



**TELEX**® Signaling Product Company

# **Models C-510C and C-504C Tone-Remote Control Consoles Instruction Manual**



NUMBER OF CONSOLES	TWO-WIRE LINE				FOUR-WIRE LINE (CLOSE J17)				
	J22	R63	RX LOSS	TX LOSS	J22	R63	R62	RX LOSS	TX LOSS
1	CLOSED	820	0 dB	0 dB	CLOSED	820	680	0 dB	0 dB
2	CLOSED	1.5 k	0 dB	0 dB	CLOSED	1.3 k	680	↑	↑
3	OPEN	X	0 dB	0 dB	CLOSED	2.7 k	750	↑	↓
4	↑	X	1 dB	1 dB	OPEN	X	820	↓	0 dB
5	↓	X	2 dB	2 dB	↑	X	1 k	↓	1.0 dB
6	OPEN	X	3 dB	3 dB	↓	X	1.1 k	↓	1.9 dB
7					↓	X	1.2 k	↓	2.7 dB
8					OPEN	X	1.5 k	0 dB	3.4 dB

Chart 1. Programming for line-terminating mode.

## TYPICAL APPLICATIONS

The C-510C or C-504C console can be used as a single unit or in parallel with other consoles on the same network, to control a remote base station (as shown in Figure 1). Referring to Figure 1, two consoles are tied to a single leased telephone line feeding a Vega tone-remote control panel at the base station. Either console can exercise full control over the remote base station by use of the push buttons and the handset. With the C-510C, a sequence of tones is generated each time the PTT switch on the handset is pushed, insuring security and constant status updating of the remote base station. (Only the PTT tone is generated when the C-504C PTT switch is pushed.)

All base-station activity, whether from a radio or from a parallel console, can be monitored over either the speaker or the handset. Thus, it is unlikely that one console operator would inadvertently interfere with any other console operator. One console operator can talk with another console operator, without keying the remote base transmitter, simply while pushing the INTERCOM switch on the front panel.

The interconnections shown in Figure 1 are typical. Additional consoles may be connected to the common leased telephone line to control the remote base station.

## INSTALLATION

The C-510C or C-504C tone-remote console may be installed in any location convenient to the operator. Exposure to extreme dampness, temperature, and radio-frequency energy should be avoided for maximum life and reliability.

If the console is to be used in the factory-prepared, single-console, two-wire-line, line-terminating, simplex mode of operation, the only installation required is to plug the wall power supply into a wall socket and connect the modular line plug to the modular jack of a leased line or audio pair.

For multiple consoles, four-wire line, line bridging, or duplex operation, refer to DISASSEMBLY instructions, to Chart 1 or Chart 2, and to the schematic.

NOTE: The console units are not designed to operate on lines carrying direct current. If direct current is on the line, isolate with external capacitors or with a 600-600-ohm transformer designed for the current involved.

NUMBER OF CONSOLES	TWO-WIRE LINE J22 OPEN		FOUR-WIRE LINE J17, J22 OPEN	
	RX LOSS	TX LOSS	RX LOSS	TX LOSS
1	1.2 dB	0.3 dB	0.3 dB	0.0 dB
2	2.3 dB	1.4 dB	0.6 dB	0.9 dB
3	3.3 dB	2.3 dB	0.9 dB	1.6 dB
4	4.2 dB	3.2 dB	1.2 dB	2.4 dB
5			1.5 dB	3.0 dB
6			1.8 dB	3.6 dB
7			2.0 dB	4.2 dB
8			2.3 dB	4.8 dB

Chart 2. Programming for line-bridging mode.

## DISASSEMBLY AND SETUP

Access to internal jumpers and controls is obtained by loosening two large screws on the bottom of the console and "folding" the case forward. This procedure opens up the entire unit for setup or maintenance. Make sure that the wall power supply is unplugged before opening the console, to prevent accidental short circuits during assembly and disassembly.

### Two-Wire-Line Operation

J18 and J20 are closed, and J19 and J21 are open, per factory programming.

### Four-Wire-Line Operation

J19 and J21 are closed, and J18 and J20 are open. (Open J18 and J20 with an Exacto knife, and close J19 and J21 with a small soldering iron.)

### Line-Bridging Operation

When other equipment is loading the line, open J17 and J22 (open J22 with an Exacto knife). Refer to Chart 2 for losses introduced. The losses shown in the RX column is the loss introduced into the other equipment if the source and terminating impedance of the other equipment is 600 ohms.

### Multiple-Console Operation

Open J17 and J22 on all except one console. Refer to Chart 1 for programming that one console.

### Duplex Operation

Close J9 for duplex operation on four-wire lines (not possible on two-wire lines).

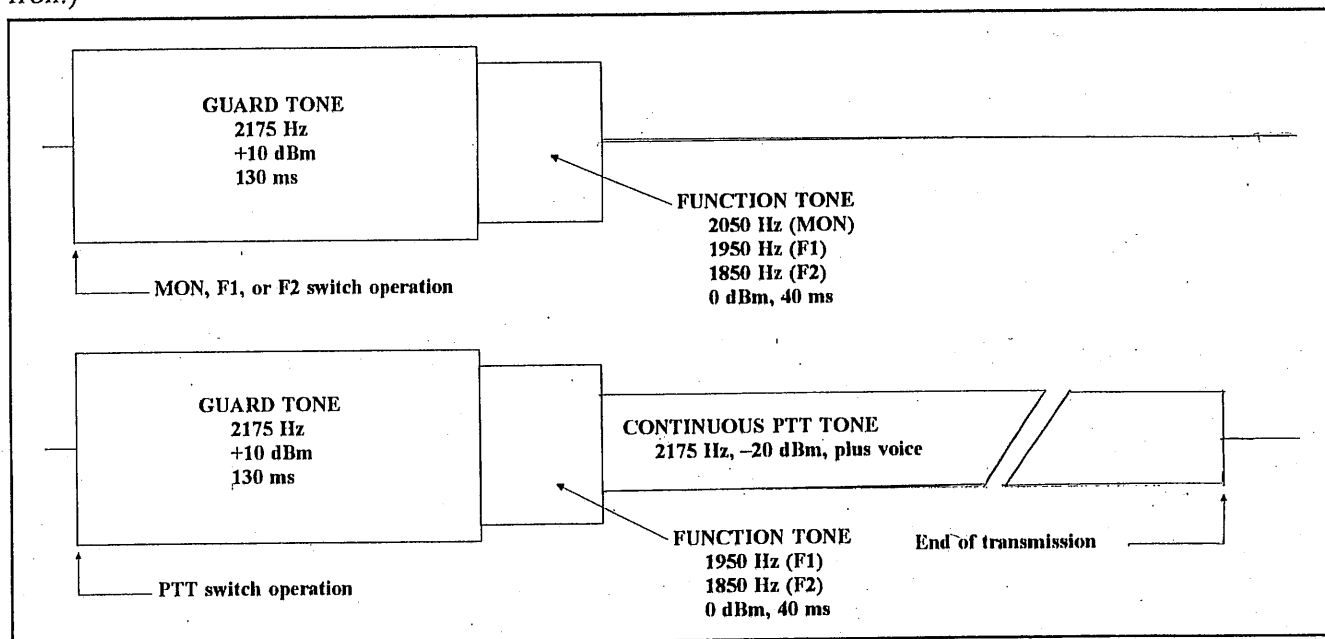


Figure 2. C-510C tone sequence chart.

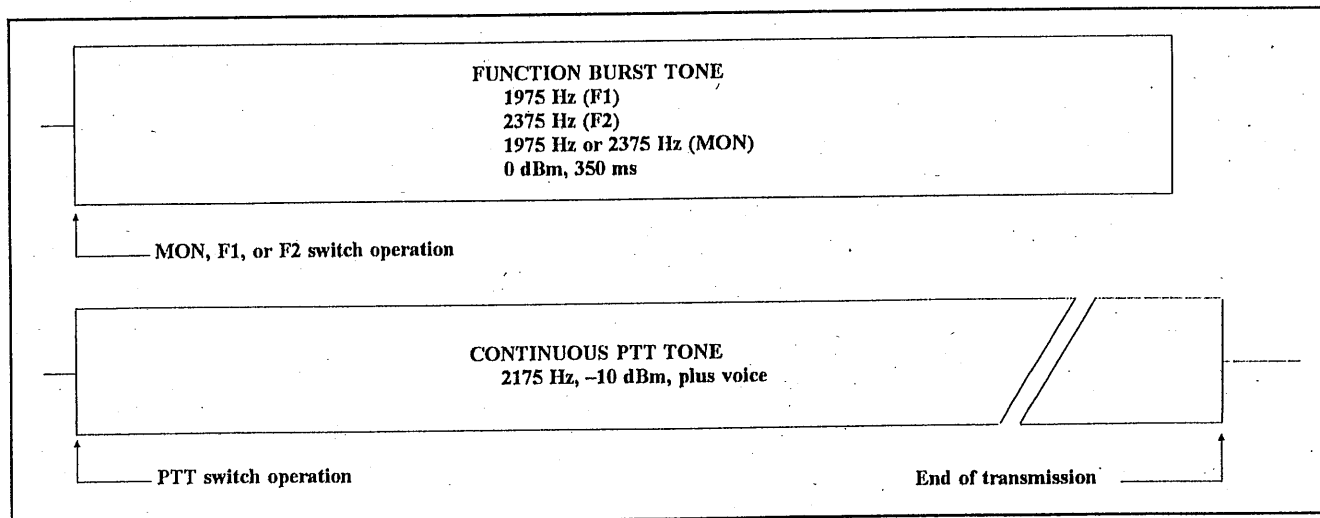


Figure 3. C-504C tone chart.

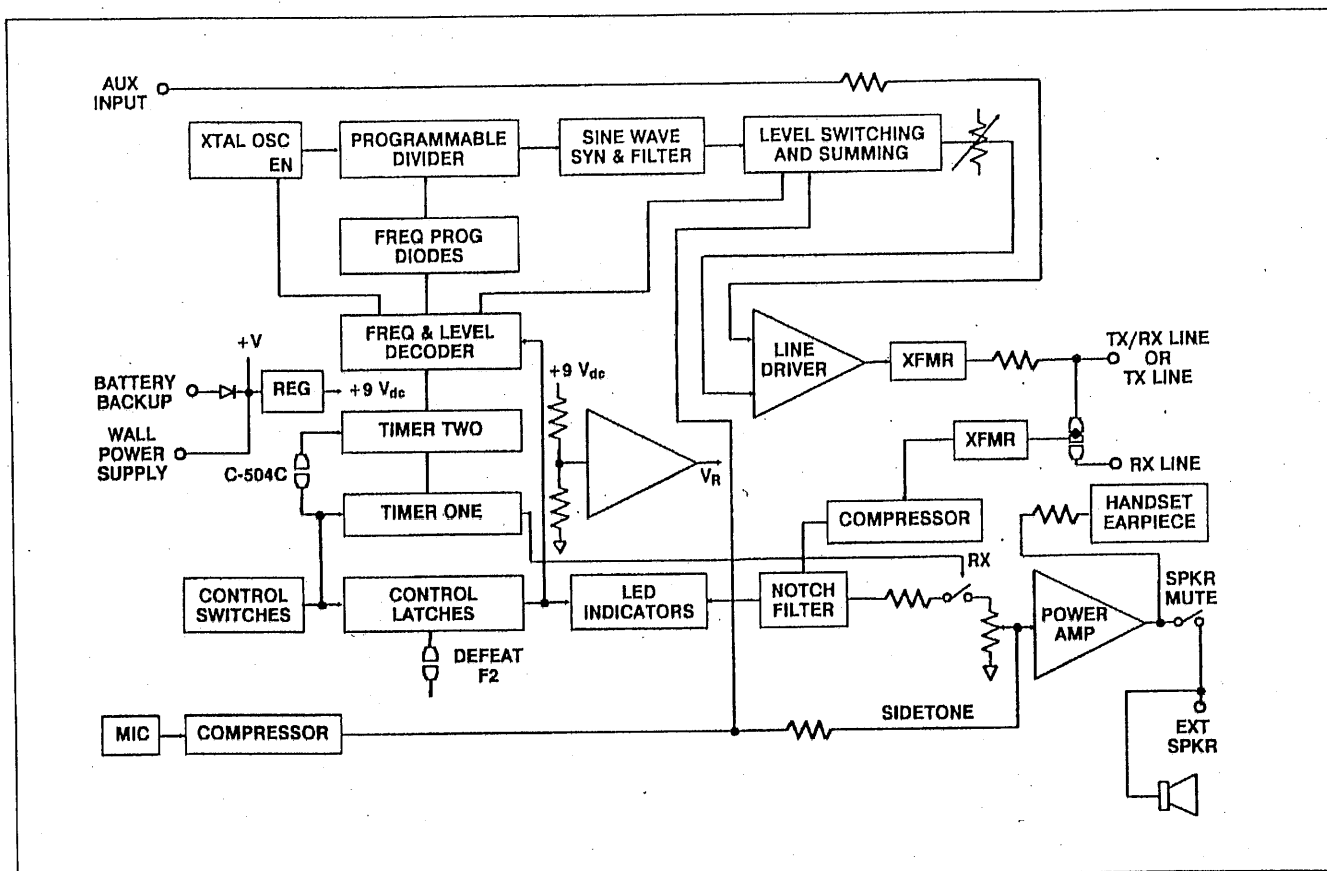


Figure 4. C-510C/C-504C block diagram.

### Level Adjustments

The C-510C console is factory-adjusted for +10 dBm guard tone, 0 dBm function tone, and -20 dBm PTT tone into a 600-ohm resistive load. The C-504C console is factory-adjusted for 0 dBm function tone and -10 dBm PTT tone into the same load. Leased lines or audio-pair lines seldom present an exact 600-ohm load to the console, and the measured levels probably will be somewhat different. R46 allows adjustment of all output levels simultaneously if other levels are desired.

For a continuous PTT tone output for measurement or adjustment purposes, push the PTT switch. For a continuous function tone, jumper TP4 to TP2 (+9 V), or, for a continuous guard tone, jumper TP3 to TP2.

Voice level is factory-preset for a peak-to-peak output level typically equal to the function-tone peak-to-peak level. An oscilloscope and typical voice should be used to measure the voice level. The compressor limits the line output power, and a sinewave, if used for this check, would have much greater power for a given peak-to-peak voltage output.

Output from the auxiliary input is controlled only by the input level, and gives about a 2-dB gain from auxiliary input to line output.

### Input-Level Adjustment

Input-level sensitivity is factory-programmed to just above the threshold of compression with typical line loss. If greater sensitivity is required, adjust R18 (LINE INPUT SENS) clockwise. If less sensitivity is required, adjust R18 counter-clockwise.

Compressor sensitivity should not be increased beyond that required by line loss, because increased sensitivity amplifies line and background noises during pauses in voice transmissions—without increasing the level of voice reception.

### Timer Adjustments

The C-510C guard-tone and function-tone duration is factory-adjusted for 130 ms and 40 ms, respectively. The C-504C function-tone duration is factory-adjusted for 350 ms. If tones of other durations are desired, adjust the guard tone with R1 and the function tone with R15.

## Tone-Burst Frequencies

Console tone frequencies are factory-programmed by a diode matrix to 2175 Hz (PTT/guard), 2050 Hz (monitor), 1950 Hz (F1), and 1850 Hz (F2) on the C-510C console, and 2175 Hz (PTT), 1975 Hz (F1), and 2375 Hz (F2) on the C-504C (monitor is the previously selected F1 or F2 tone). Consult the factory for diode-programming information to other than these standard frequencies.

## Speaker Mute

The speaker is normally muted when the handset is lifted off-hook. If off-hook speaker operation is desired, close J14.

## F1/F2 Defeat

When used with single-frequency remote base stations, the F1/F2 function may be defeated by closing J5. With J5 closed, the F1 LED and associated circuits will remain on at all times, and the F2 LED and associated circuits will be disabled.

## THEORY OF OPERATION

Crystal oscillator Y1 and U8-8,9 drives an 8-bit programmable divider U6. The most significant bit at U6-14 is wired high on the C-510C, causing the programmable division range to be 255 to 128. This provides an output at U6-1 of from 11.088 kHz to 22.09 kHz. U5 is a divide-by-10 counter, used to synthesize a sine wave. Because this stage also divides by 10, the output frequency range of U5 is 1.1088 kHz to 2.209 kHz. The synthesized sine wave has a strong tenth harmonic, which is greatly attenuated at the low-pass filter output U14-1.

At idle, the crystal oscillator is disabled by a high at U8-1. Going off-hook or operation of a MON, F1, or F2 control triggers timer one in the C-510C console, which enables the crystal oscillator and the "+10 dB" gate at U12-5. The 2175-Hz row of programming diodes is enabled by the "off" state of timer two. A "+10 dB" 2175-Hz output therefore is delivered to the line through potentiometer R46, line driver U15, and transformer T2.

Timeout of timer one after 130 ms triggers timer two, which enables the 0-dB gate at U12-13, disables the 2175-Hz row of programming diodes, and enables one of the other rows, depending upon which control has been operated. Timeout of timer two after 40 ms of operation returns conditions to the idle state.

PTT control operation causes the same sequence of operation as above, except that upon timer-two timeout, the crystal oscillator remains enabled and the "-20 dB" 2175-Hz PTT tone is delivered to the line through R48 for as long as the PTT control is operated.

The C-504C sequence of operation is the same as the C-510C, except that the "+10 dB" guard-tone timer is bypassed and operation of any of the switches except the PTT switch triggers timer two (the function-tone timer) directly. PTT switch operation enables the PTT tone only (2175 Hz at -10 dBm) and does not generate a function-tone burst.

Going off-hook or MON control operation sets the monitor latch U1-10, which enables the monitor row of programming diodes during timer-two operation. Timeout of timer two resets the monitor latch.

The F1/F2 latch is reset by the F1 control and set by the F2 control, causing the proper LED to light and the proper row of programming diodes to be enabled during timer-two operation.

In the receive mode, signals present on the 600-ohm line are coupled through T1 to the input of compressor U9 at pins 2 and 6. Maximum gain of the compressor is determined by the bias voltage on capacitor C16. This bias voltage is determined by the resistance from U9-2 to ground and is set by R18. Input signals are full-wave rectified within U9. When the rectified input signal exceeds the bias set by R18, it charges capacitor C16 to a higher voltage level, which lowers stage gain and thus maintains a near-constant average output signal at U9-7 for all inputs above the threshold.

Output signals from compressor U9-7 drives the 2175-Hz notch/bandpass filter U11. Bandpass output at U11-8 is amplified and rectified by U10 to light the TX LED. The TX LED is also activated indirectly by the PTT switch through U7-4,13. This causes TX LED activation from PTT-switch operation when the system is operating over a four-wire line.

Bandpass output is summed with an unfiltered signal at U11-2, causing a sharp notch at the U11-1 output when the two signals have been adjusted for equal amplitude by R41 and for 180° phase shift by R38.

Notched output signals from U11-1 are conducted through analog gate U12-10,11 and R39 to the high side of volume control R101, and then to the speaker and earpiece through power amplifier U13. Analog gate U12-10,11 is disabled during PTT, intercom, and tone burst, unless the unit has been solder-bridged for duplex operation.

In the transmit mode, audio from the handset microphone is compressed by the other section of U9 in the same manner as receive signals. Compressor maximum gain has been preset by the MIC SENS control (R21) to be typically 10 dB into compression from a loud male voice directly into the microphone. For less sensitivity (to reduce room-noise pickup), adjust R21 counterclockwise. For soft-voiced individuals in a quiet environment, sensitivity may be increased by adjusting R21 clockwise. Compressor output at U9-10 is conducted through analog gate U12-9,8 and R49 to the transmit audio summing point at the high side of potentiometer R46. Transmit audio from U12-8 through R51 to the wiper of volume control R101 provides sidetone audio to the earpiece and speaker. The mic-to-line audio path is disabled at U12-6 during guard tone and function tone, and also during receive.

## 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.

## SPECIFICATIONS

### Input Impedance

**Two-Wire:** 600 ohms or 2.6 kohms, transformer-isolated

**Four-Wire:** 600 ohms or 8 kohms, transformer-isolated

**Line Input Level:** -30 dBm to +15 dBm, adjustable

**Output Impedance:** 600 ohms or 2.6 kohms, transformer-isolated

**Line Output Level:** -25 to +12 dBm into a 600-ohm line

**Audio Compression (Receive and Transmit):** Less than 3 dB change in output level for a 20-dB change in input above threshold

**Distortion:** 2% maximum at full compression

**Hum and Noise:** 50 dB below operating levels

**Speaker:** 4 inch, 8 ohms, heavy-duty

**Amplifier Power:** 1.7 W at 10% THD into 8 ohms; 2.25 W at 10% THD into 4 ohms (8-ohm internal speaker plus external 8-ohm speaker); 5 W (intermittent-duty speech) at 10% THD into 4 ohms (external speaker) with optional power supply

**Handset Earpiece Level:** Volume-control adjustable

**Sidetone Level:** About 25 dB below receive level

**Audio Frequency Response:** 1.5 dB, 300 to 3000 Hz, except at the transmit tone notch frequency

**Notch Filter:** 2175 Hz; typically attenuates the parallel console PTT tone by 45 dB

**C-510C Tone Frequencies and Accuracies:** PTT, 2175 Hz, 0.01%; MON, 2050 Hz, 0.1%; F1, 1950 Hz, 0.01%; F2, 1850 Hz, 0.2%

**C-504C Tone Frequencies and Accuracies:** PTT, 2175 Hz, 0.01%; MON, 1975 Hz or 2375 Hz (depending on last F1 or F2 selected), 0.2%; F1, 1975 Hz, 0.2%; F2, 2375 Hz, 0.1%

**Operating Temperature Range:** 0 to +50°C

**Power Requirements:** 117 Vac, 60 Hz, 8 W, or 11.5 to 18 Vdc at 95 mA idle to 500 mA at 2.25 W output and 600 mA at 5 W output

**Visual Indicators:** LEDs for MON, F1, F2, INTERCOM, and TX

**Line Interface:** Two-wire or four-wire, line-terminating or line-bridging, solder-bridge selectable

**Operating Modes:** Simplex with two-wire line, simplex or duplex with four-wire lines

**Miscellaneous:** Crystal-controlled, diode-programmable tone frequencies; adjustable duration of tones; electret microphone element; modular-cord line connector; auxiliary audio input terminals; external-speaker terminals; battery-backup input terminals; speaker mute when off-hook (defeatable)

## 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.

## C-510C/C-504C PARTS LIST

Part No.	Description	Ckt Sym	
010-0562	C-510C sequential tone console	—	
010-0533	C-504C "SPEECH-PLUS" tone console	—	
011-0061	C-510C top assembly	—	
011-0062	C-504C top assembly	—	
012-0007	Phone base subassembly	—	
012-0017	C-510C main PCB assembly	—	
024-0002	C-510C/C-504C front panel, brown		
024-0027	C-510C/C-504C front panel, moonstone		
065-0382	Switch PCB	—	
065-0396	C-510C/C-504C main PCB	—	
102-0160	30 pF cer. cap., S2L, 5%, 5V	C31	
105-1001	0.001 $\mu$ F mylar cap., 10%, 100 V	C32	
		C1	
		C7	
		C14	
		C21	
		C33	
		C46	
105-1002	0.0015 $\mu$ F mylar cap., 10%, 100 V	C45	
105-1009	0.022 $\mu$ F mylar cap., 10%, 100 V	C9	
		C27	
		C29	
105-1099	0.01 $\mu$ F mylar cap., 10%, 100 V	C46	
110-1340	0.1 $\mu$ F cer. cap., small	C5	
		C6	
		C10	
		C13	
		C18	
		C20	
		C22	
		C38	
		C43	
110-1345	0.0022 $\mu$ F cer. cap., 5%, NPO	C19	
		C30	
		C34	
112-1606	10 $\mu$ F elec. cap., 25 V	C3	
		C8**	
		C12	
		C25	
112-1608	1.0 $\mu$ F elec. cap., 20%, 25 V		C42
			C44
			C4
			C8*
			C15
			C16
			C17
			C23
			C24
			C28
			C39
112-1609	100 $\mu$ F elec. cap., 20%, 25 V		C41
			C47
112-1669	220 $\mu$ F elec. cap., 10 V, RAD		C35
112-1673	2.2 $\mu$ F elec. cap., 20%, RAD		C2
			C16
			C24
			C26
112-1678	1.0 $\mu$ F elec. cap., 50 V, NP		
112-1689	470 $\mu$ F elec. cap., 25 V, RAD		C36
			C37
			C40
			C48
			C11
112-1703	0.22 $\mu$ F elec. cap., 20%, 50 V		
130-0629	10 kohm var. res., hor. mt.		R41
130-0643	100 kohm var. res., hor. mt.		R1
			R15
130-0673	10 kohm var. res., 20T, 3/8 sq.		R38
130-0724	10 kohm var. res., log, v-adj.		R46
130-0739	1 kohm var. res., PL, LG, 7/16 shift		R101
130-0742	1 Mohm var. res., v-adj		R18
132-0004	32.4 kohm res., RN55C, 1%, 1/4 W		R25
			R28
			R31
133-0001	1.0 ohm carbon res., 5%, 1/2 W		R45
133-0002	2.2 ohm carbon res., 5%, 1/2 W		R43
			R54
134-2859	35.7 kohm res., RN55D, 1%, 1/4 W		R24
134-2867	7.5 kohm res., RN55D, 1%, 1/4 W		R14
134-2879	39.2 kohm res., RN55D, 1%, 1/4 W		R27
134-2903	1.00 kohm res., RN55D, 1%, 1/4 W		R26
134-2947	249 kohm res., RN55D, 1%, 1/4 W		R11
			R13
134-2963	69.8 kohm res., RN55D, 1%, 1/4 W		R14
134-3017	442 kohm res., RN55D, 1%, 1/4 W		R10
			R12
134-3027	191 kohm res., RN55D, 1%, 1/4 W		R48**
134-3042	31.6 kohm res., RN55D, 1%, 1/4 W		R57**
136-0003	8.2 ohm comp. res., 5%, 1/4 W		R55
136-0024	220 ohm comp. res., 5%, 1/4 W		R44
136-0028	470 ohm comp. res., 5%, 1/4 W		R56
136-0029	560 ohm comp. res., 5%, 1/4 W		R64
			R65
136-0030	680 ohm comp. res., 5%, 1/4 W		R62
136-0031	820 ohm comp. res., 5%, 1/4 W		R42
			R63
136-0032	1 kohm comp. res., 5%, 1/4 W		R8
			R36
136-0036	2.2 kohm comp. res., 5%, 1/4 W		R53
136-0042	6.8 kohm comp. res., 5%, 1/4 W		R66
			R67
136-0044	10 kohm comp. res., 5%, 1/4 W		R20
			R29

		R33	161-0573	T1 3/4 red LED DIF	DS101
		R52	162-0001	Quad diode SIP cmna DNET	DN1
		R58	165-1216	2.8275 MHz HC-18 crystal	Y1
136-0045	12 kohm comp. res., 5%, 1/4 W	R34			—
		R39	249-0119	4-in square speaker, 3 W	—
136-0047	18 kohm comp. res., 5%, 1/4 W	R47	249-0121	Handset, electret, PTT switch, beige	—
136-0048	22 kohm comp. res., 5%, 1/4 W	R2	249-0216	Handset, electret, PTT switch, ash	—
		R3			
		R4	286-1768	Test-point pin	TP1
		R6			TP2
		R7			TP3
		R9			TP4
		R16			TP5
		R23			TP6
		R59			TP7
		R60	286-1773	6-pin miniature terminal strip	TB1
136-0050	33 kohms comp. res., 5%, 1/4 W	R19	286-1784	Power jack, PCB, 2.5 mm	J15
		R49	286-1830	Modular handset connector, PRB	J2
136-0054	68 kohms comp. res., 5%, 1/4 W	R5	286-1831	Modular line connector, PCB	J16
		R37	286-1833	Terminal, quick-connect	—
136-0055	82 kohms comp. res., 5%, 1/4 W	R50*	286-1851	PCB receptacle, dual, spade lug	J23
136-0056	100 kohms comp. res., 5%, 1/4 W	R35			J24
136-0062	330 kohms comp. res., 5%, 1/4 W	R22			J25
		R32	286-1852	13-position PCB receptacle, SIP	J10
136-0063	390 kohms comp. res., 5%, 1/4 W	R51	296-0588	Switch, mom. push-button, w/LED	S101
136-0066	680 kohms comp. res., 5%, 1/4 W	R48*			S102
136-0080	10 Mohms comp. res., 5%, 1/4 W	R30			S103
136-0279	24 kohms comp. res., 5%, 1/4 W	R61			S104
136-0281	43 kohms comp. res., 5%, 1/4 W	R40			
138-0017	7 x 100 kohms SIP cmn RNET	RN1	318-0246	Transformer, 10 kohm-CT-10 kohm	T1
		RN3	318-0260	Transformer, 8-1200 ohm	T2
		RN4			
138-0033	5 x 22 kohm SIP iso RNET	RN101	425-0104	4016 quad sw CMOS IC	U12
138-0044	7 x 1 kohm SIP cmn RNET	RN5	425-0105	4558 dual opamp IC	U10
138-0045	5 x 33 kohm SIP iso RNET	RN2	425-0171	4081 quad 2AND CMOS IC	U2
138-0048	5 x 4.7 kohm SIP cmn RNET	CR32	425-0178	NE570N IC	U9
161-0366	1N4003 diode	CR33	425-0181	TL084 quad BFET opamp IC	U11
		CR34	425-0186	4018 prog. cntr. CMOS IC	U5
		CR35	425-0203	4569 prog. cntr. CMOS IC	U6
		CR36	425-0204	4025 triple 3NOR CMOS IC	U4
		CR1			U8
161-0426	1N4148 diode	CR2	425-0206	4584 hex trigger CMOS IC	U3
		CR5*	425-0215	ULN2004A IC	U7
		CR6**	425-0235	UA759 IC	U15
		CR7**	425-0262	4044 quad latch CMOS IC	U1
		CR8**	425-0448	78L09 reg.-P IC, 9 V, 0.1 A	U16
		CR9	425-0454	TDA-2003V power amp. IC	U13
		CR10**	450-0016	12 V <sub>dc</sub> power supply, 0.5 A unreg.	—
		CR11**	550-0243	Black knob	—
		CR12	674-0226	Power cord	—
		CR13*	674-0239	Telephone cord w/modular plugs, 7 ft	—
		CR14**	674-0241	Flat cable, 13-conductor, 6 in	—
		CR15**	869-0024	Telephone case, beige	—
		CR16	869-0050	Telephone case, ash	—
		CR20*			
		CR22*			
		CR29			

\* Used in C-510C only

\*\* Used in C-504C only



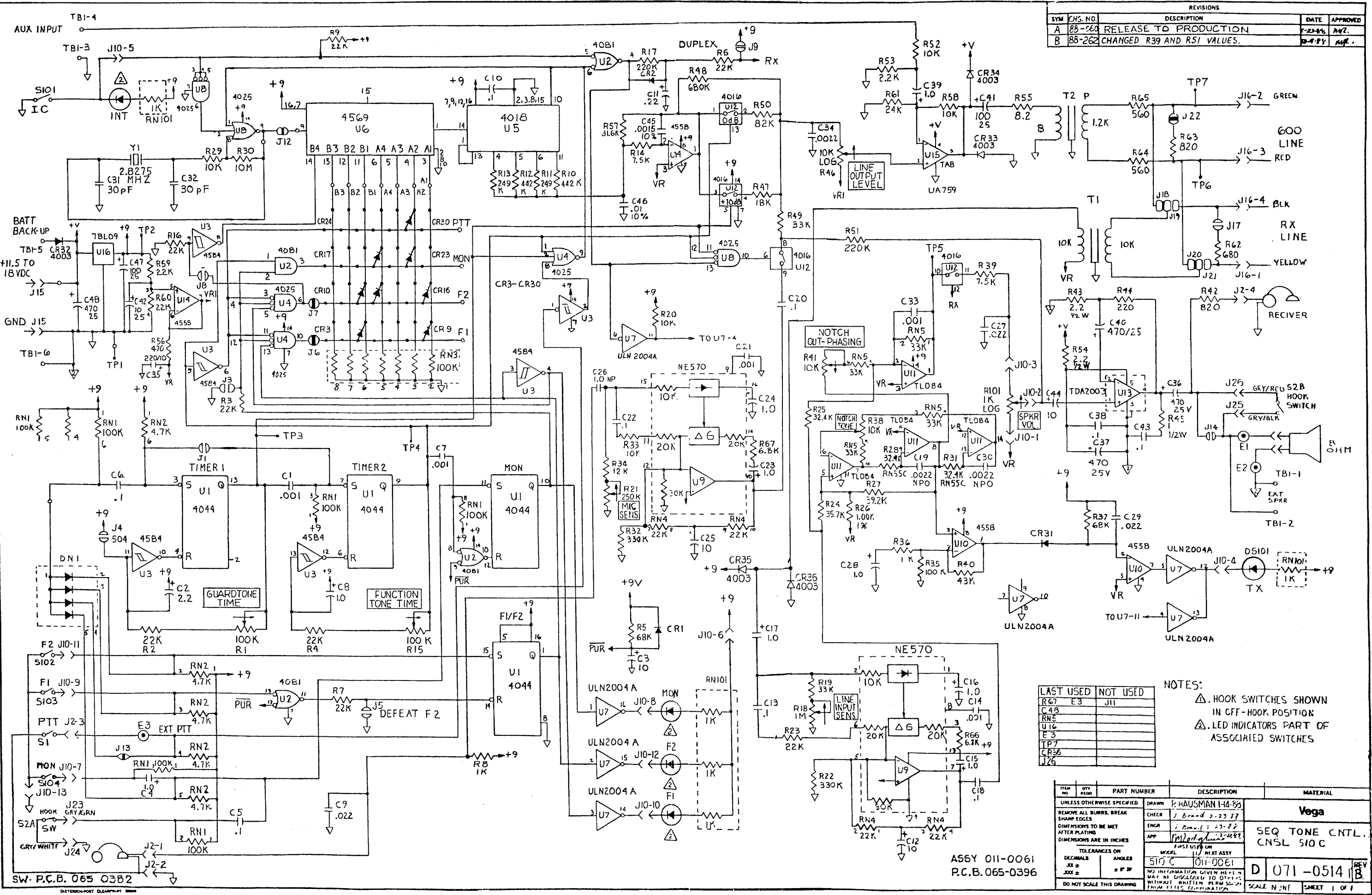


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JAN 2000

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SYN		CHG. NO.	DESCRIPTION	DATE	APPROVED
A	88-060	RELEASE TO PRODUCTION		1-2-88	AMZ.
B	88-262	CHANGED R39 AND R51 VALUES.		10-8-88	AMZ.

LAST USED	NOT USED
R67	E3
C48	J11
RN5	
U16	
E3	
TP7	
CR36	
J26	

NOTES:  
Δ. HOOK SWITCHES SHOWN IN OFF-HOOK POSITION  
Δ. LED INDICATORS PART OF ASSOCIATED SWITCHES

ITEM NO.	QTY REQD	PART NUMBER	DESCRIPTION	MATERIAL
UNLESS OTHERWISE SPECIFIED				
REMOVE ALL BURRS, BREAK SHARP EDGES				
DIMENSIONS TO BE MET AFTER PLATING				
DIMENSIONS ARE IN INCHES				
TOLERANCES ON				
DECIMALS		ANGLES		
.001		± .01		
.002		± .01		
.005		± .01		
DO NOT SCALE THIS DRAWING				
DRAWN: K. HAUSMAN 1-18-88				
CHECK: J. Brand 2-23-88				
ENGR: J. Brand 2-23-88				
APP: [Signature] 2-23-88				
FIRST USED ON: 11/11/88				
NO INFORMATION GIVEN HEREIN MAY BE DISCLOSED TO OTHERS WITHOUT WRITTEN PERMISSION FROM THE CONTROLLING OFFICE				
Vega				
SEQ TONE CNTL. CNSL 510C				
D 071-0514				
SCALE: NONE				
SHEET 1 OF 1				