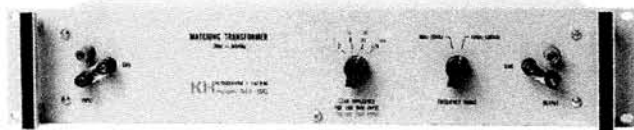


Model MT-56R

*75 Watt, 30Hz to 500kHz
Impedance Matching Transformer*



**KH KROHN-HITE
CORPORATION**

Operating Manual

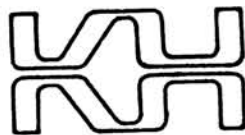
.75 WATT

30 Hz to 500 kHz

MATCHING TRANSFORMER

model MT-56 SERIAL NO. _____

OPERATING AND MAINTENANCE
MANUAL



KROHN-HITE CORPORATION

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Brockton, MA 02301-5566

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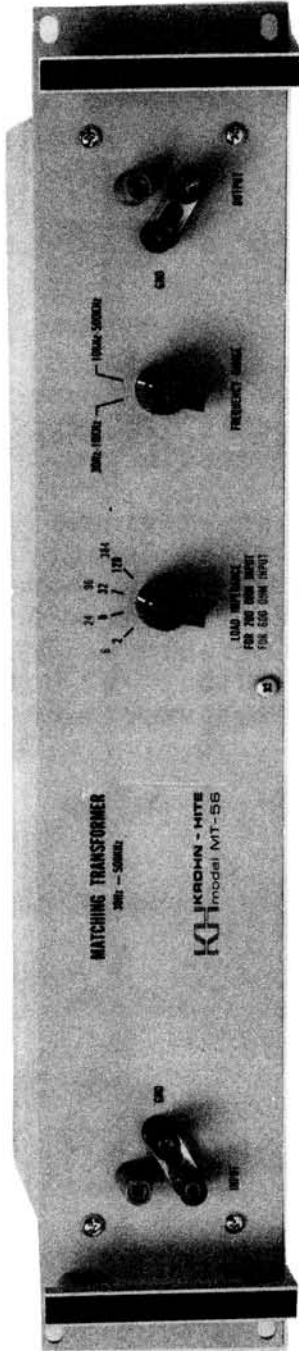


Figure 1. Model MT-56 Matching Transformer

SECTION 1
GENERAL DESCRIPTION

1.1 INTRODUCTION

The Krohn-Hite Model MT-56 Matching Transformer is an accessory designed to supplement the output capabilities of the Models DCA-10 and 7500 Power Amplifiers. The MT-56 provides matched output impedances for amplifier-to-load ratios of 100, 25, 6.25 and 1.56 to 1, selected by the front panel LOAD IMPEDANCE switch. When the MT-56 is used with the Model DCA-10, these ratios correspond to matching loads of 6, 24, 96 and 384 ohms. When the Model 7500 is used, these same ratios correspond to matching loads of 2, 8, 32 and 128 ohms. The MT-56 operates over a frequency range of 30 Hz to 500 kHz in two ranges - 30 Hz to 10 kHz and 10 kHz to 500 kHz - as selected by the front panel FREQUENCY RANGE switch.

The MT-56 is available in a rack-mounting version only. Multi-purpose binding posts are provided for input and output connections. Detachable grounding straps provide additional floating ground operation.

The transformer is carefully tested and inspected before shipment, and should be ready to use when unpacked. If it appears to have been damaged in shipment, make a claim with the carrier and notify Krohn-Hite immediately.

1.2 SPECIFICATIONS

(Specifications apply for the Model MT-56 used with either the Model DCA-10 or Model 7500 Amplifier)

Frequency Range:

Nominal 30 Hz to 500 kHz in two ranges - 30 Hz to 10 kHz and 10 kHz to 500 kHz - as selected by the front panel FREQUENCY RANGE switch.

MAXIMUM Output Power Level (with matching load):

10 Watts with Model DCA-10; 75 watts with Model 7500.
(Output power decreases slightly at ends of frequency range.)

Output Power vs. Frequency:

Figure 2 shows a typical power output curve vs. frequency of an MT-56 and a 7500 amplifier, with a matching resistive load, and a constant input to the 7500.

Frequency Response:

Figure 3 represents the typical output response of the MT-56, with matching resistive loads, at constant inputs to the Models DCA-10 and 7500 amplifiers.

Harmonic Distortion (RMS):

Figure 4 shows the typical distortion of the MT-56 for matching resistive loads, at constant inputs to the Models DCA-10 and 7500 amplifiers.

Matching Loads:

With Model 7500 - 2, 8, 32 and 128 ohms.

With Model DCA-10 - 6, 24, 96 and 384 ohms.

MODEL MT-56 ONLY

Input Impedance:

Nominal 200 ohms, AC coupled.

Primary to Secondary Turns Ratio:

10:1, 5:1, 2.5:1, 1.25:1.

Controls:

(Front Panel Only): LOAD IMPEDANCE switch, FREQUENCY RANGE switch

Terminals:

Front Panel: Multi-Purpose binding posts with detachable grounding straps for INPUT and OUTPUT.

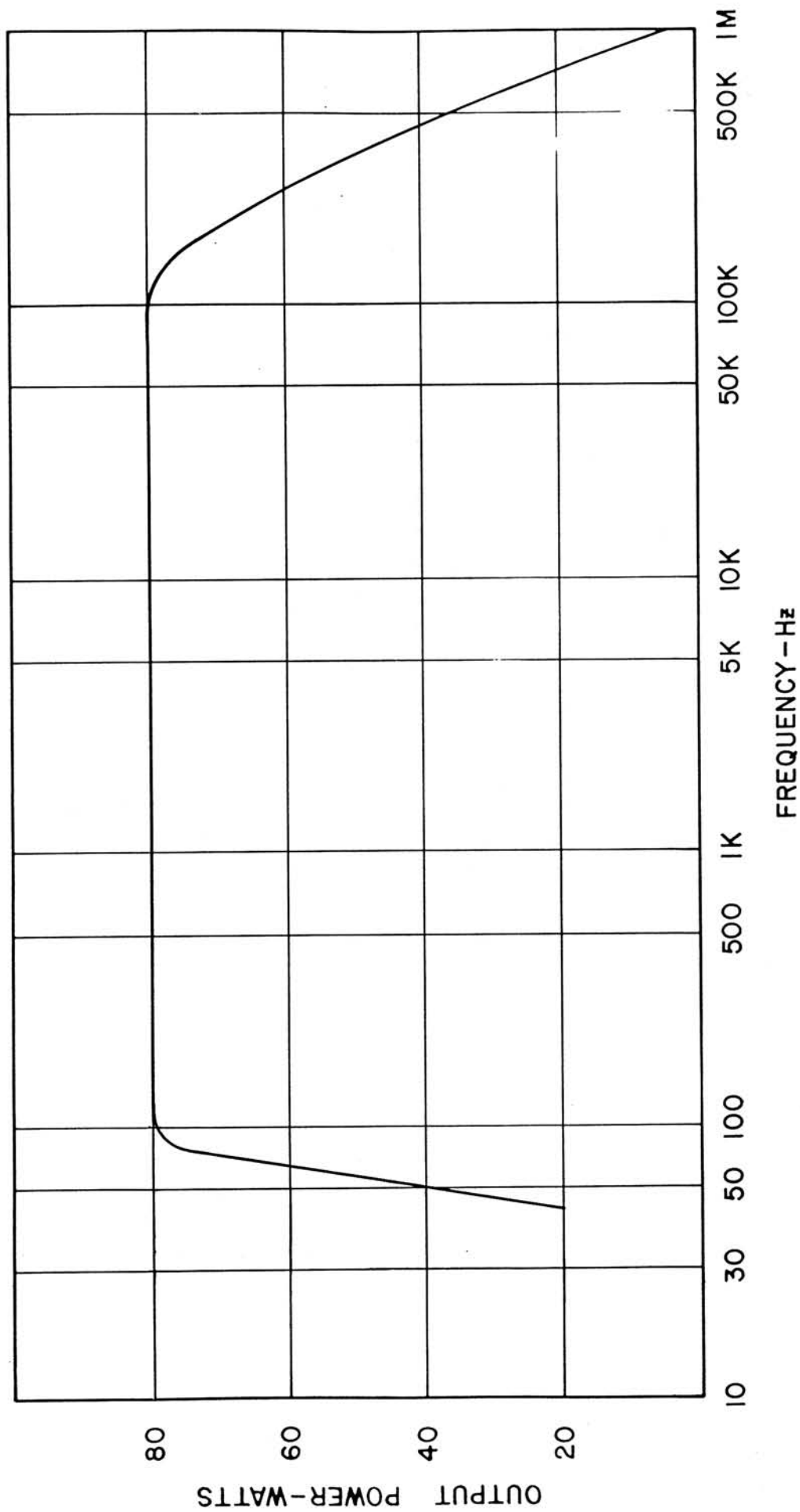
Rear Panel: BNC for INPUT, multi-purpose binding posts for OUTPUT.

AC Power Requirements:

None.

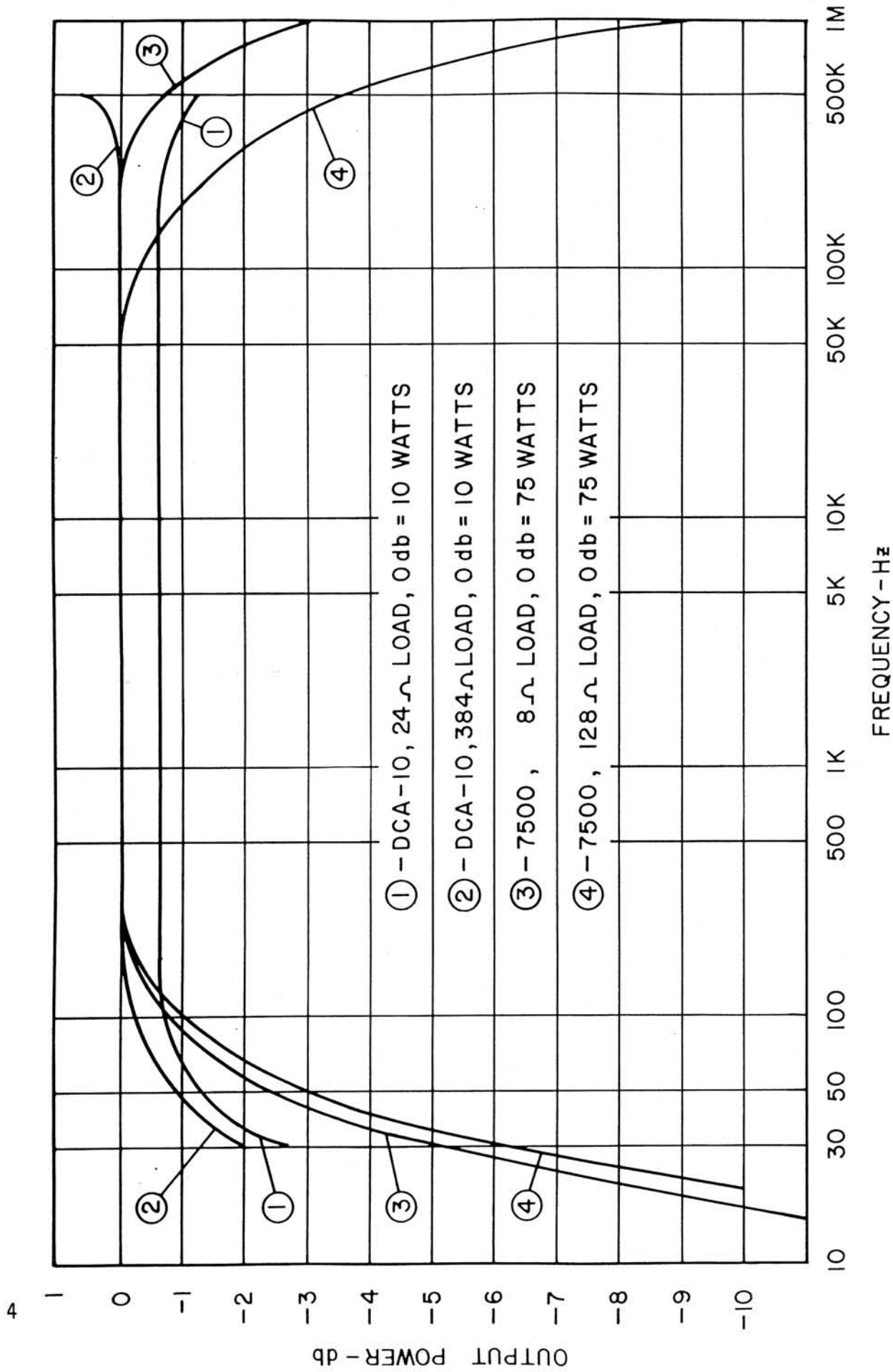
Dimensions and Weights:

Standard rack mounting only: 19" wide, 3½" high, 6½" deep, 18 lbs/9 kgs net, 20 lbs/10 kgs shipping.



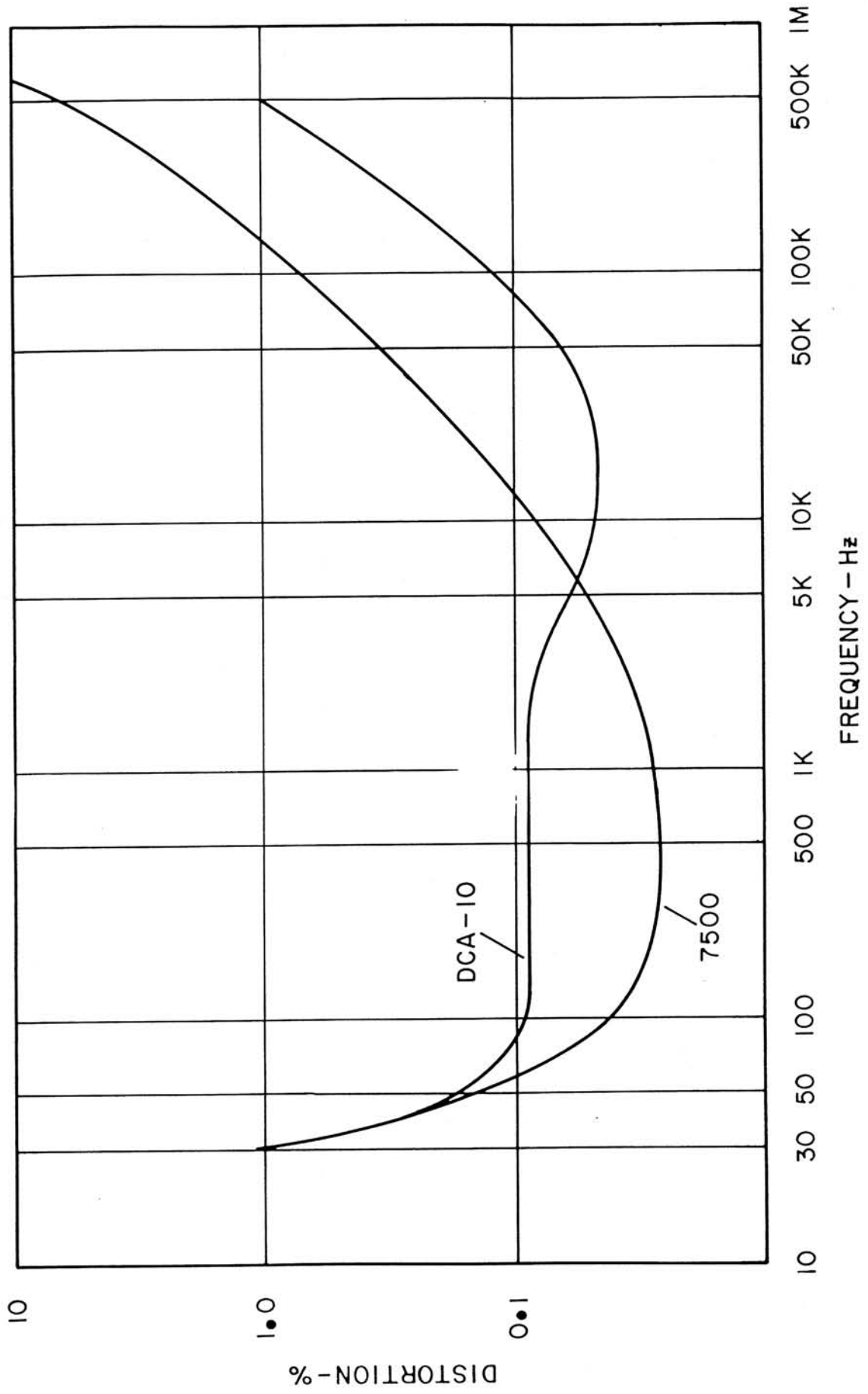
TYPICAL OUTPUT POWER vs. FREQUENCY
WITH MODEL 7500 AMPLIFIER

Figure 2.



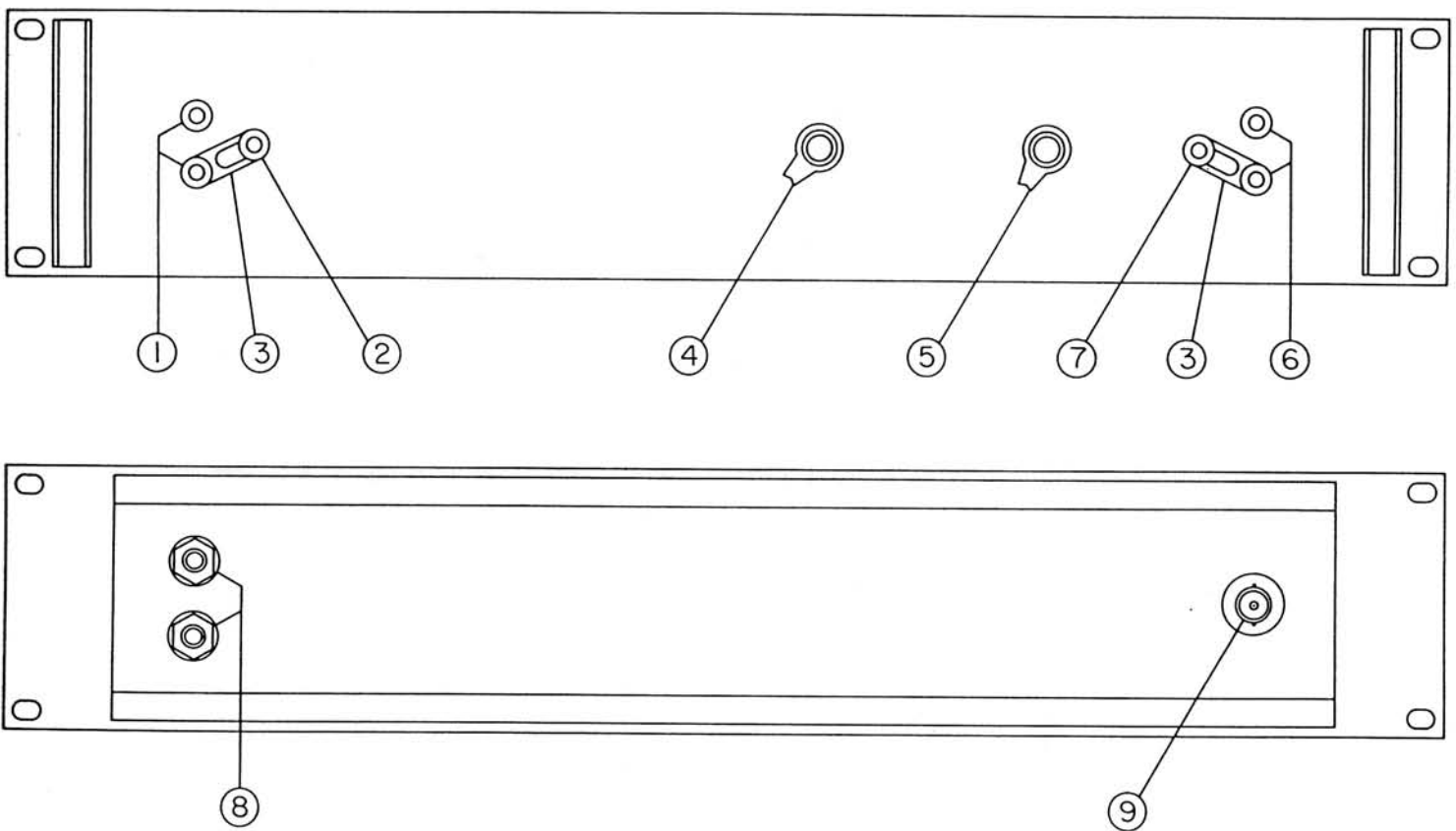
FREQUENCY RESPONSE OF MT56 WITH MATCHED RESISTIVE LOADS AND CONSTANT INPUTS TO DCA-10 AND 7500

Figure 3.



HARMONIC DISTORTION OF MT56 WITH MATCHED RESISTIVE LOADS AND CONSTANT INPUTS TO DCA-10 AND 7500

Figure 4.



- ① FRONT INPUT (BINDING POSTS)
- ② INPUT CHASSIS GROUND
- ③ CHASSIS GROUNDING STRAPS
- ④ LOAD IMPEDANCE SWITCH
- ⑤ FREQUENCY RANGE SWITCH
- ⑥ FRONT OUTPUT (BINDING POSTS)
- ⑦ OUTPUT CHASSIS GROUND
- ⑧ REAR OUTPUT (BINDING POSTS)
- ⑨ REAR INPUT (BNC)

Figure 5. Controls and Connectors

SECTION 2

OPERATION

2.1 INTRODUCTION

The Model MT-56 Transformer can be used directly with either the Model DCA-10 or Model 7500 Power Amplifier, and requires no external AC power source. It is designed to match the output impedance of either Amplifier to selected loads ranging from 2 to 384 ohms. The Transformer may also be used in a floating or balanced configuration, by removing the grounding straps on the front panel INPUT and OUTPUT terminals. The MT-56 is available in a rack-mounting version, only.

If the Transformer is being used for the first time it is recommended that the procedure outlined in Section 3, Incoming Inspection be performed upon receipt of the Transformer.

2.2 CONTROLS AND CONNECTORS (see figure 5)

The following is a brief description of the controls and connectors used on the Model MT-56:

Frequency Range:

2 position switch for selecting either low frequency (30 Hz-10 kHz) or high frequency (10 kHz-500 kHz) operation. The switch positions represent the frequency response of the two internal transformers that make up the MT-56 Transformer. The frequency response of the Transformer overlaps approximately 10-15% in either direction at the 10 kHz crossover point; beyond that, the response of the Transformer will begin to drop off sharply.

Load Impedance:

4 position switch that selects primary-to-secondary matched impedance ratios of 100, 25, 6.25 and 1.56 : 1. The actual values of the matching loads for each Amplifier are screened on the front panel for each position of the switch. The upper scale of 6, 24, 96 and 384 ohms are the values used with the DCA-10 and are screened in RED; the lower scale (BLACK) corresponds to the values for the 7500 and are labelled 2, 8, 32 and 128 ohms. (Section 2.3.2 discusses the use of other impedance values in greater detail.)

Input and Output Connectors:

The MT-56 is supplied with input and output connectors on both the front and rear panels. The front panel has multi-purpose binding posts, with separate grounding straps for both input and output terminals; the binding posts labelled "GND" are common to each other, and are tied directly to the Transformer's outer chassis. Since the Transformer's primary and secondary windings are isolated, removal of only the INPUT grounding strap will float the primary winding but not the secondary (OUTPUT) winding.

The rear panel contains a BNC connector for the INPUT, and binding posts for the OUTPUT.

Removal of the front panel INPUT grounding strap will also float the shell of the BNC connector; removal of the OUTPUT grounding strap on the front panel automatically floats the rear OUTPUT.

In addition, both front and rear INPUT terminals are AC coupled to the primary winding through a common capacitor.

2.3 OPERATION

2.3.1 General

Begin by making sure that all input and output connections are made prior to turning on the amplifier. The MT-56 is connected in series between the Amplifier and the respective load. Make sure that all CHASSIS/FLOATING ground switches and/or grounding straps on the Signal Source, the Amplifier and the Transformer are in the proper position for the particular test set-up being used. The use of short, twisted leads is recommended for making connections between the Amplifier, the Transformer and the load. This is to avoid any stray capacitive effects at high frequencies. The leads should consist of #14 AWG wire or better, preferably secured to an insulated banana plug or jack. A coaxial cable may be used for connecting the output of the signal source to the input of the Amplifier.(see Figure 6)

CAUTION !!

During operation, potentially dangerous voltage and current levels may exist, both on the output of the Amplifier and on the output of the Transformer. Therefore, extreme caution should be used when connecting or disconnecting leads.

2.3.2 Considerations for Impedance Matching

The MT-56 will deliver the respective Amplifier's maximum output power to one of the four load impedances, selected by the Transformer's LOAD IMPEDANCE switch. If the value of the load impedance falls within the settings of the LOAD IMPEDANCE switch, then the maximum power available will depend on the Amplifier's voltage and current limitations for the equivalent load impedance seen by the Amplifier. In general, the equivalent load impedance can be expressed as:

$$Z_{EQ} = \left[\frac{N_1}{N_2} \right]^2 \times Z_L$$

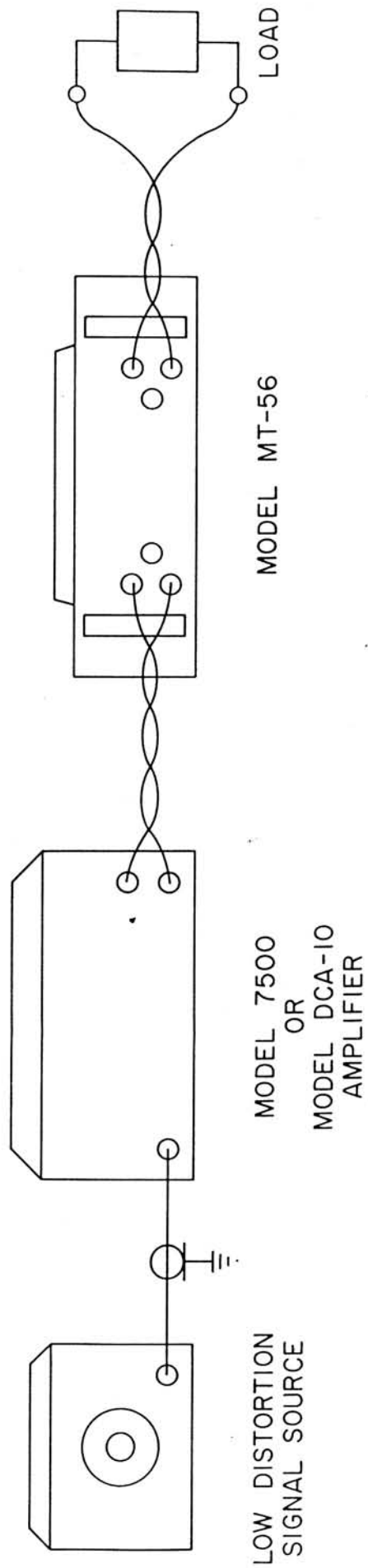
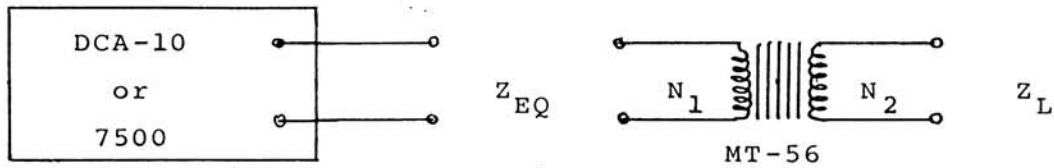


Figure 6. Typical Equipment Interfacing

where $\frac{N_1}{N_2}$ is the primary-to secondary turns ratio of the Transformer, and is either 10, 5, 2.5 or 1.25 to 1.



The Amplifier's corresponding output voltage and current for its equivalent load (Z_{EQ}) can be determined from the graphs provided on pages 13 and 14 (Figures 9-12). The voltage and current available to the load impedance of the Transformer (Z_L) will be scaled in the following ratio:

$$V_L = \sqrt{\frac{Z_L}{Z_{EQ}}} \times V_A \quad (2.3.2.a)$$

$$I_L = \sqrt{\frac{Z_{EQ}}{Z_L}} \times I_A$$

where V_A and I_A are the amplifier's output voltage and current, respectively, for Z_{EQ} .

The MT-56 may also be used to drive a reactive load. The considerations for reactive loads is that for maximum power transfer, the impedance of the inductive or capacitive load should match the selected transformer output impedance, for the particular operating frequency.

2.3.3 Floating Operation

The MT-56 may be operated in a floating mode by disconnecting the grounding straps located on the front panel INPUT and OUTPUT binding posts. Removal of the grounding strap on the INPUT terminal isolates only the primary winding from the MT-56 chassis; removing the OUTPUT grounding strap will isolate or float the secondary winding, or transformer OUTPUT terminals.

2.3.4 Balanced and Multi-Stage Operation

Two MT-56 Transformers can be combined with a DCA-10 or 7500 Amplifier, to provide a balanced output signal, as shown in fig. 7.

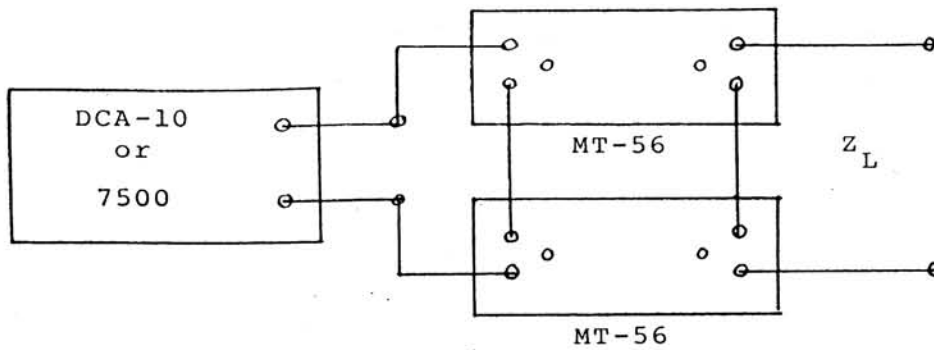


Figure 7. Balanced Operation

The Transformers are connected in series and are set for the same frequency range and load impedance. Both Transformer grounds should be floating. The output of the Amplifier is connected across the series Transformers as shown. The impedance required for matching will be equal to twice the setting of the LOAD IMPEDANCE switch, for the particular Amplifier being used. The balanced output may also be center tapped. In this case, the matching impedance required across each tap is the same as for a single-ended output.

Several Transformers and Amplifiers can be connected as shown in Figure 8 to provide an output power of several hundred watts. The input of all Amplifiers are connected in parallel to a common signal source. For maximum efficiency, the output voltages of all Amplifiers should be adjusted equal. The controls of all the Transformers, of course, should be in identical positions. Note how the grounding is connected; the LOW side of each Transformer's primary winding may or may not be grounded, as also the Amplifier's LOW output; the secondaries of all the Transformers are connected in series, however and must be floated. The matching impedance required is equal to the LOAD IMPEDANCE setting times the number (N) of Transformers used.

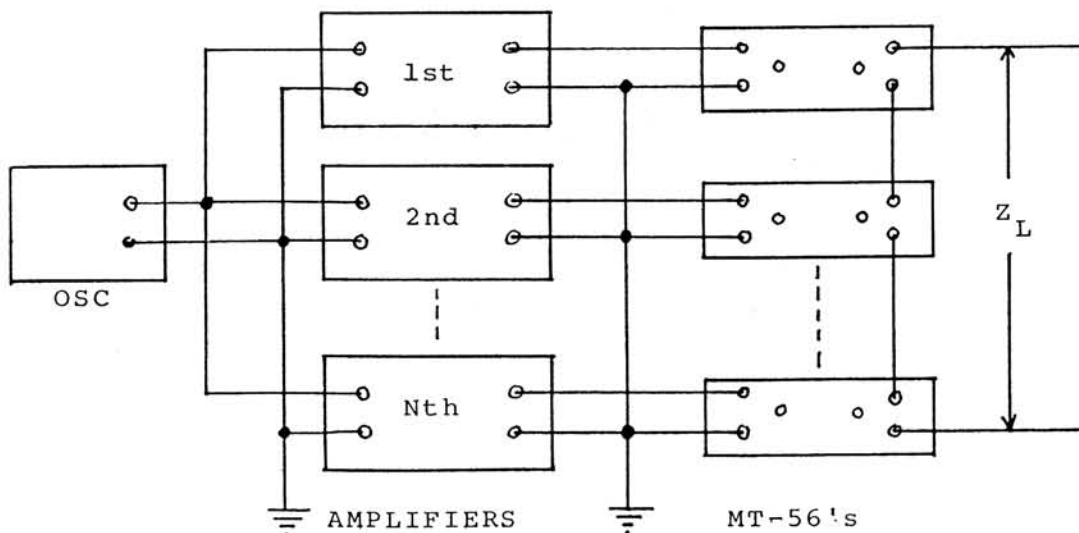
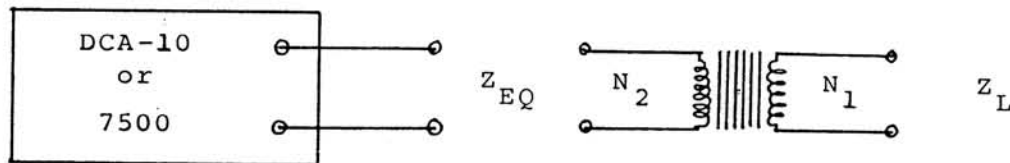


FIGURE 8.

2.3.5 Step-up Operation

Although the MT-56 is designed as a matching transformer to accommodate low impedance loads, and consequently steps down the input voltage applied, it may also be used to some extent in a reverse direction to provide voltage levels higher than the Amplifier's maximum output. The requirements for impedance matching values will be the inverse of those required for step-down operation. The equivalent impedance seen by the Amplifier will now be,

$$Z_{EQ} = \left[\frac{N_2}{N_1} \right]^2 \times Z_L$$



where $\frac{N_2}{N_1}$ equals 0.1, 0.2, 0.4 and 0.8 to 1.

A typical matching load to be expected in this condition of operation will be in the order of several thousand ohms. Also, the voltage and current available to the load will be the inverse ratio found in Equation 2.3.2.a, after determining the Amplifier's available voltage and current for its respective equivalent load, namely Z_{EQ} .

CAUTION !!

Operation will be limited by core saturation at low frequencies, and by winding insulation strength at high frequencies. Do not try to operate the Transformer at higher voltages on INPUT terminals than, 5 volts RMS/Hz of frequency, but no greater than 500 volts RMS, with FREQUENCY RANGE switch in 30 Hz - 10 kHz position; 15 volts RMS/kHz of frequency, but no greater than 500 volts RMS, with FREQUENCY RANGE switch in 10 kHz - 500 kHz position.

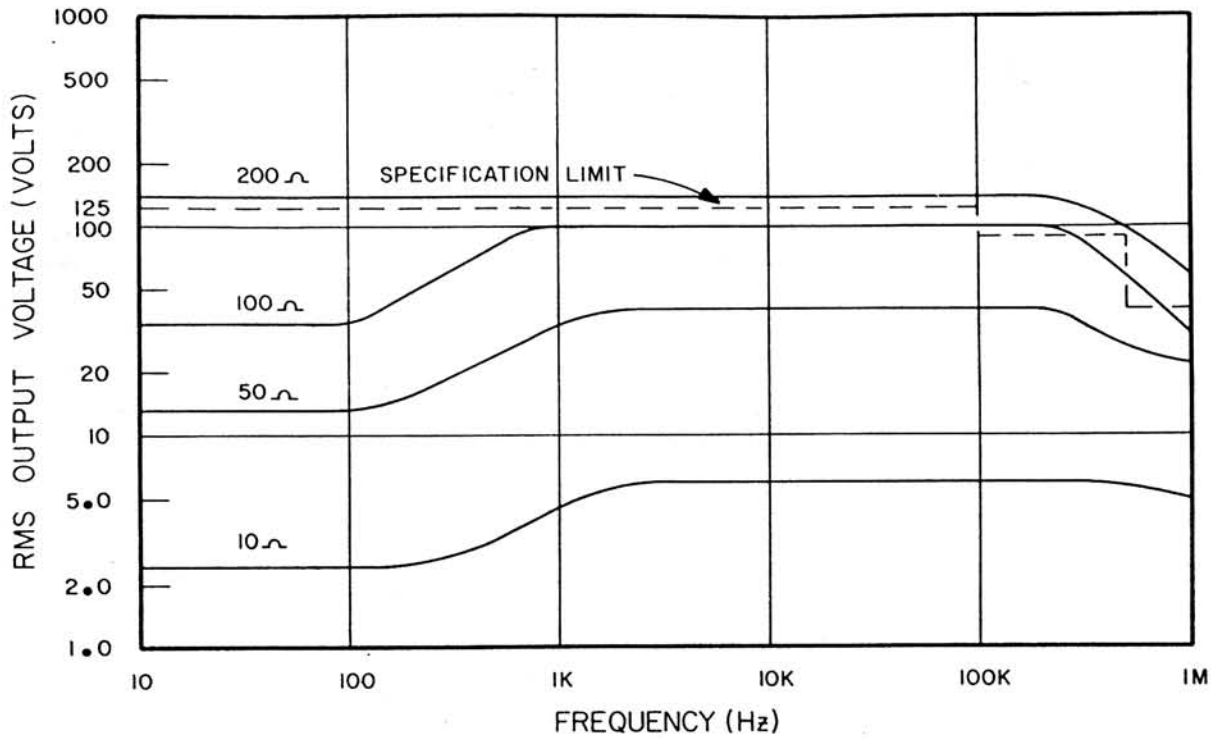


Figure 9. Typical RMS Voltage Output vs. Frequency for Different Resistive Loads.

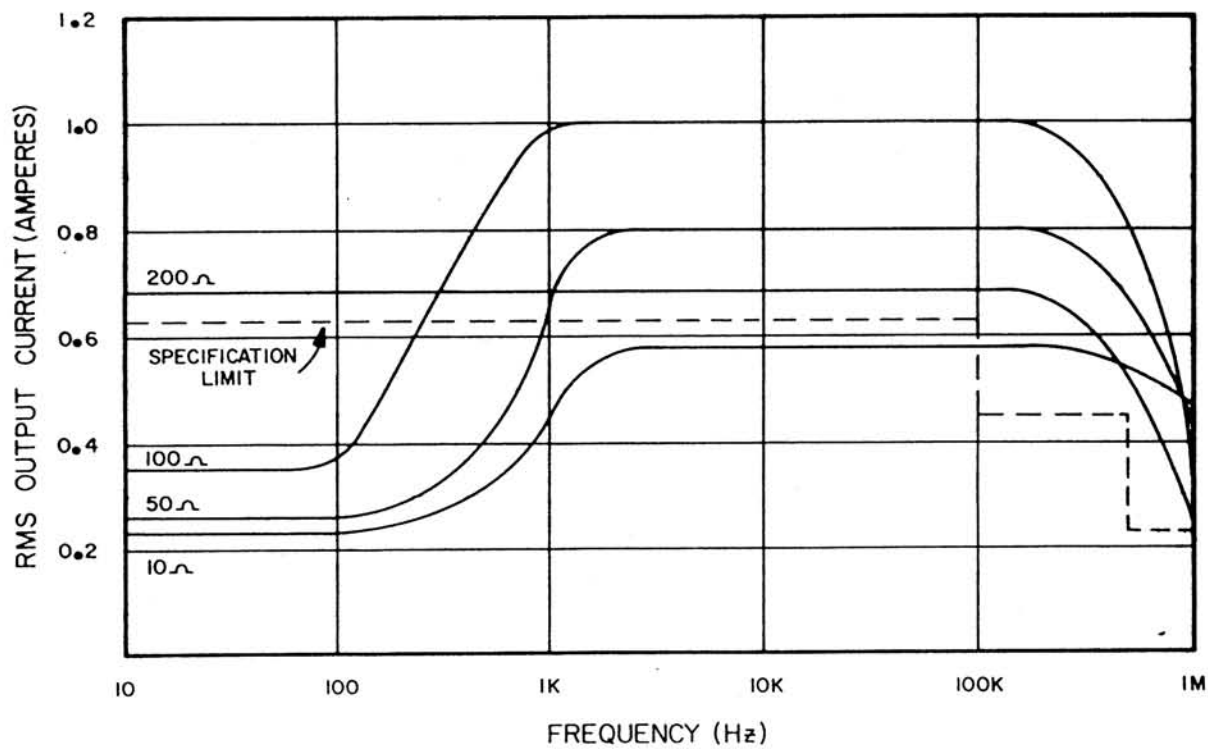
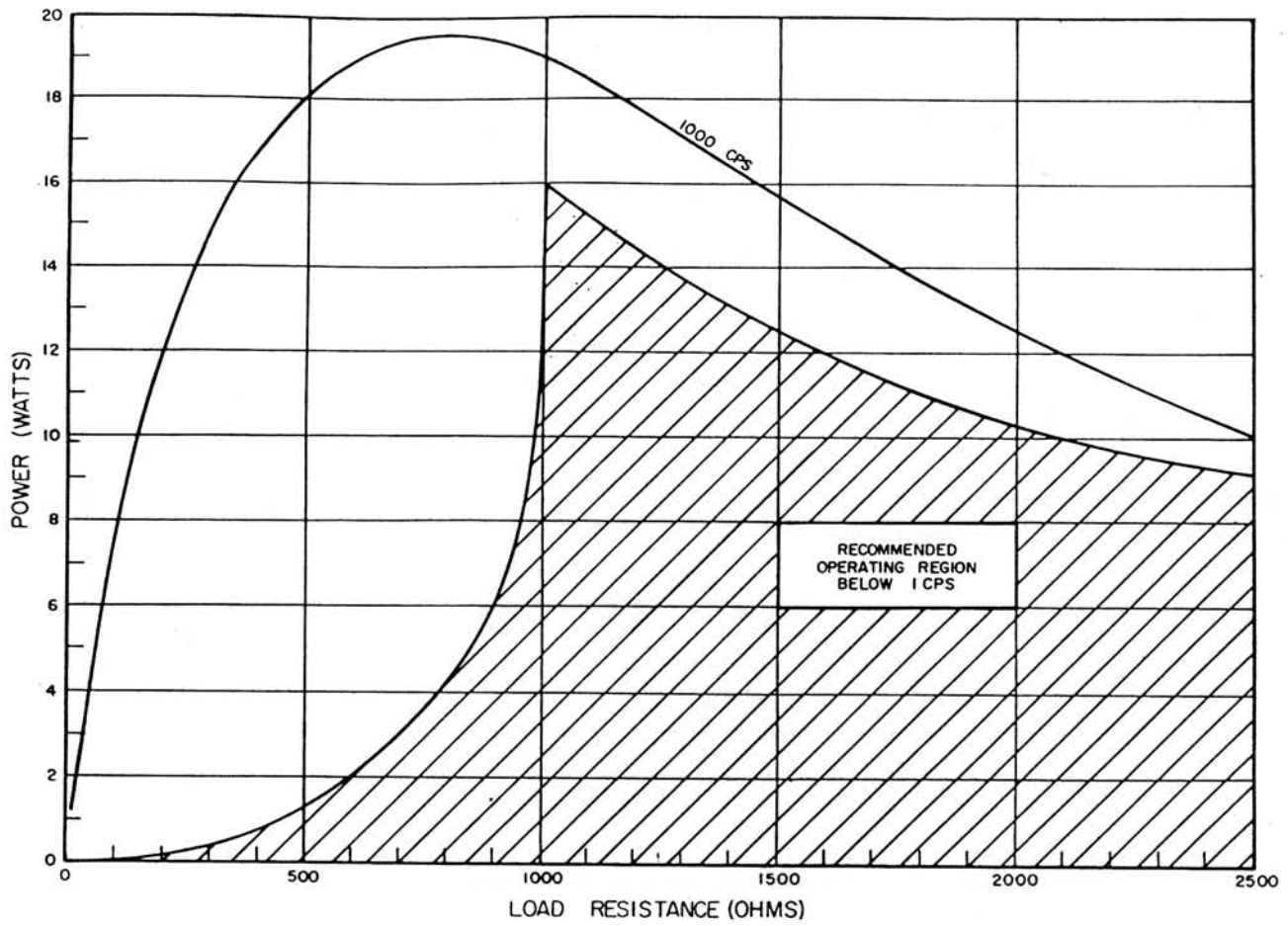


Figure 10. Typical RMS Output Current vs. Frequency, for Different Resistive Loads.



$$\text{RMS OUTPUT VOLTAGE} = \sqrt{\frac{1}{2} \times \text{Peak Power} \times R_L}$$

$$\text{RMS OUTPUT CURRENT} = \sqrt{\frac{\text{Peak Power}}{2 \times R_L}}$$

Figure 11. Model DCA-10 Power Output vs. Load.

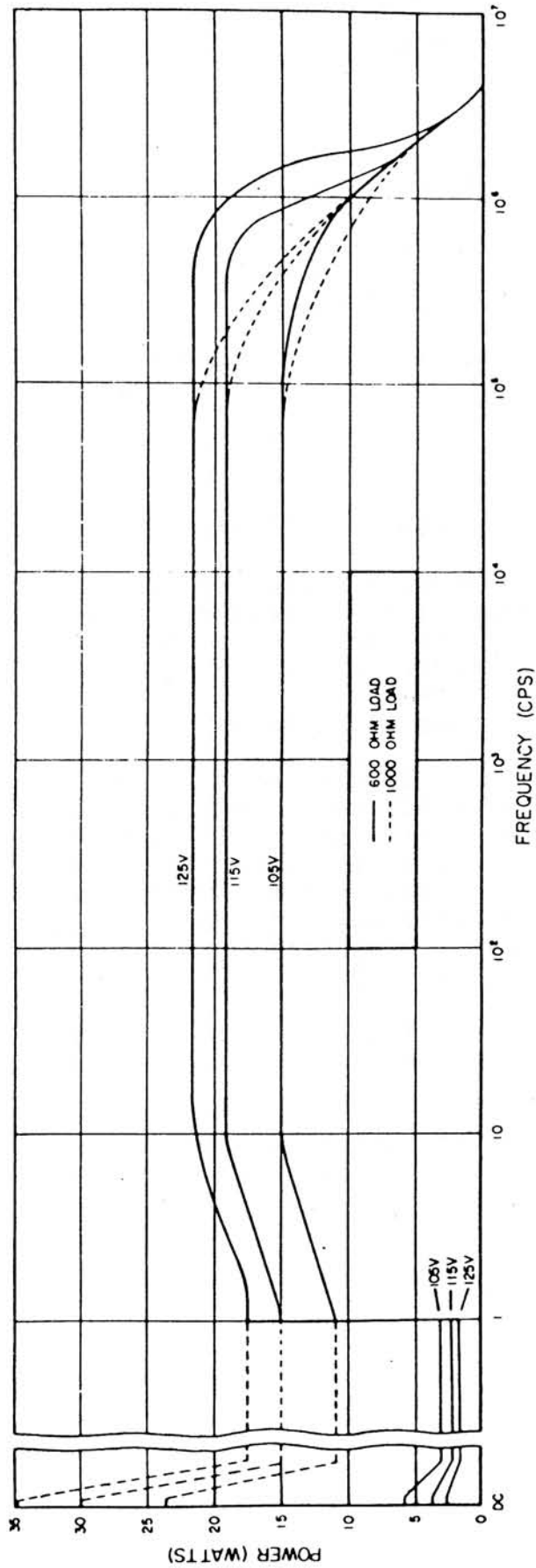


Figure 12. Model DCA-10 Power Output vs. Frequency

SECTION 3
INCOMING INSPECTION

3.1 Introduction

Upon receipt of the Transformer, unpack it carefully and check for any signs of damage that may have occurred in transit. If damage is suspected, visible or otherwise, do not attempt to use the Transformer; instead, file a claim with the carrier, and notify Krohn-Hite immediately.

The following procedure is provided to insure that the Transformer and its operating controls and connectors are working properly.

3.2 Procedure

The following equipment is required to test the Model MT-56:

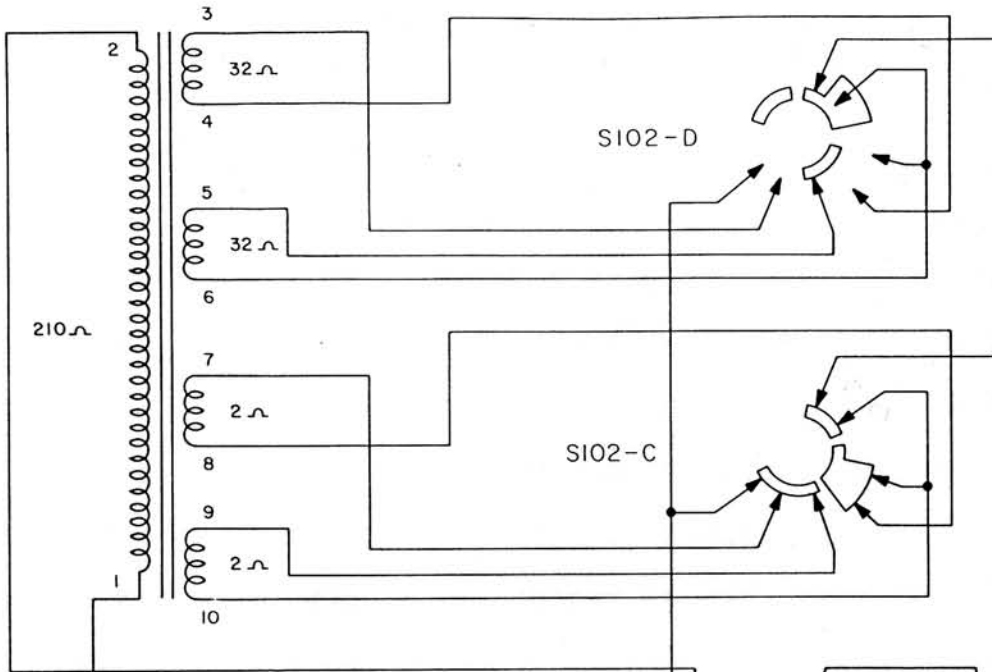
- 1) AC signal source that will provide 10 volts RMS into approximately 200 ohms with a frequency range of at least 1 kHz to 100 kHz. It will be used to check the Transformer's primary-to-secondary turns ratios.
- 2) AC voltmeter, for use with above.

Connect the AC signal source to the input of the Transformer; set the Transformer's FREQUENCY RANGE switch to the low-frequency (30 Hz - 10 kHz) position. Set the signal source frequency to 10 kHz and adjust its output for 10 volts RMS. Measure the open-circuit output of the Transformer in each position of the LOAD IMPEDANCE switch; for load settings of 2/6, 8/24, 32/96 and 128/384, the output voltage should be 1, 2, 4 and 8 volt respectively, $\pm 20\%$.

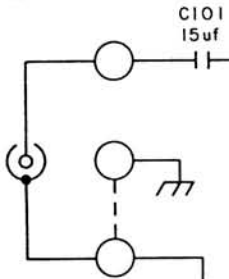
Repeat this with the FREQUENCY RANGE switch set to the high frequency (10 kHz - 500 kHz) position, and the signal source frequency to 100 kHz.

If the above tests check out satisfactorily, then the Transformer is working properly. If one or more of these steps do not pass, then contact our Factory for instructions.

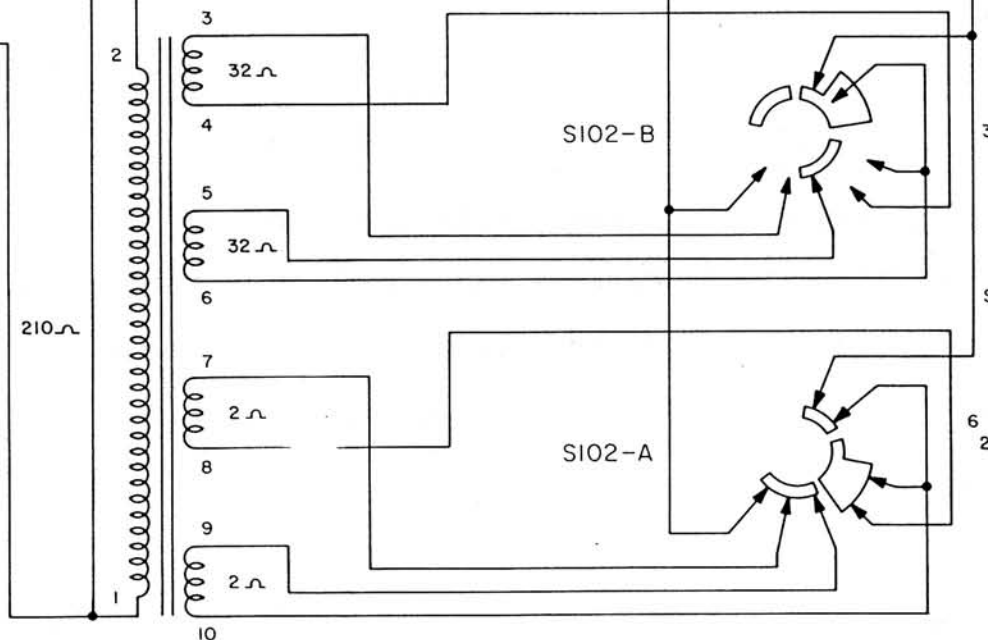
HIGH
FREQUENCY
TRANSFORMER
T102



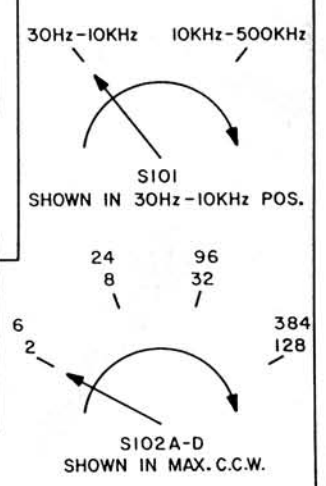
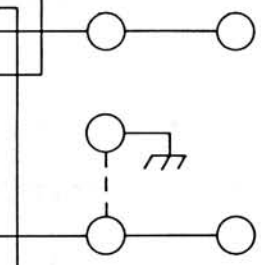
INPUT
REAR FRONT



LOW
FREQUENCY
TRANSFORMER
T101



OUTPUT
FRONT REAR



| | | | |
|--------------------------------------|-----------------------|--|---|
| TITLE MATCHING TRANSFORMER | | THIS DRAWING AND INFORMATION IS PROPRIETARY AND UNAUTHORIZED REPRODUCTION FORBIDDEN. | |
| TOLERANCES | FRACTIONS | DECIMALS | ANGLES |
| | $\frac{\quad}{\quad}$ | 0.001 | 15 |
| MODEL MT-56 | DRN BY J. Ashby | DATE 12-28-76 | KROHN-HITE CORPORATION CAMBRIDGE, MASS. U.S.A. |
| SCALE | CVD BY | DATE | |
| APP BY | DATE | APP BY | DATE |
| DWG NO C-3808 | | | REV. |
| SHEET | | | OF |

PARTS LIST

| <u>SYMBOL</u> | <u>DESCRIPTION</u> | <u>MFR.</u> | <u>PART NO.</u> |
|---------------|---------------------------------|-------------|-----------------|
| C101 | 15 uf 10% 165 VAC | CD | SERIES KK |
| S101 | SWITCH, ROTARY, FREQUENCY RANGE | KH | B-2092-B |
| S102 | SWITCH, ROTARY, LOAD IMPEDANCE | KH | B-2091-B |
| T101 | TRANSFORMER, LOW FREQUENCY | KH | P-100-53 |
| T102 | TRANSFORMER, HIGH FREQUENCY | KH | P-100-86 |
| --- | BINDING POST, BLACK (5 REQ'D) | SUP | DF21BC |
| --- | BINDING POST, RED (3 REQ'D) | SUP | DF21RC |
| --- | CONNECTOR, BNC | KH | B2440 |
| --- | HANDLE, RACK (2 REQ'D) | KH | H-3 |
| --- | KNOB (2 REQ'D) | KH | B2519-1-E |
| --- | STRAP, GROUNDING (2 REQ'D) | GR | 938L |

MANUFACTURERS' CODE

| | | |
|-----|---------|-------------------------------------|
| CD | (88419) | Cornell Dubilier, Norwood, MA |
| GR | () | General Radio Co., West Concord, MA |
| KH | (88865) | Krohn-Hite Corporation, Avon, MA |
| SUP | (58474) | Superior Electric Co., Bristol, CT |