OPERATING INSTRUCTIONS

# TYPE 1206-B

# UNIT AMPLIFIER

GENERAL RADIO COMPANY

# OPERATING INSTRUCTIONS

# TYPE 1206-B

# UNIT AMPLIFIER

Form 1206-0100-E
January, 1962

GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS, USA

# SPECIFICATIONS

Power Output: With 300-v plate supply, 600-ohm load: from 10 cps to 50 kc, 3 w; from 5 cps to 100 kc, 1.5 w; at 250 kc, 0.5 w.

Distortion: Less than 1% harmonic distortion with 2-w output (2% at 3 w) into 600 ohms from 20 cps to 40 kc.

| Pulse Response: | No Load | 600 Ω |
|---|---|---|
| Droop in 30-cps square wave: | 15% | 20% |
| Approx rise time: 50 v peak-to-peak: | 1 μsec | 2 μsec |
| 100 v peak-to-peak: | 2 μsec | 4 μsec |
| Max output, peak-to-peak: | 260 v | 120 v |

Load Impedance: 600 ohms optimum. Blocking capacitor is 100 μf. (Internal impedance about 100 ohms.)

Input Impedance: 100,000 ohms in parallel with 35 μμf.

Frequency Response: Down less than 3 db at 2 cps and 500 kc at 10-v (or less) output, with gain control at maximum. See also Power Output, above.

Voltage Gain: Continuously adjustable. Maximum gain is 50 to 1 (34 db), with no load; 42.5 to 1 (32.6 db) into 600 ohms.

A-C Hum in Output: Less than 15 mv rms, with Type 1203 Unit Power Supply; less than 3 mv rms, with Type 1201-A Unit Regulated Power Supply.

Power Requirements: 300 v at 50 ma; 6.3 v at 2.7 amp.

Power Supply: Type 1203 Unit Power Supply is recommended. Amplifier plugs directly into any one of the Unit Power Supplies.

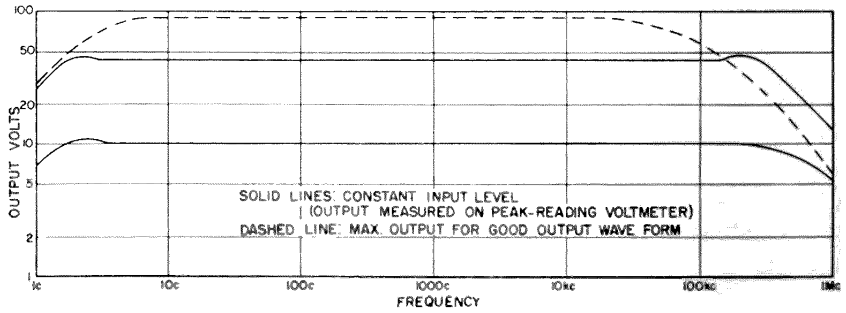
Accessories Supplied: Two connector channels for attaching power supply.

Mounting: Aluminum cabinet and chassis for bench mounting. Relay Rack panel (Type 480-P4U3) available for amplifier and power supply.

Dimensions: Width 9-7/8, height 5-3/4, depth 6-1/4 inches (250 by 150 by 160 mm), over-all.

Weight: 4 lb. (1.9 kg).

U.S. Patent Nos 2,659,775 and 2,802,907.




Frequency-Response with 600-Ohm Load.

TABLE OF CONTENTS


Figure 1. Panel View, Type 1206-B Unit Amplifier with Type 1203-B Power Supply

# TYPE 1206-B
# UNIT AMPLIFIER

## Section 1
## INTRODUCTION

1.1 PURPOSE. The Type 1206-B Unit Amplifier (Figure 1) is designed as a general-purpose laboratory instrument useful as a bridge amplifier, a driver for low-power electronic and electroacoustic devices, and as an amplifier for the Type 1210 Unit Oscillator and other low-power signal sources. The normal operating range covers the audio and ultrasonic frequencies.

1.2 DESCRIPTION. The Unit Amplifier uses a single-ended push-pull circuit,[1] with the advantage of push-pull operation of the output tubes and without the usual low- and high-frequency limitations of the output transformer. The circuit consists of a triode amplifier stage, a phase inverter, and series output tubes operated in push-pull parallel. Degenerative feedback is returned to the cathode of the input stage.

The elementary schematic diagram (Figure 2) shows the operation of the series push-pull output stage. Note that the drive for the upper tube (V3) is applied from grid to cathode and not from grid to ground. If either tube were replaced by a resistor, therefore, the other would act as an amplifier with gain, and the upper tube would give an output in phase with its input.

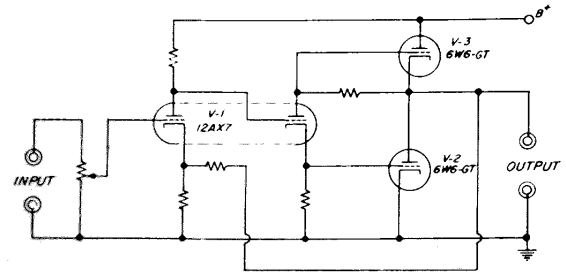



Figure 2. Elementary Schematic Diagram.

1. Peterson, A.P.G. and Sinclair, D.B., "A Single-Ended Push-Pull Audio Amplifier", Proc. IRE, January, 1952, pp. 7-11.

# Section 2

# OPERATING PROCEDURE

2.1 POWER SUPPLY. Connect an external power source to the connecting jack as shown in Figure 3. Recommended power sources are the Type 1203 Unit Power Supply, Type 1201 Unit Regulated Power Supply, and Type 1204 Unit Variable Power Supply. The power supply should be able to deliver 2.7 amp at 6.3 volts (60 cps) and 50 ma at 300 volts dc. The heater supply and the dc plate supply should not be interconnected. When using the Type 1204 Unit Variable Power Supply, set the output to 300 volts.

If the Type 1203 Unit Power Supply is used, it will not be possible to obtain the full 3 watts output if the line voltage is substantially below 115 volts. A Variac® autotransformer or other means of increasing line voltage should be used if the full 3 watts are desired. At line voltages of over 115 volts, an output of over 3 watts is obtainable; however, the amplifier should not be operated from the Type 1203 Unit Power Supply with a line voltage of over 130 volts.

The Type 1201 Unit Regulated Power Supply supplies 300 volts regulated power, and also has the advantage of reducing the hum output of the amplifier.

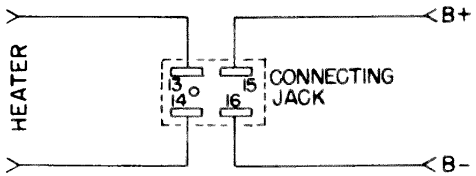



Figure 3.
Connection of External Power Source.

2.2 INPUT AND OUTPUT CIRCUITS. The INPUT and OUTPUT terminals are so indicated on the front panel. Be careful to keep the external input and output connections separate to prevent oscillation due to an external feedback path.

Each INPUT terminal is connected to one end of a logarithmic potentiometer (R1), whose variable tap is connected to a blocking capacitor that leads to the grid of the input stage. The input, therefore, may have a d-c component, which should be under 100 volts. The 100,000-ohm potentiometer (R1) should be turned fully clockwise for full gain.

Leakage in the 100-μf blocking capacitor in the output circuit results in a d-c voltage across the output terminals. The voltage is about 1 volt open-circuit, 0.1 volt with a 600-ohm load.

The optimum load is 600 ohms. Due to feedback, the actual source impedance is about 100 ohms, but the amplifier cannot supply enough current to develop 3 watts into a load impedance much smaller than 600 ohms.

2.3 FREQUENCY RESPONSE. The frequency ranges given for various power levels (refer to Specifications) are the ranges over which the output waveform is essentially sinusoidal for a sinusoidal input. Any given output is available over a wider frequency range than indicated, but the waveform is visibly distorted at frequencies much beyond those given.

High-frequency response is a function of amplitude, and is due to the limited frequency response of the phase inverter, which results in overloading of the phase inverter at high frequencies.

Although this series-tube operation permits a much better frequency response than that which is ordinarily possible with an output transformer and conventional push-pull circuit, the response is limited by the effective multiplication of the grid-to-ground capacitance of the upper tube by the gain of the output stage.

2.4 PULSE RESPONSE. The Specifications indicate that the rise time is a function of amplitude. This is due to the limited response of the phase inverter, which results in overloading of the phase inverter. At low levels the rise time of the phase inverter is improved by feedback. At sufficiently high levels the phase inverter is driven to cutoff. At cutoff, the impedance of the tube's output circuits is changed so that the circuit has a longer time constant and slower rise time. The period of time over which cutoff exists depends on the amplitude. The fall time is shorter, indicating that driving the phase inverter grid positive has less effect on the time constants of the phase inverter's output circuits.

With potentiometer R1 turned fully clockwise, a small overshoot appears on the output waveform when the amplifier is driven from a low-impedance pulse generator. To eliminate this overshoot, turn R1 slightly counterclockwise. The rise time, however, is best when R1 is near either end.

# Section 3

# SERVICE AND MAINTENANCE

3.1 GENERAL. The two-year warranty given with every General Radio instrument attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible.

In case of difficulties that cannot be eliminated by the use of these service instructions, please write or phone our Service Department, giving full information of the trouble and of steps taken to remedy it. Be sure to mention the serial and type numbers of the instrument.

Before returning an instrument to General Radio for service, please write to our Service Department or nearest district office (see back cover), requesting a Returned Material Tag. Use of this tag will insure proper handling and identification. For instruments not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay.

3.2 EXCESS DISTORTION. Excess distortion would probably be due to improper operation of the output tubes. Before replacing either of the tubes, check to see that the plate supply voltage (V3, pins 3 and 4) and the bias voltage (V2, pin 5) are correct. After replacing either V2 or V3, readjust R13 for minimum distortion. R13, a bias adjustment on V3, is set at the factory to give minimum distortion at 1 kc when delivering 3 watts into 600 ohms with a line voltage of 115 volts on the Type 1203 Unit Power Supply.

3.3 LOW GAIN OR EXCESS HUM. In the event of either low gain or excessive hum, check to see if V1 (12AX7) is defective, and replace it if necessary.

3.4 TEST VOLTAGES. The following table gives test voltages as an aid to trouble-shooting. Unless otherwise indicated, voltages are dc, to ground, with no input signal applied. A 20,000-ohm-per-volt multimeter was used.

| TUBE | | PIN | VOLTS TO GND |
|---|---|---|---|
| V1 (12AX7) | Plate | 1 | 200 |
| | Grid | 2 | 0 |
| | Cathode | 3 | 1.6 |
| | Heater | 4 | -8 |
| | Heater | 5 | -8 |
| | Plate | 6 | 250 |
| | Grid | 7 | High Impedance |
| | Cathode | 8 | 40 |
| | Heater | 9 | 6.3 ac* |

| TUBE | | PIN | VOLTS TO GND |
|---|---|---|---|
| V2 (6W6-GT) | Heater | 2 | 6.3 ac** |
| | Plate | 3 | 150 |
| | Screen | 4 | 150 |
| | Grid | 5 | -16 |
| | Heater | 7 | -8 |
| | Cathode | 8 | 0 |
| V3 (6W6-GT) | Heater | 2 | 6.3 ac** |
| | Plate | 3 | 300 |
| | Screen | 4 | 300 |
| | Grid | 5 | 134† |
| | Heater | 7 | -8 |
| | Cathode | 8 | 150 |

* Between pins 4 and 9 and 5 and 9.
** Between pins 2 and 7.
† Use dc vacuum-tube voltmeter.

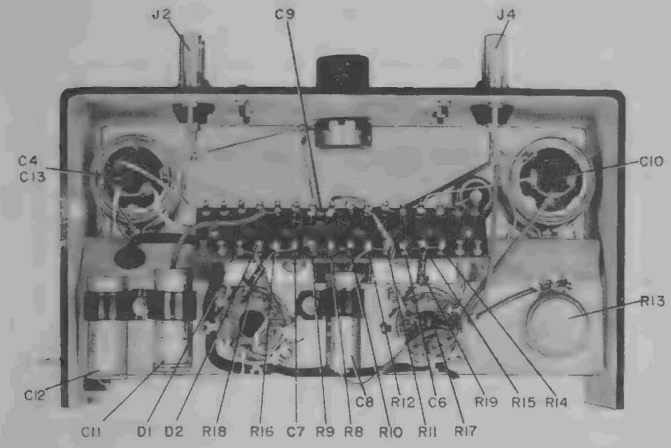



Figure 4. Top Interior View.

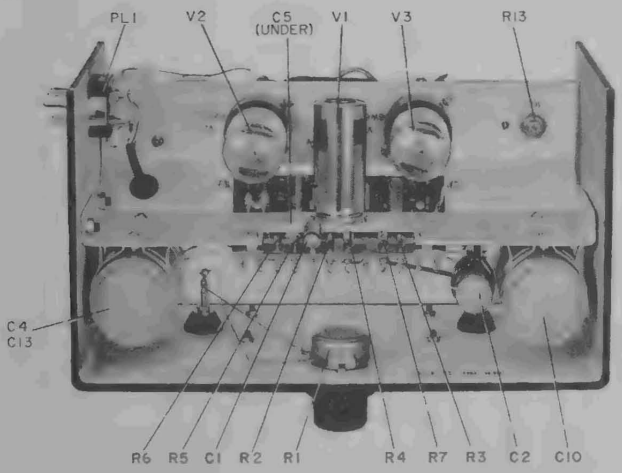



Figure 5. Bottom Interior View.

# PARTS LIST

| | | | PART NO. (Note A) |
|---|---|---|---|
| RESISTORS (Note B) | R1 | 100 k ±10% | POSC-12 |
| | R2 | 1 M ±10% 1/2 w | REC-20BF |
| | R3 | 1 k ±10% 1/2 w | REC-20BF |
| | R4 | 200 ± 1% 1/2 w | REF-70 |
| | R5 | 68 k ± 5% 1/2 w | REC-20BF |
| | R6 | 10 k ±10% 1/2 w | REC-20BF |
| | R7 | 13 k ± 1% 1/2 w | REF-70 |
| | R8 | 1 M ±10% 1/2 w | REC-20BF |
| | R9 | 1.5 k ± 5% 1/2 w | REC-20BF |
| | R10 | 39 k ± 1% 1/2 w | REF-70 |
| | R11 | 28.5 k ± 1% 1/2 w | REF-70 |
| | R12 | 27 k ±10% 1/2 w | REC-20BF |
| | R13 | 5 M ±20% | POSC-11 |
| | R14 | 6.8 M ± 5% 1/2 w | REC-20BF |
| | R15 | 1 M ±10% 1/2 w | REC-20BF |
| | R16 | 100 k ±10% 1/2 w | REC-20BF |
| | R17 | 4.7 M ±10% 1/2 w | REC-20BF |
| | R18 | 100 ±10% 1/2 w | REC-20BF |
| | R19 | 100 ±10% 1/2 w | REC-20BF |
| | R20 | 470 k ± 5% 1/2 w | REC-20BF |
| CAPACITORS (Notes C and D) | C1 | 0.1 ±10% 100 dcwv | COW-17 |
| | C2 | 200 +100%-10% 10 dcwv | COE-6 |
| | C4 | 25 +0-10% 350 dcwv | COEB-35 |
| | C5 | 0.047 ±10% 400 dcwv | COW-25 |
| | C6 | 0.1 ±10% 200 dcwv | COW-16 |
| | C7 | 0.22 ±10% 100 dcwv | COW-17 |
| | C8 | 10 +0-10% 250 dcwv | COE-33 |
| | C9 | 39 μμf ±10% 500 dcwv | COM-20B |
| | C10 | 100 +0-10% 350 dcwv | COEB-35 |
| | C11 | 16 +100%-10% 150 dcwv | COE-4 |
| | C12 | 16 +100%-10% 150 dcwv | COE-4 |
| | C13 | 75 +0-10% 350 dcwv | COEB-35 |
| | D1 | Crystal Diode | 1N1692 |
| | D2 | Crystal Diode | 1N1692 |
| | J1 | Binding Post | BP-5 |
| | J2 | Binding Post | BP-5 |
| | J3 | Binding Post | BP-5 |
| | J4 | Binding Post | BP-5 |
| | PL1 | Plug | CDMP-476-4 |
| | V1 | Tube | 12AX7 |
| | V2 | Tube | 6W6GT |
| | V3 | Tube | 6W6GT |

NOTES

(A) Type designations for resistors and capacitors:

COE - Capacitor, electrolytic
COEB - Capacitor, electrolytic block
COM - Capacitor, mica
COW - Capacitor, wax
POSC - Resistor, variable, composition
REC - Resistor, composition
REF - Resistor, film

(B) All resistances are in ohms unless otherwise indicated by k (kilohms) or M (megohms).

(C) All capacitances are in microfarads unless otherwise indicated by μμf (micromicrofarads).

(D) C4 and C13 are parts of the same unit.

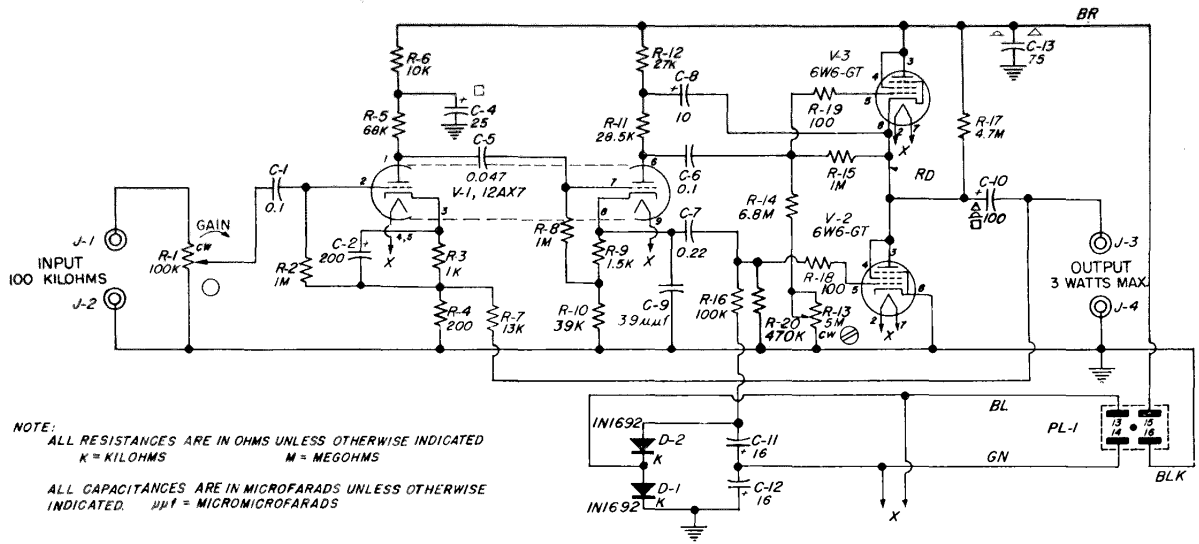



Figure 6. Schematic Diagram, Type 1206-B Unit Amplifier.

# GENERAL RADIO UNIT INSTRUMENTS

| | | |
|---|---|---|
| Type 1201 | Unit Regulated Power Supply | |
| Type 1203 | Unit Power Supply | |
| Type 1205 | Adjustable Regulated Power Supply | |
| Type 1206 | Unit Amplifier | |
| Type 1208 | Unit Oscillator | 65 to 500 Mc |
| Type 1209-B | Unit Oscillator | 250 to 920 Mc |
| Type 1209-BL | Unit Oscillator | 180 to 600 Mc |
| Type 1210 | Unit RC Oscillator | 20 cps to .5 Mc |
| Type 1211 | Unit Oscillator | 0.5 to 50 Mc |
| Type 1212 | Unit Null Detector | |
| Type 1213 | Unit Time/Frequency Calibrator | |
| Type 1214-A | Unit Oscillator | 400 and 1000 cps |
| Type 1214-D | Unit Oscillator | 120 cps |
| Type 1214-M | Unit Oscillator | 1 Mc |
| Type 1215 | Unit Oscillator | 50 to 250 Mc |
| Type 1216 | Unit I-F Amplifier | |
| Type 1217 | Unit Pulser | |
| Type 1218 | Unit Oscillator | 900 to 2000 Mc |
| Type 1219 | Unit Pulse Amplifier | |
| Type 1220 | Unit Klystron Oscillator | |
| Type 1361 | UHF Oscillator | |

# GENERAL RADIO COMPANY

**WEST CONCORD, MASSACHUSETTS**

**EMerson 9-4400** **CLearwater 9-8900**

## DISTRICT OFFICES

### NEW YORK

*Broad Ave. at Linden, Ridgefield, N. J.*

*Telephone N.Y. WOrth 4-2722*
*N.J. WHitney 3-3140*

### PHILADELPHIA

*1150 York Rd., Abington, Penna.*

*Telephone HAncock 4-7419*

### WASHINGTON

*8055 13th St., Silver Spring, Md.*

*Telephone JUniper 5-1088*

### CHICAGO

*6605 West North Ave., Oak Park, Ill.*

*Telephone VIllage 8-9400*

### LOS ANGELES

*1000 N. Seward St., Los Angeles 38, Calif.*

*Telephone HOllywood 9-6201*

### SAN FRANCISCO

*1186 Los Altos Ave., Los Altos, Calif.*

*Telephone WHitecliff 8-8233*

### CANADA

*99 Floral Pkwy., Toronto 15, Ont.*

*Telephone CHerry 6-2171*

## REPAIR SERVICES

### EAST COAST

*General Radio Company*

*Service Department*

*22 Baker Ave., W. Concord, Mass.*

*Telephone EMerson 9-4400*

### NEW YORK

*General Radio Company*

*Service Department*

*Broad Ave. at Linden, Ridgefield, N. J.*

*Telephone N.Y. WOrth 4-2722*
*N.J. WHitney 3-3140*

### MIDWEST

*General Radio Company*

*Service Department*

*6605 West North Ave., Oak Park, Ill.*

*Telephone VIllage 8-9400*

### WEST COAST

*Western Instrument Co.*

*826 N. Victory Blvd., Burbank, Calif.*

*Telephone VIctoria 9-3013*

### CANADA

*Bayly Engineering, Ltd.*

*First Street, Ajax, Ontario*

*Telephone Toronto EMpire 2-3741*

Printed in USA