

CETEC VEGA

Model 221 Series

Tone Remote Control Panels



Cetec Vega

Division of Cetec Corporation
P.O. Box 5348
9900 Baldwin Place
El Monte, California 91731
Telephone (818) 442-0782

GENERAL

The Cetec Vega Model 221 Series panels provide a reliable means of remotely controlling two way radio base stations. The 221 Series can be used in conjunction with Cetec Vega Model 510N remote control consoles, or other manufacturers' remote control consoles which use the sequential tone keying format.

The 221 Series is available in three models:

- Model 221: Transmit/receive only.
- Model 221M: Same as 221 plus "monitor" function for tone-squelched base-station receivers.
- Model 221FM: Same as 221M plus "F1-F2" function for two-frequency base stations.

The PC boards used in the 221 Series are available separately as replacements or for use in other systems. The boards include:

- Model 227A: PTT PCB for 221 (PTT only); not used in systems using function modules (such as 221M, 221FM, and Series 222FM).
- Model 227B: PTT PCB for 221M, 221FM, and Series 222FM; not used in 221 (PTT only) system.
- Model 229A: Monitor-function PCB for 221M.
- Model 229B: Monitor/F1/F2-function PCB for 221FM.

OPERATION

The 221 Series panels are interconnected to the distant remote control console(s) by a single 600-ohm audio-grade pair of wires, such as typically supplied by telephone companies as leased private circuits.

All 221 models are capable of decoding the PTT (push-to-talk/transmitter-on) tone sequence and the voice-plus-tone signals during the transmission. The tone portion of the voice-plus-tone signal is removed from the transmitted voice. Audio from the receiver is muted in the 221 panel during transmissions.

The "monitor" function provided in the 221M and 221FM models decodes the valid tone sequence and provides a relay output (DPDT) which is used to turn off the tone decoder circuit within the radio receiver. The "monitor" output model can be field-programmed for either (A) timed automatic reset (adjustable up to 5 seconds) or (B) latched on "monitor" command and reset on next PTT command.

The two-frequency select function (F1-F2) provided in the Model 221FM decodes the valid tone sequence and provides a relay output (DPDT) which holds the

last F1-F2 command until specifically changed by the remote control console. This function may also be used for other purposes, such as "repeater on-off" and "second receiver on-off", etc.

Adjustments are provided for line input, line output, modulation output, and receiver input levels. In the 221M and 221FM models, the timed monitor period is adjustable. LED indicators show the current status of the 221 panels.

INSTALLATION

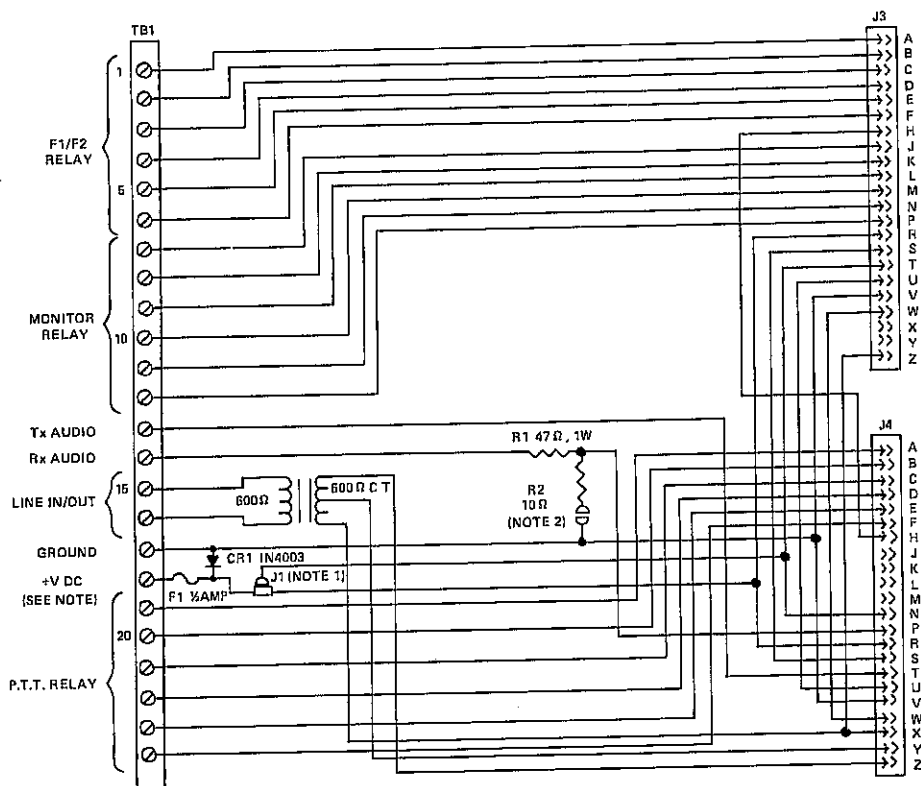
1. Connect external 12 to 18 volt continuous DC supply: -DC to TB1-17
+ DC to TB1-18

Note: If +DC is between +10 and +12 Vdc regulated, close jumper J1 on the mother board.

2. Connect telephone lines to TB1-15 and 16.
3. Connect mic input to TB1-13.

Notes: If mic input is high impedance type, shielded cable is recommended. If a DC voltage over +5 volts is on the radio mic input, a 10 μ F/50 volt capacitor should be placed in series with this connection, with the negative polarity towards the 221 panel.

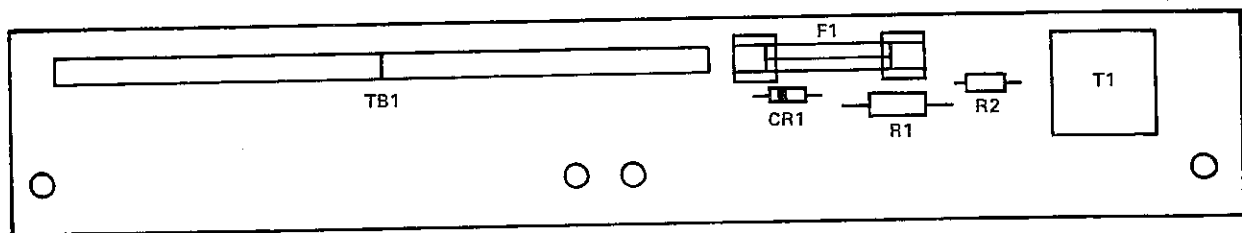
4. Connect receiver audio output to TB1-14. This must be an audio source AFTER the squelch circuit to prevent continual noise being sent to the remote consoles. If a high-impedance point in the receiver is used, shielded cable is recommended. If the speaker output is used, close jumper J2 on the motherboard. Note: When speaker outputs are used, the radio volume control will probably affect the level into the 221. If the receiver audio source connection has over +5 Vdc present, a 10 μ F capacitor should be placed in series, with the negative polarity towards the 221 panel.
5. Connect PTT circuit between TB1-23 and 24, which is a normally open set of contacts. For other contacts, see diagrams.
6. Models 221M and 221FM only: Connect "Monitor" circuit to TB1-8 (common contact) and TB1-7 (normally closed contact) or TB1-9 (normally open contact), as required. The "normal" contact conditions will reverse during the "monitoring" condition. For other contacts, see diagrams.
7. Model 221FM only: Connect F1-F2 common circuit to TB1-2. Connect F1 control to TB1-3. Connect F2 control to TB1-1.
If radio has separate transmitter and receiver frequency controls (such as some GE models), use the above connections for the transmitter control and then connect receiver F1-F2 common circuit to TB1-5. Connect receiver F1 control to TB1-4. Connect receiver F2 control to TB1-6.



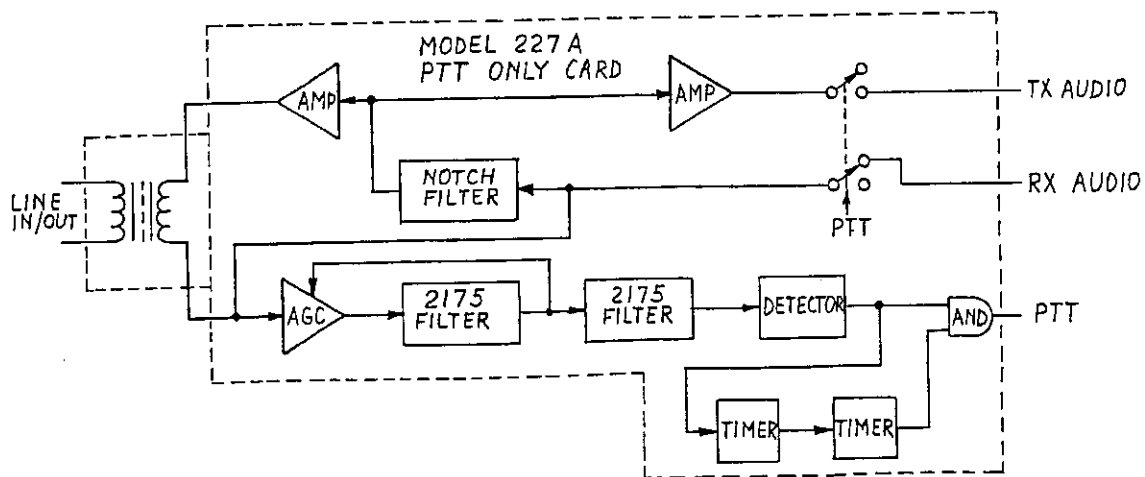
	CARDS USED		
	221	221M	221FM
FUNCTION CARD	NOT USED	229A	229B
PTT CARD	227A	227B	227B

NOTES:
 (1) Permissible Supply Voltage Options:
 +12 to +18 VDC Unregulated J1 Open
 +10 to +12 VDC Regulated J1 Closed
 (2) Close J2 when receive audio input is from a speaker output of the radio receiver.

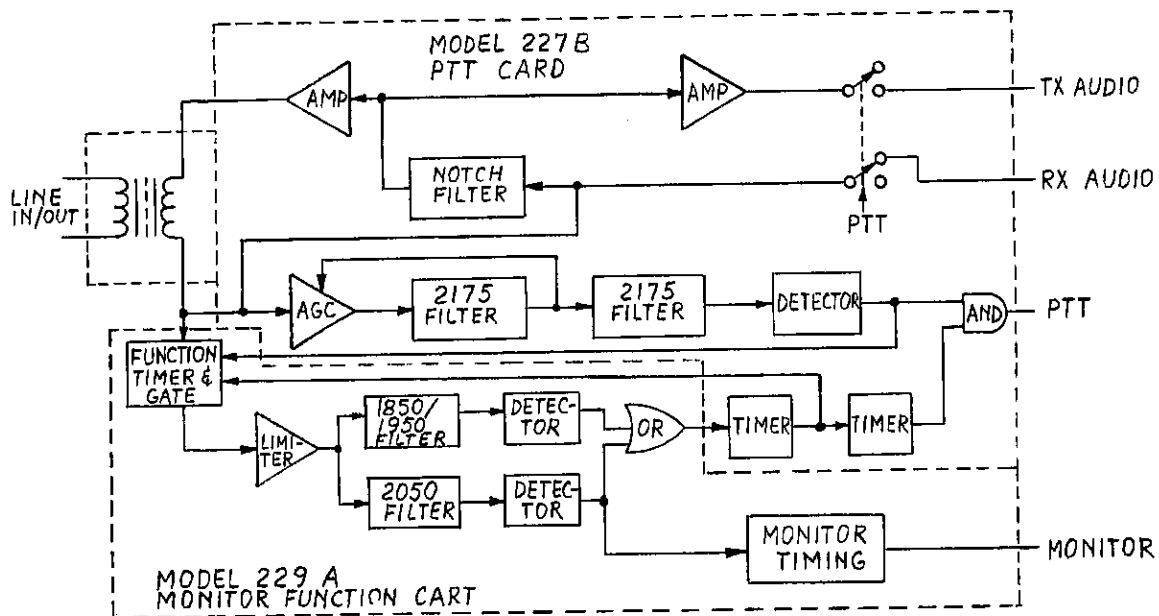
INTERCONNECTIONS OF TERMINAL BOARD



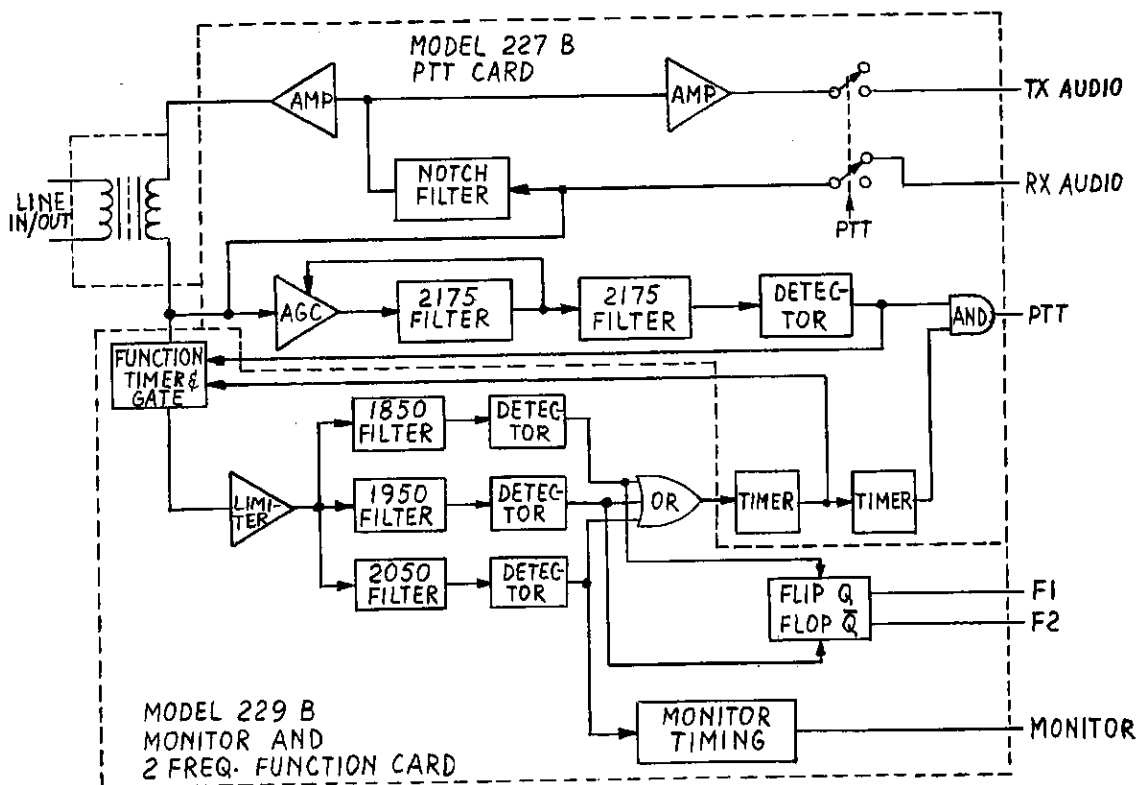
PARTS LAYOUT OF TERMINAL BOARD



SIMPLIFIED BLOCK DIAGRAM MODEL 221



SIMPLIFIED BLOCK DIAGRAM MODEL 221M



SIMPLIFIED BLOCK DIAGRAM MODEL 221FM

LEVEL ADJUSTMENTS

Level adjustments are normally only required at the time of installation or because of a change at the base station.

IMPORTANT: All level test points have DC bias on them. Use the "output" AC scales on your meter which places a DC blocking capacitor into the circuit.

1. Receiver Audio Adjustments.

Unsquench receiver so that noise is present continuously.

A) Adjust R16 "Receiver Input Level" for 1.0 Vrms maximum at TP-1.

B) Place meter across TB1-15 and 16 (telephone lines) and adjust R10 "Line Output Level" for the desired receive line level. Note: In most cases, this should be approximately 0 dBm (0.8 Vrms).

2. Transmit Level Adjustments.

A) Disable transmitter PTT circuit.

Connect top of R65 to top of R30 and top of R29 to ground (TB1-17 on terminal board), using temporary jumpers.

Adjust R64 line input to full clockwise.

Have the remote control console send a continuous PTT command (no voice). The 221 panel should respond by energizing relay K1 and illuminating DS1. Adjust R64 for a 1.0 to 1.1 Vrms reading at TP4. If reading is lower, set R64 to maximum. Key the remote control panel several times to ensure reliable operation of K1.

Remove the temporary jumpers, then key the remote control several more times to ensure reliable detection and holding of K1.

Enable the transmitter and monitor its deviation.

Have the remote control console send a PTT command plus voice. DS1 (the PTT LED) should stay lit. With voice (or a 1-kHz test tone) coming from the remote control, adjust R3 (MOD LEVEL) for proper deviation.

On the 221M and 221FM function decoder card (Model 229A or 229B), the monitor function is timed when J2 is closed and J1 is open. Have the remote control console send a monitor command and check monitor time period. Adjust R48. Repeat until desired time is obtained. Open J2 and close J1 for latched monitor function.

THEORY OF OPERATION

A) Operational amplifiers (op amps) are used for all audio amplifier stages. For those not familiar with "op amp" devices:

1. The + input, - input, and the output all have a DC bias of approximately +5 Vdc ($\frac{1}{2}$ of supply voltage) on them.
2. The output should never be shorted to either - supply or + supply during testing.
3. The + input and - input have very low DC current drain.
4. In most circuits, an AC voltage cannot be measured on the + or - inputs, even though the op amp is amplifying!

B) Solid state audio gates:

CMOS type 4016 "transmission gates" are used to switch audio paths on and off. Each IC has four separate switches. The audio path is open circuited when the control pin is at -DC and closed when at +DC.

C) Voice circuits (Model 227A or 227B 2175-Hz decoder PC board): The voice circuits are independent of the tone circuits.

- a) Line voice enters the 221 system via T1 on the motherboard and on to Pin X of the 2175-Hz board.

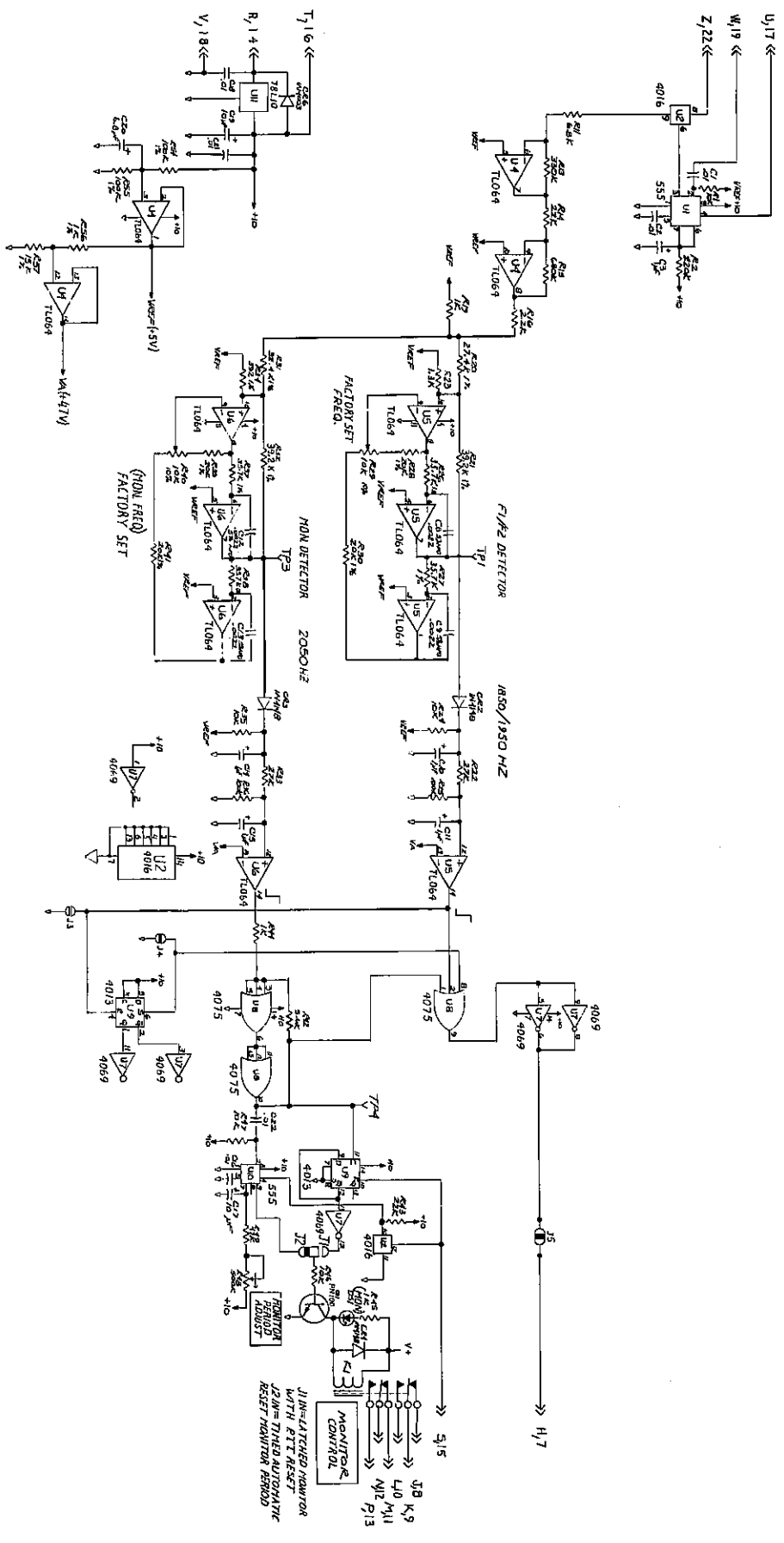
In the "PTT On" condition, audio gates U5-13 and U4-12 are closed. U5-12 and U5-5 are open.

Audio from Pin X passes through audio gate U5-13 and into the notch filter circuit (U2), and is amplified by U3. The output of U3 passes through audio gate U4 out to Pin T of the PC card. This point is directly connected, via the motherboard, to TB1-13.

- b) In the receive condition, audio gates U5-12 and U5-5 are closed. U5-13 and U4-12 are open.

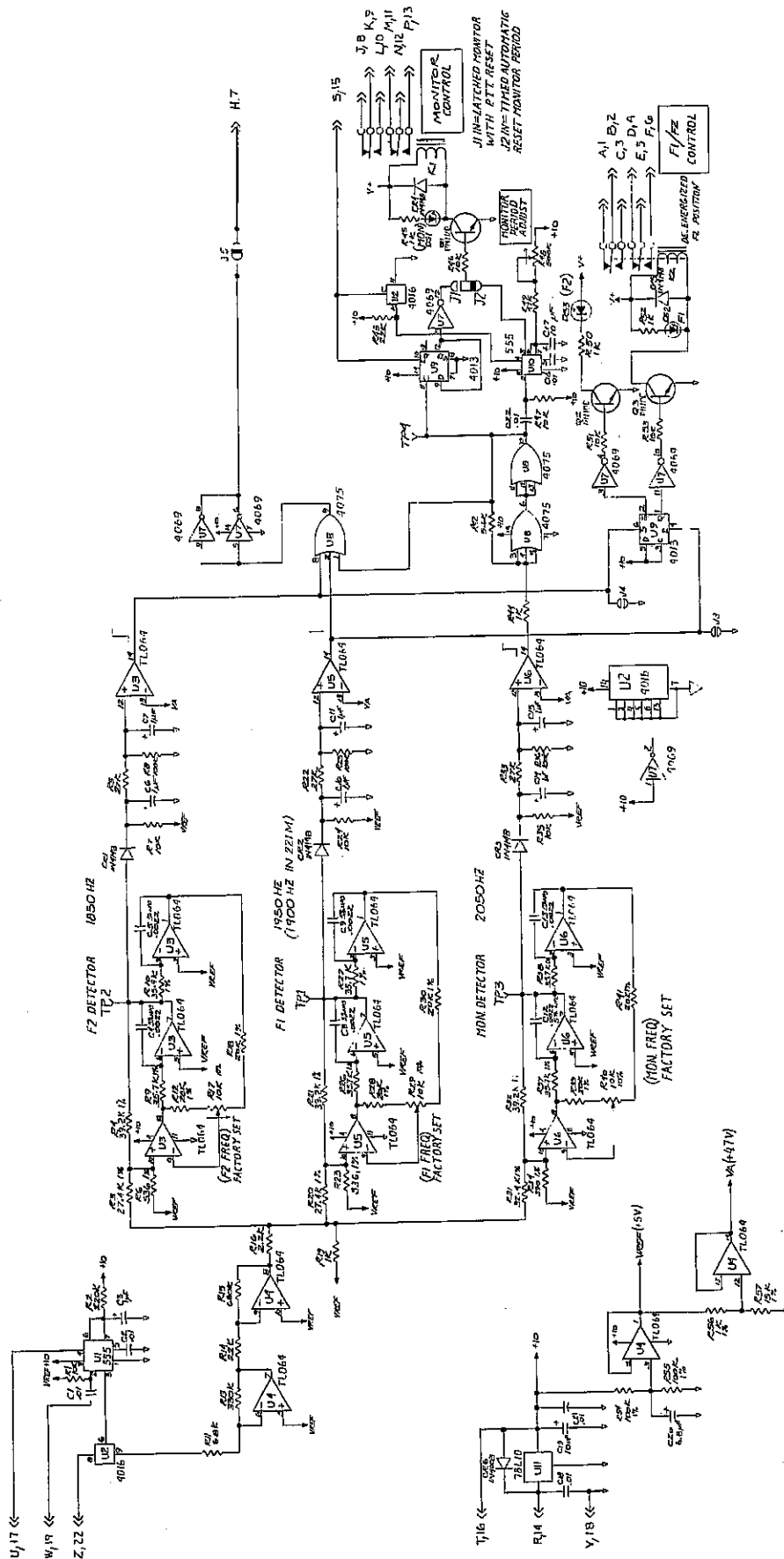
The receive audio enters on TB1-14 which is connected to Pin 13 of the 2175-Hz board. The audio on Pin 13 passes through audio gate U5-5 and into the 2175-Hz notch filter circuit (U2). The notch filter output passes through audio gate U5-12 and the line drivers, U1. U1 has push-pull outputs coupled to the motherboard on Pins Y and Z. These are connected to T1 and then to the telephone circuit.

Note that T1 secondary is center-tapped and the low output impedance of U1 effectively makes the center tap near audio ground potential in the transmit condition.



ASSY : 011 - 0015
PCB : 065 - 0246

Model 229A Monitor Function Decoder Board



ASSY 011-0016
PLB: 065-0245

PART NUMBER: 011-0013 DESCRIPTION: PCB ASSY 227A PTT ONLY
 PART NUMBER: 011-0014 DESCRIPTION: PCB ASSY 227B PTT (FUNC)

PART NO.	QTY	DESCRIPTION	CKT SYM
104-0397	1	CAP TANT .12MF 35V	C22
104-0408	5	CAP TANT 1MF 35V	C20B (227B) C1 C15 C16 C20A (227A) C4 C10 C8 C24 C5 C17 C18 C19 C21 C7 C9 C23 C6 C11 C12 C13 C14 C2 C3 R13 R16 R31 R53 R54 R64 R10 R3 R23 R15 R17 R20 R45 R46 R47 R48 R33 R34 R36 R4 R5 R51 R7 R38 R52 R21 R26 R49 R50 R55 R56 R14 R37 R39
104-0516	2	CAP TANT 10MF 25V	
105-1324	2	CAP PS 0047MF 1% 63V	
110-1140	6	CAP CER .01MF 20% 25V	
110-1142	1	CAP CER 100PF SM 50V	
110-1340	1	CAP CER .1MF SMALL	
110-1345	6	CAP CER .0022MF 5% NPO	
130-0639	6	RES VAR 10K H-MTG PCB	
130-0655	2	RES VAR 100K HOR MT	
130-0673	1	RES VAR 10K 20T 3/8SQ	
132-0004	7	RES RN55C 32.4K 1% 1/4W	
134-0195	2	RES RN55D 100K 1% 1/4W	
134-0212	5	RES RN55D 10.0K 1% 1/4W	
134-2837	1	RES RN55D 15.0K 1% 1/4W	
134-2844	1	RES RN55D 68.1K 1% 1/4W	
134-2877	6	RES RN55D 20.0K 1% 1/4W	
134-2879	3	RES RN55D 39.2K 1% 1/4W	

Continued

PART NO.	QTY	DESCRIPTION	CKT SYM
134-2884	1	RES RN55D 274. K 1% 1/4W	R35
134-2885	1	RES RN55D 562. 1% 1/4W	R41
134-2886	1	RES RN55D 332 1% 1/4W	R42
134-2888	1	RES RN55D 681 1% 1/4W	R18
134-2946	1	RES RN55D 953. 1% 1/4W	R24
134-2947	1	RES RN55D 249K 1% 1/4W	R25
136-0023	1	RES COMP 180 5% 1/4W	R12
136-0032	5	RES COMP 1K 5% 1/4W	R11
			R2
			R30
			R62
			R66
			R6
136-0040	1	RES COMP 4.7K 5% 1/4W	R65
136-0042	1	RES COMP 6.8K 5% 1/4W	R1
136-0044	8	RES COMP 10K 5% 1/4W	R32
			R43
			R57
			R58B (227B)
			R59
			R63
			R8
			R9
136-0049	2	RES COMP 27K 5% 1/4W	R27
			R40
136-0051	1	RES COMP 39K 5% 1/4W	R58
136-0056	2	RES COMP 100K 5% 1/4W	R28
			R44
			R60
136-0059	1	RES COMP 180K 5% 1/4W	R60B (227B)
136-0063	1	RES COMP 390K 5% 1/4W	R61
136-0064	1	RES COMP 470K 5% 1/4W	R29
136-0066	1	RES COMP 680K 5% 1/4W	Q2
141-0002	1	XSTR PNP 2N5087 TO92 HB	Q3
142-0001	1	XSTR NPN PN100 TO92 SW	Q1
149-0580	1	XSISTOR J201 FET	CR1
161-0366	5	DIODE 1N4003	CR10
			CR7
			CR8
			CR9
161-0426	5	DIODE 1N4148	CR2
			CR3
			CR4
			CR5
			CR6
161-0573	1	DIODE LED T1 3/4 RED DIF	DS1
180-0321	1	RELAY DPDT PCB 12V	K1
425-0104	2	IC CMOS 4016 QUAD SW	U4
			U5
425-0105	1	IC OPAMP 4558 DUAL	U6
425-0130	2	INT CKT NE555 TIMER	U11
			U12
425-0157	1	IC CMOS 4001 QUAD 2NOR	U10
425-0191	1	IC CMOS 4069 HEX INV	U9
425-0196	3	IC OPAMP TL064 QUAD LP	U2
			U3
			U8
425-0202	1	IC OPAMP 5532 DUAL RL600	U1
425-0223	1	IC REG-P 78L10 10V .1A	U7
484-0104	1	TRANSIPAD TO-18	

PART NUMBER: 011-0015 DESCRIPTION: PCB ASSY 229A 221 MON

PART NO.	QTY	DESCRIPTION	CKT SYM
104-0322	1	CAP TANT 6.8MF 10V	C20
104-0408	5	CAP TANT 1MF 35V	C10
			C11
			C14
			C15
			C3
104-0516	2	CAP TANT 10MF 25V	C17
			C19
110-1140	6	CAP CER .01MF 20% 25V	C1
			C16
			C18
			C2
			C21
			C22
110-1345	4	CAP CER .0022MF 5% NPO	C12
			C13
			C8
			C9
130-0533	1	RES VAR 500K HOR MT LIN	R48
130-0639	2	RES VAR 10K H-MTG PCB	R29
			R40
134-0195	2	RES RN55D 100K 1% 1/4W	R54
			R55
134-0233	1	RES RN55D 1.30K 1% 1/4W	R23
134-2837	1	RES RN55D 15.0K 1% 1/4W	R57
134-2842	1	RES RN55D 22.1K 1% 1/4W	R20
134-2847	1	RES RN55C 32.4K 1% 1/4W	R31
134-2859	4	RES RN55D 35.7K 1% 1/4W	R26
			R27
			R37
			R38
134-2877	4	RES RN55D 20.0K 1% 1/4W	R28
			R30
			R39
			R41
134-2879	2	RES RN55D 39.2K 1% 1/4W	R21
			R32
134-2880	1	RES RN55D 1.00K 1% 1/4W	R56
134-2883	1	RES RN55D 392 1% 1/4W	R34
136-0032	3	RES COMP 1K 5% 1/4W	R19
			R44
			R45
136-0036	1	RES COMP 2.2K 5% 1/4W	R16
136-0041	1	RES COMP 5.6K 5% 1/4W	R42
136-0042	1	RES COMP 6.8K 5% 1/4W	R11
136-0044	5	RES COMP 10K 5% 1/4W	R1
			R24
			R35
			R46
			R47
136-0048	2	RES COMP 22K 5% 1/4W	R14
			R43
136-0049	2	RES COMP 27K 5% 1/4W	R22
			R33

PART NO.	QTY	DESCRIPTION	CKT SYM
104-0322	1	CAP TANT 6.8MF 10V	C20
104-0408	7	CAP TANT 1MF 35V	C10
			C11
			C14
			C15
			C3
			C6
			C7
104-0516	2	CAP TANT 10MF 25V	C17
			C19
110-1140	6	CAP CER .01MF 20% 25V	C1
			C16
			C18
			C2
			C21
			C22
110-1345	6	CAP CER .0022MF 5% NPO	C12
			C13
			C4
			C5
			C8
			C9
130-0533	1	RES VAR 500K HOR MT LIN	R48
130-0639	3	RES VAR 10K H-MTG PCB	R17
			R29
			R40
134-0195	2	RES RN55D 100K 1% 1/4W	R54
			R55
134-2837	1	RES RN55D 15.0K 1% 1/4W	R57
134-2847	1	RES RN55C 32.4K 1% 1/4W	R31
134-2859	6	RES RN55D 35.7K 1% 1/4W	R10
			R26
			R27
			R37
			R38
			R9
134-2864	2	RES RN55D 536 1% 1/4W	R23
			R6
134-2877	6	RES RN55D 20.0K 1% 1/4W	R12
			R18
			R28
			R30
			R39
			R41
134-2879	3	RES RN55D 39.2K 1% 1/4W	R21
			R32
			R4
134-2880	1	RES RN55D 1.00K 1% 1/4W	R56
134-2883	1	RES RN55D 392 1% 1/4W	R34
134-2887	2	RES RN55D 27.4K 1% 1/4W	R20
			R3
136-0032	5	RES COMP 1K 5% 1/4W	R19
			R44
			R45
			R50
			R52
136-0036	1	RES COMP 2.2K 5% 1/4W	R16

Continued

PART NO.	QTY	DESCRIPTION	CKT SYM
136-0041	1	RES COMP 5.6K 5% 1/4W	R42
136-0042	1	RES COMP 6.8K 5% 1/4W	R11
136-0044	8	RES COMP 10K 5% 1/4W	R1
			R24
			R35
			R46
			R47
			R51
			R53
			R7
136-0048	2	RES COMP 22K 5% 1/4W	R14
136-0049	3	RES COMP 27K 5% 1/4W	R43
			R22
			R33
			R5
136-0052	1	RES COMP 47K 5% 1/4W	R49
136-0056	3	RES COMP 100K 5% 1/4W	R25
			R36
			R8
136-0060	1	RES COMP 220K 5% 1/4W	R2
136-0062	1	RES COMP 330K 5% 1/4W	R13
136-0066	1	RES COMP 680K 5% 1/4W	R15
142-0001	3	XSTR NPN PN100 TO92 SW	Q1
			Q2
			Q3
161-0366	1	DIODE 1N4003	CR6
161-0426	5	DIODE 1N4148	CR1
			CR2
			CR3
			CR4
			CR5
161-0573	3	DIODE LED T1 3/4 RED DIF	DS1
			DS2
			DS3
180-0321	2	RELAY DPDT PCB 12V	K1
			K2
425-0104	1	IC CMOS 4016 QUAD SW	U2
425-0130	2	INT CKT NE555 TIMER	U1
			U10
425-0158	1	IC CMOS 4013 DUAL D FF	U9
425-0172	1	IC CMOS 4075 TEIP 3OR	U8
425-0191	1	IC CMOS 4069 HEX INV	U7
425-0196	4	IC OPAMP TL064 QUAD LP	U3
			U4
			U5
			U6
425-0223	1	IC REG-P 78L10 10V .1A	U11

LOGIC SECTION

CMOS logic is used in the 221 panels. When the term "low" is used, the DC voltage is near ground potential. When "high" is used, the DC voltage is near + 10 Vdc.

When the "low" from TP6 appears from the first 2175-Hz(+10 dB) tone burst, TP7 goes low (muting the receive audio circuits) and U10-11 remains low due to high on U10-12, inhibiting the PTT output.

The low from TP6 goes to the function decoder board via Pin W, enabling the function decoders for 240 ms. If a valid function tone (1950 or 1850 Hz) is decoded, Pin H on both boards will go low. This signal triggers U11 timer on the 2175-Hz board, causing U11-3 to go high for 50 ms and U10-10 to go low. Pin U of both boards then goes low, which disables the tone inputs to the function decoder board, and in turn returning Pin H on both boards to high.

The path from U10-10, U9 and U10-1 keeps the audio circuits switched to the transmit audio condition.

When U11's time period is over, it triggers timer U12 through C18 for 60 ms. TP8 goes high, which keeps the function board decoders disabled via Pin U on the boards and switches U4 on to allow detection of the low level (-20 dB) 2175-Hz PTT holding tone.

If the PTT holding tone is detected, TP6 on the 2175-Hz board goes low again. Since U12-13 is still high, a low is applied to U10-4 (via U4) and U10-11 goes high. This turns on Q3 (via U9) and enables K1, the PTT control relay. Simultaneously, the high at U9-8 is applied to U5, which forces U12-3 high continuously. The high at U9-8 also goes to Pin S of both boards, which is used as the "latched monitor-PTT reset" control when J1 on the function board is closed.

If a function command only (not PTT) was sent, no low appears at TP6 during the timing period of U12 and the decode logic returns to the original state, awaiting the next tone command sequence. Note: In the PTT-only Model 221 panel, closure of J1 on the Model 227A card is required in lieu of the function-decoder board. This creates the same conditions as the function board 1950-Hz decoder described above, and can be used for testing of the 2175-Hz board only.

MODEL 221 TECHNICAL SPECIFICATIONS	
OPERATING TEMPERATURE RANGE:	-30° C to +70° C
LINE IMPEDANCE:	600 ohms balanced
LINE OUTPUT LEVEL:	Adjustable to +10 dBm
SENSITIVITY:	Sensitivity may be adjusted for line levels between 3 mVrms and 4.5 Vrms. Maximum level variation after sensitivity adjustment is + 10 dB
TRANSMIT AUDIO LEVEL:	Adjustable to 1.8 Vrms into open circuit
RECEIVE AUDIO LEVEL:	Adjustable to +13 dBm on 600 ohm line
TONE FREQUENCIES:	Transmit tone 2175 Hz Monitor burst 2050 Hz F1 burst 1950 Hz F2 burst 1850 Hz Initial burst 2175 Hz
SUPPLY VOLTAGE:	10-12 Vdc regulated, 12 to 18 Vdc unregulated
SUPPLY DRAIN:	60 mA to 180 mA, according to model, and outputs energized
DIMENSIONS:	9.25 W, 1.75 H, 7.25 D, inches 23.5 W, 4.4 H, 18.4 D, centimeters
RELAY OUTPUTS:	All functions are DPDT outputs (2A)

WARRANTY

Cetec Vega signaling products are guaranteed to be free from defects in material and workmanship for a period of three years from the date of shipment. Warranty is for factory repair or replacement only.



Cetec Vega

Division of Cetec Corporation
 P.O. Box 5348
 9900 Baldwin Place
 El Monte, California 91731
 Telephone (818) 442-0782