



Instruction Manual

223C Series Tone-Remote Adapters

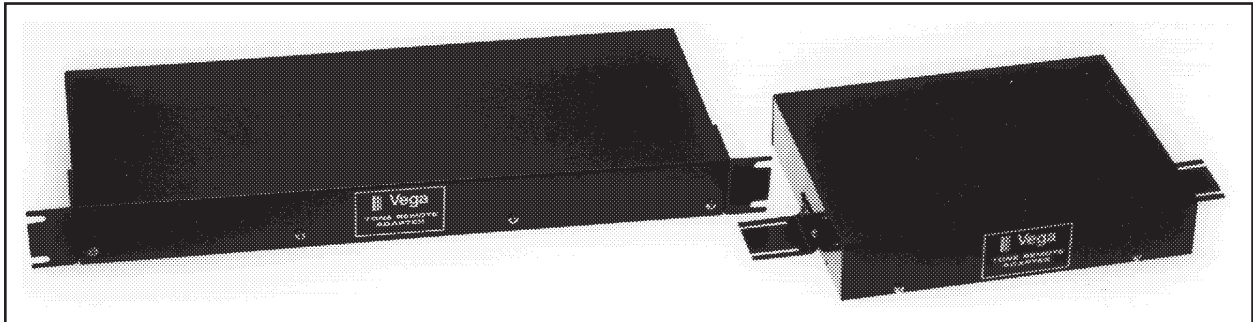


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General

The Vega 223C Series tone-remote adapters provide a reliable means of remotely controlling two-way radio base stations. The adapters can be used in conjunction with Vega Models C-510C/C-511/C-512 (two-frequency), Model C-514B (four-frequency), Model C-516 (six-line/two-frequency), Model C-1614 (six-line/four-frequency), and Model C-5110/C-5111/C-5112 (ten-line/four-frequency) tone-remote control consoles, or other manufacturers' (such as Motorola and GE) remote consoles which use the industry-standard sequential tone keying format.

The basic PC board in each adapter is the Model 223C, which provides PTT and monitor functions only, on one operating frequency. A Model 224B expansion board is added for every two frequencies. The first 224B plugs into an edge of the 223C, the second 224B into the first 224B, and so on, in a chain. The 223C Series PC boards and adapters are available in the following models:

MODEL	DESCRIPTION
223C/PCB	PC board (no case); PTT/monitor only; two-wire half-duplex) or four-wire (half-duplex or full-duplex)
224B/PCB	Two-frequency expansion PC board
RC-223C	Encased single-frequency/PTT/monitor transmit/receive adapter; includes compact case (1.75 in H, 9.25 in W, 7.25 in D) and Model 223C PTT/monitor PCB
RP-223C	Same as RC-223C, but in rack-mounting case (1.718 in H, 19 in W, 6.5 in D)
RC-223C-2	Encased two-frequency/PTT/monitor adapter; includes compact case, Model 223C PTT/monitor PCB, and Model 224B two-frequency expansion PCB
RP-223C-2	Same as RC-223C-2, but in rack-mounting case
RP-223C-4	Encased four-frequency/PTT/monitor adapter; includes rack-mounting case, Model 223C PTT/monitor PCB, and two Model 224B two-frequency expansion PCBs

RP-223C-6	Encased six-frequency/PTT/monitor adapter; includes rack-mounting case, Model 223C PTT/monitor PCB, and three Model 224B two-frequency expansion PCBs
RP-223C-8	Encased eight-frequency/PTT/monitor adapter; includes rack-mounting case, Model 223C PTT/monitor PCB, and four Model 224B two-frequency expansion PCBs

Options

LPO-1	Lightning and transient protection on-line interface
TO-23	Transformer isolation on transceiver interface

Operation

The 223C Series adapters are interconnected to the distant remote control console(s) by any voice-grade transmission medium such as a microwave link, a leased telephone line, or a twisted-pair 600-ohm line.

All 223C Series adapters are capable of decoding the PTT (push-to-talk/transmitter-on) tone sequence and the voice-plus-tone signals during transmission. The tone portion of the voice-plus-tone signal is removed from the transmitted voice. All models are prepared for jumper-plug conversion from two-wire-line operation to four-wire-line operation. In the four-wire mode, the panels also may be jumper-plug converted to full-duplex operation.

The "monitor" function provided in all 223C Series adapters decodes the valid tone sequence and provides relay-contact output to turn off the subaudible-tone-decoder circuit in the radio receiver, allowing the console operator to monitor the channel for other users before he transmits (required by FCC regulations on stations equipped with continuous-tone-coded-squelch signaling). On single-user stations not equipped with subaudible signaling, or where the CTCSS decoders are disabled, the monitor function relay output may be used for any purpose such as interrogation of a status-reporting system at the station site. The monitor function may be programmed to operate in one of three modes:

(1) *Timed mode* (as shipped), which provides the monitor function for a timed period (adjustable up to at least 9 seconds) or until a PTT command is decoded.

(2) *Latched mode*, which latches upon a monitor command until reset by a PTT command.

(3) *Refreshable timed mode*, which provides the monitor function for a timed period upon any tone-burst command. Any command received during the timed period refreshes the timer for another full timer period.

The frequency-select function is provided in all models using the 224B/PCB expansion PC board(s). The number of commandable frequencies varies from two to eight, depending upon the model chosen. As shipped, one of the frequency-select relays is always latched on, and, upon decoding a frequency-select command, the latched relay is reset and the relay associated with the command is latched on (1-of-N mode).

The frequency-select function may also be used for other purposes. For example, a pair of "frequency-select" outputs may be used to activate and deactivate a status or alarm system at the panel site, or may be used for scan-on/scan-off purposes.

Frequency-select relays may be programmed (in pairs only) by solder bridges to provide two or more independently interlocked groups. Any pair of frequency-select relays may also be programmed for momentary operation.

Installation

Connect an external 10 to 16 volt semiregulated DC power supply to the terminal board, with negative to TB1-17 and positive to TB1-18.

Connect the two-wire leased line to TB1-5 and TB1-6. For four-wire operation, move JP6 to B, connect the outgoing line to TB1-5 and TB1-6, and connect the incoming line to TB1-7 and TB1-8. Also move JP4 to B if full-duplex operation is desired.

Connect TB1-3 to the transmitter mic audio input, and TB1-4 to the transmitter mic audio return. If the TO-23 radio-interface isolation transformer option is not installed, set JP12 and JP13 both to the "A" position. If the TO-23 option is installed, set JP10 and JP11 both to the "B" position.

If the mic input is a high-impedance type, shielded cable is recommended. If the radio has a high-level mic input, move JP7 to the "B" position.

Connect the radio receiver audio output to TB1-1 and TB1-2. This must be an audio source after the squelch circuit, to prevent sending continuous noise to the remote console(s). If the radio receiver audio output is single-ended and the TO-23 option is not installed, be sure that the "low" or "grounded" side of the radio receiver audio output is connected to TB1-2. If the TO-23 option is not installed, set jumpers JP12 and JP13 both to the "A" position; if the TO-23 option is installed, set jumpers JP12 and JP13 both to the "B" position.

If a high-impedance point in the receiver is used, shielded cable is recommended. If the speaker output is used, move JP5 to B. Note that when the speaker output is used, the radio volume control will affect the audio output level at TB1-1.

Connect the radio PTT circuit to the PTT relay contact terminals of the panel. Refer to the schematic.

Connect the radio "monitor" circuit to the MON relay contact terminals. Refer to the schematic.

With all models except 223C/PCB, RC-223C, and RP-223C, connect the radio-frequency control circuits to the function-control relay output terminals on the small (224B/PCB) PC board(s). Usually the common of each relay contact switch is grounded and the normally open contact connects to the radio frequency-control terminals. Refer to the schematic.

A few radios (such as some GE models) have separate transmitter and receiver frequency controls. Use the above connections for transmitter frequency controls and connect the receiver frequency controls to the second set of relay contacts available at solder-pad terminals. Refer to the schematic.

Relay/LED defeats and active-low open-collector logic outputs have been provided for special installations. Refer to the schematics.

Transient protection has been provided near all audio inputs and outputs. This is adequate for transients up to at least 100 volts, but external transient protection such as gas-discharge or MOV devices should be installed to provide some protection from very high voltage transients such as from lightning.

For additional protection, provisions have been made on the 223C PC board for installation of the LPO-1 option consisting of Vega #146-0005 gas-discharge-tube protectors or MOV devices such as GE #V100ZA15 (one gas tube or three MOVs per line). An earth-ground terminal is also provided.

Vega will not replace units under warranty that have obvious high-voltage damage such as vaporized PC-board traces or melted components.

The RC/RP-223C line transformers are not designed to operate on lines carrying direct current. If a DC voltage is on the line, isolate with external capacitors. If the line termination must conduct direct current, install a 600:600-ohm transformer designed for the current involved.

Tuning

All models have been factory-tuned to the following frequencies, and for normal applications require no tuning:

Guard tone/PTT Tone: 2175 Hz

MON Function Tone: 2050 Hz

Frequency Select Function Tones (where used)

F1: 1950 Hz	F5: 1550 Hz
F2: 1850 Hz	F6: 1450 Hz
F3: 1750 Hz	F7: 1350 Hz
F4: 1650 Hz	F8: 1250 Hz

For special applications using other than standard frequencies, special order from the factory.

Level Adjustments

Level adjustment normally are required only at the time of installation or due to base-station changes.

Important: All test points have DC bias on them. Use the “output” AC terminals and scales on your meter, which places a DC blocking capacitor in series with the meter.

1. Line Drive Adjustment

Unsquench the receiver so that continuous noise is present. Connect the meter to TB1-5 and TB1-6 (line should also be connected) and adjust R94 (line output level) for the desired line level (usually 0 dBm or 0.8 Vrms).

2. Transmit Level Adjustment

Disable transmitter PTT circuit. Adjust R92 (line input level) to full clockwise. Have the remote control console send a continuous PTT command (no voice or loud room noise). The panel should respond by energizing the PTT relay and lighting the PTT LED. Adjust R92 (line input level) for a 1 to 1.1 Vrms reading at TP11. If the reading is lower, set R92 to maximum. Key the remote control panel several times to insure reliable operation of the PTT relay.

Enable the transmitter PTT circuit and monitor its deviation.

Have the remote control console send a PTT command plus voice. The PTT relay and the PTT LED should remain energized. With voice (or a 1-kHz test tone) coming from the remote control console, adjust R93 (modulation output level control) for proper deviation.

3. Monitor Adjustments

Momentarily jumper TP2 to TP10 (GND). The monitor relay and monitor LED should light for a timed period. Adjust R46 (monitor time) for the desired monitor period. Repeat as required. If latched monitor operation is desired, move JP1 to B. If refreshed monitor operation is desired, change JP1 to A, JP2 to B, and JP3 to B.

Have the remote control console send a monitor command and check for proper operation.

Theory of Operation

Voice Circuits

In the “PTT ON” condition, the voice-signal audio path is from the line through TB1-5 and TB1-6, T1 and JP6-A (two-wire), or through TB1-4 and TB1-5, T2 and JP6-B (four-wire), U14A-3,1-, U11D-8,-9, R70, U15A-2,-1, R93, U15B-5, U10B-3,-4, C30, and R79 to the TX audio output terminal TB1-3. At the PTT tone frequency (2175 Hz), audio from U11D-9 also passes through the U14B,C,D bandpass filter and is applied to U15A-2 180° out of phase, and at equal amplitude to the signal path through R70. This results in a deep notch at 2175 Hz and effectively eliminates the PTT tone signal.

In the receive condition, the receiver audio path is from TB1-1 through the line-output-level control R94, U15C-10,8-, U11C-11,10-, R70, U15A-2,1-, U11A-2,1-, U13, and T1 to the line at TB1-5 and TB1-6. In the full-duplex mode (JP4 to B), the path is from U15C-8 through U11B-4,3 to U13.

2175-Hz Decoder Circuits

The tone sequence generated at the remote-control console upon PTT switch operation typically is 2175 Hz at +10 dBm for 130 ms (guard tone), followed by a function-tone frequency at 0 dBm for 40 ms, followed by 2175 Hz at -20 dBm (PTT holding tone) for the duration of PTT-switch operation.

The guard-tone and PTT-tone signal path is from the line through T1 and JP6-A (two-wire) or T2 and JP6-B (four-wire), input level control R92, prefilter stage U5D-12,14-, first bandpass filter U5C,A,B, and second bandpass filter U4C,B,A to the 2175-Hz detector U1B.

Logic Circuits

CMOS logic is used in these circuits. When the term “low” is used, the DC voltage is near ground potential. When the term “high” is used, the voltage is near +9 Vdc.

When the first 2175-Hz tone (guard tone) is detected, TP1 goes low, disabling the receive analog gates and enabling the transmit analog gates through U6A-1,2,3 and U7B-2,9. The PTT circuit, however, is not energized due to the high at U6B-6.

The high-to-low transition at TP1 also triggers the 240-ms timer at U2A-5, causing U2A-6 and U10A-13 to go high. This enables the audio path from JP6 through U14A-3,1-, U4D-12,14, and U10A-2,1 to the monitor decoder U3B,C,D and all other function-tone decoders which may be connected to P1-3.

In all models except 223C/PCB, RC-223C, and RP-223C, a frequency-select function tone is always decoded during a PTT command toneburst. A low from this function-tone decode at P1-5 triggers a 50-ms timer at U8A-5. Upon timeout of the 50-ms timer, a 62-ms timer is triggered at U8B-12. U8B-9 goes low and, if TP1 has again gone low due to the presence of PTT tone, the PTT relay K2 is energized from U6B-4 through U9C-3,14. The U8B-9 and the TP1 lows also hold U8B-14 low through U6C and U12A. This U8B-14 low disables timeout of the 62-ms timer by holding capacitor C18 in a discharged condition.

When TP1 goes high from the absence of PTT tone (the console operator has released the PTT switch), the timing capacitor C18 charges to the timeout voltage in 62 ms and the PTT relay is deenergized. When the 62-ms timer times out, a new PTT command toneburst is required to energize the PTT relay; however, if a PTT tone returns before timeout of the 62-ms timer, the PTT relay reenergizes. This minimizes PTT losses from high-level noise transients or from microwave-link flutter. The analog gates are maintained in the transmit condition during operation of the 50-ms and 62-ms timers by highs at U7B-1,8 from U8B-10 and U8A-6.

In Models 223C/PCB, RC-223C, and RP-223C no frequency-select decoders are included, and there is no decode pulse to trigger the 50-ms timer U8A. The auto-select-223 P1-8 pin which is shorted to ground by a 224B frequency-select decoder is high through R54 on models without frequency-select decoders. This high enables U10D, which causes U2A to time out in 150 ms and allows U9B-15 to go high upon timeout of the 150-ms timer. This low-to-high transition triggers the 50-ms timer at U8A-5 through U9G-7,10.

If a function command only was sent (no PTT tone after the function tone), no low appears at TP1 during the 62-ms timing period of U8B, and the decode logic returns to the initial state awaiting the next command sequence.

Monitor Function Decoder

When a monitor-function command is sent, the guard-tone detection at TP1 triggers the 240-ms timer U2A, which enables audio-signal passage through analog gate U10A. U4D and U3A are both high-gain stages and, therefore, the function-tone signal at U3A-1 is a rail-to-rail squarewave. The squarewave function-tone signal from U3A-1 is applied to the monitor band-pass filter U3B,C,D through R32. Monitor-bandpass-filter output is rectified by CR3 and, after filtering, is applied to comparator opamp U1A at U1A-3. U1A-1 goes high, triggering the 50-ms timer at U8A-5 through U9F-6,11. Upon 50-ms timer timeout, the 62-ms timer is triggered, but, since TP1 is high due to the absence of PTT tone, the PTT relay is not energized.

The low-to-high transition at U1A-1 triggers the monitor timer U2B at U2B-12 through R31. U2B-10 goes high and energizes the monitor relay K1 through U9A-1,16 for a timed period. If a PTT command is de-coded before timeout of the monitor timer, the high

at U6B-4 resets the monitor timer at U2B-13 through R47 and U6D-12,11.

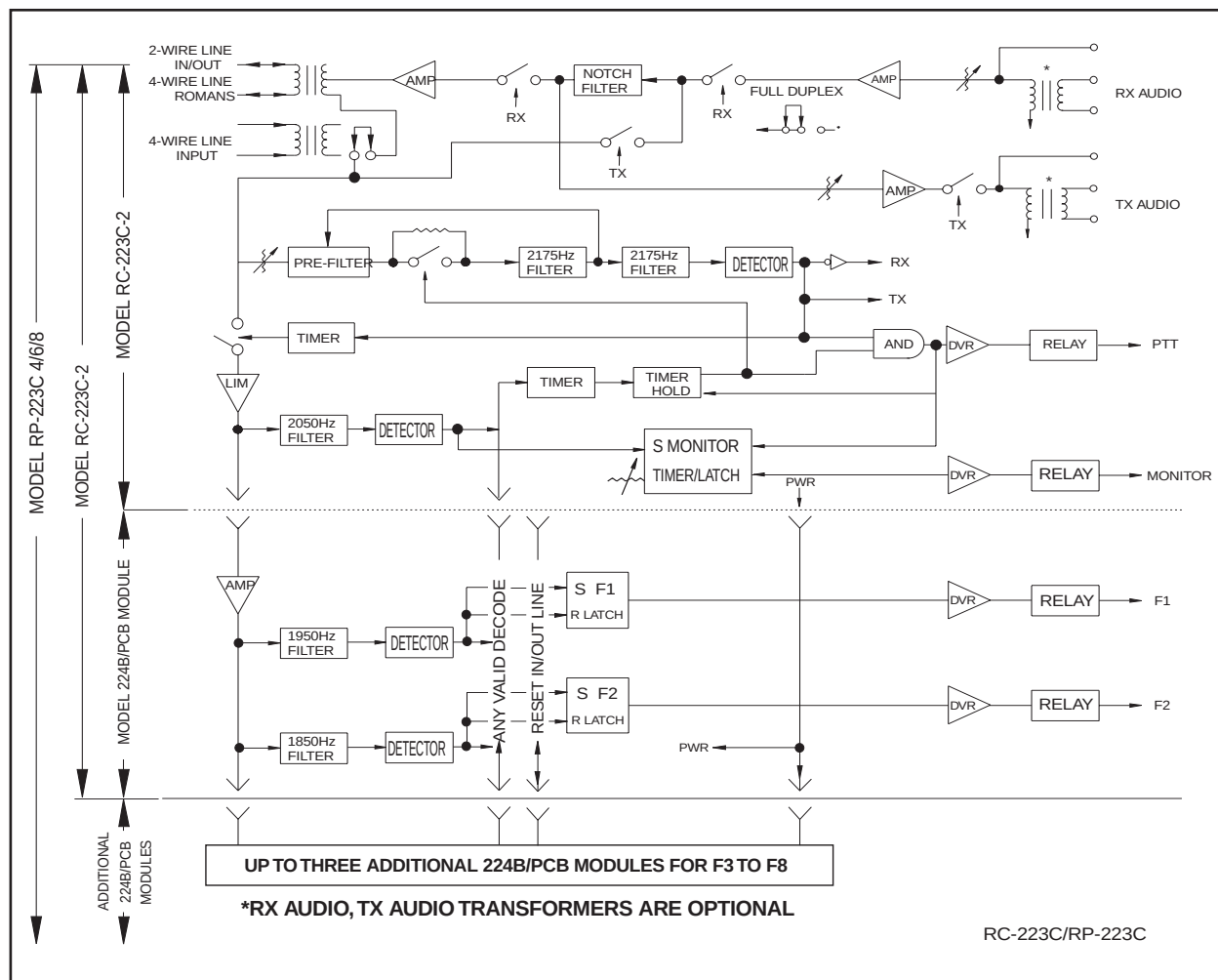
In the latched mode of operation, JP1 is in the B position, and, when U2B is triggered, U2B-7 goes low, effectively short-circuiting the C16 charging path through R30, R28, and R46, preventing C16 from charging to timeout potential. Upon a PTT command, U6B-4 goes high and resets the monitor latch at U2B-13 through R47 and U6D-12,11. U2B-10 goes low and monitor relay K1 is deenergized.

In the refresh-monitor-timed mode of operation with JP1 to A, JP2 to B, and JP3 to B, upon the decode of any valid command, TP7 goes high, triggering the monitor timer at U2B-12 through JP3. A PTT command will not reset the timer in this mode, because the reset path is short-circuited by JP2.

224B/PCB Function-Tone Decoder Module

Operation of the frequency-select function-tone decoders is identical to that of the monitor-function decoder, except that the frequency-select decoders are tuned to a different frequency.

The decoder output at U3A-1 is a high which is applied as a low to the F1-latch set input at U4A-1 through U5A-1,18. Simultaneously, a low is applied to the F1 latch reset input at U4B-6, and, if JP2 is in the



RC-223C/RP-223C block diagram.

223C Series Specifications

Operating Temperature Range: –20 to +55°C for full specifications; –30 to +70°C with reduced specifications

Power Requirements: +10 to +16 V_{dc}, semiregulated

Models 223C/PCB, RC-223C, RP-223C: 55 mA idle, 110 mA maximum at 12 V_{dc}

Models RC-223C-2, RP-223C-2: 125 mA idle, 175 mA maximum at 12 V_{dc}

Model RP-223C-4: 145 mA idle, 195 mA maximum at 12 V_{dc} (1 of 4)

Model RP-223C-6: 165 mA idle, 215 mA maximum at 12 V_{dc} (1 of 6)

Model RP-223C-8: 185 mA idle, 235 mA maximum at 12 V_{dc} (1 of 8)

Add 50 mA maximum for refresh MON operation and 50 mA for each additional relay “on” in non-1-of-N mode

Relay Contact Ratings: 2 A, 30 V_{dc} maximum

Radio Interface: ±45 V_{dc} withstand rating

Line to TX Output Gain: –26 to +16 dB into mic input load or –10 to +22 dB into 600-Ω load, adjustable

TX Output Level: –60 to –18 dBm (for mic-level output) or –40 to +2 dBm into 600-Ω load, adjustable

TX Output Impedance: 22 Ω TX ON, typical; 22 kΩ TX OFF, typical

RX Input Level: 100 mV_{rms} to 16 V_{rms}, adjustable

Audio Distortion: 2% THD maximum

Frequency Response: ±1.5 dB, 300 to 3000 Hz, except at transmit notch frequency

Line Output Level: –30 to +12 dBm, adjustable

Line Input/Output Impedance: 600 Ω nominal

Sensitivity: Ultimate sensitivity, –60 dBm PTT tone

Noise Tolerance (5-kHz-bandwidth white noise): To 18 dB above PTT tone level at ultimate sensitivity

Frequency-Select Function Tone Decoder Tuning Range: 1225 to 2025 Hz, continuously adjustable

Function-Tone Detection Bandwidth: 45 Hz ± 12 Hz, frequency-select tones; 30 Hz ± 6 Hz, MON function tone

MON Timer: 1 to 10 s, typical, adjustable

PTT Tone Detect Bandwidth: 50 Hz, typical, with sensitivity set 12 dB above threshold of detection

Tone-Detect Stability: ±0.3%, –20 to +55°C; ±0.4%, –30 to +70°C

Notch-Frequency Rejection: 45 dB minimum

Notch-Frequency Bandwidth: 70 Hz at –3 dB points, typical; 1.0 Hz at –40 dB points, typical

Dimensions

Model 223C/PCB: 5.3 in (13.5 cm) W, 5.9 in (15 cm) D, 1.0 in (2.54 cm) H

Model 224B/PCB: 1.8 in (4.6 cm) W, 5.9 in (15 cm) D, 0.85 in (2.16 cm) H

Model RC-223C/-2: 9.25 in (23.5 cm) W, 7.25 in (18.4 cm) D, 1.75 in (4.4 cm) H

Model RP-223C-2/4/6/8: 16.6 in (42.2 cm) W, 6.56 in (16.7 cm) D, 1.72 in (4.37 cm) H

Non-Relay Outputs (internal relay defeated): Open collector, active low, 200 mA maximum, 50 V maximum

A position as shipped, to the reset input of all other frequency-select function-tone decoders through U5B-4,15, JP2A, and J6-6 or P6-6.

When simultaneous set and reset inputs are applied to the F1 latch, set dominates at the Q output and the high at U4A-3 energizes the F1 relay through U5G-7,12. Simultaneously, the reset low applied to the F2 latch and all other connected latches resets the previously set latch. On the trailing edge of the F1 detect pulse, the reset pulse to the F1 latch and all other connected latches terminates, but the low to the set input of the F1 latch remains a few microseconds longer due to the time constant of R28 and C14. This insures that latch F1 will remain in the set condition.

If the JP2 jumper plug is in a no-bridge condition (hang on one side), F1 will reset F2 and vice versa, but other function-tone boards are unaffected. This allows operation with more than one 1-of-N group in multiple-function-tone-board operation.

If JP2 is in the B position, a continuous reset low is applied to both the F1 and F2 latches. Upon termination of the F1 or F2 function-tone decode pulse, the latch is

therefore reset. This momentarily energizes the relay for about 30 ms.

Warranty (Limited)

All Vega signaling products are guaranteed against malfunction due to defects in materials and workmanship for three years, beginning at the date of original purchase. If such a malfunction occurs, the product will be repaired or replaced (at our option) without charge during the three-year period, if delivered to the Vega factory. Warranty does not extend to damage due to improper repairs, finish or appearance items, or malfunction due to abuse or operation under other than the specified conditions, nor does it extend to incidental or consequential damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you. This warranty gives the customer specific legal rights, and there may be other rights which vary from state to state.

Claims

No liability will be accepted for damages directly or indirectly arising from the use of our materials or from any other causes. Our liability shall be expressly limited to replacement or repair of defective materials.

223C/PCB Parts List

Part No.	Description	Ckt Sym			
012-0068	PCB ASSY 223C/PCB				R96
031-0211	TEST SPEC 223C/224B		134-2837	RES RN55D 15.0K 1% 1/4W	R4
065-0449	PCB 223C		134-2852	RES RN55D 16.2K 1% 1/4W	R42
071-0560	SCHEMATIC 223C		134-2874	RES RN55D 182.K 1% 1/4W	R82
098-0347	MAN INST RC/RP/223C/224B		134-2877	RES RN55D 20.0K 1% 1/4W	R16
102-0060	CAP CER 6.8P S2L 5% 50V	C6			R18
102-0290	CAP CER 100P S2L 5% 50V	C19			R35
104-0408	CAP TANT 1MF 35V	C1			R36
		C2			R40
		C3			R44
		C5			R67
		C17			R74
		C18			R66
104-0748	CAP TANT 10MF 10V	C 4	134-2885	RES RN55D 562. 1% 1/4W	R33
105-1011	CAP MYLAR .047MF 10% 100V	C25	134-2886	RES RN55D 332 1% 1/4W	R2
105-1116	CAP MYLAR .0047 UF 1%	C20	134-2887	RES RN55D 27.4K 1% 1/4W	R6
		C21			R91
110-1320	CAP CER .001MF 20% 50V	C27	134-2892	RES RN55D 60.4K 1% 1/4W	R32
		C28			R56
110-1340	CAP CER .1MF SMALL	C11	134-2947	RES RN55D 249K 1% 1/4W	R25
		C22	134-2954	RES RN55D 9.53K 1% 1/4W	R88
		C29	134-2991	RES RN55D 10.5K 1% 1/4W	R10
110-1345	CAP CER .0022MF 5% NPO	C7	134-3021	RES RN55D 475 1% 1/4W	R27
		C8	134-3035	RES RN55D 8.66K 1% 1/4W	R26
		C10			R90
		C13			R39
		C14			R45
		C15			R8
		C23			R69
112-1606	CAP ELEC 10MF 25V	C31	136-0003	RES COMP 8.2 5% 1/4W	R77
		C26	136-0015	RES COMP 39 5% 1/4W	R78
112-1608	CAP ELEC 1.0MF 20% 25V	C 9	136-0020	RES COMP 100 5% 1/4W	R62
		C24	136-0022	RES COMP 150 5% 1/4W	R65
		C36	136-0027	RES COMP 390 5% 1/4W	R79
112-1613	CAP ELEC 220MF 20% 16V	C35	136-0030	RES COMP 680 5% 1/4W	R95
112-1671	CAP ELEC 22MF 16V 10%RD	C16	136-0032	RES COMP 1K 5% 1/4W	R5
112-1676	CAP ELEC 100UF 16V	C12			R21
		C32			R75
		C33			R83
112-1681	CAP ELEC 2.2UF 50V NP	C30			R87
130-0533	RES VAR 500K HOR MT LIN	R46			R89
130-0639	RES VAR 10K H-MTG PCB	R11	136-0034	RES COMP 1.5K 5% 1/4W	R50
		R20	136-0040	RES COMP 4.7K 5% 1/4W	R53
		R24			R55
		R81	136-0044	RES COMP 10K 5% 1/4W	R58
130-0673	RES VAR 10K 20T 3/8SQ	R80			R59
130-0725	RES VAR 10K LOG PC HADJ	R92			R61
		R93	136-0062	RES COMP 330K 5% 1/4W	R63
		R94	136-0066	RES COMP 680K 5% 1/4W	R15
131-1853	RES WW 68 5% 2W	R86	136-0282	RES COMP 51K 5% 1/4W	R28
132-0004	RES RN55C 32.4K 1% 1/4W	R13	136-0288	RES COMP 160K 5% 1/4W	R30
		R17	136-1953	RES COMP 62K 5% 1/4W	R31
		R19			R47
		R23	161-0366	DIODE 1N4003	R48
		R34	161-0426	DIODE 1N4148	R51
		R37			R52
		R38			R54
		R41			R57
		R43			R60
		R64			R22
		R68			R14
		R70			R49
		R71			R9
		R72			R76
		R73			R84
134-0195	RES RN55D 100K 1% 1/4W	R1	161-0573	DIODE LED T1 3/4 RED DIF	CR11
		R3	180-0321	RELAY DPDT PCB 12V	CR1
		R29			CR10
		R85	286-1766	CONN JUMPER PLUG	CR2
134-0212	RES RN55D 10.0K 1% 1/4W	R7			CR3
		R12			CR4
					CR5
					CR6
					CR7
					CR8
					CR9
					DS1
					DS2
					K1
					K2
					JP1A
					JP2A
					JP3A
					JP4A

		JP5A	134-2990	RES RN55D 6.65K 1% 1/4W	R2
		JP6A			R7
		JP7A	134-3037	RES RN55D 442 1% 1/4W	R13
		JP8A			R18
286-1768	PIN TEST POINT	JP9A	136-0032	RES COMP 1K 5% 1/4W	R30
		TP10			R31
286-1772	CONNECTOR 36PIN STRIP TIN	TP11	161-0426	DIODE 1N4148	CR1
		JP1			CR2
		JP2			CR3
		JP3			CR4
		JP4			CR5
		JP5			DS1
		JP6	161-0573	DIODE LED T1 3/4 RED DIF	DS2
		JP7			K1
		JP8	180-0321	RELAY DPDT PCB 12V	K2
286-1808	CON PCB 36 PIN 90 DEG	JP9			
286-1934	TERM STRIP 18PIN MINI	P1			
318-0246	XFORMER 10K CT-10K CT	TB1	286-1766	CONN JUMPER PLUG	TP1
318-0259	XFORMER 600CT-600CT	T2	286-1768	PIN TEST POINT	TP2
425-0157	IC CMOS 4001 QUAD 2NOR	T1			
425-0181	IC OPAMP TL084 QUAD BFET	U6	286-1772	CONNECTOR 36PIN STRIP TIN	JP1
		U3			JP2
		U4			JP3
		U5			JP4
		U14			P1
425-0202	IC OPAMP 5532 DUAL RL600	U15	286-1808	CON PCB 36 PIN 90 DEG	TB1
425-0204	IC CMOS 4025 TRIP 3NOR	U13	286-1932	TERM STRIP 6PIN MINI PCB	J1
425-0215	INT CKT ULN2004A	U7	286-1933	RECPT PCB 8PIN 90 DEG	U1
		U9	425-0181	IC OPAMP TL084 QUAD BFET	U2
425-0230	IC OPAMP LM358 DUAL	U12			U3
425-0411	IC 4538 DUAL MONO	U1	425-0230	IC OPAMP LM358 DUAL	U4
		U2	425-0255	IC CMOS 4093 QUAD TRIG	U5
425-0452	INT CKT LM2931T ADJ REG	U8	425-0263	INT CKT ULN2804A	
425-0461	IC HCMOS 74HC4066 QUADSW	U16	484-0102	STANDOFF 4-40 X 1/8 ROUN	
		U10			
484-0102	STANDOFF 4-40 X 1/8 ROUN	U11			

224B/PCB Parts List

012-0044	PCB ASSY 224B/PCB
031-0211	TEST SPEC 223C/224B
065-0420	PCB 224B
071-0538	SCHEMATIC 224B
104-0408	CAP TANT 1MF 35V
105-1099	CAP MYLAR .01MF 10% 100V
110-1340	CAP CER .1MF SMALL
110-1345	CAP CER .0022MF 5% NPO
112-1606	CAP ELEC 10MF 25V
130-0673	RES VAR 10K 20T 3/8SQ
134-0195	RES RN55D 100K 1% 1/4W
134-0212	RES RN55D 10.0K 1% 1/4W
134-0312	RES RN55D 150.K 1% 1/4W
134-2852	RES RN55D 16.2K 1% 1/4W
134-2887	RES RN55D 27.4K 1% 1/4W
134-2916	RES RN55D 16.9K 1% 1/4W
134-2946	RES RN55D 953. 1% 1/4W
134-2985	RES RN55D 64.9K 1% 1/4W

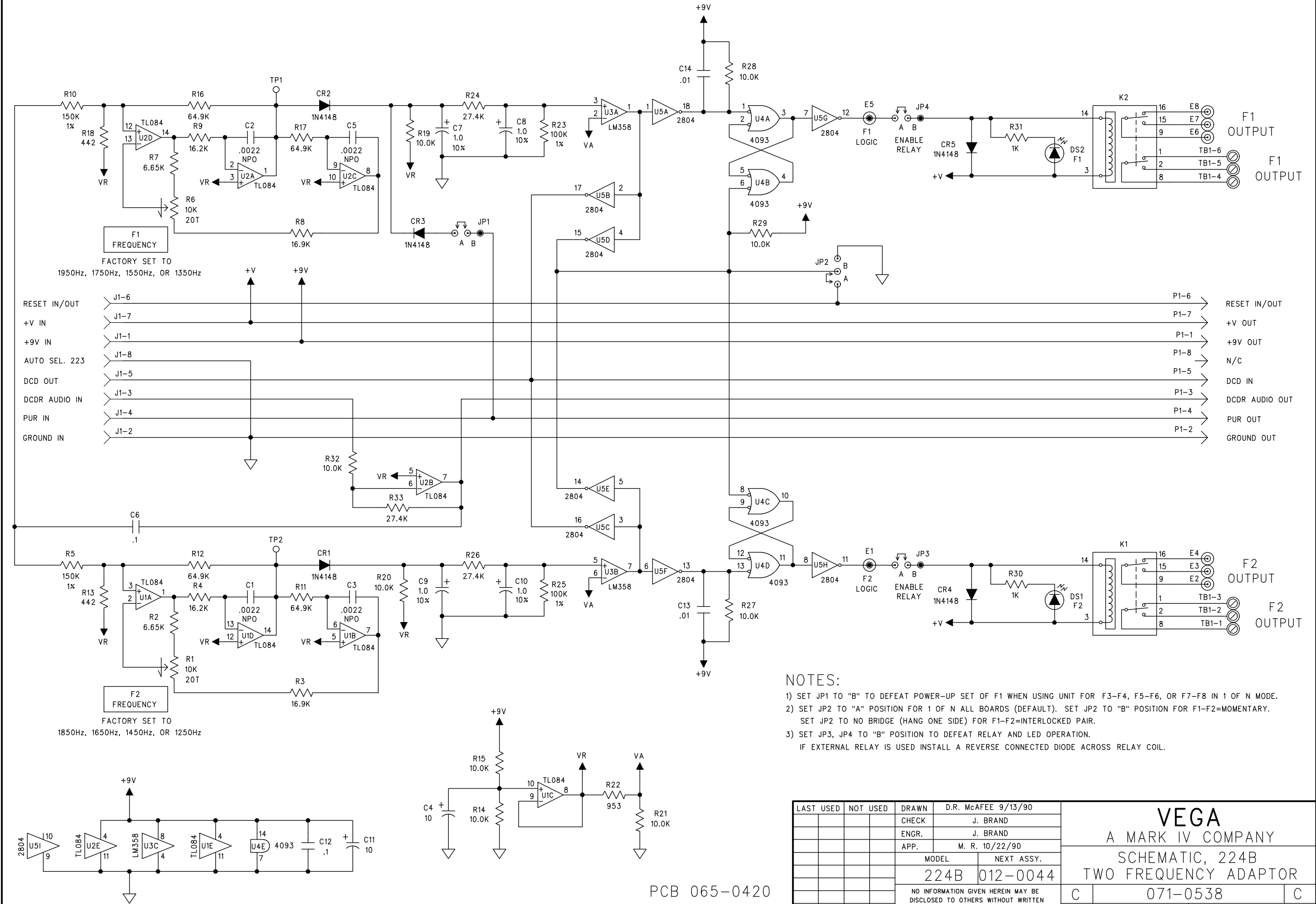
RC/RP Case Kits Parts List

012-0018	CASE KIT RC-223C
021-1918	MTG BRKT UNIVERSAL
021-6386	CHASSIS UNIVERSAL
021-6452	COVER UNIVERSAL
460-0259	GROMMET 5/16
518-0070	WASH LOCK 4 INT
527-0003	SCREW FH 4-40X1/4 100DE
528-0003	SCREW PH 4-40X1/4
817-0002	BAG POLY 4 X 8 X 18
817-0395	CARTON 12 X 9 X 3
817-0397	FOAM CONV 9 X 12 X 2
850-0213	LABEL 221 FRONT
850-0295	LABEL ID RC-223-0/-2
012-0046	CASE KIT RP-223C
021-6584	COVER BTM P-218/RP-250
021-6585	COVER TOP P-218/RP-250
021-6588	BRACKET P-218/RP-250
021-6642	PANEL REAR RP-223C
527-0003	SCREW FH 4-40X1/4 100DE
528-0069	SCREW PH 10-32 X 7/16
533-0064	SCREW PH 6-20X 1/4 TYPE B
533-0066	SCREW PH 10-12X1/2 TYPE A
817-0003	BAG POLY 10 X 12 FLAT
817-0004	BAG POLY 18 X 24 FLAT
817-0353	CARTONS FOR 211/212
850-0213	LABEL 221 FRONT
850-0296	LABEL ID RP-223-4-6-8



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REVISIONS				
SYM.	CHG NO	DESCRIPTION	APP.	DATE
A	90-301	RELEASE TO PRODUCTION	M.R.	10/22/90
B	91-016	ADDED R32 AND R33.	M.R.	12/3/91
C	91-172	R33 WAS 10.0K		



LAST USED	NOT USED	DRAWN	D.R. McAFEE 9/13/90	
		CHECK	J. BRAND	
		ENGR.	J. BRAND	
		APP.	M. R. 10/22/90	
		MODEL	224B	NEXT ASSY. 012-0044
		NO INFORMATION GIVEN HEREIN MAY BE DISCLOSED TO OTHERS WITHOUT WRITTEN PERMISSION FROM MARK IV CORPORATION.		
		VEGA A MARK IV COMPANY SCHEMATIC, 224B TWO FREQUENCY ADAPTOR		
		C	071-0538	C
		SCALE: 1:1		SHEET 1 OF 1

