

Quality. Uncompromised.

# ROTEL®

## PUBLIC ADDRESS AMPLIFIER

# QA-101

# INSTRUCTION/ TECHNICAL MANUAL

**WARNING**  
TO PREVENT FIRE OR SHOCK HAZARD,  
DO NOT EXPOSE THIS APPLIANCE TO  
RAIN OR MOISTURE

Write your **SERIAL NUMBER** here.

The number is located near the name  
plate on the rear panel.



## PRECAUTIONS

### 1. Unpacking

After removing the amplifier from the carton, inspect for any exterior damage to the unit. If damage is noted, notify the carrier at once so that a claim can be justified. Save all packing material—this is important when the claim is processed.

### 2. Ventilation

To offset heat generated by the unit, it is necessary to provide ample ventilation around the unit. Avoid blocking or impeding the ventilation holes on the unit. To prevent unnecessary problems, install the unit on a place free from any vibrations, direct sunlight, humidity or dust circulation.

### 3. If the unit gets wet or foreign matter enters

In case the unit gets wet or any water or foreign matter gets into the cabinet, immediately disconnect the a.c. line cord, and consult your dealer or qualified electrician.

## OPERATION AND CONNECTION

### (1) Power Switch

Switches the unit on or off. The LED lamp will light up when power is on.

### (2) Tone Controls for Aux/Program

Regulates frequency response of music or signal from Aux/Program input. Bass controls the low range and Treble controls the high range.

### (3) Tone Controls for Mic/Tel

Regulates frequency response of signal from MIC 1, MIC 2, or MIC 3/TEL input.

### (4) Master Volume Control

Regulates the volume level of all inputs, irrespective of individual level controls.

### (5) Aux/Program Level Control

Regulates the volume level of signal from Aux/Program input.

### (6) Mic 3/Tel Level Control

Regulates the volume level of microphone (MIC 3 input) or Telephone page (TEL PAGE input), depending on the input selected by MIC/TEL selector switch on the rear panel.

### (7) Mic 2 Level Control

Regulates the volume level of microphone connected to MIC 2 input.

### (8) Mic 1 Level Control

Regulates the volume level of microphone connected to MIC 1 input.

### (9) Aux/Program Input Terminal

Connect an auxiliary equipment such as tape player to the RCA type pin plug. Or, connect a 600 ohm input such as BGM source to the balanced 600 ohm screw terminal.

### (10) Telephone Input Terminal

Connect a telephone page unit. Please note the TEL/MIC selector switch must be set at the TEL position when the page unit is to be used.

### (11) Mute Terminal

Connect wires from push-to-talk microphone or from telephone system to mute music or signal from Program/Aux input when talking.

### (12) Tel/MIC Selector Switch

Select TEL position if the telephone page system is to be used, or select MIC position if the microphone 3 is to be used.

### (13) Microphone Input Terminals

There are 3 inputs for connecting up to 3 microphones. Connect a low impedance microphone (250 ohms) as show on Figure 2.

### (14) Speaker Terminal

Connect 4 to 16 ohms speaker to HOT and GD. Or, connect speakers with 35 volt line transformer to 35V and COM, and speakers with 70 volt line transformer to 70V and COM.

**IMPORTANT:** Ensure HOT and TR are strapped with jumper wire when using 35V and 70V.

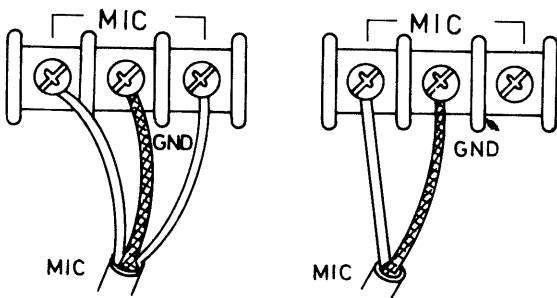
### (15) Overload Protection

If overload occurs due to mismatched speaker impedance, etc. remove the cause of the overload and push the circuit breaker button to reset power to the unit.

### (16) Unite/Separate Select Switch

Select UNITE position if this amplifier is normally to be used, or select SEPARATE position if only the control amplifier is to be used, connect wire from PRE OUT RCA type pin plug to the other main amplifier, or only the main amplifier it to be used, connect wire from MAIN IN RCA type pin plug to the other control amplifier.

### • MICROPHONE INPUT TERMINAL CONNECTION



BALANCED TYPE,  
LOW IMPEDANCE (250Ω)  
Length of shielded cord:  
200 feet (60 meters) maximum

UNBALANCED TYPE,  
LOW IMPEDANCE (250Ω)  
Length of shielded cord:  
60 feet (18 meters) maximum

Figure 2.

# CONSIDERATIONS FOR PA SPEAKER LAYOUT

## SPEAKER CONNECTIONS

In connecting speakers to a public address amplifier it is important to present the amplifier with the load impedance it is designed to handle. Failure to do this can cause overheating and component failure. In many cases problems can take months to appear in the form of reduced reliability and unnecessary service calls. A load impedance that is too low is especially bad. You should strive to have a load impedance of not less than 70% of the chosen amplifier output impedance. For example, do not connect a 4 Ohm speaker to the 8 Ohm output. Driving a load of higher impedance than rated amplifier output is not as serious, but results in a power loss proportional to the mismatch and should be avoided. For example, driving a 16 Ohm load through the 8 Ohm output will result in a 50% loss in power. The high impedance mismatch should be kept to less than 200%, especially if it is anticipated that more than 50% of the rated amplifier power will be required.

There are two methods of connecting groups of speakers to the amplifier. Firstly, using the low impedance (i.e. 4, 8, 16 Ohm) outputs. This is preferable where: -

- (a) Runs are short (less than 200 ft. [70 m]).
- (b) Few horns or speakers are to be used (i.e. typically 4-8)
- (c) Same sound levels are required at each speaker.
- (d) Low impedance also provides slightly better fidelity and frequency response.

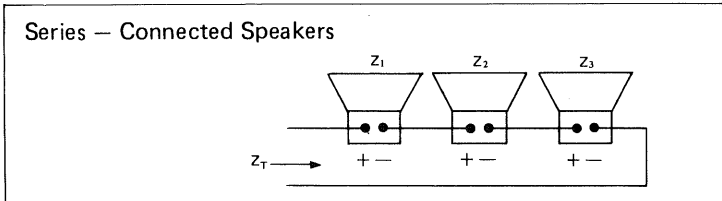
High impedance or constant voltage is the second method and is preferable where: -

- (a) The runs are long and line losses are to be avoided.
- (b) Many speakers are to be used.
- (c) Different sound levels are required at different locations, for example indoor speakers and outdoor horns.
- (d) Future expansion possibilities require flexibility in wiring layout.

The following is a more detailed discussion of these two methods.

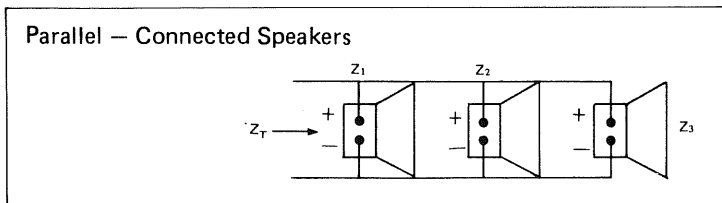
### LOW IMPEDANCE CONNECTION

The speakers must be connected so as to present a combined impedance equal to the selected amplifier output impedance, i.e. 4, 8, 16 Ohms. The connections should be arranged in a series/parallel combination to achieve this according to the following formulae. The impedance should be between 70% and 200% of the output impedance selected. If the amplifier is to be driven anywhere near its full rated output the impedance should be well within these tolerances.



$$Z_T = Z_1 + Z_2 + Z_3 + \dots + Z_N$$

where  $Z_T$  = total combined load impedance  
and  $Z_N$  = individual speaker impedance

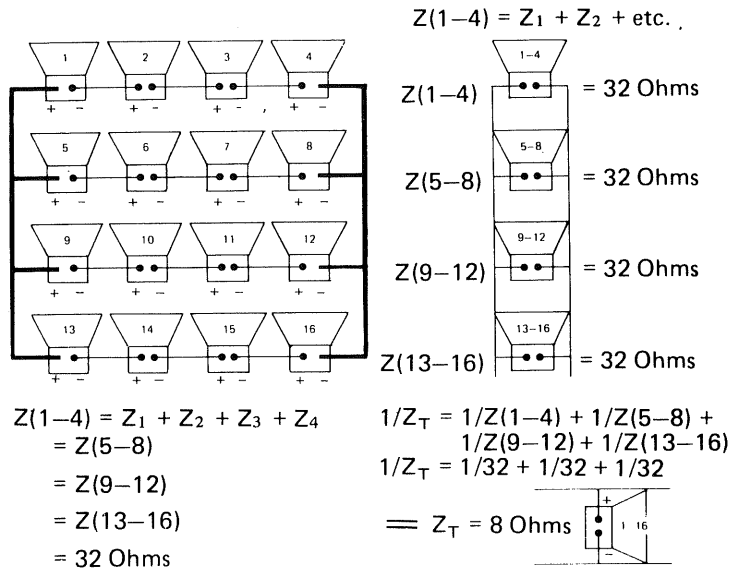


$$Z_T = \frac{1}{1/Z_1 + 1/Z_2 + 1/Z_3 + \dots + 1/Z_N}$$

### SERIES/PARALLEL COMBINATIONS

In larger systems it will be necessary to combine series and parallel connections to obtain the necessary impedance. The rules for calculating the total effective impedance is to divide the entire circuit into individual small series of parallel sub-circuits and apply the foregoing rules to them.

The following is an example using 16 x 8 Ohm speakers. Each schematic is an impedance equivalent to its predecessor but has been simplified.



As can be seen, a problem arises if one more speaker must be added at some future date, as all the connections must be changed. This is not much of a problem if only a few speakers are involved, but if the network is extensive, the problem is significant. In addition, failure of one speaker can take out a number of associated units.

### HIGH IMPEDANCE OR CONSTANT VOLTAGE (25V & 70V) SYSTEMS

The high impedance or constant voltage method of impedance matching uses a high impedance amplifier output which is transformed down to 8 Ohms by an impedance matching transformer at each individual speaker. The big advantages of this approach as compared to low impedance are: -

- (1) Reduced line losses and ability to use smaller wire gauges. This is due to the higher voltage and reduced current in the speaker lines.
- (2) Much simpler impedance matching procedures and connections.

Constant voltage is a misnomer in that the amplifier does not always produce 70V. Rather, the amplifier output impedance is set at such a level that, irrespective of its rated power, it will produce 70.7 volts output at full power. Thus a 10 Watt amplifier optimum load would have an impedance of 500 Ohms ( $V^2/P = 70.7^2/10$ ), a 40 Watt amp would be 126 Ohms and 100 Watt amp, 50 Ohms:

Multiple transformer taps allow the impedance at each speaker to be adjusted individually to give a total matched load. Because of the high impedance arrangement, the system is easier to impedance match and is also inherently less susceptible to problems caused by mismatching.

The transformer taps are marked in Watts instead of Ohms (usually 4, 2, 1, 1/2). Again, it should be borne in mind that these levels of power output are only achieved when the transformer is working at 70.7 volts. The transformers are connected in parallel. A good match is obtained by ensuring that the total of all tap settings fits into the range of 40-80% of rated amplifier output. 80% is chosen to allow for transformer insertion loss. It is also good practice not to drive the amplifier to 100% of its capacity.

Examples are shown below. For simplicity it is assumed that all tap settings are the same at each speaker.

For a 40 Watt amplifier the range 40-80% is equivalent to 16-32 Watts. Therefore:

- 6 speakers x 4 Watt taps each = 24W . . . . . Good match
- 4 speakers x 1 Watt taps each = 4W . . . . . Poor match
- 20 speakers x 1 Watt taps each = 20W . . . . . Good match
- 20 speakers x 4 Watt taps each = 80W . . . . . Very poor match - overload
- 30 speakers x 1 Watt taps each = 30W . . . . . Good match

#### NOTE:

None of the above tap settings guarantee the actual sound levels through each speaker. This is as much a function of the master volume control as the tap setting. The setting simply defines the maximum power consumed by an 8 Ohm speaker if presented with 70.7 volt input. In the case of a small number of speakers, it is always preferable to use a higher tap setting and reduced the sound level by turning down the master volume control. In calculating the amplifier rating needed for a typical music/paging system using speakers distributed in an office environment, a good rule of thumb is to allow about 1W per speaker and space speakers at 1 1/2 X ceiling height. For noisy areas, or where the volume level required is higher, more power is required.

## PHASING

When using multiple speakers in a sound system installation, it is advisable to phase the speakers in order to reduce the cancellation effect caused by improper phasing. Speakers out of phase will lose up to one-half of their normal volume and will operate with poor tonal characteristics.

For speakers facing in the same general direction, the speakers are in phase when all speaker cones move in the same direction when an equal signal is applied. With two speakers facing each other, proper phasing is achieved when the cone of one speaker moves inward while the cone of the other speaker moves outwards.

If speakers are unmarked, or not the same model, the following procedure will allow fast and simple phasing.

- (1) Connect one side of a flashlight battery to one of the speaker terminals.
- (2) Momentarily contact the other speaker terminal to the other side of the battery.
- (3) Note direction of cone movement (inward or outward).
- (4) Mark the speaker terminal that corresponds to the positive side of the battery.
- (5) Repeat the same procedure for each successive speaker, making sure that the direction of cone movement is the same for each case.
- (6) If the speaker cones are all to move in the same direction, connect the marked terminals to each other and the unmarked terminals to each other. If the cones are to move in opposite directions, as is the case when two speakers are facing each other, connect the marked terminal of each speaker to the unmarked terminal of each speaker.

## POWER LOSS IN LONG LINES

For long lines the power loss in the lines ( $I^2 R$ ) becomes a significant factor. The power supplied by the amplifier is effectively reduced by the line loss. For a 0.5 db loss in sound pressure the total wire resistance must be limited to 6% of speaker impedance. The following table shows the calculated two wire cable lengths permissible for a number of wire sizes in feet. For a 1 db loss, the lengths may be doubled. For 2 db loss, multiply by 4.4.

AWG Size	Resistance (Ohms/1000 Feet)	Low-Impedance			High-Impedance Systems		
		4Ω	8Ω	16Ω	100W/70.7V 12½W/25V (50Ω)	50W/70.7V 6¼W/25V (100Ω)	25W/70.7V 3¼W/25V (200Ω)
14	2.50	48	96	190	600	1,200	2,400
16	4.02	30	60	90	370	740	1,500
18	6.39	19	38	76	230	460	920
20	10.1	12	24	48	150	300	600
22	16.2	7	14	28	93	190	380

## TECHNICAL SPECIFICATIONS

Power Output.....100 watts RMS (8 ohm)  
 Frequency Response.....20 Hz to 20 kHz, +1.0dB, -2.0dB(8 ohm)  
 Hum and Noise:  
   MIC Inputs .....55 dB below rated output  
   AUX / PROG Input.....70 dB below rated output  
   TEL Input .....55 dB below rated output  
 Sensitivity:  
   MIC Inputs .....0.7 mV/250 ohms  
   TEL Input .....500-mV/44K ohms  
   AUX Input.....220 mV/50K ohms  
   PROG. Input.....180 mV/600 ohms  
   MAIN IN Input .....250mV/47 kohms  
 Output.....4-16 ohms  
                   35V (12.25 ohms), 70V (49 ohms)  
 Inputs.....3 MIC (low-impedance), 1 TEL PAG  
                   (high impedance), 1 AUX (high  
                   impedance, 1 PROGRAM (low-  
                   impedance),

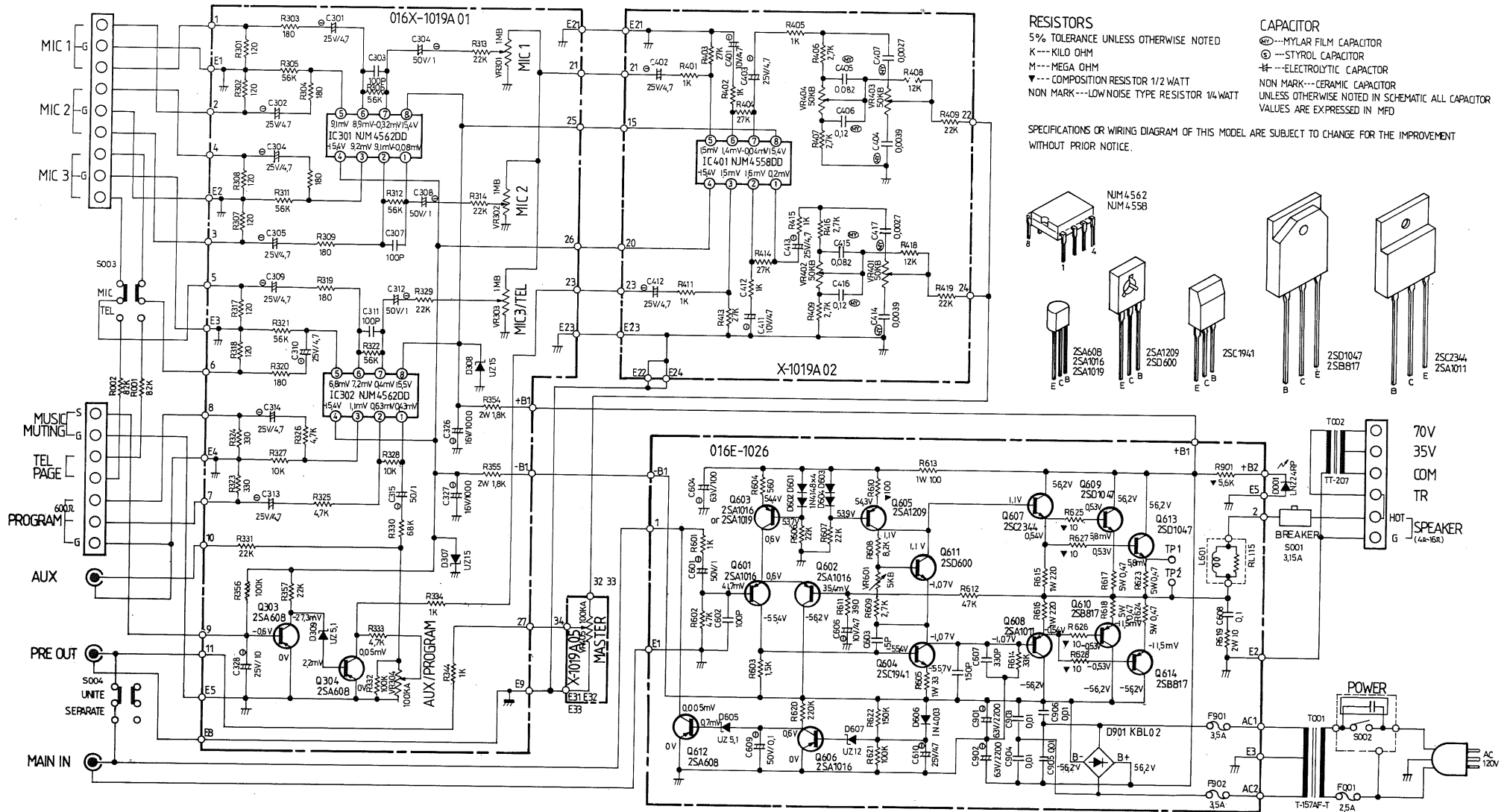
Controls.....2 MIC VOLUMES, 1 MIC/TEL VOLUME,  
                   1 AUX/PROGRAM VOLUME, 1 MASTER  
                   VOLUME 2 sets BASS and TREBLE  
 Tone Control Action:  
   AUX/PROG.....BASS (100 Hz)+ 7dB, -9dB  
                   TREBLE(10 kHz)+ 6dB, -7dB  
   MIC/TEL.....BASS (100 Hz) + 5dB, -4dB  
                   TREBLE (10 kHz) + 6dB, -7dB  
 Muting Level (AUX/PROG).....- 60 dB  
 Power Requirement.....120V AC/60 Hz  
 Power Consumption.....270VA  
 Dimensions .....430(W) x 120(H) x 265(D)mm  
                   16-15/16'' x 4-23/32'' x 10-7/16''  
 Weight ..... 9.2 kg/20.2 lbs

- Specifications and features subject to possible modification without notice.

## REPAIR PARTS LIST

Schematic Location	Computer No.	Description
Q303, Q304	TR10000126	2SA 608K (F,G), Music Mute Control
Q601, Q602	TR10000023	2SA1016, Differential Amp.
Q603	TR10000060	2SA1019, Constant Current Source
Q604	TR30000169	2SC1941, Pre-Driver
Q605	TR10000217	2SA1209, Main Amp. Compensation
Q606	TR10000023	2SA1016, Muting Circuit
Q607	TR30000303	2SC2344, Drive
Q608	TR10000138	2SA1011, Drive
Q609, Q603	TR40000045	2SD1049, Main Amp. (Power)
Q610, Q614	TR20000040	2SB817, Main Amp. (Power)
Q611	TR40000069	2SD600, Main Amp. Compensation
Q612	TR10000126	2SA608K (F,G), Muting Circuit
IC301, IC302	IC00001000	MJM4562DD, Mic/Tel/Program/Aux Amp.
IC401	IC0000019	NJM4558D, Pre-Amp.
D307, D308	DD20000193	UZ-15B, Bias Diode
D309	DD20000200	UZ-5.1, Mute Control
D601, D602	DD10000100	IN4148, Bias Compensation
D603, D604	DD10000100	IN4148, Bias Compensation
D605	DD20000200	UZ-5.1, Muting Circuit
D606	DD10000068	DS-135/IN4003, Muting Circuit
D607	DD20000016	UZ-12, Muting Circuit
D901	DD10000020	KBL-02, Rectifier
L601	LC01150002	RL-115, Anti-Parasitic
VR301, VR302	RV10000573	4TR-1886A, 1MB, MIC 1, MIC 2 Volume Control
VR303	RV10000573	4TR-1886A, 1MB, MIC 3/TEL Volume Control
VR304	RV10000792	4TR-2130, 100KA, AUX/PROGRAM Volume Control
VR401	RV10000809	4TR-2131, 50KB, Treble Control
VR402	RV10000809	4TR-2131, 50KB, Bass Control
VR403	RV10000809	4TR-2131, 50KB, Treble Control
VR404	RV10000809	4TR-2131, 50KB, Bass Control
VR405	RV10000792	4TR-2130, 100KA, Master Volume Control
F001	FU12000021	250V 2.5A UL Fuse, AC Input Protector
F901, F902	FU12000112	250V 3.5A UL Fuse, AC Circuit Protector
T001	PT21101049	T-157AF-T, Power Transformer
T002	PT24101000	TT-207, Output Transformer
	FS20000018	QA-101 Front Panel Assembly
	KB10000316	C-3407A#1, Knob 33F
	KB10000286	C-3406A#1, Knob 20F
	KB10000274	C-3187#3, Knob 13F
	KB20000106	C-3372#1, Push Button 4x14
	AU00000520	2TWE-5B#35, Upper Cover

# SCHEMATIC DIAGRAM MODEL QA-101







## OWNER'S WARRANTY

This warranty covers ROTEL QA-101 Amplifier

This equipment is warranted to be free from defects for one year with respect to material and labour from date of purchase by original purchaser under conditions of normal use and service. The warranty covers component parts and shop labour at authorized service stations only. Outside labour charges are not included.

This warranty does not apply to breakage of any kind if equipment, or any of the component parts have been damaged through accident or alteration, abuse or misuse or to any damage caused by fire, flood or other Act of God.

This warranty is in lieu of all warranties expressed or implied and of all obligations or liabilities on its part in connection with the sale of this machine.

In the event of equipment failure, contact your dealer who will advise you, or forward the unit prepaid to one of the service depots listed below. Include a description of the problems and a return address. Sales receipt must accompany the unit to validate the purchase date and hence warranty.

## TITRE DE GARANTIE DU CLIENT

Cette garantie couvre ROTEL QA-101

Cet équipement est garanti être libre de tous défauts, pour une année en ce qui concerne le matériel et le travail, à partir de la date d'achat par l'acheteur original, et sous conditions normales d'utilisation et de service.

Cette garantie ne couvre pas le bris d'aucune façon, ni l'équipement ni aucune de ses parties endommagés par accident, modifications, abus ou mauvais emploi, ou tout autre dommage causé par le feu, l'inondation ou tout autre cas de force majeure. Cette garantie remplace toute autre garantie expérimentée ou impliquée, et toute obligation ou responsabilité liée à la vente de cet appareil.

Si des réparations ou des ajustements s'avèrent nécessaires, consulter votre distributeur qui vous renseignera, ou retourner l'appareil défectueux à un des dépôts de service autorisés désignés ci-dessous. Joindre une note indiquant la nature du problème et votre adresse de retour. Inclure la facture pour confirmer la date d'achat et la validité de la garantie.

**CANADIAN AGENT:** BURTEK MARKETING INC., 3879 East 2nd Ave,  
Burnaby, B.C. V5C 3W7

**Ontario Rep:** VICOM ENTERPRISES, 3868 Chesswood Dr., Downsview,  
Ont, M3J 2W6

**Quebec & Maritimes:** S.GREENE AGENCIES INC., 8255 Mountain Sights,  
Ste, 405, Montreal, Quebec, H4P 2B5