INSTRUCTION MANUAL

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TYPE II/C

RADIO REMOTE CONTROL SYSTEM

Xmtr Copy

MOSELEY ASSOCIATES, INC.

SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

INSTRUCTION MANUAL

TYPE II/C

RADIO REMOTE CONTROL SYSTEM

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INCLUDING THE

MODEL PCL-303/C	STUDIO-TRANSMITTER LINK
MODEL PBR-30 OR TRC-15A	REMOTE CONTROL SYSTEM
MODEL SCG-4T	SCA SUBCARRIER GENERATOR
SOLID-STATE	TELEMETRY RECEIVER

MOSELEY ASSOCIATES, INC.
Santa Barbara Research Park
111 Castilian Drive
Goleta, California 93017
805-968-9621

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INSTRUCTION MANUAL

TYPE II/C RADIO REMOTE CONTROL SYSTEM

I. INTRODUCTION

The Type II/C Radio Remote Control System is designed to control and meter a remotely located FM transmitter without the aid of any metallic control or metering circuits. An aural Studio-Transmitter Link (STL) is employed to convey a complete stereo signal to the remote transmitter. The Moseley Model SCG-3T Stereophonic Generator is normally recommended as the modulating signal source. Further, the STL is multiplexed with a subcarrier which carries all the control tones required to remotely operate any FM broadcast transmitter. The transmitter meter indications are relayed back to the control point by modulating an SCA subcarrier on the main FM carrier with a low-level, subaudible tone. This technique does not destroy the usefulness of the SCA subcarrier for normal program service.

This first section of the instruction manual briefly describes the overall operation of the Type II/C Radio Remote Control System. Complete instruction manuals and schematic drawings for the individual units employed in the control system are contained in the remaining parts of the manual. The units included in the Type II/C Control System are:

- Model PCL-303/C Studio-Transmitter Link
- Model PBR-30 or TRC-15A Remote Control System
- Model SCG-4T SCA Subcarrier Generator
- Solid-state Telemetry Receiver

II. DESCRIPTION OF SYSTEM

The complete Type II/C Radio Remote Control System is shown in block diagram 92B-1005. The operation of the system can be most easily understood by considering the main channel program and control circuits which are carried from the studio, or control point, to the remote transmitter site via the STL. Next, the method of returning the meter reading indications is considered, as this will close the operating loop of the Type II/C Control System.

The main FM program channel is applied to the BNC input connector of the PCL-303/C STL while the 110 kHz control subcarrier from the remote control system is inserted into either of the multiplex input connectors. The LOWER, RAISE, and STEPPER/FAIL-SAFE tones from the Studio Unit of the control system frequency modulates the 110 kHz control subcarrier approximately 5%. In this manner the Model PCL-303/C conveys both the main channel program and control signals from the Studio Unit to the remote site. Normally, two Scala PR-450 Antennas are supplied with each STL. These antennas are parabolic in one section and incorporate a feed element driven with a balun transformer. With such an arrangement snow and ice have negligible effect on the operation of the antenna.

At the remote site the composite stereo signal is filtered (internally in the PCL-303/C Receiver) to remove the 110 kHz control subcarrier. The remaining composite signal is then applied to the wideband input of the FM exciter. The 110 kHz control subcarrier is recovered from the STL receiver prior to the low-pass filter. This signal is then applied to the control input of the transmitter unit of the remote control system.

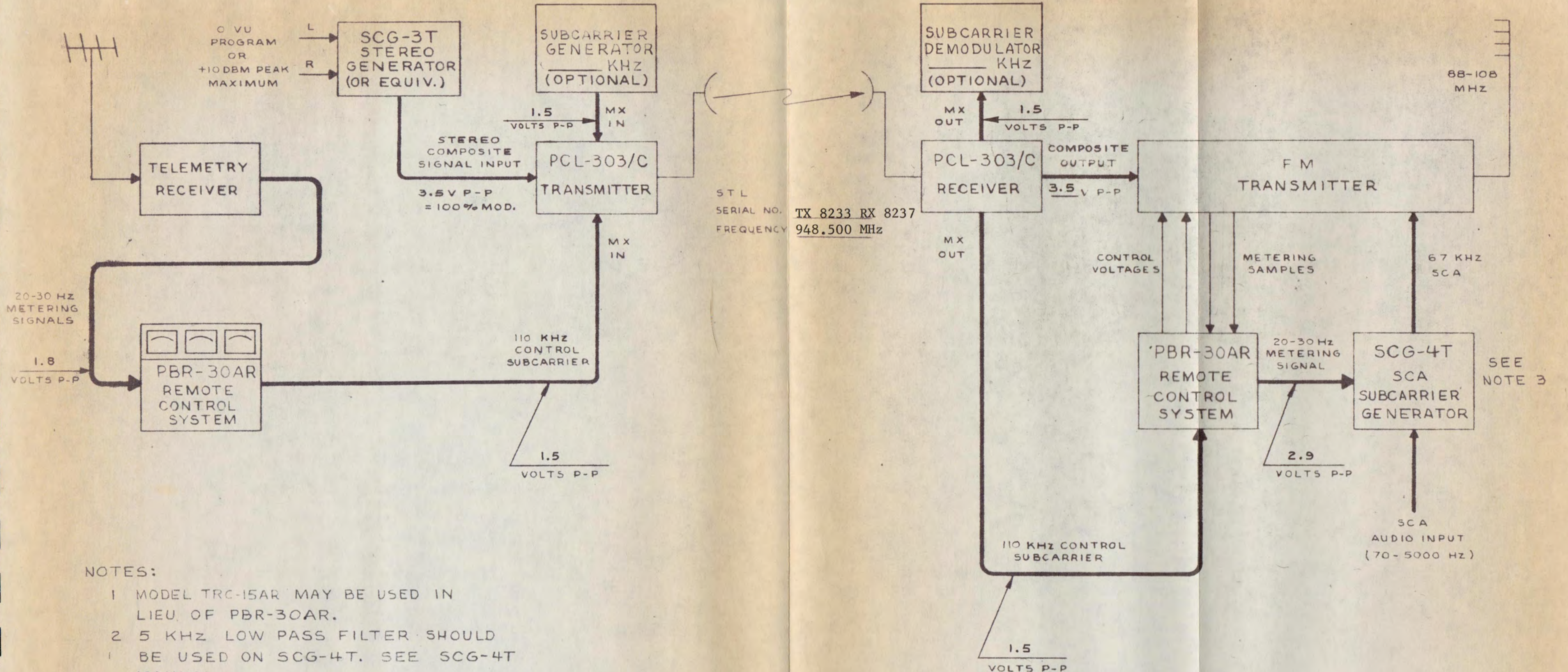
The telemetry sampling voltages from the FM transmitter are converted by a voltage-controlled oscillator (VCO) in the Transmitter Unit operating in the subaudible spectrum. The frequency of the oscillator is directly related to the magnitude of the sampling voltage. That is, when the DC sampling voltage is at zero potential, the frequency of the metering oscillator is at the lower end of its frequency range. When the voltage is approximately 1.0 volts DC, the frequency of the oscillator is at its upper limit. The output of the telemetry VCO is applied to the telemetering input on the rear of the SCG-4T 67 kHz SCA Subcarrier Generator. This low-frequency telemetering signal frequency modulates the 67 kHz SCA signal about 15 dB below the normal audio program level. Because of the relatively low level, and because of the low frequencies involved, the telemetering signal does not degrade service. With this method of telemetry, the frequency spectrum between 70 Hz and 7500 Hz can be used for other SCA purposes. For example, it may be used to relay the output of a remote pickup receiver to the studio for subsequent rebroadcast.

It is necessary, however, to restrict all frequencies below 70 Hz from the SCA program so that the metering accuracy of the Type II/C Control System will not be affected. At the control point, or studio, a solid-state multiplex receiver is used to recover the subaudible metering signals from the SCA subcarrier. The metering signal is then applied to the Studio Unit so that the control operator will be able to observe the results of his control commands.

III. INSTALLATION

Drawing 92B-1005 shows the recommended location of the various units of the Type II/C Radio Remote Control System. Type RG-58A/U coaxial cable with appropriate connectors should be used for all interconnections.

The signal levels at key points have been noted on the overall block diagram of the Type II/C Control System. These will aid in the installation and servicing of the Control System.



NOTES:

1. MODEL TRC-15AR MAY BE USED IN LIEU OF PBR-30AR.
2. 5 KHz LOW PASS FILTER SHOULD BE USED ON SCG-4T. SEE SCG-4T MANUAL.
3. IF SCG-4T IS NOT USED NOTE THAT SUBAUDIBLE METERING OUTPUT FROM PBR-30AR IS ESTABLISHED AT 2.5VP-P. IF IT IS NECESSARY TO REDUCE THIS LEVEL, RESISTOR R2312 (100Ω) ON BOARD #23 (TCU SUBAUDIBLE METERING PROCESSOR) MAY BE INCREASED IN VALUE. SEE INSTRUCTION MANUAL FOR LOCATION OF R2312. THE SUBAUDIBLE METERING OUTPUT SHOULD NOT BE APPLIED TO THE INPUT OF AN SCA GENERATOR WHICH HAS AN IMPEDANCE OF LESS THAN 500 OHMS. SUBAUDIBLE METERING SIGNAL SHOULD DEVIATE SCA GENERATOR 600 Hz.

STATION: KABL-FM

Rev.	Description
F	TRC-15AR WAS PBR-15AR 9/72
E	ADD VOLTAGE READINGS 6/2/72
D	PBR-15 REPLACED RRC-10T 12/70
C	ADD NOTE 3 2/70
B	REVISE FOR PBR-30 ADD NOTES 9/69
A	ADD SCG-3T & OPT. SCA 4/69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

BLOCK DIAGRAM
TYPE II/C SYSTEM

DWN FXY 9/67
ENG J/T 9-67
92B1005

PCL-303/C

INSTRUCTION MANUAL

MODEL PCL-303/C

STUDIO-TRANSMITTER LINK

MOSELEY ASSOCIATES, INC.

Santa Barbara Research Park
111 Castilian Drive
Goleta, California 93017

Revised

October, 1972

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INSTRUCTION MANUAL

MODEL PCL-303/C

STUDIO-TRANSMITTER LINK

I. INTRODUCTION

The Model PCL-303/C Composite Aural Studio-Transmitter Link (STL) is a wide-band system designed for the transmission of a composite FM stereophonic signal between a broadcast studio and a remotely located FM transmitter. Ruggedly built, compact, and rated for continuous duty, the Model PCL-303/C is an all solid-state unit employing only silicon semiconductors.

There are several advantages to the transmission of a composite FM stereo signal. Some of these are:

1. Only one basic RF link is utilized to transmit the composite stereo waveform, including the 19 kHz pilot subcarrier. This is in contrast to the utilization of two aural STL systems to convey the unmatrixed LEFT and RIGHT audio signal. This results in an equipment cost savings. It should also be noted that a 67 kHz SCA subcarrier can also be applied to the STL for direct rebroadcast by the FM transmitter.

2. The stereo generator is located at the studio site where adjustments, if required, can be made away from the strong RF fields found near large FM broadcast transmitters. These high RF fields can have deleterious effects on the instrumentation employed to properly align the stereophonic generation equipment.

The Model PCL-303/C Composite Aural STL is basically the same as the Model PCL-303 except that the 75 μsecond pre-emphasis/de-emphasis networks and 15 kHz 600 Ω low-pass filters have been removed from the transmitter and receiver, respectively. The basic modulation response capability of the direct FM oscillator employed in the Model PCL-303/C is sufficent to accept and faithfully transmit the frequency spectrum required for FM stereophonic broadcasting. Further, the bandwidth of the 10.7 MHz I.F. amplifier of the composite-system receiver has been increased and adjusted to follow a curve which yields a linear phase characteristic. The detected composite waveform in the Model PCL-303/C receiver is passed through a low-pass filter which does not significantly alter the phase relationship of the composite signal (does not degrade separation). This low-pass filter will attenuate any remote control or secondary program subcarriers multiplexed above the composite signal (far in excess of the requirements of FCC Rule 73.317(a).

The Model PCL-303/C STL consists of a transmitter and a receiver each mounted on a standard $5\frac{1}{4}$" x 19" rack panel with slide-out provisions. The STL receiver is a crystal-controlled, double-conversion, superheterodyne type. A relay is included in the receiver to mute the composite output should the incoming carrier fall below a given preset value. In addition, Form C contacts of this relay are terminated on the rear apron for use by external alarm or control circuits.

The transmitter incorporates a direct FM basic oscillator to achieve flat response and uniformly low distortion over a wide modulation frequency range. Provisions are included on the transmitter to multiplex two subcarriers for remote control and auxiliary service. A special extended-life, quiet fan provides cooling for the final power amplifier chain. The basic direct FM oscillator is phase locked to a temperature-controlled, low-frequency, reference crystal oscillator. Also included in the transmitter are two frequency-doubler stages, one 3-stage Class C RF power amplifier, and a parametric multiplying power diode.

A 3-section bandpass filter is incorporated in the STL transmitter RF output circuitry. A sampling diode is included in this assembly to indicate relative RF power output of the transmitter.

All transistors and IC's in the Model PCL-303/C, other than the transistors on the AFC board in the transmitter, are socket mounted. Both transmitter and receiver units are fully shielded.

It should be noted that the Model PCL-303/C Composite Aural STL can only be used with those types of FM exciters employing a direct FM oscillator. Further, the unit is designed basically to operate with the Moseley Model SCG-3T Stereo Generator. However, it is possible to apply a signal from other stereophonic generators meeting the requirements of FCC Rule 73.322. The input level requirements of the PCL-303/C transmitter must be observed to obtain satisfactory results.

II. SPECIFICATIONS Model PCL-303/C Composite Aural Studio-Transmitter Link

A. Overall System Specifications

L+R Frequency Response	±0.5 db, 50 Hz to 15 kHz
L+R Distortion	Less than 0.75%, 50 Hz to 15 kHz
L+R SNR	65 db for 35 μv input signal
Stereo Separation	Greater than 35 db, 50 Hz to 15 kHz (assuming that input stereo signal has separation in excess of 38 db)

B. Receiver Performance Specifications

Frequency	890 MHz to 960 MHz, crystal controlled
Sensitivity	Less than 8.0 μvolts for 20 db quieting
RF Input	50 Ω, Type N female connector
Modulation Acceptance	±200 kHz
Intermediate Frequencies	1st I.F. 72 MHz; 2nd I.F. 10.7 MHz
Spurious Response	Spurious and image responses attenuated more than 60 db
Stability	Maintained to within ±0.001% of assigned frequency over ambient range of 0°C to 55°C
Maximum Available Composite Output Signal	6 volts peak-to-peak, 1000 Ω minimum load impedance, unbalance
Metering	Single multimeter for monitoring essential operating parameters
Operating Temperature Range	0°C to 55°C
Dimensions	$5\frac{1}{4}$" x 19" x 14"
Weight	17 lbs.
Power Requirement	120/240 VAC, ±10%, 50-60 Hz
Mounting	Standard 19" rack

C. Transmitter Performance Specifications

Type	Direct FM
RF Output	7 watts nominal; 8 watts maximum into nominal 50Ω load. Type N female connector
Frequency Stability	Better than 0.001% (0°C to 60°C; crystals mounted in temperature-controlled oven
Multiplication	12 times basic oscillator frequency
AM Noise	Better than 75 db below carrier reference
Deviation	±70 kHz for 100% modulation
Spurious Emissions	More than 60 db below carrier
Emission Symbols	
Stereo only	246F9, 255 kHz B.W.
Stereo and 67 kHz SCA	290F9, 300 kHz B.W.
Composite Input	10,000Ω unbalanced, approximately 3.5 volts peak-to-peak for 100% modulation
Multiplex Inputs	Two BNC connectors are provided for subcarrier channels in 110-200 kHz spectrum; approximately 1.0 volt rms for 20% deviation
Operating Temperature Range	0°C to 55°C
Power Supply	Fully regulated, self-contained
Power Requirement	120/240 VAC, ±10%, 50-60 Hz
Cooling	Convection and forced; fan has long-life bearings
Dimensions	5¼" x 19" x 16"
Mounting	Standard 19" rack

III. UNPACKING AND INITIAL CHECKOUT

The Model PCL-303/C transmitter and receiver should be carefully unpacked and inspected for concealed shipping damages upon receipt of the equipment. Retain all boxes and spacers in case a claim is to be made against the carrier for damages.

Should the equipment be damaged, IMMEDIATELY file a claim with the carrier. The top-shield cover of the STL transmitter should be removed so that the shipping spacers which have been used to secure the various shock-mounted subassemblies can be removed. It is also recommended that the receiver top-shield cover be removed to confirm that the muting relay and all transistors are properly seated in their sockets. This visual inspection will also acquaint the user with the location of the key components in the equipment.

> CAUTION: Do not attempt any tuning adjustments on the receiver or transmitter at this time. All tuned circuits have been pre-aligned at the factory and should not be adjusted unless proper test equipment is available and then only after reading the Tuning and Alignment Procedure outlined elsewhere in this manual.

If a 10 watt 50 Ω RF termination capable of operation at 950 MHz is available, with or without a calibrated wattmeter, the STL transmitter can be bench checked. With the RF load connected to the output of the STL transmitter and the line cord plugged into a source of 117 VAC, 50-60 Hz power, the front-panel RADIATE switch can be turned on. The RF wattmeter, if used, will immediately indicate between 6 watts and 8 watts of output power. The RF output meter on the front panel of the PCL-303/C will indicate between 50 and 55 divisions.

The receiver should be placed on an adjacent bench and, after the power plug has been connected to the power source, the power switch can be turned on. It may be necessary to carefully insert a small wire into the Type N RF input fitting on the rear of the receiver chassis to minimize multipathing effects. Do not attempt to adjust the input or output cavities of the STL receiver and transmitter under these test conditions. These are preliminary tests and should be conducted to become familiar with the basic operation of the system. An audio test signal of 3.5 volts peak-to-peak may be applied to the Type BNC modulation input connector on the rear of the STL transmitter for the initial transmitter check. This signal can be derived from a standard audio oscillator or Model SCG-3T FM Stereo Generator. An oscilloscope or VTVM should be connected to the Type BNC output connector located on the rear of the STL receiver to confirm the presence of the test signal. Bear in mind that multipathing conditions can exist under these initial checks and will affect the measurements made. Since the STL transmitter does not employ pre-emphasis, it is not necessary to reduce the amplitude of the input signal source when making frequency response measurements. (This, of course, will not be true if the test signal source is derived from a stereo generator.)

IV. INSTALLATION

The Model PCL-303/C transmitter and receiver can be mounted in a standard 19" wide rack using the slides provided. For maximum mounting stability, the rear of these slides should be secured to the rear rails (or to the cabinet walls) with the brackets provided. The external connections which must be made for both units include the 3-wire power cord, RF input and output cables, unbalanced shielded composite program line and, if used, coaxial cables for multiplex subcarriers. The transmitter should be installed in such a manner as to allow air to freely circulate around the equipment. Transmission line considerations will determine to some extent the placement of the equipment. As lengthy transmission line will introduce undesirable amounts of attenuation of the transmitter output, it is always good practice to place the STL transmitter as close as possible to the antenna. If a long length of transmission line is required, use the lowest loss line possible consistent with mechanical and economical considerations. The same precautions should be followed in locating the receiver. Because of the use of slide-mounting rails, it is preferable to use a short length of RG-8A/U coaxial cable to connect the RF fittings on the rear of the STL transmitter and receiver to the actual transmission line. This prevents damage to the equipment and eases use of the slide-rail mounting technique. In all cases, constant impedance RF fittings should be used, such as a Type N connector, on the transmission line.

Assuming that the initial checks as outlined in the previous section have been made, the STL transmitter and receiver may now be turned on.

> CAUTION: Be sure the transmission line and antenna have been properly connected to the PCL-303/C transmitter before activating the RADIATE switch.

When the RADIATE switch is turned on, the RF output meter of the transmitter should indicate between 50 and 55 divisions. A reading different from this value usually indicates the presence of a high VSWR. The tune-up procedure is described in Section VI of this manual.

When the PCL-303/C transmitter power cord is connected to the primary power line source, operating voltages are applied to the basic oscillator, crystal oven, AFC network, and low-level frequency multiplier stages. The front-panel lamp glows when the transmitter is connected to the power line. Turning the front panel switch to the RADIATE position applies voltage to the high frequency power amplifier chain as well as the cooling fan. The RF output meter on the front panel provides an indication of carrier radiation. This turn-on procedure prevents the STL transmitter from radiating an off-frequency signal prior to the capture of the basic oscillator by the AFC circuitry.

V. ANTENNA

The Type PR-450 Scala Antenna is normally recommended for use with the Model PCL-303/C STL. The reflecting screen is a parabolic section in one plane and provides a gain of 17.5 db over a reference dipole antenna (approximately 19.6 dbi gain). Its physical aperture is 67" x 36". The anodized driver element is located at the focus of the paraboloid and is pretuned at the factory for the operating frequency. No attempt should be made to field tune the antenna. The actual radiating element is a folded dipole with a balun transformer permanently sealed within the driver-element support for impedance matching to a 50 Ω transmission line. This configuration results in less beam skewing under heavy ice and snow loading conditions. It should be noted that this antenna has a low DC resistance between the inner conductor and the shield of the Type N RF fittings supplied. On special order, the reflecting screen of the antenna can be anodized and dichromate dipped to assure long life in a corrosive environment. The PR-450 Antenna is supplied with U-bolt mounting hardware so that it can be clamped to a 2 3/8" O.D. pipe. The open grid reflector design minimizes wind loading.

In assemblying the PR-450, care should be taken to insure that the driver element support is fully seated. If this support is not fully seated, optimum gain of the PR-450 will not be achieved. Additionally, the polarization of the transmitting and receiving antennas should be in the same plane.

When mounting the PR-450 or equivalent antenna to an ungrounded standard broadcast tower, the Moseley Model ICU-1 Isoucoupler may be used to eliminate the need to construct a resonant transmission line tank circuit or the requirement for a quarter-wave insulated transmission line section up the tower. The ICU-1 Isocoupler has less than 0.5 db of insertion loss at 950 MHz and presents less than 10 pf of capacity to the base of the tower. The ICU-1 is rated for a peak instantaneous voltage breakdown of 5,000 volts. The modulation voltage peaks should be taken into consideration when using the ICU-1.

VI. DETAILED DESCRIPTION OF TRANSMITTER

A. Transmitter Operation

To place the Model PCL-303/C in operation, connect the RF transmission line to the Type N output fitting. Connect the power cord to a source of 120/240 VAC, 50-60 Hz power. The green pilot light will indicate the presence of primary power. This lamp is on whenever the transmitter is connected to the power line. The composite stereo waveform is applied to the transmitter through the Type BNC connector on the rear panel. Power is applied to the RF power amplifier by activating the switch marked RADIATE on the front panel. RF power output is continuously displayed on the front-panel meter labeled RF OUTPUT. A copy of the final test data can be found on page 20 and should be referred to for specific meter readings and system performance measurements. These measurements will serve as a guide in operation of the equipment.

An approximate curve for the POWER OUTPUT meter position is shown in Drawing 15A1055. Potentiometer R-310, located at the rear of the power amplifier chain, adjusts the level of the RF output monitor meter. Should this control be changed, it will be necessary to recalibrate the potentiometer against an RF wattmeter of known accuracy. A transmission line or antenna impedance mismatch will introduce an error into this reading.

For 100% modulation of the STL the carrier is shifted approximately ±70 kHz from its mean center frequency. A 1,000 Hz test tone at a level of 3.5 volts p-p will produce 100% modulation. Two BNC connectors are mounted adjacent to the composite input connector. These connectors provide equal but isolated multiplex inputs. For 10% subcarrier injection the voltage at the BNC input should be 0.5 volts rms. These subcarriers should be confined to the 110 kHz to 200 kHz spectrum to prevent interference to the stereo signal and out-of-band radiation. It is usually not advisable or necessary to reduce the main channel program level when a subcarrier is added to the STL.

B. Transmitter Circuit Description

The complete schematic of the PCL-303/C transmitter is shown in Drawing 91C-6242. The composite stereo input signal is first applied to the deviation control, R-145. It is then passed through a time constant correction network to the variable capacitance diodes (varicaps) CR-101 and CR-102. These diodes vary the resonant frequency of the tank circuit of the oscillator, Q-101. Q-101 oscillates at a frequency of 1/12 the final output or carrier frequency and is frequency modulated ±6 kHz by the main channel program material for 100% modulation. For discussion purposes, an operating frequency of 945.0 MHz will be assumed. Hence, the frequency of the basic oscillator Q-101 will be 945.0 ÷ 12 or 78.75 MHz. This signal is amplified by Q-102 and fed to Q-201. This 78.75 MHz signal is multiplied four times and amplified by Q-202 and Q-203 to produce a 100 milliwatt signal at 315 MHz at J-202. This power is fed to J-301 on the RF power amplifier chassis. Q-301, Q-302 and Q-303 transistors amplify the 315 MHz signal to 12 watts which is applied to the parametric multiplier CR-301. Eight watts of power are removed from the diode at 3 times 315 MHz or 945 MHz. L-313 and C-317 form the idler circuit of the parametric multiplier. The 945 MHz output of the varactor is then fed through C-323 and the 3-section, end-tuned filter cavities to J-302. The antenna coaxial cable is attached to J-302.

Automatic frequency control (AFC) of the transmitter output frequency is accomplished by phase locking the 78.75 MHz basic oscillator to a 76 kHz low-frequency, crystal-controlled, reference oscillator. The 78.75 MHz output of Q-102 is applied to the input of a high speed binary counter and divided eight times by integrated circuits IC-1, IC-2, and IC-3. This divided output, 9.844 MHz in the example, is applied to a level-changing amplifier Q-1 on the AFC printed circuit board. The output of Q-1 feeds another binary chain, IC-5 through IC-9, which divides the input frequency by 512. The total division of the basic oscillator frequency is 4.096. The low-frequency reference signal is derived from IC-4, an integrated circuit emitter-coupled crystal-controlled multivibrator. The output of this oscillator is applied to level changer Q-2 and applied to IC-10 and divided 4 times. Thus, the outputs of IC-9 and IC-10 operate at the same frequency. The phase of these two output signals is compared in IC-11 to achieve an integrated DC AFC error voltage which is amplified by Q-3. It should be noted that the entire AFC system is not frequency sensitive since all integrated circuits in the binary dividers operate in the saturated current or voltage mode. Thus, they exhibit excellent noise immunity. The AFC error voltage is then coupled through a low-pass filter network to varicap diodes CR-103 and CR-104. Thus, the frequency of the baisc oscillator is phase locked to the low-frequency, temperature-controlled, crystal reference oscillator.

It should be noted that the two capacitors used to couple the four varicap diodes to the basic oscillator tank circuit are temperature compensated to achieve optimum frequency stability of the basic oscillator.

The power supply for the transmitter has three output voltages; +28 volts DC, +15 volts DC, and +3.6 volts DC. The +28 volt DC supply powers the RF power amplifier. The +15 volt DC supply powers all other circuitry except the binary which uses the +3.6 volt output. The +28 volt, the +15 volt, and the +3.6 volt DC supplies are fully regulated by Q-401, Q-402, Q-403, Q-404, and the Zener diode references CR-407 and CR-410. R-408 adjusts the output voltage of the 28 volt supply and should never be set higher than +28 volts DC.

C. Transmitter Remote Control

The Model PCL-303/C transmitter may be operated from a remote location. A 5-pin receptacle, J-403, is mounted on the rear of the chassis. This connector enables the remote radiate switch and meters to be connected to the PCL-303/C circuitry. A 5-conductor cable should be used between the remote control point and the PCL-303/C transmitter. A plug with pins A and B shorted together is provided with each Model PCL-303/C transmitter. If remote control operation is not intended, this plug should remain inserted in J-403.

To turn the carrier on from the remote location, wires must be connected between pins C and D of J-403. A simple SPST toggle switch can be used for this purpose. Actuating this switch will operate relay K-401, applying +26 ± 2 volts DC to the RF power amplifier. To indicate the relative power output at the remote position, place a 50 μa meter in series with pins A and B of J-403. Connecting another 50 μa meter between pins J and A will provide the remote control point with an indication of the AFC error voltage.

The Model ECP-1 Extension Control Panel is available to operate the PCL-303/C from a remote location. It should be noted that a 5-conductor cable is required between the transmitter and the ECP-1 Control Panel. Thus, the use of the ECP-1 is limited to relatively short distances, usually within the same building.

D. Transmitter Adjustments and Alignments

A complete alignment of the transmitter is not recommended in the field. However, in the case of transistor replacement, a touch-up alignment can be performed. First, remove the 2 amp fuse on the power supply chassis, and adjust R-408 for +26 ± 2 volts DC at the output of the power supply. Do not set the output above +28 volts. Check the +28 volt and +15 volt DC supplies with the front panel meter. Switch the meter to the BASIC OSC. position. If the reading is over 30, switch to the REF. OSC. position. If the reading is again over 30, switch to the BINARY OUTPUT. This reading should be at 50 divisions ±10. If it reads either 10 divisions or 90 divisions, the binary is not working and service is required. If it reads 50 divisions, switch to the AFC position. This reading should be 40 to 60 divisions also. If it is not, switch to the AFC UNLOCK position. Adjust the AFC control C-104 until the meter reads zero. This can be done by adjusting C-104 until the meter reading rises and then falls to zero after some noticeable oscillation. After the meter falls to zero, switch back to the AFC position. The meter will read between 30 and 70 divisions. Continue to adjust C-104 until the meter reads 50 in the AFC position.

> NOTE: When the frequency of the basic oscillator is not "locked" to the frequency of the reference crystal oscillator, it should be noted that the reading of the meter with the selector switch in the AFC position will be approximately 50. This is the SAME reading that appears when the basic oscillator is in phase with the reference oscillator and no AFC error voltage is present. AFC control of the basic oscillator can be quickly confirmed by switching to the AFC position. If the meter follows a slight change of adjustment in C104, the AFC is locked.

In normal operation the I.P.A. DRIVE position is used as an indication of the presence of normal drive to the RF amplifier. The amplitude of the I.P.A. DRIVE position meter reading is affected by the presence of +28 volts on the RF amplifier. The meter reading will be higher when the RADIATE switch is on. No attempt should be made to adjust the tuning of the frequency multiplier stages when it is connected to the RF amplifier input.

The following procedure is used when tuning up the multiplier section. Remove the cable connected to J-202, and connect a 50Ω RF dummy load to J-202. Using an external multimeter, place it from the emitter of Q-203 to ground, and adjust L-201 and L-202 for a maximum reading on the external multimeter. Remove the external multimeter, and adjust L-203 for a maximum reading on the I.P.A. DRIVE position. Remove the RF dummy load, and reconnect the cable from J-301 to J-202. Place a dummy load or antenna on the RF output J-302. Turn the

RADIATE switch off, and replace the 2 amp fuse in the power supply chassis. Switch the meter to the FINAL CURRENT position, and turn the RADIATE switch on. The RF output meter should read approximately 50 divisions. If an RF wattmeter is used, it will read 6 to 8 watts. The FINAL CURRENT should read between 75 and 95. If the final current is correct but the power output is low, adjust C-319, C-320, C-321 for a maximum on the RF output meter. If a satisfactory maximum is achieved and the final current is correct, switch to the I.P.A. CURRENT position. It should be between 30 and 60. Switch to the MULTIPLIER BIAS. It should be between 40 and 90. C-314 through C-317 are not readily available adjustments and should not be attempted without consulting the manufacturer. Replacement of all transistors except Q-401, Q-402, Q-302, and Q-303 is straightforward. When replacing Q-401 or Q-402, be certain that the insulating washer is reinstalled between the transistor and the heat sink. If Q-203 or Q-301 are replaced, remove the finned heat sink on the old unit and install it on the replacement.

VII. DETAILED DESCRIPTION OF RECEIVER

A. Receiver Operation

After mounting the receiver, connect the power supply cord to a convenient source of 120/240 VAC, 50-60 Hz. Turn on the power switch on the front panel. Attach the antenna connection.

The potentiometer (R404, see Drawing 20A2090 for location) controlling the receiver squelch is available on the audio multiplex P.C. board. The receiver top must be removed to adjust this control. This level is preset to operate with an input signal of 50 μvolts and should not require readjustment.

The program output level control (R409) is also available on the audio multiplex board. This adjustment is factory set to deliver 6 volts peak-to-peak to the output attenuator pad, R-431 and R-432. These resistors are selected to match the deviation sensitivity of the FM exciter so that 100% modulation is achieved with the maximum signal-to-noise ratio capability of the Model PCL-303/C system.

A calibration table for SIGNAL 1 and SIGNAL 2 is included in the final test data on page 20 of this manual and shows the relationship between the meter reading and the actual input signal expressed in μvolts. For 60 db quieting in the demodulated LEFT or RIGHT channels, the received signal should be 100 μvolts or greater.

The final test data sheet also includes the multimeter readings taken on the receiver during final test. These readings will serve as a guide during the operation and servicing of the equipment.

B. Receiver Circuit Description

The receiver is a double-conversion superheterodyne type employing 19 transistors, 19 diodes, and one integrated circuit. A complete schematic of the receiver is shown in Drawing 91C-6243. The Model PCL-303/C receiver is housed in a rack-mounted, enclosed cabinet 19" wide and 5¼" high. External connections include the power cord, the RF Type N input connector located on the rear panel, type BNC connectors for the composite output signal, and two multiplex outputs. In addition, relay contacts (Form C) are also present on the rear chassis to indicate presence of a received carrier.

Quite often the STL receiver is located in a building containing high RF field energy. Under these conditions, cross-modulation products can be created in a conventional transistor amplifier stage if the input signals applied to the base circuit exceed the linear dynamic range of the device. To prevent this condition in the Model PCL-303/C receiver, the 3-stage 72 MHz I.F. amplifier employs field effect transistors (FET) with an Automatic Gain Control (AGC) circuit.

The AGC control voltage is derived from diode CR-302 in the 10.7 MHz 2nd I.F. amplifier. This voltage increases in the positive direction with an increase in the desired signal. Transistor Q-207 in the 72 MHz I.F. amplifier inverts this voltage and applies it to Gate 2 of the first and second 72 MHz FET stages (Q-204 and Q-205). A fixed bias is applied to Gate 2 of the last FET (Q-206) to assure a more constant input to the 10.7 MHz 2nd I.F. amplifier.

A table showing the readings for Signal 1 and Signal 2 meter positions is included in the final test data sheet of this instruction manual. The Signal 2 readings are shown with and without the AGC applied to the 72 MHz I.F. amplifier. Under normal conditions the meter will indicate the signal strength with AGC. To obtain a reading without AGC, it is necessary to remove Q-207 from its socket.

The input of the STL receiver is designed for an impedance of 50Ω. The antenna input connector is coupled to the first of five end-loaded resonate line cavities. The last cavity is coupled to the first crystal mixer CR-101, where it is mixed with the local oscillator injection signal. The local oscillator signal is derived from the first crystal oscillator Q-201 and multipliers Q-202, Q-203, and CR-102. The output of the crystal mixer is 72 MHz and is coupled into the signal gate of Q-204 which is the first 72 MHz I.F. stage. It is amplified by Q-205 and Q-206 and is applied to the base of the second mixer Q-302. The injection voltage for the second mixer is generated by Q-301, a crystal-controlled oscillator at 61.3 MHz. The output of this mixer is then amplified by the 10.7 MHz second I.F. amplifier, Q-303, Q-304, Q-305, and Q-306. This amplifier has a response designed to obtain maximum phase linearity over the entire stereophonic spectrum. Preservation of phase integrity is paramount to proper stereo performance. Q-306 acts as a limiter and drives a conventional ratio detector. The output of this detector is applied to a program amplifier which determines the composite output level of the receiver.

The entire baseband signal is amplified by IC-401. The composite signal is passed through a low-pass filter and amplified by Q-404, Q-405, and Q-406. The output of this amplifier is capable of delivering a 6 volt peak-to-peak composite stereo signal to a 1,000Ω load. Resistors R-431 and R-432 are selected to reduce the amplitude of the composite signal in accordance with the input requirements of the direct FM exciter being used. It is important that the AUDIO gain control R-409, be set to develop the correct voltage at the output of Q-405 and Q-406 so that the system will yield the greatest signal-to-noise ratio. Thus, resistors R-431 and R-432 should be selected to apply the proper input signal to the FM exciter. The output of

IC-401 is also applied through a 100 kHz high-pass filter and amplified by transistor Q-403 to drive the two low-impedance multiplex outputs appearing on the rear of the receiver chassis. The audio and multiplex outputs are squelched if there is no incoming carrier or if the receiver primary power is removed. Additional contacts (Form C) from K-401 are available on the rear of the panel of the receiver.

> CAUTION: To avoid hum components from appearing on the output of the receiver, it is recommended that the external squelch contacts be used in a DC control circuit.

C. Receiver Adjustments and Alignments

Under normal operating conditions all necessary tuning adjustments can be made with the aid of the selectable meter provided on the front panel and with the unit in operation. It will be necessary, however, to remove the top and bottom covers to gain access to the various circuit elements.

Two definite points of resonance or peaks of equal amplitude may be observed when aligning the coils of this receiver. However, single tuned coils adjusted from the top of the chassis should be aligned on the peak observed when the slug is nearest to the top of the coil (with the screw protruding the most).

To align the first oscillator and subsequent multiplier stages the following procedure is used. Oscillations are indicated by a reading of the meter on the 1st OSC. position. (Refer to the typical readings given elsewhere in this manual.) With the meter selector switch set to the MIXER DRIVE position, adjust L-202, L-203, and L-204 for a maximum reading. The remaining adjustments should be made with a weak signal in order to avoid saturation of the limiters. This can be accomplished by rotating the azimuth of the receiving antenna in cases where the STL transmitter signal is being used or by reducing the output level of the RF signal generator providing the test signal. Under conditions of weak signal, the SIGNAL 1 position will provide adequate indications of proper tuning. The injection cavity control C-107 should then be adjusted for maximum reading. This will complete the alignment of the 1st oscillator multiplier chain.

The input cavities can be adjusted for maximum SIGNAL 2 (with AGC defeated) reading by tuning C-101, C-102, C-103, C-104 and C-105 on the top of the cavity for maximum reading. C-101, C-102, C-103, C-104, and C-105 should be about one turn from the CCW end. Go back over this step several times to assure optimum adjustment. Next, adjust L-208, L-205, L-206, L-207, L-303, and L-302 for resonance as indicated by a maximum reading on the panel meter in the SIGNAL 2 position. When making these adjustments remove transistor Q-207 on the 72 MHz I.F. amplifier chassis. This will defeat the AGC action so that more accurate tuning can be obtained.

Since the performance of the Model PCL-303/C Receiver depends primarily on the tuning of the 10.7 MHz I.F. and ratio detector transformer, it is not recommended as a field adjustment unless an I.F. sweep generator and an exact source of 10.7 MHz are available. Considerable effort has been expended in the design of the 10.7 MHz I.F. to achieve a phase linear transfer characteristic and to eliminate the need for tuning. Replacement of Q-302, Q-303, Q-304, Q-305, and Q-306 does not require the retuning of the 10.7 I.F. Retuning should only be attempted with the use of a sweep generator. The 3 db bandwidth of the second I.F. amplifier is 400 kHz. The SQUELCH adjustment should be set to a position where 50 μv of RF at the input will cause the relay to unsquelch the output. It will be noted that three other contacts are provided on the back of the receiver. These are also controlled by the squelch relay and may be used for fail-safe or alarm operation if the STL carrier is lost.

VIII. SHIPPING INSTRUCTIONS

If it should be necessary to ship the PCL-303/C to another destination, the following procedures should be followed:

1). Remove both transmitter and receiver top covers.

2). Secure the base plate supporting the blower with a 6-32 x 3/8" machine screw.

3). Secure the BASIC OSC AFC shock-mounted chassis. This can best be done by wedging cardboard between the chassis and the top cover.

4). Check to see that the relays in the receiver and transmitter are firmly in their sockets and that the retaining clamp is in place.

5). Replace both top covers.

6). Place equipment in shipping cartons. Use adequate spacers at all edges to prevent puncture damage if carton is dropped in transit. If possible, use an inner carton with additional packing material and a substantial outer carton.

IT IS RECOMMENDED THAT THE ORIGINAL SHIPPING CARTONS AND SPACERS BE STORED IN CASE THE UNIT MUST BE RE-PACKED FOR SHIPMENT.

MOSELEY ASSOCIATES, INC.

IX. FINAL TEST DATA

Date March 5, 1973
F.O.# 10-2181
Technician WWS

MODEL PCL-303/C

Customer KABL
Serial # RX-8237/TX-8233
Frequency 948.500 MHz

METER READINGS

TRANSMITTER

Function	Reading
+28 Volts	55
+15 Volts	69
Basic Oscillator	22
Reference Oscillator	60
Binary Output	54
AFC	50
AFC Unlocked	0
I.P.A. Drive	57
I.P.A. Current	42
Final Current	77
Multiplier Bias	62
Power Out (See Drawing 15A1055)	9.0 watts

RECEIVER

Function	Reading
+10 Volts	46
-10 Volts	47
1st Oscillator	54
Mixer Drive	48
2nd Oscillator	34
Limiter	4
Signal 1	4
Signal 2	4
Discriminator (+)	12
Discriminator (-)	Neg.

PCL-303/C SYSTEM PERFORMANCE

Freq. (Hz)	Response	Distortion (%)
35	+0.1 dB	0.25
50	+0.1 dB	0.20
400	+0.1 dB	0.20
1,000	0 ref.	0.15
5,000	-0.1 dB	0.15
10,000	-0.1 dB	0.15
15,000	-0.1 dB	0.15

Mux Tx sens. 0.28 V rms (20% injection 110 kHz)
Mux Rx Out 0.50 V rms 110 kHz
Tx Deviation set for 3.5V P-P=100% mod. X
Rx Audio Gain set for 3.5V P-P=100% mod. X
SNR = 62 dB wide band
Squelch Control set 50 µvolts. X
NOTE: Distortion checks made at 100% modulation.
Wide-band quieting 50 µvolts for 45 dB SNR

COMPOSITE OUTPUT RESPONSE

0 dB (ref.) = 50 kHz
-2 dB = 81 kHz
-53 dB = 110 kHz
-49 dB = 185 kHz

Receiver input signal required for 60 dB de-emphasized SNR.

L + R mono (50-15kHz): 35 µvolts
R (or L) stereo : 95 µvolts

Ultimate SNR with saturating signal.

L + R mono (50-15kHz): 69 dB SNR
R (or L) stereo : 65 dB SNR

RECEIVER SIGNAL STRENGTH CALIBRATION*			
µV input	Sig. 1	Sig. 2	Sig. 2 (No AGC)
50	14	6	6
100	20	13	14
300	22	37	49
500	22	40	67
700	22	40	72
1,000	22	40	78
1,500	22	40	82

*Measured with 50Ω R.F. signal generator

Stereo Performance with SCG-3T

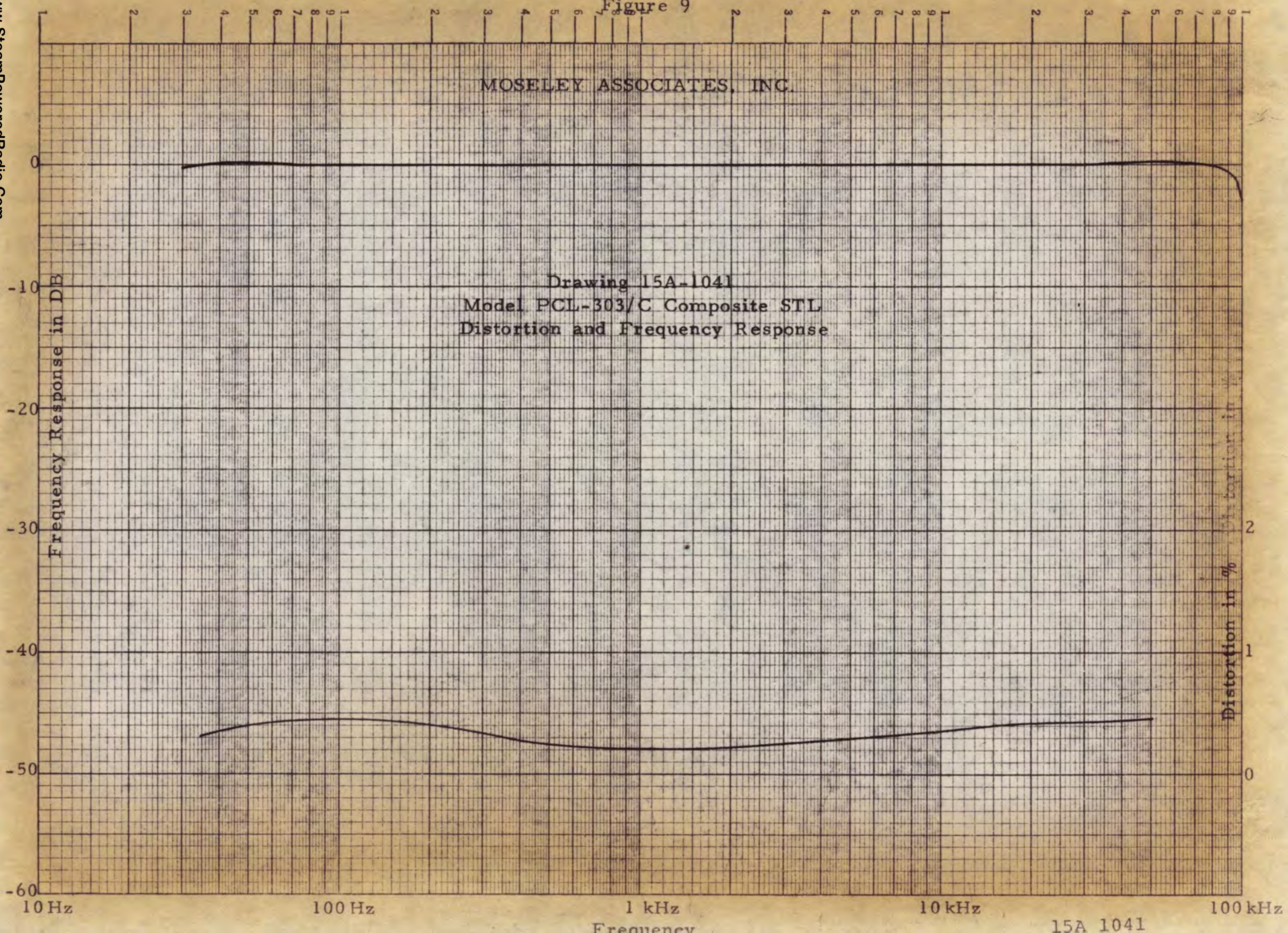
Pilot level 9.0 %

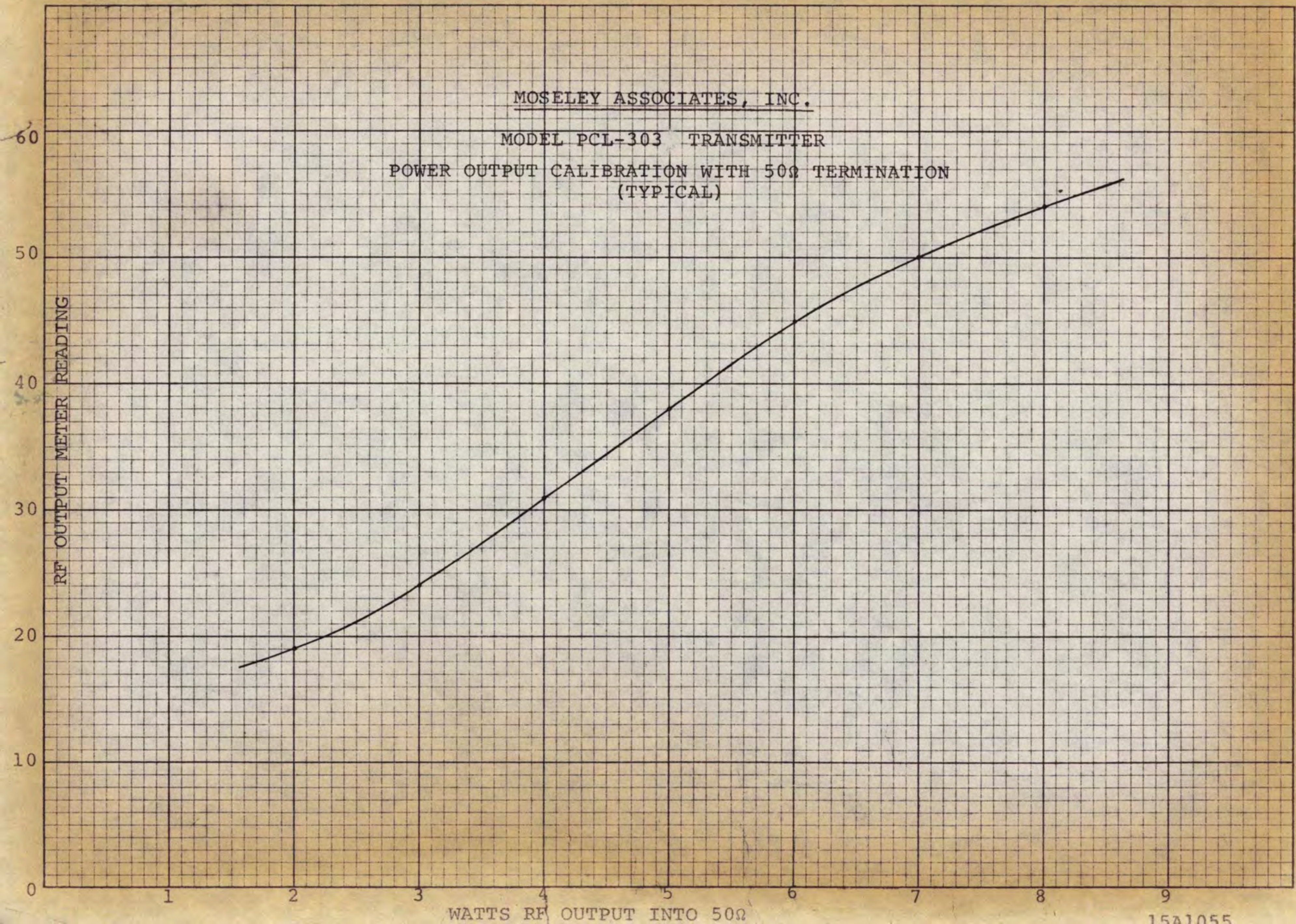
Freq.	Separation	Cross Talk
50	41	50
400	48	51
1,000	49	51
5,000	41	51
10,000	42	48
15,000	37	46

NOTE: The above readings were observed during final checkout of the equipment and are intended for reference purposes only. Readings may vary with transistor replacement, transistor aging, tuning, RF terminations, and equipment installation.

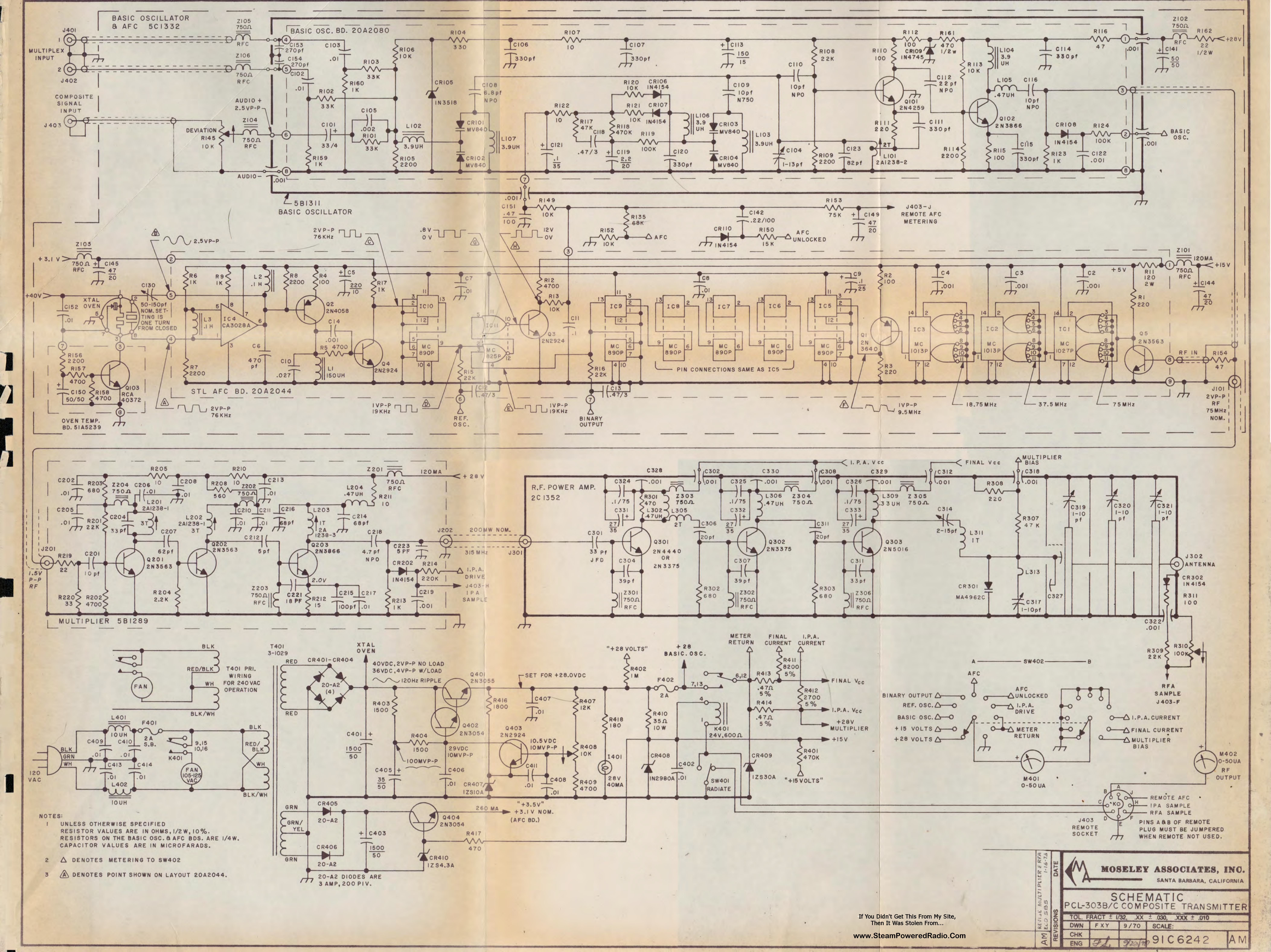
ml
12/71

Figure 9


MOSELEY ASSOCIATES, INC.
Drawing 15A-1041
Model PCL-303/C Composite STL
Distortion and Frequency Response
Frequency Response in DB
Distortion in %
0
-10
-20
-30
-40
-50
-60
2
1
0
10 Hz
100 Hz
1 kHz
10 kHz
100 kHz
Frequency
15A 1041


MOSELEY ASSOCIATES, INC.
MODEL PCL-303 TRANSMITTER
POWER OUTPUT CALIBRATION WITH 50Ω TERMINATION
(TYPICAL)
RF OUTPUT METER READING
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
WATTS RF OUTPUT INTO 50Ω

15A1055



NOTES:

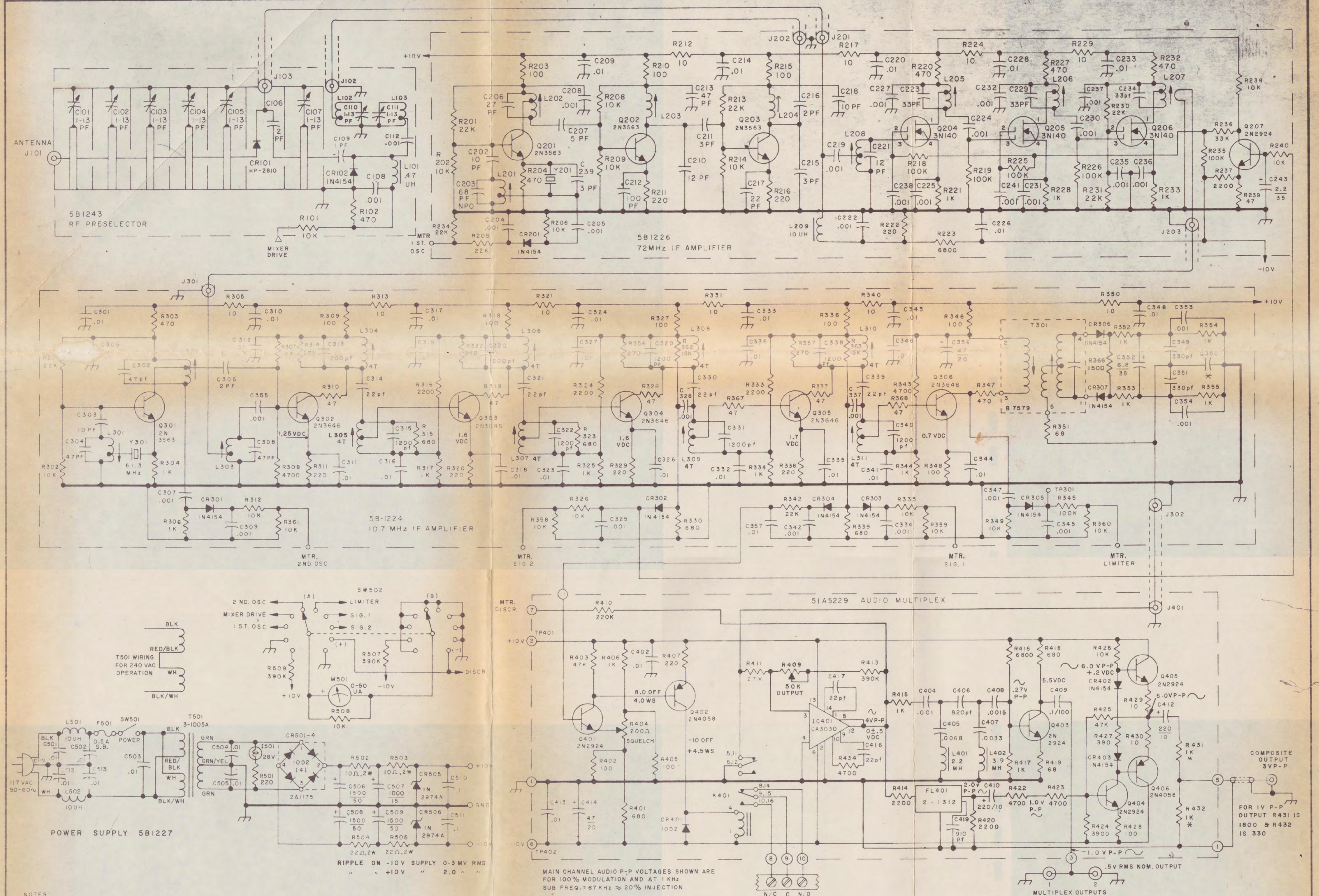
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10%. RESISTORS ON THE BASIC OSC. & AFC BDS. ARE 1/4W. CAPACITOR VALUES ARE IN MICROFARADS.
2. △ DENOTES METERING TO SW402
3. Ⓐ DENOTES POINT SHOWN ON LAYOUT 20A2044.

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC
PCL-303B/C COMPOSITE TRANSMITTER

TOL FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	FXY	9/70	SCALE:
CHK			
ENG			91C6242 AM

REVISIONS: AM — REVISE MULTIPLIER & RFA, ECO 5B15



NOTES:

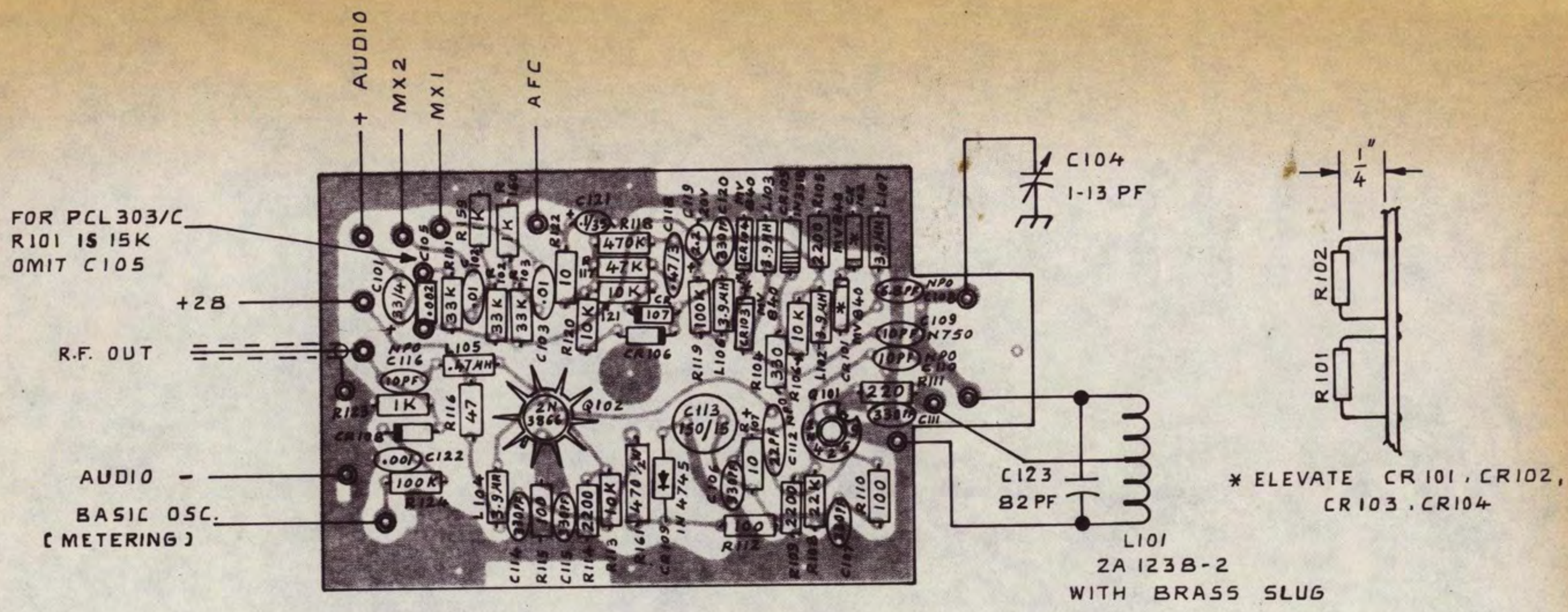
1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
   RESISTORS IN THE I F AMP SECTIONS ARE 1/4 W
   CAPACITOR VALUES ARE IN MICROFARADS
2. * DENOTES SELECTED VALUE

REVISIONS		DATE
AI	REVISED ECO 548	9/72
AH	Q301 WAS 2N3662. ECO 546	7/12/72
AG	Q201-3 WERE 2N3662 REF. ECO'S 166 & 288	7/5/72
AF	GND OUTPUT BNC, ECO 533	5/1/72
AE	T301 REVISED ECO 514	4/25/72
AD	ADD C512 & C513. ECO 511.	1/31/72
AC	C109 WAS 1 PF. Q302-6 WERE 2N 4259. ADD R367 & 8. R411 WAS 15K. ECO 459	7/26/71
AB	R314, 22, 56 & 57 WERE 680 MOVE R362 & 63. OMIT R364 ECO 429	3/25/71
AA	REVERSE N/O & N/C PER ECO 403.	11-70
Z	[illegible]	
Y	[illegible]	

MOSELEY ASSOCIATES, INC.
SANTA BARBARA CALIFORNIA

SCHEMATIC
RECEIVER PCL 303 B/C

TOL FRACT ± 1/32	XX ± .030	XXX ± .010	
DWN	F X Y	2/70	SCALE NONE
CHK			91C6243
ENG			AI



NOTES:

1 P.C. BOARD 51A5114.
2 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/4W, 10%.
CAPACITOR VALUES ARE IN MICROFARADS.
3 [diode symbol] DENOTES IN 4154 DIODE.
4 SCHEMATICS
PCL 303 91C6254
PCL 202 91C6236
PCL 303/C 91C6242
5 NEXT ASSEMBLY 21C2114.

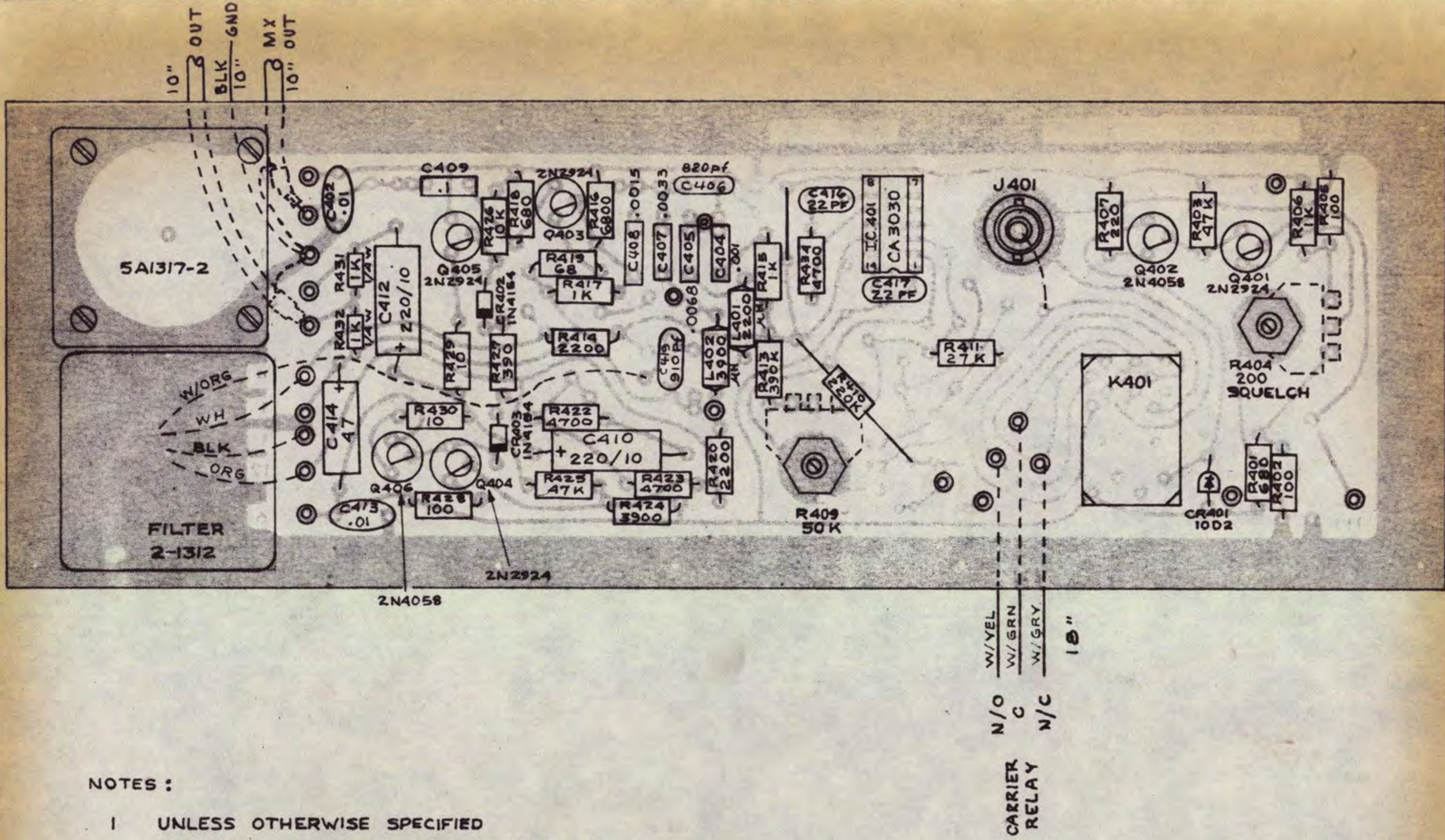
REVISIONS	DATE	MGMT. APPR.
L REDRAWN, ART WORK REV. E	9/72	

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

COMPONENT LAYOUT
BASIC OSC. BD. PCL 303,202 XMTR

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ± 1/2°

DWN	R.F.	9/27/72	SCALE: FULL
CHK	FXY	10/4/72	20 A 2080 L
ENG	SLM	4 Oct 72	



NOTES:

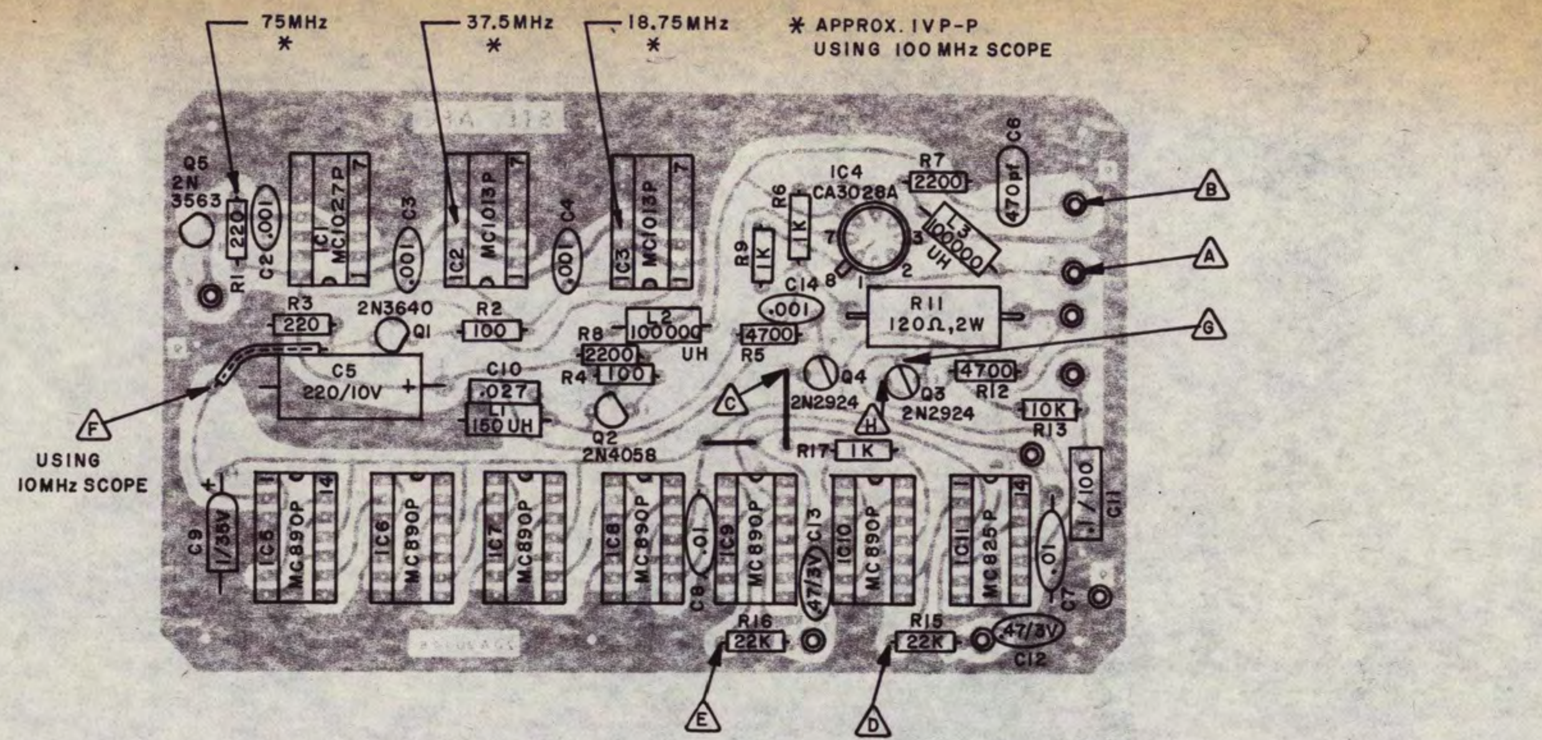
1 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%
CAPACITOR " " " MICROFARADS
2 TRIM & DRILL 51A5229
3 SCHEMATIC 91C6243
4 ✱ DENOTES SELECTED VALUE

REVISIONS		DATE
Z	FILTER ORG & WH WIRES WERE REVERSED.	1/26/73
M	R411 WAS 15K. ADD C419 VALUE. ECO 459	7/26/71
L	REVERSE N/C & N/O. ECO 403.	11-70
K	VALUE CHANGES, MOVE R410 OMIT R412 & C418. ECO 560	7-70
J	VALUE CHANGES OF C405, C406, C408, L402 PER ECO 337.	3-70
I	CORRECT WIRE COLORS.	3-70
H	OMIT VALUE OF C419.	1-70
G	OMIT C401, C415 & R433, R420 WAS 6800. ECO 290	10/69
F	ADD WIRING OUT	10/69
E	REDRAWN. NEW ARTWK. CIRCUIT MODIFIED.	9-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT
AUDIO BOARD PCL-303/C RCVR

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	JAG	9-69	SCALE: FULL
CHK	F X Y.	9/69	20A2090
ENG	[illegible]	9-69	N



NOTES

1 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/4W, 10%.
CAPACITOR VALUES ARE IN MICROFARADS.

2 △ INDICATES WAVEFORMS SHOWN ON TRANSMITTER SCHEMATIC.

3 P.C. BOARD DWG. 51A5103.

REVISIONS		DATE
D	IC1 WAS MC1013P. ECO 408.	12-70
O	REDRAWN FOR REVISED ARTWORK	2/70

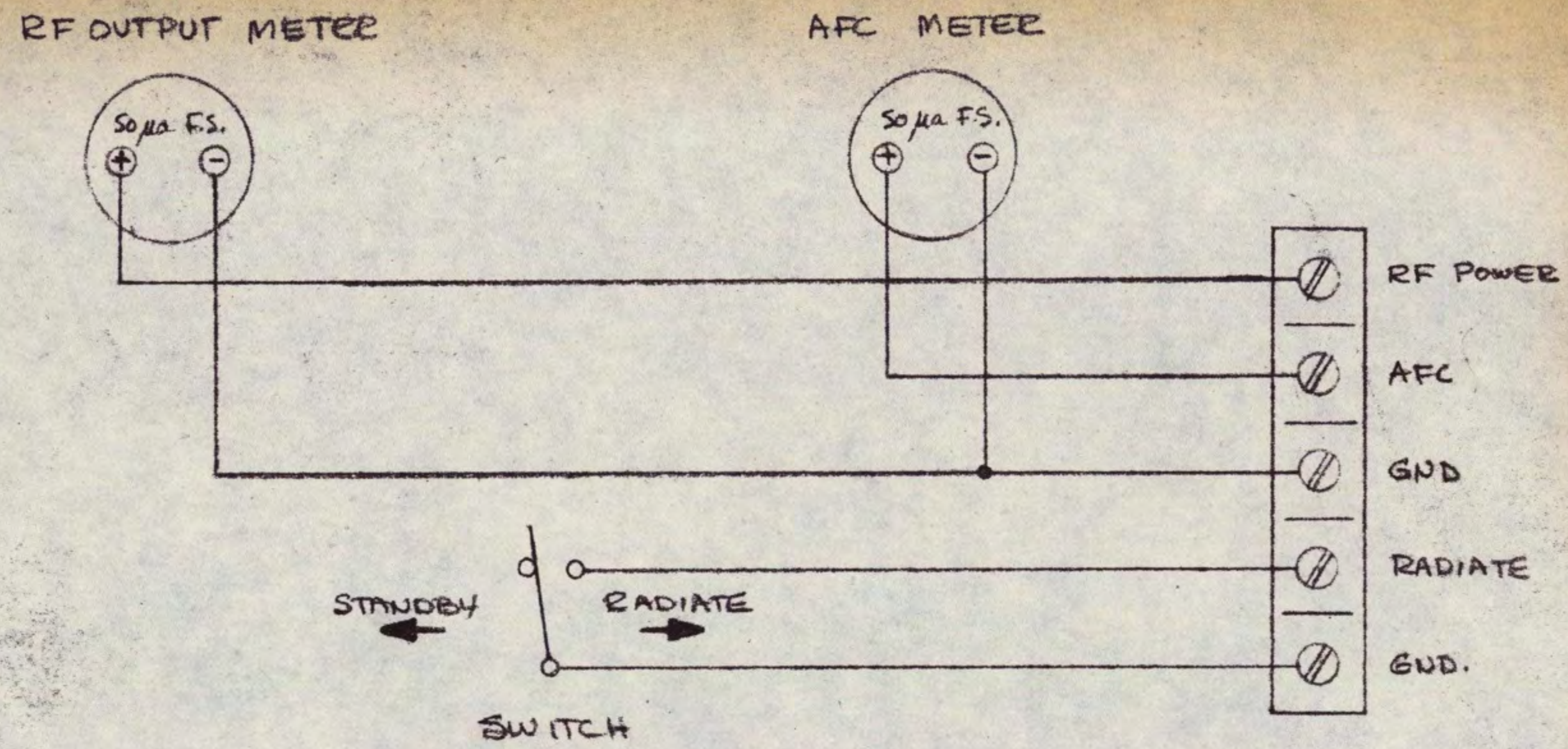
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT
STL AFC BD. PCL-303 & 202 XMTR

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010		
DWN	F X Y	2/70
CHK		
ENG		2/70

SCALE: FULL

20A2044 D



NOTE
EXTENSION CONTROL PANEL
USED ON STL UNITS -
- PCL - 303
- PCL - 303/C
- PCL - 202

DATE	MOSELEY ASSOCIATES, INC. SANTA BARBARA, CALIFORNIA		
	WIRING DIAGRAM. MODEL ECP-1		
REVISIONS	TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010		
	DWN	SCALE: NONE	
	CHK	91 A 6364	
	ENG		

PBR-30A

INSTRUCTION MANUAL

MODEL PBR-30A
REMOTE CONTROL SYSTEM

MOSELEY ASSOCIATES, INC.
Santa Barbara Research Park
111 Castilian Drive
Goleta, California 93017

Revised
December, 1972

TABLE OF CONTENTS

INSTRUCTION MANUAL

MODEL PBR-30A

REMOTE CONTROL SYSTEM

I. INTRODUCTION

The Model PBR-30A Remote Control System was designed specifically to remotely control television, FM, and standard broadcast transmitters. A total of 30 metering channels and 30 Raise/On and 30 Lower/Off control functions are provided by the system which requires only a single full-duplex telephone connection or similar full-time, two-way, communications-grade radio link. Control signals are sent to the transmitter in the form of audio tones. One of these is used to control the position of the stepping switch, and two are used to activate the Raise/On and Lower/Off circuitry. The stepping switch distributes the Raise and Lower outputs to a set of terminals on the rear of the Transmitter Unit and simultaneously selects a metering sample. The metering signals are returned from the transmitter to the studio in either the audible or subaudible spectrum.

Access to internal components is excellent. The mechanical design concept enables component testing, adjustment, and replacement to be accomplished with ease. The full-width, swing-away door on the Studio Unit provides full access from the front. The Transmitter Unit has both front and rear swing-down doors. All circuit modules are plug-in, and all transistors are socketed. All large capacitors except the computer-grade power supply filters are tantalum. The system functions well under wide temperature variations and other environmental extremes.

The PBR-30A is available in two basic versions: the PBR-30AW intended for wire-line service, and the PBR-30AR intended for radio (wireless) service. The PBR-30AR consists basically of the PBR-30AW with added plug-in subcarrier boards for simple interfacing with STL and radio receiving equipment. The PBR-30A is factory wired for either of the two basic operating modes.

II. SPECIFICATIONS

Number of Metering Channels	30
Number of Control Channels	30 Raise/On and 30 Lower/Off
Metering System Input	Approximately 1 VDC for full-scale studio meter deflection. Nominal 20K resistive floating input insulated for 350 VDC.
Calibration Controls	Multiturn potentiometers
Calibration Voltage Source	Internal Zener diode
Metering Stability	With weekly checks, better than 1%
Studio-to-transmitter Interconnection Requirements PBR-30AW	Ordinary telephone circuit, full-time two-way or any other voice-grade communications link.
PBR-30AR	Plug-in or external control subcarrier generators and detectors for STL (radio) service, typical 26 kHz and 110 kHz
Telephone Circuit Impedance	600 Ω
Telephone Circuit Levels	0 dBm (1 milliwatt) maximum
Allowable Circuit Loss	20 dB
Radio Link Impedances	2 kΩ nominal
Radio Link Levels	0.5 volt rms
Subcarrier Frequencies (PBR-30AR)	26 kHz or 110 kHz nominal
Semiconductor Devices	All silicon diodes, integrated circuits and JEDEC-registered transistors
Duty Cycle	Continuous
System Temperature Range	-10°F to 140°F
Power Requirements	20 watts average, 40 watts peak at transmitter; 20 watts at studio
19" Vertical Rack Space	8-3/4" - Transmitter Unit 10-1/2" - Studio Unit
Domestic Shipping Weight	60 lbs.
Available Metering Options	Audible (amplitude modulated 1280 Hz) or subaudible (20-30 Hz) metering return; Plug-in SCA subcarrier generators for FM and TV transmitters.

III. GENERAL DESCRIPTION (WIRE SYSTEM - PBR-30AW)

A. Control

The PBR-30A first will be discussed interconnected as a wire system (PBR-30AW). In this mode of operation the unit is designated as the PBR-30AW, and any two-way communications-grade telephone circuit can be used to interconnect the two units.

Considering the control portion first, a 920 Hz audio tone is sent from the Studio Unit (SU) to the Transmitter Unit (TU) at all times. This tone is keyed off briefly to advance the stepping switch. The number of positions the stepping switch advances is equal to the number of these brief interruptions. If the tone is keyed off for a half-second or longer, the stepping switch will seek its home or Calibrate position. The aforementioned interruptions are generated by the integrated circuitry located in the Studio Unit (SU) and are controlled by the buttons located on the front panel of the unit. The short interruptions are generated by a 10 Hz oscillator while the longer half-second interruptions are generated by a reset circuit. Of interest at this point is that failure of this 920 Hz tone to be generated at the studio or to be received at the transmitter site will cause a fail-safe relay in the Transmitter Unit (TU) to become de-energized. The contacts of this relay can be used to remove the transmitter from the air in accordance with FCC regulations.

The stepping switch selects which voltage sample in the transmitter is to be returned to the studio for metering purposes. It also selects which terminals on the rear of the PBR-30A TU are to be energized for control purposes. Each position of the stepper switch selects a metering sample, a Raise output, and a Lower output. These Raise and Lower outputs are not actually energized until either the Raise or Lower relay in the Transmitter Unit is energized. These relays are energized one at a time when either the RAISE or LOWER button at the studio is depressed. Depressing one of these buttons adds a second tone (670 Hz for Lower, 790 Hz for Raise) to the 920 Hz tone already going to the transmitter. Each button controls one oscillator, and since only one button at a time may be depressed, only one tone at a time may be added on to the normally present control tone going to the transmitter. No more than two tones are sent to the transmitter site at the same time. It should be noted that Raise and Lower signals may not be sent when the stepper switch is being advanced. The control tone actuating the stepper switch and fail-safe relay is keyed electronically, and the Raise and Lower tones are keyed manually.

B. Metering

It was mentioned that one pair of decks on the stepper switch selects a metering sample to be applied to the electronics in the PBR-30A Transmitter Unit (TU). This metering sample, normally in the 1 VDC range, is applied through gold-plated contacts on the stepper switch to a DC amplifier and then to a voltage-controlled oscillator. With no signal applied, this oscillator operates at a frequency of approximately 80 Hz. As the sample voltage increases to 1 volt, the oscillator frequency is shifted upward to 120 Hz. It is then counted down in an integrated circuit to a range of 20 Hz to 30 Hz. The reason for this counting process is twofold; one is to enable the use of reasonably-sized, high stability components in the oscillator, and the second is to eliminate any second-harmonic component in the metering signal. This is of importance in some methods of telemetry. In the wire system, however, the 20 Hz to 30 Hz signal is merely used to modulate a 1280 Hz carrier which is then sent back to the studio. Here it is detected and converted back to the original 20 Hz to 30 Hz tone. Application to a pulse-counting demodulator enables recovery of a current proportional to the original 0 to 1 volt sample. The frequency of the metering oscillator was proportional to the sample voltage; now the meter deflection is proportional to the oscillator frequency. The overall telemetry system is remarkably linear.

C. Radio and Other Options - PBR-30AR

The preceeding discussion concerned the operation of the PBR-30A when the two units are interconnected with an ordinary telephone line. Should radio remote control be used, certain options are available which allow the user to easily bypass the facilities of the telephone company. The first such option to be considered is the use of a subcarrier on a Studio-Transmitter Link (STL) to convey the control tones from the studio site to the transmitter site. This, in itself, offers some relief from wire line unreliability. The subcarrier may be external, or preferably it should consist of a set of plug-in modules available as part of a radio remote control package available from Moseley Associates, Inc. In either case, the subcarrier generator is frequency modulated by the summed control tones and delivers a subcarrier signal to the microwave Studio-Transmitter Link. The STL then conveys the subcarrier, containing control information, to the transmitter site. The subcarrier demodulator in the PBR-30AR TU consists of two boards; one a bandpass filter to extract the control subcarrier from the output of the STL receiver, and a second containing the actual subcarrier demodulator. The output of this demodulator is a replica of the control signal(s) sent from the Studio Unit.

Metering is returned, in the case of the radio systems, via a subcarrier on the FM broadcast or television transmitter. In the case of standard broadcast transmitters, the metering tones are shifted to 20 Hz to 30 Hz and are applied to the transmitter with the Moseley Associates, Inc., Model MIU-1 Metering Insertion Unit. In all of these applications, the metering signal is sinusoidalized (filtered) and used intact. In the case of FM and TV transmitters, the signal is used to modulate an SCA subcarrier. In the case of AM, the signal is used to modulate the main carrier directly at a level of 5% to 6%. In FM and TV, either an internal or an external subcarrier generator may be used. The internal subcarrier generator does not have facilities for the addition of programming, nor does it have facilities for muting. The metering signal is received at the studio with an appropriate receiver, and the subaudible telemetry signal is extracted and directly demodulated to operate the studio metering system.

IV. PRE-INSTALLATION CHECKOUT

Upon removing the units from the shipping cartons, they should be visually inspected for damage incurred during transit. One Studio Unit and one Transmitter Unit, each with an extension printed circuit board, and two instruction manuals are shipped with each system as standard items. The units should be checked out using the telephone line terminals if they are intended for wire line service, or they should be interconnected with short jumper coaxial cables with Type BNC connectors if the control system is for radio link service. With power applied to each unit, all operations should be confirmed. Operating the RECYCLE button on the Studio Unit should cause the stepper to cycle itself first to home and then on to whatever channel has been selected by the push-button assembly. Pressing the CALIBRATE bar will also cause the stepper to proceed directly to the home position. Pressing a given numbered button will cause the stepper to advance to that position. Pressing the RAISE or LOWER buttons on the Studio Unit will cause the corresponding relays in the Transmitter Unit to operate. Turning off the power on the Studio Unit or otherwise disabling the system should cause the transmitter fail-safe relay to de-energize after about 20 seconds.

When the stepping switch is at the home or Calibrate position, its gold-plated metering decks will select an internally regulated reference calibrating voltage. This is normally used to cause half-scale deflection on the first (left-hand) meter. Observe the two-point calibrating procedure. Pressing the LOWER button will remove the calibrating voltage, causing the meter to go to zero deflection. Adjust the ZERO control until the meter reads zero. Release the LOWER button. Adjust the CALIBRATE control until the meter reads midscale. Since these two controls tend to interact to some extent, this procedure may have to be repeated. Normally, the CALIBRATE control will need only occasional adjustment, perhaps weekly, and the only daily adjustment which may be required will be the ZERO adjustment.

Shorting to ground any of the ALARM terminals on the rear of the Transmitter Unit should cause the metering signal to be momentarily keyed off, and this in turn will cause the ALARM lamp on the Studio Unit to come on. Pressing the ALARM RESET button on the Studio Unit should then extinguish this lamp. It should be noted that the ALARM lamp may turn on when the power is first applied to the unit.

Pressing the LOCAL button on the Transmitter Unit will remove all control from the Studio Unit. All control can then be accomplished at the transmitter. Pressing the STEPPER button briefly will now advance the stepper one step. Doing this repeatedly will advance the stepper as many steps as the button is depressed. Holding the STEPPER button down for about half a second will cause the stepper to home.

It is advisable at this time to have all personnel concerned with the operation of this equipment become familiar with the units while they are operating in this manner.

V. INSTALLATION

The only connections required at the studio end of the system are connections to the power source and either the telephone line or the STL (radio) equipment. The Transmitter Unit requires these same connections plus connections to the control and metering circuits. Notice that the control power outputs are active only when the proper (RAISE or LOWER) relays are energized. The actual output will be a contact closure between the appropriate (RAISE or LOWER) terminals on the rear of the Transmitter Unit corresponding to the position of the stepper switch. See drawing 91A-6362.

To prolong the life of the stepper switch, the current passing through these contacts should be kept as low as possible. Use external repeating relays if the load will exceed 50 watts or 1 ampere, or if it is significantly inductive.

The metering input samples should supply 1 VDC or more. Either side of this sample may be grounded, or neither, should that be desired. The metering input system on the PBR-30A is floating. The telemetry or remote metering samples can be derived from most older transmitters with little trouble, and most modern transmitters have the sampling points built in. With the addition of the proper Moseley Associates, Inc. metering kits, older transmitters can be easily monitored. A typical voltage to be measured via the metering circuit in the PBR-30A System might be power amplifier plate voltage. The usual method of sampling this voltage is to step it down (with a resistive voltage divider) from its normal value in the kilovolt range to a more convenient value of 3 VDC to 5 VDC and then connect it to an appropriate metering terminal of the PBR-30A Transmitter Unit. The point to remember is that the voltage or current to be measured must first be converted to a voltage of 3 VDC to 5 VDC. This signal is then fed into the metering input terminal selected on the rear of the Transmitter Unit of the PBR-30A. In effect, the studio meters of the PBR-30A are connected to the transmitter through a metering system which can operationally be disregarded at this time. Merely select from the studio the signal to be monitored, and the studio meter will give a replica of the transmitter reading.

At the Transmitter Unit, 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 transmitter will go off the air in the event that the control system fails. When two or more transmitters are controlled by the PBR-30A, external fail-safe repeating relays should be used.

VI. DETAILED CIRCUIT DESCRIPTION

A. Control Circuitry

In the following discussion, occasional reference to the appropriate main frame schematic will be helpful in understanding the PBR-30A operation.

The basic control circuit of the PBR-30A involves the continuous transmission from the studio to the transmitter of a 920 Hz audible tone. The oscillator which generates this tone is located on Board 7 in the Studio Unit, as shown in schematic drawing 91B-6307.

The oscillator utilizes transistor Q-703 in a bridged-T RLC configuration. Components are selected for stable operation at the chosen frequency of 920 Hz, with a secondary winding on the inductor to provide an output for subsequent summing with other tones on another board.

If the base of transistor Q-703 is held at ground potential, the circuit will not oscillate. Note the keying input at Pin 19 of this board (Board 7). This point is normally positive, causing Q-701 to conduct. This places the base of Q-702 near ground, and it does not conduct, thereby allowing oscillation. Should the keying input drop to near ground, Q-701 will not conduct, Q-702 will conduct, and oscillation will stop. This is the method of keying the oscillator. The keying signal enters Board 7 from Board 4.

For maintenance purposes, notice that orange TP-701 and yellow TP-702 are both normally positive. Under this condition the control circuit is oscillating, and green TP-703 shows the oscillator output as delivered to Pin 5 and ultimately to the summing amplifier on Board 9.

The output of the control oscillator appears at Board 7, Pin 5. It is routed by printed circuitry to the input of the summing amplifier, Board 9, Pin 20. (See schematic 91B-6309.) Here it is summed, along with other tones which will be discussed later, for subsequent application to either a telephone line or a subcarrier generator. For the moment a wire-line system (telephone interconnection) will be assumed. The summing or output amplifier uses Q-901 as a voltage amplifier and Q-902 as a power amplifier. The output appears at Pin 14. White TP-901 will confirm satisfactory operation of the summing amplifier. The output of this board is delivered to the telephone line matching transformer and then is connected to the line terminals.

At the transmitter site, the signal from the telephone line is delivered to a 1 kHz low-pass filter and then to an input limiting amplifier, Board 17 (schematic 91B-6317). The circuitry around Q-1701 forms a limiter enabling the incoming control tone to be extracted in the following circuitry in the presence of impulse noise. The input to this limiter is available for oscilloscopic observation at the orange TP-1701, and the output of the limiter is observable at yellow TP-1702. The output of the limiter appears at Board 17, Pin 13.

The remaining circuitry on this board will be discussed later in the manual.

B. Stepper Logic and Drive

Reference is made in the following material to schematics 91B-6320, 91B-6321, and 92A-1024. The limiter output from Board 17 is fed to the Stepper Control A, Board 20, Pin 13.

The amplitude-limited control tone is applied to a 920 Hz tone detector using a circuit similar to that used to generate the tone. This circuit uses Q-2001 in a regenerative configuration, with R-2004 as a regeneration control and C-2001 as a tuning control. Q-2002 provides buffering and power amplification to drive the voltage-doubling rectifier with diodes CR-2001 and CR-2002. The signal is smoothed and applied to a Schmitt level detector using Q-2003 and Q-2004.

Now refer to drawing 92A-1024 which shows this area of the PBR-30A. The tone detector under discussion is shown at the left of the schematic, and all circuitry mentioned is shown in the "920 Hz Tone Detector" block. The output signal from this block is positive (about 3 VDC) when the tone is present, and zero when the tone is absent (during pulsing, homing, or system failure). It is fed to the Schmitt level detector, using Q-2003 and Q-2004. These transistors and associated components deliver a strong positive signal (about 12 VDC) when the tone is above a certain level and a low-level signal (about 1 VDC) when the tone is below the critical level. There is no middle ground; this is a so-called trigger circuit. Its output leaves Board 20 at Pin 10 and is passed on to a pulse-width detector using transistors Q-2005 and Q-2006. This circuit has a positive output (at Board 20, Pin 4) only when a "pulse" (missing tone or keyed-off tone) is present for 0.3 second or more. The output of this pulse-width detector is processed with transistors Q-2101 and Q-2102 on Board 21. The output of Q-2102 is near ground under normal conditions (920 Hz tone present) and about 12 volts positive when the pulse has been determined to be in excess of 0.3 second in width (home or fail-safe).

The output of the first Schmitt trigger, Q-2004, normally is positive but drops to ground when a stepping signal occurs. The output of the second Schmitt trigger, Q-2102, normally is at ground. When both of these signals are at ground and when neither Q-2004 nor Q-2102 delivers a positive signal, then the "NOR" gate using Q-2103 and Q-2104 delivers a positive signal output. This is passed on to CR-2102 and on to the power amplifier, using Q-2106 and Q-2107. The stepper is then actuated. This is the signal flow when the stepping switch is to be stepped one or more discrete steps at a time.

Consider now the action of the circuit when a reset or home signal (keying off of the 920 Hz tone for 0.5 second) is detected. The output of the Schmitt trigger Q-2004 drops to zero immediately, as if a "step" signal were being detected. Since the output of Schmitt trigger Q-2102 is at this instant near ground, both inputs of the NOR circuit, Q-2103 and Q-2104, are near ground, and it delivers a positive output to the stepper power amplifier. The stepper drive coil will be momentarily energized, and it will advance one step.

However, 0.3 second after this takes place, the pulse width detector Q-2006 delivers sufficient signal to energize Schmitt trigger Q-2101 and Q-2102. Q-2102 then applies a positive signal to the NOR circuit and prevents further discrete stepping action from taking place. The NOR circuit can deliver power to the stepper only if both inputs are near ground.

Q-2101 of the pulse width Schmitt circuitry normally delivers a positive output. Upon receipt of the long pulse (home or reset), it drops to near ground. This signal is inverted in Q-2105 so that the output of Q-2105 goes to about 12 volts when a reset signal is detected. This is routed through the homing and pulsing contacts on the stepper to the input of the OR circuit, using CR-2101. The stepper switch drive coil then pulses itself until it reaches the home position. At this time the homing contacts open up, removing drive to the OR circuit.

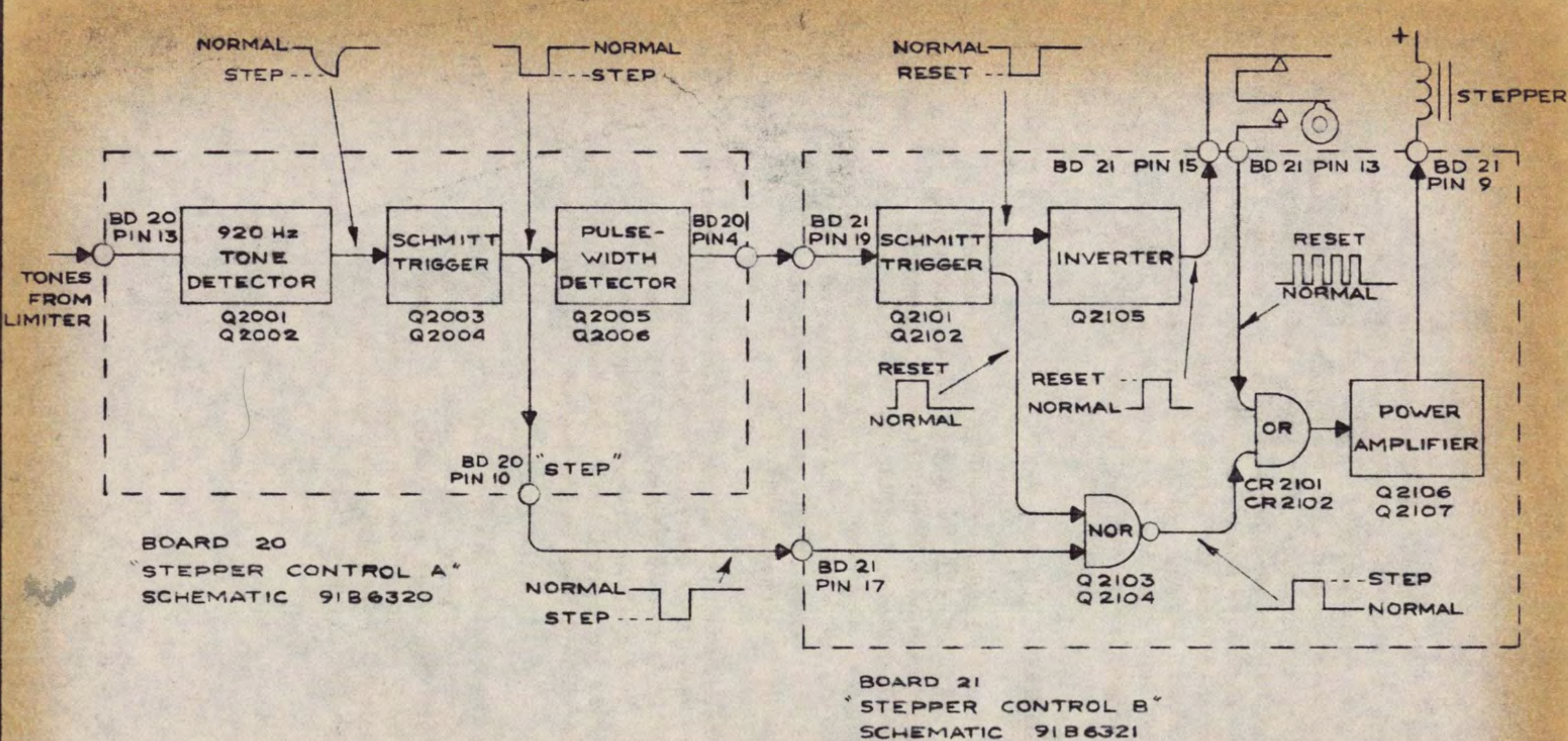
The type of circuit discussed is known in computer terminology as RTL (resistor-transistor logic), and it is reliable and rather elementary in its operation. However, should a failure occur somewhere in this system, it might be possible to apply power to the stepper switch drive coil continuously. To prevent this from happening, Capacitor C-2102 is used to AC couple the drive signals to the power amplifier. In this manner, the drive coil can not be energized continuously and so it is prevented from overheating. Another unique protective feature is the Zener diode and conventional diode-damping network across the stepping switch drive coil. This is shown on the schematic as the set of diodes CR-2104 through CR-2106. Finally, note that the drive transistor is easily capable of supplying the necessary power (in excess of 50 watts) to the drive coil.

C. Raise-Lower Generation

A pair of oscillators, each with circuitry similar to the control oscillator, is included in the PBR-30A System. These additional two oscillators are keyed on manually by depressing either the front panel RAISE or LOWER buttons. When one of these buttons is depressed, its corresponding oscillator is turned on. These two oscillators are located on the pair of boards numbered "BD 8" and are identical save for the values of the tuning capacitors. They are shown schematically in drawing 91B-6308.

To key on one of these oscillators, the emitter circuit is connected to ground. Schematically, Pin 20 of Board 8 is grounded, connecting the emitter circuit of Q-801 to ground. This allows the stage to oscillate. On the tuning inductor, as in the control oscillator, there is a winding for extraction of the tone. This signal is summed with the control tone in the output amplifier on Board 9.

Note again that there are two boards labeled "BD 8" and each is identical except for the values of tuning capacitors. One is to generate the Raise tone, and the other generates the Lower tone. They must be in their proper sockets, or the raise and lower functions will be interchanged. The Raise tone generator uses 0.047 μfarad tuning capacitors, and the Lower tone generator uses 0.068 μfarad capacitors.



RRC-10T PBR-30

REVISIONS	DATE
A REDRAWN FOR CLARITY.	7-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

BLOCK DIAGRAM
STEPPER CIRCUITRY

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	JAG	7-69	SCALE:
CHK			92A1024 A
ENG	JCT	7-69	

D. Raise Detection

Once the Raise, or Lower, and the Control tones are summed and sent to the transmitter site, they are all processed identically. The tones are applied to the limiter circuit, Board 17 in the Transmitter Unit. Refer to schematic 91B-6317. Transistor Q-1701 and associated circuitry accomplish limiting of the tone levels as previously discussed.

Also located on this board is the tone detector of the Raise channel. This detector, using transistors Q-1702 through Q-1705, operates in a manner strikingly similar to that of the control channel. The regenerative detector, buffer, and Schmitt trigger circuits are as discussed for the control channel. But, instead of driving logic circuitry for pulse-width detection and the like, the Schmitt is simply coupled to a relay-driving transistor, and the Raise relay is driven upon the receipt of a Raise tone.

E. Lower Detection

The output of the limiter on Board 17 is also applied to the input of the Lower detector on Board 18 (schematic 91B-6318). This detector is essentially a duplicate of the Raise detector except that the input limiter is eliminated.

F. Fail-safe

With reference to schematic 91B-6320, observe that the Schmitt trigger output from Q-2004 with the normal presence of the Control tone is positive. This voltage is routed to, among other places, the fail-safe circuitry located on Board 19. See schematic 91B-6319. The positive input is applied to Pin 20 of this board through diode CR-1901. Capacitor C-1901 quickly charges substantially to the full value of the input signal. It is then passed through the buffer amplifier Q-1901 to another Schmitt trigger used for level selection. The output of this circuit is positive when the control tone (used now for fail-safe purposes) is present. The positive signal is used to drive transistor Q-1904 and actuate the fail-safe relay.

Failure of the control system will result in a loss of the positive input to the fail-safe board, and capacitor C-1901 will slowly discharge through resistor R-1901. The voltage present across C-1901 is normally about 10 volts. When this has discharged down to about 1.5 volts, the fail-safe relay will be de-energized. This will then cause the transmitter to be removed from the air. The time lag between control system failure and transmitter shut down is about 20 seconds.

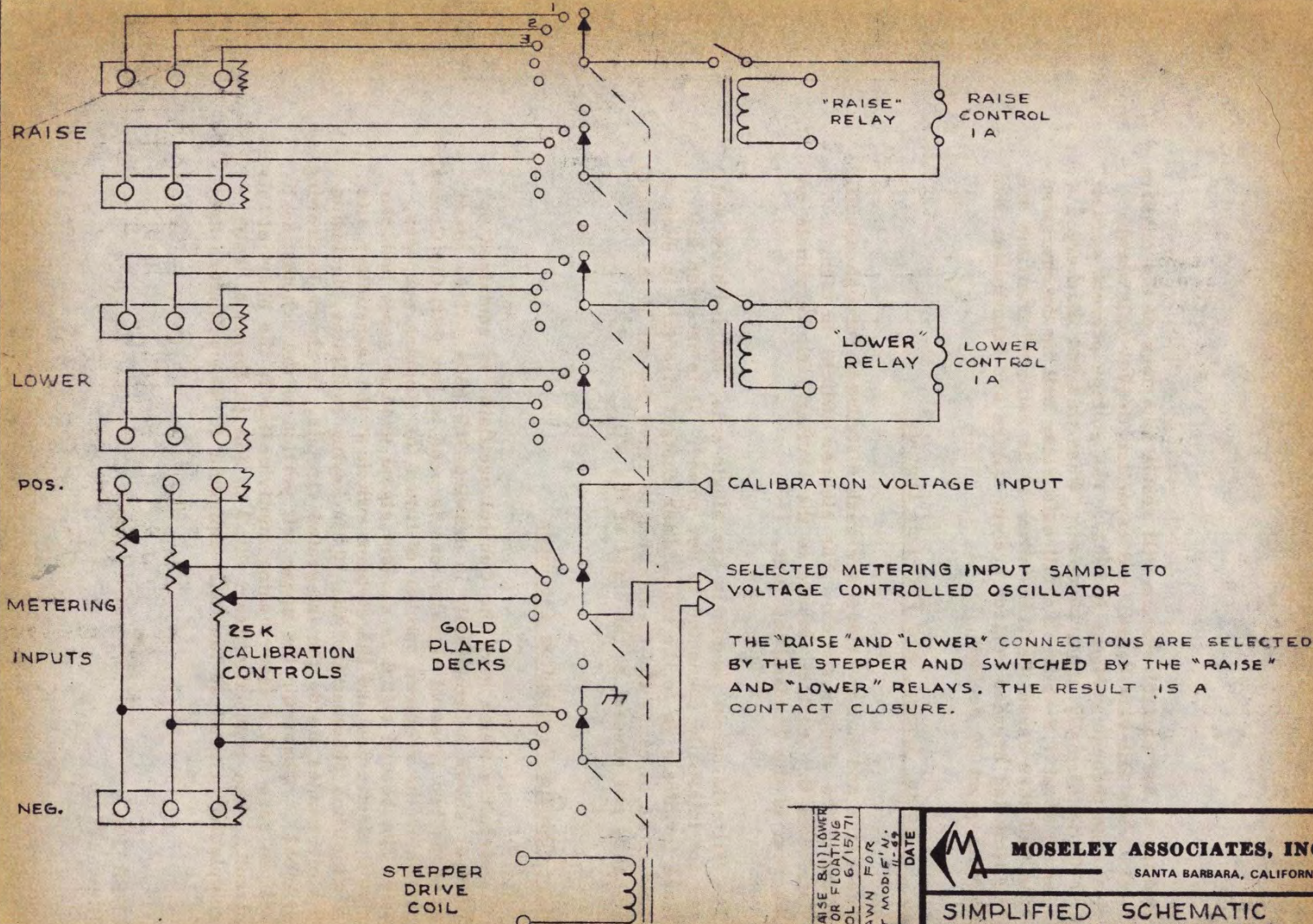
G. Raise, Lower, and Fail-safe Outputs

The Raise and Lower relays are each distributed through specific decks of the stepper switch. The stepper switch, in turn, distributes this contact closure to the barrier strip terminals on the rear of the Transmitter Unit.

The fail-safe output terminals are single-pole, double-throw and are not internally connected to any power. It is intended that these terminals go to the transmitter control circuitry in such a manner as to cause the transmitter to leave the air if the control signal is not present at the input of the TU.

H. Studio Push-button Circuitry

The circuitry which keys the Control oscillator is contained on Boad 4, shown schematically in drawing 91B-6304. This board develops two types of signals; one is used to key (off) the Control oscillator the required number of times for stepping purposes, while the second signal is a reset signal used to reset both the studio electronics and the stepper switch at the transmitter site. A simplified schematic of the 10 Hz keying oscillator, including the electronics inside the integrated circuits, is shown in drawing 91A-6327. Observing the upper left portion of the schematic, it will be seen that a free-running multivibrator is the heart of this circuit. The connection from Pin 3 to Pin 13 forms a "self-completing" circuit so that only complete 10 Hz oscillators are



REVISIONS		DATE
B	ADD (1) RAISE & (1) LOWER DECK FOR FLOATING CONTROL	6/15/71
A	REDRAWN FOR CIRCUIT MODIF'N.	11-69

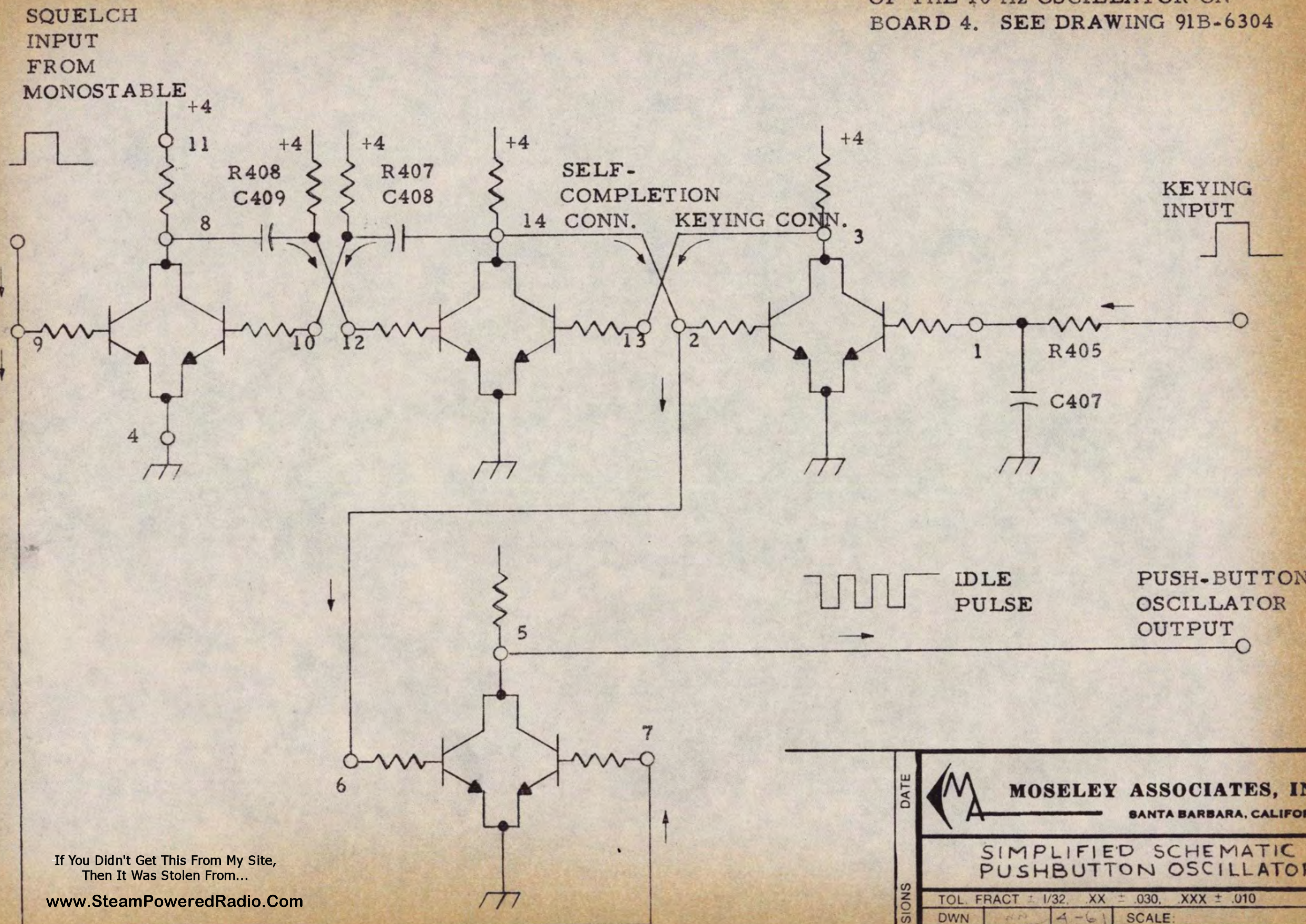
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SIMPLIFIED SCHEMATIC
PBR-30 RAISE-LOWER CIRCUITRY

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	JAG	11-69	SCALE: NONE
CHK	FXY	11/69	91A6362 B
ENG	JCT	11-69	

THIS DRAWING WILL ASSIST IN UNDERSTANDING THE OPERATION OF THE 10 Hz OSCILLATOR ON BOARD 4. SEE DRAWING 91B-6304



MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SIMPLIFIED SCHEMATIC
PUSHBUTTON OSCILLATOR

DATE	REVISIONS

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010		
DWN		4-61
CHK		
ENG	JCT	11-67

SCALE:

91A6327

developed. The input to Pin 6 and the resultant output from Pin 5 provide an isolated (buffered) output whose signal polarities are proper for operating the keyer on the 920 Hz Control generator board.

The input to Pin 9 at the left side of the schematic is a "muting" input. When this point is driven with a positive signal, the oscillator cannot function.

The input to Pin 1 at the right side of the schematic is a "keying" input. When this point is positive, the oscillator is allowed to function. The keying input signal is derived from a set of integrated circuits on another series of boards, and is positive if the button pushed does not agree with what the electronics has stored as the current stepper position. As soon as the electronics portion is in agreement with which button has been depressed, the keying signal is switched off, and the 10 Hz oscillations cease.

It was mentioned that Pin 9 of this integrated circuit was a "muting" input. When this point is driven positive, the oscillator cannot function. Further, the output buffer is also keyed into conduction. The positive pulse which accomplishes this is derived from a monostable multivibrator. This circuit when triggered any of three ways will generate a single pulse whose amplitude is sufficient to operate the "muting" circuits and whose time length is sufficient to allow all the studio electronics as well as the transmitter stepper switch to go to home position.

The monostable multivibrator can be triggered by pushing the RECYCLE button on the front panel, by pushing the CALIBRATE button, or by allowing the integrated circuitry on other boards to signal the end of the counting process.

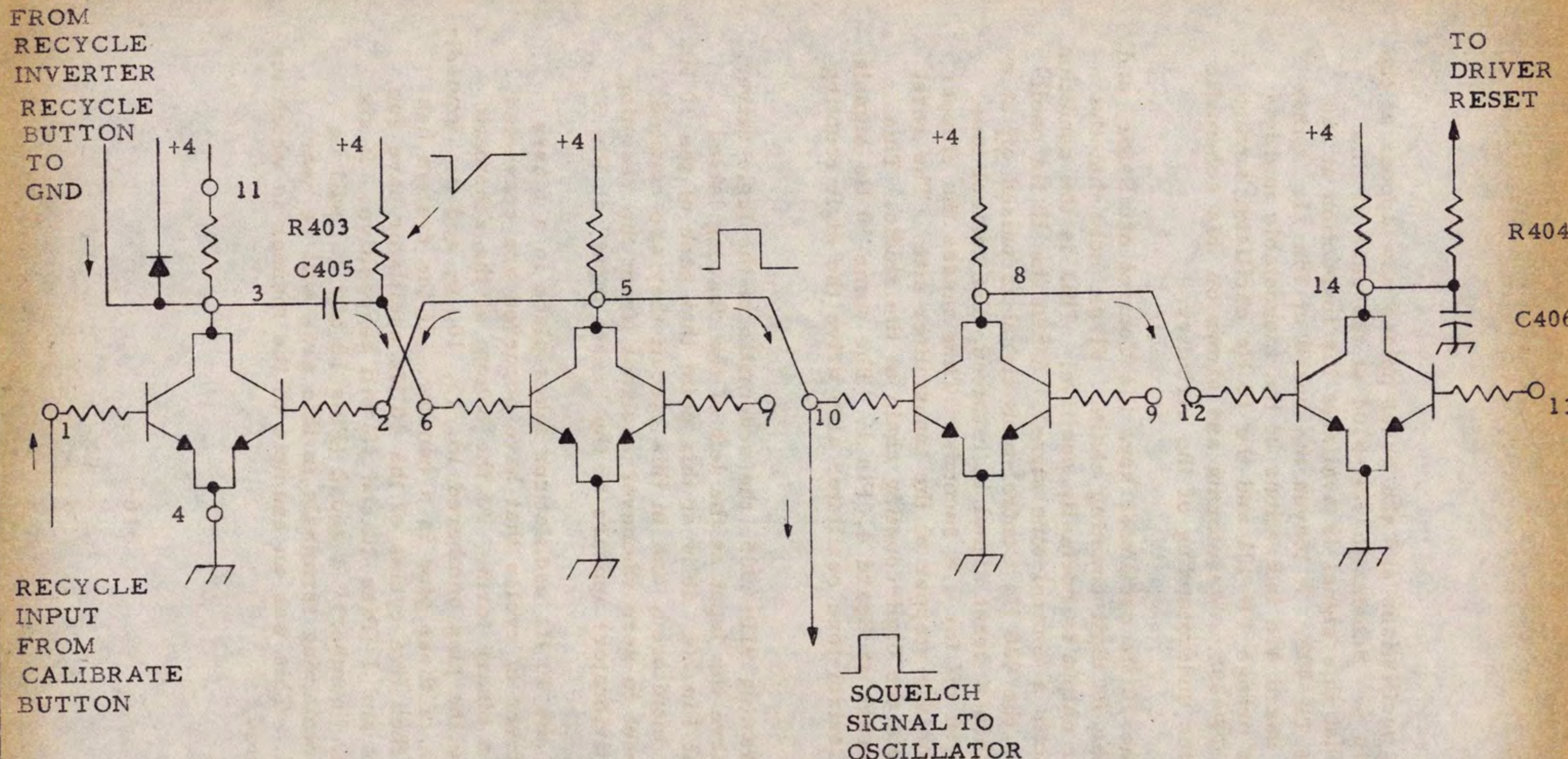
Examine drawing 91A-6328 which shows that the monostable multivibrator is triggered by pulling the collector at Pin 3 down to near ground. This is accomplished by applying power into Pin 1, by grounding Pin 3, or by grounding Pin 3 through a diode. This latter technique is the method by which the inbuilt electronic counter accomplishes the resetting of the system. Once this action has been started, the output pulse is applied to the remaining sections of this IC for buffering.

Both the 10 Hz oscillations and the reset pulses now appear at the oscillator IC Pin 5. Schematic 91B-6304 at the rear of this manual shows that this signal is available for inspection at the green test point TP-403. It leaves the board at Pin 11. Other signals on this board are indications of the monostable multivibrator output at orange TP-401 and the 10 Hz oscillator keying input at yellow TP-402. Waveforms are shown on this schematic to enable a better understanding of the circuitry.

The output of the 10 Hz oscillator keys the Control oscillator, and it also drives the IC digit-counting chain. First, note that the 10 Hz oscillator output is normally positive. This is the condition required to sustain a control-tone signal. When the 10 Hz oscillator is pulsing, the 920 Hz Control-tone signal is pulsed off at a 10 Hz rate. When a reset signal is involved, the control-tone oscillator is keyed off for 1.8 seconds. This causes the stepper circuitry to home the stepper at the transmitter site. The reset signal also resets the digit-counting chain at the studio. This reset signal appears at Board 4, Pin 1. The same 10 Hz signals that drive the Control-tone oscillator also drive the digit-counting chain.

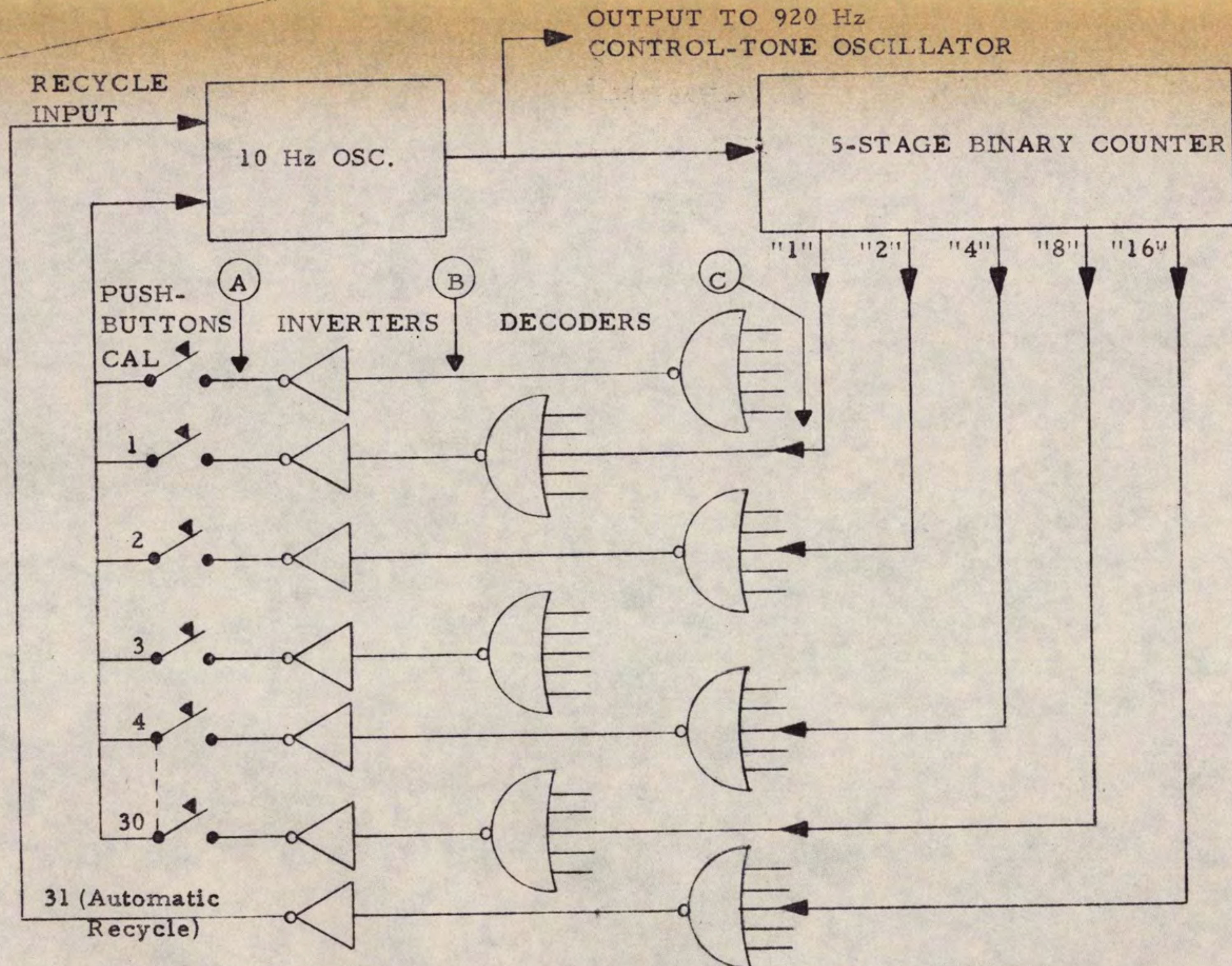
Refer now to drawing 91B-6305, the schematic of the logic driver, Board 5. Observe the input at the left of the drawing labled "toggle input" at Pin 20. It is at this point that each of the 10 Hz oscillations are monitored, and in this circuit they are counted. The count is reset to zero whenever a signal (from the resetting monostable multivibrator) appears at the "reset input" at Pin 3.

The counting of the 10 Hz oscillations takes place in a binary manner; the number of cycles that have occurred are converted immediately to a binary form. At the bottom of the schematic (91B-6305), note the pins numbered 18, 13, 10, 6, and 2. Immediately below each of these pins is a number. If the system has been reset and then five cycles of the 10 Hz oscillator have run, the "numbers" 4 and 1 (Pins 10 and 18) will be positive. If six cycles have run, "numbers" 4 and 2 (Pins 10 and 13) will be positive. The remaining terminals in this area will be near ground potential. This was an example of the manner in which the pulses are counted.



THIS DRAWING SHOWS THE DETAILS OF CIRCUITRY AROUND IC-401, SCHEMATIC 91B-6304, BOARD 4.
NUMBERS NEAR CIRCLES ARE INTEGRATED CIRCUIT PIN NUMBERS.

DATE	MOSELEY ASSOCIATES, INC. SANTA BARBARA, CALIFORNIA
	SIMPLIFIED SCHEMATIC RESET CIRCUIT
REVISIONS	TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010
DWN	4-69
SCALE:	
CHK	91A6328
ENG JCT	11-69



Note: DECODERS ALL HAVE 5 INPUTS; FOR THIS REASON THE COMPLETE WIRING IS NOT SHOWN. SIMILARLY, ALL 31 PUSHBUTTONS ARE NOT SHOWN.

MOSELEY ASSOCIATES, INC. SANTA BARBARA, CALIFORNIA			
SIMPLIFIED SCHEMATIC PUSHBUTTON LOGIC			
TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	[illegible]	4-69	SCALE:
CHK	JLP	4-69	91A6329
ENG	JLP	4-69	

DATE

REVISIONS

These voltages or signals (at the bottom of drawing 91B-6305) are routed to a set of eight identical boards, each containing four decoding circuits. A total of 32 decoders is thus set up. One detects a count of zero (home or calibrate), another detects a count of 1, and so on up to 31. The 31st decoder is used to indicate that the system has gone past the 30th position, and electrically it applies a signal to the reset circuit. These decoders are shown schematically in drawing 91B-3606. All eight boards are shown as Board 6, and they may be interchanged.

Pushing the manual RECYCLE button on the front of the Studio Unit will reset all of the integrated circuit electronics, and the process will reset the stepper switch at the transmitter site. The 10 Hz oscillator will then oscillate, producing a series of pulses equal in number to the button number which has been pushed. For example, if Button 5 is depressed and the RECYCLE button is then pushed, the system will reset and then count out five pulses at a 10 Hz rate.

Refer now to the simplified block diagram of the decoding system shown in drawing 91A-6329. If a given push button is depressed, it connects the "key-on" input on the 10 Hz oscillator to the output of a corresponding inverter. The output of this inverter will be positive; its input is near ground. The inverter input will rise to a positive value only when all five input lines to the corresponding decoder are at ground potential. This is the case only when sufficient pulses have been counted into the 5-stage binary counter to satisfy the decoder. Its inputs will one by one drop to ground, and when all five inputs are at ground, its output will be positive. This will bring the output of the inverter down to ground, removing excitation to the key-on input on the 10 Hz oscillator.

Should the binary chain for any reason count to Position 31, the last decoder detects this immediately and automatically resets the system. Counting will then restart on its own accord.

Meanwhile, the 920 Hz Control tone oscillator is following this activity and keying (off) the Control tone as necessary to allow the stepping switch to be continuously synchronized with the studio electronics.

I. Metering Generation

The metering or telemetry system in the PBR-30A is unusually flexible in its operation. The metering samples from the transmitting equipment are applied to their individual calibration controls and then routed to contacts on the stepper switch.

One of these metering systems at a time is selected by the stepper switch for application to the metering system electronics. This is located in the Transmitter Unit Board 22. See drawing 91B-6322 for the schematic.

The input from the stepping switch is routed to Pin 18 of this board and applied to Pin 3 of the integrated circuit DC amplifier. This amplifier has components around it for phase compensation.

The DC amplifier is non-inverting and heavily gain-stabilized with negative feedback. A positive input from 0 through 0.7 VDC yields an output from this stage of 0 through 7 VDC.

The output of this DC amplifier is applied to the voltage-controlled oscillator. This is a multivibrator whose frequency is directly proportional to the voltage applied to it from the DC amplifier. The output waveform is a good approximation of a square wave.

In applications where the final metering waveform must be a good sine wave (sinusoid), it is important that all harmonic content be reduced far below the fundamental. Filtering of the metering signal can be simplified if it contains no second harmonic. This condition is met by dividing the metering signal (twice) from its original range of 80 Hz - 120 Hz down to 20 Hz - 30 Hz. An ideal square wave, it must be remembered, contains no even harmonics. This division process also results in the voltage-controlled oscillator using smaller components with better temperature coefficients than if the metering signal (20 Hz - 30 Hz) were generated "on frequency." Dividing the original metering signal down with bistable circuits also assures a constant output amplitude.

The metering signal leaves Board 22 on Pin 5, and it is applied to the metering processor. At this point an option is available; the basic 20 Hz - 30 Hz metering square-wave signal is either filtered and turned into a sine wave, or else it is used to key (amplitude modulate) a 1280 Hz tone. The first option is used when the metering signal is to be applied to an AM transmitter or to an FM SCA subcarrier with programming. The 1280 Hz option is used when the metering is returned from the transmitter to the studio via a communictions-grade link such as a telephone line or other voice-quality system.

The output of the metering oscillator is a square wave of about 1 volt peak-to-peak amplitude in the range of 20 Hz to 30 Hz. Discussing first the subaudible processing, reference is made to schematic 91B-6530, Board 23.

The input to this board appears at Pin 20 and is immediately applied to a low-pass filter which removes harmonics to a level of 60 dB below 100% modulation. Following the low-pass filter is a voltage amplifier and a power amplifier. This latter has the ability to drive a subcarrier generator or an AM transmitter. Remember that in the case of AM broadcast, the metering processor output frequency is in the range of 20 Hz to 30 Hz.

J. Metering Detection

The metering signal is recovered at the studio from an AM receiver or modulation monitor using the MRU-1 Metering Recovery Unit. In the case of FM, a specially modified telemetry receiver is used. In either case, the metering signal is recovered and applied to the subaudible metering processor (Board 11) at the studio. The schematic for this circuit is shown in drawing 91B-6528. The signal is applied immediately to a low-pass filter. The purpose of this filter is to reject program material which may be present with the metering signals. Only the 20 Hz to 30 Hz signal will be passed by the filter.

In the case of the audible metering return (modulated 1280 Hz), the square-wave metering oscillator output is applied to Pin 20 of Board 24, the Audible Metering Processor at the transmitter. See schematic 91B-6324. The metering oscillator output stage acts as a keyer for the 1280 Hz tone oscillator. The output from this oscillator is applied immediately to a line-driving amplifier. The output connections are arranged in a manner such that the BNC connector for metering output is also brought into play. Metering signals appear at both the telephone line and at the Metering Output BNC connector.

At the studio, the input from the wire line (via the Type 2-1300 High-pass Filter) or from the BNC connector is applied to the audible metering processor, Board 12. Refer to schematic 91B-6312. Here the metering signal is limited and applied to the 1280 Hz tone detector. This detector recovers the 20 Hz to 30 Hz modulation impressed on the tone at the transmitter site. Simple filtering and amplification follow this detection process.

The metering signal, whether it has been conveyed to the studio via audible (modulated 1280 Hz signal) or subaudible (20 Hz to 30 Hz) tones, is applied now to the actual metering demodulator, board 13. The schematic for this unit is shown in drawing 91B-6529.

The processed input signal is applied to Pin 19 of this board and is used to actuate a Schmitt trigger circuit. This is a circuit to produce a waveform of uniform amplitude with rapid rise and fall times. It is used to operate the monostable integrated circuit IC-1302 which produces pulses of uniform width and amplitude at a rate equal to the metering signal frequency. The output of the monostable is applied to power amplifier Q-1302 and then to the low-pass filter using IC-1303. The output of this IC drives the meter movement via multiplier resistor R-1319, damping resistor R-1322, and acceleration capacitor C-1307.

The presence of metering signals at the output of the monostable multivibrator is detected by diode CR-1303 operating in conjunction with capacitor C-1308 and resistor R-1326. The resultant voltage across C-1308 is used to drive the DC amplifier using transistors

Q-1303 and Q-1304. The signal at the collector of Q-1304 provides an output to the alarm detector (Pin 6) to the squelch system using transistor Q-1305 and to the "READ" lamp driver using transistors Q-1306 and Q-1307.

K. Alarm Encoder

Unique with the Moseley Associates, Inc., PBR-30A System is an alarm system based on momentary key-off of the metering signal.

Basically, receipt of an alarm condition at the Transmitter Unit causes a brief interruption of the metering signal. This is accomplished electronically by the Alarm Encoder, Board 25. Refer to schematic 91B-6325.

If any of the input terminals (Pins 10, 12, 14, 16, or 18) are connected to ground, then that terminal which has been held at -2 volts will suddenly go to ground potential. This positive-going signal is coupled through a capacitor (C-2501 through C-2505) to an input of IC-2501. This is a 5-input gate. If any of its inputs go positive, its output (Pin 7) will go to ground. This negative-going excursion is used to key a monostable multivibrator using IC-2502. The pulse width of the signal so generated is about 0.5 second in length. It is used to provide drive to transistor Q-2501. When this transistor is conducting, it effectively shorts to ground the output of the metering oscillator board.

In summary, when any alarm input is connected to ground, the metering is removed from the system for a period of 0.5 second. This brief metering key-off is detected at the studio by the metering demodulator and alarm detector.

L. Metering Read

On the metering demodulator, Board 13 in the SCU, is a metering presence circuit, using the components around transistor Q-1303 and Q-1304. In the presence of metering, capacitor C-1308 is discharged via diode CR-1303 to near ground potential. This removes the drive to the base of transistor Q-1303 and its collector will then reside at a positive voltage. This causes transistor Q-1304 to conduct and its collector will be near ground potential. As a result, the positive voltage to Pin 6 (to operate the alarm system) is removed, squelch transistor Q-1305 is cut off and amplifier Q-1306 is cut off. The positive voltage at the collector of Q-1306 then provides drive to lamp driver Q-1307. As a result, the front-panel "READ" lamp will be on.

Should metering fail, the alarm detector will receive a positive voltage via Pin 6, the squelch transistor will clamp the meter at zero deflection and the "READ" lamp will be extinguished.

M. Alarm Detection Circuitry

With reference to the schematic of the Alarm Detector, Board 14, schematic 91B-6314, this positive-with-alarm signal enters the alarm detector circuit at Pin 19. This point is normally at near ground potential and rises to about +3 volts with metering cessation. Integrated circuit IC-1401 generates a 0.8 second pulse upon cessation of metering. At the end of this pulse, another pulse is generated, using IC-1402, which is about 1 second in width. Should the metering return during the time of this second pulse ("window"), another pulse is generated which sets the set-reset bistable using IC-1403. This in turn will energize transistor Q-1401 which illuminates the front-panel alarm lamp. The lamp is turned off by manually resetting the bistable using the front-panel ALARM RESET button. Note that in order to activate the alarm detector in its entirety, the metering signal must be keyed off for a period of time greater than 0.8 second but less than 1.8 seconds. Very brief or very long metering system failures will not actuate the alarm circuitry.

N. Subcarrier Equipment

The discussion of the PBR-30A has been primarily limited to operation on a telephone line. At this point, the additional circuitry to enable wireless (radio) operation will be covered. This system is designated the PBR-30AR.

Considering first the signals at the studio site, the control tones are summed in the Output Amplifier and applied to the Subcarrier Generator. These control tones can be observed at the orange test point, TP-1001, on the Subcarrier Generator, Board 10. Potentiometer R-1001 sets the amount of control-tone signal applied to the voltage-controlled oscillator. The center frequency of the frequency-modulated control subcarrier oscillator is set with the frequency control, R-1004. The oscillator is of the multivibrator type, using Q-1001 and Q-1002. The signal is a square wave and is applied to the filter-driving buffer amplifier Q-1003. A low-pass filter removes unwanted harmonics of the carrier signal and leaves a sine wave. This is amplified in voltage amplifier Q-1004 and is applied to the output power amplifier Q-1005. The output level control R-1028 sets the degree of injection into the microwave equipment.

The subcarrier generator produces a signal with a center frequency of 26 kHz (or other frequencies for special applications) which is deviated approximately plus and minus 5% of the carrier frequency. It is fed into the multiplex input of the STL equipment. In the case of the Moseley Associates, Inc. Model PCL-202/PCL-303 aural STL equipment, the control subcarrier is set for an injection level of about 10%.

At the transmitter site, where the Transmitter Unit and the STL receiver are located, the subcarrier signal is extracted and demodulated. The extraction is accomplished with a bandpass filter located on Board 15. This filter consists of five tuned circuits with sufficient bandwidth to pass the modulation sidebands of the control subcarrier and adequate skirt selectivity to reject unwanted subcarriers or other signals.

The output of the subcarrier filter is passed on to the subcarrier demodulator. This is shown schematically in drawing 91B-6316 and is labeled Board 16. The recovered control subcarrier is applied to Pin 16 of this board and is observable at the orange test point TP-1601. It is then applied to the first transistor in the integrated circuit array IC-1601. This transistor then drives the voltage amplifier using the second transistor in this array. The output of this amplifier is symmetrically clipped by the back-to-back silicon diodes CR-1601 and CR-1602. Symmetrical limiting gives this demodulator good spurious signal rejection (capture ratio). Subsequent amplification in the third section and buffering in the fourth allows a high-level signal to be applied to the Schmitt trigger. This uses the first two sections in the second transistor array, IC-1602. The output of the Schmitt trigger is a sharp-edged square wave which is applied to the pulse-counting demodulator. This demodulator uses the third section of the array actively and the fourth section as a base-emitter protection diode. The output of the demodulator appears at Pin 11 of IC-1602, and the waveform at this point consists of a series of pulses of equal pulse width and amplitude. The pulse rate, however, is the same as the input subcarrier frequency. The average voltage is proportional to the center frequency of the subcarrier.

This signal is applied to a filter-driving buffer using the first section of the third array, IC-1603. This buffer drives a filter using inductors L-1601 and L-1602 as well as capacitors C-1607 through C-1609 to remove the subcarrier frequency.

The voltage at the junction of C-1609 and C-1610 consists of two components; a DC voltage proportional to the subcarrier center frequency, and an AC voltage proportional to the subcarrier modulation. C-1610 passes the AC (modulation) component on to the amplifier stages consisting of the last two sections in array IC-1603. The output of the last stage is a replica of the control tones impressed on the subcarrier generator at the studio or control site. This demodulated output is routed via the Type 2-1301 low-pass filter to the various tone detectors. From this point onward, operation of the PBR-30AR is identical to wire-line operation.

O. Metering Return, Wireless Operation

In radio remote control operation, the metering signals are normally returned to the studio in the subaudible spectrum. Should an AM transmitter be involved in this process, the metering subcarrier generator in the Transmitter Unit is replaced with a jumper board. (The schematic for this complex item is shown in drawing 91B-6326.) In this manner, the subaudible signals are available directly at the "Metering Out" BNC connector on the rear of the TU. It is intended in AM operation that this signal be applied to the transmitter with external equipment to modulate the carrier in the order of 5%.

In FM and TV operation, two possibilities exist. If only metering signals are to be returned to the studio on a subcarrier, then an internal subcarrier generator can be used in lieu of an external multiplex (SCA) generator. For FM this generator is normally supplied tuned to 67 kHz. For TV the subcarrier generator should be set to 39 kHz. In either case, the subcarrier generator is deviated about 5% with the subaudible metering signal, and the injection into the FM or TV aural transmitter is set to about 10%.

If, especially in the case of FM, an external subcarrier generator is employed, then the complex jumper board, BD 26, is installed, and the metering output is taken at the subaudible rate from the BNC connector. It is then routed to the Telemetering Input on the rear of the Subcarrier Generator, such as the Moseley Associates, Inc., Model SCG-4T. The subaudible metering signals will then modulate the resultant SCA signal about 15 dB to 20 dB below program level and will be inaudible on a standard multiplex receiver.

In the patented Moseley Associates, Inc., Type III* Radio Remote Control System, the subaudible metering signals are taken from the BNC connector and are applied to the Multiplex Processing Amplifier Model MPA-1. The metering signals then phase-modulate the subcarrier passing through the MPA-1. They are subsequently detected at the studio in a phase-comparison system.

P. Metering Detection, Wireless Operation

In AM radio remote control, the subaudible metering signals modulating the AM transmitter at about 5% are detected on a

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*U.S. Patent 3,317,838

modulation monitor, tuned to the station's carrier. They are then applied to the Metering Input on the Studio Unit. It is suggested that the Model MRU-1 Metering Recovery Unit be used as interface between the modulation monitor and Studio Unit.

In TV radio remote control, the TV aural signal is detected on a receiver tuned to the TV aural carrier. The subcarrier at 39 kHz is extracted and demodulated from this composite signal. The resultant demodulated aural subcarrier modulation is applied to the Metering Input on the Studio Unit.

Similarly, in FM radio remote control, the demodulated 67 kHz subcarrier is applied to the Metering Input BNC connector.

In the Moseley Associates, Inc. Type III System, the metering signals are extracted from the SCA receiver undemodulated (intact at 67 kHz) and are routed directly to the Model SPC-1 Subcarrier Phase Comparator. The output of the SPC-1 is then fed to the Metering Input on the Studio Unit.

VII. POWER SUPPLIES

The power supplies in the PBR-30A are elementary in their operation, and because very rugged components have been used, they should be of little concern. The rectifiers are plug-in types as are the emitter-follower regulators. The filter capacitors are not plug-in because socketed capacitors develop several ohms of contact resistance over several years' usage. In low-voltage applications this is most undesirable. Should one of the plug-in rectifiers need replacement, bear in mind that the diodes used can be replaced with any other silicon diode having a voltage rating in excess of 200 volts PIV and a current rating in excess of 1 ampere. Generally, diodes of this nature are available locally and purchasing them in this manner may expedite repair.

To operate low-powered external equipment, such as the Model TSK-2 Temperature Sensing Kit, regulated plus and minus 10 volts have been brought out to terminals located on the rear of the T.U. Indiscriminate usage of this power for miscellaneous non-remote control purposes is not advised. These terminals are NOT for battery operation of the equipment. They are intended to supply power to accessory kits supplied by Moseley Associates, Inc.

VIII. FIELD ADJUSTMENT, STUDIO UNIT

The following paragraphs outline recommended procedures to be followed should internal adjustments be required on the PBR-30A System.

The control tone oscillator, Board 7, is set on its frequency of 920 Hz by removing transistor Q-702 and adjusting the trimmer capacitor C-705. Set the frequency to 920 Hz using a counter connected to green test point TP-703. Reinsert transistor Q-702 to restore the unit to normal service.

The Raise and Lower oscillators, Board 8, with 0.047 μfarad and 0.068 μfarad tuning capacitors, respectively, are set in a manner similar to the control tone oscillator. First, remove the control tone oscillator board. Then short the orange test point on the Raise oscillator board to ground. Observe the yellow test point TP-802 with a counter. Set tuning capacitor C-805 so that a 790 Hz tone is counted.

To set the Lower oscillator, be sure the control tone oscillator is removed. Short the orange test point on the Lower oscillator board to ground. Observe the yellow test point TP-802 with a counter. Set tuning capacitor C-805 so that a 670 Hz tone is counted.

The subcarrier generator, should this board be used, is set by first putting it on the correct frequency. Observe the white test point, TP-1008, with a counter. Remove the control tone oscillator, Board 7. Adjust the middle potentiometer, R-1004, so that the correct frequency is generated. This will normally be 26 kHz but in special systems may be 110 kHz or 135 kHz. Then adjust the subcarrier output level control (top control) for 1.5 volts peak-to-peak as observed at the white test point TP-1008. Reinstall the control tone oscillator board. Adjust the modulation control (bottom control) until an oscilloscopic observation gives 5% deviation. This pattern is shown on schematic drawing 91B-6310.

To adjust the audible metering processor at the studio, remove the Output Amplifier Board 9, any connection to the telephone line, and any connection to the metering input connector. Observe the blue test point TP-1204. Adjust the regeneration control, R-1211, until this test point indicates a DC voltage. This indicates that the tone detector is oscillating. Set it to its assigned frequency of 1280 Hz by connecting the frequency counter to the green TP-1203. Adjust tuning capacitor C-1205 until the counter reads 1280 Hz. Disconnect the counter, and back off the regeneration control R-1211 until the DC signal at the blue test point TP-1204 drops. This indicates the detector has dropped out of oscillation. Continue in this same direction for two more turns.

IX. FIELD ADJUSTMENT, TRANSMITTER UNIT

The control subcarrier filter in the TU must be sweep-aligned. If the subcarrier generator at the studio has been set on frequency, this sweep process is simply a matter of tuning the inductors for maximum output signal coincident with minimum ripple. It has been shown that this filter will neither drift nor vary to a significant extent with temperature variations, and so field adjusting this filter is <u>not</u> advised.

The three tone detectors may eventually require checking. Bearing in mind that these devices are intended to receive signals generated at the studio, a modification of earlier metering tone-detector tuning may be used. Turn off power at the studio to insure that no signals are sent to the transmitter site. Adjust the regeneration control R-1711 on the Raise Detector, Board 18, with R-1804.

The regeneration control on the Stepper Control board is best adjusted by turning it clockwise several turns and then slowly backing off until the stepper homes. Continue for four more turns.

The above paragraphs have enabled correct adjustment of the regeneration controls. Should adjustment of the <u>tuning</u> controls ever be deemed necessary, simply transmit from the studio to the transmitter site the tone in question and adjust the tuning control for maximum recovered DC out of the corresponding rectifier. For the Raise Detector, adjust its tuning control for maximum DC as observed at the green test point TP-1703. This will require that the Raise push button at the studio be depressed. In the case of the Lower Detector, its tuning capacitor is adjusted for maximum DC as measured at the yellow test point, TP-1802. In the case of the Control Detector, its capacitor is tuned for maximum at the yellow test point TP-2002.

In all cases a voltage near +1.8 VDC at each rectifier output is to be expected when the proper tone is present. Setting the tuning control in each case midway between the points where the amplitude falls off due to mistuning will be satisfactory. For a more precise tuning adjustment, remove the transistor following the rectifier. This will unload the rectifier circuit and allow a precise tuning adjustment. Because the tuning circuits are composed of temperature-stabilized inductors and stable (metalized polycarbonate) capacitors, tuning should seldom, if ever, be required.

The metering oscillator board has a total of three adjustments. One, R-2204, is used to set the integrated-circuit DC amplifier to its proper operating point. A second, R-2220, is used to set the frequency of the oscillator (after the countdown process) to a frequency of 20 Hz without input signal. The third, R-2216, is used to set the oscillator to a frequency of 25 Hz when the calibration voltage is being read.

With no input signal applied, adjust R-2204 (middle) for zero VDC as measured with an ordinary voltmeter connected between the yellow and black test points on the metering oscillator board. Then set R-2220 (top) for a frequency of 22 Hz as measured at the violet test point. Then apply the calibration voltage by advancing the stepper to the home position. Adjust R-2216 (bottom) for a frequency of 25 Hz. This completes the metering oscillator adjustment procedure.

Should the metering be returned to the studio via an audible metering processor, this oscillator must be set to its assigned frequency of 1280 Hz. Remove the metering oscillator board to allow sustained oscillations of the 1280 Hz oscillator. Connect a frequency counter to the yellow TP-2402. Adjust the tuning control C-2402 for a frequency of 1280 Hz. Restore the system to normal.

Remember that the end result to be expected in any tone oscillator/ tone detector combination is that the detector satisfactorily receive its mating generator. Other techniques may very well prove quite satisfactory if the individual station has other trustworty specialized equipment.

The above adjustments are not meant to be accomplished routinely, but rather only if considered absolutely necessary. Routine maintenance of this equipment should consist only of keeping it free from dust or other potentially corrosive deposits. Along this line, do not use other than recommended products on the stepper switch. Specifically, use only Automatic Electric Rotary Switch Lubrication, Kit Number PD-9100-1. This is available from Automatic Electric Company, Northlake, Illinois. See drawing SKA-6142.

X. STUDIO CONTROL UNIT PUSH-BUTTON SEQUENCE CHANGE

Unless otherwise specified, the push-button sequence of the PBR-30A Remote Control System is as follows. When the CALIBRATE bar is depressed, the calibration signal is routed to the left-hand meter which has the arrow marks for calibration. When button #1 is pushed, the meter signal is directed to the right-hand meter. This is generally used for filament control, with filament voltage being read on the logging scale. Button #2 and #3 route the meter information to the left-hand and center meters, respectively, for power amplifier voltage and current readings. All of the remaining buttons direct the telemetry information to the right-hand meter. When a Frequency and Modulation Meter Panel, Type 1077-2, is provided, buttons #29 and #30 are used unless otherwise specified.

The sequence of the push-button assembly can be modified to suit individual applications by removing the cover over the push-button assembly in the Studio Unit and altering the jumpers on this assembly in accordance with drawing 93B-1004 enclosed at the rear of this manual. Note that this print shows the provisions which are included in the unit for the addition of five external meters.

PUSH-BUTTON OSCILLATOR

LOGIC DRIVER

PUSH-BUTTON LOGIC

PUSH-BUTTON LOGIC

PUSH-BUTTON LOGIC

PUSH-BUTTON LOGIC

PUSH-BUTTON LOGIC

PUSH-BUTTON LOGIC

PUSH-BUTTON LOGIC

PUSH-BUTTON LOGIC

CONTROL OSCILLATOR
(.033 µfd capacitors)

RAISE OSCILLATOR
(.047 µfd capacitors)

LOWER OSCILLATOR
(.068 µfd capacitors)

~~OUTPUT AMPLIFIER~~

SUBCARRIER GENERATOR
(Radio only)

METERING PROCESSOR
(Audible, except radio is normally subaudible)

ALARM DETECTOR

METERING DEMODULATOR

SUBCARRIER FILTER
(Radio only)

SUBCARRIER DEMODULATOR
(Radio only)

RAISE DETECTOR

LOWER DETECTOR

STEPPER CONTROL A

STEPPER CONTROL B

FAIL-SAFE

SUBCARRIER GENERATOR
(Radio, if and only if external subcarrier not used; install JUMPER if external subcarrier used.)

METERING PROCESSOR
(Audible, except radio is normally subaudible)

METERING OSCILLATOR

ALARM ENCODER

STUDIO SITE
These boards are all marked SCU.
Components are on right side of board.

TRANSMITTER SITE
These boards are all marked TCU.
Components are on left side of board.

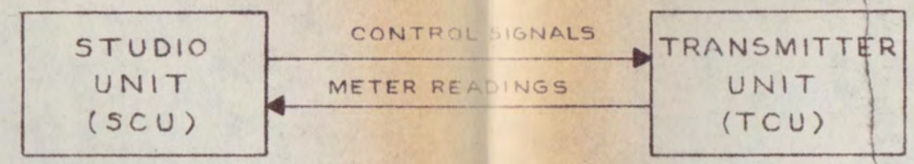
A	STUDIO SITE WAS REVERSED. 1ST 10 UNITS	5/69
REVISIONS		DATE

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

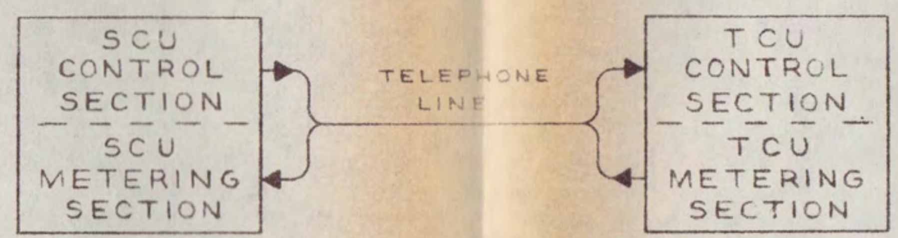
PC BOARD LOCATION
Model PBR-30

TOL. FRACT ± 1/32 .XX ± .030 .XXX ± .010
DWN
CHK
ENG JCS 2-69
SCALE:

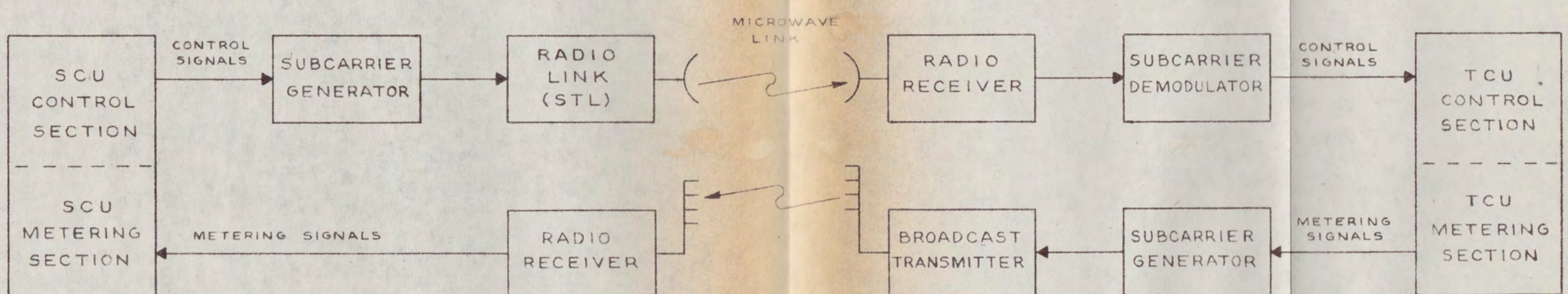
20B2140 A



A) SIMPLIFIED BLOCK DIAGRAM, ELEMENTARY REMOTE CONTROL SYSTEM



B) WIRE REMOTE CONTROL SYSTEM



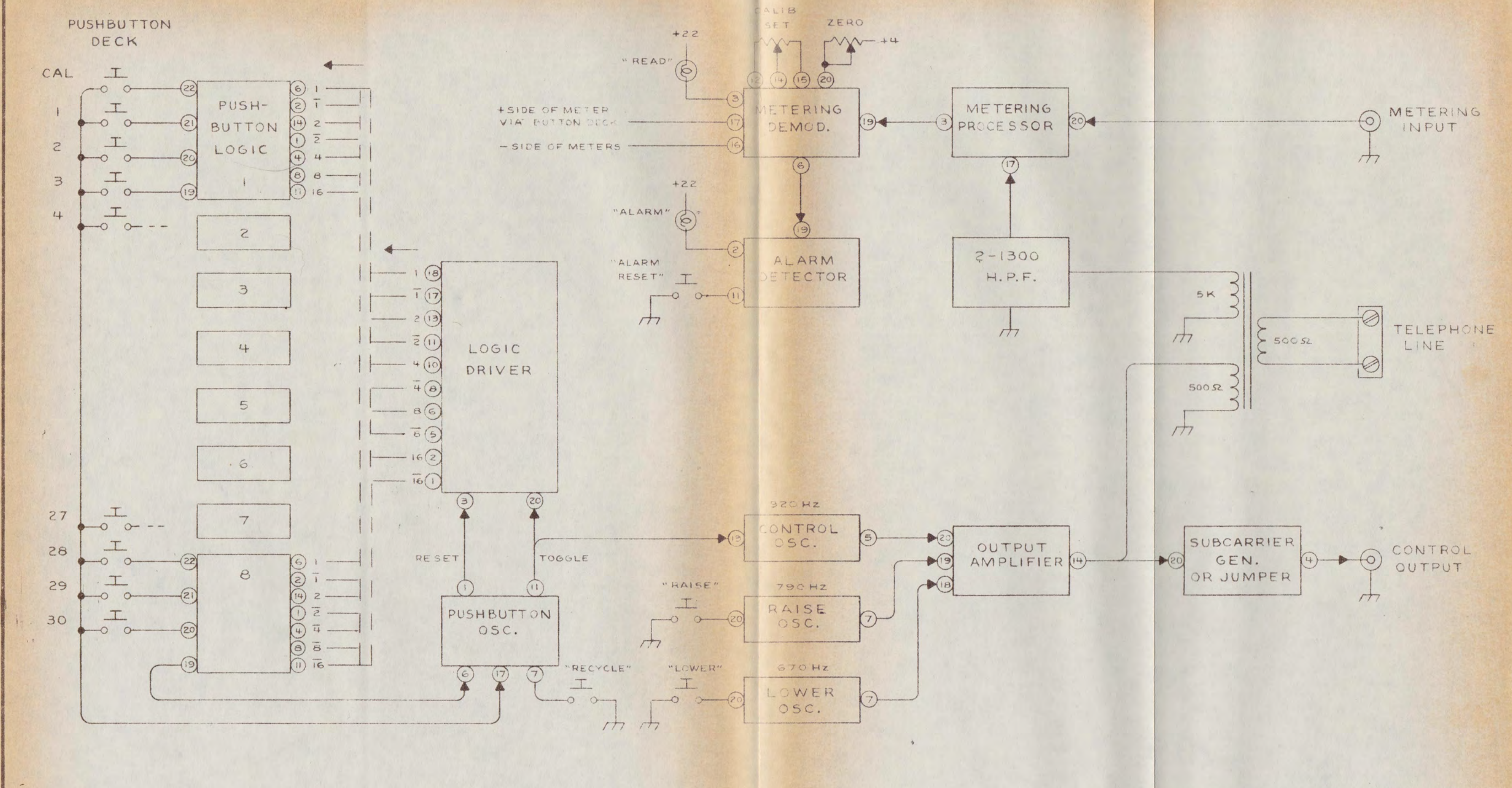
C) RADIO REMOTE CONTROL SYSTEM

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

BLOCK DIAGRAM
REMOTE CONTROL SYSTEMS

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	F X Y	4/69	SCALE:
CHK			
ENG	JLT	4-69	92B1021

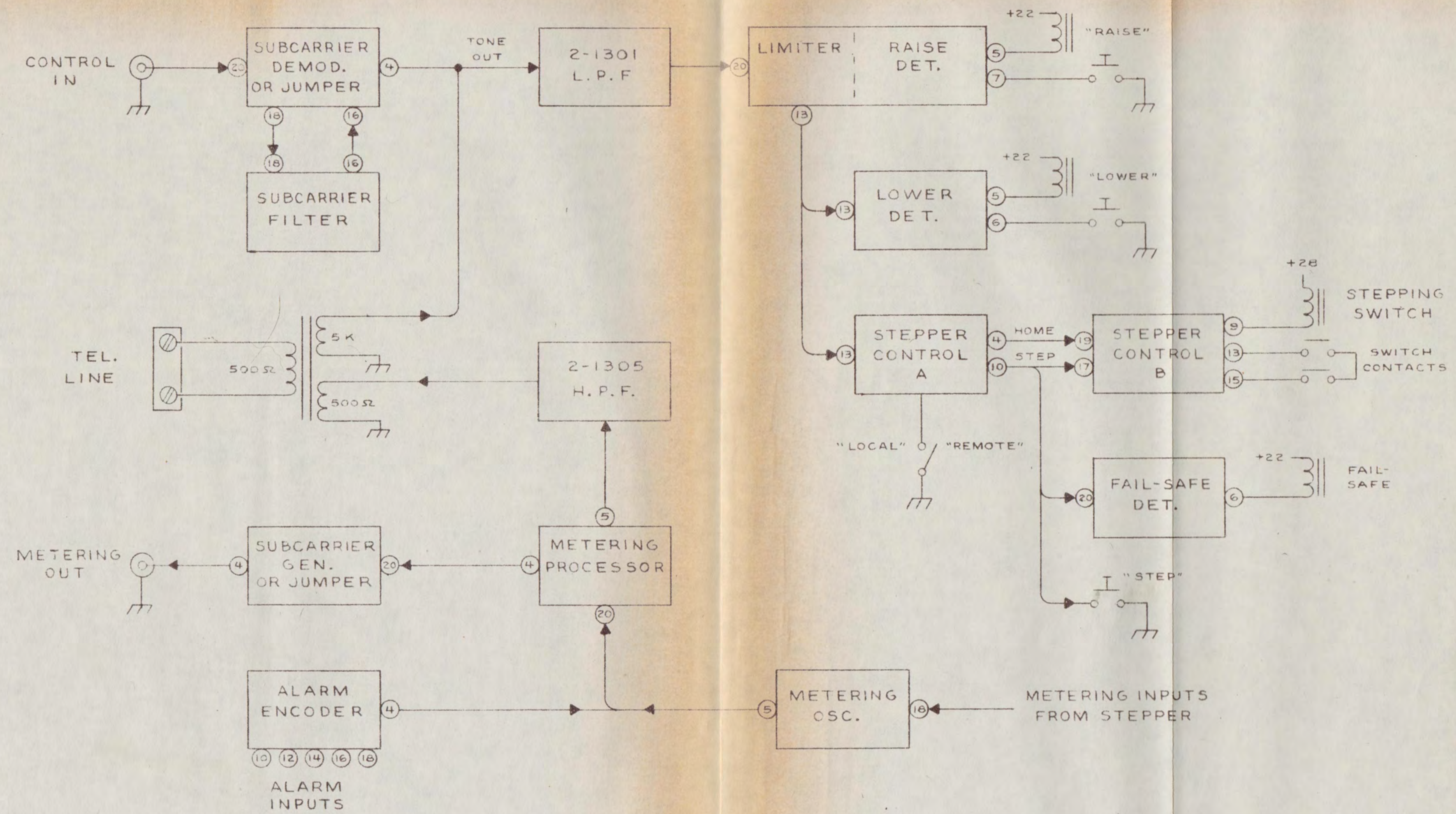
REVISIONS | DATE



MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

BLOCK DIAGRAM
STUDIO UNIT PBR-30

DATE	REVISIONS		
TOL	FRACT ± 1/32	.XX ± .030	.XXX ± .010
DWN	FXY	4/69	SCALE:
CHK			
ENG			92 B 1018

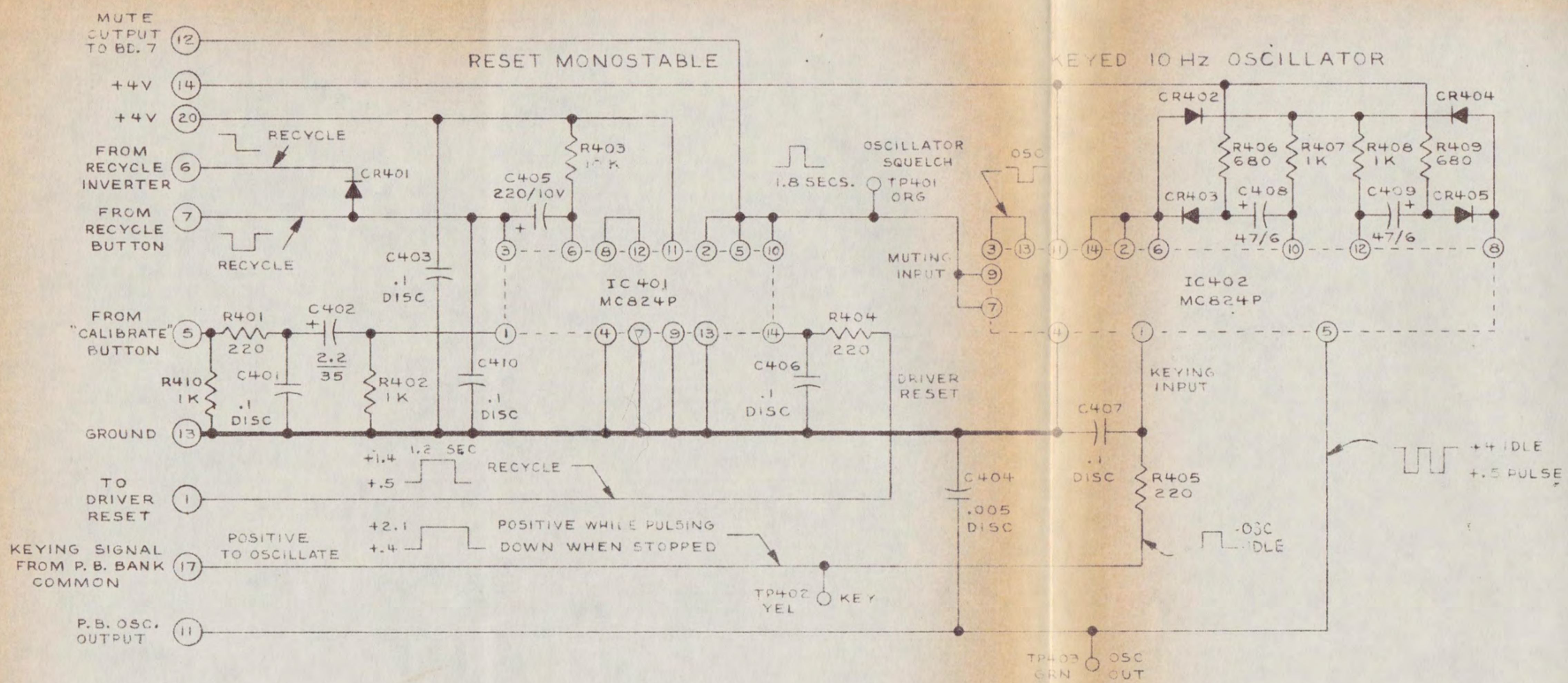


MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

BLOCK DIAGRAM
TRANSMITTER UNIT PBR-30

DATE		
REVISIONS	TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010	
	DWN FXY 4/69	SCALE:
	CHK	
	ENG	92 B 1019

IC402 R410 C410 CR405 TP403



NOTES:

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%.
   CAPACITOR VALUES ARE IN MICROFARADS.
   DIODES ARE IN4154 OR EQUIVALENT.

2. P.C BOARD 51A5169

3. COMPONENT LAYOUT 20A2109

PBR-30

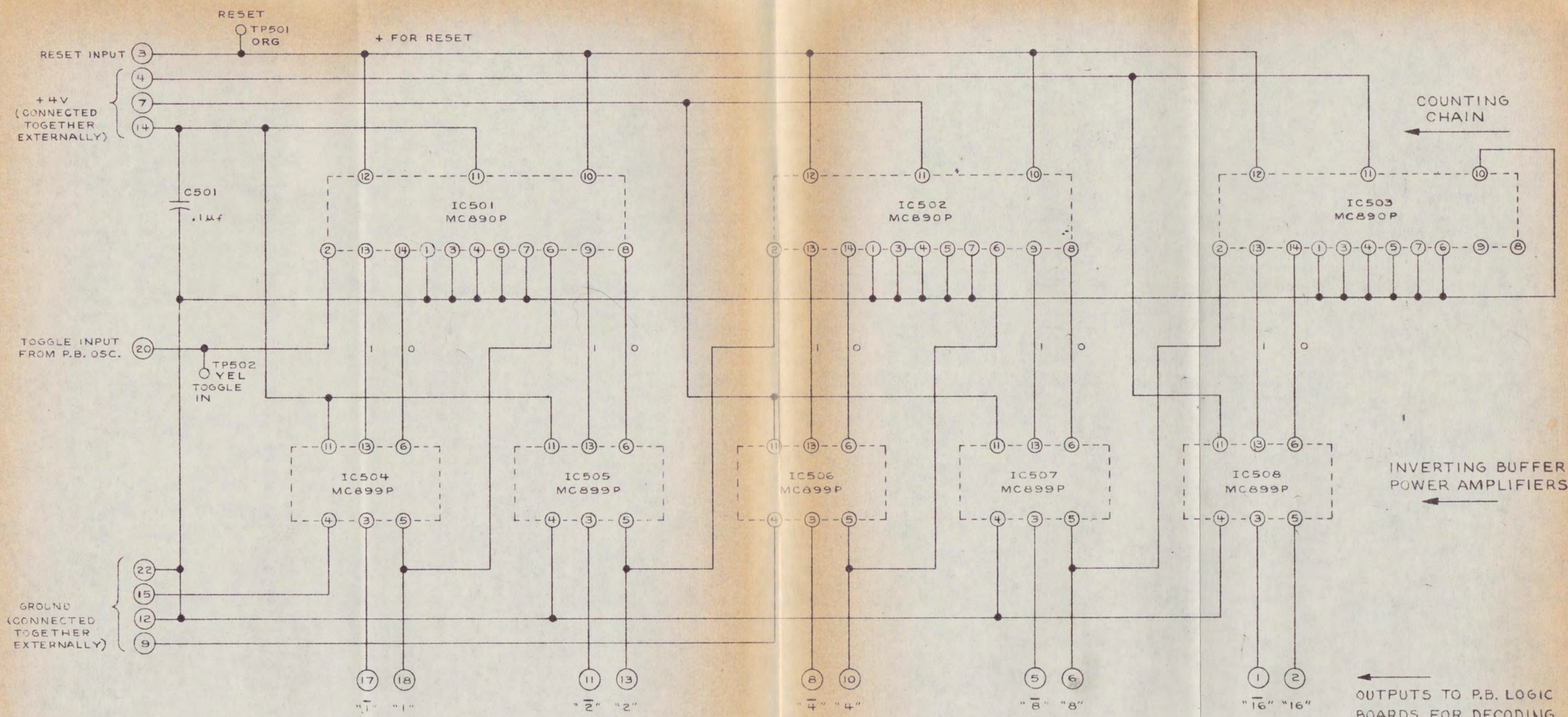
REVISIONS		DATE
C	ADD MUTE OUTPUT ECO 452; R403 WAS 8.2K; ECO 448	6/30/71
B	R403 WAS 680; ECO 424	2-1-71
A	ADD VOLTAGES TO OUTPUT WAVEFORM	10/1/70

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC - BOARD 4
SCU PUSHBUTTON OSC

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	F X Y	2/69	SCALE: NONE
CHK			91 B 6304 C
ENG	JCP	5-69	



NOTES:

1 P.C. BOARD 51A5170

2 COMPONENT LAYOUT 20A2110

3 MC890P PINS 9 & 13 GO TO GROUND POTENTIAL WHEN 10 OR 12 GO POSITIVE.

4 MC899P INVERTS: 3 IS HIGH WHEN 13 IS LOW.

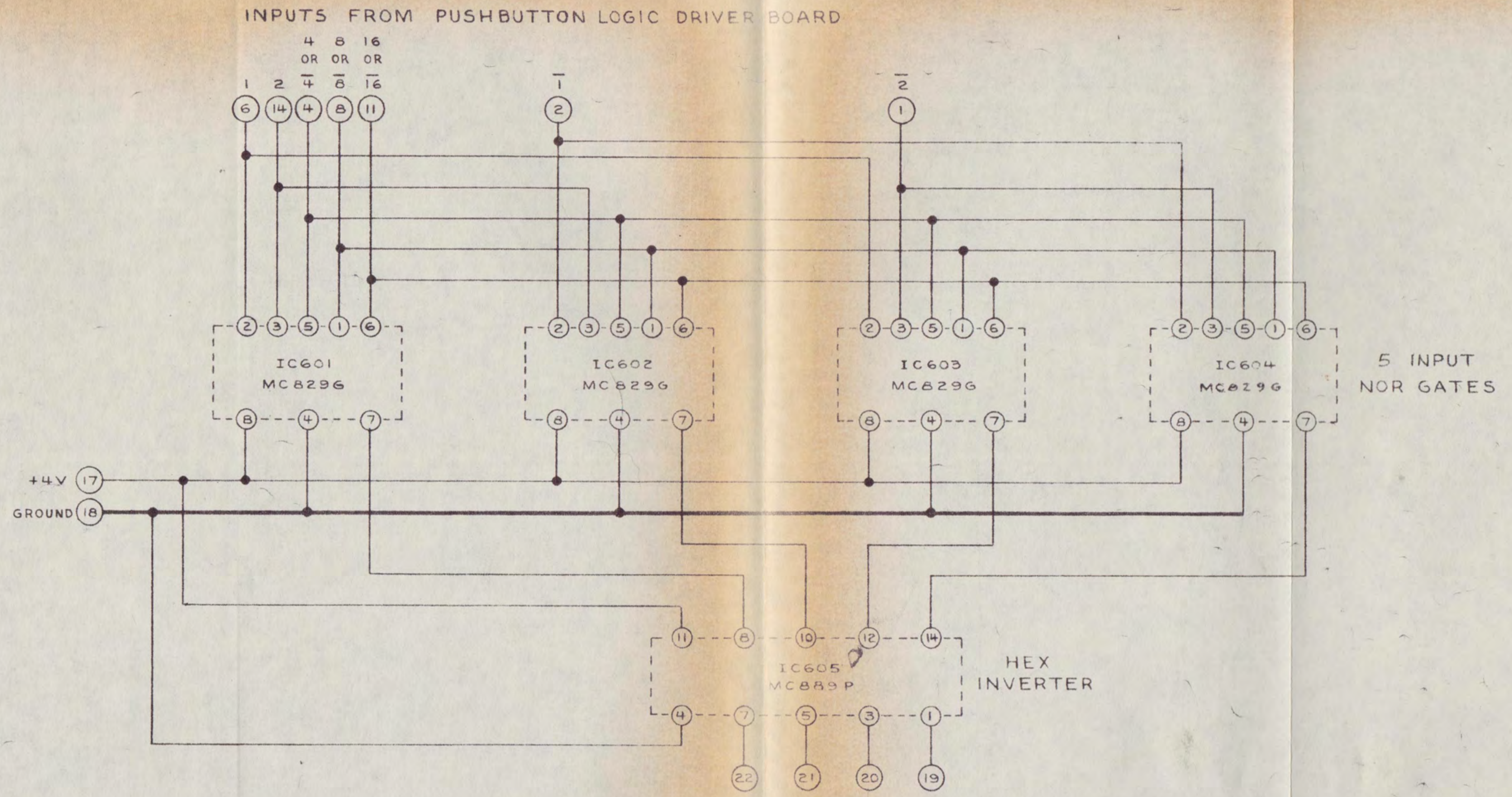
PBR-30

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC-BOARD 5
SCU LOGIC DRIVER

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	FXY	2/69	SCALE: NONE
CHK			
ENG	JCP	5-69	91 B 6305

DATE
REVISIONS



NOTES:

1 P.C. BOARD 51A5171

2 COMPONENT LAYOUT 20A2111

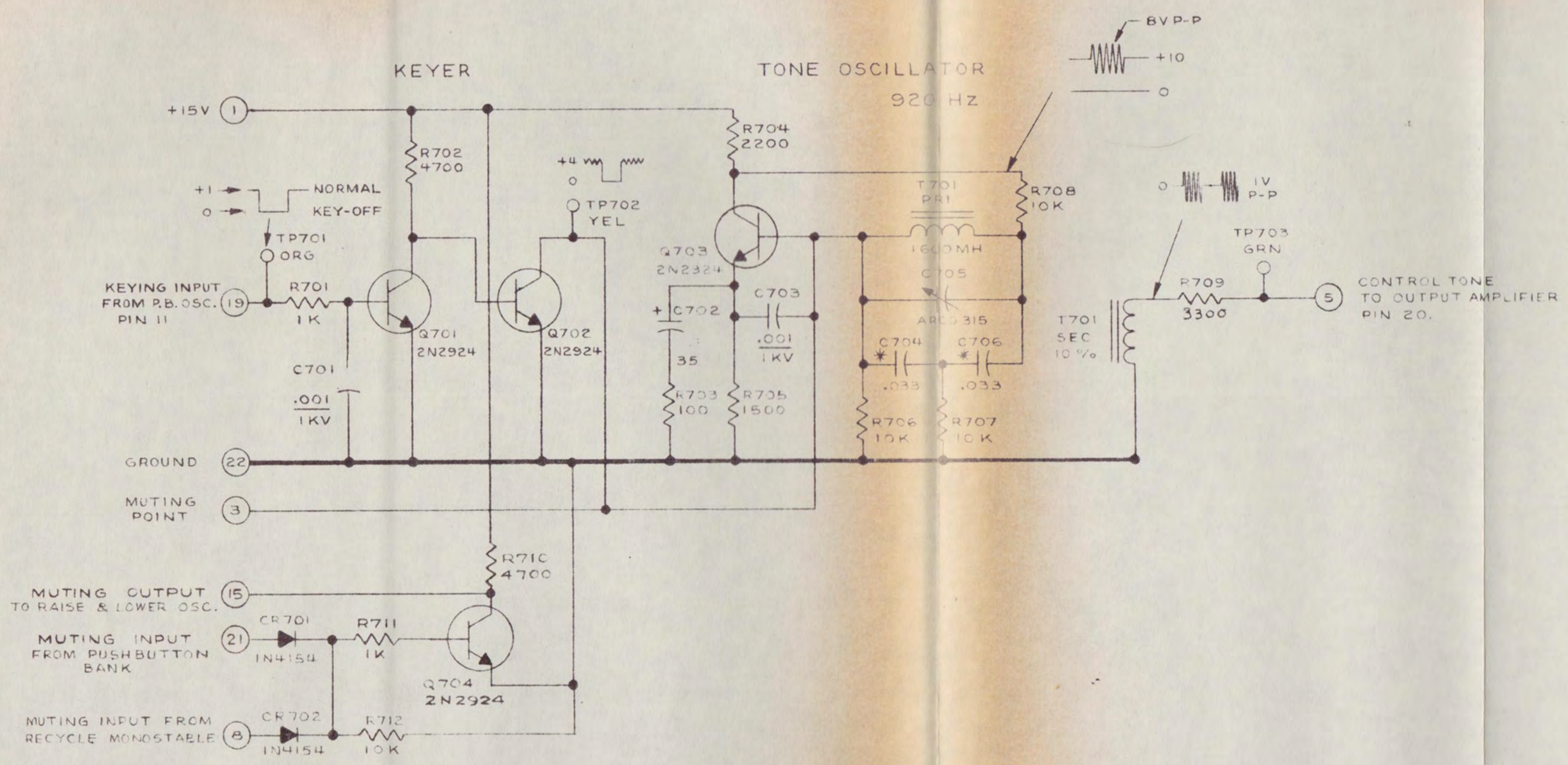
PBR-30

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC – BOARD 6
SCU PUSHBUTTON LOGIC

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	FXY	2/69	SCALE:
CHK			91 B 6306
ENG	JCT	5-69	

REVISIONS / DATE



NOTES:

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

2. P.C. BOARD 51A5197.

3. COMPONENT LAYOUT 20A2117

4. * C704 + C706 ARE METALIZED
POLYCARBONATE ± 3%.

PBR-30

REVISIONS	DATE
D R709 WAS 2200 ECO 4156	12-9/71
C ADD CR701, 702 & R712 ... R709 WAS 4700 ... ECO 4526	3-/71
B ADD NOTE 4, ECO 326	3-72
A ADD R710, 711, Q704 PINS 15 & 21	10-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

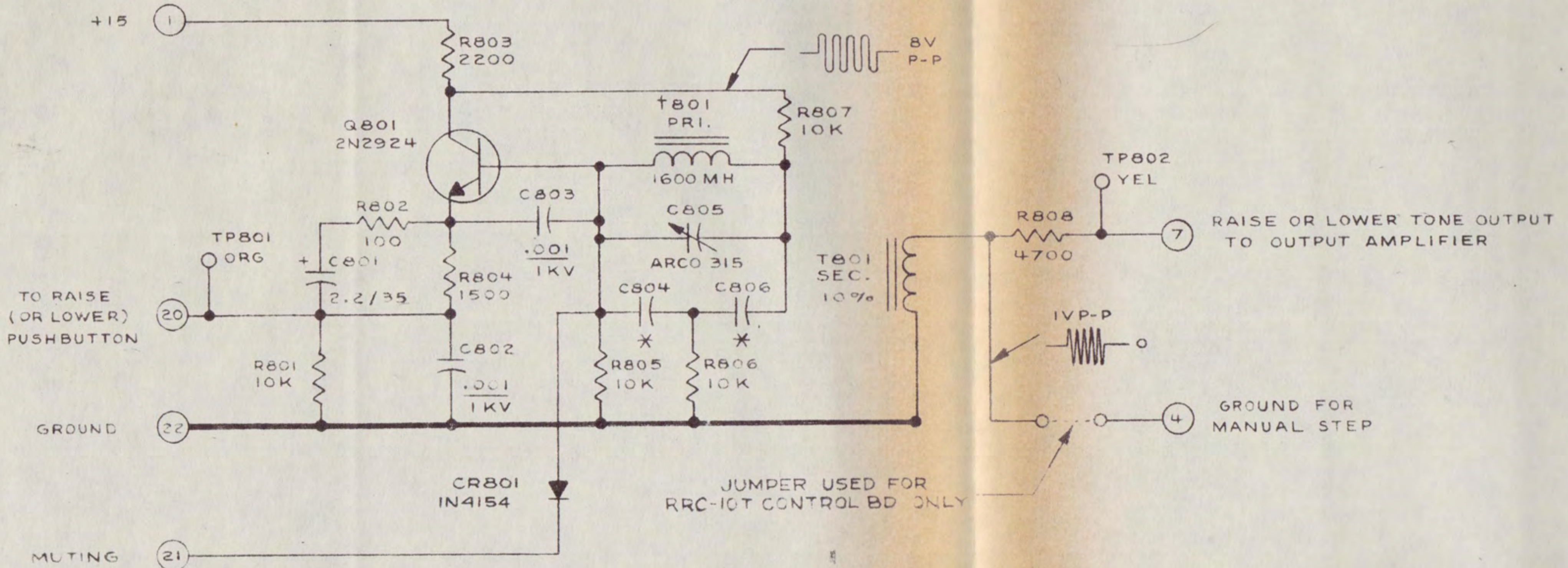
SCHEMATIC – BOARD 7
SCU CONTROL OSC

TOL. FRACT ± 1/32, XX ± .030, XXX ± .010

DWN	FXY	2/69	SCALE:
CHK	JCT	6-69	
ENG	JCT	6-69	91 B 6307 D

Q801 R808 C806 T801 TP802 CR801

OSCILLATOR 790 Hz (RAISE)
670 Hz (LOWER)



NOTES:

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

2 * TUNING CAPACITORS C804 & C806 ARE
METALIZED POLYCARBONATE ± 3%.
.068µF FOR "LOWER" (670 Hz)
.047µF FOR "RAISE" (790 Hz)
.033µF FOR "CONTROL" (920 Hz) RRC-10T ONLY

3 P.C. BOARD 51A5198

4 COMPONENT LAYOUT 20A2118

RRC-10T PBR-30

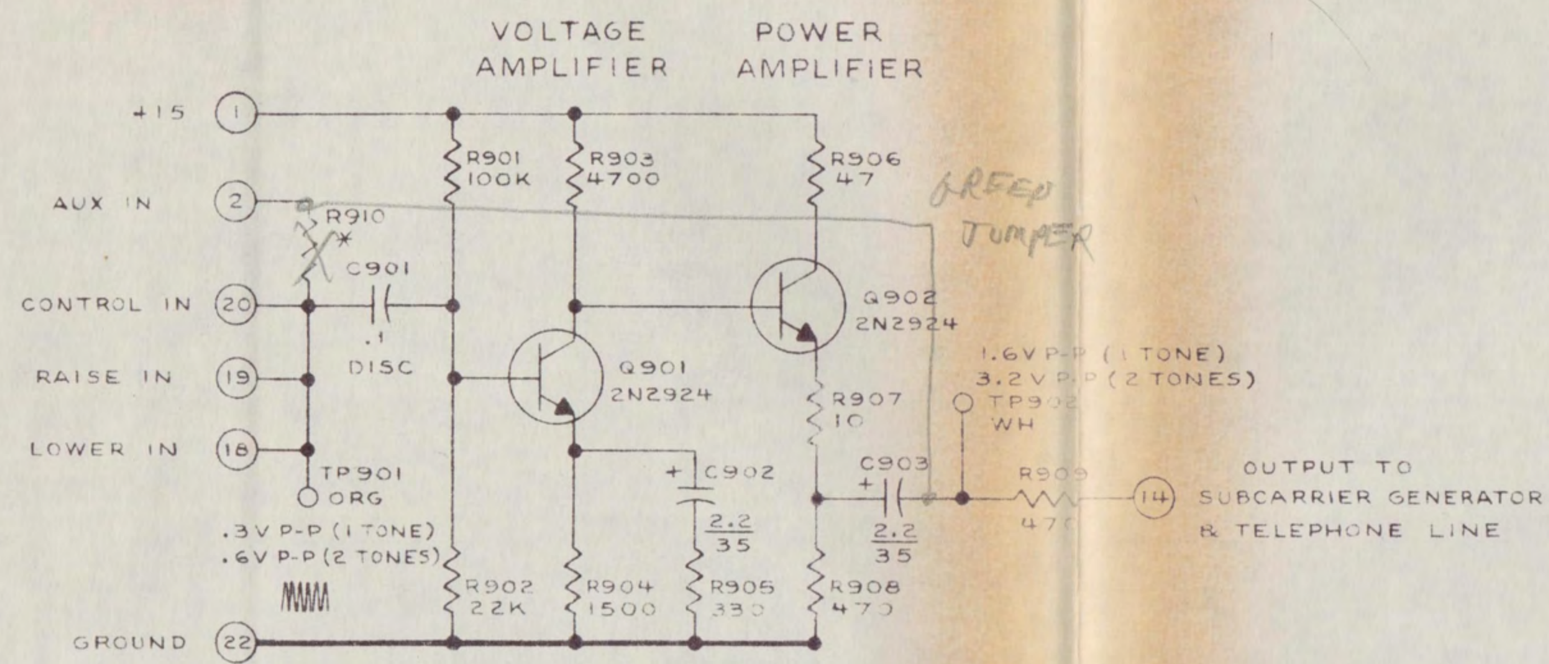
REVISIONS	DATE
D PIN 21 WAS PIN 15	3/70
C ADD CR804 AND PIN 15.	10-69
B ADD RRC-10T JUMPER	9-69
A NOTE 2. ADD .033 FOR RRC-10T	9/69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC - BOARD 8
SCU TONE OSC'S

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	F X Y	2/69	SCALE:
CHK	JCT	6-69	91B6308 D
ENG	JCT	6-69	

Q902 R910 C903 TP902



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 51A5200
3. COMPONENT LAYOUT 20A2120
4. * DENOTES SELECTED VALUE.

RRC-10T, PBR-30

REVISIONS	DATE
A ADD PIN 2 AND R910	10-69

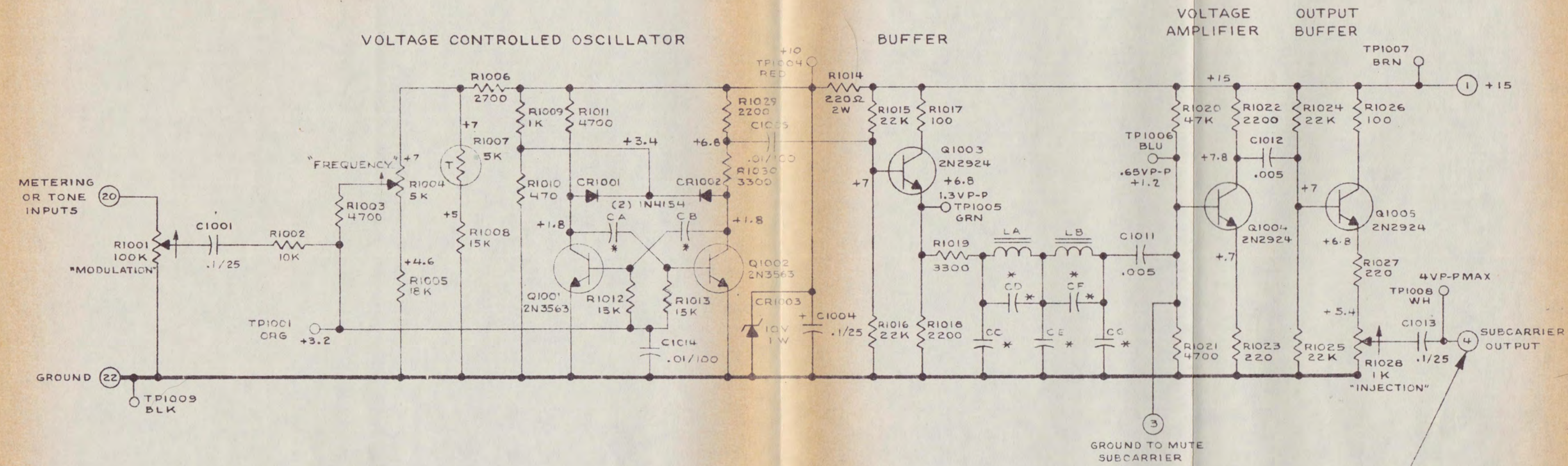
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

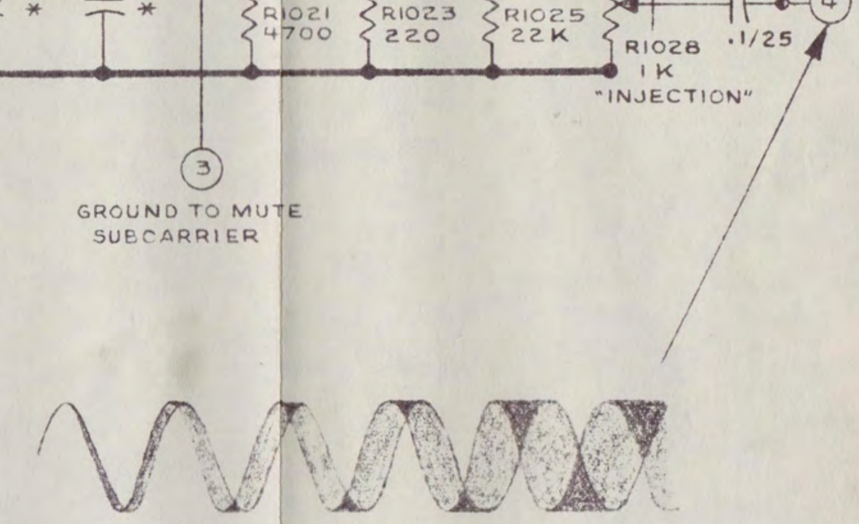
SCHEMATIC - BOARD 9
SCU OUTPUT AMPLIFIER

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	FXY	2/69	SCALE:
CHK			
ENG	JLT	5-69	91B6309 A

Q1005 R1030 C1014 CR1003 L1002 TP1009





NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. P. C. BOARD 51A5201 A
3. COMPONENT LAYOUT 20A2121
4. CA THRU CG, LA AND LB VALUES SHOWN ON DRAWING 94A4501

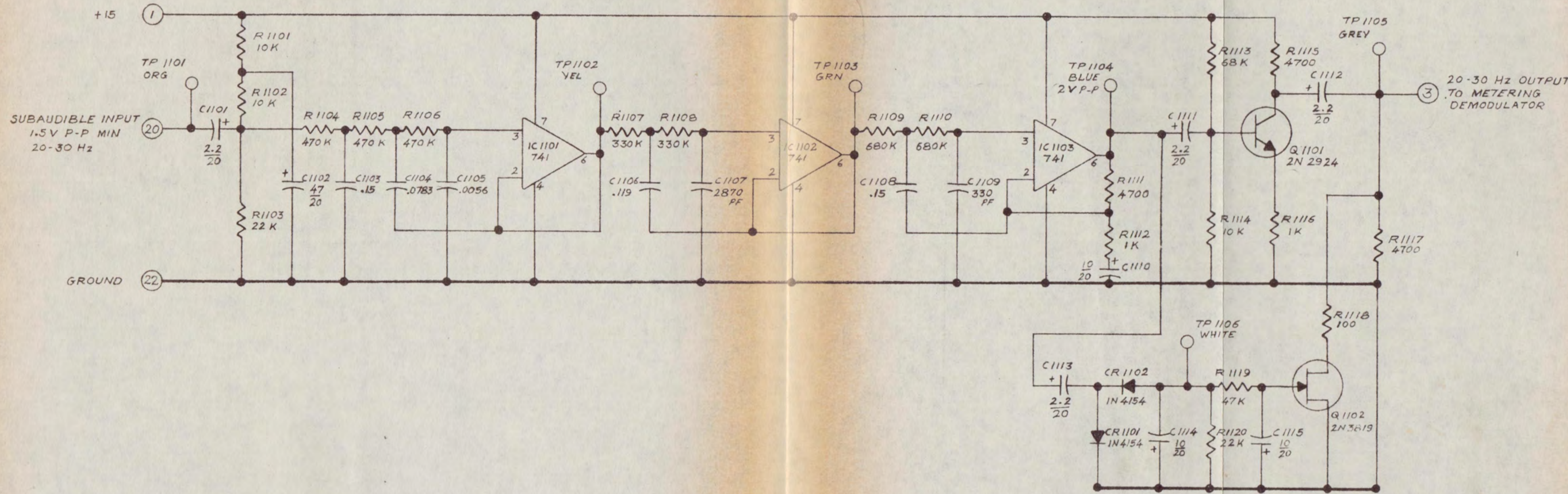
RRC-10T PBR-30

REVISIONS		DATE
D	ADD OUTPUT WAVE-FORM.	11/13/72
C	REVISE * NOTATION PER ECO 232.	3-70
B	CIRCUIT MODIF. PER ECO 309.	1-70
A	OMIT 26 KHz VALUES. CHANGE NOTE 4	7-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC-BOARD 10A
SUBCARRIER GENERATOR

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	FXY	3/69	SCALE:
CHK			91B6310 D
ENG	JCP	5-69	



NOTES:

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

2 P. C. BOARD 51A 5366

3 COMPONENT LAYOUT 20A 2302

PBR-30

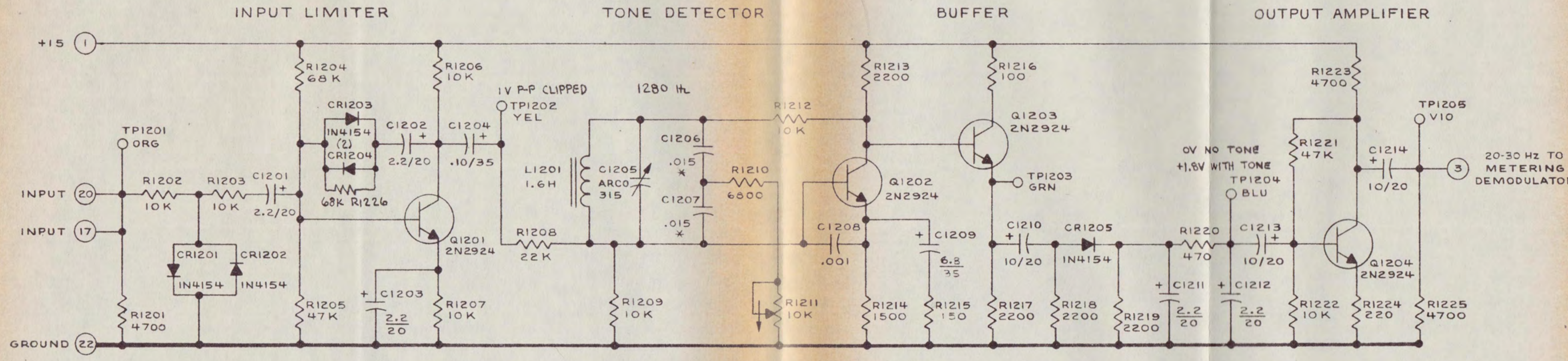
MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

SCHEMATIC BOARD-11
SCU SUBAUDIBLE METERING PROC.

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°			
DWN	[illegible]	12-6-71	SCALE:
CHK	FXY	12/15/71	
ENG	JCT	15 [illegible] 71	91 B 6528

REVISIONS | MGMT. APPR. | DATE

Q1204 R1226 C1214 CR1205 L1201 TP1205



NOTES:

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

2 * C1206 & C1207 ARE METALIZED POLYCARBONATE, ± 3%.

3 P.C. BOARD 51A5202.

4 COMPONENT LAYOUT 20A2122.

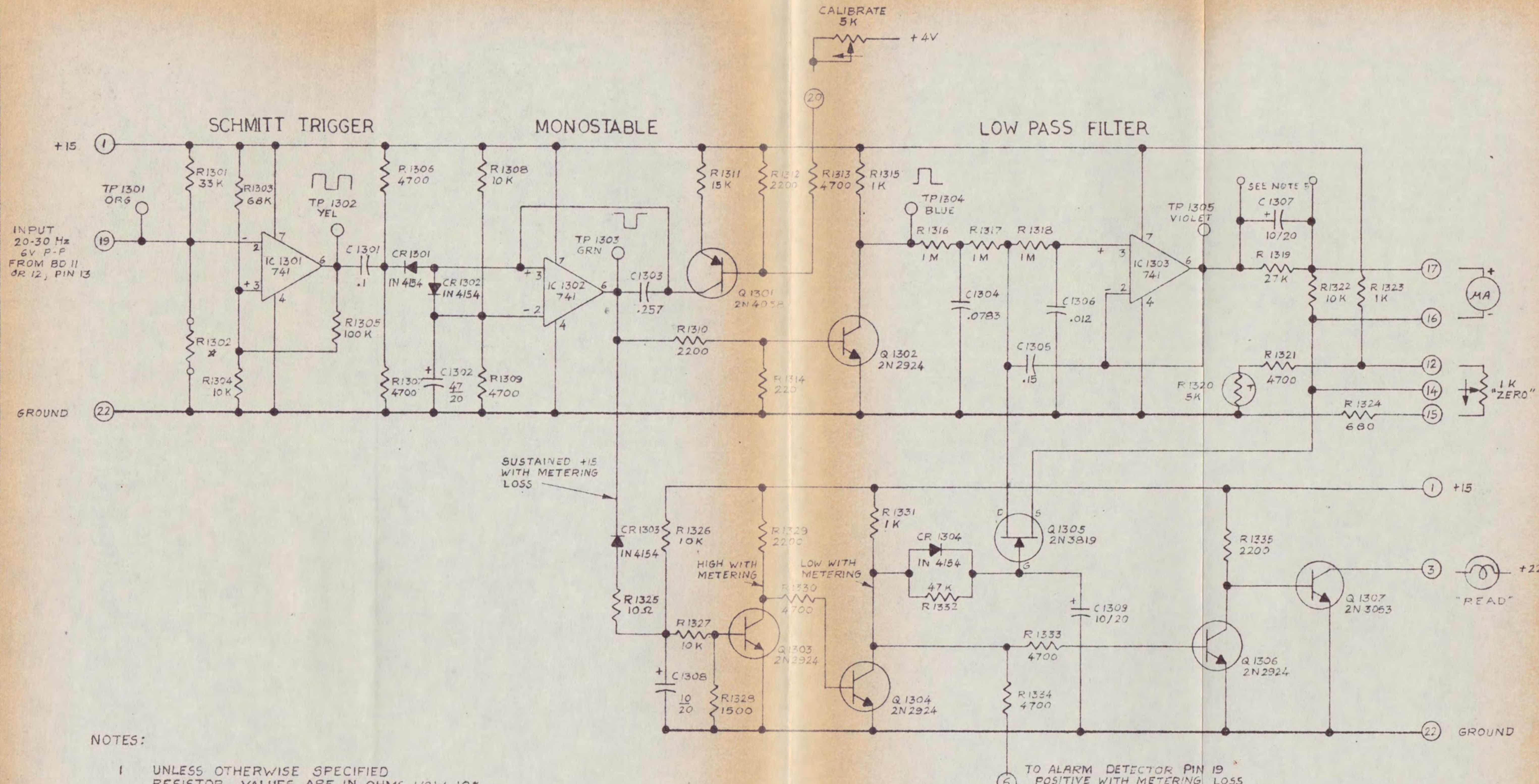
PBR-30

REVISIONS		DATE
B	OUTPUT WAS 22-36 Hz	12/8/71
A	C1209 WAS 2.2 uf, R1215 WAS 220Ω, ECO 384.	9-70

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC-BOARD 12
SCU AUDIBLE METERING PROC

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	F X Y	3/69	SCALE:
CHK			91 B 6312 B
ENG	JCP	5-69	



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 51 A 5370
3. COMPONENT LAYOUT 20 A 2298
4. * DENOTES SELECTED VALUE.
5. OPTIONAL COMPONENT.

PBR 30

REVISIONS		DATE
C	NOTE 5 ADDED ECO 566	9/29/72
B	R1303 WAS SELECTED ECO 549.	7/27/72
A	R1326 WAS 6800. R1328 WAS 1K. R1324 WAS 1500. ECO 542	6/22/72

MGMT. APPR.

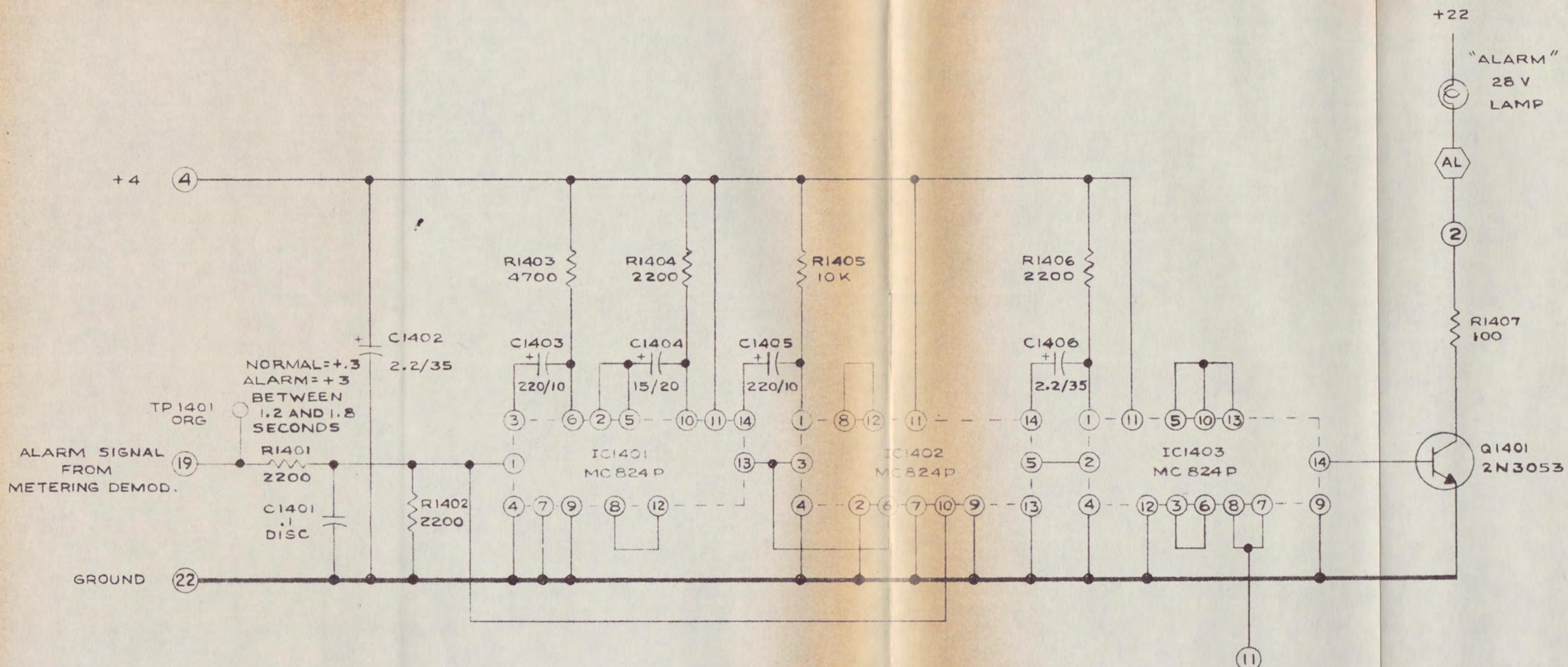
MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

SCHEMATIC BOARD 13
SCU METERING DEMODULATOR

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°

DWN	[illegible]	12-8-71	SCALE:
CHK	FXY	12/15/71	91 B 6529 C
ENG	[illegible]	16 DEC 71	

5/71 DIETERICH-POST CLEARPRINT 1020-8



NOTES :

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%
   CAPACITOR " " " MICROFARADS
2. ⬡ DENOTES TERMINAL ON MOTHER BD.
3. C1402 AND R1403 DETERMINE WINDOW DELAY
4. C1404 AND R1405 " " WIDTH
5. P.C. BOARD 51A5204A
6. COMPONENT LAYOUT 20A2124

PBR-30

REVISIONS	A	REDRAWN FOR CIRCUIT MODIFICATION 10-69

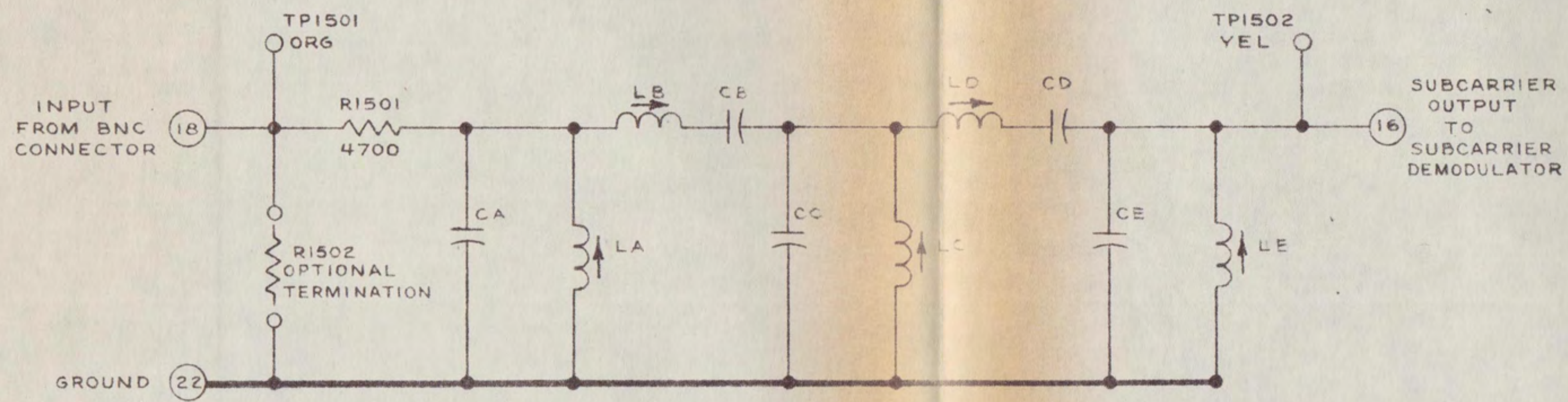
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC - BOARD 14
SCU ALARM DET

TOL. FRACT ± 1/32, XX ± .030, XXX ± .010

DWN	JAG	10-69	SCALE: NONE
CHK	FXY	10/69	91B6314
ENG	JCT	11-69	A

R1502 CE LE TP1502



NOTES:

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

2 COMPONENT VALUES SHOWN ON DWG. 94A4503.

3 P.C. BOARD 51A5214.

4 COMPONENT LAYOUT 20A2134.

PBR-30

REVISIONS	DATE
A REVISE NOTE 2 PER ECO 330.	3-70

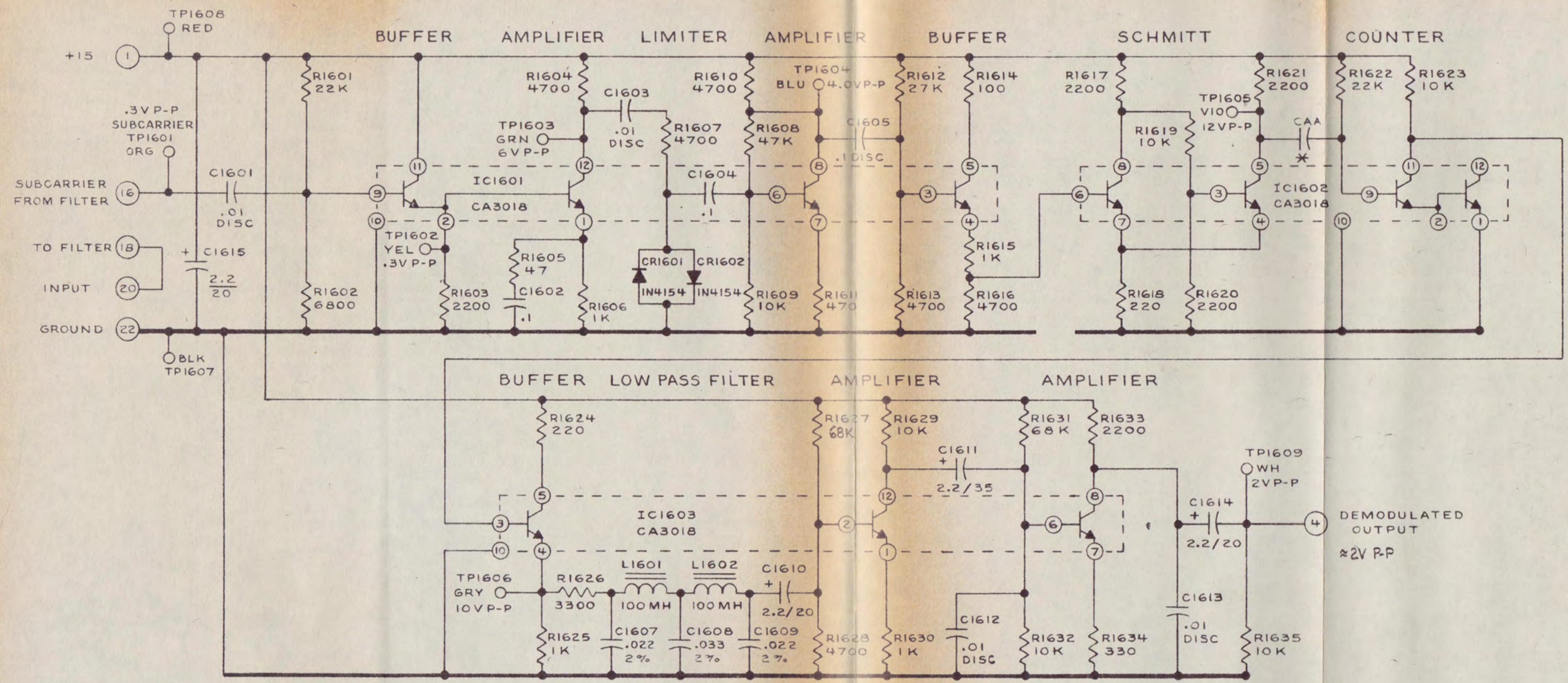
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC - BOARD 15
SUBCARRIER FILTER

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	FXY	3/69	SCALE:
CHK			91B 6315 A
ENG	JCT	5-69	

IC1603 R1635 C1615 CR1602 L1602 TP1609



NOTES:

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

2 ✱ VALUE OF CAA IS GIVEN ON 94A4502

3 P.C. BOARD 51A5212.

4 COMPONENT LAYOUT 20A2132.

PBR-30

A	REVISE NOTE 2 PER ECO 331.	3-70
REVISIONS		DATE

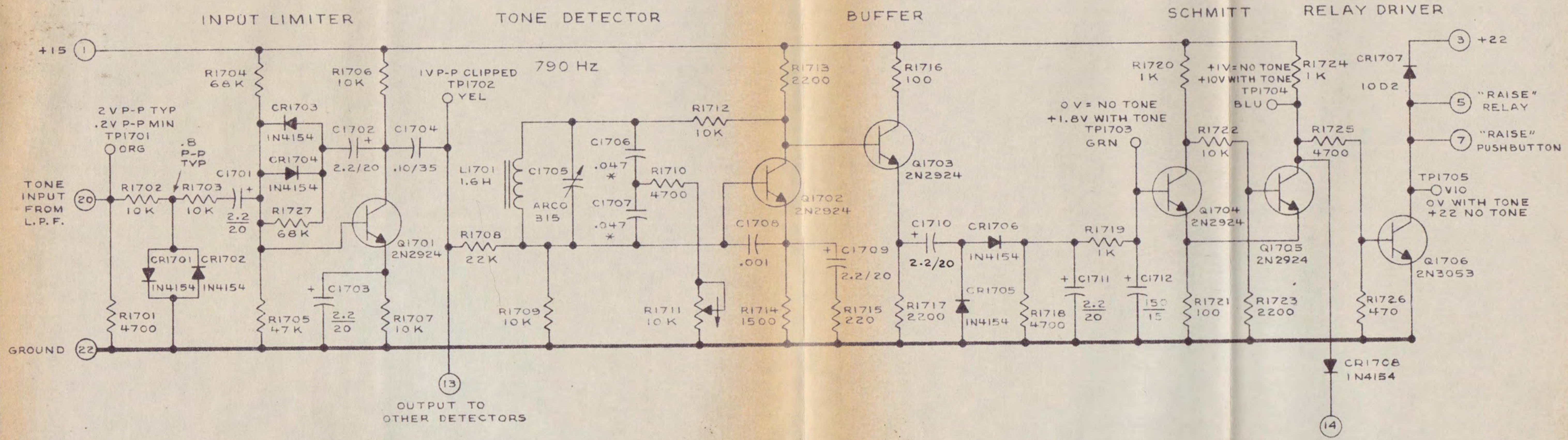
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC-BOARD 16
SUBCARRIER DEMOD

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	FXY	3/69	SCALE:
CHK			
ENG	JCP	5-69	91 B 6316 A

Q1706 R1727 C1712 CR1708 L1701 TP1705



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. * C1706 & C1607 ARE METALIZED POLYCARBONATE ±3%
3. P.C. BOARD 51A5211
4. COMPONENT LAYOUT 20A2131

RRC-10T PBR-30

REVISIONS		DATE
C	C1712 WAS 2.2/20. ECO 450	6/30/71
B	ADD CR1708 AND PIN 14.	10-69
A	C1710 WAS 10/20. ECO 270.	7-69

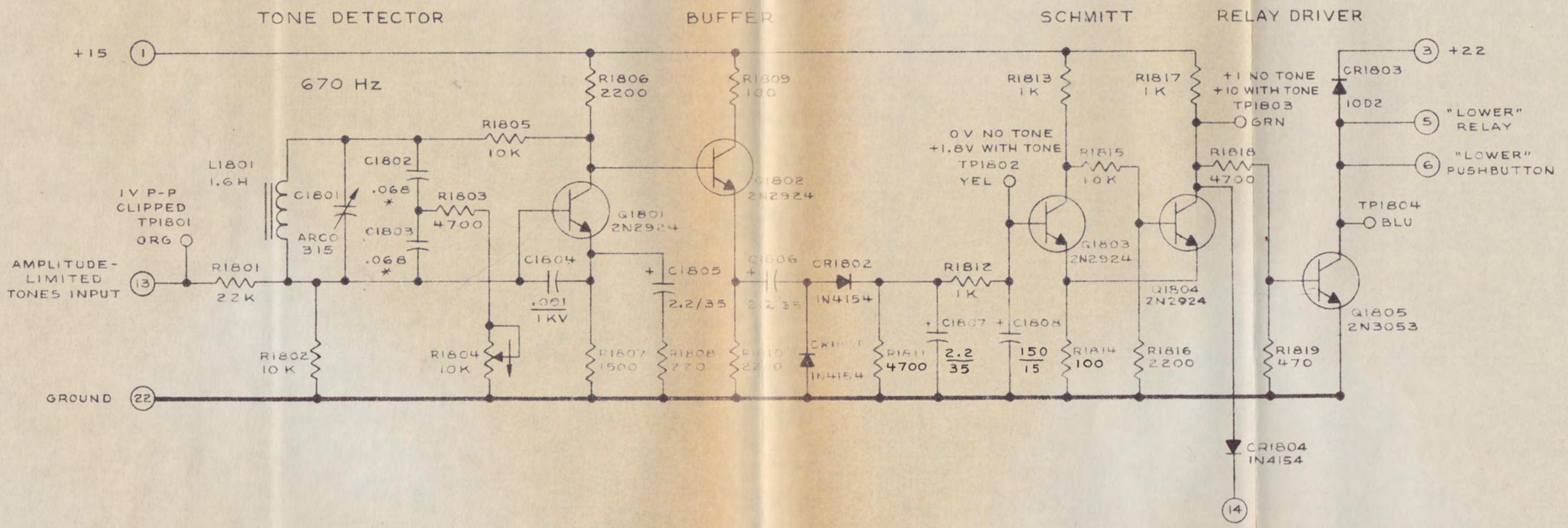
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC-BOARD 17
TCU RAISE DET

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	FXY	3/69	SCALE:
CHK			
ENG	JCT	5-69	91 B 6317 C

Q1805 R1819 C1808 CR1804 L1801 TP1804



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. *C1802 & C1803 ARE METALIZED POLYCARBONATE ±3%.
3. P.C. BOARD 51A5210
4. COMPONENT LAYOUT 20A2130

RRC-10T PBR-30

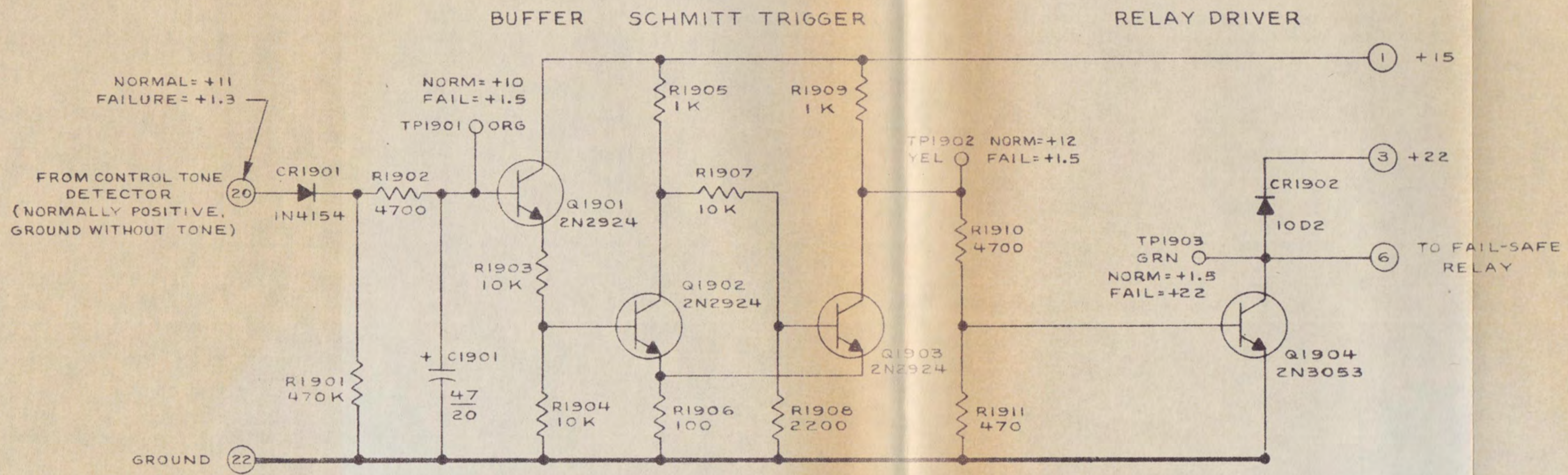
REVISIONS		DATE
C	C1808 WAS 2.2µF ECO 450	6/30/71
B	ADD CR1804 AND PIN 14.	10-69
A	C1806 WAS 15/20 ECO 270	7-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC-BOARD 18
TCU LOWER DET

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	FXY	3/69	SCALE:
CHK			
ENG	JCP	5-69	91 B 6318 C

Q1904 R1911 CR1902 TP1903 C1901



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 51A5209.
3. COMPONENT LAYOUT 20A2129.

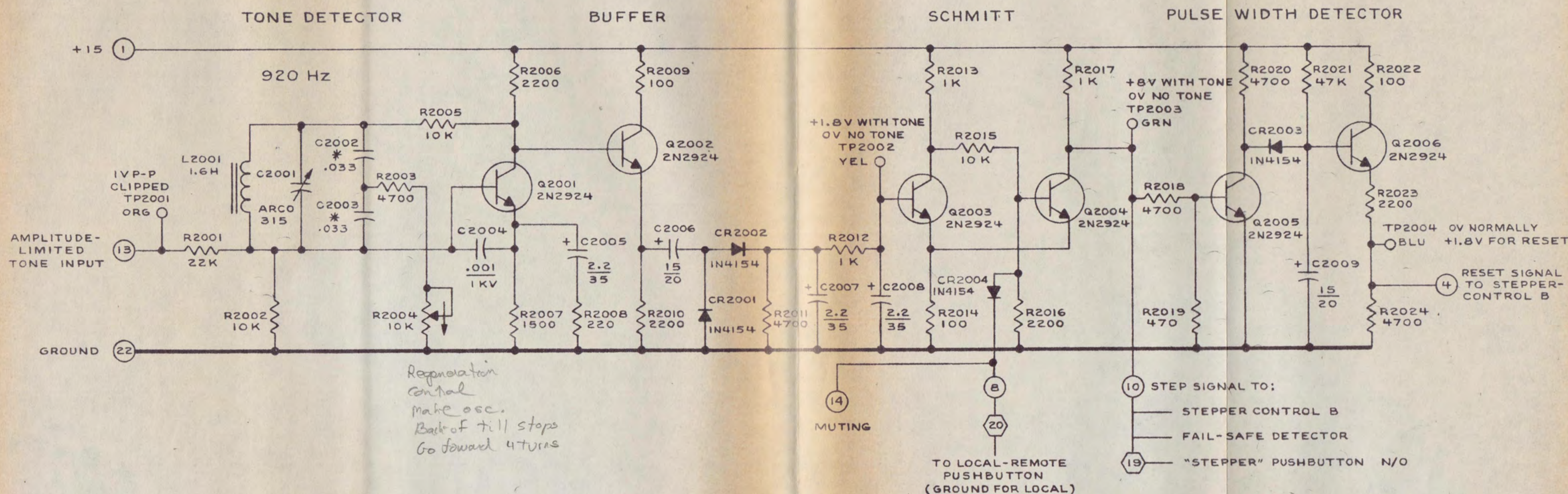
PBR-30

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC - BOARD 19
TCU FAILSAFE

DATE / REVISIONS			
TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	FXY	3/69	SCALE:
CHK			91B 6319
ENG	JCA	5-69	

Q2006 R2024 C2009 L2001 CR2004 TP2004



NOTES:

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

2 ⬡ DENOTES TERMINAL ON MOTHER BOARD.

3 P.C. BOARD 51A5218.

4 COMPONENT LAYOUT 20A2138.

5 * C2002 AND C2003 ARE METALIZED POLYCARBONATE ± 3%

RRC-10T PBR-30

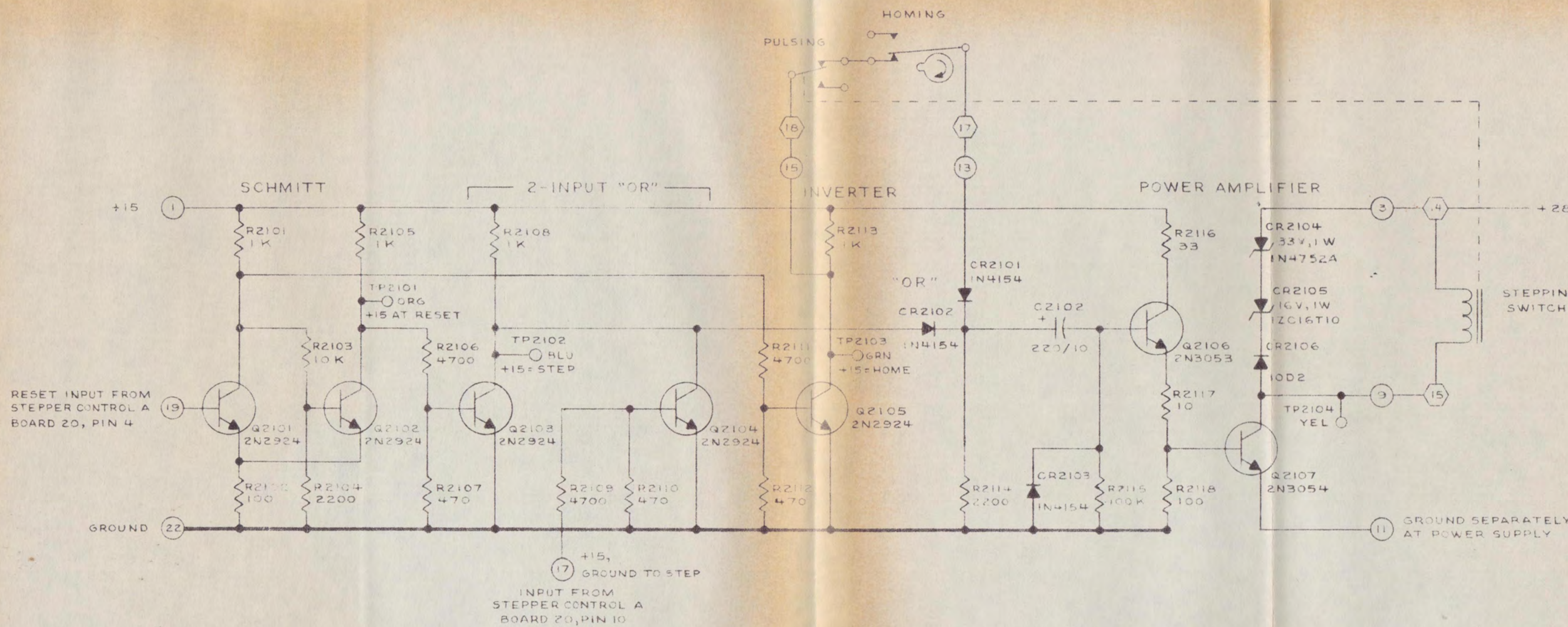
REVISIONS		DATE
B	ADD NOTE 5, ECO 326.	3-70
A	ADD CR2004 AND PIN 14.	10-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC-BOARD 20
TCU STEPPER CONTROL A

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	FXY	3/69	SCALE:
CHK			
ENG	JCP	5-69	91 B 6320 B



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. ⬡ DENOTES TERMINAL ON MOTHER BOARD.
3. P. C. BOARD 51A5216.
4. COMPONENT LAYOUT 20A2136.

PBR-30

REVISIONS	DATE
A DELETE C2101, CR2104 WAS 1ZC10T10. ECO 451	6/30/71

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

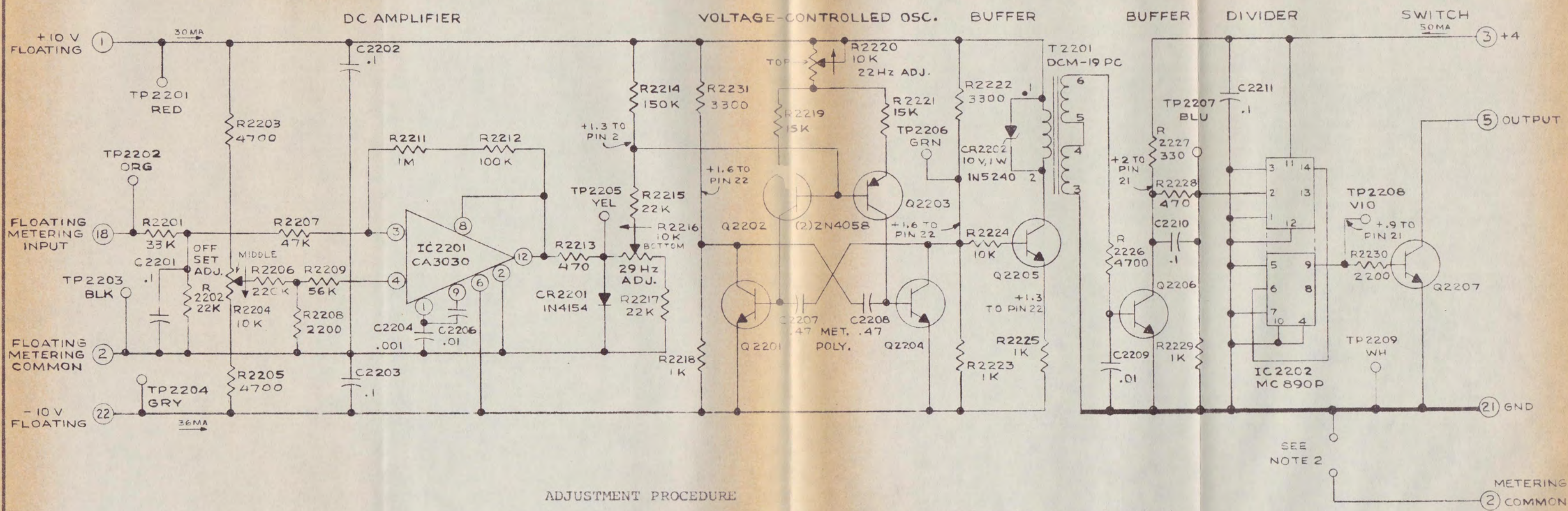
SCHEMATIC-BOARD 21
TCU STEPPER CONTROL B

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010		
DWN	FXY	3/69
CHK		
ENG	JCT	5-69

SCALE:

91 B 6321 A

R2231 Q2207 C2211



ADJUSTMENT PROCEDURE

1) With no input (orange test point connected to black test point), adjust the middle potentiometer for zero volts DC as measured between the black and the yellow test points.

2) At that time, adjust the top potentiometer (R-2220) for an output frequency of 22 Hz as measured at the violet test point. For standard AM broadcast transmitters, adjust for a frequency of 20 Hz.

3) Remove the connection between the orange and black test points. Home the stepping switch to the Calibrate position and adjust the bottom potentiometer (R-2216) for an output frequency of 29 Hz as measured at the violet test point. For standard AM broadcast transmitters, adjust for a frequency of 25 Hz.

NOTES:

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2 W, 10 %
   CAPACITOR " " " MICROFARADS
   TRANSISTORS ARE 2N2924
2. CONNECT ON RRC-10T ONLY OR OLDER EQUIPMENT.
3. P.C. BOARD 51A5213 A
4. COMPONENT LAYOUT 20A2133

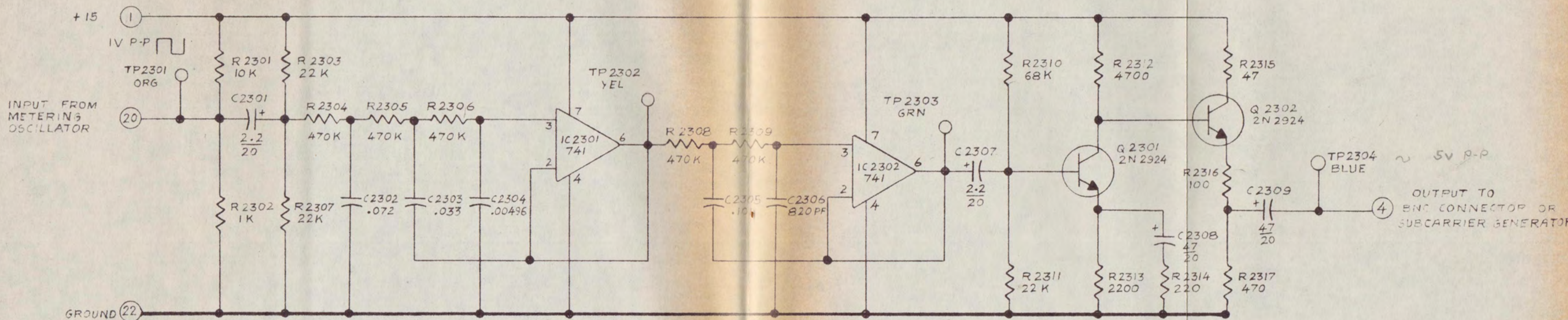
RRC-10T, PBR-30

REVISIONS		DATE
F	REMOVE R2210 & C2205 ECO 498	12/30/71
E	R2221 & R2219 WIREWOUND, R2218 & R2223 WERE 4700. ECO 302.	12-69
D	ECO 299. COMP VALUE CHANGES. ADD TOP, MIDDLE, BOTTOM TO POTS. ADD ADJ. PROCEDURE.	11-69
C	REVISED & REDRAWN	10-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC — BOARD 22
TCU METERING OSC.

TOL FRACT ± 1/32	XX ± .030	XXX ± .010
DWN J A G	10-69	SCALE
CHK F X Y	10/69	91B6322
ENG JCT	11-69	F



NOTES:

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2W, 10%
   CAPACITOR VALUES ARE IN MICROFARADS
2. P.C. BOARD 51 A 5367
3. COMPONENT LAYOUT 20A 2301

PBR-30

REVISIONS	DATE	MGMT. APPR.

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

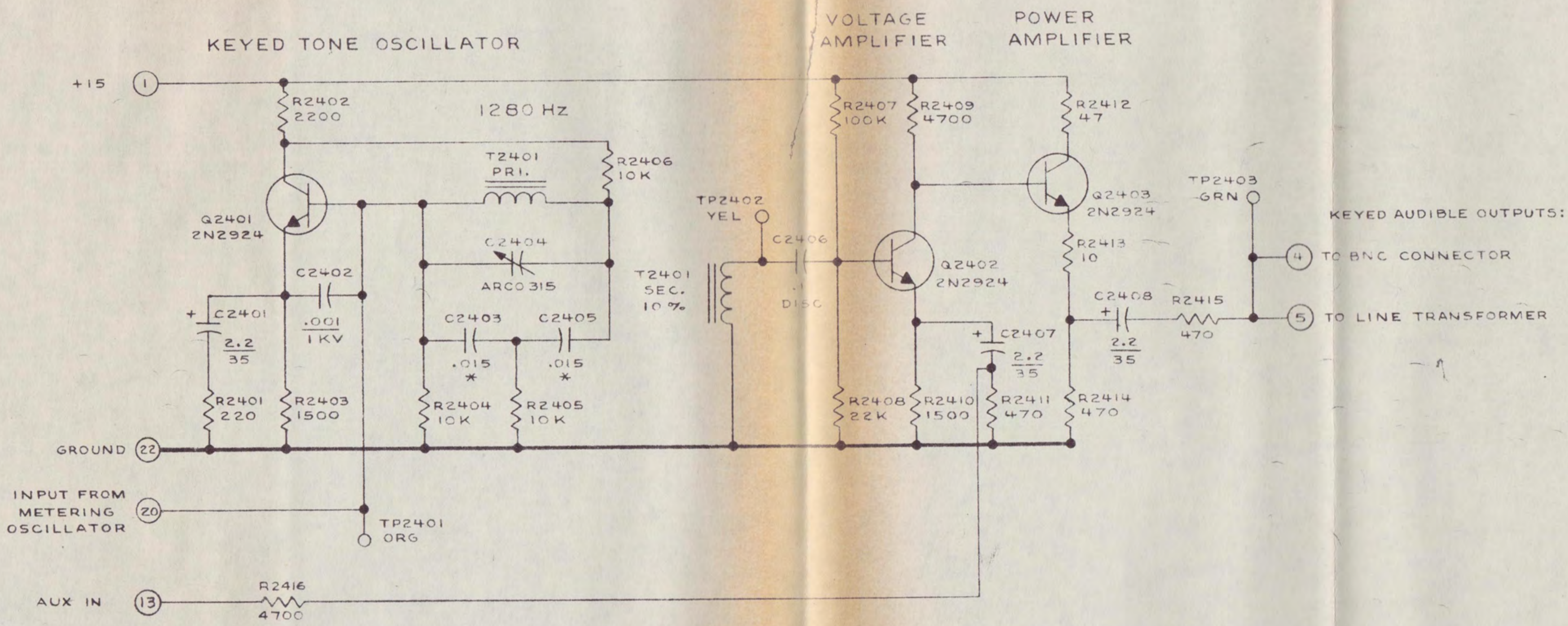
SCHEMATIC - BOARD-23
TCU SUBAUDIBLE METERING PROC

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°

DWN	R.F.	12-7-71	SCALE:
CHK	FXY	12/15/71	
ENG	JCT	16 DEC 71	91 B 6530

5/71 DIETERICH-POST CLEARPRINT 1020-8

Q2403 R2416 C2408 T2401 TP2403



NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS, 1/2, 10% CAPACITOR VALUES ARE IN MICROFARADS.
2. * C2403 & C2405 ARE METALIZED POLYCARBONATE, ± 3%.
3. P. C. BOARD 51A5215
4. COMPONENT LAYOUT 20A2135

RRC-10T, PBR-30

REVISIONS	DATE
A ADD PIN 13 AND R2416.	10-69

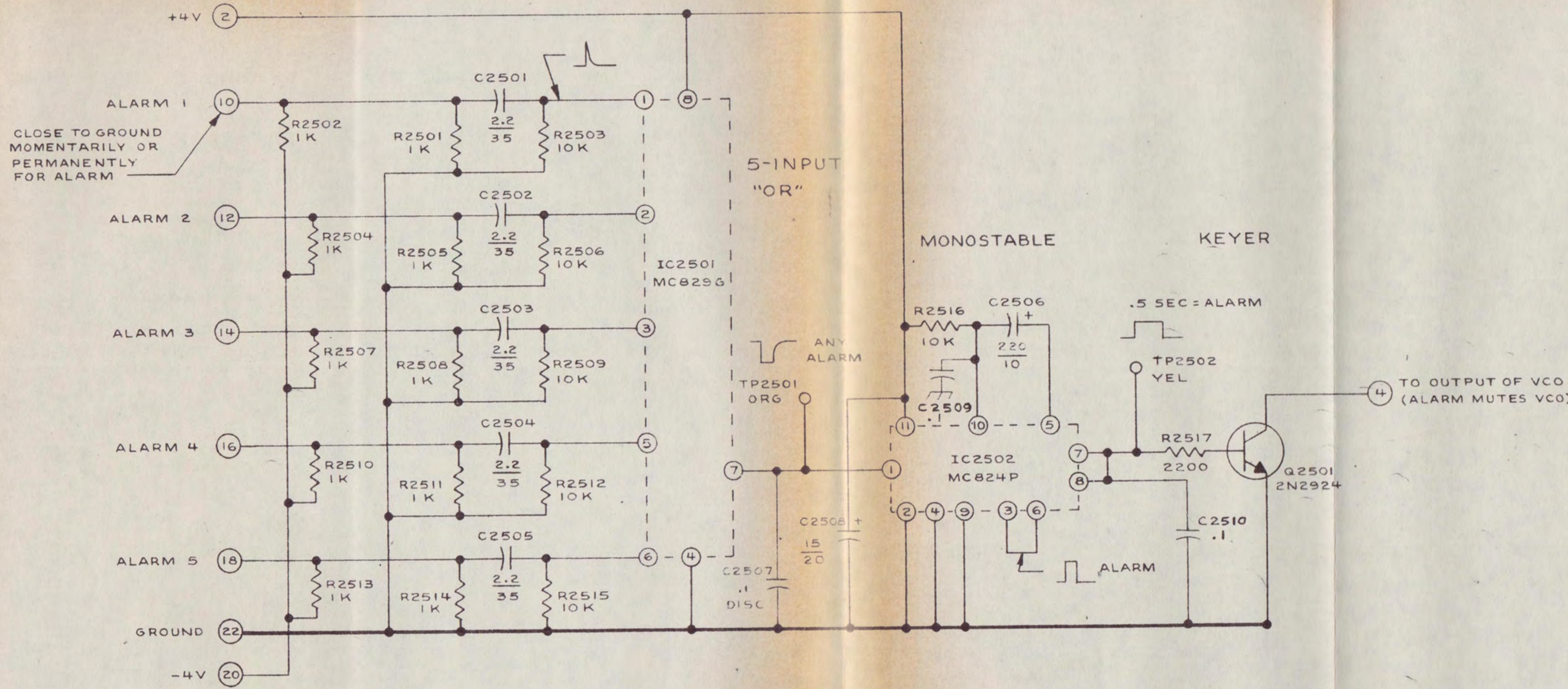
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC - BOARD 24
TCU AUDIBLE METERING PROC.

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	FXY	3/69	SCALE:
CHK			
ENG	JCK	5-69	91 B 6324 A

IC2502 Q2501 R2517 C2510 TP2502



NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS, 1/2W, 10% CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 51A5217.
3. COMPONENT LAYOUT 20A2137.

PBR-30

REVISIONS		DATE
B	C2506 WAS 47/20 ECO 359	7/70
A	ADD C2509 & 2510	10 69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC-BOARD 25
TCU ALARM ENCODER

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	FXY	3/69	SCALE:
CHK			91 B 6325 B
ENG	JCT	5-69	

NOTES

1. THIS BOARD SUBSTITUES FOR A SUBCARRIER GENERATOR OR DEMODULATOR WHEN BNC CONNECTORS ARE USED IN A NON-SUBCARRIER APPLICATION.

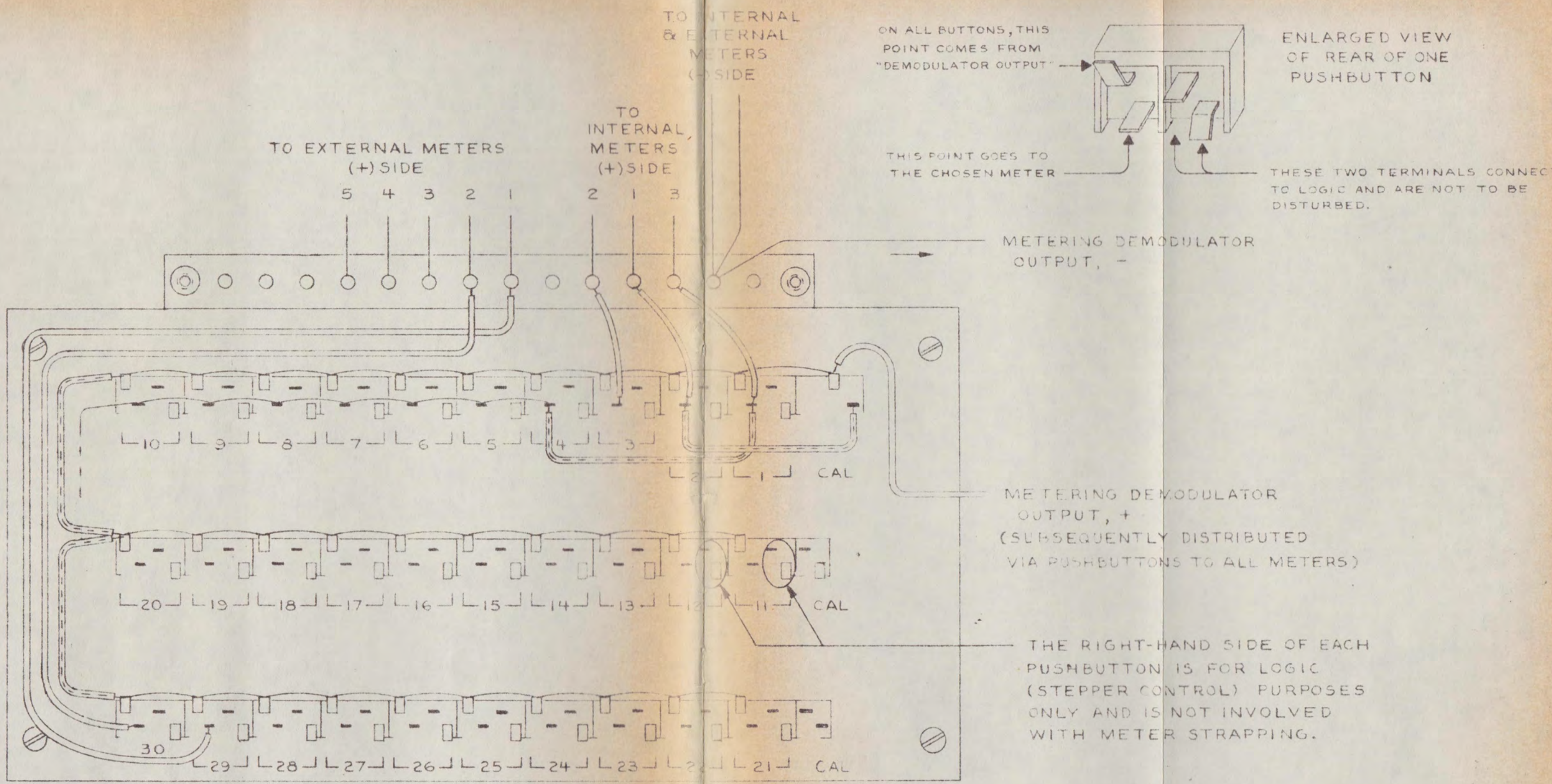
2. P.C. BOARD 51A5206.

PBR-30

MOSELEY ASSOCIATES, INC. SANTA BARBARA, CALIFORNIA	
SCHEMATIC - BOARD 26	
TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010	
DWN FXY 3/69	SCALE:
CHK	91 B 6326
ENG JCP 5-69	

DATE

REVISIONS



IN THIS PARTIAL DRAWING, "CALIBRATE" AND BUTTON 2 GO TO METER 1. 1 AND 4 THRU 28 GO TO METER 3. BUTTON 3 GOES TO METER 2. BUTTON 29 GOES TO EXTERNAL METER 1. BUTTON 30 GOES TO EXTERNAL METER 2.

REVISIONS		
C	ADD JUMPER-CAL TO P.B. 1	12/18/70
B	REVISE CALIB. BUTTON SWITCHES FOR MAXI-SWITCH CONFIGURATION.	2-70
A	DELETE WIRES 6 & 7	7-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

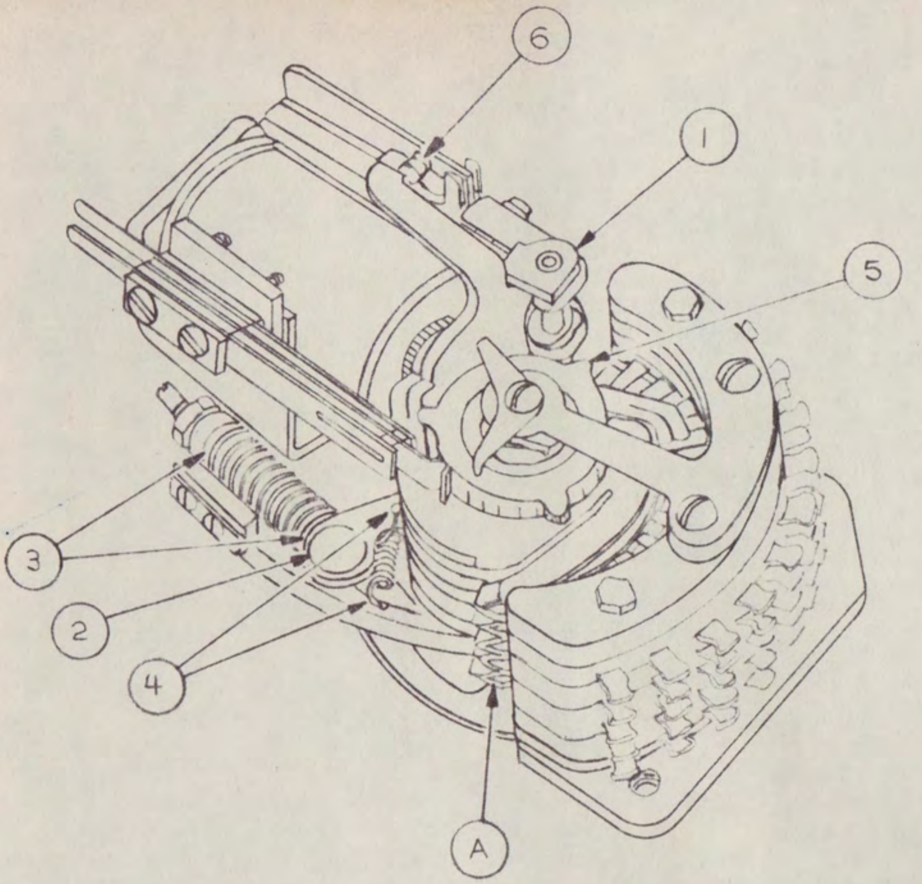
SWITCH FUNCTION GUIDE
PBR-30 PUSHBUTTON SWITCH

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	FXY	4/69
CHK		
ENG		

SCALE: FULL

93 B 1004 C



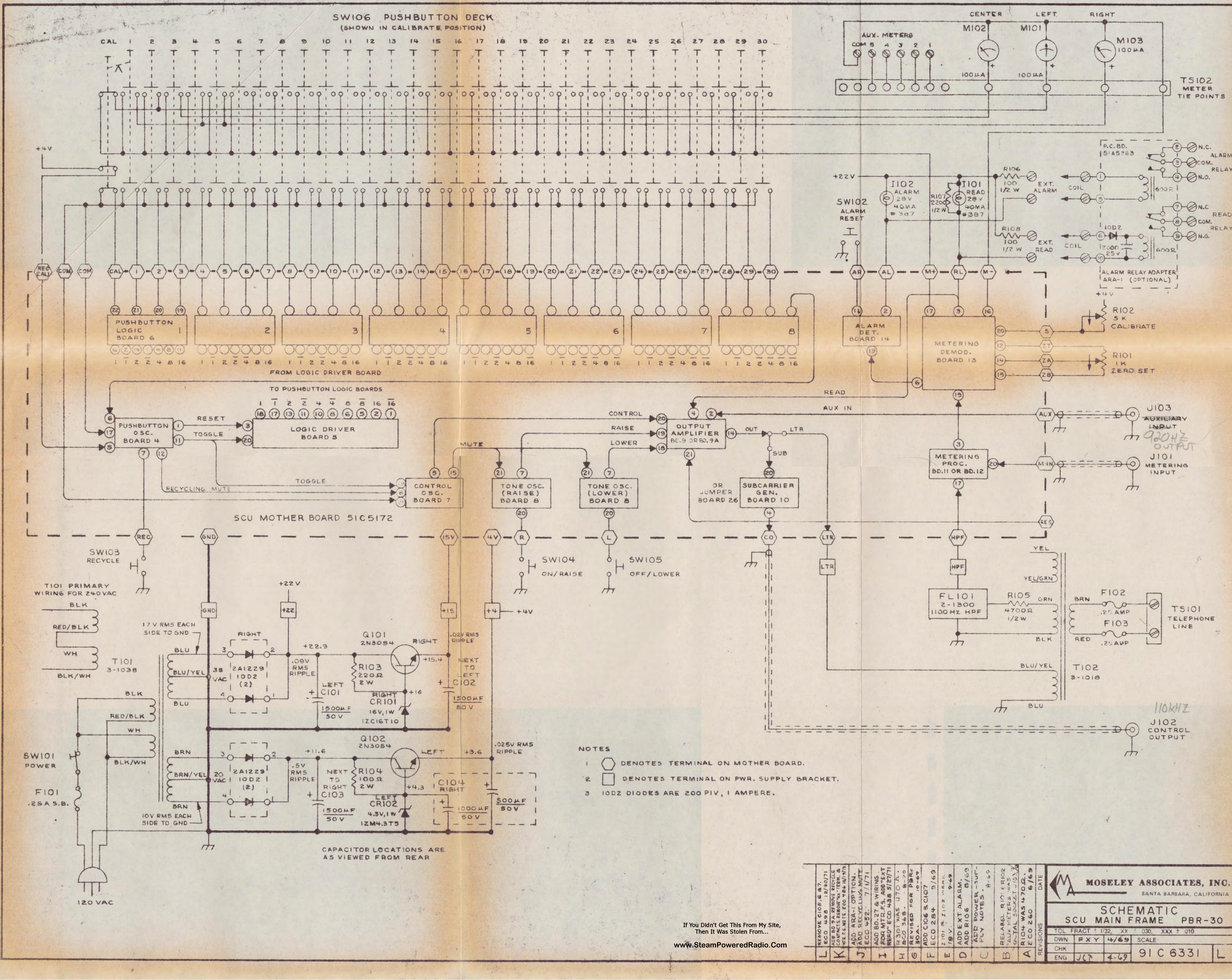
1. Apply one dip of blended lubricating oil to each of the numbered locations.

2. Apply one dip of watch oil to each set of wiper tips as shown at location "A".

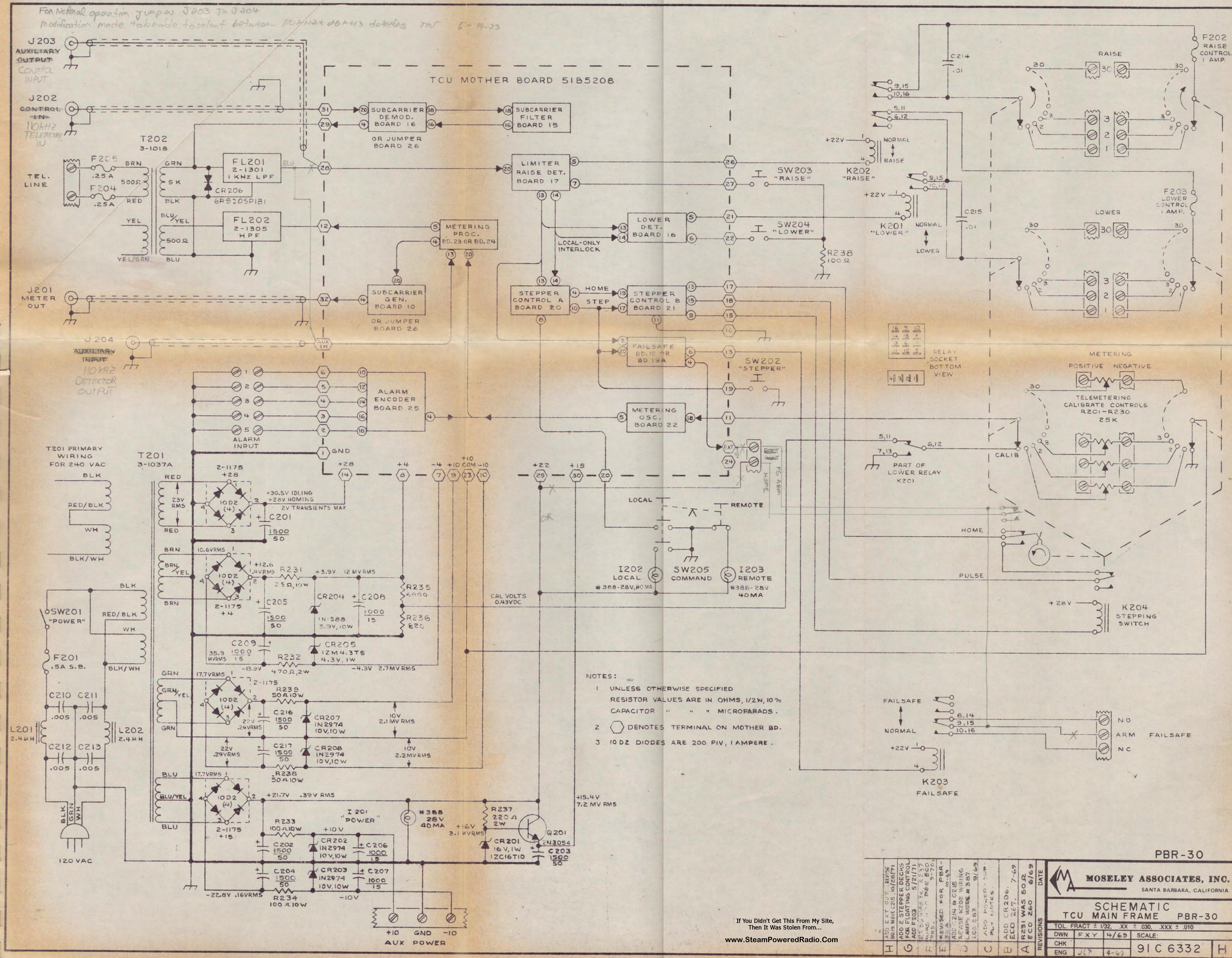
3. Apply two dips of graphite oil lubricant to the ratchet teeth (not shown) while operating the stepping switch.

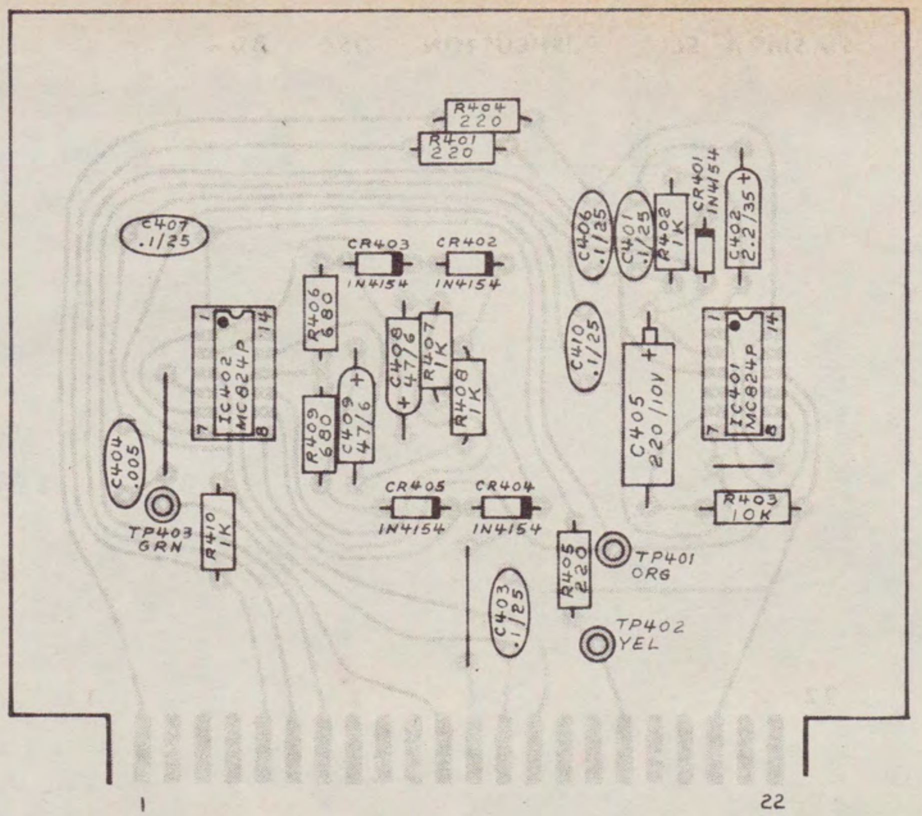
Standard lubrication kit available from Automatic Electric, Northlake, Illinois. Order PD-9100-1.

MOSELEY ASSOCIATES, INC. SANTA BARBARA, CALIFORNIA	
LUBRICATION INSTRUCTIONS FOR STEPPING SWITCH	
DWN FXY 4-66	SKA 6142
CHK 4-66	



SW106 PUSHBUTTON DECK
(SHOWN IN CALIBRATE POSITION)
CAL 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
AUX. METERS
COM 5 4 3 2 1
CENTER M102
LEFT M101
RIGHT M103 100µA
100µA
100µA
TS102 METER TIE POINTS
+4V
+22V
SW102 ALARM RESET
I102 ALARM 28V 40MA #387
R107 220Ω 1/2 W
I101 READ 28V 40MA #387
R106 100 1/2 W
EXT. ALARM
R108 100 1/2 W
EXT. READ
P.C. BD. 51A5363
COIL
600Ω
N.C.
COM.
N.O.
ALARM RELAY
READ RELAY
1002
1200Ω
25V
ALARM RELAY ADAPTER ARA-1 (OPTIONAL)
REC CAL
COM
AR
AL
M+
RL
M-
PUSHBUTTON LOGIC BOARD 6
FROM LOGIC DRIVER BOARD
ALARM DET. BOARD 14
METERING DEMOD. BOARD 13
R102 5K CALIBRATE
R101 1K ZERO SET
TO PUSHBUTTON LOGIC BOARDS
PUSHBUTTON OSC. BOARD 4
RESET
TOGGLE
LOGIC DRIVER BOARD 5
READ
AUX IN
CONTROL
RAISE
LOWER
MUTE
OUTPUT AMPLIFIER BD.9 OR BD.9A
OUT
LTR
SUB
AUX
J103 AUXILIARY INPUT
920HZ OUTPUT
METERING PROC. BD.11 OR BD.12
M-IN
J101 METERING INPUT
RECYCLING MUTE
CONTROL OSC. BOARD 7
TONE OSC. (RAISE) BOARD 8
TONE OSC. (LOWER) BOARD 8
OR JUMPER BOARD 26
SUBCARRIER GEN. BOARD 10
RES
SCU MOTHER BOARD 51C5172
REC
GND
15V
4V
R
L
CO
LTR
HPF
SW103 RECYCLE
SW104 ON/RAISE
SW105 OFF/LOWER
YEL
YEL/GRN
FL101 2-1300 1100 HZ HPF
R105 4700Ω 1/2W
GRN
BLK
BRN
RED
F102 .25 AMP
F103 .25 AMP
TS101 TELEPHONE LINE
BLU/YEL
T102 3-1018
BLU
110KHZ
J102 CONTROL OUTPUT
T101 PRIMARY WIRING FOR 240VAC
BLK
RED/BLK
WH
BLK/WH
T101 3-1038
17V RMS EACH SIDE TO GND
BLU
BLU/YEL
35 VAC
2A1229 1002 (2)
RIGHT
+22.9
.09V RMS RIPPLE
Q101 2N3054
R103 220Ω 2W
LEFT C101
1500µF 50V
RIGHT CR101 16V,1W 1ZC16T10
+15.4
+16
.02V RMS RIPPLE
NEXT TO LEFT C102
1500µF 50V
+4V
SW101 POWER
F101 .25A S.B.
BRN
BRN/YEL
20 VAC
10V RMS EACH SIDE TO GND
+11.6
.5V RMS RIPPLE
Q102 2N3054
NEXT TO RIGHT C103
R104 100Ω 2W
1500µF 50V
LEFT CR102 4.3V,1W 1ZM4.3T5
+3.6
+4.3
.025V RMS RIPPLE
C104 RIGHT
1000µF 50V
500µF 50V
120 VAC
CAPACITOR LOCATIONS ARE AS VIEWED FROM REAR
NOTES
1 DENOTES TERMINAL ON MOTHER BOARD.
2 DENOTES TERMINAL ON PWR. SUPPLY BRACKET.
3 1002 DIODES ARE 200 PIV, 1 AMPERE.
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA
SCHEMATIC
SCU MAIN FRAME PBR-30
DWN FXY 4/69
ENG 4-69
91C6331 L
REVISIONS


For normal operation jumper J203 to J204
modification made to enable to select between 110KHz & 26A43 detectors JMV 6-19-73
J203
AUXILIARY OUTPUT
CONTROL INPUT
J202
CONTROL IN
110KHZ TELEMETRY IN
J201
METER OUT
J204
AUXILIARY INPUT
110KHZ DETECTOR OUTPUT
TEL. LINE
F205 .25A
F204 .25A
T202 3-1018
FL201 2-1301 1 KHz LPF
FL202 2-1305 HPF
CR206 6RS20SP1B1
TCU MOTHER BOARD 51B5208
SUBCARRIER DEMOD. BOARD 16
OR JUMPER BOARD 26
SUBCARRIER FILTER BOARD 15
LIMITER RAISE DET. BOARD 17
LOWER DET. BOARD 18
LOCAL-ONLY INTERLOCK
METERING PROC. BD. 23 OR BD. 24
SUBCARRIER GEN. BOARD 10
OR JUMPER BOARD 26
STEPPER CONTROL A BOARD 20
HOME
STEP
STEPPER CONTROL B BOARD 21
FAILSAFE BD. 19 OR BD 19A
ALARM ENCODER BOARD 25
ALARM INPUT
METERING OSC. BOARD 22
SW203 "RAISE"
SW204 "LOWER"
SW202 "STEPPER"
R238 100Ω
K202 "RAISE"
K201 "LOWER"
C214 .01
C215 .01
F202 RAISE CONTROL 1 AMP.
F203 LOWER CONTROL 1 AMP.
RAISE
LOWER
NORMAL
RELAY SOCKET BOTTOM VIEW
METERING
POSITIVE NEGATIVE
TELEMETERING CALIBRATE CONTROLS R201-R230 2.5K
CALIB
PART OF LOWER RELAY K201
LOCAL
REMOTE
I202 LOCAL #388-28V, 40MA
SW205 COMMAND
I203 REMOTE #388-28V 40MA
HOME
PULSE
K204 STEPPING SWITCH
CAL VOLTS 0.43VDC
T201 PRIMARY WIRING FOR 240 VAC
T201 3-1037A
2-1175 +28
+30.5V IDLING
+28V HOMING
2V TRANSIENTS MAX
C201 1500 50
R231 2.5Ω, 10W
CR204 1N1588 3.9V, 10W
C208 1000 15
R235 5600
R236 820
C205 1500 50
C209 1000 15
CR205 1ZM4.3T5 4.3V, 1W
R232 470Ω, 2W
SW201 "POWER"
F201 .5A S.B.
C210 .005
C211 .005
L201 2.4μH
L202 2.4μH
C212 .005
C213 .005
120 VAC
R239 50Ω 10W
C216 1500 50
CR207 1N2974 10V, 10W
C217 1500 50
CR208 1N2974 10V, 10W
R238 50Ω 10W
R233 100Ω 10W
C202 1500 50
CR202 1N2974 10V, 10W
C206 1000 15
C204 1500 50
CR203 1N2974 10V, 10W
C207 1000 15
R234 100Ω 10W
I201 "POWER" #388 28V 40MA
R237 220Ω 2W
CR201 16V, 1W 1ZC16T10
Q201 2N3054
C203 1500 50
+10 GND -10
AUX POWER
NOTES:
1 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10%. CAPACITOR " " " MICROFARADS.
2 DENOTES TERMINAL ON MOTHER BD.
3 10D2 DIODES ARE 200 PIV, 1 AMPERE.
FAILSAFE
NORMAL
K203 FAILSAFE
NO ARM NC
PBR-30
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA
SCHEMATIC
TCU MAIN FRAME PBR-30
DWN FXY 4/69
91 C 6332 H



NOTES:

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

2. P.C. BD. 51A5169.
3 SCHEMATIC 91B6304.

PBR-30

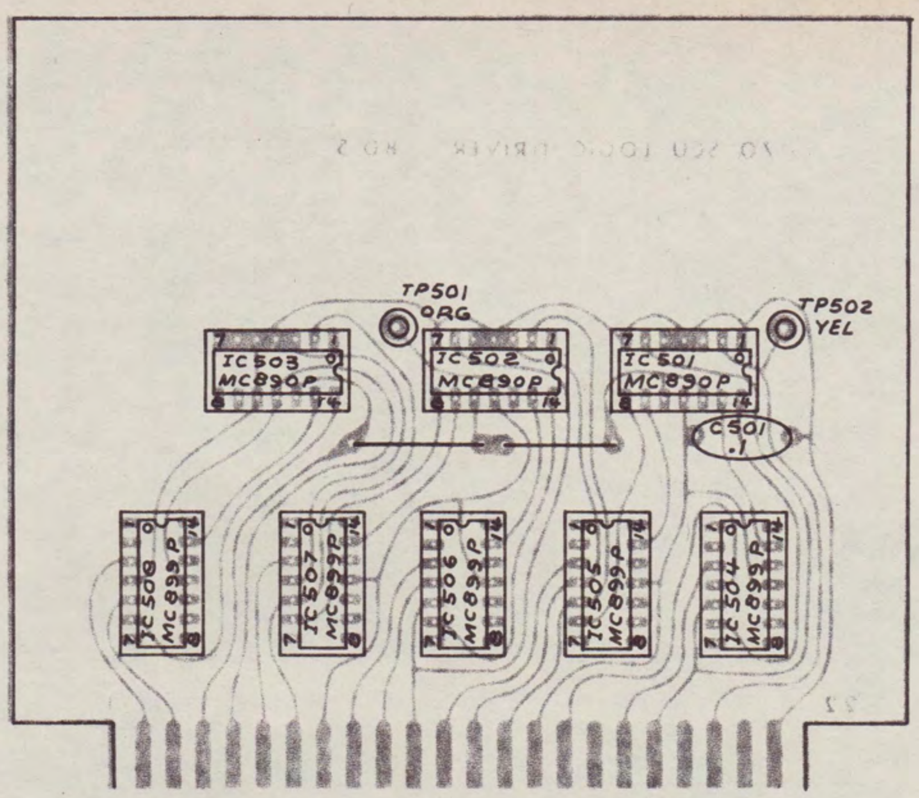
REVISIONS	DATE
B	ADD JUMPER TO PIN 12 R403 WAS 8200 ECO 4-5452 6/30/71

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD-4
SCU PUSHBUTTON OSC.

TOL. FRACT ± 1/32 XX ± .030, XXX ± .010			
DWN	F X Y	1/25/71	SCALE: FULL
CHK			20A2109 B
ENG	JCP	1 JUL 71	

www.SteamPoweredRadio.Com



NOTES:

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

2 P.C. BD. 51A5170

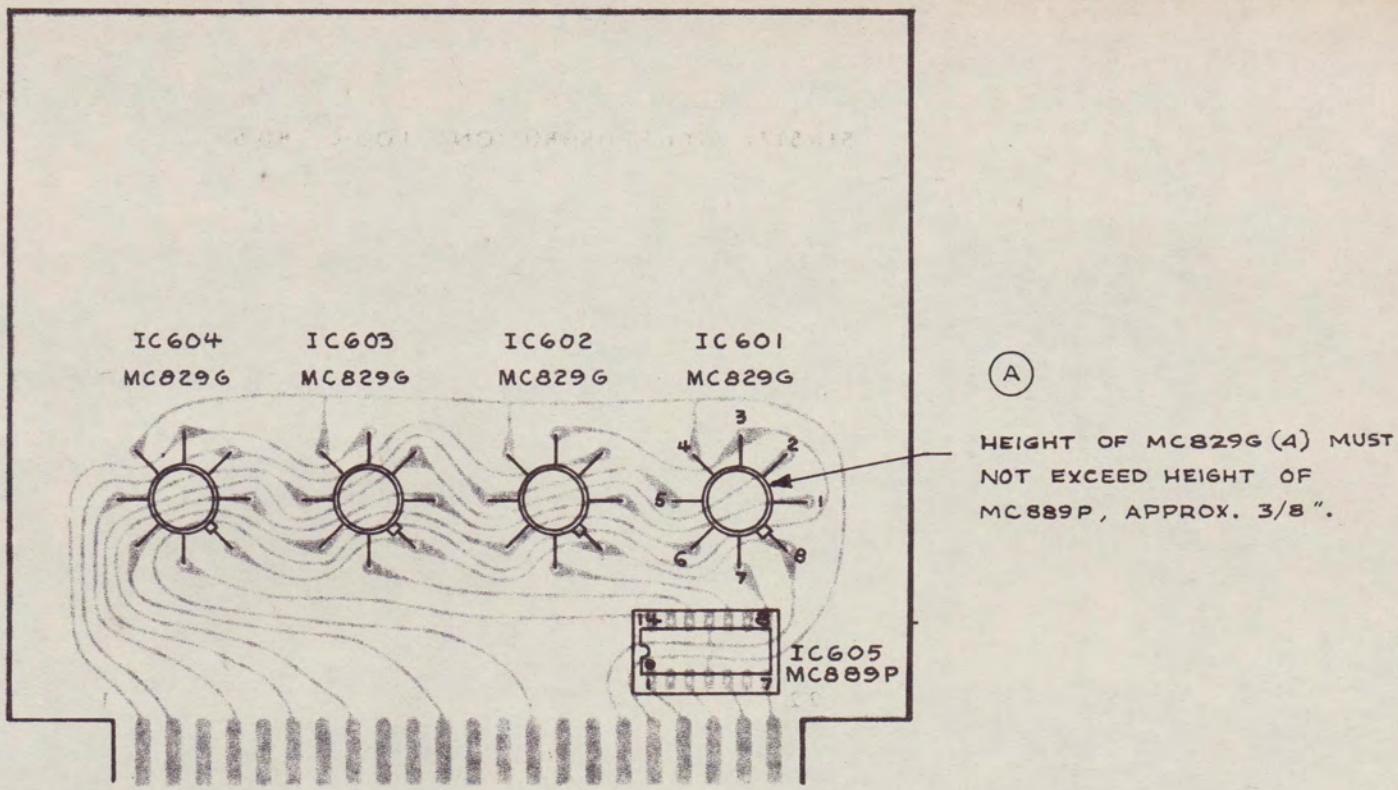
3 SCHEMATIC 91B6305

PBR-30

MOSELEY ASSOCIATES, INC. SANTA BARBARA, CALIFORNIA			
COMPONENT LAYOUT-BOARD 5 SCU LOGIC DRIVER			
TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	F X Y	5/69	SCALE: FULL
CHK	JCT	5-69	20 A 2110
ENG	JCT	5-69	

DATE

REVISIONS



NOTES:

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

2 P.C. BOARD 51A5171.

3 SCHEMATIC 91B6306

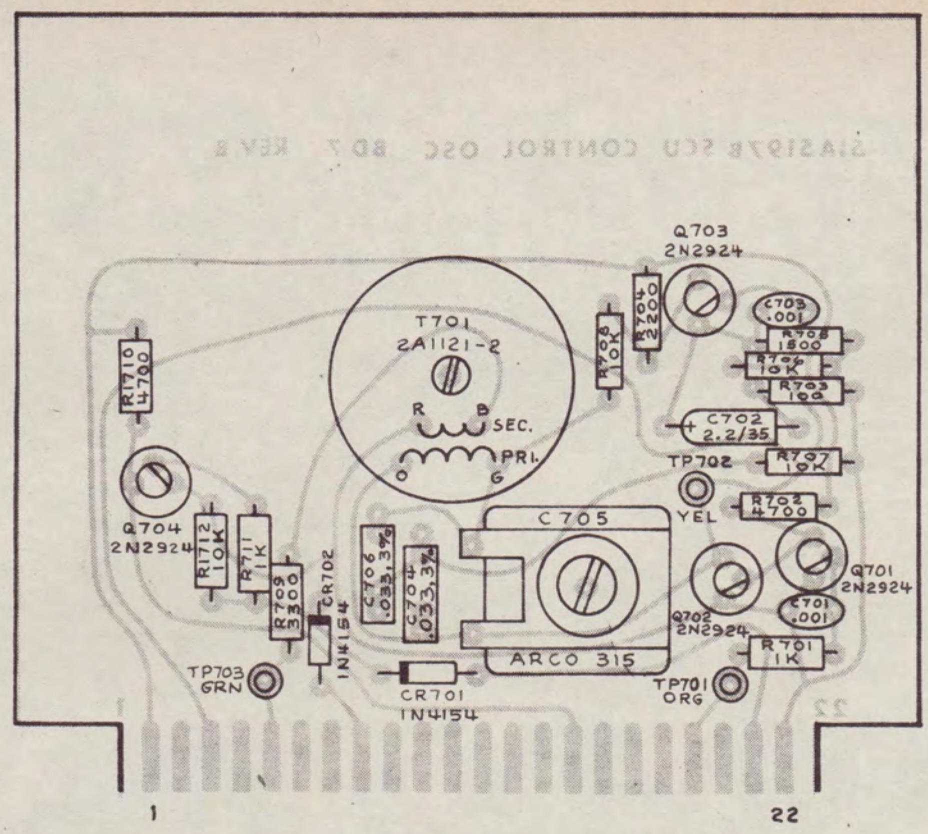
PBR-30

REVISIONS	DATE
A NOTE (A) ADDED	

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 6
SCU PUSHBUTTON LOGIC

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	FXY	5/69	SCALE: FULL
CHK	JCT	5-69	20A2111 A
ENG	JCT	5-69	



NOTES:

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

2 P.C. BOARD 51A5197A

3 SCHEMATIC 91B6307

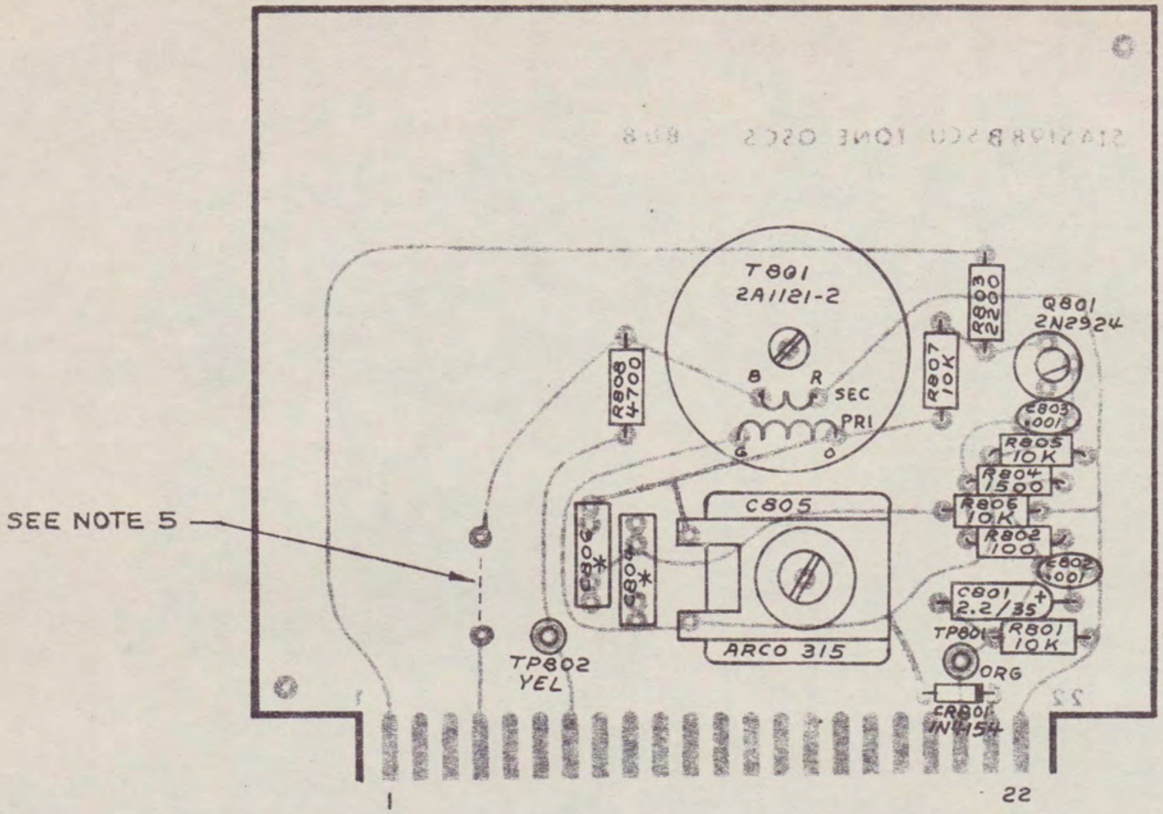
PBR-30

REVISIONS		DATE
C	R709 WAS 2200. ECO 496	12/29/71
B	ADD CR701, 702 & R712. R709 WAS 4700. ECO 449 & 452	6/30/71

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD-7
SCU CONTROL OSC.

TOL. FRACT ± 1/32, XX ± .030, XXX ± .010			
DWN	F X Y	1/25/71	SCALE: FULL
CHK			20A2117 C
ENG	JLT	1 JUL 71	



NOTES:

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

2 * C804 & C806 ARE METALIZED POLYCARBONATE ±3%
.068 μf FOR "LOWER" (670 Hz)
.047 μf FOR "RAISE" (790 Hz)
.033 μf FOR "CONTROL" (920 Hz) RRC-10T ONLY

3 P.C. BD. 51A5198.

4 SCHEMATIC 91B6308.

5 ADD JUMPER FOR RRC-10T CONTROL BD ONLY.

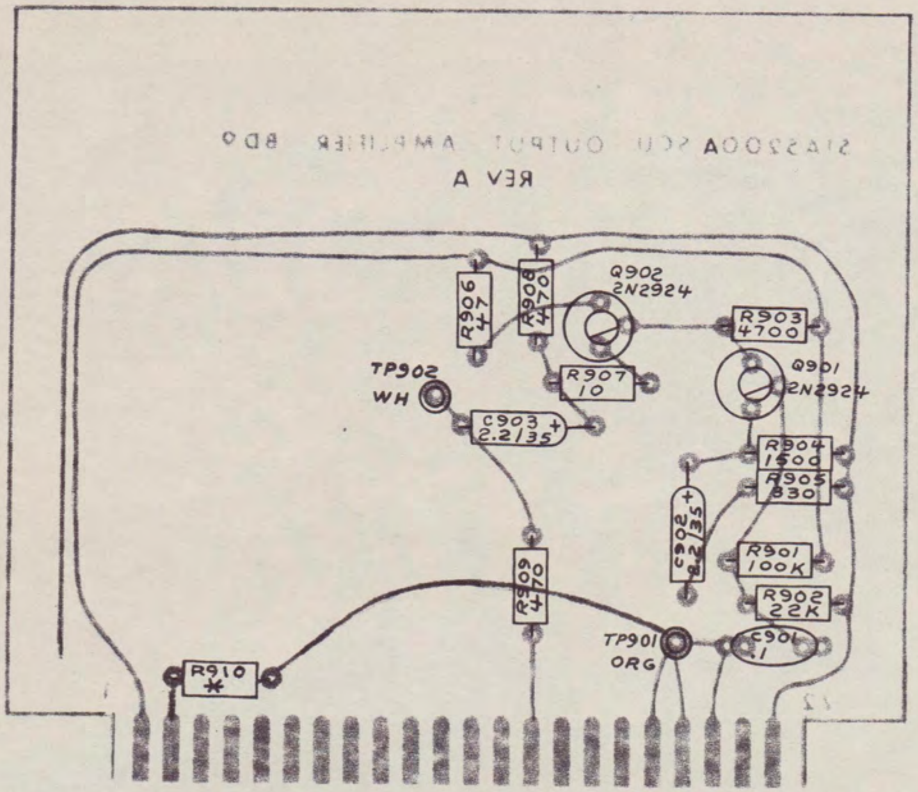
RRC-10T PBR-30

REVISIONS	DATE
D CR801 WAS TO PIN 15 NEW ARTWORK	3/70
C ADD CR801 AND IT'S CIRCUITRY.	11-69
B ADD RRC-10T JUMPER, NOTE 5.	9-69
A NOTE 2 ADD .033 FOR RRC-10T	9/69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 8
SCU TONE OSC'S

TOL. FRACT ± 1/32, XX ± .030, XXX ± .010		
DWN FXY	5/69	SCALE: FULL
CHK		20 A 2118 D
ENG	5-69	



NOTES
1 P.C. BD 51A5200
2 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
CAPACITOR VALUES ARE IN MICROFARADS.
3 SCHEMATIC 91B6309
4 * SELECTED VALUE.

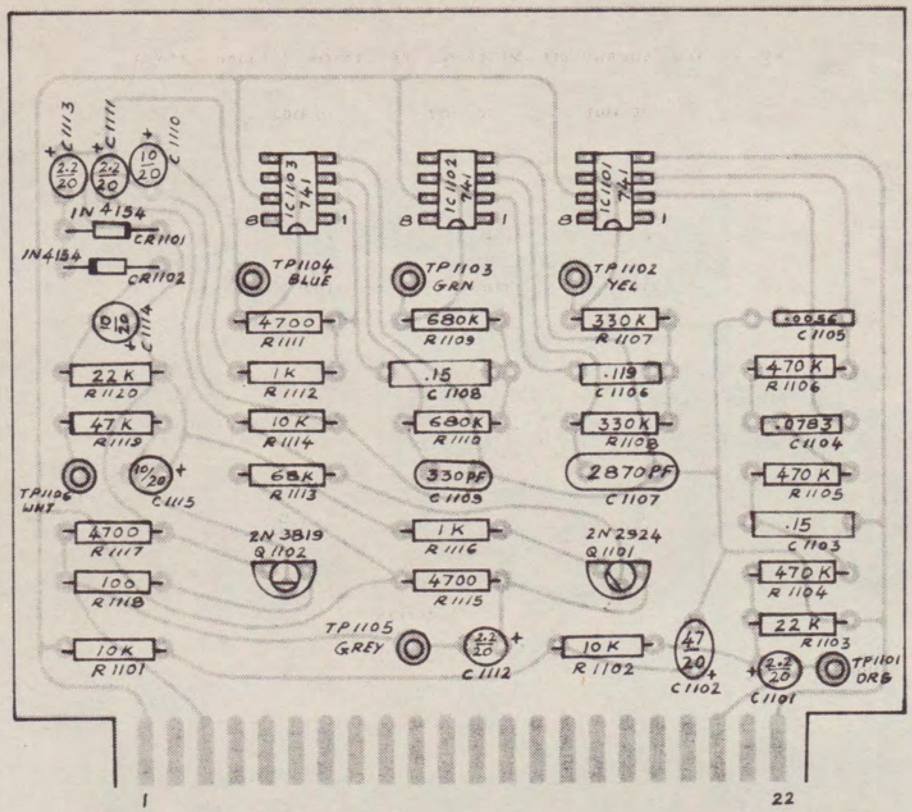
RRC-10T PBR-30

REVISIONS	DATE
A CIRCUITRY ADDED. ADD R910.	10-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 9
SCU OUTPUT AMPLIFIER

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	FXY	5/69	SCALE: FULL
CHK			20 A 2120 — A
ENG	JLT	11-69	



NOTES:

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2W, 10%
   CAPACITOR VALUES ARE IN MICROFARADS
2. P.C. BOARD 51A 5366
3. SCHEMATIC 91 B 6528

PBR-30

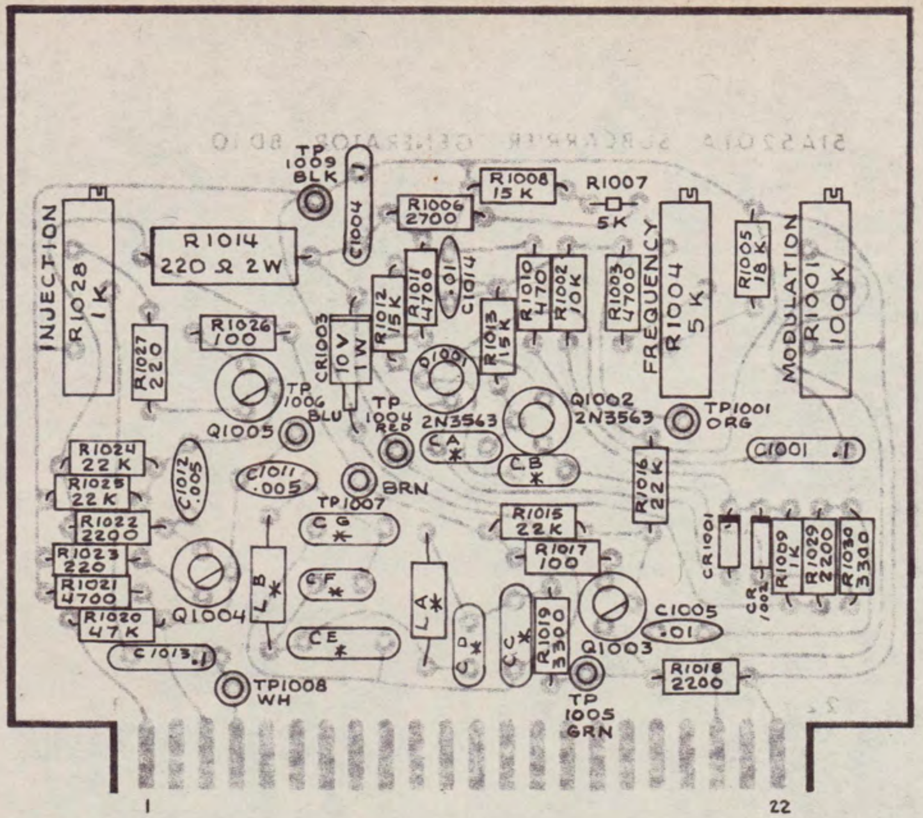
REVISIONS	DATE	MGMT. APPR.

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

COMPONENT LAYOUT BOARD-II
SCU SUBAUDIBLE METERING PROCESS

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°

DWN	[signature]	12-10-71	SCALE:	FULL
CHK	FXY	12/15/71	20 A 2302	
ENG	JCT	15 DEC 71		



NOTES:

1 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%.
CAPACITOR VALUES ARE IN MICROFARADS.
TRANSISTORS ARE 2N2924
DIODES ARE IN4154

2 * SEE CHART ON DWG. 94A4501

3 P.C. BOARD 51A5201A

4 SCHEMATIC 91B6310

RRC-10T PBR-30

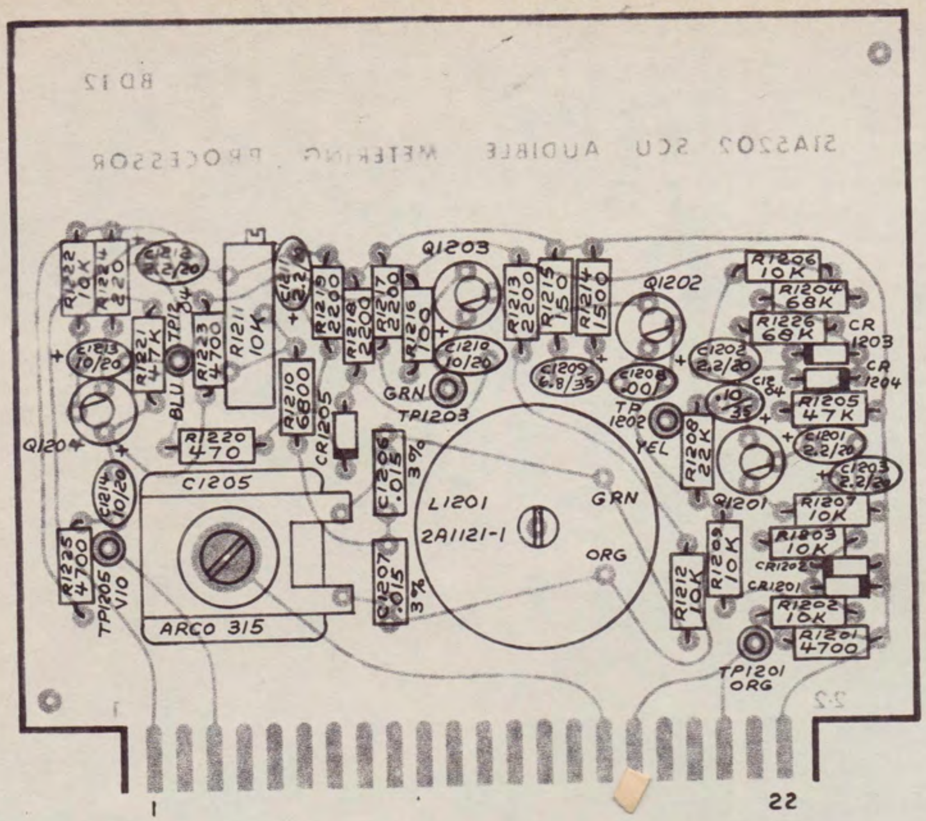
REVISIONS		DATE
D	REVISE * NOTATION PER ECO 332.	3-70
C	REDRAWN. CIRCUIT MODIFIED PER ECO 309.	2-70

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 10A
SUBCARRIER GENERATOR

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	JAG	2-70	SCALE: FULL
CHK	FXY	2/70	20A2121 D
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 IN4154.
2. P.C. BD. 51A5202.
3. SCHEMATIC 91B6312.

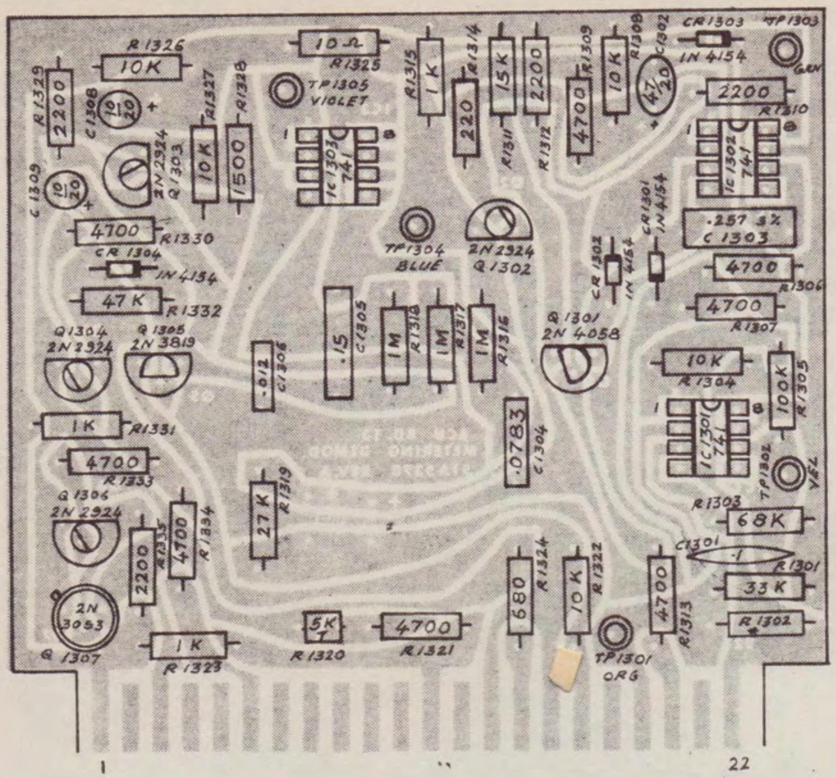
RRC-10T PBR-30

REVISIONS		DATE
A	C1209 WAS 2.2 µF, R1215 WAS 220Ω. ECO 884.	9-70

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 12
SCU AUDIBLE METERING PROC.

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	F X Y	5/69	SCALE: FULL
CHK			20A2122 A
ENG			



NOTES:

1. UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%.
CAPACITOR VALUES ARE IN MICROFARADS
2. P. C. BOARD 51A 5370
3. SCHEMATIC 91 B 6529
4. * DENOTES SELECTED VALUE

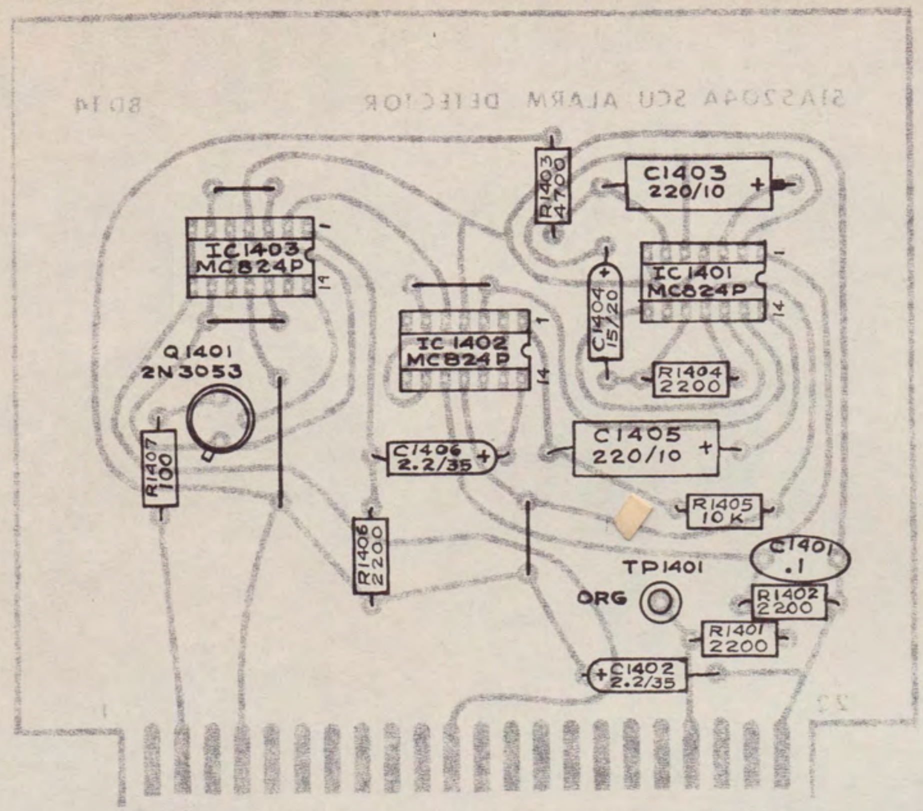
PBR-30

REVISIONS		DATE
C	TAKE OFF C1307, ECO 566	9/29/72
B	R1303 WAS SELECTED. ECO 549.	7/27/72
A	R1326 WAS 6800, R1328 WAS 1K, R1324 WAS 1500. ECO 542	6/22/72
MGMT. APPR.		

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

COMPONENT LAYOUT BOARD 13
SCU METERING DEMODULATOR

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°			
DWN	[illegible]	12-14-71	SCALE: FULL
CHK	FXY	12/15/71	20 A 2298 — C
ENG	JCA	15 DEC 71	



NOTES :

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

2 P.C. BD. 51A5204A

3 SCHEMATIC 91B6314

PBR-30

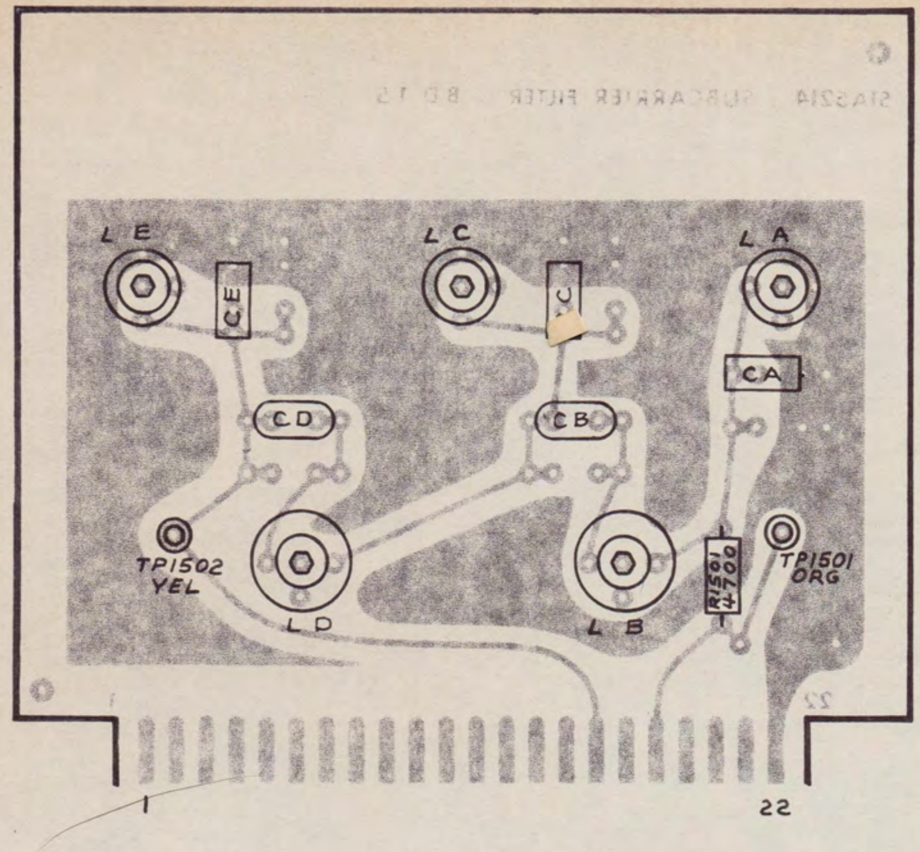
REVISIONS	DATE
A REDRAWN FOR CIRCUIT MODIF.	9-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 14
SCU ALARM DETECTOR

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	JAG	9-69	SCALE: FULL
CHK	FXY	9/69	20 A 2124
ENG	JCP	9-69	A



NOTES:

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

2 COMPONENT VALUES SHOWN ON
DWG. 94A4503.

3 P.C. BD. 51A5214.

4 SCHEMATIC 91B6315.

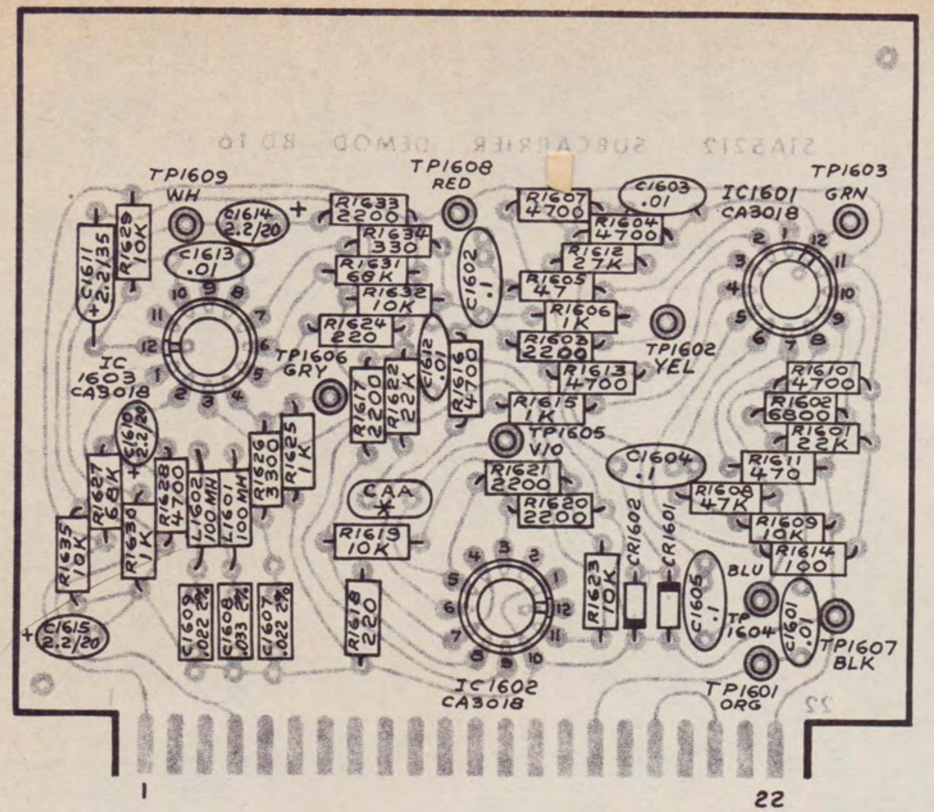
RRC-10 T PBR-30

REVISIONS		DATE
A	ADD CHART.	9-69
B	REVISE NOTE 2 PER ECO 330.	3-70

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 15
SUBCARRIER FILTER

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	F X Y	5/69	SCALE: FULL
CHK	JCM	5-69	20 A 2134
ENG	JCM	5-69	



NOTES:

1 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%.
CAPACITOR VALUES ARE IN MICROFARADS.
DIODES ARE IN4154.

2 * VALUE OF CAA GIVEN ON DWG. 94A4502.

3 P.C. BD 51A5212.

4 SCHEMATIC 91B6316

RRC-10T PBR-30

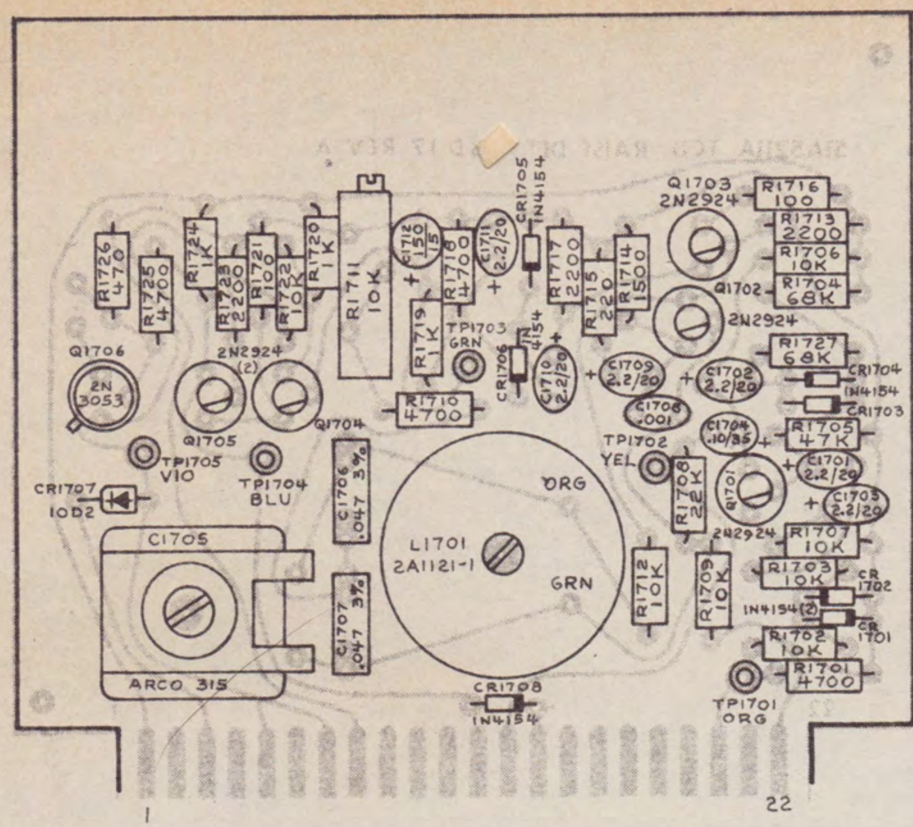
REVISIONS		DATE
B	NOTE 2 REVISED PER ECO 331, 3-70	
A	ADD C1606 VALUES	7/69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 16
SUBCARRIER DEMOD

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	F X Y	5/69	SCALE: FULL
CHK	JCP	5-69	20A2132 B
ENG	[illegible]	5-69	



NOTES:

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

2 P.C. BD. 51A5211.
3 SCHEMATIC 91B6317.

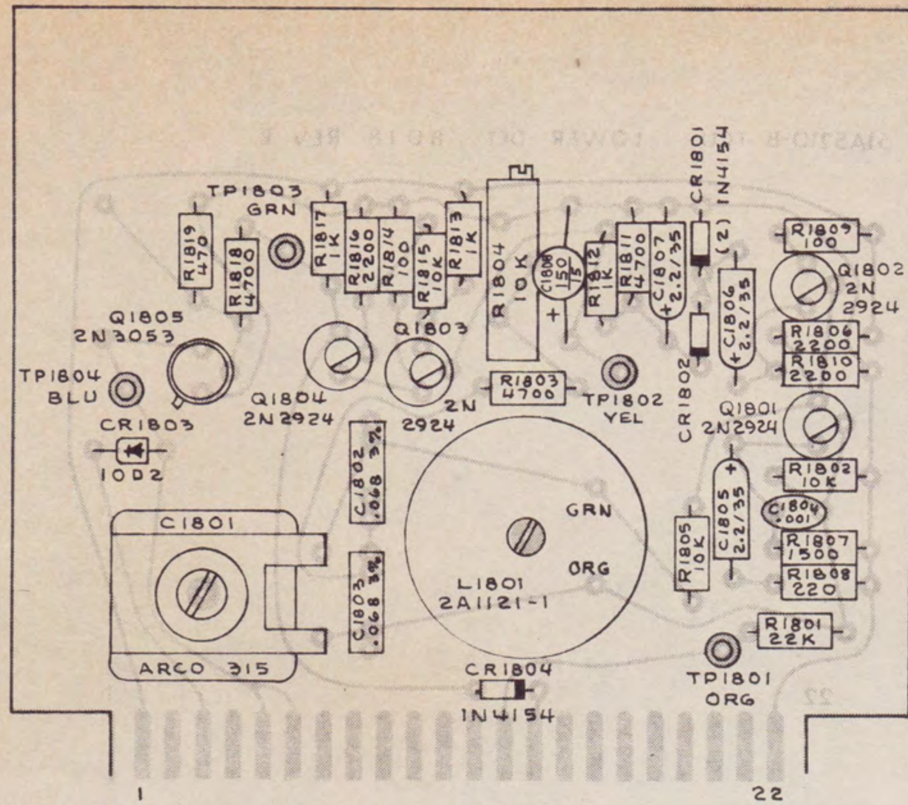
RRC-10T PBR-30

REVISIONS	DATE
C — C1712 WAS 2.2 µF, ECO 450	6/30/71

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 17
TCU RAISE DET.

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	FXY	2/1/71	SCALE: FULL
CHK			20 A 2131 — C
ENG	JLP	1 JUL 71	



NOTES:

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

2 P. C. BD. 51A5210

3 SCHEMATIC 91B6318

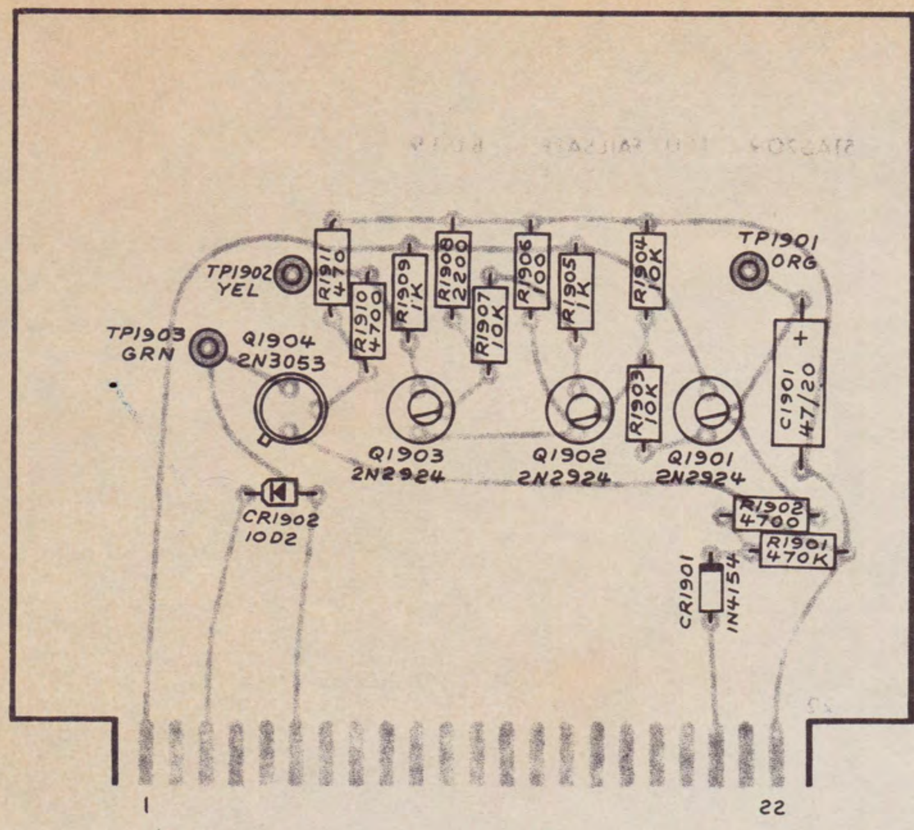
RRC-10T PBR-30

REVISIONS		DATE
C	C1808 WAS 2.2 µF. ECO 450	6/30/71

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 18
TCU LOWER DET

TOL. FRACT ± 1/32, XX ± .030, XXX ± .010			
DWN	JAG	2-1-71	SCALE: FULL
CHK			
ENG	JCT	1 Jul 71	20A2130 C



NOTES:

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

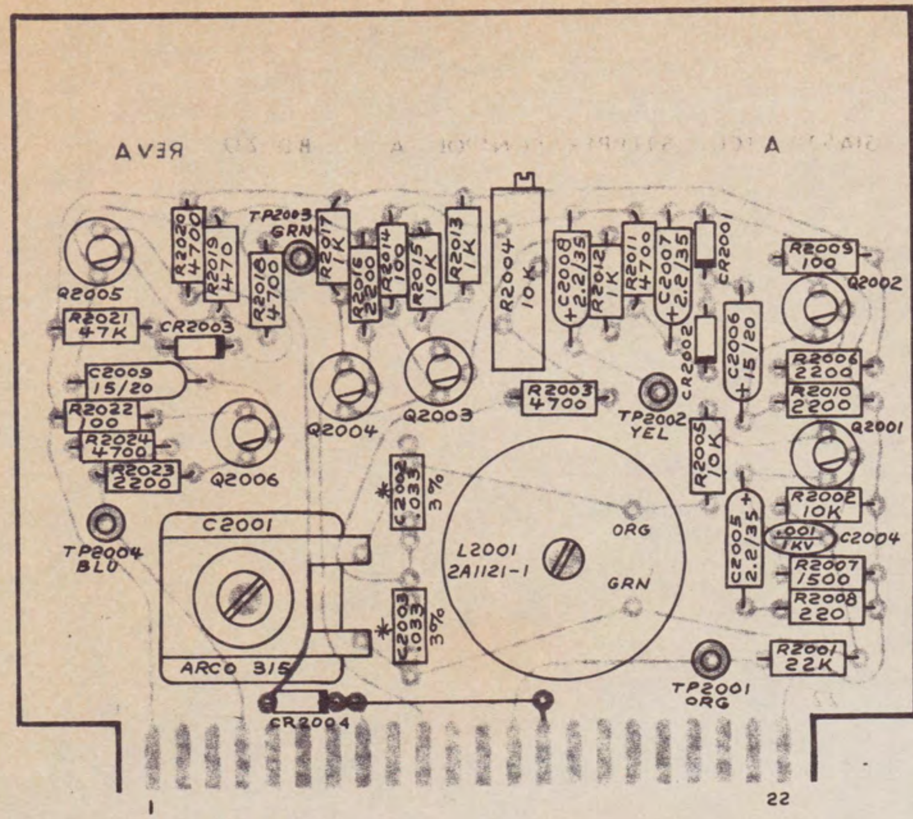
2 P.C. BD. 51A5209.

3 SCHEMATIC 91B6319.

PBR-30

MOSELEY ASSOCIATES, INC. SANTA BARBARA, CALIFORNIA			
COMPONENT LAYOUT-BOARD 19 TCU FAILSAFE			
TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	F X Y	5/69	SCALE: FULL
CHK			20 A 2129
ENG			

DATE | REVISIONS



NOTES:

1 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%.
CAPACITOR VALUES ARE IN MICROFARADS.
TRANSISTORS ARE 2N2924.
DIODES ARE IN4154.

2 P.C. BOARD 51A5218.

3 SCHEMATIC 91B6320.

4 ✱ C2002 & C2003 ARE METALIZED POLYCARBONATE.

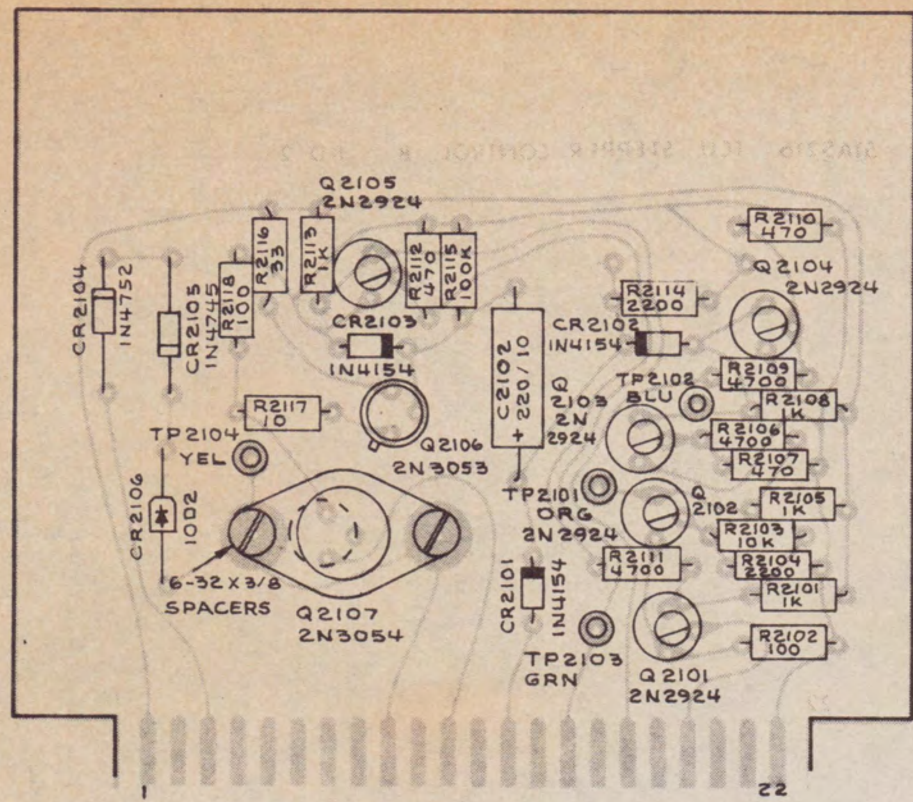
RRC-10T PBR-30

REVISIONS		DATE
A	CIRCUITRY MODIFIED. ADD CR2004.	10-69
B	ADD NOTE 4. ECO 326.	3-70

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 20
TCU STEPPER CONTROL A

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	F X Y	5/69	SCALE: FULL
CHK			20 A 2138
ENG	JCT	11-69	B



NOTES:

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

2 P. C. BOARD 51A5216
3 SCHEMATIC 91B6321

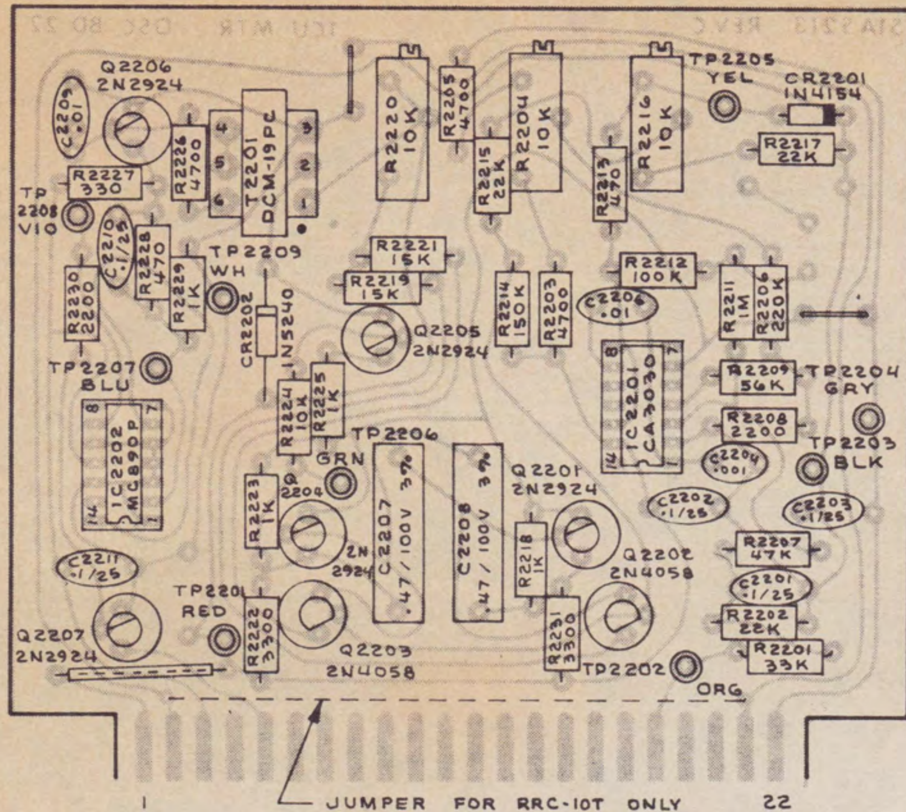
RRC-10T PBR-30

REVISIONS		DATE
C	DELETE C2101.CR2104 WAS IN4740. ECO 451	6/30/71

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 21
TCU STEPPER CONTROL B

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	JAG	2-2-71	SCALE: FULL
CHK			20A2136 C
ENG	JLT	1 JUL 71	



NOTES:

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%.
   CAPACITOR VALUES ARE IN MICROFARADS.
2. P.C. BOARD 51A5213
3. SCHEMATIC 91B6322

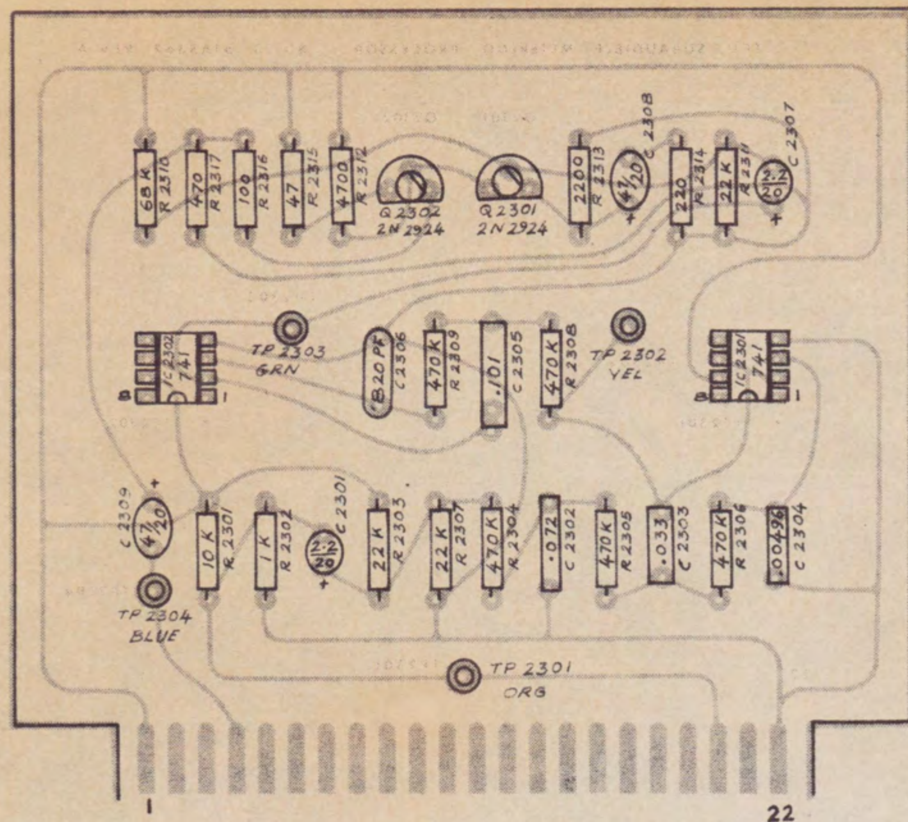
RRC-10T PBR-30

REVISIONS	DATE
G REMOVE R2210 & C2205. RE-DRAWN. E CO 498. 12/30/71	

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 22
TCU METERING OSC

TOL. FRACT ± 1/32 XX ± .030, XXX ± .010			
DWN	JAG	2-2-71	SCALE: FULL
CHK			20A2133 G
ENG			



NOTES:

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

2 P. C. BOARD 51A 5367

3 SCHEMATIC 91 B 6530

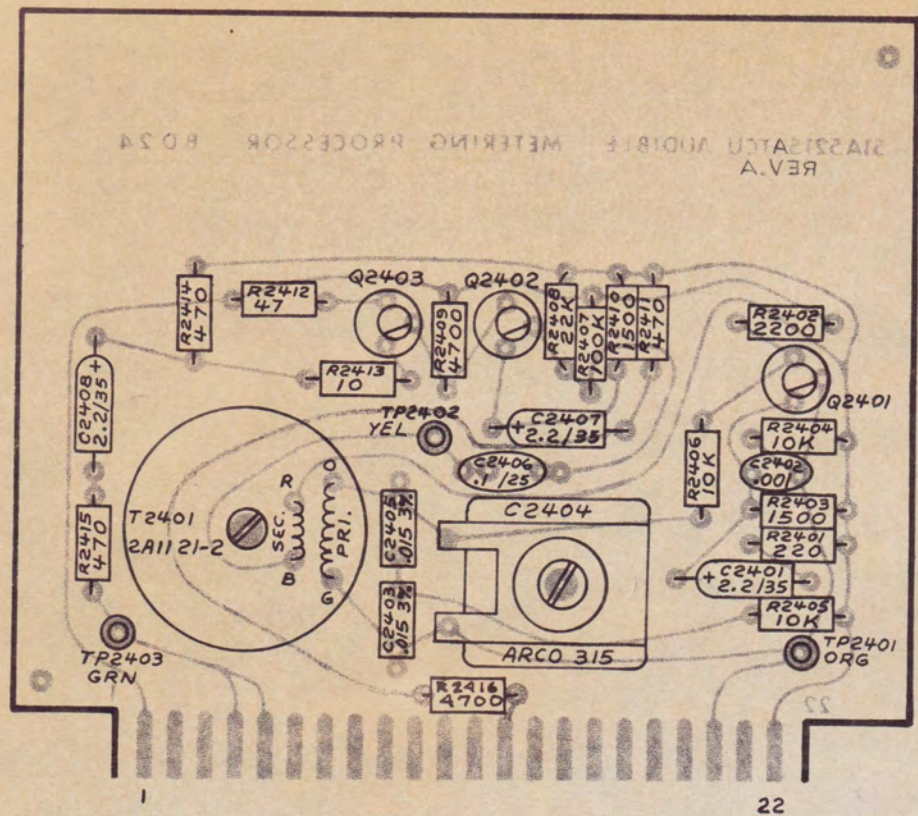
PBR - 30

REVISIONS	DATE
MGMT. APPR.	

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

COMPONENT LAYOUT BOARD-23
TCU SUBAUDIBLE METERING PROCESS

TOL: FRACT. ± 1/32, .XX ± .030, .XXX ± .010, ∠ ± 1/2°			
DWN		12-13-71	SCALE: FULL
CHK	FXY	12/15/71	20 A 2301
ENG	JCT	13 DEC 71	



NOTES:

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

2 P.C. BD. 51A5215.

3 SCHEMATIC 91B6324.

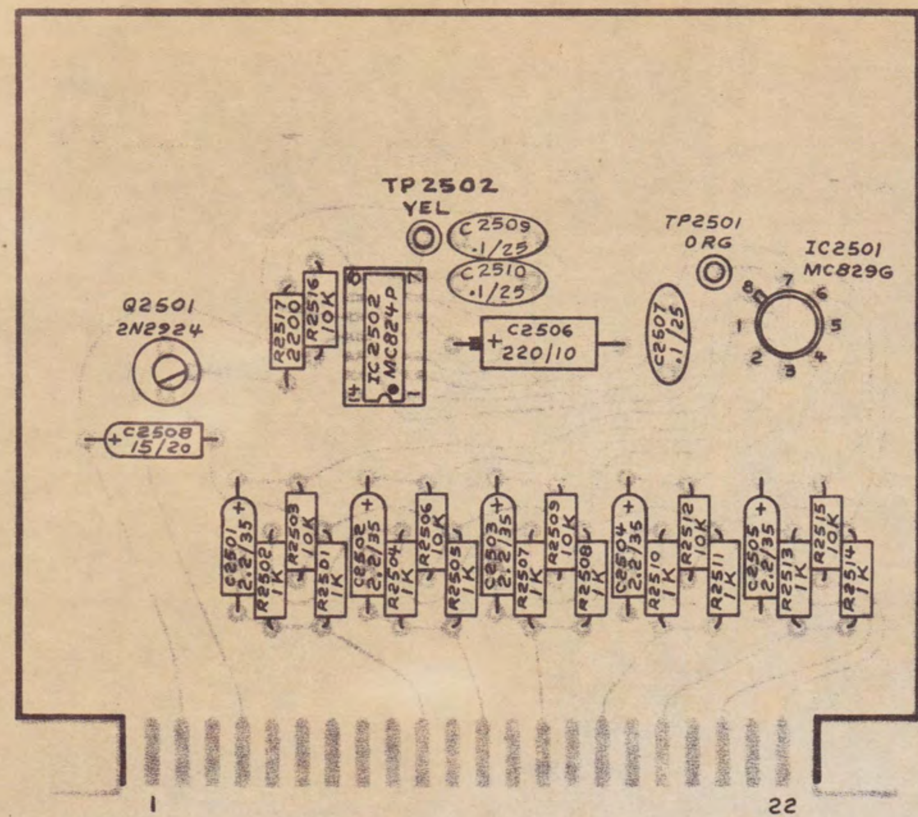
RRC-10T PBR-30

REVISIONS	DATE
A ADD R2416 & ITS CIRCUITRY.	11-69

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 24
TCU AUDIBLE METERING PROC.

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010			
DWN	F X Y	5/69	SCALE: FULL
CHK			20A2135
ENG			A



NOTES:

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

2 P.C. BD. 51A5217.

3 SCHEMATIC 91B6325.

PBR-30

REVISIONS	DATE
A ADD C2509 & 2510	10-69
B C2506 WAS 47/20 ECO 359	7/70

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

COMPONENT LAYOUT-BOARD 25
TCU ALARM ENCODER

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010		
DWN	F X Y	5/69	SCALE: FULL
CHK			20 A 2137	B
ENG	JLT	11-69		