

SERVICE MANUAL SUPPLEMENT

NUTONE MODEL IMA-406

REVISED CIRCUIT AND PARTS LIST.



SPECIAL NOTE TO SERVICEMAN

This Supplemental information contains a REVISED circuit and parts listing. Refer to Basic Service Manual for RF-IF Alignment.

NuTone Housing Products

Scovill

MADISON & RED BANK ROADS

CINCINNATI, OHIO 45227

PHONE 1-513-527-5415

THEORY OF OPERATION

POWER SUPPLY

- (1) The Power Transformer is supplied with the rough-in housing and should be located remotely from the Master Unit — near fuse panel, basement, etc.
- (2) The Power Transformer in the IR-10 rough-in housing is rated at 120V AC 60Hz primary and 16V AC 15VA secondary.
- (3) The Power Transformer in the IR-10A rough-in housing is rated at 120V AC 60Hz primary and 16V AC 17VA secondary. This transformer is mainly used when it is impossible to mount the transformer in a low ambient temperature area as in (1) above.
- (4) The secondary of the Power Transformer may be connected to the Master Unit by 100 feet (Maximum) of No. 18/2 cable (NuTone S-142). For runs up to 200 feet, use No. 14/2 cable — Not supplied by NuTone.
- (5) The GREEN wire of the Master Unit power input must be connected to earth ground.
- (6) The 16V AC is turned ON (or OFF) by the ON/OFF SWITCH — S101 (operate by the shaft of the Master Unit Speaker Volume Control R101).
- (7) When S101 is ON, 16Vac is applied to the pilot lights PL101; PL102 and PL103 which are connected in series across the 16Vac.
- (8) The 16V AC is applied to D203, D204, D205 and D206, the full wave bridge rectifier. The output of the bridge is filtered by C221 resulting in Vcc of +22.5V DC.
- (9) Capacitors C217, C218, C219 and C220 bypass the high frequency switching noise that may be generated by the diode rectifiers.
- (10) The +22.5V DC is connected to the voltage regulator circuit: R224, Zener diode, D208 and Q205. This circuit supplies a regulated +15.5V DC to the Audio Amplifier.
- (11) The regulated +12V DC from voltage regulator, IC202, is switched by SELECTOR switch, S102, to the AM or FM tuner and is open ended when S102 is in PHONO or TAPE position.

RADIO MODULE

- (1) The Radio Module includes the complete AM and FM tuners.
- (2) When S102 is in AM position, the regulated +12 Vdc is fed through P1-2/J1-2 to the AM tuner.
- (3) When S102 is in FM position, the regulated +12 Vdc is fed through P1-3/J1-3 to the FM tuner.

FM TUNER

- (1) The FM signal is fed through the coaxial antenna lead-in to the balanced primary of the antenna transformer L301. The transformer primary is center tapped to FM RF ground through C301.
- (2) The RF amplifier Q301 (Dual gate MOSFET) is operated tuned-gate, tuned-drain — resulting in high-gain at low noise.
- (3) The FM RF signal is fed through a section of the antenna transformer secondary through C304 to G1 of Q301. The gate tuned circuit is varied by tuning one section of the ganged tuning capacitor C303A. C303B is the high frequency trimmer. Tuning slug in L301 is tuned for low frequency padding. (Figure 6)
- (4) The MOSFET drain is loaded by the tuned RF tank circuit. The tank's resonant frequency is varied by C303F. C303E is high-frequency trimmer and L302 is low-frequency padder.
- (5) The output of the tank circuit is coupled through C310 to the base of the Mixer Q302.
- (6) The oscillator Q303 resonant frequency is tuned by C303J. C328 is high-frequency trimmer and L303 is adjusted for low-frequency padding.
- (7) The output of the oscillator is coupled through C327 to the base of Mixer Q302.
- (8) The Mixer Q302 beats the RF and oscillator signals and is loaded by T301A tuned to the 10.7 Mhz. IF frequency.
- (9) For additional selectivity, the output of T301A is coupled through C314 to T301B.
- (10) The output of T301B is coupled from the highside of C315 to the Ceramic Filter CF301.
- (11) CF301 is rated at 10.7 Mhz. with a 3 db bandwidth of 200 to 280 KHz. — more than sufficient for the FM broadcast band. The filter has a very high rejection of all other RF frequencies, eliminating the need of additional IF transformer for high-selectivity.
- (12) The output of CF301 is fed to terminal 1 of IC301.
- (13) IC301 is a monolithic integrated circuit that provides all the functions of a comprehensive FM IF system, including 3-stage FM IF amplifier/limiter with level detector and an audio amplifier that features use of a noise squelch circuit.
- (14) The quadrature detector is tuned by the outboard coil L304.

(15) The squelch circuit is adjusted by R315. Use of the squelch circuit helps to eliminate side responses that are characteristic of limiter-discriminator type FM receivers.

(16) Suppression of these side responses permit the design of an FM receiver that tunes as easily as an AM tuner without resorting to AFC — where AFC is not required to correct for oscillator drift.

(17) The FM oscillator in this system has been designed with quality components and by the use of the regulated 11.5Vdc supply should be practically free of drift under normal operating conditions.

(18) The magnitude of the squelch control voltage depends only on the signal-to-noise ratio at the tuner input and is essentially independent of the front-end gain because the quadrature signal is fully limited.

(19) Adjustment of the "Squelch Threshold" control affects primarily the degree of noise suppression rather than the threshold. Control R315 is generally operated at maximum value, i.e. full-clockwise as viewed from the FM side of the Radio Module PC Board. (Refer to page 8).

(20) VR301 protects the FM and AM front end from static discharge and nearby lightning. It will not protect the set from a direct lightning strike.

AM TUNER

(1) The AM signal is fed from the center tap of the FM antenna transformer primary, through C345 to the tuned RF circuit.

(2) The RF circuit is tuned by gang capacitor C303D. C303C is the high-frequency trimmer and coupling of L309 is adjusted for low-frequency padding.

(3) Delayed AGC is supplied from pin 15 of IC302 through R329 and across D301 to ground. When the signal increases beyond desired level, the diode will conduct, changing the impedance of the input circuit and tend to swamp the AM signal.

(4) The output of the tuned RF circuit is fed through C333 to pin 2 of IC302.

(5) IC302 is a monolithic integrated circuit providing AM convertor; IF amplifier and detector. In this application it also supplies AGC to the first IF stage and delayed AGC to the RF tuned circuit.

(6) Pin 2 of IC302 is the base of the oscillator/convertor stage.

(7) The oscillator tank is tuned by varying C303G. C303H is the oscillator trimmer and L310 oscillator collector coupling is adjusted for low frequency padding.

(8) The oscillator/convertor output is loaded by the 455 KHz. IF transformer T302. The output of T302 is fed through Ceramic Filter CF302 to the input of the first IF stage in the IC302.

(9) The amplified output of the first IF stage is fed from Pin 6 through CF303 to the input of the second IF amplifier and second detector.

(10) CF302 and CF303 Ceramic Filters' center frequency is 455 KHz. \pm 2 KHz. with a 3 db band width of 10 KHz. \pm 3 KHz. with a frequency stability within 0.4% from -10°C to $+80^{\circ}\text{C}$.

(11) Use of these filters provides improved selectivity; the elimination of IF transformers and the resulting small space.

(12) C337 is the internal AGC filter.

(13) The recovered audio is fed from the detector output through R326; J1-I/P1-1 and R228 to the AM terminal on S102.

ALIGNMENT

(1) The Master Units are shipped from the factory completely aligned.

(2) Alignment should be performed by qualified personnel **ONLY WHEN ABSOLUTELY NECESSARY.**

(3) Use the alignment method recommended in this manual.

AUDIO CONTROLS; INPUTS AND OUTPUTS

(1) SELECTOR SWITCH S102; One side of this switch selects the audio entertainment program that is fed to the audio amplifier.

(1.1) The other side of the switch controls the regulated 12 Vdc to the AM and FM RF and IF stages — driving the tuner that is being used. When the switch is in PHONO or TAPE, the +12Vdc is open ended and, neither the AM nor FM tuner has voltage applied.

(2) The AM program, from P1-1 through R228 is selected when S102 is in number 1 (top) position. The +12Vdc is fed to the AM tuner through P1-2.

(3) The PHONOGRAPH signal is fed through PHONO INPUT J4 and is loaded by C224 and R227 to the number 2 position of S102. C224 and R227 supply the correct load for the cartridges used in NuTone record changers.

(4) The TAPE PLAYER signal is fed through TAPE INPUT J5 and is loaded by R226 through the number 3 position of S102. The TAPE input matches the NuTone Tape Players.

(5) The FM program, through P1-4 and R229 is selected when S102 is in the number 4 (bottom) position. The regulated +12Vdc is fed to the FM tuner through P1-3.

(6) The common audio terminal of S102 feeds the audio program to the LOW LEVEL RADIO OUTPUT and through C208 to the 2.2 Megohm Level Set CONTROL R216.

(6.1) The LOW-LEVEL RADIO OUTPUT may be used to drive the IM-516 Amplifier in "Background Music Systems." See BACKGROUND MUSIC page 6 for details.

(6.2) The wiper terminal of R216 is connected to the collector of muting transistor Q204. The audio signal is shorted to ground when Q204 is turned on. Q204 is turned on by applying a positive voltage — from the control module — to its base.

(7) The audio signal from wiper of R216 is also fed through R215 to the TONE CONTROL circuit C101 and R102; and to the ALL SPEAKER VOLUME CONTROL R103.

(8) The wiper terminal of R103 is fed through a shielded cable and R210 to the base of the first audio amplifier Q203.

(9) The intercom signal, from door speaker(s); Inside/Patio Speaker(s); Master Unit Speaker, security/fire alarm and electronic chime is fed through the Intercom Input Transformer T201 and C201 to the base of the intercom preamplifier Q201.

(10) The diodes D201 and D202 will short to ground high voltages developed (particularly those generated during intercom switching) across the secondary of T201.

(11) The amplified intercom signal is coupled from the collector of Q201 through C203, R206 and C204 to the base of the first audio amplifier Q203.

(12) The collector of Q202 is connected to junction of R206 and C204 and will short the audio signal to ground when Q202 is turned on by the positive "Key Click" suppression voltage supplied from the control module.

AUDIO AMPLIFIER

(1) Vcc is furnished by the +16V DC regulator circuit.

(2) The audio signal from intercom preamp or from R103 is fed through the first audio voltage amplifier Q203.

(3) The amplified output of Q203 is coupled through C207 to Pin 8 of IC201.

(4) The power amplifier, IC201, is a Class AB audio amplifier capable of approximately 4.5 watts output into a 5 speaker load (5 ohms) at 10% total harmonic distortion.

(4.1) This IC has a built-in circuit to provide thermal overload protection in cases of shorted output loads. However, the output of the IC, pin 12, should not be shorted. After IC201 heats up in excess of 100°C, the amplifier shuts itself down to prevent any damage to it caused by excessive temperature. After the short is removed and the IC cools down, normal operation is resumed.

(4.2) Bias for the input amplifier is provided by R217.

(4.3) The sensitivity of the IC201 Amplifier and the closed loop gain is set by R219. The low frequency response is determined by C212.

(4.4) Decoupling of the driver stages from the output stages is provided by the bypass capacitor, C213.

(4.5) AC feedback is provided through C214 and together with C215, set the high frequency response and amplifier stability.

(4.6) A "bootstrap" circuit is provided by R218 and C210 to insure the symmetry of the upper part of the output voltage waveform.

(4.7) R220 and C216 serve to further increase stability of the amplifier at high frequencies.

(5) The amplified audio output is coupled through C211 to the load. The circuit is protected against shorts on the speaker side of C211 by the built-in thermal overload protection of IC201.

(6) Unless there is a failure of component(s), the DC feedback will lock the DC operating voltages at their designated values.

CONTROL MODULE

(1) IM-406 system's intercom switching is controlled by this module in conjunction with the Talk/Listen intercom controls in the Master Unit and Inside/Patio speakers.

(2) The Control Module includes 4 transistors and their associated circuits:

(2.1) Q401: Control Transistor in association with R410, R411, R412, D402 and C402 provides MUTING of the entertainment program during Intercom operation and operating voltage to Q404 and its associated circuit for "Key Click" suppression.

(2.2) Q402: Operates the TALK/LISTEN Relay K401.

(2.3) Q403: Operates the STANDBY (ST'BY) Relay K402.

(2.4) Q404: Key-Click (switching noise) suppression.

(3) All transistors on the Control Module are turned OFF when the system is in normal mode, i.e. no intercom function being used.

- (4) The CONTROL LINE is connected from the Cathode of D407 and Cathode of D401 (point "A" on schematic) through J/P2-4, J/P3-4 and R501 and R502 to the BLK and BLK/W terminals.
- (5) When point "A" is connected direct (or through 50-100 ohms) to ground, as is done when Inside Patio Talk, Door Talk or Door Listen functions are utilized, current will flow through R401, R402 and D407, putting a forward bias on the Base of Q401.
- (5.1) With this forward bias, Q401 is turned ON and its collector voltage rises to near V_e (+22V). Collector current is limited by the Control line resistance, D407 and R403.
- (6) Q401 being turned on, causes current to flow through R408 putting a forward bias on the Base of Q403, turning on Q403. Q403 Emitter voltage will be switched to near V_c (+22.5V). This 22.5V will energize ST'BY Relay, K402. Current through K402's coil is limited by its own resistance and R409.
- (6.1) D404 protects Q203 from excessive reverse voltage that may be developed across the coil when Q403 K402 is turned OFF.
- (7) D401 maintains point "Y" approximately +0.5 volts above point "X". This voltage will not draw enough current through Q402's base bias resistor R406 to turn Q402 ON. TALK/LISTEN Relay K401 remains deenergized.
- (8) Assuming Q401 V_c goes to +21.5V. The voltage divider R410 and R411 results in a +2.1V on anode of D402. With a drop of 0.5 to 0.7 volts across the diode the voltage at high-side of C402 (point "U") is approximately 1.4 volts. This voltage is fed through J/P2-13 to the base of Q204, turning it ON.
- (8.1) MUTING: When Q204 is turned ON, its collector goes to emitter potential (in this case ground) shorting any audio signal present on the wiper contact of LEVEL SET CONTROL R216. This occurs when any TALK or LISTEN switch in the system is activated (pushed in).
- (8.2) When Q401 is turned OFF (as happens when the TALK or LISTEN switch is released), the voltage at point "Z" goes to zero. C402 has been charged to the 1.4V muting voltage. This voltage decreases at an exponential rate depending of the RC constant of C402 and the emitter-base junction in series with D407. (R412 is so large in respect to the other discharge paths that it has very little effect on the time constant.)
- (8.3) The voltage on C402 decreases from +1.4V through Q204's saturation and then through Q204's cutoff. The audio voltage on wiper of R216 starts coming back when the voltage drops through saturation and is at full level when Q204 is turned OFF. (The music fades back to full volume in something less than $\frac{1}{2}$ second). R412 discharges the residual voltage on C402.
- (9) KEY CLICK SUPPRESSION: When Q401 is turned ON, the 21.5 volts at point "Z" is applied to the base of PNP transistor Q404, with a drop of approximately 0.7 volts across D405. The transistor emitter-base junction is reverse biased and Q404 is clamped OFF.
- (9.1) The 20.8V at the emitter of Q404 is divided by R414 and R415 and 14.2 volts is applied to the positive side of C403.
- (9.2) This positive pulse is coupled through C403 and with a 0.7V drop across D406 appears instantaneously as 0.8V at point W and then immediately starts to decay toward zero. (Measurable at 0.8V with scope at J/P2-12.)
- (9.3) This decaying voltage is connected from point "W" through J/P2-12 to the base of Q202, turning it ON. When Q202 is turned ON, its collector goes to approximately the emitter ground potential, shorting the audio output of the intercom preamp Q201 and the audio at the base of the first audio amplifier Q204.
- (9.4) The base voltage decays very rapidly (approximately 150 milliseconds) and the audio at this point is shorted only during switching operation, eliminating most of the key clicks.
- (9.5) All of the key click will not be eliminated. The noise should be just enough to allow the operator to know that the switching system is functioning.
- (9.6) C404 and R419 reduce the sensitivity of Q401 to being turned on by transient voltages on the CONTROL LINE.
- (10) When the TALK or LISTEN switch is released, the voltage at point "Z" goes to zero.
- (10.1) The positive voltage on the high side of C403 is now connected through R414 to the Emitter of Q404. This results in a forward bias on Q404, turning it ON and its Collector voltage going to near V_e . The Base bias current flows through R410 and R411 to ground.
- (10.2) This positive voltage at "W" is the key-click voltage applied to the base of Q202 and disappears in approximately 150 milliseconds.
- (11) INSIDE/PATIO LISTEN OPERATION: When S3A/B in any Inside/Patio Speaker Control or S103 in the Master Unit is activated, the Control Line is connected through a 10K resistor (R2 in I/P Speakers or R104 in Master Unit) to ground.
- (12) Current flow through R401, R402, D407 and the Control Line resistance results in forward bias on Q401, turning it ON.
- (12.1) At the same time the voltage at point "A" goes to approximately +12V and the voltage at point "Y" goes to near +13.5 volts.
- (12.2) When Q401 is turned ON, its collector voltage goes positive and the MUTING and KEY CLICK operation is the same as noted above.

(13) The positive voltage at "Y" is coupled through H404 and R405 to the base of Q402 and through R406 to ground. The transistors Veb will equal approximately +1.33 volts and it will be turned ON.

(14) When Q402 is turned on, its collector goes to near ground potential, and the TALK/LISTEN Relay K401 is energized.

(14.1) D403 protects Q402 from excessive reverse voltages that may be generated by K401's coil when Q402/K401 is turned OFF.

(15) When K401 is energized, the RED and RED/W leads from the speakers that are normally connected to the audio amplifier output are now connected to the input transformer and, the ORN and ORN/W leads that are normally connected to the Input Transformer are now connected to the audio amplifier output.

(16) The STANDBY Relay K402 operated the same as described above.

BACKGROUND MUSIC

(1) The IM-406 can be used as a background music source. Its "Low-Level Radio Output" can be connected to NuTone's IM-516 Amplifier, and the IM-516 used to drive speakers whose entertainment program will not be interrupted when the IM-406's intercom capability is being used. (See IM-516 Installation Instructions)

(2) Connecting the IM-406 to the IM-516:

(2.1) IM-516 within 25-feet of IM-406: Connect a No. 22/2 twisted-pair (NuTone IW-2-60) between the BLUE/BLACK "Low Level Radio Output" wires in the IM-406 and the BLUE/BLACK "Low-Level Radio Connection" wires in the IM-516. Match the color-coded wires.

(2.2) When the IM-516 is more than 25-feet from the IM-406 (maximum of fifth-feet): Use a shielded audio cable between the units. Connect the shield between the BLACK wires and the center conductor between the BLUE wires.

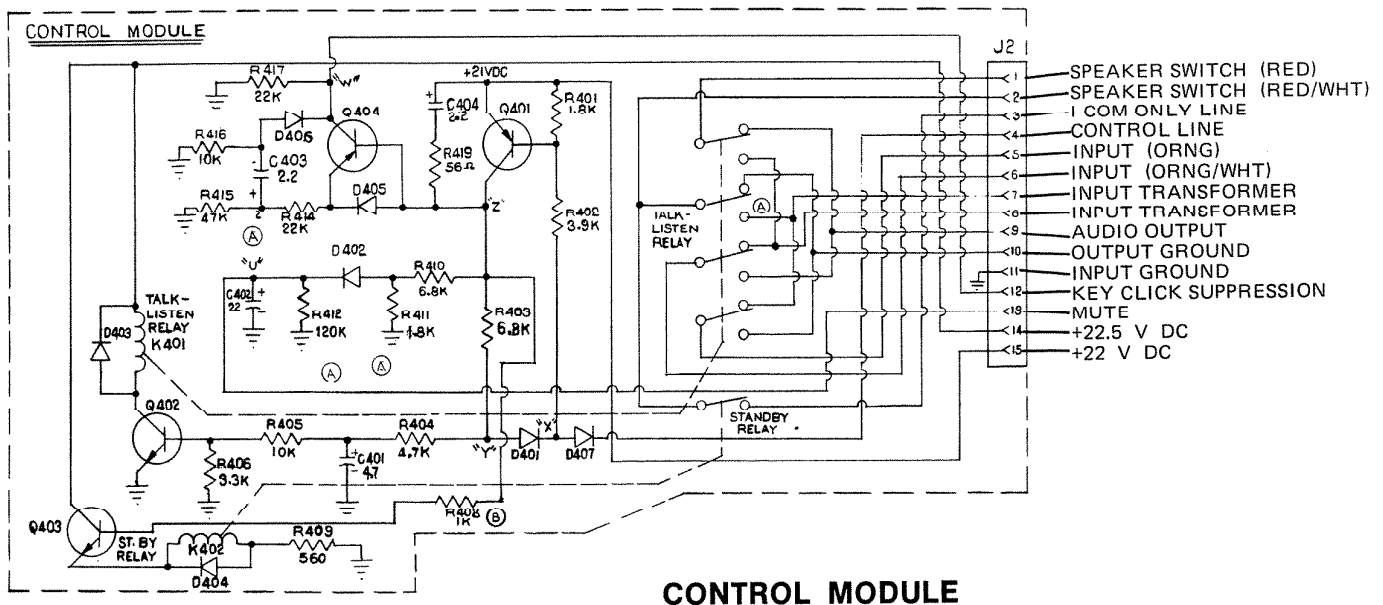
(3) If the IM-406 is to be used with other amplifiers in "Background Music" systems, NuTone's Field Engineering Department should be contacted for specific details.

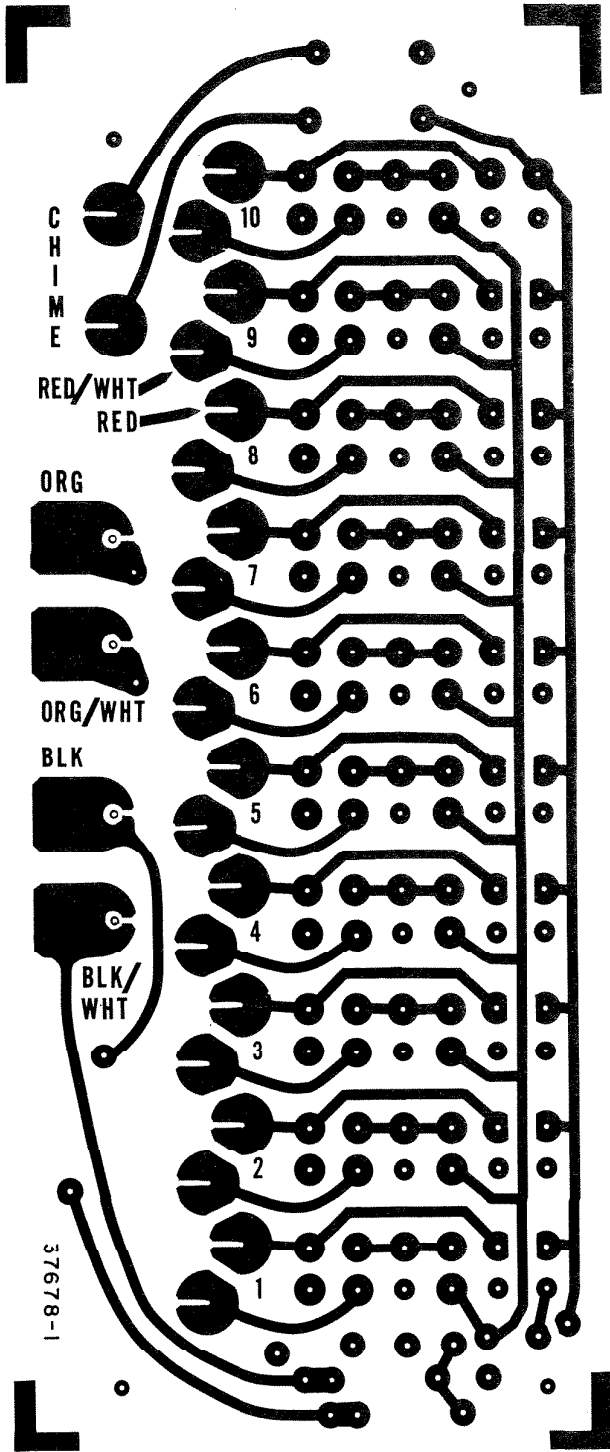
(4) The LEVEL SET CONTROL R237 on the Amplifier/Power Supply Module is generally operated at maximum level, i.e. full-clockwise. Turn this control to 10° to 15° counter-clockwise to prevent MUTING of background music during intercom operation.

(5) Adjust volume level of IM-516 (or other auxiliary amplifier) for desired background music level.

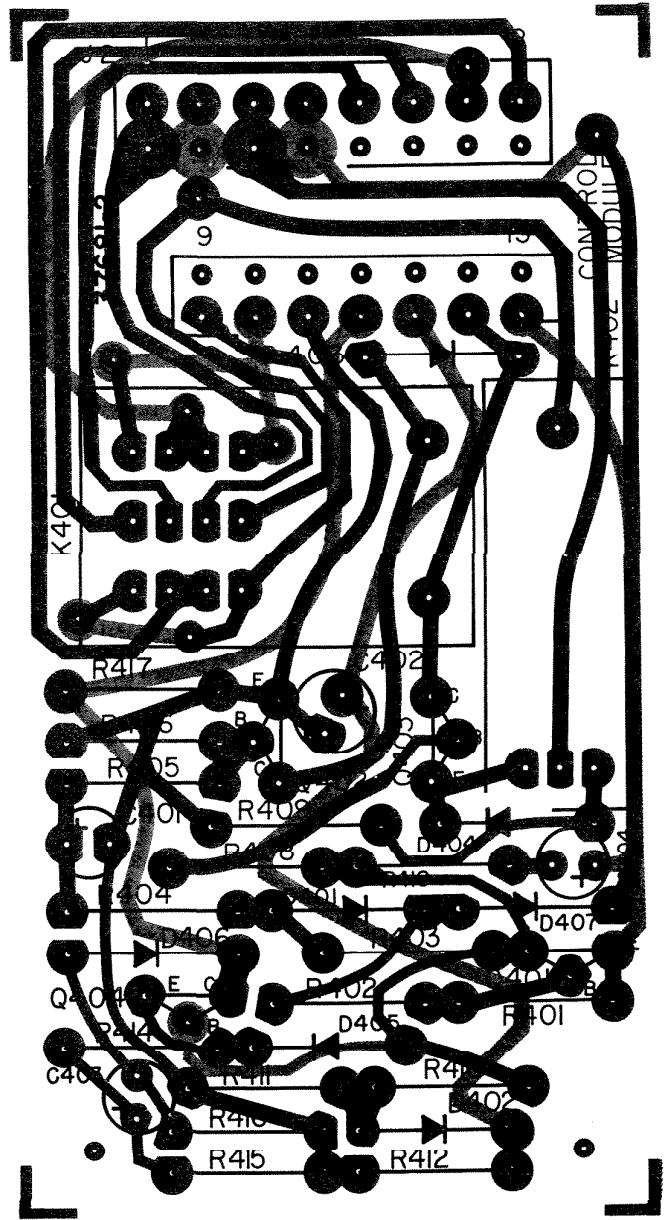
(6) Readjust intercom master unit ALL SPEAKER VOLUME CONTROL as required.

SPECIAL NOTICE: When the IM-516 Amplifier is used with the IMA series of Radio-Intercom Systems, please refer to complete instructions in the IM-516 Service Manual, NuTone Part Number FE 975-1.

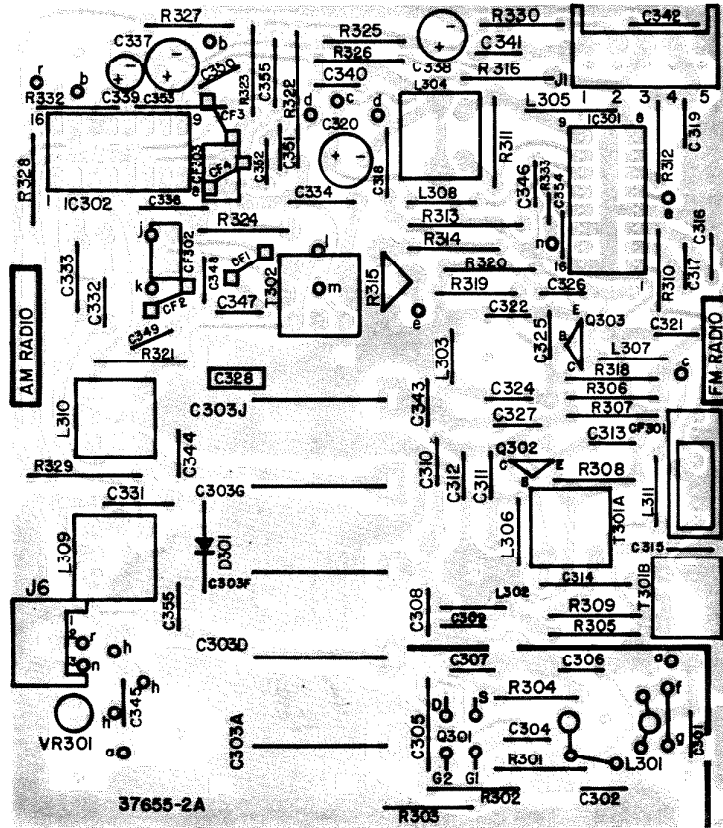




REMOTE SWITCH
TERMINAL BOARD

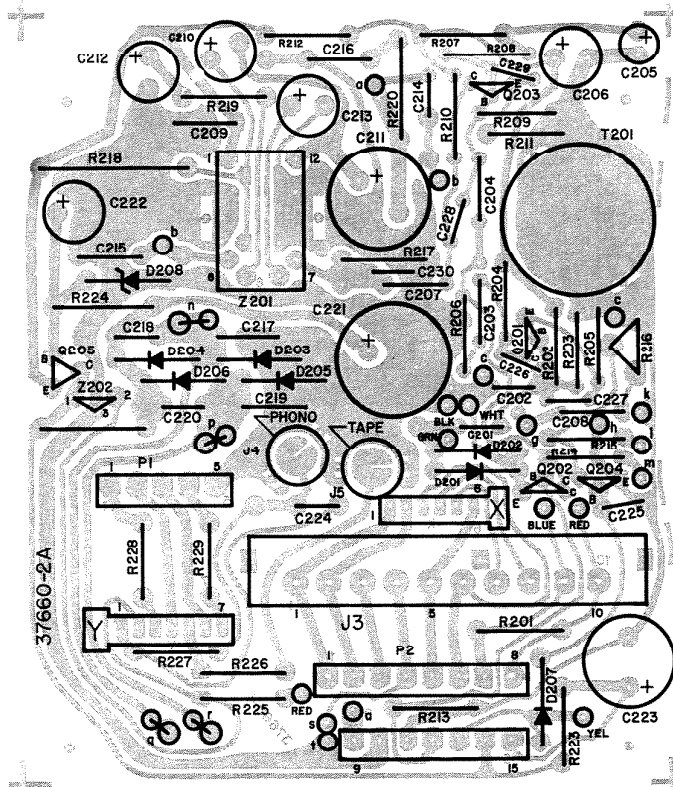


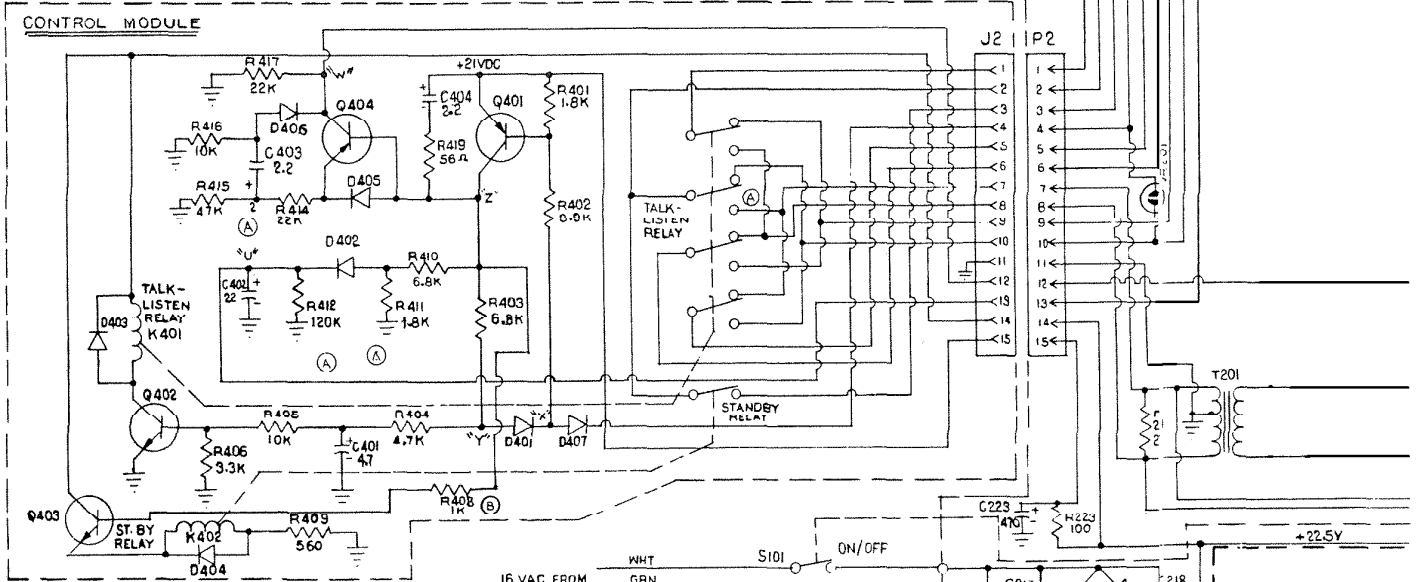
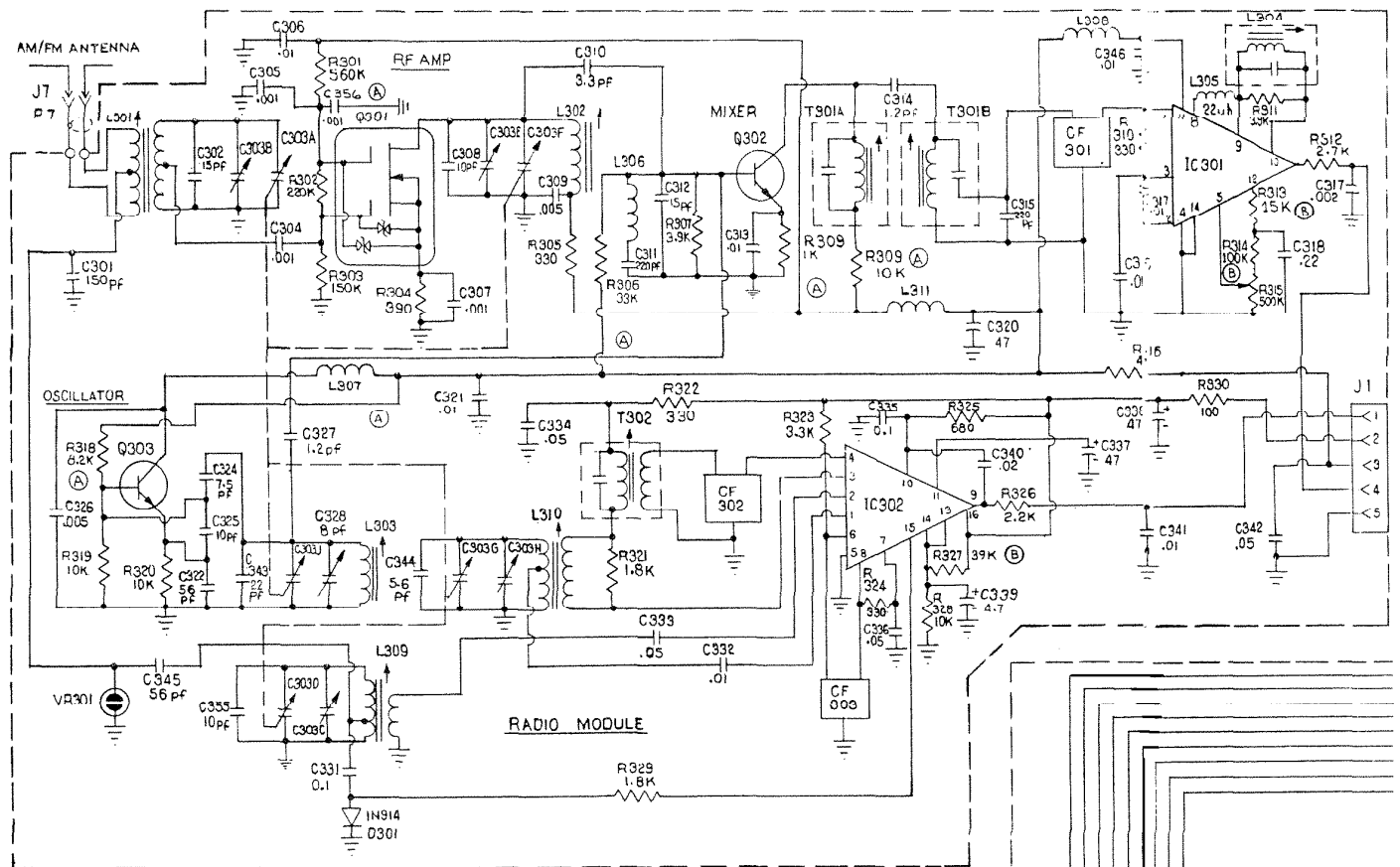
CONTROL MODULE



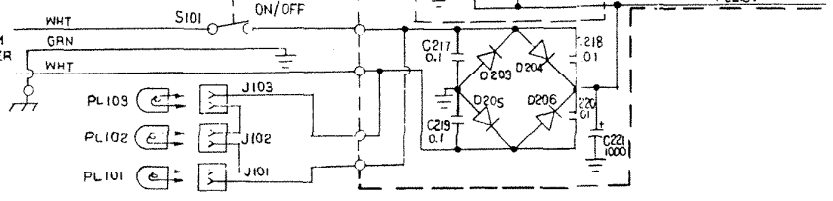
AM/FM TUNER
COMPONENT LAYOUT

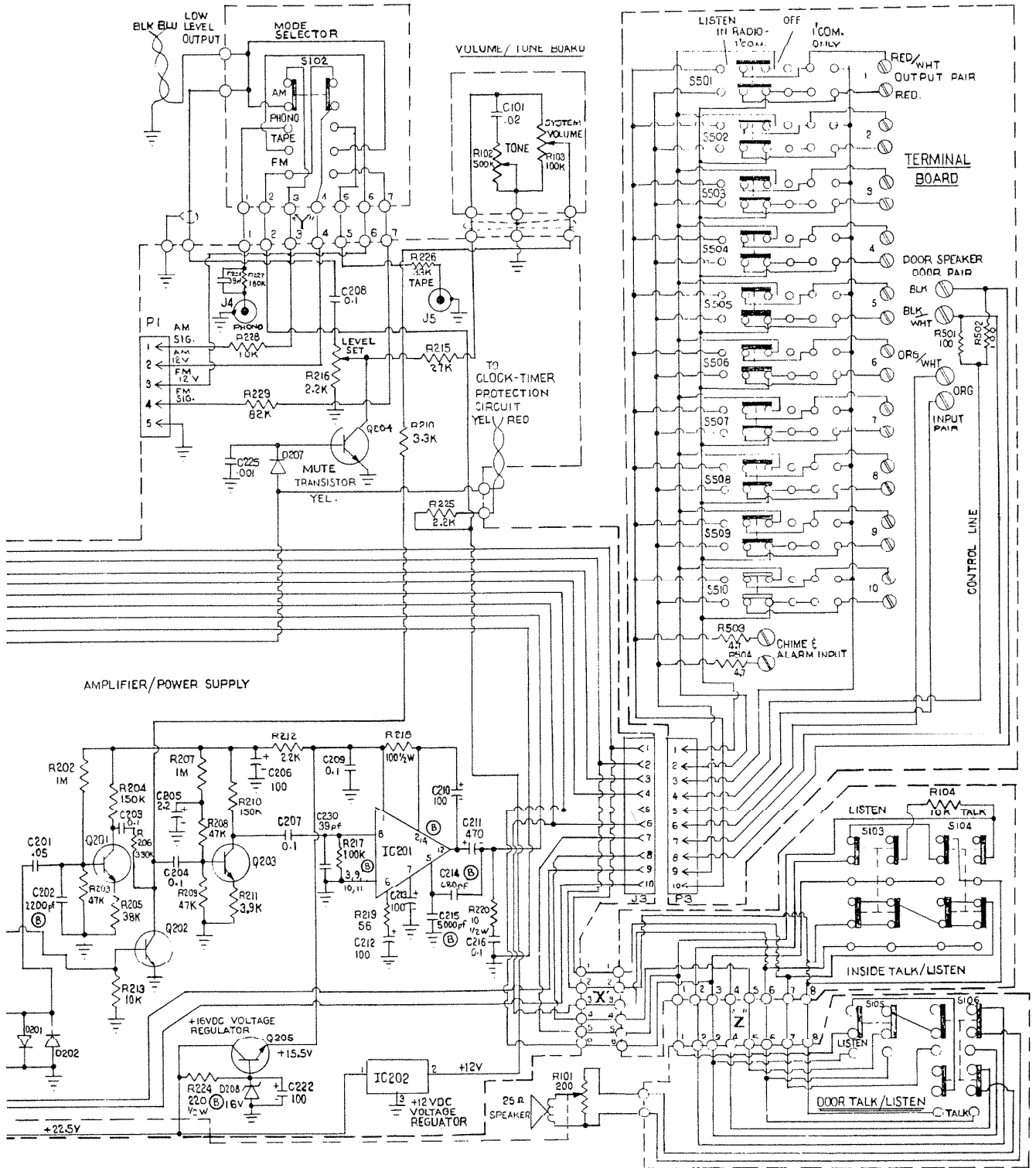
AMPLIFIER/POWER
SUPPLY MODULE





- NOTES:**
1. ALL RESISTORS 1/4 WATT, UNLESS OTHERWISE SPECIFIED. VALUE IN OHMS, TOLERANCE $\pm 5\%$.
 2. ALL CAPACITOR VALUES IN MFD. UNLESS OTHERWISE SPECIFIED.
 3. COMPONENT IDENTIFICATION: 100 - CHASSIS MOUNTED COMPONENTS
200 - AMPLIFIER/POWER SUPPLY
300 - RADIO MODULE
400 - CONTROL MODULE
500 - TERMINAL BOARD





SCHEMATIC MODEL IMA-406.

OPERATING VOLTAGES

INPUT: 120 Vac, 60 Hz.
 AC TO BRIDGE RECTIFIER: 17 Vac, 60 Hz.
 BRIDGE DC OUTPUT: Vcc = 23 Vdc (Measure at J/P2-2)
 Regulated = 12 Vdc (Measure at J/P1-2)
 R103 VOLUME CONTROL: Minimum
 S102 SELECTOR SWITCH: AM (No Signal, Tune Off Station.)

PIN NUMBER

DEVICE	1	2	3	4	5	6	7	8	9	10	11	12	TABS
IC201	15.5	15.2	0	15.2	.75	1.3	8.1	.02	0	0	0	7.75	0
IC202	23	12.0	0										

PIN NUMBER

DEVICE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
IC302	0.9	1.5	10.9	0.7	0	8	1.5	1.5	0.8	5.5	0.64		1	1	0	11

S1-2 SELECTOR SWITCH: FM (No Signal, Tune Off Station.)
 Regulated = 11.5 Vdc (Measure at J/P1-3)

PIN NUMBER

DEVICE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
IC301	2.1	2.1	2.1	0	2.4*	5.4		5.9	6	6	10	5.3*		0		

(*) Must be measured by Oscilloscope or by meter with Hi-Z input.

ELEMENT

DEVICE	FUNCTION	SOURCE	GATE 1	GATE 2	DRAIN
Q301	R.F. Amplifier	1.7	1.85	3.6	8.6
		EMITTER		BASE	COLLECTOR
Q302	F.M. Mixer	0.25		0.9	10
Q303	F.M. Oscillator	4.5		5.2	4.2
Q201	I.C. Preamp	.13		.68	10.5
Q202	Key Click Suprsn.	0		0*	0
Q203	1st Audio Amp.	.13		.68	10.5
Q205	Voltage Regulator	15.5		16.0	23.0
Q204	Muting	0		0**	0
Q401/OFF	Door Relay	0		.049	20.1
Q401/ON		0		0.9	0.19
Q402/OFF	Key Click Suprsn.	0		0	0
Q402/ON		9.5		10	.25***

(*) Goes to 0.3 on meter (0.8 on scope) when "Key Click" suppression voltage is ON.

(**) Goes to 0.7 when "Muting" is ON.

(***) Measured with meter. Actual voltage measured on scope equal 0.8 volts maximum; discharging to zero in 150-200 milliseconds when depressing or releasing any TALK or LISTEN switch.

CONTROL MODULE INTERCOM OPERATION

INTERCOM FUNCTION	RESISTANCE AT POINT X	VOLTAGE POINT X	VOLTAGE POINT Y	Q401	K401 Q402	K402 Q403	Q404	
							T/L ON	T/L RELEASED
OFF	25K To 00	22.5	0	OFF	OFF	OFF		
I/P TALK	70	0.9	1.5	ON	OFF	ON	Momentary On	MOMENTARY ON*
I/P LISTEN	7.5K	12.6	13.1	ON	ON	ON	"	"
DOOR TALK	58	0.9	1.5	ON	OFF	ON	"	"
DOOR LISTEN	52	0.9	1.5	ON	OFF	ON	"	"

(*) ON for approximately 150 milliseconds, during "Key Click" suppression.

MASTER UNIT PARTS LIST - IMA - 406

ALL RESISTORS ARE CARBON FILM UNLESS OTHERWISE SPECIFIED. 1/4 WATT CARBON RESISTORS MAY BE SUBSTITUTED AND ARE AVAILABLE FROM LOCAL ELECTRONIC OUTLETS.

Schematic Symbol	NuTone Part No.	Description
AM/FM TUNER MODULE		
	41881-000	Complete Ass'y
DIODES		
D301	36651-000	Silicon Switching, 50ma DC 75PIV 1N914(TI-1N4148)
RESISTORS		
R301	33082-564	560K 1/4 Watt
R302	33082-224	220K 1/4 Watt
R303	33082-154	150K 1/4 Watt
R304	33082-391	390 1/4 Watt
R305, R310, R322, R324	33082-331	330 1/4 Watt
R306	33082-333	33K 1/4 Watt
R307, R311	33082-392	3.9K 1/4 Watt
R308	33082-102	1K 1/4 Watt
R309	33082-103	10K 1/4 Watt
R312	33082-272	2.7K 1/4 Watt
R313	33082-153	15K 1/4 Watt
R314	33082-104	100K 1/4 Watt
R315	34043-000	500K Trim Pot FM Squelch
R316	33082-470	47 1/4 Watt FM Squelch
R318	33082-822	8.2K 1/4 Watt
R319, R320, R328	33082-103	10K 1/4 Watt
R321, R329	33082-182	1.8K 1/4 Watt
R323	33082-332	3.3K 1/4 Watt
R325	33082-681	680 1/4 Watt
R326	33082-222	2.2K 1/4 Watt
R327	33082-393	39K 1/4 Watt
R330	33082-101	100 1/4 Watt
CAPACITORS		
C301	35100-174	150pf
C302, C312	35101-142	15 pf
C303A-J	35092-000	Variable AM/FM Tuning Gang
C304, C307	35100-120	.001mfd
C305	35100-173	.001mfd
C306, C313, C316, C317, C321, C332, C341, C346	35100-139	.01 mfd
C308, C325, C355	35101-140	10pf
C309, C326	35100-138	.005mfd
C310	35101-134	3.3pf
C311, C315	35100-125	220pf
C314	35101-147	1.2pf
C318	35076-101	.22mfd
C319	35100-156	2200pf
C320, C337, C338	35091-109	47mfd @ 16V, Electrolytic

Schematic Symbol	NuTone Part No.	Description
C322, C344	35101-141	5.6pf
C324	35101-135	7.5pf
C327	35101-126	1.2pf
C328	35090-000	1-8pf Variable Osc. Hi Freq. Trimmer
C331, C335	35076-106	.1mfd
C333, C334, C336, C342	35100-141	.05mfd
C339	35091-103	4.7mfd @ 25V Electrolytic
C340	35076-108	.02mfd @ 16V
C343	35101-148	22pf
C345	35100-175	56pf
C356	35100-120	.001 mfd. (on Foil Side of P/C Board)
COILS AND TRANSFORMERS		
L301	30087-000 30086-000 30096-000	FM Ant. Primary FM Ant. Tap FM Ant. Secondary
L302	30097-000	FM RF
L303	30088-000	FM Osc
L304	30092-000	10.7MHz Quadrature
L305	30091-101	22 μ h RF Coil
L306, L307, L308, L311	30062-000	10.7MHz Trap Coil
L309	30597-000	AM Ant
L310	30598-000	AM Osc
	Alternate 30599-000	Alternate
T301A	30590-000	10.7MHz FM IF Primary
T301B	30591-000	10.7MHz FM IF Secondary
T302	30589-000	455KHz AM IF
FILTERS		
CF301	36088-000	10.7MHz FM IF Ceramic
CF301	36102-000	10.7MHz FM IF Ceramic
	(Alternate)	
CF302	36087-000	455KHz AM IF Ceramic
CF303	36087-000	455KHz AM IF Ceramic
TRANSISTORS		
Q301	36624-000	Dual Gate, FET, FM RF Amp. (3N201, 3N202, 3N203)
Q302	36578-000	NPN Epitaxial Planer Silicon FM Mixer
Q303	36581-000	NPN Planer Silicon FM Osc
INTEGRATED CIRCUITS		
IC301	36623-000	FM IF Detector (RCA CA3089E)
IC302	36622-000	AM Mixer, IF Detector (RCA CA3088E)
CONNECTOR		
J1	39339-101	5 Pin Receptacle
LAMPS		
VR301	39438-000	105-125V DC/AC 1/4 Watt, 1.9ma Neon - GE "Glow Lamp" C2A-ET (NE-2H3T) or Equiv.

Schematic Symbol	NuTone Part No.	Description
AMPLIFIER/POWER SUPPLY		
	1515-A	Complete Assembly (Includes the following): Door T/L Switch Ass'y, I/P Switch Ass'y, Function Switch, I/P All Speakers Volume Control, Tone Control and Pilot Lamp Sockets. Mounted on Sub Assembly Frame.
DIODES		
D201 - D207	36549-000	Rectifier 1N4002
D208	39594-000	Zener, 16V @ 15.5 ma DC 1 Watt (1N4745)
RESISTORS		
R201	33082-270	27 Ohms
R202, R207	33082-105	1 Meg Ohm
R203, R208, R209	33082-473	47K Ohms
R204, R210	33082-154	150K Ohms
R205, R211	33082-392	3.9K Ohms
R206	33082-334	330K Ohms
R212, R225	33082-222	2.2K Ohms
R213, R228	33082-103	10K Ohms
R214	33082-332	3.3K Ohms
R215	33082-273	27K Ohms
R216	34023-000	2.2Meg Potentiometer, Level Set
R217	33082-104	100K Ohms
R218	33101-101	100 Ohms - 1/2 Watt Carbon
R219	33082-560	56 Ohms
R220	33101-100	10 Ohms 1/2 Watt Carbon
R223	33082-101	100 Ohms
R224	33101-221	220 Ohms 1/2 Watt Carbon
R226	33082-333	33K Ohms
R227	33082-184	180K Ohms
R228	33082-820	82K Ohms
CAPACITORS		
C201	35076-105	.05 mfd @ 25V
C202	35100-156	2200pf Ceramic
C203, C204, C207, C208, C209, C216	35076-106	.1mfd @ 25V
(alternate)	35100-127	.1mfd @ 100V
C205	35091-111	2.2mfd @ 25V Electrolytic
C206, C210, C212	35091-108	100mfd @ 25V Electrolytic
C213, C222	35091-105	470mfd @ 25V Electrolytic
C211	35100-183	680pf Ceramic
C214	35100-187	5000pf Ceramic

Schematic Symbol	NuTone Part No.	Description
C217, C219	35100-127	.1mfd @ 100V Ceramic
C218, C220	35076-107	.01mfd @ 50V Ceramic
(Alternate)	35100-139	.01mfd @ 50V Ceramic
C221	35091-107	1000mfd @ 35V Electrolytic
C223	35091-101	470mfd @ 35V Electrolytic
C224, C230	35100-172	39pf Ceramic
C225	35100-120	1000pf Ceramic
TRANSISTORS		
Q201, Q203	36580-000	NPN Planar Silicon
Q202, Q204	36613-000	NPN Silicon (Motorola MPS-A20)
Q205	36614-000	NPN Power Silicon (Motorola MJE-520)
INTEGRATED CIRCUITS		
IC201	36647-000	Power Amplifier SGS-ATES TBA 810S RCA CA810Q
IC202	36648-000	Voltage Regulator Fairchild 78L12 WC Motorola MC78L12CP
TRANSFORMER		
T201	30592-000	Intercom Input
	32159-003	Mounting Bracket for T201
PLUGS AND CONNECTORS		
J4, J5	39595-000	Tape/Phono Jacks
P1	39338-101	Connector Post 5 Pin
P2	39338-102	Connector Post 7 Pin
	39338-103	Connector Post 8 Pin
J3	39333-102	Connector End Block 4 Pin Blue
	39333-103	Connector End Block 6 Pin Blue
LAMPS		
VR201	39438-000	Neon Lamp
PL101, PL102, PL103	39330-000	Pilot Lamps - GE #259 or Equiv.
J6, J7, J8	41833-000	Lamp Socket Ass'y.
CONTROL MODULE		
	42096-000	Complete Assembly
DIODES		
D401 - D406	36617-000	Silicon Switching 50ma DC 75PIV - 1N914 or 1N4148
D407	36549-000	Silicon Rectifier 1N4002

Schematic Symbol	NuTone Part No.	Description
RESISTORS		
R401, R411	33082-182	1.8K Ohms
R402	33082-392	3.9K Ohms
R403, R410	33082-682	6.8K Ohms
R404	33082-472	4.7K Ohms
R405, R416	33082-103	10K Ohms
R406	33082-332	3.3K Ohms
R408	33082-102	1K Ohms
R409	33082-561	560 Ohms
R412	33082-124	120K Ohms
R414, R417	33082-223	22K Ohms
R415	33082-473	47K Ohms
R419	33082-560	56 Ohms
CAPACITORS		
C401	35091-103	4.7mfd @ 25V Electrolytic
C402	35091-110	.22mfd @ 16V Electrolytic
C403, C404	35091-106	2.2mfd @ 25V Electrolytic
TRANSISTORS		
Q401	36509-000	PNP Planar Silicon Darlington (Motorola MPS-A65)
Q402	36590-000	NPN Planar Silicon Darlington Motorola MPS-A13
Q403	36613-000	NPN Silicon - Motorola MPS-A20
Q404	36606-000	PNP Silicon - Motorola MPS-A70
RELAYS		
K401	39336-000	4PDT Talk/Listen American Zettler - AZ429-70-101
K402	39337-000	SPST Reed Standby New Products Engineering - 118-3-1, F3
CONNECTORS		
J2	39339-103	Receptacle - 8 pin
	39339-105	Receptacle - 3 Pin
	39339-106	Receptacle - 4 Pin

Schematic Symbol	NuTone Part No.	Description
INTERCOM SWITCHBOARD ASSEMBLY		
	42035-000	Complete Assembly
P3	37604-000	10 Pin Connector
R501, R502	33101-101	100 Ohms ½ Watt
R503, R504	33101-047	4.7 Ohms ½ Watt
S501 - S510	34624-000	DP5T Slide Switch - Remote Station Selector
CHASSIS MOUNTED PARTS		
INSIDE TALK/LISTEN SWITCH ASSEMBLY		
	42033-000	Complete Assembly
S103, S104	34630-000	Talk/Listen Switch
(Alternate)	34627-000	
	37676-000	Inside Talk/Listen P/C Board
R104	33082-103	10K Ohm ¼ Watt
DOOR TALK/LISTEN SWITCH ASSEMBLY		
	42034-000	Complete Assembly
S105, S106	34629-000	Talk/Listen Switch
(Alternate)	34626-000	
	37677-000	Door Talk/Listen P/C Board
VOLUME/TONE CONTROL ASSEMBLY		
	41879-000	Complete Assembly
	37653-000	Volume/Tone P/C Board
C101	35076-108	.02mfd 16V Ceramic
R102	34070-000	Potentiometer - 500K Tone
R103	34071-000	Potentiometer - 100K Volume
AM/FM/TAPE/PHONO MODE SWITCH ASS'Y.		
	41880-000	Complete Assembly
	37654-000	Mode Switch P/C Board
S102	34657-000	Switch - DP4T
DIAL CORD		
	41535-000	Complete Assembly
	39262-000	Spring, Dial Pointer
	39335-000	Dial Pointer
	38603-000	Lens, Rear

SETTING OF F.M. SQUELCH CONTROL R315

(1) The Master Unit is supplied, from the factory, with Squelch Control R315 set at maximum position, i.e. with full squelch.

(2) When sufficient (normally excess of 5 microvolts) F.M. broadcast band R.F. signal is fed to the input of the F.M. tuner, it will operate with full limiting and the setting of R315 will not effect the quantity nor quality of the recovered audio signal, and the signal-to-noise ratio will be in the order of 45 db. As the input signal increases, the signal-to-noise ratio will rise to the order of 70db. (See Figure A5)

(3) When there is sufficient RF signal and the squelch can be operated at maximum, the side-band response that is characteristic of limiter-discriminator F.M. operation will be eliminated. (Figure A6) The set will be quiet when tuned between stations, and tuning is as easy and unambiguous as in an AM receiver-without resorting to AFC. This eliminates AFC pull from a strong station when attempting to tune to a weak station.

(4) When the RF input is below 5 microvolts, due to: distance from transmitter (fringe area); poor antenna; shielded RF area; etc., there will not be sufficient signal to drive the set to limiting, and it may be required that the squelch control be set to a lower point.

(4.1) This may improve listening satisfaction, but the receiver may be operating at a point where signal-to-noise ratio has deteriorated and the recovered audio is not acceptable.

(5) In the field adjustment of the Squelch Control R315 may be accomplished as follows:

(5.1) Set ALL SPEAKER VOLUME CONTROL R103 and MASTER UNIT SPEAKER VOLUME CONTROL R101 for normal operation.

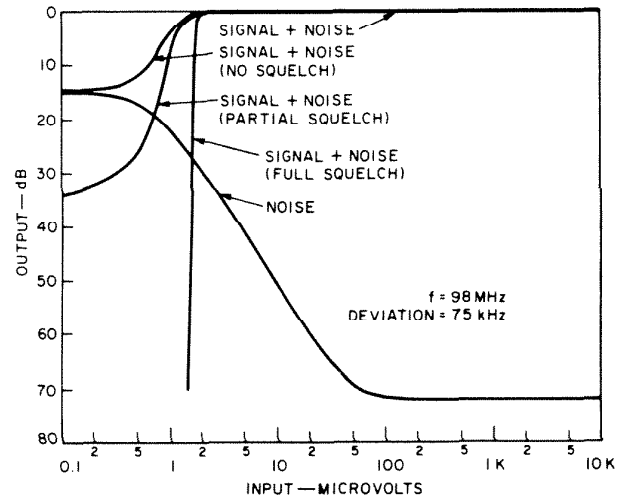
(5.2) Set SQUELCH CONTROL R315 to minimum, i.e. no squelch.

(5.3) Tune receiver to weakest F.M. station that the home owner will normally listen to.

(5.4) If the weak station (paragraph (5.3) above) reception is acceptable, advance the SQUELCH CONTROL R315 until it interferes with reception of the station, then, back the control until reception is acceptable.

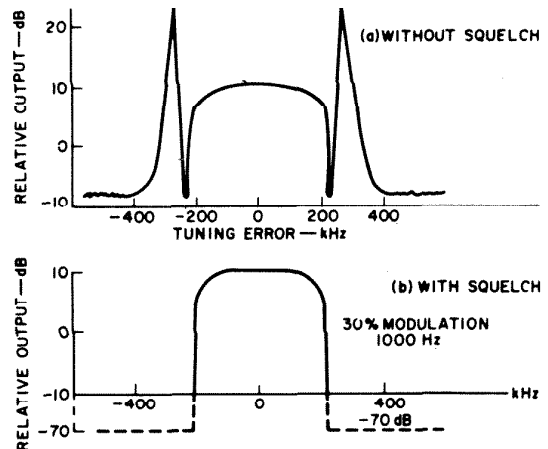
(6) IN NORMAL OPERATION, WITH THE FM TUNER PROPERLY ALIGNED, THE RECOMMENDED PROCEDURE IS TO IMPROVE THE R.F. SIGNAL INPUT. THIS MAY BE ACCOMPLISHED BY INSTALLING AN OUTSIDE ANTENNA, AND IF REQUIRED, A DIRECTIONAL ARRAY: RAISING THE ANTENNA: OR BY CHANGING THE POSITION OF THE INSIDE ANTENNA THAT IS SUPPLIED WITH THE MASTER UNIT ROUGH-IN.

REMEMBER, SUB-PAR OPERATION OF THE SQUELCH CIRCUIT IN A WELL ALIGNED MASTER UNIT IS DUE TO INSUFFICIENT INPUT SIGNAL.



S + N AND N FOR NO SQUELCH; PARTIAL SQUELCH; AND FULL SQUELCH PLOTTED AGAINST RF INPUT

FIGURE A5



TYPICAL TUNING CHARACTERISTIC: (a) WITHOUT SQUELCH; AND (b) WITH SQUELCH, SHOWING THE SUPPRESSION OF SIDE RESPONSE CHARACTERISTIC OF LIMITER - DISCRIMINATOR RECEIVERS

FIGURE A6