INSTRUCTION BOOK

GATES

GATES RADIO COMPANY
A Subsidiary of Harris-Intertype Corporation
QUINCY, ILLINOIS

M5575 MONITOR AMPLIFIER

SPECIFICATIONS

GAIN:	100 db, ±2 db Matching; approximately 50 db Bridging.
RESPONSE:	±1.5 db from 30 to 15,000 cycles.
DISTORTION:	1% or less from 50 to 15,000 cycles @ +40 dbm output (10 watts).
MAXIMUM INPUT LEVEL:	-40 dbm for 1% or less distortion from 50 to 15,000 cycles.
NOISE:	60 db or better below -50 dbm input and +40 dbm output.
POWER CONSUMPTION:	105/125 volts, 50/60 cycles, 85 watts.
INPUT IMPEDANCES:	30/50-150/250 ohms Matching, 30,000 ohms Bridging; balanced or unbalanced.
OUTPUT IMPEDANCES:	6/8-12/16 ohms, unbalanced only.
TUBES:	(1) GZ34 or 5V4G, (2) EL84, (3) 12AX7, (1) 0A2, (1) 0B2.
FUSE:	2 ampere.
SIZE:	19" wide, 7" high, and 8" deep.
WEIGHT:	18 pounds.

INTRODUCTION

Gates M5575 Monitoring Amplifier is a high quality amplifier designed for loudspeaker distribution or audioning. The high gain permits it to be fed directly from a turntable cartridge or microphone, console mixing bus or any other low level source. The bridging pad permits it to connect to high level lines with levels of -10 dbm or less. Of course, the bridging pad permits connection to circuits without any loading effects.

Rack mounted construction permits the unit to be mounted in a standard 19" relay rack, using only 7" of vertical panel space. The front panel is hinged to drop down for internal inspection and servicing. The tubes and most of the components are accessible from the rear (through the back door of the relay rack).

The amplifier has five stages of gain. The first two stages are located on the small Monitor Booster deck (M5568), feeding the 10,000 ohm volume control. The output of the volume control feeds another stage of voltage amplification, a floating paraphase phase inverter and the push-pull output stage. The volume control, switch, fuse and pilot lamp are located on the front panel.

Both the Monitor Booster and the Monitor Amplifier are built on a printed wiring chassis for the M5575 Assembly. The power supply uses hand-wired construction. Input and output connections are on screw terminations at the rear of the unit. Power is connected through a television set type plug.

INSTALLATION

The unit will be received in one packing carton with all of the tubes installed in the tube sockets. Carefully remove all the fillers and packing tape from the unit. Give it a complete visual examination prior to installing it in the equipment rack. It would be a good idea to perform a brief operating check on it before its initial use to see if any damage has occurred since its final test at the factory.

The unit mounts in the rack cabinet with four standard rack mounting screws through the slots in the sides of the panel. Connect the input circuit to TB2, C-77875 shows the connections for the various impedances. For 30/50 ohms input: Jumper terminal 6 to 7, jumper 4 to 8, connect to 4 and 6. For 150/250 ohms input: Jumper 7 to 8, connect to 4 and 6. For 30,000 ohms bridging: Jumper 5 to 6, jumper 7 to 8, connect to 1 and 2.

For 6/8 ohms output: Connect to TB1-1&2, terminal 2 is grounded. For 12/16 ohms output: Clip out R16 (620 ohms, located on the lower center of the large printed chassis as viewed through the opening covered by the drop-down front panel). Connect a 1000 ohm resistor (1 watt, to get sufficient pig-tail lead length) from the left-hand lug (that R16 was connected to) to the lug that the yellow transformer lead is connect to (16 ohm connection). This may be easier to understand by referring to C-77875: The view is through the front panel opening. R16 is shown in the lower center of the large printed chassis, remove R16 by clipping it out with diagonals. Connect the 1000 ohm resistor as shown in the dotted lines, the resistor is labelled RX. It would be best to slip spaghetti over both leads to prevent the danger of it shorting out to other conductors. Then, connect the 12/16 ohm load to terminals 2&3 of TB1, terminal 2 is grounded.

Plug the power cord into the rack A.C. receptacle. Or, if the rack does not contain receptacles, cut the plug off and attach lugs to permit wiring into the common A.C. line in the rack. The power required is 105/115 volts, 50/60 cycles @ slightly less than 1 ampere.

PREOPERATION

Turn on the power switch. The neon lamp should glow at once. If it does not, check the fuse and the voltage into the unit. Allow a five minute warm-up period. With all the adjacent rack equipment operating (that is normally operated) adjust the "hum balance" control (R6) on the rear of the chassis for the lowest amount of noise. This should be done with fairly high gain (with the volume control about 3/4 open) and no signal applied to the amplifier. It will be necessary to use a noise and distortion analyzer or a vacuum tube voltmeter capable of reading minute hum voltages to get an optimum setting on this control. However, if you listen closely to the speaker, you can get a decent indication. Rotate the control back and forth, then reverse the power cord and repeat the process. Choose the phasing and control position that gives the lowest amount of hum.

Apply the input signal. If the output sounds (or measures) highly distorted, probably the input level is too high. The maximum input level of the amplifier is -40 dbm. To maintain a little margin, set the normal input level between -45 dbm and -55 dbm, for 30/50 or 150/250 ohm matching. If the bridging input is used, the maximum level is ±10 dbm; for best results the normal input should be ±5 dbm to -5 dbm. The bridging pad has about 52 db loss. If more loss is desired, another bridging pad can be inserted ahead of the one installed in the unit. If less bridging loss is desired: Changing R7 and R8 to 7500 ohms will reduce the loss from 52 db to 46 db. Changing them to 3600 ohms will reduce the loss to 40 db, and give a bridging impedance of about 7500 ohms. If you are bridging lines of 150 ohms or lower impedance, the resistors may be changed to 750 ohms to reduce the bridging loss to 26 db. This would give a maximum amplifier gain of about 74 db. Of course, matching pads may be used to get about any amount of loss desired. The only precautions are: Do not exceed 40 db attenuation in one matching pad or the high frequency leakage will probably destroy the response of the amplifier. Keep the circuits and the amplifier terminated in the proper impedance at all times.

OPERATION

Operation is quite simple and consists of turning the unit on and adjusting the gain for proper output level. For small variations in input level, or where the input to the amplifier ranges from -70 db to -40 db (matching) or -20 db to -10 db (bridging), adjustment of the front panel volume control is sufficient to keep a constant output. As explained in the Preoperation chapter, levels in excess of these figures should be padded down to prevent overloading of the input circuit of the amplifier. The maximum output level is ±40 dbm. It is suggested that the normal output level be kept to ±36 dbm or lower for peak overloads.

THEORY OF OPERATION

The amplifier is made up of three major sections: The Monitor Booster deck, the power amplifier deck and the main chassis. C-78116 is the schematic of the main power amplifier. B-65310 is the schematic of the Monitor Booster amplifier. C-77875 is the schematic and wiring diagram of the main chassis. The monitor booster deck contains the input transformer and a cascaded dual triode (12AX7) for voltage amplification. It feeds the 10,000 volume control (chosen for minimum high frequency losses with high capacity shielded wire, used for interconnection). The output of the volume control feeds the grid of the first tube on the power amplifier deck, the other section of this tube (12AX7) is not used. This, in turn, feeds the floating paraphase type of phase inverter (12AX7) to develop a push-pull signal to feed the grids of the power output tubes (type EL84's). These tubes are connected in an ultra-linear circuit, that is: Both the plate and screen grid of each tube is used to develop power. Negative feedback is derived from the secondary winding of the output transformer. It is best practice to take the feedback from the impedance tap that is connected to the load. So, for 8 ohm operation, a 620 ohm resistor is used from the 8 ohm tap back to the cathode of the first section of the phase inverter. For 16 ohm operation, this resistor must be clipped out and a 1000 ohm resistor installed from the 16 ohm tap back to the cathode of the phase inverter. See "Installation" and C-77875 for details. C7 is used to reduce the high frequencies and correct frequency response. C8 and R15 are used to increase low frequencies and correct frequency response. It is not necessary to change them when changing from 8 to 16 ohms output.

The main chassis mounts the two printed chassis decks and contains the power supply, output transformer and terminal boards. The power supply is very conventional, utilizing full wave rectification and R-C filtering in a double pi section. Perhaps the only unusual thing about the power supply is the filament bias and balance circuit.

This consists of R3 and R4 (the voltage divider which develops about ⁄23 volts of bias), C4 (a .5 MFD. capacitor which furnishes a low impedance path to ground for any signal and hum frequencies present on the filament string) and R6 (the hum balancing control). When the cathode is more positive than the filament there is current flow from the filament to the cathode. Even when they are both at ground potential there is some flow because the very hot filament has a lot more free electrons; a reverse bias is required to minimize this flow. It has been determined that ⁄20 to ⁄25 volts on the filaments will reduce this current flow to a value which is sufficient to achieve our goal.

This filament to cathode current flow would not cause trouble with a D.C. filament supply. However, the 60 cycle supply causes 60 cycle modulation of the current flow and results in hum being introduced into the signal circuit. This could be reduced by using grounded cathodes or very heavy bypass capacitors, but neither method works out to best advantage in all stages of a high gain amplifier.

The best method is the use of bias and balance to reduce the hum to a minimum. This method has a further advantage in the fact that it can cancel out small amounts of hum inductively coupled into the input and output transformers or into the external circuits. Thus, it is possible to actually improve the hum ratio of an input circuit with this method; where an amplifier without any hum generated at all could not have any effect.

The two amplifier sections are constructed on printed wiring chassis: This method uses a phenolic base with etched copper conductors laminated to it. Standard components are used, not printed components as used with "printed circuits". Some of the components are in special enclosures to facilitate their use with a printed chassis. Thus, the components are very reliable and of a type the station engineer is acquainted with. The printed chassis assures extreme uniformity, high reliability and easy maintenance (when approved methods of repair are used, see the bulletin "Replacing Components On The Printed Chassis"). This will answer most questions and serve as a guide for working out any others.

MAINTENANCE

One of the most common causes of failure in electronic equipment is the accumulation of dirt and dust. With proper cleaning and periodic tube checking, this equipment will give long trouble-free service. A soft clean brush should be used to remove the dust from the printed chassis. Compressed air may be used if it has an accurate regulator that limits the maximum air pressure to 60 pounds per square inch. Grease and oily residue may be removed with naptha or cleaning fluid (DANGER: FIRE HAZARD), or carbon tetrachloride (DANGER: AVOID SKIN EXPOSURE AND INHALING FUMES). When it is necessary to use a grease solvent -- we strongly urge that the unit be removed from the rack and carried out-doors to be cleaned with naptha or cleaning fluid, where there is no danger of an explosion.

We do not recommend the use of carbon tetrachloride! It is a great health hazard and actually requires much more ventilation than naptha for safety. It should not be allowed to touch the skin, swallowed or the fumes inhaled. So, it is best to discontinue its use.

Voltage readings are inserted on the three diagrams. Those listed on C-77875 and C-78116 are approximately correct. They are typical readings taken with a certain meter under a certain set of conditions. Perhaps your meter and/or conditions will differ enough to give a substantial variation in the readings. It would be good practice to take your own reading on the unit and tabulate them on the drawings; with your meter and with your own set of conditions. If this is done when the unit is on the test bench and functioning correctly, it will be of much more value in trouble shooting than factory values.

The readings listed on B-65310 are for a previous application with ∠310 volts supply instead of the ∠255 volts used in this unit. The signal voltages are essentially unchanged but the D.C. voltages have all shifted. The following chart applies to this unit for your service:

XV1-pin 1	∠160	C1A	∠221
pin 3	∠1.3	C1B	∠238
pin 6	∠210	Supply	∠255
pin 8	∠1.6		

Should it be necessary to replace any of the parts on the amplifier deck, follow the instructions on the section titled "Replacing Components On The Printed Chassis". The methods outlined will assure the success of the operation. Of course, there are other ways of accomplishing the same results but if you are not thoroughly familiar with them you should be careful. The coupling capacitors are in special cases. They may be replaced temporarily with standard capacitors. Exact replacements may be ordered from the Gates Radio Company.

When ordering replacement parts be sure to list the number of the unit (M5575), the symbol number (C5), the description (0.1 MFD, 400 V.), and the number of the part (C-D BC 105). This will allow the item to be double checked and assure that the correct replacement will be received.

PARTS LIST

Symbol No.	Drawing No.	Description
A1		Tiny Glow Neon Lamp Ass'y.
C1,C2,C3		Cap., 20/20 mfd., 450 V.
C4		Cap., .5 mfd., 200 V.
F1		Fuse, 3 AG 2 amp.
J1		Receptacle
R1,R2		Res., 500 ohm, 25 W.
R3		Res., 270K ohm, 1 W., 10%
R4		Res., 22K ohm, 1 W., 10%
R5		Res., Adj. 10K ohm, 10 W.
R6	A-3404-17	Control, 100 ohm
R7,R8		Res., 15K ohm, 1/2 W., 10%
R9		Res., 150 ohm, 1/2 W., 10%
R10	A-3404-34	Control, 10K ohm
R11		Res., 10K ohm, 1 W., 5%
S1		Toggle Switch
T1		Transformer
T2		Output Transformer
TB1		Terminal Board
TB2	B-10105-2	Terminal Board
TP1	B-11729-11	Tie Point
TP2	B-11729-1	Tie Point
V1		Tube, GZ34
V2		Tube, 0A2
V3		Tube, 0B2
XF1		Fuseholder
XV1		Socket
XV2,XV3		Socket, 7 pin

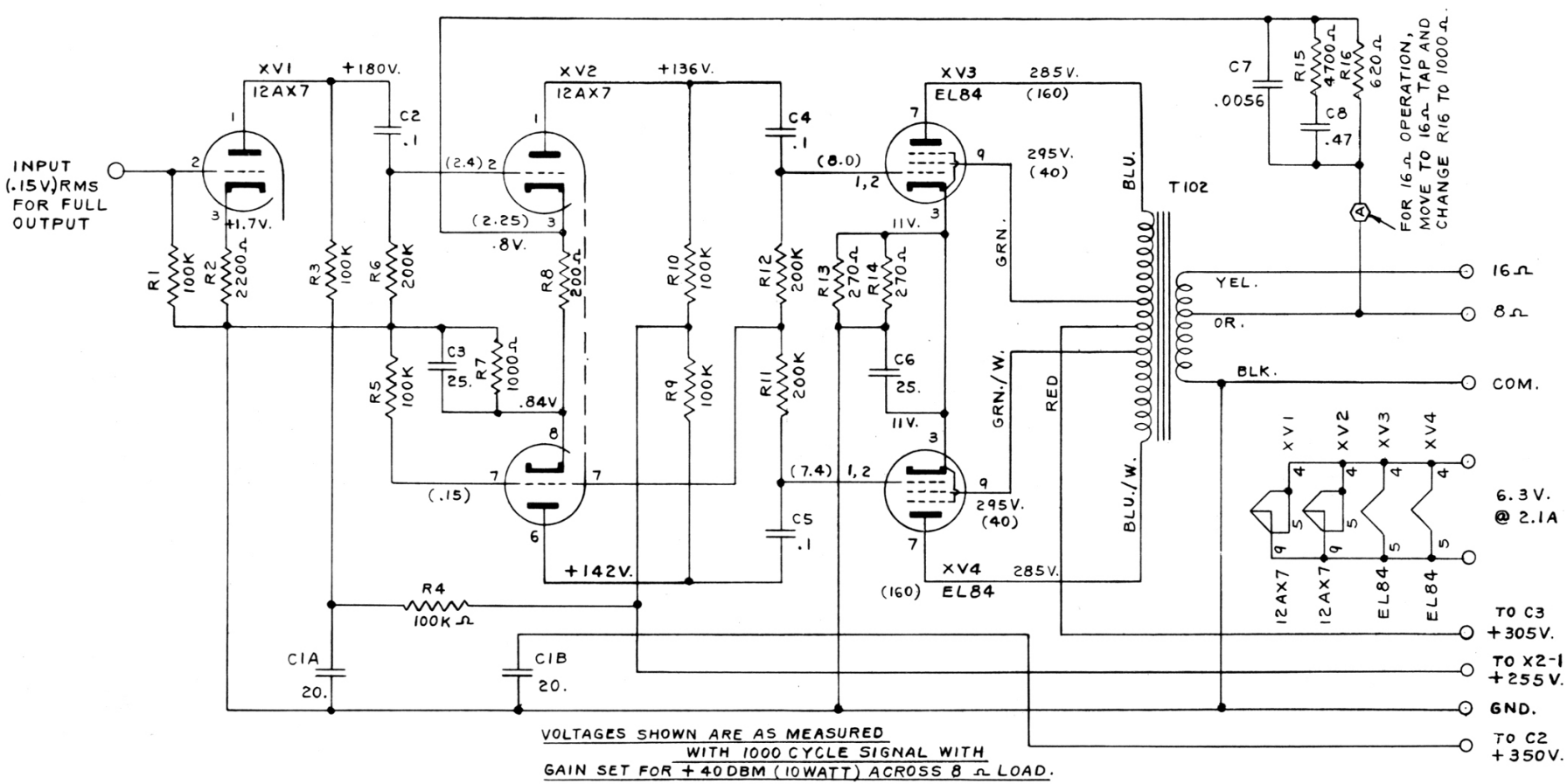
Printed Wiring, Mon-Booster Amplifier

C1A,C1B		Cap., 20-20 mfd., 450 V.
C2		Cap., .1 mfd., 400 V. w/1/4" leads
C3		Cap., 8 mfd., 350 V.
C4		Cap., .15 mfd., 200 V. w/1/4" leads
C5		Cap., .0002 mfd., 500 V.
R1		Res., 2200 ohm, 1/2 W., 10%
R2		Res., 100K ohm, 1/2 W., 5%
R3		Res., 180K ohm, 1/2 W., 10%
R4		Res., 1500 ohm, 1/2 W., 5%
R5,R6		Res., 10K ohm, 1/2 W., 5%
R7		Res., 33K ohm, 1/2 W., 10%
T1	AI-10426T	Input Transformer
V1		Tube, 12AX7
XV1		Socket, 9 Pin Min.

10 Watt Monitor Amplifier

Symbol No.	Drawing No.	Description
C1A,C1B		Cap., 20-20 mfd., 450 V.
C2,C4,C5		Cap., .1 mfd.,400V.,(Min. Lead length 1/4")
C3,C6		Cap., 25 mfd., 25V.,with 1/4" min. lead length
C7		Cap., .0056 mfd., 400V.,with 1/4" min. lead length
C8		Cap., .47 mfd., 200V., with 1/4" min. lead length.
R1,R3,R5, R9, R10,R4		Res., 100K ohm, 1/2 W., 10%
R2		Res., 2200 ohm, 1/2 W., 10%
R6, R11, R12		Res., 200K ohm, 1/2W., 5%
R7		Res., 1000 ohm, 1/2 W. 10%
R8		Res, 200 ohm, 1/2 W., 5%
R13,R14		Res., 270 ohm, 2W. 10%
R15		Res. 4700 ohm, 1/2 W. 10%
R16		Res. 620 ohm, 1/2 W. 5%
T102		Output transformer (Part of overall assembly)
V1,V2		Tube, 12AX7
V3,V4		Tube EL84
XV1 , XV2		Socket , 9 pin

						FIRST USED ON	GATES RADIO COMPANY QUINCY, ILLINOIS				C-78116 SCALE
106	105	104	103	102	101	SER NO	LIST OF PARTS				
QTY.	QTY.	QTY.	QTY.	QTY.	QTY.	ITEM	REFERENCE	PT. OR G.N.	FIN.	DESCRIPTION	MATERIAL



VOLTAGES SHOWN ARE AS MEASURED WITH 1000 CYCLE SIGNAL WITH GAIN SET FOR +40 DBM (10 WATT) ACROSS 8 Ω LOAD.

ALL D. C. MEASUREMENTS WITH 20KΩ/VOLT METER
ALL R M S SIGNALS (.) MEASURED WITH V. T. V. M.
ALLOW 20% ERROR ON MOST READINGS.

ECN 8301 8-5-60 D.L. 1

TITLE SCHEMATIC - PRINTED CHASSIS FOR M5575 MONITOR AMPLIFIER

MTL. FIN. UNLESS OTHERWISE SPECIFIED, ALL TOLERANCES PER GATES SPEC 60M100.

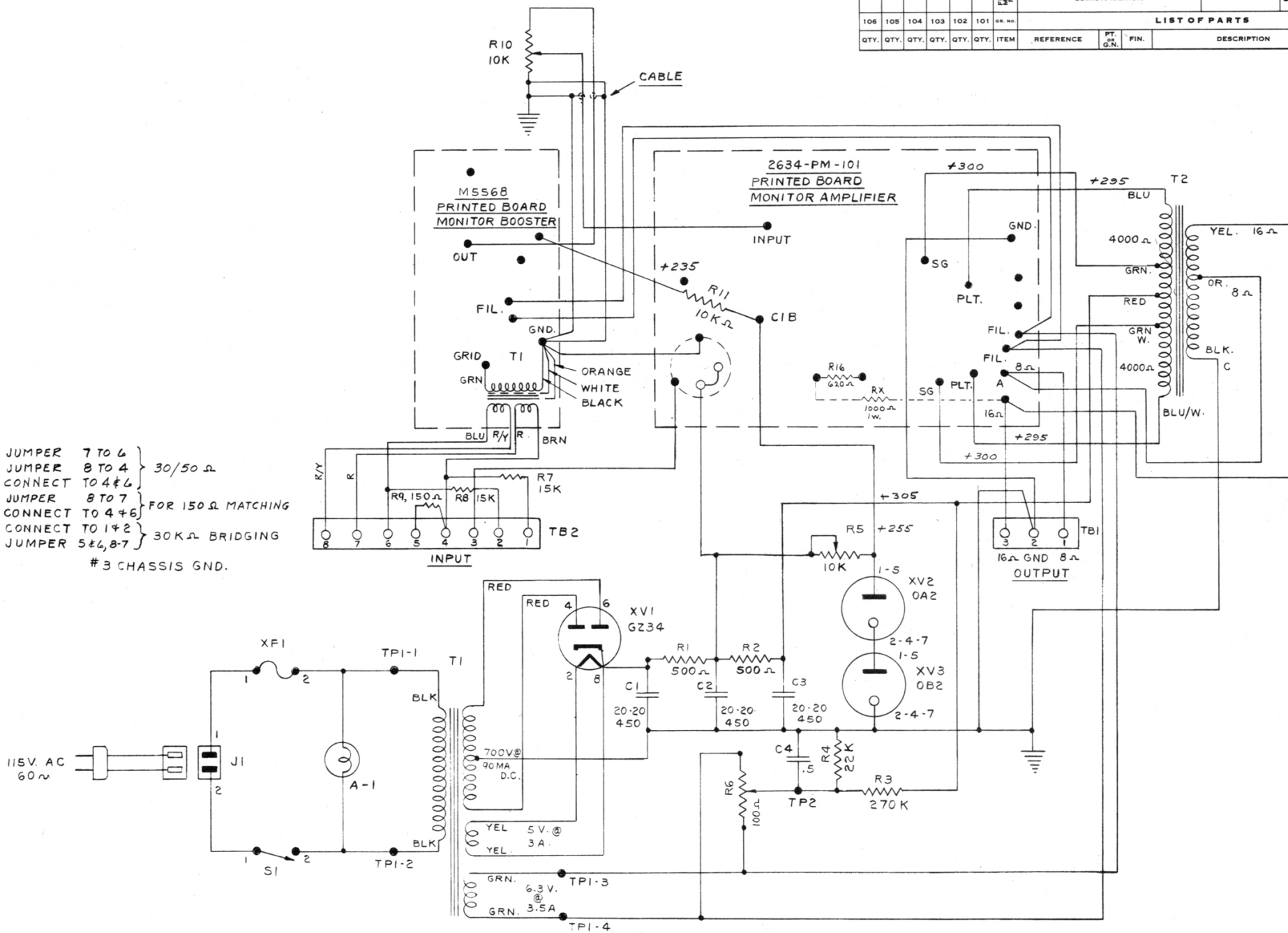
DR. BY D.L. DATE 6-20-58 CH. BY DATE J.A. ENG. W.K. DATE

C-78116

GATES RADIO COMPANY
QUINCY, ILLINOIS

C-77875
SCALE

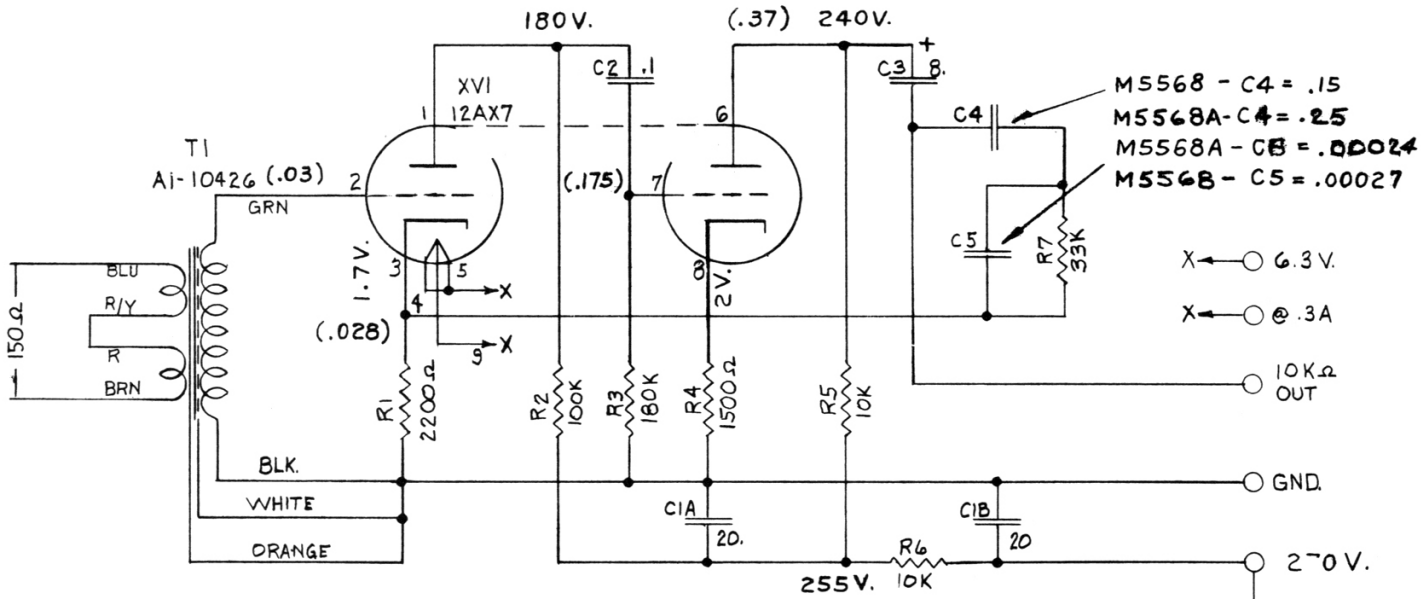
106 QTY.	105 QTY.	104 QTY.	103 QTY.	102 QTY.	101 QTY.	FIRST MADE FOR GR. No.	LIST OF PARTS				
						ITEM	REFERENCE	PT. OR G.N.	FIN.	DESCRIPTION	MATERIAL



TITLE
SCHEMATIC, MONITOR AMPLIFIER
M5575

MTL		FIN.	UNLESS OTHERWISE SPECIFIED, ALL TOLERANCES PER GATES SPEC GBM105
DR. BY D.L. DATE 12-13-57	CH. BY DATE	ENG. DATE 1-20-58	C-77875

						FIRST MADE FOR	GATES RADIO COMPANY QUINCY, ILLINOIS				B-65310 SCALE
106	105	104	103	102	101	GR. No.	LIST OF PARTS				
QTY.	QTY.	QTY.	QTY.	QTY.	QTY.	ITEM	REFERENCE	PT. OR G.N.	FIN.	DESCRIPTION	MATERIAL



VOLTAGES SHOWN ARE AS MEASURED ON M5526 YARD CONSOLE WITH -10DBM 1000 CYCLE 150Ω SIGNAL TO CHANNEL 4 ON THE AUDITION POSITION. WHEN USED ON OTHER EQUIPMENT SEE VOLTAGES AS LISTED FOR THAT EQUIPMENT IN THE INSTRUCTION BOOK.

ALL D. C. MEASUREMENTS WITH 20KΩ/VOLT METER
ALL R M S SIGNALS (.) MEASURED WITH V. T. V. M.
ALLOW 20% ERROR ON MOST READINGS.

2	ECN 7997 G.A. 10/23/59	TITLE	SCHEMATIC OF MONITOR BOOSTER AMPLIFIER M5568, M5568A
1	ECN 7418 CTH 4-24-58	MTL	FIN.
		DR. BYLES DATE 7-8-57	CH. BY DATE
		ENG. V.W. DATE 7-15-57	UNLESS OTHERWISE SPECIFIED, ALL TOLERANCES PER GATES SPEC GSM102.
			B-65310