McMartin industries, inc.

TBM-1005D
TBM-1003D

FM
RELAY RECEIVER

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MCMARTIN

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TBM-1005D
5 Channel FM Relay Receiver

INSTRUCTION MANUAL

I. SPECIFICATIONS

Main Channel

ANTENNA INPUT IMPEDANCE	50/72 ohm unbalanced
RANGE - TBM-1005D	88-108 mHz
- TBM-1003D	VHF-TV channels 2-13 aural carriers
SENSITIVITY - TBM-1005D	1 microvolt for 30 dB quieting
- (Monaural)	3 microvolts for 50 dB quieting
TBM-1003D - (Ch. 2-6)	1.5 microvolt for 30 dB quieting
- (Ch. 7-13)	3 microvolts for 30 dB quieting
SELECTIVITY - TBM-1005D	50 dB alternate channel (Standard) 70 dB with optional filter
CAPTURE RATIO	1 dB or less (wide band) 1.5 dB or less(with narrow band filter)
COMPOSITE OUTPUT	1.5v (P-P) adjustable
COMPOSITE FREQUENCY RESPONSE	±0.3 dB 10-75,000 Hz

Program Audio Outputs
(Monaural Plug-In Card, standard)

AUDIO OUTPUT IMPEDANCE	600 ohm balanced
OUTPUT LEVEL	+8 dBm @ 100% mod. 400 Hz
FREQUENCY RESPONSE	±0.5 dB 30-15,000 Hz
DE-EMPHASIS	75 microsecond standard 25 or 50 microsecond available
S/N RATIO	Typically 65 dB or greater below 100% mod., 400 Hz
DISTORTION	THD 0.5% or less (30-15,000 Hz)
19 kHz PILOT CARRIER REJECTION	65 dB or greater

Stereo Plug-In Card STE-1D (optional)

AUDIO OUTPUT IMPEDANCE	600 ohm balanced right and left channel
OUTPUT LEVEL	+8 dBm right and left channel

FREQUENCY RESPONSE	+0.5 dB 30-15,000 Hz
DE-EMPHASIS	75 microsecond standard 25 or 50 microsecond available
S/N RATIO	55 dB or greater below 100% Modulation 400 Hz left or right Ch.
DISTORTION	THD 1% or less 30-15,000 Hz
CHANNEL SEPARATION	40 dB 50-10,000 Hz 30 dB 10,000-15,000 Hz
PILOT INJECTION METERING	±1% accuracy when receiver is completely limited
SCA REJECTION	65 dB or greater

SCA Plug-In Card SCA-2-67D (optional)

AUDIO OUTPUT IMPEDANCE	600 ohm balanced
OUTPUT LEVEL	+8 dBm 100% modulation (±6 kHz deviation) @ 200 Hz
FREQUENCY RESPONSE	±3 dB - 30-6,000 Hz with modified 150 microsecond de-emphasis
S/N RATIO	Typical 60 dB below 100% modulation referenced @ 200 Hz
DISTORTION	1% or less 30-6,000 Hz - Typically 0.5% at 400 Hz
SCA INJECTION METERING	±1% accuracy when receiver is completely limited
SCA MODULATION METERING	Meter is semi-peak reading and referenced at ±6 kHz deviation for 100% modulation

SCA -- Plug-In Card SCA-2-41D (optional)

Specifications are generally the same as for the SCA-2-67 kHz plug-in card excepting the 100% modulation is referenced at ±4 kHz deviation. NOTE: Other SCA frequencies are available.

METERING FUNCTIONS	Relative RF level, total modulation, pilot injection, SCA injection and SCA modulation
POWER REQUIRED	120/240 VAC 50/60 Hz -- 25 watts

DIMENSIONS	19" (48.26 cm) width standard EIA rack mount. 3½" (8.89 cm) height 12" (30.48 cm) depth
FINISH	McMartin beige with woodgrain trim

Plug-In Accessories

STE-1D	Stereo demodulator card
SCA-2-67D	67 kHz SCA demodulator card
SCA-2-41D	41 kHz SCA demodulator card
	NOTE: Other SCA frequencies available. The TBM-1005D and 1003D are normally supplied with the plug-in mono card.

REAR CHASSIS TERMINATION	Antenna (BNC), composite output (BNC) monaural or stereo left, SCA-2 or stereo right, SCA-1 and carrier relay contacts (NO) or (NC)
RELAY CONTACTS RATING	0.5 amp. @ 24 volts
WEIGHT	12 pounds

II. INSPECTION

Upon receipt of the receiver, inspect the unit carefully for any shipping damage incurred in transit. If damage is found, immediately notify the shipping agency and McMartin Industries, Customer Service Department of said action.

III. INSTALLATION

The TBM-1005D receiver is normally shipped with the standard mono card. If the receiver was ordered with the optional stereo plug-in card (STE-1D) and/or the optional SCA plug-in card (SCA-2D), remove the top cover and insure that they are inserted in their respective sockets. The receiver should be installed

in a standard rack enclosure which is electrically grounded to the main station ground and located away from strong RF fields generated by transmitting equipment. Ambient temperature should not exceed 130°F.

3.1 ANTENNA

Connect the antenna cable to the antenna (BNC) connector. A properly installed antenna is an important requirement for optimum reception. Multipath reception will give erroneous pilot and SCA injection readings and can also greatly affect stereo separation and distortion. Yagi-type, cut to frequency arrays will generally give the best results. If SCA multiplex reception is used, good directional antenna characteristics are essential to minimize crosstalk as this is the most common cause of main/sub channel crosstalk. Only the antenna can eliminate it. Multipath is most prevalent in large metropolitan areas or in mountainous terrain where strong reflected signals may arrive at the antenna in an out-of-phase relationship with the original signal, resulting in disturbance of the original carrier and its attendant side bands.

The input impedance is 50 ohm, unbalanced. It is recommended that the transmission line be RG-58/U or other low loss 50 ohm cable. RG-8/U has approximately half the loss of RG-58/U and recommended for transmission lines in excess of 100 ft.

CAUTION must be used when mounting the receiving antenna on the transmitting tower as experience has shown that 8 to 10 volts of RF energy can appear at the input of the receiver even if the frequency difference is 5 to 10 MHz. No receiver can accept this level of RF without serious front end overload. It may even destroy the RF input circuitry or RF amplifier; also the RF amplifier is over-driven and becomes a mixer rather than an amplifier and will render the receiver inoperative or cause a high noise level in the audio output.

It is recommended that the antenna not be mounted on the FM transmitting tower. However, if it becomes necessary to do this, tuned stubs or high "Q" helical resononators can sometimes prove effective to reduce the induced transmitter energy down to a level of 1 volt or less and provide a satisfactory signal. The TBM-1005D can handle input signals up to approximately 1 volt with minimum cross-modulation.

3.2 AUDIO OUTPUT CONNECTIONS

Audio outputs appear on a series of labeled barrier strips on the rear chassis. Connections to external loads should be made with shielded two-conductor audio cable. The load is connected across the appropriate two outer terminals. The center terminal is chassis ground. The audio output terminations can drive 600 ohm loads at a level of +8 dBm or higher.

3.3 CARRIER RELAY CONNECTIONS

The carrier controlled relay contact terminations appear on the labeled barrier strip on the rear chassis. The center terminal is common. The two outside terminals will provide either normally closed (NC) or normally open (NO) contact to the center common terminal in the absence of the RF carrier. The rating of these contacts are 0.5 amperes at 24 volts and must be used as a slave relay if 120 volt circuits are to be controlled.

3.4 AC POWER INPUT

The TBM-1005D is designed for operation on either 120 or 240 volt operation. The receiver is normally shipped for 120 volt operation unless specified by the customer. See the maintenance section for changing the operating voltage in the field.

Plug the three-prong AC card into the power receptacle and turn the receiver on with the monitor (Mon.) level control and the pilot light will indi-

cate that the receiver is ready for operation.

3.5 COMPOSITE OUTPUT

The wide band composite signal appears on the BNC connector marked composite output. The level may be adjusted from zero to 1.5v (P-P). CAUTION: The load impedance must be at least 2,000 ohms (Min.) and the capacitance must not exceed 100pf or composite error may occur.

3.6 INITIAL ADJUSTMENT

All circuits have been factory aligned and should require no re-adjustments.

Apply power to the receiver by turning the monitor level control on.

Turn the selector switch to the No. 1 channel and the function switch to the RF level position. An RF level indication will occur if it is receiving the designated channel. RF levels as low as one microvolt will give a meter reading. A 100% reading indicates that the signal level is adequate for proper operation of the receiver. Note: A residual reading of 2% is normal.

The modulation (Mod.) position of the function switch indicates the total modulation of the FM transmission including the 19 kHz pilot and SCA injection levels if being transmitted. The "pilot inj." position will indicate a reading only if the receiver utilizes the STE-1D stereo plug-in card. The "SCA inj." and "SCA Mod." positions will operate only if the receiver utilizes either the SCA-2-67D or SCA-2-41D SCA plug-in cards. NOTE: If two SCA plug-in cards are used, the "pilot inj." position will read the SCA-2 injection level. The muting level of the SCA-1 or SCA-2 channel may be adjusted to the desired level by the respective controls on the rear chassis.

The main channel muting has been factory adjusted at approximately 5 microvolts and is controlled by an internal main channel mute control (R-34) on the

main channel PC board.

IV. GENERAL DESCRIPTION

The McMartin TBM-1005D is a 1-5 channel crystal-controlled FM relay receiver which supercedes the performance proved TBM-1000B series. The McMartin TBM-1003D is available for operation in the VHF-TV aural channels, Channel 2 through 6 and Channel 7 through 13 only.

The McMartin TBM-1005D is a high performance FM relay receiver with an accurate wide band composite signal output. The receiver also provides stereo and/or SCA outputs by simple insertion of optional plug-in cards. Two cards may be accommodated. The optional STE-1D stereo plug-in card provides a left and right channel output at a level of +8 dBm (600 ohms). It also provides accurate measurement of the stereo pilot injection level.

The optional SCA-2-67D or SCA-2-41D SCA plug-in cards will provide an SCA audio output of +8 dBm (600 ohms) and provide measurement of the SCA injection level plus monitoring of the modulation level, selectable by the front panel function switch. Two SCA plug-in cards may be used simultaneously with the second SCA card inserted in the mono or stereo socket.

The standard mono card incorporates a 15 kHz low-pass filter to remove the troublesome 19 kHz stereo signal from the audio which can otherwise create problems if the signal is used for rebroadcast or recording.

The TBM-1005D utilizes a new concept in receiver design providing space age technology in which the receiver actually tracks the modulated signal from the FM transmitter providing accurate composite signals identical to what was originally transmitted.

The front end of the TBM-1005D is crystal controlled and utilizes a diode protected dual gate D-MOS field effect RF amplifier. This device has very

linear AGC control providing greater than 50 dB gain reduction resulting in an overall tuner dynamic range of over 100 dB with minimum of cross modulation. The AGC does not produce any skewing or detuning of the RF circuits. All RF circuitry switching and tracking is performed by using Varactor tuning techniques. No switch contacts are used in RF circuits and each channel is tuned by a trimpot potentiometer controlled by the front panel function switch.

An entirely new IF system has been designed eliminating the large multi-section 10.7 MHz IF band-pass filter. The TBM-1005D provides better selectivity to reject unwanted signals and still provide accurate composite signals. Provisions are provided for the addition of an optional filter for exceptional high selectivity.

The wide-band composite signal is amplified and converted to a low impedance and available to feed the following circuits, the STE-1D stereo plug-in card, the SCA-2D, SCA plug-in card and the composite output jack on the rear chassis. The composite signal is also routed through position No. 2 of the function switch to the metering circuitry for measurement of total modulation.

A monitor amplifier is provided to drive the front panel speaker for monitoring the mono or SCA audio modulation. A carrier failure relay circuit driven from the RF level voltage is provided. Single pole, single throw relay contacts are terminated on the rear chassis for interconnection to appropriate alarm devices or audio system control. Adjustable squelch control of main and two SCA channels are provided. The two SCA squelch controls are mounted on the rear chassis and adjustable from 3% to 10% injection levels.

V. CIRCUIT DESCRIPTION

The desired FM signal fed into the rear chassis BNC connector is fed to an approximately 50 ohm tap on the antenna resonant circuit consisting of

inductor L1 and Varactor tuning capacitor VVC1. The impedance of the antenna resonant circuit is 7,500 ohms matching the input impedance of gate No. 1 of the dual gate D-MOS FET RF amplifier. Gate No. 2 of the RF amplifier requires +5.5v for maximum gain and is obtained from the AGC circuit described later. The drain circuit of the D-MOS FET is fed through the high impedance choke coil feeding the high impedance (7,500 ohm) resonant circuit L-3 and Varactor VVC2. The RF amplifier Q-1 provided typically 20 dB RF gain with excellent stability. The amplifier signal is fed into the gate No. 1 of the dual gate MOS FET mixer. The input impedance is very high providing negligible loading of the RF resonant circuit. The oscillator inductor L-6 resonates at a frequency lower than the lowest crystal frequency to insure crystal oscillations. A positive voltage is required to activate any one of the five crystals controlled by the diode switches. The diode switches are controlled by the front panel selector switch. The crystal frequency for the TBM-1005D is determined by the following formula:

$$\text{F-XTAL} = \frac{\text{F-10.7 MHz}}{2}$$

The crystal frequency for the TBM-1003D is determined by the following formual:

$$\text{Ch. 2-6} \quad \text{F-XTAL} = \frac{\text{F+10.7 MHz}}{2}$$

$$\text{Ch. 7-13} \quad \text{F-XTAL} = \frac{\text{F-10.7 MHz}}{2}$$

The crystal oscillator frequency is fed to the low impedance tap of the doubler coil L-7. The doubler resonant circuit consists of inductor L-7 and tuning Varactor VVC3, thus the L.O. frequency is twice the crystal frequency and is fed to gate No. 2 of the MOS FET mixer. This gives very good isolation of the L.O. signal into the antenna input.

The antenna coil L1, mixer coil L3 and doubler coil L5 are tuned simultaneously by controlling the voltage on Varactors VVC1, VVC2, and VVC3. This is

accomplished by adjusting the appropriate trimpot for the desired channel. RF tracking is accomplished by adjustment of the slugs in L1, L2, and L7 and can be made to track the FM band within 3% or better.

Matching transformer T-1 presents a 7,500 ohm load to the drain of the MOS FET mixer providing a mixer that has a very large 10.7 MHz voltage swing without overload. The output impedance of T-1 is low to match the wide band 10.7 MHz filter. The 10.7 MHz signal is fed to amplifier Q-4 which provides approximately 10 dB gain and drives the second 10.7 MHz filter which provides good selectivity on the first alternate channel and a good stereo composite signal.

The wide band 10.7 MHz signal is fed to an entirely new IF system called the Precise Tracking Decoder (PTD). This IF system actually tracks the modulated 10.7 MHz IF signal providing a very accurate composite signal. This PTD provides a delayed AGC voltage at pin No. 15. The voltage at this pin is +5.5 volts with no input signal and will drop to zero at high levels providing at least 55 dB gain reduction in the RF amplifier Q-1. Selectivity is also realized in the PTD chip.

A squelch voltage appears at pin No. 13 and feeds the main channel squelch circuit, the relay control circuit and the RF signal level to the metering circuit. The composite signal is fed to Q-9 and Q-10 where the signal is amplified and reduced to a low impedance to feed several circuits. The composite signal is fed to pins No. 3 and 8 on the stereo plug-in socket and to pin No. 3 of the SCA plug-in socket. The composite signal is also routed through the "Mod." position of the function switch to the meter circuitry.

The composite signal is fed through pin No. 8 of the stereo or mono plug-in socket to the 15 kHz low-pass filter and de-emphasis network of the mono card. The filter removes the troublesome 19 kHz pilot carrier by approximately 65 dB. The output of the mono plug-in card is routed back through pin No. 7 to

to the input of the line amplifier IC-1 on the main PC board. When the stereo plug-in card STE-1D is used, the composite signal is fed into pin No. 3 and the recovered left and right channels are fed through 15 kHz low-pass filters and de-emphasis networks which are part of the STE-1D card. The left audio signal of the stereo card is fed back through pin No. 7 to the input of the line amplifier IC-2. The right channel on the stereo card has its own line amplifier and the right channel audio is fed through pins No. 11 and 12 directly to the right output terminals on the rear chassis barrier strip. The audio output of IC-2 main PC board is routed to the left output terminals on the rear chassis barrier strip, thus IC-2 is used for either the mono or stereo audio output. The SCA plug-in card also has its own line amplifier and is routed through pins No.11 and 12 to the SCA-1 audio output terminals on the rear barrier strip.

Integrated circuit IC-3 is utilized as a wide-band amplifier with a bandwidth of at least 75 kHz and extremely low impedance to drive the peak reading meter. The composite signal is coupled directly from pin No. 8 to diode D9 which charges capacitor C-65 to the peak DC voltage. The rectified DC voltage is fed through a voltage divided consisting of R-78 and R-79. The one side of the meter is connected to this junction. A balancing voltage from pin No. 8 is fed through R-75 and diode D8 through the zero balance control R-81 to the other side of the meter. This produces a very stable meter circuit which is self-balancing and is not sensitive to voltage variations. Any DC shift that occurs at pin No. 8 produces identical changes on both sides of the meter and the zero reference remains constant.

Capacitor C-67 shunted across R-78 provides a rapid rise time of the meter as it has extremely low impedance on short duration pulses. Resistor R-77 provides the decay time of the meter.

The frequency response of the metering circuit is flat out to 75 kHz and will accurately indicate the 19 kHz pilot and the 67 kHz SCA sub-carrier. When

the STE-1D stereo card is utilized, the filtered 19 kHz pilot carrier routed through the function switch will give accurate indication of pilot injection. The same occurs when reading the SCA injection level.

The 1C-4 is used to drive the monitor speaker and is capable of delivering one watt of low distortion audio to the monitor speaker. The function switch selects either the mono or SCA signal to the monitor amplifier. The carrier relay circuit senses the squelch voltage which is active down to approximately one microvolt. The voltage across relay threshold control R-34 is approximately zero volts with no signal and rises to 5 volts at high RF levels. With no input signal, Q-5 is turned off and its collector goes high; Q-6 turns on and its collector goes low, Q-7 turns off de-energizing the relay. Capacitor C-46 is used to prevent inductive spikes from destroying transistor Q-7. The voltage at pin 13 increases with signal and is routed through Diode D-7 to the function switch and meter, indicating RF input level. The relay threshold can be adjusted from approximately one to 1000 microvolts input levels. The power supply is well regulated at 24 volts and each stage is well decoupled and critical circuits are agian regulated.

5.1 STE-1D STEREO DECODER

The composite signal is fed to pin No. 3, into the stereo decoder 1C-1, and the highly selective 19 kHz amplifier. The 19 kHz pilot is selected out of the composite signal by the three stage amplifier consisting of Q-3, Q-4, and Q-5. L-1 and L-2 are very high "Q" circuits with selectivity sufficient to eliminate any interference from audio signals up to 15 kHz providing accurate measurement of the pilot injection level. C-21 and C-23 are polystyrine capacitors with opposite temperature characteristics of the inductors L-1 and L-2 for excellent temperature and long term stability. The selected 19 kHz pilot carrier is fed to the calibration control R-29 and through the function

switch to the metering circuitry. IC-1 is an integrated FM stereo demodulator using phase locked loop techniques to regenerate the 38 kHz sub-carrier. No coils are required and the tuning is accomplished by trimpot R-1. The de-emphasis of the left and right channel is derived from R-6, C9 and R-7 and C10. The left channel signal from pin No. 4 is fed to amplifier Q-1 where the signal is amplified and fed to FL-1, a 15 kHz low-pass filter which removes all 19 kHz pilot and 39 kHz components producing a clean audio signal. The left channel audio calibration trimpot (R-12) feeds the audio through pin No. 7 to the line amplifier 1C-2 on the main PC board. The amplified signal from 1C-2 is fed to the stereo left terminals on the rear chassis of the receiver.

The right channel from pin No. 5 is fed to amplifier Q-2 where the signal is amplified and fed to FL-2, a 15 kHz low pass. The right channel audio calibration trimpot R-17 feeds 1C-2 line amplifier. Transformer T-1 provides a balance output which is fed through pin 11 and 12 to the stereo right terminals on the rear chassis of the receiver.

5.2 SCA-2-67D SCA DEMODULATOR

The composite signal appears at pin No. 3. The composite signal is fed through R-5 and C-6 which acts as a high-pass filter, and into the two section 67 kHz bandpass filter. The bandpass filter consists of two 67 kHz resonant circuits. Inductor L1 and capacitor C-8 resonate at 67 kHz, and is coupled through C-9 to the second resonant circuit consisting of L2 and C-10. The band width is 18 kHz at the 3 dB points.

The recovered 67 kHz carrier is fed to an amplifier consisting of Q-1 and Q-2, the output impedance is low and fed to the SCA injection trimpot R-16 and to IC-2, the new McMartin SCA demodulator. The SCA signal level fron the injection calibrate trimpot is fed through pin No. 4 and the front panel function switch to the metering circuit for indication of the injection level.

The new McMartin SCA Demodulator IC-2 contains the complete SCA circuitry in one chip. The 1C-2 contains a 60 dB amplifier/limiter, the SCA squelch circuitry, main channel noise sensing, PLL demodulator and an audio amplifier capable of driving a 600 ohm load at a level of one volt.

Trimpot R-25 is used to adjust the PLL lock frequency. The recovered SCA audio, from pin No. 15, is fed to trimpot R-20 which adjusts the audio level into 1C-1 line amplifier. The output feeds transformer T-1 which produces a balance 600 ohm output at a level of +8 dBm and fed through pin No. 11 and 12 to the rear chassis terminals labeled SCA-1 output.

Trimpot R10 is used to adjust the modulation level that is routed through pin No. 10, function switch, and to the modulation metering circuitry.

VI. MAINTENANCE

The receiver has been factory aligned. However, should adjustments be required in the field, the following procedure should be followed.

6.1 OSCILLATOR/RF ADJUSTMENT

1. Remove top cover.
2. Ascertain that the correct crystal frequency is used for the desired frequency per this formula: $\text{Crystal Freq.} = \frac{F - 10.7\ \text{MHz}}{2}$

   The Crystal Oscillator utilizes a self-resonant choke and does not require any tuning.
3. Turn the function switch to the RF input level position.
4. Turn the function switch to the desired channel.
5. Adjust the corresponding trimpot for maximum RF meter reading with the correct frequency signal applied.

   NOTE: The signal must be attenuated as the meter will give full

deflection with a 30 microvolt input signal. R-62 tunes Ch. 1; R-63, Ch. 2; R-64, Ch. 3; R-65, Ch. 4; and R-66, Ch. 5.

6. Tune channels 1 to 3 to designated signals from 88 to 100 MHz. Tune 3 to 5 to designated signals from 100 to 108 MHz.

NOTE: RF tracking was adjusted at factory and should not be attempted in the field.

6.2 10.7 MHz PHASE LOCK LOOP PLL ADJUST

1. Remove top cover.
2. RF front end must be correctly aligned as per Oscillator/RF Alignment.
3. Reduce signal to three microvolts or less.
4. Turn PLL trimpot R-50 in on direction until audio signal breaks up. Note position of trimpot. Turn PLL trimpot in opposite direction until audio signal breaks up. Note position of trimpot. Turn the trimpot to the center of the two positions.

6.3 TOTAL MODUALTION METER ZERO ADJUSTMENT

1. Remove top cover.
2. Short circuit pin No. 2 of IC-3 meter amplifier to ground.
3. Short circuit meter terminals and adjust mechanical zero - remove short after adjusting mechanical zero.
4. Adjust trimpot R-81 for electrical meter zero. Remove short circuit from pin No. 2 to ground.

6.4 TOTAL MODULATION CALIBRATION

1. Remove top cover.
2. The standard mono card must be used for this calibration, and is inserted into the Mono/Stereo socket.
3. Modulate the desired RF carrier with a 400 Hz sine wave exactly 100% modulation.

4. Turn function switch to "Total Mod." position.

5. Adjust Mod. Meter Calibration trimpot R-57 for 100% meter reading.

NOTE: The RF input level must be adequate to provide full limiting to prevent noise from producing erroneous readings.

6.5 LINE AMPLIFIER 1C-2 CALIBRATION

1. Remove top cover.
2. The standard Mono Card must be used for this calibration, and must be inserted into the Mono/Stereo socket.
3. Modulate the desired RF carrier with a 400 Hz sine wave exactly 100% modulation.
4. Connect a 600 ohm resistor across the rear terminals labeled Mono/Stereo left. Center terminal is ground.
5. Connect an audio analyzer across the 600 ohm resistor.
6. Adjust trimpot R-70 for an output of +8 dBm as measured with the audio analyzer.

NOTE: It may be desirable to connect the analyzer ground to the center ground terminal of the receiver to prevent any ground loops.

6.6 CARRIER RELAY ADJUST AND MAIN CARRIER

1. Remove top cover.
2. Remove all RF input signal.
3. Adjust R-34 for desired operation of relay and main channel mute.

6.7 STE-1D STEREO PLUG-IN CARD CALIBRATION

The receiver must be calibrated with the mono card prior to calibration of the STE-1D stereo card.

1. Modulate the RF signal with a left stereo composite signal (1,000 Hz). The accuracy of the calibration depends on the accuracy of the composite

signal.

2. Connect a 600 ohm load resistor across the rear terminals labeled Mono/Stereo left.
3. Connect an audio analyzer across the 600 ohm load and note the audio reference level.
4. Modulate the RF carrier with a right stereo signal.
5. Adjust PLL control R-1 for phase lock indicated by minimum audio as measured on audio analyzer. The audio level should be at least 40 dB below the referencle level. Also, adjust seperation control R-34 for minimum audio output.

   NOTE: R-1 should not be set for the absolute best separation, but for stable operation of the PLL. Switch the stereo generator to mono and stereo several times to insure that the separation will be the same each time. Readjust the separation control R-34 for best separation.
6. After proper and satisfactory separation is assured, modulate the left channel with 400 Hz and 100% total modulation, adjust R-12 for an output of +8 dBm.
7. Connect the 600 ohm and analyzer to the rear terminals labeled Stereo Right.
8. Modulate the right stereo channel with 400 Hz and 100% total modulation, adjust R-17 for an output of +8 dBm.
9. Modulate the left stereo channel and separation should be approximately the same as the left channel. This assumes that the stereo signal is accurate.
10. Switch the stereo generator to mono and the audio output level should be within 1 dB of the stereo right signal.
11. Remove all modulation excepting pilot, and insure that pilot level is exactly 10% injection.

12. Turn the function switch to pilot injection.

13. Adjust R-29 for a pilot reading of 4% or 5%.

14. Tune L-1 and L-2 for maximum reading on meter.

15. Adjust R-29 for 10% injection or 100% on the meter. 80% = 8% injection; 90% = 9% injection.

6.8 SCA-2-67D SCA DEMODULATOR CALIBRATION

1. Remove top cover.

2. 2. Insert the SCA-2D card into the socket.

3. Modulate the RF carrier with an SCA carrier of exactly 10% injection.

NOTE: The accuracy of calibration depends on the accuracy of the transmitted signal.

4. Turn the function switch to SCA injection.

5. Modulate the SCA carrier 100%, ±6 kHz deviation at 200 Hz.

6. Connect an oscilliscope to junction of R-13 and R-14.

7. Tune L-1 and L-2 for maximum amplitude and best symetry as viewed on the oscilliscope.

8. Adjust "Inj Cal" trimpot for 10% injection on the meter. 100% = 10% injection.

9. Connect the oscilliscope to the junction of cap. C-15 and trimpot R-20.

10. Adjust PLL trimpot R-25 for good lock and set the control between the two settings where the audio break up.

NOTE: If no audio appears, the SCA channel may be squelched. Turn the rear chassis SCA-1 mute control until audio appears.

11. Connect the 600 ohm load and audio analyzer to the tqo terminals labeled SCA-1 output.

12. Adjust trimpot R-20 for an audio output of +8 dBm.

13. Turn the function switch to SCA modulation.

14. Adjust trimpot R-3 for a reading of 100% modulation.

15. Set audio reference level with 100% mod at 200 Hz.

16. Remove SCA modulation and SCA noise should be down approximately 60 dB or greater.

17. Modulate main channel with 400 Hz at 90% modulation, and note the noise figure or crosstalk. This should be at least 55 dB below reference level. If not, adjust 10.7 MHz matching transformer (T-1) on main board for minimum crosstalk.

    NOTE: The accuracy of this reading depends on the accuracy of the RF modulation system as the TBM-1000D with the SCA-2-67D is capable of at least 55 dB crosstalk figure.

18. Adjust the rear chassis SCA mute control for a mute point of approximately 5% injection.

VII. PARTS LIST

The majority of the components in the TBM-1005D are of standard value, and tolerance, and generally available from local electronic parts distributors. Those items of McMartin manufacture or of special value or tolerance are listed.

Main PC Board

Symbol	Part Number	Description
L-1	930080	Ant. Coil (brown)
L-2, L-4	930176	4.7U Henry Choke
L-3	930081	RF Coil (white)
L-5	930080	Doubler Coil (brown)
L-6	930097	22U Henry Choke
T-1	940019	10.7 MHz Transformer
Q-2	201111	SD-306 D MOS-FET
Q-2	201120	SD-305 MOS-FET
Q-3	201022	SE-4000 OSC Transistor
Q-4	201079	2N5179 Transistor
Q-5, Q-6, Q-9, Q-10	201049	SE-4002 Transistor
Q-7, Q-8	201056	2M-3569 Transistor
VVC1, VVC2, VVC3	220042	MV-104 Varactor
IC-1,	230085	MOB-605 IC
IC-2, IC-3, IC-4	230037	LM-380 IC
T-2	910029	Line Transformer
K-1	470031	SPDT/Reed Relay
R-57, R-70, R-62 through R-66	400042	50K ohm Trimpot
R-50	400021	5K ohm Trimpot
R-34	400053	2.5K Trimpot

Symbol	Part Number	Description
R-81	400050	250 ohm Trimpot
D-1 through D-5, D-8, D-9	220005	1N3604 Diode
FL-1 (Mono Card)	935068	15 kHz Low-pass Filter
STE-1D Stereo Plug-in Card		
IC-1	230071	LA-3350 Stereo Decoder
IC-2	230037	LM-380 Line Amplifier
Q-1 through Q-5	201049	SE-4002 Transistor
FL-1, FL-2	935068	15 kHz Low-pass Filter
T-1	910029	Line Transformer
L-1, L-2	930026	19 kHz Coils
R-29	400062	10K ohm Trimpot
R-1, R-12, R-17	400068	5K ohm Trimpot
SCA-2-67D SCA Plug-in Card		
IC-1	230037	LM-380N Line Amplifier
IC-2	230066	MOB-604B IC
Q-1, Q-2	201050	SE-4010 Transistor
R-3, R-16, R-20	400062	10K ohm Trimpot
R-25	400068	5K ohm Trimpot
T-1	910029	Line Transformer
L-1, L-2 (SCA-2-670)	930181	Inductors 67 kHz
L-1, L-2 (SCA-2-410)	930209	Inductors 39-41 kHz

WARRANTY

McMartin products are warranted to be free from defects in materials and workmanship for a period of one year after shipping date, when subjected to normal usage and service. All warranties are void if (a) equipment has been altered or repaired by others without McMartin's specific prior authorization; or (b) equipment is operated under environmental conditions or circumstances other than those specifically described in McMartin literature or instruction manuals.

Upon notification within the applicable warranty period, McMartin agrees without charge, to repair, replace, or supply replacement parts for any properly maintained equipment or parts that are defective as to design, materials or workmanship and that are returned in accordance with McMartin's instructions to the Buyer. At McMartin's sole discretion, the Buyer may be requested to return the defective part or equipment to McMartin, FOB Omaha, Nebraska. Parts or equipment may be returned only with McMartin's prior authorization and must be identified by a return authorization number previously issued by McMartin's Customer Service Department. All merchandise so returned must be sent transportation prepaid, at Buyer's risk. Full details of the failure or malfunction should be included so as to expedite repair or replacement. Repair parts or repaired or replaced equipment will be returned to the Buyer, FOB factory.

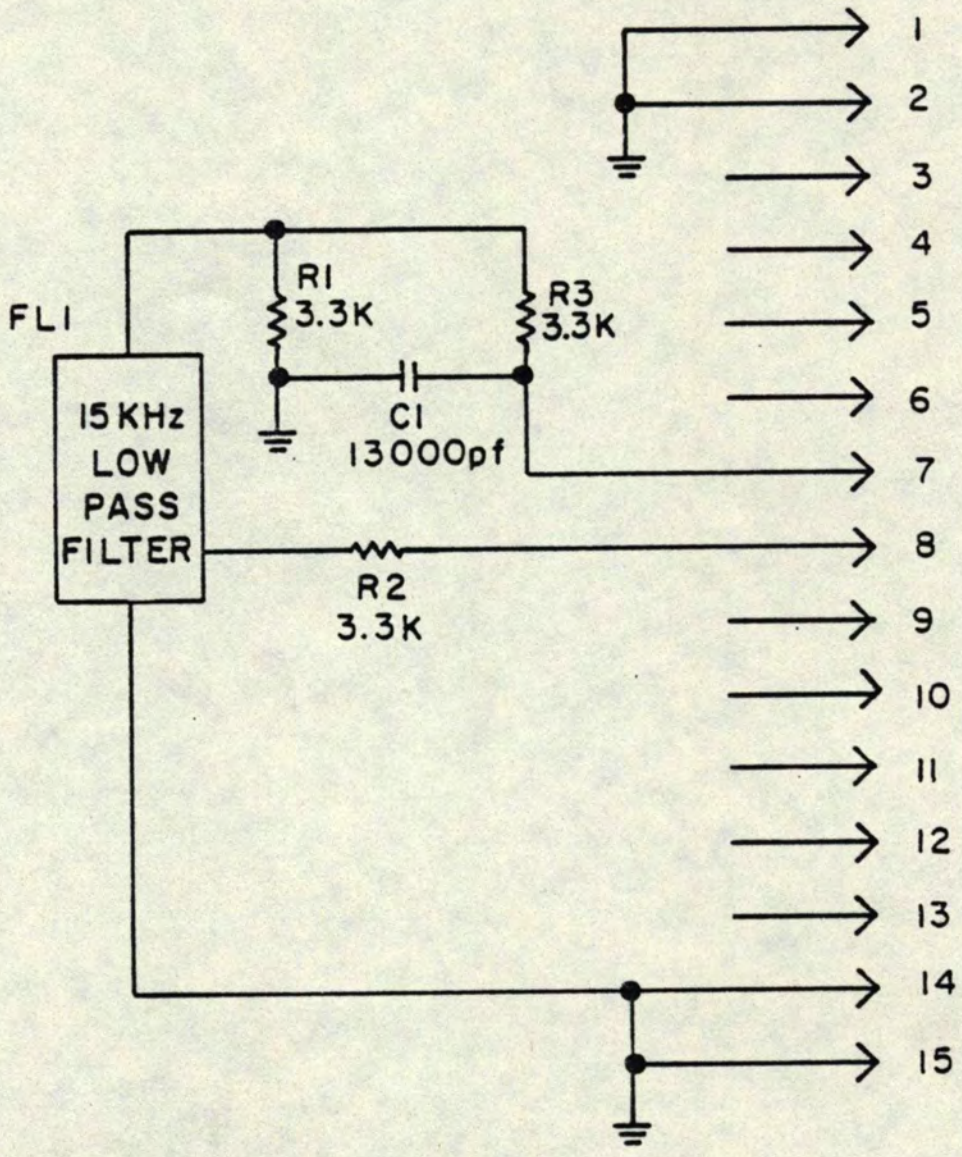
The above warranty does not extend to other equipment, such as tubes, transistors, I.C.'s lamps or fuses manufactured by others, which are subject to only such adjustment as McMartin may obtain from the suppliers thereof. McMartin shall not be liable for consequential damages resulting from the use of, or the inability to use, the equipment; nor for any loss, damage or expense incurred thereby; nor from any other cause.

Except as set forth herein, and except as to title, there are no warranties, or any affirmations of fact or promises by McMartin, with reference to the equipment, or to merchantability, fitness, for particular application, signal coverage, infringement, or otherwise, which extend beyond the description of the equipment on the face hereof.

VIII. SCHEMATIC DIAGRAMS

Mono Card	P/N 550241/1
5 Channel Receiver	P/N 554088/1
Stereo Demodulator (STE-1D)	P/N 550238/1
SCA Demodulator (SCA 2-41D)	P/N 550240/1
SCA Demodulator (SCA 2-67D)	P/N 550239/1
Master Schematic	P/N 000097

MCMARTIN



2. UNLESS OTHERWISE SPECIFIED:
RESISTORS IN OHMS, 1/2W, 5%.
CAPACITORS IN MFD.

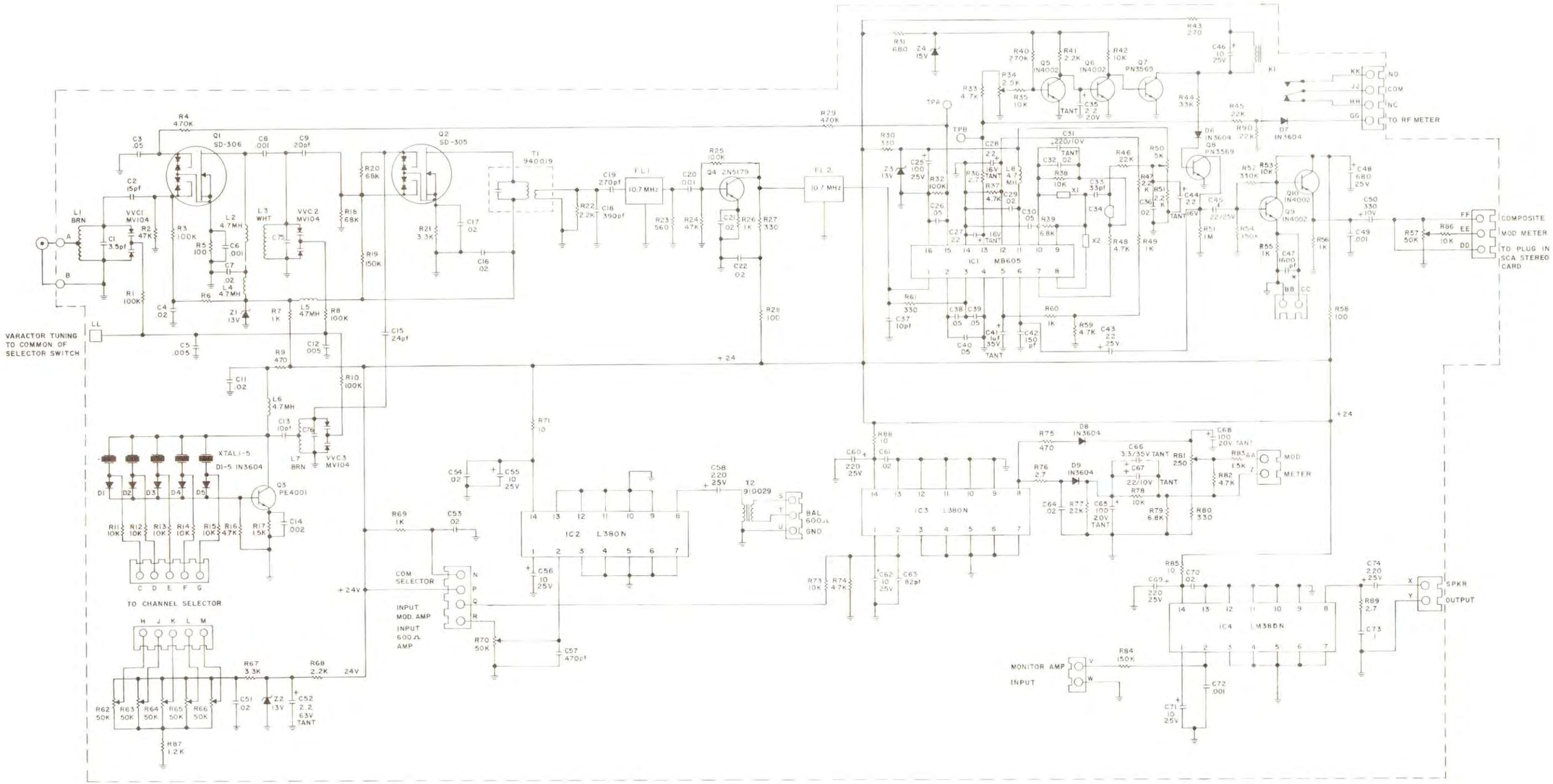
NOTES: 1. DATE OF THIS SCHEMATIC: SEPT. 8, 1977

TBM-1005D

MONO CARD

550241/1

June 26, 1978



TBM-1005D

5 CHANNEL RECEIVER

554088/1

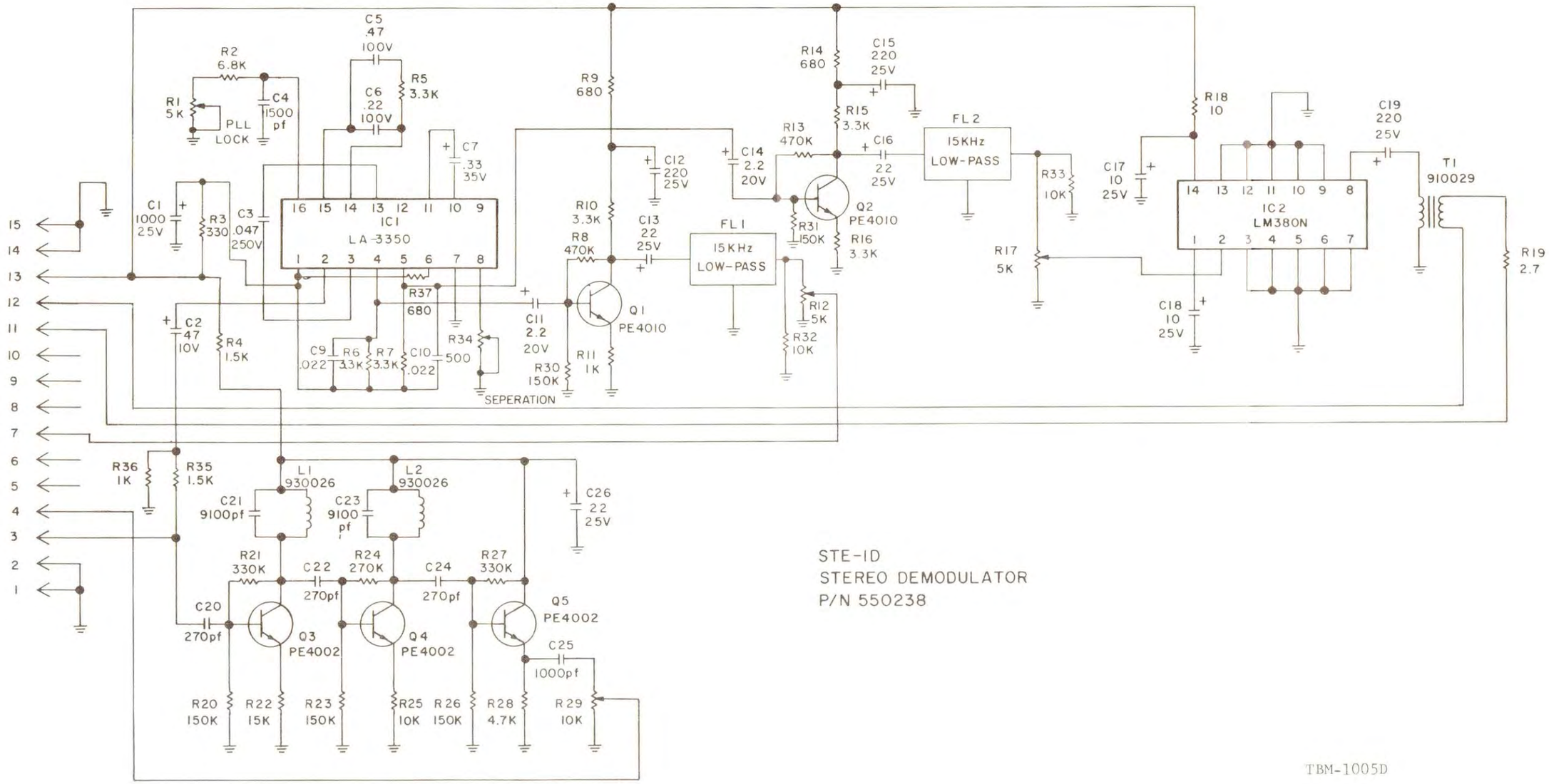
April 17, 1979

NOTES: 1. DATE OF THIS SCHEMATIC MARCH 1, 1979
2. UNLESS OTHERWISE SPECIFIED
RESISTORS IN OHMS, 1/4W, 5%
CAPACITORS IN MFD
3. * STARRED VALUE SELECTED IN TEST

ADDENDUM (August 1980)

1. Value of R21 should be changed to 470Ω
2. Value of R22 should be changed to 220Ω
3. Note: Values of C75 and C76 are determined in factory testing

MCMARTIN



STE-1D
STEREO DEMODULATOR
P/N 550238

2. UNLESS OTHERWISE SPECIFIED:
RESISTORS IN OHMS, 1/4W, 5%.
CAPACITORS IN MFD.

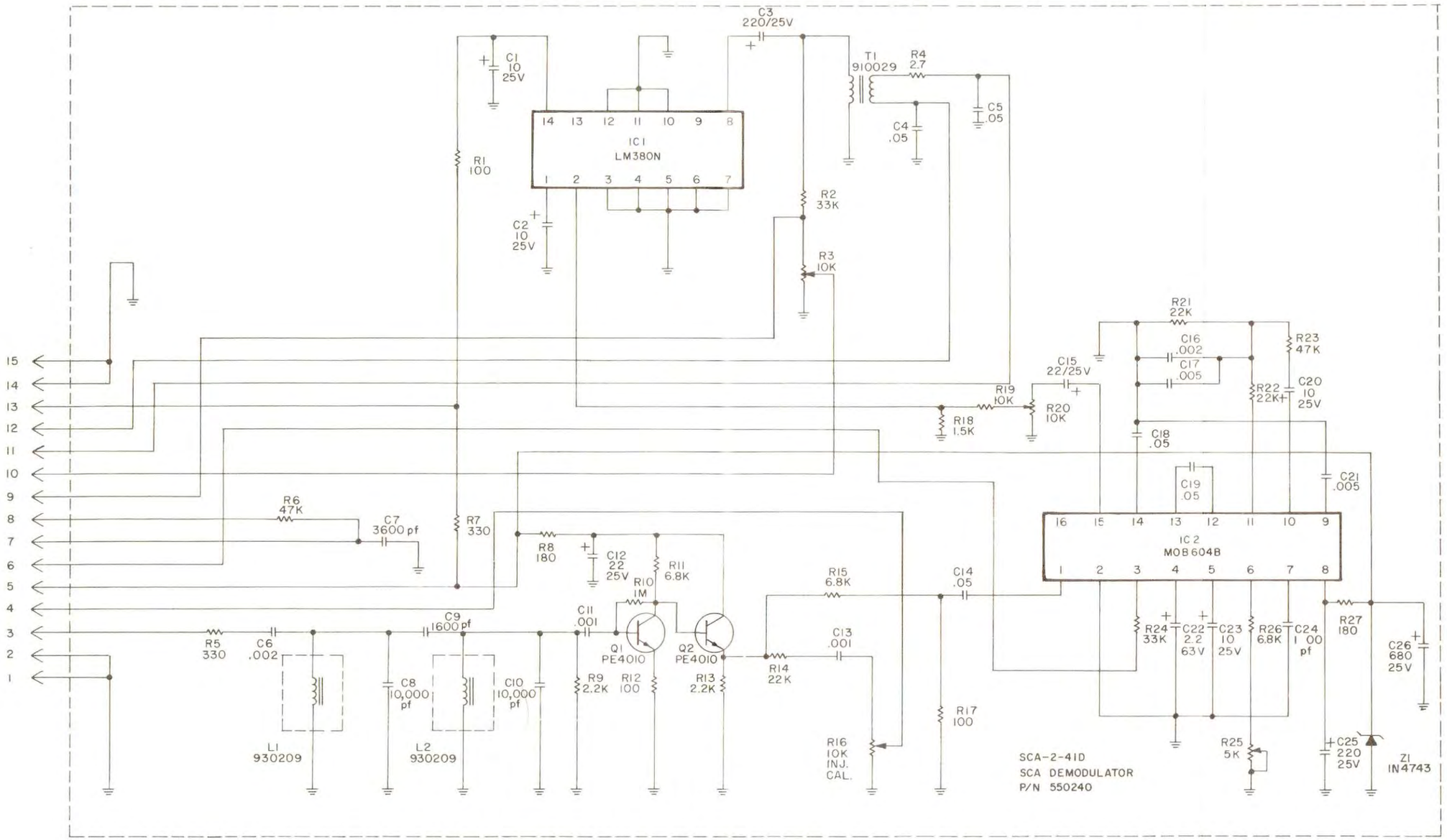
NOTES: 1. DATE OF SCHEMATIC: OCT. 14, 1977.

TBM-1005D

STEREO DEMODULATOR (STE-1D)

550238/1

November 15, 1978



2. UNLESS OTHERWISE SPECIFIED:

RESISTORS IN OHMS, 1/4W 5%
CAPACITORS IN MFD.

NOTES: 1. DATE OF THIS SCHEMATIC: SEPT. 15, 1977

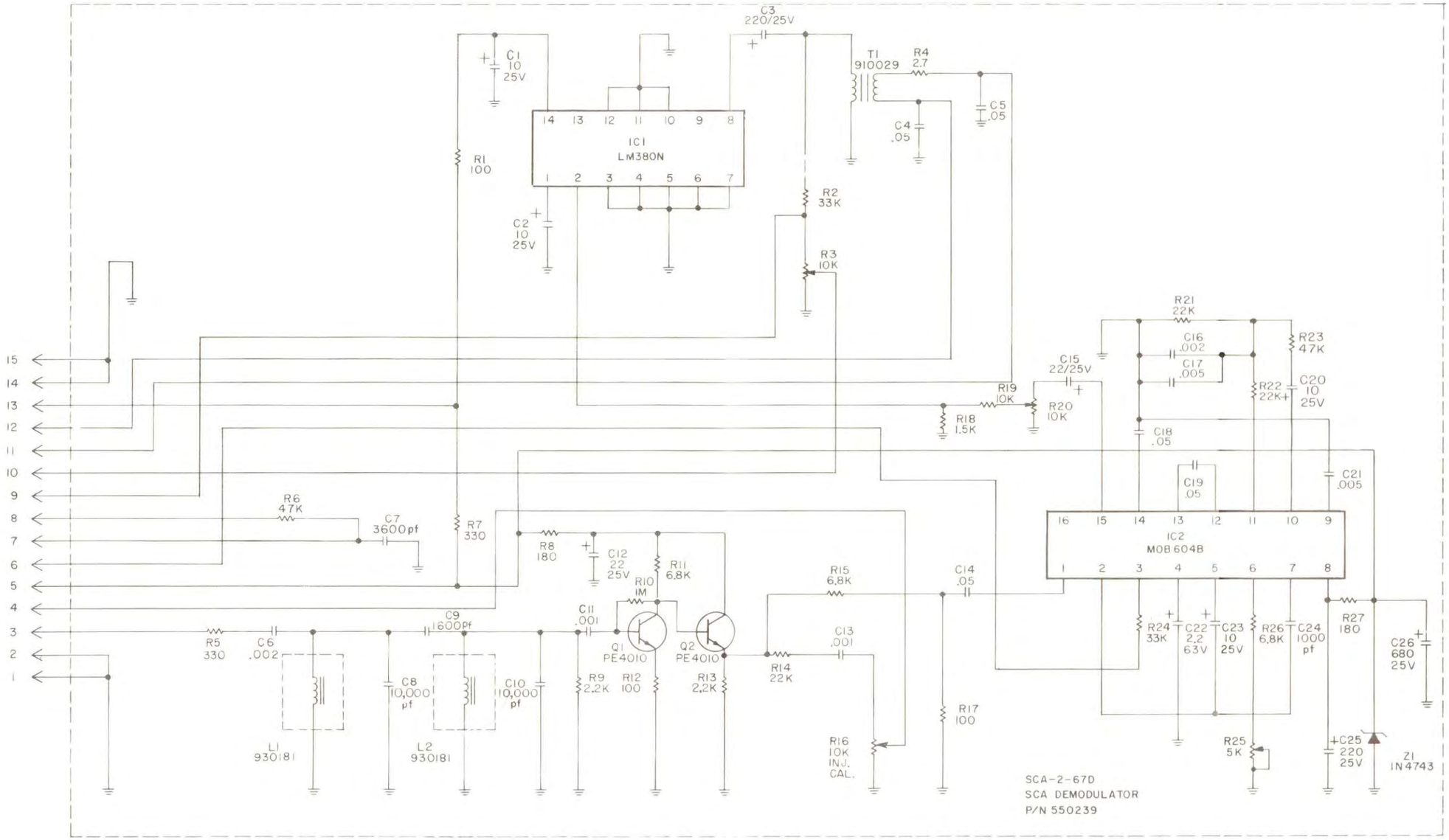
TBM-1005D

SCA DEMODULATOR (SCA-2-41D)

550240/1

October 14, 1977

MCMARTIN



3. VALUE CHANGE: R2 - 3.3k

2. UNLESS OTHERWISE SPECIFIED:
RESISTORS IN OHMS, $\frac{1}{4}$W 5%
CAPACITORS IN MFD

NOTES: 1. DATE OF THIS SCHEMATIC:
SEPT. 14, 1977

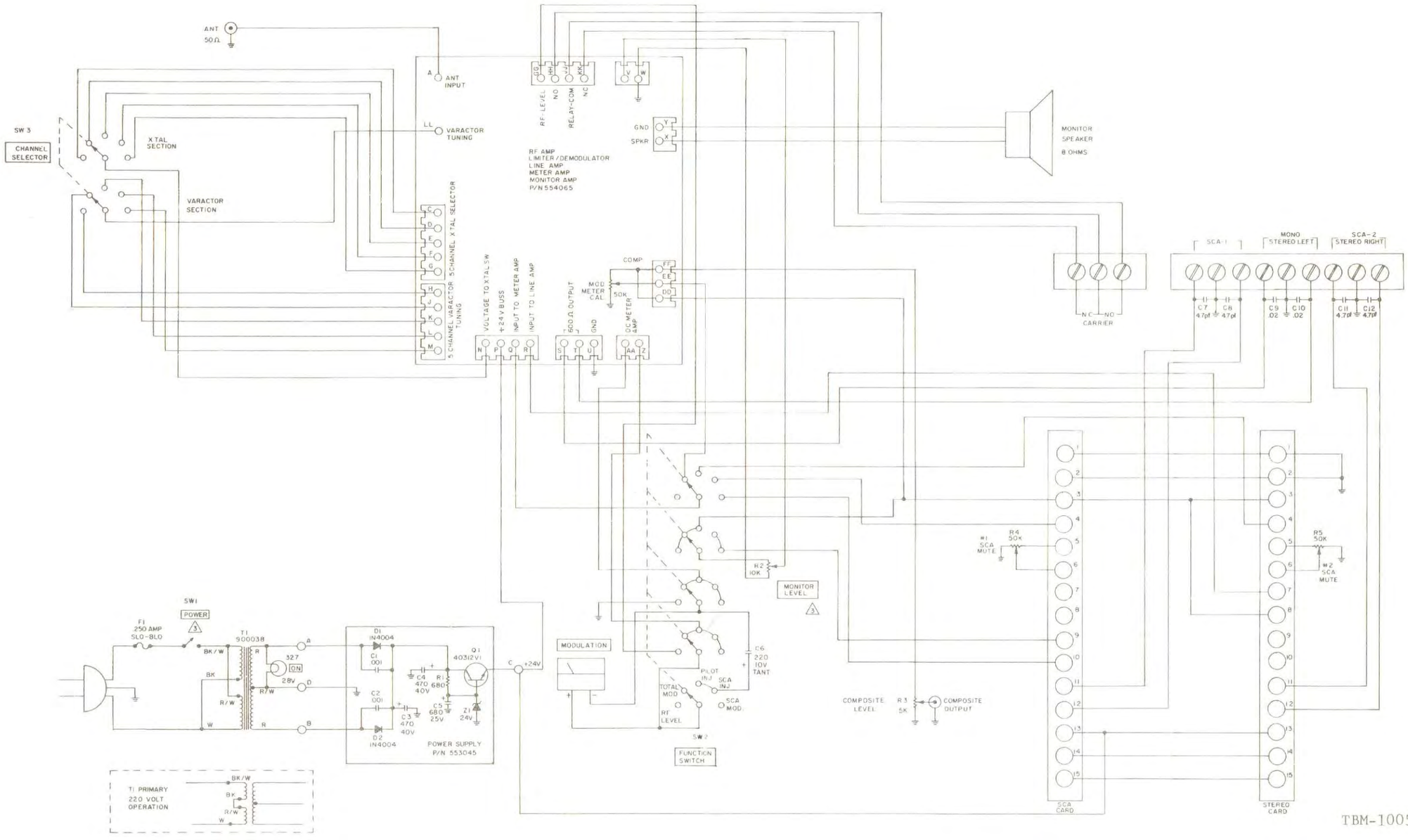
TBM-1005D

SCA DEMODULATOR (SCA-2-67D)

550239/1

October 13, 1977

MCMARTIN



3 POWER SWITCH SW1 IS GANGED TO THE MONITOR LEVEL CONTROL R1.

2. UNLESS OTHERWISE SPECIFIED:
RESISTORS IN OHMS, 1/4W, 5%.
CAPACITORS IN MFD.

NOTES: 1. DATE OF THIS SCHEMATIC: SEPT 19, 1977

TBM-1005D

MASTER SCHEMATIC

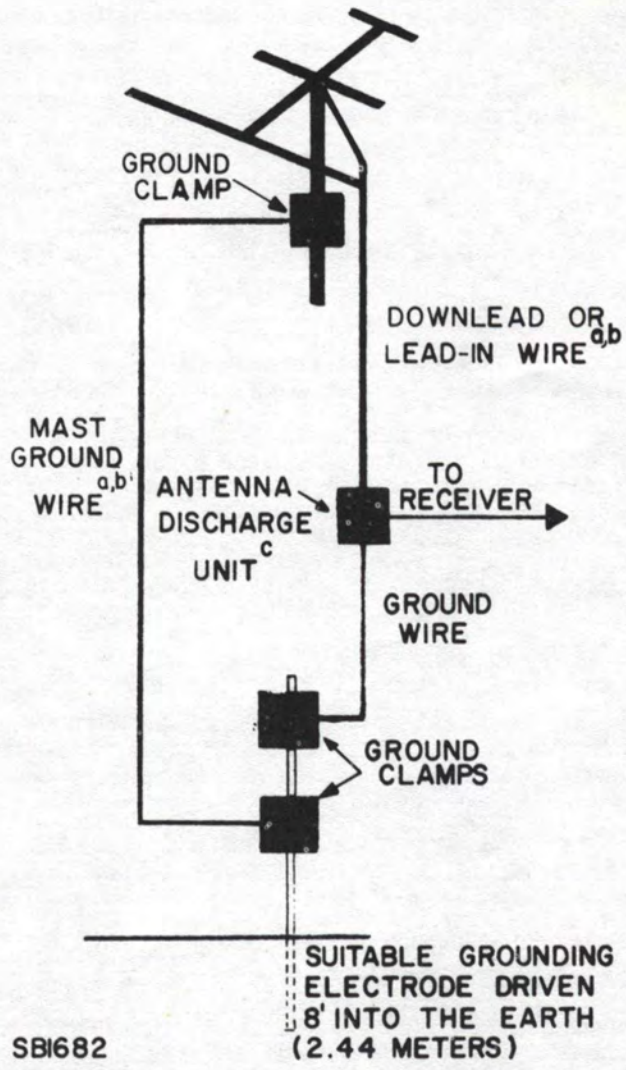
000097

June 15, 1979

SAFETY INSTRUCTIONS

McMartin products are designed to provide a high degree of safety to the user. However, as with all electronic appliances, it is necessary to follow correct safety procedures to minimize the danger of electrical shock or fire. These procedures are as follows:

1. **Read Instructions** All the safety and operating instructions should be read before the appliance is operated.
2. **Retain Instructions** The safety and operating instructions should be retained for future reference.
3. **Heed Warnings** All warnings on the appliance and in the operating instructions should be adhered to.
4. **Follow Instructions** All operating and use instructions should be followed.
5. **Water and Moisture** The appliance should not be used near water – for example, near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool, etc.
6. **Ventilation** The appliance should be situated so that its location or position does not interfere with its proper ventilation. For example, the appliance should not be situated on a bed, sofa, rug, or similar surface that may block the ventilation openings; or, placed in a built-in installation, such as a bookcase or cabinet that may impede the flow of air through the ventilation openings.
7. **Heat** The appliance should be situated away from heat sources such as radiators, heat registers, stoves, or other appliances (including amplifiers) that produce heat.
8. **Power Sources** The appliance should be connected to a power supply only of the type described in the operating instructions or as marked on the appliance.
9. **Grounding or Polarization** On units equipped with a three prong grounding AC plug, it is important not to defeat the grounding function by the use of "adapters" or extension cords that do not use the third (grounding) prong. Adaptors that connect the grounding prong to the center screw on the outside of the outlet plate do not provide adequate grounding.
10. **Power-Cord Protection** Power-Supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the appliance.
11. **Cleaning** The appliance should be cleaned only as recommended by the manufacturer.
12. **Power Lines** An outdoor antenna should be located away from power lines.
13. **Outdoor Antenna Grounding** If an outside antenna is connected to the receiver, be sure the antenna system is grounded so as to provide some protection against voltage surges and built up static charges. Section 810 of the National Electrical Code, ANSI/-NFPA No. 70-1978, provides information with respect to proper grounding of the mast and supporting structure, grounding of the lead-in wire to an antenna discharge unit, size of grounding conductors, location of antenna-discharge unit, connection to grounding electrodes, and requirements for the grounding electrode. See illustration on the reverse side of this sheet.
14. **Nonuse Periods** The power cord of the appliance should be unplugged from the outlet when left unused for a long period of time.
15. **Object and Liquid Entry** Care should be taken so that objects do not fall and liquids are not spilled into the enclosure through openings.
16. **Damage Requiring Service** The appliance should be serviced by qualified service personnel when:
    A. The power supply cord or the plug has been damaged; or
    B. Objects have fallen, or liquid has been spilled into the appliance; or
    C. The appliance has been exposed to rain; or
    D. The appliance does not appear to operate normally or exhibits a marked change in performance; or
    E. The appliance has been dropped, or the enclosure damaged.
17. **Servicing** The user should not attempt to service the appliance beyond that described in the operating instructions. All other servicing should be referred to qualified service personnel.



[a] Use No. 10 AWG copper or No. 8 AWG aluminum or No. 17 AWG copper-clad steel or bronze wire, or larger as ground wires for both mast and lead-in.

[b] Secure lead-in wire from antenna to antenna discharge unit and mast ground wire to house with stand-off insulators, spaced from 4 feet (1.22 meters) to 6 feet (1.83 meters) apart.

[c] Mount antenna discharge unit as closely as possible to where lead-in enters house.

EXAMPLE OF ANTENNA GROUNDING AS PER NATIONAL ELECTRICAL CODE INSTRUCTIONS

McMartin industries, inc.

McMartin Industries, Inc. • 4500 South 76th Street • Omaha, Nebraska 68127–1880 • (402) 331-2000 • Telex 484485