INSTRUCTION MANUAL

INSTRUCTION MANUAL FOR MODEL WRC-10T WIRE REMOTE CONTROL SYSTEM

MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

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FOR
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WIRE REMOTE CONTROL SYSTEM

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111 Castilian Drive
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FOR

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Introduction

The Moseley Associates, Inc. Model WRC-10T Remote Control System was designed expressly for the broadcaster. It is intended to remotely control a radio transmitter and will provide up to ten meter readings at the studio and up to ten bi-directional (on and off) control signals at the transmitter. Only a single DC telephone line with audio frequency response usable through 920 Hz is required between the studio or controlling point and the transmitter. The signals sent to the transmitter from the studio are audio tones. The returned meter readings are in the form of DC voltages. One tone is sent to the transmitter at all times. This tone is interruped briefly whenever the dial at the studio is operated. The tone is detected at the transmitter end and brief interruptions advance the stepping switch one position. Longer interruptions of about one-half second or more will return the stepping switch to its home or calibrate position. Should the tone fail for over approximately fifteen seconds, a fail-safe relay will operate, removing the carrier from the air in accordance with FCC requirements. (See FCC Rules and Regulations, Sec. 73.275.) The stepping switch selects which voltage in the transmitter is to be returned to the studio for remote metering purposes. This same stepping switch also selects which terminals on the rear of the WRC-10T are to be energized for controlling purposes. Thus each position of the steppong switch selects a metering voltage, a RAISE output and a LOWER output. These RAISE and LOWER output terminals are not actually energized until either the RAISE or LOWER relays in the Transmitter Control Unit of the WRC-10T are energized. These relays are energized one at a time when the RAISE or LOWER position at the studio is selected.

In summary then, the telephone line carries a DC metering voltage from the transmitter back to the studio, a fail-safe control tone from the studio to the transmitter, and another tone when a RAISE or LOWER output at the transmitter is to be energized. Note that there are never more than two tones on the telephone line at one time.

Initial Test and Installation Instructions

Upon removing the units from the shipping cartons, they should be visually inspected for damage incurred during transit. The units should next be checked out on a back-to-back basis. The line output terminals of the Studio Control Unit should be connected to the line input terminals of the Transmitter Control Unit using a series resistor. The value of this resistor should be about equal to the loop resistance of the entire telephone line to be used. Plug in the units and turn them on. Turn the CONTROL INJECTION adjustment on the rear of the Transmitter Control Unit until the PULSING relay on the front panel of the Transmitter Control Unit is activated. Operating the dial on the Studio Control Unit should actuate the stepping switch in the Transmitter Control Unit. Operating the RAISE-LOWER switch on the Studio Control Unit should cause the corresponding relays in the Transmitter Control Unit to operate.

Now press the red RESET button on the Studio Control Unit for one second or more. Notice that the stepping switch in the Transmitter Control Unit returns to its home or calibrate position. At this point in its travel, the stepping switch connects the calibrate voltage to the interconnecting line. If the line is polarized correctly, the Studio Unit meter will read upscale. The meter reading should be set to the broad mark at 100%. It is not mandatory that the 100% mark be used for calibration. Any other suitable number can be selected; the sole purpose of this calibration procedure in actual service will be to correct for telephone line changes during wet or severe weather conditions. It is recommended that this calibration level be logged on the plastic identification card located on the front panels of the Control Units.

Next verify that the local control switch and button on the Transmitter Control Unit perform properly. The RESET button should advance the stepping switch each time it is pushed very briefly, and should cause the stepping switch to advance to the home or calibrate position if it is held down for a half second or more. Pushing the control switch to the RAISE position should cause the RAISE relay to operate, and pushing the control switch to the LOWER position should cause the LOWER relay to operate.

The equipment can now be installed. The only connections required at the studio end of the circuit are connections to the power source and to the telephone line. The Transmitter Control Unit requires these same connections plus connections to the control and metering circuits.

When the power is turned on and the system is actually installed, the CONTROL INJECTION potentiometer may require some adjustment so that the RAISE, LOWER and PULSING relays all operate reliably. At the end of the manual is a chart showing how to modify the equipment for very short or very long lines.

With reference to schematic Drawing 91B-6146, notice that the stepping switch has four decks. The first two of these (A and B) are gold-plated for consistently low contact resistance; these two decks select the telemetry or remote metering signals which go back to the studio. The other two decks are plated with phosphor bronze. These are Decks C and D which distribute the control signals to the transmitter via the RAISE and LOWER relays. For example, if it is desired to distribute 117VAC to a particular relay when the stepping switch is in position 1 and the RAISE relay is activated, connect the coil of the external relay between COMMON (any of the four appearing on the rear of the Transmitter Control Unit chassis) and terminal 2 of the RAISE barrier strip. In addition, 117VAC must be connected to the COMMON and 117VAC terminals. If it is desired to control a bank of low voltage relays, as for example a group of 24V relays, then connect the relays as in the example above but, instead of connecting the COMMON and 117VAC terminals to 117VAC, connect these terminals to a source of 24V. As a further case, if it is desired to merely close external contacts, merely jumper the 117VAC terminals to the COMMON terminals. In this manner, operating the RAISE or LOWER Relays at any given position of the stepper will connect the RAISE barrier strip terminal of the corresponding number to the common terminal. Caution must be exercised when several transmitter circuits are operated in this manner; it is rather easy to indiscriminately bring pairs of wire into the control circuitry of the WRC-10T and connect their wrong sides together. By far the simplest method of control operation is the first method described. Use external 117VAC relays to control external circuits. These relays can be of the holding or latching types, and they can either close or open one or more circuits at a time. The relay contacts are rated at 117VAC, 2 amperes resistive load. It is recommended that external relays with large contact ratings be used when loads of 50 watts or more are to be controlled.

The telemetry or remote metering can be added to most transmitters not designed for remote control with a minimum of effort. Neither side of the meter sampling circuit needs to be at ground potential; consequently, signals of either polarity can be telemetered back to the studio. With the addition of the proper Moseley Associates, Inc. metering kits, all pertinent parameters can be measured accurately and reliably at the studio. A typical voltage to be telemetered to the studio might be power amplifier plate voltage. The usual method of sampling this voltage is to step down the high voltage to a more convenient value, for example 3V to 10V (rather than bring out the full voltage) and then connect it to the Transmitter Control Unit of the WRC-10T. The point here is that whatever voltage or current is to be measured at the studio must first be converted to a DC voltage of about 3V minimum. Then connect the positive side of this voltage to the selected positive telemetry terminal and the negative side of the selected negative telemetry terminal on the WRC-10T Transmitter Control Unit. Then, when stepping switch K 606 selects that voltage, Deck A will connect to the positive side of the telemetered voltage and Deck B will connect to the negative side of the telemetered voltage. In effect, the studio meter is now connected through a long section of telephone cable to the voltage sample in the transmitter.

The fail-safe terminals should be inserted in series with the rear-door interlock system or other control circuitry in the transmitter in order that the system will operate in the approved fail-safe manner. Loss of control tone or telephone line will then turn off the transmitter as required by the FCC Rules and Regulations.

Theory of Operation

The WRC-10T Studio Control Unit is shown schematically in Drawing 91B-6145. Plugged into the 22 terminal connector is a printed circuit board (Board A) containing the three control tone oscillators and shown schematically in Drawing 91B-6135. A smaller circuit board in this unit (Board B) contains the power supply rectifiers, a line output amplifier and a spare transistor as shown in Drawing 91A-6136.

The oscillators generating the CONTROL, RAISE and LOWER tones are of the R-L-C bridged-T type and are fabricated with temperature-stabilized toroids. Each oscillator is followed by its own buffer amplifier in order that load changes will not affect the oscillator. The oscillator outputs are essentially sinusoidal and appear continuously at terminals 7, 13, and 20 of the printed circuit board. Terminal 13 delivers the 920 Hz control tone; it is fed to terminal 3 of the small printed circuit board 91A-6136 through the dial contacts and RESET push button. When the dial is operated, this tone is interrupted by the dial contacts. When the RESET button is pushed, the tone is interrupted and, if the button is held down for about a half second or longer, the stepping switch will return to its home or calibrate position.

Terminals 7 and 20 on Board A deliver the RAISE (790 Hz) and LOWER (670 Hz) tones. These are selected one at a time and are fed into the line amplifier at the input terminal 4 of Board B. These two tones (the control tone and either the RAISE or LOWER tones, if either of them are present) are mixed and have their power level amplified in the line amplifier Q-210 on the small printed circuit board. The output of this line amplifier appears at terminal 2 and is used to drive the primary of the output transformer 3-1018. The secondary of this transformer drives the telephone line through DC blocking capacitor C-101. 681?

The metering circuitry would shunt this tone were it not for the fact that a pair of chokes (3-1024) are in series with the metering circuitry. By the same token, the DC metering voltage returned to the studio from the transmitter cannot enter the output transformer 3-1018 because of the presence of the capacitor C-101. The DC metering signal and the AC tone controlling signals are thus isolated by this selection of the proper values of chokes and capacitors.

Should the 100 μa meter on the front of the Studio Control Unit not have the proper scale or current range for some particular application, the front panel meter transfer switch SW2 can be used to connect an external meter in place of the internal meter. Three such external meters can be connected. Typical examples might be frequency, where the meter would go both above and below some center value, and a modulation meter.

Note that the primary of the power transformer has a split winding for use on either 117VAC or 240VAC. The output of the bridge rectifier is well filtered and finally regulated by the use of the Zener diode, CR-101. The AC output from the transformer is used to operate the panel light.

The Transmitter Control Unit is shown schematically in Drawing 91B-6146. The same system of chokes and a capacitor is used to isolate the DC metering signal from the AC tone controlling signals. The A and B Decks of the stepping switch select the metering terminals and calibrating potentiometer which will send back telemetry to the studio. R-603, the CONTROL INJECTION adjustment, sets the level of the signal entering the small printed circuit Board D which contains the limiting amplifier and fail-safe circuitry. This board is shown in greater detail in Drawing 91B-6138. The input signal enters the board at terminal 3; it is amplified and limited in amplitude and leaves the board at terminal 2.

From terminal 2 of this board, the signal goes to the inputs of the three tone detectors which are contained on the large plug-in board (Board B), shown schematically in Drawing 91B-6137. The tones are amplified in a set of three selective amplifiers, again of the R-L-C design. Each tone detecting channel also contains an emitter-follower buffer amplifier, a voltage-doubling detector, and a relay-driving transistor. The transistors operate the relays on the front panel for RAISE, PULSING, and LOWER control. The system can also be operated locally at the transmitter site by pressing the RAISE or LOWER switch or the RESET button. These local control functions are obtained by simulating the rectified tones with a small DC signal obtained from the power supply through resistors R-511 and R-538. In the case of the CONTROL channel, the amplifier is muted by biasing it to saturation with a small current obtained from the power supply when resistor R-519 is switched in.

As long as the control tone is present, the pulsing relay K-603 will be pulled in. This relay supplies 15V to the fail-safe circuitry by keeping capacitor C-404 charged. Should the tone disappear for approximately 15 seconds, C-404 will discharge to the point where the Schmitt trigger Q-403 and Q-404 will operate and allow the fail-safe relay to fall out. The fail-safe relay K-601 is connected between the collector of Q-403 and the +15V supply bus.

When the stepping switch K-606 is advanced to its home or calibrate position, the telephone line is connected to an internal regulated voltage source obtained from a second Zener diode regulator and a voltage divider. This voltage is returned to the studio and is used to standardize or calibrate the system.

Remember that the control tone is on the line at all times and is keyed off briefly to advance the stepping switch K-606 one step. K-603, the pulsing relay, follows the short dial pulses accurately. Shown on the schematic in the no-tone position, it is normally pulled in when the CONTROL tone is present. When dialing takes place, the relay de-energizes (as shown) and allows 24V from pin 11 of K-605 to reach the stepping switch coil via the pulsing relay K-603, pins 11 and 12. However, if the tone should remain off for a period of a half second or more, which represents a reset or homing command, reset relay K-605 will pull in. This is accomplished by connecting the coil of K-605, which is shunted by the large capacitor C-607, to 15V through the 68 ohm charging resistor R-608. When the tone is missing, K-605 eventually pulls in. This allows 24V to go directly from the supply, at pin 12 of K-605, through the homing contacts to the stepping switch coil. The self-interrupting pulsing contacts of the stepping switch are in series with this circuit so that the stepping switch continues to advance until the homing contacts are interrupted. This position corresponds to the calibrate or home position.

The RAISE and LOWER Relays, K-602 and K-604, are driven directly from their amplifier stages and further comment is unnecessary. The contacts of these relays apply the 117VAC power to the wiper arms of Decks C and D of the stepping switch.

The power supply for the Transmitter Control Unit is quite similar to the supply in the Studio Control Unit. The component layouts for the small boards in the Studio and Transmitter Control Units are shown in Drawing 20A-2077 and 20A-2079 while the larger boards for generating and detecting the tones are shown in Drawings 20A-2076 and 20A-2078.

Mechanical and Electrical Adjustments

All transistors and diodes employed in the Model WRC-10T Remote Control System are silicon devices. The transistors are all of one type and are mounted in sockets which are all oriented in the same position on any given printed circuit board. A spare transistor is included on both Boards B and D for convenience in trouble shooting. Being an all solid-state unit, the Model WRC-10T Control System should require little maintenance. The stepping switch in the Transmitter Control Unit is lubricated at the time of final inspection and should not require oiling for 50,000 operations. If it becomes exposed to excessive dust and grime such that operation becomes erratic, the stepping switch should be oiled in accordance with the instructions given in an oiling kit, PD-9100-1, available from Automatic Electric Company, Northlake, Illinois, 60164.

All internal adjustments in the Model WRC-10T Control System have been set during final test and should not require field adjustments. Only the CONTROL INJECTION potentiometer located on the rear of the Transmitter Control Unit should be adjusted for the telephone line being used per the instructions given in the preceding section.

The frequency of the control tone oscillators are determined by the fixed and variable capacitors across the inductors in the oscillator circuits. These have been set at the factory to the approximate values shown in the schematic diagram. A multiturn potentiometer is located in the shunt arm of the bridged-T tuned circuit and is adjusted to obtain stable operation of the oscillators. The correct setting for these controls (R-307, R-319, and R-331) is two full turns beyond the point at which oscillations begin. An oscilloscope can be connected to pins 4, 11, and 17 of PC Board A to observe the waveform of the oscillators. At these points, a clipped sine wave with an approximate 10V peak-to-peak value will be present.

The control tone detectors in the Transmitter Control Unit are quite similar to the oscillator circuits except that the output winding is not employed. The tuning capacitors should be tuned for a maximum response to the control signals generated by the Studio Control Unit by observing the waveforms on pin 6, 12, and 19 of PC Board C. The multiturn potentiometers associated with the detector circuitry are used to control the sensitivity of the system. To properly set these controls, advance the potentiometer in the CW direction until oscillations are observed on the test points. Then turn the controls in the CCW direction until oscillations stop. Continue to turn these potentiometers past this point for one and one-half turns. This is the correct setting for the detector potentiometers (R-503, R-517, and R-530) and will provide optimum sensitivity with stable operation.

If necessary, a standard audio oscillator may be used to set the frequencies of the control oscillators. The accuracy of the oscillator being used can be checked against the 60 Hz power line frequency. In all cases, the detector circuits on PC Board C should be tuned to the frequencies of the corresponding oscillators on PC Board A in the Studio Control Unit.

Installation Suggestions

A suggested order of connection for a typical radio transmitter would possibly be as follows: The first or home position would be the calibrate position. Dialing 1 would then take the system to position 1. Metering at this position might be line or filament voltage. RAISE and LOWER controls would turn on and off the transmitter filaments. Dialing 1 again, or resetting and dialing 2, would take the stepping switch to position 2. Metering at this position might then be plate voltage; control at position 2 would be plate voltage on and off. Position 3 would then be plate current metering. Position 4 would measure antenna voltage or current and the RAISE and LOWER controls would control transmitter loading or power output. In this manner, the RAISE and LOWER controls will have an immediately observable effect. If the percent-of-normal scale is used, a table converting the percentages to actual numbers (amperes, etc.) should be at the control point. These numbers are the numbers that are normally logged in the transmitter or operating log. Position 6 would measure modulation and position 7 could indicate whether the tower lights were on or not.

It is suggested that the Remote Control Unit be left in the modulation position when no other readings are being taken. For the frequency and modulation positions, the external meter switch, SW2, on the Studio Control Unit could be used to shift the DC telemetry voltage to the more appropriate external meter.

In this typical example, positions 8, 9, and 10 are left unused. With appropriate kits, building temperature, line voltage or any other signals of interest can be telemetered to the studio. Positions 1, 2, and 4 only were used for control. It would be possible to use any of the other unused control positions to operate ventilators, outside lights, etc. It should be pointed out that confirmation of this action will not be available if a metering signal has previously been assigned to that channel.

Appendix I

It is recommended that the calibration reference point be chosen as 100 on the meter scale. For telephone lines having a total loop resistance in excess of 16,000 ohms, the 50% calibration line is suggested.

The following table shows the value of R-101 for various loop resistances. As normally supplied, the value of R-101 is 10,000 ohms.

Loop Resistance of Telephone Line	R-101
0 to 2K ohms	Change to 12K ohms.
2K to 5K	Leave R-101 at original value of 10K.
5K to 8K	Change R-101 to 6.8K or shunt with 22K.
8K to 10K	Change R-101 to 4.7K or shunt with 10K.
10K to 13K	Change R-101 to 1.8K or shunt with 2.2K.
13K to 16K	Short R-101.
16K to 20K	Change R-101 to 15K. Calibrate at 50% mark.
20K to 25K	Leave R-101 at original value of 10K. Calibrate at 50% mark.

R-101 is located on the rear of the front panel of the Studio Control Unit, between the CALIBRATE control and the meter switch.

In addition to this resistor change, a 10µF at 6V capacitor should be installed across the emitter resistor of the limiting input amplifier (Q-401) in the Transmitter Control Unit if the line resistance is in excess of 10,000 ohms. Space has been left on the printed circuit board for this addition, and the location of the capacitor is shown as the "Optional" component (C-403) in Drawing 20A-2079. The negative side of the capacitor should go to the edge of the board. The positive side of the capacitor should be towards the inside of the board.

Appendix II

The meter selector switch on the Studio Control Unit of the Model WRC-10T has been modified to provide an additional switch position. This position is not labeled on the front panel, but it is the position immediately beyond the third external meter position. The purpose of this change is to enable the meter to be shorted (dynamically braked) during shipment. Further, should excessive DC voltage be inadvertently applied to the telephone line, the meters can be protected by turning the selector switch to this position. Operation of this switch will not affect the control function of the Model WRC-10T.

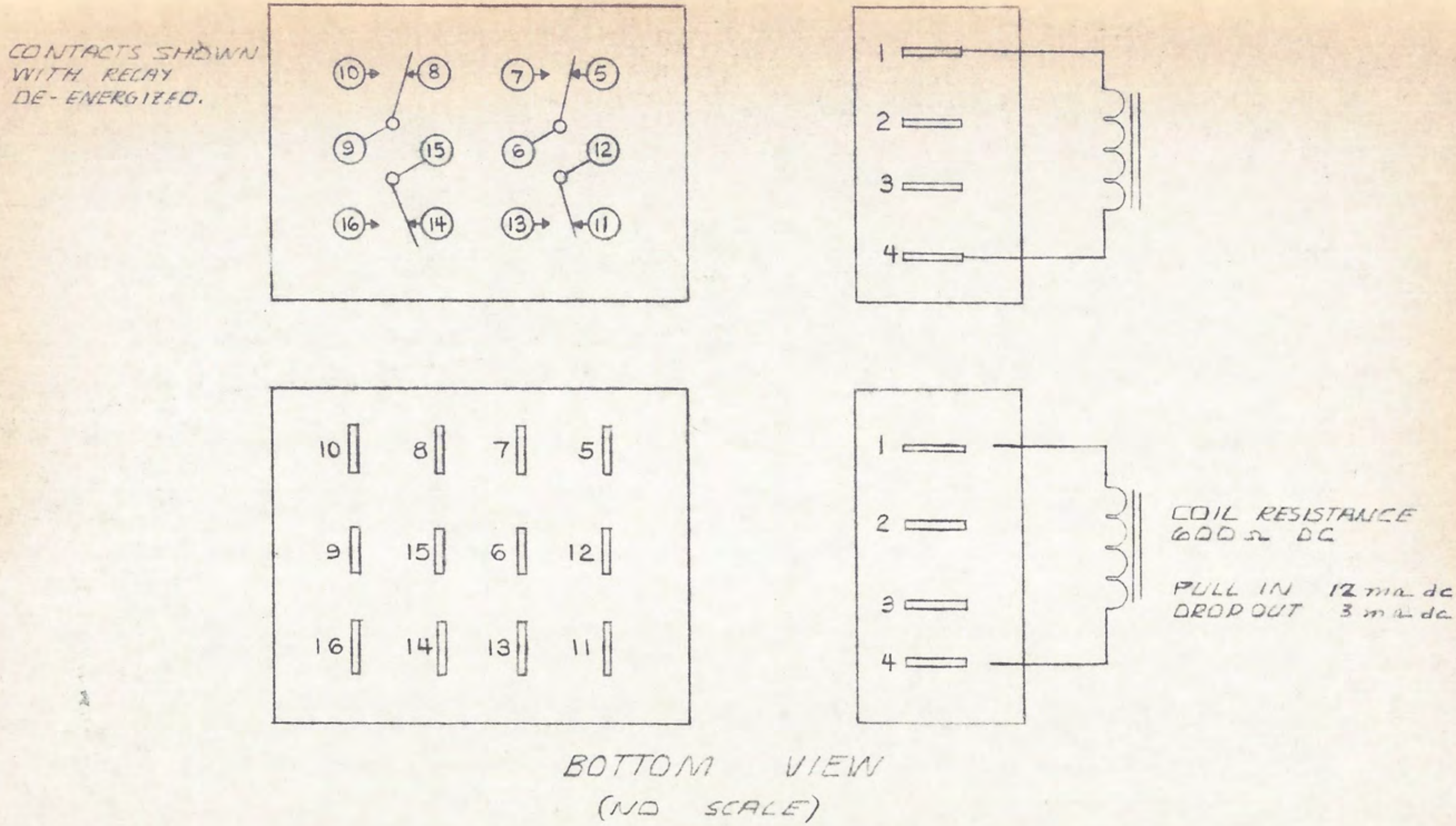
(3/66)

Appendix III

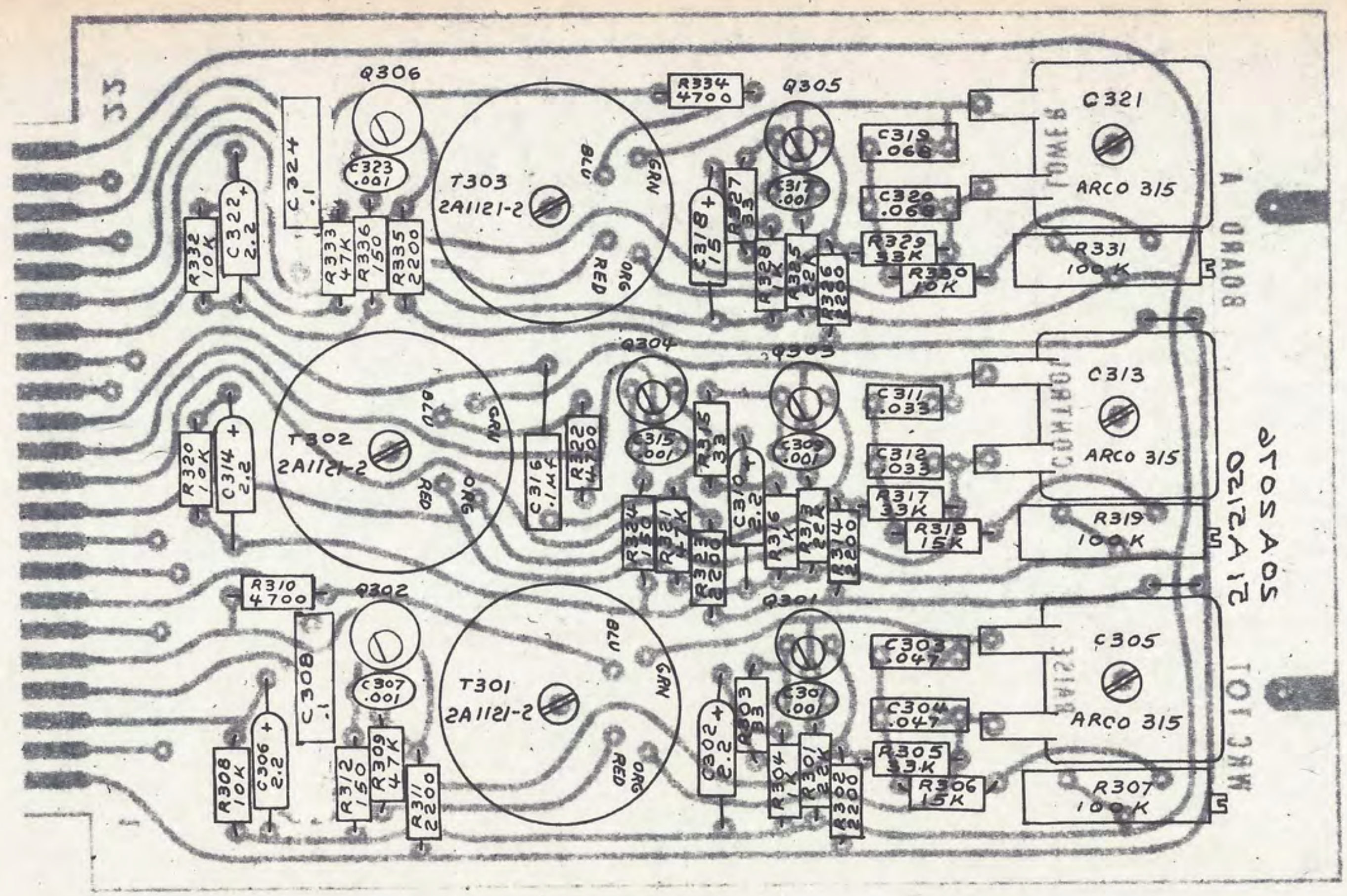
On all Model WRC-10T Remote Control Systems with serial number 1675 and above, two miniature jacks have been added on the rear of the Transmitter Control Unit. These jacks are marked AUX 1 and AUX 2. They are intended to provide a source of regulated 15 volts to power various sampling kits now available from Moseley Associates, Inc. A 680 ohm resistor is wired in series with each of these jacks to prevent the power supply from being overloaded due to a possible short external to the Transmitter Control Unit.

The kits which are intended to be powered by these jacks have a miniature phone plug attached to the cable supplied with the kit. Attach the phone plug to either of these power jacks and attach the remaining wire to the selected telemetry input terminal. As a specific example, the Model TSK-1 Temperature Sensing Kit may be used, with the temperature reading being selected, for instance, on telemetry position 10. Simply plug the miniature phone plug into either of the power jacks and attach the remaining wire to telemetry terminal 10. Then the temperature at the sensing head can be read at the studio by pushing button 10. A second TSK-1 or another kit which requires +15 volts can be added in a similar manner by powering it from the other power jack and connecting it to another telemetry input terminal.

(10/66)



A REVISED 8/66	**MOSELEY ASSOCIATES, INC.** SANTA BARBARA, CALIFORNIA	
	RELAY SOCKET DIAGRAM	
	DWN. RM 8/65 — APP. H. Hane 8/65	5A 1113 — A



NOTES:

1 UNLESS OTHERWISE SPECIFIED

RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%
CAPACITOR VALUES ARE IN MICROFARADS
TRANSISTORS ARE 2N2924

2 SCHEMATIC 91B6135

3 THIS DWG. SUPERSEDES DWG. 2A1131

4 P.C. BOARD 51A5150

REVISIONS		DATE
A	C308, C324 CHGD. TO MIDWEC	7/68

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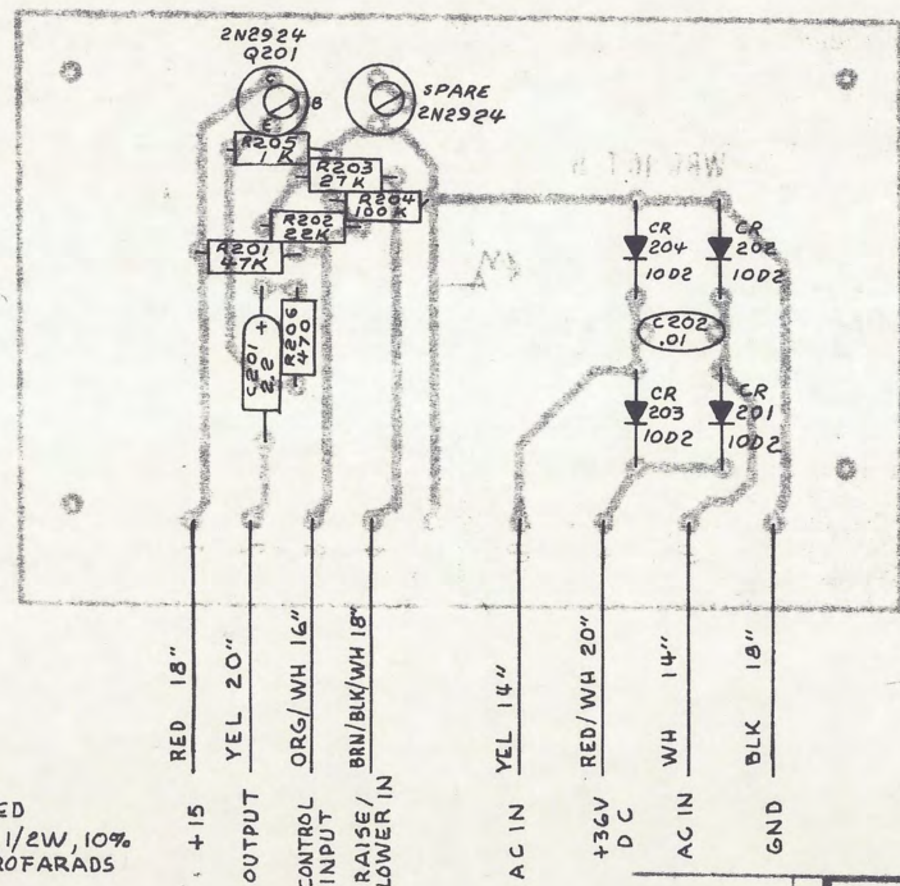
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT
P.C. BOARD A SCU WRC-10T

TOL · FRACT ± 1/32, .XX ± .030, .XXX ± .010		
DWN	FXY	4/68	SCALE: FULL
CHK			20A2076 A
ENG			



NOTES:

1 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/2W, 10%
CAPACITOR VALUES ARE IN MICROFARADS

2 SCHEMATIC - 91A6136

3 THIS DWG SUPERCEDES DWG 2A1128

4 P.C. BOARD 51A5151.

REVISIONS	DATE

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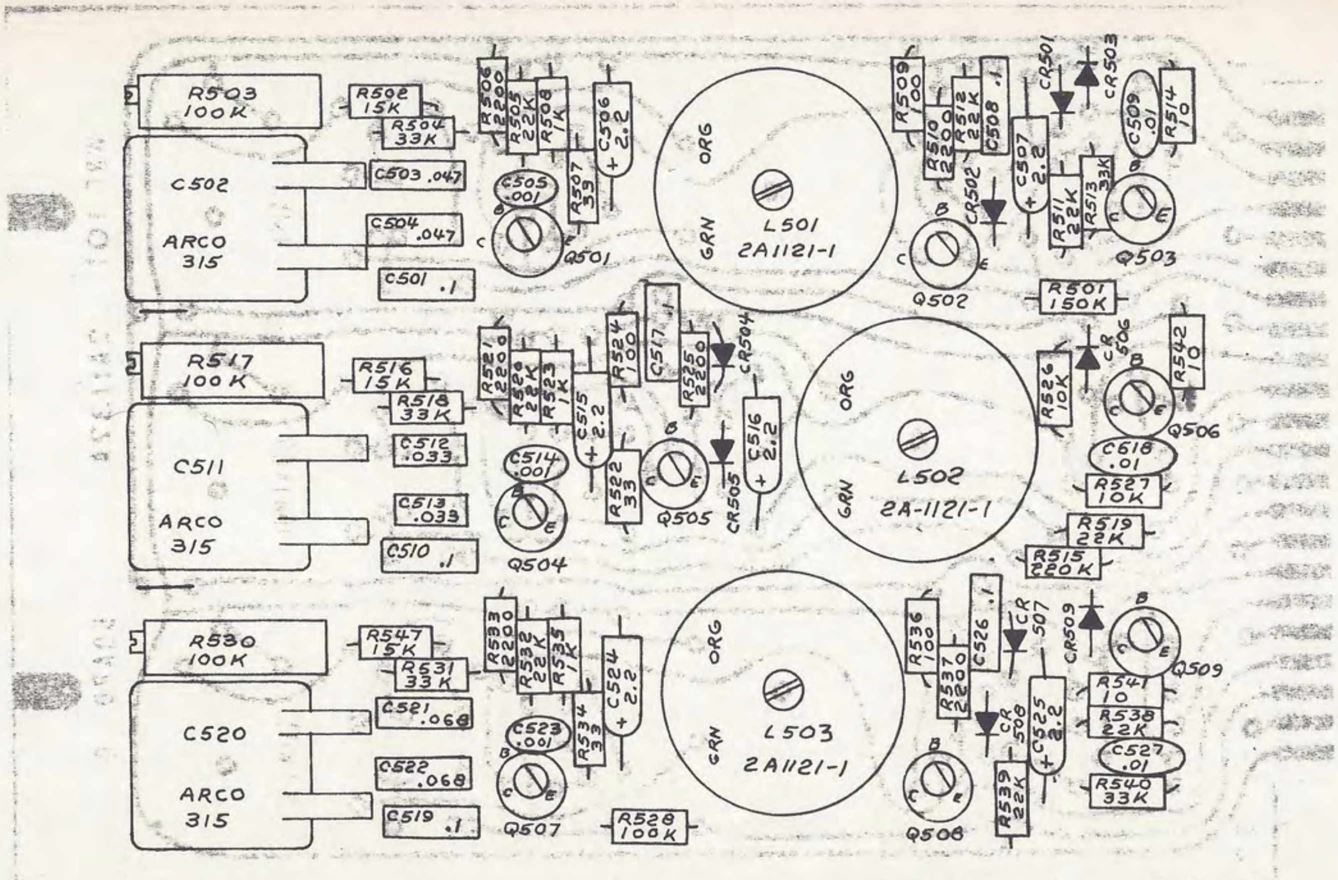
COMPONENT LAYOUT
P.C. BOARD B SCU WRC-10T

TOL FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	FXY	4/68	SCALE: FULL
CHK			20A2077
ENG			



NOTES:

1 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%.
CAPACITOR VALUES ARE IN MICROFARADS
TRANSISTORS ARE 2N2924.
DIODES ARE I.R. 10D2

2 SCHEMATIC 91B6137

3 THIS DWG. SUPERCEDES DWG 2A1132

4 P.C. BOARD 51A5152.

DATE	
REVISIONS	

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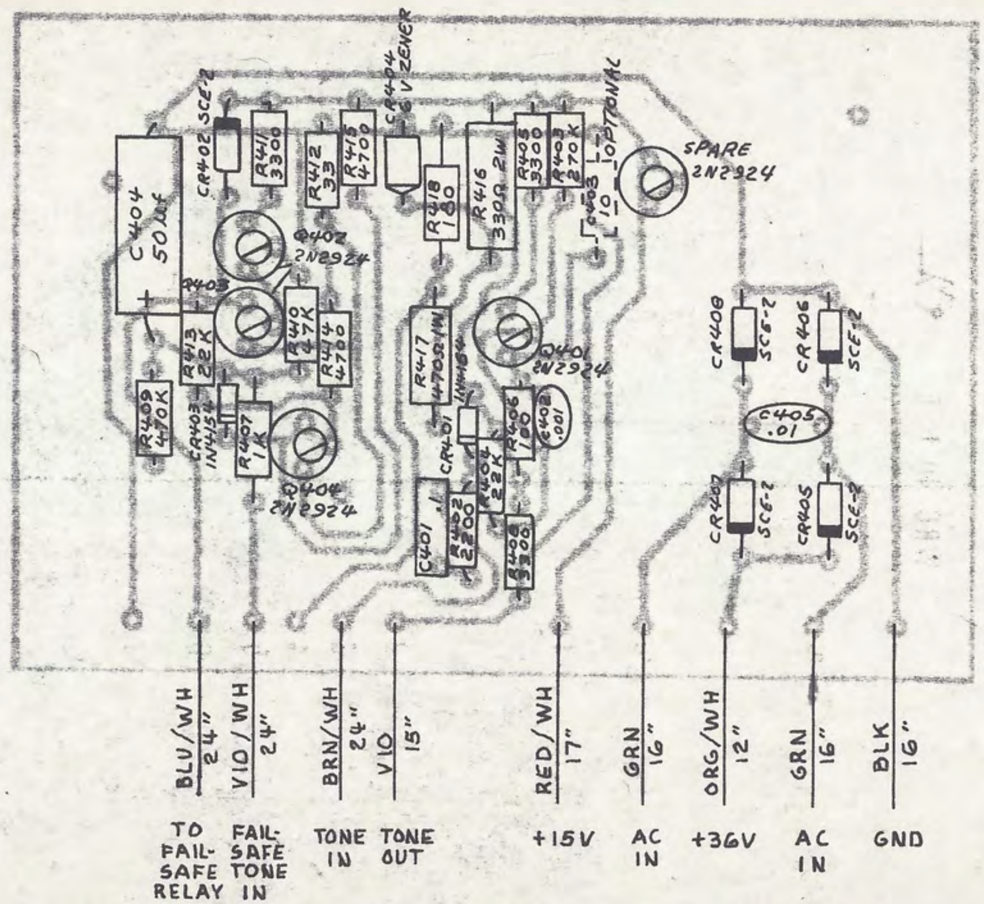
COMPONENT LAYOUT
P.C. BOARD C TCU WRC-10T

TOL. FRACT. ± 1/32, XX ± .030, XXX ± .010			
DWN:	FXY	4/68	SCALE: FULL
CHK			20A 2078
ENG			



NOTES.

1 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%
CAPACITOR VALUES ARE IN MICROFARADS.
2 SCHEMATIC 91B6138
3 THIS DWG. SUPERCEDES DWG 2A1129
4 P.C. BOARD 51A5153.

DATE		
REVISIONS		

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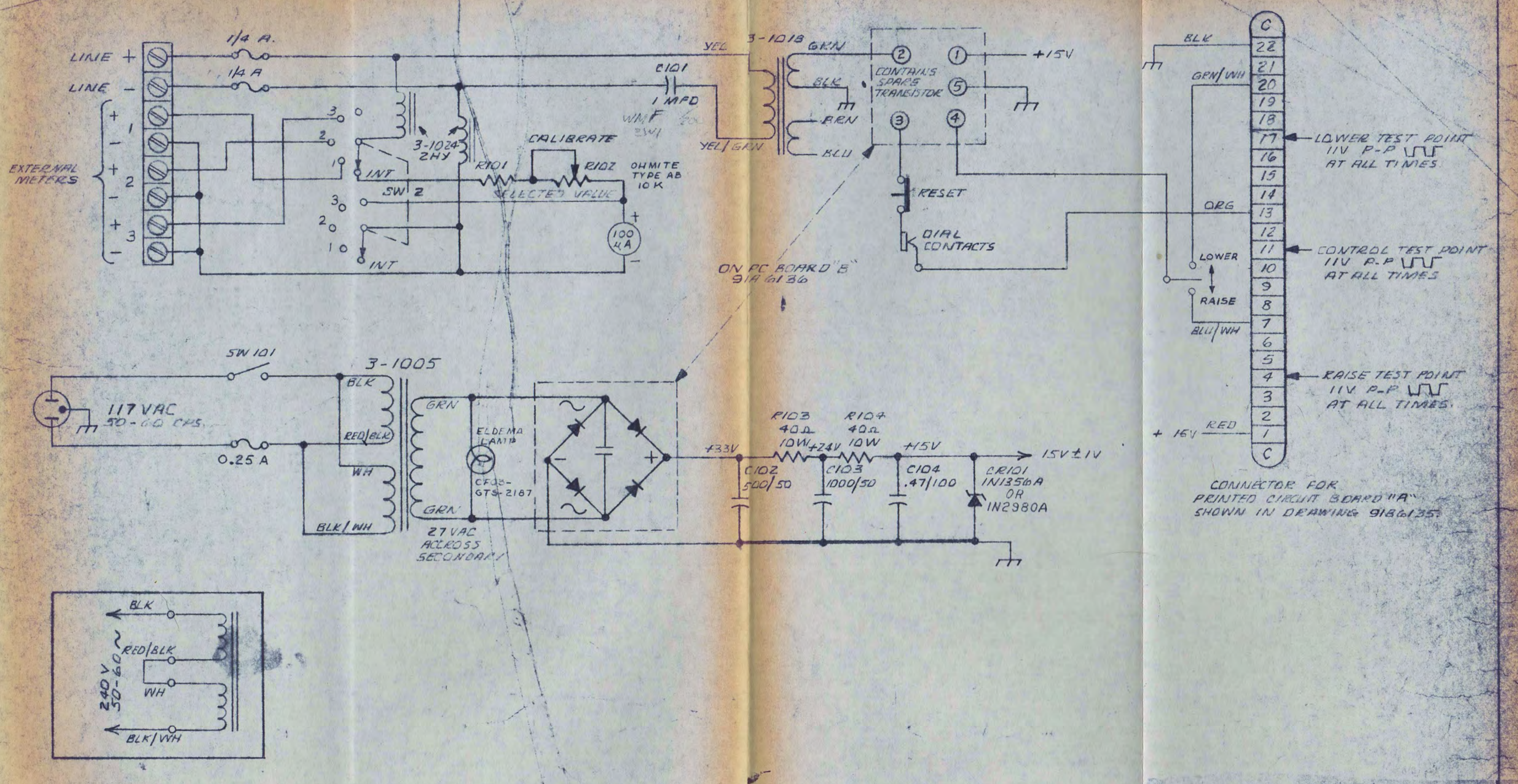
COMPONENT LAYOUT
P.C. BOARD D TCU WRC-10T

TOL. FRACT ± 1/32	XX ± .030	XXX ± .010
DWN	FXY	4/68	SCALE: FULL
CHK			20 A 2079
ENG			



B	117 V LINE FUSE WAS 1A	7/66
A	CHANGE WIRING	

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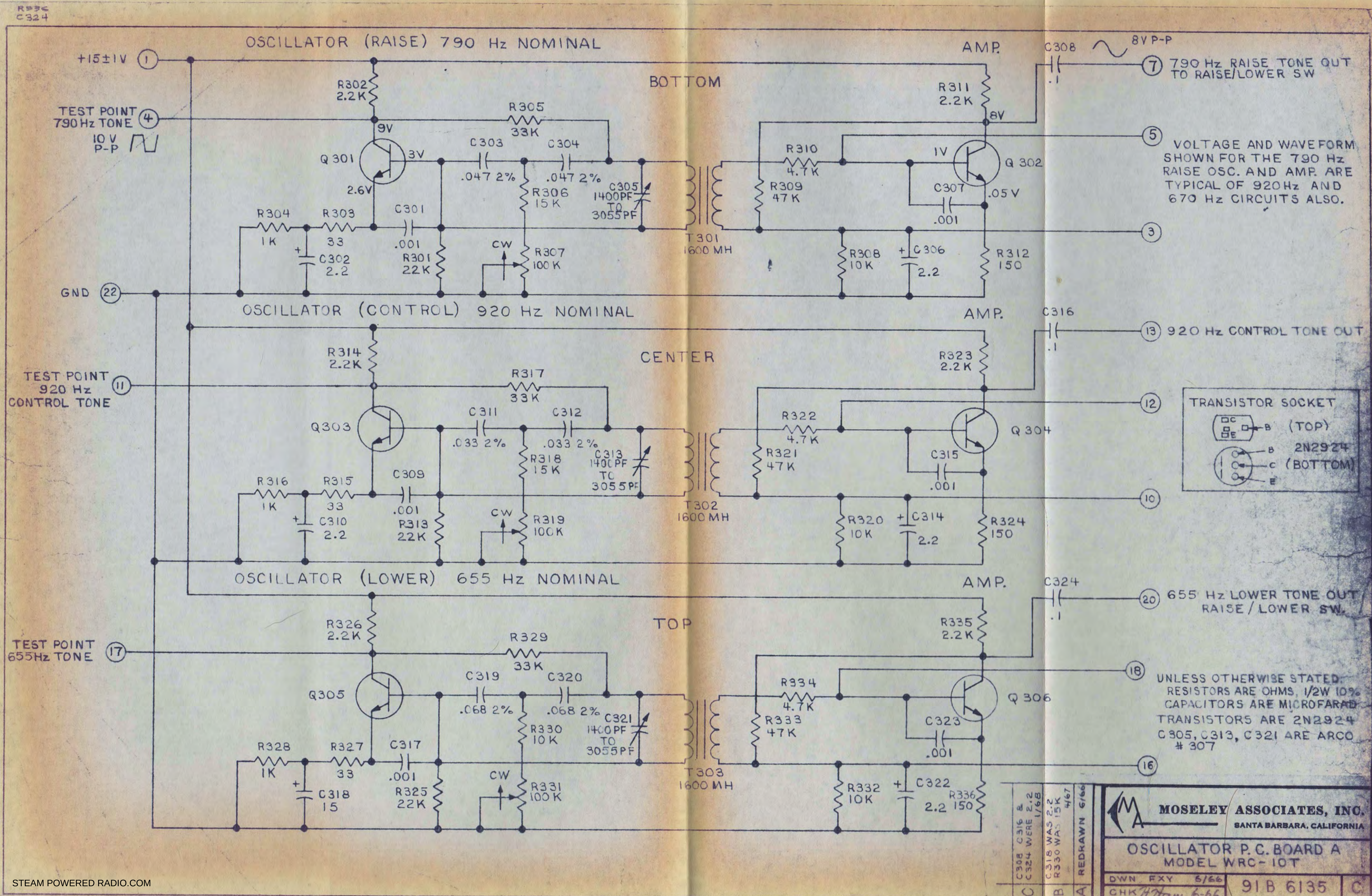
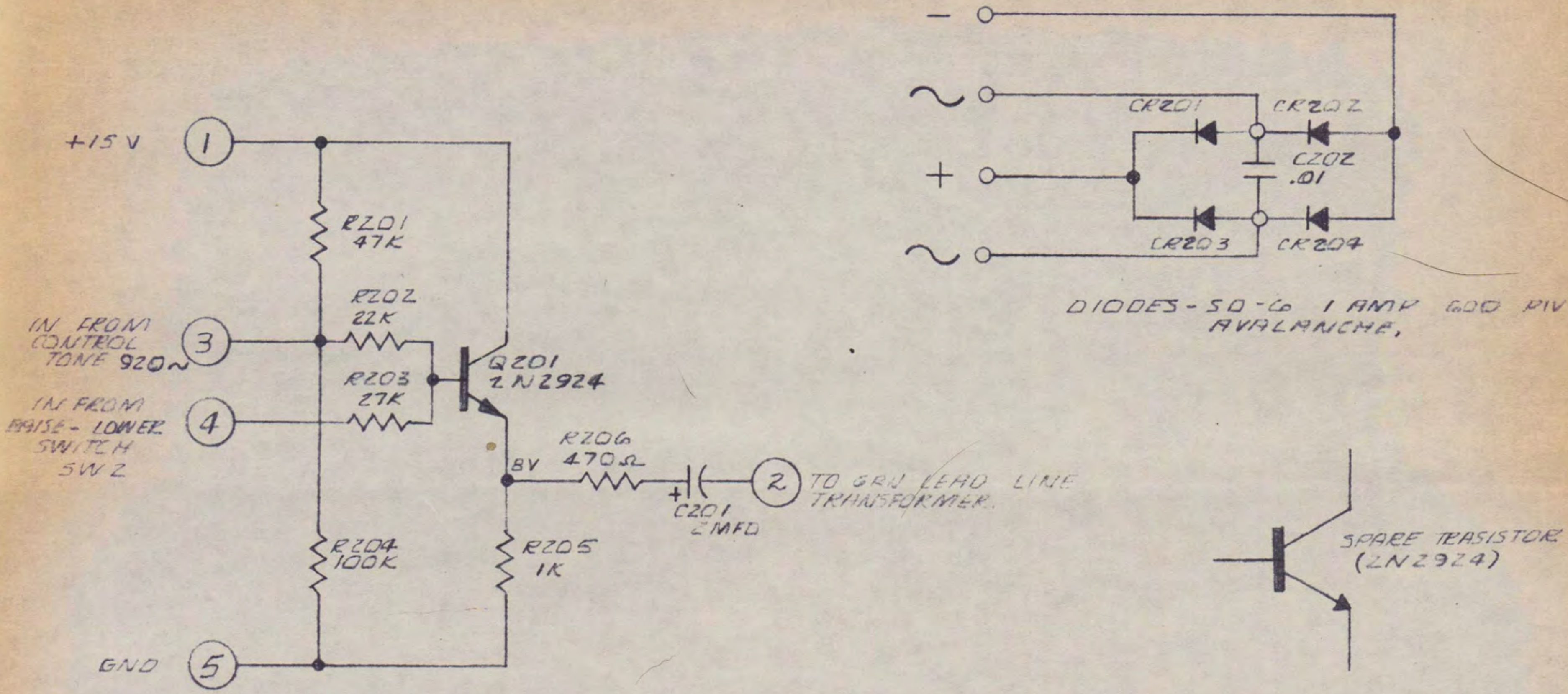
STUDIO CONTROL UNIT
MODEL WRC-10T

DWN RM · CHK'D · 91B 6145 · B


R336
C324
OSCILLATOR (RAISE) 790 Hz NOMINAL
+15±1V
BOTTOM
AMP.
C308
8V P-P
790 Hz RAISE TONE OUT
TO RAISE/LOWER SW
R302
2.2K
TEST POINT
790 Hz TONE
10 V
P-P
R305
33K
9V
R311
2.2K
8V
Q301
3V
C303
.047 2%
C304
.047 2%
R310
4.7K
1V
Q302
VOLTAGE AND WAVEFORM
SHOWN FOR THE 790 Hz
RAISE OSC. AND AMP. ARE
TYPICAL OF 920 Hz AND
670 Hz CIRCUITS ALSO.
2.6V
R306
15K
C305
1400PF
TO
3055PF
R309
47K
C307
.001
.05 V
R304
1K
R303
33
C301
.001
C302
2.2
R301
22K
CW
R307
100K
T301
1600 MH
R308
10K
C306
2.2
R312
150
GND
OSCILLATOR (CONTROL) 920 Hz NOMINAL
AMP.
C316
.1
920 Hz CONTROL TONE OUT
R314
2.2K
CENTER
R323
2.2K
TEST POINT
920 Hz
CONTROL TONE
R317
33K
Q303
C311
.033 2%
C312
.033 2%
R322
4.7K
Q304
TRANSISTOR SOCKET
(TOP)
2N2924
(BOTTOM)
B
C
E
R318
15K
C313
1400PF
TO
3055PF
R321
47K
C315
.001
R316
1K
R315
33
C309
.001
R313
22K
CW
R319
100K
T302
1600 MH
R320
10K
C314
2.2
R324
150
C310
2.2
OSCILLATOR (LOWER) 655 Hz NOMINAL
AMP.
C324
.1
655 Hz LOWER TONE OUT
RAISE / LOWER SW.
R326
2.2K
TOP
R335
2.2K
TEST POINT
655Hz TONE
R329
33K
Q305
C319
.068 2%
C320
.068 2%
R334
4.7K
Q306
UNLESS OTHERWISE STATED:
RESISTORS ARE OHMS, 1/2W 10%
CAPACITORS ARE MICROFARAD
TRANSISTORS ARE 2N2924
C305, C313, C321 ARE ARCO
307
R330
10K
C321
1400PF
TO
3055PF
R333
47K
C323
.001
R328
1K
R327
33
C317
.001
R325
22K
CW
R331
100K
T303
1600 MH
R332
10K
C322
2.2
R336
150
C318
15
C308 C316 & C324 WERE 2.2 1/68
C318 WAS 2.2 R330 WAS 15K 4/67
REDRAWN 6/66
C
B
A
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA
OSCILLATOR P.C. BOARD A
MODEL WRC-10T
DWN FXY 6/66
CHK 6-66
91 B 6135
C



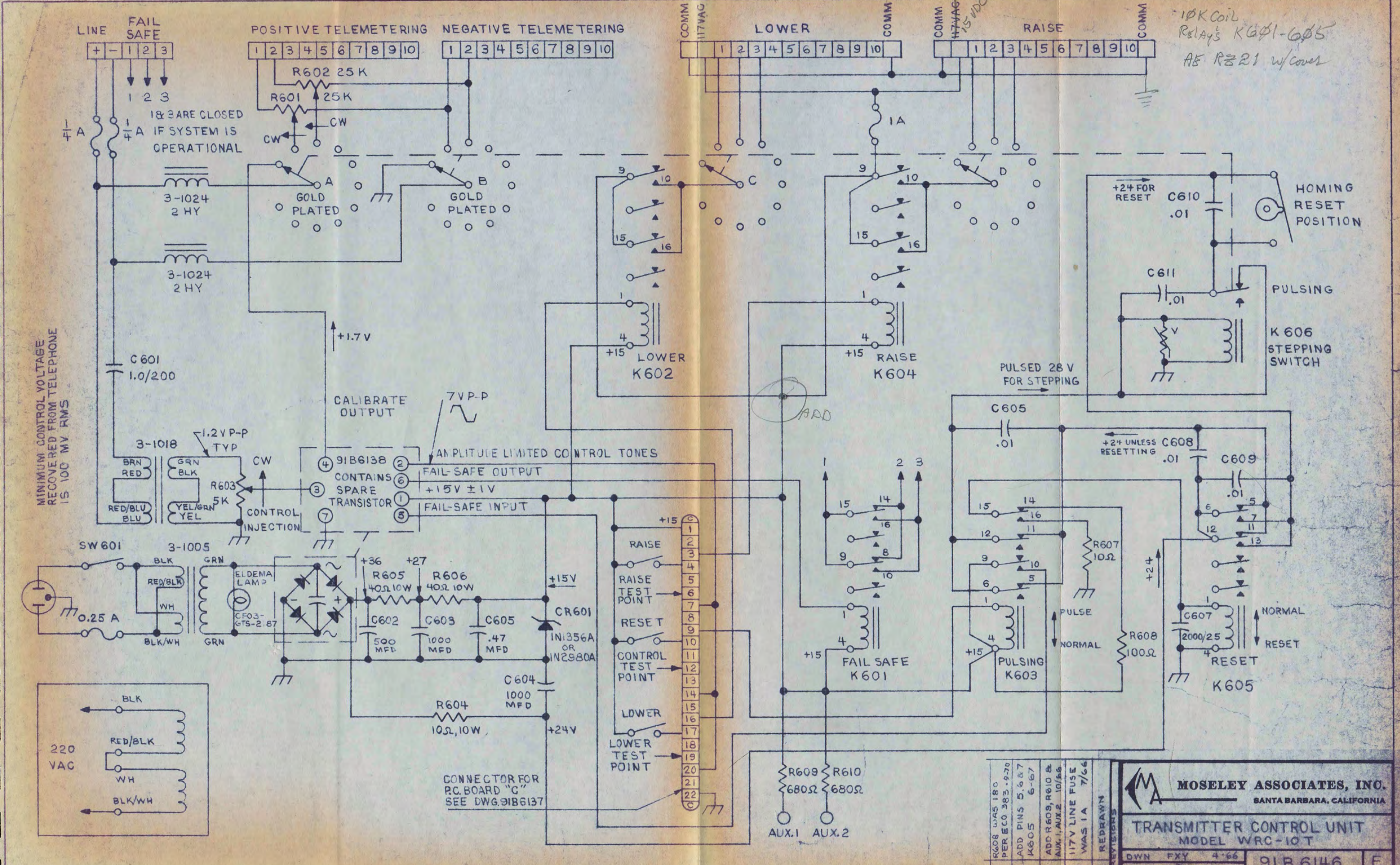
NOTES: UNLESS OTHERWISE NOTED.

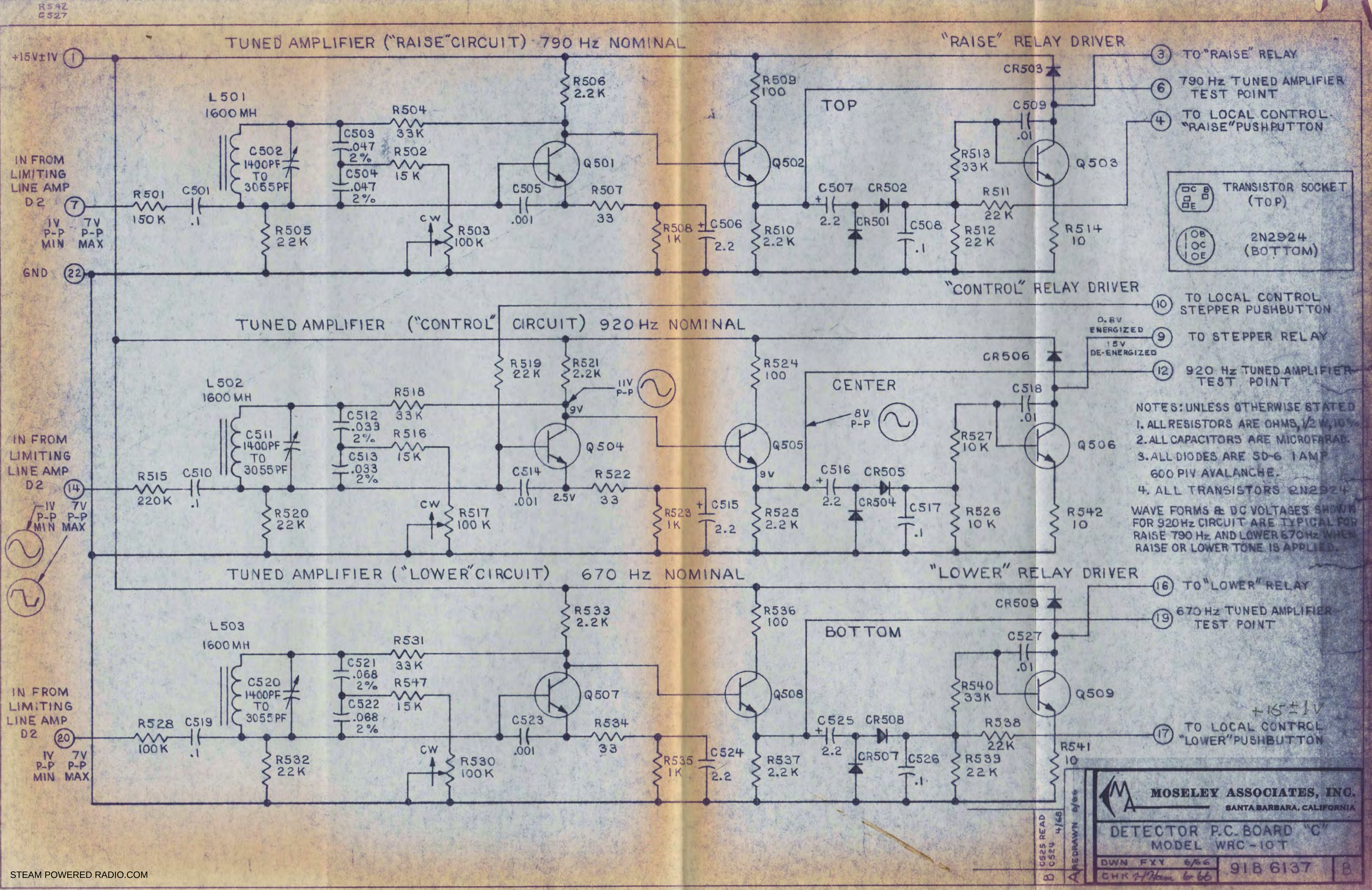
1. RESISTORS 1/2W, 10%.

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

P. C. BOARD "B"
MODEL WRC-10T

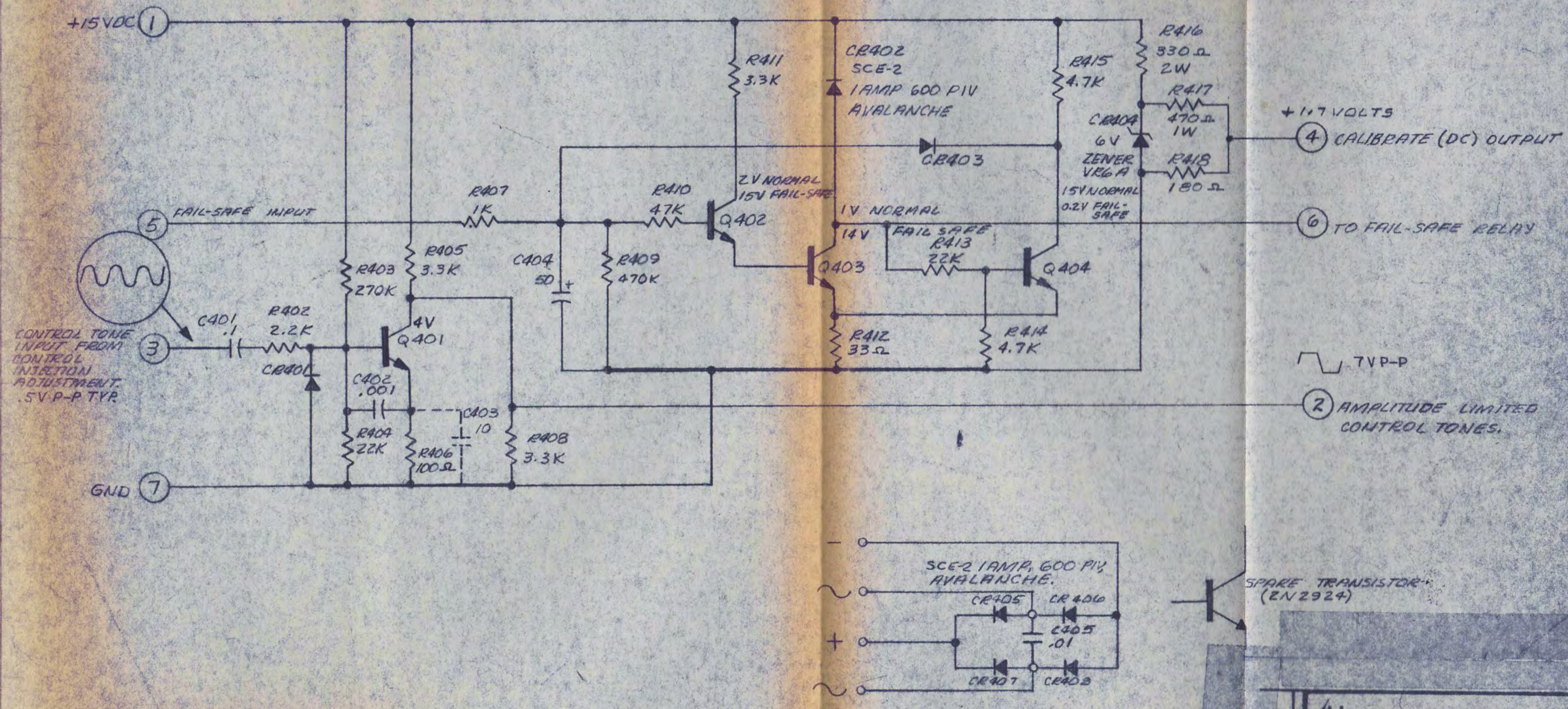
DWN RM 9/65	91A6136	
CHKD. GW 11/65		


LINE
FAIL SAFE
+ - 1 2 3
1 2 3
1& 3 ARE CLOSED IF SYSTEM IS OPERATIONAL
1/4 A
1/4 A
POSITIVE TELEMETERING
1 2 3 4 5 6 7 8 9 10
NEGATIVE TELEMETERING
1 2 3 4 5 6 7 8 9 10
R602 25K
R601 25K
CW
COMM
117VAC
LOWER
COMM
RAISE
1A
10K Coil Relays K601-605 AE RZ21 w/cover
3-1024 2 HY
GOLD PLATED
A
B
C
D
C601 1.0/200
MINIMUM CONTROL VOLTAGE RECOVERED FROM TELEPHONE IS 100 MV RMS
+1.7 V
LOWER K602
RAISE K604
+15
+24 FOR RESET
C610 .01
HOMING RESET POSITION
C611 .01
PULSING
K606 STEPPING SWITCH
PULSED 28 V FOR STEPPING
ADD
CALIBRATE OUTPUT
7VP-P
1.2VP-P TYP
3-1018
BRN RED GRN BLK RED/BLU BLU YEL/GRN YEL
R603 5K
CONTROL INJECTION
91B6138 CONTAINS SPARE TRANSISTOR
AMPLITUDE LIMITED CONTROL TONES
FAIL-SAFE OUTPUT
+15V ±1V
FAIL-SAFE INPUT
C605 .01
+24 UNLESS RESETTING
C608 .01
C609 .01
SW601
3-1005
0.25 A
ELDEMA LAMP CF03-GTS-2.67
+36
+27
R605 40Ω 10W
R606 40Ω 10W
+15V
C602 500 MFD
C603 1000 MFD
C605 .47 MFD
CR601 1N1356A OR 1N2980A
C604 1000 MFD
R604 10Ω, 10W
+24V
RAISE
RAISE TEST POINT
RESET
CONTROL TEST POINT
LOWER
LOWER TEST POINT
CONNECTOR FOR P.C. BOARD "C" SEE DWG. 91B6137
FAIL SAFE K601
R607 10Ω
PULSE
NORMAL
PULSING K603
R608 100Ω
C607 2000/25
NORMAL
RESET
RESET K605
R609 680Ω
R610 680Ω
AUX.1
AUX.2
220 VAC
BLK
RED/BLK
WH
BLK/WH
E R608 WAS 180 PER ECO 383-9-70
D ADD PINS 5,6,&7 K605 6-67
C ADD R609, R610 & AUX.1, AUX.2 10/66
B 117V LINE FUSE WAS 1A 7/66
A REDRAWN
REVISIONS
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA
TRANSMITTER CONTROL UNIT
MODEL WRC-10T
DWN FXY 4-66
CHK 5-66
91B6146
E



TUNED AMPLIFIER ("RAISE" CIRCUIT) 790 Hz NOMINAL
"RAISE" RELAY DRIVER
+15V±1V
IN FROM LIMITING LINE AMP D2
1V P-P MIN
7V P-P MAX
GND
TOP
TO "RAISE" RELAY
790 Hz TUNED AMPLIFIER TEST POINT
TO LOCAL CONTROL "RAISE" PUSHPUTTON
TRANSISTOR SOCKET (TOP)
2N2924 (BOTTOM)
"CONTROL" RELAY DRIVER
TUNED AMPLIFIER ("CONTROL" CIRCUIT) 920 Hz NOMINAL
CENTER
TO LOCAL CONTROL STEPPER PUSHBUTTON
0.6V ENERGIZED
15V DE-ENERGIZED
TO STEPPER RELAY
920 Hz TUNED AMPLIFIER TEST POINT
NOTES: UNLESS OTHERWISE STATED
1. ALL RESISTORS ARE OHMS, 1/2 W, 10%
2. ALL CAPACITORS ARE MICROFARAD.
3. ALL DIODES ARE SD-6 1 AMP 600 PIV AVALANCHE.
4. ALL TRANSISTORS 2N2924
WAVE FORMS & DC VOLTAGES SHOWN FOR 920 Hz CIRCUIT ARE TYPICAL FOR RAISE 790 Hz AND LOWER 670 Hz WHEN RAISE OR LOWER TONE IS APPLIED.
TUNED AMPLIFIER ("LOWER" CIRCUIT) 670 Hz NOMINAL
"LOWER" RELAY DRIVER
BOTTOM
TO "LOWER" RELAY
670 Hz TUNED AMPLIFIER TEST POINT
TO LOCAL CONTROL "LOWER" PUSHBUTTON
+15±1V
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA
DETECTOR P.C. BOARD "C"
MODEL WRC-10T
DWN FXY 6/66
91B 6137
B

R418 Q404
Q405 CR408



4. ALL TRANSISTORS 2N2924.
3. ALL DIODES 1N4154.
2. ALL CAPACITORS ARE MICROFARAD.
1. ALL RESISTORS ARE 1/2W, 10%
NOTES: UNLESS OTHERWISE NOTED.

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

P. C BOARD "D"
MODEL WRC-10T

DWN	RM	9/65	91-B 6138
CHK	G.K	11/65	