Vega
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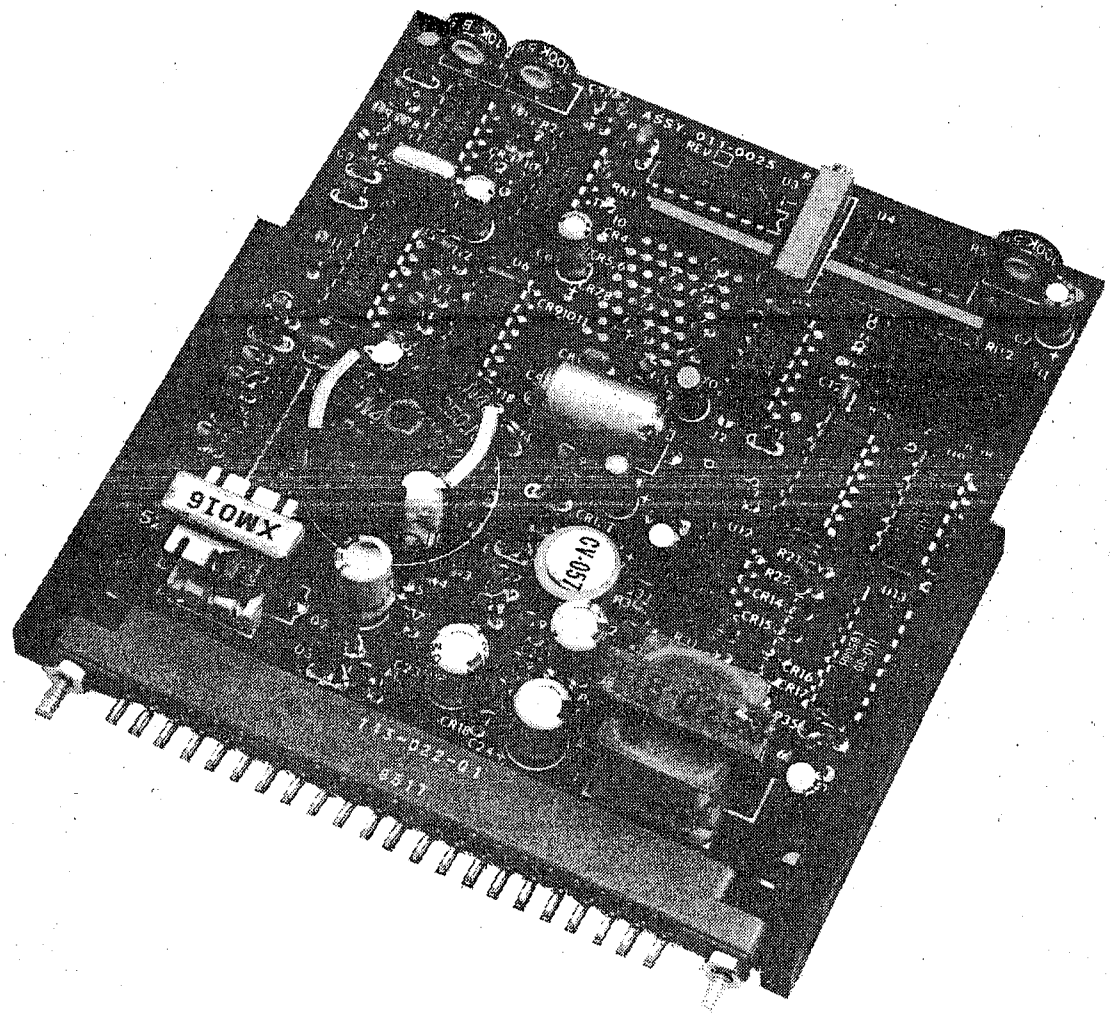
Instruction Manual

098-0296

Model DTC-520

DC-to-Tone Converter Card



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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-kΩ, 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-Ω 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_{rms} or 2.2 V_{p-p} on the 600-Ω 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.

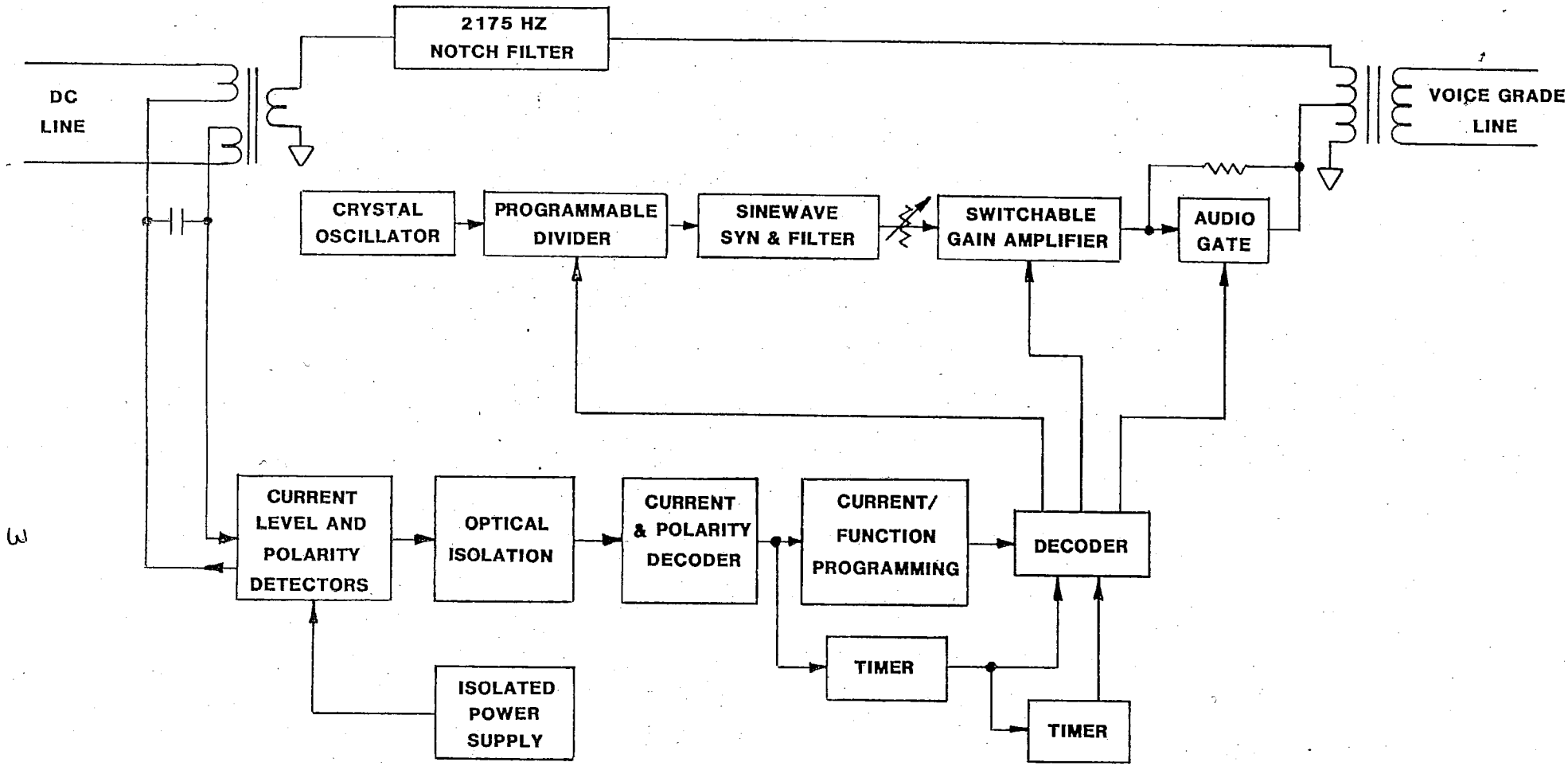
The low at U4-10 enables the tone-generator section, consisting of crystal oscillator U1-6, programmable divider U3, sinewave synthesizer U6, and filter U10-7. Latch U1-10/U7-11 is set by any row-logic change of state. This set latch triggers the burst timers after a short delay. U2-4 goes high for 130 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.

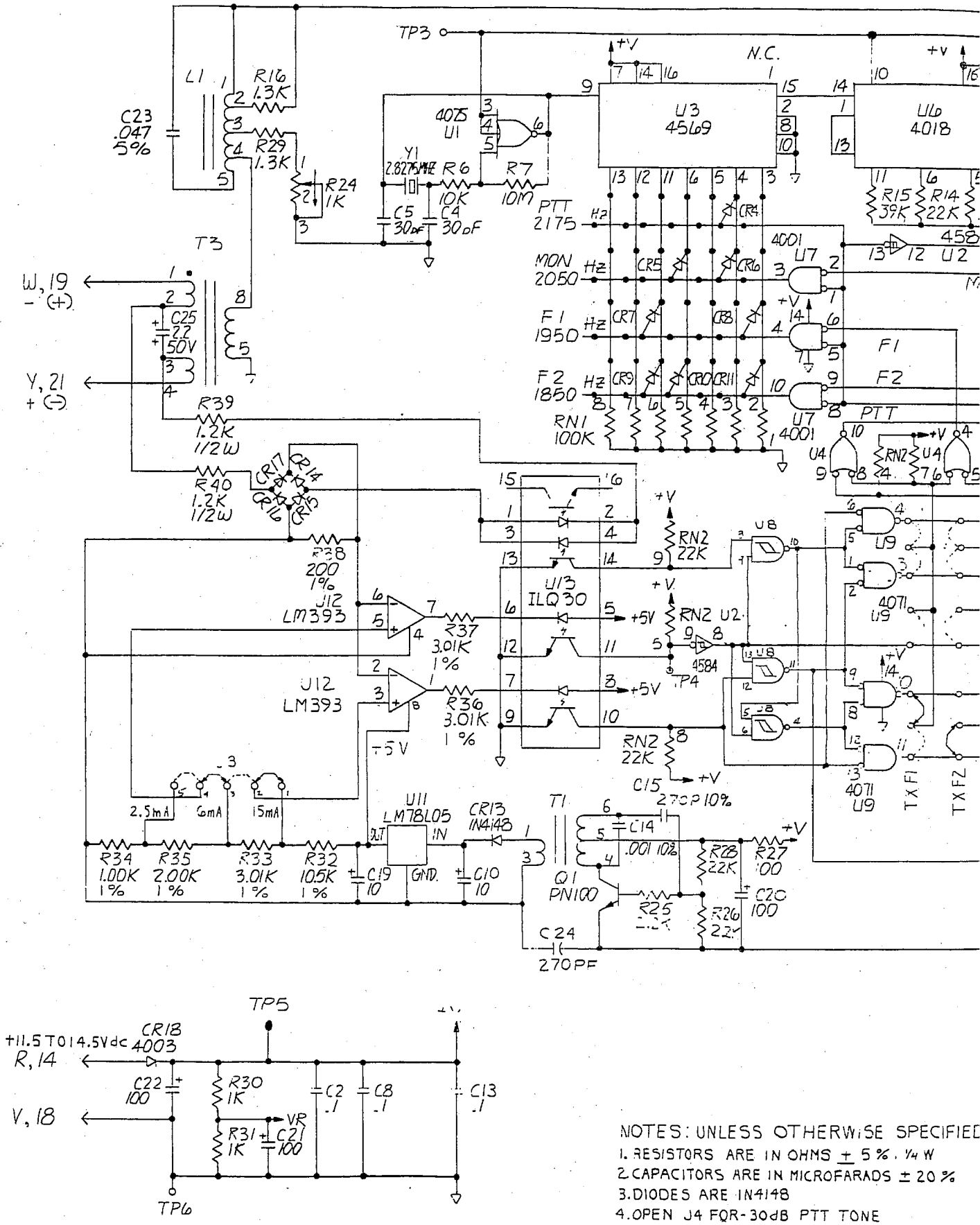
Upon timeout of the 40-ms timer, the 2175-Hz PTT diode-matrix programming row is reenabled and the tone level is switched to "–20 dB" by Q2 and Q3. The "–20 dB" 2175-Hz tone continues for as long as the incoming control current remains unchanged.

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

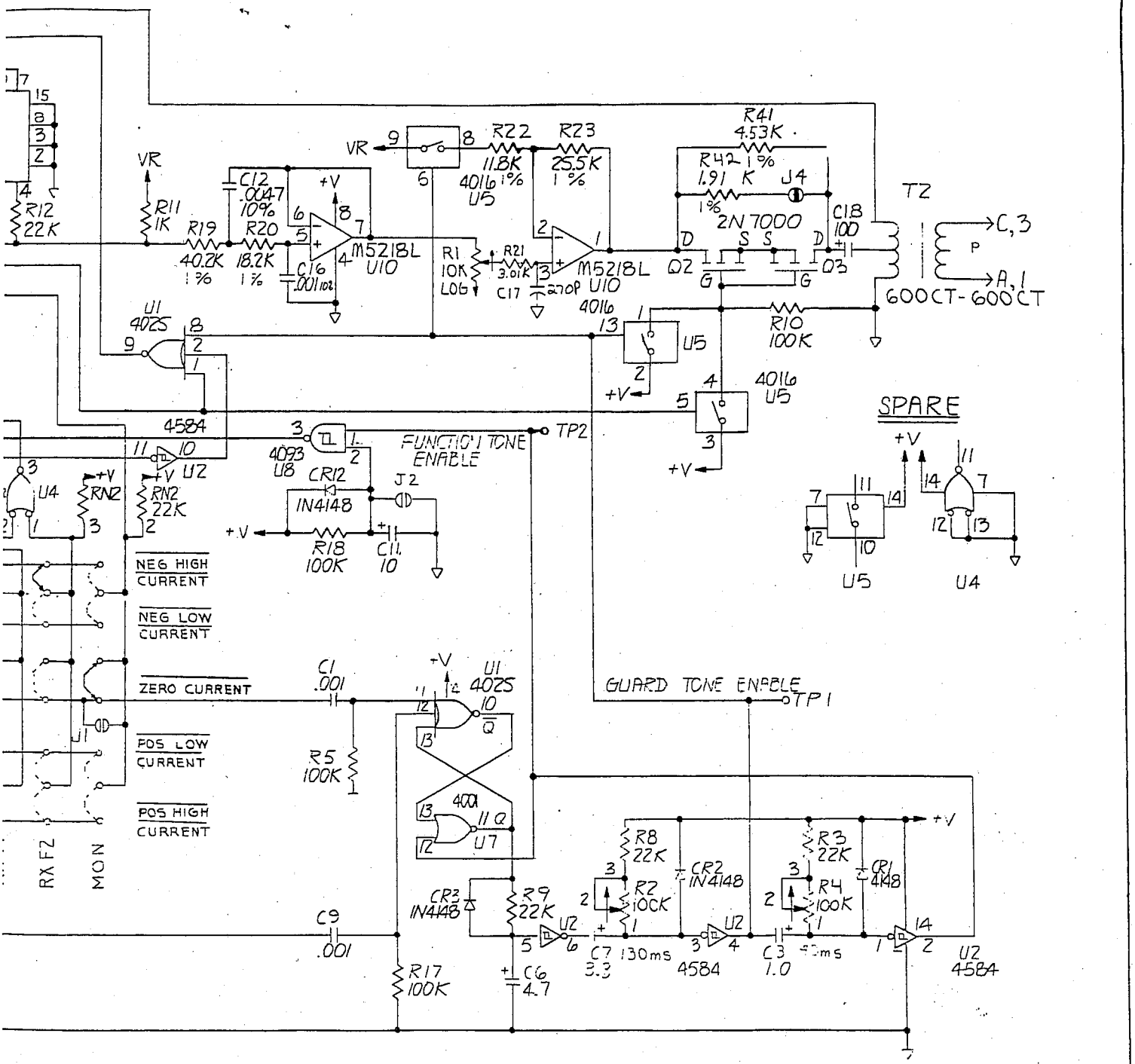


DTC-520 BLOCK DIAGRAM



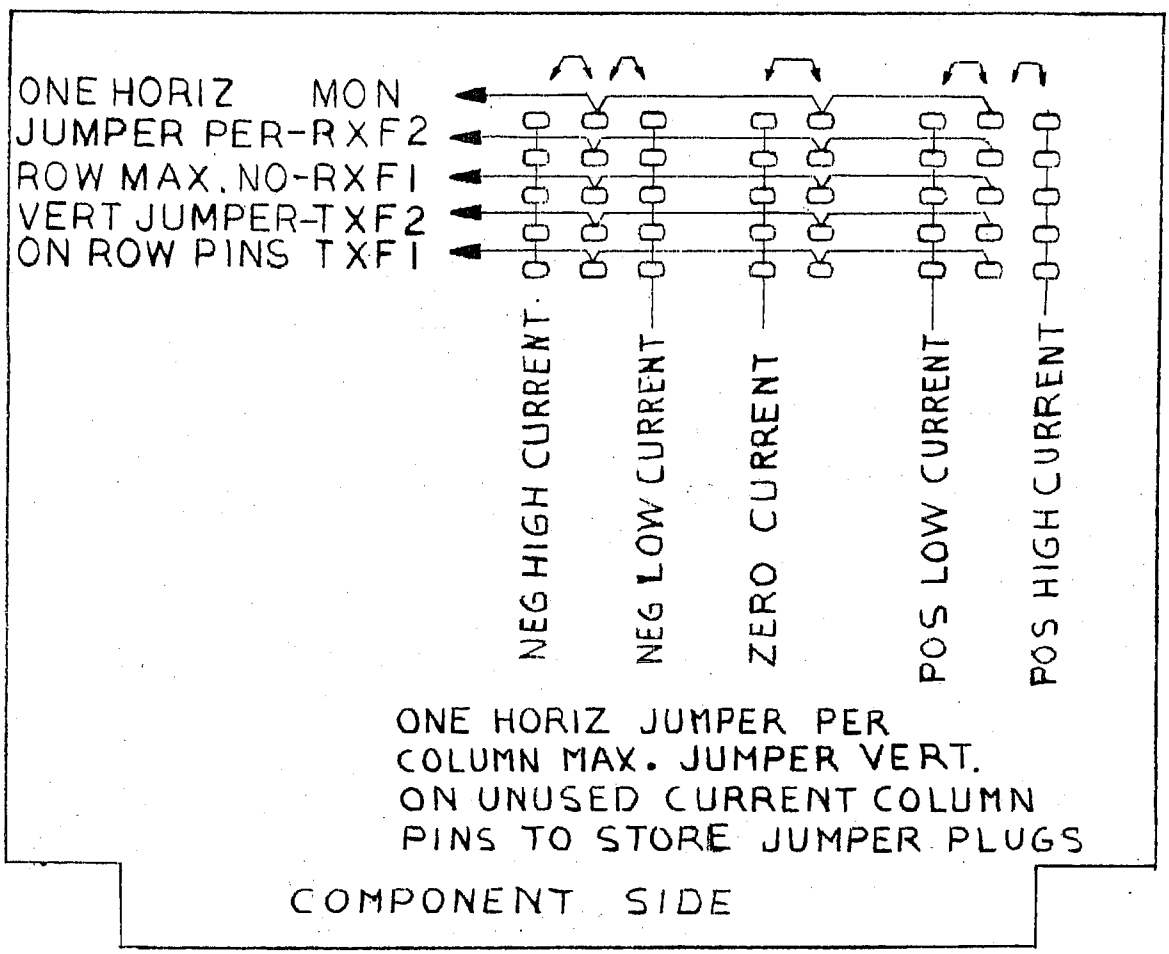
NOTES: UNLESS OTHERWISE SPECIFIED

1. RESISTORS ARE IN OHMS ± 5%, ¼ W
2. CAPACITORS ARE IN MICROFARADS ± 20%
3. DIODES ARE 1N4148
4. OPEN J4 FOR -30dB PTT TONE
5. CLOSE J2 TO DEFEAT FUNCTION TONE



Cetec Vega

DC TO TONE CONVERTER



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_{dc} to 14.5 V_{dc}, semiregulated

Supply Current: 20 mA idle, 50 mA maximum, at 12-V_{dc} 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" ± 5%

Maximum Applied DC Control Current: 20 mA, either polarity

DC Input Resistance: 2.8 kΩ at 15 mA, 3.0 kΩ at 6 mA, 3.65 kΩ at 2.5 mA ± 5% over temperature range

DC Detector Isolation: 10 MΩ at 250 V_{dc}

Input and Output Impedance: 600 Ω nominal

Audio Insertion Loss: 4 dB maximum

Frequency Response: ±1 dB, 300 to 3500 Hz

Notch-Filter Rejection Ratio: 45 dB minimum with 500 to 800 Ω source and load impedances

Burst-Tone Output Level: +10 dBm maximum into 600-Ω line, 30-dB adjustment range

Burst-Tone Frequencies and Tolerances: 2175 Hz ± 0.05%; 2050 Hz ± 0.25%; 1950 Hz ± 0.25%; 1850 Hz ± 0.25%

Tone Duration and Accuracy: 130 ms ± 5%, 2175-Hz guard tone; 40 ms ± 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 µF PS cap., 5%, 100 V	C23
105-1001	0.001 µF mylar cap., 10%, 100 V	C1
		C9
		C14
		C16
105-1102	0.0047 µF mylar cap., 10%, 100 V	C12
110-1340	0.1 µF cer. cap., small	C2
		C8
		C13
112-1606	10 µF elec. cap., 25 V	C10
		C11
		C19
112-1608	1.0 µF elec. cap., 20%, 25 V	C3
112-1609	100 µF elec. cap., 20%, 25 V	C18
		C20
		C21
		C22
112-1663	4.7 µF elec. cap., rad., 10%	C6
112-1670	3.3 µF elec. cap., rad., 10%, 50 V	C7
112-1681	2.2 µF elec. cap., NP, 50 V	C25
130-0526	100 kΩ var. res., ver. mt., lin.	R2
		R4
130-0633	1 kΩ var. res., hor. mt.	R24
130-0725	10 kΩ var. res., log, PC, hadj.	R1
134-0233	1.30 kΩ RN55D res., 1%, 1/4 W	R16
		R29
134-2875	18.2 kΩ RN55D res., 1%, 1/4 W	R20
134-2894	3.01 kΩ RN55D res., 1%, 1/4 W	R21
		R33
		R36
		R37

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

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