

8. REPAIR

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DTMF DECODE TEST

This test is provided to allow testing the operation of the DTMF decoder in the Model 40. When using the DTMF setup mode, this test only decodes DTMF from the telephone and, when using terminal mode programming either connected directly to the Model 40 or via modem, it only decodes digits from the receiver.

How to program it:

- 1) Using DTMF either on the telephone line or through the local telephone port (the DTMF setup commands cannot be used from the radio side):

Enter the program mode using the program access code (default is 0012123).

Enter: 111# (the unit will key and start the Tx gain test)

Enter: 6 (the unit starts the DTMF decode test)

At this point, if you enter any more digits, the Model 40 will send "beeps" back to the telephone, the number of beeps being equal to the digit decoded. To terminate the DTMF decode test, enter a "*" or a "#"; however, unlike the other tests, this does not get you all the way out of the test mode. The Model 40 will stop the DTMF test and go back to the Transmitter gain test. To exit the test mode completely, you need to enter one more '#'.
#

WARNING!!: Once you have started the test, YOU must terminate it! The Model 40 will NOT time out and exit the test mode the way it will from the general program mode. If you do not terminate the test with a "#" prior to hanging up the telephone, then you must cycle power on the unit to stop the test.

- 2) Programming via a computer or terminal, either connected directly to the Model 40 or through its optional modem:

Once connected to the Model 40 and at the Main menu, type a '4' and press Enter to bring up the Diagnostics menu. Then type a '8' and press Enter to start the test.

The unit will display to the screen all the digits that it decodes from the receiver until the test is terminated.

Press any key to terminate the test.

IN CASE OF DIFFICULTY...

In case of installation difficulty, call Zetron Model 40 Applications Engineering Department at (206) 820-6363. Please have the serial number of the unit and/or the Zetron Order number. If the call is made from the installation site by the installer or radio technician, often the problem can be solved over the phone.

If a problem develops after a unit has been in service for some time, call the Zetron Model 40 Service Department at (206) 820-6363. If the call is made from the installation site by a radio technician, the problem can often be solved over the phone.

MISCELLANEOUS SERVICE NOTES

1. When the unit is reset or powered on, an automatic memory test will be executed. If greater than 15 memory errors are detected, the unit will reset all of its memory to the default settings.
2. If the audio does not sound correct, perform an audio sweep test by generating an audio signal on the RF input of the repeater (of known deviation), and monitor the repeater output deviation. The deviation should be fairly flat from 300 to 2500 Hz.
3. When using the internal noise detector for COR, if the COR polarity switch seems backward, the audio input from the receiver may not have enough high frequency content for the noise detector to operate. It is usually caused by low pass filtering of the discriminator signal. An alternate connection point must be found in the receiver which provides unfiltered audio, or a receiver generated COR signal must be connected.
4. The "Carrier" LED MUST follow carrier activity on the channel. It must be lit with carrier present, and extinguished when carrier is absent. If it is always off, the Model 40 will not function correctly.

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THEORY OF OPERATION

The design of the Model 40 System Patch is microprocessor based, resulting in a software intensive product whose operation can change simply by updating the instructions stored in memory. The microprocessor controls the relay, LED's, audio paths, and peripheral chips such as the timers.

Microprocessor Operation

To ensure an orderly power-on sequence to the microprocessor U30, and its peripheral devices, the active low reset signal is not brought up until the 12-volt supply has stabilized; CR6, CR7, R7, R10, C11 and U9A accomplish this task. The delayed reset also gives crystal Y2 time to stabilize. The reset duration is controlled by R10 and C11.

The microprocessor contains random access memory (RAM) for short term system use, and a watchdog that oversees system operation and will reset the unit if a problem exists.

Memory is functionally divided into three sections: Program memory, operating/protected Database memory, and SMDR memory. Program memory resides in erasable programmable read-only memory (EPROM U4, U5) and stores the actual operating instruction that control the Model 40.

Operating/database memory is provided by battery-backed static read/write memory (RAM U7). The Model 40 performs computations, maintains data and stores permanent system and user data in this area. All of this information must be retained regardless of how often the unit loses power. To do this, the Model 40 stores it in a low power static read/write memory that plugs into a socket with a battery (U7). The protected memory chip has its own private power supply with a 10-year lifespan. SMDR memory is identical to operational memory but holds detailed call transaction records.

Two peripheral timer/counters, U1 and U2, are available to the microprocessor. Each counter chip contains three timers which are used for tone generation.

The microprocessor is able to directly control 46 I/O lines that interface to the different circuits on the board. These carry information to/from the DTMF decoder chip, the serial port, the audio path gate controls, the noise detector and squelch, and the LED's. The Non Maskable Interrupt (NMI) is an edge triggered input that is tripped by the connect/disconnect button on the front panel.

Power Supply

Full wave bridge rectification and filtering is normally used to smooth the 9-12 VAC from the wall transformer, or supply additional filtering of 12 VDC input. The 12 volts is used to power the relays and audio amplifiers. The main +5 VDC supply is regulated by VR1, a +8 VDC supply is regulated by VR2 for audio circuits. Bias supply for audio circuits is provided by R51, R52, R53, C30, C83, C50, C38 and C82.

Serial Communications

A feature of the microprocessor is that it contains an internal UART for asynchronous data transfer. The UART receives data through pin 20 of the microprocessor after being level shifted to 0 to 5 volt levels by U6. Transmitted data leaves through pin 21 of the microprocessor, then gets level shifted by U8 to standard RS-232 levels. The internal programming supports the XON/XOFF protocol. All standard baud rates are generated internally by the microprocessor.

DTMF Decoding

The mobile audio is passed thru gain stage U11B, then is hi-pass filtered by U40 to remove CTCSS/Digital frequencies. The DTMF decode audio path is selected by the microprocessor by controlling audio gate U36B. Audio is then routed through a de-emphasis filter. Finally the signal is presented to the DTMF decoder chip U22.

CTCSS Encoding

Two signals are used for CTCSS generation. One is a clock frequency at the exact CTCSS rate from the counter U5, and the other is a clock frequency at 64 times the CTCSS rate from the timer module. These signals are fed into a low pass filter U15, then sent out gain stage U26B to the transmitter. Since most transmitters will transmit higher deviation when fed higher audio frequencies (pre-emphasis), filter C62 is switch selectable to de-emphasize the signal before being presented to the transmitter.

Digital Encoding

For generating Digital Squelch signals, the microprocessor will send the digital code out through U33 pin 9. Data inversion is done inside the microprocessor if required. The timer module U1 will produce a high frequency clock signal that is fed into the low pass filter U15. Operation is very similar to CTCSS encoding described above.

DTMF Encoding

To generate a DTMF tone on the radio channel or out the telephone line, the fundamental frequency of each tone is generated by timer/counter U5 while the 64X clock frequency is generated by U1. Low pass filters U8, U10 remove the square edges from the signal. The signal is routed to the telephone or transmitter through audio gate U36A. Level is controlled by switching in R154 using audio gate U35A. Transmitter audio is summed and emphasized through JP11, R98, R104, R105, R126, and C56 and presented to the audio amplifier U26A.

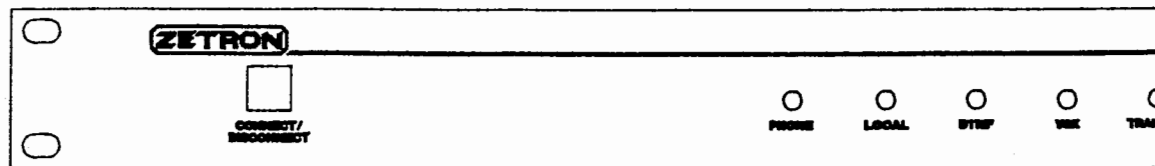
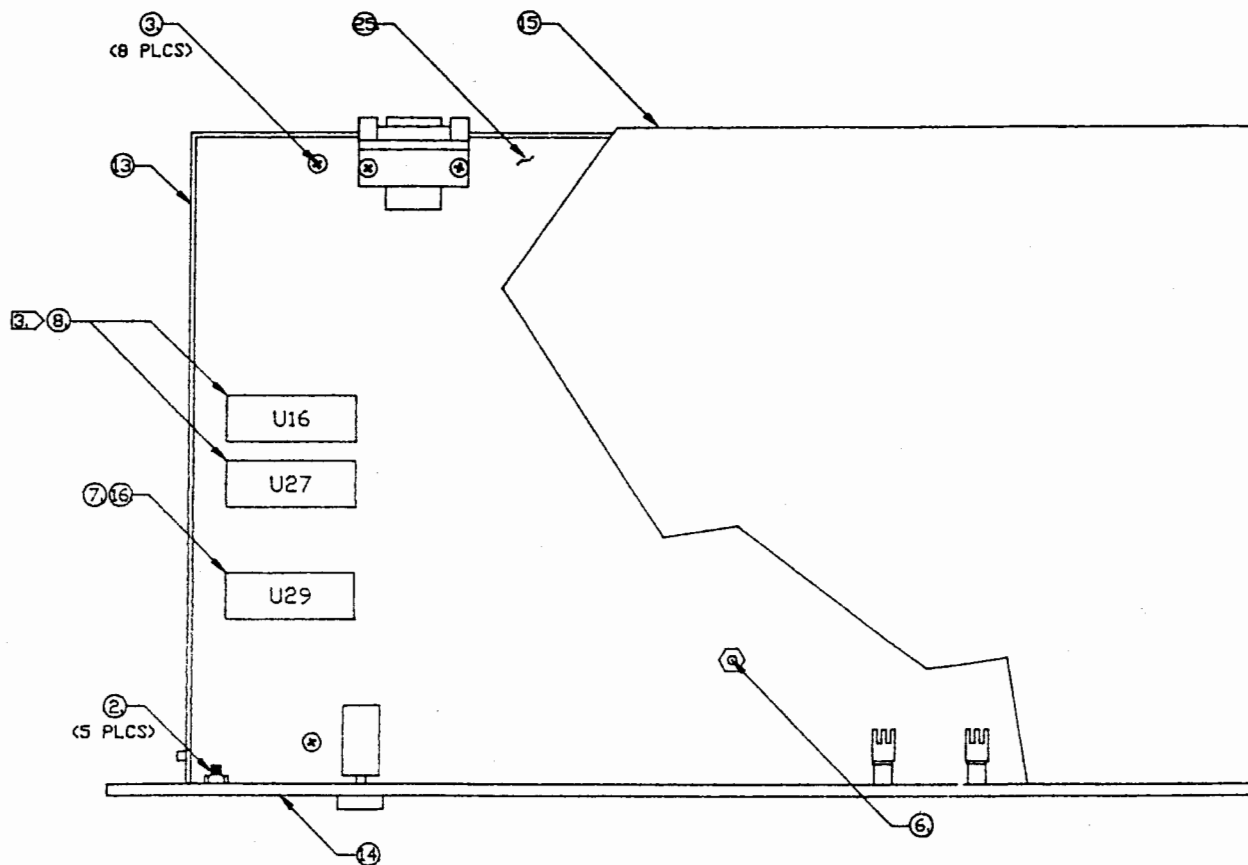
Squelch/Repeat Audio

The repeat audio is passed through the input gain stage, the audio hi-pass to remove the CTCSS/Digital encode, and finally to the squelch gate. After the squelch gate, the audio is routed through a signal processing chip (U39). The microprocessor routes the audio to the transmitter through audio gate U35B. The audio is routed to the telephone line through audio gate U36C and through audio amplifier U25 after which it is presented to the hybrid circuit.

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COR Input

When using external COR input, R22, R23 and C21 provide input protection. The signal then is presented to U12A and compared against the level set by the threshold pot R112. JP13 provide COR polarity selection. The COR logic signal is presented to the microprocessor input port pin 33. When external COR is not possible, the internal dual time constant squelch may be used. JP10 selects internal or external COR.



REVISIONS				
REV	DESCRIPTION	DRAWN	APPROV	DATE
B	RELEASE (ECN 1222)	NK		
B1	ECN 1441	NK		
C	ECN 2034	AH		

NOTES:

1. PLACE ITEMS 4, 5, 9-11 & 17 IN PLASTIC BAG ITEM 22.
2. COMPRESS CABLES AS TIGHT AS POSSIBLE. PLACE ONE EACH INTO BAG, ITEM 22.
3. PROGRAM EPROMS ITEMS 8 WITH SOFTWARE ITEM 24.
4. FCC DECAL, ITEM 12 WILL BE INSTALLED AT FINAL INSPECTION.
5. PLACE MANUAL, ITEM 1, INTO BAG ITEM 21.
6. PLACE COMPLETED UNIT IN BAG, ITEM 23.
7. PACK PER INSTRUCTIONS 029-9123.

26.	1	709-7000	6 COND MOD CABLE
25.	1	702-9201	PCB
24.	1	601-0239	SOFTWARE
23.	1	449-9052	BAG, PLASTIC 10x6x24
22.	1	449-9019	BAG, PLASTIC 5 X 7
21.	1	449-9002	BAG, PLASTIC 10 X 12
20.	2	449-0383	BIPOLAR FOAM
19.	1	449-0386	M38 INTERIOR TRAY
18.	1	449-0385	M38 PKG BOX
17.	4	431-0006	FOOT, BUMPON
16.	1	416-1214	28 PIN SKT/BAT 8/32K
15.	1	415-9485-1	TOP/REAR COVER
14.	1	415-9484-1	FRONT PANEL, FNISHED
13.	1	415-9347	BOTTOM COVER
12.	1	415-9003	DECAL, TS100 SN/PN/DP
11.	1	401-0058	15 POS BLK FEMALE
10.	1	401-0039	9 PIN DB HOOD
9.	1	401-0038	9 PIN DB
8.	2	322-7256	32Kx8 CMOS EPROM
7.	1	321-6264	8Kx8 RAMS 150ns
6.	1	250-0104	440x1/2 W/STUD
5.	4	236-0004	WASHER, NYLON #10 BLK
4.	4	220-0250	1032x3/4 F.H. PHIL BLK
3.	8	220-0108	440x1/4 PAN PHILLIPS
2.	5	210-0001	440 KEPT NUT PLTD
1.	1	025-9136	MANUAL

ITEM	QTY	PART NUMBER	DESCRIPTION
BOM	NK	3-5-91	
CHK			
APV			
TO DRAWING		TITLE	
COPY AS SHOWN		ZETRON	
REVISION		ZETRON, INC. 18800 134TH COURT N.E. REDMOND, WA 98072	
ANGLER		MODEL 40 SYSTEM PATCH	
SCALE		901-9123	
SHEET		C L	

MODEL 40 SYSTEM PATCH

SECTION 8 - REPAIR

MODEL 40 CONTROL BOARD SPARE PARTS LIST (951-9049A)

ITEM	QTY	ZETRON P/N	DESCRIPTION	MANUFACTURER PART #
1.	2	105-0001	VARISTOR 250V AC	V250LA20
2.	2	106-0047	4.7 OHM 1/2W 5% FUSIBLE	BW1/2F-4.7OHM5%B
3.	1	107-0500	500 OHM TRIMPOT 1 TURN	3386P-1-501
4.	1	107-0501	5K POT 1 TURN	3386P-1-502
5.	1	107-0502	50K POT 1 TURN	3386P-1-503
6.	1	107-3085	10K POT 1 TURN	3386P-1-103
7.	4	152-0012	.1 UF 50V +-5% POLYESTER	ECQ-V1H104JZ
8.	2	152-0085	.01 UF 50V +- 5% POLYESTER	ECQ-V1H103JZ
9.	1	152-0089	.001 UF 50V +-5% POLYESTER	ECQBIH102JZ
10.	1	154-0025	1 UF 35V TANTALUM	ECS-F-35E1
11.	2	155-0052	10 UF 35V +-20% RADIAL ALUMINUM ELECTROLYTIC	ECEA1VU100
12.	2	155-0077	100UF 25V +-20% RADIAL ALUMINUM ELECTROLYTIC	ECEA1EU101
13.	1	155-0090	1000 UF 25V +-20% RADIAL ALUMINUM ELECTROLYTIC	ECE-A1EU102
14.	1	155-0140	3300 UF 25V +50%-10% AXIAL ALUMINUM ELECTROLYTIC	ECEB1EU332
15.	2	210-0001	440 KEPT NUT	
16.	2	250-0104	440X1/2 W/STUD	
17.	1	305-1540	LO SIZE/COST PHONE HYBRID XFMR	671-1540
18.	1	311-0011	LED RED FLUSH	TLSR-5201
19.	1	311-1001	OPTO ISOLATOR, BI-POLAR	H11AA1
20.	1	316-0004	TONE FILTER	MF4CN-50
21.	1	316-0232	RS232 DRIVER	MAX 232
22.	2	316-0358	OP-AMP, DUAL	LM358N
23.	1	316-7805	REGULATOR, +5V 1.5A	LM340T-5
24.	1	321-0204	DTMF RECEIVER	SSI-204P
25.	1	321-6264	8K X 8 RAM	HM6264 LP-1
26.	1	321-6811	UP-HC MOS	MOT68HC11A0FN
27.	1	321-6840	PTM	MC6840
28.	1	323-4053	3PDT SWITCH	MC144053
29.	1	323-4066	QUAD ANALOG SWITCH	MC14066B
30.	1	324-4138	DECODER 1 OF 8	MCH74HC138
31.	1	324-4259	LATCH, 8 BIT ADDRESSABLE	74HC259
32.	1	324-4373	OCTAL LATCH	MC74HC373
33.	1	324-7400	QUAD NAND	MC74HC00
34.	1	324-7414	HEX SCHMIDT	74HC14
35.	1	340-2003	RELAY DRIVER 50V/.5A	ULN2003
36.	1	340-3821	JFET N-CHAN Vp=-2.5V	MPF3821
37.	2	340-3904	NPN 40V/200MA	2N3904
38.	1	340-3906	PNP 40V/200MA	2N3906
39.	1	340-5460	JFETP-CHAN	2N5460
40.	2	342-3009	SILICON	1N4148
41.	2	342-3011	SILICON 1A 1000V	1N4007
42.	1	343-3030	1W 6.2V +-5%	1N4735A
43.	1	343-3035	1W 12V +-5%	1N4742A
44.	1	376-3686	3.6864 MHZ HC 18 CASE	368S
45.	1	376-0358	3.58 MHZ HC 18 CASE	SKO-DS357
46.	1	376-1106	11.0592 MHZ HC 18 CASE	
47.	1	380-0001	SPDT 12V	MZ-12HG
48.	1	380-0030	DPDT 12V COIL MINI	DS2E-M-DC12V
49.	2	402-3040	MINI JUMPER	
50.	2	416-1202	FUSE AGC 2A	AGC 2A

MODEL 40 CONTROL BOARD PARTS LIST (702-9201E)

LEGEND:

= NOT INSTALLED

^ = INSTALLED ON HIGHER ASSY

+ = OPTION (INSTALLED PER CUSTOMER ORDER)

Item	Quantity	Reference	Part	Description	Mfg.Part No.
1	1	R50	101-0013	2.2 OHM 1/4W 5% CARBON FILM	
2	4	R27,R28,R29,R166	101-0047	47 OHM 1/4W 5% CARBON FILM	
3	4	R53,R91,R98,R120	101-0049	100 OHM 1/4W 5% CARBON FILM	
4	6	R149,R155,R156,R157,R159, R165	101-0057	220 OHM 1/4W 5% CARBON FILM	
5	1	R68	101-0059	270 OHM 1/4W 5% CARBON FILM	
6	5	R69,R74,R88,R119,R164	101-0065	470 OHM 1/4W 5% CARBON FILM	
7	6	R2,R18,R20,R26,R49,R162	101-0066	510 OHM 1/4W 5% CARBON FILM	
8	1	R148	101-0067	560 OHM 1/4W 5% CARBON FILM	
9	15	R30,R32,R45,R70,R78,R92, R110,R121,R130,R150,R151, R154,R158,R160,R163	101-0073	1K 1/4W 5% CARBON FILM	
10	5	R80#,R81,R86,R97,R105, R134	101-0075	1.5K 1/4W 5% CARBON FILM	
11	9	R34,R47,R52,R62,R90,R107, R126,R152,R153	101-0081	2.2K 1/4W 5% CARBON FILM	
12	2	R122,R125	101-0083	2.7K 1/4W 5% CARBON FILM	
13	2	R51,R82	101-0085	3.3K 1/4W 5% CARBON FILM	
14	1	R135	101-0087	3.9K 1/4W 5% CARBON FILM	
15	8	R12,R42,R43,R61,R99,R102, R128,R147	101-0089	4.7K 1/4W 5% CARBON FILM	
16	1	R108	101-0094	7.5K 1/4W 5% CARBON FILM	
17	15	R1,R4,R5,R7,R15,R16, R17,R35,R58,R67,R73,R85, R94,R117,R145	101-0097	10K 1/4W 5% CARBON FILM	
18	6	R83,R101,R103,R104,R132, R144	101-0099	12K 1/4W 5% CARBON FILM	
19	2	R56,R84	101-0101	15K 1/4W 5% CARBON FILM	
20	6	R44,R46,R60,R113,R115, R141	101-0105	22K 1/4W 5% CARBON FILM	
21	5	R54,R95,R100,R123,R124	101-0109	33K 1/4W 5% CARBON FILM	
22	4	R37,R39,R40,R87	101-0111	39K 1/4W 5% CARBON FILM	
23	12	R24,R25,R31,R33,R63,R64, R93,R136,R138,R139,R143, R161	101-0113	47K 1/4W 5% CARBON FILM	
24	3	R66,R96,R106	101-0115	56K 1/4W 5% CARBON FILM	
25	3	R36,R38,R41	101-0117	68K 1/4W 5% CARBON FILM	
26	3	R118,R131,R133	101-0119	82K 1/4W 5% CARBON FILM	
27	10	R6,R8,R9,R10,R14,R22, R23,R55,R127,R140	101-0121	100K 1/4W 5% CARBON FILM	
28	3	R59,R111,R116	101-0131	270K 1/4W 5% CARBON FILM	
29	1	R146	101-0143	820K 1/4W 5% CARBON FILM	

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MODEL 40 CONTROL BOARD PARTS LIST (702-9201E) cont'd

Item	Quantity	Reference	Part	Description	Mfg. Part No.
30	4	R3,R72,R129,R137	101-0145	1M 1/4W 5% CARBON FILM	
31	1	R65	101-0150	2.7M 1/4W 5% CARBON FILM	
32	1	R114	101-0160	10M 1/4W 5% CARBON FILM	
33	1	R48	103-0175	75 OHM 2W 5%	RD-200BJ75
34	2	RV1,RV2	105-0001	VARISTOR 250V AC	V250LA20
35	2	R11,R13	106-0047	4.7 OHM 1/2W 5% FUSIBLE	BW1/2F-4.7OHM5%B
36	1	R19	106-0115	15 OHM 1/2W 5% FUSIBLE	BW1/2F-15OHM5%B
37	1	R142	107-0204	200K 1TURN 1/4W	3329H-1-204
38	3	R21,R75,R79	107-0501	5K POT 1 TURN	3386P-1-502
39	4	R57,R76,R109,R112	107-0502	50K POT 1 TURN	3386P-1-503
40	2	R71,R77	107-3085	10K POT 1 TURN	3386P-1-103
41	2	C71,C72	150-0024	24 PF 1KV +10% CERAMIC DISC	GG-240K
42	2	C60,C75,C76	150-0033	33 PF 1KV +10% CERAMIC DISC	GH-330K
43	3	C15,C17,C20	150-0096	1000 PF 1KV +20% CERAMIC DISC	GE-102G
44	5	C34,C54,C79,C102,C103	151-0047	470 PF 50V +10% CERAMIC, TEMPERATURE STABLE	CW15C471K
45	3	C96,C97,C98	151-0120	.01 UF 50V +10% CERAMIC, TEMPERATURE STABLE	CW15C103K
46	30	C1,C6,C8,C10,C12,C18,C38,C39,C40,C41,C42,C43,C49,C50,C63,C65,C66,C70,C73,C74,C78,C80,C81,C82,C83,C84,C90,C93,C94,C95	151-0180	.1 UF 50V +10% CERAMIC, UNSTABLE	AVXSR205E104MAA
47	3	C56,C62,C99	151-0199	.47 UF 50V +5% POLYESTER	ECQVIH474JZ
48	7	C16,C46,C67,C77,C91,C106,C107	152-0012	.1 UF 50V +5% POLYESTER	ECQ-V1H104JZ
49	1	C13	152-0021	.47 UF 250V +10% POLYESTER	713A1KK474PK251SM
50	1	C27	152-0030	2.2 UF 250V +10% POLYESTER	ECQ-E2225KS
51	1	C19	152-0040	4.7 UF 50V NON-POLAR ELECTROLYTIC	RHN-4.7M50BA
52	2	C35,C45	152-0080	.22 UF 50V +5%	ECQ-VIH224JZ
53	8	C22,C23,C26,C31,C32,C87,C88,C89	152-0085	.01 UF 50V +- 5% POLYESTER	ECQ-VIH103JZ
54	1	C104	152-0088	.0047UF 50V +5% POLYESTER	ECQ-B1H472JZ
55	8	C21,C24,C25,C33,C36,C37,C47,C53	152-0089	.001 UF 50V +5% POLYESTER	ECQB1H102JZ
56	2	C100,C101	152-0122	.022UF 50V POLYESTER	ECQIH223JZ
57	1	C61	152-0250	.047 UF 50V POLYESTER	ECQ-VIH473JZ
58	4	C7,C85,C86,C108	154-0025	1 UF 35V TANTALUM	ECS-F-35E1
59	4	C9,C59,C92,CX1 (NOTE 9)	154-0100	10 UF 16V TANTALUM	ECS-FICE106K
60	1	C28	155-0012	2.2 UF 100V +50-10% RADIAL ALUMINUM ELECTROLYTIC	ECEA2AV2R2S
61	11	C2,C3,C4,C5,C11,C44,C51,C52,C68,C69,C105	155-0052	10 UF 35V +20% RADIAL ALUMINUM ELECTROLYTIC	ECRA1VU100
62	5	C29,C48,C55,C57,C58	155-0077	100UF 25V +20% RADIAL ALUMINUM ELECTROLYTIC	ECEA1EU101
63	1	C30	155-0090	1000 UF 25V +20% RADIAL ALUMINUM ELECTROLYTIC	ECE-A1EU102
64	1	C14	155-0120	2200 UF 25V +20% AXIAL ALUMINUM ELECTROLYTIC	ECE-B1EU222
65	1	C64	155-0140	3300 UF 25V +50%-10% AXIAL ALUMINUM ELECTROLYTIC	ECEB1EU332
66	3	E1,E2,E3 (NOTE 1)	305-0007	BRAD FERRITE PLZ	56-590-65-3
67	1	T1	305-1540	LO SIZE/COST PHONE HYBRID XFMR	671-1540
68	6	DS1,DS2,DS3,DS4,DS5,DS6	311-0011	LED RED FLUSH	TLSR-5201
69	1	DS7	311-0012	LED GREEN FLUSH	TLSG-5201

MODEL 40 CONTROL BOARD PARTS LIST (702-9201E) cont'd

Item	Quantity	Reference	Part	Description	Mfg.Part No.
70	2	U4,U9	311-1001	OPTO ISOLATOR, BI-POLAR	H11AA1
71	3	U8,U10,U15	316-0004	TONE FILTER	MF4CN-50
72	1	U6	316-0232	RS232 DRIVER	MAX 232
73	9	U11,U12,U23,U24,U25,U26, U37,U38,U40	316-0358	OP-AMP, DUAL	LM358N
74	1	U39	316-5107	512 BIT ANOLOG DELAY	RD5107AND
75	1	VR1 (NOTE 2)	316-7805	REGULATOR, +5V 1.5A	LM340T-5
76	1	VR2	316-7808	REGULATOR, +8V	LM78L08CZ
77	1	Y22	321-0204	DTMF RECEIVER	75T204
78	1	U34	321-0222	5V 1200 BAUD SINGLE CHIP MODEM	SSI73K212LIP
79	0	U29^	321-6264	8K X 8 RAM 150ns	HM6264ALP-15
80	1	U30	321-6811	UP-HC MOS	MOT68HC11A0FN
81	2	U1,U5	321-6840	PTM	MC6840
82	0	U28^	321-8256	32K X 8 RAM LP	HPD43256-15L
83	0	U16^,U27^	322-7256	32Kx8 CMOS EPROM	AM27C256-200DC
84	2	U2,U36	323-4053	3PDT SWITCH	MC144053
85	2	U3,U35	323-4066	QUAD ANALOG SWITCH	MC14066B
86	3	U13,U18,U19	324-4138	DECODER 1 OF 8	MCH74HC138
87	3	U20,U32,U33	324-4259	LATCH, 8 BIT ADDRESSABLE	74HC259
88	2	U21,U31	324-4373	OCTAL LATCH	MC74HC373
89	1	U17	324-7400	QUAD NAND	MC74HC00
90	1	U7	324-7414	HEX SCHMIDT	74HC14
91	1	U14	340-2003	RELAY DRIVER 50V/.5A	ULN2003
92	1	Q4	340-3821	JFET N-CHAN Vp=-2.5V	MPF3821
93	6	Q1,Q2,Q6,Q7,Q8,Q9	340-3904	NPN 40V/200MA	2N3904
94	1	Q3	340-3906	PNP 40V/200MA	2N3906
95	1	Q5	340-5460	JFETP-CHAN	2N5460
96	0	CR16#,CR17#	342-0103	SCHOTTKY .37V @ 20MA	SD103A
97	6	CR3,CR4,CR5,CR6,CR8,CR18	342-3009	SILICON .50 SP	1N4148
98	4	CR9,CR10,CR11,CR12	342-3011	SILICON 1A 1000V .50 SP	1N4007
99	3	CR1,CR2,CR7	343-3030	1W 6.2V +-5% .50 SP	1N4735A
100	3	CR13,CR14,CR15	343-3035	1W 12V +-5% .50 SP	1N4742A
101	1	SW1	371-0005	SINGLE KEY RA PWB MOUNT	L21217-2-MV-02-G
102	1	Y2	376-3686	3.6864 MHz HC 18 CASE	368S
103	1	Y1	376-0358	3.58 MHz HC 18 CASE	SKO-DS357
104	1	Y3	376-1106	11.06 MHz HC-18 CASE	MP49 11.0592 18PF
105	0	K1#	380-0001	SPDT 12V	M2-12HG-C
106	2	K2,K3	380-0030	DPDT 12V COIL MINI	DS2E-M-DC12V
107	1	J1	401-0021	DB9 S	DEP-9S-CA
108	1	J4	401-0059	15 POS R/A HEADER	6923.6
109	0	J5#	401-6001	10-POS FEMALE	09-52-3103
110	0	J9#	401-6005	6-POS FEMALE	09-52-3063
111	1	J7 (NOTE 10)	401-6006	6-POS MALE	09-64-1061
112	2	J2,J3	401-7000	6-POS TELCO JACK	66011-002
113	4	JP1,JP2,JP3#,JP4#,JP8, JP14	403-0002	2 OF 401-0052	
114	7	JP5,JP6#,JP7,JP9,JP10, JP11,JP12,JP15	403-0003	3 OF 401-0052	
115	1	J8	403-0010	10 OF 401-0052	

SECTION 8 - REPAIR

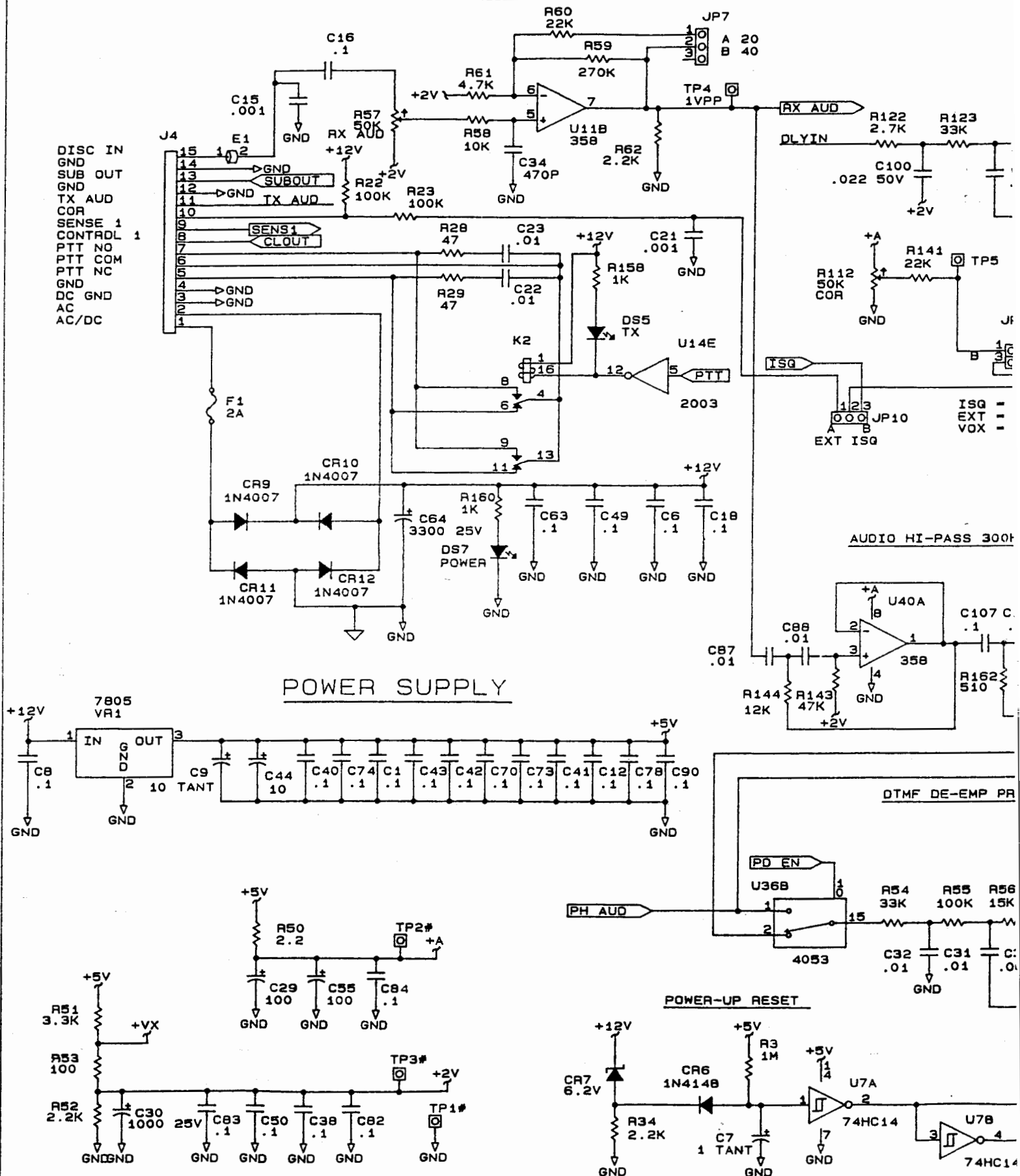
MODEL 40 CONTROL BOARD PARTS LIST (702-9201E) cont'd

Item	Quantity	Reference	Part	Description	Mfg.Part No.
116	1	J6	403-0018	18 OF 401-0052	
117	1	JP13	403-0202	4 OF 401-0052 [2X2]	
118	2	TP1#,TP2#,TP3#,TP4,TP5	406-0001	1 OF 401-0108	
119	1	F1	416-1202	FUSE AGC 2A	AGC 2A
120	6	XVR1(1),XJ1(2),STUD(3)	210-0001	440 KEPT NUT	
121	3	XVR1,XJ1	220-0106	440X5/16 PAN PHILLIPS	
122	3		250-0104	440X1/2 W/STUD	
123	1	XVR1 (NOTE 2)	381-0010	HEATSINK TO-220 BLACK	
124	2	XJ1	401-0042	DB LOCK SCREWS	
125	10	XJP6,XJP7,XJP8,XJP10 XJP11,XJP12,XJP13 XJP14(2),XJP15 (POS A)	402-3040	MINI JUMPER	
126	2	XU4,XU9	407-0006	SKT, 6 PIN DIP	
127	13	XU8,XU10,XU11,XU12,XU15, XU23,XU24,XU25,XU26,XU37, XU38,XU39,XU40	407-0008	SKT, 8 PIN DIP	
128	5	XU3,XU7,XU17,XU22,XU35	407-0014	SKT, 14 PIN DIP	
129	10	XU2,XU6,XU13,XU14,XU18 XU19,XU20,XU32,XU33,XU36	407-0016	SKT, 16 PIN DIP	
130	2	XU21,XU31	407-0020	SKT, 20 PIN DIP	
131	7	XU1,XU5,XU16,XU27,XU28, XU29,XU34	407-0028	SKT, 28 PIN DIP	
132	1	XU30	407-0052	SKT, 52 PIN QUAD	
133	1	PCB	410-9201A	PCB, M40	
134	2	XF1	416-3040	FUSE CLIPS	
135	7	XDS1,XDS2,XDS3,XDS4 XDS5,XDS6,XDS7	417-0010	LED MOUNT R/A	
136	A/R	XVR1 (NOTE 2)	561-0001	THERMAL COMPOUND	

NOTES:

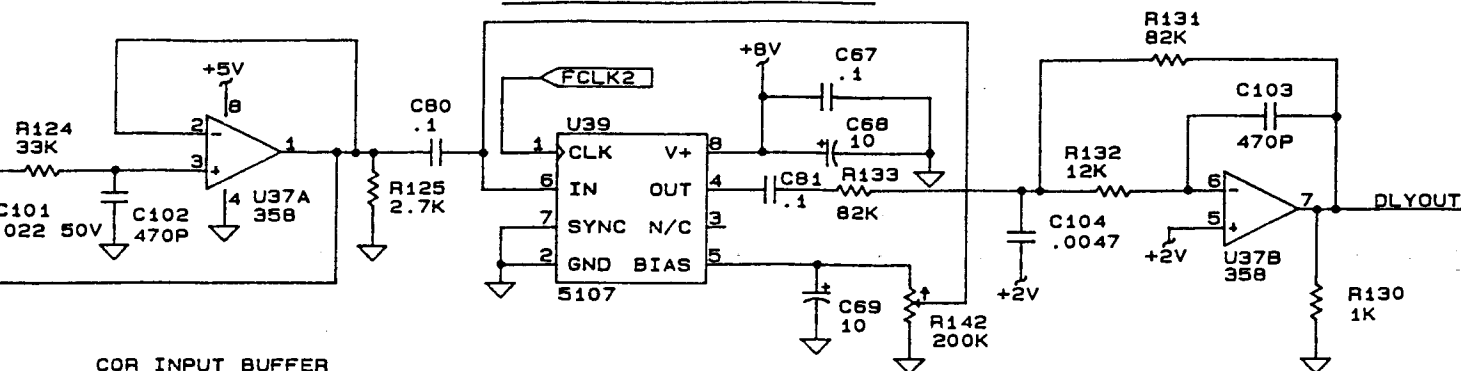
Notes are for production use only.

DISCRIMINATOR BUFFER

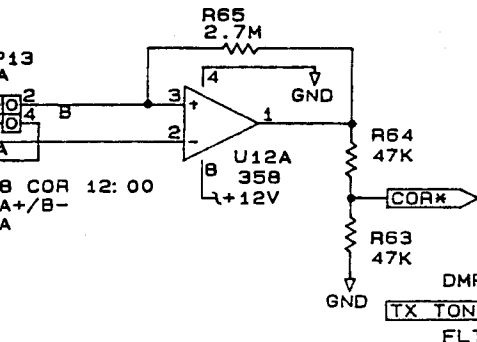


TRANSMITTER AUDIO

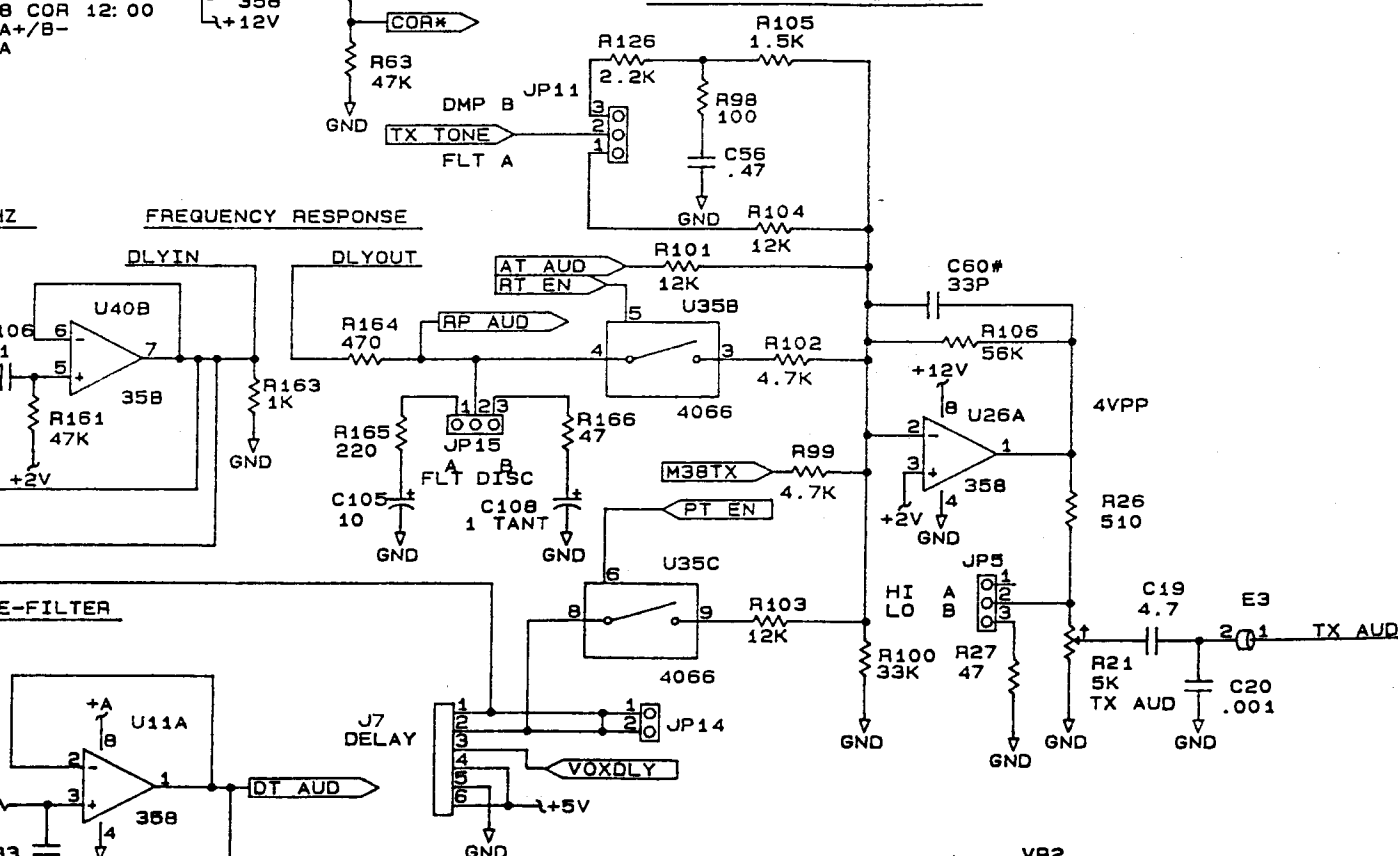
AUDIO CONTROL



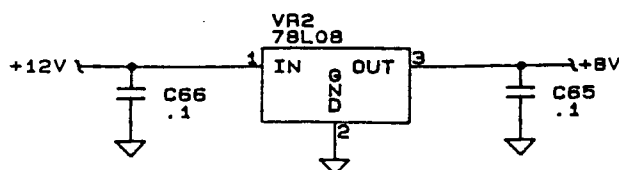
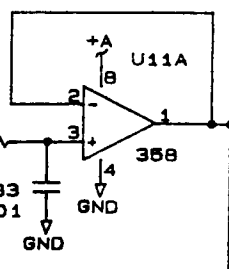
AUDIO DELAY



TRANSMIT COMBINING AMP



E-FILTER



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Title

MODEL 40

Size Document Number

008-9201

REV

E

Date: February 6, 1991 Sheet 2 of 5

MICROPROCESSOR SHEET 5

A [0..15]
 COR*
 D [0..7]
 DC
 DT AUD
 LLP*
 LOC
 MRX*
 R
 R*
 RNG1
 SENS1

AS
 CORLED
 CTL1
 FCLK1
 FCLK2
 FCLK3
 FUND1
 FUND2
 IRQ*
 LFO
 LINE
 LINE1
 LOCAL
 LRX
 LTX
 MODEM38
 M38CTCSS
 M38CTRL
 M38TXAUD
 NO38
 PD EN
 PT EN
 PTT
 *READ
 RP EN
 RT EN
 TONE/2
 TXT EN
 URX
 UTX
 VOXDLY
 VP0
 VP1
 VP2
 VP3
 VPW
 *WRITE
 MODEM-TX

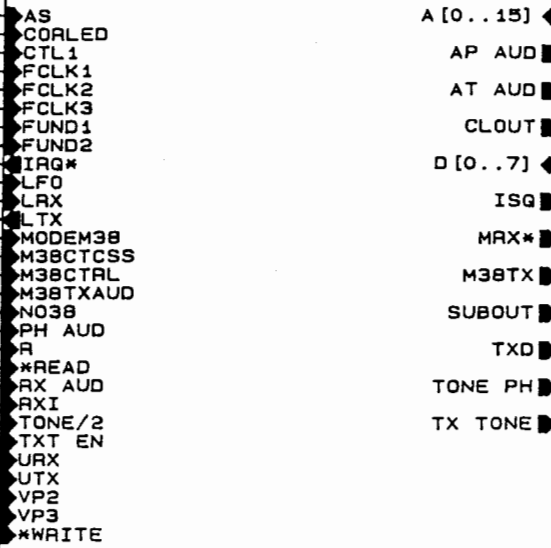
RX/TX AUDIO SHEET 2

AT AUD
 PH AUD
 PD EN
 PT EN
 RT EN
 PTT
 SUBOUT
 CLOUT
 TX TONE
 ISQ
 M38TX
 FCLK2
 VOXDLY

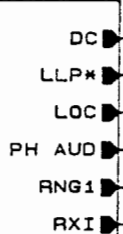
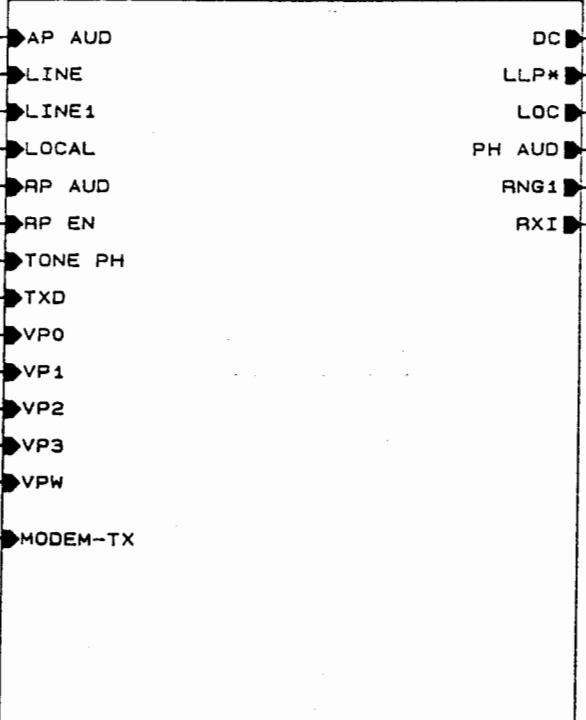
DT AUD
 RP AUD
 RX AUD
 COR*
 R
 R*
 SENS1

REV	DESCRIPTION	DRN	APVD	DATE
A	RELEASE	DGW		
B	ECN 1221, 1304	KM	RE	2-11-91
C	ECN 1421	KN		
D	ECN 1444	KN	NK	5-7-91
E	HCN 1833	KN	RE	5/13/92

CONTROL INTERFACE SHEET 3



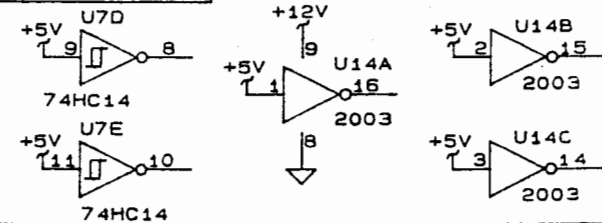
TELEPHONE SHEET 4



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL CAPACITORS ARE IN MICROFARADS.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
3. ALL POTENTIOMETERS ARE 1 TURN.
4. USA VERSION OMITTS CRX1, CRX2 & SETS R114 = 5.6K.

UNUSED PARTS:



LEGEND:

+	OPTION, INSTALL PER CUSTOMER ORDER.
-	INSTALLED ON HIGHER ASSEMBLY.
*	NOT INSTALLED.
—X—	CUT TRACE.
----	JUMPER WIRE.

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REDMOND, WASHINGTON, 98052-2433

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MODEL 40

Size Document Number

B

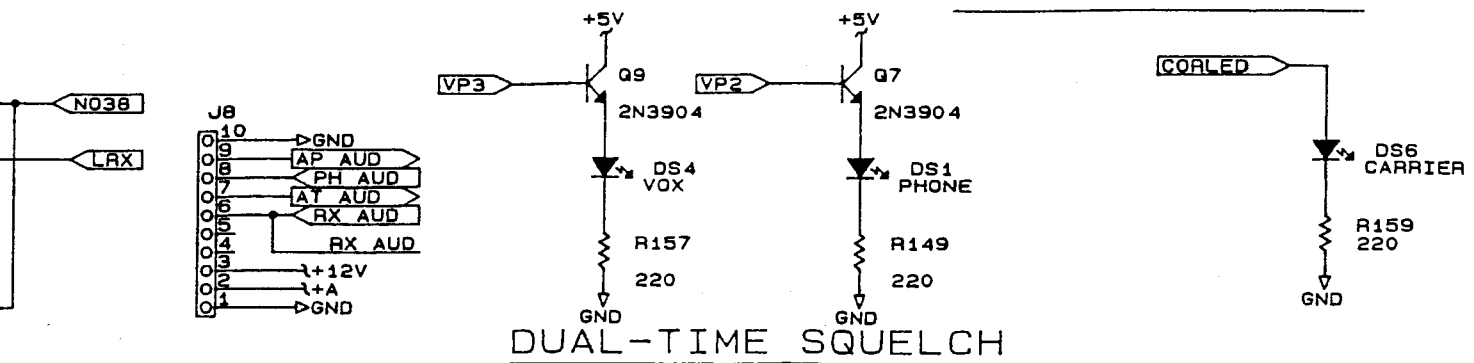
008-9201

REV

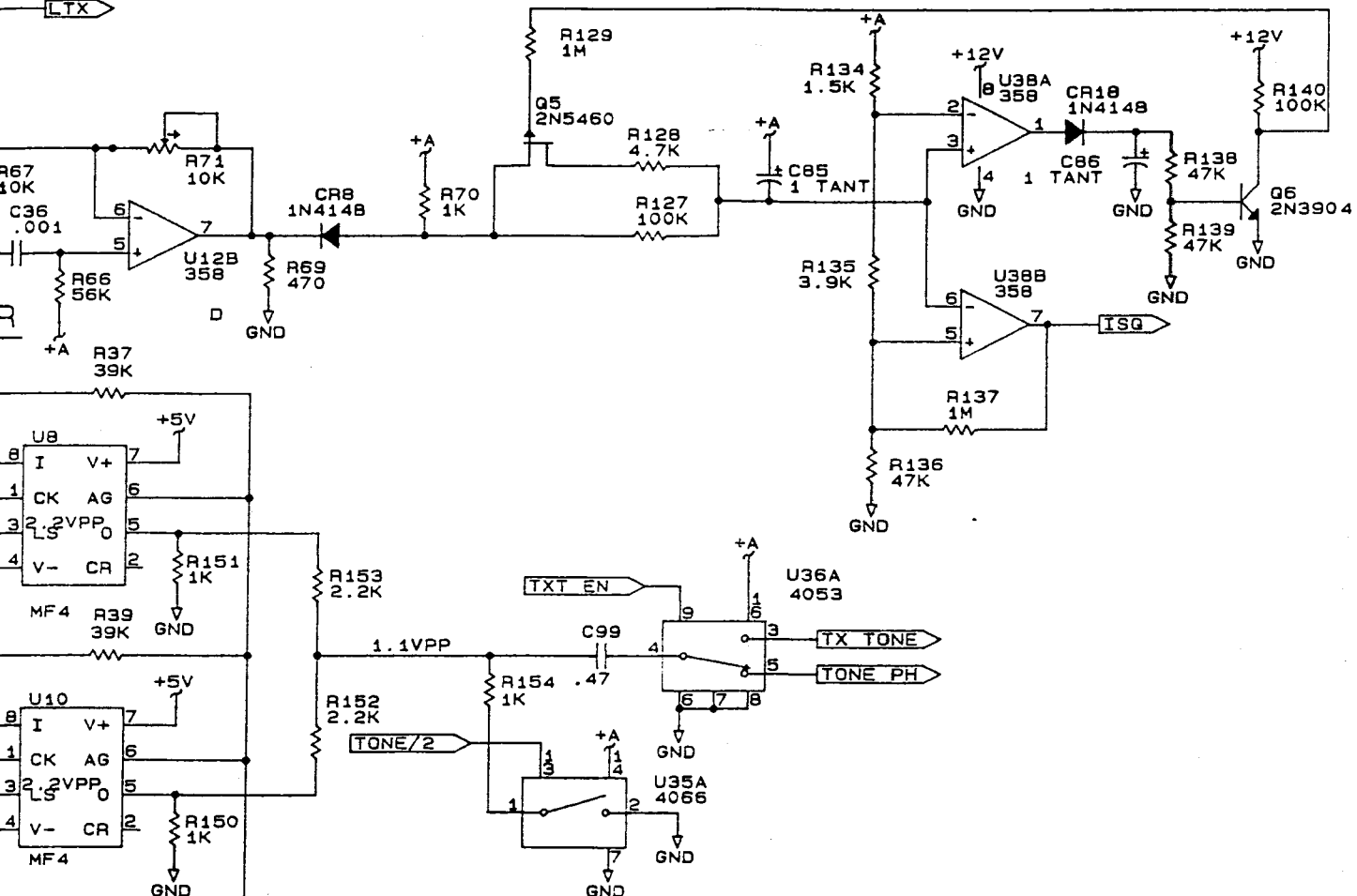
E

Date: February 6, 1991 Sheet 1 of 3

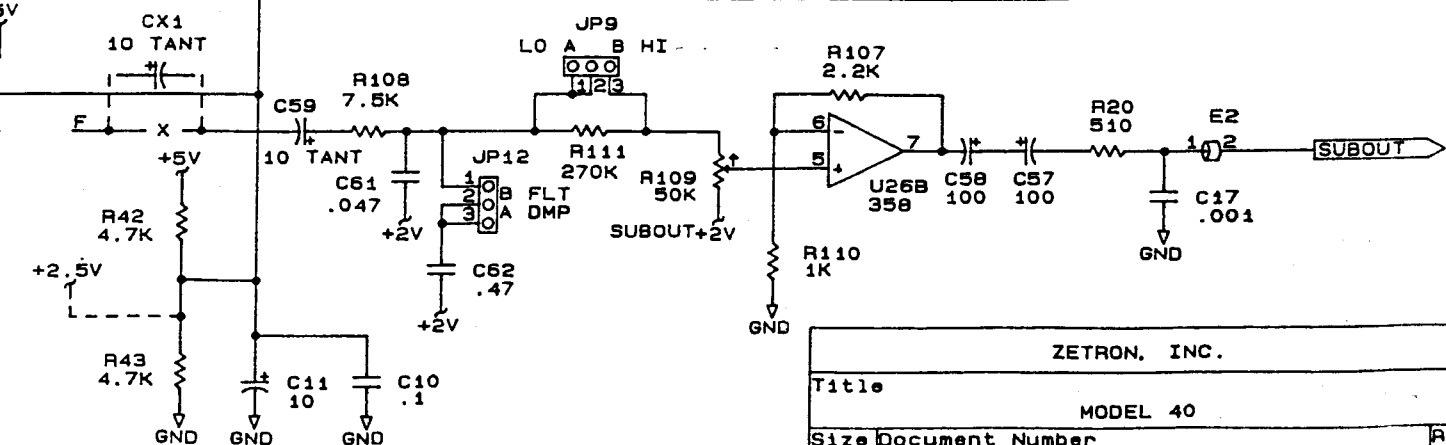
LED INDICATORS



DUAL-TIME SQUELCH



SUBAUDIBLE TONE GENERATOR



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Title	
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MODEL 40

Size	Document Number
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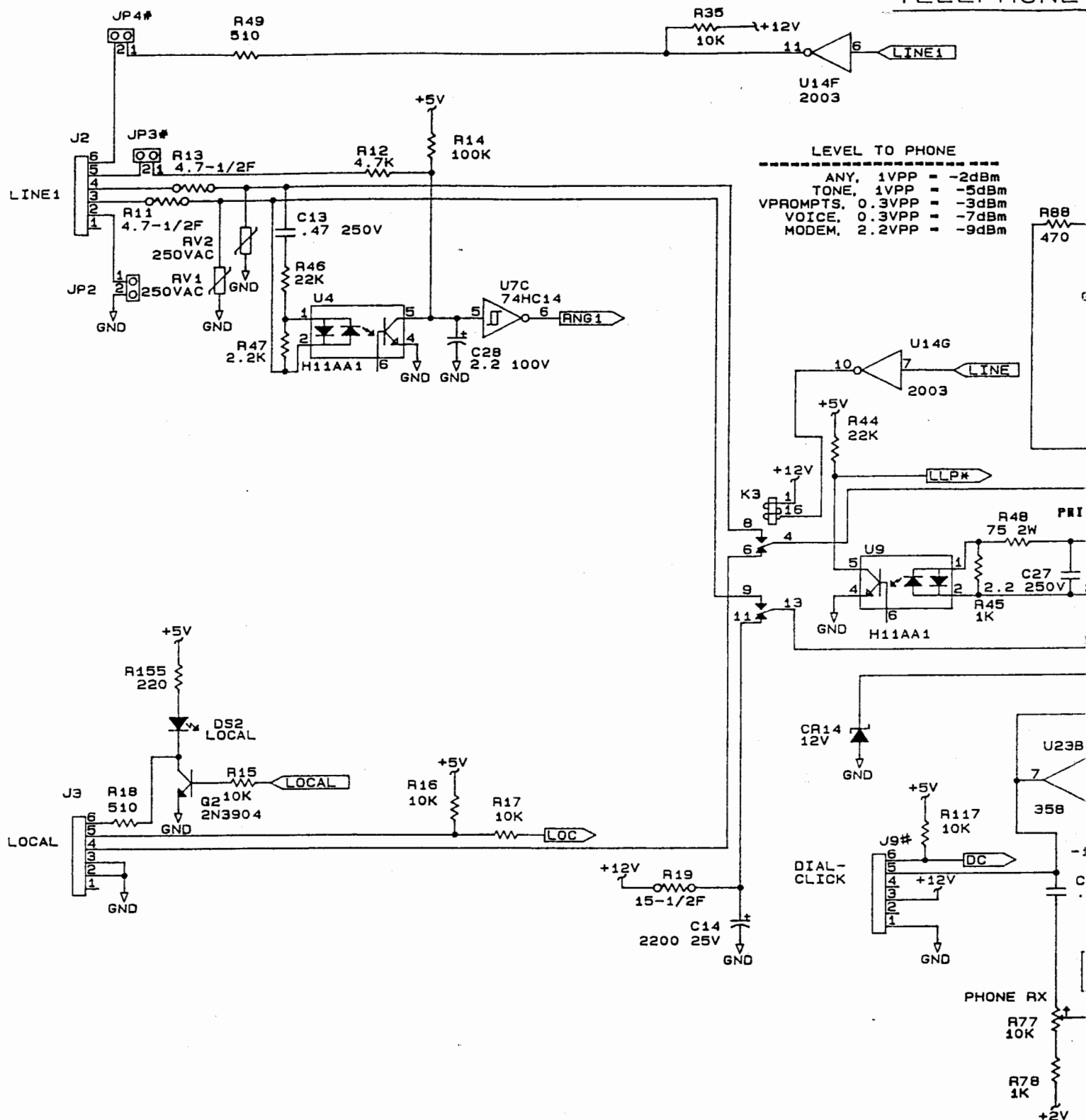
ARE Y

B	008-9201
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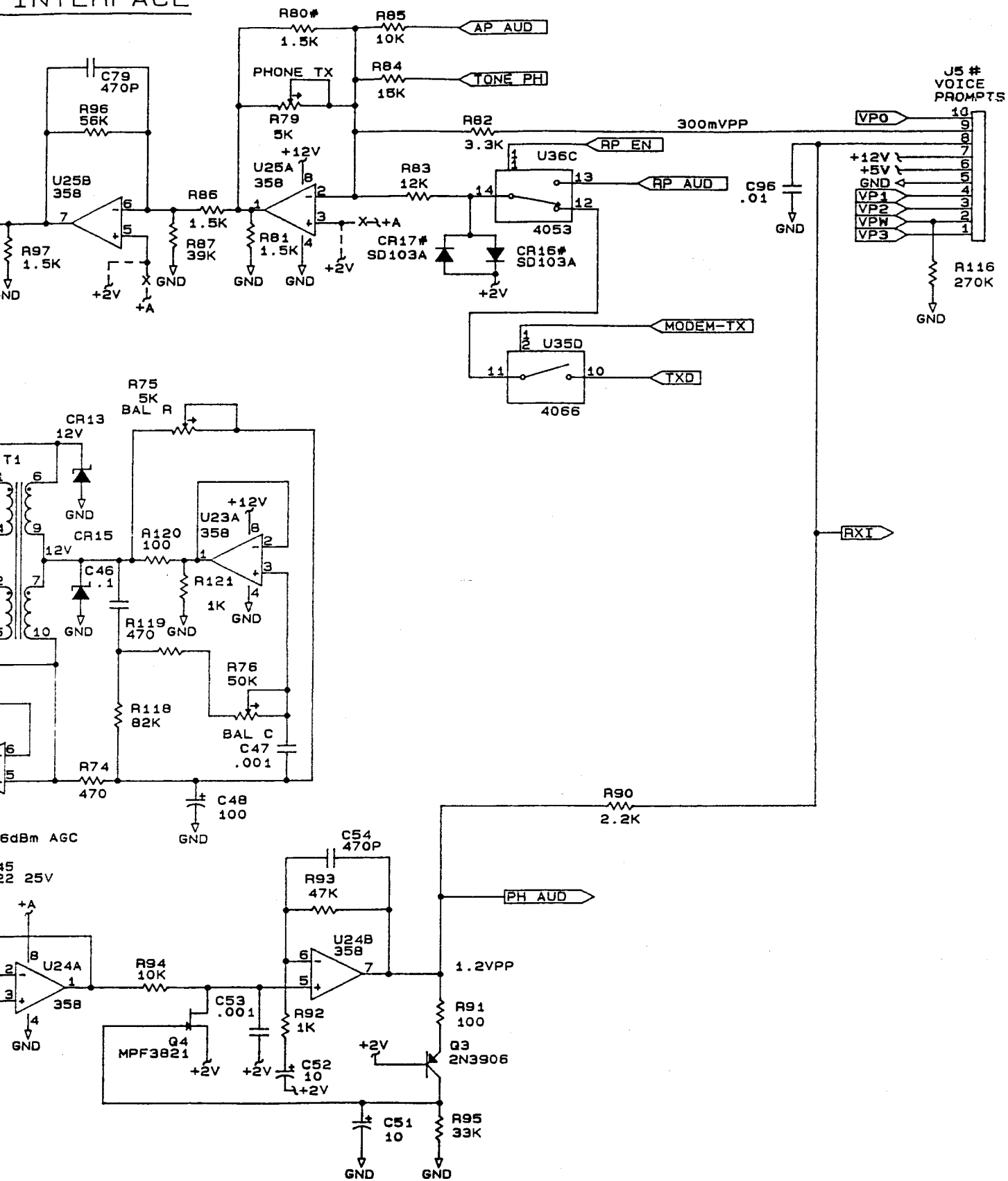
Date: February 6, 1991 Sheet 3 of 4

4-13

TELEPHONE

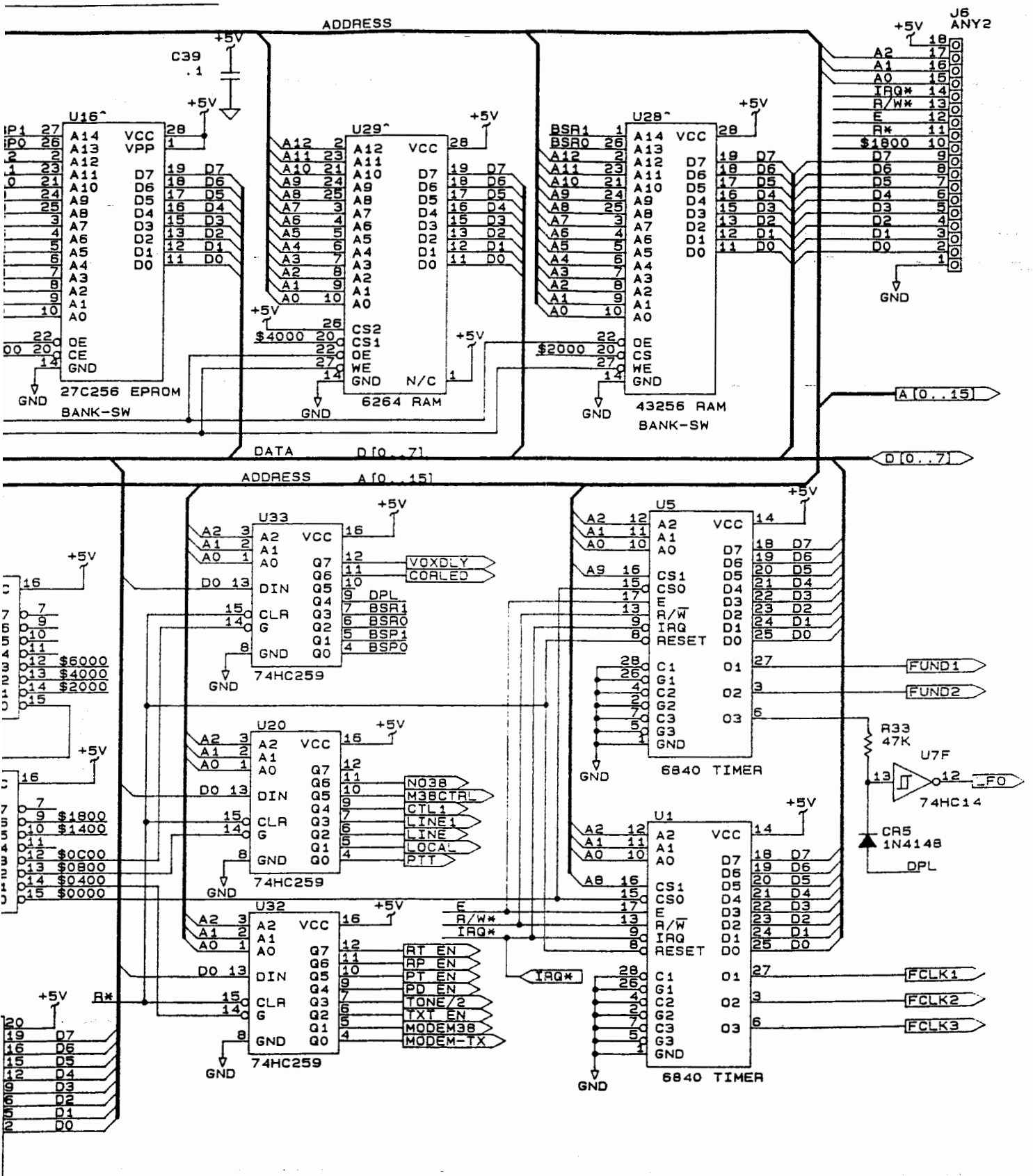


INTERFACE

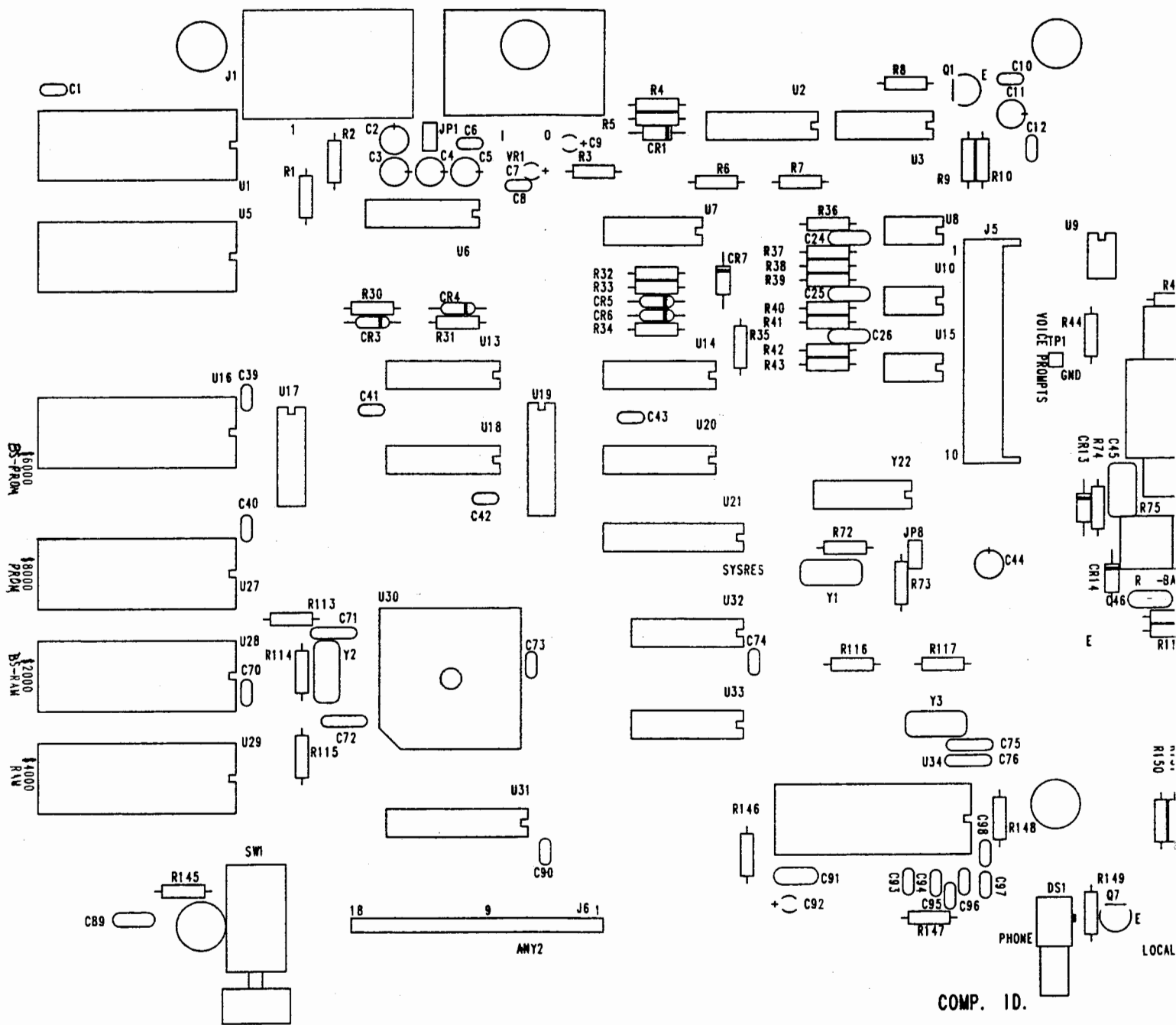


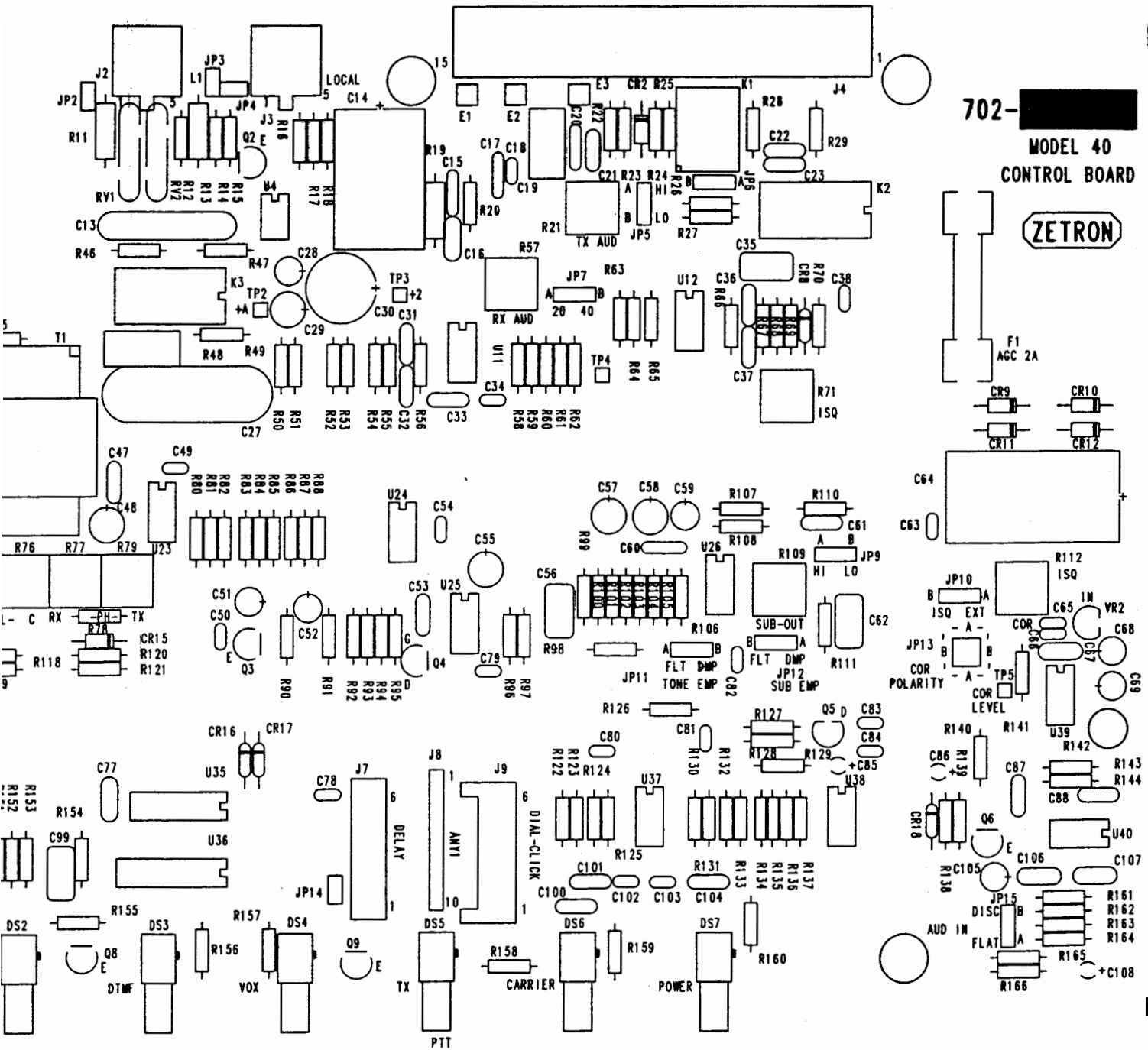
ZETRON, INC.			
Title			
MODEL 40			
Size	Document Number		REV
B	008-9201		E
Date: February 6, 1991 Sheet 4 of 5			

SOR CONTROL



ZETRON, INC.		
Title		
MODEL 40		
Size	Document Number	REV
B	008-9201	E
Date:	February 6, 1991	Sheet 5 of 5





9. QUICK REFERENCE

System settings	9-1
Simplex commands	9-1
Autodial commands	9-2
ANI user settings	9-2
DPL inversion	9-3
Diagnostics	9-3
SMDR commands	9-3

SYSTEM SETTINGS

		Range	Default
00#	EXIT PROGRAM MODE		
01# N#	MOBILE DIALOUT MODE		
	0/1 = SLOW/FAST DTMF		
	2/3 = SLOW/FAST PULSE		(0)
02# NN#	EXTENDED CALL LIMIT TIMER (MINUTES)	1-60	(6)
03# NNN#	MOBILE ACTIVITY TIME (SECONDS)	15-150	(30)
04# NNNN..#	MORSE ID CALL SIGN (NN=CHARACTERS)		
05# NN#	MORSE ID INTERVAL (MINUTES)	0-99	(15)
	(0 = ID AFTER EVERY CALL)		
06# NN#	NUMBER OF RINGOUTS SENT TO MOBILE	1-16	(6)
07# NN#	MOBILE ANSWER TIME (SECONDS)	1-60	(15)
08# NN#	PAGER TALK TIME IN SECONDS	5-60	(10)
09# NN#	DTMF TIMEOUT (SECONDS)	2-10	(4)
10# N#	NUMBER RINGS BEFORE ANSWER	1-9	(2)
11# NN#	REPEATER TRANSMIT HOLD TIME 0.0-9.9 SEC	0-9	(20)
12# N#	USER DIAL-IN MODE		
	1 = LOCAL USER #/LINE 1 USER #		
	2 = LOCAL USER #/LINE 1 ANI		
	3 = LOCAL ANI/LINE 1 USER #		
	4 = LOCAL ANI/LINE 1 ANI		(1)
13# N#	REPEAT ENABLE (0=OFF, 1=CARRIER)	0-1	(0)
18# NNNN#	PBX OUTSIDE LINE PREFIX	0-9	NO PREFIX
19# NN#	CORDLESS TELEPHONE MODE	0-99	(0)
22# UU#	AUTO-CALL USER (0=NONE)	1-99	(0)
23# UU#	SUPERVISOR USER NUMBER	0-99	(0=NONE)
24# NNNNN#	PROGRAM ACCESS CODE	0-9	(0012123)
25# PPP# N#	ADD/DELETE PREFIX IN TABLE PPP=PREFIX, N=ON/OFF		
26# N#	BAUD RATE SELECT	0-3	(3)
			(300,1200,2400,4800)
27# N#	TRACK SMDR ERRORS (0=NO/1=YES)	0-1	(1)

SIMPLEX COMMANDS (REQUIRES SIMPLEX OPTION)

30# N#	SIMPLEX MODE (SEE CHART AT BOTTOM)	0-6	(0)
31# NN#	VOX HOLD TIME (100 mSEC)	0-25	(20)
32# N#	COR HOLD TIME (10 mSEC)	0-99	(0)
33# NNN#	SAMPLE RATE (10 mSEC)	1-250	(200)
34# NNN#	SAMPLE WIDTH (mSEC)	1-999	(200)

SIMPLEX MODES:

- 0 = DUPLEX
- 1 = SIMPLEX VOX
- 2 = SIMPLEX VOX WITH VOICE DELAY
- 3 = SIMPLEX VOX WITH PRE-KEY
- 4 = SIMPLEX SAMPLING
- 5 = SIMPLEX SAMPLING WITH VOX TO EXTEND SAMPLE INTERVAL
- 6 = VOX/SAMPLING BETWEEN WORDS/REVERT TO SAMPLE MODE (INTELLIGENT MODE)

SECTION 9 - QUICK REFERENCE

AUTODIAL COMMANDS

40# NNNN...#	AUTODIAL #0	0-9
41# NNNN...#	AUTODIAL #1	0-9
42# NNNN...#	AUTODIAL #2	0-9
43# NNNN...#	AUTODIAL #3	0-9
44# NNNN...#	AUTODIAL #4	0-9
45# NNNN...#	AUTODIAL #5	0-9
46# NNNN...#	AUTODIAL #6	0-9
47# NNNN...#	AUTODIAL #7	0-9
48# NNNN...#	AUTODIAL #8	0-9
49# NNNN...#	AUTODIAL #9	0-9

ANI USER SETTINGS

(ENTER '00' TO PROGRAM ALL USERS)
(UU = USER #)

50# UU# N#	USER ENABLE	0-1	(0)
51# UU# NNNN...#	ANI ACCESS CODE 1-8 DIGITS	0-9	
52# UU# NNNN...#	CALL CODE DTMF=1-8 DIGITS		

TWO TONE = TCCABCX WHERE

T = TIMING

CC = CODEPLAN

A = TONE BLOCK

B = TONE 1

C = TONE 2

X = 0=GROUP, 1=DIAG1, 2=DIAG2

FIVE TONE = P12345X WHERE

P = PREAMBLE (OPTIONAL)

1-5 = CAPCODE

X = SECOND ADDRESS (1=NO ADDRESS, 2=2ND ADDRESS)

NOTE: X IS REQUIRED

53# UU# N#	SELECTIVE CALL FMT	(0=NONE/1=2TONE/2=DTMF) (0)	
		(3=DTMF RTX/4=EIA/5=CCIR/6=ZVEI)	
54# UU# N#	ANSWER TYPE 0=COS 1=* 2=*+ANI	0-2	(2)
55# UU# N#	DISCONNECT CODE 0=#, 1=#+ANI	0-1	(0)
56# UU# N#	EQUIPMENT 0=MOB 1=PAGER 2=T+V 3=TB 4=DIR	0-4	(0)
57# UU# NNN#	CTCSS/DCS DECODE 0=CARRIER, MODEL 38 USER #		
58# UU# NNN#	CTCSS/DCS ENCODE 0=CARRIER		
	670-2503 (10TH'S NOT REQUIRED)		
	9000-9777 (ANY DCS CODE)		(0)
59# UU# N#	CTCSS DROP MODE	0-1	(0)
60# UU# N#	TOLL RESTRICT TYPE 0=NONE 1=0+ 2=TOLL	0-2	(0)
61# UU# N#	INTER. SECURITY 0=REPEAT 2=PRIVACY		(0)
62# UU# N#	EXTENDED CALL LIMIT TIMER ON/OFF	0-1	(0)
64# UU# N#	COURTESY TONE	0-1	(0)
65# UU# N#	SMDR TRACK MODE 0=NONE, 1=LONG DISTANCE,	0-2	(2)
	2=ALL		
66# UU# N#	MOBILE-MOBILE OPERATION	0-1	(1)
67# UU# N#	MOBILE-PHONE OPERATION	0-1	(1)
68# UU# N#	MOBILE REPEAT OPERATION (ANI REQ.)	0-1	(0)

DPL INVERSION

103# N# INVERT DCS TX (1 = INVERT) 0-1 (0)

DIAGNOSTICS

(ALL TESTS END WITH '#')

110# 12345# MEMORY SETUP, FULL RESET TO FACT. DEFS
 111# N# TX SETUP TESTS
 0 = TX GAIN SET (1K AUDIO TONE)
 1 = TX PREEMPHASIS TEST (250 500 1K 2K 4K)
 2 = CTCSS GAIN SET (136 HZ)
 3 = CTCSS PREEMPHASIS (67 136 250)
 4 = HYBRID TEST 800HZ TO PHONE, KEY TX, NULL CHECK
 5 = REPEAT AUDIO TEST, SETS RX INPUT GAIN
 6 = DTMF DECODE TEST
 (SENDS BEEPS TO TELEPHONE FOR NUMBER)

SMDR COMMANDS

120# 54321# CLEAR CALL DETAIL STORAGE
 121# N# SMDR OOPS! (1=RESTORE) 0-1

10. APPENDIX

Two-tone tone groups	10-1
Two-tone codeplans	10-2
Two-tone timing	10-3
Five-tone groups/timing	10-3

TWO-TONE TONE GROUPS

Zetron Group Number		1	2	3	4	5	6	7	8	9	10	11	12
Mfr. Tone Groups		Mot 1	Mot 2	Mot 3	Mot 4	Mot 5	Mot 6	Mot A	Mot B	Mot Z	GE A'	GE B'	GE C
T	0	330.5	569.1	1092.4	321.7	553.9	1122.5	358.9	371.5	346.7	682.5	652.5	667.5
O	1	349.0	600.9	288.5	339.6	584.8	1153.4	398.1	412.1	384.6	592.5	607.5	712.5
N	2	368.5	634.5	296.5	358.6	617.4	1185.2	441.6	457.1	426.6	757.5	787.5	772.5
E	3	389.0	669.9	304.7	378.6	651.9	1217.8	489.6	507.0	473.2	802.5	832.5	817.5
	4	410.8	707.3	313.0	399.8	688.3	1251.4	543.3	562.3	524.8	847.5	877.5	862.5
N													
U	5	433.7	746.8	953.7	422.1	726.8	1285.8	602.6	623.7	582.1	892.5	922.5	907.5
M	6	457.9	788.5	979.9	445.7	767.4	1321.2	668.3	691.8	645.7	937.5	967.5	952.5
B	7	483.5	832.5	1006.9	470.5	810.2	1357.6	741.3	767.4	716.1	547.5	517.5	532.5
E	8	510.5	879.0	1034.7	496.8	855.5	1395.0	822.2	851.1	794.3	727.5	562.5	577.5
R	9	539.0	928.1	1063.2	524.6	903.2	1433.4	912.0	944.1	881.0	637.5	697.5	622.5
Diagonal		569.1	979.9	569.1	569.1	979.9	979.9	979.9	979.9	979.9	742.5	742.5	742.5

This table should be used to select the two-tone tone groups for Model 40 100-call programming. Use the Zetron group number, from 1 to 12 above.

Format for two-tone entry: TCCABCX where,

T = Timing
 CC = Codeplan
 A = Tone Block
 B = Tone 1
 C = Tone 2
 X = 0=Group, 1=Diag1, 2=Diag2

SECTION 10 - APPENDIX

TWO-TONE CODEPLANS

Pager Cap-Code	Z 0	Z 1	Z 2	Z 3	Z 4	Z 5	Z 6	Z 7	Z 8	Z 9	Z 10	Z 11	Z 12	Z 13	Z 14	Z 15
	Mot B Groups	Mot C Groups	Mot D Groups	Mot E Groups	Mot F Groups	Mot G Groups	Mot H Groups	Mot J Groups	Mot K Groups	Mot L Groups	Mot M Groups	Mot N Groups	Mot P Groups	Mot Q Groups	Mot R Groups	Mot S Groups
0xx	2+4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4+2	4+2	4+2	4+2	4+2	4+2
1xx	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	2+3	2+3	2+3	2+4	2+4	2+5
2xx	2+2	2+2	2+2	2+2	1+3	1+3	1+3	1+4	1+4	1+5	2+2	2+2	2+2	2+2	2+2	2+2
3xx	3+3	1+2	1+2	1+2	3+3	3+3	3+3	4+1	4+1	5+1	3+3	3+3	3+3	4+2	4+2	5+2
4xx	1+2	4+4	1+5	2+1	4+4	3+1	3+1	4+4	4+4	1+6	4+4	3+2	3+2	4+4	4+4	2+6
5xx	1+3	1+4	5+5	1+6	3+1	5+5	1+6	5+5	1+6	5+5	3+2	5+5	2+6	5+5	2+6	5+5
6xx	2+1	2+1	2+1	6+6	1+4	1+5	6+6	1+5	6+6	6+6	2+4	2+5	6+6	2+5	6+6	6+6
7xx	3+1	4+1	5+1	6+1	4+1	5+1	6+1	4+5	6+1	6+1	4+2	5+2	6+2	4+5	6+2	6+2
8xx	2+3	2+4	2+5	2+6	3+4	3+5	3+6	5+4	4+6	5+6	3+4	3+5	3+6	5+4	4+6	5+6
9xx	3+2	4+2	5+2	6+2	4+3	5+3	6+3	5+1	6+4	6+5	4+3	5+3	6+3	5+2	6+4	6+5
Groups:	1,2,3,4	1,2,4	1,2,5	1,2,6	1,3,4	1,3,5	1,3,6	1,4,5	1,4,6	1,5,6	2,3,4	2,3,4,5	2,3,4,6	2,4,5	2,4,6	2,4,5,6

Pager Cap-Code	Z 16	Z 17	Z 18	Z 19	Z 20	Z 21	Z 22	Z 23	Z 24
	Mot T Groups	Mot U Groups	Mot V Groups	Mot W Groups	Mot Y Groups	Mot MT Groups	GE X Groups	GE Y Groups	GE Z** Groups
0xx	4+2	4+2	4+2	4+2	N/A	4+2	A'+A'	B'+B'	A'+A'
1xx	3+4	3+4	3+5	4+6	A+A	1+1	B'+A'	C'+B'	C'+A'
2xx	4+3	4+3	5+3	6+4	B+B	2+2	B'+B'	C'+C'	C'+C'
3xx	3+3	3+3	3+3	5+6	Z+Z	1+2	A'+B'	B'+C'	A'+C'
4xx	4+4	4+4	3+6	4+4	A+B	4+4	C'+C'	N/A	N/A
5xx	5+5	3+6	5+5	5+5	A+Z	5+5	C'+A'	N/A	N/A
6xx	3+5	6+6	6+6	6+6	B+A	2+1	C'+B'	N/A	N/A
7xx	4+5	6+3	6+3	4+5	Z+A	4+5	A'+C'	N/A	N/A
8xx	5+4	4+6	5+6	5+4	B+Z	5+4	B'+C'	N/A	N/A
9xx	5+3	6+4	6+5	6+5	Z+B	2+4	N/A	N/A	N/A
Groups:	2,3,4,5	2,3,4,6	4,5,6	2,4,5,6	A,B,Z	1,2,4,5	A',B',C'	B',C'	A',C'

This table should be used when programming two-tone codeplans into the Model 40. Note: "Z 5" indicates Zetron codeplan number 5 (codeplan G), use this number when programming the Model 40 codeplan.

Notes: **G.E. 100-call plan Z is tone groups C'+C'; use (100-Call programming). For cap-codes ending in double-digits using tone group twice, (example: 122 in code plan C), use diagonal as one of the tones.

TWO-TONE TIMING

Timing	1st	Gap	2nd	Group Call	Type
1	1.0	0	3.0	8.0	GE std, Mot std Tone+Voice
2	0.4	0	0.8	8.0	Motorola Tone Only
3	1.0	0	3.0	6.0	NEC-B
4	1.0	.25	3.0	6.0	NEC-A
5	1.0	0	1.0	4.0	NEC-C
6	0.4	0	0.8	4.0	NEC-M
7	0.5	0	0.5	3.0	NEC-L
8	0.4	0	0.4	3.0	NEC-D

For two-tone timing, select a number from the chart above, 1 through 8. This table should be used for both 100- and 1000-call two-tone programming.

FIVE-TONE GROUPS/TIMING

Zetron Group number		0	1	2
Tone series		EIA	CCIR	ZVEI
Tone Frequency in Hz.	Tone number	0	600	1981
		1	741	1124
		2	882	1197
		3	1023	1275
		4	1164	1358
		5	1305	1446
		6	1446	1540
		7	1587	1640
		8	1728	1747
		9	1869	1860
2nd ADDR "X" tone		2010	2247	2796
REPEAT "R" tone		459	2110	2600
TIMING IN msec	Preamble	690	690	690
	Gap	65	65	65
	Tone	33	100	100
	X Tone	65	100	100

Format for entry:

P12345X where,

P = Preamble (optional)
 1-5 = Capcode
 X = Second Address
 (1=No Address,
 2=2nd Address)

Note: X is required.

This table indicates the five-tone frequency and tone timing values for the three available tone plans.