INSTRUCTION BOOK

FOR

M-5576-B PROGRAM AMPLIFIER

994 5576 003

I. B. # 888 0776 001
10/24/62

Gates Radio Company
Quincy, Illinois

M-5576-B PROGRAM AMPLIFIER

SPECIFICATIONS

GAIN:	75 db, ±2 db @ 1000 cycles.
RESPONSE:	±1.5 db from 30 to 15,000 cycles.
DISTORTION:	.5% or less from 50 to 15,000 cycles @ +12 dbm output. .75% or less @ 30 cycles @ +12 dbm output. 1% or less from 50 to 15,000 cycles @ +22 dbm output.
MAXIMUM INPUT:	-35 dbm for 1% or less distortion from 50 to 15,000 cycles.
NOISE:	60 db or better below +12 dbm output with -60 dbm input or a relative input noise level of -120 dbm or better.
POWER CONSUMPTION:	105/125 volts, 50/60 cycles, 15 watts.
INPUT IMPEDANCES:	150/250-500/600 ohms balanced or unbalanced.
OUTPUT IMPEDANCES:	150/250-500/600 ohms balanced or unbalanced.
TUBES:	(1) 6X4, (3) EF86, (1) 12AU7.
FUSE:	1/2 Ampere.
SIZE:	19" wide, 5-1/4" high and 7-1/2" deep.
WEIGHT:	12 pounds.

INTRODUCTION

Gates M-5576-B Program Amplifier employs rack mounted construction for use in a standard 19" relay rack. It uses only 5-1/4" of vertical rack space. It may be used as a high quality line or program amplifier for radio or television service. 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 four stages of gain. The tandem connected dual volume control is an interstage control; connected between the first and second, and the second and third stages for best signal to noise ratio over the entire input level range. This volume control, the main switch, fuse and pilot lamp are located on the front panel.

The amplifier utilizes a printed wiring chassis for the four amplifying tubes and their associated components. The power supply is very conventional and 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 anything has happened to it 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 TB1, the outside terminals. Connect the shield and/or earth ground to the center terminal of TB1. Connect the output circuit to the outside terminals of TB2, the shield to the center terminal. 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 105/125 volts, 50/60 cycles.

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 on the rear of the chassis for the lowest amount of noise. This should be done with 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 the amplifier is fed into a high gain monitoring amplifier, the gain can be increased until the hum is easily heard on the speaker. 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 -35 dbm. You really should allow a 10 db margin, so the normal input should be padded down (if necessary) to -45 dbm to -50 dbm. A 10,000 to 600 ohm bridging pad would allow the unit to be connected to most circuits without causing any mismatch. This pad has a minimum loss of 31 db. If it is desired to bridge a circuit with +8 dbm level a 22 db 600/600 ohm pad could be inserted between the bridging pad and the amplifier. This would reduce the level to -45 dbm. About the only precautions that are necessary in adjusting the levels are: do not exceed 40 db attenuation in one pad or the high frequency leakage will probably destroy the frequency response. Keep the circuits and 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 -63 dbm to -35 dbm, adjustment of the front panel volume control is sufficient to keep a constant output. As explained in the Preoperation chapter, levels above -35 dbm must be padded down to prevent overloading of the input circuits of the amplifier. The maximum output level of the amplifier is +22 dbm, it is suggested that the normal output level should be +12 dbm or lower for optimum operation.

THEORY OF OPERATION

The amplifier has four stages of gain: three pentode connected stages of voltage gain and a parallel connected dual triode for power output. The tandem connected dual volume control has the first section connected between the first and second stages. The second section is connected between the second and third stages. This gives the best noise reduction with signal reduction over the usable range of input and output levels. Negative feedback is employed around the last two stages. It is connected from the tertiary winding of the output transformer, through an R-C network, back to the cathode of the third stage. This stabilizes the operation of the amplifier, reduces distortion, reduces noise and reduces the reflected output impedance to minimize the effects of changes of output circuit loading.

The main amplifier section is constructed on a 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. The bulletin ("Replacing Components On The Printed Chassis") will be furnished on request, no charge, this will serve as a guide and answer most questions.

838 0009 011 is the schematic diagram of the printed chassis amplifier. It is quite conventional and there is practically nothing to explain about it that is not covered in most general electronic test and reference books. Of course, optimum values have been chosen for all components to do the job that the amplifier is specifically designed for.

838 0437 001 is the wiring diagram of the entire unit. It shows the wiring of the power supply section, the front panel volume control and the connections into the printed chassis. A full wave rectifier is used along with a pi section L-C filter network. Perhaps the only unusual feature of the circuitry is the filament bias and balancing network.

This consists of R1 and R2 (the voltage divider which develops about +25 volts of bias), C1 (a .5 mfd. capacitor which furnishes a low impedance path to ground for any signal and hum frequencies present on the filament string) and R3 (the hum balancing control). When the cathode is more positive than the filament there is current flow from filament to 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.

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 reulator 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). We strongly urge that the unit be removed from the rack and carried outdoors to be cleaned with naptha or lighter fluid type of cleaning fluid, where there is no danger of an explosion, when it is necessary to use a grease solvent. We do not recommend the use of carbon tetrachloride! It is a great health hazard and actually requires much more ventilation than naptha. 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 schematic diagrams. These 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 readings 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 test and functioning correctly, it will be of much more value in trouble shooting than factory values.

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 very 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 M-5576-B, the symbol number (C5), the description (0.1 mfd, 400 V.), and the number of the part (C-D BC105). This will allow the item to be double checked and assure that the correct replacement will be received.

PARTS LIST

Symbol No.	Gates Stock No.	Description
A1	406 0252 000	Glow Light
C1A, C1B	524 0062 000	Cap., 20/20/450 V.
C2	506 0007 000	Cap., .5 mfd., 200 V.
F1	398 0017 000	Fuse, 1 Amp.
J1	610 0401 000	A.C. Receptacle
L1	476 0003 000	Choke
R1	540 0484 000	Res., 22K ohm, 1 W, 10%
R2	540 0496 000	Res., 220 K ohm, 1 W, 10%
R3	552 0541 000	Control, 100 ohm
R4A, R4B	550 0198 000	Dual Control, 100K ohm
S1	604 0005 000	Toggle Switch
T1	472 0006 000	Transformer
TB1,TB2	614 0214 000	Terminal Board
TP1	614 0172 000	Tie Point
TP2	614 0132 000	Tie Point
V1	370 0105 000	Tube, 6X4
XF1	402 0021 000	Fuseholder
XV1	404 0032 000	Socket

M-6142-K Basic Program Amplifier

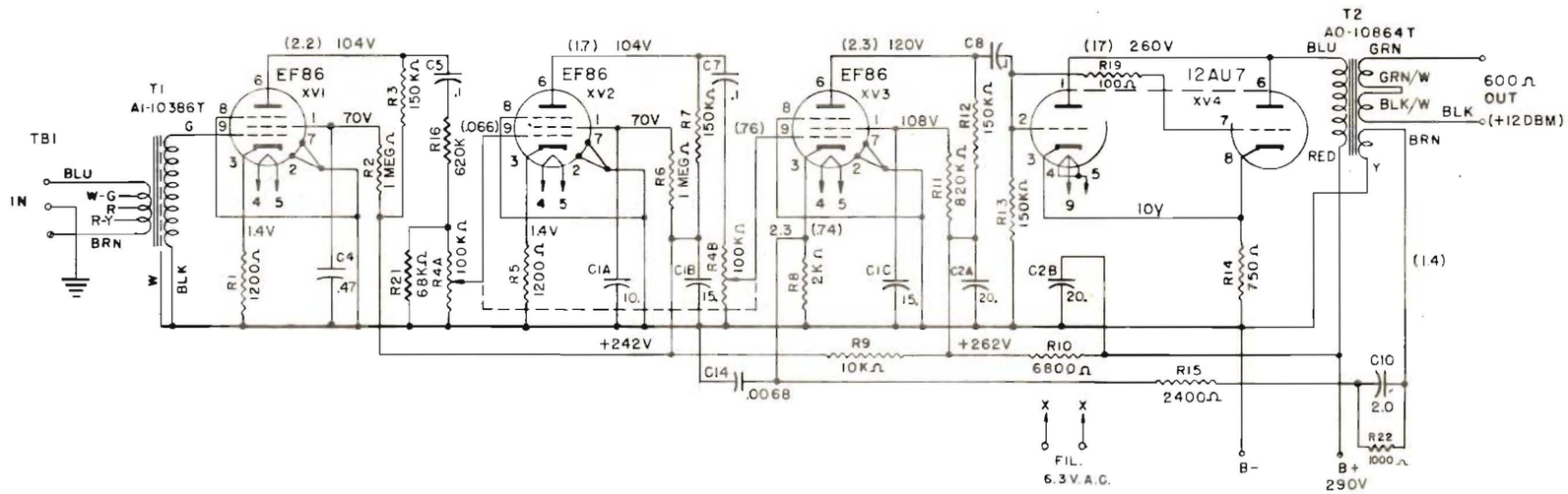
C1	524 0079 000	Cap., 15-15-10 mfd., 450 V.
C2	524 0062 000	Cap., 20-20 mfd., 450 V.
C4	506 0026 000	Cap., .47 mfd., 200 V.
C5,C7,C8	506 0028 000	Cap., .1 mfd., 400 V. (Min. lead length 1/4")
C6		Cap., (Det. by Freq. Response)
C10	506 0009 000	Cap., 2 mfd., 200 V. (Min. lead length 1/4")
C14	508 0043 000	Cap., .0068 mfd. 400 V.

Symbol No.	Gates Stock No.	Description
R1,R5	540 0179 000	Res., 1200 ohms, 1/2 W, 10%
R2,R6	540 0214 000	Res., 1 meg. ohms, 1/2 W, 10%
R3,R7,R12,R13	540 0204 000	Res., 150K ohms, 1/2 W, 10%
(R4A,R4B)	550 0198 000	Control, Dual 100K ohms
R8	540 0056 000	Res., 2 K ohms, 1/2 W, 5%
R9	540 0190 000	Res., 10K ohms, 1/2 W, 10%
R10	540 0188 000	Res., 6800 ohms, 1/2 W, 10%
R11	540 0213 000	Res., 820K ohms, 1/2 W, 10%
R14	540 0046 000	Res., 750 ohms, 1/2 W, 5%
R15	540 0058 000	Res., 2400 ohms, 1 W, 5 %
R16	540 0116 000	Res., 620K ohms, 1/2 W, 10%
R19	540 0166 000	Res., 100 ohm, 1/2 W, 10%
R21	540 0093 000	Res., 68K ohms, 1/2 W, 5%
R22	540 0049 000	Res., 1000 ohm, 1/2 W, 5%
T1	478 0144 000	Input Transformer
T2	478 0120 000	Output Transformer
V1, V2, V3	370 0144 000	Tube, EF86/6267
V4	370 0195 000	Tube, 12AU7A
XV1,XV2, XV3,XV4	404 0059 000	Socket

								GATES RADIO COMPANY QUINCY, ILLINOIS	838-0009-011
									SCALE —
106 QTY.	105 QTY.	104 QTY.	103 QTY.	102 QTY.	101 QTY.	ITEM	REFERENCE	PT. OR NO.	FIN.	DESCRIPTION	MATERIAL
							LIST OF PARTS				

NOTE:

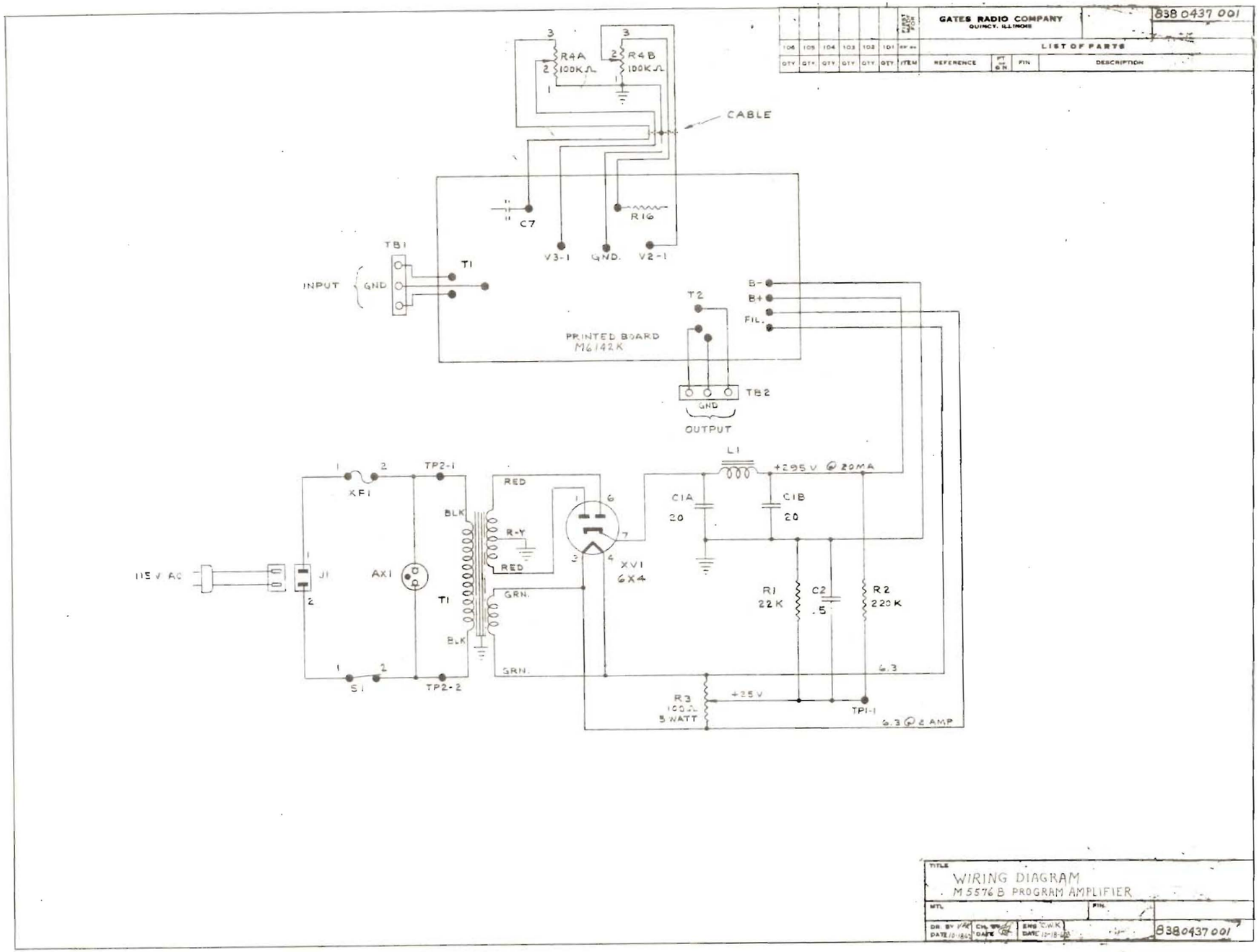
R4A & R4B (EXTERNAL CONTROL)



RMS VOLTAGES MEASURED AT 1KC WITH
-50 DBM INPUT AND +12DBM OUTPUT.

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.

1	TITLE SCHEMATIC, M6142K PROGRAM AMPLIFIER FOR M5576B RACK MOUNT PROGRAM AMPLIFIER			
ECN 9243 GWY 6-29-62	MTL		FIN	838-0009-011
	DR BY GA DATE 1-31-62	CH BY W.R. DATE 2-1-62	ENG R.D.D DATE 2-1-62	


GATES RADIO COMPANY
QUINCY, ILLINOIS
838 0437 001
LIST OF PARTS
REFERENCE
PTS PER UNIT
P/N
DESCRIPTION
R4A 100K Ω
R4B 100K Ω
CABLE
C7
R16
V3-1
GND.
V2-1
TB1
T1
INPUT
GND
T2
B-
B+
FIL.
PRINTED BOARD
M6142K
TB2
GND
OUTPUT
L1
+295 V @ 20MA
TP2-1
XF1
RED
BLK
R-Y
RED
C1A
20
C1B
20
115 V AC
J1
AX1
T1
GRN.
XV1
6X4
R1
22K
C2
.5
R2
220K
BLK
GRN.
6.3
S1
TP2-2
R3
100Ω
5 WATT
+25 V
TP1-1
6.3 @ 2 AMP
TITLE
WIRING DIAGRAM
M-5576 B PROGRAM AMPLIFIER
838 0437 001