

CETEC VEGA

Models D-703 and D-704

DTMF Mobile Decoders



Cetec Vega

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GENERAL

Cetec Vega Models D-703 and D-704 DTMF mobile decoders feature DIP-switch programmable addresses. Any of the 16 DTMF characters are DIP-switch programmable. The message length (2-4 digits; 6 digits on special order) is also DIP-switch programmable. The decoders also feature wrong-digit lockout or wrong-digit reset (user-selectable). As shown in the specifications in this manual, the decoders have high tolerance of weak signals, noise, twist, and skew. Speaker, horn and reset functions are provided, as well as a buzzer and call lamp on the front panel.

The Model D-704 has the added features of DIP-switch-programmable all-call and group-call functions and tone-burst transponder.

When the proper address sequence of DTMF digits is received, a call lamp lights, a buzzer sounds, a speaker relay is energized, and a horn control output is energized (if the horn switch is on). The address length is DIP-switch-settable from two to four digits, and provision has been made for increasing the address length to six digits.

The Model D-704 has all-call, group-call, and tone-burst transpond as additional features. All-call responds to a DIP-switch-programmable digit in the second-digit position. Group-call responds to a DIP-switch-programmable digit in the second, third, or fourth position. Upon decoding an address (not all-call or group-call), the transpond feature initiates PTT and a tunable sine-wave tone-burst output. The D-704 is factory-programmed for a second-digit star (★) all-call, a fourth-digit pound (#) group-call, and a 1-kHz/10-dBm tone-burst transpond.

Both models are factory-programmed for - 20 dBm to + 10 dBm (220 mVp-p to 7 Vp-p) DTMF input, 50 ms minimum to 2.5 ± 0.5 s maximum interdigit time, $\frac{1}{3}$ to 10 digits/s DTMF rate, four-digit message length, 7777 station address, wrong-digit reset, and operation from an external hookswitch.

INSTALLATION

Models D-703 and D-704 are supplied with mounting bracket, connector, and cable. Avoid mounting the decoder in areas that may exceed temperature specifications or in areas of strong magnetic or RF fields. Interconnection to associated mobile radio equipment is shown in Figure 1. A rear connector is provided for removal of the decoder for servicing. These decoders are not designed for use with positive ground or for non-relay-operated horns. The power-supply and horn-control ground connection should be made to the vehicle's chassis and not to a ground on associated radio equipment.

SETUP

Referring to the Figure 4 chart and to Figure 2 for DIP-switch locations, program the message length on S4 (only one of the first five positions should be on). Program the address digits using S1 and S2. The first four positions of S1 program the first digit; the last four positions of S1 program the second digit; the first four positions of S2 program the third digit; and the last four positions of S2 program the fourth digit.

In D-704 decoders, program the group-call digit using the first four positions of S8, and the all-call digit using the last four digits of S8. In addition, program the group-call digit position using one of the last three positions of S4.

THEORY OF OPERATION

Referring to the schematic diagram (Figure 3), U1 accepts a DTMF input and decodes valid tone combinations into a 4-bit binary output code. U1 also produces a VALID output on U1-15. U2 is a 4-bit comparator which compares the 4-bit output of U1 with 4 bits from the diode/DIP-switch matrix. If the same 4-bit code is present at both the "A" and "B" inputs of U2, an output high will appear at U2-6. If the U2 "A" and "B" inputs do not have identical codes, the U2-6 output will be low. A VALID and a U2-6 high ($A = B$) represent a correct digit decode. A VALID and a U2-6 low ($A \neq B$) represent a wrong digit received. A correct digit clocks counter U6 to the next position on the trailing edge of the VALID output from U1-15. With J5 open (for wrong-digit reset mode, as shipped from the factory), a wrong digit received at any time resets counter U6 to the initial position (position 1) on the leading edge of the VALID output. If J5 is closed (for wrong-digit lockout mode), a wrong digit will hold counter U6 in reset (position 1) until interdigit timer CR4/R6/C7 times out (about 2.5 seconds after the last digit of the series containing a wrong digit). The interdigit timer capacitor C7 is charged and recharged by VALIDs from U1-15. When a VALID has not been received for about 2.5 seconds, the voltage at U5-9 falls below threshold and U7A is reset, which enables counter U6.

When counter U6 has been clocked by correct digits to the position set by the message-length DIP switch S4, latch U7B is set through U3C. When U7-9 is set low, buzzer X1 is triggered and latch U7D is set by Q1. The horn is also sounded if horn switch S6 is depressed. The high at U7-10 lights call lamp DS1 through U8-2,17 and energizes speaker relay K1 through diode CR7. Capacitor C6 discharges through R5 to the threshold level of U5-11 in about 2.5 seconds, setting U7C, which then clears U7B, causing the buzzer (and the horn, if S6 is "on") to stop sounding. The call lamp and the speaker relay remain "on", however, because U7D has not been reset.

Normally, the operator starts to answer the call this time by taking the microphone off hook. When the hookswitch input opens, U8-3 goes high and U8-16 goes low, providing an additional path for K1 relay coil current. The open hookswitch input also resets latches U7D and U7C after a short delay. Speaker relay K1 remains energized by the low at U8-16, but the call lamp goes out. When the microphone goes back on-hook, the speaker relay is also deenergized.

Momentary operation of the reset switch S7 at any time stops buzzer and horn sounding, and turns off the call lamp and speaker relay (if microphone is on hook).

If an external hookswitch is not used, J3 must be solder-bridged or the hookswitch input must be grounded. In this case, the speaker relay must be manually reset with the reset switch S7.

A speaker switch, S5, is provided to allow all calls to be heard when desired.

D-704 TONE-BURST TRANSPONDER

When the station address is decoded (not all-call or group-call), U4C-8,9 goes high. U8-1 is driven high by U4C-10 through U4D. U8-18 and the PTT output go low, keying the external transmitter on. Sine-wave oscillator U13 is enabled at U13-9 by the high at U4C-10. The high at U4C-10 also causes a high at U12-7 and a high at U12-9 for the duration of the time constant of C9/RN4A. U12-8 goes low, forward-biasing the PNP tone-gate transistor Q2. The sine-wave oscillator signal from U13-2 develops a signal at the tone-output pin through U12-12,14,Q2, and C8. When timeout occurs on either the horn timer or the interdigit timer, or if a new DTMF digit is received, the oscillator is disabled by a low at U13-9 from U4C-10.

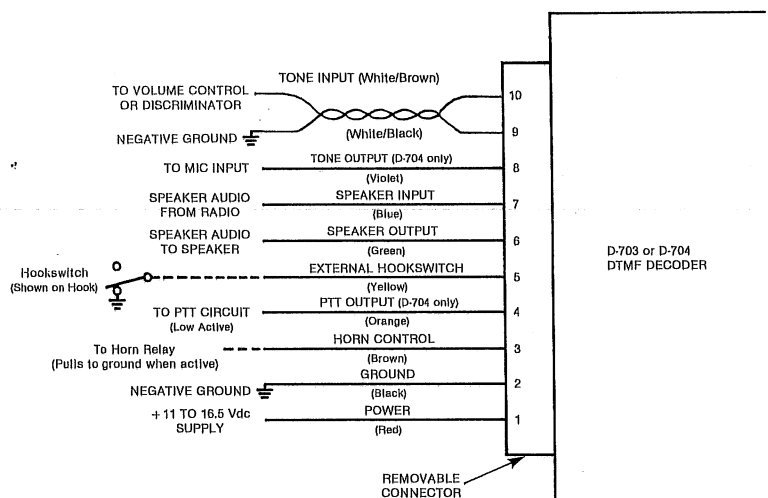


Figure 1. Rear-panel connector lead assignments.

D-704 ALL-CALL AND GROUP-CALL

If a correct first digit has clocked counter U6 to position 2 and a second digit is received, which is the correct digit for the all-call but is the wrong digit for the second digit of the station address, latch U7B is set by a high at U10-6 through U11D, U11-B, U5-13,12, and U3C. A very short time later (about 250 ns), counter U6 is reset by a high at U2-6 caused by the wrong station address digit. PTT output and tone burst is not initiated, because U4C-8 remains low, but all other functions operate the same as with a station-address decode.

Group-call operation is the same as all-call operation, except that decode is usually from a different digit in a different position.

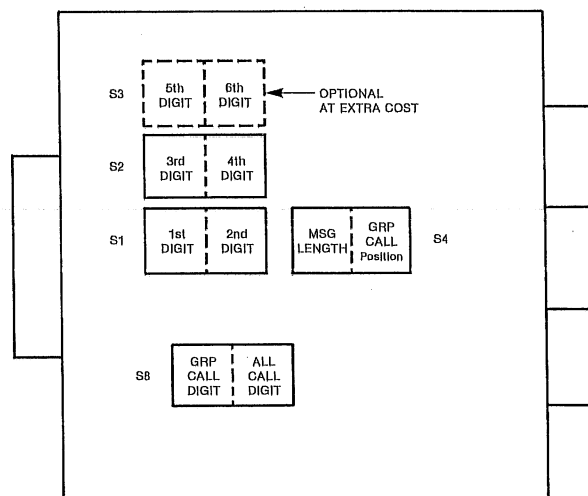


Figure 2. DIP-switch locations for programming.

BURST-TONE TUNING (Model D-704 only)

Jumper TP-2 to TP-3 and TP-1 to TP-4 (+5 V). Connect frequency counter and voltmeter or oscilloscope to tone output, pin 8 (violet). Tune 15-turn potentiometer R10 for desired frequency and adjust potentiometer R8 for desired amplitude. (It is suggested that the frequency chosen should not be on, or within 5% of, a DTMF frequency.)

WRONG-DIGIT PROGRAMMING

Wrong-digit reset mode: J5 open (as shipped from factory)
Wrong-digit lockout mode: J5 closed

Station Address —Program message length on S4, positions 1 through 5
 —Program digits on S1 and S2

All-call and group-call —Program all-call digit on S8, positions 1 through 4
 (Model D-704 only) —Program group-call digit on S8, positions 5 through 8
 —Program group-call digit position on S4 positions 6 through 8

DTMF DIGIT	S1, S2, S8			
	DIP SW POS			
	1	2	3	4
	5	6	7	8
	1st, 3rd, OR ALL-CALL DIGIT			
	2nd, 4th, OR GROUP-CALL DIGIT			
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
0	1	0	1	0
*	1	0	1	1
#	1	1	0	0
A	1	1	0	1
B	1	1	1	0
C	1	1	1	1
D	0	0	0	0

MESSAGE LENGTH	S4 DIP SW POSITION				
	1	2	3	4	5
2	1	0	0	0	0
3	0	1	0	0	0
4	0	0	1	0	0
5	0	0	0	1	0
6	0	0	0	0	1

GROUP-CALL DIGIT POSITION	S4 DIP SW POSITION		
	6	7	8
2	1	0	0
3	0	1	0
4	0	0	1

Notes: 1. 0 = switch off; 1 = switch on
 2. Fifth or sixth digit positions will decode "D" without optional extra DIP switch and diode networks

Figure 4. Digit programming chart

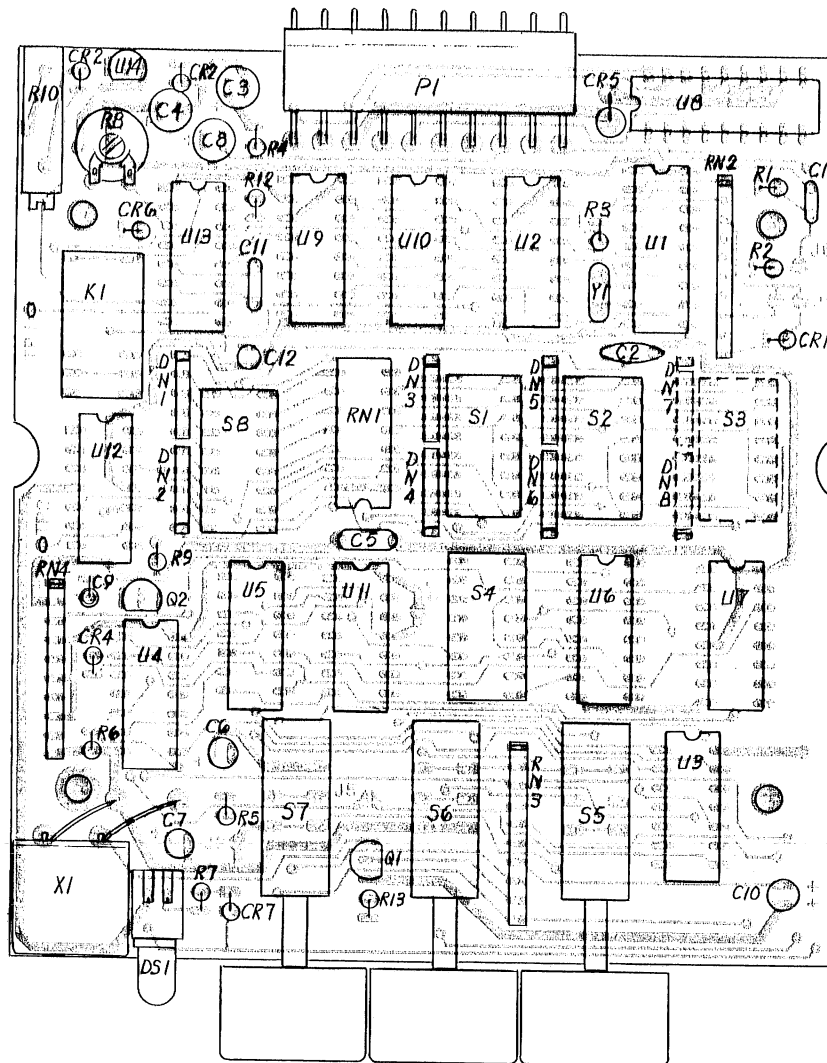


Figure 5. D-703/D-704 parts locator.

SOLDER-BRIDGE OPTIONS

J1, J2 open:	1/3 to 10 digits/s, 50% duty factor, DTMF decoding
J1 closed, J2 open:	4 to 22 digits/s, 50% duty factor, DTMF decoding
J1 open, J2 closed:	1/3 to 10 digits/s, 15-ms fixed interdigit time, DTMF decoding
J1 closed, J2 closed:	4 to 22 digits/s, 15-ms fixed interdigit time, DTMF decoding
J3 open:	external hookswitch
J3 closed:	no external hookswitch
J4 open:	Model D-704
J4 closed:	Model D-703
J5 open:	wrong-digit reset
J5 closed:	decoder is reset and disabled by a wrong digit until timeout of interdigit timer (about 2.5 s after last valid digit)
J6 open:	– 20 dBm to + 10 dBm DTMF input
J6 closed:	– 40 dBm to – 10 dBm DTMF input

MODELS D-703 AND D-704 SPECIFICATIONS

TONE INPUT	Standard 2 of 7 or 2 of 8 DTMF tones
INPUT IMPEDANCE	50 k ohms minimum, DC blocked for 100 V
TONE INPUT DYNAMIC RANGE	30 dB minimum
TONE INPUT LEVEL	– 20 dBm to + 10 dBm, or – 40 dBm to – 10 dBm, selectable
SIGNAL TWIST ACCEPTANCE	+ 12 dB minimum
S/N ACCEPTANCE	7 dB at 10 digits/s, 50% duty-factor programming
DTMF FREQUENCY ACCEPTANCE	± 1.5% minimum
DIALING RATE	1/3 to 10 digits/s, or 4 to 22 digits/s
DTMF DUTY FACTOR (Automatic Dialing)	50% nominal duty factor, or 15 ms fixed interdigit time, selectable
INTERDIGIT TIME (Manual Dialing)	15, 25, or 50 ms minimum, 2.5 ± 0.5 s maximum
ADDRESS DIGITS	Standard 12 or 16 DTMF digits, DIP-switch programmable
ADDRESS LENGTH	2 to 4 digits (provision for 6 digits)
TALK OFF	Not possible
TALK ON	Less than 1 decode in 8 hours when set for two digits at normal dialing rates, using Mitel CM7291 test tape. Less than one decode per 4000 hours (estimated) for four-digit message.
TEMPERATURE RANGE	– 30°C to + 70°C
SPEAKER-RELAY CONTACTS	2 A maximum
HORN-CONTROL OUTPUT	2 A maximum
SUPPLY VOLTAGE	+ 11.5 to 16.5 Vdc (negative ground vehicular, unregulated)
SUPPLY CURRENT (D-703)	13 mA idle, 110 mA maximum, at 13.8 Vdc
SUPPLY CURRENT (D-704)	26 mA idle, 132 mA maximum, at 13.8 Vdc
CASE DIMENSIONS	1.4 H × 5.1 W × 5.25 L (inches) 3.56 H × 13 W × 13.3 L (centimeters)

MODEL D-704 SPECIFICATIONS

TONE-BURST FREQUENCY RANGE	500 Hz to 2600 Hz minimum
TONE-BURST DURATION	750 ± 250 ms
TONE-BURST OUTPUT LEVEL	– 30 dBm to 0 dBm (600-ohm load), adjustable
TONE-BURST OUTPUT DISTORTION	0.6% typical, 2.5% maximum
TONE-BURST OUTPUT IMPEDANCE	Off: 100 k ohms minimum On: 100 ohms maximum
PTT OUTPUT	Open collector, 200 mA maximum, active low

WARRANTY

Cetec Vega signaling products are guaranteed to be free from defects in material and workmanship for a period of three years from the date of shipment. Warranty is for factory repair or replacement only.



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THE FOLLOWING ALTERNATE LOGIC SYMBOLS ARE USED ON THIS SCHEMATIC TO PROMOTE UNDERSTANDING OF OPERATION. THESE ALTERNATE SYMBOLS ARE USED WHENEVER AN INPUT IS ACTIVE LOW.

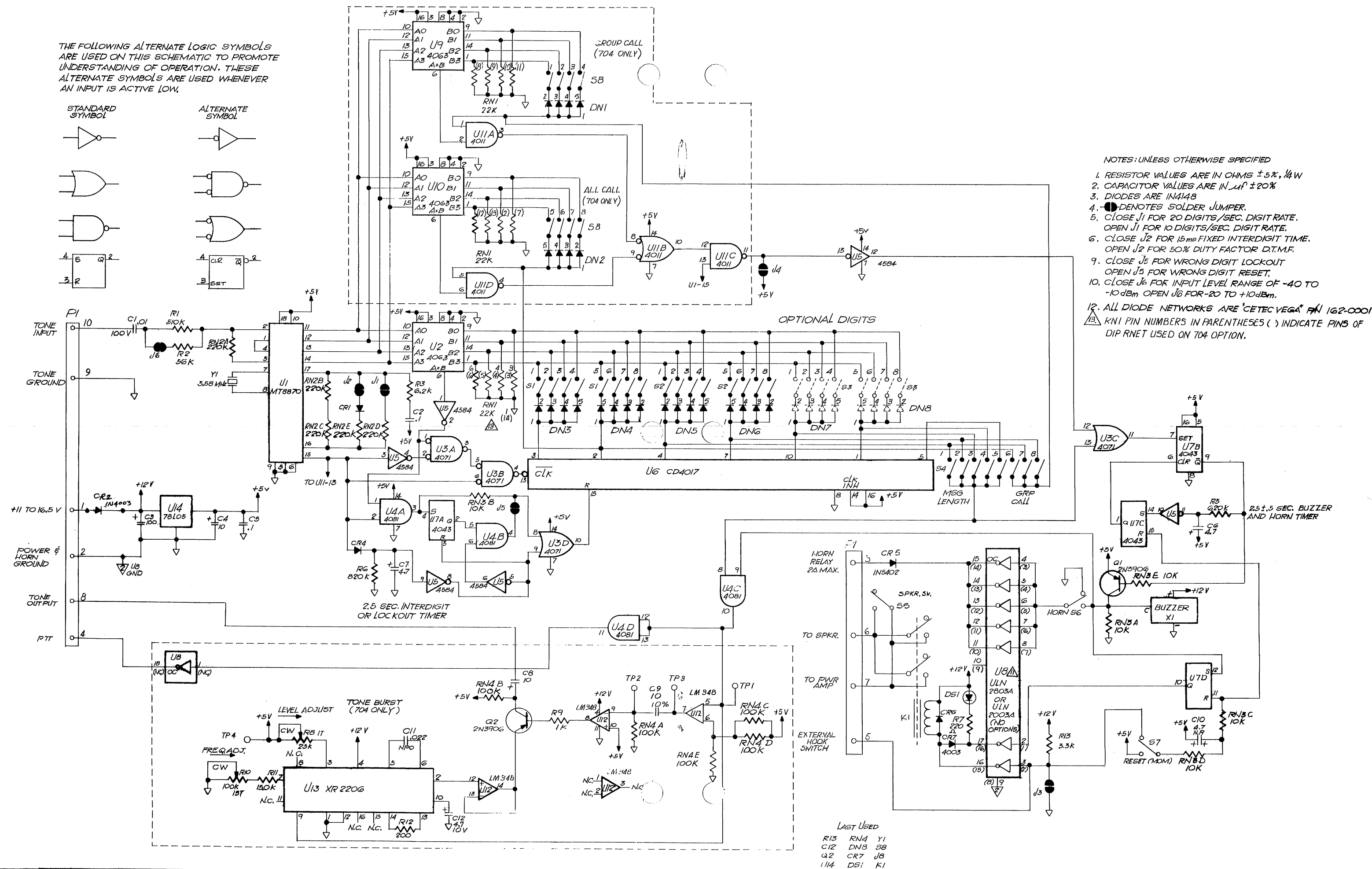
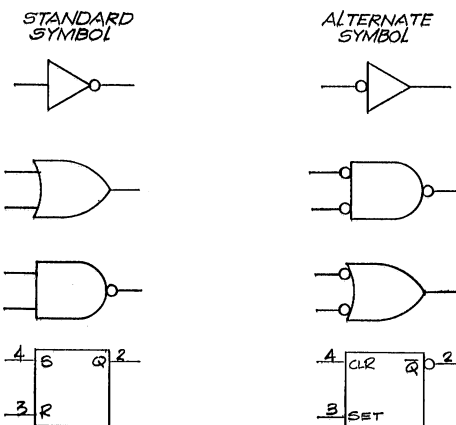


Figure 3. D-703/D-704 DTMF decoder schematic diagram.