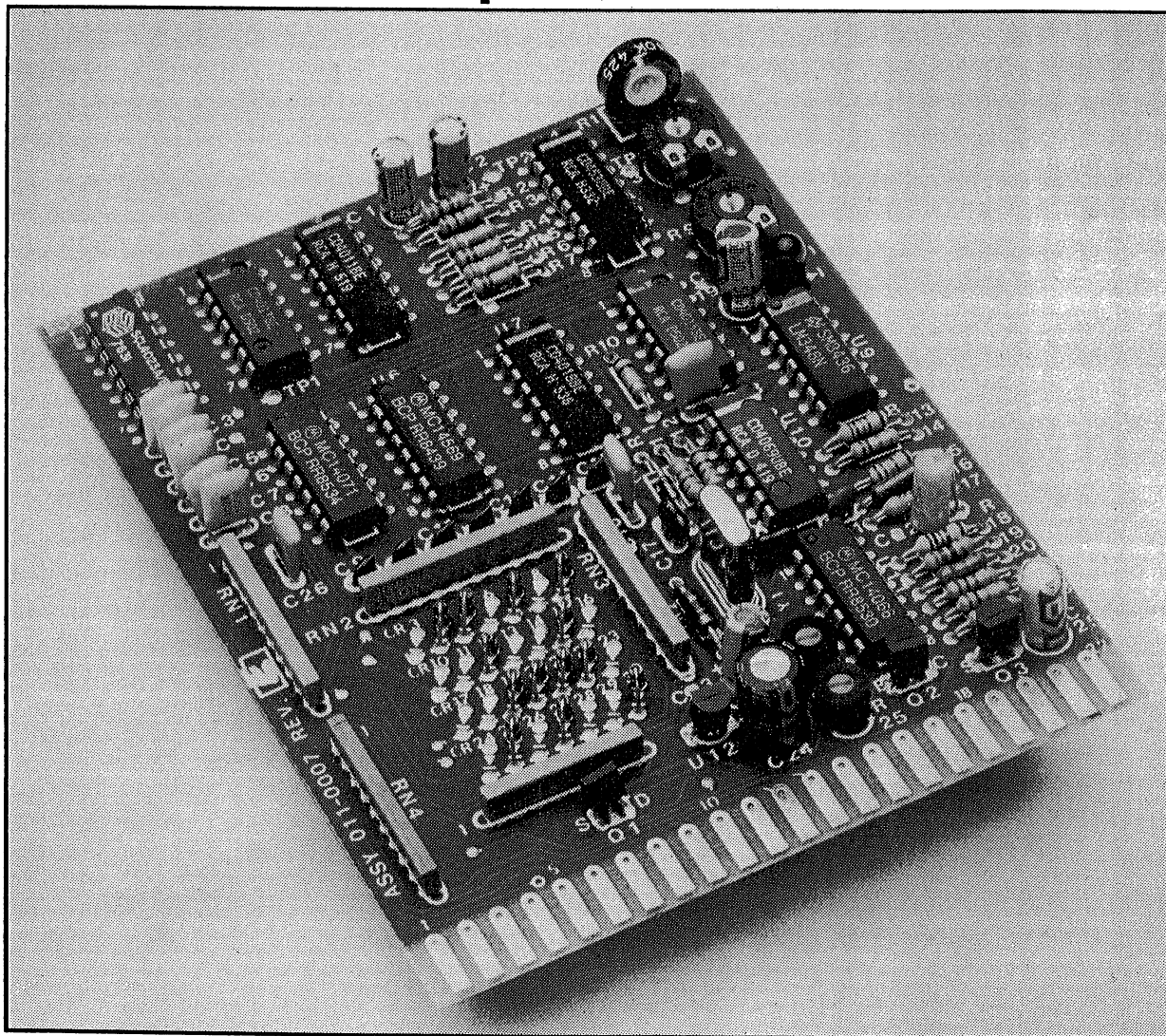


**Vega<sup>®</sup>** a MARK IV company  
**Signaling Products**

## Instruction Manual

098-0281

## Model E-509 Sequential Tone Generator



## General

The Vega Model E-509 sequential audible tone generator is intended for use in systems to remotely control radio base stations and repeaters. It provides the required tone sequences to interface with Vega 223 Series tone-remote station panels and other remote adapters (such as GE, Motorola, etc.) conforming to the industry-standard sequential-tone-control format. The E-509 is not a stand-alone unit, because it does not include the audio-processing functions necessary to implement a complete tone-remote console. The E-509 is intended primarily as a component in large multi-function consoles, paging terminals, centralized dispatch systems, and related applications. It may also be used to update existing DC control consoles to tone-format remote control.

The sequential audible frequencies generated by the unit are developed from a crystal oscillator and are highly stable. Output frequencies are programmable via a diode matrix over a range of 1725 Hz to 3150 Hz; this range may be extended downwards to 875 Hz with external logic. The standard version supplies a guard-tone burst and PTT holding tone frequency of 2175 Hz, a monitor-enable burst frequency of 2050 Hz, and radio-frequency-select control burst tones of 1950 Hz and 1850 Hz. In accordance with industry practice, the E-509, when combined with the Model A-508 summing line driver, Model AA-690 universal audio amplifier/processor, or other appropriate amplifier module, provides a 130-ms burst of 2175-Hz guard tone at +10 dBm, followed by a 40-ms function-tone burst (2050 Hz monitor, 1950 Hz F1, 1850 Hz F2, or other frequency as externally programmed) at 0 dBm, followed by the 2175-Hz PTT holding tone at -20 dBm.

Inputs are provided for external logic to program additional second (function) tone frequencies.

Frequency-select switches (F1, F2, F<sub>ext</sub>) must be maintained-contact types, with one of the three selected at all times. If a select burst is required upon a frequency change (which is normal practice for this tone format), break-before-make switching is necessary. That is, all three switches must be momentarily open for 10 to 20 milliseconds during the frequency change. Upon actuation, a frequency-select switch causes a guard-tone burst, followed by a function burst. Closing the frequency-select switch generates a single function burst sequence (guard-tone burst, followed by a function-tone burst).

The PTT and monitor switches should be momentary types. Upon actuation, the PTT switch causes a guard-tone burst, followed by a function burst (with the frequency-select tone being the one

currently selected via the F1, F2, or F<sub>ext</sub> inputs), followed by the PTT holding tone for as long as the PTT switch remains closed. Closing the monitor switch generates only a single "MON" burst sequence (guard-tone burst, followed by a monitor-tone burst), no matter how long the switch is held closed. However, the monitor switch must be released prior to using the PTT or frequency-select functions.

Multiple units can be connected in parallel, because of the very high gated tone output impedance and open-collector PTT output impedance when inactive.

## Theory of Operation

Crystal oscillator Y1, U10-1,2 drives the 8-bit programmable divide-by-N counter U6. The useful "N" range of this counter is divide-by-255 to divide-by-139, providing output at U6-15 of from 17.23 kHz to 31.6 kHz. The programmable divide-by-2 circuit U2, U3-3,4 is inactive for all output frequencies 1725 Hz and higher; thus, normally the same U6 output frequency is supplied to pin 14 of U7. U7 is a presettable divide-by-N counter used to provide a synthesized sinewave output at one-tenth of its input frequency. The input and output frequency of U9-2,1 is, therefore, 1723 Hz to 3160 Hz when the divide-by-2 terminal P,13 is high, and 861.5 Hz to 1580 Hz when low. The synthesized sinewave output at U9-1 has a tenth-harmonic component. Low-pass filter U9-6,7 attenuates this component. The signal at U9-7 generates a sinewave output signal at the tone output terminal Z,22 through potentiometer R1, buffer U9-10,8, and audio gate Q3.

Normally, one of the frequency-control input terminals (F1, F2, MON, or F<sub>ext</sub>) is externally grounded by mechanically interlocked switches or held low by external 1-of-N CMOS logic. If none of the frequency-control inputs is low, the F1 frequency is automatically selected.

The tone-burst sequence is initiated by a high-to-low transition at one of the frequency-control inputs or at the PTT input terminal. The tone-burst sequence from a frequency-control input transition activates the PTT output terminal only for the tone-burst period, but the PTT input terminal activates PTT output for the duration of the input low.

When the PTT input terminal X,20 goes low, the PTT output Y,21 goes low through U3-11,10, U10-13,12, DS1, R21, and Q2. Audio gate Q3 is activated through U3-11,10, U10-11,10, and R23. U7 and crystal oscillator U10-1,2 are also enabled by the low at U3-10.

The initial state of the function-burst timer U4B is a low at U4-10 and a high at U4-9. This enables the 2175-Hz programming line and disables the 2050-

1950-, and 1850-Hz lines. Upon oscillator and U7 enable, a 2175-Hz tone therefore is generated. The PTT input low has also triggered U4A through U1-11,10, and U8-11,12. The high at U4-6 causes a low at U11-5,13 through U5-13,11 and U10-3,4. U11-6 is also low due to the initial state of U4-10. All U11 "switches" therefore are open and the gain of summing amplifier U9-2,1 is determined only by R18. The 2175-Hz output therefore is at the +10-dB level referenced to the function-burst level.

U8-12 is reset at U8-10 in nanoseconds after U4A is triggered and timing starts. After 130 ms, timeout occurs, causing U4-7 to go high, triggering U4B at U4-11 through U8-3,2. U4-10 goes high, disabling the 2175-Hz programming line, closing "switch" U11-8,9, maintaining U11-1,2 and U11-4,3 "switches" open through U5-12, 11 and U10-3,4, and enables the other three frequency-control lines at U5-1,5,8 from the low at U4-9. If all frequency-control inputs are high or if F1 is low, the highs at U1-1,2,8 cause a low at U1-9 and U5-6, causing a low at U5-4, enabling the 1950-Hz (F1) programming line. The closing of "switch" U11-8,9 lowers the feedback resistance of summing amplifier U9-2,1 to a value that causes the 10-dB reference level to be developed at U9-1.

U8-2 is reset at U8-4 in nanoseconds after U4B is triggered and timing starts. After 40 ms, timeout occurs, causing U4-10 to go low and U4-9 to go high. The 1950-Hz (F1) line is disabled and the 2175-Hz is activated again. The low at U4-10 has opened "switch" U11-8,9 but the lows at both U4-10 and U4-6 have closed "switches" U11-1,2 and U11-4,3, causing the gain of summing amplifier U9-2,1 to be at the -20-dB level. The 2175-Hz output therefore is at the -20-dB level, which continues as long as the PTT input terminal X,20 is low.

For certain Motorola and other base-station interfaces, the -20-dB, 2175-Hz PTT tone should be adjusted to a -30-dB level. Adjustment of R24 for this purpose does not change the levels of the +10-dB or the 0-dB tones.

Nonstandard PTT and function frequencies may be generated by adding or deleting diodes (customer-supplied 1N4148) in the on-board diode matrix. (Refer to the frequency-programming chart.)

A low applied to the divide-by-2 input P,13 causes both the PTT and the function frequencies to be divided by two. This is not normally desirable. A strobe output is provided to enable the divide-by-2 input only during the function tone.

A low applied to the EXT FREQ input N,12 disables on-board function-tone diode programming and allows external logic to apply lows to certain of the data inputs during STROBE output to generate

other second (function) tone frequencies. A low may also be applied to the divide-by-2 input during STROBE output if desired. The external logic should be CMOS 1-of-N type when multiple external frequencies are to be generated. We recommend that the external logic be powered from the 10-volt regulated output pin T,16 of the E-509.

Mechanically interlocked DPDT switches and diodes may be used in place of the external 1-of-N logic if desired.

## Setup

The tone-output terminal should be connected to the 600-ohm audio pair or leased line through suitable interface (transformer) with all other equipment which loads the line in place.

Connect a clip lead between TP1 (ground) and TP2. This activates 1950-Hz (F1) output. Adjust potentiometer R1 for the desired line level, which is usually -10 dBm (245 mV<sub>rms</sub> or 980 mV<sub>p-p</sub> of DTMF across a 600-ohm load). The actual output in this case is 0 dBm first (guard) tone, -10 dBm second (function) tone, and -30 dBm sustaining (PTT) tone. Remove the clip lead.

Normally, this completes the setup procedure. However, for certain Motorola and other radios, the PTT sustaining tone should be 30 dB below the function tone. In this case, set the function-tone level as above, remove the clip lead from TP2, and connect the clip lead from the PTT input terminal X,20 to TP-1 (ground). After completion of the first and second tones, a PTT sustaining tone remains. Adjust R-24 for an output 30 dB below the function-tone level. Remove the clip lead.

## Technical Assistance

Vega products are engineered to meet your requirements of performance, reliability, and compatibility. Technical assistance is offered by correspondence or telephone, should it be required, to assure your satisfaction.

## Warranty

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.

## Safety & Life Support Policy

Vega's products are not authorized for use in applications where nonperformance may be life-threatening or where substantial risk to life and property may be present, without the express written approval of the President of Vega.

| DESIRED<br>OUTPUT<br>FREQ<br>(Hz) | PROGRAMD<br>DIVISOR | +2<br>P,13 | B3<br>E,5 | B2<br>F,6 | B1<br>H,7 | A4<br>J,8 | A3<br>K,9 | A2<br>L,10 | A1<br>M,11 | ADD<br>±0.005%<br>XTAL ERROR |
|-----------------------------------|---------------------|------------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------------------------|
|                                   |                     |            |           |           |           |           |           |            |            | PERCENT<br>ERROR             |
| 3150                              | 139                 | 1          | 0         | 0         | 0         | 1         | 0         | 1          | 1          | +0.343                       |
| 3100                              | 142                 | 1          | 0         | 0         | 0         | 1         | 1         | 1          | 0          | -0.193                       |
| 3050                              | 144                 | 1          | 0         | 0         | 1         | 0         | 0         | 0          | 0          | +0.034                       |
| 3000                              | 146                 | 1          | 0         | 0         | 1         | 0         | 0         | 1          | 0          | +0.308                       |
| 2950                              | 149                 | 1          | 0         | 0         | 1         | 0         | 1         | 0          | 1          | -0.046                       |
| 2900                              | 152                 | 1          | 0         | 0         | 1         | 1         | 0         | 0          | 0          | -0.329                       |
| 2850                              | 154                 | 1          | 0         | 0         | 1         | 1         | 0         | 1          | 0          | +0.103                       |
| 2800                              | 157                 | 1          | 0         | 0         | 1         | 1         | 1         | 0          | 1          | -0.057                       |
| 2750                              | 160                 | 1          | 0         | 1         | 0         | 0         | 0         | 0          | 0          | -0.148                       |
| 2700                              | 163                 | 1          | 0         | 1         | 0         | 0         | 0         | 1          | 1          | -0.170                       |
| 2650                              | 166                 | 1          | 0         | 1         | 0         | 0         | 1         | 1          | 0          | -0.125                       |
| 2600                              | 169                 | 1          | 0         | 1         | 0         | 1         | 0         | 0          | 1          | -0.011                       |
| 2550                              | 172                 | 1          | 0         | 1         | 0         | 1         | 1         | 0          | 0          | +0.171                       |
| 2500                              | 176                 | 1          | 0         | 1         | 1         | 0         | 0         | 0          | 0          | +0.148                       |
| 2450                              | 179                 | 1          | 0         | 1         | 1         | 0         | 0         | 1          | 1          | +0.182                       |
| 2400                              | 183                 | 1          | 0         | 1         | 1         | 0         | 1         | 1          | 1          | +0.034                       |
| 2350                              | 187                 | 1          | 0         | 1         | 1         | 1         | 0         | 1          | 1          | -0.023                       |
| 2300                              | 191                 | 1          | 0         | 1         | 1         | 1         | 1         | 1          | 1          | +0.011                       |
| 2250                              | 195                 | 1          | 1         | 0         | 0         | 0         | 0         | 1          | 1          | +0.137                       |
| 2200                              | 200                 | 1          | 1         | 0         | 0         | 1         | 0         | 0          | 0          | -0.148                       |
| 2175                              | 202                 | 1          | 1         | 0         | 0         | 1         | 0         | 1          | 0          | 0.000                        |
| 2150                              | 204                 | 1          | 1         | 0         | 0         | 1         | 1         | 0          | 0          | +0.171                       |
| 2100                              | 209                 | 1          | 1         | 0         | 1         | 0         | 0         | 0          | 1          | +0.103                       |
| 2050                              | 214                 | 1          | 1         | 0         | 1         | 0         | 1         | 1          | 0          | +0.148                       |
| 2000                              | 220                 | 1          | 1         | 0         | 1         | 1         | 1         | 0          | 0          | -0.148                       |
| 1950                              | 225                 | 1          | 1         | 1         | 0         | 0         | 0         | 0          | 1          | +0.137                       |
| 1900                              | 231                 | 1          | 1         | 1         | 0         | 0         | 1         | 1          | 1          | +0.103                       |
| 1850                              | 237                 | 1          | 1         | 1         | 0         | 1         | 1         | 0          | 1          | +0.205                       |
| 1800                              | 244                 | 1          | 1         | 1         | 1         | 0         | 1         | 0          | 0          | +0.034                       |
| 1750                              | 251                 | 1          | 1         | 1         | 1         | 1         | 0         | 1          | 1          | +0.023                       |
| 1700                              | 258                 | 0          | 0         | 0         | 0         | 0         | 0         | 0          | 1          | +0.171                       |
| 1650                              | 266                 | 0          | 0         | 0         | 0         | 0         | 1         | 0          | 1          | +0.103                       |
| 1600                              | 274                 | 0          | 0         | 0         | 0         | 1         | 0         | 0          | 1          | +0.217                       |
| 1550                              | 284                 | 0          | 0         | 0         | 0         | 1         | 1         | 1          | 0          | -0.193                       |
| 1500                              | 292                 | 0          | 0         | 0         | 1         | 0         | 0         | 1          | 0          | +0.308                       |
| 1450                              | 304                 | 0          | 0         | 0         | 1         | 1         | 0         | 0          | 0          | -0.329                       |
| 1400                              | 314                 | 0          | 0         | 0         | 1         | 1         | 1         | 0          | 1          | -0.057                       |
| 1350                              | 326                 | 0          | 0         | 1         | 0         | 0         | 0         | 1          | 1          | -0.170                       |
| 1300                              | 338                 | 0          | 0         | 1         | 0         | 1         | 0         | 0          | 1          | -0.011                       |
| 1250                              | 352                 | 0          | 0         | 1         | 1         | 0         | 0         | 0          | 0          | -0.148                       |
| 1200                              | 366                 | 0          | 0         | 1         | 1         | 0         | 1         | 1          | 1          | +0.034                       |
| 1150                              | 382                 | 0          | 0         | 1         | 1         | 1         | 1         | 1          | 1          | +0.011                       |
| 1100                              | 400                 | 0          | 1         | 0         | 0         | 1         | 0         | 0          | 0          | -0.148                       |
| 1050                              | 418                 | 0          | 1         | 0         | 1         | 0         | 0         | 0          | 1          | +0.103                       |
| 1000                              | 440                 | 0          | 1         | 0         | 1         | 1         | 1         | 0          | 0          | -0.148                       |

E-509 frequency programming chart. ON BOARD, 0 = install diode, 1 = no diode. EXT PROGRAMMING, 0 = logic low, 1 = logic high or open circuit. Note: EXT logic must revert to open circuit to use on-board programming. Other frequencies available include 439.35 kHz divided by any whole number from 128 to 255 inclusive and any even whole number from 256 to 510 inclusive.

## Model E-509 Specifications

**Output Impedance:** 60  $\Omega$  unbalanced during PTT output; 100 k $\Omega$  unbalanced when idle

**Output Level:** -25 dBm to +6 dBm, adjustable

**Frequency Accuracy:** 0.015% (PTT/guard, 2175 Hz); 0.35% (monitor and function)

**Operating Temperature Range:** -30°C to +70°C

**Power Requirements:** 10.0-12.5 V<sub>dc</sub> regulated, or 12.5-16.0 V<sub>dc</sub> unregulated at 8 mA idle, 25 mA maximum

**Visual Indicator:** PTT LED

**Factory-Programmed Frequencies:** 2175 Hz PTT, 2050 Hz MON, 1950 Hz and 1850 Hz function

**Control Inputs:** PTT, MON, F1, F2, +2, INH, EXT FREQ, 7-BIT EXT FREQ DATA (F1 is selected if PTT input only)

**Outputs:** Open-collector PTT, 100 mA, maximum; tone, +6 dBm, maximum, into 600-ohm load; open-drain STROBE, 100 mA, maximum

**Factory-Adjusted Tone-Burst Sequence, PTT Input:** 140 ms, 2175 Hz, at 0 dBm output; 40 ms, 1950 Hz at -10 dBm output; -30 dBm, 2175 Hz PTT tone until termination of PTT input

**Factory-Adjusted Tone-Burst Sequence, Function Input:** 140 ms, 2175 Hz, at 0 dBm output; 40 ms, function frequency at -10 dBm output

**Output-Level Change, with Frequency:**  $\pm 0.5$  dB, 875 Hz to 2200 Hz;  $\pm 2$  dB, 875 Hz to 3000 Hz

**Size:** 3.6 in (9.1 cm) W, 4.5 in (11.4 cm) D, 0.7 in (1.8 cm) H

## E-509 Parts List

| Part No. | Description              | Ckt Sym |
|----------|--------------------------|---------|
| 001-1764 | CONN KIT JK-22           |         |
| 011-0007 | TOP ASSY E-509 TONE GEN  |         |
| 065-0353 | PC BD E-509              |         |
| 101-1316 | CAP MICA 30PF 5% 300V    | C17     |
|          |                          | C20     |
| 104-0765 | CAP TANT 3.3UF 16V 10%   | C2      |
| 105-1007 | CAP MYLAR .01MF 20% 100V | C16     |
|          |                          | C18     |
|          |                          | C26     |
|          |                          | C3      |
|          |                          | C4      |
|          |                          | C5      |
|          |                          | C6      |
|          |                          | C7      |
|          |                          | C8      |
| 105-1104 | CAP MYLAR .0068 10%      | C22     |
| 110-1320 | CAP CER .001MF 20% 50V   | C10     |
|          |                          | C11     |
|          |                          | C12     |
|          |                          | C13     |
|          |                          | C14     |
|          |                          | C15     |
|          |                          | C9      |
| 110-1419 | CAP CER 470 PF 10% 50V   | C21     |
| 112-1606 | CAP ELEC 10MF 25V        | C1      |
|          |                          | C19     |
|          |                          | C23     |
|          |                          | C25     |
| 112-1609 | CAP ELEC 100MF 20% 25V   | C24     |
| 130-0532 | RES VAR 10K VER MT LIN   | R1      |
| 130-0629 | RES VAR 10K HOR MT       | R8      |
|          |                          | R9      |
| 130-0632 | RES VAR 1K HOR MT        | R24     |
|          |                          | R25     |
| 134-2855 | RES RN55D 12.4K 1% 1/4W  | R15     |
| 134-2908 | RES RN55D 3.57K 1% 1/4W  | R20     |
| 134-2940 | RES RN55D 10.7K 1% 1/4W  | R18     |
| 134-2954 | RES RN55D 9.53K 1% 1/4W  | R17     |
| 134-2959 | RES RN55D 12.7K 1% 1/4W  | R13     |
| 134-2960 | RES RN55D 38.3K 1% 1/4W  | R16     |
| 136-0019 | RES COMP 82 5% 1/4W      | R19     |
| 136-0032 | RES COMP 1K 5% 1/4W      | R21     |
| 136-0036 | RES COMP 2.2K 5% 1/4W    | R23     |
| 136-0040 | RES COMP 4.7K 5% 1/4W    | R11     |
| 136-0043 | RES COMP 8.2K 5% 1/4W    | R2      |
| 136-0044 | RES COMP 10K 5% 1/4W     | R14     |
|          |                          | R22     |
|          |                          | R3      |
| 136-0056 | RES COMP 100K 5% 1/4W    | R10     |
| 136-0060 | RES COMP 220K 5% 1/4W    | R5      |
|          |                          | R7      |

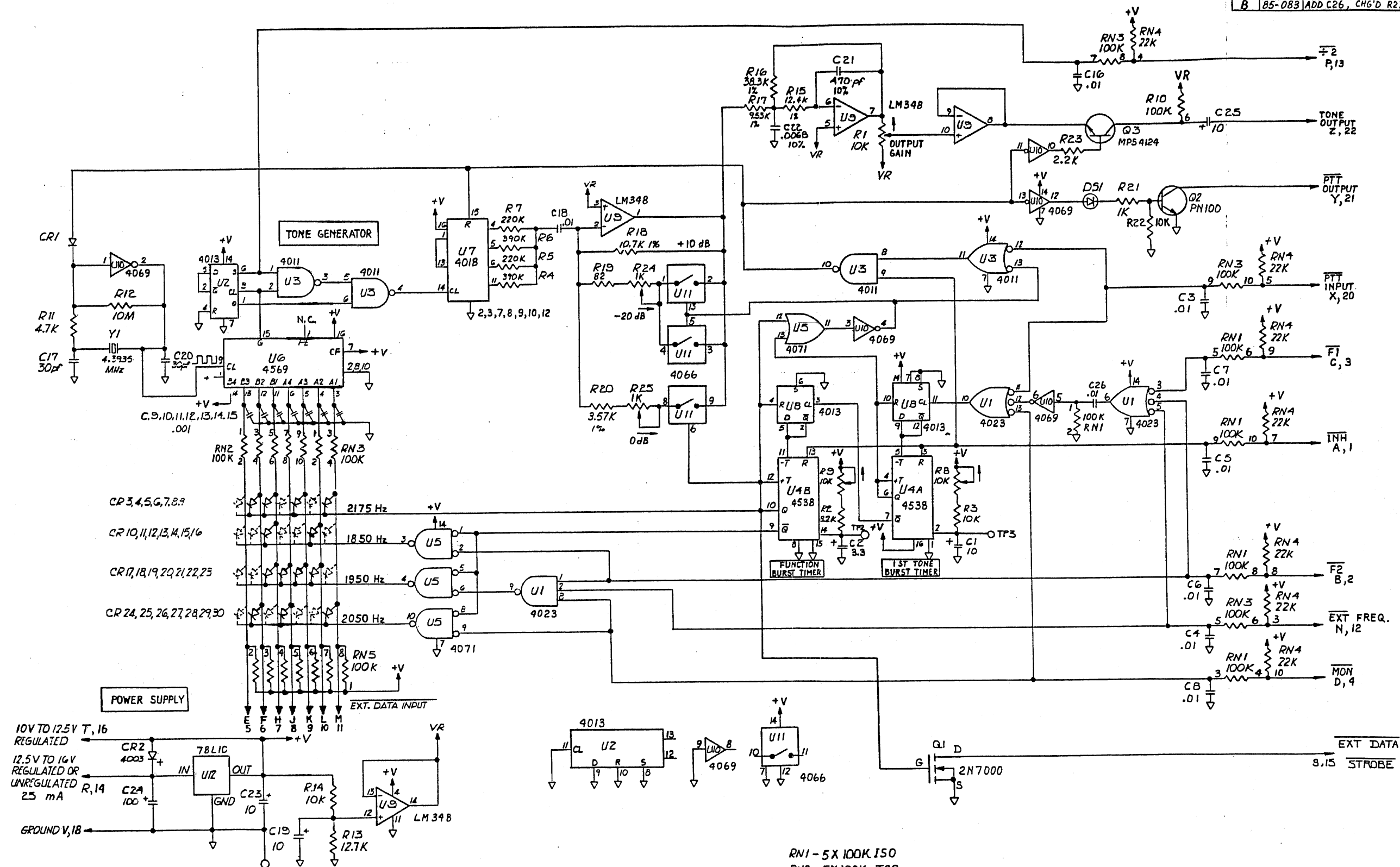
# Sequential Tone Generator

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|                                   |      |                                  |      |
|-----------------------------------|------|----------------------------------|------|
| 136-0063 RES COMP 390K 5% 1/4W    | R4   |                                  | CR27 |
|                                   | R6   |                                  | CR30 |
| 136-0080 RES COMP 10M 5% 1/4W     | R12  |                                  | CR4  |
| 138-0016 RNET ISO 5X100K SIP      | RN1  |                                  | CR5  |
|                                   | RN2  |                                  | CR7  |
|                                   | RN3  |                                  | CR9  |
| 138-0017 RNET CMN 7X100K SIP      | RN5  | 161-0537 DIODE LED               | DS1  |
| 138-0041 RNET CMN 9X22K SIP       | RN4  | 165-1214 XTAL 4.3935 HC-18       | Y1   |
| 140-0001 XSTR NPN MPS4124 TO92 GP | Q3   | 425-0158 IC CMOS 4013 DUAL D FF  | U2   |
| 142-0001 XSTR NPN PN100 TO92 SW   | Q2   |                                  | U8   |
| 144-0001 XSTR NDMOS2N7000 TO92 SW | Q1   | 425-0164 IC CMOS 4011 QUAD 2NAND | U3   |
| 161-0366 DIODE 1N4003             | CR2  | 425-0186 IC CMOS 4018 PROG CNTR  | U7   |
| 161-0426 DIODE 1N4148             | CR1  | 425-0191 IC CMOS 4069 HEX INV    | U10  |
|                                   | CR12 | 425-0193 IC CMOS 4023 TRIP 3NAND | U1   |
|                                   | CR15 | 425-0203 IC CMOS 4569 PROG CNTR  | U6   |
|                                   | CR19 | 425-0210 IC OPAMP LM348 QUAD     | U9   |
|                                   | CR20 | 425-0221 IC CMOS 4071 QUAD 2OR   | U5   |
|                                   | CR21 | 425-0223 IC REG-P 78L10 10V .1A  | U12  |
|                                   | CR22 | 425-0285 IC CMOS 4066 QUAD SW    | U11  |
|                                   | CR25 | 425-0411 IC 4538 DUAL MONO       | U4   |



| REVISIONS |          |                                |         |          |
|-----------|----------|--------------------------------|---------|----------|
| SYM       | CHG. NO. | DESCRIPTION                    | DATE    | APPROVED |
| A         | 05-035   | RELEASE TO PRODUCTION,         | 3/12/85 | CAF      |
| B         | 85-083   | ADD C26, CHG'D R23, Q1, Q2, Q3 | 5/20/87 | CAF      |



NOTES: UNLESS OTHERWISE SPECIFIED  
1. ALL DIODES IN 4013  
2. RESISTOR VALUES ARE IN OHMS  $\pm 5\%$ ,  $1/4W$   
3. CAPACITOR VALUES ARE IN  $\mu F$ ,  $\pm 20\%$   
4. ARROW NEAR CONTROLS INDICATE CLOCKWISE ROTATION.  
5.  $\times$  DENOTES FACTORY-INSTALLED PROGRAMMING DIODES.  
6. PCB P/N : 065-0353  
ASSY P/N : 011-0007

RN1 - 5X 100K ISO  
RN2 - 5X 100K ISO  
RN3 - 5X 100K ISO  
RN4 - 9X 22K CMN  
RN5 - 7X 100K CMN

| LAST DESIGNATOR USED |  | ITEM | QTY | PART NUMBER | DESCRIPTION | MATERIAL |
|----------------------|--|------|-----|-------------|-------------|----------|
| R 25                 |  |      |     |             |             |          |
| RN 5                 |  |      |     |             |             |          |
| C 26                 |  |      |     |             |             |          |
| CR 29                |  |      |     |             |             |          |
| U 12                 |  |      |     |             |             |          |
| Q 3                  |  |      |     |             |             |          |
| Y 1                  |  |      |     |             |             |          |
| DS 1                 |  |      |     |             |             |          |

|                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                            |                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| UNLESS OTHERWISE SPECIFIED:<br>REMOVE ALL BURNS, BREAK<br>SHARP EDGES<br>DIMENSIONS TO BE SET<br>AFTER PLATING<br>DIMENSIONS ARE IN INCHES<br>TOLERANCES ON<br>DECIMALS<br>ANGLES<br>DO NOT SCALE THIS DRAWING | DRAWN<br>SCOTT SLATER<br>CHECK<br>C. N. 12-25-84<br>ENGR<br>J. Brand 12-24-84<br>APP<br>J. Brand 12-24-84<br>FIRST USED ON<br>MODEL<br>E-509<br>NEXT ARMY<br>011-0007<br>NO INFORMATION GIVEN HEREIN<br>MAY BE DISCLOSED TO OTHERS<br>WITHOUT WRITTEN PERMISSION<br>FROM CETEC CORPORATION | Cetec Vega<br>SCHEMATIC<br>PROGRAMMABLE<br>TONE GENERATOR<br>D 071-0460<br>SCALE NONE<br>SHEET 1 OF 1 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|