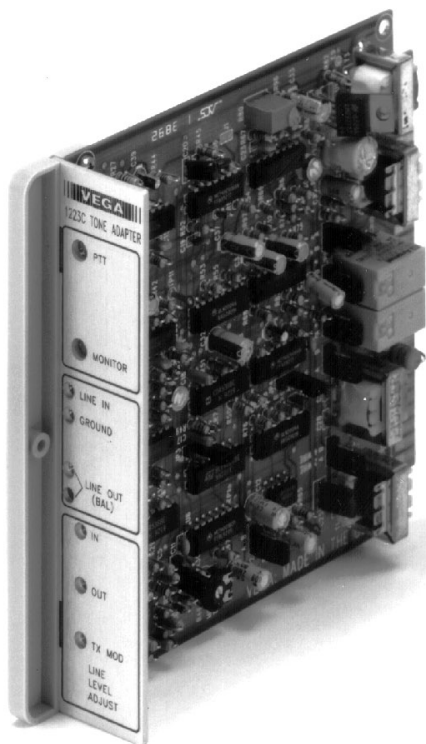




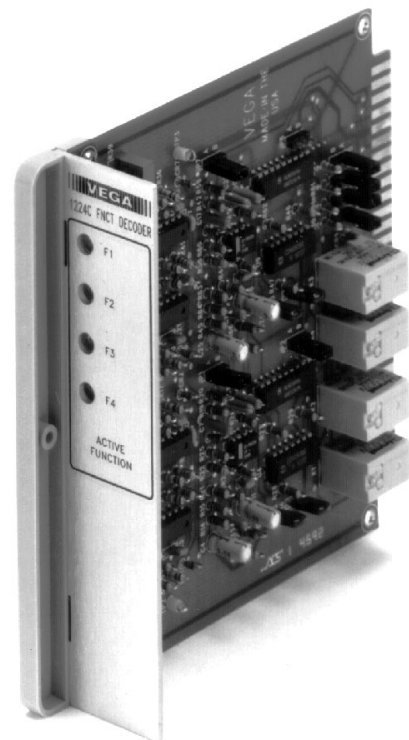
# Technical Manual

## 1223C/1224 Series Tone-Remote Adapters

1223C Series Tone-Remote Adapter



1224 Expansion Module



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### General

The Vega 1223C tone-remote adapter provides a reliable means of remotely controlling a two-way radio base station. It utilizes industry-standard control tone frequencies and timing to provide normal remote system functions of transmitter keying and CTCSS tone squelch monitoring.

Adding the optional Model 1224 expansion module extends the capability to selecting one of up to four frequencies or up to two paired functions per module, for control of properly equipped base stations. Both the 1223C and 1224 are designed to plug into telco shelves (such as Tellabs Type 10 and Wescom or Dantel 400 Type).

The adapter is mounted in or near the base station it is to control, and is connected via hard wire to applicable connection points. Interface to the remote control console is through any voice-grade medium, such as 600-ohm twisted pair, leased telephone line, or microwave link.

### Options

#### Model 1224 Expansion Module

This four-frequency decoder extends the capability of the basic unit to accommodate up to a four-frequency transmitter, or it can provide two “on/off” ancillary base-station functions of properly equipped base stations. A second 1224 can be added to double the number of frequencies or paired functions.

#### LPO-23 Lightning and Transient Protector

These gas-discharge tubes provide lightning and transient protection to maintain system integrity in a difficult environment. Vega highly recommends the incorporation of this option for each installation.

#### TO-23 Transformer Isolation

Isolation for transmit and receive interfaces is provided by a TO-23 Transformer isolation option. Transmitter line input isolation is provided by a 600-ohm CT:600-ohm CT transformer. Receiver output isolation is provided by a 10-kilohm CT:10-kilohm CT transformer.

## Compatibility

### Vega Tone Remote Consoles

The following Vega consoles are fully compatible with 1223Cs:

| Model Number                | Description              |
|-----------------------------|--------------------------|
| C-510C/C-511/C-512          | Two-frequency transmit   |
| C-514B                      | Four-frequency transmit  |
| C-516                       | Six-line/two frequency   |
| C-1614                      | Six-line/four frequency  |
| C-582/C-583                 | Eight-frequency transmit |
| C-5110/C-5111/C-5112/C-5200 | Ten-line/four frequency  |

Other Vega consoles may be compatible with 1223Cs. Consult the factory for compatibility information.

### Other Manufacturers Tone-Remote Consoles

Other consoles (such as Motorola, Ericsson and GE) using industry-standard control tone frequencies and timing are generally compatible with these modules. If in doubt, consult the factory for compatibility.

### Operation

The 1223C decodes industry-standard tone control sequences to provide the following functions: PTT (push-to-talk/transmitter key); CTCSS tone squelch receiver monitoring, and with the optional 1224 expansion module, selection of one of up to four frequencies for transmission, or selection of up to two paired functions, on base stations so equipped. A second 1224 can be added to double the number of frequencies or paired functions.

The unit is capable of two-wire or four-wire operation, and is easily converted by means of jumper plugs. In addition, full-duplex operation can also be accommodated in the four-wire mode, by a simple jumper plug.

**PTT.** Base-station keying is accomplished by decoding the tone-control command, and providing a jumper-selected switched transistor or relay-closure output. Transmitter keying is indicated by a front panel LED. During PTT operation, the control tone portion (2175 Hz, hold tone) of the voice-plus-tone signal received from the remote console is removed from the transmit audio applied to the base station.

**Monitor.** A “monitor” function disables the base-station receiver CTCSS (Continuous Tone Coded Squelch Signaling) sub-audible-tone-decoder circuit, as required by FCC regulations, on stations so equipped. The monitor function is accomplished by decoding a 2050 Hz tone command, and providing a jumper-selected switched transistor or relay-closure output, to turn off the radio receiver CTCSS decoder, allowing the console operator to monitor the channel for other users before keying the transmitter. A monitor LED is provided on the front panel.

Three modes of monitor operation are provided, any one of which is easily jumper selectable.

**1. Timed Mode.** In this method of operation, the monitor function operates for a timed period (adjustable for up to 9 seconds) or until a PTT command is decoded.

**2. Latched Mode.** Upon receipt of the monitor command, the function is latched on, until reset by a PTT command.

**3. Timed/Refresh mode.** A timed monitor function is initiated by receipt of any tone command. Any command received during the timed period refreshes the timer for another full cycle. This mode is extremely useful for systems in which frequent dispatch/mobile interchanges occur, or where frequent frequency selections are made.

**Alternate Function Capability.** On single-user stations not equipped for CTCSS operation, the monitor function may be used for another purpose, such as interrogation of a status-reporting system at the station site.

**Frequency Selection.** Frequency selection is provided by the optional Model 1224 expansion module(s). Each module can select one of up to four frequencies. The number of selectable frequencies varies with the number of modules 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). Relay outputs can be jumpered for latched or momentary outputs.

**Ancillary Functions.** The 1224 expansion module(s) can also be jumper selected to provide up to two paired “on/off” toggle functions per module, for control of properly equipped base stations. Relay outputs can be jumpered for latched or momentary outputs.

## Installation

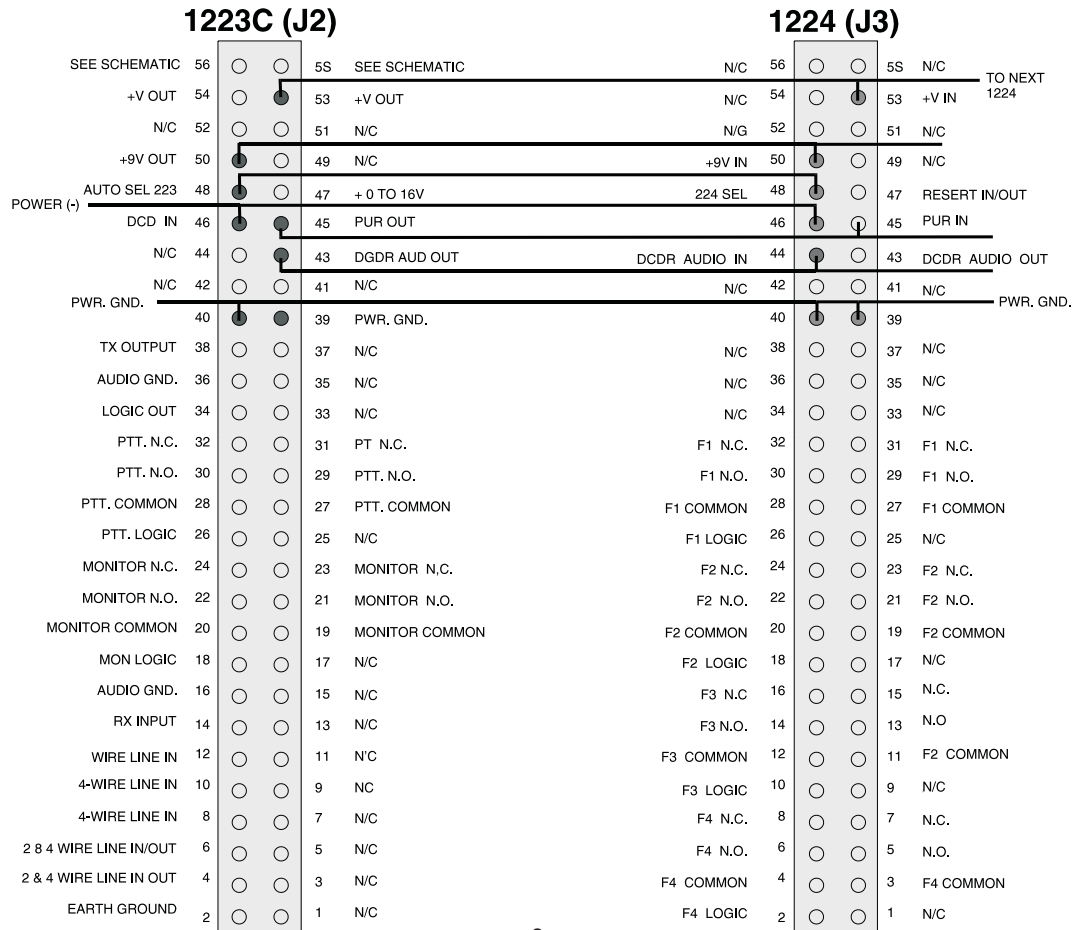
Connect an external 10- to 16-volt semiregulated DC power supply to the card shelf, with ground to J2-39 and positive to J2-47.

Connect the two-wire leased line to J2-4 and J2-6. For four-wire operation, move JP6 to B, connect the outgoing line to J2-4 and J2-6, and connect the incoming line to J2-8 and J2-10. Also move JP4 to B if full-duplex operation is desired.

Connect J2-38 to the transmitter mic audio input, and J2-36 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 JP12 and JP13 both to the “B” position.

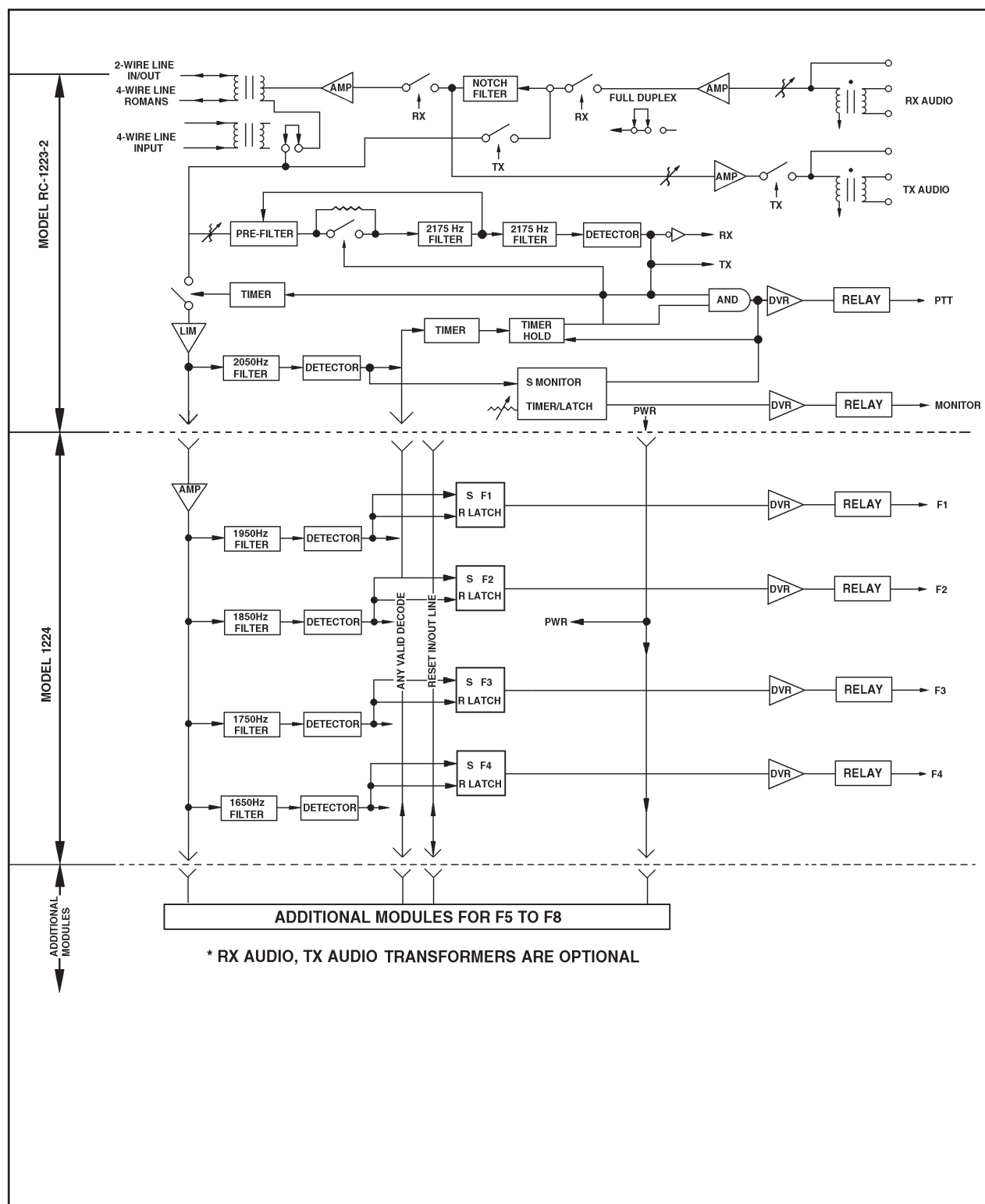
If the mic input is a high-impedance type, shielded cable is recommended. If the radio has a high-level mic input, move JP7 to the “B” position.

Connect the radio receiver audio output to J2-14 and J2-16. 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 J2-16. If the TO-23 option is not installed, set jumpers JP10 and JP11 both to the “A” position; if the TO-23 option is installed, set jumpers JP10 and JP11 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 J2-14.

Connect the radio PTT circuit to the PTT relay contact terminals of the panel. Connect the radio “monitor” circuit to the MON relay contact terminals. Refer to the schematic.



1223C/1224 Block Diagram

## 1224 Installation

Make the following essential connections between the 1223C and 1224 boards: J2-53 to J3-53, J2-50 to J3-50, J2-48 to J3-48, J2-46 to J3-46, J2-45 to J3-45, J2-40 to J3-40, and J2-43 to J3-44 (not J3-43).

When one or more 1224 models are installed, connect radio-frequency control circuits to the function-control relay output terminals on the 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.

Although there is no complete protection from lightning, gas-discharge devices such as North Supply #S-561034 (two-wire) or S-561034 plus S-561035 (four-wire) provide a high degree of protection when a nearby earth ground is connected.

For additional protection, provisions have been made on the 1223C for installation of either Model LPO-23 gas-discharge-tube protectors. 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 1223C 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:

**Guard Tone/PTT Tone:** 2175 Hz

**MON Function Tone:** 2050 Hz

## Frequency-Select Function Tones (where used)

**F1: 1950 Hz F2: 1850 Hz F3: 1750 Hz F4: 1650 Hz**

## 1223C to 1224 Tuning Instructions

1. Connect audio source to R52 lead on 1223c through a 1uf dc blocking cap.
2. Insert required decode signal at 0dbm for F1 of 1224 to be retuned.
3. Connect O'scope or rms. volt meter to TP3 and tune R39 for Max signal.
4. Repeat the same for F2 using TP4 and R53.
5. Repeat the same for F3 using TP1 and R6.
6. Repeat the same for F4 using TP2 and R1.

## Level Adjustments

Level adjustments 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

the receiver so that continuous noise is present. Connect the meter to J2-4 and J2-6 (line should also be connected) and adjust R94 (line output level) for the desired line level (usually 0 dBm or 0.8 V<sub>rms</sub>).



## 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- $V_{rms}$  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 (refer to page 3) is desired, move JP1.

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 J2-4 and J2-6, T1 and JP6-A (two-wire), or through J2-8 and J2-10, 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 J2-38. 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 J2-14 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 PTT tone sequence generated by the remote-control console is typically 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 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  $V_{dc}$ .

When the first 2175-Hz tone (guard tone) is detected, TP1 goes low. TX gate activates with the logic high at U6B-4 that energizes the PTT Relay.

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, 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.

When a 1224 is installed, 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 time-out 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. This disables the receive analog gates, and enables the transmit analog gates through a logic high at U6B-4 and U7B-1, 2, 8.

The U8B-9 and the TP1 lows also hold U8B-14 low through U6C and U12A. This U8B-14 low disables time-out 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 time-out 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 remains energized. 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 62-ms timer by highs at U7B-1, 2, 8 from U6B-4.

If a 1224 is not installed, no frequency-select decoders are included, and there is no decode pulse to trigger the 50-ms timer U8A. The auto-select 1223 J2-48 pin which is shorted to ground by a 1224 four-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.

### 1223C 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 square wave. The square-wave function-tone signal from U3A-1 is applied to the monitor bandpass 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 decoded 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 command will not reset the timer in this mode, because the reset path is short-circuited by JP2.



## **1224 Four-Frequency 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 U7A-1 is a high, and is applied as a low to the F1-latch set input at U9A-1 through U8A-1,18. Simultaneously, a low is applied to the F1 latch reset input at U9B-6, and, if JP2 and JP8 are in the A position as shipped, to the reset input of all other frequency-select function-tone decoders through U8D-4,15, JP8A, JP2A, and J3-47.

When simultaneous set and reset inputs are applied to the F1 latch, set dominates at the Q output and the high at U9A-3 energizes the F1 relay through U8D-7,12. Simultaneously, the reset low applied to F2, F3, F4, 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 R47 and C19. This ensures that latch F1 will remain in the set condition.

If the JP8 jumper plug is in a no-bridge condition (hung 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 a no-bridge condition, the same thing happens with F3 and F4.

If JP8 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.

If JP2 is in the B position, the same thing happens with F3 and F4.

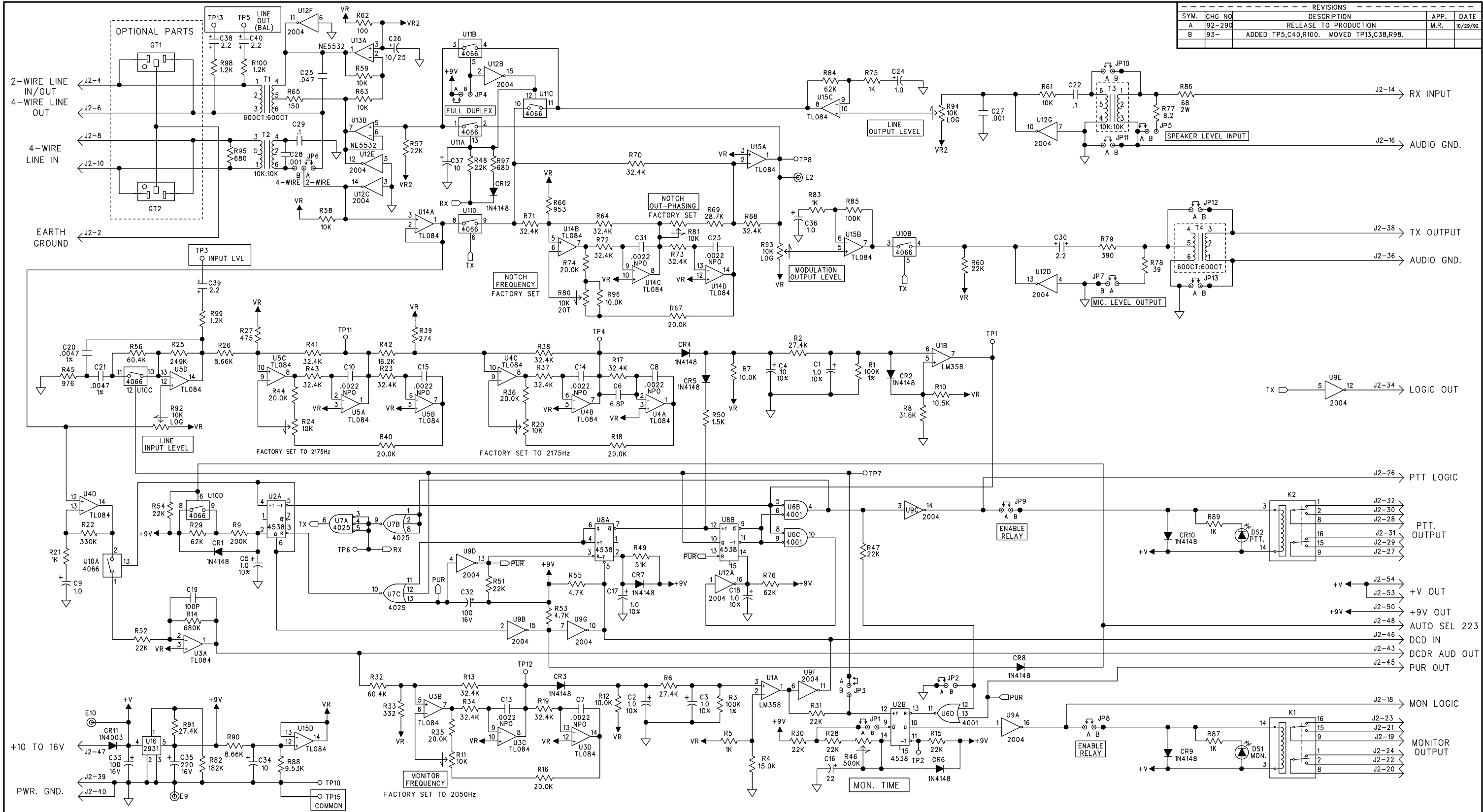
## **Technical Assistance**

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 (Limited)**

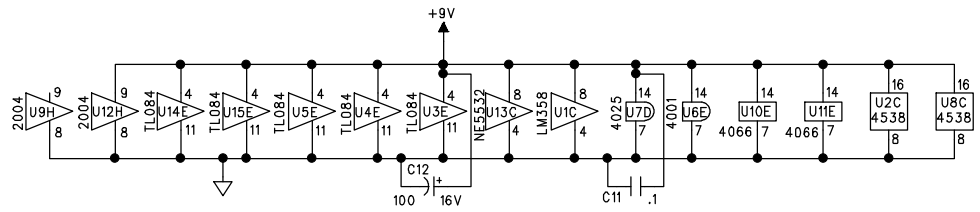
All Vega signaling products are guaranteed against malfunction due to defects in materials and workmanship for three years, beginning at the date of original purchase. If such a malfunction occurs, the product will be repaired or replaced (at our option) without charge during the three-year period, if 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.

| REVISIONS |        |                                         |               |
|-----------|--------|-----------------------------------------|---------------|
| SYM.      | CHG NO | DESCRIPTION                             | APP. DATE     |
| A         | 92-290 | RELEASE TO PRODUCTION                   | M.R. 10/29/92 |
| B         | 93-    | ADDED TP5,C40,R100. MOVED TP13,C38,R98. |               |



# NOTES:

- 1) FOR TIMED MONITOR SET JP1,2,3 TO "A". FOR LATCHED MONITOR SET JP1 TO "B", JP2,3 TO "A". FOR REFRESHED MONITOR SET JP1 TO "A", JP2,3 TO "B".
- 2) SET JP6 TO "A" FOR 2-WIRE AND "B" FOR 4-WIRE OPERATION.
- 3) SET JP4 TO "B" FOR FULL DUPLEX OPERATION (4-WIRE ONLY).
- 4) SET JP8,9 TO "B" POSITION TO DEFEAT RELAY AND LED OPERATION. IF EXTERNAL RELAY IS USED INSTALL A REVERSE CONNECTED DIODE ACROSS RELAY COIL.
- 5) T3 AND T4 ARE OPTIONAL, WHEN INSTALLED SET JP10-JP13 TO "B".
- 6) FOR 600 OHM RX TERMINATION: SHORT R86, REPLACE R77 WITH 680 OHM, AND MOVE JP5 TO "B" POSITION.

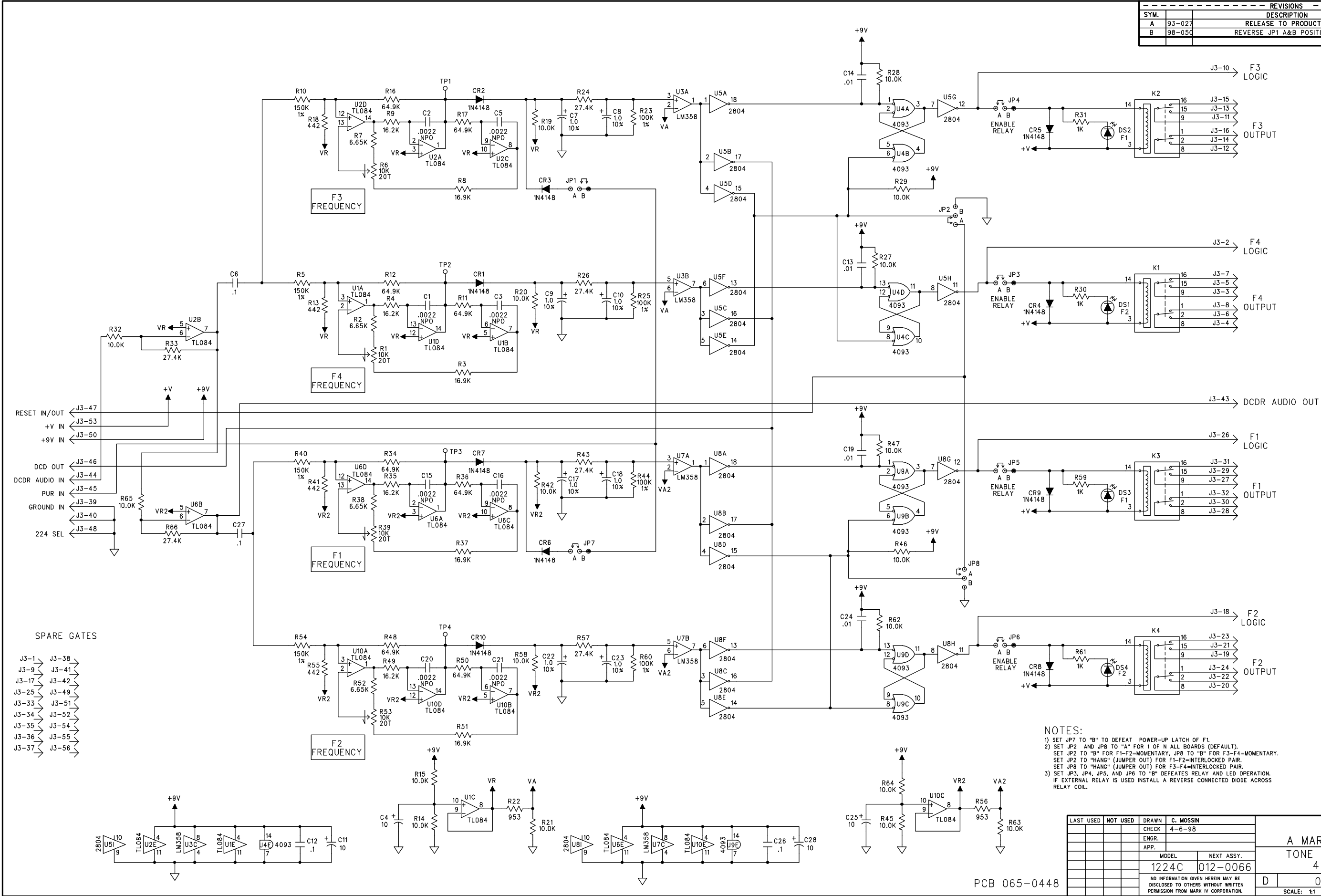


PCB 065-0447

| LAST USED | NOT USED | DRAWN | D.R. MCAFEE                                                                                                 |
|-----------|----------|-------|-------------------------------------------------------------------------------------------------------------|
|           |          | CHECK | D.R. MCAFEE 10/27/92                                                                                        |
|           |          | ENGR. | ARNIE RATNER 10/29/92                                                                                       |
|           |          | APP.  | MARK RODEGHIERO 10/29/92                                                                                    |
|           |          | MODEL | NEXT ASSY.                                                                                                  |
|           |          |       | 1223C 012-0065                                                                                              |
|           |          |       | NO INFORMATION GIVEN HEREIN MAY BE DISCLOSED TO OTHERS WITHOUT WRITTEN PERMISSION FROM MARK IV CORPORATION. |
|           |          |       | SCALE: 1:1                                                                                                  |
|           |          |       | SHEET 1 OF 1                                                                                                |

**VEGA**  
A MARK IV COMPANY  
TONE REMOTE ADAPTER  
STN. PNL./WITH PTT./MON.  
D 071-0558 B

| REVISIONS |             |                           |      |
|-----------|-------------|---------------------------|------|
| SYM.      | DESCRIPTION | APP.                      | DATE |
| A         | 93-027      | RELEASE TO PRODUCTION     |      |
| B         | 98-050      | REVERSE JP1 A&B POSITIONS |      |



## 1223C Parts List

| PART No. | DESCRIPTION               | CKT SYM |
|----------|---------------------------|---------|
| 010-0891 | 1223C TONE ADAPTER CARD   |         |
| 012-0065 | PCB 1223C TONE ADPT       |         |
| 098-0348 | MAN INST 1223/1224        |         |
| 012-0065 | PCB 1223C TONE ADPT       |         |
| 021-6721 | PANEL FRONT 1223C         |         |
| 031-0221 | TEST SPEC 1223C/1224C     |         |
| 065-0447 | PCB 1223                  |         |
| 071-0558 | SCHEMATIC 1223C           |         |
| 102-0060 | CAP CER 6.8P S2L 5% 50V   | C 6     |
| 102-0290 | CAP CER 100P S2L 5% 50V   | C19     |
| 104-0408 | CAP TANT 1MF 35V          | C 1     |
|          |                           | C 2     |
|          |                           | C 3     |
|          |                           | C 5     |
|          |                           | C17     |
|          |                           | C18     |
| 104-0748 | CAP TANT 10MF 10V         | C 4     |
| 105-1011 | CAP MYLAR .047MF 10% 100V | C25     |
| 105-1116 | CAP MYLAR .0047 1%        | C20     |
|          |                           | C21     |
| 110-1320 | CAP CER .001MF 20% 50V    | C27     |
|          |                           | C28     |
| 110-1340 | CAP CER .1MF SMALL        | C11     |
|          |                           | C22     |
|          |                           | C29     |
| 110-1345 | CAP CER .0022MF 5%        | C 7     |
|          |                           | C 8     |
|          |                           | C10     |
|          |                           | C13     |
|          |                           | C14     |
|          |                           | C15     |
|          |                           | C23     |
|          |                           | C31     |
| 112-1606 | CAP ELEC 10MF 25V         | C26     |
|          |                           | C34     |
|          |                           | C37     |
| 112-1608 | CAP ELEC 1.0MF 20% 25V    | C 9     |
|          |                           | C24     |
|          |                           | C36     |
| 112-1613 | CAP ELEC 220MF 20% 16V    | C35     |
| 112-1671 | CAP ELEC 22MF 16V 10%RD   | C16     |
| 112-1676 | CAP ELEC 100UF 16V        | C12     |
|          |                           | C32     |
|          |                           | C33     |
| 130-0533 | RES VAR 500K MT LIN       | R46     |
| 130-0639 | RES VAR 10K PCB           | R11     |
|          |                           | R20     |
|          |                           | R24     |
|          |                           | R81     |
| 130-0673 | RES VAR 10K 20T 3/8SQ     | R80     |

## 1223C Parts List (continued)

| PART No. | DESCRIPTION             | CKT SYM                                                                                               |
|----------|-------------------------|-------------------------------------------------------------------------------------------------------|
| 130-0725 | RES VAR 10K LOG PC HADJ | R92<br>R93<br>R94                                                                                     |
| 131-1853 | RES WW 68 5% 2W         | R86                                                                                                   |
| 132-0004 | RES RN55C 32.4K 1% 1/4W | R13<br>R17<br>R19<br>R23<br>R34<br>R37<br>R38<br>R41<br>R43<br>R64<br>R68<br>R70<br>R71<br>R72<br>R73 |
| 134-0212 | RES RN55D 10.0K 1% 1/4W | R 7<br>R12<br>R96                                                                                     |
| 134-2837 | RES RN55D 15.0K 1% 1/4W | R 4                                                                                                   |
| 134-2852 | RES RN55D 16.2K 1% 1/4W | R42                                                                                                   |
| 134-2874 | RES RN55D 182.K 1% 1/4W | R82                                                                                                   |
| 134-2877 | RES RN55D 20.0K 1% 1/4W | R16<br>R18<br>R35<br>R36<br>R40<br>R44<br>R67<br>R74                                                  |
| 134-2886 | RES RN55D 332 1% 1/4W   | R33                                                                                                   |
| 134-2887 | RES RN55D 27.4K 1% 1/4W | R 2<br>R 6<br>R91                                                                                     |
| 134-2892 | RES RN55D 60.4K 1% 1/4W | R32<br>R56                                                                                            |
| 134-2946 | RES RN55D 953. 1% 1/4W  | R66                                                                                                   |
| 134-2947 | RES RN55D 249K 1% 1/4W  | R25                                                                                                   |
| 134-2954 | RES RN55D 9.53K 1% 1/4W | R88                                                                                                   |
| 134-2991 | RES RN55D 10.5K 1% 1/4W | R10                                                                                                   |
| 134-3021 | RES RN55D 475 1% 1/4W   | R27                                                                                                   |
| 134-3035 | RES RN55D 8.66K 1% 1/4W | R26<br>R90                                                                                            |
| 134-3036 | RES RN55D 274 1% 1/4W   | R39                                                                                                   |
| 134-3038 | RES RN55D 976 1% 1/4W   | R45                                                                                                   |
| 134-3042 | RES RN55D 31.6K 1% 1/4W | R 8                                                                                                   |
| 134-3046 | RES RN55D 28.7K 1% 1/4W | R69                                                                                                   |
| 136-0003 | RES COMP 8.2 5% 1/4W    | R77                                                                                                   |
| 136-0015 | RES COMP 39 5% 1/4W     | R78                                                                                                   |



### 1223C Parts List (continued)

| PART No. | DESCRIPTION              | CKT SYM |
|----------|--------------------------|---------|
| 136-0020 | RES COMP 100 5% 1/4W     | R62     |
| 136-0022 | RES COMP 150 5% 1/4W     | R65     |
| 136-0027 | RES COMP 390 5% 1/4W     | R79     |
| 136-0030 | RES COMP 680 5% 1/4W     | R95     |
|          |                          | R97     |
| 136-0032 | RES COMP 1K 5% 1/4W      | R 5     |
|          |                          | R21     |
|          |                          | R75     |
|          |                          | R83     |
|          |                          | R87     |
|          |                          | R89     |
| 136-0034 | RES COMP 1.5K 5% 1/4W    | R50     |
| 136-0040 | RES COMP 4.7K 5% 1/4W    | R53     |
|          |                          | R55     |
| 136-0044 | RES COMP 10K 5% 1/4W     | R58     |
|          |                          | R59     |
|          |                          | R61     |
|          |                          | R63     |
| 136-0048 | RES COMP 22K 5% 1/4W     | R15     |
|          |                          | R28     |
|          |                          | R30     |
|          |                          | R31     |
|          |                          | R47     |
|          |                          | R48     |
|          |                          | R51     |
|          |                          | R52     |
|          |                          | R54     |
|          |                          | R57     |
|          |                          | R60     |
| 136-0062 | RES COMP 330K 5% 1/4W    | R22     |
| 136-0066 | RES COMP 680K 5% 1/4W    | R14     |
| 136-0282 | RES COMP 51K 5% 1/4W     | R49     |
| 161-0366 | DIODE 1N4003             | CR11    |
| 161-0573 | DIODE LED T1 3/4 RED DIF | DS1     |
|          |                          | DS2     |
| 180-0321 | RELAY PCB 12V            | K1      |
|          |                          | K2      |
| 286-1766 | CONN JUMPER PLUG         | JP1A    |
|          |                          | JP2A    |
|          |                          | JP3A    |
|          |                          | JP4A    |
|          |                          | JP5A    |
|          |                          | JP6A    |
|          |                          | JP7A    |
|          |                          | JP8A    |
|          |                          | JP9A    |
| 318-0246 | XFORMER (10KCT-10KCT) T2 |         |
| 318-0259 | XFORMER (600CT:600CT) T1 |         |

## 1224 Parts List

| PART No. | DESCRIPTION              | CKT SYM |
|----------|--------------------------|---------|
| 010-0802 | 1224 FUNCT DECODER CARD  |         |
| 012-0066 | PCB ASSY 1224C           |         |
| 098-0348 | MAN INST 1223/1224       |         |
| 012-0066 | PCB ASSY 1224C           |         |
| 021-6701 | PLN FRONT 1224C          |         |
| 031-0221 | TEST SPEC 1223C/1224C    |         |
| 065-0448 | PCB 1224C                |         |
| 071-0559 | SCHEMATIC 1224C          |         |
| 104-0408 | CAP TANT 1MF 35V         | C 7     |
|          |                          | C 8     |
|          |                          | C 9     |
|          |                          | C10     |
|          |                          | C17     |
|          |                          | C18     |
|          |                          | C22     |
|          |                          | C23     |
| 105-1099 | CAP MYLAR .01MF 10% 100V | C13     |
|          |                          | C14     |
|          |                          | C19     |
|          |                          | C24     |
| 110-1340 | CAP CER .1MF SMALL       | C 6     |
|          |                          | C12     |
|          |                          | C26     |
|          |                          | C27     |
| 110-1345 | CAP CER .0022MF 5% NPO   | C 1     |
|          |                          | C 2     |
|          |                          | C 3     |
|          |                          | C 5     |
|          |                          | C15     |
|          |                          | C16     |
|          |                          | C20     |
|          |                          | C21     |
| 112-1606 | CAP ELEC 10MF 25V        | C 4     |
|          |                          | C11     |
|          |                          | C25     |
|          |                          | C28     |
| 130-0673 | RES VAR 10K 20T 3/8SQ    | R 1     |
|          |                          | R 6     |
|          |                          | R39     |
|          |                          | R53     |
| 134-0195 | RES RN55D 100K 1% 1/4W   | R23     |
| 425-0157 | IC CMOS 4001 QUAD 2NOR   | U6      |
| 425-0181 | IC OPAMP TL084 QUAD BFET | U 3     |
|          |                          | U 4     |
|          |                          | U 5     |
|          |                          | U14     |
|          |                          | U15     |
| 425-0202 | IC OPAMP 5532 DUAL RL600 | U13     |
| 425-0204 | IC CMOS 4025 TRIP 3NOR   | U 7     |

## 1224 Parts List (continued)

| PART No. | DESCRIPTION              | CKT SYM                                                                                                                    |
|----------|--------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 425-0215 | INT CKT ULN2004A         | U 9<br>U12                                                                                                                 |
| 425-0230 | IC OPAMP LM358 DUAL      | U 1                                                                                                                        |
| 425-0411 | IC 4538 DUAL MONO        | U 2<br>U 8                                                                                                                 |
| 425-0452 | INT CKT LM2931T ADJ REG  | U16                                                                                                                        |
| 425-0461 | IC HCMOS 74HC4066 QUADSW | U10<br>U11                                                                                                                 |
| 568-0005 | BRACKET PC CARD INSERT   |                                                                                                                            |
|          |                          | R25<br>R44<br>R60                                                                                                          |
| 134-0212 | RES RN55D 10.0K 1% 1/4W  | R14<br>R15<br>R19<br>R20<br>R21<br>R27<br>R28<br>R29<br>R32<br>R42<br>R45<br>R46<br>R47<br>R58<br>R62<br>R63<br>R64<br>R65 |
| 134-0312 | RES RN55D 150.K 1% 1/4W  | R 5<br>R10<br>R40<br>R54                                                                                                   |
| 134-2852 | RES RN55D 16.2K 1% 1/4W  | R 4<br>R 9<br>R35<br>R49                                                                                                   |
| 134-2887 | RES RN55D 27.4K 1% 1/4W  | R24<br>R26<br>R33<br>R43<br>R57<br>R66                                                                                     |
| 134-2916 | RES RN55D 16.9K 1% 1/4W  | R 3<br>R 8<br>R37                                                                                                          |
|          |                          | R51                                                                                                                        |
| 134-2946 | RES RN55D 953. 1% 1/4W   | R22<br>R56                                                                                                                 |

## 1224 Parts List (continued)

| PART No. | DESCRIPTION              | CKT SYM                                              |
|----------|--------------------------|------------------------------------------------------|
| 134-2985 | RES RN55D 64.9K 1% 1/4W  | R11<br>R12<br>R16<br>R17<br>R34<br>R36<br>R48<br>R50 |
| 134-2990 | RES RN55D 6.65K 1% 1/4W  | R 2<br>R 7<br>R38<br>R52                             |
| 134-3037 | RES RN55D 442 1% 1/4W    | R13<br>R18<br>R41<br>R55                             |
| 136-0032 | RES COMP 1K 5% 1/4W      | R30<br>R31<br>R59<br>R61                             |
| 247-1523 | LED HOLDER PCB MOUNT     | W/DS1-4                                              |
| 286-1766 | CONN JUMPER PLUG         |                                                      |
| 425-0181 | IC OPAMP TL084 QUAD BFET | U 1<br>U 2<br>U 6<br>U10                             |
| 425-0230 | IC OPAMP LM358 DUAL      | U 3<br>U 7                                           |
| 425-0255 | IC CMOS 4093 QUAD TRIG   | U 4<br>U 9                                           |
| 425-0263 | INT CKT ULN2804A         | U 5<br>U 8                                           |
| 527-0272 | SCREW FH 100PH 4-40X7/16 |                                                      |
| 528-0258 | SCREW PH 4-24X1/4 TYPE B |                                                      |
| 538-0075 | NUT KEP 4-40             |                                                      |
| 561-0623 | SPACER SPCR LED .150     | W/DS1-4                                              |
| 568-0005 | BRACKET PC CARD INSERT   |                                                      |

### Options

#### LPO-23

146-0005 ARRESTER, GAS TUBE

#### TO-23

318-0246 ( 10KCT-10KCT) T3

318-0259 XFORMER (600CT:600CT) T4

## 1223C/1224 Series Specifications

|                                                       |                                                                                                                                                                   |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Operating Temperature Range:</b>                   | ..... –20 to +55°C for full specifications;<br>–30 to +70°C with reduced specifications                                                                           |
| <b>Power Requirements:</b>                            | ..... +10 to +16 Vdc, semiregulated                                                                                                                               |
| <b>Model 1223C:</b>                                   | ..... 55 mA idle, 110 mA maximum at 12 Vdc                                                                                                                        |
| <b>Model 1224:</b>                                    | ..... 90 mA idle, 85 mA maximum at 12 Vdc (1 of 4). Add 50 mA<br>maximum for refresh MON operation and 50 mA for each<br>additional relay “on” in non-1-of-N mode |
| <b>Relay Contact Ratings:</b>                         | ..... 2 A, 30 Vdc maximum                                                                                                                                         |
| <b>Radio Interface:</b>                               | ..... (45 Vdc withstand rating                                                                                                                                    |
| <b>Line to TX Output Gain:</b>                        | ..... –26 to +16 dB into mic input load or –10 to +22 dB into<br>600- $\Omega$ load, adjustable                                                                   |
| <b>TX Output Level:</b>                               | ..... –60 to –18 dBm (for mic-level output) or –40 to +2 dBm into<br>600- $\Omega$ load, adjustable                                                               |
| <b>TX Output Impedance:</b>                           | ..... 22 $\Omega$ TX ON, typical; 22 k $\Omega$ TX OFF, typical                                                                                                   |
| <b>RX Input Level:</b>                                | ..... 100 mVrms to 16 Vrms, adjustable                                                                                                                            |
| <b>Audio Distortion:</b>                              | ..... 2% THD maximum                                                                                                                                              |
| <b>Frequency Response:</b>                            | ..... (1.5 dB, 300 to 3000 Hz, except at transmit notch frequency                                                                                                 |
| <b>Line Output Level:</b>                             | ..... –30 to +12 dBm, adjustable                                                                                                                                  |
| <b>Line Input/Output Impedance:</b>                   | ..... 600 $\Omega$ nominal                                                                                                                                        |
| <b>Sensitivity:</b>                                   | ..... Ultimate sensitivity, –60 dBm PTT tone                                                                                                                      |
| <b>Noise Tolerance (5-kHz-bandwidth white noise):</b> | ..... To 18 dB above PTT tone level<br>at ultimate sensitivity                                                                                                    |
| <b>Tuning Range</b>                                   |                                                                                                                                                                   |
| <b>Frequency-Select Function Tone Decoder:</b>        | .... 1225 to 2025 Hz, continuously adjustable                                                                                                                     |
| <b>Function-Tone Detection Bandwidth:</b>             | ..... 45 Hz (12 Hz, frequency-select tones;<br>30 Hz (6 Hz, MON function tone                                                                                     |
| <b>MON Timer:</b>                                     | ..... 1 to 10 s, typical, adjustable                                                                                                                              |
| <b>PTT Tone Detect Bandwidth:</b>                     | ..... 50 Hz, typical, with sensitivity set 12 dB<br>above threshold of detection                                                                                  |
| <b>Tone-Detect Stability:</b>                         | ..... (0.3%, –20 to +55°C; (0.4%, –30 to +70°C                                                                                                                    |
| <b>Notch-Frequency Rejection:</b>                     | ..... 45 dB minimum                                                                                                                                               |
| <b>Notch-Frequency Bandwidth:</b>                     | ..... 70 Hz at –3 dB points, typical; 1.0 Hz<br>at –40 dB points, typical                                                                                         |
| <b>Non-Relay Outputs:</b>                             | ..... Open collector, active low, 200 mA maximum, 50 V<br>(internal relay defeated) ..... maximum                                                                 |

## Dimensions (including PCB)

|                     |                                                                    |
|---------------------|--------------------------------------------------------------------|
| <b>Model 1223C:</b> | ..... 5.58 in (14.2 cm) H, 5.43 in (13.8 cm) D, 1.40 in (3.6 cm) W |
| <b>Model 1224:</b>  | ..... 5.58 in (14.2 cm) H, 5.43 in (13.8 cm) D, 1.40 in (3.6 cm) W |



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NOV. 2000

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