

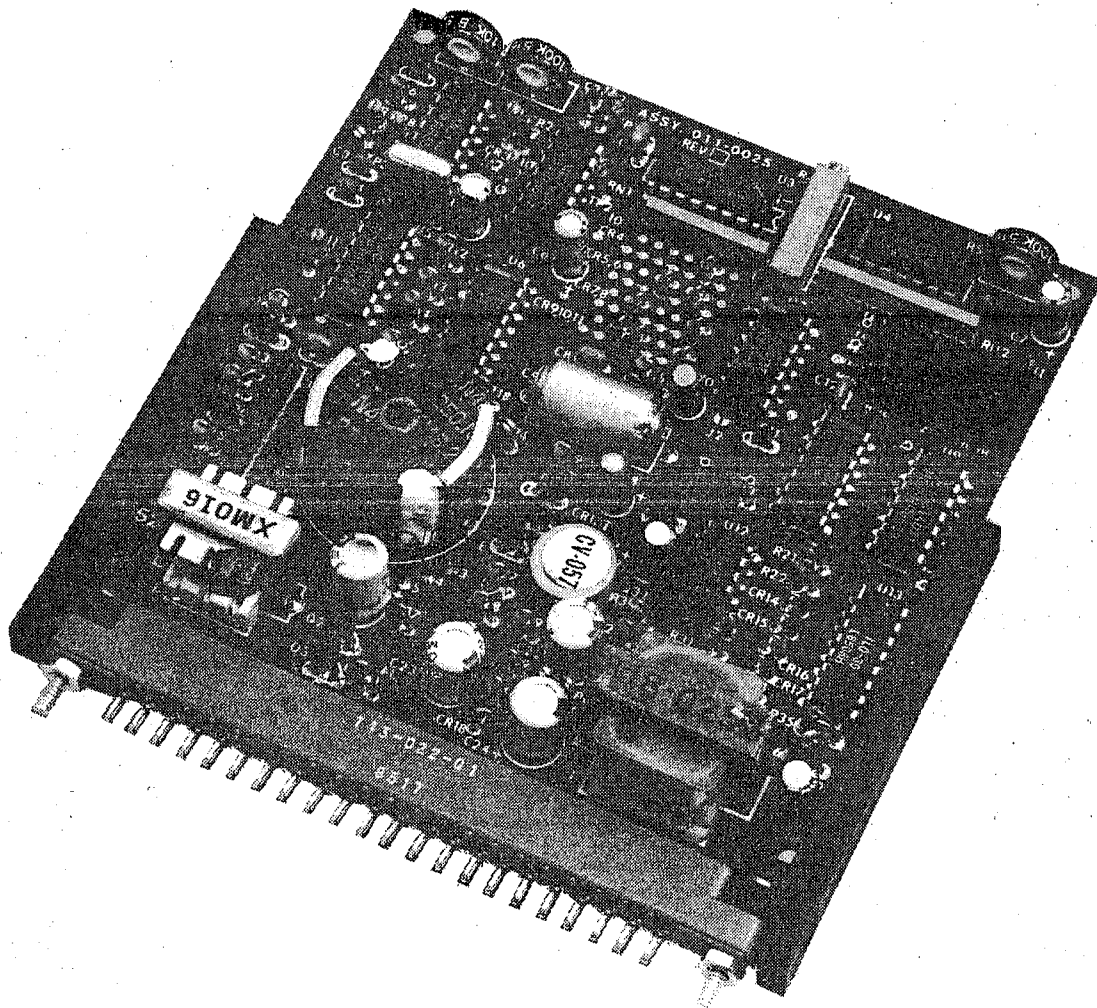
**Vega**  
a MARK IV company

## Instruction Manual

098-0296

# Model DTC-520

## DC-to-Tone Converter Card



**Vega**  
a MARK IV company  
9900 Baldwin Place  
El Monte, California 91731-2204  
Telephone: (818) 442-0782  
Toll-free: 800-877-1771  
FAX: (818) 444-1342

## Model DTC-520

### GENERAL

The Cetec Vega Model DTC-520 DC-to-tone converter card is designed to convert existing DC control systems to the industry-standard sequential tone-remote-control format used in Motorola, GE, and other systems, and as generated by the Model C-510B tone-remote control console. The DTC-520 allows existing DC control systems to use voice-grade links such as leased telephone lines, radio, and microwave.

Sensors are provided to detect the presence of positive and negative 2.5-mA, 6-mA, and 15-mA currents and zero current. Upon detection of a current change from one state to another, a sequential guard-tone-format tone burst is generated. If one of the push-to-talk currents has been detected, a -20 or -30 dB continuous 2175-Hz tone is also generated as the third tone in the sequence. This tone appears only on the outgoing line.

Jumper-plug programming allows any two of three currents of either polarity and zero current to be selected for up to five control functions (TX-F1, TX-F2, RX-F1, RX-F2, and MON). Diode-matrix frequency programming allows nonstandard frequencies to be derived from the crystal oscillator.

Standard factory programming is +6 mA for TX-F1, +15 mA for TX-F2, -6 mA for RX-F1, -15 mA for RX-F2, and zero current for MON.

### INSTALLATION AND SETUP

The DTC-520 is shipped with a 22-pin connector and card guides for installation in panels such as the Series 211 and Models P-217 and P-218.

In a typical DTC-520 installation, the DC line resistance is much less than with the original DC line. Before connecting the DC line to the DTC-520, terminate the DC line with a 2.7-k $\Omega$ , 2-W resistor, and readjust the control currents to the original level. Alternatively, set the control-current adjustment to minimum, connect the DC line to the DTC-520, and then adjust the DC current up to the desired 2.5 mA, 6 mA, or 15 mA. These procedures insure that the 20-mA maximum current rating of the DTC-520 is not exceeded.

Referring to the DTC-520 silkscreen and the Figure 2 schematic, connect the DC line so that terminal Y,21 is positive in respect to W,19 when a positive current is being generated. Program the DTC-520 with the jumper plugs for current and polarity versus desired function. Only one jumper plug (one current) can be used per function. If one or more of the functions are not to be used, the unused jumper plugs may be hung on the last inside pin to prevent loss. If the DTC-520 is to be used for PTT (TX) only, solder bridge J2 to disable the function tone.

Connect the 600- $\Omega$  leased line and an AC meter to A,1 and C,3. Clip lead TP1 to TP5 to enable the high-level 2175-Hz tone and adjust R1 for the desired line level which is usually 0 dBm (775 mV<sub>rms</sub> or 2.2 V<sub>p-p</sub> on the 600- $\Omega$  line). The function-tone level is automatically 10 dB below the high-level 2175-Hz tone, and the low-

level 2175-Hz (PTT) tone is automatically 20 dB below the function tone.

Cetec Vega's Series 221 and other tone-remote equipment are designed for a -20 dB PTT tone (20 dB below the reference 0-dB function tone), but certain Motorola equipment is designed to receive a -30 dB PTT tone. If -30 dB equipment is to be used, open J3.

### THEORY OF OPERATION WITH FACTORY PROGRAMMING

Referring to the Figure 2 schematic, a direct current from the DC control line flows through the split primary of T3, through part of the optocoupler U13, through the diode bridge, and through R34 which develops a voltage proportional to the DC control line current. Polarity of the current is detected by line current flow through the U13 LEDs, which, when positive, causes U13-14 to go low. The diode bridge maintains a positive polarity at U12-2,6, regardless of incoming polarity.

The DC voltage across R34 is compared by U12 to reference voltages generated by the isolated power supply. Line current above 4.5 mA causes U12-7 and U13-11 to go low. Line current above 9 mA causes U12-1 and U13-10 also to go low. If U13-11 is high (current less than 4.5 mA), this is sensed as zero current.

U8 and U9 decode the three optocoupler outputs and generate a low at only one of the five programming rows. A positive 6-mA line current causes the POS LOW CURRENT row to go low. Since POS LOW CURRENT is connected to TX-F1 through a jumper plug, U4-10 and U4-4 go low.

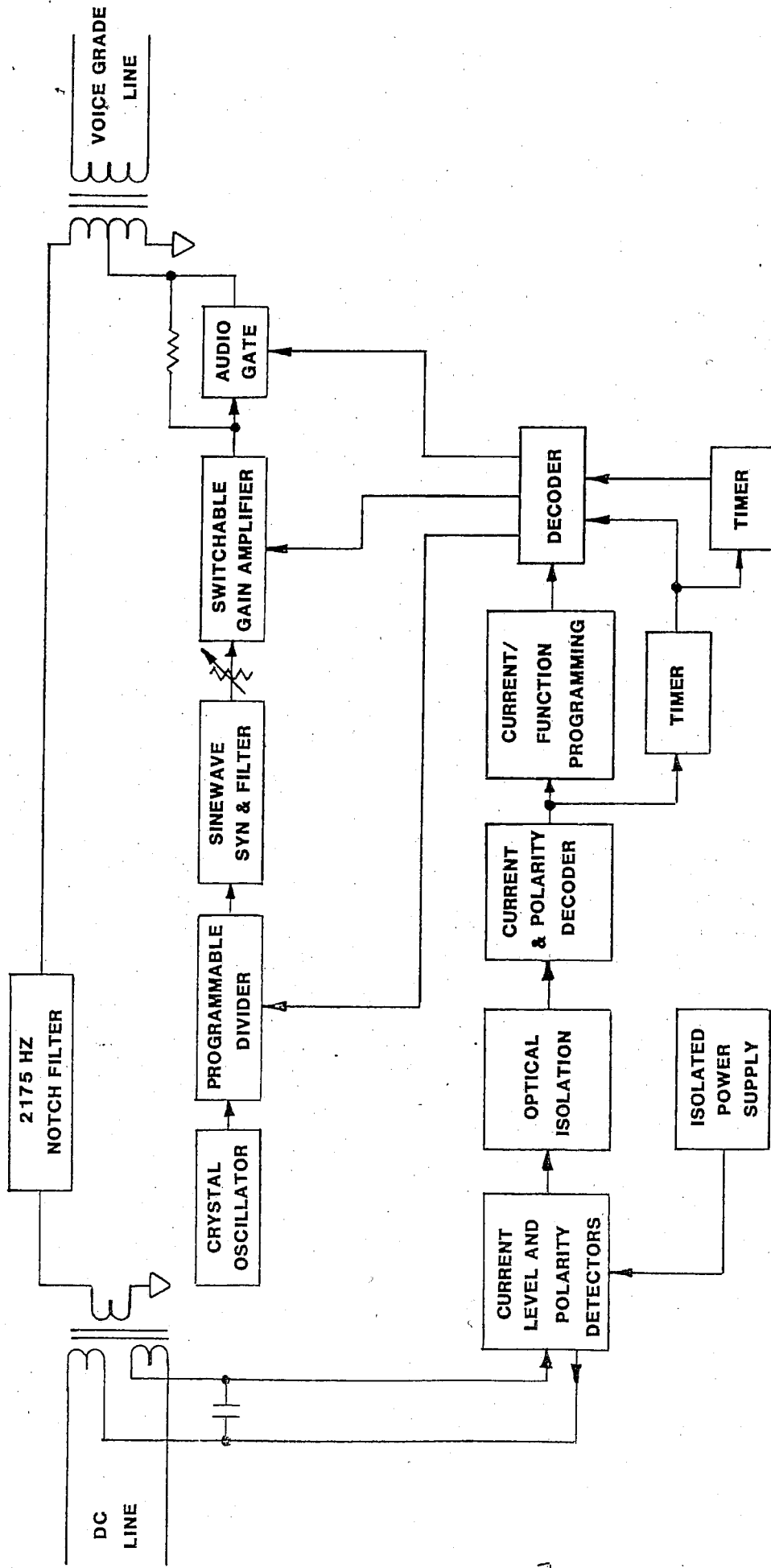
The low at U4-10 enables the tone-generator section, consisting of crystal oscillator U1-6, programmable divider U3, sinewave synthesizer U6, and filter U10-7. Latch U1-10/U7-11 is set by any row-logic change of state. This set latch triggers the burst timers after a short delay. U2-4 goes high for 130 ms and switches the output to the "+10 dB" guard-tone level. The PTT row of the frequency-programming diode matrix is high at idle and remains high during guard-tone-timer output. Tone output from T2 is therefore 2175 Hz at a "+10 dB" level.

Upon timeout of the 130-ms timer, the 40-ms function timer is triggered; which disables the PTT diode-matrix programming row and activates the 1950-Hz F1 row. The 40-ms function timer also switches tone level to "0 dB". Tone output from T2 is therefore 1950 Hz at a "0 dB" level.

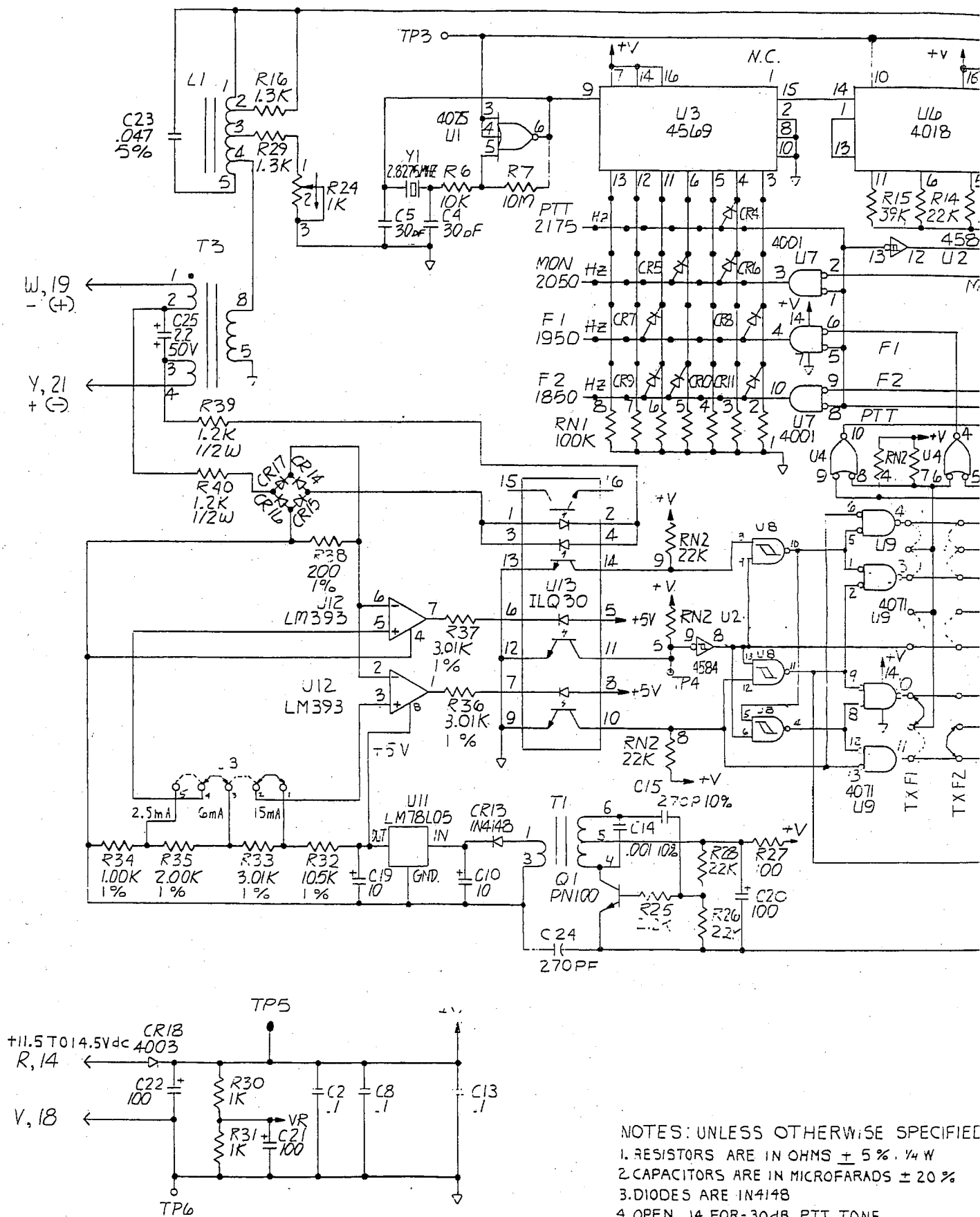
Upon timeout of the 40-ms timer, the 2175-Hz PTT diode-matrix programming row is reenabled and the tone level is switched to "-20 dB" by Q2 and Q3. The "-20 dB" 2175-Hz tone continues for as long as the incoming control current remains unchanged.

In systems with multiple DC control stations or with monitor speakers, the continuous low-level 2175-Hz tone would be annoying. Therefore, a notch filter has been provided to attenuate the -20 dB PTT tone by 45 dB or more towards the DC-control stations.

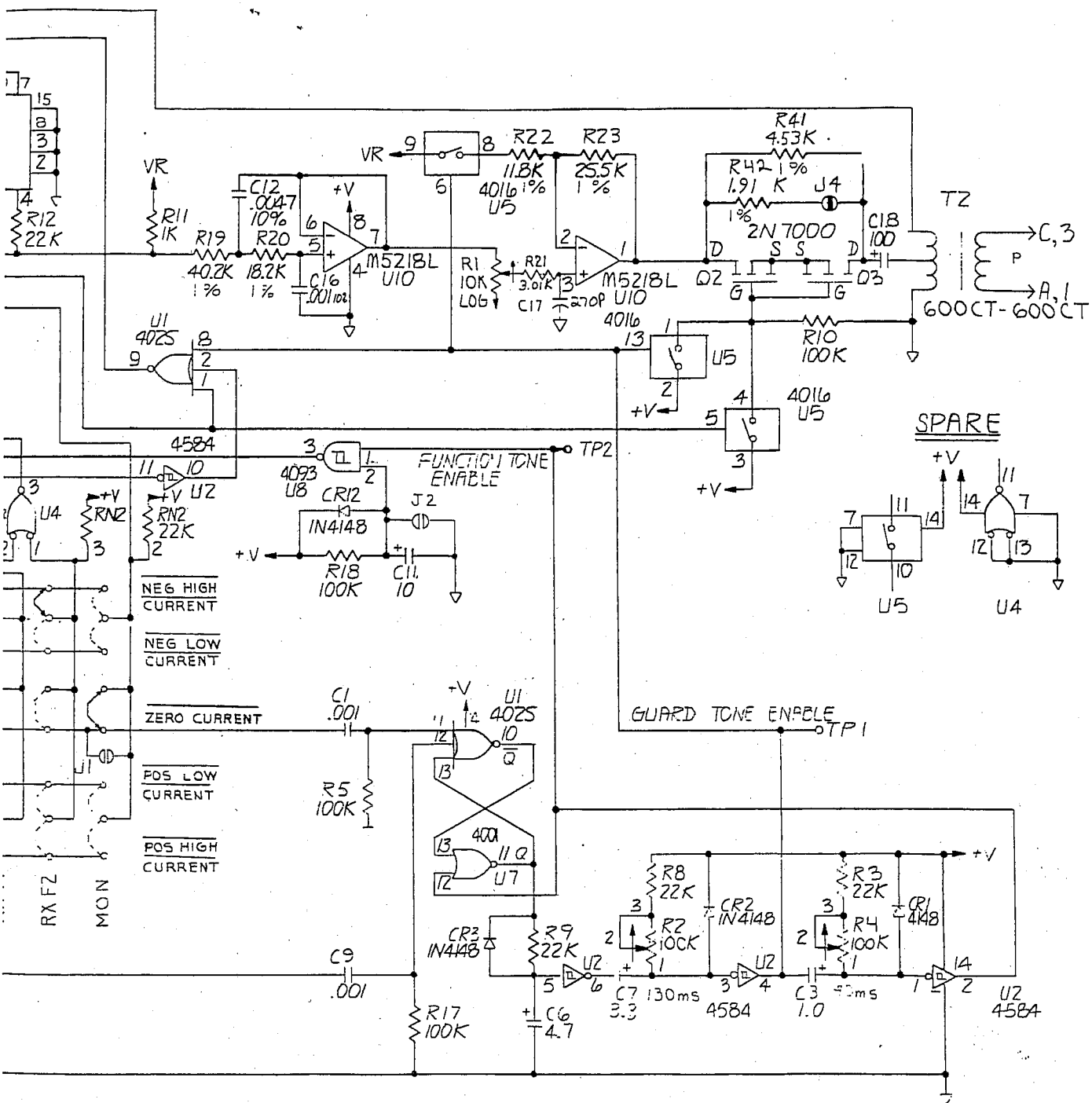
FIGURE 1

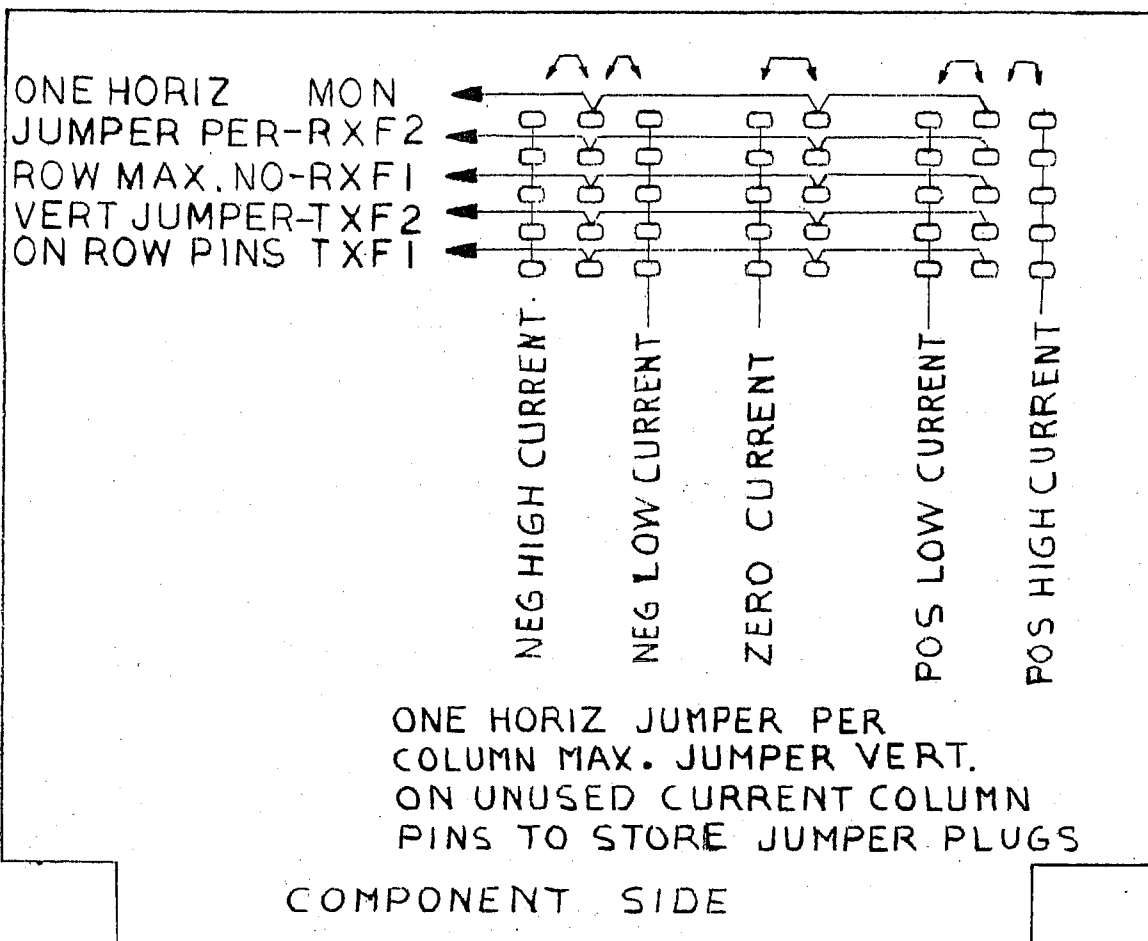


DTC-520 BLOCK DIAGRAM



- NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE IN OHMS  $\pm 5\%$ ,  $\frac{1}{4}$  W
  2. CAPACITORS ARE IN MICROFARADS  $\pm 20\%$
  3. DIODES ARE IN4148
  4. OPEN J4 FOR -30dB PTT TONE
  5. CLOSE J2 TO DEFEAT FUNCTION TONE





DTC-520 PROGRAMMING  
MATRIX

TX-F2 operates in the same manner as FX-F1, except that a 15-mA control current enables the F2 1850-Hz diode-matrix programming row during the function-tone burst. Detection of a non-TX current (including zero) will trigger the same sequence of operation as a TX current, except for the continuous "-20 dB" 2175-Hz PTT tone which is not present, and the function tone may be of a different frequency.

The isolated power for U12 and the reference voltages are derived from a 70-kHz oscillator consisting of Q1 and the primary of T1. Output from the secondary is rectified by CR13 and regulated by U11.

## SPECIFICATIONS

**Supply Voltage:** 1.5 V<sub>dc</sub> to 14.5 V<sub>dc</sub>, semiregulated  
**Supply Current:** 20 mA idle, 50 mA maximum, at 12 V<sub>dc</sub> supply  
**Control Current Limits:** "zero current" = 0-1.5 mA; "2.5 mA" = 1.5-4.5 mA; "6 mA" = 4.5-9.0 mA; "15 mA" = 9-18 mA; all "currents"  $\pm 5\%$   
**Maximum Applied DC Control Current:** 20 mA, either polarity  
**DC Input Resistance:** 2.8 k $\Omega$  at 15 mA, 3.0 k $\Omega$  at 6 mA, 3.65 k $\Omega$  at 2.5 mA  $\pm 5\%$  over temperature range  
**DC Detector Isolation:** 10 M $\Omega$  at 250 V<sub>dc</sub>  
**Input and Output Impedance:** 600  $\Omega$  nominal  
**Audio Insertion Loss:** 4 dB maximum  
**Frequency Response:**  $\pm 1$  dB, 300 to 3500 Hz  
**Notch-Filter Rejection Ratio:** 45 dB minimum with 500 to 800  $\Omega$  source and load impedances  
**Burst-Tone Output Level:** +10 dBm maximum into 600- $\Omega$  line, 30-dB adjustment range  
**Burst-Tone Frequencies and Tolerances:** 2175 Hz  $\pm 0.05\%$ ; 2050 Hz  $\pm 0.25\%$ ; 1950 Hz  $\pm 0.25\%$ ; 1850 Hz  $\pm 0.25\%$   
**Tone Duration and Accuracy:** 130 ms  $\pm 5\%$ , 2175-Hz guard tone; 40 ms  $\pm 5\%$ , function tones  
**Temperature Range:** -20 to +55°C  
**Size:** 4.5 in (11.4 cm) W, 4.7 in (11.9 cm) D, 0.9 in (2.3 cm) H

## 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.

## TECHNICAL ASSISTANCE

Cetec 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.

## DTC-520 Parts List

Part No.	Description	Ckt Sym
010-0555	DTC-520 DC-to-tone converter card	---
011-0025	DTC-520 PCB assembly	---
001-1797	Potcore, type 215 (L1)	L1
065-0378	PCB for DTC-520	---
102-0160	30 pF ceramic cap., S2L, 5%, 50 V	C4
102-0390	270 pF ceramic cap., S2L, 5%, 50 V	C15 C17 C24
105-0119	0.047 $\mu$ F PS cap., 5%, 100 V	C23
105-1001	0.001 $\mu$ F mylar cap., 10%, 100 V	C1 C9 C14 C16 C12
105-1102	0.0047 $\mu$ F mylar cap., 10%, 100 V	C12
110-1340	0.1 $\mu$ F cer. cap., small	C2 C8 C13
112-1606	10 $\mu$ F elec. cap., 25 V	C10 C11 C19
112-1608	1.0 $\mu$ F elec. cap., 20%, 25 V	C3
112-1609	100 $\mu$ F elec. cap., 20%, 25 V	C18 C20 C21 C22
112-1663	4.7 $\mu$ F elec. cap., rad., 10%	C6
112-1670	3.3 $\mu$ F elec. cap., rad., 10%, 50 V	C7
112-1681	2.2 $\mu$ F elec. cap., NP, 50 V	C25
130-0526	100 k $\Omega$ var. res., ver. mt., lin.	R2 R4
130-0633	1 k $\Omega$ var. res., hor. mt.	R24
130-0725	10 k $\Omega$ var. res., log, PC, hadj.	R1
134-0233	1.30 k $\Omega$ RN55D res., 1%, 1/4 W	R16 R29
134-2875	18.2 k $\Omega$ RN55D res., 1%, 1/4 W	R20
134-2894	3.01 k $\Omega$ RN55D res., 1%, 1/4 W	R21 R33 R36 R37

## Model DTC-520

134-2897	40.2 kΩ RN55D res., 1%, 1/4 W	R19		CR7	
134-2903	1.00 kΩ RN55D res., 1%, 1/4 W	R11		CR8	
		R30		CR9	
		R31		CR10	
		R34		CR11	
134-2987	11.8 kΩ RN55D res., 1%, 1/4 W	R22		CR12	
134-2988	25.5 kΩ RN55D res., 1%, 1/4 W	R23		CR13	
134-2991	10.5 kΩ RN55D res., 1%, 1/4 W	R32		CR14	
134-2992	2.00 kΩ RN55D res., 1%, 1/4 W	R35		CR15	
134-2993	200 Ω RN55D res., 1%, 1/4 W	R38		CR16	
134-2994	4.53 kΩ RN55D res., 1%, 1/4 W	R41		CR17	
134-2995	1.91 kΩ RN55D res., 1%, 1/4 W	R42			
136-0020	100 Ω comp. res., 5%, 1/4 W	R27	165-1216	2.8275 MHz xtal, HC-18	Y1
136-0036	2.2 kΩ comp. res., 5%, 1/4 W	R25	286-1766	Jumper-plug connector	P1
		R26			P2
136-0044	10 kΩ comp. res., 5%, 1/4 W	R6			P3
136-0048	22 kΩ comp. res., 5%, 1/4 W	R3			P4
		R8			P5
		R9			P6
		R12			P7
		R14	286-1768	Test-point pin	TP1
		R28			TP2
136-0051	39 kΩ comp. res, 5%, 1/4 W	R13			TP3
		R15			TP4
136-0056	100 kΩ comp. res., 5%, 1/4 W	R5			TP5
		R10			TP6
		R17	286-1772	36-pin connector, strip tin	----
		R18			
136-0080	10 MΩ comp. res., 5%, 1/4 W	R7	318-0256	600 Ω-split-600 Ω xfmr	T3
136-0150	1.2 kΩ comp. res., 5%, 1/2 W	R39	318-0259	600 Ω/CT-600 Ω/CT xfmr	T2
		R40			
			326-0490	DC-DC power xfmr	T1
138-0015	9X22 kΩ SIP RNET, CMN	RN2	425-0104	4016 quad SW CMOS IC	U5
138-0017	7X100 kΩ SIP RNET, CMN	RN1	425-0157	4001 quad 2NOR CMOS IC	U7
142-0001	PN100 NPN xstr, TO92, SW	Q1	425-0166	78L05 REG-P IC, 5 V, 0.1 A	U11
			425-0171	4081 quad 2AND CMOS IC	U4
144-0001	2N7000 NDMOS xstr, TO92, SW	Q2	425-0186	4018 prog. cntr CMOS IC	U6
		Q3	425-0203	4569 prog. cntr CMOS IC	U3
			425-0204	4025 trip. 3NOR CMOS IC	U1
161-0366	1N4003 diode	CR18	425-0206	4584 hex trig. CMOS IC	U2
161-0426	1N4148 diode	CR1	425-0221	4071 quad 2OR CMOS IC	U9
		CR2	425-0231	LM393 dual comp. opamp IC	U12
		CR3	425-0255	4093 quad trig. CMOS IC	U8
		CR4	425-0420	quad ILQ-30 opto cplr	U13
		CR5	425-0425	M5218L dual SIP opamp IC	U10
		CR6			

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Printed in USA  
October 1987