MFJ REPEATER CONTROLLER

MODEL MFJ-204[illegible]
INSTRUCTION MA[illegible]JAL

CAUTION: Read All Instructions Before Operating Equipment

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1.0 INTRODUCTION

Thank you for purchasing the MFJ-2040 Repeater Controller. The MFJ-2040 offers more features, dollar for dollar, than any other repeater controller on the market.

The MFJ-2040 repeater controller is a simple controller made to fit even the most modest budgets.

1.1 Overview of features.

This controller is a 8749 CPU-based system. The 8749 has internal 4K of EPROM, 128 bytes of RAM, and a timer counter clock.

The controller has 4 alarm inputs and 8 Gen. Pur. outputs. There is also a phone input (for ring detection), receiver audio input (for DTMF decoding), and an audio output (for audio and CW ID, confirmation beeps, courtesy tones and audio test signals). All inputs and outputs have RFI filters to help prevent interference from other radio services, as well as keeping their signals out of the controller box. The optional voice ID is a real persons voice that sounds as good as most cassette tape recorders. The voice comes from an 8-bit D/A converter, and is held in a 27C512 EPROM.

The MFJ-2040 controller comes with the following features:

REMOTE FUNCTIONS:

Turn ON and OFF eight remote functions by DTMF. Also by dip switches, the remotes can be put on a preset time limit.

TEST TONES:

This function will send out a flat set of tones at 3KHz, 1 KHz, and 300 Hz. This is useful in making sure your system has a flat frequency response. This function is turned on/off by DTMF or by one of the dip switches on the board.

PHONE PATCH:

This allows you to control the internal phone patch. This function comes with a five-minute timeout. Warning beeps are sent out the repeater starting 25 seconds before timeout. Resetable to another five minutes by DTMF. Another control can be used to lock out the phone patch feature.

AREA CODE LIMITING:

The MFJ-2040 has the ability to limit calls to local only, local and ANY long distance calls, or local and any FIVE long distance area codes.

PHONE LINE IN:

The phone input is used to ring the phone on the air, for applications with phone patches and reverse patch.

ID:

You have your choice of voice or CW ID. If no CW ID is programmed, the controller uses voice ID. If you have not installed a voice ID EPROM, you should program the CW ID.

KEYDOWN TIME:

If someone is keyed for more than ten minutes, the controller will remove the PTT closure to the transmitter. The transmitter will stay off until a key up condition is detected.

RESET:

Hard or soft reset by DTMF.

DTMF COMMANDS:

All commands are listed in this manual. The last two digits of all but one command are fixed and can't be changed. A command can have up to four numbers. The commands are split into 3 different groups. Two of the groups may have their own prefix. These two groups are called CONTROL OPERATOR, and USER. The OWNER control code is the only control code that is completely un-defined. Once the OWNER control code has been selected, it is used to set the CONTROL OPERATOR codes. The CONTROL OPERATOR codes are used to select the USER codes.

MUTE OUT:

Used to prevent re-transmission of DTMF. DTMF tones are re-transmitted if the user uses a D at the beginning of a sequence of tones.

ALARM INPUTS:

Four alarm inputs are available. You can check alarms and turn them off by DTMF.

LINK RECEIVER MUTE:

If a link receiver is used, this line will help prevent circular feedback.

TX PL OFF:

Used to turn off TX PL while receiving a signal from the link receiver. This helps prevent circular feedback. It is also used, via DTMF, to disconnect the link.

RX PL OFF:

This DTMF command is used to drop the requirement for receive PL. This is used so that others without PL can use the system. It is reset automatically if there is no system activity for one minute. The PL requirement can also be dropped permanently by making sure Dip switch 3 is off.

Transmitter Hang-in Time:

By DTMF, the hang-in time is adjustable from 0 to 15 seconds, in steps of one second.

2.0 Specifications

POWER:	Minimum 9.5 Volts @ 300 mA Maximum 15 Volts @ 300 mA The MFJ-1315 can be used with the controller.
LOGIC INPUTS:	Minimum 0-4 Volts DC Maximum 0-15 Volts DC Impedance 10K ohms
LOGIC OUTPUTS:	Maximum 40 Volts, 200 mA., 475 mW
Phone IN:	For ring detection. 10 K ohms during ring.
AUDIO OUT:	600 ohms, unbalanced 0 dBm
AUDIO IN:	For DTMF decoding. 10 K ohm unbalanced. Minimum -24 dBm. Maximum +62 dBm.
Cabinet:	1 11/16" Height (1 EIA Rack Unit) 17" Width 7" Depth Standard Rack Mount front panel 19"

3.0 Warnings

1. Never run the MFJ-2040 without a properly programmed CPU!

2. Never remove the paper that covers the window of the CPU! The EPROM will eventually lose its program.

3. Never change any IC without turning off the power. The back-up battery must also be disconnected.

4. If IC19 (phone ring detect) is removed, and the phone rings, you may have to replace D3. To disable ringback, remove IC19, lift pin 5 straight out, then replace IC19 in its socket.

5. Be careful as to not damage any of the connectors on the rear of the controller. These connectors are soldered to the circuit board and will take time and skill to replace.

4.0 Installation

4.1 Hardware Installation.

Carefully unpack your MFJ-2040 Repeater Controller. Here's what you should have:

1 MFJ-2040 Repeater Controller
1 MFJ-2040 Owner's Manual

1. First you need to purchase the connectors for the rear panel. These are available from MFJ.

   The The D-Subminiature connectors you will need are:

   J1 DB-15 plug
   J2 DB-15 plug
   J3 DB-15 socket
   J4 DB-15 socket
   J5 DB-9 plug
   J6 DB-9 socket

   The connectors are available as a package from MFJ. This includes the locking hoods. The order number for the 2040 Connector kit is 10-20104. The price is $19.95 plus $4.00 shipping. See the order blank page in this manual to order the connectors as well as the voice ID EPROM, the second message EPROM, and the MFJ-1315 power supply adapter.

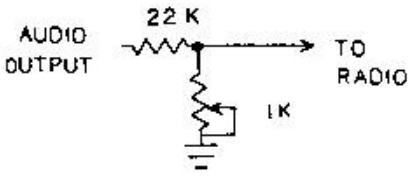
2. Decide what equipment you are going to use in addition to the MFJ-2040. Are you going to use a link transmitter and link receiver or not? What kind of power supply are you going to use? It is ok to use one huge power supply to power all your equipment. Are you going to have emergency power, i.e., batteries? Where are you going to mount the equipment? All these questions need to be answered before starting on the connecting cables.

3. Connect the positive voltage supply line to PIN 2 of J6. Connect the negative voltage supply line to PIN 6 of J6.

4. Connect the Receiver Audio + line to any of PINS 3, 4, or 5 of J6. Pin 3 is Audio Input #1, Pin 4 is Audio Input #2, and Pin 5 is Audio Input #3.
   Connect the ground side of the Receiver Audio line to ground (PINS 6 through 9 of J6).

5. Connect the Audio Output (J5 pin 1) to the transmitter audio input. This is high level, typically about -12.8 dBm. This level is too low to be speaker level, but

IF you do, the excessive level will badly distort the audio. You will have to reduce the setting of VR 3 to such an extent that the output IC (LM386) will be operating down in its noise floor. VR13 and VR3 should be around mid-scale. Either bypass the mic pre-amp (in the repeater) or install a 22k/1k pad at the input to the transmitter.



6. The DTMF input (J5 PIN 2) should be connected to the output of the audio mixer (IC24 PIN 7) if you don't have a seperate DTMF source. A small jumper can be soldered from one end of R54 (100K) to one end of R34 (1K).

7. If you are connecting a telephone line to the controller, connect the green wire L1 to J5 PIN 4. Connect the red wire L2 to J5 PIN 5.

WARNING: Be extremely careful when handling a live telephone line. If the telephone rings while you are across the lines, you will have as much as 150 volts 20 hertz across the line. This voltage is enough to make you a Silent Key. Handle only one line at a time, or disconnect the line at the wall plug before connecting to the controller.

8. Connect any alarms you have to J4 PINS 5 through 8. These must be a closure to ground when they are true. Alarms can be anything from an intrusion alarm to power failure or temperature sensing. Anything that produces a ground when true can be an alarm input.

9. If using link receiver,connect the link COS to J3 PIN 6.

10. If using a PL demodulator, connect the digital output to J3 PIN 7. This line should go low when the PL TONE is being received. If you have an "open" repeater, there is no need to connect this line.

11. Connect the local receiver (repeater receiver) COS to J3 PIN 8. Pin 8 should go low when receiving a signal. If you want to delete the requirement for RX PL, connect Pins 7 and 8 of J3 together or make sure Dip SW 3 is OFF.

12. Connect remote #1 to J2 PINS 1, remote #2 to J2 PIN 2, etc. through 8. These are logically true when low. False is high impedance to ground. These outputs can be

used to trip tape cartridge machines, time modules, or provide the ground for a relay. Output current is limited to 200 mA.

13. Connect the TRANSMIT (PTT) output of J1 PIN 1 to the PTT input of your transmitter. The maximum current of this outputs is 200 mA.
This output, in fact all the outputs on J1, may not be needed. Some repeaters simply transmit automatically when the receiver is receiving.

14. If you have ordered the optional voice ID chip, place the chip into socket IC11. Make sure the notch in the end of the chip is facing the same direction as the rest of the chips on the board.

4.2 Voice ID PROM INSTALLATION

1. Disconnect the power from the MFJ-2040 controller.
2. Remove the top cover.
3. Unplug the battery backup power.
4. Insert the voice ID prom into IC socket 11.
5. Be careful about handling the pins. Static electricity can damage the pins. Ground yourself for a few seconds before handling the pins.
6. Make sure the prom is inserted in the correct direction. Pin 1 on all ICs on the controller board are pointing in the same direction.
7. Install the battery backup.
8. Connect the main power connector.
9. Turn on your receiver and monitor the repeater output.
10. Turn on Dip Switch 2 on the controller board.
11. Adjust VR3 for proper audio level.
12. Adjust VR1 for proper speech speed.
13. Turn off Dip Switch 2.
14. Replace the top cover.

15. Dress up all cables, put the controller in a 19 inch rack cabinet, install the repeater and RF cables, turn on the power and you are ready to go.

4.3 Battery backup.

This probably should be labeled REMOTE POWER instead of battery backup. Backup refers more to keeping some RAM active. The battery backup feature actually runs the whole board, not just RAM. For this reason, and since the normal current drain is 100 mA to 200 mA, a battery with a large amp-hour rating is desirable. If you don't use a large capacity battery, your emergency backup may only last a half hour or so.

The two pins standing up beside the phone patch relay are the pins for the "battery backup" The pin

closest to the back (connector) side of the board is the positive voltage input, the pin inboard is the negative voltage input. This pin is connected to ground.

4.4 AUDIO LEVEL ADJUSTMENTS.

4.4.1 ID audio level.

Switch Dip Switch 1 on the controller board ON. You should hear three test tones in sequence. The frequencies are 300 Hz, 1000 Hz, and 3 kHz. These tones are sent in sequence continually until you turn off Dip Switch 1 and key in any digit on the touchtone pad.

While the tones are playing, adjust VR3 for the correct level, whatever that is. You should either listen to the output of your repeater or use a service monitor from the local two-way radio person to determine the proper deviation.

HINT: If you adjust the test tones and the voice ID for the proper level, the courtesy beep will sound too loud for some people. Adjust the ID level a little lower than the receiver level. If you don't and you have the courtesy beeps on, the courtesy beeps will seem to pierce through the speaker. This is rather annoying, particularly to HT uses. The bottom line is adjust them to suit your own taste.

Turn the tones off by turning off Dip Switch 1 and pressing a digit on the touchtone pad.

4.4.2 Receiver audio level.

Have a second person key up the repeater and speak so that you can set the receive audio level. Adjust VR8, VR9, or VR10, depending on which audio input you are using, and VR13 for the final audio output level. Again...if you have the courtesy tones on, you will need to turn down the voice ID slightly below the receiver audio level.

4.4.3 Phone Patch Adjustments.

Using a handy talkie, key in 08 on the touch tone pad and phone an amateur who can help with the level adjustments.
Unsquelch the receiver so that the white noise is input into the audio input.

With an oscilloscope attached to the audio output line (J5 PIN 1), adjust VR4, VR5, VR6, and VR7 for a null reading on the scope. You will not get a perfect null. Keep working with all these pots until you get the best null possible.

Ask the person you called to carry on a normal conversation with you.
Adjust the phone patch input pot VR11 until the repeater output is normal. Adjust output pot (VR12) until the person on the phone says it is normal volume.

5.0 DTMF Commands

The DTMF commands are divided into three different catagories, USER commands, CONTROL OPERATOR commands, and the OWNER commands.

5.1 USER Commands

00 Soft Reset
01 Not Assigned
02 PL not required
03 PL required
04 Force ID
05 Prom 2 talk
06 Wake up mode
07 Sleep mode
08 Phone patch up
09 Phone patch down
10 Remote 1 ON
11 Remote 1 OFF
12 Remote 2 ON
13 Remote 2 OFF
14 Remote 3 ON
15 Remote 3 OFF
16 Remote 4 ON
17 Remote 4 OFF
18 Remote 5 ON
19 Remote 5 OFF
20 Remote 6 ON
21 Remote 6 OFF

5.2 CONTROL OPERATOR FUNCTIONS

22 Remote 7 ON
23 Remote 7 OFF
24 Remote 8 ON
25 Remote 8 OFF
26 Phone enable
27 Phone disable
28 Not Assigned
29 Not Assigned
30 Hard Reset
31 Test Tones
32 Connect link
33 Disconnect link
34 Enable TX
35 Disable TX
36 Report alarms
37 Alarms OFF
38 Sleep mode enabled

39 Sleep mode disabled
40 Install CW ID
41 Set TX hang in time
42 Set phone area code
43 Not Assigned
44 Courtesy tones ON
45 Courtesy tones OFF
46 Not Assigned
47 Not Assigned
48 Set USER prefix LOCK with Dip Switch 8

5.3 OWNER code

49 Set Owner code LOCK with Dip Sw 7
XXXX Set ctrl oper. prefix LOCK with Dip Sw 6

6.0 Detailed explanation of DTMF Codes.

6.1 User codes

00 SOFT RESET
Reset is used to set all functions to a standard state.

EXAMPLE:
You 00
RESPONSE: beep

RESULT:
All remotes in the timer mode are reset (off).
Phone is off.
Alarms are off.

02/03 PL required/ PL Not required

Dip Switch 3 should be ON if you want to use a tone decoder in order to access the repeater. There are two receiver COS lines, one from the local receiver (J3-8) and one from the link receiver (J3-6). The PL input to the controller is on J3-7. If Dip Switch 3 is OFF, the controller ignores the PL input. If Dip Switch 3 is ON, there must be a ground (PL=true) on J3-7 for the local receiver to trip the PTT line (J1-1). There is no PL requirement for the link receiver. When Dip Switch 3 is ON, you can defeat the PL requirement by inputing 03 on the DTMF pad. This will drop the requirement for PL for the duration of the conversation. J1 pin 5 goes to ground while the PL requirement is dropped. After one minute of repeater inactivity, the PL requirement is turned on again and J1 pin 5 goes to a high impedance state.

NOTE: Of course you can turn off the PL requirement entirely by simple turning off Dip Switch 3 (default setting).

EXAMPLE:
You 03
RESPONSE: BEEP

RESULT:
No PL is required to use the repeater.

04 **Force ID**
This function causes the controller to ID. If a voice ID prom has been installed, the voice ID prom will play. If a CW ID has been installed, the ID will be in CW.

05 **Force prom 2 to talk**
This function forces prom 2 to speak. This does not change the ID to prom 2. Without a prom in this socket (U21), the carrier will stay on for the length of time it takes prom 2 to speak as if a prom were present.

06/07 **Sleep modes**
The sleep modes are enabled with the 38 command and disabled with the 39 command.
If disabled with the 39 command, this function does nothing. If enabled with the 38 command, the user can put the repeater to "sleep" two different ways.
Entering 06 puts the controller to sleep after 1 minute of inactivity.
Entering 07 causes the repeater to go to "sleep" immediately.
Sleep is defined as the PTT output (J1-1) not functioning. If your repeater is not using the PTT output from the controller, you can't put it to sleep.

EXAMPLE: (Assume the sleep mode has been enabled with the 38 command.)

YOU 06
RESPONSE BEEP

RESULT: The system will go to sleep after one minute of inactivity.

08/09 **Phone patch ON/ OFF**

To turn ON the phone patch, press 08 on the DTMF pad. You must start entering the telephone number within five seconds after the patch has been turned on. Also, the first four digits must be entered with no more than five seconds between digits. Otherwise, the patch will turn off.
Once accessed, the patch will beep every five seconds starting 25 seconds before the five minute time-out. To talk longer than five minutes, the amateur accessing the patch must press 08 again. The person on the telephone will not hear the beeps.
When you are through with the conversation, press 09 to hang-up the phone.

10/11 **Remotes ON/OFF**
To turn any of the six USER controlled remotes, press any of the even numbers, 10 through 20. Once turned on, press the number following the on number command in order to turn the remote OFF.

EXAMPLE:
YOU press 10.
RESPONSE: BEEP
RESULT: Remote one (J1-8) is ON.
To turn remote OFF, press 11.

6.1 Control operator codes

22-25 **Remotes Seven and Eight**
These two remotes can be user or control operator controlled, depending on whether you have set the Control operator's code or not. If not, all remotes can be controlled be anyone. If the control operator code has been set, only the owner and control operator can set remotes seven and eight.

EXAMPLE:
YOU 22
RESPONSE: BEEP

RESULT: Remote seven is now on.

26/27 Phone enable/disable

Disable the phone with 27. Enable with 26. When the phone is disabled, the phone ringing is not heard over the repeater.

EXAMPLE:
Assume you want to disable the phone.
YOU: 27
RESPONSE BEEP

RESULT: The phone is disabled and the phone no longer rings.

28/29 NOT ASSIGNED

30 **Hard Reset**
Hard reset differs from soft reset only in the way the reset is acheived. Hard reset jumps to a software loop. The watch dog timer never gets reset. The watch dog timer then puts the CPU into a hard reset. The hard reset should only be used as a last resort to free the system of an unknown problem. A hard

reset takes a little longer than a soft reset. Outputs may glitch for a moment as they do on power up.

EXAMPLE:
YOU 30
RESPONSE BEEP
RESULT:
All remotes in the timer mode are off.
Phone is off.
Alarms are off.

31 TEST TONES ON

To turn the test tones on, press 31 on the DTMF pad.

You will hear a sequence of three different tones which are digitally produced within the controller. The three frequencies are 300 Hz, 1000 Hz, and 3.1 KHz. Each tone is played for about four seconds.
EXAMPLE:
YOU 31
RESPONSE BEEP
RESULT:
You now hear the test tones at the repeater output. You can test the frequency response of the repeater. You should hear all three tones.
To turn off the tones, touch any key on the DTMF pad.

32/33 Link enable/disable

To turn off the link, just push 33 on the DTMF pad. When the link is disabled, transmit PL is turned off, and the link COS is ignored.

34/35 Transmitter enable/disable

Disabling the transmitter does nothing more than disable the PTT function. All other functions work normally.

36/37 Alarms ON/OFF/Clear/Test

The alarms are always on. By DTMF you can turn off the audible alarms. Although the audible alarms may be turned off the MFJ-2040 still counts alarms. When you turn the alarms on by pressing 36 on the DTMF pad, you will

hear any alarms that have been activated. For alarm one you will hear one low frequency beep, for alarm two, two beeps, etc. 36 also clears any alarms that have been set and also clears the low frequency beep at the end of the transmit tail.

38/39 Sleep Mode Enable/Disable

This function is used to enable or disable the sleep mode. See also 06/07.

40 Install CW ID

To install the CW ID, press 40. After you hear the confirmation beep, you have five seconds to start installing the ID. The ID is installed by using the numbers 1, 2, and 3 on the DTMF pad. 1 is used for SPACE, 2 is used for DOT, and 3 is used for DASH.

EXAMPLE: Assume your call is WB6SIQ/R. in CW it looks like this:

.-- -... -.... ... .. --.- -.-. .-.

SPACE = 1
DOT = 2
DASH = 3

In numbers it looks like this:
233132221322221222122133231322321232

YOU: 40
RESPONSE BEEP
YOU 233132221322221222122133231322321232

RESPONSE: .-- -... -.... ... .. --.- -.-. .-.

RESULT: All IDs will be in CW. Cancels Voice ID.
If you want to re-install the voice ID, key in 40 without any code.

41 Transmit Hang time

To install a different transmit hang time than the standard default, type 41 on the DTMF pad.

Wait for the confirmation beep then press the number corresponding to the number of seconds you wish the tail length to be. The table below shows the keys to push to get the different hang times.

KEY	SECONDS	KEY	SECONDS	KEY	SECONDS
1	1	6	6	*	11
2	2	7	7	#	12
3	3	8	8	A	13
4	4	9	9	B	14
5	5	0	10	C	15
				D	0

42 Install Area Codes.

To install an area code, just push the arear code command 42, wait for the confirmation beep, then press the number of the LOCATION (1-5) of that particular area code, then the area code.

1-454
1 800
(illegible)

NOTE: DO NOT PUT A 1 IN FRONT OF YOUR AREA CODE

A * as the first character in location 1 will remove all dialing limitations.

A # as the first character in location 1 will restrict all calls to local calls (seven digits).

EXAMPLE 1:
Suppose you want to enable local calls, and area codes in the 714 and 818 areas. Let's say you want 714 in location 1 and 818 in location 2.

YOU 42
RESPONSE BEEP
YOU 1714
RESPONSE BEEP
YOU 42
RESPONSE BEEP
YOU 2818
RESPONSE BEEP

RESULT:
All calls are now local, 714, and 818 areas.

EXAMPLE 2:

YOU 42
RESPONSE BEEP
YOU 1
RESPONSE BEEP

RESULT:
The area code in location 1 has been cleared. All calls are now local and 818 only.

At this point, by putting a # in location 1 you can effectively turn off the area codes in location 2 through 5 without destroying the area codes in those locations. By the same token, by clearing location 1, you can limit the area codes

to what is in locations 2 through 5.

43 NOT ASSIGNED

44/45 Courtesy tones ON/OFF

To install the courtesy tones, press 44 on the DTMF pad. There are two tones for the courtesy tones. The last tone goes up if the received audio is from the link receiver and the last tone goes down if the audio is from the local receiver.

EXAMPLE:
YOU 44
RESPONSE BEEP

RESULT:
The courtesy tone has now been installed and the controller will produce the courtesy tones 1.5 seconds after the end of the receiver COS.

IMPORTANT: Receive COS (J3-8 or J3-6) must be connected for this function to work.

46/47 NOT ASSIGNED

48 Install User Prefix Code.

NOTE: Code 49 (Install Owner Code) must be done first.

To install the USER prefix codes, simply type in 48 or if you have modified the prefix, use your control operator prefix and 48. You should hear a confirmation beep in 2 seconds. You now have 5 seconds to start installing your USER prefix. Enter the new prefix you desire (up to four digits). You should hear another confirmation beep within five seconds.

To remove the USER prefix code, type in 48 or Operator code and 48. You should hear the first confirmation beep. Wait another six seconds and all prefix codes are gone.

EXAMPLE:
Assume your USER code is ABCD48.
Assume you want your USER code to have the prefix AAAA.

YOU ABCD48
RESPONSE BEEP
YOU AAAA

RESULT:
All user codes have been modified with the prefix AAAA.
Your old patch up code was ABCD08.
Your new patch up code is AAAA08.
At this point you can turn on Dip Switch 8 to lock the USER prefix code.

6.2 Owner code.

49 **Install Owner Code.**
Upon installation of your MFJ-2040 repeater controller, you probably will want to set your owner code. This is so you and/or the control operator will have control over use of the functions of the controller.
The OWNER code is used later to set the prefix of the Control Operator cammands.

To install the Owner Code, type 49 on the DTMF pad. You will hear a confirmation beep within two seconds. You now have five seconds to start installing the Owner Code. Enter the new code you desire. You should hear another confirmation beep in five seconds. Your new code has been installed.

EXAMPLE:
Assume you want to install 111A as the owner code.

YOU 49
RESPONSE BEEP
YOU 111A ←
RESPONSE BEEP

Your owner code of 111A has been installed.
If you want to make it unchangeable by DTMF, switch DIP Switch 6 ON. Later, if you want to change the owner code, you will have to turn off DIP Switch 6.

NEVER GIVE OUT YOUR OWNER CODE!!!

Now that you have installed the owner code , you will want to install the control operator code and perhaps the user code. Lock your owner code prefix by switching Dip Switch 7 to the ON position on the controller board.

To install the control operator prefix, key in 111A (your owner code) and wait for beep. Key in your control operator code (up to four digits). Let's assume you want 12 to be the control operator prefix. You should get a beep. Your control code prefix is now 12.

Assume now you want to install a user code prefix of 50. Key in 1248. 12 is the control operator code and 48 is the command to install user code.

You should get a beep. Now key in 50. Wait for beep. Your new user code is 50. To enter any user command, the user must now prefix the command with 50. For example, to bring up the phone, enter 5008.

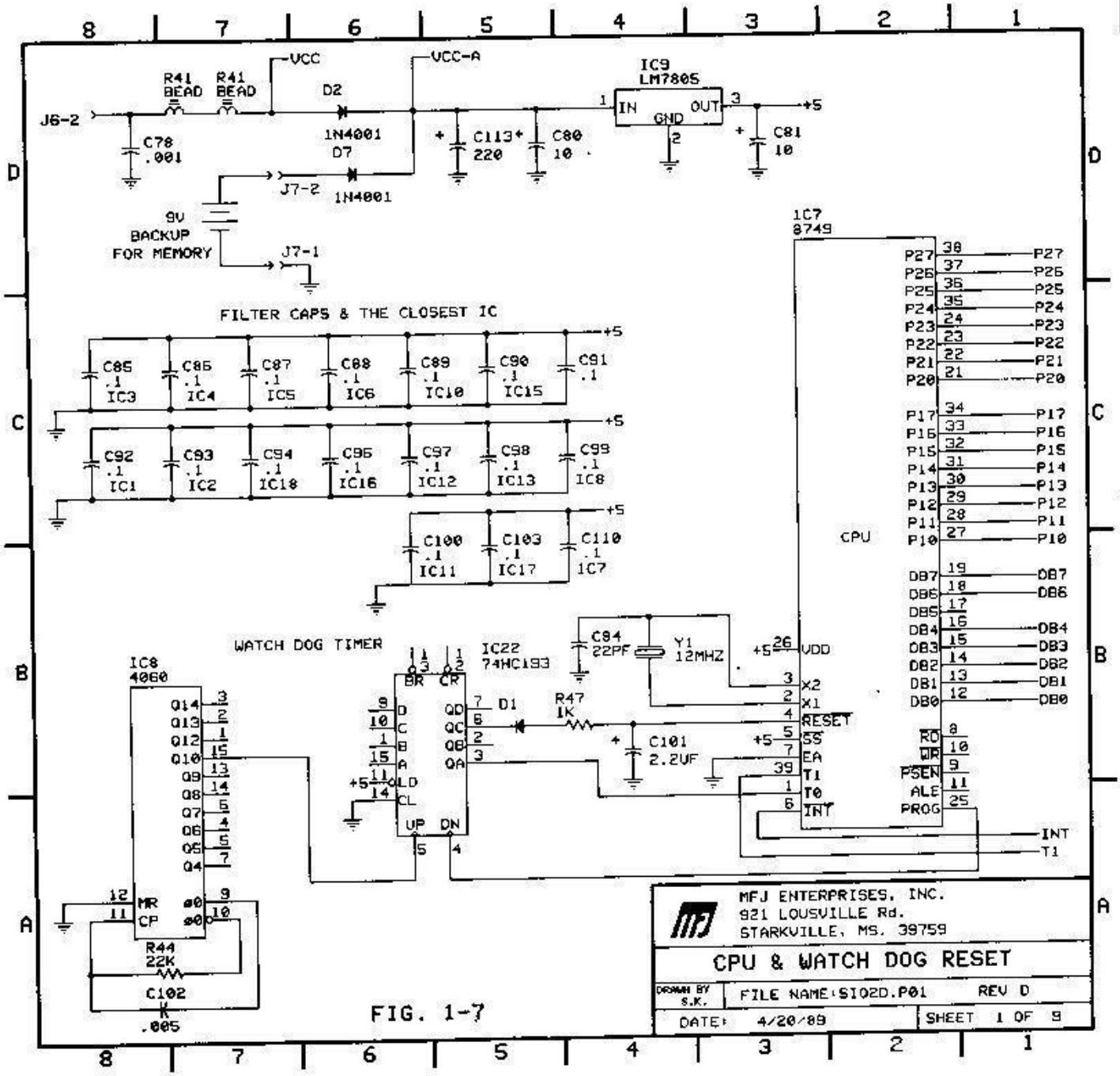

VCC
VCC-A
R41 BEAD
R41 BEAD
D2
1N4001
D7
1N4001
J6-2
J7-2
C78 .001
C113 220
C80 10
IC9 LM7805
IN
GND
OUT
C81 10
+5
9V BACKUP FOR MEMORY
J7-1
FILTER CAPS & THE CLOSEST IC
C85 .1 IC3
C86 .1 IC4
C87 .1 IC5
C88 .1 IC6
C89 .1 IC10
C90 .1 IC15
C91 .1
C92 .1 IC1
C93 .1 IC2
C94 .1 IC18
C95 .1 IC16
C97 .1 IC12
C98 .1 IC13
C99 .1 IC8
C100 .1 IC11
C103 .1 IC17
C110 .1 IC7
WATCH DOG TIMER
IC8 4060
IC22 74HC193
C84 22PF
Y1 12MHZ
R47 1K
C101 2.2UF
D1
R44 22K
C102 .005
IC7 8749
CPU
VDD
X2
X1
RESET
SS
EA
T1
T0
INT
RD
WR
PSEN
ALE
PROG
P27
P26
P25
P24
P23
P22
P21
P20
P17
P16
P15
P14
P13
P12
P11
P10
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
MFJ ENTERPRISES, INC.
921 LOUSVILLE Rd.
STARKVILLE, MS. 39759
CPU & WATCH DOG RESET
DRAWN BY S.K.
FILE NAME: S102D.P01
REV D
DATE: 4/20/89
SHEET 1 OF 9

FIG. 1-7

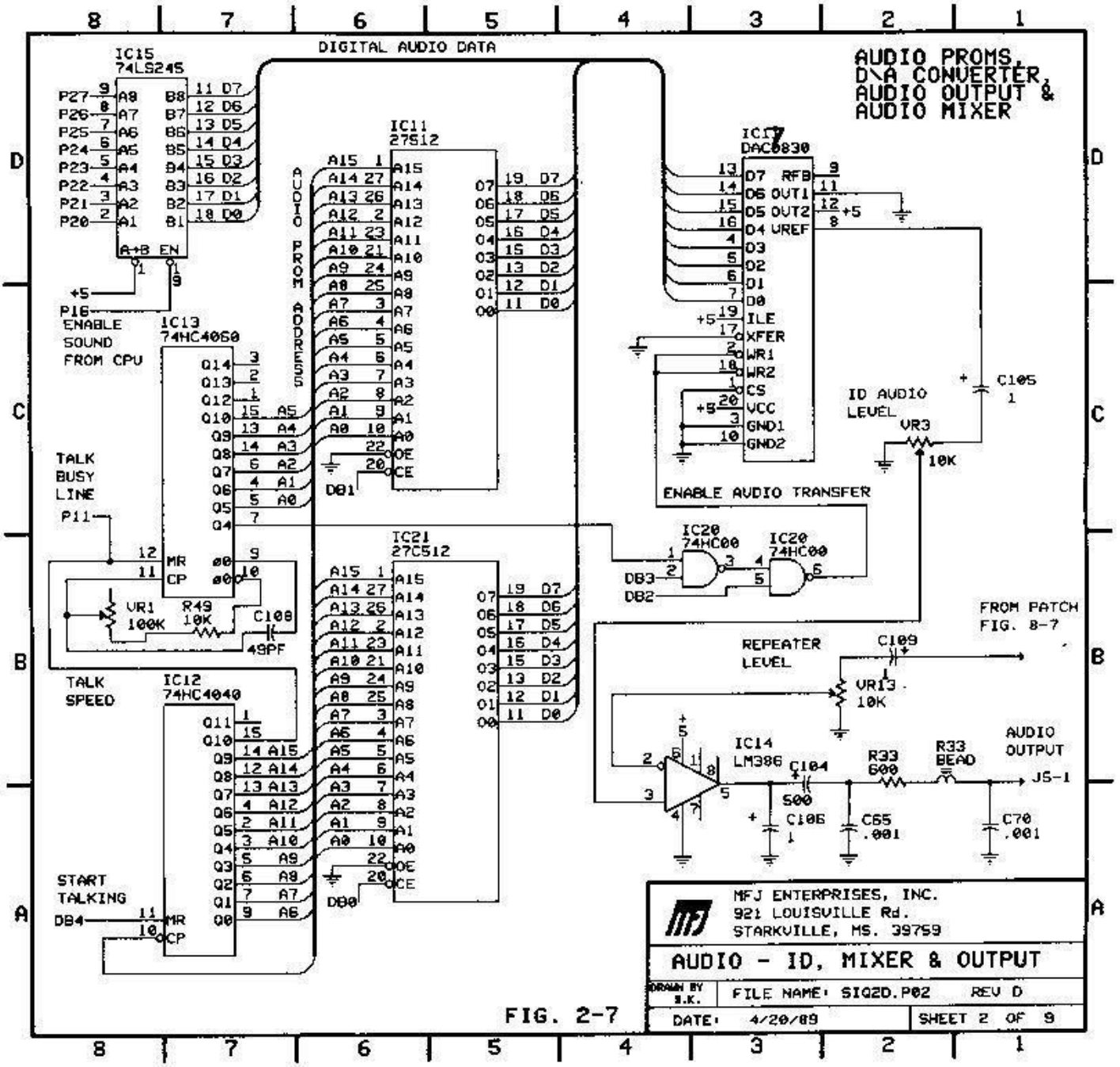

DIGITAL AUDIO DATA
AUDIO PROMS, D\A CONVERTER, AUDIO OUTPUT & AUDIO MIXER
IC15 74LS245
IC11 27512
IC17 DAC0830
IC13 74HC4060
IC21 27C512
IC12 74HC4040
IC20 74HC00
IC14 LM386
P16 ENABLE SOUND FROM CPU
TALK BUSY LINE
TALK SPEED
START TALKING
ENABLE AUDIO TRANSFER
ID AUDIO LEVEL
REPEATER LEVEL
FROM PATCH FIG. 8-7
AUDIO OUTPUT
J5-1
MFJ ENTERPRISES, INC.
921 LOUISVILLE Rd.
STARKVILLE, MS. 39759
AUDIO - ID, MIXER & OUTPUT
FILE NAME: SIQ2D.P02
REV D
DATE: 4/20/89
SHEET 2 OF 9

FIG. 2-7

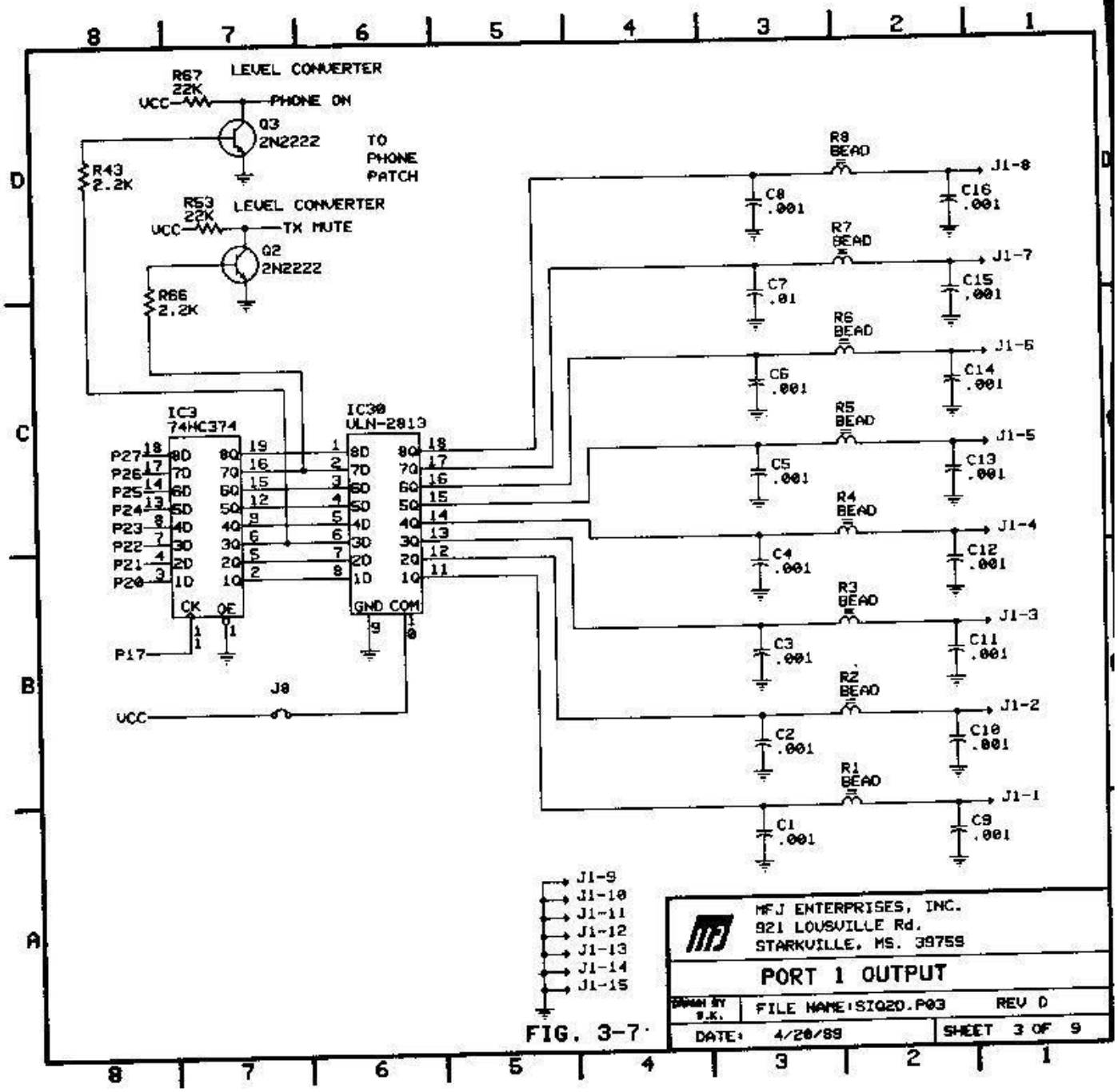

LEVEL CONVERTER
R67 22K
VCC
PHONE ON
Q3 2N2222
TO PHONE PATCH
R43 2.2K
R53 22K
LEVEL CONVERTER
VCC
TX MUTE
Q2 2N2222
R66 2.2K
IC3 74HC374
IC30 ULN-2813
P27
P26
P25
P24
P23
P22
P21
P20
P17
CK
OE
GND COM
J8
VCC
R9 BEAD
R7 BEAD
R6 BEAD
R5 BEAD
R4 BEAD
R3 BEAD
R2 BEAD
R1 BEAD
C8 .001
C7 .01
C6 .001
C5 .001
C4 .001
C3 .001
C2 .001
C1 .001
C16 .001
C15 .001
C14 .001
C13 .001
C12 .001
C11 .001
C10 .001
C9 .001
J1-8
J1-7
J1-6
J1-5
J1-4
J1-3
J1-2
J1-1
J1-9
J1-10
J1-11
J1-12
J1-13
J1-14
J1-15
MFJ ENTERPRISES, INC.
921 LOUSVILLE Rd.
STARKVILLE, MS. 39759
PORT 1 OUTPUT
FILE NAME:SIO20.P03
REV D
DATE: 4/20/89
SHEET 3 OF 9

FIG. 3-7

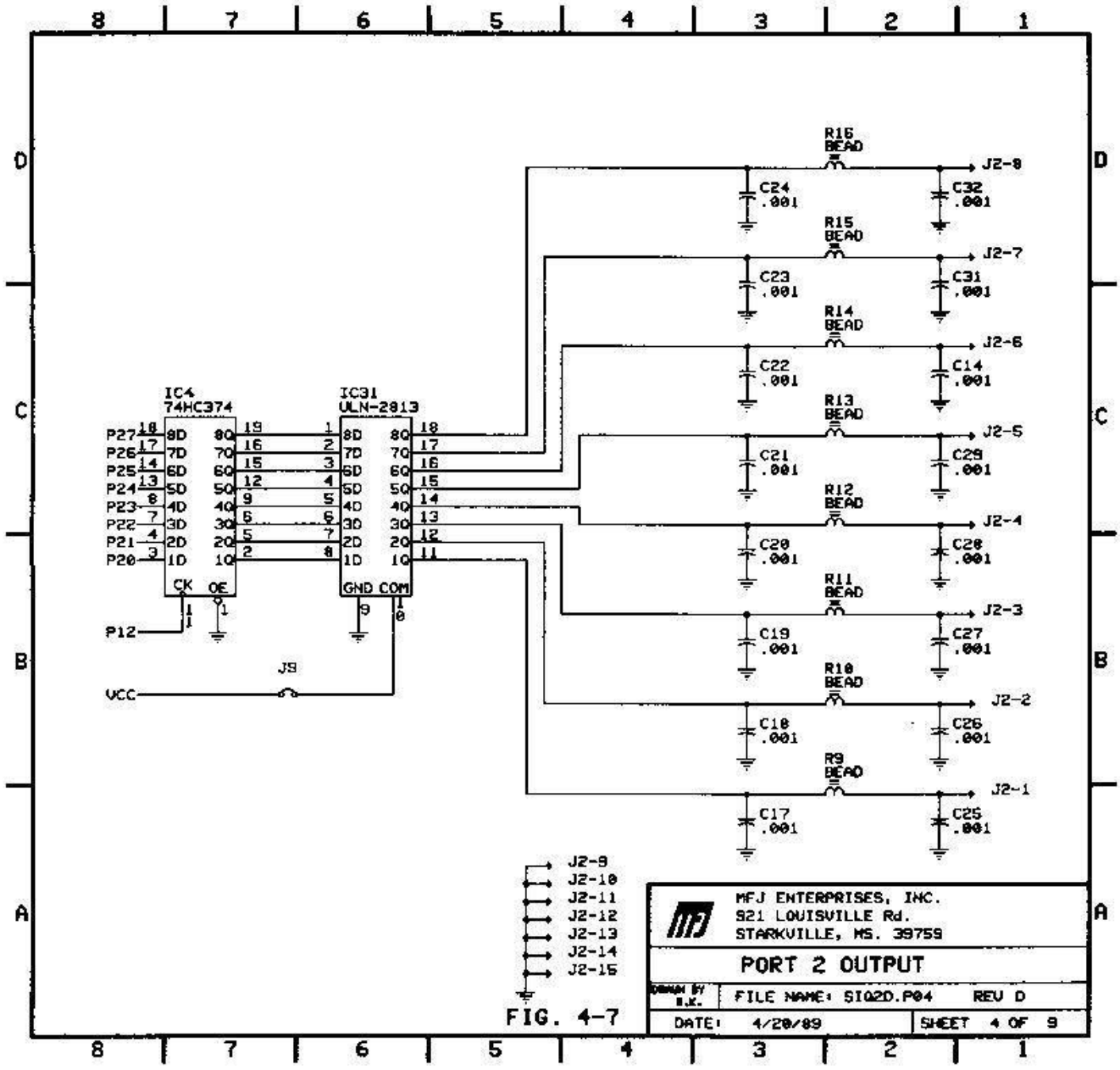

IC4
74HC374
IC31
ULN-2813
P27
P26
P25
P24
P23
P22
P21
P20
P12
JS
VCC
CK
OE
GND
COM
R16 BEAD
R15 BEAD
R14 BEAD
R13 BEAD
R12 BEAD
R11 BEAD
R10 BEAD
R9 BEAD
C24 .001
C23 .001
C22 .001
C21 .001
C20 .001
C19 .001
C18 .001
C17 .001
C32 .001
C31 .001
C14 .001
C29 .001
C28 .001
C27 .001
C26 .001
C25 .001
J2-8
J2-7
J2-6
J2-5
J2-4
J2-3
J2-2
J2-1
J2-9
J2-10
J2-11
J2-12
J2-13
J2-14
J2-15
MFJ ENTERPRISES, INC.
921 LOUISVILLE Rd.
STARKVILLE, MS. 39759
PORT 2 OUTPUT
FILE NAME: SIO2D.P04
REV D
DATE: 4/20/89
SHEET 4 OF 9

FIG. 4-7

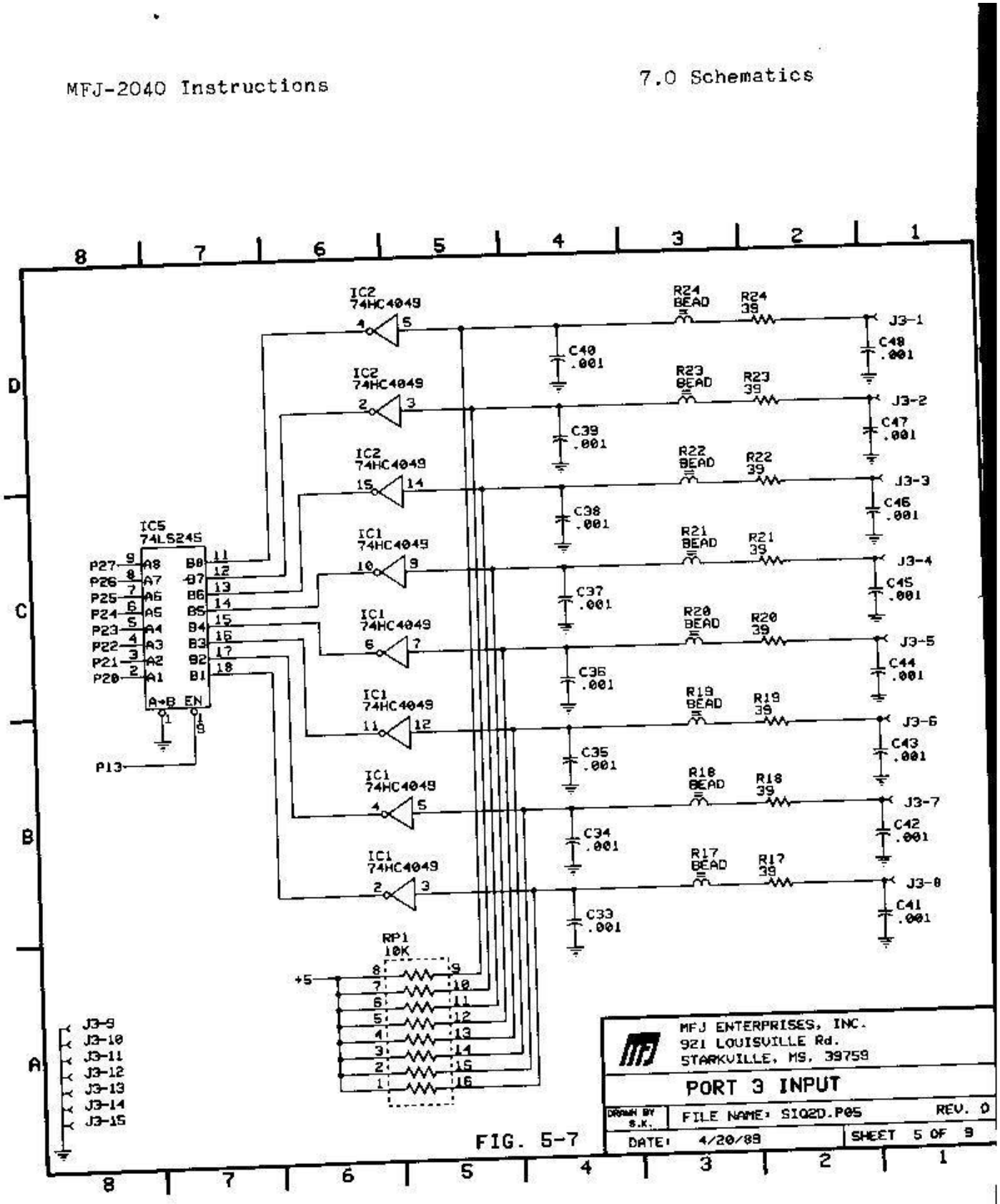

IC2 74HC4049
IC1 74HC4049
IC5 74LS245
RP1 10K
R24 BEAD
R24 39
R23 BEAD
R23 39
R22 BEAD
R22 39
R21 BEAD
R21 39
R20 BEAD
R20 39
R19 BEAD
R19 39
R18 BEAD
R18 39
R17 BEAD
R17 39
C40 .001
C39 .001
C38 .001
C37 .001
C36 .001
C35 .001
C34 .001
C33 .001
C48 .001
C47 .001
C46 .001
C45 .001
C44 .001
C43 .001
C42 .001
C41 .001
J3-1
J3-2
J3-3
J3-4
J3-5
J3-6
J3-7
J3-8
J3-9
J3-10
J3-11
J3-12
J3-13
J3-14
J3-15
P27
P26
P25
P24
P23
P22
P21
P20
P13
+5
MFJ ENTERPRISES, INC.
921 LOUISVILLE Rd.
STARKVILLE, MS. 39759
PORT 3 INPUT
DRAWN BY S.K.
FILE NAME: SIO2D.P0S
REV. 0
DATE: 4/20/89
SHEET 5 OF 9

FIG. 5-7

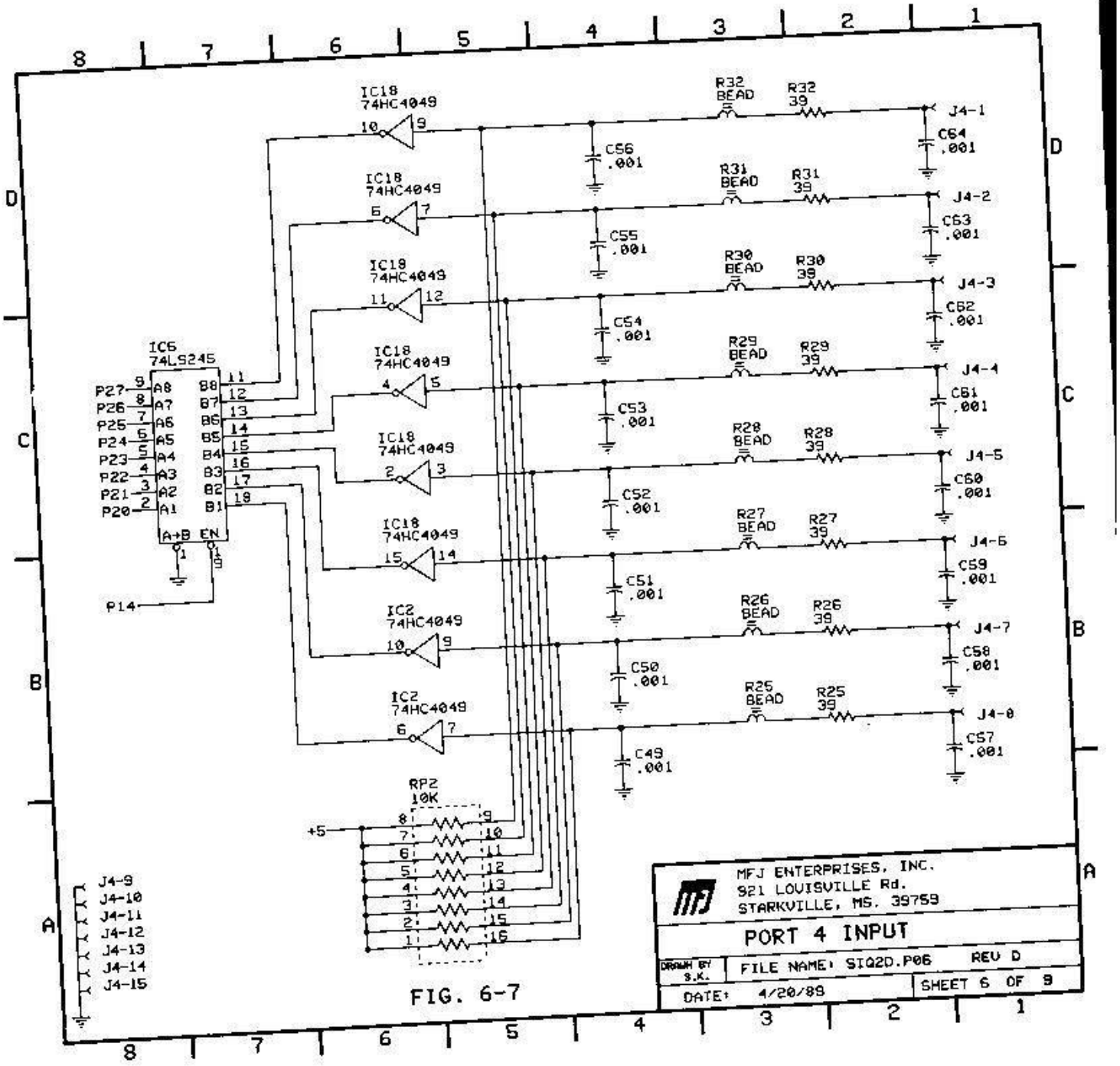

IC18 74HC4049
IC6 74LS245
IC2 74HC4049
RP2 10K
R32 BEAD
R32 39
R31 BEAD
R31 39
R30 BEAD
R30 39
R29 BEAD
R29 39
R28 BEAD
R28 39
R27 BEAD
R27 39
R26 BEAD
R26 39
R25 BEAD
R25 39
C56 .001
C55 .001
C54 .001
C53 .001
C52 .001
C51 .001
C50 .001
C49 .001
C64 .001
C63 .001
C62 .001
C61 .001
C60 .001
C59 .001
C58 .001
C57 .001
J4-1
J4-2
J4-3
J4-4
J4-5
J4-6
J4-7
J4-8
J4-9
J4-10
J4-11
J4-12
J4-13
J4-14
J4-15
P27
P26
P25
P24
P23
P22
P21
P20
P14
+5
MFJ ENTERPRISES, INC.
921 LOUISVILLE Rd.
STARKVILLE, MS. 39759
PORT 4 INPUT
DRAWN BY S.K.
FILE NAME: SIQ2D.P06
REV D
DATE: 4/20/89
SHEET 6 OF 9

FIG. 6-7

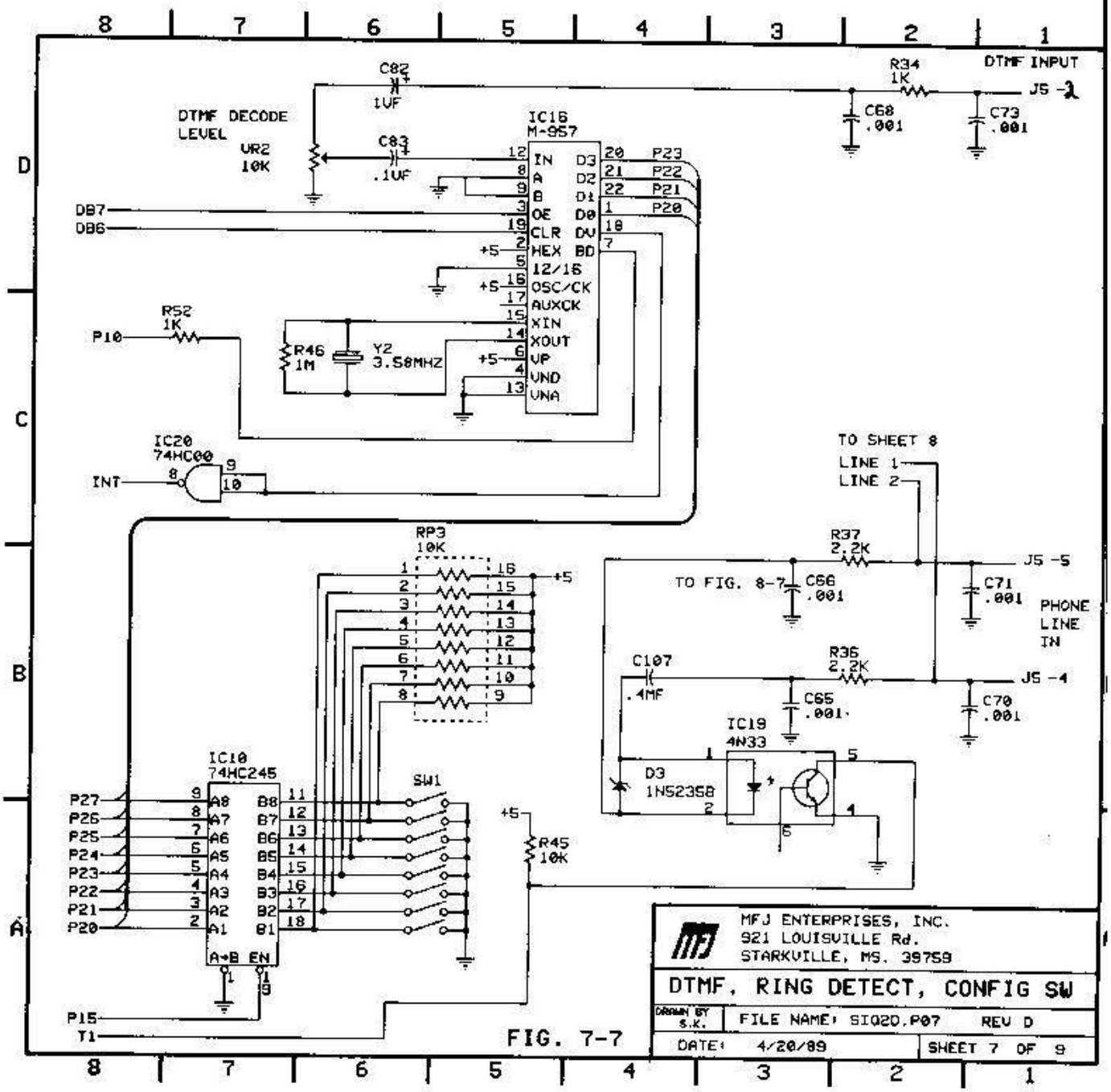

DTMF INPUT
J5 -3
R34 1K
C68 .001
C73 .001
C82 1UF
C83 .1UF
DTMF DECODE LEVEL
VR2 10K
IC16 M-957
IN
A
B
OE
CLR
HEX
12/16
OSC/CK
AUXCK
XIN
XOUT
VP
VND
VNA
D3
D2
D1
D0
DV
BD
P23
P22
P21
P20
DB7
DB6
+5
R52 1K
P10
R46 1M
Y2 3.58MHZ
IC20 74HC00
INT
TO SHEET 8
LINE 1
LINE 2
RP3 10K
R37 2.2K
J5 -5
TO FIG. 8-7
C66 .001
C71 .001
PHONE LINE IN
C107 .4MF
R36 2.2K
J5 -4
C65 .001
C70 .001
IC19 4N33
D3 1N5235B
IC10 74HC245
SW1
R45 10K
P27
P26
P25
P24
P23
P22
P21
P20
P15
T1
MFJ ENTERPRISES, INC.
921 LOUISVILLE Rd.
STARKVILLE, MS. 39759
DTMF, RING DETECT, CONFIG SW
DRAWN BY S.K.
FILE NAME: SI02D.P07
REV D
DATE: 4/20/89
SHEET 7 OF 9

FIG. 7-7

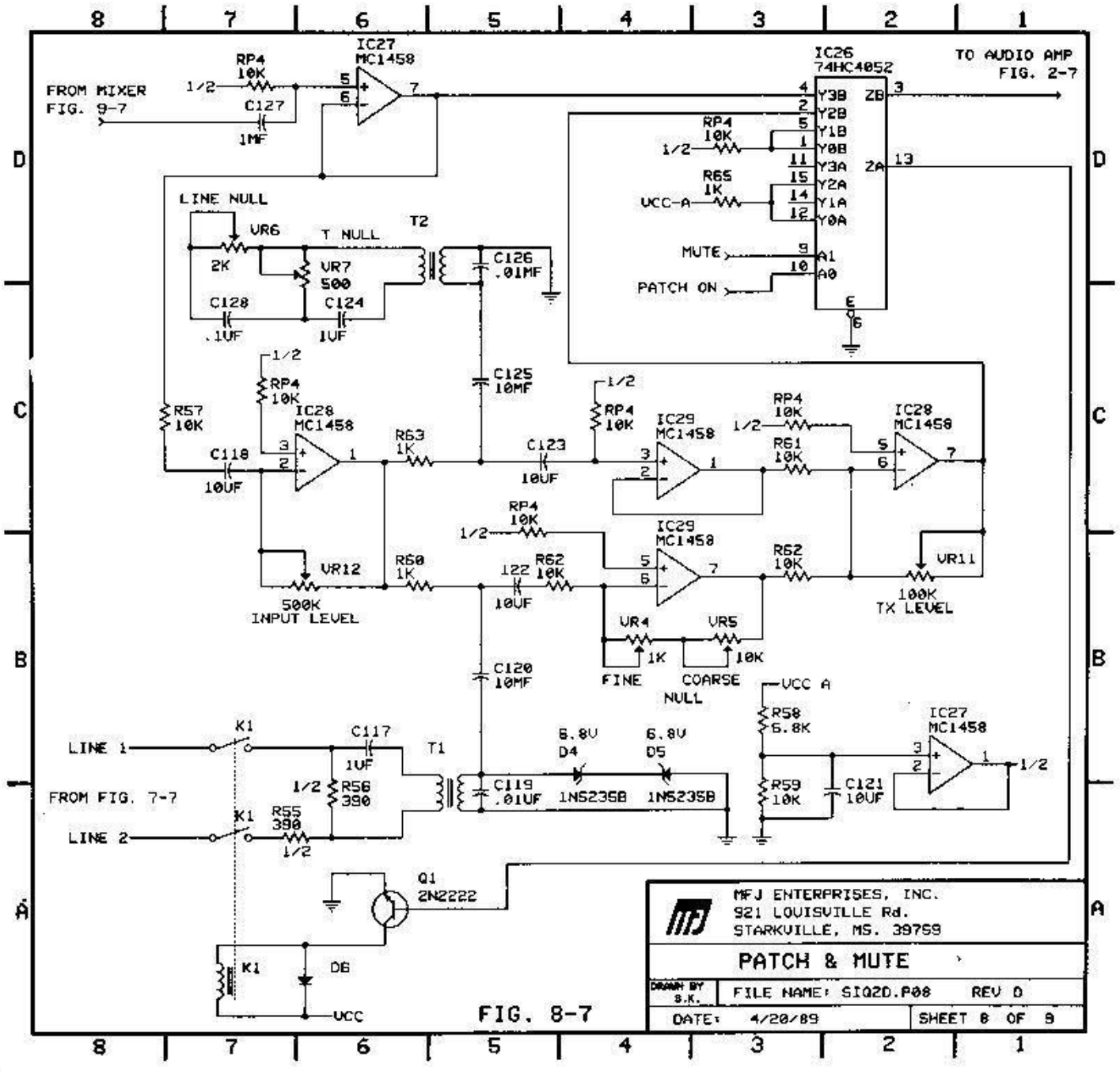

FROM MIXER FIG. 9-7
RP4 10K
IC27 MC1458
C127 1MF
IC26 74HC4052
TO AUDIO AMP FIG. 2-7
LINE NULL
VR6 2K
T NULL
VR7 500
T2
C126 .01MF
C128 .1UF
C124 1UF
C125 10MF
R57 10K
IC28 MC1458
C118 10UF
R63 1K
C123 10UF
IC29 MC1458
R61 10K
R65 1K
VCC-A
MUTE
PATCH ON
VR12 500K INPUT LEVEL
R60 1K
C122 10UF
R62 10K
VR11 100K TX LEVEL
VR4 1K
VR5 10K
FINE
COARSE NULL
C120 10MF
VCC A
R58 6.8K
R59 10K
C121 10UF
LINE 1
LINE 2
FROM FIG. 7-7
K1
C117 1UF
R56 390
R55 390
T1
C119 .01UF
6.8V D4
6.8V D5
1N5235B
Q1 2N2222
D6
VCC
MFJ ENTERPRISES, INC.
921 LOUISVILLE Rd.
STARKVILLE, MS. 39759
PATCH & MUTE
DRAWN BY S.K.
FILE NAME: SIQ2D.P08 REV D
DATE: 4/20/89
SHEET 8 OF 9

FIG. 8-7

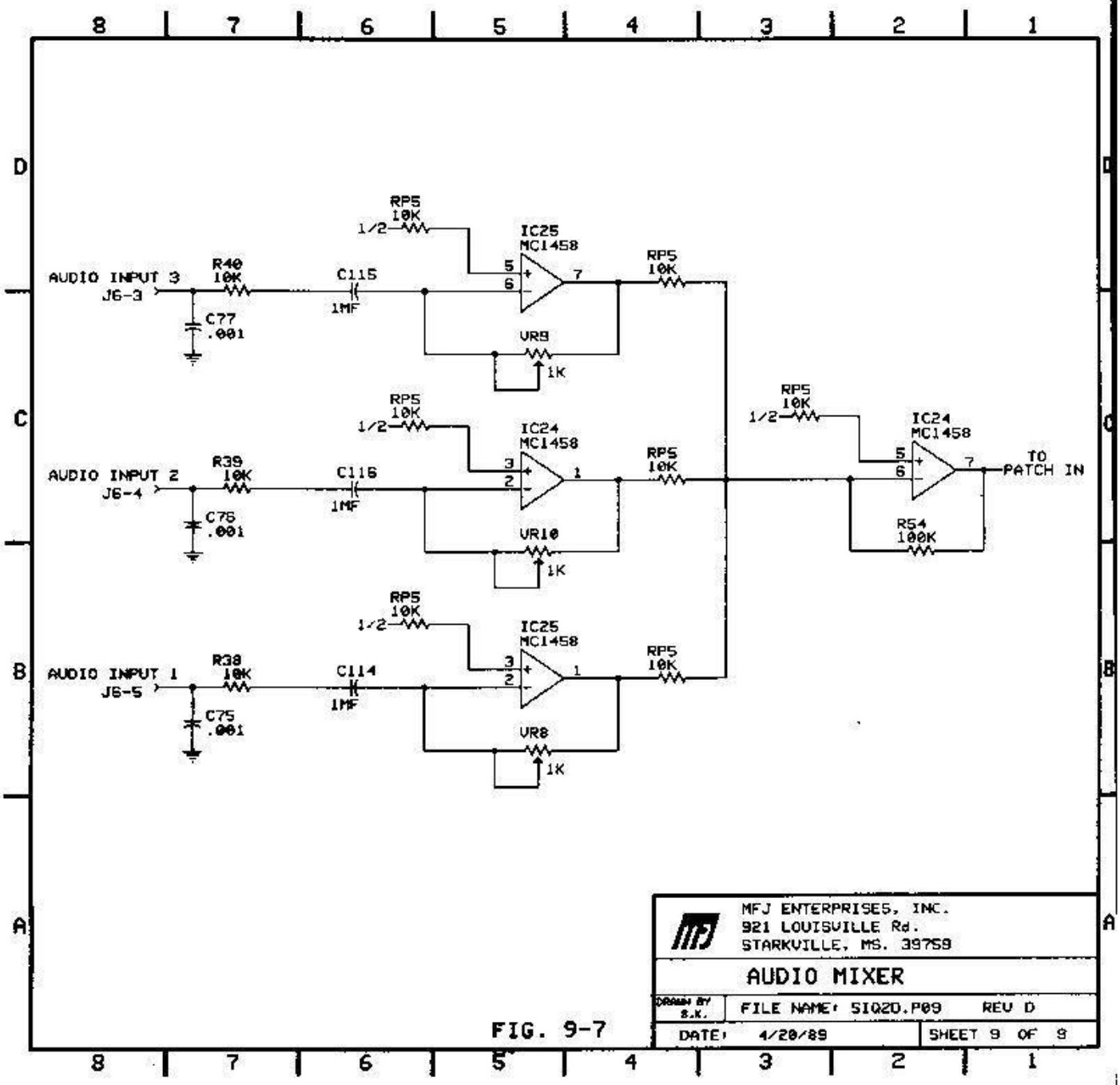

AUDIO INPUT 3
J6-3
R40
10K
C77
.001
C115
1MF
RP5
10K
1/2
IC25
MC1458
VR9
1K
AUDIO INPUT 2
J6-4
R39
10K
C76
.001
C116
1MF
IC24
MC1458
VR10
1K
AUDIO INPUT 1
J6-5
R38
10K
C75
.001
C114
1MF
IC25
MC1458
VR8
1K
IC24
MC1458
R54
100K
TO
PATCH IN
MFJ ENTERPRISES, INC.
921 LOUISVILLE Rd.
STARKVILLE, MS. 39759
AUDIO MIXER
FILE NAME: SIQ2D.P09
REV D
DATE: 4/20/89
SHEET 9 OF 9

FIG. 9-7

Order Form

DATE _____

Call Sign _____

Name _____

Company _____

Address _____

City _____ State _____ ZIP _____

Phone # _____

☐	Voice ID Prom (5 seconds max.) MFJ-50	$39.95
☐	2nd Voice Message Prom (5 sec max.) MFJ-51	$39.95
☐	Cassette Included	
☐	Female Voice	
☐	Male Voice	

Print words for ID or 2nd message:

_____

_____

_____

_____

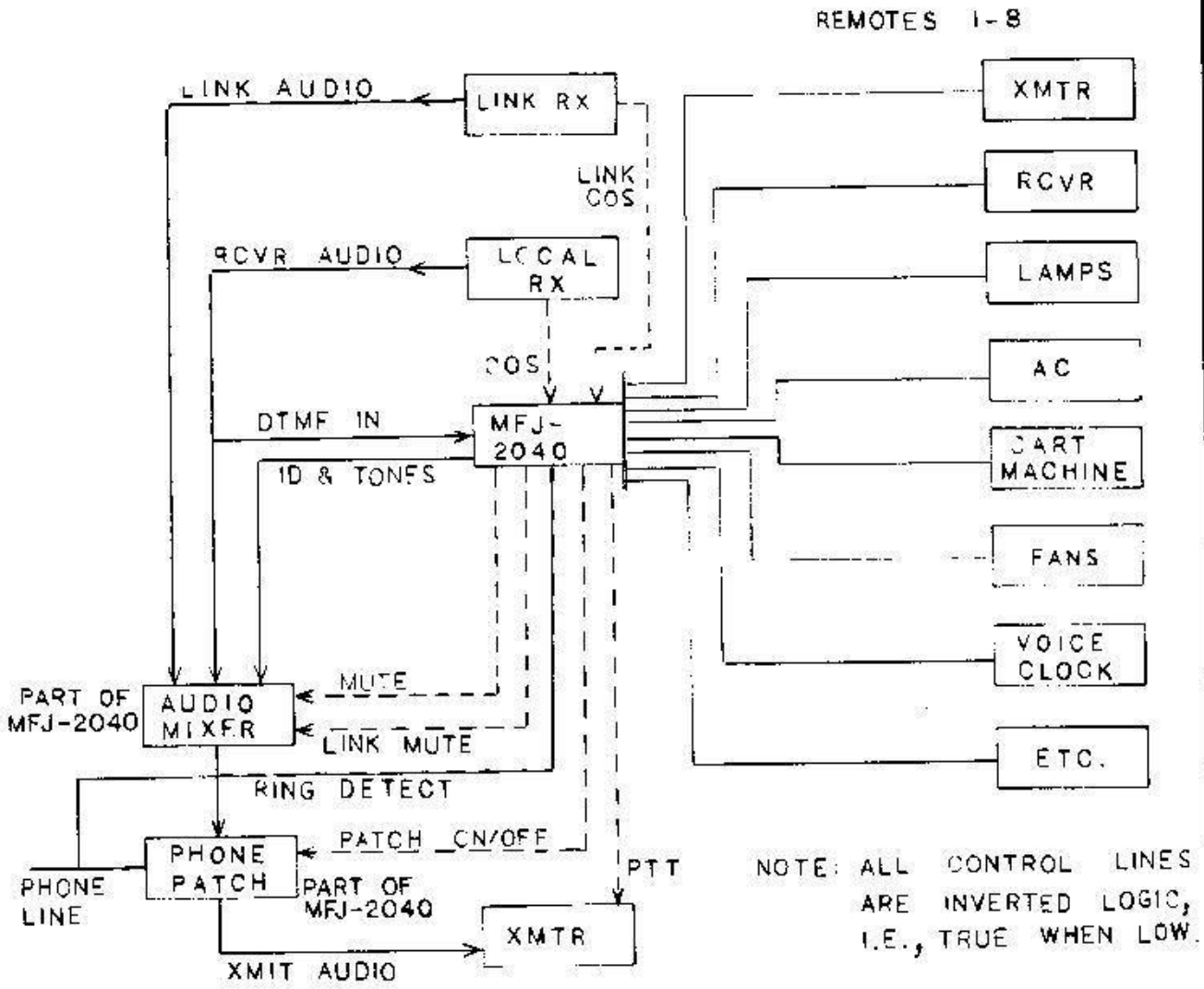
☐	Connector Kit 10-20104		$19.95
☐	MFJ-1315 power adapter		$14.95
		Shipping	$ 5.00
		Total	_____

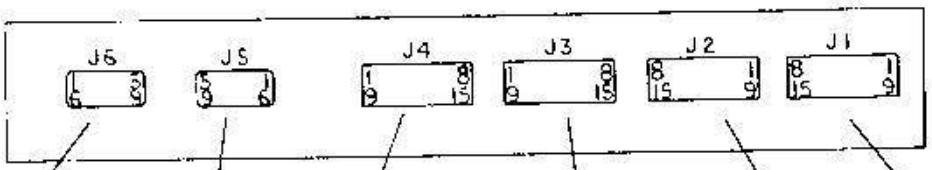
☐ Check Enclosed
☐ Visa/Mastercard/American Express
Discover

Card Number :
Expiration date:

Mail order to: MFJ Enterprises, Inc.
P.O. Box 494
Mississippi State, MS 39762

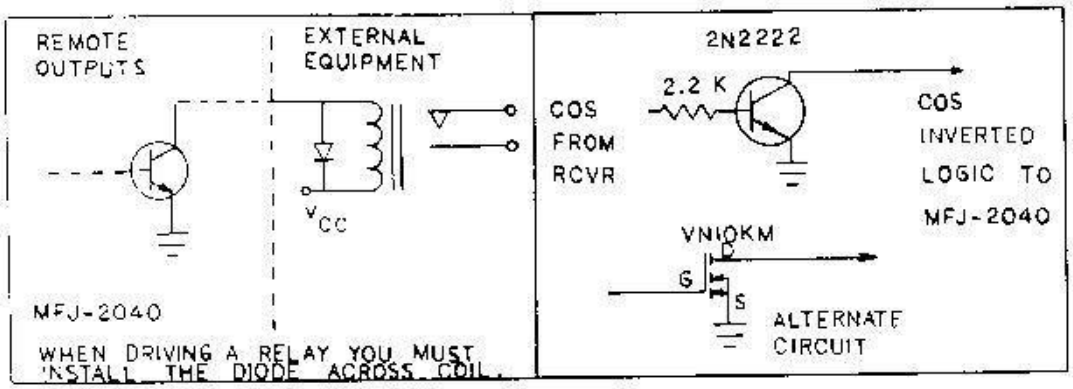
1-800-647/800


REMOTES 1-8
LINK AUDIO
LINK RX
LINK COS
RCVR AUDIO
LOCAL RX
COS
DTMF IN
ID & TONES
MFJ-2040
XMTR
RCVR
LAMPS
AC
CART MACHINE
FANS
VOICE CLOCK
ETC.
PART OF MFJ-2040
AUDIO MIXER
MUTE
LINK MUTE
RING DETECT
PHONE PATCH
PATCH ON/OFF
PHONE LINE
PART OF MFJ-2040
PTT
XMTR
XMIT AUDIO
NOTE: ALL CONTROL LINES ARE INVERTED LOGIC, I.E., TRUE WHEN LOW.

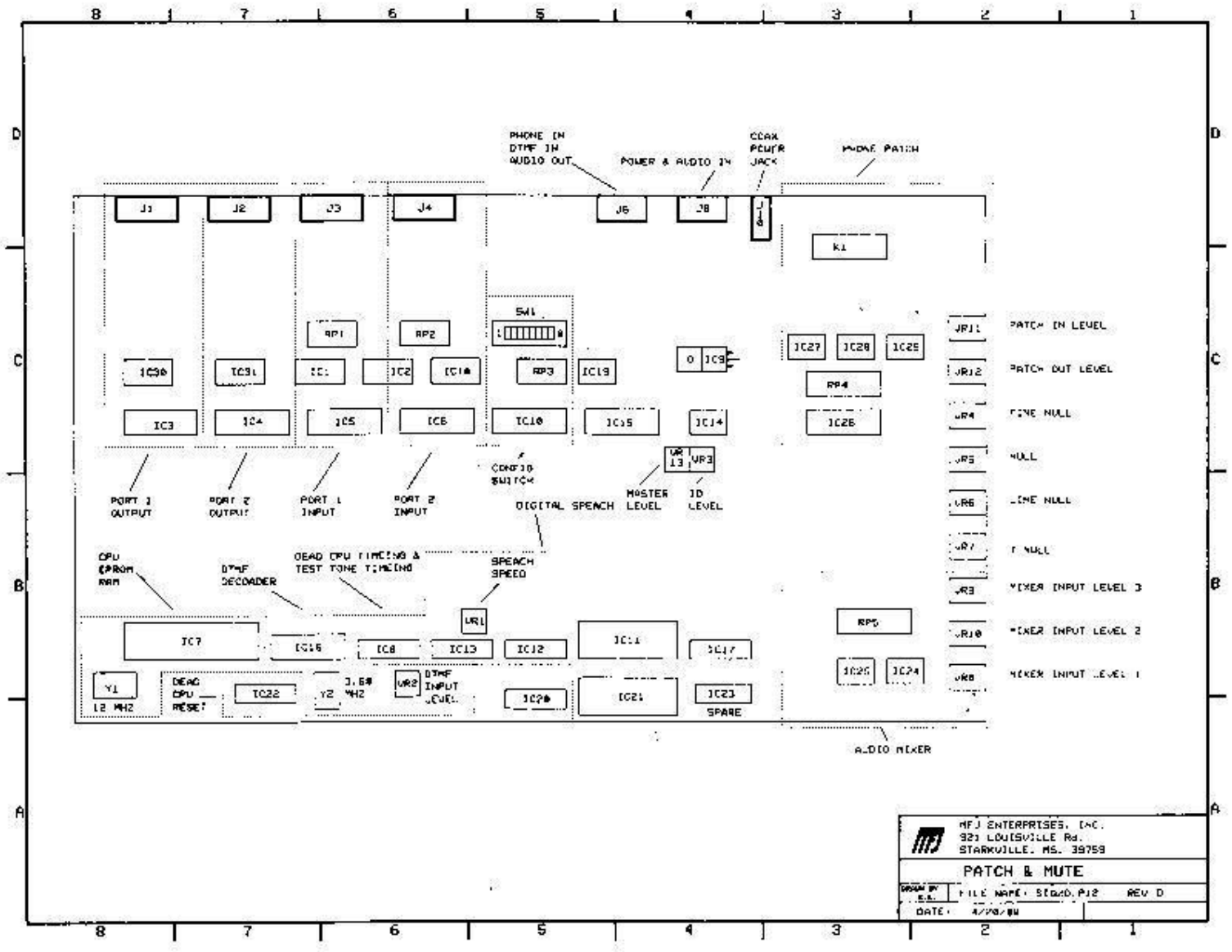


PIN	J6	J5	J4 IN	J3 IN	J2 OUT	J1 OUT
1	N/C	AUDIO OUT	Not in use	Not In use	Remote 1	Transmit (PTT)
2	POWER +	DTMF IN	Not in use	Not in use	Remote 2	TX Mute
3	AUDIO IN 1	N.C.	Not in use	Not in use	Remote 3	TX PL on
4	AUDIO IN 2	PHONE IN	Not in use	Not in use	Remote 4	Link RX MUTE
5	AUDIO IN 3	PHONE IN	Alarm 4	Not in use	Remote 5	NC RX PL
6	POWER -	GND.	Alarm 5	Link Receiver	Remote 6	PHONE ON
7	GROUND	GND.	Alarm 2	Local PL	Remote 7	Not in use
8	GROUND	GND	Alarm 1	Local Receiver	Remote 8	Not in use
9	GROUND	GND.	GND.	GND.	GROUND	GROUND
10			GND.	GND.	GROUND	GROUND
11			GND.	GND.	GROUND	GROUND
12			GND.	GND.	GROUND	GROUND
13			GND.	GND.	GROUND	GROUND
14			GND.	GND.	GROUND	GROUND
15			GND.	GND.	GROUND	GROUND

NOTE: All logic inputs on J3 and J4 and all outputs on J1 and J2 are at power low, i.e., grounded.



REMOTE OUTPUT CIRCUIT LOGIC INVERTER CIRCUIT



MFJ ENTERPRISES, INC.
921 LOUISVILLE Rd.
STARKVILLE, MS. 39759

PATCH & MUTE

DRAWN BY: E.S. | FILE NAME: STDAD.PJ2 | REV D

DATE: 4/20/88

CONFIGURATION SWITCHES

TEST TONES: This is a very useful function!
Test Tones are used to check the frequency response, deviation, and audio levels. There are 3 tones:
3.1 KHz, 1 KHz, and 300 Hz.
Each tone is sent in sequence and lasts for approximately 4 seconds each.
Once the tones are turned on, the only way to turn them off is to turn Dip Switch 1 OFF, then press a key on the DTMF pad or to turn Dip Switch 1 OFF then the power OFF.

Repeat ID: This function causes the controller to put out a continuous ID. Turn off Dip Switch will cause the ID to cease at the end of its current ID cycle.

RX/RX & PL: When the MFJ-2040 is used to control a PL decoder, this switch should be in the OFF position. If the MFJ-2040 is hooked to the output of a decoder, this switch should be ON.

REMOTE CONFIG 1 & 2:
These switches are used to control the auto off function of REMOTES 1-4, 5 & 6, or 1-8.
With switches 4 and 5 OFF, remotes can only be turned OFF by DTMF.
With Switch 4 ON, remotes 1-4 will automatically shut off after 10 minutes of no repeater activity. If switch 5 is on, remotes 5 & 6 will automatically shut off after 10 minutes of inactivity. If both switches 4 and 5 are on, all remotes will automatically shut off after 10 minutes of repeater inactivity.

Lock Operator: In the ON position, this switch prevents anyone from changing the Control Operator prefix.
The OWNER prefix code is the key to changing the Control Operator code.

Lock Owner: In the ON position, this switch prevents anyone from changing your control operator code.

Lock USER: In the ON position, this switch prevents anyone from changing your USER prefix code.