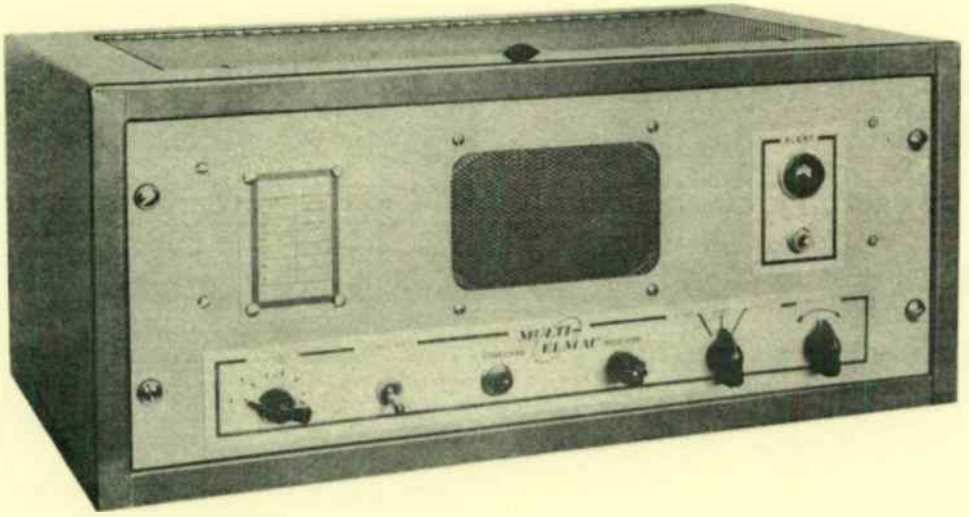
MULTI-ELMAC

Conelrad Monitor Receiver

MODEL CM-1



INSTALLATION

AND

OPERATING INSTRUCTION

MANUAL

FCDA APPROVED

MULTI-PRODUCTS CO. **OAK PARK, MICH.**

Manufacturers of ***"MULTI-ELMAC"*** *Products*

CONELRAD MONITOR RECEIVER

MODEL CM-1

IMPORTANT FEATURES

Six Channels: (A) 640 kc. (B) 1240 kc. (C, D, & E) Crystal Controlled (F) Adjustable.

Crystal Controlled Channels minimize the possibility of drift.

Requires both Carrier Break and 1000 cycle Tone to activate the alarm circuit, eliminating many false alarms.

Fail-Safe Design. Component failures give visual indication.

FCDA Approved for matching funds.

ELECTRICAL PERFORMANCE SPECIFICATIONS

Frequency Range	540 kc. to 1600 kc.
Sensitivity	Audio - 5 microvolts for 4 to 1 s/n ratio. Alarm - 8 microvolts.
Selectivity	6 db down — ± 3 kc. 40 db down — ± 15 kc.
Spurious and Image Response	60 db down.
Audio Output	1½ watts minimum at 10% distortion @ 1000 cycles.
Frequency Stability	± .05%.
Power Input	117 volts, 60 cycles, 60 watts.
AVC Action	Output held within 15 db from 10 microvolts to 100,000 microvolts.
AVC Delay Time	Less than 160 milliseconds from 100,000 microvolts to 10 microvolts.
Carrier Break Response Time	Less than one second.
1000 cycle Response Time	Approx. three seconds.
Receiver Power Failure Duration	1½ seconds without actuating the alarm circuit
1000 cycle Tolerance	± 75 Cycles.

M-125

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SECTION 1

Description

1.1 GENERAL. This CONELRAD MONITOR RECEIVER is designed to give long trouble free service in continuous operation. This is not just a carrier monitor, but a CONELRAD monitor. In order to activate the alarm circuit a carrier break followed by a 1000 cycle tone modulated carrier is required.

The circuit is designed to give fail – safe operation wherever possible. In the event of any tube or component failure in the R.F. or I.F. section the "fail – safe" panel indicator will light up. The audio portion can be readily checked by switching to the "LISTEN" position and audibly monitoring the KEY radio broadcast station. Also included in the circuitry are delay circuits to prevent alarm indications in case of momentary power failures to the receiver.

Six channels are provided:

Channel "A", 640 kc. crystal controlled.
Channel "B", 1240 kc. crystal controlled.
Channel "C", crystal controlled, 540 kc. to 1000 kc. or 1000 kc. to 1600 kc.*
Channel "D", crystal controlled, 540 kc. to 1000 kc. or 1000 kc. to 1600 kc.*
Channel "E", crystal controlled, 1000 kc. to 1600 kc. or 540 kc. to 1000 kc.*
Channel "F", adjustable covering 540 kc. to 1600 kc.*
*See paragraph 2.1 pertaining to the extension of these ranges.

When a CONELRAD signal is received the alarm circuit locks in until manually reset by the user with the front panel "RESET" control. Until the alarm circuit is reset the following conditions prevail:

(1) "ALERT" panel indicator lights up.
(2) Speaker is energized at full pre-set level.
(3) "External relay" contacts close.
(4) Alarm circuit is "locked in". Power failures to receiver will not reset the alarm circuit.

1.2 CIRCUIT DESCRIPTION. The R.F. and I.F. stages are conventional in design. The input circuit consists of six separate antenna coils selected by the channel switch and connected to the pentode section of a 6X8 tube, (V1a), used as the mixer. The triode section, (V1b), of this 6X8 tube is used as the local oscillator. The mixer output is connected to two I.F. amplifier stages, (V2 & V3), operating at 265 kc. A 6AV6 tube, (V4), is used as the detector, AVC rectifier, and first audio amplifier. The "PRE-SET VOLUME" control is in the grid circuit of this tube. The audio output of V4 is connected to the grid of the 6AQ5 power amplifier tube, (V5). The grid of the power amplifier, V5, is also connected to the relay so that as long as no alarm signal is received the grid is effectively grounded, muting the receiver. (Only if the "ALERT-RESET-LISTEN" switch is in the "ALERT" position). V5 grid is connected to the top of the volume control potentiometer, (R50), in the "ALERT" and "RESET" position and to the movable contact of R50 in the "LISTEN" position. This arrangement prevents the user from leaving the switch set in the "RESET" position, circumventing the alarm function.

A type 2D21 thyratron tube, (V6), is used as the carrier break detector. This tube is held normally nonconductive by the AVC voltage applied to its grid. The carrier break sensitivity is adjusted by a potentiometer, R60, which sets the fixed bias for this tube.

When the carrier of the broadcast station being monitored fails the AVC voltage drops allowing V6 to conduct. This lights the "fail – safe" panel indicator and charges capacitor C71. C71 is connected between grid and cathode of the triode section of V7, (negative end of C71 at the grid terminal). When C71 is charged V7 is blocked. When the triode section of V7 is blocked the screen voltage applied to the pentode section of V7 is increased (common load resistor R72) allowing V7 to function as an amplifier. The control grid of V7 pentode section is connected to the audio output of the detector. V7 will now amplify this audio signal and feed it to the audio selector circuit comprised of R81, L81, C81, R82, C82, R83, C83 and the two diode sections of V8.

When the carrier is returned with 1000 cycle modulation, V6 again becomes blocked. However, due to the time constant of R62 and C71, V7 will continue to amplify for about 10 seconds more. This allows the 1000 cycle tone to be fed to the audio selector circuit after the carrier is returned. After the 10 second time interval V7 will again become inoperative preventing any further signal from reaching the audio selector circuit.

This audio selector circuit operates in the following manner: Resistor R81 is in series with the 1000 cycle parallel resonant circuit, L81 and C81, connected across the output of V7. If a 1000 cycle voltage is impressed across this network a small portion of this voltage appears across R81 and a large portion across L81 and C81. If a voltage of any other frequency is impressed across this network, most of the voltage will appear across the resistor R81 and very little across L81 and C81. The voltage appearing across R81 is rectified by one diode of V8 and is applied as positive bias across R82 and C82 in the cathode circuit of the other diode of V8. This other diode will only conduct when the voltage appearing across L81 and C81 is greater than the voltage across R82 and C82. This happens only when the input signal frequency from V7 is the same as the resonant frequency of L81 and C81. The output voltage of the second diode of V8 appears across R83 and C-83 This output voltage is coupled through the time delay network, R84 and C84 to the grid of V8.

The relay control section of V8 operates normally with no bias and is conducting at all times keeping the relay in the plate circuit energized. When a 1000 cycle signal is received, the grid of V8 becomes negative, cutting off the plate current and de-energizing the relay. When the relay drops out the grid of V8 is grounded, and since the cathode is at +14 volts above ground the grid now has 14 volts negative bias and will keep V8 in a blocked condition until manually reset.

The reset function connects the grid and cathode of V8 together, effectively removing any bias from this tube, causing it to conduct and energize the relay. Rotating the "Alert-Reset-Listen" switch to the "Alert" position will ready the alarm circuit to receive a CONELRAD signal.

1.3 TUBE COMPLEMENT.

V1 – 6X8 Mixer – Oscillator.
V2 – 6BJ6 First I.F. Amplifier (265 kc.)
V3 – 6BJ6 Second I.F. Amplifier (265 kc.)
V4 – 6AV6 Detector, AVC Rectifier, First audio amplifier.
V5 – 6AQ5 Audio Power Amplifier.
V6 – 2D21 Carrier Break Detector.
V7 – 6AN8 1000 cycle amplifier and squelch for alarm circuit.
V8 – 6BJ8 1000 cycle audio selector and Relay Control.
V9 – 6BW4 High Voltage Rectifier.

1.4 ANTENNA. This receiver is designed to be used with an external antenna. The antenna input impedance is 72 ohms.

The complexity of the antenna system will depend upon the signal level of the broadcast station being monitored and the ambient noise level surrounding the receiver location.

Antenna systems will be more fully discussed in paragraph 2.2 under installation and operation.

1.5 AUDIO OUTPUT. A single type 6AQ5 power amplifier tube delivers 1½ watts of audio power to a self contained 4" x 6" oval panel speaker. A terminal strip is provided on the rear apron of the chassis that allows the connection of external speakers. The self contained speaker can be disconnected by removing the wire jumper from the speaker terminal strip.

The output impedance is 3.2 ohms.

1.6 CONTROLS, FRONT PANEL ITEMS.

(1) Channel Selector ..... Selects the two CONELRAD cluster frequencies of 640 kc. and 1240 kc. as well as four other pretuned broadcast stations.

(2) "ON – OFF" switch	Controls primary power, must be "ON" at all times.
(3) Green pilot light	Indicates primary power "ON".
(4) Fuse	Primary power. Does not fuse "ALERT" light. "ALERT" light will be on if fuse is defective.
(5) "ALERT-RESET-LISTEN" switch	Normally left in "ALERT" position. "RESET" position resets alarm circuit. "LISTEN" position can be used to audibly monitor a broadcast station. The "LISTEN" position will not destroy the alarm function. The red "ALERT" light will still function if a CONELRAD signal is received.
(6) Volume Control	Controls the speaker volume in the "LISTEN" position only.
(7) Fail – Safe Indicator	Indicates broadcast station carrier failures as well as component failures in the receiver circuitry.
(8) "ALERT" Indicator Light	Lights when a CONELRAD signal is received and also when the primary power fuse is defective.
(9) "Pre-set" Volume (In rear)	Regulates the volume level at which the CONELRAD message is received after the speaker is energized before the "RESET" switch is operated.
(10) Carrier Break Sensitivity Control (On rear apron)	Adjusts the sensitivity of the carrier break detector for the KEY CONELRAD broadcast station.

SECTION 2

Installation & Operation

2.1 ADJUSTING CHANNELS TO DESIRED STATIONS. Channels A and B (640 and 1240 kc.) are pre-aligned at the factory with the proper crystals installed. A slight peaking of the antenna coil primaries, (T11A and T12A), may be necessary for best performance after the permanent antenna is connected to the receiver.

Channels C and D are designed for crystal controlled operation in the range from 540 kc. to 1000 kc. The ranges of these two channels can be modified to cover from 1000 kc. to 1600 kc. by removing the two 200 mmf. capacitors C113 and C903 from coil T13A (channel C) and C114 and C904 (channel D). Channel E is designed for crystal controlled operation in the range from 1000 kc. to 1600 kc. This can be modified to cover from 540 kc. to 1000 kc. by adding a 200 mmf. silver mica capacitor across terminals 1 and 2 and another 200 mmf. silver mica capacitor across terminals 1 and 4 of coil T15A.

The crystal frequency required for a particular broadcast station is determined by adding 265 kc. to the broadcast station frequency in kilocycles.

To adjust a channel to a particular broadcast station it is only necessary to plug the appropriate crystal into the proper crystal socket, turn the channel selector switch to the correct channel and peak the primary and secondary tuning slugs of the associated antenna coil for maximum AVC voltage. (The primary tuning slugs are accessible through holes in the bottom of the cabinet without removing the chassis.) A vacuum tube voltmeter connected across the AVC circuit will facilitate correct adjustment. Channel F uses a self-excited oscillator and can be adjusted to receive any broadcast station over the entire broadcast band. However, the 200 mmf. capacitors C116 and C906 across T16A and the 39 mmf. capacitor C18A across L11 must be removed if operation between 1000 kc. and 1600 kc. is desired on this channel.

The self-excited oscillator should be operated on the high side of the broadcast station for best sensitivity. It may be operated on the low side if an image interference condition exists, as explained in paragraph 3.2.

(It is not practical to cover the entire broadcast band with a given value of capacitors, hence the addition and removal of capacitors mentioned above.

2.2 ANTENNA SYSTEM. In areas of high signal strength a short piece of wire will probably suffice for an antenna.

Care must be taken that a good signal to noise ratio is available for proper alarm operation. If the noise level is too high, several volts of AVC may be developed which could interfere with the carrier break detector circuit operation, due to insufficient AVC voltage change when a carrier break occurs.

If the noise level is too high, or the signal level from the desired broadcast station is low, an outside antenna up in the clear, out of noise area, with a coaxial antenna lead-in must be provided.

A good electrical ground to the receiver will help to reduce the noise pick-up. If at all possible, a good permanent antenna system should be provided. A short vertical antenna mounted on the roof of the building, with a coaxial cable lead-in is recommended.

2.3 SET-UP PROCEDURE FOR THE KEY CONELRAD STATION.

(A) After determining the key Conelrad broadcast station frequency in your area, the proper quartz oscillator control crystal must be secured.

(B) The crystal is inserted in the proper socket, corresponding to the channel desired.

(C) The channel selector is set to this channel, and the associated antenna coil is adjusted for maximum AVC voltage.

Any other three broadcast stations can be tuned in on the remaining channels in the same manner.

(D) After the key Conelrad station has been tuned in, it will be necessary to adjust the carrier break sensitivity control. Connect a vacuum tube voltmeter or any voltmeter having a sensitivity of 20,000 ohms per volt or more, across the "fail – safe" indicator light.

Set the voltmeter scale to 100 volts D.C.

Rotate the carrier break sensitivity control, R60 through its range. The voltmeter should read approximately 75 to 80 volts with the control in one position and should drop to zero in the other. This voltage will not drop suddenly, due to the time-delay network.

The proper setting for this control is the point at which the voltmeter reading just drops to zero.

Any reduction in signal strength should light the "fail-safe" indicator and produce a voltmeter reading.

All adjustments should be made during the daylight hours when the signal strength from the broadcast station is the lowest.

The "Alert-Reset-Listen" switch can be kept in the "Listen" position during these adjustments.

2.4 OPERATING PROCEDURE. After all adjustments have been made, rotate the "Alert-Reset-Listen" switch to the "Reset" position to allow the relay to pull-in and extinguish the "Alert" light. While in the "Reset" position, the "pre-set volume" can be adjusted to the desired level. The panel volume control is used only to adjust the "Listen" volume level, and is ineffective in the "Alert" or "Reset" position.

The "pre-set volume" is the audio level that is heard upon reception of the Conelrad signal.
Rotate the "Alert-Reset-Listen" switch to the "Alert" position; the receiver is now ready to monitor the key Conelrad station.

It is suggested that when all the adjustments have been made, that the key Conelrad station, to which this receiver has been tuned, be contacted and the time of the regularly scheduled Conelrad tests be requested.

The operation of the receiver should be checked at the specified time to verify its operation, once the installation is completed.

During the reception of the Conelrad signal sequence, the "fail – safe indicator" will light for 5 seconds, go out for 5 seconds, relight for 5 seconds, go out again and 3 seconds later the "Alert" signal will light, and the 1000 cycle tone will be heard at the "pre-set volume" level. The speaker will remain "on" at the pre-set volume allowing subsequent Conelrad voice messages to be heard until reset by the owner. If desired the "Alert-Reset-Listen" switch can be rotated to the "Listen" position so that the volume can be controlled.

If this receiver is shut down for the night, or any other period of time, the alarm circuit must be reset after if is again turned on. This is done by turning the "ALERT-RESET-LISTEN" switch to the "RESET" position for a few seconds after the receiver has warmed up for about one minute.

SECTION 3

Maintenance

3.1 GENERAL PREVENTIVE MAINTENANCE. The dependability and life of any electronic equipment can be greatly increased by preventive maintenance. This can be done on a regularly scheduled basis, possibly to coincide with the maintenance and inspection routine given other radio equipment.

Along with the regular testing of tubes, look for overheated resistors and transformers, sealing compound leaking from capacitors, coils and transformers, loose parts and connections, and the condition of all cables and plugs.

Since the R.F., I.F., and audio sections are conventional no detailed service information will be given, except for voltage and resistance measurements.

3.2 I.F. AND R.F. ALIGNMENT. The alignment of these stages in conventional and standard broadcast receiver procedures should be followed.

(A) The I.F. frequency is 265 kc. The I.F. stages may be aligned in any order. However since the local oscillator is crystal controlled, the 265 kc. must be accurate because any misalignment cannot be corrected by an oscillator adjustment.

The crystals all operate on the high side of the broadcast station carrier (except possibly if an image condition exists).

If two powerful local broadcast stations are separated by the image frequency (530 kc.) the crystal should be chosen to operate on the side that will eliminate this image interference condition.

Example: The desired station operates on 1070 kc. and another station operates on 1600 kc. If a crystal of (1070 kc. + 265 kc.) 1335 kc. is chosen, the 1600 kc. station would also produce a 265 kc. beat; (1600-1335 kc.=265 kc.) This could cause interference to the desired station if the 1600 kc. station is powerful enough.

This can be avoided by choosing a crystal frequency on the low side at 805 kc. (1070-265 kc.=805 kc.)

(B) The variable oscillator used in channel "F" operates on the high side of all broadcast stations.

3.3 ALARM CIRCUIT, TESTING AND ALIGNMENT. An oscilloscope, a 1000 cycle generator, a signal generator covering the broadcast band and a high sensitivity voltmeter will be necessary for checking the alarm circuit operation.

(A) Connect the broadcast signal generator to the antenna terminals of the Conelrad receiver. Modulate the generator with 1000 cycles (must be accurate, 1000 cycles ± 10 cycles) at 30% modulation. Set the R.F. output at approximately 50 microvolts.

Set the signal generator frequency to any one of the six receiver channels.

(B) Connect a 100 volt, high sensitivity voltmeter across capacitor C71 (pins 2 and 3 of V-7). Rotate the carrier break sensitivity control and note the voltmeter readings, they should be approximately 75 to 80 volts in one position and drop to zero in the other.

Set the control so that the meter reads 75 to 80 volts.

Connect the oscilloscope vertical plates between pin 6 and ground of V-7, the 1000 cycle tone should appear at this point.

(C) Now rotate the carrier break sensitivity control to where the voltmeter reading drops to zero. As this voltage drops to zero (5 to 8 seconds time delay) the 1000 cycle output from V-7 should also drop to zero.

This indicates that the V-6 and V-7 circuits are functioning correctly.

(D) Again rotate the carrier break sensitivity control, until the voltmeter reads 75 to 80 volts and the 1000 cycle output appears at V-7.

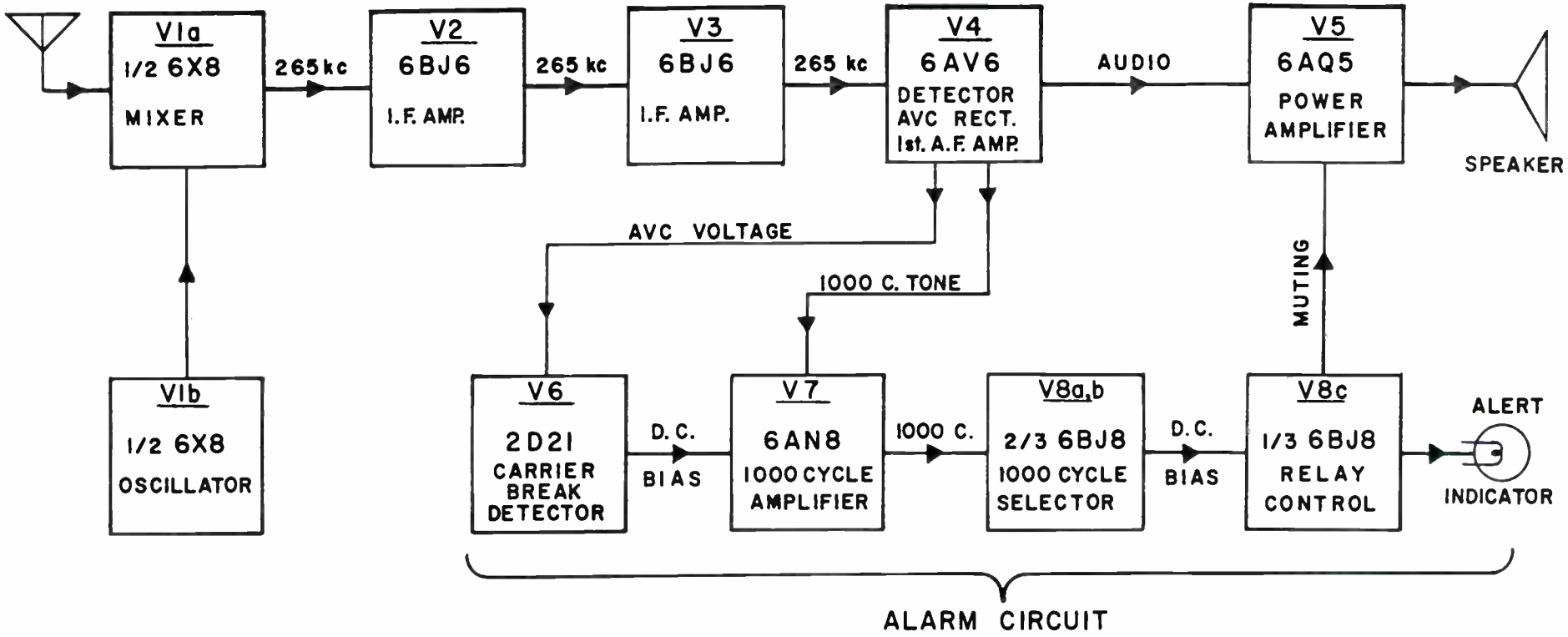
(E) Turn the "Alert-Reset-Listen" switch to the "Reset" position. Remove the voltmeter from C-71 and reconnect across C-83 (pins 6 and 9 of V-8).

(F) Adjust the tuning slug of L-81 for maximum voltmeter reading, approximately 15 to 20 volts, pin 6 being negative and pin 9 being the positive voltmeter lead.

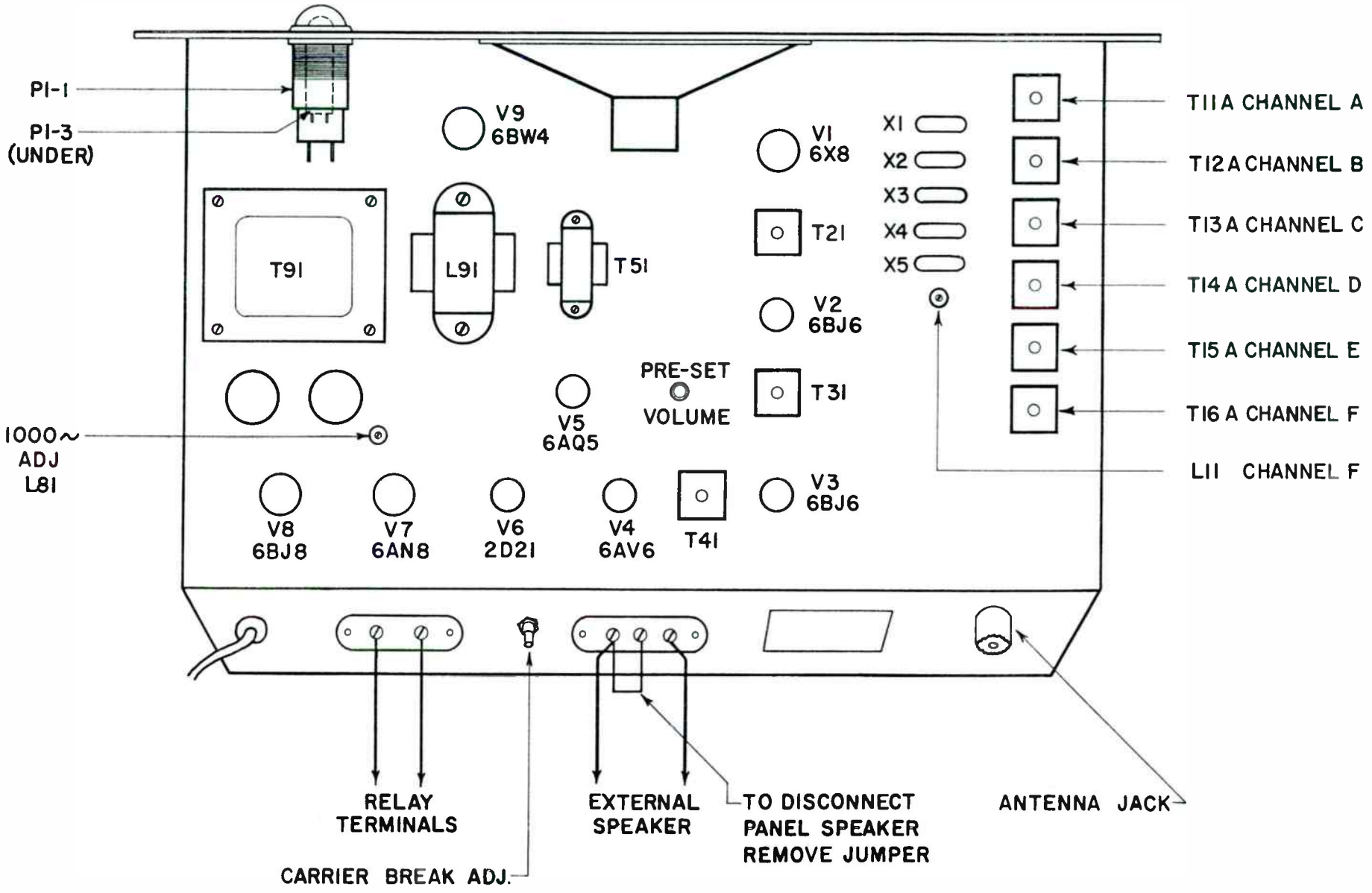
The relay must be in the energized position (pulled in) for this test.

(G) Rotate the "Alert-Reset-Listen" switch to the "Alert" position. The relay should drop out after 3 seconds time interval, energizing the "Alert" panel indicator and allow the 1000 cycle tone to be heard from the speaker.

(H) Readjust the carrier break sensitivity control according to the instructions given in paragraph 2.3.



4.1 - BLOCK DIAGRAM



4.2 - TOP OF CHASSIS LAYOUT

4.3 RESISTANCE CHART

	TUBE PINS								
TUBE	1	2	3	4	5	6	7	8	9
V1 6X8	0	220K	300K 150K*	0	0	0	8.3M	350K 200K*	200K 49K*
V2 6BJ6	1.6M	470	0	0	150K 6700*	300K 150K*	0	—	—
V3 6BJ6	1.6M	2700	0	0	150K 6700*	300K 150K*	0	—	—
V4 6AV6	6.8M	0	0	0	530K	530K	370K 220K*	—	—
V5 6AQ5	1K to 500K Note 1	390	0	0	150K 450*	150K 0*	Same as Pin 1	—	—
V6 2D21	3.8M	0 to 13K Note 2	0	0	Same as Pin 2	3.3M	Same as Pin 2	—	—
V7 6AN8	1.15M 1M*	4.7M	0	0	0	370K 220K*	Same as Pin 1	6.8M	47K
V8 6BJ8	100K	330K	330K	0	0	1M† 0	165K 15K*	5.7M† 4.7M 390‡	390
V9 6BW4	440	Inf.	Inf.	Inf.	Inf.	Inf.	440	Inf.	150K 250*

* Read from tube pin to B plus. (Red lead to 5000 ohm, 7 watt resistor, R85).

† Measured with relay held in manually.

‡ With "Alert-Reset-Listen" switch in "Reset" position.

Note 1 — Reading depends on volume control setting. With the "Alert-Reset-Listen" switch in the "Alert" position and the relay held in manually this should read zero ohms.

Note 2 — Reading depends on "Carrrier break sensitivity" control setting.

All resistance values in ohms except K — X1000 and M — X1,000,000.

4.4 VOLTAGE CHART

	TUBE PINS								
TUBE	1	2	3	4	5	6	7	8	9
V1 6X8	0	— 10 to — 15 Note 4	40	6.3 AC	0	0	— ½ to — 1	65	125
V2 6BJ6	0 to — ½	½	0	6.3 AC	205	75	0	—	—
V3 6BJ6	0 to — ½	5.5	0	6.3 AC	230	125	0	—	—
V4 6AV6	0 to — ½	0	0	6.3 AC	0 to — 1	0 to — 1	100	—	—
V5 6AQ5	0	15	0	6.3 AC	230	245	0	—	—
V6 2D21	0	0 Note 1 / — 16 Note 2	0	6.3 AC	Same as Pin 2	Note 3	Same as Pin 2	—	—
V7 6AN8	110	— 75 to — 80 Note 5	0	0	6.3 AC	140	110	30	85
V8 6BJ8 Relay In Relay Out	14 12	14 12	14 12	0 0	6.3 AC 6.3 AC	14 0	90 245	14 0	14 14
V9 6BW4	250 AC	0	0	— 6.3 AC —		0	250 AC	0	260

All DC readings taken with 20,000 ohms per volt meter, all AC readings taken with 1000 ohms per volt meter. Receiver set to any channel with the antenna disconnected. Primary line voltage should be 117 volts AC. Carrier break sensitivity control fully counter-clockwise.

Note 1 — Carrier break sensitivity control in counter-clockwise position.

Note 2 — Carrier break sensitivity control in clockwise position.

Note 3 — Both AC and DC voltages appear at this terminal and conclusive values can not be given.

Note 4 — Measurement made with 100,000 ohm resistor in series with meter lead to pin 2 of V-1.

Note 5 — With no signal.

All measurements taken between specified tube base pin and chassis, except pins 4 and 5 of V9. 6.3V AC should appear between pins 4 and 5 of V9.

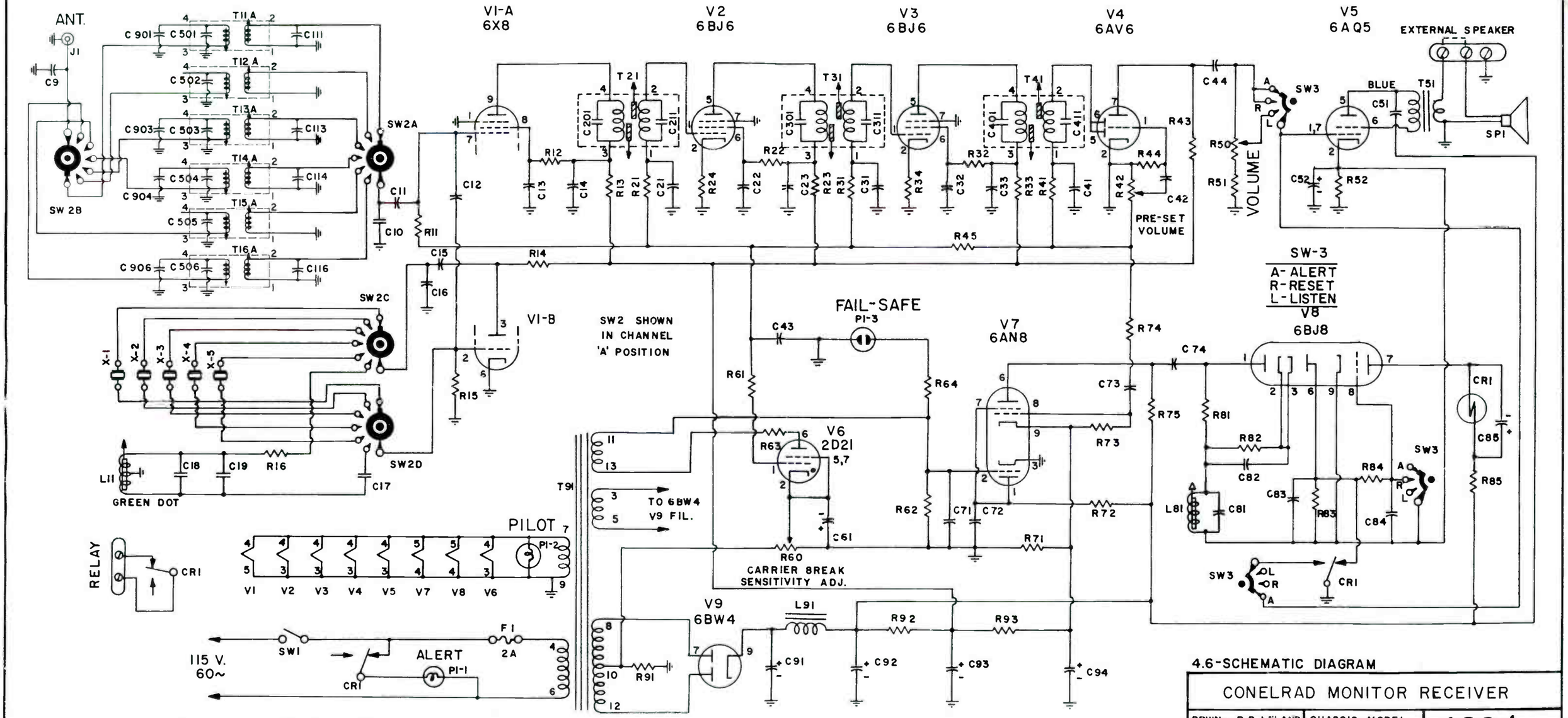
Symbol	Description		Motorola Part Number
	Capacitors		
C9	.002 mfd ±10% disc ceramic, 1000 vdcw		
C10	75 mmf ±10% Silver mica, 300 vdcw		
C11	100 mmf ±10% Silver mica, 500 vdcw		
C12	2 mmf ±.5 mmf Silver mica, 500 vdcw		
C13	.01 mfd GMV disc ceramic, 600 vdcw		
C14	.01 mfd GMV disc ceramic, 600 vdcw		
C15	.005 mfd GMV disc ceramic, 600 vdcw		
C16	15 mmf ±10% Silver mica, 500 vdcw		
C17	100 mmf ±10% Silver mica, 500 vdcw		
C18	68 mmf ±5% Silver mica, 500 vdcw		
C18A	39 mmf ±5% Silver mica, 500 vdcw		
C19	27 mmf N750 ±2% tubular ceramic		
C21	.01 mfd GMV disc ceramic, 600 vdcw		
C22	.01 mfd GMV disc ceramic, 600 vdcw		
C23	.01 mfd GMV disc ceramic, 600 vdcw		
C31	.01 mfd GMV disc ceramic, 600 vdcw		
C32	.01 mfd GMV disc ceramic, 600 vdcw		
C33	.01 mfd GMV disc ceramic, 600 vdcw		
C41	250 mmf ±10% GP tubular ceramic, 600 vdcw		
C42	.005 mfd 600 vdcw tubular paper		
C43	.01 mfd GMV disc ceramic, 600 vdcw		
C44	.01 mfd GMV disc ceramic, 600 vdcw		
C51	.0047 mfd GMV disc ceramic, 1000 vdcw		
C52	20 mfd 25 vdcw electrolytic, 3 section can, with C91 and C92		ME - 41138
C61	2 mfd 150 vdcw tubular electrolytic		
C71	1 mfd 200 vdcw tubular paper		
C72	.1 mfd. 400 vdcw tubular paper		
C73	.002 mfd ±20% disc ceramic, 1000 vdcw		
C74	.01 mfd GMV disc ceramic, 600 vdcw		
C81	.01 mfd 400 vdcw tubular paper		
C82	.01 mfd GMV disc ceramic, 600 vdcw		
C83	.01 mfd GMV disc ceramic, 600 vdcw		
C84	1 mfd 200 vdcw tubular paper		
C85	20 mfd 150 vdcw tubular electrolytic		
C91	10 mfd 350 vdcw electrolytic	Included in C52	
C92	20 mfd 350 vdcw electrolytic	Included in C52	
C93	20 mfd 350 vdcw electrolytic, 3 section can with C94		ME - 41138
C94	10 mfd 350 vdcw electrolytic	Included in C93	

Symbol	Description	Motorola Part Number
	Capacitors	
C111	200 mmf ±5% Silver mica	
C113	200 mmf ±5% Silver mica	
C114	200 mmf ±5% Silver mica	
C116	200 mmf ±5% Silver mica	
C201	100 mmf ±5% Silver mica } Part of T21	
C211	100 mmf ±5% Silver mica } Part of T21	
C301	100 mmf ±5% Silver mica } Part of T31	
C311	100 mmf ±5% Silver mica } Part of T31	
C401	100 mmf ±5% Silver mica } Part of T41	
C411	100 mmf ±5% Silver mica } Part of T41	
C501	75 mmf ±5% Silver mica, Part of T11A	
C502	75 mmf ±5% Silver mica, Part of T12A	
C503	75 mmf ±5% Silver mica, Part of T13A	
C504	75 mmf ±5% Silver mica, Part of T14A	
C505	75 mmf ±5% Silver mica, Part of T15A	
C506	75 mmf ±5% Silver mica, Part of T16A	
C901	200 mmf ±5% Silver mica	
C903	200 mmf ±5% Silver mica	
C904	200 mmf ±5% Silver mica	
C906	200 mmf ±5% Silver mica	
	Resistors	
R11	6.8 megohm ±10%; 1 w; ins. carbon	
R12	150,000 ohm ±10%; 1 w; ins. carbon	
R13	47,000 ohm ±10%; 1 w; ins. carbon	
R14	150,000 ohm ±10%; 1 w; ins. carbon	
R15	220,000 ohm ±10%; 1 w; ins. carbon	
R16	68 ohm ±10%; ½ w; ins. carbon	
R21	100,000 ohm ±10%; 1 w; ins. carbon	
R22	150,000 ohm ±10%; 1 w; ins. carbon	
R23	4,700 ohm ±10%; 1 w; ins. carbon	
R24	470 ohm ±10%; 1 w; ins. carbon	
R31	100,000 ohm ±10%; 1 w; ins. carbon	
R32	150,000 ohm ±10%; 1 w; ins. carbon	
R33	4,700 ohm ±10%; 1 w; ins. carbon	
R34	2,700 ohm ±10%; 1 w; ins. carbon	
R41	33,000 ohm ±10%; 1 w; ins. carbon	
R42	500,000 ohm potentiometer, PRE-SET VOLUME	LC - 500 MP
R43	220,000 ohm ±10%; 1 w; ins. carbon	
R44	6.8 megohm ±10%; 1 w; ins. carbon	

Symbol	Description	Motorola Part Number
	Resistors	
R45	1 megohm ±10%; 1 w; ins. carbon	
R50	500,000 ohm potentiometer; VOLUME	LC - 500 MP
R51	1,000 ohm ±10%; 1 w; ins. carbon	
R52	390 ohm ±10%; 2 w; ins. carbon	
R60	50,000 ohm potentiometer; 4 watt wirewound CARRIER BREAK SENSITIVITY	M 50 MP
R61	2.2 megohm ±10%; 1 w; ins. carbon	
R62	4.7 megohm ±10%; 1 w; ins. carbon	
R63	47,000 ohm ±10%; 1 w; ins. carbon	
R64	100,000 ohm ±20%; ½ w; Part of PI-3	
R71	47,000 ohm ±10%; 2 w; ins. carbon	
R72	1 megohm ±10%; 1 w; ins. carbon	
R73	6.8 megohm ±10%; 1 w; ins. carbon	
R74	1 megohm ±10%; 1 w; ins. carbon	
R75	220,000 ohm ±10%; 1 w; ins. carbon	
R81	100,000 ohm ±10%; 1 w; ins. carbon	
R82	330,000 ohm ±10%; 1 w; ins. carbon	
R83	1 megohm ±10%; 1 w; ins. carbon	
R84	4.7 megohm ±10%; 1 w; ins. carbon	
R85	5,000 ohm ±10%; 7 w; ins. wirewound	
R91	375 ohm ±10%; 10 w; ins. wirewound	
R92	2,000 ohm ±10%; 7 w; ins. wirewound	
R93	100,000 ohm ±10%; 2 w; ins. carbon	
	Coils	
L11	RF oscillator	423-A
L81	1,000 cycle filter	436
L91	Choke, power supply filter	121C2
	Transformers	
T11A	Antenna; channel 'A'	341-B
T12A	Antenna; channel 'B'	341-B
T13A	Antenna; channel 'C'	341-B
T14A	Antenna; channel 'D'	341-B
T15A	Antenna; channel 'E'	341-B
T16A	Antenna; channel 'F'	341-B
T21	IF; 265 kc., input	337
T31	IF; 265 kc., interstage	337
T41	IF; 265 kc., output	337-A
T51	AF: output; primary 5000 ohm, secondary 3.2 ohm	121A6
T91	Power: plate; filament; primary; term. 4 & 6; 117 VAC, 60 cycle secondary; term. 3 & 5; 6.3 V. @ 1. A. secondary; term. 7 & 9; 6.3 V. @ 3.5 A. secondary; term. 8, 10, 12; 265 V.-0-265 V. @ 100 ma. secondary; term. 11 & 13; 100 V. @ 25 ma.	Drwg. 429-A, 121P72

Symbol	Description	Motorola Part Number
	Crystal Units	
X1	Quartz: 905 kc. for channel 'A' oscillator	
X2	Quartz: 1505 kc. for channel 'B' oscillator	
X3 X4 X5	Special: Frequency must be specified by customer to match the broadcast stations in his area.	
	Tubes	
V1	Mixer-oscillator	6X8
V2	1st IF amplifier	6BJ6
V3	2nd IF amplifier	6BJ6
V4	Detector and 1st audio	6AV6
V5	Audio output	6AQ5
V6	Carrier detector	2D21
V7	1000 cycle amplifier	6AN8
V8	Relay Control	6BJ8
V9	Rectifier	6BW4
	Switches	
SW1	Toggle: S.P.S.T. POWER ON	20994HB
SW2	Rotary: 4 pole, 6 pos. CHANNEL	433
SW3	Rotary: 3 pole, 3 pos. ALERT - RESET - LISTEN	432
	Miscellaneous	
F1	Fuse holder; 3AG 2 amp. fuse for above	342003 312002
SP1	Speaker; PM, 3.2 ohm voice coil, 4" x 6"	46A1AP
J1	Receptacle; coaxial antenna	83-1R
CR1	Relay: 3 P.D.T., 110 VDC, 10,000 ohm coil	KA-14D-10K
PI-1	Indicator: 1" candelabra screw base assembly with red jewel Lamp for above; 6 w. candelabra screw base	75 AP GE S-6
PI-2	Indicator; single contact min. bayonet base with ½" green jewel Lamp for above; 6-8 V, .15 A. S.C. bay. base	D40 47
PI-3	Indicator: neon, ½" clear plastic lens	1040-A2
	Card: channel station log, 2⅜" x 3¼"	426
	Window: clear plastic, for station log card, same size as card.	425

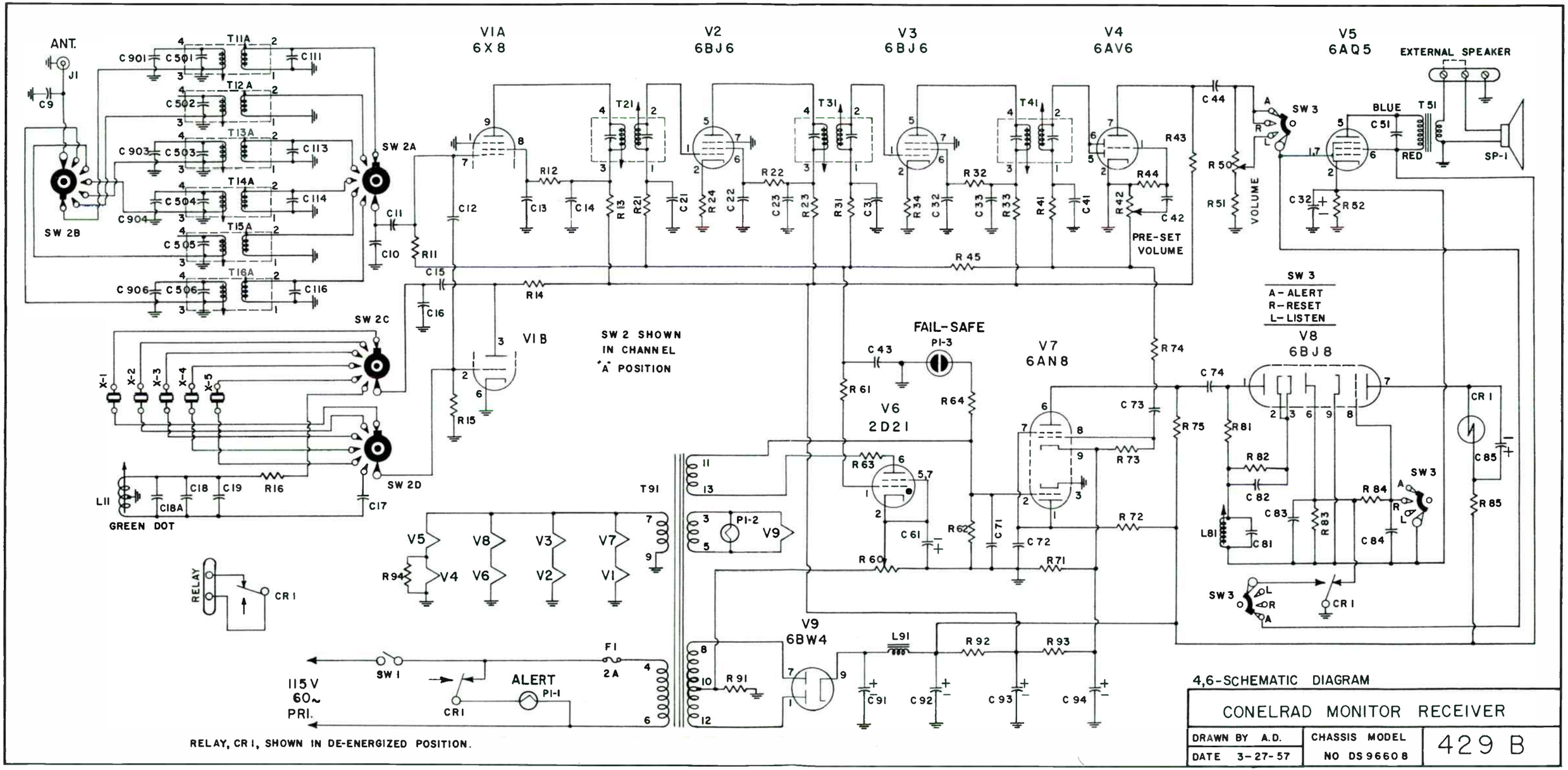
Notes



RELAY, CRI, SHOWN IN DE-ENERGIZED POSITION

4.6-SCHEMATIC DIAGRAM

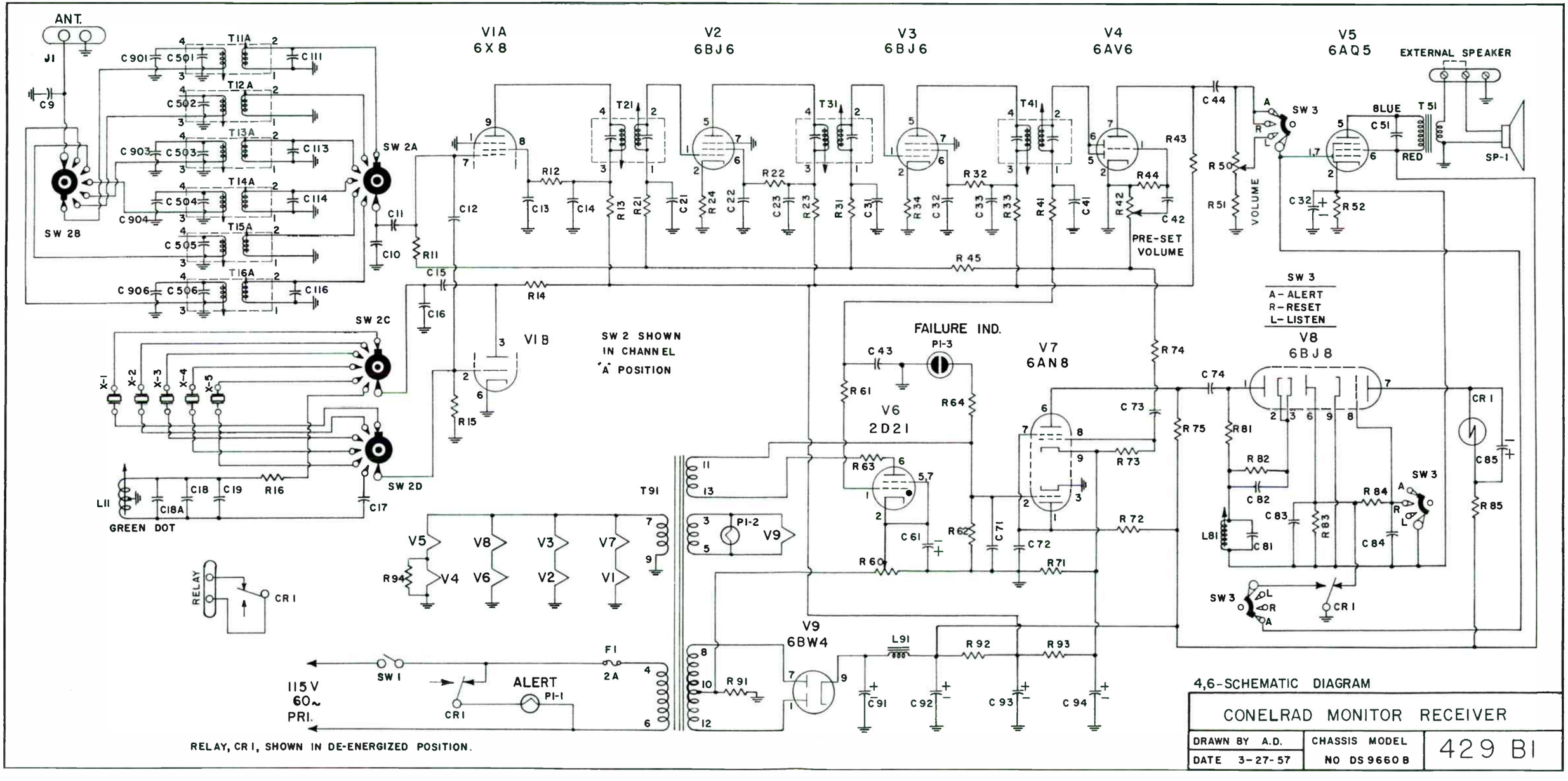
CONELRAD MONITOR RECEIVER		
DRWN.- R.D. LELAND	CHASSIS MODEL NO. DS 9660 A	429A
DATE- 1-23-57		



RELAY, CR 1, SHOWN IN DE-ENERGIZED POSITION.

4,6-SCHEMATIC DIAGRAM

CONELRAD MONITOR RECEIVER		
DRAWN BY A.D.	CHASSIS MODEL NO DS 96608	429 B
DATE 3-27-57		



4,6-SCHEMATIC DIAGRAM

CONELRAD MONITOR RECEIVER		
DRAWN BY A.D.	CHASSIS MODEL NO DS 9660 B	429 B1
DATE 3-27-57		

MANUAL REVISION SHEET #1
TO
INSTRUCTION MANUAL PART M-125

Change T91 to T91B Change Part #121P72 - Drawing #429-A to 121P73 - Drawing #429B

Transformer, Power: Plate, Filament;

Primary; Term. 4 & 6 117 VAC, 60 Cycle
Secondary; Term. 7 & 9 12.6 V. @ 1.75 A.
Secondary; Term. 3 & 5 6.3 V. @ 1A.
Secondary; Term. 8, 10 & 12 265/0/265 V. @ .1 A.
Secondary; Term. 11 & 13 100 V. @ .025 A.

VOLTAGE CHART REVISION

Measure Filament Voltages
From Pin To Pin Instead Of To Chassis.

V1 (6X8) From Pin 4 to 5 = 6.3 VAC
V2 (6BJ6) From Pin 3 to 4 = 6:3 VAC
V3 (6BJ6) From Pin 3 to 4 = 6:3 VAC
V4 (6AV6) From Pin 3 to 4 = 6.3 VAC
V5 (6AQ5) From Pin 3 to 4 = 6.3 VAC
V6 (2D21) From Pin 3 to 4 = 6.3 VAC
V7 (6AN8) From Pin 4 to 5 = 6.3 VAC
V8 (6BJ8) From Pin 4 to 5 = 6:3 VAC
V9 (6BW4) From Pin 4 to 5 = 6.3 VAC

Addenda For Drawing 429 B & 429 B 1

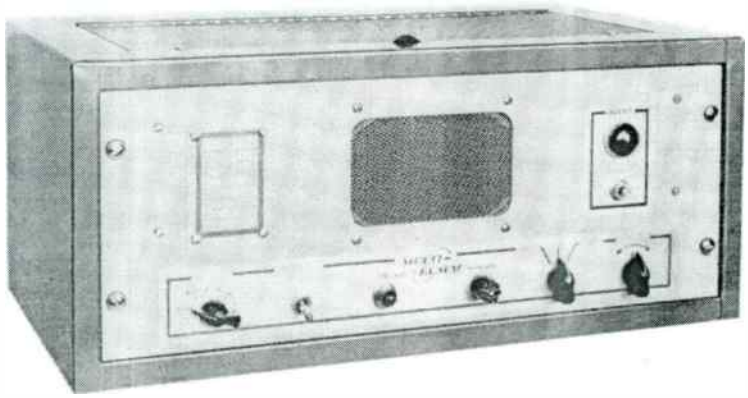
Change - R62, 4.7 Megohm 1 watt resistor to 6.8 Megohm 1 watt ± 10% ins. resistor.

Antenna Connection - - Antenna input connection has been changed from a coaxial fitting to a screw terminal strip for antenna and ground connections.

FORM NO. M-123

THE "MULTI-ELMAC" CONELRAD MONITOR RECEIVER

MODEL CM-1



FCDA APPROVED

Especially Designed for Use by:

- Broadcast Stations
- FM Stations
- TV Stations
- Civil Defense Organizations
- Police Departments
- Fire Departments
- Hospitals
- Other Public Institutions

The "MULTI-ELMAC" CONELRAD MONITOR Receiver is not just a carrier monitor, but a CONELRAD monitor. It is a dependable, fool-proof unit designed to give reliable operation without false indications in the event of normal broadcast station shut-down or unavoidable carrier breaks.

The "MULTI-ELMAC" CONELRAD MONITOR Receiver depends upon two segments of the CONELRAD sequence for operation. Namely: carrier break of five seconds followed by a 1000 cycle tone modulated carrier for fifteen seconds. The occurrence of either one without the other will not operate the alarm circuit.

A fail-safe indicating device has been incorporated into the design of this CONELRAD MONITOR Receiver. In the event of any component failure in the R. F. or I. F. stages of this receiver the fail-safe indicator will light. This indicator will also show defective antenna wiring, power failure to the receiver, and the presence of the broadcast station carrier.

FEATURES AND SPECIFICATIONS

1. Supplied with six channels:
   (A) 640 Kc. crystal controlled.
   (B) 1240 Kc. crystal controlled.
   (C, D, & E) 540 Kc. to 1600 Kc. crystal controlled.
   (F) 540 Kc. to 1600 Kc. adjustable.
2. Any channel can be monitored audibly at any time by operating a front panel switch without disturbing the alarm feature.
3. Reception of a CONELRAD alert signal will:
   (a) light the "ALERT" indicator light,
   (b) turn on the speaker at a preset level,
   (c) close a set of relay contacts, and
   (d) lock-in the alarm circuit until manually reset by a front panel control.
4. Receiver sensitivity: AUDIO, 5 microvolts, ALARM, 8 microvolts.
5. Selectivity: Plus or minus 3 Kc. 6 db down, plus or minus 15 Kc. 40 db down.
6. Audio output at least 1 watt into a self contained panel speaker. Provisions are made for the connection of external speakers. The output impedence is 3.2 ohms.
7. Fail-safe indicator gives visual check of receiving conditions.
8. Antenna input is 72 ohms unbalanced.
9. Self contained power supply, input 115 volts, 60 cycles. Consumption, 60 watts.
10. Supplied with cabinet, Panel is standard size for rack mounting.
11. Cabinet is painted blue wrinkle with a smooth grey panel.
12. Size: 20½" wide, 8½" high, and 11" deep. Shipping weight: 33 pounds.

PRICE – INCLUDING SIX CHANNELS, TWO CRYSTALS, AND CABINET . . .

Manufactured by MULTI-PRODUCTS COMPANY. 21470 Coolidge Highway, Oak Park 37, Michigan.