicating with.

Note that the TAPR TNC 1 and other TNCs using the same
firmware interpret n in 40 ms intervals. The value of
TXDELAY on MFJ-1278 will thus be 4 times the value used by a
TNC 1 user to give the same delay time.

TXDELAYC nnn   Mode: Packet   Default: 2

Parameter:

   nnn   0 thru 255 in 1 ms step

The time delay between when the MFJ-1278 depresses the PTT
and when it starts sending packets is specified in terms of
how long it takes to send (TXDELAYC) characters at the
current radio baud rate. TXDELAYC controls a new timer that
runs after the regular TXDELAY time has expired (see
TXDELAY).

High speed radio users will find this command useful because
they can select transmit delays much smaller than the 10 ms
grains in TXDELAY. For high speed use, set TXDELAY to 0 and
set TXDELAYC according to the formula below:

$$TXDELAYC = \frac{Radio\text{-}PTT\text{-}delay\text{-}time}{Time\text{-}per\text{-}character}$$

The time-per-character as related to the radio baud rate is
as follows:

baud rate	time-per-character
9600	.83 ms
2400	3.30 ms
1200	6.70 ms
300	26.00 ms

Examples:

1.   For a 200 ms 2 meter HT at 1200 baud, TXDELAYC is:

$$TXDELAYC = \frac{200\ ms}{6.7\ ms} = 30$$

2.   For a 400 ms HF radio at 300 baud, TXDELAYC is:

$$TXDELAYC = \frac{400\ ms}{26\ ms} = 16$$

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TXFLOW ON¦OFF   Mode: All   Default: OFF

Parameters:

    ON   Software flow control can be enabled for the
               MFJ-1278 in Transparent Mode.

    OFF   Software flow control is disabled for the
               MFJ-1278 in Transparent Mode.

If TXFLOW is ON, the setting of XFLOW is used to determine
the type of flow control used in Transparent Mode.   If
TXFLOW is OFF, the MFJ-1278 will use only hardware flow con-
trol and all data sent to the terminal remains fully trans-
parent.

If TXFLOW and XFLOW are ON, the MFJ-1278 will use the MFJ-
1278 Restart and MFJ-1278 Stop characters (set by XON and
XOFF) to control input from the terminal.   Unless TRFLOW is
also ON, only hardware flow control is available to the
computer or terminal to control output from the MFJ-1278.

Note that if the MFJ-1278 Restart and MFJ-1278 Stop
characters are set to $00, hardware flow control will always
be selected regardless of the setting of TXFLOW.

TXINVERT   ON|OFF   Mode: RTTY/ASCII   Default: OFF

When TXINVERT is ON, transmitted RTTY/ASCII data by the MFJ-1278 are sent inverted, i.e. the marks are sent as spaces and vice versa.

TXTMO   n   n=0-65535   Mode: Packet   Default: 0

TXTMO is a HEALTH counter that registers the number of packet transmitter timeout/recovery events that have occurred since the MFJ-1278 was powered up.

TXUIFRAME   ON|OFF   Mode: Packet   Default: ON

TXUIFRAME is used to tell the MFJ-1278 what to do with unconnected information left in its buffers. When this parameter is ON, all unconnected data are transmitted as "UI" (unconnected) frames.

This command should be OFF for bulletin-board stations as it precludes the unnecessary transmission of text that occurs when the BBS user disconnects -and- unacknowledged packets remain.

UNSHIFT ON|OFF   Mode: RTTY   Default: ON

In Baudot RTTY receive mode only, UNSHIFT ON forces the
receiver shift to the LTRS case whenever the Baudot SPACE
character is received.   This helps in many situations in
reducing garbling when conditions are not good.

Some   stations,   particularly those transmitting weather
information and other strings of numeric text, are not
compatible with unshift on space (USOS).   When receiving
those stations, UNSHIFT should be turned OFF.

UNPROTO call1   Mode: Packet   Default: "CQ"

                [VIA call2[,call3...,call9]]

Parameters:

    call1   Callsign to be placed in the TO address
               field.

    call2 - 9 Optional digipeater call list, up to eight
               calls.

This command is used to set the digipeat and destination
address fields of packets sent in the unconnected (unproto-
col) mode.   Unconnected packets are sent in unnumbered I
frames with the destination and digipeat fields taken from
call1 through call9 options.   When no destination is speci-
fied, unconnected packets are sent to CQ. Unconnected pack-
ets sent from other TNCs can be monitored by setting MONITOR
ON and setting BUDLIST and LCALLS appropriately.   The digi-
peater list is also used for BEACON packets (which are sent
to destination address BEACON).

USERS n   Mode: Packet   Default: 1

Parameters:

        n   0 - 10, specifying the number of active
                       connections that may be established to this
                       MFJ-1278 by other TNCs.

USERS affects only the manner in which incoming connect
requests are handled, and has no effect on the number or
handling of connections you may initiate with this MFJ-1278.

For example,

        USERS 0 allows incoming connections on any free stream
        USERS 1 allows incoming connections on   stream A only
        USERS 2 allows incoming connections on   streams A & B
        USERS 3 allows incoming connections on streams A, B & C

and so on through USERS 10.

WDMODE   ON|OFF   Mode: AMTOR   Default: OFF

WDMODE (word mode) determines whether mode A transmission
takes place any time you type a SPACE or RETURN character,
or only when you type a carriage return.

WDMODE OFF, the default condition, sets the MFJ-1278 so that
it buffers you're transmitted text a line at a time before
sending it. If it's ON, the MFJ-1278 immediately sends each
word as you end it with a SPACE or RETURN.

WEIGHT n n = 0 thru 255   Mode: CW   Default: 0

The WEIGHT command is used to set the weight factor applied
to paddle and CW keyboard generated code elements.   The
value of weight is represented as a 2's complement byte and
it alters the dot / space ratio. Therefore one should use
values between 128 and 255 to DECREASE the weight factor,
and 1 to 127 to INCREASE the weight factor.

The number specified results in an absolute increase or
decrease in the ratio of dot to space time that is
equivalent to approximately 8.67 ms.

NOTE: For weight calculation purposes,   a dash gets the
       factor   applied to only 1 of its 3 dot times.   So
       that the time added to or removed from each element
       whether it is a dot or a dash is either removed
       from or added to the space following the element.

WRU   Mode: AMTOR   Default: (command)

The WRU command causes the remote mode A "ARQ" station
currently in contact with to transmit it's answerback
message (if any).

WRU is a standard signal recognized by most AMTOR stations.
The WRU response will vary from station to station.

(also see ANSBSTR)

MFJ-1278 MESSAGES

This chapter describes the messages your MFJ-1278 may produce and the circumstances under which they can appear.

Packet Messages


```
*:J
bbRAM:LOAD WITH DEFAULTS
MFJ Enterprises, Inc.
Model MFJ-1278
AX.25 Level 2 Version 2.0
RELEASE X.X.X - DATE - 32K RAM
Checksum XXX
cmd:
```

This is the sign-on message that appears when you turn on your MFJ-1278 or when you issue the RESET command. The release number will be updated whenever the firmware is changed. The checksum is a hex number which you can compare against the correct checksum given for the firmware version you are using.

bbRAM loaded with defaults

This message appears along with the sign-on message above if the battery backed-up RAM checksum verification fails at power-on time, causing the MFJ-1278 to load the default parameters from ROM. (This will be the case the first time you turn on your MFJ-1278.)

This message also appears if the MFJ-1278 loads the defaults in response to the RESET command.

cmd:

This is the Command Mode prompt. When this prompt appears, the MFJ-1278 is waiting for you to issue a command. Anything you type after this prompt will be interpreted as a command to the MFJ-1278. If a monitored packet has been displayed, the prompt may not be visible, even though you are in Command Mode. You can type the redisplay-line character (set by REDISPLA) to retype the prompt.

was

> Whenever you change the setting of one of the MFJ-1278's parameters, the previous value will be displayed. This confirms that the MFJ-1278 properly interpreted your command, and reminds you of what you have done.

too many packets outstanding

> This message would appear in response to a **CONVERS** or **TRANS** command, under special circumstances. If you have previously entered packet data filling the outgoing buffer in Converse Mode or Transparent Mode and then returned to Command Mode. You will be allowed to enter one of these modes when some of the packets have been successfully transmitted.

Mailbox Messages

? Not while mail server enabled

> This message occurs when you are trying to access the mailbox when the system operator is using his mailbox.

You have mail!

> Upon access to a mailbox, this message will appear if there are messages addressed to you.

?EH

> This message occurs when a command issued is not understood by the mailbox. This could be out of range slot number, missing slot number where one is required, or bad command.

Cannot, not yours

> This message occurs when a remote user attempts to kill a message which is not his, or he tries to read personal message by or for someone else.

?Mailbox full

> This message occurs when either all of the available slots (30) are full, or the actual message space (3000 bytes) is full. Messages must be killed to recover from this error.

Not found

> This message occurs when one attempts to read or kill a non-existent message from an empty slot.

None found

> A parameterless Kill or Read command. Can not find any messages addressed to the user.

Command Mode Error Messages

If you make a mistake typing a command to the MFJ-1278, an error message will be printed. You may see any of the following messages depending on the type of error you have made.

?bad

> You typed a command correctly, but the remainder of the command line couldn't be interpreted.

?call

> You entered a **callsign** argument that does not meet the MFJ-1278's requirements for **callsigns**. A **callsign** may be any string of numbers and letters, including at least one letter. Punctuation and spaces are not allowed. The sub-station ID, if given, must be a (decimal) number from 0 to 15, separated from the call by a hyphen.

?clock not set

> This message !ppears if you give the command DAYTIME to
> display the date and time without having previously set
> the clock.   DAYTIME sets the clock if it is given with
> the daytime parameters, and displays the date and time
> if it is given without parameters.

?EH

> The first word you typed is not a command or a command
> abbreviation.

?not enough

> You didn't give enough arguments for a command that
> expects several parameters.

?not while connected

> You   attempted to change MYCALL or AX25L2V2 while in a
> connected or connecting state.

?range

> A numeric argument for a command was too large.

?too long

> You entered too long a command line, and the line was
> ignored. This might happen, for example, if you try to
> enter too long a message with BTEXT or CTEXT.   If you
> get this message, the previous text entry was not
> changed.

?too many

> You gave too many arguments for a command that expects
> several parameters.   For example, MFILTER can have up
> to 4 arguments.
>
> > cmd:MFILTER $1B,$0C,$1A,$03,$07
> > ?too many

?VIA

>This message appears if you attempt to enter more than
>one **callsign** for the CONNECT or UNPROTO commands with-
>out the VIA keyword.

Link Status Messages

These messages inform you of the status of AX.25 connections
your MFJ-1278 may be involved in. You can always interrogate
the link status by giving the CONNECT command without para-
meters. If you attempt a connection when your MFJ-1278 is
not in the disconnected state, the MFJ-1278 will display the
link status but will take no other action.   The following
messages appear in response to the CONNECT command.

Link state is: CONNECTED to call1
                          [VIA call2[,call3...,call9]]

>This   display shows the station your MFJ-1278 is
>connected to and the digipeater route if any.   The
>**callsign** sequence is the same sequence you would enter
>to initiate the connection.

Link state is: DISCONNECTED

>No connection currently exists.   You may issue the
>**CONNECT** command to initiate a connection.

Link state is: CONNECT in progress

>You have issued a connect request, but the acknowledg-
>ment from the other station has not been received.   If
>you issue a DISCONNE command, the connect process will
>be aborted.

Link state is: DISCONNECT in progress

>You have issued a disconnect request, but the acknow-
>ledgment from the other station has not been received.
>If you issue a second DISCONNE command, the MFJ-1278
>will go immediately to the disconnected state.

Link state is: FRMR in progress

> The MFJ-1278 is connected but a protocol error has occurred. This should never happen when two TAPR TNCs are connected. An improper implementation of the AX.25 protocol could cause this state to be entered. The MFJ-1278 will attempt to re-synchronize frame numbers with the TNC on the other end, although a disconnect may result. Connects are not legal in this state, and a disconnect will start the disconnect process.

The MFJ-1278 will inform you whenever the link status changes. The link status may change in response to a command you give the MFJ-1278 (CONNECT or DISCONNE), a connect or disconnect request packet from another station, a disconnect due to the retry count being exceeded, an automatic time-out disconnect (CHECK), or a protocol error.

*** CONNECTED to: call1 [VIA call2[,call3...,call9]]

> This message appears when the MFJ-1278 goes from the "disconnected" or "connect in progress" state to the connected state. The connection may be a result of a **CONNECT** command you issued, or of a connect request packet received from another station.

*** connect request:call1 [VIA call2[,call3...,call9]]

> This message indicates that the MFJ-1278 has received a connect request from another station which it has not accepted. This can happen if you have set CONOK OFF or if you are already connected to another station. When the MFJ-1278 types this message it also sends a DM packet (busy signal) to the station that initiated the connect request. If the MFJ-1278 rejects a connect request because you have set CONOK OFF, you can issue your own request to the station that called.

*** DISCONNECTED

> This message is displayed whenever the MFJ-1278 goes to the disconnected state from any other link state. This message may be preceded by a message explaining the reason for the disconnect, below.

*** retry count exceeded
*** DISCONNECTED

> This message is given if the disconnect was caused by a retry failure rather than by a disconnect request from one of the stations.

*** <callsign> busy
*** DISCONNECTED

> This message indicates that your connect request was rejected by a DM packet (busy signal) from the other station. The MFJ-1278 will reject a connect request if CONOK is OFF, or if it is already connected to another station, or the connect request is from a station with a totally blank callsign.

frmr frame just sent:
FRMR sent: xxxxxx

> The MFJ-1278 is connected, and a protocol error has occurred. The MFJ-1278 has sent a special FRMR packet to attempt to re-synchronize frame numbers with the MFJ-1278 on the other end. The string **xxxxxx** is replaced with the hex codes for the three bytes sent in the information part of the FRMR frame. This message will not appear if your MFJ-1278 is in Transparent Mode.

FRMR rcvd:

> This message is followed by a display of the FRMR packet received in the trace display format. This format is explained in the **TRACE** command entry. This message will not appear if your MFJ-1278 is in Transparent Mode.

***LINK OUT OF ORDER, possible data loss [opt. daytime stamp].

> This message indicates failure of a CONPERMed.

HARDWARE

This chapter includes detailed specifications and a functional description of the hardware design of the MFJ-1278.

MFJ-1278 Specifications

Processor CMOS Z-80A

Clocks Processor master clock input frequency: 4.9152 MHz

User Port Clock: Switch selectable at 16x baud rate.

Memory All memory in industry-standard JEDEC Byte-Wide sockets.

Standard complement of ROM: 64K = 1 x 27C512

Standard complement of RAM: 32K = 1 x 43256C-15L

Serial Port Z8440 SIO/O port B configured as UART plus low-power TTL-to-RS-232C signal level interface.

Baud rates supported: 300, 1200, 2400, 4800 and 9600.

Standard female DB-25S (DCE) RS-232C connector. 8-pin TTL connector for TTL serial port.

Modem Demodulator: XR2211 PLL demodulator circuit plus related components to receive up to 1200 baud.

Modulator: XR2206 modulator circuit plus related components to produce tones for all modes of operation.
Built-in modem calibration system.

An external modem may be attached via a single connector which completely bypasses the on-board modem.

Tuning Indicator is built in to support tuning aid for all modes of operation.

bbRAM Non-volatile storage of all important operating parameters is accomplished by using a battery

backed-up system for the entire 32K bytes of sys-
tem RAM.

Protocol   AX.25 Level 2 is supported.   Pre-Version 2.0 sup-
            port is compatible with earlier TAPR TNCs running
            3.x software.   Full support of Version 2.0 proto-
            col is provided. Full duplex radio link operation
            is supported.

Packet   Command Mode: accepts commands via user port.
Operating   Converse Mode: accepts digital data, transmits and
Modes   receives packets, permits terminal editing fea-
            tures (character delete, line delete, input packet
            delete, output packet delete and redisplay input)
            via special characters trapped by the MFJ-1278.
            Escape to command mode via special character or
            BREAK signal.   Optional use of packet completion
            timer as in Transparent mode.

            Transparent Mode: accepts digital data, transmits
            packets via packet completion timer or buffer full
            only, and receives packets.   No local editing
            features permitted.   Escape to command mode via
            specially timed character sequence or BREAK sig-
            nal.

Power   +12 volts DC at 500 mA.
Required

General Description

The MFJ-1278   is based on the Zilog Z80 (tm) family of
microprocessor components.

Major electronic devices in the MFJ-1278 include a CPU
(Central Processing Unit) for controlling the MFJ-1278 and a
SIO (Serial Input/Output) chip for   providing   serial
interface ports to the on-board modem (which connects to
your radio) and to the RS-232C or TTL serial terminal port
(which connects to your computer or terminal).

The MFJ-1278 also includes two types of memory.   ROM (Read
Only Memory) stores the program that tells the MFJ-1278 how
to implement the AX.25 protocol.   Battery backed-up RAM
(Random Access Memory) provides a scratch-pad area for
temporary data as well as non-volatile storage for operating
parameters such as your station call sign.   The battery
back-up feature enables the MFJ-1278 to "remember" these
values when power is off so you don't have to enter them
every time you want to operate.

Other integrated circuits are used for functions including

clock oscillator, baud-rate generator, memory-space decoder, power supply and voltage inverter, clock recovery, transmit watch-dog timer and modem. Refer to the schematic diagram while reading the following circuit descriptions.

Detailed Circuit Description

Oscillator

U10a, U10b, U10c, R46, R47, R48, C24, C47, C51, and Y1 provide an accurate crystal-controlled oscillator for system timing.

R48 forces inverter U10a into its linear region and provides a load for crystal Y1. C47 provides an adjustable reactive element to allow the oscillator's frequency to be precisely set (this precision is not normally required). Inverter U10c buffers the clock for additional stability before driving additional dividers.

R46 is used to bias "HCT" logic to the proper levels for best oscillator operation; it is not necessary if U10 is an "HC" logic element.

Dividers and Baud-rate Generator

U10e, U10f, U4a, U4b, U1, U30 ad U31 provide clock outputs derived from the oscillator. Electronics switches within U30 and U31 provide all the terminal baud rate and the RF baud rate under software command.

Inverter U10f provides buffering and isolation between the divide-by-two output of counter U4a and the capacitive load presented by the CPU (U22) and the SIO (U21). U10f's input may be at 2.4576 MHz or 4.9152 Mhz. MFJ-1278 operation at the faster clock of 4.9152 MHz. Capacitors C59 and C60 are used to slow the edges of the outputs of U4a, and capacitor C61 is used to slow the edges from U10f, helping to reduce RFI.

Counter U1 is a multiple-stage divide-by-two circuit that divides the signal at its input many times. This allows the switches within U30 and U31 to select the desired signaling (baud) rate to be used for your computer or terminal as well as the radio channel baud rate.

The output from counter U1 at pin 12 provides a real-time clock interval signal for the SIO. During normal operation, the SIO will be programmed to interrupt the CPU on every transition of this 600 Hz signal. This interrupt occurs 1200 times a second, and is used for protocol and calibra-

tion timing functions.

Inverter U10e buffers the radio port "16x" baud-rate signal
in case it is routed, via modem disconnect J4 pins 11 and
12, to an external modem. If this buffer were not included,
reflections from the distant termination might cause counter
U1 to generate count errors.

Counter U4b provides a properly scaled clock for the trans-
mit NRZ to NRZI encoder (see Serial Interface, below).

CPU Complex

EPROM U23 provides system ROM for program storage. Selector
U12a acts as a ROM decoder, mapping the ROM into the CPU's
memory address space beginning at address 0.

Static RAM provides system RAM for temporary scratch-pad
storage, message buffers, etc. Also, because the RAM is
backed up by a battery and will not lose its contents when
the main power is removed, it is used to provide semi-
permanent storage of user-supplied information (such as your
callsign). Selector U12b acts as a RAM address decoder,
with RAM starting at address 8000 hex.

The sections of CMOS switch U13 are used to insure that the
RAM is not selected when main power is removed. This en-
sures that the contents of the RAM are not accidentally
scrambled as the CPU loses power; it also ensures that the
RAM is in the "power-down" state for minimum battery power
consumption.

Serial Interface

Serial Input/Output (SIO) device U21 provides two channels
of serial I/O.

The B SIO channel is used for the computer or terminal
interface. Operational amplifier sections U3a, U3b, and U3d
act as RS-232C drivers while Schmitt trigger inverters U9a
and U9b act as RS-232C receivers. These circuits consume
less power than conventional RS-232C drivers and receivers.

The A SIO channel is used for the radio/modem interface and
is normally operated as a full duplex HDLC channel for
compatibility with the AX.25 protocol specification. Latch
U5 and ROM U6 provide a "state machine" for recovering the
clock from the received NRZI data. The state machine also
converts NRZI data to NRZ for the SIO. Inverter U9c and
flip-flop U11a provide NRZ to NRZI conversion for the trans-
mit side of the radio channel. This conversion between NRZ

formatted data and NRZI formatted data is necessary because
the AX.25 protocol specification requires NRZI operation
while the SIO is only capable of NRZ.   Jumper JMP11 may be
used to bypass the NRZ --> NRZI conversion for use with
external modems, if required.

Watch-dog Timer

Inverters U7c, U7d, U7e, and Q10 provide a "watch-dog" timer
on the transmit key line to ensure that the transmitter does
not remain keyed for more than about 30 seconds if the TNC
fails.   This allows you to leave a station (such as a remote
digipeater) on-the-air and unattended without much chance of
having a malfunction "lock up" the packet channel.   This
also helps ensure compliance with FCC regulations regarding
unattended station operation.

Jumper JMP4 is provided for testing purposes.   When JMP4 is
installed, timing capacitor C31 is shunted, disabling the
watch-dog timer.

Modem

U16, an XR2206, is a Frequency Shift Keying (FSK) modulator
that generates an audio data signal for use by the radio
transmitter. Two tones are used, one for each digital
level, and these tones may be calibrated via trimpots
R77/R78, R105/R106, R119/R122 and R139/R138 in conjunction
with the on-board calibration support circuitry and sof-
tware. When the transmitter is not being keyed, transistor
Q9 is switched on, thus preventing U16 from producing tones.
This allows you to leave a microphone connected to your
packet transmitter for voice operation.

R157 and R158 are used to set the tone output levels to the
transmitter.

U20, an XR2211, provides a Phase Locked Loop (PLL) FSK
demodulator. It converts the received audio FSK signals
into digital data at standard logic levels. This data is
sent to the state machine clock recovery and NRZI to NRZ
format conversion circuits. R79, R113, R114 and R115 are
used to calibrate the PLL demodulator's free-running freque-
ncy which is set midway between the FSK tones being re-
ceived. These tones are measured by the calibration
software and the output signal produced by U8a and U8b,
which is a frequency doubling shaping circuit.

Power Supply

Regulator Q3 and associated components provide a +5 volt
regulated output for the MFJ-1278 digital logic circuitry.
In order to reduce conducted RFI from the digital power
source, series inductor L1 is provided. Transistor Q4, in
conjunction with CMOS inverters in U14, provides a "power
failure" circuit for the battery-backed RAM chips to ensure
that RAM is in the "power-down" state when the main power is
removed. In addition, this circuit provides the main power-
on reset signal via U7f.

Transistors Q5 and Q6 are used to isolate the battery from
the +5 volt line when main power is available. R33 protects
the lithium battery from overload conditions and provides a
convenient means of monitoring battery current drain when
the TNC is switched off. JMP5 provides a means of disconne-
cting the lithium battery for MFJ-1278 maintenance.

U2 and associated components form a charge-pump voltage
inverter which generates an unregulated negative supply for
the RS-232C drivers.

U3c, Q2, CR6 and surrounding components provide a regulated
source of -5 volts for the modem chips.

The modem power sources and ground are isolated from digital
logic switching noise by inductor L2.

RS-232C Handshaking Protocol

The CTS, DSR and DTR lines of the RS-232C port (J1) are used
for hardware "handshaking" protocol to control the flow of
data between the terminal (DTE) and the MFJ-1278 (DCE).

The MFJ-1278 always asserts (makes 4rue) Data Set Ready
(DSR) on J1 pin 6 via resistor R16. Thus, whenever the MFJ-
1278 is powered up, it signals to the terminal connected to
J1 that the MFJ-1278 is "on line."

The terminal indicates it is ready to receive data from the
MFJ-1278 by asserting its Data Terminal Ready (DTR) output,
J1 pin 20. The MFJ-1278 will send data when it has data to
send and DTR is asserted. If the terminal is not ready to
receive data, it should negate (make false) DTR to the MFJ-
1278. Thus, data flow from the MFJ-1278 to the terminal is
controlled by the use of the DTR line. The state of the DTR
line is ignored by the software if "software flow control"
is enabled in this direction.

The MFJ-1278 asserts its Clear To Send (CTS) output, J1 pin
5, whenever it is ready to receive data from the terminal.
If the MFJ-1278's buffers fill, it will negate CTS,
signaling the terminal to stop sending data. The MFJ-1278
will assert CTS when it is again ready to receive data from
the terminal. Thus, data flow from the terminal to the MFJ-
1278 is controlled by the use of the CTS line. The CTS line
is always asserted if "software flow control" is enabled in
this direction.

Some serial I/O ports do not implement CTS, DTR and DSR
handshaking. If these pins are not connected at the termi-
nal end, they will be pulled up (and thus asserted) by
resistors at the MFJ-1278 end. However, a non-standard
serial connector may use some pins for other purposes, such
as supplying power to a peripheral device, so be sure that
your system either implements the CTS, DTR and DSR handshake
or has no connections to these pins of J1 whatsoever. Note
that reference to RS-232C "compatibility" or the presence of
a DB-25 type connector does not guarantee that you have a
full RS-232C serial port!

The MFJ-1278 supports most standard baud rates from 300
through 9600. The port supports standard parity options as
well as 7- or 8-bit character lengths. Setting these termi-
nal parameters is discussed in Chapter 4.

If you want to interface your MFJ-1278 with a device
configured as DCE, such as a telephone modem or another TNC,
a so-called "null modem" cable may be constructed to
interchange the data and handshake signals. See for example
Byte, February, 1981, page 198.

Jumper Functions

The following table lists the function of each jumper on the
MFJ-1278. For normal operation a shorting jumpers must be
placed on the following connectors: JMP 5; JMP 8; JMP 9; JMP
13; JMP 14 pin 1,2; JMP 16 pin 1,3 - pin 2,4 and on J4 pin
11,12 - pin 13,14, pin 17,18.

Jumper #	Position	Function
JMP1	Pin 1 & 2	!DCD (RS-232C) stays on
	Pin 2 & 3	!DCD (RS-232C) stays off
	OFF (default)	!DCD reflects connect status
JMP2	Pin 1 & 2 (default)	4.92 MHz CPU clock
	Pin 2 & 3	2.46 MHz CPU clock
JMP4	ON	disable Tx watch-dog
	OFF (default)	enable Tx watch-dog
JMP5	ON (default)	Lithium battery connected
	OFF	Lithium battery disconnected
JMP6	NOT used	
JMP7	ON	analog loopback mode
	OFF (default)	normal modem operation
JMP8	ON (default)	demodulator enabled
	OFF	demodulator calibrate
JMP9	Pin 1 & 2	calibrate U16 tones
	Pin 2 & 3 (default)	normal modem operation
JMP10	ON	digital loopback mode
	OFF (default)	normal modem operation
JMP11	LEFT	transmit data NRZ
	RIGHT (default)	transmit data NRZI
JMP12	Pin 2 & 3	16k RAM (2 x 6264)
	Pin 1 & 2 (default)	32k RAM (1 x 43256)

Jumper #	Position	Function
JMP13	ON (default) OFF	TTL, RTS enable TTL, RTS disable
JMP14	Pin 1 & 2 (default) Pin 2 & 3	FSK out normal FSK out reverse
JMP15	Pin 1 & 2 Pin 2 & 3 (default)	U23 is 27C256 type U23 is 27C512 type
JMP16	Pin 1 & 2 Pin 1 & 3 (default) Pin 2 & 4 (default)	Without multi-gray levels With multi-gray levels
JMP17	Pin 1 & 2 Pin 2 & 3 (default)	2400 baud ext. modem clock 9600 baud ext. modem clock
JMPA	ON OFF(default)	without multi-gray levels with multi-gray levels
JMPB	ON (default) OFF	on board transmit low tone out board transmit low tone
JMPC	ON OFF (default)	external DCD enabled external DCD disabled
JMPJ	ON OFF (default)	TX audio has flat response TX audio 6db/oct pre- emphasized
JMPK	ON OFF (default)	TX audio loopback to PTT (for Radio Port 2)
JMPL	ON OFF (default)	TX audio loopback to PTT (for Radio Port 1)
JMPR	ON OFF (default)	Analog audio loopback (for Radio Port 1)
JMPS	not used	
JMPX	ON (default) OFF	Speaker Transmit Tone Enable Speaker Transmit Tone Disable
JMPY	ON (default) OFF	Speaker Receive Tone Enable Speaker Receive Tone Disable
JMPZ	ON (default) OFF	Speaker Connect Tone Enable Speaker Connect Tone Disable

Parallel Printer Port Pin Function - J12

Printer Port Pin #	Pin Function
1	Strobe
2	Data Bit 1
3	Data Bit 2
4	Data Bit 3
5	Data Bit 4
6	Data Bit 5
7	Data Bit 6
8	Data Bit 7
9	Data Bit 8
10	Acknowledge
11	Busy
12 thru 17	No connection
18 thru 25	Ground

External I/O Interface Port Pin Function - CN1

CN1 Pin #	Pin Function
1	Read Request
11	Write Request
2	Data Bit 1
5	Data Bit 2
6	Data Bit 3
9	Data Bit 4
12	Data Bit 5
15	Data Bit 6
16	Date Bit 7
19	Date Bit 8
3	Address Bit 1
4	Address Bit 2
7	Address Bit 3
8	Address Bit 4
13	Address Bit 5
14	Address Bit 6
17	Address Bit 7
18	Address Bit 8
10	Ground
20	+ 5 Volts

Multi-level Interface Connector - J13

J13 Pin #	Pin Function
1	No connection
2	No connection
3	No connection
4	Ground
5	SSTV/FAX receive signals
6	153.6 KHz clock
7	SSTV/FAX select
8	SSTV/FAX transmit tones
9	SSTV/FAX receive control
10	SSTV/FAX transmit control
11	-5 Volts
16	Data Bit 1
17	Data Bit 2
18	Data Bit 3
19	Data Bit 4
15	Data Bit 5
14	Data Bit 6
13	Data Bit 7
12	Data Bit 8
20	+5 Volts

External Modem Interface Connector - J14

J14 Pin #	Pin Functions
1	-5V
2	+5V
3	Ground
4	Receive Audio
5	Transmit Audio

Modem Disconnect - J4

The modem disconnect, J4, on the MFJ-1278 PC board is
provided for using an external modem with the MFJ-1278.
This allows use of higher-speed modems, such as 9600 baud,
or more sophisticated, higher-performance modems for OSCAR
or other uses.

The following information is primarily for those who wish to
interface external modems to the MFJ-1278. Familiarity with
modem and serial data channel terms is assumed.

The signals used at connector J4 are at standard TTL inter-
face levels. A TTL high, or 1, is greater than +2.4 volts
but less than +5.25 volts. A TTL low, or 0, is less than
0.8 volts but greater than -0.4 volts. DO NOT connect an
RS-232C level modem directly to J4!

> **NOTE:** The modem disconnect is <u>similar</u>, but <u>not</u>
> identical to that used in TNC 1. Be very careful
> about interfacing an external modem using the same
> cabling you may have prepared for use with TNC 1!

The connector pin-outs are as follows.

Pin 1   Carrier Detect Input

> This pin tells the SIO radio port that a valid data
> carrier has been detected. It should be pulled high
> when no carrier is detected and low when a carrier is
> present. This line must be implemented unless the
> software release notes indicate otherwise. It is nor-
> mally jumpered to pin 2 when the on-board modem is
> used.

Pin 2   Carrier Detect Output

> This pin is an output from the the on-board modem and
> satisfies the requirements outlined for pin 1 above.
> It is normally jumpered to pin 1 when the on-board
> modem is used.

Pin 3   SIO Special Interrupt Input

> This signal is routed to the radio port DCD input pin
> on SIO U21. This signal is normally used during modem
> calibration. It may also be used for other purposes;
> if so, these functions will be listed in the software
> release notes. This pin is normally jumpered to pin 4
> when the on-board modem is used.

Pin 4   SIO Special Interrupt Generator Output

    This signal is an output from the on-board modem.   It
    is normally used for modem calibration only.   If it is
    used for other functions, they will be stated in the
    software release notes.   This pin is normally jumpered
    to pin 3 when the on-board modem is used.

Pin 5   SIO RTS Output

    This signal is used for transmitter activation.   The
    SIO will pull this output low when the MFJ-1278 wants
    to transmit; otherwise it will remain high.   This pin
    is normally jumpered to pin 6 when the on-board modem
    is used.

Pin 6   Transmitter Key Input

    This signal is an input to the on-board modem.   It
    activates the PTT pin of the radio connector via the
    watch-dog timer. It should be left high and pulled low
    only when transmission is desired. This pin is normal-
    ly jumpered to pin 5 when the on-board modem is used.

Pin 7   CONNECT Status Output

    This pin is an output from the SIO. It is normally low
    and goes high only when the MFJ-1278 is in the
    connected (error-free) mode with another packet
    station. Its status is monitored via the CON LED.

Pin 8   Unacknowledged Packets Pending Status Output

    This pin is an output from the SIO. It is normally low
    and   goes   high   only   when   this   MFJ-1278   has
    unacknowledged packets in its transmit buffer.   Its
    status is monitored via the STA LED.

Pin 9   CTS Input

    This pin is an input to the SIO.   It is high when the
    attached modem is not ready to accept data, and low
    when the attached modem is ready to accept data.   The
    TNC will not attempt to send data when this pin is
    high. This pin is normally jumpered to pin 10 when the
    on-board modem is used.

Pin 10   Transmitter Key Input

    This pin is physically tied to pin 6, above.   It is
    used in conjunction with pin 9, above to allow the MFJ-
    1278 to use the on-board modem whenever the transmitter
    is activated.

Pin 11   Transmitter Clock (16x) Input

       This pin is tied to the NRZ-to-NRZI converter, which
       expects a clock signal at 16 times the desired radio
       port data rate, e.g., 4800 Hz for 300 baud. This pin
       is normally jumpered to pin 12 when the on-board modem
       is used.

Pin 12   Transmitter Clock (16x) Output

       This pin is tied to the radio baud rate switch network.
       It provides a clock at 16 times the desired radio port
       data rate.   This pin is normally jumpered to pin 11
       when the on-board modem is used.

Pin 13   Receive Clock Input

       This pin is tied to the SIO receive clock input pin.
       It expects a clock at the desired data rate (1200 Hz
       for 1200 baud), of the proper phase relationship to the
       received data. This pin is normally jumpered to pin 14
       when the on-board modem is used.

Pin 14   Receive Clock Output

       This pin is the received data clock signal derived from
       the NRZI-to-NRZ state machine.   This pin is normally
       jumpered to pin 13 when the on-board modem is used.

Pin 15   MFJ-1278 Ground Reference

       This pin ties to the MFJ-1278 digital ground system, at
       the SIO.

Pin 16   Tubro LED output

       This pin is used to connect the Tubro LED on the mother
       board to the external modem board. When this pin is
       high (+5Vdc), the Tubro LED will light.

Pin 17   Receive Data Input

       This pin is the received data input to the NRZI-to-NRZ
       state machine. This pin is normally jumpered to pin 18
       when the on-board modem is used.

Pin 18   Receive Data Output

       This pin provides receive data from the on-board modem.
       This pin is normally jumpered to pin 17 when the on-
       board modem is used.

Pin 19   Transmit Data Output

    This line is the NRZ or NRZI (depending on the state of
    JMP11) data output.   This pin is normally jumpered to
    pin 20 when the on-board modem is used.

Pin 20   Transmit Data Input

    This input line accepts data to be be transmitted by
    the modem.   This pin is normally jumpered to pin 19
    when the on-board modem is used.

If you elect to use an off-board modem, be sure to properly
shield the interconnecting cables for RFI protection.

HF Tuning Indicator

The MFJ-1278 has a built-in tuning indicator for   HF
operation.   It is set for a center frequency of 2210 Hz.
The incoming audio frequency is centered at 2210 Hz.   This
is indicated by one or two of the center most LEDs brightly
lit.   When you are tuned to a lower center frequency, the
LED to the left of center lights. When you are tuned too
high, the right of center LED lights.   The resolution
between each bar segment is approximately 10 Hz.

TROUBLESHOOTING

WARNING: <u>Never</u> <u>remove</u> <u>or</u> <u>insert</u> <u>an</u> <u>IC</u> <u>with</u> <u>power</u> <u>on</u>!

Your MFJ-1278 is a complex piece of electronic equipment. Servicing must be approached in a logical manner. The best preparation for troubleshooting is to study the detailed hardware description in Chapter 7. While it is not possible to present all possible problems, symptoms and probable cures, this section of the manual will give direction to troubleshooting based on our experience.

General Tests

In most cases we have found that careful visual inspection combined with simple measurements generally reveals the problem. The most useful single instrument for trouble-shooting is a good DVM that can read AC and DC volts, and can non-destructively test resistance while the ICs are still in their sockets.

While a number of checks may be made without the aid of an oscilloscope, you will need one to check signals at various points on the board if you fail to locate the problem by visual means or with a meter. Be very careful about short-ing pins on ICs when applying meter or scope probes to the board. It is a good idea to attach a secure ground lead to the meter or scope, one that won't accidentally short across components on the board. A good place to pick up this ground is on the head of the screws which mount the printed-circuit board to the case.

Step 1: Power Supply

The first thing to check in any malfunction is the power supply. Check the power supply levels at the outputs of the voltage regulators (Q2 and Q3) as well as the output of the inverter (U2). Are they close to their nominal values? Do all the ICs in the suspected area have the proper voltage on their power pins? Is there excessive ripple in any of the DC voltage lines? If so, check the regulator and associated components, working backwards toward the input power switch. If the voltage is low, in conjunction with a hot regulator, suspect a short circuit on the board.

If the problem is in the -5 volt supply, work backwards from Q2's collector (also at U16 pin 1), which should be -5 volts regulated, to the junction of C9 and CR2 (-V unregulated).

If no voltage appears at -V, then U2 or a related component
may be at fault.   Verify that U2 is oscillating by looking
at the wave form at U2 pin 5.   If -V is more negative than -
7 volts (i.e., normal), but the -5 volt regulated voltage is
wrong, check the negative regulator components U3, Q2, R5,
R6, R7, R8, CR6, C10, C11 and C158. If both -V and the -5
volt regulated voltage are wrong, look for shorts.

Step 2: Obvious Problems

Look for any unusual physical symptoms.   Are any components
discolored?   Does something smell burnt?   Do any of the
parts seems excessively warm?   If you have never had your
fingers on operating digital integrated circuits before you
may erroneously conclude they are too hot when they are
actually operating normally. In general their normal tempe-
rature will be well below the boiling point of water, but
you may not want to keep your finger on them very long.

Step 3: Assembly Problems

Carefully inspect the PC board and component installation.
Are any cold solder joints present? Is a metal screw
shorting to the board anywhere?   Are all ICs firmly seated
in their sockets? Are any IC leads tucked under the chip or
otherwise bent in such a manner that they aren't making
proper contact with the IC socket?   (This is a **very** common
error, accounting for most problems!)

Inspect the diodes and electrolytic capacitors for proper
installation.   Are the diode cathodes pointing the correct
way?   Are the negative ends of the electrolytic capacitors
pointing the correct way?

Step 4: Cabling Problems

Inspect the interconnection cabling.   Does it work on an-
other TNC?   Has the radio and/or terminal been successfully
used on packet with this or another TNC?   Are all the con-
nections tight? Has the cable frayed or broken?

Specific Symptoms

While the steps described above may seem obvious, careful
inspection often will point to the problem or give signifi-
cant clues as to the probable area of the MFJ-1278 most
suspect.   After the above inspection has been completed and
apparent problems dealt with, it is time to proceed to more
specific analysis.

Symptom: TNC appears dead

If the MFJ-1278 powers up with the PWR, STA, and CON LEDs
lit, followed by STA and CON extinguishing a second or so
later, the processor is working and the software is probably
working correctly.   You should suspect the terminal port at
this point.   Check all connections and verify the logic
levels according to the terminal interface troubleshooting
section in this chapter.

Oscillator and Reset Circuits

If no LEDs wink during the reset cycle the problem may be
more serious.   Check to see that the crystal oscillator is
working and that an "M1" signal (154 kHz square wave, 0 to
+5 volts) is coming from U22 pin 27. The crystal oscillator
input to the processor (U22) is pin 6.   The input clock
should be a (possibly distorted) square wave signal. Verify
that the clock input at pin 6 of U22 is running at the
correct frequency (near 4.9152 MHz).

Verify that the battery backed-up RAM protection circuit,
composed of Q4, U14 and associated devices, is going to +5
volts at U14 pin 6 after input power is applied.   This
signal enables normal operation of U24 and U25.   There
should be a logical low on the output of U7 pin 12 coinci-
dent with the application of power and lasting for a few
hundred milliseconds.   Without this RESET signal, the Z80
probably won't start up properly.

Digital Logic Lines

Remember that all the logic circuits operate at standard TTL
levels (a "low" is less than +0.8 V and a "high" is greater
than +2.4 volts), and all digital inputs and outputs switch
between these two levels.   Thus, if you see logic signals
switching between 0 and, say, 1 volt, you can be sure there
is a problem (usually a short).   On the other hand, do not
mistake switching transients on digital logic lines for
improper operation -- these show up as ringing and other
distortions.

Verify that there is activity on the control bus READ and
WRITE lines, the 3 CHIP-ENABLE lines on the memories (U23-
25, pins 20), the IOREQ line on U21 pin 36, and the INT line
on pin 16. Each of these lines should show activity, and if
any line is quiet this is a sign of trouble.

Logic lines that show no activity may often be traced to a
short on the pc board, probably due to a solder splash or
bridge.

Address and data line shorts may also show up as lack of
activity on the control bus lines, especially the chip
selects. Check each of the 16 address and 8 data lines for
activity. Any lines showing a lack of activity are not
operating properly.

If you suspect problems with address or data lines, try
removing all the memory chips. Each address and data line
will now show a distinct pattern. The address lines should
be (possibly distorted) square waves whose periods increase
by a factor of two on successive lines as you step line by
line from A0 to A15.

If you decide to use an ohmmeter to check for shorted lines,
use a low voltage/low current test instrument. (Most Modern
DVMs are fine for this.) If in doubt, remove any ICs con-
nected to the lines you are measuring. If you suspect a
short, check the high density areas of the PC board for the
problem. In most cases the short will be found there. It
is very unlikely that the PC board itself will have a short.

Symptom: Modem won't calibrate or key transmitter.

Troubleshooting improper calibration amounts to checking for
proper signals at U21 and following up any improper signal.
If the calibration signal is present, but you cannot suc-
cessfully calibrate the frequency, you may have an out-of-
spec frequency determining component. Check the values of
the appropriate passive components. Also, check the place-
ment of jumpers! As a last resort, check the signal fre-
quency with a frequency counter. Note that, due to frequen-
cy jitter while calibrating the demodulator, the STA and CON
LEDs may blink somewhat even when the 1700 Hz demodulator
frequency is correct.

Calibration of the demodulator and the modulator tones are
discuss in the Appendix chapter.

If the transmitter doesn't key, the problem may be in the
watchdog timer, U7, or the PTT transistors, Q10 or Q20.
Check especially for an open timing capacitor C31 or a bad
solder connection associated with R83.

Symptom: Uncopyable transmitted or received packets

If no one seems able to decode your packet transmissions, it
is often the case that your transmitter is being overdriven.
The solution is to reduce the drive level via trimpots R157
and R158. Note that direct connection to typical microphone

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inputs requires R157 or R158 to be turned to near the minimum signal position to produce sufficiently low signal levels.

If you are having problems hearing other stations, the demodulator circuitry associated with U20 may be at fault. Check the center frequency of the VCO in U20 using the calibration procedure. Working in the direction of flow of the input signal from the radio, verify that it is being passed through to pin 2 of U20, the input pin. The signal there should be above 50 mV and below 3 V peak-to-peak for proper operation of the demodulator. It should be relatively clean, although a few tens of millivolts of noise is normal, and the signal amplitude should not change by more than about 25% between high and low tones.

Note: Make sure that JMP 8 is on.

Terminal Interface Troubleshooting

If you can't get the MFJ-1278 to sign on and accept data from your terminal or computer, the problem may be in the RS-232C interface. The troubleshooting guide below is provided as an aid to help in resolving problems that may be related to the RS-232C port.

Symptom: MFJ-1278 won't sign on to the terminal.

If you find the MFJ-1278 won't send data to your terminal, one of the first things to do is to verify that the RTS line at pin 4 of J1 is not being held low. If the software flow control option is disabled, the MFJ-1278 will not send data to the terminal unless its RTS is asserted. If the terminal does not implement the RTS/CTS protocol, the RTS/CTS lines (pins 4 and 5 on J1) should remain unconnected.

Verify that the voltages on the MFJ-1278 are correct. If the MFJ-1278 is in otherwise good condition, check the following pins on the SIO, U21 (Z8440). Pin 23 should be TTL low (between 0 and +0.8 volts). If this voltage is incorrect, check the voltage at U9 pin 3 and verify that it is greater than +3 volts. If this voltage is correct, U9 or the traces around it may be bad. If this is not the problem, disconnect the terminal and check it again. If this doesn't help, U9, R20 or R22 may be at fault.

If the above checks are ok, observe pin 26 of U21 with an oscilloscope and cycle the power switch on the MFJ-1278. Transitions on this pin shortly after reset indicate that the MFJ-1278 is sending data. Verify that transitions are also present on U3 pin 1. If these tests fail, the fault could be with U13, R25, R26, U21, J1, the attached cable or

faulty soldering (shorts, cold joints, etc.)

Symptom: The MFJ-1278 appears to be signing on but only
            gibberish is printed on the terminal.

This indicates that some combination of the data rate (baud
rate), parity option, or number of start and stop bits are
not set the same at the MFJ-1278 and at the terminal.   If
possible, set your terminal to 1200 baud. Also verify that
the terminal is set for eight data bits, no parity, and 1
stop bit.   These are the default settings stored in EPROM.
Perform a hard reset by the power switch OFF then ON (out
then in).   The sign on message should appear.

If the MFJ-1278 still prints gibberish, verify that the
terminal is set to the MFJ-1278's baud rate and do a power
off then on cycle on both the MFJ-1278 and terminal. If the
message still fails to appear try troubleshooting with an
oscilloscope, looking first at the TXD pin (pin 26) of U21
(Z8440), then at the x16 baud rate clock (19200 Hz at 1200
baud) on pin 27 of U21.

Symptom: The MFJ-1278 signs on OK but won't accept
            commands.

After the MFJ-1278 signs on, try giving it a command such as
MYCALL or any other command. If the default settings are in
effect, it will attempt to echo each character you type back
to the screen.   If it doesn't echo, be sure that U21 pin 23
has a voltage level between 0 and +0.8 volts on it.   The
voltage on U9 pin 3 should be greater than +3 volts.   If
these voltages aren't correct, the fault could be in   U9,
U21, J1, R20, R22, soldering, or the interconnecting cable.

If the above checks are OK, use an oscilloscope to verify
that data is present on U21 pin 28 and U9 pin 1 when you
strike a key on your terminal.   If not,   the data isn't
getting from your terminal to the MFJ-1278.   Check J1,   the
cable and U9 again.   Finally, be sure that your terminal
actually uses levels less than -3 volts and greater than
+3 volts for signal levels.   0 and +5 volts may not work,
especially if they are being used direct from a computer.

Symptom: The MFJ-1278 appears to have "lock-up" i.e. not
            responding to any commands.

This may be due to some invalid parameters having been
stored in the memory.   Try turning the MFJ-1278 off and
disconnect   JMP 5 on the MFJ-1278 board.   This will
disconnect the memory back-up circuit and allow the memory

to be erased.   Re-install JMP 5 after about 2 minutes and
try operating again.

PACKET RADIO PROTOCOL

Explanation of Protocol

The material in this chapter is intended to supply an overview of the packet protocol used to transmit data by the TAPR software. MFJ-1278 employs the **genuine** TAPR TNC 2 packet software. References are given to more detailed information required by those wishing to implement these protocols on other hardware. The material presented below is somewhat tutorial in nature for those who have not had previous exposure to layered network protocols, but it presumes some knowledge of general communications hardware and software. Persons already well versed in networking may want to skip this chapter and refer to the primary defining document, Amateur Packet-Radio Link-Layer Protocol, AX.25 Version 2.0, available from the ARRL, 225 Main Street, Newington, CT 06111 ($8.00 US, postpaid in the United States as of this writing).

The MFJ-1278 hardware and software architecture is organized in accordance with the International Standards Organization (ISO) layered network model. The model describes seven levels and is officially known as the ISO Reference Model of Open Systems Interconnection, or simply the ISO Model. The model and many other interesting topics are discussed in Computer Networks by Andrew S. Tanenbaum.

The ISO model provides for layered processes, each supplying a set of services to a higher level process. The MFJ-1278 currently implements the first two layers, the Physical layer and the Data Link layer.

Physical Layer

The duty of the Physical Layer, layer one, is to provide for the transmission and reception of data at the bit level. It is concerned only with how each bit is physically transmitted, i.e., voltages on a hardwire line or modem tones on phone or RF links.

The physical layer of the MFJ-1278 is described in Chapter 7, Hardware. It is compatible with the various TNCs currently available to radio Amateurs. The actual modem interface is compatible with the Bell 202 standard which is similar to the CCITT V.23 standard. Any other hardware device which is compatible with the Bell 202 standard should

be compatible with the MFJ-1278, at least at level one of the ISO reference model.

Data Link Layer

The duty of the Data Link layer is to supply an error-free stream of data to higher levels. Since level one simply passes any bits received to level two and is unaware of the content or overlying structure of the data, transmission errors are not detectable at level one. Level two carries the responsibility of detecting and rejecting bad data, retransmitting rejected data, and detecting the reception of duplicate data.

Level two accomplishes this task by partitioning data to be transferred by level one into individual frames, each with its own error detection field and frame identification fields. The MFJ-1278 supports two versions of a level-two layer, AX.25 version 1.0 and AX.25 version 2.0. Each of these protocols is based on HDLC, the High-Level Data Link Control protocol defined by the ISO.

HDLC Frames

Exact knowledge of the format of HDLC frames has been made largely unnecessary by the advent of LSI and VLSI communications chips which interface directly with the level one hardware. The level two software need only supply data to fill in various fields and the chip takes care of the rest. For completeness however, an HDLC frame looks like this:

| FLAG | ADDRESS | CONTROL | PID & DATA | FCS | FLAG |

FLAG   A unique bit sequence (01111110) used to detect frame boundaries. A technique called "bit stuffing" is used to keep all other parts of the frame from looking like a flag.

ADDRESS   A field normally specifying the destination address. AX.25 uses a minimum of 14 bytes and a maximum of 70 bytes containing the actual call signs of the source, destination, and optionally up to eight digipeaters.

CONTROL   A byte which identifies the frame type. In the AX.25 protocol, the control field may include frame numbers in one or two 3-bit fields.

PID   A Protocol Identification byte appears as the first byte of the HDLC DATA field in AX.25 Level Two information frames, and identifies which Level

3 protocol is implemented, if any. In the case where no Level 3 protocol is implemented, PID = $FO.

DATA   This field contains the actual information to be transferred. This field need not be present. Most frames used only for link control do not have data fields.

FCS   Frame Check Sequence, a 16-bit error detection field.

The communications chip recognizes the opening and closing flags and passes the address, control, and data (including PID) fields to the software. The FCS field is a Frame Check Sequence computed by the transmitting chip and sent with the frame. The receiving chip recomputes the FCS based on the data received and rejects any frames in which the received FCS does not match the computed FCS. There is virtually no chance of an undetected bad frame using this method. This satisfies the level two task of bad data detection.

The communications chip used in the MFJ-1278 is a Zilog 8440 SIO operating in conjunction with a two-chip "state machine" which is used to recover the data clock. The transmitted data is encoded in NRZI form, which encodes a "0" data bit as a transition in the encoded bit stream and a "1" data bit as no transition. This, in combination with the "bit-stuffing" which ensures that no more than five "1"s occur in a row except when FLAG bytes are being transmitted, guarantees that a logic level transition occurs at least once every 5 bit times. These frequent transitions allow the receiver to synchronize its clock with the transmitter. Other chips which are compatible with the SIO + "state machine" are the Western Digital 1933/1935, the Intel 8273 (used on the VADCG and Ashby TNCs) and the Zilog 8530 (used on the Xerox 820 FAD adapter).

While the HDLC format supplied by the communications chips is used by the AX.25 protocol, there are several other Layer Two concerns. These are duplicate frame detection, connection and disconnection of the level two layers on different TNCs, and buffer overrun avoidance. The AX.25 protocol solves these problems as described below.

AX.25 Level Two

AX.25 is based on the Balanced Link Access Procedure (LAPB) of the CCITT X.25 standard. LAPB in turn conforms to the HDLC standard. Two extensions are made to LAPB in AX.25. These are the extended address field, and the unnumbered information (UI) frame. In LAPB, addresses are limited to

eight bits, while AX.25 uses from 112 to 560 bits, con-
taining the originator's call sign, the destination call
sign and an optional list of one to eight digipeater (sim-
plex digital repeater) call signs.

The UI frame is used to send information bypassing the
normal flow control and acknowledgment protocol. The UI
frame is not acknowledged but can be transmitted at layer
two without fear of disturbing higher layers. It is used
for beacon frames, for automatic identification packets, and
for sending information frames when the MFJ-1278 is not
connected to another TNC, e.g., CQ and QST activities.

The exact specifications for AX.25 are supplied in the ARRL
publication Amateur Packet-Radio Link-Layer Protocol, AX.25
Version 2.0. The TAPR implementation adheres to this stand-
ard for AX.25 version 2.0. The implementation of version
1.0 is almost identical to the TAPR TNC 1 version of AX.25
protocol in software releases 3.x. This provides compati-
bility with the majority of Amateur packet radio stations.

The following table lists the frame types used by AX.25 and
describes their purpose. This material is provided to give
a general understanding of the protocol, and is not intended
to replace the published specification. The byte fields are
given as they appear in memory after data is received, i.e.,
the high order bit is at the left and the low order bit is
at the right. This is also the format of the display pro-
vided by the TRACE command. Some texts, including the AX.25
protocol specification, list the bits in the order in which
they are transmitted, which is low order bit first.

The control bytes are presented in hex with "x" used to
indicate four bits which depend on the acknowledge functions
the packet is performing. Usually "x" is a frame number.
Frame numbers fit into three bits and are used to ensure
that frames are received in order and that no frames are
missed. Since only three bits are available, the frame
number is counted module 8. This is why the MAXFRAME para-
meter has a ceiling of 7: no more than seven frames can be
"in flight" (transmitted but unacknowledged) at one time. A
short description of the use of the frames is given after
the table.

Table 9-1. AX.25 Control Codes

Code   Abbrv   Frame Type

x1   RR   Receive Ready
x5   RNR   Receive Not Ready
x9   REJ   Reject
03   UI   Unnumbered Information
OF   DM   Disconnected mode
2F   SABM   Connect request .
43   DISC   Disconnect request
63   UA   Unnumbered Acknowledge
87   FRMR   Frame reject
even   I   Any frame ending in an even number (in-
                   cluding $A, $C, and $E) is an information
                   frame.

I   This and UI frames are the only frame types con-
       taining user data. The control byte contains this
       frame's number and the number of the next frame
       expected to be received from the other end of the
       link.

RR   Usually used to acknowledge receipt of an I frame.
       The RR function can also be performed by sending an I
       frame with an updated "expected next frame number"
       field.

RNR   Used when the buffer space on the receiving side is
       full.

REJ   Used to request retransmission of frames starting
       from "x".   Missed frames are detected by receiving a
       frame number different from that expected.

DM   Sent in response to any frame received other than a
       connect request (SABM) when the TNC is disconnected.
       Sent in response to an SABM whenever the TNC is on
       the air but can't connect to the requesting user,
       e.g., if the TNC is already connected to someone else
       or if CONOK is OFF.

SABM   Set Asynchronous Balanced Mode - initiates a connect.

DISC   Initiates a disconnect.

UA   Sent to acknowledge receipt of an SABM or DISC.

FRMR   Sent when an abnormal condition occurs, i.e., the
       control byte received is undefined or not proper
       protocol at the time received.

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UI   An I frame without a frame number. It is not acknow-
        ledged.

Channel Use and Timing Functions

The following discussions mention timing parameters which
are set by various commands.   These timing functions are
also discussed in Chapter 5.

An important part of any packet radio protocol is the means
by which many stations make efficient use of an RF channel,
achieving maximum throughput with minimum interference. The
basis for this time domain multiplexing is Carrier-Sensed
Multiple Access (CSMA) with collision detection and colli-
sion avoidance.

CSMA means simply that (as every Amateur knows) no station
will transmit if the frequency is in use. The MFJ-1278
continually monitors for the presence of an audio data
carrier on frequency and transmits only if there is no
carrier.   (The   RF carrier is not normally detected;
however, an input is available on the MFJ-1278 radio
interface connectors to allow such an input.) In order to
make detection of a busy channel more reliable, the MFJ-1278
sends an audio signal (continuous flags) any time the
transmitter is keyed and a packet is not being sent, as
during the transmitter keyup delay (TXDELAY), or while a
slow audio repeater is being keyed (AXDELAY).

By itself, CSMA is not enough to insure a minimum, or even
low, interference rate, due to the likelihood of simultan-
eous keyup by two or more stations. This is where collision
detection and collision avoidance come in.   The MFJ-1278
detects a collision by the absence of an ACK from the
station it is sending to.   The receiving station does not
acknowledge the frame that suffered the collision, since
either the FCS was incorrect or the packet was not heard.
There are other possible reasons for non-receipt of the
packet,   but the MFJ-1278's response is based on the
assumption of a collision.

After   transmitting a packet,   the MFJ-1278   waits   a
"reasonable" length of time (FRACK) for an acknowledgment.
"Reasonable" is determined by the link activity, frame
length, whether the packet is being digipeated, and other
time-related factors.   If no ACK is received, the packet
must be re-sent.   If the unACKed frame was lost due to a
collision, the assumption is that there is at least one
other packet station out there that also lost a frame and
will probably have exactly the same criterion for deciding
when to retry the transmission as this station is using.

In order to avoid a second collision, the collision avoid-
ance protocol calls for the stations retrying transmissions
to wait a random time interval after hearing the frequency
become clear before they key their transmitters. There must
be enough different random wait times to provide a reason-
able chance of two or more stations selecting different
values. The difference between adjacent time values must be
similar to the keyup time delay of typical stations on the
frequency. This is the time lapse after a station keys its
transmitter before other stations detect its presence on the
channel, and is a function of the keying circuitry of the
transmitter and the signal detection circuitry of the recei-
ver. We have chosen the random time to be a multiple (0-15)
of the transmitting station's keyup delay (TXDELAY). This
is reasonable if one's own keyup delay is similar to that of
other stations on the channel.

One other factor must be taken into consideration in optimi-
zing data throughput. The currently implemented link proto-
cols provide for relaying (digipeating) of packets. The
acknowledgment procedure for such packets is that the relay
station simply repeats packets without acknowledgment to the
sending station. The receiving station sends its ACK back
through the same digipeaters to the originating station.
Since the digipeated packets are not acknowledged to the
digipeater, an unsuccessful transmission must be retried
from scratch by the originating station. In order to help
alleviate the congestion of the frequency that tends to
result when digipeated packets suffer collisions, the digi-
peater is given first shot at the frequency every time it
becomes clear. Other stations, instead of transmitting as
soon as they hear the channel clear, must wait a short time
(DWAIT). This restriction applies to all stations except
the digipeater, which is permitted to transmit relayed pac-
kets immediately. This prevents digipeated packets from
suffering collisions except on transmission by the origina-
ting station.

A special time delay (RESPTIME) is used as the minimum wait
time prior to transmitting acknowledgment frames, to prevent
TNCs accepting data at high speed from the asynchronous port
from colliding with acknowledgment frames when fewer than
MAXFRAME packets are outstanding. The receiving TNC will
wait long enough before sending the ACK so that it will hear
the data packet which would have caused the collision, thus
avoiding a fairly frequent source of delay in versions of
AX.25 prior to 2.0.

Channel Flow Control

Flow control of data through the link is determined by the
rate at which data is being supplied to a sending TNC and
accepted from a receiving TNC.

A TNC receiving data from the link will send an RNR when the
next I frame successfully received will not fit into the
buffer for output to the serial port.

Whenever a TNC transmitting data received from the serial
port over the link runs out of temporary buffer space, the
serial port will be halted by an XOFF character or CTS
signal. In the MFJ-1278 implementation this happens
whenever there are 7 packets built and less than 210
characters left in the buffer for input from the serial
port.

When the TNC receiving data from the link clears out its
buffers, it sends an RR to the transmitting TNC. In order
to guard against the possibility of the RR being lost and
the link becoming permanently locked, the transmitting TNC
will periodically re-transmit the packet that provoked the
RNR. The receiving TNC will continue to respond with RNR
until it can accept the packet.

Table: A-1 HOOKUP FOR SPECIFIC RADIOS

MFGS. OR RADIOS	CONNECTOR TYPE	MIC. AUDIO To pin 1 of 1278	PTT To pin 3 of 1278	RX. AUDIO To pin 4 of 1278	GROUND To pin 2 of 1278
KENWOOD	4 pin	pin 1	Pin 2	Speaker	Pin 3,4
	5 pin	Pin 1	Pin 2	Speaker	Pin 4,5
	6 pin	Pin 1	Pin 2	Speaker	Pin 6
	8 Pin	Pin 1	Pin 2	Speaker	Pin 7,8
TR-2500	HTs	Tip-Lg.	Sleeve-Lg	Tip-Sm.	Sleeve-Sm
TR-x600	HTs	Ring-Lg.	Sleeve-Lg	Tip-Sm.	Sleeve-Sm
TH-x1xx	"	"	"	"	"
TH-x15	"	"	"	"	"
TH-x5	"	"	"	"	"
ICOM	4 pin	Pin 1	Pin 2	Speaker	Pin 4
	8 pin	Pin 1	Pin 5	Speaker or pin 8	Pin 6,7
	HTs*	Tip-Sm	Tip-Sm	Tip-Lg.	Sleeves
YAESU	4 pin	Pin 2	Pin 3	Speaker	Pin 1
	8 Pin	Pin 8	Pin 6	Speaker	Pin 7
FT-208	HTs	Pin 1	Pin 3	Pin 2	Pin 4
FT-x09	HTs*	Tip-Sm	Tip-Sm	Tip-Lg	Sleeves
FT-x3	HTs*	"	"	"	"
FT-727	HTs*	"	"	"	"

*:   Some ICOM and Yaesu HTs key the transmitter by comple-
ting the ground connection on the microphone. If your HT is
one that is noted in the above chart, you must follow the
instruction given in Chapter 3 of this instruction manual.

NOTE: The radio connection information listed in the above
chart is believed to be accurate. However, you should check
the accuracy of this information with the instruction manual
of your radio. MFJ Enterprises, Inc. is not responsible for
any inaccuracy of information listed in the above chart.

MODEM CALIBRATION

MFJ-1278 Modem is factory calibrated to operate all of the operation modes. If it becomes necessary to re-calibrate the modem, follow the following procedure:

Modulator and Demodulator Frequency Calibration

Two Modulator and Demodulator Calibration procedures are presented. Method I requires test equipment as noted. Method II does not require test equipment.

Method I

Test equipment required: DVM, frequency counter and oscilloscope.

For All Modes

1. After the cmd: prompt, enter the following command to change the MFJ-1278 to HP mode:

    MODE HP   <CR>

    MFJ-1278 responds:

    RADIO: 1   TERMINAL: 4800
    MODEM: HF PACKET, 300
    CMD:

2. Type: **CALSET 32**   <CR>

    MFJ-1278 responds:
    cmd:

3. After the cmd: prompt, enter the following to set the frequencies:

    CALI   <CR>

4. Place the frequency counter probe at pin 1 of JMP 9.

5. Push on a jumper at JMP 4 and JMP 7.

6. Press the "K" key on your computer or terminal (no carriage return is needed for this command).

7. Verify that the voltage on pin 9 of U16 is +5 Vdc.   If
    it is -5 Vdc instead of +5 Vdc, push the space bar.
    The voltage should alternate between +5 Vdc and -5 Vdc
    each time the space bar is pressed. Set this point to
    +5 Vdc.

8. Adjust R105 for a frequency reading of 2310 Hz, +/- 2
    Hz.

9. Press the space bar once and adjust R106 for a
    frequency reading of 2110 Hz, +/- 2 Hz.

10. Type Q

    MFJ-1278 responds with CMD: and DCD, PTT, and CON LEDs
    extinguish.

11. Type:

    RXCAL   <CR>

    MFJ-1278 responds with PTT & CON LEDs or STA LEd lit.

12. Set the TIME/DIV. scale on your scope to 1 ms/div and
    the Volt/Div scale to 5 V/div. Connect scope probe to
    the left pin of JMP 10.

13. Adjust R113 so that the signal on the scope shows a 50%
    duty cycle square wave. The square wave should be
    uniform in width (i.e. high time = low time).   Pulse
    duration of the high time and low time is approximately
    2.4 Ms. CON STA LED's may blink simultaneously.

14. Adjust R212 so that the 10th segment of the tuning
    indicator from left is lit.

15. Type:

    Q.

    MFJ-1278 responds with CMD: prompt and DCD, PTT and CON
    LEDs extinguish.

16. Type:

    TUNEPROC   <CR>

    MFJ-1278 will respond with:

    "Install loopback, begin transmit tone alignment. R139
    for 850 Hz."

    Note: "loopback" is JMP 7, which you have already

installed.   Adjust R139 for 850 Hz, +/- 2 Hz.

17. Press RETURN key on the computer keyboard and adjust R138 for 1500 Hz, +/- 2 Hz.

18. Press RETURN key and adjust R78 for 1300 Hz, +/- 2 Hz.

19. Press RETURN key and adjust R77 for 2100 Hz, +/- 2 Hz.

20. Press RETURN key and adjust R122 for 2125 Hz, +/- 2 Hz.

21. Press RETURN key and adjust R119 for 2975 Hz, +/- 2 Hz.

22. Press RETURN key and adjust R115 so that the 10th segment from left of the tuning indicator is lit.

23. Press SPACE BAR, MFJ-1278 will respond:

Multilevel XMIT....1550.

24. Adjust R307 for a reading of 1550 Hz, +/- 1 Hz.

Note: For steps 25 thru 38 the frequency readings on the frequency counter should be compared to the frequency readouts indicated by the MFJ-1278.   Note that the difference in the two readings can be as much as 20 Hz, this is normal.

25. Press RETURN key, MFJ-1278 display frequency: 1600 Hz, +/- 20 Hz.

26.	"	: 1650 Hz,	"
27.	"	: 1700 Hz,	"
28.	"	: 1750 Hz,	"
29.	"	: 1800 Hz,	"
30.	"	: 1850 Hz,	"
31.	"	: 1900 Hz,	"
32.	"	: 1950 Hz,	"
33.	"	: 2000 Hz,	"
34.	"	: 2050 Hz,	"
35.	"	: 2100 Hz,	"
36.	"	: 2150 Hz,	"

37.   "   : 2200 Hz,   "

38.   "   : 2250 Hz,   "

39. Press the RETURN key. MFJ-1278 will display:

Multilev Demod
1550 Hz: 53
53

Note that the "53" on the third line will fluctuate
between 50 to 59. This is normal.

40. Press the RETURN key. MFJ-1278 will display:

Multilev Demod
2250 Hz: 35
35

Note that the "35" on the third line will fluctuate
between 30 to 40. This is normal.

Steps 39 and 40 test the ability of the MFJ-1278 to transmit
tones from the add-on multi-level board at 1550 Hz and then
2250 Hz. These two tones are looped back thru JMP 7 and are
received by the MFJ-1278 by a counting process thru U20, U8a
then to the SIO. These counts are displayed on the screen
not in Hz but with numbers, like "35" or "40" etc.

DEMODULATOR ALIGNMENT: For steps 41 and 42, turn trimpot
called for until 10th LED is lit.

41. Press RETURN key and adjust R79 so that the 10th
     segment from left of the tuning indicator is lit.

42. Press RETURN key and adjust R114 so that the 10th
     segment from left of the tuning indicator is lit.

43. Remove the frequency counter probe.

This completes the Modulator and Demodulator frequency
calibration.

Method II

MFJ-1278 Modulator and Demodulator Calibration with CALSET.

This procedure is a three step process. The three steps are:

1. Center the modulator tones over the required modem center frequency (Fc).

2. Align the demodulator center frequency.

3. Align the tuning indicator.

NOTE: ALL THREE STEPS SHOULD BE PERFORMED IN THE ABOVE ORDER!

If they are not all done at the same time, or in the correct order, the modem may not be receiving and transmitting on the same frequency, and the tuning indicator may not indicate properly.

The third step, alignment of the tuning indicator, should only be used in conjunction with alignment of the 300 baud 200 Hz shift demodulator.

The other AFSK modems available in the MFJ-1278 can be aligned using exactly the same steps presented here but substituting the appropriate part numbers for the adjustments. However, do NOT align the tuning indicator to anything but the 300 baud 200 Hz shift HF packet modem.

Comprehensive Alignment Procedure

It is important that the tuning indicator alignment be optimized for the 300 baud 200 Hz shift HF packet modem. It will indicate correctly for all other modes when aligned for the HF packet modem.

As described elsewhere in this manual, the exact configuration of your radio's filters and whether it has IF shift or not will determine the exact required center frequency for the modem. Once the required center frequency has been determined, the modem calibration can be carried out.

NOTE! It is essential that the modulator tones be properly aligned FIRST as they will be used to align the demodulator center frequency.

Set the modulator tones to Fc MINUS 1/2 of the shift for the low tone and Fc PLUS 1/2 of the shift for the high tone.

For the 200 Hz shift 300 baud modem used for HF packet this
would be Fc + 100 Hz for the high tone and Fc - 100 Hz for
the low tone.

Set Modulator Tones Using Built-in Calibration Software

1. Make sure that the modem and TNC are both configured for
    200 Hz shift 300 baud operation. This is done by typing
    "MODE HP <CR>" from the command prompt on the MFJ-1278.

2. Place a push on jumper at JMP 4.

3. Place a push on jumper at JMP 9, pins 1 and 2.   This
    connects the modulator square wave output to the SIO
    chip so that the CPU can measure the tone frequency for
    you.

4. Type   "CALSET n <CR>".   Where n is a number determined
    by:

$$n = INT [525000 / F(low)] + 1$$

    This tells the CPU what tone frequency you are trying to
    achieve.

    A table of CALSET numbers to use for the various
    "standard" modem tone frequencies will be included at
    the end of this procedure.

5. Command the MFJ-1278 into calibrate mode by typing "CALI
    <CR>".

6. Command the MFJ-1278 to key the modem by typing "K".

7. Select the low tone by pressing the space bar until a
    voltmeter connected to U16, pin 9 reads - 5 volts.

8. Adjust R106 carefully until both the "CON" and "STA"
    LEDs on the front panel of the TNC are lit.

9. Type a "Q". This exits the MFJ-1278 from calibrate mode
    to command mode.

10. Type   "CALSET n <CR>". Where n is a number determined
    by:

$$n = INT [525000 / F(high)] + 1$$

11. Command the MFJ-1278 into calibrate mode by typing "CAL
    <CR>".

12. Command the MFJ-1278 to key the modem by typing "K".

13. Select the high tone by pressing the space bar until a
    voltmeter connected to U16, pin 9 reads + 5 volts.

14. Adjust R105 carefully until both the "CON" and "STA"
    LEDs on the front panel of the MFJ-1278 are lit.

15. Remove the jumper placed at JMP 9.

This completes the modulator tone alignment using the built
in calibration facility.

Now that the modulator tones have been properly centered
over the intended modem center frequency (Fc), the
demodulator center frequency will be aligned.

Demodulator Center Frequency Alignment

1. Place push on jumpers at JMP 4 and JMP 7 if they are not
    already in place.

2. Remove jumper at JMP 9 if it is still in place.

3. Set the baud rate for use by RXCAL to 300 baud by typing
    "CALSET 32 <CR>". This will cause the modulator to send
    a square wave FSK signal when RXCAL is invoked. CALSET
    8 should be used if you are aligning the 1200 baud wide
    shift packet demodulator.

4. Command the MFJ-1278 to do a demodulator calibration by
    typing "RXCAL <CR>".

5. CAREFULLY adjust R113 until the DCD LED on the front
    panel is fully illuminated.

    NOTE! The threshold control on the MFJ-1278 must be set
    to a position which will allow the DCD circuit to
    function properly. A setting approximately 1/3 to 1/2
    of the total range starting from maximum CCW should be
    adequate.

    Continue to VERY CAREFULLY adjust R113 until the STA and
    CON LEDs on the front panel either change state very
    slowly (alternate which one is lit) or until both are
    simultaneously illuminated.

    NOTE! This is a very critical adjustment and it is
    unlikely that you will be able to cause both LEDs to be
    turned on simultaneously for longer than a very brief
    instant.

6.   Return the MFJ-1278 to command mode by typing a "Q".

This completes demodulator center frequency alignment using
the built in calibration facility.

Now that the demodulator and modulator are properly aligned
to one another, the tuning indicator can be set for proper
center indication.

Tuning Indicator Alignment

This procedure adjusts the tuning indicator so that it
correctly indicates when a signal is properly tuned in
relation to the demodulator center frequency.

     NOTE! The tuning indicator should ONLY be adjusted in
     reference to the 300 baud 200 Hz shift modem used for HF
     packet and RTTY. If adjusted for this modem, It will
     indicate with sufficient accuracy for all other modes.

1.   If you have not just finished aligning the modem as per
     the above instructions, do so now. Otherwise you may be
     aligning the tuning indicator to an incorrect setting.

2.   Install push on jumpers at JMP 4 and JMP 7 if they are
     not still in place from the modem alignment procedure.

3.   Command the MFJ-1278 into calibrate mode by typing "CAL
     <CR>".

4.   Command the calibration routine to send 50 percent duty
     cycle square wave data from the modulator by typing "D".

5.   Command the MFJ-1278 to key the modem by typing "K".

6.   While observing the LEDs in the tuning indicator, adjust
     R212 in the tuning indicator area so that either the
     10th   or 11th led from the left (or   both)   are
     illuminated.

7.   Return the MFJ-1278 to command mode by typing "Q".

8.   Remove jumpers at JMP 4 and JMP 7.

This completes the tuning indicator alignment.

Now the modulator, demodulator, and tuning indicator are all
aligned to the same center frequency. If you notice that on

the air reports suggest that you are transmitting and
receiving on significantly different frequencies after
successfully completing the above alignment procedure, it is
possible that the radio needs realignment. Many different
transceivers for HF are capable of being misaligned due to
reference oscillator crystal aging or careless alignment by
amounts exceeding 500 Hz. RIT inadvertently left on can
also cause hard to detect problems in this area. Reliable
HF packet communications requires that the frequency error
presented to the demodulator be below 30 Hz. If several
stations are to successfully share a single channel,
transmitter / receiver offsets larger than this will be
intolerable.

MFJ-1278 Adjustment Location Map

This is a map of the physical locations of the adjustment
potentiometers on the MFJ-1278 circuit board. They are
shown as they appear when looking down on top of the board
with the board oriented so that the rear panel connectors
are to the left. Information in the boxes is organized as
shown below.

PART   MODE
CALSET   #

DEMODULATOR

PART MODE H/L	PART MODE H/L
FREQ / CALSET	FREQ / CALSET

MODULATOR

R113   HP
CALSET   32

R114   VB
CALSET   32

R79   VP
CALSET   8

R115   CW
NO CALSET SEE NOTE

R106 HP L	R77 VP H
2110 250	2100 250

R122 VB L	R105 HP H
2125 248	2310 228

R78 VP L	R119 VB H
1300 404	2975 177

R138 SSiV H	R129 MCW
1500 351	850 618 SEE NOTE

NOTE!   Separate procedure required to do alignment of CW
demodulator center frequency.

NOTE!   CW receive through a narrow
filter for HF CW operation will require the CW
demodulator center frequency to be selected to
align with the radio's filter passband. MCW
operation on VHF FM will require that both stations

have both the modulator tone and demodulator center
frequency to the same frequency.

Calset Values for Various Modulator Tone frequencies

Tone	CALSET #	Adjust	Modem / Remarks
2110	250	R106	HF Packet & RTTY
			Fc = 2200 Hz
2310	228	R105	200 Hz shift
1300	404	R78	Packet / Fc = 1700 Hz, 800 Hz shift. CCITT V.23 std., preferable for HF 1200 baud, works
2100	250	R77	well on VHF FM too.
1200	438	R78	Packet / 1000 Hz shift standard. Too wide to fit comfortably through SSB filters for linear
2200	240	R77	mode 1200 baud use
2125	248	R122	VHF RTTY
			Fc = 2550 Hz
2975	177	R119	850 Hz shift
750	701	R139	CW
775	678	R139	CW
800	657	R139	CW
825	637	R139	CW
850	618	R139	CW / SSTV
1500	351	R138	SSTV
2178	242	R122	HF RTTY/ASCII/AMTOR
			Fc = 2220 Hz
2263	233	R119	85 Hz shift.

MFJ-1278 CW Modem Tune-up Procedure

The CW modem in the MFJ-1278 is fundamentally different from
the other modems. It is NOT an AFSK modem. It sends
and receives only 1 tone. For this reason, it
requires a different alignment procedure than the others.

    NOTE! If the modulator AND demodulator are not EXACTLY
    on the same frequency for BOTH stations involved in
    VHF FM MCW operation, CW receive will be degraded if
    not eliminated.

    NOTE! If the DEMODULATOR is not EXACTLY centered in
    the receiver's CW filter passband, CW receive
    performance through a narrow filter will be
    degraded. Also, the demodulator will likely not be
    receiving on the transmitted signal frequency.
    This note is for the HF direct keyed radio case (NOT
    MCW via SSB transmitter microphone audio which is
    discouraged).

Since MCW operation is primarily intended to provide a
means to transmit code practice and not for CW
reception, the demodulator center frequency may be set
to a different frequency than the modulator without
penalty in most cases. Typically, the modulator will be
set to 850 Hz, and the demodulator will be set to whatever
frequency is dictated by the HF radio with which it is to
be used.

The CW demodulator can be used without a narrow filter in
the radio. It will of course be subject to more noise and
QRM in this case. The tuning range for the demodulator will
be VERY restricted even though the wide filter is used in
the radio since the demodulator itself acts as a very narrow
filter.

An oscilloscope will be required to adjust the demodulator
to a 50 percent duty cycle square wave output. The main
difference when aligning the CW modem is that there will be
only 1 continuous tone presented to the demodulator for this
adjustment.

Tuning the CW modem is basically a 4 step procedure.
The steps should be followed in the order presented. The
steps (in broad outline) are:

1. Determine the required demodulator center frequency
    (Fc) for the radio you intend using in the direct keyed
    CW mode.

2. Set the CW modulator tone to this frequency.

3. Set the demodulator center frequency using the modulator
    tone as reference.

4. Set the modulator tone to 850z.

Detailed CW Demodulator Alignment Procedure

1. Determine the required Fc for the demodulator.   If the
    radio has a narrow filter for CW, one of the 2 methods
    presented   elsewhere in this manual should be used to
    determine the filter center frequency.   This frequency
    should be used for Fc.   If the radio has no narrow CW
    filter, use the CW carrier offset frequency of the
    radio.   This information should be available in the
    radio manuals.

2. Set the modulator tone to the required Fc using the
    following procedure.

    a. Command the MFJ-1278 into MCW mode by typing
        "MODE MC <CR>".

    b. Install push on jumper at JMP-4.   This is the
        watchdog timer defeat jumper.

    c. Place a push on jumper at JMP 9, pins 1 and 2. This
        connects the modulator square wave output to the SIO
        chip so that the CPU can measure the tone frequency
        for you.

    d. Type   "CALSET n <CR>".   Where n is a   number
        determined by:

        $$n = INT [525000 / F(low)] + 1$$

        This tells the CPU what tone frequency you are
        trying to achieve.

    e. Command the MFJ-1278 into calibrate mode   by
        typing "CAL <CR>".

    f. Command the MFJ-1278 to key the modem by typing "K".

    g. Select the MCW tone by pressing the space bar until
        a voltmeter   connected to U16, pin 9 reads + 5
        volts.   This   signal   is   more   conveniently
        available at   the junction of Q12 collector and
        R62.

    h. Adjust R139 carefully until both the "CON" and "STA"
        LEDs on the front panel of the MFJ-1278 are lit.

      i. Remove the jumper placed at JMP 9.

      j. Return the MFJ-1278 to command mode by typing "Q".

3. Align the demodulator to Fc using the MCW tone. Use the following procedure.

      a. Place a push on jumper at JMP 7. This connects the modulator output to the demodulator input.

      b. Place a scope probe on left pin of JMP 10 (pin closest to Q 14). The oscilloscope will be used to indicate when the square wave that will appear at this point during the adjustment procedure approaches 50 percent duty cycle.

      c. Command the TNC into calibrate mode by typing "CAL <CR>".

      d. Command the TNC to key the modem by typing "K".

      e. Select the MCW tone by pressing the space bar until a voltmeter connected to U16, pin 9 reads +5 volts. This signal is more conveniently available at the junction of Q12 collector and R62.

      f. Turn R115 fully clockwise, until a click can be heard from turning the pot.

      g. Now begin to rotate R115 CCW slowly. Watch the scope while rotating R115. A stable square wave should appear between about turn 4 and turn 9. Which turn on the pot where you find the spot that produces a stable square wave may vary from unit to unit. There are only about 1 to 2 turns where the square ware will appear on the scope.

      h. Adjust R115 so the square wave displayed has a 50 percent duty cycle. Note that when R115 is adjusted properly, the period of the square wave should be about 0.66 milliseconds.

NOTE! If you have a square wave on the scope face but the tuning indicator is not near center, you are on a false setting. Adjust R115 so that the tuning indicator is near center and THEN set the square wave duty cycle.

4. If MCW transceive operation with another station is desired, do the above procedure to BOTH MFJ-1278s using an agreed upon frequency for Fc. Then leave the

modulator   tone   on the agreed on frequency   with   the demodulator Fc.

5. Remove jumpers placed at JMP 4 and JMP 7.

This completes the CW modem alignment procedure.

AUDIO OUTPUT CALIBRATION

The transmit audio output levels of MFJ-1278 Radio Port 1 and Radio Port 2 both are factory set to 250 mV. If it is necessary to set either one of the radio port output to a different level necessary to drive your radio, you should follow the procedure given in this appendix.

Note that the output levels of radio port 1 and radio port 2 are set independently. Adjust R157 for radio port 1 and R158 for radio port 2. Both controls are accessible from the outside thru screw driver adjustment holes on the left side of the MFJ-1278. It is not necessary to remove the cover.

Most often audio output level of the MFJ-1278 can be set simply by monitoring the transmitting audio with a connecting station. However, if you require a more precise setting or making the adjustment without an on-the-air test, then use the procedure given here.

Audio Output Level Adjustment Procedure

1.   After the cmd: prompt sign, set the MFJ-1278 to VHF packet mode by typing:

   MODE VP   <CR>

2.   Verify that you are connected to radio port 1, type:

   RADIO 1   <CR>

3.   Enter: CALI   <CR>

4.   Press the "K" key. The PTT LED should illuminate.

5.   Place the oscilloscope probe at JMP 7.

6.   Signal on the scope should be approximately 1 volt p-p.

7.   Verify that the voltage on pin 9 of U16 is -5 Vdc. If it is +5 Vdc instead of -5 Vdc, push the space bar. The voltage should alternate between +5 Vdc and -5 Vdc each time the space bar is pressed. Set this point to -5 Vdc.

8.   Move the probe to J9 pin 1 (TX audio). Adjust R157 for a signal of 250 mV p-p or to a level recommended by your radio instruction manual.

9. Move the probe to J9 pin 4 (RX audio). The signal should be approximately 1 V p-p.

10. Press the space bar and again measure the peak to peak voltage at J9 pin 4. The audio level should not change. (Both mark and space audio should be at the same level.)

11. Type:

    Q

    the cmd: prompt appears on the screen.

12. Switch to radio port 2 by typing:

    RADIO 2 <CR>

13. MFJ-1278 responds:

    cmd:

14. Enter: **CALI**   <CR>

15. Press the "K" key. The PTT LED should illuminate.

16. Verify that the voltage on pin 9 of U16 is -5 Vdc. If it is +5 Vdc instead of -5 Vdc, push the space bar. The voltage should alternate between +5 Vdc and -5 Vdc each time the space bar is pressed. Set this point to - 5 Vdc.

17. Place the scope probe on J2 pin 1 (TX audio). Adjust R158 for a signal of 250 mV p-p or for a level recommended by your radio instruction manual.

18. Move the scope probe to J2 pin 4 (Rx Audio). the voltage should be approximately 1 V p-p.

19. Press the space bar and again measure the peak to peak voltage at J2 pin 4. The audio level should not change. (Both mark and space audio should be at the same level.)

20. Type:

    Q   <CR>

21. Remove the jumper from JMP 4.

22. Switch SW1 to the OFF position.

.HF RADIO ALIGNMENT

If you have determined that it is necessary to realign the MFJ-1278 modem center frequency to your radio filter center frequency, one of the following 2 methods should be used to make the radio filter center frequency (Fc) determination. Both methods require access to a frequency counter capable of measuring audio frequencies to a resolution of 1 Hz. Almost any frequency counter should be capable of this.

First method: NOISE AVERAGE FREQUENCY

This method also requires an active noise source like a receiver noise bridge. There are several suitable units available for this purpose.

1. Set the receiver to LSB mode with the 500 Hz filter selected.

2. Connect the noise source to the receiver input. Make sure there is no antenna connected to the system and that the receiver is tuned to a frequency which is free of coherent internally generated signals (birdies).

3. Set the noise source output for a reading of approximately S-9 on the receiver S meter.

4. Connect the counter to the receiver audio output

5. Adjust the receiver output level for enough audio to reliably trigger the counter.

6. Make sure the radio's IF shift control, if one is present, is in its proper position (centered or on detente).

7. Record the frequency indicated by the counter. The counter should indicate the average frequency of the noise spectrum passed by the filter in the receiver and translated to audio by the product detector. This will be the frequency used for the modem center frequency (Fc).

NOTE: If the counter is a phase locked loop (PLL) based prescaling type, its PLL may not lock properly to the noise signal. If this is the case, use method 2 below. If your counter can resolve 1 Hz with a counting gate time of less than 1 second, it is a PLL prescaling counter.

Second method: FILTER SKIRT AVERAGE FREQUENCY

1.   Set the receiver to LSB mode with the 500 Hz filter
      selected.

2.   Make sure the radio's IF shift control, if one is
      present, is in its proper position (centered or on
      detente).

3.   Using either a signal generator or a stable, relatively
      strong   carrier from an AM broadcast transmission
      (preferably ground wave signal), tune the receiver so
      that the carrier falls near the center of the filter
      passband.   Choose   a   signal level near S-9 for this
      test.   If your rig has a built in   calibration
      oscillator, this is a good source for this signal.

4.   Slowly and carefully tune the receiver so that the tone
      frequency is decreasing.

5.   Find the point where the signal is reduced by 1 S-UNIT
      from the peak value reached near the center of the
      filter passband.

6.   Measure this tone frequency with the counter.   Record
      this value as F(low).

7.   Slowly and carefully tune the receiver so that the tone
      frequency is increasing.

8.   Find the point where the signal is reduced by 1 S-UNIT
      from the peak value reached near the center of the
      filter passband.

9.   Measure this tone frequency with the counter.   Record
      this value as F(high).

10.   Calculate the required modem center frequency as:
                    Fc = [F(low)+F(high)]/2

Once the required center frequency has been determined, the
modem calibration can be carried out.

NOTE: It is essential that the modulator tones be properly
      aligned FIRST as they will be used to align the
      demodulator center frequency.

Set the modulator tones to Fc MINUS 100 Hz for the low tone
and Fc PLUS 100 Hz for the high tone using the procedure
given in the owners manual.   Align the demodulator to
the modulator tones using the built in demodulator alignment
facility   invoked with the RXCAL command described Appendix
B of this manual.

CONVERTING THE MFJ-1278 TO "LIKE-TNC 2"

With a simple modification as described in APPENDIX E,   the
MFJ-1278 can be converted to a "like TNC 2" controller.
Once converted, the MFJ-1278 can run programs such as
NET/ROM (tm), THE NET (tm) and other special firmware which
are developed for the TNC 2. The modification described
below sets the MFJ-1278 into a "like" TNC 2 mode. What this
means is the MFJ-1278 will work like a TNC 2.   MFJ-1278
will be set to operate 1200 baud VHF packet.   Radio   port
will be set to port No.1. Terminal baud rate will be set by
the AUTOBAUD routine which is 300, 1200, 4800 or 9600 baud.

The modification involves in replacing IC U27 and U28 with
pre-programmed header as shown in Figure E-1 and Figure E-2
below. Firmware EPROM, U23 will be replaced by an EPROM
which contains program such as NET/ROM, THENET etc.

Modification of MFJ-1278 for "Like" TNC 2 operation involved
making it to default 4800 baud for the terminal baud rate,
1200 baud radio baud using VHF packet tones on Radio Port 1.
The procedure is as follow:

1.   Remove power from the MFJ-1278.

2.   Construct **Header** U27 by connecting pins 9, 12, 16 and
     19 to ground at pin 10. Connect pins 2, 5 and 15 to +5
     Volts at pin 20. See Figure E-1 below.
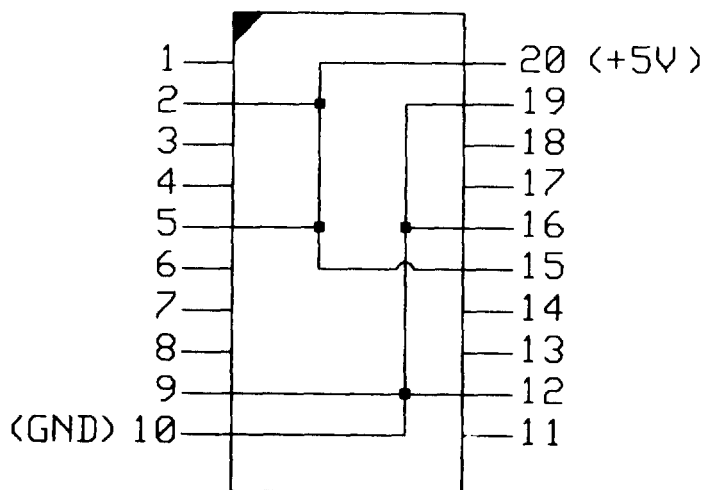
Fig. E-1: Header U27

3. Construct Header U28 by connecting pins 2, 5, 6, 12, 15
    and 19 to ground pin 10. Connect pins 9 and 16 to +5
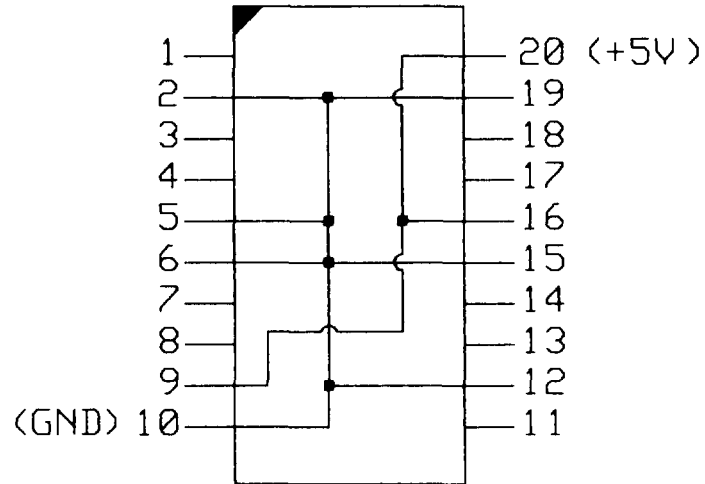   Volts at pin 20. See Figure E-2 below.

Fig.   E-2: Header U28

4. Remove U27 on the MFJ-1278 PC board and replace it with
    Header U27.

5. Remove U28 on the MFJ-1278 PC board and replace it with
    Header U28.

6. Set the terminal program parameter as specified by the
    NET/ROM documentation.

Upon power on the MFJ-1278 should signed on like a TNC 2 and
it is ready to operate NET/ROM or other TNC 2 firmwares.

MFJ-1278 2400 PACKET OPERATION

If your MFJ-1278 does not have the 2400 modem, an optional
modem (MFJ-2400) can be purchased and installed.
Installation is simple; your MFJ-1278 is equipped with all
connectors necessary to make this installation without
modification or soldering.

With the 2400 modem installed, your MFJ-1278 is capable of
operating 300, 1200 or 2400 baud packet. 300 baud and 1200
baud packet are not affected by the installation of the 2400
modem.

The addition of the 2400 modem feature will in no way
require any internal modification to your transceiver.

2400 Packet Operation Setup

All default parameters set for 1200 packet operation can be
used for the 2400 operation. 2400 operation needs no
unusual setup or parameter changes. There are however, some
changes that can be made later to the MFJ-1278 parameters
which will enable you to improve the speed the throughput
performance of the 2400 operation. The "honing" of the
parameters may not seem like much, but we have found that at
2400, the MFJ-1278 seems to be more responsive to the
TXDELAY, DWAIT, RESPONSE and SLOTTIMES. When using direct
connects and good paths, the MAXFRAME and PACLEN commands
can be increased to allow larger packets to be moved during
each transmission. When returning to the active thru-put
frequencies, these two commands should be reduced to their
original settings. You may find that if you were using a
TXD of 50, then a TXD of 40 will now perform better. The
DWAIT can be shortened or lengthened to suit the AGC
recovery time of your radio. For instance, if you have been
running the DWAIT of 16, it may now perform better at DWAIT
of 12 or even 10. The FRACK will appear to exercise more at
2400.

2400 really shows its place in the packet world when used to
pass large ASCII, BINARY and PICTURE files. It is always
good to use clear frequency and/or use direct connects to
the target station rather than going thru a node or
digipeater. The reason is obvious. There are few 2400
nodes at the present time. However, it should be pointed
out that implementation of a 2400 node is just as easy as
building and using a 1200 node.

To select 2400 packet operation, under the CMD: command
prompt, type:

MODE VP,2400

MFJ-1278 will be set to 2400 packet operation.   TURBO LED
will light. 2400 packet can be operated with Radio Port 1
or Radio Port 2 on the MFJ-1278.   Note that if your MFJ-
1278 is not equipped with the 2400 modem, TURBO LED will not
function and you will not be able to operate 2400 packet.

Receive Audio Setting

The MFJ 2400 modem employs automatic gain control (AGC) for
its receive audio. The receive is pre-set for proper 2400
operation; no adjustment is necessary in most cases. If you
set the receive audio of your radio properly for 1200
operation, then it will be suitable for the 2400 operation
also. No adjustment for the receive audio on the 2400 modem
board is needed.

Transmit Audio Setting

Transmit audio on the 2400 board is set by adjusting R38
(next to T2) on the 2400 modem board. Transmit audio for
the 1278T is pre-set at the factory to match the audio
level of the 1200 modem on the MFJ-1278 mother board.   Once
the 1200 and the 2400 transmit audio are set to the same
level, then you may adjust the audio level going into your
radio by using the "Transmit Audio" controls on the left
side of the MFJ-1278.   Note that these controls set the
transmit audio levels for all the operation modes of the
MFJ-1278, including the 2400 packet operation.

JUMPER FUNCTIONS AND LOCATIONS

The MFJ-1278 mother board has many jumper connectors.   Each
jumper connector has special function.   The **Jumper Function**
chart in this appendix identify each jumper function. **Figure
G-1** will help in locating the jumper connector easily.

For normal operation a shorting jumper must be placed on the
following connectors: JMP 5; JMP 8; JMP 9; JMP 13; JMP 14 -
pin 1,2; JMP 16 - pin 1,3 - pin 2,4 and on J4 -pin 11,12 -
pin 13,14 - pin 17,18.

Table G-1: Jumper Function

Jumper #	Position	Function
JMP1	Pin 1 & 2 Pin 2 & 3 OFF (default)	!DCD (RS-232C) stays on !DCD (RS-232C) stays off !DCD reflects connect status
JMP2	Pin 1 & 2 (default) Pin 2 & 3	4.92 MHz CPU clock 2.46 MHz CPU clock
JMP4	ON OFF (default)	disable Tx watch-dog enable Tx watch-dog
JMP5	ON (default) OFF	Lithium battery connected Lithium battery disconnected
JMP6	NOT used	
JMP7	ON OFF (default)	analog loopback mode normal modem operation
JMP8	ON (default) OFF	demodulator enabled demodulator calibrate
JMP9	Pin 1 & 2 Pin 2 & 3 (default)	calibrate U16 tones normal modem operation
JMP10	ON OFF (default)	digital loopback mode normal modem operation
JMP11	LEFT RIGHT (default)	transmit data NRZ transmit data NRZI
JMP12	Pin 2 & 3 Pin 1 & 2 (default)	16k RAM (2 x 6264) 32k RAM (1 x 43256)

Jumper #	Position	Function
JMP13	ON (default)	TTL, RTS enable
	OFF	TTL, RTS disable
JMP14	Pin 1 & 2 (default)	FSK out normal
	Pin 2 & 3	FSK out reverse
JMP15	Pin 1 & 2	U23 is 27C256 type
	Pin 2 & 3 (default)	U23 is 27C512 type
JMP16	Pin 1 & 2	Without multi-gray levels
	Pin 1 & 3 (default)	With multi-gray levels
	Pin 2 & 4 (default)	With multi-gray levels
JMP17	Pin 1 & 2	2400 baud ext. modem clock
	Pin 2 & 3 (default)	9600 baud ext. modem clock
JMPA	ON	without multi-gray levels
	OFF(default)	with multi-gray levels
JMPB	ON (default)	on board transmit low tone
	OFF	out board transmit low tone
JMPC	ON	external DCD enabled
	OFF (default)	external DCD disabled
JMPJ	ON	TX audio has flat response
	OFF (default)	TX audio 6db/oct pre-emphasized
JMPK	ON	TX audio loopback to PTT
	OFF (default)	(for Radio Port 2)
JMPL	ON	TX audio loopback to PTT
	OFF (default)	(for Radio Port 1)
JMPR	ON	Analog audio loopback
	OFF (default)	(for Radio Port 1)
JMPS	not used	
JMPX	ON (default)	Speaker Transmit Tone Enable
	OFF	Speaker Transmit Tone Disable
JMPY	ON (default)	Speaker Receive Tone Enable
	OFF	Speaker Receive Tone Disable
JMPZ	ON (default)	Speaker Connect Tone Enable
	OFF	Speaker Connect Tone Disable
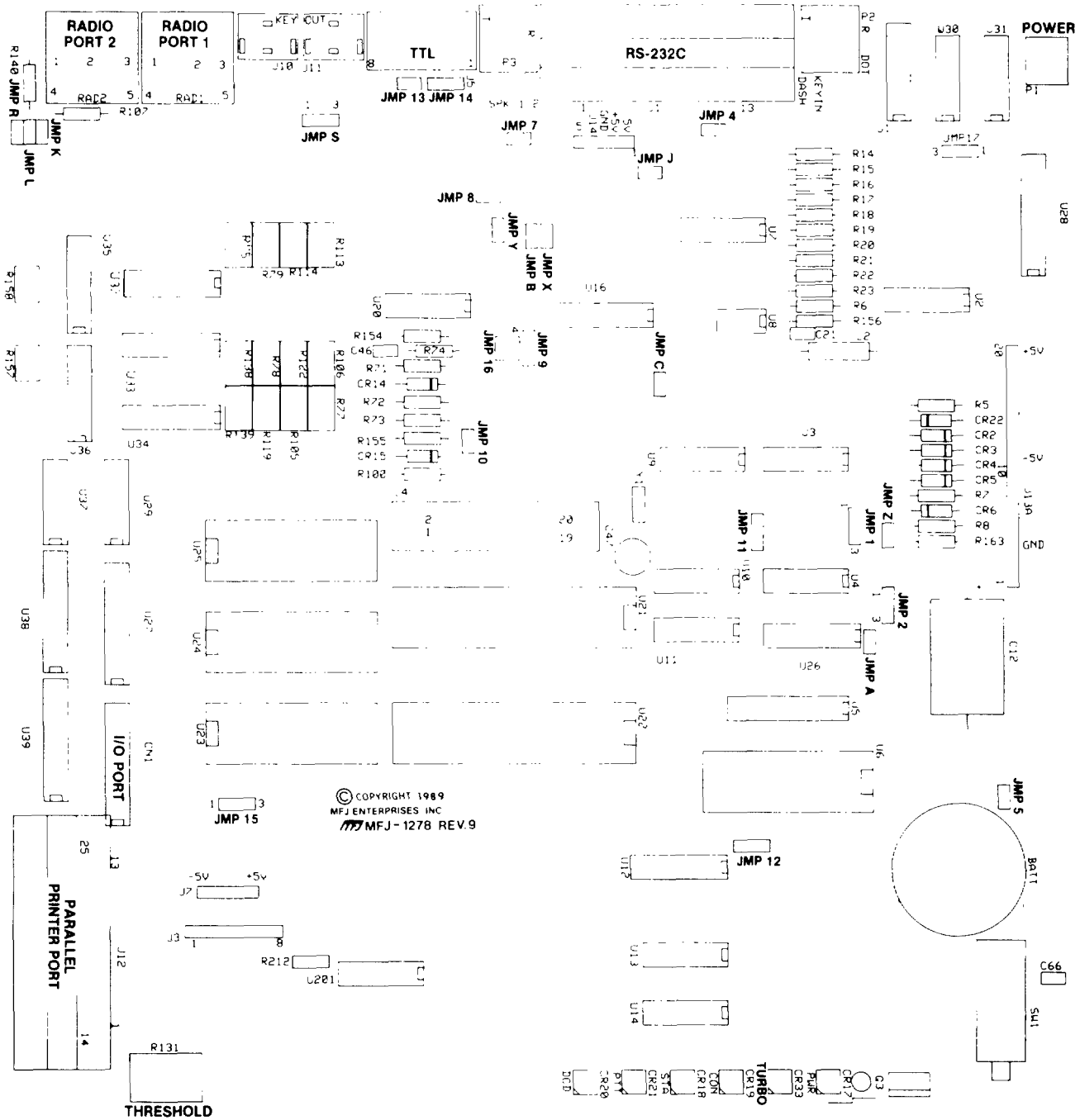
Fig. G-1: Jumper Connector Location

COMMAND SUMMARY

Command	Parameter	Default	Mode	Function	Page
8BITCONV	ON|OFF	off	Packet	Enables transmission of 8-bit data in converse mode	6-5
8LEVELS	ON|OFF	off	FAX/SSTV	Enables MFJ-1278 to operate 8 gray levels in FAX and SSTV modes.	6-5
AALT	ON|OFF	off	AMTOR	Enables the alternate SELCALL set by the ALTCALL command in mode A ARQ.	6-6
ACKPRIORITY	ON|OFF	on	Packet	Permits an acknowledging TNC to transmit without regard to slotting delay.	6-6
ACKTIME	n	30	Packet	Controls a delay that occurs whenever any packets that have been received are not addressed to that unit.	6-6
ALOCKCHAR	nn	$15 (^U)	CW/MCW	Character used to force the MFJ-1278 to match its transmit speed to that of the incoming signal.	6-7
ALTCALL	ssss	blank	AMTOR	Sets an alternate SELCALL that the MFJ-1278 responds to in AMTOR mode A.	6-7
ANSBSTR	cccc	blank	AMTOR	Enables the MFJ-1278's response to a "Who Are You?".	6-7
ARCVCHAR	nn	$12 (^R)	RTTY/CW/ ASCII	Specifies the character used to return to receive after transmitting.	6-8
ARQ	ssss	I-command	AMTOR	Initiates mode A "ARQ" connection.	6-8
ASENDCHA	nn	$14 (^T)	RTTY/CW/ ASCII	Specifies the transmit character.	6-8
ASPECT	n	2	FAX	Sets a reasonable aspect ratio between the Hor/Ver. representation of the FAX picture.	6-9
AUTOBAUD	ON|OFF	on	All	Enables the autobaud function which matches MFJ-1278 terminal baud rate to terminal program baud rate.	6-10
AUTOLF	ON|OFF	on	Packet	Determines the way the <CR> characters are displayed.	6-11
AUTOTRAC	ON|OFF	on	CW/MCW	Automatically locks onto the incoming cw signal and displays the speed.	6-11

Commands	Parameter	Default	Mode	Function	Page
AWLEN	n	8	All	Defines the word length used by the MFJ-1278's RS-232 port.	6-12
AX25L2V2	ON¦OFF	on	Packet	Determines the use of AX.25 Level 2 Ver. 2 or Ver. 1 Protocol.	6-13
AXDELAY	n	0	Packet	Sets the voice repeater keyup delay in 10 ms intervals.	6-14
AXHANG	n	0	Packet	Sets the voice repeater hang time in 100 ms intervals.	6-15
BBSMSGS	ON¦OFF	off	Packet	Controls the display of certain messages in command and CONVERS mode.	6-16
BEACON(BEA)	n	0	Packet	Sets the timing for an automatic transmission of a packet.	6-17
BKONDEL	ON¦OFF	on	Packet	Determines the way the screen is updated when a character is deleted in the command mode.	6-18
BTEXT	text	blank	Packet	Specifies the text of the beacon packet.	6-19
BUDLIST	ON¦OFF	off	Packet	Determines if the packets listed in LCALLS are to be displayed.	6-20
BUF	n	0-9	CW/RTTY/ ASCII	Allows addressing of the ten user programmable memories.	6-21
BUFKEY	nnn	9	CW/RTTY/ ASCII	Allows the user to transmit the buffer without using the (CTRL-T).	6-21
BUFTIME	n	0	CW	Used to transmit buffer 0 when it is a non-zero value at the set interval.	6-22
BWNL	ON¦OFF	off	AMTOR	Causes the MFJ-1278 to transmit when it receivers a <CR>.	6-22
CALIBRA	-	I-command	All	Used to transfer the control to the modem calibration routine.	6-23
CALSET	n	0	All	Specifies the count setting for use by the calibration routing.	6-23
CANLINE	n	$18 (^x)	Packet	Changes the cancel-line input editing command character.	6-24

Command	Parameter	Default	Mode	Function	Page
CANPAC	n	$19 (^Y)	Packet	Changes the cancel-packet input editing command character.	6-25
CBELL	ON|OFF	off	Packet	Sends a bell tone through the computer or terminal speaker when a packet connection is made.	6-26
CCITT	ON|OFF	on	RTTY	Determines whether U.S. standard or the internationally recognized character set is used.	6-26
CHECK	n	30	Packet	Sets a connection timeout.	6-27
CHECKV1	ON|OFF	off	Packet	Enables the automatic idle-link-disconnect feature for AX.25 L2V1 connections.	6-27
CHANGE	-	I-command	AMTOR	Switches from receiver to transmitter in AMTOR mode A "ARQ".	6-27
CLKADJ	n	0	Packet	Specifies the correction factor to be applied to the real-time clock routine.	6-28
CONPERM	ON|OFF	off	Packet	Allows a connection to become permanent.	6-29
CMDTIME	n	1	Packet	Sets the transparent mode timeout value.	6-29
CMSG	ON|OFF	off	Packet	Enable a message to be transmitted whenever there is a connection made.	6-30
CMSGDISC	ON|OFF	off	Packet	Controls whether the MFJ-1278 will initiate a disconnect sequence after it is connected to.	6-30
COMMAND	n	$03 (^C)	All	Sets the character used to enter the command mode from CONVERS mode.	6-31
CONMODE	C|T	C	Packet	Sets the MFJ-1278 to enter the transparent mode or converse mode automatically.	6-32
CONNECT	C1|Cx	none	Packet	Issues a connect from the command mode to another packet station.	6-33
CONOK	ON|OFF	on	Packet	Determines the action take by the MFJ-1278 when it receives a connect request.	6-34

Commands	Parameter	Default	Mode	Function	Page
CONSTAMP	ON|OFF	off	Packet	Enables the time stamping when a dis-connect occurs.	6-35
CONVERS	-	I-command	All	Forces the MFJ-1278 to enter the converse mode.	6-35
CONVERSE	-	I-command	AMTOR	Switches from the command mode to the text transmission mode in AMTOR.	6-35
CPACTIME	ON|OFF	off	Packet	Enables the automatic transmission of packets in the converse mode.	6-36
CR	ON|OFF	on	Packet	Causes the MFJ-1278 to send a <CR> every time a new line character is sent.	6-37
CTEXT	text	blank	Packet	Determine the packet to be sent when a connect is made.	6-38
CSTATUS	--	I-command	Packet	Shows streams identifier and link state of all streams.	6-39
CWCALL	ssss	blank	AMTOR	Characters are sent as CW when ID character are issued.	6-39
CWSENDCH	nnn	000	CW	Controls how MFJ-1278 transmits the pending text in the CW buffer.	6-40
CWSPEEDM	ON|OFF	off	CW	Causes the MFJ-1278 to adopt the in-coming CW speed as its transmit speed.	6-40
DAYTIME	D/T	none	Packet	Sets time and date of the MFJ-1278.	6-41
DAYUSA	ON|OFF	on	Packet	Determines the format for displaying the time and date.	6-42
DEADTIME	nnn	33(330Ms)	Packet	Determines the basic time interval used by the slotting procedure.	6-43
DELAY	nn	20 (20Ms)	AMTOR	Sets the delay between keying the transmitter and transmitting AMTOR.	6-44
DELCHR	n	^X	CW/RTTY/ ASCII	Used for deleting the content of the buffers during transmission.	6-44
DELETE	ON|OFF	off	Packet	Changes the input editing command.	6-45
DIDDLE	ON|OFF	on	ASCII/ RTTY	Synchronization character sent by the MFJ-1278 each time transmitter is is keyed in RTTY/ASCII modes.	6-45

Command	Parameter	Default	Mode	Function	Page
DIGIPEAT	ON¦OFF	on	Packet	Allows your station to be used as a digipeater.	6-46
DISCONNE	--	I-command	Packet	Used to disconnect a connected station in packet.	6-47
DISPLAY	--	class	Packet	Used to list all the commands the MFJ-1278 acknowledges.	6-48
DISPLAY	--	I-command	AMTOR	Used to list all the commands used in AMTOR.	6-51
DWAIT	n	33	Packet	Used to avoid collisions with digipeating.	6-51
EASIN	ON¦OFF	off	AMTOR	Allows the echoing of text that you have transmitted the instant it is sent.	6-52
ECHO	ON¦OFF	on	AMTOR	Allows the MFJ-1278 to transmit back to you everything that you type.	6-52
ECHO	ON¦OFF	on	All	Allows the MFJ-1278 to transmit back to you everything that you type in all mode of operation.	6-53
EPSON	ON¦OFF	on	All	Determines if you are using an EPSON/ IBM or C. ITOH printer.	6-53
ERUS	ON¦OFF	on	AMTOR	Inserts an underscore if the MFJ-1278 detects an error while receiving AMTOR.	6-54
ESCAPE	ON¦OFF	off	Packet	Specifies the character which will be output when an <escape> character is to be sent.	6-54
FARNSWOR	ON¦OFF	on	CW	Enables the MFJ-1278 to transmit CW in Farnswor method.	6-55
FAXEOP	ON¦OFF	on	FAX	Determines if the user will have terminate the end of a FAX picture.	6-55
FAXMODE	n	1-7	FAX	Sets the FAX formats in FAX mode.	6-56
FAXNEG	ON¦OFF	off	FAX	Causes the receiving FAX picture to print the white areas black, and black areas white.	6-56
FAXREV	ON¦OFF	off	FAX	Inverts all received FAX data.	6-56

Command	Parameter	Default	Mode	Function	Page
FEC	--	I-command	AMTOR	Initiates the broadcasting of Mode B forward error correcting mode.	6-57
FIRMRNR	ON¦OFF	off	Packet	Controls the handling of busy states by MFJ-1278.	6-57
FLOW	ON¦OFF	on	Packet	Sets type-in flow control to the terminal.	6-58
FRACK	n	3	Packet	Sets the time interval between retries.	6-58
FULLDUP	ON¦OFF	off	Packet	Allows communication in full duplex.	6-59
GRAPHLF	ON¦OFF	off	FAX/SSTV	Adds an extra "line feed" in graphic printing to the printer.	6-59
HEADERLN	ON¦OFF	off	Packet	Affects the display format of monitored packets.	6-60
HEALLED	ON¦OFF	off	Packet	Redefines the function of the STA and CON LEDs.	6-60
HID	ON¦OFF	off	Packet	Controls the sending of identification packets by the MFJ-1278.	6-61
ID	--	I-command	AMTOR	Sends a keyed modulated CW ID of your station in AMTOR.	6-61
ID	--	I-command	Packet	Sends a special identification packet to be sent in packet.	6-62
KISS	ON¦OFF	off	Packet	Allows the MFJ-1278 to works as a modem for special programs such as TCP/IP.	6-62
LCALLS	call	none	Packet	Used in conjunction with BUDLIST, allows selective monitoring of other packets.	6-63
LCSTERM	ON¦OFF	on	Packet	Allows MFJ-1278 to understand lower case characters as upper case after the streamswitch is entered.	6-63
LCOK	ON¦OFF	on	packet	Determines whether the lower or upper case characters are set.	6-64
LFADD	ON¦OFF	off	ASCII/ Packet	Enables the MFJ-1278 to go to the next line when a <CR> character is received.	6-65

Command	Parameter	Default	Mode	Function	Page
LFADDALT	ON¦OFF	on	RTTY	Enables the MFJ-1278 to go to the next line when a <CR> character is received in RTTY mode.	6-65
LFIGNORE	ON¦OFF	off	Packet	Line feeds are ignored except in transparent mode.	6-66
LISTEN	--	I-command	AMTOR	Used to monitor someone else's mode A AMTOR connection.	6-66
MAILBOX	ON¦OFF	off	Packet	Enables the personal mailbox.	6-67
MAILLED	ON¦OFF	on	Packet	Controls the STA/MAIL LED. Flashes when mail is presence.	6-68
MALL	ON¦OFF	on	Packet	Determines the class of packets which are monitored.	6-68
MATCH	ON¦OFF	on	AMTOR	Used for selectively monitoring portions of mode B FEC transmissions.	6-69
MAXFRAME	n	4	Packet	Sets the upper limit for outstanding packets that can occur at one time.	6-69
MBEGIN	cccc	<<>>	AMTOR	Allows the display of mode B transmissions only after the reception of the beginning of the signal.	6-70
MEND	cccc	nnnn	AMTOR	Used with MBEGIN and MATCH and the mode B receiving end when the MEND string is received.	6-70
MCOM	ON¦OFF	off	Packet	Enables monitoring of connected and disconnected packet when monitor is on.	6-71
MCON	ON¦OFF	on	Packet	Allows the monitoring of other packets while connected to another station.	6-71
MFILTER	n1-n4	none	Packet	Allows you to eliminate certain characters from received packets.	6-72
MHCLEAR	--	I-command	Packet	Clears the MHEARD list.	6-72
MHEARD	--	I-command	Packet	A list of all packet monitored.	6-73
MODE	--	I-command	All	Selects the operation mode of the MFJ-1278.	6-73
MNONAX25	ON¦OFF	off	Packet	Allows MFJ-1278 to monitor non AX.25 packet.	6-76

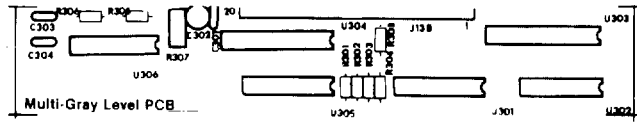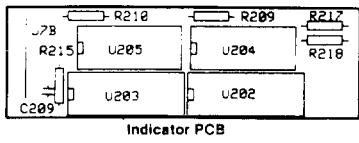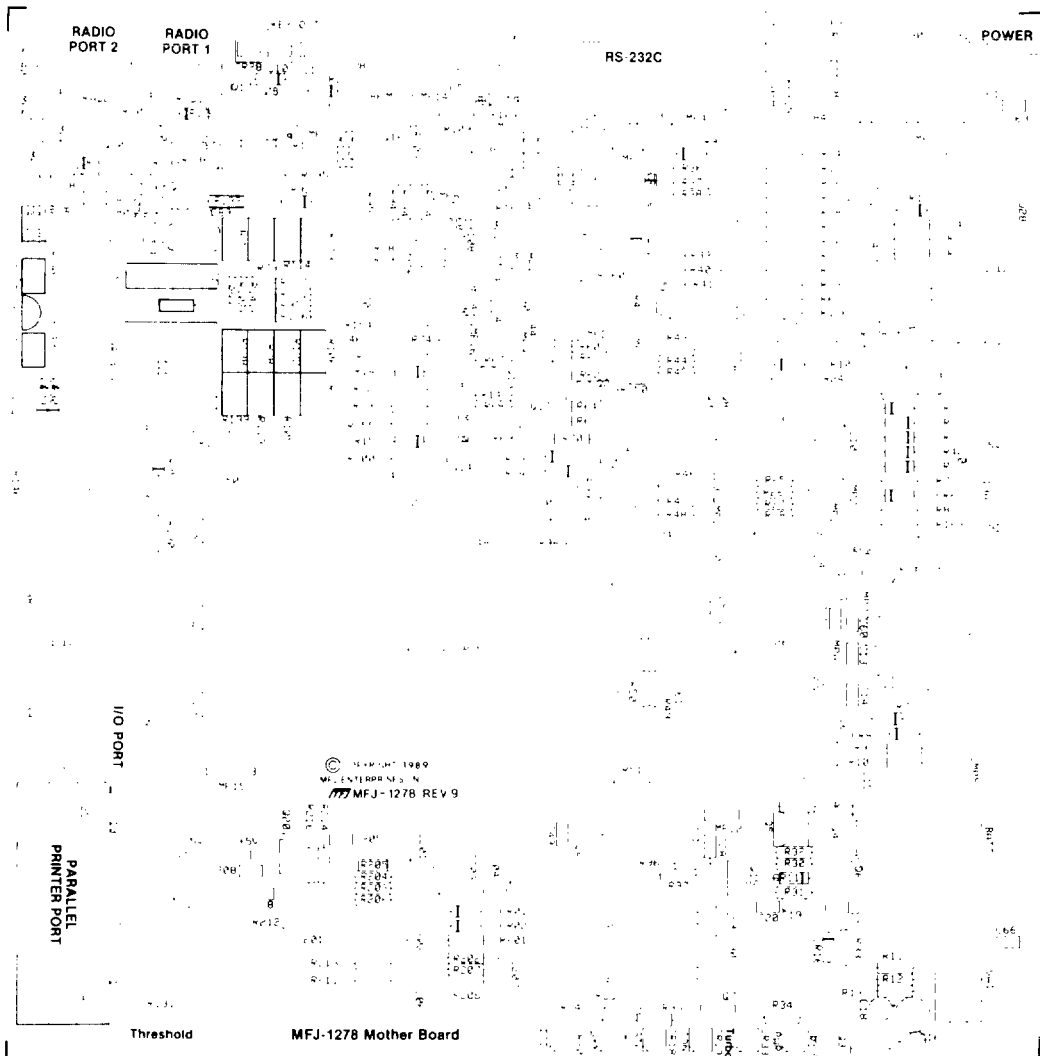| Command	Parameter	Default	Mode	Function	Page
MONITOR	ON¦OFF	on	Packet	Enables packets that are not addressed to you to be displayed.	6-74
MRPT	ON¦OFF	on	Packet	Affects the way monitored packets are displayed.	6-75
MSPEED	nn	20	CW	Sets the speed of CW to operate by the MFJ-1278.	6-76
MSTAMP	ON¦OFF	off	Packet	Enables the time stamping of monitored packets.	6-76
MULTIFAX	ON¦OFF	off	FAX	Enables multi-level FAX transmitting and receiving.	6-77
MYCALL	call	nocall	Packet	Sets the callsign of the MFJ-1278.	6-78
MYALIAS	call-n	blank	Packet	Specifies an alternate callsign for use as a digipeater only.	6-79
MYSELCAL	ssss	blank	AMTOR	Tells the MFJ-1278 what SELCALL your station should respond to.	6-79
NAVTEX	--	I-command	NAVTEX	Allows you to receive NAVTEX signals.	6-80
NAVSTN	xxxxx	all	NAVTEX	Allows you to receive certain NAVTEX stations.	6-80
NAVMSG	x	all	NAVTEX	Allows you to receive certain NAVTEX messages.	6-81
NEWMODE	ON¦OFF	off	Packet	Selects the way the MFJ-1278 behaves when connections are made and broken.	6-82
NOMODE	ON¦OFF	off	Packet	Determines if the MFJ-1278 will switch manually or automatically to command mode.	6-83
NUCR	ON¦OFF	off	Packet	Causes transmission of <null> characters, producing a delay following any <cr> sent to the terminal.	6-83
NULF	ON¦OFF	off	Packet	Same as NUCR, instead of <cr> it sends a delay after a <lf>.	6-84
NULLS	n	0	Packet	Used in conjunction with NUCR and NULF, and specifies how many <null> characters are sent.	6-84

Command	Parameter	Default	Mode	Function	Page
OMLC	ON│OFF	off	AMTOR	Instructs the MFJ-1278 to convert all characters, except those echoed, to their lower case equivalent.	6-85
PACLEN	n	128	Packet	Determines the number of characters it takes to automatically transmit a packet.	6-85
PACTIME	n	10	Packet	Determines the length of time between transmit and receive.	6-86
PARITY	n	0	Packet	Sets the parity mode for terminal or computer data transfer.	6-87
PASS	n	$16 (^V)	Packet	Selects the ASCII character used for the "pass" input editing character.	6-88
PASSALL	ON│OFF	off	Packet	Causes the MFJ-1278 to display packets received with invalid CRC fields.	6-89
PIXTONES	n	see 6-90	FAX/SSTV	Sets transmit tones for multi-level FAX/SSTV pictures.	6-90
PKTPIX	ON│OFF	off	Packet	Allows MFJ-1278 to print packet pictures to the built-in printer port.	6-92
PRINTGRA	ON│OFF	on	FAX/SSTV	Determines whether the MFJ-1278 will print the graphics to the printer or the terminal screen.	6-93
PRINTER	ON│OFF	off	All	Turns the parallel printer port on or off.	6-94
PRINTTES	--	I-command	All	Used to test the printer connected to the parallel printer port.	6-94
QRT	--	I-command	AMTOR	Used to break a link in AMTOR.	6-95
R	--	I-command	AMTOR	Is the equivalent to QRT.	6-95
RADIO	n	I-command	All	Allows the user to select the radio port on the MFJ-1278.	6-96
RANDOMCW	ON│OFF	off	CW	Allows the used of the random code generator.	6-96
RBITMASK	$xx	0	RTTY/ASCII	Set the bit inversion during receiving.	6-96

Command	Parameter	Default	Mode	Function	Page
RECONNECT	call1-9	I-command	Packet	Used to change the path through which you are currently connected to a station.	6-97
RESTART	--	I-command	Packet	Re-initializes the MFJ-1278 using the stored parameters.	6-97
REDISPLA	n	$12 (^R)	All	Used to change the redisplay-line input editing character.	6-98
RESET	--	I-command	All	Resets all parameters to their default values and reinitiates the unit.	6-99
RESPTIME	n	5	Packet	Sets a minimum delay that is imposed on acknowledging packets.	6-99
RESTORE	--	I-command	AMTOR	Returns the MFJ-1278 AMTOR code converter to "LTRS" case, and flushes the transmit buffer.	6-100
RETRY	n	10	Packet	Allows retransmission of frames that are not acknowledged.	6-100
RFE	ON¦OFF	off	AMTOR	Will continue to retry until a QRT is received.	6-101
RINV	ON¦OFF	off	AMTOR	Controls the incoming received signal to be inverted before detection/processing occurs.	6-101
RXBLOCK	ON¦OFF	off	Packet	Determines whether the information will be sent in standard or block format.	6-102
RXCAL	--	I-command	All	Generates test signals that are used by the internal tuning software to align the demodulator circuit.	6-103
RXINVERT	ON¦OFF	off	RTTY/ACII	Inverts the mark and space tones.	6-105
SCREENLN	n	80	All	Used to properly format terminal output.	6-105
SELCALL	ssss	I-command	AMTOR	Initiate a mode L "SELCALL" broadcast.	6-106
SENDPAC	n	$0D (CR)	Packet	Selects the character that will force a packet to be sent in CONVERSE mode.	6-106

Command	Parameter	Default	Mode	Function	Page
SERIANLNO	0-65535	0	CW	Used for contest serial numbering.	6-107
SETUP	n	I-command	All	Used to set the mode and baud rate. Similar to the MODE command.	6-108
SFNL	ON¦OFF	off	AMTOR	Controls whether the 1278 adds a new line character to "+?" and WRU.	6-109
SLOTS	nn	3	Packet	Determines how many sides are on the slot time dice.	6-109
SOLF	ON¦OFF	on	AMTOR	Determines whether only <lf> characters from the AMTOR receiver are sensed as newline characters.	6-110
SRXALL	ON¦OFF	on	AMTOR	Causes the MFJ-1278 to print all receivable mode S transmissions.	6-110
START	n	$11 (^Q)	All	Selects the user restart character.	6-111
STATUS	--	I-command	AMTOR	Returns diagnostic information useful for helping us help you with your problems.	6-111
STOP	n	$13 (^S)	All	Selects the user stop character.	6-112
STREAMCA	ON¦OFF	off	Packet	Used to enable the display of the connected to station after the stream identifier.	6-113
STREAMDB	ON¦OFF	off	Packet	Used to display received STREAMSWITCH characters by "doubling" them.	6-114
STREAMSW	n	$7C (¦)	Packet	Selects the character used by both the MFJ-1278 and the user to select a new "stream".	6-115
SYSOP	--	I-command	Packet	Enables the MAILBOX systems operator to enter in messages to the BBS system/bbs.	6-116
TINV	ON¦OFF	off	AMTOR	Allows the user to invert the transmitted AMTOR signals.	6-116
TRACE	ON¦OFF	off	Packet	Enables the debugging protocol function.	6-117

Commands	Para.	Default	Mode	Function	Page
TRANS	--	I-command	Packet	Transparent mode.	6-118
TRFLOW	ON¦OFF	off	Packet	Enables and disables the software flow control.	6-118
TRIES	n	none	Packet	Retrieves the count of "tries" on the currently selected input stream.	6-119
TUNE	--	I-command	All	Keys the PTT and low tone for the current modem for 30 seconds or until you strike a key on your keyboard.	6-119
TUNEPROC	--	I-command	All	Used to tune the MFJ-1278 modulator and demodulator.	6-120
TVHSYNC	ON¦OFF	off	SSTV	Allows MFJ-1278 to look for Hsync on dark area around the picture.	6-120
TVMODE	n	1	SSTV	Selects the formats under the SSTV mode.	6-121
TVBREAK	n	see 6-122	SSTV	Sets the brightness and contrast of SSTV picture received on the built-in printer port.	6-122
TVX	ON¦OFF	off	SSTV	Enables multi-gray levels SSTV raw data to be sent to the terminal without any SSTV format.	6-123
TXDELAY	n	33	Packet	Tells the MFJ-1278 how long to wait after keying up the transmitter before sending data.	6-124
TXDELAYC	n	2	Packet	Controls a new timer that runs after the regular TXDELAY time has expired.	6-125
TXFLOW	ON¦OFF	off	All	Enables the software flow control for the transparent mode.	6-126
TXINVERT	ON¦OFF	off	RTTY/ ASCII	Inverts the mark and space on the transmitted signals on RTTY/ASCII.	6-127
TXTMO	n(0-65535)	0	Packet	A health counter that registers the number of packet timeout/recovery events that have occurred sine the MFJ-1278 was powered up.	6-127
TXUIFRAME	ON¦OFF	on	Packet	Used to tell the MFJ-1278 what to do with the unconnected information left in its buffer.	6-127

Command	Parameter	Default	Mode	Function	Page
UNSHIFT	ON|OFF	ON	RTTY/ ASCII	Determines the way the SPACE character is displayed in RTTY/ASCII.	6-128
UNPROTO	call1	CQ	Packet	Sets the digipeat and destination address fields of packets sent in the unconnected mode.	6-128
USERS	n	1	Packet	Controls the manner in which the incoming connect requests are handled.	6-129
WDMODE	ON|OFF	off	AMTOR	Determines whether A mode transmission takes place any time you type a SPACE or RETURN character.	6-129
WEIGHT	n(0-255)	0	CW	Sets the weight factor for the CW transmission.	6-130
WRU	--	I-command	AMTOR	Causes the remote mode A "ARQ" station currently in contact with you to transmit its answer back message.	6-130
XFLOW	ON|OFF	on	All	Enables the flow control.	6-131
XMITOK	ON|OFF	on	Packet	Enables the transmit function.	6-131
XOFF	n	$13 (^S)	All	Selects the MFJ-1278 stop character.	6-132
XON	n	$11 (^Q)	All	Selects the MFJ-1278 restart character.	6-132

RADIO PORT 2   RADIO PORT 1   RS-232C   POWER

I/O PORT

PARALLEL PRINTER PORT

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MFJ-1278 REV 9

Threshold   MFJ-1278 Mother Board

R210   R209   R217
J7B
R215   U205   U204   R218

U203   U202

C209
Indicator PCB

C303   R304   R306
C304   R307
U306
Multi-Gray Level PCB

U304   J13B   U303

U305   J301   U302

MFJ-1278 COMPONENT PLACEMENT DIAGRAM

MFJ ENTERPRISES, INC.

MFJ-1278 2400 Packet Modem

MFJ ENTERPRISES, INC.

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