SCM-I SCA FREQUENCY & MODULATION MONITOR INSTRUCTIONS

BELAR ELECTRONICS LABORATORY, INC.
P.O. BOX 76, 119 LANCASTER AVENUE
DEVON, PENNSYLVANIA 19333

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All Belar products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, FOB factory or, in the case of certain major components listed in the instruction manual, for the specified period. Belar will repair or replace products which prove to be defective during the warranty period provided that they are returned to Belar prepaid. No other warranty is expressed or implied. Belar is not liable for consequential damages.

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SCM-1

ADDENDUM

The Model SCM-1 SCA Frequency and Modulation Monitor is designed for direct interconnection to the FMM-1 FM Frequency and modulation monitor.

For use with the FMM-2 FM Modulation Monitor or the FMS-2 FM Stereo Modulation Monitor, it is necessary to adjust the SCM-1 baseband input level. This is accomplished by inserting a 33K ohm ¼ or ½ watt in series with the lead from J1 (SCM-1 baseband composite input jack) to Pin 1 on the A2 circuit board.

This modification for use with the FMM-2 or FMS-2 is usually done at the plant prior to shipment.

SECTION 1

GENERAL INFORMATION

1-1 GENERAL DESCRIPTION

The Belar SCM-1 SCA Frequency and Modulation Monitor, (FCC Type Approval Number 3-162), is an all solid state SCA demodulator designed to operate in conjunction with the Belar FMM-2 Modulation Monitor or FMM-1 Frequency and Modulation Monitor to provide all of the SCA monitoring requirements outlined in part 73 of the Federal Communications Commission's Rules and Regulations for FM radio stations engaged in multiplex SCA programming and remote control applications. The SCM-1 has been designed to meet FCC requirements for measuring the SCA center frequency and SCA modulation characteristics of SCA multiplexed FM transmitters having an SCA center frequency range of 24 to 100 kHz. In addition, the SCM-1 may be used as a low distortion and low noise SCA demodulator for driving audio monitors. The SCM-1 incorporates a crystal controlled, deviation type modulation calibrator to insure the accuracy of the modulation readings at any time.

1-2 PHYSICAL DESCRIPTION

The SCM-1 is constructed on a standard 5¼ x 19 inch rack mount. Seldom used controls and test points are located under the hinged name-plate cover. Factory adjustments are located within the shielded compartment of the unit and on the back panel. The AC power input, baseband input, and monitor outputs are located at the rear of the SCM-1 chassis on individual connectors and rear terminal block.

The SCM-1 is completely solid state utilizing all silicon transistors for long, trouble-free life. The individual circuits are constructed on two military grade, glass-epoxy, printed circuit boards. High reliability industrial and military grade components are used throughout.

1-3 ELECTRICAL DESCRIPTION

The SCM-1 is a solid state crystal controlled, superheterodyne, SCA adaptor incorporating a 260 kHz IF strip and a stable, broadband frequency discriminator that measures the SCA center frequency deviation and demodulates the SCA subcarrier. Four switched crystal positions are available to measure and monitor up to four subcarriers, one at a time. Various metering and testing provisions are contained within the SCM-1 to measure an SCA center frequency deviation meter; a peak reading modulation meter; a peak modulation light independent of SCA modulation polarity that responds to both positive and negative peaks; a modulation calibrator to accurately set the SCA modulation meter calibration; a sensitive average voltmeter circuit for injection level, crosstalk, and noise measurements; and metering circuits to standardize the SCM-1 with the FMM-1, and FMM-2 FM monitors. FCC Type Approved remote monitoring of the SCM-1 may be externally provided for the SCA center frequency deviation meter, modulation meter, and peak modulation light.

As a test instrument, the SCM-1 permits the measurement of:

*1. Incidental AM
*2. AM Noise
*3. SCA Injection
4. SCA Modulation
5. Main Channel Modulation
6. Crosstalk into the main channel (30Hz-15kHz)
7. Crosstalk into the SCA Channel
8. Distortion of the SCA Channel
10. Response of the SCA Channel

* Main Channel

1-4 ELECTRICAL SPECIFICATION

Modulation Meter Range	133% to -70dB
SCA Modulation Sensitivities	100% = 6 kHz, 4 kHz, 2 kHz deviation, switched
Maximum Modulation Frequency	5 kHz at 6 kHz Deviation
SCA Modulation Calibrator	2 kHz
SCA Subcarrier	24 kHz to 100 kHz, 4 switched crystal positions, SCA subcarrier and deviation maintained in the FCC allowable total frequency deviation.
SCA Injection Level	133% to 5%
SCA Peak Indicator	100% = 6 kHz, 4 kHz, 2 kHz deviation, switched, independent of modulation polarity.
SCA Frequency Meter	±2 kHz
Internal Crosstalk:	
Sub to Main	-66 dB
Main to Sub	Better than 50 dB
Stereo to Sub	Better than 50 dB
Remote Metering	Both frequency meter and modulation meter may be remotely metered, 5000 ohm external loop resistance.

1-5 MECHANICAL SPECIFICATIONS

Dimensions	5¼" x 19" x 11 7/8"
Net Weight	14 pounds
Shipping Weight	19 pounds

1-6 INSTRUMENT IDENTIFICATION

The instrument is identified by the type number and a six digit serial number. The type number and serial number appear on a plate located on the rear panel. All correspondence to your Belar representative or to the Belar factory in regard to the instrument should reference the type number and complete serial number.

1-7 ACCESSORIES

The Belar type SCM-1 Frequency and Modulation Monitor may be used for the remote monitoring of an SCA FM transmitter with the Remote Meter Panel, MP-3. The meter panel contains a peak indicator lamp, an SCA frequency deviation meter and a modulation meter, both designed for 5000 ohm loop resistance.

SECTION 2

INSTALLATION

2-1 INITIAL INSPECTION

Check the shipping carton for external damage. If the carton exhibits evidence of abuse in handling (holes, broken corners, etc.,), ask the carrier's agent to be present when the unit is unpacked. Carefully unpack the unit to avoid damaging the equipment through use of careless procedures. Inspect all equipment for physical damage immediately after unpacking. Bent or broken parts, dents and scratches should be noted. If damaged is found refer to paragraph 2-2 for the recommended claim procedure. Keep all packing material for proof of damaged claim or for possible future use.

2-2 CLAIMS

If the unit has been damaged, notify the carrier immediately. File a claim with the carrier or transportation company and advise Belar of such action to arrange the repair or replacement of the unit without waiting for a claim to be settled with the carrier.

2-3 REPACKING FOR SHIPMENT

If the unit is to be returned to Belar, attach a letter to it showing owner, owner's address and phone number. A description of service required should be included in the letter. The original shipping carton and packaging materials should be used for reshipment. If they are not available or reusable, the unit should be repackaged in the following manner:

a. Use a double-walled carton with a minimum test strength of 275 pounds.

b. Use heavy paper or sheets of cardboard to protect all surfaces.

c. Use at least 4 inches of tightly packed, industry approved, shock absorbing material such as extra firm polyurethane foam or rubberized hair. NEWSPAPER IS NOT SUFFICIENT FOR CUSHIONING MATERIAL!!

d. Use heavy duty shipping tape to secure the outside of the carton.

e. Use large FRAGILE labels on each surface.

f. Return the unit, freight prepaid. Be sure to insure the unit for full value.

2-4 PREPARATION FOR USE

The SCM-1 SCA Frequency and Modulation Monitor is designed to be mounted in a standard 19 inch rack mount. When mounted in a rack, no cooling area need be provided above or below the unit as very little heat is generated by the monitor. When the monitor is mounted above high heat generation equipment such as vacuum-tube power supplies, consideration should be given to cooling requirements which allow a free movement of cooler air through and around the SCM-1. In no instance should the ambient chassis temperature be allowed to rise above 50°C (122°F). Mount the SCM-1 to the rack mount panel using four No. 10 countersunk finishing washers.

Plug the line cord into a nominal 117 volts 60 Hz source. For use with an FMM-1 connect an 18 inch coaxial cable (supplied) between J1 on SCM-1 to J2 on the FMM-1. Connect an 18 inch coaxial cable (supplied) between J2 on the SCM-1 to J6 on the FMM-1. Connect an 18 inch coaxial cable (supplied) between J3 on SCM-1 to J5 on the FMM-1. These last two are for AM noise and incidental AM measurements and are not to be connected if an FMS-1 Stereo Frequency and Modulation Monitor is used. (The FMS-1 will perform these measurements.)

For use with an FMM-2 FM Modulation Monitor, connect an 18 inch coaxial cable (supplied) between J1 on the SCM-1 to J4 (SCA) on the FMM-2. (Refer to Addendum, Pg. #2)

For use with an FMS-2 Stereo Modulation Monitor, connect an 18 inch coaxial cable (supplied) between J1 on the SCM-1 and J4 (composite output) on the FMS-2.

Whenever convenient, connect the SCM-1 to J4 on the FMS-2, as this is a buffered output.

If desired, an external aural monitoring amplifier can be connected to terminals 1 and 2 on TB1. Note that this is an unbalanced output with terminal 1 grounded.

A remote center frequency deviation meter and remote modulation meter may be connected to terminals 5,6 and 3,4 respectively, if desired. Observe the proper polarities and note that the external loop resistance not including meters must be 5000 ohm. These meters must be obtained from Belar in order to comply with FCC regulations on remote metering. A remote peak modulation lamp may be connected to terminals 8 and 9. CAUTION: DO NOT SHORT TERMINAL 9 TO GROUND. Audio tests may be made at the audio test jack on the front panel. The remote meters and lamp contained in the Remote Meter Panel, MP-3.

SECTION 3

OPERATION

3-1 INITIAL OPERATION

The following procedure should be followed for placing the unit into initial operation. Refer to the FRONT PANEL CONTROLS AND INDICATORS drawing for location of the control functions.

1. Before turning unit on, depress FREQ CAL switch, the REMOTE METER switch to off (released) and the TOTAL MOD switch to on (depressed).

2. Place FMM-1 or FMM-2 into operation, with the AMP BAL switch depressed on the FMM-1 or the POWER switch depressed depressed on the FMM-2.

3. Depress the SCM-1 POWER switch PWR to on (depressed) and allow a 15 minute warm-up. Turn RANGE switch to MOD.

4. Adjust FREQ ZERO potentiometer to zero deviation meter and adjust MOD ZERO potentiometer to zero modulation meter.

5. Depress MOD CAL switch on FMM-1 or the CAL switch on the FMM-2 and adjust R1 on the rear panel of the SCM-1 chassis so that the SCM-1 modulation meter reads 100%. This adjustment will be necessary only during initial set-up or installation. This adjustment normalizes the SCM-1 with the FMM-1 or FMM-2.

   When using the FMM-2 SCA output, the FMM-2 meter will read approximately ½% low when the FMM-2 is selected for CAL and the SCM-1 is selected for TOTAL. This is normal, and the SCM-1 meter should be calibrated to read as the FMM-2 meter. In normal operation, the meters will read properly.

   If the FMS-2 composite output is used as the baseband source for the SCM-1, the FMM-2 and SCM-1 will read as calibrated.

6. Place the FMM-1 or the FMM-2 into the operate (OP) position.

7. Depress the SCM-1 MOD CAL switch to on (depressed) and the DEV switch to 2 kHz (depressed). Adjust MOD CAL to read 100%.

   NOTE: The MOD CAL rolls off the frequency response and must not be depressed when measuring total modulation or main modulation.

8. The SCM-1 is now calibrated and may be placed into normal operation by depressing the desired FREQ switch and desired DEV range. When the SCM-1 is supplied with only one crystal, it will normally be on FREQ 3 position.

3-2 NORMAL OPERATION

To monitor normal SCA programming, depress the desired FREQ switch and the desired DEV switch. 4 kHz deviation is normally used when broadcasting both SCA and stereo. 6 kHz deviation is normally used when broadcasting SCA an monaural. 2 kHz deviation may be used when broadcasting remote telemetering tones used in remote control applications.

3-3 SCA MEASUREMENTS

The following operating procedures describe methods that may be used to operate each of the functions of the SCM-1 SCA monitor. Refer to the FRONT PANEL CONTROLS AND INDICATORS drawing for the location of the front panel controls and also a brief explanation of the controls.

3-3-1 TOTAL MODULATION

Depress the TOTAL MOD switch and turn the RANGE switch to MOD. The SCM-1 measures total negative modulation. If the FMM-2 OPERATE switch or the FMM-1 MOD POL switch is depressed (positive modulation), both positive and negative modulation polarities may be observed simultaneously to check assymmetrical program material. CAUTION: The MOD CAL switch must not be depressed when measuring total modulation for it rolls off the frequency response.

3-3-2 MAIN CHANNEL MODULATION

Depress the MAIN MOD switch and turn the RANGE switch to MOD. The SCM-1 measures main channel modulation through a 15 kHz low pass filter. CAUTION: The MOD CAL switch must not be depressed when measuring total modulation for it rolls off the frequency response.

3-3-3 CROSSTALK (SUB TO MAIN)

Depress the MAIN MOD switch. Cross talk measurements from SCA to main channel may be made with no modulation on the main channel and the RANGE switch turned to a more sensitive position (0-50 dB). The crosstalk reading is the sum of the meter reading and range reading, i.e., -12 dB on meter and -50 dB on range yields -62 dB. CAUTION: The MOD CAL switch must not be depressed when measuring total modulation for it rolls off the frequency response. Crosstalk components above 15 kHz (into the stereo subchannel) are not measured in this check.

3-3-4 SUBCARRIER INJECTION

Depress the desired FREQ switch. Depress the SUB INJ switch. The RANGE switch may be set to the desired range: 10%, 30%, or 100% and the corresponding meter scale is used. Note that the indicated injection level may change with SCA modulation. This is normal since the injection is measured through a narrow band pass filter. The injection level should be measured in the absence of SCA modulation.

3-3-5 SCA MODULATION

Depress the desired FREQ switch. Depress the DEV switch for the desired range, i.e., 6,4, or 2 kHz deviation. The calibration is changed accordingly. With RANGE switch in MOD, the 100% meter reading corresponds to 6,4, or 2 kHz deviation according to the above setting. When switched to the sensitive positions, say -50 dB, then the range is -50 dB below the 6,4, or 2 kHz deviation. This is to say that the SCA modulation measurements are normalized to the deviation setting.

3-3-6 CROSSTALK (MAIN TO SUB)

Place the SCM-1 into operation as in step 3-3-5. With SCA injection and no SCA modulation, modulate the main channel with the desired modulation. The residual reading on the modulation meter with the RANGE switch set to a more sensitive position is the crosstalk (without de-emphasis) from the main channel into the SCA channel. The crosstalk reading is the sum of the meter reading and the range reading, i.e., -12 dB on meter and -40 dB on range switch setting yields -52 dB below the deviation used (6,4, or 2 kHz).

De-emphasized crosstalk and noise measurements may be made with an external distortion meter and a de-emphasis capacitor as described under SCA distortion, 3-3-10 or from the de-emphasized audio output at TB1 terminals 1 and 2.

Crosstalk, distortion and noise measurements are normally made with de-emphasis.

3-3-7 AM NOISE (WITH FMM-1)

With the main channel unmodulated (subcarrier and pilot OFF), depress the AM NOISE switch and turn the RANGE switch from 0 to a position where a reading is obtained. The algebraic sum of the meter reading and the range switch setting is the main channel AM noise reading WHEN THE RF LEVEL IS SET TO 100% on the FMM-1. For example, a meter reading of -5 dB and a range switch setting of -50 dB yields and AM noise measurement of -55 dB.

3-3-8 INCIDENTAL AM (WITH FMM-1)

Depress the INC AM switch and turn the range switch from 0 to a position where a reading is obtained. The transmitter main channel is modulated for this measurement. The algebraic sum of the meter reading and the range switch setting is the incidental AM noise of the main channel. There is no FCC specification on this measurement but it may be used as an aid for proper tuning of an FM transmitter.

3-3-9 SCA FREQUENCY RESPONSE

Frequency response may be measured by using an audio oscillator to modulate the SCA generator and measuring the input signal level from the audio oscillator with an AC audio voltmeter, such as one contained in a distortion analyzer. Adjust the level at 400 Hz to indicate the desired modulation. Change the frequency of the audio oscillator to all the frequencies to be measured, adjusting the audio oscillator output to keep the SCA modulation constant. The AC voltmeter indication of the oscillator output should follow the standard de-emphasis curve (commonly 150 usec) used in the SCA generator. Standard modulating frequencies used are 50, 100, 400, 1000, and 5000 Hz.

3-3-10 SCA DISTORTION

Distortion measurements may be made by connecting a distortion analyzer to the AUDIO TEST jack on the front panel and applying a modulating signal to the SCA channel of the transmitter. The measurements may be made with de-emphasis by connecting an external capacitor across the AUDIO TEST jack output. 7500 pF yields a 75 usec de-emphasis curve, 0.015 uF yields a 150 usec de-emphasis curve.

Distortion measurements may be made from the aural monitor output (TB1 terminals 1 and 2). This output is de-emphasized by A2C21. 0.047 uF yields 75 usec and 0.1 uF yields 150 usec de-emphasis. A2C21 is plugged in and is normally supplied for 75 usec unless otherwise specified. Distortion measurements will be higher than actual due to the narrow bandwidth of the SCA channel filter normally supplied in the SCM-1. A narrowband filter is used in order to make possible accurate crosstalk measurements.

3-3-11 SCA NOISE

Place the SCM-1 into operation as in step 3-3-5. Apply SCA injection but no SCA modulation or main channel modulation. The residual reading on the modulation meter with the RANGE switch set to a more sensitive position is the SCA noise (without de-emphasis). The SCA noise reading is the sum of the meter reading and the range switch

setting, i.e., -12 dB on the meter and -40 dB on the range switch setting yields -52 dB below the deviation used (6,4, or 2 kHz).

De-emphasized crosstalk and noise measurements may be obtained with an external distortion meter, and a de-emphasis capacitor as described under SCA distortion, 3-3-10 or from the de-emphasized audio output at TB1 terminals 1 and 2. Crosstalk, distortion and noise measurements are normally made with de-emphasis.

SECTION 4

PRINCIPLES OF OPERATION

4-1 CIRCUIT DESCRIPTION

The chassis schematic along with the individual card schematics in the back of the manual may be referred to for operation of the SCM-1. The incoming multiplex composite input is applied to the BASEBAND INPUT J1. Buffer amplifier A2Q1 and Q2 on CARD A2 applies the signal to both the mixer, on CARD A1, and the TOTAL MOD and MAIN MOD switches, S8 and S9.

The Oscillator, Mixer, and IF CARD A1 selects the particular SCA channel to be monitored and filters out the main channel and stereo subchannel or other SCA channels. The particular SCA channel is amplified and limited by A1Q1, Q2, and Q3 and demodulated by the balanced discriminator. The output of the discriminator is applied to the voltmeter circuits on CARD A2 through the low pass filters FL2 and FL3.

CARD A2 contains the peak voltmeter, average voltmeter, peak lamp, and audio amplifier circuits to measure and monitor the various SCA functions. The peak voltmeter and peak lamp circuits are the same as used in the FMM-1.

Switches S2 through S6 select the subchannel or calibrating frequency to be measured. Switched S7 through S15 select the particular function to be measured.

4-1-1 OSCILLATOR, MIXER AND IF CARD A1

The baseband signal containing the multiplex composite signal is applied to pin 2 of the Oscillator, Mixer and IF CARD A1 where it is then applied to the balanced mixer along with the local oscillator frequency to form an intermediate frequency (IF) of 260 kHz. This signal contains the main channel and all the Subcarriers. The local oscillator operates 260 kHz above the desired subcarrier frequency so that the desired subcarrier with its sidebands is centered around 260 kHz; for example, a 67 kHz subcarrier requires a 327 kHz local oscillator frequency. The main channel and all other subcarriers are removed by the 260 kHz bandpass filter FL1 located on the main chassis. The desired subcarrier and its sidebands are passed by the filter and applied to the limiters A1Q2 and Q3 which removes any AM component that may be present. The SCA signal is further amplified by A2Q4 and demodulated by the balanced discriminator A1T3, T4, A1CR7, and CR8.

The output of the discriminator is applied to the buffer amplifier A1Q5 and split by A1Q6 and Q7. A1Q6 drives the low pass filters FL2 and FL3 to remove the IF components. The output of the filter FL3 is applied to CARD A2 through the switches S9, S11, S12, and S13. The DC signal from the discriminator is amplified by A1Q7 to drive the

frequency deviation meter M1 and remote meter if used. The DC signal is proportional to the frequency deviation.

The local oscillator is a crystal controlled oscillator whose crystals are located on the push button switches S2 through S6. The frequency of the local oscillator is determined by the crystal selected. When the unit is supplied for more than one subcarrier, the crystals are placed on switches S2 through S5 in increasing order, a 260 kHz crystal is placed on S6 for frequency calibration.

Frequency calibration is accomplished by operating the local oscillator at 260 kHz. When the FREQ CAL push button is depressed, a 260 kHz crystal is applied to the local oscillator. A DC voltage is also applied to the mixer through S6 and terminal 4 on CARD A1. This DC voltage unbalances the mixer to allow an output of 260 kHz to be applied to the IF amplifier and discriminator. The frequency meter M1 is zeroed with this signal.

Modulation calibration is accomplished by applying the modulation calibrating oscillators A1Q10,Q11 to the IF amplifier and discriminator. When the MOD CAL push button is depressed, the 25V DC is applied to terminal 25 to turn on the calibrating oscillators. A2Q10 operates 2 kHz above 260 kHz and A1Q11 operates 2 kHz below 260 kHz. 60 Hertz AC is applied to terminals 26 and 27 which turns the diodes A1CR9 and CR10 on and off alternately at a 60 Hertz rate to form a 4 kHz peak-to-peak square wave FM signal centered at 260 kHz. This deviation is an accurate deviation since it is controlled by the 262 kHz and 258 kHz crystals. The MOD CAL switch S7 also shorts terminal 40 to 41 to connect the 0.22 uF capacitor A2C32 to ground on CARD A2 to remove the spike from the square wave calibrating signal. The output of the mixer is also applied to a 260 kHz narrow bandpass filter A1FL1 and amplified by A1Q12 to measure the subcarrier injection. A1FL1 removes most of the sidebands from the SCA signal so that when subcarrier injection is measured with SCA modulation, the subcarrier varies with this modulation. The subcarrier injection should be measured with no SCA modulation.

4-1-2 AUDIO AMPLIFIER, VOLTMETER, METERING AND FLASHER CARD A2

The incoming baseband signal is amplified by transistor A2Q1. Potentiometer R1 (INPUT LEVEL) adjusts the gain slightly to allow the SCM-1 to be normalized with the FMM-1. Transistor A2Q2 provides a low impedance to drive the A1 CARD and also the TOTAL and MAIN CHANNEL switches S8 and S9. The particular function to be measured is applied to the input of the wideband feedback amplifier A2Q3, Q4, and Q5 which drives the peak voltmeter circuit. Section 4-2-3 in the FMM-1 manual may be referred to for its operation since the circuits are the same.

The output of the feedback amplifier also drives the RANGE switch S17 which provides attenuation steps for the sensitive average voltmeter. The output of the RANGE switch S17 is applied to the average voltmeter amplifier A2Q9 and Q10. Diode bridge A2CR3 through CR6

rectifies the output to drive the modulation meter. A sample of the output is applied to the emitter of A2Q9 to provide feedback to stabilize the gain and linearize the meter reading. The gain is adjusted A2R41. An output is also taken from the amplifier to provide an oscilloscope output (SCOPE) that follows the sensitivity setting of the RANGE switch.

When the RANGE switch is on MOD, the modulation meter M2 is switched to the peak reading voltmeter circuit on terminals 19 and 20. When the RANGE switch is on 0-50 dB positions, the modulation meter M2 is switched to the diode bridge on terminals 26 and 27. Note that if a remote modulation meter is used it always remains on the peak voltmeter circuit.

The peak lamp circuit consists of a phase splitter, Schmitt voltage comparator, and monostable multivibrator. This circuit is the same as used in the FMM-1 and Section 4-2-3 may be referred to for its operation. Note that the peak lamp circuit is independent of modulation simultaneously. Also note that the peak lamp circuit only monitors the SCA modulation.

The monitoring amplifier is a three stage feedback amplifier to provide a low distortion signal for aural monitoring. The signal is applied to the input stage A2Q11 which both amplifies the signal and sums the feedback voltage in the emitter. Transistor A2Q12 provides additional amplification to drive the output transistor A2Q13. Feedback is taken from the output and applied to the emitter of the input stage through A2R54 and A2C21 to de-emphasize the signal. Note that 0.047 uF is used for 75 usec de-emphasis and 0.1 uF is for 150 usec de-emphasis.

4-1-3 MAIN CHASSIS

The main chassis contains the power supply and 25 volt preregulator to supply the cards. It also contains the 260 kHz wide bandpass filter FL1, 9 kHz lowpass filter FL2, and 15 kHz wide bandpass filter FL3. Depressing one of the FREQ switches S2 through S5 applies the particular local oscillator crystal for the subcarrier used. Depressing the FREQ CAL switch S6 or SUB INJ switch S10 applies the 260 kHz crystal to the local oscillator. The SUB INJ switch also applies the output of the subchannel injection amplifier to the input of the voltmeter through the normalizing potentiometer R13.

Depressing one of the SCA deviation switches S11 through S13 applies the output of the discriminator to the deviation attenuator, R20, R21, and R22 through the two low pass filters FL2 and FL3. The output of the attenuator is applied to the input of the voltmeter on CARD A2. Note that the deviation atenuator normalizes the modulation meter to read 100% for 5,4, and 2 kHz deviations.

Depressing the TOTAL MOD switch S8 applies the baseband signal to the voltmeter through the normalizing potentiometer R14. Depressing the MAIN MOD channel switch S9 applies the baseband signal to the voltmeter through the 15 kHz lowpass filter FL3 and normalizing potentiometer R15.

SECTION 5

MAINTENANCE

This section contains maintenance and service information for the SCM-1 SCA Frequency and Modulation Monitor. Included are Performance Checks, Adjustments, and Calibration Procedures.

5-1 PERFORMANCE CHECKS

Before performing any checks on the SCM-1, it is suggested that the FMM-1 performance be verified. See Section 5-2 in the instruction manual for the FMM-1.

5-2 FREQUENCY DEVIATION METER CHECK

Depress FREQ CAL switch. Verify that by rotating the FREQ ZERO control from maximum clockwise to maximum counterclockwise the kHz DEVIATION meter pointer will go up scale in the positive and negative directions respectively. Return the pointer to zero. Depress the particular FREQ switch corresponding to the subchannel to be measured and read the frequency deviation.

5-2-1 MODULATION MOD ZERO METER CHECK

Depress FREQ CAL and 6 kHz DEV switches. Verify that by rotating the MOD ZERO control from maximum clockwise to maximum counterclockwise th modulation meter pointer will move in a positive to negative direction about zero. Return the pointer to zero after check.

5-2-2 MODULATION CALIBRATOR CHECK

Depress MOD CAL and 2 kHz DEV switches. Verify that by rotating the MOD CAL control from maximum clockwise counterclockwise the modulation meter pointer will move in a positive to negative direction about 100%. Return the pointer to 100% after check.

5-2-3 PEAK LAMP CHECK

With the monitor placed in operation as in step 5-2-3, rotate the PERCENT MOD control from maximum clockwise to the point at which the

PEAK MOD lamp just lights. The reading of the PERCENT MOD should be approximately 110%. This is normal since the modulation calibrating signal is a 60 Hertz square wave and the restricted low frequency response of the peak lamp circuit causes a droop in the square wave signal which increases its peak value to 110%. The peak lamp is accurate for sinewave or program modulation.

5-3 ADJUSTMENTS AND CALIBRATIONS

Place the FMM-1 or FMM-2 in normal operation. Before performing any adjustments on the SCM-1, verify that the FMM-1 or FMM-2 is operating normally as outlined in the instruction manual for the FMM-1 or FMM-2. Before proceeding with the SCM-1 alignment, depress the FMM-2 AMP BAL switch, or the FMM-2 CAL switch to verify that the the FMM-1 modulation meter reads zero; reset to zero if necessary, using the MOD ZERO control on the FMM-1 or FMM-2. Adjust the SCM-1 MOD ZERO control for zero indication on the SCM-1 modulation meter as in step 5-2-2.

5-3-1 PRELIMINARY

Connect an RF sample from a properly operating multiplex exciter to the RF input jack of the FMM-1 or FMM-2 FM monitor. Set the FMM-1 or FMM-2 input level potentiometer for an indication of 100% on the FMM-1 or FMM-2 modulation meter with the RF LEVEL switch depressed.

5-3-2 DESCRIMINATOR ADJUSTMENT

Depress the MOD CAL switch and 2 kHz DEV switches and rotate the MOD CAL control maximum counterclockwise on the SCM-1 for a minimum reading. The minimum reading should be approximately 92%. If this reading is not below 100% or cannot be set to 100%, the discriminator must be aligned and proceed as follows.

With a clip lead, short the cold end of the discriminator output (junction of A1R23, R24, R25, and C9) to ground. Bypass the discriminator output (junction of A1R21, R22, R23, and gate of A1Q5) to ground with a 0.01 uF capacitor. Observe the square wave calibrating signal on the output of the discriminator with a calibrated oscilloscope. The amplitude of the square wave should be 2 Volts peak-to-peak.

Adjust the slugs in A1T3 and T4 until this amplitude is 2 Volts peak-to-peak. Check the discriminator zero by depressing the FREQ CA switch and measure the DC output. It not 0 Volts DC, turn the slug in either A1T3 or T4 and re-adjust the slug on the other for the 2 Volts peak-to-peak amplitude as in above. Adjust the slugs in A1T3 and T4 for 2 Volts peak-to-peak on MOD CAL and 0 Volts DC on FREQ CAL. Remove the bypass capacitor and short from the A1 Card.

5-3-3 A2R15 ADJUSTMENT

With the MOD CAL control still maximum counterclockwise and the MOD CAL and 2 kHz switches depressed, adjust potentiometer A2R15 for an indication of 92% on the modulation meter. Check control as in step 5-2-3 and return the pointer to 100%.

5-3-4 R12 ADJUSTMENT

Depress FREQ CAL switch and zero the frequency deviation meter. Depress the particular FREQ switch corresponding to the subchannel being measured and adjust the subcarrier frequency to +1 kHz and -1 kHz deviation while measuring its frequency with a frequency counter. Adjust R12 on main chassis to correspond with the + and -1 kHz deviation.

5-3-5 R14 ADJUSTMENT

Apply a 1 kHz 100% modulating tone to the exciter input as read on the FMM-1 or FMM-2. No other modulation should be present. On the SCM-1, depress the FREQ CAL switch and the TOTAL MOD switch and adjust R14 on the main chassis to read 100% on the SCM-1. The RANGE switch should be on MOD.

5-3-6 R15 ADJUSTMENT

Apply a 1 kHz 100% modulating tone to the exciter input as read on the AMM-1 or FMM-2. No other modulation should be present. On the SCM-1 depress FREQ CAL switch and the MAIN MOD switch, rotate the RANGE switch to MOD and adjust R15 on the main chassis to read 100% on the SCM-1.

5-3-7 A2R41 ADJUSTMENT

Apply a 1 kHz modulating tone to the exciter input as in step 5-3-5. Rotate the RANGE switch to 0 dB and adjust A2R41 to read exactly that value as read in the MOD position.

5-3-8 A2R55 ADJUSTMENT

Apply a 400 Hz modulating tone to the SCA generator. Depress the particular FREQ switch corresponding to the subchannel being measured and depress the 2 kHz DEV switch. Adjust the modulation to read exactly 100% as read on the SCM-1. Rotate the PERCENT MOD control from maximum

clockwise to the point at which the PEAK MOD lamp just lights and note the reading. Rotate the PERCENT MOD control to 50 percentage points below the above reading and adjust the modulation level until the PEAK MOD light just lights and note the reading on the modulation meter. Adjust A2R55 so that the percentage difference on the PERCENT MOD CONTROL is 50% when the modulation level is changed form 100% to 50%. Slip the PERCENT MOD knob by loosening the two set screws and retightening after adjusting to correct the reading of the PERCENT MOD at 100% after the span has been adjusted.

5-3-9 R13 ADJUSTMENT

Apply the SCA subcarrier to the transmitter. Depress TOTAL MOD switch and rotate the RANGE switch to 10% (-20 dB). No other modulation should be present. Adjust subcarrier level to read 100% on modulation meter (10% injection). Depress the particular FREQ switch corresponding to the subchannel being measured and depress the SUB INJ switch. Adjust R13 on main chassis so that 100% is indicated on the modulation meter.

5-3-10 R10 ADJUSTMENT

Apply a 400 Hertz audio signal to the AM NOISE jack J2 on the back panel of the SCM-1. Adjust the level to 0.78 volts RMS. Depress the AM NOISE switch and rotate the RANGE switch to 0 dB. Adjust R10 on main chassis to indicate 100% on the modulation meter.

5-3-11 R11 ADJUSTMENT

Apply a 400 Hertz audio signal to the INC AM jack J3 on the back panel of the SCM-1. Adjust the level to 0.9 volts RMS. Depress the INC AM switch and rotate the RANGE switch to 0 dB. Adjust R11 on the main chassis to indicate 100% on the modulation meter.

REPLACEMENT PARTS

INTRODUCTION

This section contains information for ordering replaceable parts for the monitor. The table lists the parts in alphanumerical order of their reference designations and provides a description of the part with the manufacturer's part number.

ORDERING INFORMATION

To order a replacement part from Belar, address the order or inquiry to Belar and supply the following information:

a. Model number and serial number of unit.

b. Description of part including the reference designation and location.

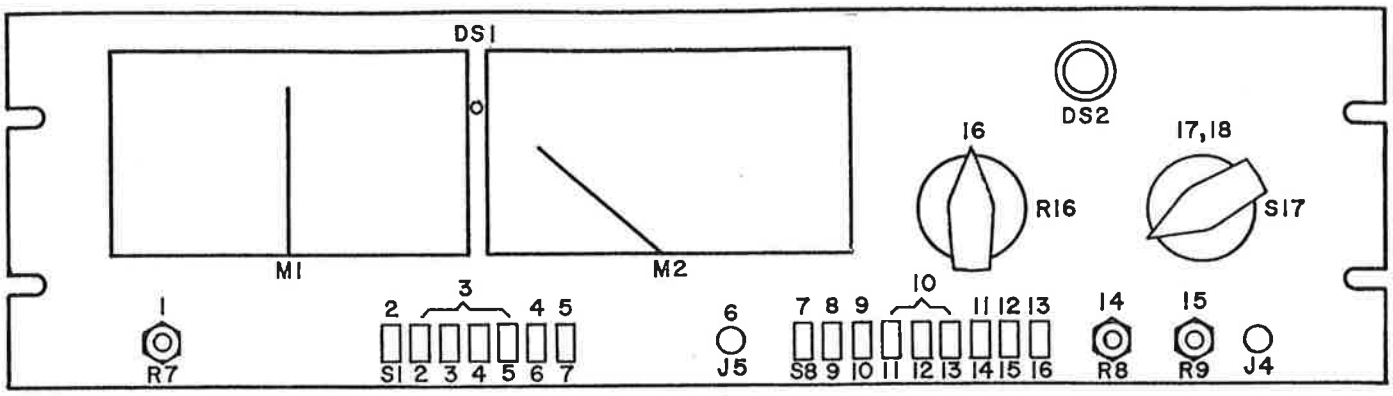
To order a part from a manufacturer other than Belar, provide the complete part description and the manufacturer's part number from the table.

REFERENCE DESIGNATORS

A	=	assembly	J	=	jack	S	=	switch
C	=	capacitor	L	=	inductor	T	=	transformer
DS	=	device signaling (lamp)	M	=	meter	TB	=	terminal board
F	=	fuse	P	=	plug	W	=	cable
FL	=	filter	Q	=	transistor	X	=	socket
			R	=	resistor	Y	=	crystal

ABBREVIATIONS

CER	=	ceramic	PC	=	printed circuit
COMP	=	composition	PF	=	picofarads
CONN	=	connector	PIV	=	peak inverse voltage
ELECT	=	electrolytic	POLY	=	polystyrene
F	=	farads	PORC	=	porcelain
FLM	=	film	POT	=	potentiometer
FXD	=	fixed	SEMICON	=	semiconductor
GE	=	germanium	SI	=	silicon
K	=	kilo = 1000	U	=	micro
M	=	meg = 1,000,000	VDCW	=	DC working volts
METFLM	=	metal film	W	=	watts
MY	=	mylar	WW	=	wire wound



1. FREQ ZERO POTENTIOMETER-Zeroes the frequency deviation meter in the FREQ CAL position.

2. POWER SWITCH-Turns the unit on.

3. FREQUENCY 1, 2, 3, 4 SWITCH-Selects one of the four crystal positions to heterodyne the SCA subcarrier frequency up to the 260 KHz IF frequency.

4. FREQ CAL SWITCH-Selects the 260 KHz calibrating crystal for frequency calibration.

5. MOD CAL SWITCH-Activates the 258 KHz and 262 KHz calibrating oscillators and the chopper to develop the 4 KHz peak-to-peak modulation deviation. Also inserts de-emphasis in the voltmeter circuits to remove the overshoot in the calibrating waveform.

6. AUDIO TEST JACK-Test output from the monitoring amplifier. Permits linearity tests, frequency response tests, and FM noise tests to be made from the front panel, (this output is not de-emphasized).

7. TOTAL MOD SWITCH-Measures total negative modulation of baseband signal.

8. MAIN MOD SWITCH-Inserts 15 KHz low pass filter to measure main modulation.

9. SUB INJ SWITCH-Measures subcarrier injection when FREQ switch is in an active position.

10. DEVIATION, 6, 4, 2 SWITCH-Selects one of three SCA deviation ranges. Modulation meter a peak indicator lamp are normalized to this 6 K 4 KHz, or 2 KHz deviation.

11. AM NOISE SWITCH-Measures AM noise of FM carrier.

12. INC AM SWITCH-Measures incidental AM noise of FM carrier.

13. REMOTE METER SWITCH-When in the off positi (released) removes remote meters from the moni circuits and substitutes their equivalent resis tances.

14. MOD CAL POTENTIOMETER-Sets level into discriminator to 100% when DEV switch is in 2 KHz position.

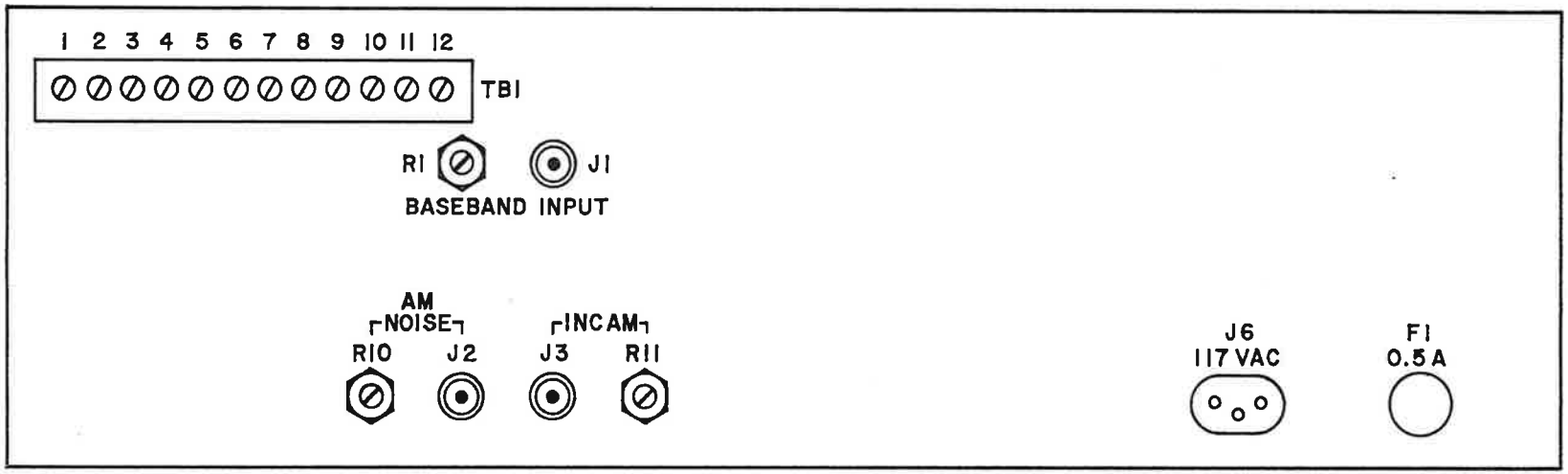
15. MOD ZERO POTENTIOMETER-Zeroes modulation meter with no signal and RANGE switch in MOD position.

16. PERCENT MODULATION POTENTIOMETER-Pre-sets t peak modulation lamp to flash at the indicated modulation setting. This circuit is independer of modulation polarity and can be activated by either a positive or negative modulation peak.

17. RANGE SWITCH-MOD-Measures the percentage of modulation with the peak reading voltmeter.

18. RANGE SWITCH-0 to 50 db-Measures crosstalk, noise and modulation with the average reading voltmeter.

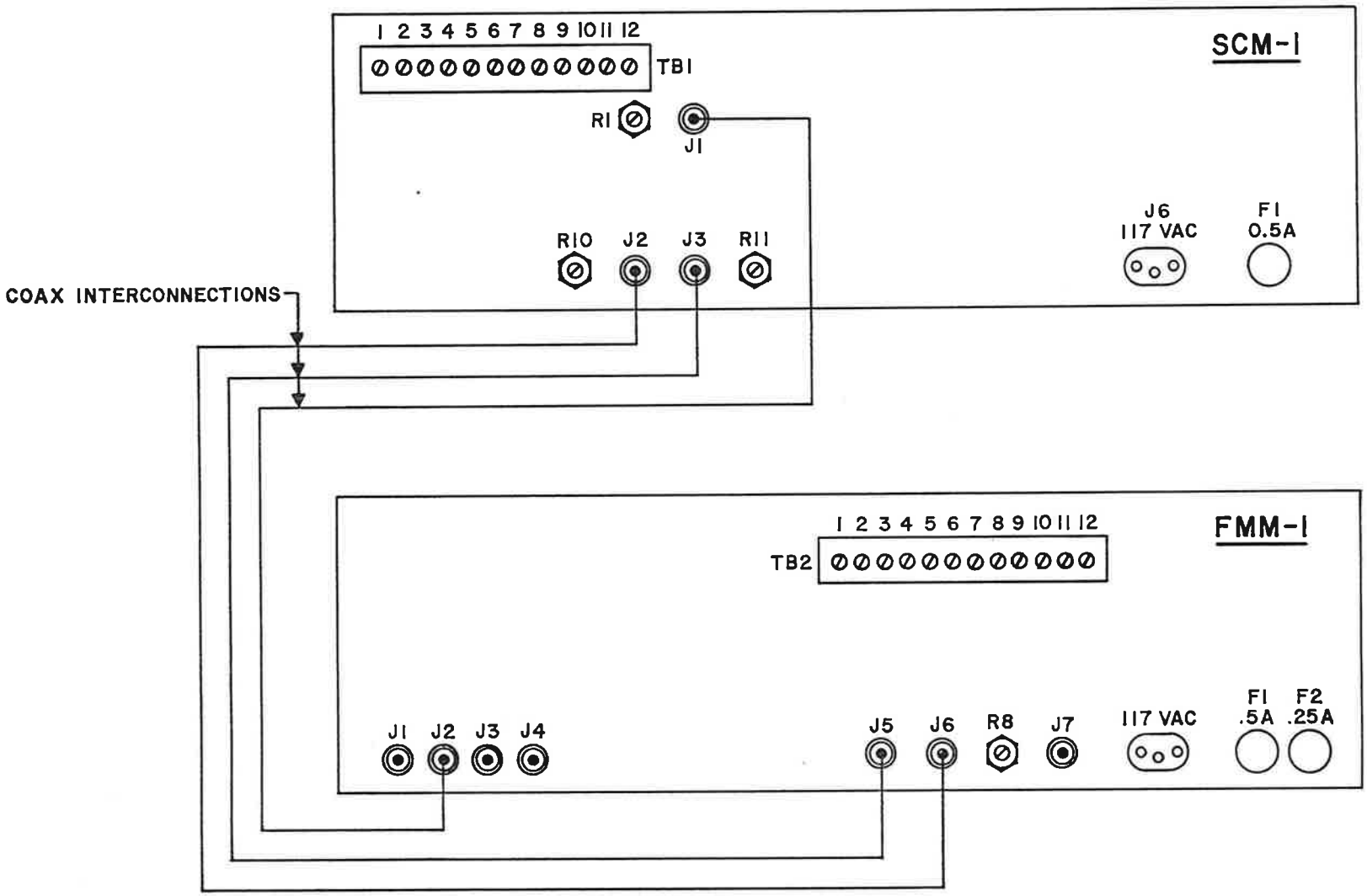
FRONT PANEL CONTROLS & INDICATORS



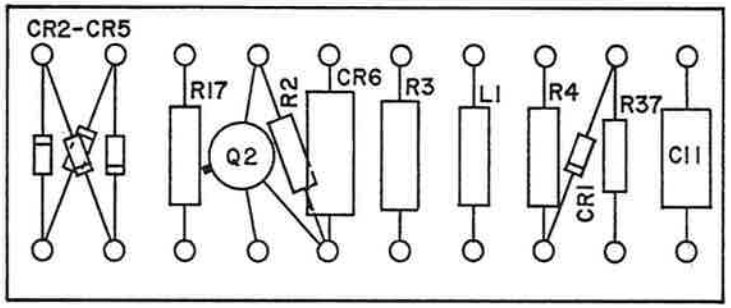
TB1-

1. GROUND
2. MONITOR OUTPUT
3. – REMOTE MODULATION METER
4. + REMOTE MODULATION METER
5. – REMOTE FREQUENCY METER
6. + REMOTE FREQUENCY METER
7. N.C.
8. > REMOTE PEAK LIGHT
9. >
10. N.C.
11. N.C.
12. N.C.

SCM-1 REAR CONNECTIONS & ADJUSTMENTS



COAXIAL CABLE CONNECTIONS BETWEEN SCM-1 & FMM-1



NOTE:
SYMBOL NUMBERS APPEAR ON CHASSIS SCHEMATIC DIAGRAM.

SCM-1 POWER SUPPLY ASS'Y

SECTION 6

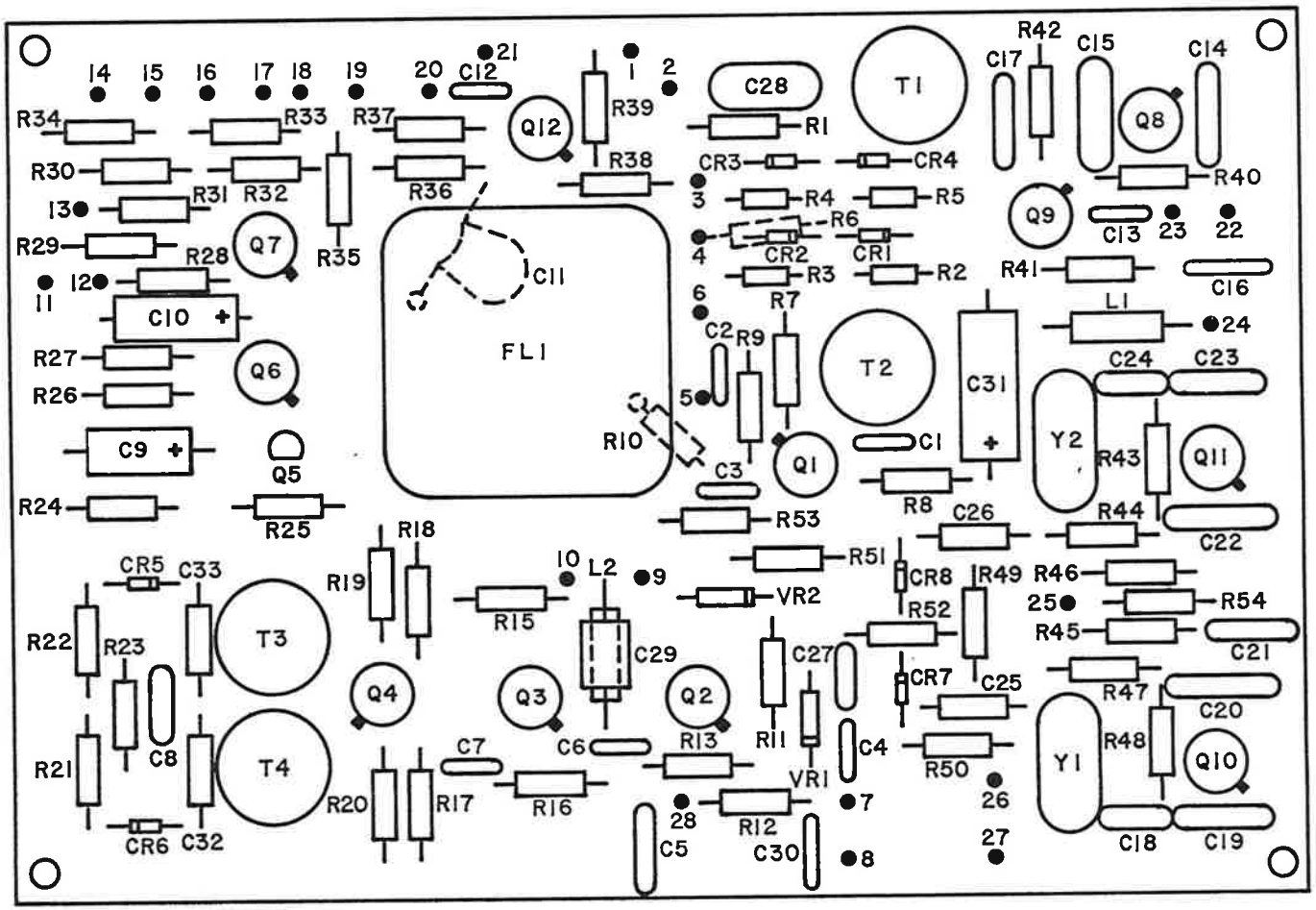
SCM-1 PARTS LISTS

MAIN CHASSIS

Reference Designation	Description	Part Number
C1,C2,C3	CAPACITOR: FXD ELECT 1000uF 50V	0180-0002
C4,C5	CAPACITOR: FXD CER 0.01uF 1kV	0151-0004
C6 THRU C10	CAPACITOR: FXD MICA 36pF 5% 500V	0140-3605
C11	CAPACITOR: FXD FLM 0.22uF 10% 80V	0120-2241
CR1 thru CR5	DIODE: 1N4006	1900-0016
CR6	DIODE: 3 x 1N4006	1900-0016
DS1	LAMP: INDICATOR ASSEMBLY AMBER	1450-0001
DS2	LAMP: INCANDESCENT - #1829	2140-0001
F1	FUSE: CARTRIDGE ½A 250V	2110-0001
FL1	FILTER: 260 kHz, BANDPASS	Belar
FL2	FILTER: 9 kHz, LOWPASS	Belar
FL3	FILTER: 15 kHz, LOWPASS	Belar
J1,J2,J3	JACK: RF BNC	0360-0005
J4,J5	JACK: PHONO	0360-0007
J6	JACK: POWER	0360-0004
M1	METER: FREQ, ±2 kHz (API)	1120-0005
M2	METER: MOD, 0-133% (API)	1120-0004
Q1	TRANSISTOR: 2N3054	1850-0009
Q2	TRANSISTOR: 2N3053	1850-0008
R1	RESISTOR: VAR COMP 100 10% 2W	2100-0010
R2	RESISTOR: FXD COMP 1k 5% ½W	0686-1025
R3	RESISTOR: FXD WW 0.33 5% 3W	0811-0002
R4	RESISTOR: FXD WW 100 5% 3W	0811-0004
R5	RESISTOR: FXD COMP 6.2k 5% ½W	0686-6225
R6	RESISTOR: FXD COMP 5.1k 5% ½W	0686-5125
R7	RESISTOR: VAR WW 100 10% 2W	2100-0003
R8	RESISTOR: VAR WW 500 10% 2W	2100-0001
R9	RESISTOR: VAR WW 100 10% 2W	2100-0003
R10,R11	RESISTOR: VAR COMP 100k 10% 2W	2100-0006
R12	RESISTOR: VAR COMP 50k 10% 2W	2100-0009
R13	RESISTOR: VAR COMP 5k 10% 2W	2100-0008
R14,R15	RESISTOR: VAR COMP 1k 10% 2W	2100-0007
R16	RESISTOR: VAR WW 500 10% 2W	2100-0001
R17	RESISTOR: FXD WW 1.5k 5% 3W	0811-0008
R18,R19	RESISTOR: FXD COMP 1.2k 5% ½W	0686-1225
R20	RESISTOR: FXD FLM 1k 1% ¼W	0731-1001
R21	RESISTOR: FXD FLM 499 1% ¼W	0731-4990

MAIN CHASSIS - SCM-1

Reference Designation	Description	Part Number
R22	RESISTOR: FXD FLM 1.5k 1% ¼W	0731-1501
R23 thru R27	RESISTOR: FXD COMP 8.2M 5% ½W	0686-8255
R28	RESISTOR: FXD FLM 200 1% ¼W	0731-2000
R29	RESISTOR: FXD FLM 442 1% ¼W	0731-4420
R30,R31	RESISTOR: FXD FLM 221 1% ¼W	0731-2210
R32	RESISTOR: FXD FLM 1.37k 1% ¼W	0731-1371
R33	RESISTOR: FXD FLM 442 1% ¼W	0731-4420
R34	RESISTOR: FXD FLM 1.37k 1% ¼W	0731-1371
R35	RESISTOR: FXD FLM 442 1% ¼W	0731-4420
R36	RESISTOR: FXD FLM 1.37k 1% ¼W	0731-1371
R37	RESISTOR: FXD COMP 2.4k 5% ½W	0686-2425
S1 thru S7	SWITCH: PUSHBUTTON	3101-0006
S8 thru S16	SWITCH: PUSHBUTTON	3101-0007
S17	SWITCH: ROTARY	3100-0002
T1	TRANSFORMER: POWER	9100-0001
TB1	TERMINAL BLOCK: 12 POINT	0360-0002
VR1	DIODE: 1N3030B (IN4750A)	1900-0004
XF1	FUSEHOLDER: BUSS HKP	2110-0003
Y1	CRYSTAL: 301 kHz (FOR 41 kHz SUBCARRIER FREQUENCY)	
Y2	CRYSTAL: 302 kHz (FOR 42 kHz SUBCARRIER FREQUENCY)	
Y3	CRYSTAL: 327 kHz (FOR 67 kHz SUBCARRIER FREQUENCY)	
Y4	CRYSTAL: OTHER THAN ABOVE (SPECIFY FREQUENCY)	
Y5	CRYSTAL: 260 kHz	



NOTE: DOTTED COMPONENTS ON BOTTOM OF BOARD.

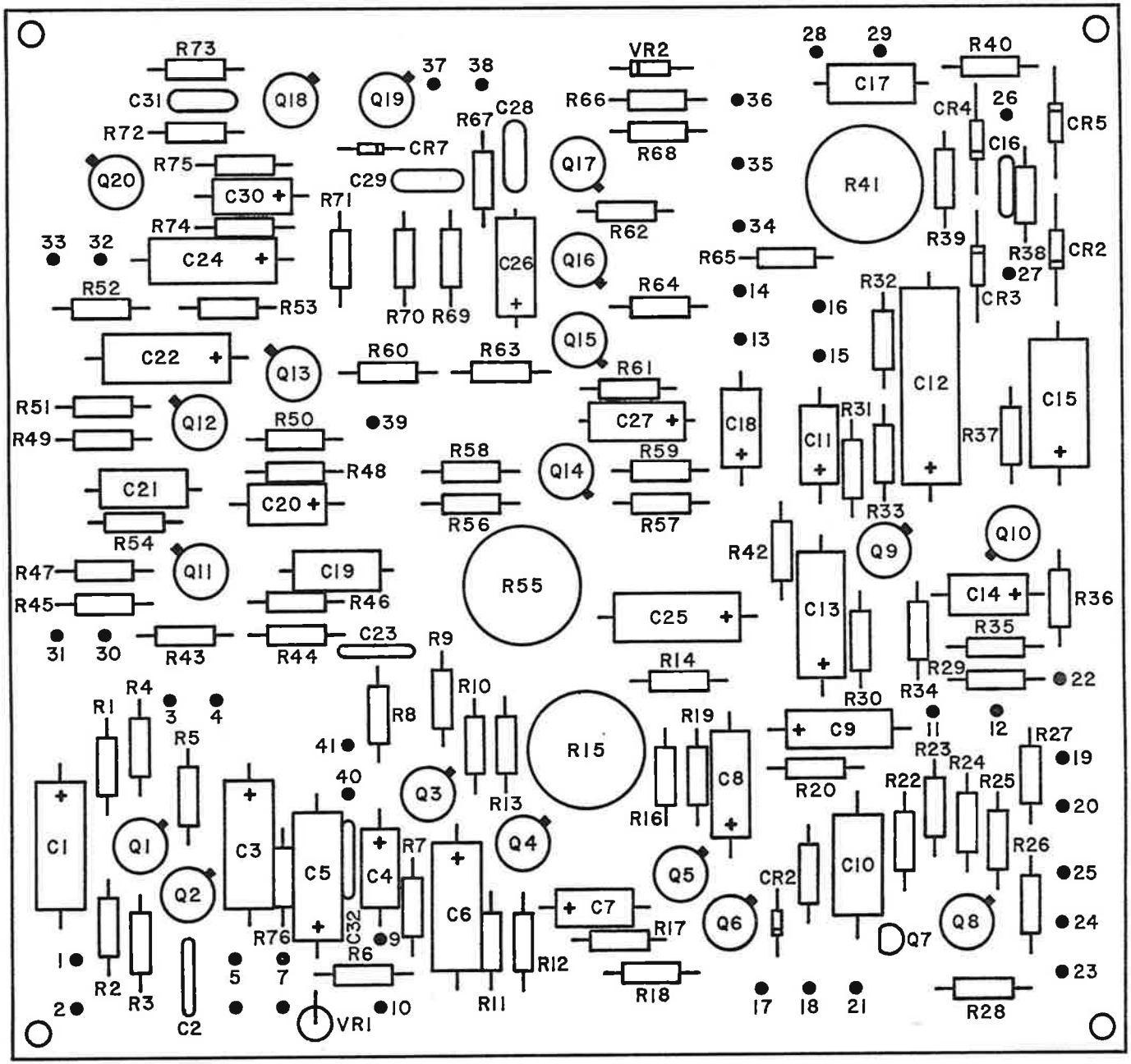
OSC, MIXER & IF COMPONENTS - A1 CARD

A1 BOARD - SCM-1

Reference Designation	Description	Part Number
C1,C2,C3,C4	CAPACITOR: FXD CER 0.01uF 100V	0151-0003
C5	CAPACITOR: FXD CER 1.0uF 50V	0151-0008
C6,C7	CAPACITOR: FXD CER 0.01uF 100V	0151-0003
C8	CAPACITOR: FXD MICA 250pF 5% 500V	0140-2515
C9	CAPACITOR: FXD ELECT 5uF 25V	0180-0007
C10	CAPACITOR: FXD ELECT 25uF 12V	0180-0009
C11	CAPACITOR: FXD CER 0.001uF 1kV	0151-0002
C12,C13	CAPACITOR: FXD CER 0.01uF 100V	0151-0003
C14	CAPACITOR: FXD MICA 1500pF 5% 500V	0141-1525
C15	CAPACITOR: FXD MICA 1800pF 5% 500V	0141-1825
C16	CAPACITOR: FXD CER 0.1uF 50V	0151-0006
C17	CAPACITOR: FXD CER 1.0uF 50V	0151-0008
C18	CAPACITOR: FXD MICA 36pF 5% 500V	0140-3605
C19	CAPACITOR: FXD MICA 1500pF 5% 500V	0141-1525
C20	CAPACITOR: FXD MICA 1800pF 5% 500V	0141-1825
C21	CAPACITOR: FXD CER 1.0uF 50V	0151-0008
C22	CAPACITOR: FXD MICA 1800pF 5% 500V	0141-1825
C23	CAPACITOR: FXD MICA 1500pF 5% 500V	0141-1525
C24	CAPACITOR: FXD MICA 36pF 5% 500V	0140-3605
C25,C26	CAPACITOR: FXD POLY 100pF 2.5% 160V	0130-1012
C27	CAPACITOR: FXD MICA 27pF 5% 500V	0140-2705
C28	CAPACITOR: FXD MICA 0.033uF 10% 100V	0135-0002
C29	CAPACITOR: FXD POLY 3900pF 2.5% 160V	0130-3922
C30	CAPACITOR: FXD CER 0.1uF 50V	0151-0006
C31	CAPACITOR: FXD ELECT 50uF 25V	0180-0005
C32,C33	CAPACITOR: FXD POLY 390pF 2.5% 160V	0130-3912
CR1 THRU CR8	DIODE: 1N4446	1900-0002
FL1	FILTER: INJECTION	Belar
L1,L2	INDUCTOR: RF 100 UH	9140-0005
Q1	TRANSISTOR: 2N3053	1850-0008
Q2,Q3	IC: CA3005	1820-0002
Q4	TRANSISTOR: 2N3053	1850-0008
Q5	TRANSISTOR: 2N3819	1850-0001
Q6,Q7,Q8,Q9	TRANSISTOR: 2N3053	1850-0008
Q10,Q11,Q12	TRANSISTOR: 2N3053	1850-0008
R1	RESISTOR: FXD COMP 270 5% ½W	0686-2715
R2 thru R5	RESISTOR: FXD COMP 300 5% ¼W	0683-3015
R6	RESISTOR: FXD COMP 3.3k 5% ½W	0686-3325
R7	RESISTOR: FXD COMP 1.5k 5% ½W	0686-1525
R8	RESISTOR: FXD COMP 5.1k 5% ½W	0686-5125
R9	RESISTOR: FXD COMP 2.4k 5% ½W	0686-2425
R10	RESISTOR: FXD COMP 510 5% ½W	0686-5115
R11	RESISTOR: FXD COMP 2.7k 5% ½W	0686-2725
R12	RESISTOR: FXD COMP 750 5% ½W	0686-7515

A1 BOARD - SCM-1

Reference Designation	Description	Part Number
R13	RESISTOR: FXD COMP 2.7k 5% ½W	0686-2725
R14	NOT USED	
R15	RESISTOR: FXD COMP 100 5% ½W	0686-1015
R16	RESISTOR: FXD COMP 1.1k 5% ½W	0686-1125
R17	RESISTOR: FXD COMP 4.7k 5% ½W	0686-4725
R18	RESISTOR: FXD COMP 47k 5% ½W	0686-4735
R19	RESISTOR: FXD COMP 20k 5% ½W	0686-2035
R20	RESISTOR: FXD COMP 470 5% ½W	0686-4715
R21,R22	RESISTOR: FXD FLM 10k 1% ¼W	0731-1002
R23	RESISTOR: FXD COMP 100k 5% ½W	0686-1045
R24	RESISTOR: FXD COMP 5.1k 5% ½W	0686-5125
R25	RESISTOR: FXD COMP 6.2k 5% ½W	0686-6225
R26	RESISTOR: FXD COMP 10k 5% ½W	0686-1035
R27	RESISTOR: FXD COMP 1k 5% ½W	0686-1025
R28	RESISTOR: FXD COMP 2.4k 5% ½W	0686-2425
R29	RESISTOR: FXD COMP 1k 5% ½W	0686-1025
R30	RESISTOR: FXD COMP 5.1k 5% ½W	0686-5125
R31	RESISTOR: FXD FLM 2.21k 1% ¼W	0731-2211
R32,R33	RESISTOR: FXD COMP 5.1k 5% ½W	0686-5125
R34,R35	RESISTOR: FXD COMP 510 5% ½W	0686-5115
R36	RESISTOR: FXD COMP 100k 5% ½W	0686-1045
R37	RESISTOR: FXD COMP 3.3k 5% ½W	0686-3325
R38	RESISTOR: FXD COMP 15k 5% ½W	0686-1535
R39	RESISTOR: FXD COMP 510 5% ½W	0686-5115
R40	RESISTOR: FXD COMP 150k 5% ½W	0686-1545
R41	RESISTOR: FXD COMP 1.2k 5% ½W	0686-1225
R42	RESISTOR: FXD COMP 1k 5% ½W	0686-1025
R43	RESISTOR: FXD COMP 100k 5% ½W	0686-1045
R44	RESISTOR: FXD COMP 1.2k 5% ½W	0686-1225
R45,R46	RESISTOR: FXD COMP 180 5% ½W	0686-1815
R47	RESISTOR: FXD COMP 1.2k 5% ½W	0686-1225
R48	RESISTOR: FXD COMP 100k 5% ½W	0686-1045
R49,R50	RESISTOR: FXD COMP 10k 5% ½W	0686-1035
R51	RESISTOR: FXD COMP 4.7k 5% ½W	0686-4725
R52	RESISTOR: FXD COMP 10k 5% ½W	0686-1035
R53	RESISTOR: FXD COMP 5.1k 5% ½W	0686-5125
R54	RESISTOR: FXD COMP 180 5% ½W	0686-1815
T1	TRANSFORMER: MIXER, INPUT	Belar
T2	TRANSFORMER: MIXER, OUTPUT	Belar
T3	TRANSFORMER: DISCRIMINATOR	Belar
T4	TRANSFORMER: DISCRIMINATOR	Belar
Y1	CRYSTAL: 262 kHz	
Y2	CRYSTAL: 258 kHz	



AUDIO AMP, VOLTMETER, METERING & FLASHER COMPONENTS - A2 CARD

A2 BOARD - SCM-1

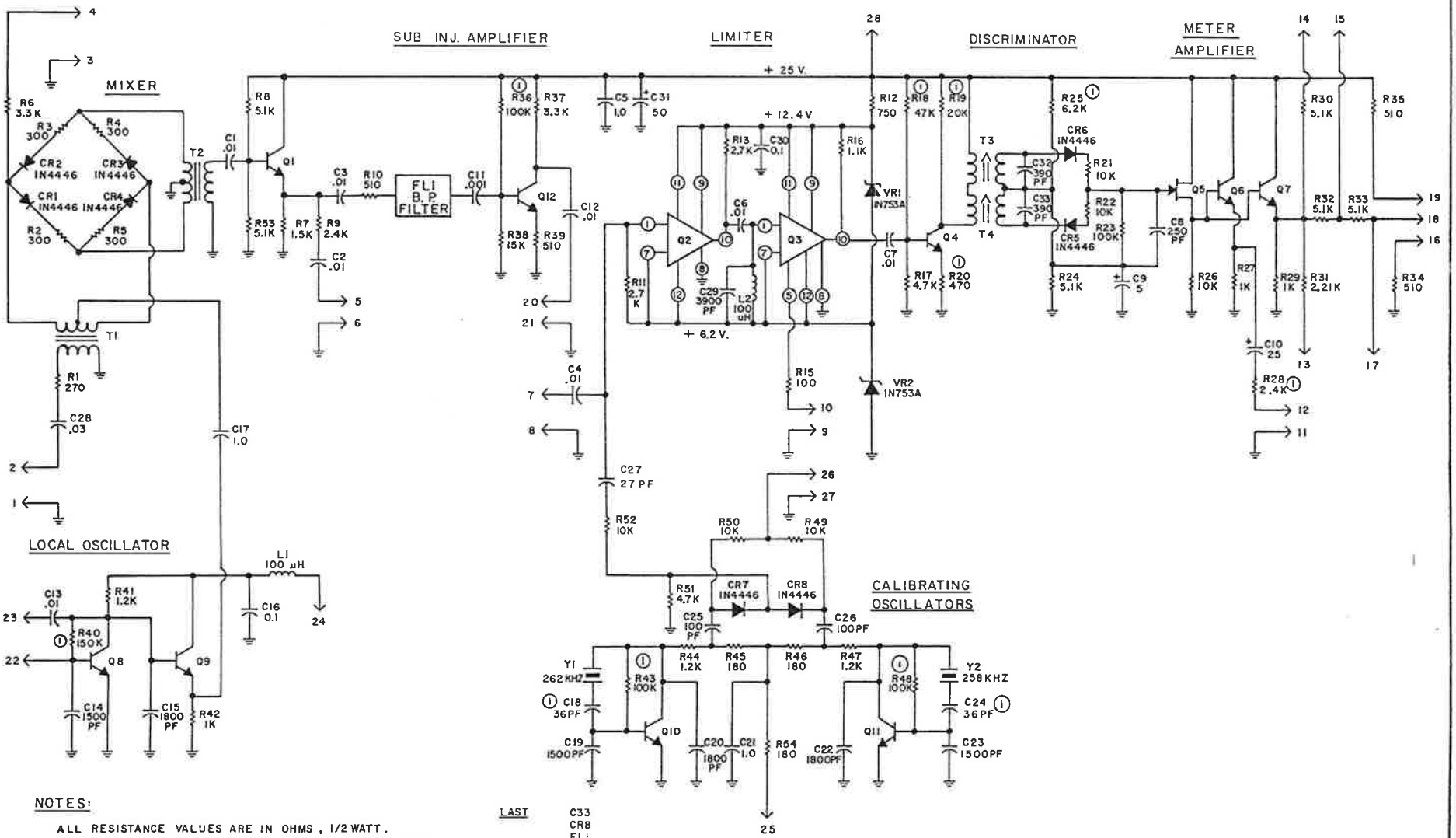
Reference Designation	Description	Part Number
C1	CAPACITOR: FXD ELECT 50uF 25V	0180-0005
C2	CAPACITOR: FXD CER 0.1uF 50V	0151-0006
C3	CAPACITOR: FXD ELECT 50uF 25V	0180-0005
C4	CAPACITOR: FXD ELECT 5uF 25V	0180-0007
C5,C6	CAPACITOR: FXD ELECT 50uF 25V	0180-0005
C7	CAPACITOR: FXD ELECT 5uF 25V	0180-0007
C8,C9	CAPACITOR: FXD ELECT 25uF 12V	0180-0009
C10	CAPACITOR: FXD FLM 0.22uF 10% 80V	0120-2241
C11	CAPACITOR: FXD ELECT 5uF 25V	0180-0007
C12	CAPACITOR: FXD ELECT 250uF 16V	0180-0008
C13	CAPACITOR: FXD ELECT 50uF 25V	0180-0005
C14	CAPACITOR: FXD ELECT 5uF 25V	0180-0007
C15	CAPACITOR: FXD ELECT 100uF 16V	0180-0006
C16	CAPACITOR: FXD CER 0.01uF 100V	0151-0003
C17	CAPACITOR: FXD FLM 0.1uF 10% 80V	0120-1041
C18	CAPACITOR: FXD ELECT 5uF 25V	0180-0007
C19	CAPACITOR: FXD FLM 0.1uF 10% 80V	0120-1041
C20	CAPACITOR: FXD ELECT 5uF 25V	0180-0007
C21	CAPACITOR: FXD FLM 0.047uF 10% 200V	0120-4731
C22	CAPACITOR: FXD ELECT 50uF 25V	0180-0005
C23	CAPACITOR: FXD CER 0.1uF 50V	0151-0006
C24,C25	CAPACITOR: FXD ELECT 50uF 25V	0180-0005
C26,C27	CAPACITOR: FXD ELECT 25uF 12V	0180-0009
C28	CAPACITOR: FXD MICA 250pF 5% 500V	0140-2515
C29	CAPACITOR: FXD MICA 120pF 5% 500V	0140-1215
C30	CAPACITOR: FXD ELECT 5uF 25V	0180-0007
C31	CAPACITOR: FXD MICA 250pF 5% 500V	0140-2515
C32	CAPACITOR: FXD CER 0.22uF 50V	0151-0007
CR1	DIODE: 1N4446	1900-0002
CR2 thru CR5	DIODE: AA119	1900-0001
CR6	DIODE: 1N4446	1900-0002
Q1 thru Q6	TRANSISTOR: 2N3053	1850-0008
Q7	TRANSISTOR: 2N3819	1850-0001
Q8,Q9	TRANSISTOR: 2N3053	1850-0008
Q10	TRANSISTOR: 2N4037	1850-0011
Q11 thru Q14	TRANSISTOR: 2N3053	1850-0008
Q15,Q16	TRANSISTOR: MP 2N3053	1850-0008
Q17 thru Q20	TRANSISTOR: 2N3053	1850-0008
R1	RESISTOR: FXD COMP 22k 5% ½W	0686-2235
R2	RESISTOR: FXD COMP 75k 5% ½W	0686-7535
R3	RESISTOR: FXD FLM 2.21k 1% ¼W	0731-2211
R4	RESISTOR: FXD COMP 750 5% ½W	0686-7515
R5	RESISTOR: FXD COMP 1.2k 5% ½W	0686-1225
R6	RESISTOR: FXD COMP 820 5% ½W	0686-8215
R7	RESISTOR: FXD COMP 100k 5% ½W	0686-1045
R8	RESISTOR: FXD COMP 120k 5% ½W	0686-1245

A2 BOARD - SCM-1

Reference Designation	Description	Part Number
R9	RESISTOR: FXD COMP 10k 5% ½W	0686-1035
R10	RESISTOR: FXD COMP 4.7k 5% ½W	0686-4725
R11	RESISTOR: FXD COMP 47k 5% ½W	0686-4735
R12	RESISTOR: FXD COMP 3.3k 5% ½W	0686-3325
R13	RESISTOR: FXD COMP 240 5% ½W	0686-2415
R14	RESISTOR: FXD COMP 1.8k 5% ½W	0686-1825
R15	RESISTOR: VAR WW 3k 2W	2100-0005
R16	RESISTOR: FXD COMP 4.7k 5% ½W	0686-4725
R17	RESISTOR: FXD COMP 24k 5% ½W	0686-2435
R18	RESISTOR: FXD COMP 3.3k 5% ½W	0686-3325
R19	RESISTOR: FXD COMP 330 5% ½W	0686-3315
R20	RESISTOR: FXD COMP 820 5% ½W	0686-8215
R21	RESISTOR: FXD COMP 8.2M 5% ½W	0686-8255
R22	RESISTOR: FXD COMP 10k 5% ½W	0686-1035
R23	RESISTOR: FXD COMP 1.5k 5% ½W	0686-1525
R24	RESISTOR: FXD COMP 6.2k 5% ½W	0686-6225
R25,R26	RESISTOR: FXD FLM 1k 1% ¼W	0731-1001
R27,R28	RESISTOR: FXD COMP 510 5% ½W	0683-5115
R29	RESISTOR: FXD COMP 1k 5% ½W	0686-1025
R30	RESISTOR: FXD COMP 220k 5% ½W	0686-2245
R31	RESISTOR: FXD COMP 47k 5% ½W	0686-4735
R32	RESISTOR: FXD COMP 100 5% ½W	0686-1015
R33	RESISTOR: FXD COMP 6.2k 5% ½W	0686-6225
R34	RESISTOR: FXD COMP 12k 5% ½W	0686-1235
R35	RESISTOR: FXD COMP 6.2k 5% ½W	0686-6225
R36	RESISTOR: FXD COMP 100 5% ½W	0686-1015
R37	RESISTOR: FXD COMP 12k 5% ½W	0686-1235
R38	RESISTOR: FXD COMP 10k 5% ½W	0686-1035
R39	RESISTOR: FXD COMP 180 5% ½W	0686-1815
R40	RESISTOR: FXD COMP 10k 5% ½W	0686-1035
R41	RESISTOR: VAR WW 100 2W	2100-0013
R42	RESISTOR: FXD COMP 10k 5% ½W	0686-1035
R43	RESISTOR: FXD COMP 12k 5% ½W	0686-1235
R44	RESISTOR: FXD COMP 24k 5% ½W	0686-2435
R45	RESISTOR: FXD COMP 2.2k 5% ½W	0686-2225
R46	RESISTOR: FXD COMP 1.5k 5% ½W	0686-1525
R47	RESISTOR: FXD COMP 100 5% ½W	0686-1015
R48	RESISTOR: FXD COMP 27k 5% ½W	0686-2735
R49	RESISTOR: FXD COMP 3k 5% ½W	0686-3025
R50	RESISTOR: FXD COMP 820 5% ½W	0686-8215
R51	RESISTOR: FXD COMP 100 5% ½W	0686-1015
R52	RESISTOR: FXD COMP 1.5k 5% ½W	0686-1525
R53	RESISTOR: FXD COMP 620 5% ½W	0686-6215
R54	RESISTOR: FXD COMP 1.6k 5% ½W	0686-1625
R55	RESISTOR: VAR WW 3k 2W	2100-0005
R56	RESISTOR: FXD COMP 10k 5% ½W	0686-1035
R57	RESISTOR: FXD COMP 4.3k 5% ½W	0686-4315
R58,R59	RESISTOR: FXD FLM 1k 1% ¼W	0731-1001
R60	RESISTOR: FXD COMP 390 5% ½W	0686-3915

A2 BOARD - SCM-1

Reference Designation	Description	Part Number
R61,R62	RESISTOR: FXD COMP 4.7k 5% ½W	0686-4725
R63	RESISTOR: FXD COMP 1k 5% ½W	0686-1025
R64	RESISTOR: FXD COMP 560 5% ½W	0686-5615
R65	RESISTOR: FXD COMP 51 5% ½W	0686-5105
R66	RESISTOR: FXD FLM 2.21k 1% ¼W	0731-2211
R67	RESISTOR: FXD COMP 15k 5% ½W	0686-1535
R68	RESISTOR: FXD COMP 6.8k 5% ½W	0686-6825
R69	RESISTOR: FXD COMP 1k 5% ½W	0686-1025
R70,R71	RESISTOR: FXD COMP 2.2k 5% ½W	0686-2225
R72	RESISTOR: FXD COMP 10k 5% ½W	0686-1035
R73	RESISTOR: FXD COMP 2.2k 5% ½W	0686-2225
R74	RESISTOR: FXD COMP 82k 5% ½W	0686-8235
R75	RESISTOR: FXD COMP 2.2k 5% ½W	0686-2225
R76	RESISTOR: FXD FLM 1k 1% ¼W	0731-1001
VR1	DIODE: 1N3024B	1900-0009
VR2	DIODE: 1N965B	1900-0007



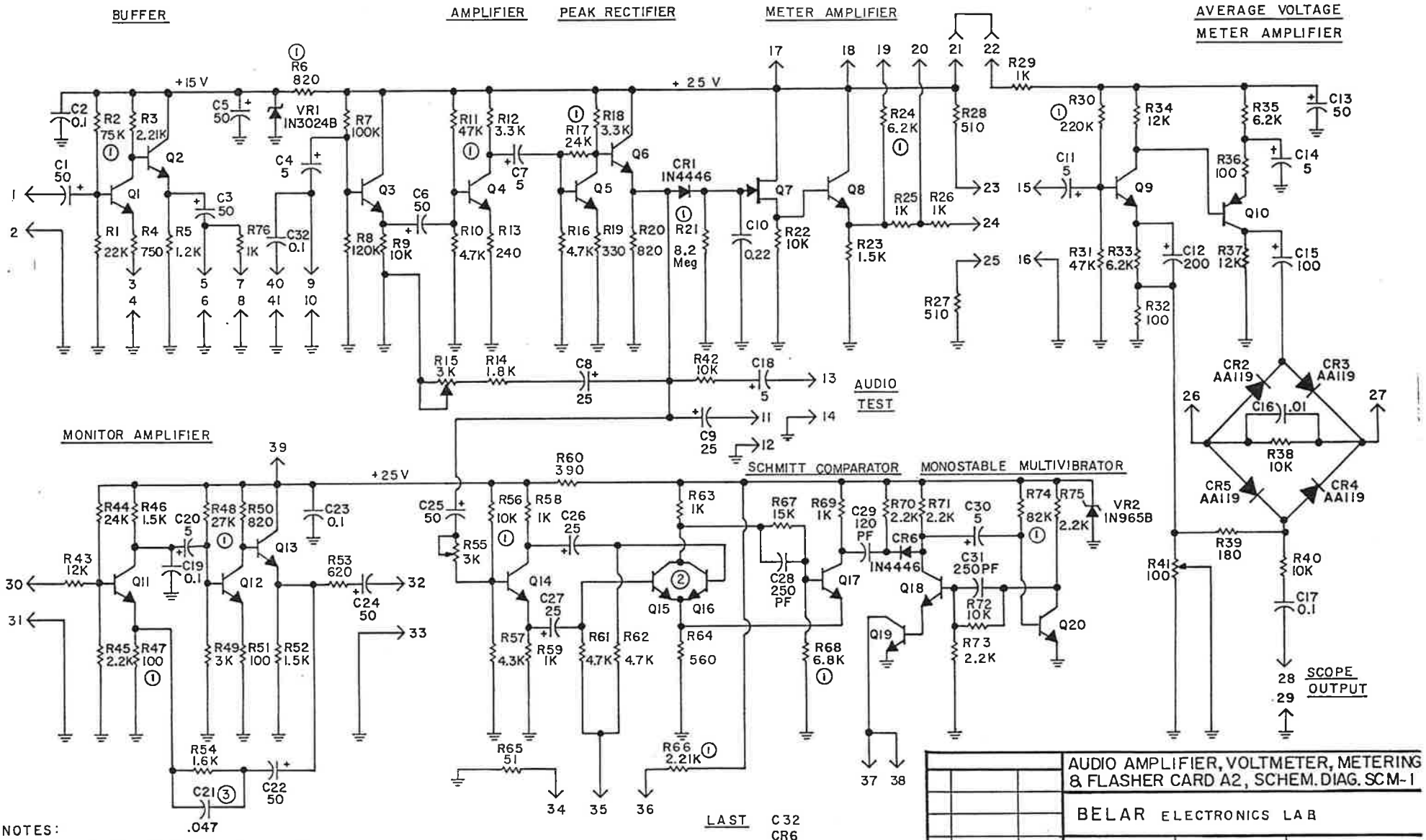
NOTES:

ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT.
ALL CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS NOTED.
(1) VALUES SELECTED IN PRODUCTION, NOMINAL VALUES SHOWN.

LAST

C33
CR8
FL1
L2
Q12
R54
T4
VR2
Y2
TERMINAL 28

	OSCILLATOR, MIXER & IF CARD A1, SCHEMATIC DIAGRAM, SCM-1
	BELAR ELECTRONICS LAB.
	C00189



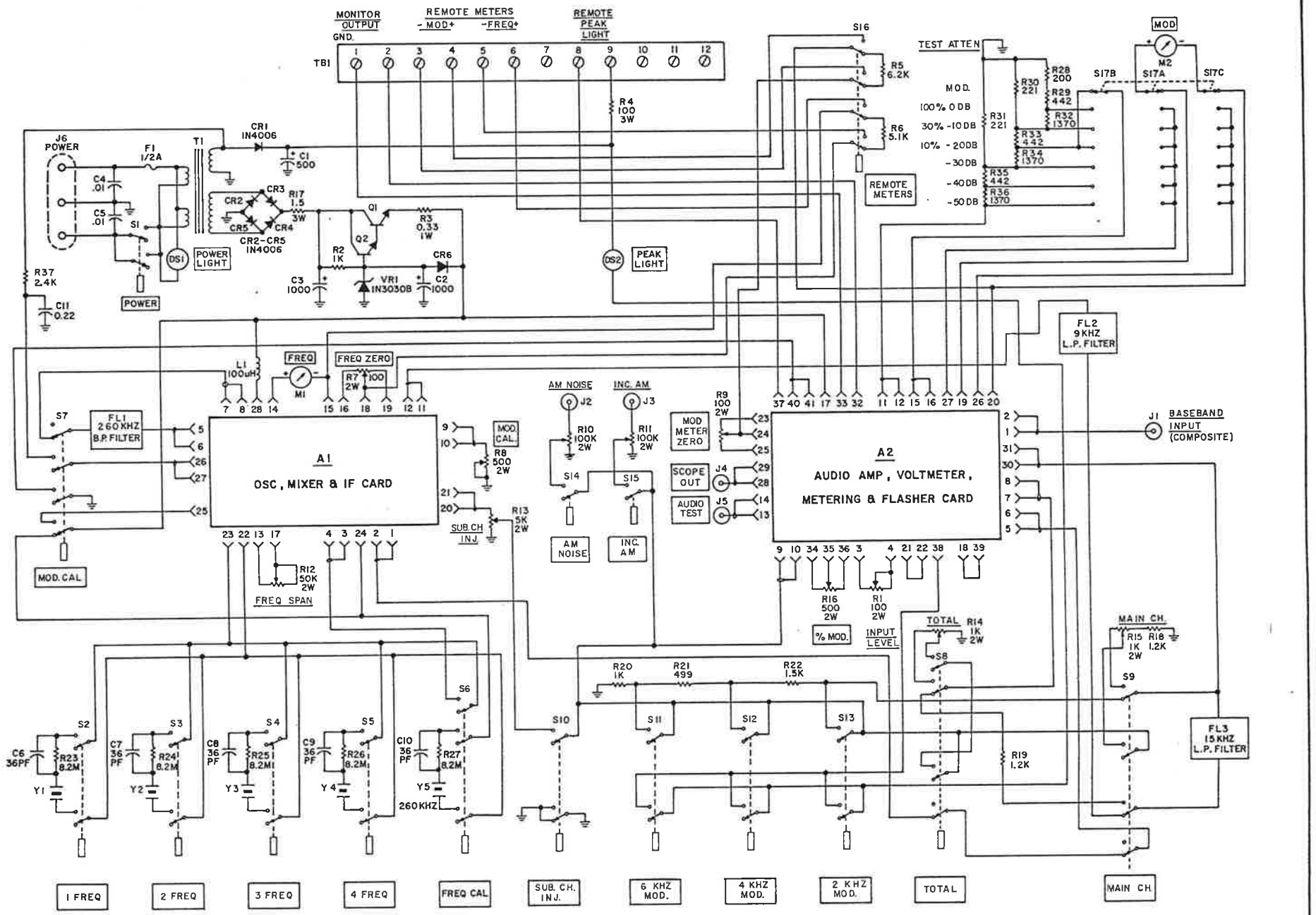
NOTES:
ALL RESISTANCE VALUES ARE IN OHMS.
ALL CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS NOTED.
① VALUES SELECTED IN PRODUCTION, NOMINAL VALUES SHOWN.
② MATCHED PAIR ③ 0.1 μF 150 μ SEC DE-EMPH.

LAST C32 CR6 Q20 R76 VR2 TERM 41

AUDIO AMPLIFIER, VOLTMETER, METERING & FLASHER CARD A2, SCHEM. DIAG. SCM-1

BELAR ELECTRONICS LAB

B00174



NOTE

ALL RESISTANCE VALUES ARE IN OHMS.
CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS NOTED.

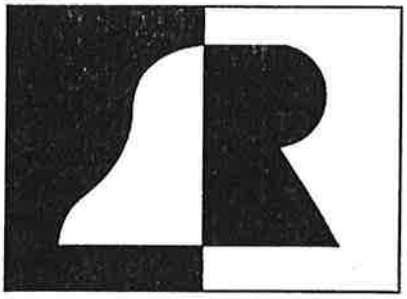
LAST

C11
CR6
DS2
F1
FL3
J6
L1
M2

LAST

Q2
R37
S17
T1
TB1
VR1
Y5

REVISIONS			
No	Date	By	
1			SCM-1 SCA MONITOR CHASSIS SCHEMATIC DIAGRAM
2			
3			
4			C00190
5			



BELAR

ELECTRONICS LABORATORY, INC.

119 LANCASTER AVENUE
P.O. BOX 76
DEVON, PA 19333-0076 USA
VOICE (610) 687-5550 • FAX (610) 687-2686

http://www.belar.com
sales@belar.com
service@belar.com
parts@belar.com