

ZETRON

**Model 38A Repeater Tone Panel
Instruction Manual**

Part No. 025-9043Y

Please check for change information at the end of this manual.

Zetron Master Product Manual

Model 38A

Part No. 025- 9043Y

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None

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CHANGE INFORMATION

1. INTRODUCTION

INTRODUCTION

The Zetron Model 38 is a flexible repeater panel that provides individualized repeater service to up to 60 or 68 different customer groups. It is a complete interface between a transmitter and receiver, providing CTCSS encode/decode, repeat audio processing, and all timer functions. It can be remote-controlled from a variety of sources. The Model 38A is equipped with an RS-232 serial port for connection to computers and modems. An internal database keeps track of all airtime use and, for accounting purposes, downloads into a PC. Nearly all of the Model 38's functions can easily be customized for each of the 38 or 50 CTCSS tones and 22 or 18 digital coded squelch codes.

FEATURES

- Supports 38 or 50 CTCSS user groups, with ToneLock™ high sensitivity decoding
- Supports 18 or 22 digital coded squelch (DCS) codes
- Programmable via RS-232 and DTMF
- Attributes are programmable for each user group
- Remote enable and disable of all tones and DCS codes
- Temporary enable and disable of cross encoding
- Automatic Morse code station identification
- Stuck microphone timeout and identification
- DTMF paging when site alarm triggered
- Vacant tones and codes can be reserved
- Airtime Hog Penalty mode
- Cross-tone, cross-code, tone-code encoding
- Courtesy beeps and tailbips
- Privacy mode to prevent “barge-ins”
- Airtime is tallied for each user group
- Prepaid airtime feature

2. SPECIFICATIONS

GENERAL

Radio interface	Compatible with most any commercial FM two-way radio or repeater.
User group capacity	38 CTCSS tones and 22 DCS codes, or 50 CTCSS tones and 18 DCS codes.
Airtime capacity	249 hours, 59 minutes, 59 seconds per user group.
Airtime retrieval	RS-232 port, DTMF or Morse code over radio channel.
Station ID	Callsigns configurable for each user group, with independent activity timers.
Station ID frequency	1,200 Hz; adjustable ± 800 Hz. (per FCC rules).
Courtesy tone frequency	1,000 Hz; adjustable 400 to 3,000 Hz.
Indicators	Power, carrier, transmit, decode, encode, DTMF.
Current consumption	350 mA at 13.8 VDC.
Operating voltage	11.0 to 15.0 VDC.
Rack space	1.7 x 19 x 4.8 inches.
Weight	2.2 lb.
Operating temperature	0 to 65° Celsius.

CTCSS / DCS

CTCSS frequencies	67.0 to 254.1 Hz. Tables include all standard EIA frequencies and extensions.
CTCSS sensitivity	Better than 3dB SINAD.
CTCSS accuracy	Better than 0.1 Hz.
Digital squelch codes	Selectable, any octal codes between 000 to 777.
Squelch tail elimination	Compatible with CTCSS reverse burst, DCS turn-off code, and loss of carrier.

Section 2. Specifications

INTERFACE

Connections	Rx audio, Tx key, CTCSS / DCS encode, Tx audio (mic), 12 VAC or DC power, ground. Optional carrier detect, alarm input and aux output.
Connector type	Detachable screw terminal.
Rx input impedance	50 K Ω AC coupled. For connection to unscelched discriminator audio.
CTCSS / DCS output	Level: 0 to 4 Volts p-p. Impedance: Less than 1 K Ω AC coupled.
Transmitter type	Direct FM, or phase modulation. Flat or de-emphasized CTCSS encode.
Transmitter keying	SPDT relay.
Carrier detect	Internal noise detector or external carrier detect input. External input threshold adjustable 0 to 7 VDC.
Adjustments	Four adjustments from rear panel: Rx input gain, CTCSS / DCS encode gain, Tx audio output gain, and carrier detect threshold.
Configuration switches	Eight switches on rear panel: Rx audio gain high/low, repeat audio flat/de-emphasized, encode gain high/low, encode flat/de-emphasized, tx audio gain high/low, COR source internal/external, COR polarity positive/negative, COR pull up on/off.
RS-232 serial data port	Front panel DB9 connector (non-standard pinout). Interface cables available.
Alarm / Remote PTT input	Activated via contact closure to ground.
Cables, interface notes	Available for most repeaters and two-way radios.

3. OPERATION

OVERVIEW

This section of the manual covers key ideas and features that define the operation of the Model 38A Repeater Tone Panel.

CTCSS TONES AND DIGITAL CODED SQUELCH (DCS)

The Model 38 monitors the channel for CTCSS tones and/or DCS codes. When a tone or code is detected, it is converted into a User-Number that contains the user privileges and attributes. The DCS decode numbers are completely user programmable. Two versions of the Model 38 are available; 38 CTCSS + 22 DCS users (see Table 3. -1), or 50 CTCSS + 18 DCS users (Table 3. -2).

When ordered with the 50 tone set, the unit has a narrower CTCSS decoder bandwidth than the standard 38 tone version. The 50 tone version is not recommended for use with radios that use tunable encoders, due to the possibility of the encoder becoming mistuned or drifting onto adjacent tones.

Table 3. -1. User Number Cross reference Table: 38 Tone Version

User	Tone	User	Tone	User	Tone	User	Code
1	67.0	16	114.8	31	192.8	46	DCS
2	71.9	17	118.8	32	203.5	47	DCS
3	74.4	18	123.0	33	210.7	48	DCS
4	77.0	19	127.3	34	218.1	49	DCS
5	79.7	20	131.8	35	225.7	50	DCS
6	82.5	21	136.5	36	233.6	51	DCS
7	85.4	22	141.3	37	241.8	52	DCS
8	88.5	23	146.2	38	250.3	53	DCS
9	91.5	24	151.4	39	DCS	54	DCS
10	94.8	25	156.7	40	DCS	55	DCS
11	97.4	26	162.2	41	DCS	56	DCS
12	100.0	27	167.9	42	DCS	57	DCS
13	103.5	28	173.8	43	DCS	58	DCS
14	107.2	29	179.9	44	DCS	59	DCS
15	110.9	30	186.2	45	DCS	60	DCS

Section 3. Operation

Table 3. -2. User Number Cross Reference Table: 50 Tone Version

User	Tone	User	Tone	User	Tone	User	Tone
1	67.0	18	118.8	35	183.5	52	DCS
2	69.4	19	123.0	36	186.2	53	DCS
3	71.9	20	127.3	37	189.9	54	DCS
4	74.4	21	131.8	38	192.8	55	DCS
5	77.0	22	136.5	39	196.6	56	DCS
6	79.7	23	141.3	40	199.5	57	DCS
7	82.5	24	146.2	41	203.5	58	DCS
8	85.4	25	151.4	42	206.5	59	DCS
9	88.5	26	156.7	43	210.7	60	DCS
10	91.5	27	159.8	44	218.1	61	DCS
11	94.8	28	162.2	45	225.7	62	DCS
12	97.4	29	165.5	46	229.1	63	DCS
13	100.0	30	167.9	47	233.6	64	DCS
14	103.5	31	171.3	48	241.8	65	DCS
15	107.2	32	173.8	49	250.3	66	DCS
16	110.9	33	177.3	50	254.1	67	DCS
17	114.8	34	179.9	51	DCS	68	DCS

HOW TONES/CODES ARE ENABLED

User Validation

The Model 38 is always listening to the receive audio for the presence of an enabled user. All 38 or 50 CTCSS tones and 18 or 22 of the digital codes can be marked as enabled or disabled (consult the programming section).

Disabled Tones

When a disabled CTCSS tone is detected, the time accumulator will keep track of the airtime used by that tone. This feature lets the system manager gain information about the CTCSS tones that are in use on the channel, perhaps by another repeater in the area. The Model 38 will accumulate airtime for all CTCSS tones, but not disabled DCS codes.

Enabled Users, CTCSS / DCS Encode

When an enabled tone or digital code is detected, the transmitter will be keyed. Depending on programming, the system will: (1) encode nothing, (2) regenerate the received tone or code, or (3) encode a different tone or digital code (cross-tone encoding).

Carrier Controlled Repeat (Open Repeater)

The Model 38 can be programmed to activate based on just carrier. In this mode the Model 38 will provide simultaneous tone and open repeater operation; users that have CTCSS or Digital Squelch encode operate normally, users that have no encode repeat also. This allows a mix of CTCSS tone users with open repeat capability and is ideal when adding tone users to an existing open repeater.

To enable carrier (COR) for repeat, a user number is identified as the “CARRIER” repeat user. This allows all standard user-programmable attributes to apply to open repeat, including; enable/disable for the carrier user, CTCSS or digital code encoding, airtime accumulation, station ID, etc. If the COR user number is set to “0”, the carrier repeat function is disabled.

Reserved Users

If a user is marked as “Reserved,” the repeat audio will be squelched and a beep tone sent in place of voice communications. A chirp tone will be sent when the user unkeys to indicate reserve mode. This mode allows the system manager to reserve CTCSS tones and DCS codes for seasonal users, or to temporarily prevent communications for a delinquent account.

WHAT HAPPENS WHEN A MOBILE UNKEYS

When a mobile unkeys, CTCSS tone or DCS code is no longer detected, the Model 38 will do the following:

Anti-Kerchunker Filter

The anti-kerchunker filter cancels the transmit hold time and drops the repeater immediately if a mobile transmission is less than the programmed “anti-kerchunk” time. This serves two main purposes:

- It will discourage users from “kerchunking” the repeater to death.
- It will make the repeater co-exist better on shared-channels. When a lot of CTCSS tones are enabled on a single channel, it’s not uncommon for voice falsing of active CTCSS tones on a co-channel repeater to occur. This is because a human voice often contains frequencies in the CTCSS band. A radio user could be talking and cause a co-channel repeater to key up over the conversation. When the repeater transmit hold time is greater than about a second, this causes major interference to the voice communication. With the anti-kerchunker filter enabled, the repeater will key ONLY for the duration that the voice simulates CTCSS, not the entire transmit hold time. The anti-kerchunker filter is disabled by programming the time to zero.

Courtesy Tone

If the courtesy tone is enabled for the user group, a short beep will be sent. The beep frequency may be set from 400 to 4000 Hz (default setting is 1000 Hz). A system programmable setting called “tailbips” can be enabled to cause the courtesy tone to

Section 3. Operation

be sent every second during the transmit hold time. If a 400 Hz beep (low tone) is heard just prior to the transmitter unkeying, a system memory error has been detected, consult the repair section.

Prepaid Customer Low-Airtime Warning

The repeater operator (or owner) can allow a customer to purchase a block of airtime in advance (see “Prepaid Users” in the programming section). These prepaid blocks decrease as the customer uses the repeater. When the remaining airtime falls below two hours, a low-airtime warning chirp will be heard when the user unkeys. The chirp sounds like a fast “bee-doo-bee-doo-bee-doo”. If the airtime drops to zero, the tone is “reserved” as described above. A prepaid user who falls all the way into the “reserved” mode will still hear warning chirps upon unkeying.

Reserved User Mode

If a user is programmed as reserve tone mode, a “chirp” will be sent when the user unkeys. This gives a positive indication that communication has not occurred.

CTCSS / DCS Encode During Transmit Hold Time

When a valid user unkeys, the CTCSS or DCS encode may either be left on during the transmitter hold time or turned off. This feature is programmable for each user. When using a control station phone patch through the repeater, the encode should be turned off during Tx-hold. This allows the phone patch to know when the mobile has unkeyed, as opposed to knowing when the repeater has dropped off the channel. When using the repeater for dispatch only, the encode may be left on during the Tx-hold time to keep the mobile decoders open. This feature eliminates the decode delay observed in the mobile between transmissions, and is generally required in order for the busy channel lockout feature to function properly in the subscriber radios.

Morse Code Station Identification

When an enabled user unkeys, the Model 38 looks to see how long it has been since the station ID was last sent. If enough time has passed (initially 15 minutes, programmable 1-99 minutes) then the call sign will be sent. Each user group has its own call sign and individual ID interval timer. The Morse ID is sent at the selected ID speed (15 to 25 words per minute). The call sign is sent at 30% deviation (meets FCC Part 90 rules) such that voice communication can occur during the ID. Note: if the Morse ID is not programmed, or the first character is a “space”, an ID will not be sent. A single system ID may also be programmed for use in co-op and private carrier applications.

Last User Identification via DTMF

The Model 38 checks to see if the user is configured to send “Last User ID”. If enabled, the user number will be sent via fast DTMF. This allows the system manager to identify which users are active on the system in real time. All that’s required is a DTMF decoder with display capability, such as the Zetron Model 8 Repeater Programmer / Timekeeper.

Privacy Mode

Finally, the Model 38 checks to see if the user is set for “Privacy Mode”. If enabled, then no other users (CTCSS or DCS) will be allowed on the system until the transmit hold time has expired. This feature can prevent other user groups from “barging in” on the conversation and taking over control of the repeater.

Airtime Accumulation

The Model 38 keeps track of the airtime used by each customer group on the channel. Both enabled and disabled users are logged. The airtime is stored in “hours:minutes:seconds” format and will hold up to 250 hours per user. The airtime counts may be retrieved over the channel or via the RS-232 port. The airtime may be set to accumulate including or excluding the repeater transmit hold time (see programming section).

Repeater Hold Time

The programmable repeater transmit hold timer is adjustable from 0.0 to 9.9 seconds. When a mobile unkeys, the Model 38 will begin monitoring for a valid CTCSS tone or DCS code to be received again. If a valid user is not detected within a timeout period, a reverse burst for CTCSS or digital turn-off code will be sent then the encode will be turned off (if it was previously on). After a 0.2 second delay, the transmitter PTT will be dropped. This method will remove the second squelch tail heard by the mobiles when the repeater transmitter unkeys. Repeater “tailbips” may be enabled to beep once every second during the repeater hold time.

Timeout Timer

While mobiles are conversing through the repeater, a timeout timer is running. If a mobile does not un-key within the timeout period, warning tones will be sent, and then the transmitter PTT will be dropped. This is a “stuck mic” time-out feature.

Timeout User Identification

After a timeout occurs, the system may be set to transpond (via slow DTMF) the user number of the mobile that is still keyed up. The repeater will key up every 15 seconds while the mobile is transmitting and send the user number. This feature can be enabled or disabled by the system manager.

DTMF Regeneration

The Model 38 may be used to regenerate DTMF tones over the radio channel for applications involving mobile DTMF decoders or control station telephone interconnects (such as Zetron Models 30 or 45). DTMF regeneration ensures that all DTMF signaling occurs at the same tone level. DTMF regeneration can occur for any or all users. A user commands the repeater to regenerate DTMF digits by sending a DTMF “*” for greater than 1 second. When the digit is released, the Model 38 squelches the repeat audio and begins regenerating all DTMF tones received from the user until no digit has been received for the interdigit timeout (programmable; factory set at 4 seconds). All sixteen DTMF tones can be regenerated.

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Airtime Hog Penalty

The Airtime Hog Penalty feature allows the system manager to penalize “airtime hogs” so that other users on the system have a chance to complete dispatch calls. This feature disallows a user from conversing through the repeater for a penalty duration (programmable 10-9990 seconds) if the user has recently exceeded the maximum allowable conversation time limit (1-99 minutes). While a user is being penalized, the system will ignore the user. A long-winded talker who is approaching the end of the conversation time limit will start hearing warning tones (sounding like “bee-doo”) 1 per second prior to cut-off. To avoid an impending Hog Penalty, the user must let the repeater transmitter un-key for an “idle duration” (1-99 seconds), giving another mobile a chance to use the system. If another user keys up, or if the idle duration is met, the conversation timer is reset. The Hog Penalty is programmable on/off for each tone, and all users have their own penalty timers in the case of multiple hogs on the system.

Temporary Cross-tone or Cross-code Encoding

Temporary cross-tone or cross-code encoding allows the system manager to converse with a subscriber on any CTCSS tone or digital code. This mode is a temporary cross-tone or cross-code assignment that allows users on different tones/codes to communicate. It is accessed with a DTMF command sequence, and can be enabled/disabled on a per-user basis. An alert signal is sent during the transmitter hang time while the temporary cross-tone or cross-code mode is active. Command sequence:

- If the DTMF regenerate mode is enabled for the user, a long “#” (greater than two seconds) plus a tone or code number, then a “#” (# 12#) will activate cross encoding.
- Any channel activity will encode the originating mobile’s tone or code.
- When the originating mobile transmits, the called mobile’s CTCSS tone or digital code will be encoded.
- The Tx-hold time is set at 30 seconds during cross encoding.
- An “Eeddl-eeddl-eeddl” queuing tone will indicate cross encoding is active.
- A long “#” (greater than .75 second) will exit the mode.

Temporary Defeat of Cross-tone or Cross-code Encoding

In many dispatch systems the Repeater Panel is programmed to always perform cross-tone or cross-code encoding, which enables the dispatcher to communicate with vehicles operating on a different tone or code, but prevents the vehicles from communicating directly with each other. The dispatcher is usually the center of all communications: when a vehicle needs to relay information to another vehicle, the dispatcher must listen to one vehicle, then transmit the information to the other vehicle. This method wastes airtime and increases the chance of miscommunication. If the dispatcher temporarily defeats cross encoding, users can talk amongst themselves, and the dispatcher doesn’t have to relay information. Temporarily defeating cross encoding is achieved by a DTMF command sequence, and is enabled or

disabled for each user with the “DTMF COMMANDS” enable function. An alert tone is sent in the squelch tail while the cross encoding is active. Command sequence:

- If the DTMF regenerate mode is enabled for the user, a long “0” will enter the car-to-car mode.
- The Tx-hold time is set at 30 seconds during the cross-tone mode.
- An “Eedlll-eedlll-eedlll” queuing tone will indicate that cross-tone encoding is defeated.
- A long “#” (greater than .75 second) will exit the mode.

Remote PTT Function

The site alarm input may be used as a “Remote PTT” function. This feature is initiated by the site alarm input being pulled to ground by a contact closure or other input. When the alarm input goes active, any repeater activity will be suspended, then the programmed CTCSS tone or DCS code will be encoded, the repeat audio squelched, and the transmitter keyed. This condition will continue until the site alarm input is released.

This feature can be used for wireline control of the transmitter from a tone or DC remote control, or by wiring the local mic PTT to this input, a method of local control to talk to specific users. See the site alarm system programming section.

Site Alarm

The Site Alarm feature sends out an audible alert, DTMF page, and CTCSS/DCS encode in response to a contact closure input. This can be used to monitor external functions such as system break-in or power failure. The alarm DTMF code can be received by a Zetron Model 8 Repeater Programmer / Timekeeper for remote alarm monitoring. Whenever the alarm input is held in the active state, a 2000 Hz confirmation beep tone is sent over the transmit audio just prior to unkeying when the repeater is in use.

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CONSIDERATIONS WHEN USING DIGITAL CODED SQUELCH (DCS)

When a DCS radio unkeys, it sends a 134.4 Hz squelch tail elimination turn off code bit sequence for about 120 milliseconds. To avoid potential problems, users should not be installed on the adjacent CTCSS frequencies of 131.8 and 136.5 if possible.

When installing DCS codes for the first time, use this procedure:

1. Use a radio with a known digital code.
2. Use the DCS encode test mode in the Model 38 to generate the digital squelch code that the mobile is set to. If the mobile does not unsquelch, use the Model 38 digital encode invert selection. The mobile should unsquelch on either the normal or inverted code.
3. Set the transmitter CTCSS/DCS encode deviation using a CTCSS tone, not a DCS code. Most deviation meters will give an inaccurate reading of DCS deviation.
4. Make sure Jumper JP3 is in the "B" position (factory default).
5. To setup a DCS user in the Model 38 database, select a user number above the last CTCSS tone (38 or 50). Enable the user and set the DCS decode number. Key up the mobile and verify that the Model 38 "decode" led follows the transmission. If the mobile is not decoded, try inverting the Model 38 receive polarity.
6. Once a single mobile is working through the Model 38, additional mobiles may be added.

Table 3. -3. Commonly Used DCS Codes, with Binary and Hex Shown

Code	Binary	Hex	Code	Binary	Hex
023	11101100011100000010011	640E37	311	01110001101100011001001	498D8E
025	11010110111100000010101	540F6B	315	11011000110100011001101	598B1B
026	11001011101100000010110	340DD3	325	00110010110100011010101	558B4C
031	10100011111100000011001	4C0FC5	331	01000111110100011011001	4D8BE2
032	10111110101100000011010	2C0D7D	332	01011010100100011011010	2D895A
036	00010111110100000011110	3C0BE8	343	01010010111100011100011	638F4A
043	10110110110100000100011	620B6D	346	01110101001100011100110	338CAE
047	00011111101100000100111	720DF8	351	00011101011100011101001	4B8EB8
051	11111001010100000101001	4A0A9F	356	10101001010100011101110	3B8A95
053	01101010101100000101011	6A0D56	364	11010000101100011110100	178D0B
054	11011110100100000101100	1A097B	365	01011110000100011110101	57887A
065	10111010001100000110101	560C5D	371	0010101100010001111001	4F88D4
071	11001111001100000111001	4E0CF3	411	11101110110100100001001	484B77
072	11010010011100000111010	2E0E4B	412	11110011100100100001010	2849CF
073	01011100110100000111011	6E0B3A	413	01111101001100100001011	684CBE
074	11101000111100000111100	1E0F17	423	10010111001100100010011	644CE9
114	01101011110100001001100	190BD6	431	11011000101100100011001	4C4D1B
115	11100101011100001001101	590EA7	432	11000101111100100011010	2C4FA3
116	11111000001100001001110	390C1F	445	11110111000100100100101	5248EF
122	10111011010100001010010	250ADD	446	11101010010100100100110	324A57
125	00001111011100001010101	550EF0	452	10011111010100100101010	2A4AF9
131	01111010011100001011001	4D0E5E	454	10100101110100100101100	1A4BA5
132	01100111001100001011010	2D0CE6	455	00101011011100100101101	5A4ED4
134	01011101101100001011100	1D0DBA	462	01110101010100100110010	264AAE
143	01101111010100001100011	630AF6	464	01001111110100100110100	164BF2
145	01010101110100001100101	530BAA	465	11000001011100100110101	564E83
152	00111101100100001101010	2B09BC	466	11011100001100100110110	364C3B
155	10001001101100001101101	5B0D91	503	01111000110100101000011	614B1E
156	10010100111100001101110	3B0F29	506	01011111000100101000110	3148FA
162	11010111100100001110010	2709EB	516	10000011011100101001110	394EC1
165	01100011101100001110101	570DC6	523	01001110101100101010011	654D72
172	00001011111100001111010	2F0FD0	526	01101001011100101010110	354E96
174	00110001011100001111100	1F0E8C	532	00011100011100101011010	2D4E38
205	11011101001100010000101	508CBB	546	00110011110100101100110	334BCC
212	10110101011100010001010	288EAD	565	00011000111100101110101	574F18
223	11010001110100010010011	648B8B	606	10111011001100110000110	30CCDD
225	11101011010100010010101	548AD7	612	11001110001100110001010	28CC73
226	11110110000100010010110	34886F	624	00011110101100110010100	14CD78
243	10001011011100010100011	628ED1	627	00000011111100110010111	74CFC0
244	00111111010100010100100	128AFC	631	11100101000100110011001	4CC8A7
245	10110001111100010100101	528F8D	632	11111000010100110011010	2CCA1F
246	10101100101100010100110	328D35	654	10011000011100110101100	1ACE19
251	11000100111100010101001	4A8F23	662	01001000111100110110010	26CF12
252	11011001101100010101010	2A8D9B	664	01110010011100110110100	16CE4E
255	01101101100100010101101	5A89B6	703	01000101011100111000011	61CEA2
261	00101110111100010110001	468F74	712	00010111101100111001010	29CDE8
263	10111101000100010110011	6688BD	723	01110011000100111010011	65C8CE
265	10000111100100010110101	5689E1	731	00111100100100111011001	4DC93C
266	10011010110100010110110	368B59	732	00100001110100111011010	2DCB84
271	11110010100100010111001	4E894F	734	00011011010100111011100	1DCAD8
274	11010101010100010111100	1E8AAB	743	00101001101100111100011	63CD94
306	00011001111100011000110	318F98	754	01000001111100111101100	1BCF82

Section 3. Operation

Table 3. -4. Normal and Inverted DCS Codes

Normal	Inverted	Normal	Inverted	Normal	Inverted
023	047	223	134	445	043
025	244	225	122	446	255
026	464	226	411	452	053
031	627	243	351	454	266
032	051	244	025	455	332
036	172	245	072	462	252
043	445	246	523	464	026
047	023	251	165	465	331
051	032	252	462	466	662
053	452	255	446	503	162
054	413	261	732	506	073
065	271	263	205	516	432
071	306	265	156	523	246
072	245	266	454	526	325
073	506	271	065	532	343
074	174	274	145	546	132
114	712	306	071	565	703
115	152	311	664	606	631
116	754	315	423	612	346
122	225	325	526	624	632
125	365	331	465	627	031
131	364	332	455	631	606
132	546	343	532	632	624
134	223	346	612	654	743
143	412	351	243	662	466
145	274	356	212	664	311
152	115	364	131	703	565
155	731	365	125	712	114
156	265	371	734	723	431
162	503	411	226	731	155
165	251	412	143	732	261
172	036	413	054	734	371
174	074	423	315	743	654
205	263	431	723	754	116
212	356	432	516		

REVERSE FREQUENCY WORKING (OPTION)

Reverse Frequency Working or “RFW” is a method of controlling a repeater from a control station or fixed location mobile. The purpose is to replicate the service previously only available using a direct audio connection from the radio operator to repeater site. This connection would usually be a leased line for EIA tone or DC remote control.

The document from the (UK) Radio Agency RA263 titled “Reverse frequency working and talkthrough for PMR (standard) licenses” fully details what is available and who can use it. The following is a description of an implementation of this method of operation using the Zetron Model 38.

The Model 38 equipped with the RFW option will operate as standard or RFW mode. RFW mode allows the unit to act as a cross tone encoder and decoder as shown below.

RFW mode

Description	Dispatcher radio setup	Model 38	Mobile radio setup
Dispatcher to mobile call	Tx CTCSS 01	→ Rx 01 Tx 02	→ Rx CTCSS 02
Mobile to dispatcher call	Rx CTCSS 01	← Tx 01 Rx 02	← Tx CTCSS 02

In this mode the dispatcher can communicate with the fleet, but the fleet can not hear each other.

In order for talkthrough to be used, the Model 38 is sent a 4 or 5 digit code in DTMF which changes the mode of operation. In talkthrough mode, the radio fleet can talk to each other. In order for the dispatcher to also communicate it must change its CTCSS encode and decode tone to the same as the fleet. As it would be usual for only the dispatcher to have the ability to switch talkthrough then this would be done at the same time.

Some radios have the ability to send a DTMF sequence when the channel is changed. This would then completely automate operation. If the dispatch radio does not have a DTMF capability, then a Zetron ZMX microphone could be used. This could have two speed dials programmed to allow switching modes from a single button press.

Talkthrough mode

Description	Dispatcher radio setup	Model 38	Mobile radio setup
Mobile to mobile call		Tx 02 Rx 02	Tx / Rx CTCSS 02
Dispatcher to mobile call	Tx CTCSS 02	→ Rx 02 Tx 02	→ Rx CTCSS 02
Mobile to dispatcher call	Rx CTCSS 02	← Tx 02 Rx 02	← Tx CTCSS 02

Section 3. Operation

Programming

In order for RFW to be used, two users must be enabled on the Model 38. An example of this programming shown in Table 3. -5. The necessary system programming is shown in Table 3. -6.

Table 3. -5. RFW User Programming

User 10 - Dispatcher		User 15 - Radio fleet	
1. User enable	= On	1. User enable	= On
2. Decode (DCS)	= 91.5 Hz	2. Decode (DCS)	= 107.2 Hz
3. Encode	= 15 107.2 Hz	3. Encode	= 10 91.5 Hz
4. Tx hold time	= 0	4. Tx hold time	= 20
5. CTCSS tail	= On	5. CTCSS tail	= On
6. Morse Id	= DISPATCH	6. Morse Id	= FLEET
7. Reserve mode	= Off	7. Reserve mode	= Off
8. Privacy mode	= On	8. Privacy mode	= On
9. Courtesy tone	= Off	9. Courtesy tone	= Off
10. Last user Id = Off		10. Last user Id = Off	
11. DTMF function	= Off	11. DTMF function	= Off
12. Hog limit	= 0	12. Hog limit	= 0
13. Prepay mode	= Off	13. Prepay mode	= Off
14. Airtime	= 000:00:00	14. Airtime	= 000:00:00
15. Aux relay	= Off	15. Aux relay	= Off

Table 3. -6. RFW System Programming

System Programming			
1. Timeout time	= 3	16. Remote PTT	= 0
2. Timeout ID	= Off	17. DCStx invert	= Off
3. AntiKerchunk	= 0	18. DCSrx invert	= Off
4. ID timer	= 15	19. Password	= 123
5. ID freq	= 1200	20. Access alarm	= Off
6. ID speed	= 22	21. Remote type	= 0 Morse
7. ID sys user	= 0	22. COR user#	= 0
8. ID periodic	= Off	23. Min airtime	= Off
9. Beep freq	= 1000	24. Serial tone#	= Off
10. Tail bips	= On	25. CTCSS hold	= 0
11. Hog idle	= 5	26. Slow CTCSS	= Off
12. Hog penalty	= 30	27. Interdigit	= 4
13. Alarm DTMF	=	28. DCS bit errs	= 2
14. Alarm tone	= 0	29. CTCSS delay	= 70
15. Alarm pwr up	= Off	30. Reverse Chn	= 9801

The RFW feature is enabled and disabled globally, that is, only one command is used for On and Off, and all users which have a cross tone set will be effected by enabling RFW.

The command for RFW On is the Reverse Chn value (Item 30 in system programming) plus 1 then the # key. To disable RFW, send the access code plus a #. For standard Model 38 operation, send the access code plus 2, and #. The range for the RFW password is 100 to 9997. An example is provided in Table 3. -7.

Table 3. -7. RFW Password Examples

Description	DTMF command
RFW Off	9801#
RFW On	9802#
Standard Model 38 operation	9803#

Note

When in RFW mode, users may notice a small delay from pushing the PTT to being heard by the dispatcher. This is due to the model 38 CTCSS decode time followed by the receiving radio CTCSS decode time. This effect is not a fault, but is inherent in the basic concept of how RFW works.

4. PROGRAMMING

OVERVIEW

The Model 38 can be programmed from a variety of sources, they are:

1. DTMF over the radio channel, from a mobile, base station or handheld.
2. CRT/display terminal with an RS-232 serial port directly connected to the Model 38.
3. CRT/display terminal with an RS-232 serial port connected to a modem on a phone line to the repeater site, and an auto-answer modem connected to the Model 38.
4. CRT/display terminal with an RS-232 serial port connected to a packet radio controller attached to a control station, and a packet controller at the repeater site connected to the Model 38.
5. A Model 8 DTMF terminal connected to a base station or mobile for “over the air” programming.
6. A Model 8 DTMF terminal directly connected to the Model 38 for “front panel keyboard and display” operation.
7. A DTMF audio source connected to the “Program” connector on the front of the Model 38, which is the same as DTMF over-the-air programming.

PROGRAMMING MODES

DTMF Programming Via The Radio Channel

Program Mode Access

To program the Model 38, the program mode password must first be entered. The code is a 5 or 6 digit sequence. The default password is 12123#. To access the program mode, a CTCSS tone or DCS code may be required if desired. While programming the unit, it is helpful to have a secondary receiver (scanner, or monitor receiver) tuned to the repeater output frequency to hear the prompt tones generated by the Model 38.

When the program mode is activated, the repeater transmitter is keyed, and a chirp will indicate proper access. A command is provided which will cause the transmitter to unkey except during progress tones. Usually it is a good idea to keep the transmitter keyed during the program mode to discourage traffic on the repeater.

Entering a Command

To execute a program command, a DTMF number is entered followed by the “#” key. Some commands require additional numbers, as in the case of cross tone encoding. While entering a command or data, the “*” key may be used as a “clear entry” key. While programming, a key must be depressed every 90 seconds, or the Model 38 will automatically exit the program mode. All numbers may be entered with or without leading zeros (one may be entered as

Section 4. Programming

0001, or 1). Some commands will send a progress or prompt tone while programming, and all commands will send either a “go-ahead” or “error” tone after completion of the command. If the programming radio does not switch from transmit to receive very quick, a delay before sending the prompt tones may be programmed (see the Program Mode Progress Tone Delay command). Please note that you do not have to wait for the prompt tones before entering the next command as all commands are internally buffered (although it is a good idea to listen for the proper acknowledge tones).

Commands identified with “tt” may have the user number entered to program a single user, or by entering “99” ALL users will be programmed with the same information.

Programming Via The Model 8 Repeater Programmer / Timekeeper

Local Programming

For local programming, the Model 8 is attached directly to the Model 38 RS-232 serial data port. The Model 38 must know whether a Model 8 or a CRT terminal is connected to the port, since the output data formats are completely different, and possibly the baud rate. See “RS-232 Port Configuration”.

The Model 8 must be in the “PANEL” mode to communicate with the Model 38. It operates like a front panel keyboard and display. Most functions may be executed while the panel is in operation. There is no “Program mode access” required, and no repeater “down-time” while programming.

Remote Programming

When using the Model 8 to program from a remote location, the Model 8 is connected to a control station or a mobile transceiver. The Model 8 and 38 communicate using DTMF tones. When the “Prog” mode is entered, the Model 8 will send the DTMF code required to put the Model 38 into the “Program mode”. Since the Model 38’s program mode password is user programmable, the Model 8 must be told what the code is. It is set in the Model 8 with the “Setup” command (See the Model 8 manual “Setup” mode). If the Model 8 sends the correct password to the Model 38, after a short delay, the LED read-out should display “READY”. The prompt to enter a command is indicated by a blank display with a single “_” prompt character. No transmission of data will take place until the “Enter” key is pressed. The “Clear” key may be used to backspace over incorrect data. Please note that if the READY prompt does not appear, you should press the MODE key to back out of the “Prog” mode. The password is sent only when the “Prog” mode is first entered.

When a command is sent to the Model 38, an alphanumeric prompt will be returned along with the requested data. To examine a setting in the Model 38, enter the command, then when prompted to enter a new setting, simply press the “Enter” key. The data will not be changed. Some settings such as the Site Alarm code, may be greater than 6 digits in length. To display these, the Model 8 will scroll the code slowly across the display. For faster operation, when a alphanumeric prompt is displayed, pressing any key will cause the Model 8 will jump to the next phase of programming.

When prompted with a “Yes/No” question, enter a “1” for “Yes” or “0” for “No”. When prompted for a value with a decimal place, enter the number ignoring the decimal. Example: Tx-hold = 0.0 to 9.9 seconds, to enter 1.5 seconds, press “15 Enter”, or to enter 0.5 seconds, press “5 Enter” or “05 Enter”.

Programming Via The RS-232 Interface

The Model 38 RS-232 port is valuable for initial test and adjustment, as well as general purpose programming and monitoring. All programming is done with friendly menus and plain English prompts. Programming is best done with an RS-232 display terminal or PC. Tasks such as adding, deleting, modifying parameters, retrieving airtime, and real-time monitoring may all be accomplished without disrupting communications. Most any RS-232 terminal or computer running a communications program may be used.

The Model 38 may be connected directly to an RS-232 terminal or computer when the equipment is located near each other. When this is not possible, other methods may be considered such as phone modems or packet radio controllers. For phone modem programming, an auto-answer modem is typically connected between the phone line and the Model 38 RS-232 port. Multiple Model 38s or other units programmable via RS-232 may be programmed over a single telephone line with the use of an RS-232 port selector.

RS-232 Port Configuration

The RS-232 serial data port on the Model 38 may be configured for three different modes of operation:

- CRT mode.
This mode is for connection to a PC or CRT terminal, and provides menu-driven text prompts. The baud rate may be set from 150 to 4800 baud. *This is the default RS-232 Interface mode, at 1200 baud.*
- Modem mode.
This mode functions like the CRT mode except that it will ignore the “temporary Model 8 mode” feature. This mode should be selected in all applications (especially modems) that won’t have a Model 8 connected to the RS-232 port.
- Model 8 direct connect mode.
This mode expects a Zetron Model 8 Repeater Programmer / Timekeeper will be connected via RS-232 interface. The Model 8 will operate as sort of a “front panel” keypad and display resource for the Model 38.

Setting the RS-232 Port for CRT Mode

Often the easiest method is to use the DTMF programming commands over the radio channel to change the port configuration. The baud rate may also be set via DTMF commands. Cycle power or send a DTMF digit for at least 15 seconds to cause the unit to update the port operating mode.

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If the port is currently set for Model 8 mode and DTMF programming on the radio channel is not possible, the terminal may be used to simulate a Model 8 to change the settings. Perform the following procedure: Set the terminal for 4800 baud, then cycle power on the Model 38. The message “rEAdY” will appear on the terminal, followed by a “_” prompt. On the CRT, type in “19”, then press the ENTER key. The message “rS232” should appear, followed by “=2”. Type in a “0” (selects CRT mode) and press “ENTER”. When the “_” prompt returns, type in “25” and press “ENTER”. Then at the prompt “bAUd =“, type a “6” (selects 4800 baud) and press “ENTER”. Now cycle power on the panel to update the parameters on the serial port.

Setting the RS-232 Port for Modem Mode

The modem mode is selected via RS-232 system programming in the RS-232 port menu.

Setting the RS-232 Port for Model 8 Mode

There are multiple methods of changing the port configuration to Model 8 direct connect, select one of the following:

- The easiest method is to use the DTMF programming commands over the radio channel to change the port configuration to Model 8 mode (see the DTMF command summary).
- If this is not possible, use a paper clip or jumper wire to short pins 3 and 4 together on the RS-232 connector. Remove power, then reapply power and wait 15 seconds. Remove the short between pins 3 and 4 then plug the Model 8 into the RS-232 connector. Note: This is only a temporary switch to Model 8 mode, use the Model 8 command “19” to select the permanent operating mode of the RS-232 port.
- Connect the DTMF output from the Model 8 into the “program” connector on the front panel of the Model 38. Use the “Live” mode to DTMF-program the Model 38 port configuration.

After doing step one or three, remove then reapply the power to the Model 38, or generate a DTMF digit on the receiver frequency for at least 15 seconds. This will reinitialize the port configuration.

CRT Mode

Access to Programming via RS-232 Port

When a user first accesses the Model 38 either over the phone line or directly connected, the message “Enter Password ==> _” will appear. This is to prevent unauthorized access to the programming information. The password is the same five-digit program password used for “over the air” programming (default is 12123). The only difference in the passwords is the trailing “#” is not used. If the code is incorrect, the terminal will beep, delay one second, beep, and repeat this sequence 10 times. This slows down any “hackers” from attempting to find the password by trial and error methods.

XON / XOFF Protocol

The Model 38 follows “XOFF/XON” protocol. This sequence prevents data from flowing too rapidly for the display device (printer/terminal) or host to assimilate. If the Model 38 receives an “XOFF” code (Control S), the data output will pause until a “XON” code (Control Q) is received.

RS-232 Buffer

The serial data port has a “type-ahead” buffer to allow the input to get ahead of the printout. This feature should be used with caution since the operator cannot see the results of an input command immediately. The buffer does allow faster programming once the operator gets used to it.

Disable Panel Command

The CRT programming task is the lowest priority for the Repeater Panel, so when users are active on the channel, the CRT programming menu outputs will begin to slow down. A command is provided at the main menu level to disable the Repeater Panel. This command provides for much faster programming when using baud rates above 300. Be sure to re-enable the Panel when programming is completed.

Serial Interface Connections

The RS-232 Interface port on the Model 38 is compatible with RS-232C signals and uses an asynchronous ASCII serial communications protocol. Only three wires need to be connected between the PC or terminal to the connector on the Model 38: Pin-3, (Txdata) Pin-4 (Rxdata) and Pin-5 (GND) (see Table 4-1). The connector on the PC or terminal end should have jumpers installed to connect the handshake lines DTR to DSR, and CTS to RTS. Set the terminal for 8 bits per character, no parity bit, and 1 or 2 stop bits (see the reference manual for the terminal you are using). The Model 38 defaults to 1200 baud. To change the baud rate, use the DTMF programming commands (programming section).

Many people ask why the pinout of the DB9 connector on the Model 38 is not “PC standard”? The reason is that the Zetron DB9 RS-232 pinout was introduced to the market when personal computers and terminals all had DB25 connectors. No DB9 standard existed. Due to the volume of Zetron products in the field with DB9 connectors, and the existing Zetron serial cables in use, it is not likely to change. Newer Zetron products often include internal jumpers for the serial port to select “Zetron” or “PC” compatibility.

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Table 4-1. Typical Connections to a Video Terminal or Computer

Model 38:		Connections & Signal Direction	PC or Terminal:		
Pin	Function		Signal Name	Terminal or PC with DB-25	PC with DB-9
1	Ground				
2	Ground				
3	RS-232 Transmit	→	Rx data	Pin 3	Pin 2
4	RS-232 Receive	←	Tx data	Pin 2	Pin 3
5	Ground	←	Ground	Pin 7	Pin 5
6	+12VDC fused	Jumper →	DTR	Pin 20	Pin 4
7	No connect	Jumper →	DSR	Pin 6	Pin 6
8	No connect	Jumper →	RTS	Pin 4	Pin 7
9	No connect	Jumper →	CTS	Pin 5	Pin 8

PROGRAMMING COMMANDS

The following is a description of the programmable features in the Model 38, divided into categories as shown:

- Access and exit from the programming mode.
- User Commands, for items selectable on a “per-user” basis.
- System Commands, for items that relate to overall system operation.
- Diagnostic Tests, that aid the installer in system setup.

A summary of all of the commands is included in the quick reference section at the back of the manual. The list shows the following information for each programmable setting:

- The item description
- The DTMF programming command
- The default setting
- The programmable range of values
- Comments

A similar summary is provided for the Model 8 programming commands.

Program Mode Access

RS-232 CRT or PC

The prompt “Enter Password --> _” will appear at top level access. The password is a four or five digit number followed by ENTER. The default is 12123 <CR>. If the password is correct, the main menu will be displayed. If the password is incorrect, the Model

38 will beep, send a carriage return, and delay one second, then repeat the sequence 10 times before prompting for a password again, to reduce the possibility of unauthorized access.

The unit may be set back to the password prompt by entering the EXIT command from the main menu. It is not necessary to exit the CRT mode, as the Model 38 will operate while programming. Only when in the Test Menu, or using the Disable Panel command, does the unit disable the repeat function.

DTMF radio or keypad

The DTMF access code is a four or five digit number followed by the “#” key, the default being 12123#. NOTE: The access code may be set to require a specific CTCSS tone or DCS code in order to respond. Upon access, the unit will key and send a “chirp” tone. A delay before acknowledging is user programmable, as well as the possibility of sending the site alarm. During the program mode, the repeater will remain keyed to keep other mobiles from trying to access the channel. Since the repeater transmitter is continuous duty, this should not present a problem. The DTMF programming commands are not repeated out the transmit audio as a security measure. If desired, the transmitter may be set to unkey during the program mode (except during prompt beeps), refer to the PTT OFF command.

Command 293# will cause the unit to exit the program mode. A confirmation tone that sounds like telephone ringing will be heard. Please note that the unit will exit the program mode automatically if no DTMF digits are decoded within a 90 second period.

Zetron Model 8 Repeater Programmer / Timekeeper

When locally connected to a Model 38 via RS-232 port, no password is required. For remote access the password is automatically sent when the “PROG” mode is first entered. The code must match between the Model 8 and the Model 38. The code may be set in the Model 8 with the SETUP mode.

Note

The password is only sent when the ENTER key is pressed after selecting the PROG mode. This causes the DTMF password to be sent as above. By monitoring the repeater transmit channel, the prompt tone from DTMF program mode access may be heard when proper access occurs. For more information, refer to the Model 8 instruction manual.

To exit the program mode, press “99 ENTER”. If locally connected, the message “READY” will be displayed. For remote “PROG” mode, “DONE” will be displayed.

User Commands

Enable a User

To activate a CTCSS or DCS group in the Model 38 (similar to plugging in a tone card) a “user number” must be enabled. When a user is enabled, the repeater transmitter will key

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whenever carrier and the CTCSS tone or DCS code are decoded. Please note that for DCS operation, the user must be enabled *AND* a DCS decode number set (000 and 777).

Disable a User

In order to de-activate a CTCSS tone or DCS code, the user number is disabled (same as unplugging a tone card). When a user is disabled, the transmitter will no longer key in response to the user group.

Note

For expired user groups (no-pay) or seasonal use, the “reserved mode” may be used which is separate from user enable/disable.

DCS Decode Number

The Model 38 is capable of decoding all 38 or 50 CTCSS tones and up to 22 or 18 digital squelch codes. The digital user numbers exist above the CTCSS users. Each of these user “slots” are capable of decoding any digital code, so the decode “code number” must be set by the system operator. The selection of digital polarity is done with System Programming, and affects all users equally. Please note, the user must also be enabled (see Enable a User) in order to function.

CTCSS / DCS Encode and Tone Translation

Typically, a repeater panel will encode the same tone or DCS code that it decodes. For each user, the Model 38 may be set to encode any CTCSS tone, DCS code, or no encode at all (just carrier). The encode number may be set to a tone number (1 to 38, or 50), no encode (0), or for DCS enter the octal code plus 1000 (code 023 would be entered as 1023). Please note that the Model 38 is capable of cross format operation, in that when decoding CTCSS is can encode DCS, or when decoding DCS, it can encode CTCSS.

Transmit Hold Time

The transmitter hold time is the amount of time the repeater transmitter remains keyed after mobile activity is no longer detected. It may be set from 0.0 to 25.0 seconds in 0.1 second increments.

CTCSS Encode During Transmit Hold Time

When a user unkeys, the CTCSS or DCS encode may either be left on during the transmitter hold time, or turned off. When using a control station phone patch through the repeater, the encode should be turned off during tx-hold. This allows the phone patch to know when the mobile has unkeyed, as opposed to knowing when the repeater has dropped off the channel. When using the repeater for dispatch only, the encode may be left on during the tx-hold time to keep the mobile decoders open. This feature eliminates the decode delay observed in the

mobile between transmissions, and is generally required in order for the busy channel lockout feature to function properly in the subscriber radios.

Privacy Mode

The “Privacy” mode (when enabled) won’t allow other CTCSS or DCS user groups to access the repeater until the transmit hold time has expired. This feature can prevent other user groups from “barging in” on the conversation and taking over control of the repeater.

Reserve a User

A CTCSS tone or digital squelch code may need to be reserved for future use. If a user keys up on a “Reserved” user, the transmitter will key but the repeat audio will be disabled. A beep tone will be sent for the duration of the transmission and a chirp tone sent when the user unkeys. This mode is designed to be used when disabling a user possibly due to a “no-pay” condition, or seasonal use. A “Reserved” user will keep the tone active in the repeater so as to prevent other repeater operators from seeing the tone as “Available”.

Note

The User must be ENABLED as well as Reserved.

Courtesy Beep

A courtesy tone may be sent whenever a user unkeys if desired. The frequency of the beep can be set in the System Programming section. The system operator can use this feature on a per user basis as required.

Last User DTMF Identification

The last user DTMF ID will send the DTMF user number when the user unkeys. With the use of a DTMF decoder on the repeater output frequency, the system operator can keep track of problem users (misuse of the channel, etc..) by seeing which user was just active. A two digit DTMF code (the User number) is sent whenever the user unkeys. The DTMF is sent at high speed, so as to sound similar to a courtesy tone.

Hog Mode

The hog penalty allows the system operator to penalize “airtime hogs” so that other users on the system have a chance to complete calls. This feature disallows a user from conversing through the repeater for a penalty duration (10-9990 sec.) if the user has recently exceeded a specified conversation limit (1-25.0 min.). While a user is penalized, the system will ignore the user. Warning tones are sent to the user prior to cut-off. To avoid the penalty, the mobile must let the repeater transmitter unkey for an “Idle duration” (1-99 sec.), to allow another mobile to use the system. If another user keys up, or the idle duration is met, the conversation timer is reset. The Hog Mode conversation limit time is programmable for each user, and all users have their own penalty timers in the case of multiple hogs on the system. The

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conversation limit timer is programmable in 0.1-minute increments (10 = 1 minute). See System Programming for penalty and idle timer settings. To disable the Hog mode for a user, set the conversation limit time to zero.

DTMF Functions Enable

Subscribers may be allowed to initiate a temporary cross tone mode to communicate with a group on a different CTCSS tone or DCS code. A DTMF regenerate mode is also available for use with a phone patch or mobile DTMF decoders, and a temporary cross tone disable mode may be accessed to allow a group normally disabled by cross tone to communicate. This feature determines whether or not the user has access to these functions. Since they are all accessed by a DTMF sequence, it may be desirable to disable these functions and cause the Model 38 to ignore any DTMF from the mobile. The operation section of this manual explains the detailed operation of these modes when selected.

Set Station ID Call Sign

Each user group in the Model 38 can have their own Morse code station ID. Each group also has its own ID timer. The Morse ID is sent the first time the user unkeys after the interval timer has expired. If the user keys up again, voice communications may occur while the station ID is being sent. The call sign is sent at 30% deviation and a selectable speed from 15 to 25 (default is 22) words per minute (to meet FCC Part 90 regulations). The Morse code tone frequency may be set with the System programming from 400 to 2000 Hz so as not to interfere with paging or other tone signaling on the channel. The ID interval may be set with System programming anywhere from 1 to 99 min. The call sign may be 0 to 8 characters. A single System ID call sign may be selected and the unit may be configured to send the ID at regular intervals, not based on repeater activity, see the System Programming Section.

When installing the call signs via DTMF programming, a simple, easy to remember procedure is used as follows: Look at Table 4-2 or Table 4-3; notice the first digit of a letter code is selected from the top row (1,2, or 3). This is a “shift” key. Now notice the letters above each key. By using the “shift” key plus a letter key, the code is complete. The only letters not represented are Q and Z. Numbers are entered directly. Just remember to insert the “#” key between all characters. To enter a call sign less than 8 characters, press the “#” key for the last code. The call sign will be sent back in Morse code after entering the call. To remove a call sign, enter a “#” for the first character.

Table 4-2. Station ID Cross Reference

Digits	Number	Code	Digits	Letter	Code	Digits	Letter	Code
00	0	-----	12	A	•-	26	N	-•
01	1	•-----	22	B	-•••	36	O	---
02	2	••-----	32	C	-•••	17	P	•--•
03	3	•••----	13	D	-•••	10	Q	---•-
04	4	••••-	23	E	•	27	R	•-•
05	5	•••••	33	F	••-•	37	S	•••
06	6	-•••••	14	G	---•	18	T	-
07	7	--••••	24	H	••••	28	U	••-
08	8	---•••	34	I	••	38	V	•••-
09	9	-----•	15	J	•----	19	W	•--
			25	K	-•-	29	X	-••-
			35	L	•-••	39	Y	-•--
#		(DONE)	16	M	--	20	Z	---•

Table 4-3. DTMF Keypad with Letters Shown

1	ABC 2	DEF 3
GHI 4	JKL 5	MNO 6
PRS 7	TUV 8	WXY 9
*	0	#

Example: Set the station ID call sign “WNCR-414” to 100.0 Hz CTCSS tone (user # 12):

DTMF commands: 43# 12# 19# 25# 32# 27# 4# 1# 4# #

Comments: Set ID User 12 W N C R 4 1 4 done

Playback Morse ID

The station ID for a user may be played back over the channel while in the program mode. This command is only available when using the DTMF program mode (not from RS-232 or Model 8 mode).

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Prepaid Airtime Mode

The Prepaid Airtime feature allows a customer to purchase a block of airtime in advance. As the customer groups uses the repeater, the amount of airtime decreases, and when the supply is nearly gone (below two hours remaining) the customer hears warning beeps upon unkeying. Unless a new payment is received, the tone becomes “reserved” as soon as the prepaid airtime runs out. This feature eliminates billing since customers always know when it’s time to pay.

Display or Change a User’s Airtime Counter

The airtime counter for each user may be viewed, cleared, or changed perhaps to add airtime when the user is in prepay mode.

Note

The maximum airtime allowed is 249 hours:59 minutes:59 seconds. If a user exceeds this time, the counter limits at 249:59:59, and will not roll over.

When programming the unit via DTMF over the radio channel, the airtime counts may be retrieved and displayed using a Zetron Model 8 Repeater Programmer / Timekeeper or any other DTMF display device. Commands are supplied to support DTMF display devices that only have four digit displays. If desired, the data may also be sent via Morse code, at any speed from 4 to 25 words per minute. The format of the data is selected from the System Programmable Feature “DTMF repeater programmer unit type”. When a remote DTMF display decoder is not available, anyone should be able to copy slow Morse code digits. Digits are the easiest code to remember, since all characters are 5 elements in length. Table 4-4 is provided for reference.

Table 4-4. Numerals in Morse Code

Digit	Sound	Dot / Dash
1	dit dah dah dah dah	•-----
2	dit dit dah dah dah	••-----
3	dit dit dit dah dah	•••-----
4	dit dit dit dit dah	••••-----
5	dit dit dit dit dit	•••••
6	dah dit dit dit dit	-----••
7	dah dah dit dit dit	-----•••
8	dah dah dah dit dit	-----•••
9	dah dah dah dah dit	-----••••
0	dah dah dah dah dah	-----•••••

Optional Auxiliary Relay Function

This option allows the aux relay to close while a predetermined CTCSS tone, or DCS code, or group of tones or codes is received. The aux relay will follow the CTCSS or digital decode for programmed users; closing only while the user is transmitting. Jumpers allow the system operator to provide a pair of normally open or normally closed contacts. With the auxiliary relay option installed, the Model 38 provides a ground on TB1, pin 8 upon receipt of a tone or code programmed for auxiliary relay activation.

System Commands

Carrier Repeat (Open Repeater)

The Model 38 can be programmed to repeat based on just carrier, sometimes called “carrier controlled repeat”, or “open repeater”. In this mode the unit will provide simultaneous tone, DCS, and open repeater operation; users that have CTCSS or DCS encode operate normally, users that have no encode repeat also. This allows a mix of CTCSS tone users with open repeat capability and is ideal when adding tone users to an existing open repeater.

To enable the carrier repeat function, a user number is identified as the “CARRIER” repeater user. This allows all of the user programmable features to be applied to open repeat, including; enable/disable for the carrier user, CTCSS or DCS encode, air time accumulation, etc. If the COR user number is set to “0”, the no carrier repeat is available.

Anti-Kerchunker Filter

The anti-kerchunker filter cancels the transmit hold time and drops the repeater immediately if a mobile transmission is less than the programmed “anti-kerchunk” time. This serves two main purposes:

- It will discourage users from “kerchunking” the repeater to death.
- It will make the repeater co-exist better on shared-channels. When a lot of CTCSS tones are enabled on a single channel, it’s not uncommon for voice falsing of active CTCSS tones on a co-channel repeater to occur. This is because a human voice often contains frequencies in the CTCSS band. A radio user could be talking and cause a co-channel repeater to key up over the conversation. When the repeater transmit hold time is greater than about a second, this causes major interference to the voice communication. With the anti-kerchunker filter enabled, the repeater will key ONLY for the duration that the voice simulates CTCSS, not the entire transmit hold time. The anti-kerchunker filter is disabled by programming the time to zero.

Morse ID Frequency, Interval, Speed, and System ID

The Morse code station identification is programmable in frequency, interval and speed. Each user group has its own independent station ID callsign, and timer accurate to one second per interval. The timer is reset when the station ID is sent. The call will be transmitted on the first dispatch message after the timer has expired.

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The frequency is programmable from 400 to 2000 Hz (per FCC part 90), the default setting being 1200 Hz.

The interval is selectable from 1 to 99 minutes, with a default of 15.

The Morse ID speed is selectable from 4 to 25 words per minute, the default setting being 22 WPM. During normal dispatch, the minimum speed will be 15 WPM. This allows the “List” functions in the program mode (using Morse code) such as airtime retrieval to be sent at real slow speed, while maximizing airtime use during normal dispatch.

For co-op systems and other requirements, the repeater may have a single call sign that may need to be sent at regular intervals (periodic ID enabled) or based on repeater usage. This is referred to as the “System ID”, and it is enabled in the unit by selecting one of the user slots (CTCSS or DCS) as an index. The user can be either a valid (enabled) subscriber or disabled user. The System ID user number will specify the call sign and CTCSS or DCS encode attached to the repeater ID. When it’s time to ID, the transmitter will be keyed and after a 0.75 second delay, the call sign sent. The conditions that must be met before the system ID is sent include:

- The ID interval timer must expire (adjustable 1 to 99 minutes)
- The Model 38 must be inactive (DECODE LED off), no conversation in process
- The System ID must have a user number programmed

Courtesy Tone Frequency

The Courtesy tone is programmable in frequency from 400 to 4000 Hz. The default setting is 1000 Hz. It is used for courtesy tones and prompt beeps. It may be desirable to change the frequency of the tone in order to distinguish co-channel repeaters at different locations.

Tailbips

For some installations, a courtesy beep sent once per second during the transmit hold time can help users identify repeater access. To activate Tailbips, the Courtesy Tone must also be enabled for each user group desiring the feature. Please note that the tone frequency of the Tailbips is system programmable as the Courtesy Tone Frequency.

Hog Mode

The Airtime Hog feature penalizes long-winded talkers. If a talker exceeds a time limit (programmable per-user), he will be prohibited from placing a call for a penalty period. Warning tones are sounded when a Hog penalty is imminent.

The hog mode requires three separate timer functions. They are the Conversation time limit, Idle timer, and Penalty timer. The Idle timer runs whenever a mobile is inactive, and when satisfied will reset the conversation time limit. The penalty time is the amount of time a mobile will be disabled when the conversation time limit is reached. Each user may have the Hog function enabled or disabled (see user programmable features). The Conversation timer

is programmable per user from 1 to 25.0 minutes, the Idle time programmable from 1 to 99 seconds, and the Penalty timer programmable from 10 to 9990 seconds in 10-second increments. Hog mode may be disabled for a user by setting the conversation limit time to zero.

A long-winded talker who is approaching the end of the conversation time limit will start hearing warning tones (sounding like “bee-doo”) 1 per second prior to cut-off. To avoid an impending Hog Penalty, the user must let the repeater transmitter un-key for the idle duration, giving another mobile a chance to use the system. If another user keys up, or if the idle duration is met, the conversation timer is reset. The Hog Penalty is programmable user, and all users have their own penalty timers in the case of multiple hogs on the system.

Timeout Timer

The timeout timer is the maximum amount of time a mobile may continuously transmit on the channel. This is a stuck mic timeout feature. The timer is reset each time CTCSS or DCS decode stops. During a timeout condition, an alert tone will be sent, then the repeater transmitter will unkey. If desired, the user number causing the timeout can be identified via DTMF every 15 seconds while the fault exists. This is referred to as Timeout ID. To disable the timeout timer, set the value to zero.

Timeout ID

In order to determine what user group has a stuck transmitter, the timeout ID feature can be enabled. During a timeout condition with timeout ID enabled, the repeater will key every 15 seconds (while the user is still transmitting) and send the user number via slow DTMF.

Site Alarm Programming / Remote PTT Function

The Site Alarm function of the Model 38 has multiple purposes. It can be used to:

- Generate a programmable DTMF sequence, a warble alert tone, and a specific CTCSS tone or DCS code.
- Indicate an event triggering the site alarm input pin (on the back of the Model 38) such as a door contact, high temperature, AC fail, low fuel...
- Indicate the program mode has been accessed.
- Indicate power has been restored to the repeater (power on alarm).
- Indicate when the site alarm input pin is being held active by generating a 2 Khz beep whenever the repeater is in use just before unkeying.
- Interrupt repeater operation, key the transmitter, and generate carrier or a specific CTCSS or DCS code (remote PTT function). This can provide the capability for a tone/dc remote or local mic to communicate with a specific user group.

The site alarm DTMF sequence can be set for 0-8 digits, including the 0 to 9, *, #, A, B, C, or D keys. The Site Alarm may be sent with a contact closure input, and/or each time power

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is restored to the Model 38. When the Alarm is tripped, the Model 38 will wait until dispatch activity is completed, then wait for 2 seconds of clear channel, key the transmitter, select a CTCSS or DCS encode tone, wait 1 second, then send the DTMF digits. Following the DTMF code, a warble alert tone will be sent. If the alarm is from the contact closure, a slow warble will be heard. If the alarm is from a power up condition, a fast warble will be heard.

The site alarm may also be sent upon program mode access. This can be useful information where unauthorized access is suspected. If the site alarm is enabled for program mode access, the DTMF alarm is sent followed by the five unique digits of the Model 38's serial number. The serial number can be useful for verification of the panel being programmed.

Note

This function should not be used when using a Model 8 for over-the-air programming.

The site alarm input may be used as a "Remote PTT" function. This feature is initiated by the site alarm input being pulled to ground by a contact closure or other input. When the alarm input goes active, any repeater activity will be suspended, then the programmed CTCSS tone or DCS code will be encoded, the repeat audio squelched, and the transmitter keyed. This condition will continue until the site alarm input is released.

When the site alarm digits are entered via DTMF programming (command 25276#), the input is terminated with a timeout period, not the "#" key. For example: To set the site alarm code to "12345", press 25276#12345 then wait for the go-ahead "chirp". Don't press 25276#12345#

A Model 8 Repeater Programmer / Timekeeper may be used to decode the DTMF digits sent during an alarm condition. The Model 8 will flash it's display and close a relay in response to an alarm decode.

Digital Coded Squelch Data Polarity

Since the polarity of the encode and decode data depends on which radio it's attached to, and the connection points within the radio, programmable inverters are incorporated into the DCS encoder and decoder software. The polarity is either Normal, or Inverted. The digital code being sent is not changed, only the polarity of the bits. The easiest way to verify proper data polarity is trial and error during installation.

Program Mode Access Code

The program mode password is a number between 1000 and 32000. If it is set to less than 1000, the password will be 12nnn (where nnn is the password). If it is set to greater than 1000, the password is the number entered.

When the program mode is accessed via DTMF over-the-air, a programmable delay may be included after the code is recognized, but before the program mode becomes active. This feature provides added security from hackers using trial-and-error techniques to break into a

tone panel. During the delay time, the tone panel continues to operate normally. The delay can be set from 0 to 30 seconds. For additional security, the site alarm and serial number of the panel may be sent upon access (see Site Alarm programming above).

Note

The setup mode in the Model 8 controls which code it sends to the Model 38A when the Model 8 is in the program mode. Model 8 units with software prior to version 3.7 only support the 12nnn format of Model 38 password. Model 8s with version 3.7 and later support 12nnn or 1000 to 32000.

Program mode progress tone delay (DTMF Mic Hold Time)

This function allows a delay to be inserted before the progress tones are sent during DTMF programming. In many radios equipped with DTMF encode, the transmitter remains keyed for a short time after releasing a DTMF digit. This can prevent the user from hearing the prompt tones. To remedy this condition, a delay may be inserted into the Model 38. Enter the number of seconds to delay, from 0 to 3, the default setting being 0.

Note

While programming, the user does not have to wait for the prompt tones, all DTMF is received even while processing a command, or issuing a prompt tone.

DTMF Repeater Programmer Unit type

When programming the unit over the channel via DTMF, the “list” functions (such as airtime retrieval) send back data as either DTMF or Morse code. The format may be “straight DTMF” for use with a Zetron Model 8 Repeater Programmer / Timekeeper, or compatible with the RDU or DI-16 terminals. For Morse code format, the speed may be set with System programming from 4 to 25 words per minute. Once the command is recognized (the “#” key released) the Model 38 will delay for three seconds then begin sending back the data. If a remote DTMF display decoder is not available, anyone should be able to copy the Morse code digits. Digits are the easiest code to remember, since all characters are 5 elements in length. Table 4-5 is provided for reference.

Table 4-5. Numerals in Morse Code

Digit	Sound	Dot / Dash
1	dit dah dah dah dah	• - - - -
2	dit dit dah dah dah	•• - - -
3	dit dit dit dah dah	••• - -
4	dit dit dit dit dah	•••• -
5	dit dit dit dit dit	•••••
6	dah dit dit dit dit	- ••••

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7	dah dah dit dit dit	--•••
8	dah dah dah dit dit	----••
9	dah dah dah dah dit	-----•
0	dah dah dah dah dah	-----

DTMF Interdigit Timeout

The DTMF timeout is used to detect when the radio user has finished entering DTMF digits. It is used during program mode access, DTMF regenerate mode, and a few other places. The default setting of four seconds should be adequate for nearly all applications.

Select RS-232 Port Configuration

The RS-232 port may be configured for connection to a Model 8 Repeater Programmer / Timekeeper, an RS-232 terminal, PC, or modem. When changing port configuration, the new configuration is loaded after power on, top menu access, and long digit DTMF reset. Refer to the beginning of this section for more information.

RS-232 Baud Rate

The baud rate of the RS-232 port when configured for CRT or Modem mode may be set to any one of the following baud rates. The default baud rate is 1200.

Baud Rate	150	300	600	1200	2400	4800
Enter number	1	2	3	4	5	6

RS-232 Port Serial Tone Output

When enabled, the Model 38 will send a character out the serial port whenever CTCSS or DCS is decoded, and another character when decode is lost. This feature can be used to inform other equipment of real-time channel status. The format is as follows: When the Model 38 decodes a user (CTCSS or DCS) it will take the user number of the decode, add 96 then send it as a character. When decode is dropped the ASCII character with a decimal value of 96 will be sent. Table 4-6 provides an example.

Table 4-6. Serial Tone Decode Output

Model 38 decodes	Serial tone output character
User 13, 103.5 CTCSS	ASCII 109
Decode goes away	ASCII 96
User 55, DCS 047	ASCII 151
Decode goes away	ASCII 96

Airtime Accumulation

The airtime may be accumulated including or excluding the transmit hold time.

DCS Bit Errors

This feature allows adjustment of the number of allowable bit errors that are acceptable when acquiring a DCS code. Setting this value to 1 means that one bit error is allowed for each DCS code word when the panel is attempting to determine if a digital code is being received. The number of allowable bit errors is adjustable from 1 to 4. This adjustment only affects DCS acquisition and does not affect operation once a code has been decoded. Operation once DCS decode has been acquired is set to ignore up to 4 bit errors in any position of the code word. Setting a low value will cause the unit to require better signal quality for access, setting a higher value will cause the unit to decode in poorer signal conditions but be more likely to false on noise. Note: For proper DCS decode operation without noise falsing, the carrier detect LED on the front panel should be set to come on at a 6 dB SINAD level.

Voted CTCSS Acquire, Slower Decode

Two algorithms are selectable for CTCSS acquisition which affect CTCSS tone frequencies below 140 Hz. The selections are either fast decode with some chance of falsing, or slightly slower decode with little chance of falsing. The selection typically only affects the first time a mobile keys up during a conversation.

CTCSS Delay

This command allows the CTCSS squelch tail elimination detector in the Model 38A to function despite the variations between manufacturers in how long the phase reverse burst is sent when the radio is unkeyed. When the phase inverted CTCSS tone is sent too long by a radio, the Model 38A can reacquire the tone and open up the repeat path again, causing a long squelch tail “crunch”. By adding the CTCSS delay, when the reverse burst is detected it will mute the repeat audio path and refuse to decode the tone again until the time period set by this command has expired. The default setting is 70 milliseconds which should work well with all current radio manufactures.

CTCSS Decode Hold Time

A timer is available to extend the duration between loss of CTCSS decode and repeat audio muting (while carrier is still present). The unit will always mute within 5 milliseconds after loss of carrier.

The industry standard DCS hold time is one second. If the CTCSS hold time is set above one second, it will apply to DCS also. Whenever the squelch tail elimination “turnoff code” bit sequence is recognized, repeat audio will be muted independent of any hold time.

Note

This value should be left at the factory default setting of “0” except in very special situations. About the only reason to use this timer is the case where low frequency paging tones close to a CTCSS tone need to be sent through the repeater. Since the paging tone deviation is generally 5 times higher than the CTCSS tone, it can de-sense the decoder, causing repeat audio to mute.

List And Airtime Functions

List the Number of Active Users

Programming commands are available to show how many users (CTCSS tones and DCS codes) are enabled in the repeater panel. The number will be sent back via Morse code or DTMF as selected.

List the Active User Numbers

The active users in the Model 38 may be displayed for reference. The user numbers will be sent via two digit numbers, in DTMF or Morse code. To interrupt the display, press the “*” key between packets. If using a DI-16 remote, the numbers will be sent in “high-speed” download mode.

List Airtime Counts Greater than Zero

This command will display the user number and associated airtime count, if greater than zero. All airtime accumulated will be displayed, not just enabled users to allow the system operator to monitor co-channel airtime use. The user number will be sent, a 1-second delay, then the Hours:Minutes will be sent as a 4-digit number. A 3-second delay will separate the user numbers. For use with a DI-16 remote, the counts will be sent in “high-speed” download mode.

Clear All Airtime Counters

All user airtime counts may be reset to zero with a command. A password is required to reduce the possibility of accidentally losing the airtime counts.

Diagnostic Commands

The following commands are provided to aid the system operator and installer in setting up the system. All commands may be used interactively with other commands. For example, the transmitter may be keyed, the repeat audio path opened, a CTCSS tone generated, and a DTMF tone generated all at the same time.

Site Alarm

The site alarm may be sent in order to verify proper decoding with associated equipment.

PTT On / Off

The transmitter may be keyed and unkeyed in order to test PTT function. If left in the Off state, it will still key to send progress tones or download data.

Repeat Audio Path

The repeat audio path may be opened or closed (squelch or unsquelched) for testing purposes.

DTMF Encode

A DTMF digit may be generated on the repeater output channel to set the deviation of the transmitter, and the Audio Output adjustment in the Model 38. When using the DTMF program mode, use Table 4-7 as a cross reference.

Audio Test Tone

An audio test tone may be generated if desired. The tone generator is used for Morse ID and various prompt tones. The amplitude and shape of the signal will vary with frequency, since it is not a pure sign wave generator. Any frequency between 400 and 4000 Hz may be encoded.

Table 4-7. Digit Assignments for DTMF Encode Test

Number	DTMF Encode Digit	Number	DTMF Encode Digit
0	0	9	9
1	1	10	A
2	2	11	B
3	3	12	C
4	4	13	D
5	5	14	*
6	6	15	#
7	7	99	Turn off DTMF tone
8	8		

CTCSS Tone or Digital Squelch Code Encoding

This function is used to set the CTCSS deviation and test the DCS encode polarity. All of the CTCSS tones, any frequency between 50.0 and 300.0 Hz, and any octal DCS code (000-777) can be generated. For DCS enter the octal code plus 1000 (023 is entered as 1023). To disable the encode, enter zero.

A CTCSS tone sweep mode is provided (via DTMF programming) which will generate a low, mid, and high frequency CTCSS tone. Each tone is turned on for 4 seconds. This mode is good for checking the deviation of the tones at each end of the CTCSS limits. All tones

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should be close in deviation. If not, de-emphasis may need to be switched in or out. To terminate the sweep command hold down the DTMF “*” key for 5 seconds. Note: This test may be slow to exit.

The precise sub-audible frequency encode command can be used to test the bandwidth of a CTCSS decoder over the air. As an example, testing a mobile decoder on 100.0 Hz. By entering 1015 the Model 38 will encode 101.5 Hz, the mobile should unsquelch. Then encode 98.5 Hz, the mobile should still unsquelch. If it doesn't, the decoder bandwidth is wrong, or in the case of a tunable decoder, the center frequency is probably adjusted wrong.

List Resets, Power Fails, Program Access

The Model 38 keeps track of the number of program mode access, resets or brownouts, and power fails. The counters limit at 9999 and may be read via RS-232, Morse code, DTMF or Model 8. The counters may be cleared via DTMF programming.

Repeater Enable / Disable (setup / knockdown)

The Repeater Panel may be temporarily disabled if required. When disabled, it will remain out of service until the program mode is accessed again, or the main power is cycled, or a “long DTMF digit reset” is performed.

System Memory Test

The program and database memory in the unit include integrity check features to ensure proper operation. The status of the system can be checked with program mode commands. When an error condition exists, the unit will generate a 400 Hz beep over the transmit audio during repeater operation just before unkeying. If this tone is heard, the unit can be interrogated as to the source of the problem. Use Table 4-8 to identify system memory errors.

Table 4-8. System Memory Errors

Error number	Type of fault
0	None, system is functioning properly
1	EPROM memory error, U14 or U16 defect
2	An error may exist in the System programmable features setting area
3	EPROM and System programming errors
4	User database error (CTCSS / DCS attributes)
5	User database and EPROM memory errors
6	User database and System programming errors
7	User database, System programming, and EPROM errors

When an EPROM error exists (error number 1, 3, 5 or 7), the unit may or may not function properly. The EPROMs contain the operating software program that determines all of the

operation of the unit. In case of an EPROM error (which is extremely rare) the EPROMs should be replaced as soon as possible, or the unit returned for service.

If a system programming error exists, some value in the system programmable features is either out of range or somehow changed unintentionally. If this occurs, the system programmable settings should be viewed to look for undesirable settings. The error may be cleared by simply changing any of the system programmable settings.

If a user database memory error is indicated, a value in the user database area is either out of range or somehow changed unintentionally. The items affected by a user error may or may not affect operation. In this case, the number of users with errors may be important as well as the actual user numbers with errors. If only a few users have errors, they may be reprogrammed with little trouble. If many errors are reported, it may be a better idea to clear all memory and reset the system.

What will the unit do in response to an error?

- If more than 20 users report errors when the unit is powered up, it will automatically reset the entire system to the factory default values.
- If the error is an out of range system or user programmable settings, the factory default will be used.
- EPROM errors may cause undesirable operation of the unit. Some errors can be tolerated, others cannot, depending upon the location of the error.

What can cause an error?

- The system and user programmable values in the unit are contained in a battery backed memory. The memory contains two batteries for redundancy: if one fails or gets used up, the other one takes over. The lifetime of the batteries is between 5 and 12 years with or without power applied. When the battery is used up and power is removed from the unit, errors may be introduced into the programmable settings.
- A direct hit or near strike of lightning may contain enough energy to alter a setting within the system or user database memory.
- Installing different versions of software in the unit, upgrades, swapping EPROMs, changing between 38 or 50 tone versions may introduce memory errors.
- EPROM errors should not occur.

Reset the unit to the Factory Default Settings

This command will load the factory defaults into the system and user database settings, and clear the airtime totals.

5. INSTALLATION

INSTALLATION WARNING

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause interference to radio communications. Installation of the Model 38 Repeater Panel should only be attempted by qualified radio service personnel.

For instructions on installing new software, see “INSTALLING A NEW PROM” on page 5-27.

GENERAL

Connections to the transmitter, receiver, and power are grouped on a detachable terminal strip on the rear for ease of installation. The Model 38 includes installation test modes to aid in installation. All adjustments and switches are accessible from the rear.

REQUIRED EQUIPMENT

Required equipment includes:

- A communications service monitor
- A handheld or mobile radio with DTMF encode capability
- A VOM (volt-ohmmeter).
- A PC or terminal with RS-232 is desirable

SCREW TERMINAL CONNECTIONS

Pin #	Signal	Pin #	Signal
1	+12 VDC or 9 VAC, fused input	9	Site alarm input
2	9 VAC input	10	Rx carrier input
3	DC supply ground	11	Tx microphone audio
4	Ground	12	Ground
5	PTT N.C.	13	CTCSS / DCS encode
6	PTT common	14	Ground
7	PTT N.O.	15	Rx discriminator input
8	Auxiliary relay output		

Section 5. Installation

INSTALLATION PROCEDURE

1. Remove the 15-pin screw-terminal connector from the rear of the unit.
2. **POWER SUPPLY:** Locate the 12 Volt DC supply for the repeater receiver/transmitter. With a VOM, measure the DC voltage. It should be between 10.5 and 15.0. If 12 Volt DC is not available, a 9 Volt AC wall transformer may be used. For DC operation, connect the power supply ground lead to pin 3, and the positive supply lead to pin 1. For 9 Volt AC operation, connect between pins 1 and 2 (pin 1 is internally fused).
3. **GROUND CONNECTION:** Connect a chassis ground wire from pin 3 to the chassis ground of the transmitter / receiver.
4. **TRANSMITTER PTT:** For most transmitters, a contact closure to ground will cause the transmitter to key. For this configuration, connect a wire from pin 7 (relay N.O. contact) to the PTT input of the transmitter, then ground pin 6 (relay common contact).
5. **TRANSMITTER AUDIO INPUT:** Connect pin 11 to the mic or line input of the transmitter. Shielded cable may be used for this connection, connect the braid to pin 12.
6. **CTCSS / DCS ENCODE:** Connect pin 13 to the direct modulation or CTCSS tone input of the transmitter. Shielded cable may be used for this connection, connect the braid to pin 12.
7. **DISCRIMINATOR INPUT:** Connect pin 15 to the receiver discriminator output. Shielded cable may be used for this connection, connect the braid to pin 14.
8. **COR INPUT:** Connect pin 10 to the carrier detector in the receiver. The signal must be between 0 and 7 VDC, and change at least 1 volt between carrier and no-carrier conditions. A built in noise detector squelch can be used if a carrier indication from the receiver is not readily available.
9. **ALARM / REMOTE PTT:** Connect pin 9 to alarm input or the remote PTT source. A closure to ground will actuate the input.
10. Reconnect the screw terminal connector.

Installation Tips

The following are some hints for correctly installing a Zetron Model 38 Repeater Panel.

Audio Input Connection

Older repeater panels just decode CTCSS tones, and don't handle repeat audio or squelch-related functions. Repeat audio is usually passed between the receiver and transmitter through a "Repeater Audio" circuit board. This board or circuitry must be removed.

To ensure that CTCSS tones and/or DCS codes will be decoded, and that repeat audio signals will be processed correctly, the Model 38 must be connected to an audio source within the receiver that passes frequencies from 1 Hz to at least 3,500 Hz.

If the internal noise squelch is to be used, the audio source must pass frequencies up to at least 6 kHz. Without such an audio source, the noise detector will operate as a VOX detector only. Many receivers have a signal brought out that is labeled “discriminator”. Quite often this signal is low pass filtered, and removes the high frequencies required for proper noise detector operation. Look at the diagram for any caps or filtering in the chain before using the noise detector.

Audio Output Adjustment

The “Audio Output” potentiometer (on the back panel) is not a “repeat audio” level control. It’s a deviation control that regulates the levels of the DTMF encode and audible tones (e.g. warning beeps), along with repeat audio.

To properly set these levels, put the Model 38 into the Test Mode and have it encode a DTMF tone. Using a service monitor, set the potentiometer for 60% of full channel (typically 3 kHz) deviation.

The “Audio Output” potentiometer should be adjusted before setting repeat audio deviation with the “Audio Input” potentiometer.

Shielding, Grounding

Using quality shielded cable for audio connections and practicing good grounding techniques will eliminate the possibility of “hiss” and “hum” interfering with the repeat audio.

ADJUSTMENT PROCEDURE USING THE DTMF PROGRAM MODE

1. AUDIO INPUT GAIN FROM RECEIVER

Rough setting. Key up on the repeater receiver frequency, and generate the DTMF tones 0 to 9, * and #. Please note that CTCSS encode is not required yet. The DTMF indicator should light with every key. Adjust the AUDIO INPUT GAIN to a rough setting where all tones are decoded (switch 1 may need to be toggled).

2. ACCESS THE PROGRAM MODE

Key in the DTMF program mode password. It is initially set to “12123#”. When the mode is accessed, the transmitter will be keyed.

3. SET THE AUDIO OUTPUT GAIN

Access the DTMF encode test mode (key 3863#) then encode the DTMF digit 5 (key 5#). Set the deviation to 60% of full channel (typically 3 kHz) with AUDIO OUTPUT GAIN adjustment. If the deviation will not go high enough, move switch 2 to the off position, and readjust. Note: This is not the repeat audio level! Exit the DTMF encode test (key 3863# 99#).

Section 5. Installation

4. SET THE CTCSS ENCODE OUTPUT GAIN

Access the CTCSS encode test mode (key 28277# 18#) and generate tone number 18 (123.0 Hz). Adjust the CTCSS OUTPUT GAIN for 0.75 kHz deviation. If the deviation will not go high enough, move switch 3 to the OFF position, and readjust. Now access the CTCSS tone sweep mode (key 8378#), and monitor the deviation. It should be the same for each of the three tones. If the 250 Hz tone is much lower than the 67.0 Hz tone, move switch 5 to the OFF position. The gain may need to be readjusted. Exit the test mode (key # for 5 seconds).

5. SET THE REPEAT AUDIO GAIN

Access the repeat audio test mode (key 7781#). Supply a test tone of known deviation on the receiver frequency, then monitor the deviation of the transmit frequency. Adjust the AUDIO INPUT GAIN for unity gain (input deviation = output deviation). If the level cannot be adjusted high enough, move switch 1 to the off position, then readjust. Now insert 500 Hz, 1000 Hz, and 2000 Hz. The output deviation should be flat. If not, move switch 4 to the off position (no de-emphasis). Readjustment of the AUDIO INPUT GAIN may be necessary. Be aware that if you are using a DTMF test tone, you should not hold the digit for greater than 8 seconds or a reset will occur.

6. COR (SQUELCH) ADJUSTMENT

Internal Squelch (no connection to pin 10). Set Sw-6 ON, and Sw-7 ON. Adjust the COR threshold by watching the CARRIER LED. It should be set exactly like the squelch would be set on a receiver. This adjustment must be made AFTER the repeat audio level.

When using an external COR, set Sw-6 OFF, and Sw-7 will select COR polarity (off for positive, on for negative COR). Adjust the COR threshold while watching the CARRIER LED for optimum performance. When using a dry contact closure for COR input, switch 8 should be set in the ON position to enable the internal pull-up resistor.

7. CTCSS DECODE VERIFICATION

The DECODE indicator should light whenever a CTCSS tone is present on the radio channel.

8. Exit the program mode (key 293#).

ADJUSTMENT PROCEDURE USING THE SITE ALARM INPUT

1. Connect the Model 38 to the radio using the installation instructions on the previous pages, or follow the application note supplied for your specific radio.
2. Connect a clip lead to the site alarm input of the Model 38 (pin 9).
3. Connect the communications service monitor to the antenna, set for receive deviation display on the repeater transmit frequency.

4. Power on the Model 38 and immediately pulse the site alarm jumper to ground at least fifteen times during the first ten seconds of power up. This will cause the Model 38 to access the following test sequence.

PTT on.
DTMF digit 5 encoded.
CTCSS mid tone encode.
CTCSS high tone.
CTCSS low tone.
DCS code 023.
Repeat audio enabled.
PTT off.

5. Each test lasts 15 seconds and may be advanced by momentarily grounding the SITE ALARM. The test will repeat up to 20 times (approx. 40 minutes if left unattended).
6. Hit the site alarm input (ground) until the DTMF digit is being encoded on the transmit channel. Set the deviation for 3kHz (or 60% of maximum allowable deviation) using the AUDIO OUTPUT level adjustment.
7. Hit the site alarm again to advance to the CTCSS output test. Set the CTCSS OUTPUT adjustment for 700Hz (or 15%) deviation of the CTCSS encode tone.
8. Hit the site alarm again then verify the deviation of the 250Hz CTCSS tone is similar deviation.
9. Hit the site alarm again then verify the deviation of the 67Hz CTCSS tone. If the tones are not close to the same deviation, toggle the CTCSS DE-EMPHASIS switch and readjust.
10. Hit the site alarm again then verify the deviation and polarity of DCS code 023. Note: DCS encode may cause the deviation meter to give inaccurate (high) reading.
11. Hit the site alarm again then verify the operation of the CARRIER LED on the front panel. Generate a carrier signal on the repeater input (receiver) frequency, then reduce the RF level until the led goes out. The LED should follow the squelch noise from the receiver, and is usually controlled by the receiver squelch knob. If the LED does not light, adjust the COR level until the CARRIER LED follows carrier on the channel.
12. Now supply a test tone of known deviation on the receiver frequency, then monitor the deviation of the transmit frequency. Adjust the AUDIO INPUT GAIN for unity gain (input deviation = output deviation). If the level cannot be adjusted high enough, move switch 1, then readjust. Now insert 500 Hz, 1000 Hz, and 2000 Hz. The output deviation should be flat. If not, move switch 4 then readjust. Note: If using a DTMF test tone, do not hold the digit for greater than 8 seconds or a reset will occur.

Section 5. Installation

13. Note: DO NOT use the AUDIO OUTPUT control to adjust the repeat audio level! The AUDIO INPUT control MUST be used for repeat level.

RADIO-SPECIFIC CONNECTIONS

The following pages provide information for connecting specific radios to the Model 38. These same application notes can be used with the Model 39, Model 39-MAX, Model 45B, Model 48B, and Model 48-MAX.

GE MASTR III Base/Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: GE MASTR III base/repeater

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	P5.1 (A+ / DC Power)
2	12 volts AC input	---	No Connection
3	DC ground	Black	P2.2, P2.3 (Power ground)
4	Ground	Drain	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	P2.13 (Repeat PTT In)
8	Aux relay	---	No Connection
9	Sense / alarm	---	No Connection
10	COR input	Yellow	P3.5 (CAS)
11	Tx audio	Blue	P5.8 (Repeat Audio)
12	Ground	---	No Connection
13	CTCSS/DCS/encode	Green	P3.14 (CTCSS Encode)
14	Ground	Brown	P4.2
15	Discriminator in	White	P2.5 (Demodulated Audio)

MASTR III Configuration:

1. Connectors P2, P3, P4, and P5 are located on the GE Mastr III backplane.
2. Cut the printed wire pattern at JP-1 on the T/R Shelf's backplane 19D902948.
3. Program the base station using the standard PC programming software. For proper operation, the station firmware must be 344A3307G12 (Group 12) or higher (see the label at Mastr III System Board - U4).
4. Program the following parameters in the Mastr III:

A. Repeater (Single Channel only)	E. Set the TX Pot to 200.
B. Repeater Panel option	F. Set the CG pot to 255.
C. RF duplex	G. No CCT or DODT Timers (set to 0)
D. No TX CG or RX CG (leave blank)	H. Remote Control optional
5. Set the repeat and CTCSS modulation levels by adjusting the Zetron unit. See the Tests and Adjustments subsection.

Section 5. Installation

GE MASTR II Base/Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: GE MASTR II base/repeater

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	Station Supply +12VDC
2	12 volts AC input	---	No Connection
3	DC ground	Black	Station Supply Ground
4	Ground	Drain	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	J931 Pin 14, Local PTT
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	J932 Pin 18, CAS
11	Tx audio	Blue	J933 Pin 6 in OLD stations, Control board P2 Pin 4 on NEW IDA stations
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	J933 Pin 3, CG Hi
14	Ground	Brown	J933 Pin 2, CG Lo
15	Discriminator in	White	J606 on IF/Audio/ Sq. board

MASTR II Configuration:

1. Two versions of the GE Repeater Control Panel exist. The “Earlier” version is identified by multiple plug-in cards, the 10 volt regulator card being on the far right. The “Later” version is a single panel (no plug-in cards), and is identified by the local mic connector, speaker and volume knob on the front. All connections are the same except the for TX AUDIO. On “Late” models, the audio is connected to the “battery alarm audio” point.
2. Remove the jumper between H16 and H17 (if installed) on the 10-volt regulator card.
3. If DCS decode is required, discriminator audio **MUST** be connected to J606 on the IF/Audio/Squelch board. If only CTCSS tone decode is required, discriminator audio may be connected to Volume Squelch Hi (J932 Pin 3).
4. Remove any existing repeater tone panel (card-per-tone), and “Repeater Audio” and/or “Repeater Control” cards (if installed).
5. If digital coded squelch encode is to be used, the exciter **MUST** be the newer style “FM” unit. If using the Audio Processor board number 19C321542G1, C105 must be 10uf, and C110 must be 22uf for proper digital encoding.

GE Exec II Base

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: GE Exec II base

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	J904 pin 8
2	12 volts AC input	---	No Connection
3	DC ground	Black	J904 pin 5
4	Ground	Drain	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	H6 or J907 pin 10
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	Q923 collector (CAS)
11	Tx audio	Blue	J902 pin 4
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	J902, pin 9 (CG Hi)
14	Ground	Brown	J904 pin 5
15	Discriminator in	White	J907, pin 8 (Vol. Hi)

GE Exec II Configuration:

To modify the radio for full duplex (repeater) operation, make the following changes on the System Audio Squelch board:

1. Remove Q905, or disconnect Q905 collector.
2. Install a wire jumper from Q908 emitter to Q908 collector.
3. Short CR901 cathode to CR902 cathode.
4. Care should be taken not to damage the transmitter PA due to continuous duty operation.

Section 5. Installation

ICOM IC-RP1510 Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: ICOM IC-RP1510 repeater

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connections / Signal Name
1	12 volts AC/DC in	Red	Anode DC, power bus
2	12 volts AC input	---	No Connection
3	DC ground	Black	J2 pin 1, GND (logic board)
4	Ground	Drain	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	J2 pin 5, PTT (logic board)
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	P5 pin 2, Sqlsw (green wire RX unit)
11	Tx audio	Blue	Junction of R49 and C20 (logic board)
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	Right side of R43 (logic board)
14	Ground	Brown	J2 pin 3, GND (logic board)
15	Discriminator in	White	Negative side of C32 (logic board)

Radio Configuration:

1. Remove R22 (22K) to isolate PTT indication to control logic.
2. Isolate PTT control line from control logic by cutting trace next to J2 pin 6 (PTT).
3. Remove C20 (0.1uf) to isolate voice audio from summing amp.
4. Change R43 to 10K ohm, and cut trace between IC8 pin 7 and R43.
5. Remove C32 (0.47uf) to isolate discriminator output from logic board.

Operational Notes:

1. Squelch control on front panel sets COR for tone panel and speaker.
2. Front panel speaker will monitor all channel activity.
3. Microphone jack on front panel will still function.
4. This transmitter is not capable of DCS encode.

E.F. Johnson CR1010 Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: E.F. Johnson CR1010

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	Logic Drawer Pin 15, +13.8V
2	12 volts AC input	---	No Connection
3	DC ground	Black	Logic Drawer Pin 13, Gnd
4	Ground	Drain	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	Logic Drawer Pin <u>23</u> , $\overline{\text{PTT}}$
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	Logic Drawer Pin 19, Fast squelch
11	Tx audio	Blue	Exciter Drawer Pin 1, Tx audio
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	Logic Drawer Pin 18, Tx tone CG
14	Ground	Brown	Ground
15	Discriminator in	White	Logic Drawer Pin 5, CG Audio

CR1010 Configuration:

1. Remove the brown wire from receiver going to the exciter transmit audio (Pin 1).
2. Please note, this configuration uses the limiter and high-pass filter in the exciter. Since the Zetron unit has a high-pass filter to remove the CTCSS or digital coded squelch encode from the repeat audio, as well as the exciter, two high-pass filters in series may degrade the audio quality. The repeat audio quality may be improved by deleting (bypassing) the high-pass filter in either the Zetron unit or the exciter.

Section 5. Installation

E.F. Johnson CR1010 Repeater (Alternate Hookup)

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: E.F. Johnson CR1010, alternate hookup

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	Logic Drawer Pin 15, +13.8V
2	12 volts AC input	---	No Connection
3	DC ground	Black	Logic Drawer Pin 13, Gnd
4	Ground	Drain	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	Logic Drawer Pin 23 $\overline{\text{PTT}}$
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	Logic Drawer Pin 19, Fast squelch
11	Tx audio	Blue	Via 56K resistor Logic Drawer Pin 18, Tx tone CG
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	Via 15K resistor Logic Drawer Pin 18, Tx tone CG
14	Ground	Brown	Ground
15	Discriminator in	White	Logic Drawer Pin 5, CG Audio

CR1010 Configuration:

1. Remove the brown wire from receiver going to the exciter transmit audio (Pin 1).
2. Add a 10K ohm resistor across R123 in the exciter.

NOTE

This configuration does not use the deviation limiter in the exciter. It does provide a higher quality repeat audio quality than the hookup on the previous page.

E.F. Johnson Viking Universal Station

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: E.F. Johnson Viking Universal Station

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	volts AC/DC in	Red	J2-23, +15_ACC
2	12 volts AC input	---	No Connection
3	DC ground	Black	J2-21, Ground
4	Ground	Shield	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	J2-7, PTT
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	J2-4, SQUELCH
11	Tx audio	Blue	J2-5, TX_AUDIO
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	J2-6, TX_DATA
14	Ground	Brown	J2-22, Ground
15	Discriminator in	White	J2-2, WB_DISC

Radio Configuration:

1. The radio requires the Third Party Interface Card.



Section 5. Installation

Kenwood TKR-720 / TKR-820 Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: Kenwood TKR-720 / TKR-820 repeater

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	Pin 7 SB
2	12 volts AC input	---	No Connection
3	DC ground	Black	Pin 11 Ground
4	Ground	Shield	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	Pin 8 PTT
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	Pin 13 CO
11	Tx audio	Blue	Pin 5 L1
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	Pin 3 D1
14	Ground	Brown	Pin 6 SG
15	Discriminator in	White	Pin 4 DE
			PTT enable Pin 1 HK
	jumper		Pin 2 LG
			Speaker enable Pin 9 SI
	jumper		Pin 12 SO

Radio Modifications:

[Note: These modifications may not apply to all versions of the TKR-radio. Refer to the Kenwood service manual and schematic diagram.]

1. On the TX/RX Unit board, foil side: Cut the trace leading to CN3-8 (AFO). Add a jumper wire between CN3-8 and CN6-9 (DET). This corrects a foil error found in older Kenwood units. Cut the trace between CN7-1 (tone) and R68. This isolates the tone board injection point when the Zetron device keys the repeater.
2. On the Display Unit board, foil side: Remove J14, and add a jumper wire between CN8-4 (DE) and CN2-6 (DET). This bypasses C22 on the display board for DCS decode capability.
3. Set the switches for:
 - Takeover = Off / disabled
 - Repeat = Off / full duplex transceiver
 - Monitor = DC

Motorola GR300 Repeater (or Two GM300 Radios)

For: Zetron Model 38, 39-MAX, 45B, 48B, 48-MAX

To: Motorola GR300 repeater or a pair of GM300 mobiles

Using: 709-7264 Interface Cable

ZETRON END			RECEIVE GM300	
Function	Pin	Color	Connection / notes	
12 volts AC/DC in	1	Red	STATION POWER SUPPLY	
DC ground	3	Black		
Ground	4	Shield	AUX Pin 9, Emergency Alert	
COR input	10	Yellow	AUX Pin 8, CSQ Detect	
Discriminator in	15	White	AUX Pin 11, Disc audio	
Ground	12	Brown	AUX Pin 7, Ground	
		Green	AUX Pin 14, Alternate CSQ	
		Speaker enable jumper	AUX Pin 15, Internal speaker	
			AUX Pin 16, External speaker	

ZETRON END			TRANSMIT GM300	
Function	Pin	Color	Connection / notes	
Ground	4	Jmpr		
PTT NC	5	---		
PTT COM	6	Jmpr		
PTT NO	7	Orange	AUX Pin 3, Microphone PTT	
Aux relay	8	---		
Sense/alarm	9	---		
Tx audio	11	Blue	AUX Pin 2, Microphone audio	
Ground	4	Shield	AUX Pin 9, Emergency Alert	
CTCSS/DCS encode	13	Green	AUX Pin 5, Flat Tx audio	
Ground	14	Brown	AUX Pin 7, Ground	
		White	AUX Pin 8, CSQ Detect	
		Speaker enable jumper	AUX Pin 15, Internal speaker	
			AUX Pin 16, External speaker	

Radio Configuration:

- Set radio jumpers as follows:
 - JU551 position A, flat/unmuted discriminator audio
 - JU651 position A, Tx audio gain selection
 - JU701 position B, flat Tx audio limiter bypass (16ch only)
- Program both radio accessory connectors (with the RSS) as follows:

ACCESSORY CONNECTOR CONFIG				
PIN#	DESCRIPTION	DATA DIR	DEBOUNCE	ACT LEVEL
4	NULL 2	Output	No	High
6	NULL 1	Input	No	High
8	CSQ Detect	Output	No	Low
9	NULL 1	Input	No	High
12	NULL 1	Input	No	High
14	NULL 1	Input	No	High

- Install the cable (709-7264) from the 15-pin connector on the controller to the appropriate 16-pin connectors on the rear of the Radius mobiles. Remove the power cable from the mobile being used as a receiver. CAUTION! Observe correct polarity (wire colors) while connecting power cables. Connect the "TO RADIO" plug on the Zetron power cable to the receive radio, and connect the remaining plug to the station power supply cable.

Section 5. Installation

Motorola MTR2000 Stations

For: Zetron Model 38, 39-MAX, 45B, 48-MAX, 735, 748

To: Motorola MTR2000 Station

Using: 950-9919 MTR2000 Interface kit

Radio Configuration:

1. On the rear of the MTR2000, remove the screw centered under the SYSTEM J5 connector. Remove the connector strain relief / fuse access plate.
2. Connect the Zetron supplied interface cable to the MTR2000 “J5” backplane connector. Use caution when installing the cable so as not to damage the equipment with ESD.



Note

The component side of the Zetron interface circuit board should be facing up. If not, the MTR2000 is an older revision (J5 connector is upside-down) and SHOULD NOT BE USED! Reference Motorola PSB # 793, December 1996.

3. Re-install the connector strain relief / fuse access plate.
4. Configure the radio using the MTR2000 RSS as follows:

RSS Screen	Item	Setting
Personality: Station Configuration: Station Options:	Base Operation	Base Operation, not Repeater
Personality: Station Configuration: Station Options:	System Type	Conventional
Personality: Channel Information: Option Audio:	Analog Audio Activation	Carrier, for repeater controllers, PL/DPL, if required for interconnects
Personality: Channel Information: Option Audio:	Aux Tx Audio Control	Flat
Personality: Channel Information: Option Audio:	Audio Control	All OFF, no boxes checked: Y De-Emphasis Y Pre-Emphasis Y Noise Canceller Y Compander Y Rx Signal Inversion Y MRTI
Personality: Channel Information: Option Audio:	PTT Priority	Local = Low
Personality: Channel Information: Option PTT:	External PTT Mapping	Aux Audio
Service: Station Alignment: Audio Input/Output:	Discriminator	Set the slider mid-point
Service: Station Alignment: Transmitter: Note: for MTR2000 version R3.01.01 and later	Aux Tx Input	Set the level control slider to “50”

5. The Interface Adapter provides the following signals to the Model 38 Repeater Panel:

Signal	Configuration
Rx Audio	Unfiltered discriminator audio, delayed ~ 2.5 ms
Tx Audio	Pre-emphasized “microphone” audio, delayed ~ 4.5 ms
PL, DPL, LTR or FSK encode	Flat Tx audio input
PTT	Active low Push-TO-Talk input
Carrier Detect Input	External, active high polarity
Decode Validation Input	Active high during PL/DPL decode

Motorola MSF 5000 Analog Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: Motorola MSF 5000 analog (older) repeater

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	J800 Pins 1 and 2, or TB601 (A+) on pwr supply
2	12 volts AC input	---	No Connection
3	DC ground	Black	J800 Pins 7 and 8, or TB601 (GND) on pwr supply
4	Ground	Drain	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	J801 Pin 14
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	Test Point 6 (0.5v SQ., 2.9v US)
11	Tx audio	Blue	Via 33K Ω resistor U834 Pin 13 (1vpp=3kHz)
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	Via 33K Ω resistor, Wiper of R889 IDC pot(3vpp = 750 kHz)
14	Ground	Brown	No connection
15	Discriminator in	White	Test Point 3 (3kHz=1vpp)

MSF 5000 Configuration:

1. Make all connections to the Station Control Module PCB.
2. Set "AccDis" switch UP.

Section 5. Installation

Motorola MSF 5000 Digital Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: Motorola MSF 5000 “digital capable” station

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	R8121, side closest to center of PCB
2	12 volts AC input	---	No Connection
3	DC ground	Black	TP2
4	Ground	Drain	No connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	SW800 (pin closest to outer edge of PCB)
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	U1552, pin 1
11	Tx audio	Blue	Via 33K Ω resistor U814, pin 2
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	Via 33K Ω resistor U831, pin 3
14	Ground	Brown	TP2
15	Discriminator in	White	Test point 3

MSF 5000 Digital Capable Station Configuration:

1. Drill a cable access hole in the rear of the Station Control Module plastic housing, about mid point. Install a cable access hole grommet and strain relief.
2. Make all connections to the Station Control Module PCB.
3. Set “AccDis” switch UP.

CAUTION

The front panel SQUELCH control (on the MSF) will set the CARRIER threshold for the Zetron unit.

Motorola MCR-100 / RADIUS R-100

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: Motorola MCR-100 / Radius R-100

Using: 709-7112 Generic radio cable, or 709-7109

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	JAUX Pin 3, A+
2	12 volts AC input	---	No Connection
3	DC ground	Black	JAUX Pin 14, Desk set ground
4	Ground	Drain	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	JAUX Pin 4, PTT
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	JAUX Pin 12, Audio Control
11	Tx audio	Blue	JAUX Pin 5, Audio from phone patch
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	JAUX Pin 23, uncommitted
14	Ground	Brown	JAUX Pin 6
15	Discriminator in	White	JAUX Pin 25, uncommitted

Radio Modifications:

1. Install a jumper from U601 pin 9 on the TX Command Board to JAUX Pin 23. This routes CTCSS/DCS modulation to the TX Command Board.
2. Install a jumper from U551A pin 4 on the RX Board to JAUX Pin 25. This routes unfiltered discriminator audio to the JAUX connector. For newer units, use pin 7 of U552 (identified by two 8-pin surface mount ICs soldered in at U552, instead of a single DIP).
3. Program the R-100 for carrier squelch operation and disable repeater operation using the RPTR Disable Switch on the RPT Control Board.
4. If the R-100 was ordered as either the PL or carrier squelch model, several capacitors need to be changed in the receiver and transmitter to support DPL operation. See the R-100 service manual for additional information concerning what capacitor values require changing.
5. Repeat audio from the Zetron unit will be heard in the local speaker if the transmit audio is connected to JAUX Pin 5. This is because audio appearing at pin 5 is distributed to several points in the R-100 Interface Board before being sent to the TX Command Board. If desired, transmitted voice modulation may be applied directly to the TX Command Board using the emitter of Q601.



Section 5. Installation

Motorola MICOR *Single User Repeater*

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: Motorola MICOR Single User Repeater

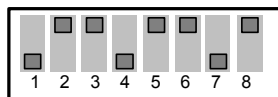
Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	Power Supply A+
2	12 volts AC input	---	No Connection
3	DC ground	Black	Power Supply A-
4	Ground	Drain	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange 	TB3 Pin 14, Repeater PTT on backplane
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	J2 Pin 5, Rx Unsquelch on backplane
11	Tx audio	Blue	Station Control Pin 16, on backplane
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green 	J5 Pin 27, on backplane
14	Ground	Brown	No Connection
15	Discriminator in	White	Squelch Gate Pin 10, on backplane

Radio Modifications:

1. Remove all modules except Station Control and the Squelch Gate card. Remove the PL/DPL encoder and decoder cards.
2. Modify the control modules as follows:
 - a) Station Control: Jumper the PL Disable switch ON
 - b) Squelch Gate: Remove C17, in the exciter output line
3. Modify RX Audio Squelch Board (TRN-6006A); add a jumper from U202 pin 10 to P903 pin 14.
4. Modify the Exciter Board (TLE-1720A); add a jumper from the IDC pot wiper to P902 pin 8, cut the trace between P902 pin 8 and JU401.
5. Modify the backplane board (TLN-5644A); cut the trace going to J2 pin 5, cut the trace going to J5 pin 27.

Model 38 Switches: Set switches as shown; DPL Polarity: Encode = invert, Decode = normal





Motorola MICOR Community Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: Motorola MICOR Community Repeater

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	Power Supply A+
2	12 volts AC input	---	No Connection
3	DC ground	Black	Power Supply A-
4	Ground	Drain	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange 	TB3 Pin 14, Repeater PTT
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	J2 Pin 5, Rx Unsquelch
11	Tx audio	Blue	Station Control Pin 16
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green 	J5 Pin 27
14	Ground	Brown	No Connection
15	Discriminator in	White	Squelch Gate Pin 10

Radio Modifications:

1. Remove all modules except Station Control and the Squelch Gate card.
2. Modify the control modules as follows:
 - a) Station Control: Jumper the PL Disable switch ON
 - b) Squelch Gate: Remove C17, in the exciter output line
[Both of these steps disable installed PL circuits.]
3. Modify RX Audio Squelch Board (TRN-6006A); add a jumper from U202 pin 10 to P903 pin 14.
[Brings out a negative squelch indication, 0 VDC = Unsquelched.]
4. Modify the Exciter Board (TLE-1720A); add a jumper from the IDC pot wiper to P902 pin 8, cut the trace between P902 pin 8 and JU401. [Provides a path for Tx Audio to a point just before the Deviation Adjust pot.]
5. Modify the backplane board (TLN-6421A); cut the trace going to J2 pin 5, cut the trace going to J5 pin 27. [Frees up these two pins to be used by COR and CTCSS/DCS Encode.]

Model 38 Switches: Set switches as shown; DPL Polarity: Encode = invert, Decode = normal



Section 5. Installation

Tait T800 Series Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B

To: Tait T800 Series Repeater

Using: 709-7112 Generic radio cable

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name
1	12 volts AC/DC in	Red	+13.8V
2	12 volts AC input	---	No Connection
3	DC ground	Black	TX LINE (ground)
4	Ground	Shield	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Orange	12 TX KEY
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Yellow	RX GATE
11	Tx audio	Blue	TX LINE
12	Ground	---	No Connection
13	CTCSS/DCS encode	Green	CTCSS
14	Ground	Brown	(ground)
15	Discriminator in	White	RX AUDIO
			RX LINE CT (jumper) RX LINE CT (jumper)
			TX LINE CT (jumper) TX LINE CT (jumper)

Radio Configuration:

- The wiring to the terminal blocks on the Tait T800 repeaters will vary depending on what configuration of features and options was ordered. Documentation of this wiring is supplied along with each repeater, and should be referred to in order to obtain the correct terminal numbers for each signal.
- Set the jumpers in the receiver as follows:
 - PL101: 1-2. Flat audio.
 - PL105: 1-2 and 4-5.
 - PL106: 1-2.
- Disable the transmitter timeout timer by removing R257 (near IC202 on bottom of PCB).
- Default levels:
 - Tx-audio = 0.11vrms = 3 kHz deviation
 - CTCSS/DCS = 0.32vrms = 700 Hz deviation
 - COR = +12vdc SQ., 0vdc USQ
 - Rx-audio = 0.77vrms = 3 kHz deviation, flat 3-3000 Hz. Do not use with noise detector.

Tait T300 Series Radio

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: Tait T300 series base station Direct replacement for Tait T311 panel

Pin	Zetron Signal Name	Wire	Radio Connection / Signal Name (25 way "D" range female socket)
1	12 volts AC/DC in	Red	Pin 8, +VE 12V
2	12 volts AC input	---	No Connection
3	DC ground	Gray	Pin 5, GROUND
4	Ground	---	No Connection
5	PTT NC	---	No Connection
6	PTT COM (to GND, pin 4)	Jumper	No Connection
7	PTT NO	Yellow	Pin 10, TX KEY
8	Aux relay	---	No Connection
9	Sense/alarm	---	No Connection
10	COR input	Purple	Pin 20, RX GATE (NOTE 2)
11	Tx audio	Brown	Pin 7, TX AF
12	Ground	---	No Connection
13	CTCSS/DCS encode	White	Pin 2, CTCSS ENCODE
14	Ground	---	
15	Discriminator in	Blue	Pin 6, RX AF

Tait Configuration:

- Links made on "D" range socket: 1 to 4 = Earth one side Rx 600 ohm
1 to 3 = Earth one side Tx 600 ohm
1 to 5 = Earth
- Check that the RX GATE lead goes to RX GATE on the Tait Base Station as on some models this lead may have been left disconnected.

Section 5. Installation

TONE PANEL PERFORMANCE TEST

Put your repeater to the test! To insure maximum performance of the system, all elements must be functioning properly. The repeater is much like a chain in that total performance is only as good as the weakest part. To guard against weak links, the system should be thoroughly tested including:

- Receive antenna and feedline
- Receiver sensitivity
- Tone panel sensitivity and audio response
- Transmitter power, purity and deviation
- Duplexer or combiner
- Transmitter feedline and antenna

RECEIVER AND TONE PANEL TEST:

1. Set a service monitor to generate a full quieting signal on the repeater receiver frequency. Verify the “CARRIER” LED is lit when signal is applied to the receiver.
2. Encode a 1kHz audio tone at 3kHz deviation.
3. Encode a valid (enabled) CTCSS tone (67-250Hz) at 600 Hz deviation, verify the “DECODE” and “TRANSMIT” LEDs are lit.
4. Reduce the RF signal strength into the receiver until the “DECODE” LED goes out, then increase it until the LED just goes back on. With a SINAD meter connected to the speaker terminals of the receiver, note the SINAD reading. This number represents the decode sensitivity of the tone panel. The lower the SINAD reading, the better the tone panel. For good operation, the tone panel must decode CTCSS at 6dB SINAD or lower. The Zetron Model 38 should decode CTCSS tones reliably at below 3dB SINAD.

NOTE

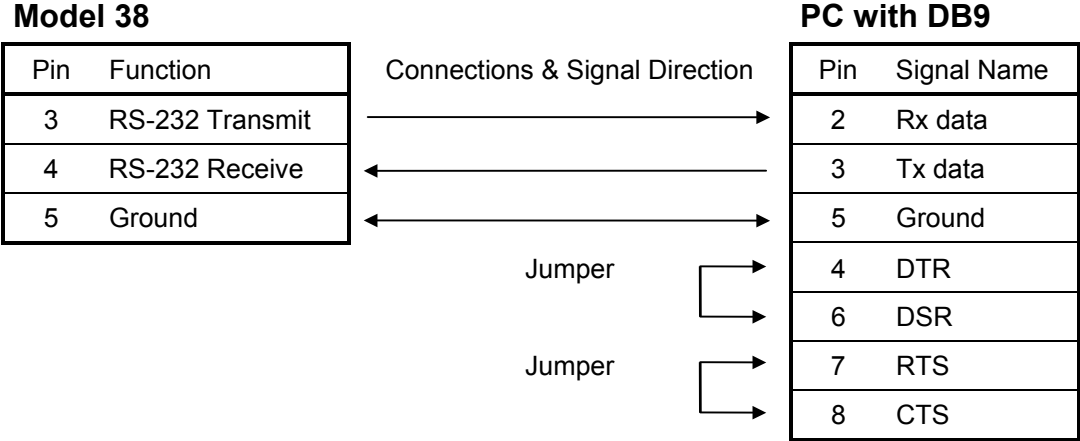
The squelch control of the receiver may have to be set “open” during the test to keep the “Carrier” indication on to the tone panel, and unsquelched audio to the SINAD meter.

5. Measure the RF input (in microvolts) signal strength into the receiver. The lower the number, the higher the sensitivity. For most UHF receivers, a desirable number is about 0.35 μV for 12-dB SINAD. The squelch adjustment in the receiver should be set for 6 dB SINAD.

RS-232 CABLE DIAGRAMS

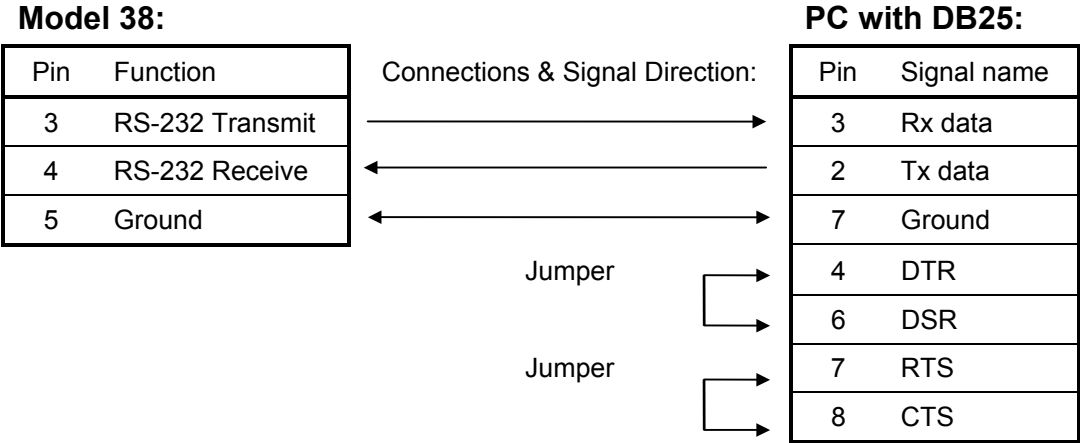
A cable diagram for connecting a Model 38 to a 9 pin RS-232 port is shown in Table 5-1. This cable is available from Zetron as part number 709-7144.

Table 5-1. Serial Cable for 9-pin Connector



A cable diagram for connecting a Model 38 to a 25 pin RS-232 port is shown in Table 5-2. This cable is available from Zetron as part number 709-9030 for connection to a PC (DB25S), or 709-7027 for connection to a terminal (DB25P).

Table 5-2. Serial Cable for 25-pin Connector



Section 5. Installation

Auto-Answer Modem Settings

When connecting an external modem to a Zetron RS-232 port for remote dial-up programming or control, the modem must be configured for auto-answer. The modem may need to be set so as not to send status information to the Zetron equipment, which may cause interference to the system. For most applications, the commands shown in Table 5-3 may be used to configure an “AT” command set compatible modem for auto-answer service. The modem is configured by connecting it to a terminal or PC and sending the following commands.

Table 5-3. Modem Initialization Commands

Command	Description
AT&F	Reset to factory defaults
ATSO=1	Answer on first telephone ring
ATE0	Disable command state character echo
ATQ1	Disable result codes
AT&W0	Write settings to stored profile #0
AT&Y0	Select stored profile #0 at power-up

PROGRAMMING THE MODEL 38 VIA FRONT PANEL CONNECTOR

To use the front panel “Program” connector, a DTMF encoder must be provided that can generate DTMF tones between 0.5 and 2.0 volts peak-to-peak. The connector is a three wire interface (miniature, stereo type, phone plug) that provides the following signals:

- Signal Ground on the “ring” conductor.
- DTMF audio is sent to the Model 38 on the “sleeve” conductor.
- Model 38 transmit audio is output on the “tip” conductor.

An amplifier may be used on the transmit audio output to hear the prompt tones generated by the Model 38 during programming.

Note

While the stereo plug is installed in the Program connector, DTMF on the radio channel will not reach the DTMF decoder in the Model 38.

INSTALLING A NEW PROM**IMPORTANT NOTE**

The EPROM label has the sequence portion of the serial number written on it. This must match the serial number of the panel it is to be installed in.

The software is contained in an Integrated Circuit (IC) called an Erasable Programmable Read Only Memory (EPROM). This device is delicate and sensitive to static electricity. When handling it, be sure to keep your fingers in contact with the chassis sheet metal to keep yourself grounded. Only remove the IC from the static protective shipping material when ready for installation. To install the new EPROM IC, do the following:

1. Turn off the power.
2. Remove the cover.
3. Remove the old EPROM from the board.
4. Look at the old EPROM carefully. There is an orientation notch on the end.
5. Install the new EPROM(s) in the socket with the orientation notches aligned with the notches in the socket.
6. Now take some time to look carefully at all of the pins of the chip. Make sure that the pins are aligned in the socket and are fully inserted, not bent out, and not bent under. If the unit is powered on without proper EPROM connection, the programmable settings (database) may be cleared.
7. If using Digital Coded Squelch (DCS) decode, on older units circuit board 702-9075 revision E to H put JP4 in position "B", or for "J" and later units - put JP3 in position "B". If this jumper is not moved to the "B" position, digital squelch decode will exhibit poor sensitivity.
8. Read any attached rework instructions for your hardware version.
9. Replace the cover and turn on the power and make sure that the display indicates normal.

6. REPAIR

IN CASE OF DIFFICULTY

In case of installation difficulty, call Zetron Model 38 Applications Engineering Department at (425) 820-6363. Engineers are available. 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, the problem can usually be solved over the phone. If a problem develops after a unit has been in service for some time, call the Zetron Model 38 Service Department. If the call is made from the installation site by a radio tech, the problem can often be solved over the phone.

SERVICE NOTES

1. If a 400 Hz. beep is heard just prior to the transmitter being unkeyed, the Model 38 is reporting a memory problem. Use the “Diagnostic Commands” (Programming Section) to find the source of the problem.
2. When the unit is reset or powered on, automatic self test functions are performed. If a large number of errors exist in the User programmable database, it will reset all settings to the factory defaults.
3. If the unit fails to operate (possibly due to a lightning strike to the radio tower), a DTMF key may be held for greater than 15 seconds to perform a complete reset of the unit.
4. If the audio does not sound proper, 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 flat from 300 to 3000 Hz.
5. When using the internal noise detector for COR, if the COR polarity switch seems backwards, the audio input from the receiver does not have enough high frequency content for the noise detector to operate. It is usually caused by a capacitor or some low pass filtering of the actual discriminator signal. An alternate connection point must be found in the receiver for either audio, or a receiver generated COR signal must be connected.
6. The “Carrier” LED MUST follow carrier activity on the channel. If it is always off, the Model 38 will not detect CTCSS tones or DCS codes. If it is always on, the unit may false DCS decode.
7. If DCS decode seems sluggish or exhibits poor sensitivity, verify jumper JP4 (circuit board revisions E through H) or JP3 (revision J or later) is in the “B” position.
8. When power is applied to the unit it will perform a self test. The Decode LED will flash 20 times if any memory errors are detected in the firmware or database segments of the unit. It will also flash the Decode LED twice to indicate a 38 CTCSS tone version, or 5 flashes for 50 tone units.

Section 6. Repair

MODEL 38 REPEATER PANEL PARTS LIST (702-9075)

ZETRON MODEL 38 REPEATER TONE PANEL PARTS LIST (702-9075S)

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFG. PART NO.
1.	1	101-0010	1	R7	
2.	3	101-0047	47	R21 30 31	
3.	1	101-0061	330	R93	
4.	3	101-0066	510	R22 23 55	
5.	2	101-0068	620	R25 59	
6.	6	101-0071	820	R8 89-92 94	
7.	2	101-0073	1K	R24 36	
8.	1	101-0074	1.2K	R58	
9.	2	101-0081	2.2K	R46 48	
10.	2	101-0085	3.3K	R33 77	
11.	11	101-0089	4.7K	R2 9 29 40 41 50 51 57 64-66	
12.	2	101-0091	5.6K	R53 78	
13.	15	101-0097	10K	R4 5 10 16 17 20 26 27 35 37 42 43 47 61 63	
14.	1	101-0101	15K	R39	
15.	3	101-0103	18K	R18 85 100	
16.	7	101-0105	22K	R49 80 81 86 97 98 99	
17.	1	101-0107	27K	R60	
18.	5	101-0113	47K	R32 52 56 84 95	
19.	3	101-0115	56K	R19 44 45	
20.	1	101-0117	68K	R87	
21.	6	101-0121	100K	R38 62 69 76 82 88	
22.	1	101-0123	120K	R83	
23.	5	101-0145	1M	R3 6 67 68 79	
24.	1	105-0001	VARISTOR 250V AC	RV1	
25.	1	107-0005	5K POT 1T RA	R14	
26.	3	107-0015	50K POT 1T RA	R11-13	
27.	1	119-0008	10Kx7 R-SIP	RP1	
28.	2	150-0024	24pF/D	C50 51	
29.	1	151-0047	470pF/TS	C16	
30.	1	151-0120	.01/TS	C44	
31.	1	151-0100	.033/TS	C23	
32.	2	151-0199	.47/50V/P	C5 22	
33.	10	152-0012	.1/50V/P	C18 26 35-37 56 57 59 64 70	
34.	2	152-0040	4.7/50V/P	C17 19	
35.	19	152-0085	.01/50V/P	C7 9 12 25 32 40 43 45-47 49 52 53 61 63 65 66 68 69	
36.	11	152-0089	.001/50V/P	C21 27-29 33 34 38 39 48 60 62	
37.	3	152-0250	.047/50V/P	C30 41 42	
38.	1	154-0025	1/35V/T	C20	
39.	3	154-0100	10/16V/T	C10 54 58	
40.	8	155-0052	10/35V/A	C1 C2 NOTE 1 C3 C4 11 13 15 24	
41.	3	155-0080	100/25V/A	C14 31 71	
42.	1	155-0140	3300/25V/A	C67	
43.	1	210-0001	#4 NUT	XVR1	
44.	1	220-0103	440x1/2"	XVR1	
44.5	1	236-0005	CRYSTAL INSULATOR	XY1	
45.	5	305-0001	FERRITE W/LEADS	E1-5	
46.	5	311-0011	LED RED FLUSH	DS1-5	
47.	1	311-0012	LED GREEN FLUSH	DS6	
48.	1	316-0004	tone FILTER	U6	MF4CN-50
49.	1	316-1232	RS232 DRIVER	U1	RS232

MODEL 38 REPEATER PANEL PARTS LIST (702-9075, Continued)

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFG. PART NO.
50.	2	316-0353	OP-AMP, DUAL BIFFET	U7 9	LF353
51.	5	316-0358	OP-AMP, DUAL	U10 11 21-23	LM358N
52.	1	316-7805	REG. +5V 1.5A	VR1	LM340T-5
53.	1	316-7808	REG. +8V	VR2	LM78L08CZ
54.	1	321-2090	DIMF XCVR	U5	20C90
55.	1	321-6264	8Kx8 RAM	U15	HM6264 LP-15
56.	1	321-6804	MICROPROCESSOR	U12	MC6803P
57.	1	321-6840	PTM	U17	MC6840
58.	1	323-4053	3PDT SWITCH	U8	MC144053
59.	1	324-4139	DUAL 2-4 DECODER	U4	74HC139
60.	1	324-7400	QUAD NAND	U2	74HC00
61.	1	324-7414	HEX SCHMIDT	U3	74HC14
62.	1	325-4373	OCTAL LATCH	U13	74HCT373
63.	1	340-2003	RELAY DRIVER	U19	ULN2003
64.	4	340-3904	NPN-40V/200MA	Q2 3 4 5	2N3904
65.	4	342-0001	SILICON 1A 100V	CR9-12	1N4002
66.	7	342-3009	SILICON	CR3 4 7 8 16	1N4148
67.	2	343-3017	1/2W, 6.2V	CR1 15	1N5234B
68.	1	371-0008	SW OCTAL DIP	SW1	
69.	1	376-4032	4.032MHZ XTAL	Y2	
70.	1	376-0358	3.58 MHZ XTAL	Y1	
71.	1	380-0030	RELAY DPDT	K2	
72.	1	381-0010	HEATSINK	XVR1	
73.	1	401-0664	CONN, D-SUB, 9-PIN RA	J5 NOTE 3	
74.	1	401-0034	3 CON STEREO JACK	J6	
75.	3	401-0052	STAKE PINS	JP3 (3 EA)	
76.	1	401-0059	15 POS R/A HEADER	TB1	
77.	1	402-3040	MINI JUMPER	JP3 (POS B)	
78.	8	407-0008	SKT, 8 PIN DIP	U6 7 9-11 21-23	
79.	2	407-0014	SKT, 14 PIN DIP	U2 3	
80.	4	407-0016	SKT, 16 PIN DIP	U1 4 8 19	
81.	1	407-0020	SKT, 20 PIN DIP	U13	
82.	1	407-0022	SKT, 22 PIN DIP	U5	
83.	4	407-0028	SKT, 28 PIN DIP	U14 15 16 17	
84.	1	407-0040	SKT, 40 PIN DIP	U12	
85.	1	408-0001	WIRE JUMPER	JP6A	
86.	1	410-9075F.2	PCB		
87.	1	416-1214	SMART SOCKET	U15	
88.	2	416-1576	FUSE 1A AGC	F1 2	
89.	4	416-3040	FUSE CLIP	XF1 2	
90.	6	417-0010	LED R/A	XDS1-6	
91.	1	561-0001	THERMAL COMPOUND	XVR1	

NOT INSTALLED:

C6 8 55
 CR2 5 6
 J1-4
 JP2 4 5 7
 K1
 Q1
 R1 15 28 34 54 70-75 96
 U14 16 18 20

NOTES:

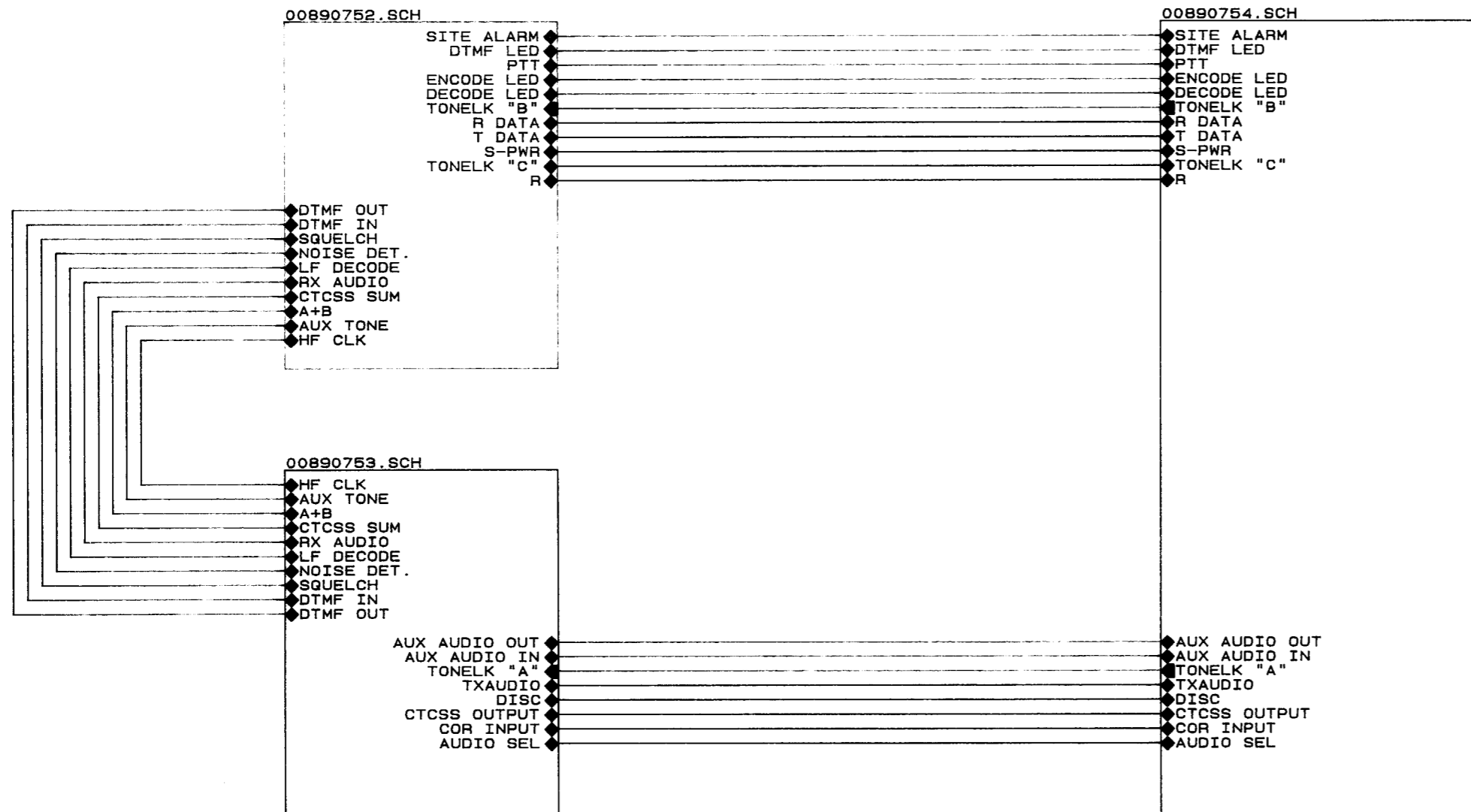
(Notes are for production use only.)

Section 6. Repair

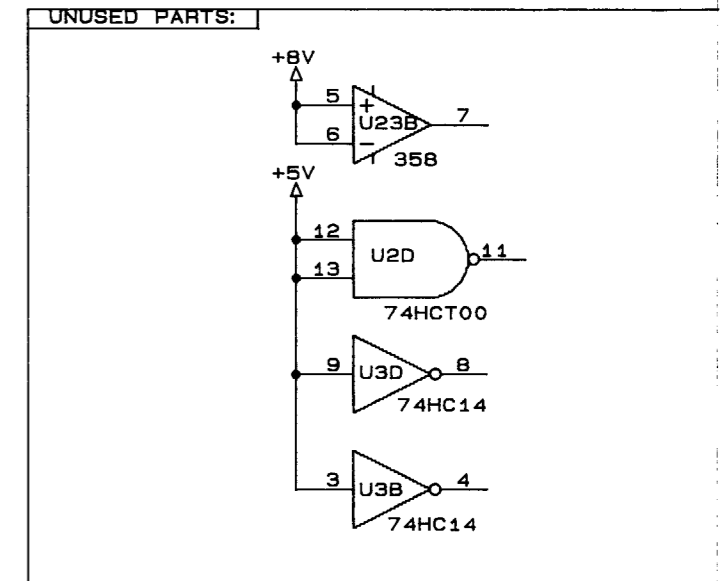
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MODEL 38 REPEATER PANEL ASSEMBLY DIAGRAM

REV	DESCRIPTION	DRN	APV	DATE
J	ECN 533			
K	ECN 745	KN		
L	ECN 745	DW		
M	ECN 825	KN		
N	ECN 948	KN		
N	ECN 1239	KN	MM	11-16-90
P	ECN 1755	DW	MM	3-92
Q	REDLINE	DW	MM	9-95
Q.4	REDLINE	BW	GH	10-95
R	ECN 3880	GH	SK	10-17-96
S	ECN 4811	BW	MM	1-15-98
T	ECN 9084	MM	GD	24 Feb 2006



- 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.



LEGEND:

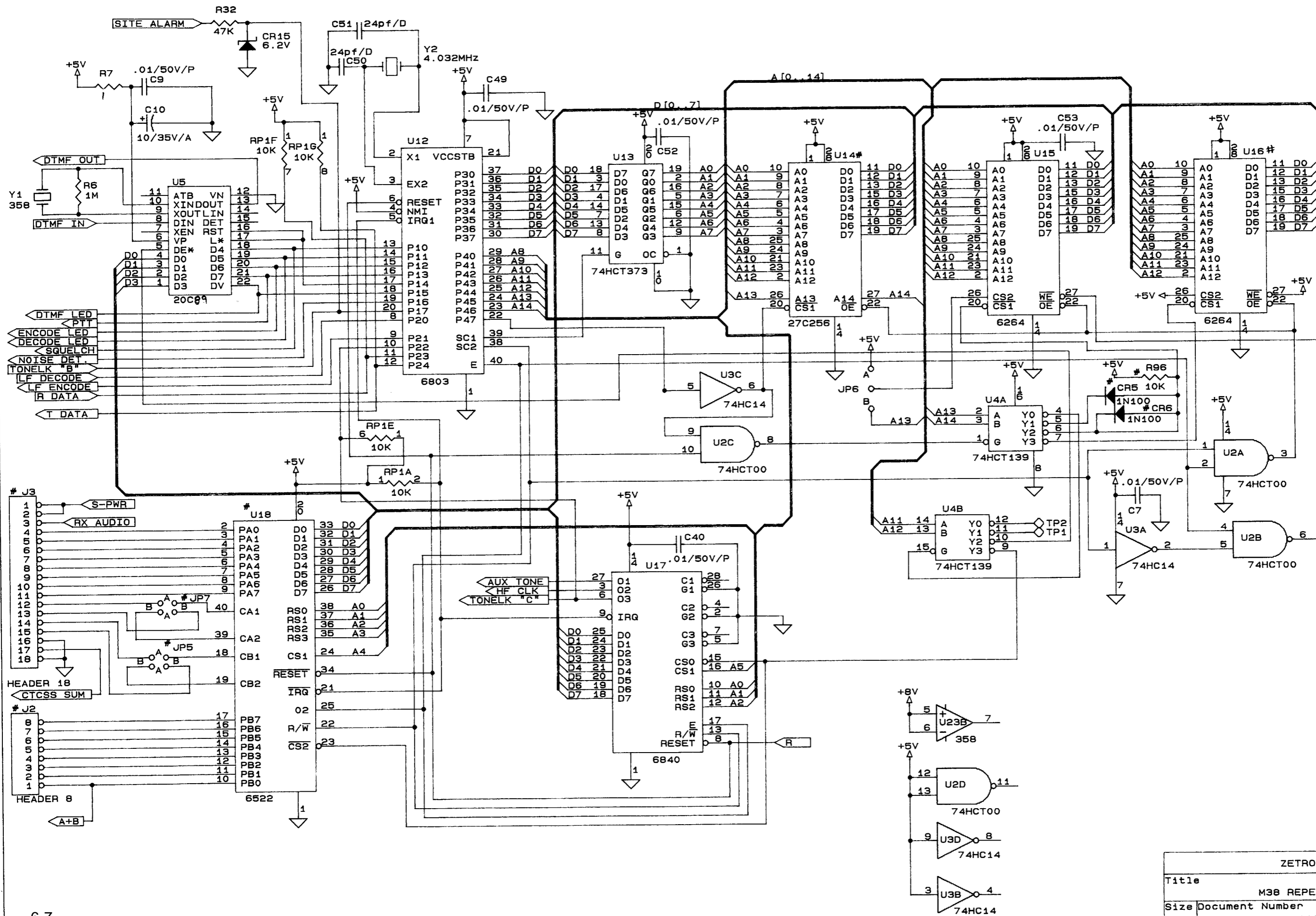
+	OPTION, INSTALL PER CUSTOMER ORDER.
~	INSTALLED ON HIGHER ASSEMBLY.
#	NOT INSTALLED.
—X—	CUT TRACE.
----	JUMPER WIRE.

ZETRON, INC.
12335 134TH COURT N.E.
REDMOND, WASHINGTON, 98052-2433

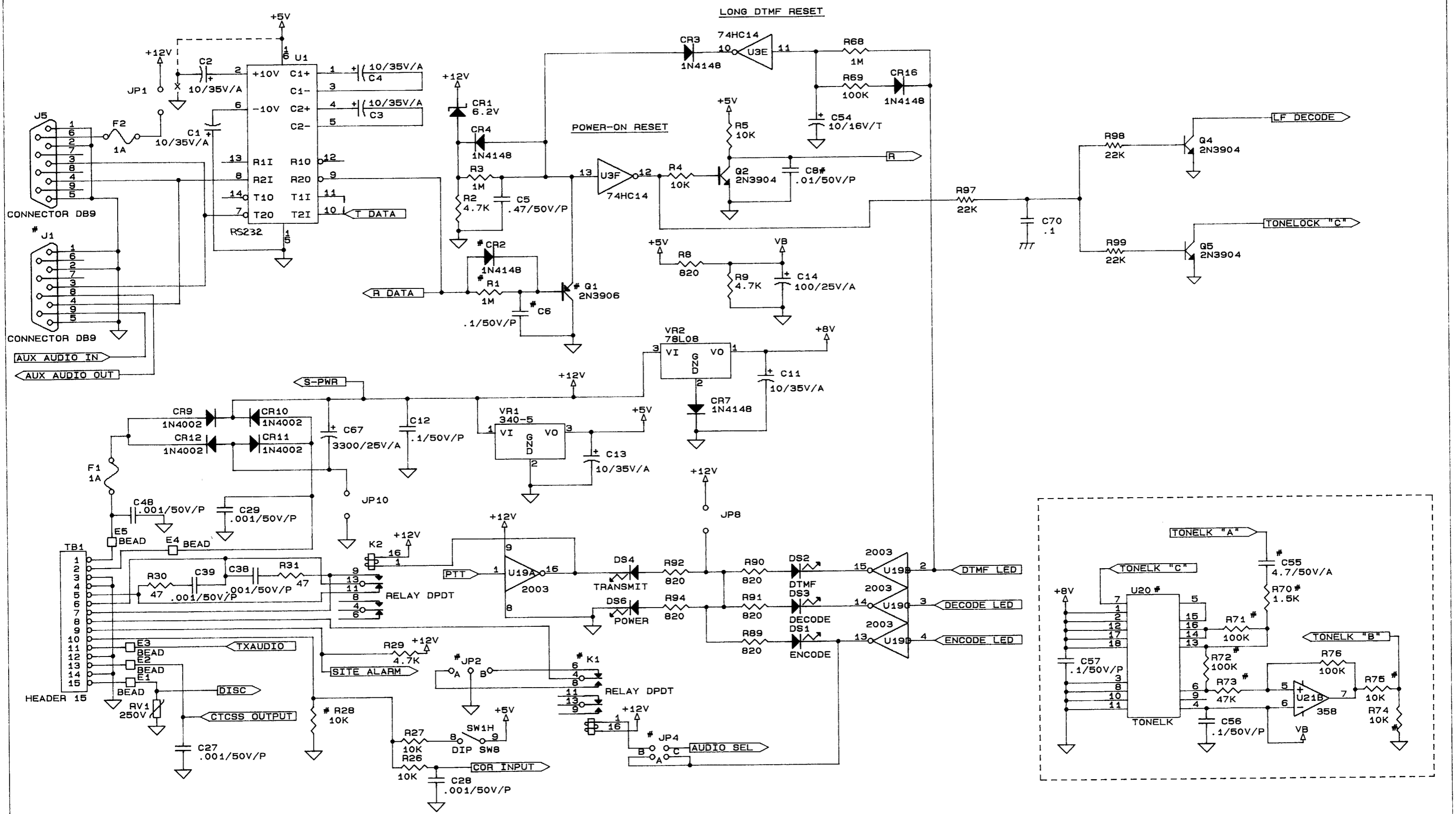
Title: M38 REPEATER PANEL

Size Document Number: B 008-9075 REV T

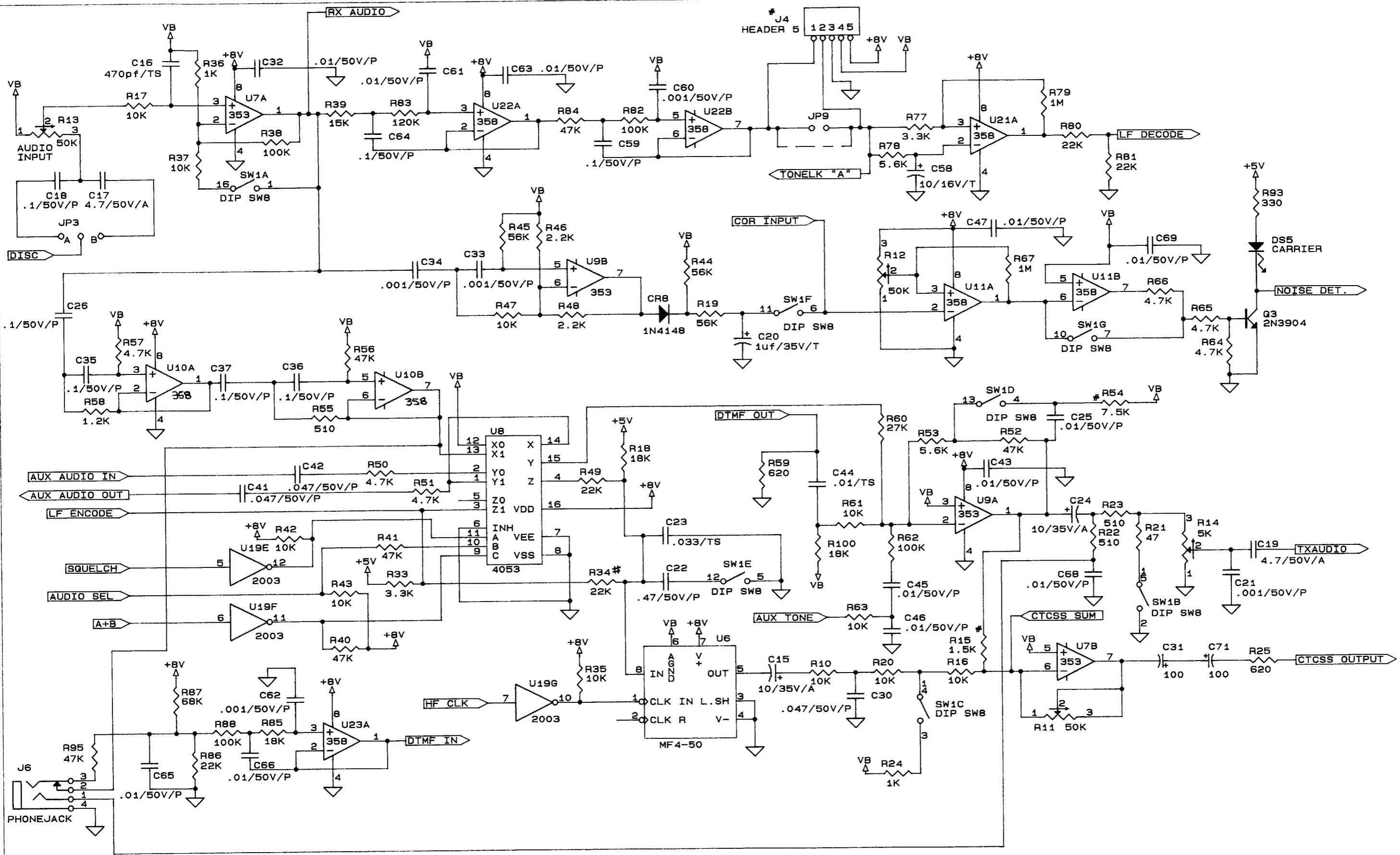
Date: November 15, 1990 Sheet 1 of 4



ZETRON, INC.		
Title M38 REPEATER PANEL		
Size	Document Number	REV
B	008-9075	T
Date:	November 15, 1990	Sheet 2 of 4



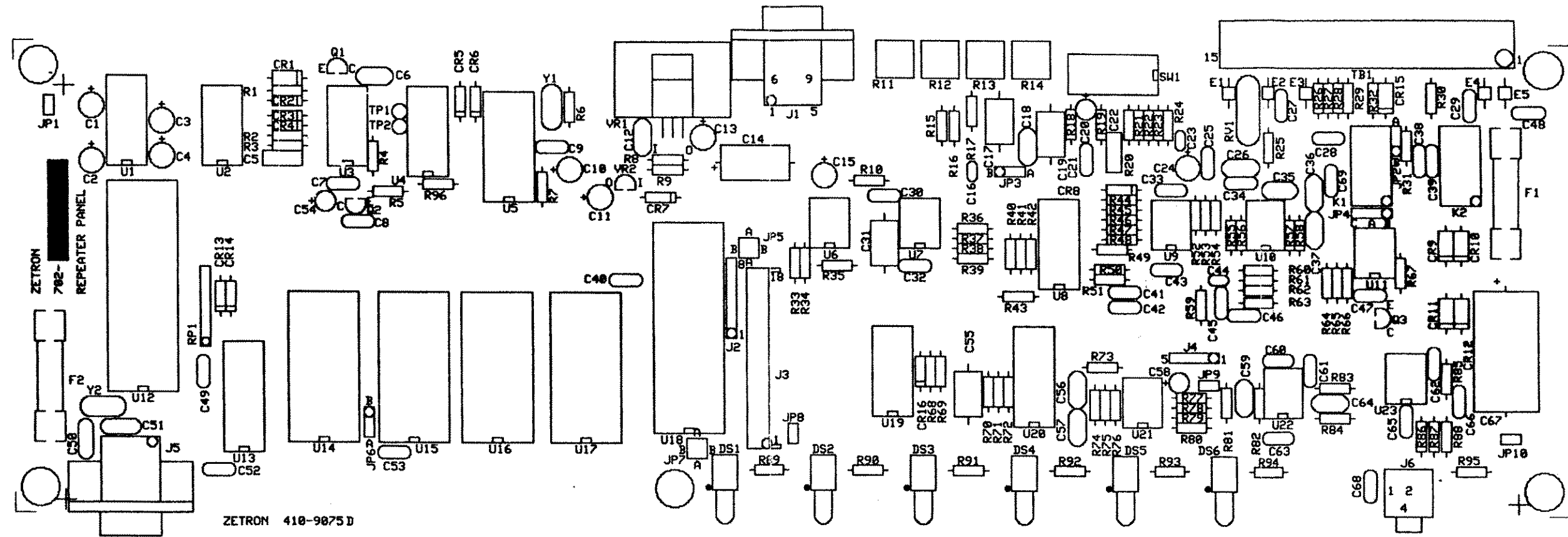
ZETRON, INC.		
Title		
M38 REPEATER PANEL		
Size	Document Number	REV
B	008-9075	T
Date:	November 15, 1990	Sheet 3 of 4



ZETRON, INC.	
Title	M38 REPEATER PANEL
Size	Document Number
B	008-9075
Date:	November 15, 1990 Sheet 4 of 4

Section 6. Repair

MODEL 38 REPEATER PANEL SILKSCREEN (702-9075)



7. QUICK REFERENCE

The following section includes a log to keep track of the settings installed in the unit. A complete list of the programming commands is also included.

DTMF REMOTE PROGRAMMING MODE NOTES

1. Numbers may be entered with or without leading zeros.
2. All commands are ended with the “#” key (except the site alarm DTMF code).
3. The “*” key may be used as a Clear Entry key.
4. Where the variable “uu” is used, user numbers are to be entered. To program all users in a single operation, the number “99” should be entered.
5. The remote program mode will automatically terminate if no keys are pressed within 90 seconds.
6. The default DTMF program mode access code is 12123#.

Section 7. Quick Reference

MODEL 38 SYSTEM PROGRAMMING LOG

SYSTEM FUNCTIONS	Command	Default	Range	Comments	LOG
Carrier repeat enable / user number	267# nn#	0	0 - 68	0=disable carrier repeat	
Anti-Kerchunker filter, qualifies txhold	5371# nn#	0	0 - 50	0.1 second increment	
Station ID interval timer	436# nn#	15	1 - 99	Minutes	
Station ID tone frequency	433# nnnn#	1200	400 - 2000	Hz	
Station ID speed in words per minute	976# nn#	22	4 - 25	Minimum 15 wpm during operation	
Station ID system user number	437# nn#	0	0 - 68	0=disable, user number	
Station ID periodic mode on/off	430# - 431#	0	0 - 1	0=disable, 1=enable	
Courtesy tone frequency	23373# nnnn#	1000	400 - 4000	Hz	
Tailbip, courtesy beeps during tx-hold	8920# - 8921#	Off	0 - 1	0=disable, 1=enable	
Hog mode idle reset time	4648# nn#	5	1 - 99	Seconds	
Hog mode penalty timer	4678# nn#	30	1 - 999	10 second increments (10-9990 sec)	
Stuck mic timeout timer	868# n#	3	0 - 9	Minutes, 0=disable	
Timeout ID of stuck mic via DTMF	8640# - 8641#	0	0 - 1	0=disabled, 1=enabled	
Site alarm DTMF encode	25276# nnn...	blank		Up to 8 DTMF digits, 0-9 ABCD*#	
Site alarm CTCSS/DCS encode	258# nnnn#	0	0 - 1777	0=none, 1-50=CTCSS 1nnn=DCS	
Site alarm sent when powers is applied	250# - 251#	0	0 - 1	0=Off, 1=On	
Site alarm sent at program mode access	254# - 255#	Off	Off - On	0=disable, 1=enable	
Remote PTT encode (site alarm input)	7788# nnnn#	0	0 - 1777	0=disabled, 1-50=CTCSS 1nnn=DCS	
DCS encode data polarity	3750# - 3751#	Off	0 - 1	0=normal, 1=invert	
DCS decode data polarity	3758# - 3759#	Off	0 - 1	0=normal, 1=invert	
Program mode access code	7764# nnnn#	12123	0 - 32000	DTMF / CRT access code	
Program mode DTMF access delay	7463# nn#	0	0 - 30	Seconds of delay before confirmation	
Program mode progress tone delay	642# n#	0	0 - 3	Seconds, delays response prompts	

Section 7. Quick Reference

SYSTEM FUNCTIONS	Command	Default	Range	Comments	LOG
DTMF repeater programmer unit type	7360# - 7363#	0	0 - 3	0=Morse, 1=Model 8, 2=RDU, 3=DI-16	
DTMF interdigit timeout	386# n#	4	1 - 9	Seconds	
RS-232 port mode	CRT=680# M8=681#	0	0 - 2	0=CRT, 1=Modem, 2=Model 8	
RS-232 port CRT / Modem baud rate	2283# n#	2	1 - 6	1=150 2=300 3=600 4=1200 5=2400 6=4800	
RS-232 port CRT mode sign on message	n/a	blank		Characters (site name or freq)	
RS-232 port serial tone output	7720# - 7721#	Off	Off - On	Decoder output via rs232	
Airtime accumulation including txhold	281#	✓		Default setting	
Airtime accumulation excluding txhold	280#				
DCS bit errors, maximum for access	3273# n#	2	1 - 4	For acquire only	
Voted CTCSS acquire, slower decode	2870# - 2871#	0	0 - 1	0=fastest decode, 1=slower	
CTCSS delay after decode drops	3755# nnn#	70	1 - 150	Milliseconds, prevents acquire on STE	
CTCSS hold time <i>[should always be 0]</i>	4653# nn#	0	0 - 25	0.1 second increment (0-2.5 sec)	
Reverse channel working access code	9801# nnnn#	9801	100 - 9997	DTMF code	

Section 7. Quick Reference

MODEL 38 CTCSS USER DATABASE PROGRAMMING LOG

38 Tone	50 Tone	Decode	Encode	O	S	P	R	L	Q	D	A	X	Hog Limit	Tx-hold	Station ID
1	1	67.0													
	2	69.4													
2	3	71.9													
3	4	74.4													
4	5	77.0													
5	6	79.7													
6	7	82.5													
7	8	85.4													
8	9	88.5													
9	10	91.5													
10	11	94.8													
11	12	97.4													
12	13	100.0													
13	14	103.5													
14	15	107.2													
15	16	110.9													
16	17	114.8													
17	18	118.8													
18	19	123.0													
19	20	127.3													
20	21	131.8													
21	22	136.5													
22	23	141.3													
23	24	146.2													
24	25	151.4													
25	26	156.7													
	27	159.8													
26	28	162.2													
	29	165.5													
27	30	167.9													
	31	171.3													
28	32	173.8													
	33	177.3													
29	34	179.9													

Section 7. Quick Reference

38 Tone	50 Tone	Decode	Encode	O	S	P	R	L	Q	D	A	X	Hog Limit	Tx-hold	Station ID
	35	183.5													
30	36	186.2													
	37	189.9													
31	38	192.8													
	39	196.6													
	40	199.5													
32	41	203.5													
	42	206.5													
33	43	210.7													
34	44	218.1													
35	45	225.7													
	46	229.1													
36	47	233.6													
37	48	241.8													
38	49	250.3													
	50	254.1													

O = = = = = User **On** / Off, enable / disable user decode
 S = = = = = **Send** CTCSS/DCS during transmit hold time
 P = = = = = **Privacy** mode (no new user decode during txhold)
 R = = = = = **Reserved** user mode
 L = = = = = **Last** user DTMF ID sent when users unkey
 Q = = = = = **Queuing** beep (courtesy tone) enable
 D = = = = = **DTMF** functions enable (temporary cross tone)
 A = = = = = Prepaid **A**irtime mode
 X = = = = = Au**X** relay enable

Section 7. Quick Reference

MODEL 38 DCS USER DATABASE PROGRAMMING LOG

38 Tone	50 Tone	DCS Decode	Encode	O	S	P	R	L	Q	D	A	X	Hog Limit	Tx-hold	Station ID
39	51														
40	52														
41	53														
42	54														
43	55														
44	56														
45	57														
46	58														
47	59														
48	60														
49	61														
50	62														
51	63														
52	64														
53	65														
54	66														
55	67														
56	68														
57															
58															
59															
60															

O = = = = = User **O**n / Off, enable / disable user decode
 S = = = = = **S**end CTCSS/DCS during transmit hold time
 P = = = = = **P**rivacy mode (no new user decode during txhold)
 R = = = = = **R**eserved user mode
 L = = = = = **L**ast user DTMF ID sent when users unkey
 Q = = = = = **Q**ueuing beep (courtesy tone) enable
 D = = = = = **D**TMF functions enable (temporary cross tone)
 A = = = = = **A**irtime mode
 X = **AuX** relay enable

MODEL 38 PROGRAM MODE COMMAND SUMMARY

GENERAL FUNCTIONS	DTMF command	Default	Range	Comments	Model 8	prompt
PTT off during DTMF program mode	7880#			Unit will key PTT during prompt tones	n/a	
PTT on during DTMF program mode	7881#	✓			n/a	
Repeater disable (knock down)	7633#			To re-enable, access/exit prog mode	n/a	
Exit the DTMF remote program mode	293#			Return to operational mode	99	donE

SYSTEM FUNCTIONS	DTMF command	Default	Range	Comments	Model 8	prompt
Carrier repeat enable / user number	267# nn#	0	0 - 68	0=disable carrier repeat	27	cor-r=
Anti-Kerchunker filter, qualifies txhold	5371# nn#	0	0 - 50	0.1 second increment	24	Chunk=
Station ID interval timer	436# nn#	15	1 - 99	Minutes	10	Id-int=
Station ID tone frequency	433# nnnn#	1200	400 - 2000	Hz	9	Id-F=
Station ID speed in words per minute	976# nn#	22	4 - 25	Minimum 15 wpm during operation	22	Id-SP=
Station ID system user number	437# nn#	0	0 - 68	0=disable, user number	26	Id-S=
Station ID periodic mode on/off	430# - 431#	0	0 - 1	0=disable, 1=enable	n/a	
Courtesy tone frequency	23373# nnnn#	1000	400 - 4000	Hz	8	BEEP-F=
Tailbip, courtesy beeps during tx-hold	8920# - 8921#	Off	0 - 1	0=disable, 1=enable	23	t-bip=
Hog mode idle reset time	4648# nn#	5	1 - 99	Seconds	4	HOG-I=
Hog mode penalty timer	4678# nn#	30	1 - 999	10 second increments (10-9990 sec)	6	HOG-P=
Stuck mic timeout timer	868# n#	3	0 - 9	Minutes, 0=disable	2	tot=
Timeout ID of stuck mic via DTMF	8640# - 8641#	0	0 - 1	0=disabled, 1=enabled	17	TO-Id=
Site alarm DTMF encode	25276# nnn...	blank		Up to 8 DTMF digits, 0-9 ABCD*#	11	S-codE=
Site alarm CTCSS/DCS encode	258# nnnn#	0	0 - 1777	0=none, 1-50=CTCSS 1nnn=DCS	12	S-tonE=
Site alarm sent when powers is applied	250# - 251#	0	0 - 1	0=Off, 1=On	13	S-Pron=
Site alarm sent at program mode access	254# - 255#	Off	Off - On	0=disable, 1=enable	n/a	
Remote PTT encode (site alarm input)	7788# nnnn#	0	0 - 1777	0=disabled, 1-50=CTCSS 1nnn=DCS	29	r-Ptt=
DCS encode data polarity	3750# - 3751#	Off	0 - 1	0=normal, 1=invert	20	d-inv=
DCS decode data polarity	3758# - 3759#	Off	0 - 1	0=normal, 1=invert	21	r-inv=
Program mode access code	7764# nnnnn#	12123	0 - 32000	DTMF / CRT access code	18	A-code=
Program mode DTMF access delay	7463# nn#	0	0 - 30	Seconds of delay before confirmation	n/a	
Program mode progress tone delay	642# n#	0	0 - 3	Seconds, delays response prompts	n/a	
DTMF repeater programmer unit type	7360# - 7363#	0	0 - 3	0=Morse 1=Model 8, 2=RDU 3=DI-16	n/a	
DTMF interdigit timeout	386# n#	4	1 - 9	Seconds	7	Dt-to=
RS-232 port mode	CRT=680# M8=681#	0	0 - 2	0=CRT, 1=Modem, 2=Model 8	19	rS232=
RS-232 port CRT / Modem baud rate	2283# n#	2	1 - 6	1=150 2=300 3=600 4=1200 5=2400 6=4800	25	Baud=
RS-232 port CRT mode sign on message	n/a	blank		Characters (site name or freq)	n/a	
RS-232 port serial tone output	7720# - 7721#	Off	Off - On	Decoder output via rs232	n/a	
Airtime accumulation including txhold	281#	✓		Default setting	n/a	
Airtime accumulation excluding txhold	280#				28	d-bill=
DCS bit errors, maximum for access	3273# n#	2	1 - 4	For acquire only	n/a	
Voted CTCSS acquire, slower decode	2870# - 2871#	0	0 - 1	0=fastest decode, 1=slower	n/a	
CTCSS delay after decode drops	3755# nnn#	70	1 - 150	Milliseconds, prevents acquire on STE	n/a	
CTCSS hold time [should always be 0]	4653# nn#	0	0 - 25	0.1 second increment (0-2.5 sec)	3	C-hold
Reverse channel working access code	9801# nnnn#	9801	100 - 9997	DTMF code	n/a	

LIST and AIRTIME FUNCTIONS	DTMF command	Default	Range	Comments	Model 8	prompt
List number of enabled users	568#			Sends result to repeater programmer	14	TONES=
List the enabled user numbers	528#				15	TONES=
List all airtime counts	522#				n/a	
Clear all airtime counts	8463# 25327#				16, 12345	CLEAR

USER FUNCTIONS	DTMF command	Default	Range	Comments	Model 8	prompt
Enable user number "nn"	66# nn#	Off	Off - On	Repeater keys for enabled users	30nn	Enable=
Disable user number "nn"	633# nn#	✓		Repeater ignores disabled users	30nn	Enable=
Set user nn's DCS decode number	3753# nn# xxx#	0	0 - 777	Any octal DCS code 000-777	41nn	Decode=
Set user nn's CTCSS/DCS encode to xxxx	89# nn# xxxx#		0 - 1777	0=Carrier, 1-50=CTCSS, 1xxx=DCS	31nn	EncodE=
Transmit hold time	8245# uu# nn#	20	0 - 250	0 to 25.0 seconds	43nn	T-hold=
CTCSS/DCS during tx-hold disable	890# uu#	✓		Encode CTCSS/DCS during tx-hold	32nn	tAIL=
CTCSS/DCS during tx-hold enable	891# uu#					
Privacy mode, anti barge-in disable	760# uu#	✓		Prevents other groups from barging in during transmit hold time.	33nn	Priv=
Privacy mode, anti-barge-in enable	761# uu#					
Reserved user mode disable	780# uu#	✓		Keys with CTCSS/DCS, but doesn't pass audio, for reserve or no-pay.	34nn	Res=
Reserved user mode enable	781# uu#					
Courtesy tone disabled	220# uu#	✓		Send a courtesy beep when each radio user unkeys.	35nn	CUE=
Courtesy tone sent when user unkeys	221# uu#					
Last user ID via DTMF disabled	540# uu#	✓		Send the user number via fast DTMF when each user unkeys.	36nn	LU-id=
Last user ID via DTMF enabled	541# uu#					
Hog mode conversation limit time.	4658# uu# nnn#	0	0 - 250	0=Disabled, 1-250 = .1 - 25.0 min	37nn	HOG-L=
DTMF user functions disabled	360# uu#	✓		Subscriber DTMF functions such as temp cross tone, DTMF regenerate...	38nn	Dt=
DTMF user functions enabled	361# uu#					
Station ID call sign	43# uu# xx# xx#...	blank	8 char	Enter characters from table	n/a	
Playback station ID	743# uu#	-		Playback a station ID	n/a	
Prepaid airtime mode disable	770# uu#	✓		Prepaid airtime counts down, when 0 reserves the user.	40nn	PrePay=
Prepaid airtime mode enable	771# uu#					
Display & set user airtime	see other cmds	-	0 - 249.59.5	Model 8 shows airtime in HH:MM:S format (10 sec increment)	39nn	Air=
Clear a users airtime count	25327# nn#	-	-	Resets airtime count to zero	39nn	
Add "hhh" hours to user "nn" airtime count	247# nn# hhh#	-	0 - 249	Adds airtime for prepay mode	39nn	
List airtime hours	547# nn#	-			39nn	
List hours:minutes	546# nn#	-			39nn	
List minutes:seconds	567# nn#	-			39nn	
Auxiliary relay disable	290# uu#	✓		Aux relay will follow user "uu" CTCSS/DCS decode	42nn	relay=
Auxiliary relay enable	291# uu#					

DIAGNOSTIC FUNCTIONS	DTMF command	Default	Range	Comments	Model 8	prompt
List number of program mode accesses	5764#			Data sent to repeater programmer	70	P-Cnt=
List number of resets and brownouts	5778#			Formatted as Morse code / DTMF	71	R-Cnt=
List number of power fails	5797#				72	PF-Cnt=
List system error number (memory test)	5377#				73	SySErr=
List number of users with suspect data	5637#				74	t-Err=
List the user numbers with suspect data	5837#				75	tn-Err=
Clear reset, power fail & access counters	797#			Model 8 password = 12345	76	C-SyS=
Reset to factory defaults	3282# 25327#			Model 8 password = 25327	77	ErASE
Site alarm test	252#				60	Site-A=
Repeat audio on/off	7780# - 7781#				**61	rREPEAT
Encode a DTMF digit	3863# nn#		0 - 15, 99	0-15, 99=off	**62	Dt=
Encode CTCSS/DCS	28277# nnnn#		0 - 1777	0=Carrier, 1-50=CTCSS, 1nnn=DCS	63	SQ=
Encode audio frequency	8663# nnnn#		400 - 4000	400-4000, 0=off	**64	BEEP=
Encode sub-tone	7823# nnn.n#		500 - 3000	50.0-300.0	65	Ct-F=
CTCSS sweep	8378#			Test ends with a DTMF digit	66	C-Test
Display CTCSS/DCS decode				** Model 8 direct connect mode only.	**80	[100.0]
Display rx/tx user number				** Model 8 direct connect mode only.	**81	[r12.t12]
Display user / airtime				** Model 8 direct connect mode only.	**82	[hhh.mm.s]

WARRANTY

Zetron's warranty is published in the current Zetron *United States Price Book*.

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FEDERAL COMMUNICATIONS COMMISSION (FCC) REGULATIONS

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

Changes or modifications not expressly approved by the manager of Zetron's compliance department can void the FCC authorization to operate this equipment.

Repair work on this device must be done by Zetron, Inc. or a Zetron authorized repair station.

CANADIAN EMC COMPLIANCE NOTICE

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

AVIS CANADIEN

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

CHANGE INFORMATION

At Zetron, we continually strive to improve our products by updating hardware components and software as soon as they are developed and tested.

Due to printing and shipping requirements, this manual may include information about the latest changes on the following pages.

702-9075S

ZETRON INC ASSEMBLY PARTS LIST:

702-9075
 MODEL 38
 REPEATER
 TONE PANEL

DATE	REV	DESCRIPTION	DN	CK	APD
06-03-90	M	ECN 948	KN		
10-04-90	M.1	ECN 1158	GN		
11-15-90	N	ECN 1239	KN		
02-24-92	P	HCN 1789	DW		
08-24-93	Q	HCN 2233	AH		
09-13-95	Q.4	REDLINES	GH	WW	
10-17-96	R	ECN 3880	GH		SR
01-13-98	S	ECN 4811	BW		

ZETRON MODEL 38 REPEATER TONE PANEL PARTS LIST (702-9075S)

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MGF.PART NO.
1.	1	101-0010	1	R7	
2.	3	101-0047	47	R21 30 31	
3.	1	101-0061	330	R93	
4.	3	101-0066	510	R22 23 55	
5.	2	101-0068	620	R25 59	
6.	6	101-0071	820	R8 89-92 94	
7.	2	101-0073	1K	R24 36	
8.	1	101-0074	1.2K	R58	
9.	2	101-0081	2.2K	R46 48	
10.	2	101-0085	3.3K	R33 77	
11.	11	101-0089	4.7K	R2 9 29 40 41 50 51 57 64-66	
12.	2	101-0091	5.6K	R53 78	
13.	15	101-0097	10K	R4 5 10 16 17 20 26 27 35 37 42 43 47 61 63	
14.	1	101-0101	15K	R39	
15.	3	101-0103	18K	R18 85 100	
16.	7	101-0105	22K	R49 80 81 86 97 98 99	
17.	1	101-0107	27K	R60	
18.	5	101-0113	47K	R32 52 56 84 95	
19.	3	101-0115	56K	R19 44 45	
20.	1	101-0117	68K	R87	
21.	6	101-0121	100K	R38 62 69 76 82 88	
22.	1	101-0123	120K	R83	
23.	5	101-0145	1M	R3 6 67 68 79	
24.	1	105-0001	VARISTOR 250V AC	RV1	
25.	1	107-0005	5K POT 1T RA	R14	
26.	3	107-0015	50K POT 1T RA	R11-13	
27.	1	119-0008	10Kx7 R-SIP	RP1	
28.	2	150-0024	24pf/D	C50 51	
29.	1	151-0047	470pf/TS	C16	
30.	1	151-0120	.01/TS	C44	
31.	1	151-0100	.033/TS	C23	

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32.	2	151-0199	.47/50V/P	C5	22
33.	10	152-0012	.1/50V/P	C18	26 35-37 56 57 59 64 70
34.	2	152-0040	4.7/50V/P	C17	19
35.	19	152-0085	.01/50V/P	C7	9 12 25 32 40 43 45-47 49 52 53 61 63 65 66 68 69
36.	11	152-0089	.001/50V/P	C21	27-29 33 34 38 39 48 60 62
37.	3	152-0250	.047/50V/P	C30	41 42
38.	1	154-0025	1/35V/T	C20	
39.	3	154-0100	10/16V/T	C10	54 58
40.	8	155-0052	10/35V/A	C1 C2	NOTE 1 C3 C4 11 13 15 24
41.	3	155-0080	100/25V/A	C14	31 71
42.	1	155-0140	3300/25V/A	C67	
43.	1	210-0001	#4 NUT	XVR1	
44.	1	220-0103	440x1/2"	XVR1	
44.5	1	236-0005	CRYSTAL INSULATOR	XY1	
45.	5	305-0001	FERRITE W/LEADS	E1-5	
46.	5	311-0011	LED RED FLUSH	DS1-5	
47.	1	311-0012	LED GREEN FLUSH	DS6	
48.	1	316-0004	tone FILTER	U6	MF4CN-50
49.	1	316-1232	RS232 DRIVER	U1	RS232
50.	2	316-0353	OP-AMP,DUAL BIFFET	U7 9	LF353
51.	5	316-0358	OP-AMP, DUAL	U10 11 21-23	LM358N
52.	1	316-7805	REG. +5V 1.5A	VR1	LM340T-5
53.	1	316-7808	REG. +8V	VR2	LM78L08CZ
54.	1	321-2090	DIMF XCVR	U5	20C90
55.	1	321-6264	8Kx8 RAM	U15	HM6264 LP-15
56.	1	321-6804	MICROPROCESSOR	U12	MC6803P
57.	1	321-6840	PIM	U17	MC6840
58.	1	323-4053	3PDT SWITCH	U8	MC144053
59.	1	324-4139	DUAL 2-4 DECODER	U4	74HC139
60.	1	324-7400	QUAD NAND	U2	74HC00
61.	1	324-7414	HEX SCHMIDT	U3	74HC14
62.	1	325-4373	OCTAL LATCH	U13	74HCT373
63.	1	340-2003	RELAY DRIVER	U19	ULN2003
64.	4	340-3904	NPN-40V/200MA	Q2 3 4 5	2N3904
65.	4	342-0001	SILICON 1A 100V	CR9-12	1N4002
66.	7	342-3009	SILICON	CR3 4 7 8 16	1N4148
67.	2	343-3017	1/2W, 6.2V	CR1 15	1N5234B
68.	1	371-0008	SW OCTAL DIP	SW1	
69.	1	376-4032	4.032MHz XTAL	Y2	
70.	1	376-0358	3.58 MHZ XTAL	Y1	
71.	1	380-0030	RELAY DPDT	K2	
72.	1	381-0010	HEATSINK	XVR1	
73.	1	401-0664	CONN,D-SUB,9-PIN RA	J5	NOTE 3
74.	1	401-0034	3 CON STEREO JACK	J6	
75.	3	401-0052	STAKE PINS	JP3 (3 EA)	
76.	1	401-0059	15 POS R/A HEADER	TB1	
77.	1	402-3040	MINI JUMPER	JP3 (POS B)	
78.	8	407-0008	SKT, 8 PIN DIP	U6 7 9-11 21-23	
79.	2	407-0014	SKT, 14 PIN DIP	U2 3	
80.	4	407-0016	SKT, 16 PIN DIP	U1 4 8 19	
81.	1	407-0020	SKT, 20 PIN DIP	U13	

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82.	1	407-0022	SKT, 22 PIN DIP	U5
83.	4	407-0028	SKT, 28 PIN DIP	U14 15 16 17
84.	1	407-0040	SKT, 40 PIN DIP	U12
85.	1	408-0001	WIRE JUMPER	JP6A
86.	1	410-9075F.2	PCB	
87.	1	416-1214	SMART SOCKET	U15
88.	2	416-1576	FUSE 1A AGC	F1 2
89.	4	416-3040	FUSE CLIP	XF1 2
90.	6	417-0010	LED R/A	XDS1-6
91.	1	561-0001	THERMAL COMPOUND	XVR1

NOT INSTALLED:

C6 8 55
CR2 5 6
J1-4
JP2 4 5 7
K1
Q1
R1 15 28 34 54 70-75 96
U14 16 18 20

NOTES:

1. ON SOLDER SIDE CUT TRACE FROM C2 (-) SIDE.
JUMPER FROM C2 (-) TO U1.16 (+5V).
2. JUMPER FROM U1.10 TO U1.11.
3. ON SOLDER SIDE, CUT THE **THREE** TRACES THAT CONNECT TO THE MOUNTING SCREW HOLES OF J5.

QUICK! --- GET ME ON THE AIR!

If this is your first Model 38 Repeater Tone Panel, your first questions probably are, “What do I have to do to enable a tone?” and “Do I have to understand all the features just to make it work?” Here are the answers: Before you can work with the Model 38, it must be installed. FOLLOW THE INSTALLATION INSTRUCTIONS. Installation should be accomplished by a qualified radio service technician. Then get your transceiver (on the repeater frequency with a touch-tone keypad) ready to enable some tones.

ACCESS THE PROGRAM MODE

To access the program mode, key up and press “12123#”. A chirp should be heard coming back from the repeater (the chirp, or 5 beeps, is the “go-ahead” prompt tone). If the program mode is not accessed, check the DTMF LED on the front panel to see if it lights with every key pressed.

PROGRAM MODE PROMPT TONES

During programming, the Model 38 will issue prompt tones to indicate how it’s doing. A “warble” or “dee-doo dee-doo dee-doo” tone indicates an invalid command, or error condition exists. A “chirp” or “bip bip bip bip bip” indicates proper completion of a command, and ready for the next command. A single “bip” indicates ready for more digits. When exiting the program mode a “ringing” sound will be sent to verify exit from the program mode. If a key is not pressed within 90 seconds, the Model 38 will exit automatically.

ENABLE A CTCSS TONE

A CTCSS tone may be enabled by pressing “66# nn#” where “nn” is the tone number from the chart in the operation section of this manual.

PROGRAMMING EXAMPLES

Enable user groups 67.0, 100.0, DCS 023, and 186.2 (user numbers are shown for the 38 tone version):

Description	User Group	DTMF Commands	Progress tones heard
Access the DTMF program mode.		12123#	5-beep go-ahead “chirp”.
Enable 67.0 Hz CTCSS user group.	1 = 67.0 CTCSS	66# 1#	Bip, chirp.
Enable 100.0 Hz.	12 = 100.0 CTCSS	66# 12#	Bip, chirp.
Enable DCS user 40.	40 = Any DCS	66# 40#	Bip, chirp.
Install DCS 023 decode into user 40.	40 = 023 now	3753# 40# 023#	Bip, bip, chirp.
Install DCS 023 encode into user 40.	40 = 023	89# 40# 1023#	Bip, bip, chirp.
Enable 186.2 Hz.	30 = 186.2 CTCSS	66# 30#	Bip, chirp.
Exit the program mode.		293#	Ringing tone.