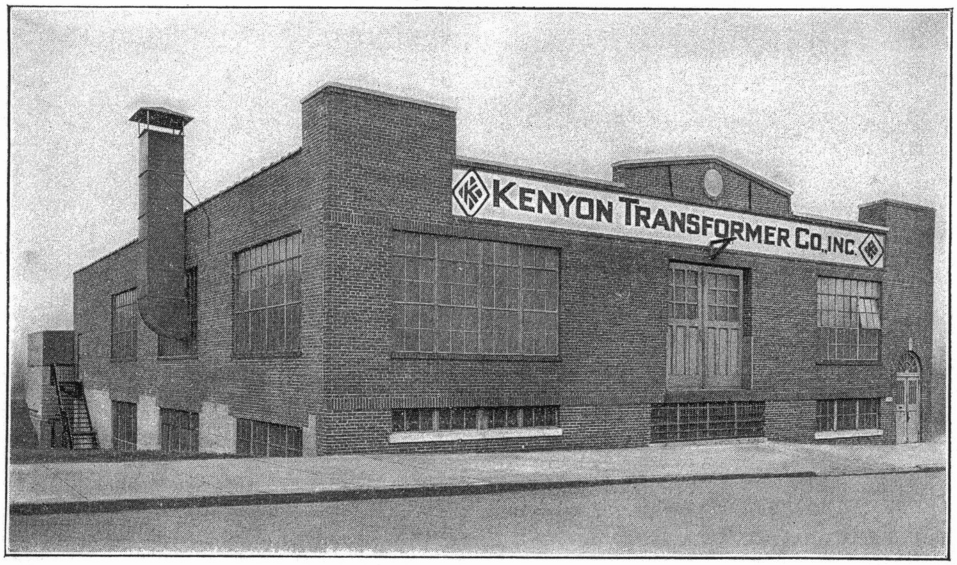
CATALOG

Number Two



KENYON TRANSFORMER CO., Inc.
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INDEX TO AUDIO TRANSFORMER TYPE NUMBERS

LINE TO LINE TRANSFORMERS

K-100 Multiple 500 ohm line to multiple 500 ohm line.

LINE TO GRID TRANSFORMERS

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K-201 Multiple line to Push-Pull grids. (For low level operation)

K-202 Dynamic microphone or low impedance line to Single grid.

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K-414 Push-Pull 6L6's operated class AB with no grid current (8500 or 6000 ohms plate to plate) to Multiple 500 Ohm Line.

K-415 Push-Pull 6L6's operated class AB with no grid current (8500 or 6000 ohms plate to plate) to Multiple Voice Coil Line.

K-416 Push-Pull 6L6's operated class AB with no grid current (6600 or 3800 ohms plate to plate) to Multiple 500 ohm Line.

K-417 Push-Pull 6L6's operated class AB with no grid current (6600 or 3800 ohms plate to plate) to Multiple Voice Coil Line.

K-418 Push-Pull 6L6's operated class AB with grid current. (6000 or 3800 ohms plate to plate) to Multiple 500 ohm Line.

K-419 Push-Pull 6L6's operated class AB with grid current. (6000 or 3800 ohms plate to plate) to Multiple Voice Coil Line.

KENYON

LABORATORY STANDARD
» » Line to Line Transformer

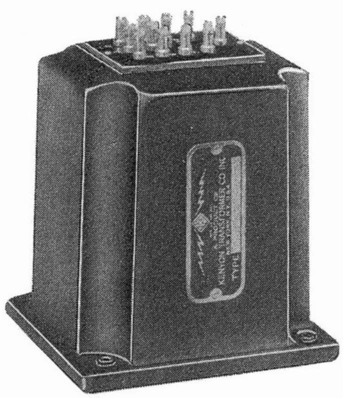
TYPE K-100

List Price. . . . $20.00

GENERAL APPLICATIONS

Transformer type K-100 has a unity impedance ratio total primary to total secondary. The unit was fundamentally designed to act as a circuit isolation device. The Kenyon Multiple Line impedance arrangement, supplied on both primary and secondary, provides for a wide range of impedance terminations varying from 50 to 500 ohms.

The audio engineer frequently encounters the necessity for an isolating transformer. A few practical applications of transformer K-100 are given below.



Top Mounting

In bridge circuits ease and accuracy of balance are dependent upon isolating the elements of the bridge from all outside sources of disturbance or difference of potential to ground. These conditions are realized in transformer K-100 through the balanced coil construction of the transformer and the copper electrostatic shield between the primary and secondary.

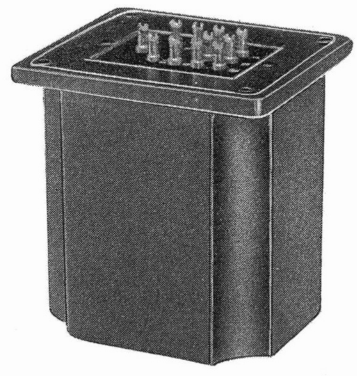
There are also applications when it is desirable to ground one side or the center tap of a transmission line. The generator or source impedance may already be grounded. The insertion of an isolation transformer between the generator (or source impedance) and the line will permit the operator to ground the line at any point without changing the constants of the circuits involved.

The variety of impedance terminations provided for with type K-100 make it valuable for use in mixer circuits. It can be used to couple a carbon microphone, dynamic microphone, or low impedance pickup to the Multiple Line secondary.

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

Electrostatic shielding is very important in a unit such as type K-100 because of the great amount of gain often succeeding it. Any radio frequency pick-up or interference effects of a longitudinal nature are coupled capacitively from primary to secondary. The resultant noises may be amplified as much as 130 DB if an electrostatic shield is not provided between these windings. The complete electrostatic shield incorporated between the primary and secondary coils of the type K-100 forms a perfect barrier against any interference of this type.

The coil structure employed in this transformer is of the type frequently referred to as self shielding, hum bucking, or hum cancellation. This type of construction consists of a core which approaches a toroidal shape. Identical coils are placed on each side of this core. Any stray field of an audio or radio frequency which cuts the windings of the unit will induce equal and opposite voltages in each of the coils. Since these coils are connected in series, the two induced voltages add to zero, thus cancelling the effects of the interference voltages. The unit is further shielded by a high permeability cast case which reduces pickup by 18 DB.



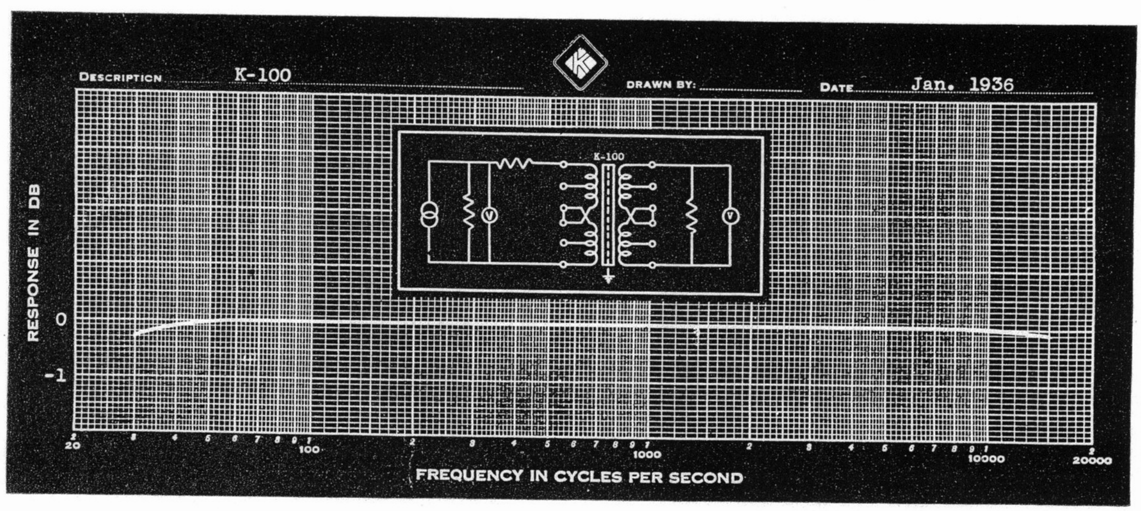
Bottom Mounting

DESIGN CONSIDERATIONS

The low frequency response of transformer K-100 is dependent upon the primary inductance. The reactance of this winding must be sufficiently high to provide a minimum shunting effect at the lowest frequencies to be transferred. When the reactance of the primary of a transformer, whose secondary is properly loaded, is twice the impedance of the line or source from which it is working, the frequency response is impaired by ½ DB. The primary of transformer K-100 must have a reactance of at least 1000 ohms at 30 cycles when working out of a 500 ohm line. The primary inductance of this unit has been kept high through the use of a special high permeability core material.

The high frequency response of K-100 is determined almost entirely by the leakage reactance between primary and secondary. Since the highest impedance of either winding is 500 ohms, the effect of distributive or mutual capacity is small enough to be neglected at frequencies within the audio range. Leakage reactance acts like a small reactor in series between primary and secondary. The impedance of this leakage reactance increases directly with frequency as does the voltage drop across it. Assume that two volts is fed by a generator into a transformer having a leakage reactance of 500 ohms at 10,000 cycles. Nine tenths volts will appear across the internal impedance of the generator, nine-tenths volts across the secondary load and nine-tenths volts across the leakage reactance. (This statement is made on the assumption that the secondary load is a pure resistance.)

At 60 cycles the impedance of the leakage reactance is negligible. Two volts at this frequency will divide equally, 1 volt across the generator impedance and 1 volt across the secondary load. The difference in power output between the



two cases is 1 DB indicating a 1 DB loss at 10,000 cycles. The leakage reactance in type K-100 has been kept to such a value that the loss is not more than ½ DB at 15,000 cycles.

SPECIAL APPLICATIONS

The rated impedance terminations provided by this transformer are given in the specifications. A great many other combinations may be obtained by the audio engineer at a slight sacrifice of performance characteristics.

The following considerations will apply if it is desired to couple a 5 ohm source to a 50 ohm load. The 5 ohm load is connected to the terminals rated for 50 ohms and the 50 ohm load connected to the terminals rated for 500 ohms. This provides the proper ratio from primary to secondary although each winding is operating at an impedance of one-tenth of its rated value. The low frequency response will be improved by an amount which will be seen from the following consideration of the effects of primary reactance. The 50 ohm winding was designed to have sufficient reactance to develop a maximum loss of ½ DB at 30 cycles when working out of a 50 ohm source. This winding, working out of 5 ohms, will develop sufficient reactance to prevent a loss greater than ½ DB at one-tenth of the frequency. The frequency response curve will show a ½ DB loss at 3 cycles. The same system of reasoning will apply to the computation of the high frequency response of the transformer used in this application. Leakage reactance is practically the only limitation on the high frequency response of this unit. The effect of leakage reactance in this application will be ten times as great as when the item is connected to impedances for which it is rated. This indicates that the frequency response will fall off ½ DB at 1500 cycles.

Suppose it is desired to couple a 1000 ohm source to a 1000 ohm load. This is the opposite extreme to the example given above. The 1000 ohm source would be connected to the primary terminals rated for 500 ohms and the 1000 ohm load would be connected to the secondary terminals rated for 500 ohms. In this case the impedance ratio is correct but the impedance connected to the terminals of the transformer is twice that for which it was designed.

Under these conditions the primary has only ½ enough inductance to insure good response down to 30 cycles. At 60 cycles the reactance is approximately twice that at 30 cycles so the loss at 60 cycles will be ½ DB. The high frequency response instead of being impaired will in this case be improved, since the leakage reactance of this transformer is of such a value as to cause a loss not greater than ½ DB when 500 ohms are connected to the input and output terminals. The comparative effect when 1000 ohms are connected to these terminals is one half as great. This indicates that the frequency response at 15,000 cycles will be impaired by less than ½ DB.

ELECTRICAL SPECIFICATIONS

The following detailed electrical characteristics are supplied for the assistance of the audio engineer in the application of this transformer in practical communication and measuring circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response curve shown below was made at a level of − 30 DB

Primary and Secondary Impedances — 50, 125, 200 (balanced) 250, 333, and 500 ohms (balanced)

Maximum Level — + 26 DB

Minimum Level — The frequency response characteristics illustrated, will be maintained at all levels between a maximum level of + 26 DB and a minimum level of − 30 DB. If this transformer is operated at levels below − 30 DB the low frequency response will be impaired. At − 90 DB the response at 30 cycles will be down 1 DB.

Pri. Inductance —
7 hy at 30 cycles at − 30 DB
10 hy at 30 cycles at zero level
15 hy at 60 cycles with 25 volts applied

Pri. D.C. Resistance — 30 ohms (total pri. or total sec.)

Maximum Primary D.C. Current — 100 MA (balanced)

Coil Structure — Hum cancellation type composed of symmetrical sections balanced for inductance, capacity, and resistance

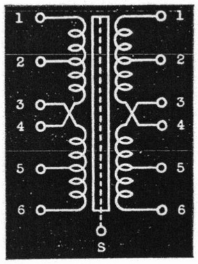
Core Material — High-permeability alloy

Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc., cancels the effect of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a heavy high permeability cast case.

Electrostatic Shielding — Copper shield between primary and secondary minimizes electrostatic coupling

Insulation Test Voltage — 750 volts

Terminal Arrangement

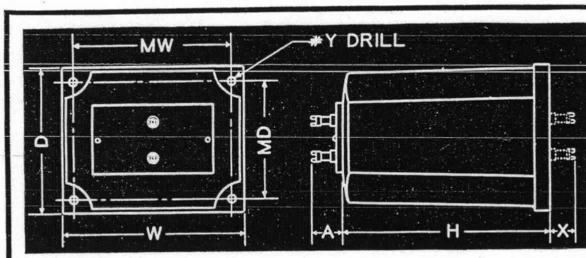


PRIMARY AND SECONDARY TERMINALS
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

ELECTROSTATIC SHIELD
Terminal "S" connects to shield between primary and secondary and to core. The core is insulated from the case.

MECHANICAL SPECIFICATIONS

Transformer K-100 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-100

Casting Type. T1

Approx. Weight. . . . . 3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾"	3½"	3⅛"	2 13/16"	2 7/16"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from the date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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KENYON

LABORATORY STANDARD

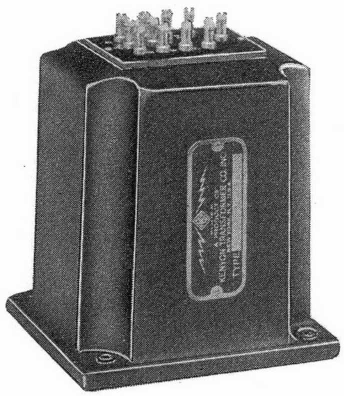
» » Line to Grid Transformer

TYPE K-200

List Price. . . . $25.00

GENERAL APPLICATIONS

Transformer K-200 is designed to operate from a low impedance transmission line to grid of a single tube operated class A. The primary is supplied with the Kenyon Multiple Line impedance arrangement which provides for a wide range of input terminations from 50 to 500 ohms. This transformer was primarily designed to operate at low levels (− 80 DB to − 90 DB) and still develop the frequency response characteristic specified below. This is an important and distinguishing characteristic of this unit. There are many line to grid transformers commercially available, only a few of which will maintain their rated frequency response specifications at − 90 DB. The low frequency response of most of these transformers falls off at levels below − 40 DB. The frequency response of K-200 is guaranteed to be within the limits of ± ½ DB from 30 to 15,000 cycles at all levels between + 26 DB and − 90 DB. Because of this fact this transformer has found many applications coupling from a dynamic or velocity ribbon microphone line, to grid of a low level pre-amplifier system.



Top Mounting

ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING

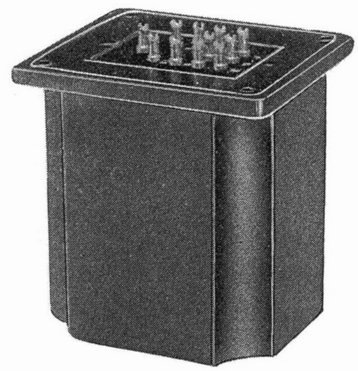
Electrostatic shielding is very important in a unit such as type K-200 because of the great amount of gain succeeding it. Any radio frequency pick-up or interference effects of a longitudinal nature are coupled capacitively from primary to secondary. The resultant noises may be amplified as much as 130 DB if an electrostatic shield is not provided between these windings. The complete electrostatic shield incorporated between the primary and secondary coils of the type K-200 forms a perfect barrier against any interference of this type.

The coil structure employed in this transformer is of the type frequently referred to as self-shielding, hum-bucking, or hum-cancellation. This type of construction consists of a core which approaches a toroidal shape. Identical coils are placed on each side of this core. Any stray field of an audio or radio frequency which cuts the windings of the unit will induce equal and opposite voltages in each of the coils. Since these coils are connected in series, the two induced voltages add to zero, thus cancelling the effects of the interference voltages. The unit is further shielded by a high-permeability cast case which reduces pick-up by 18 DB.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with low level input transformers is essential to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information.

While type K-200 operates satisfactorily at any level from − 90 to + 26 DB it is primarily designed for the extremely low levels. The rated frequency response of this transformer at − 90 DB has been maintained only by careful consideration of the following facts. The primary inductance of any transformer is directly proportional to the permeability of the core material used — all other things being constant. The permeability of all steels is effected by the A.C. flux density. At extremely low levels — −90 DB for instance, only 35 micro-volts is applied to the primary. This means that the A.C. flux density is only a fraction of gausse. The permeability of the core material diminishes as the flux density diminishes. This means that in order to have sufficient inductance to provide good low frequency response the highest grade of core material available must be used, and the cross sectional area of the core must be kept large. Which in turn means that extreme caution must be taken in the distribution of the windings to provide good high frequency response.



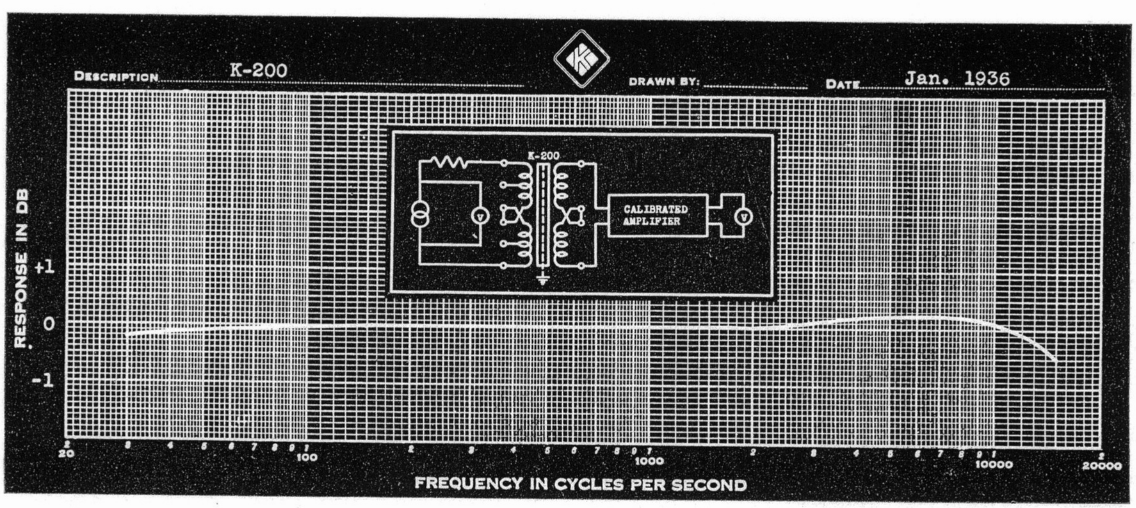
Bottom Mounting

A high quality transformer of this type is the product of the correlation of these design considerations. The Kenyon Transformer Co., Inc., sincerely believes that this has been done successfully in transformer K-200.

SPECIAL APPLICATIONS

The Multiple Line incorporated in the primary of this unit provides for a wide range of impedance terminations. However, the following data is given for the assistance of engineers who find it necessary to use type K-200 in applications other than those for which it was designed.

If it is desired to couple a 20 ohm source to a single grid the following conditions will hold. The 20 ohm source should be connected to the terminals normally used for a 50 ohm source. Since the 50 ohm winding supplies sufficient inductance to maintain the frequency response on the low end within ½ DB down to 30 cycles there will be more than ample inductance for a 20 ohm source. Since reactance varies directly as fre-



quency the low frequency response in this case will be extended to ⅖ times 30 cycles or to 12 cycles. The high frequency response of a unit such as this, where step-up ratio must be high and secondary impedance correspondingly high, is governed by two factors; leakage reactance and the combined effect of distributive and mutual capacity. Leakage reactance appears like a small choke coil in series between primary and secondary. Distributive capacity appears like many small condensers shunting the turns of the secondary. Mutual capacity appears as a condenser shunting the high impedance side of the secondary to ground. At the higher frequencies these values of capacity and leakage tend to resonate producing either dips or peaks in the frequency characteristic curve. This unit has been so designed that with rated primary terminations the dips or peaks do not appear in the audio range. A change in primary impedance also results in change in the effects of capacity and leakage reactance. If the primary impedance is cut in half the secondary impedance is also effectively cut in half. If the secondary impedance is lower than the rated value, the detrimental effect of capacity and leakage reactance will be reduced. When working out of a 20 ohm source the high frequency response will therefore be improved.

If it is desired to work from 1000 ohm line, the following conditions will hold. The 1000 ohm line should be connected to the terminals indicated for a 500 ohm line. In this case the primary inductance will be only one half of the inductance required to maintain the frequency response to within ½ DB at 30 cycles. Since reactance increases directly with frequency, the primary reactance at 60 cycles will be sufficient to hold the response to a loss of ½ DB. The loss at 30 cycles will be approximately 1 DB. An increase in primary impedance will result in an increase in secondary impedance, which in turn will increase the apparent effect of capacity and leakage. This will cause poor response at the higher frequencies, seriously impairing any response over 5000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles. The frequency response curve illustrated was made at a level of − 90 DB.

Primary Impedance — 50, 125, 200 (balanced) 250, 333 and 500 ohms (balanced)

Secondary Impedance — 75,000 ohms

Maximum Level — + 26 DB

Minimum Level — − 90 DB

Primary Inductance —

10 hy at 30 cycle at — 90 DB
12 hy at 30 cycles at — 50 DB
18 hy at 30 cycles at — zero level
23 hy at 60 cycles with 10 volts applied

Coil Structure — Hum cancellation type composed of inductively, capacitively and magnetically balanced sections.

Core Material — High-permeability alloy

Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc., cancels the effects of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a heavy high-permeability cast case.

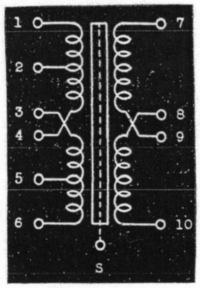
Primary D.C. (balanced) — 60 MA

Primary D.C. Resistance — 35 ohms (total pri.)

Electrostatic Shielding — Copper shield between primary and secondary minimizes electrostatic coupling.

Insulation Test Voltage — 750 volts.

Terminal Arrangement —



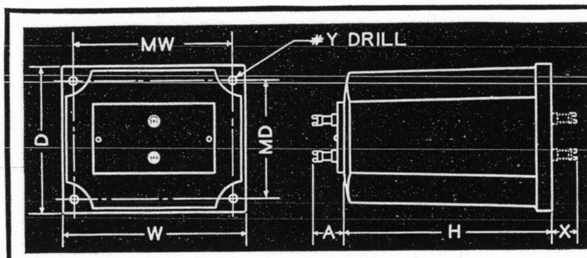
PRIMARY TERMINALS:
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

ELECTROSTATIC SHIELD:
Terminal "S" connects to shield between primary and secondary and to core. The core is insulated from the case.

SECONDARY TERMINALS:
Grid — connect to 10
Cathode return — connect to 7
Join — 8 and 9

MECHANICAL SPECIFICATIONS

Transformer K-200 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-200

Casting Type. T1

Approx. Weight. . . . . .3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾"	3½"	3⅛"	2 13/16"	2 7/16"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from the date of purchase.

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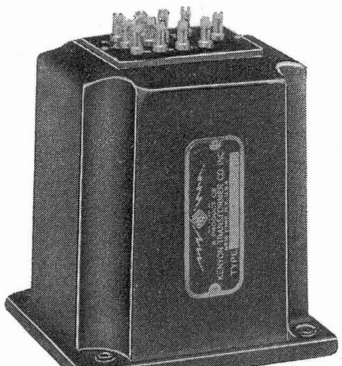
LABORATORY STANDARD
» » Line to Grid Transformer

TYPE K-201 **List Price. . . .$25.00**

GENERAL APPLICATIONS

Transformer K-201 is designed to operate from any low impedance source—pickup, carbon microphone, or transmission line—to push pull class A grids, e.g., push pull 56, 76, 6C6, 45, 2A3, 2A5, 6L6, 845, or 50 grids. The primary is supplied with the Kenyon Multiple Line impedance arrangement which provides for terminations varying from 50 to 500 ohms. This unit will develop the rated frequency response at any level from – 90 DB to + 28 DB.



Top Mounting

ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING

Electrostatic shielding is very important in a unit such as type K-201 because of the great amount of gain succeeding it. Any radio frequency pickup or interference effects of a longitudinal nature are coupled capacitively from primary to secondary. The resultant noises may be amplified as much as 130 DB if an electrostatic shield is not provided between these windings. The complete electrostatic shield incorporated between the primary and secondary coils of the type K-201 forms a perfect barrier to any interference of this type.

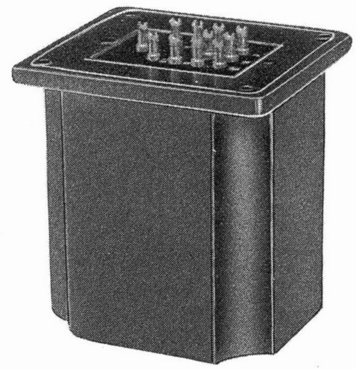
The coil structure employed in this transformer is of the type frequently referred to as self shielding, hum bucking, or hum cancellation. This type of construction consists of a core which approaches a toroidal shape. Identical coils are placed on each side of this core. Any stray audio or radio frequency fields which cut the windings of the unit will induce equal and opposite voltages in each of the coils. Since these coils are connected in series, the two induced voltages add to zero thus cancelling the effects of the interference voltages. The unit is further shielded by a high permeability cast case which reduces pickup by 18 DB.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with all low level input transformers is essential to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information.

An important and distinguishing characteristic of K-201 is the fact that this transformer will operate satisfactorily at any level from – 90 DB to + 28 DB. The rated frequency response at – 90 DB has been maintained only by careful consideration of the following facts. The primary inductance of any transformer is directly proportional to the permeability of the core material used — all other things being constant. The permeability of all steels is effected by the AC flux density. At extremely low levels, – 90 DB for instance, only 35 microvolts is applied to the primary. This means that the AC flux density is only a fraction of a gausse. The permeability of the core material diminishes as the flux density diminishes. This means that in order to have sufficient inductance to provide good low frequency response the highest grade of core material available must be used, and the cross sectional area of the core must be kept large. Which in turn dictates extreme caution in the distribution of the windings to provide good high frequency response.

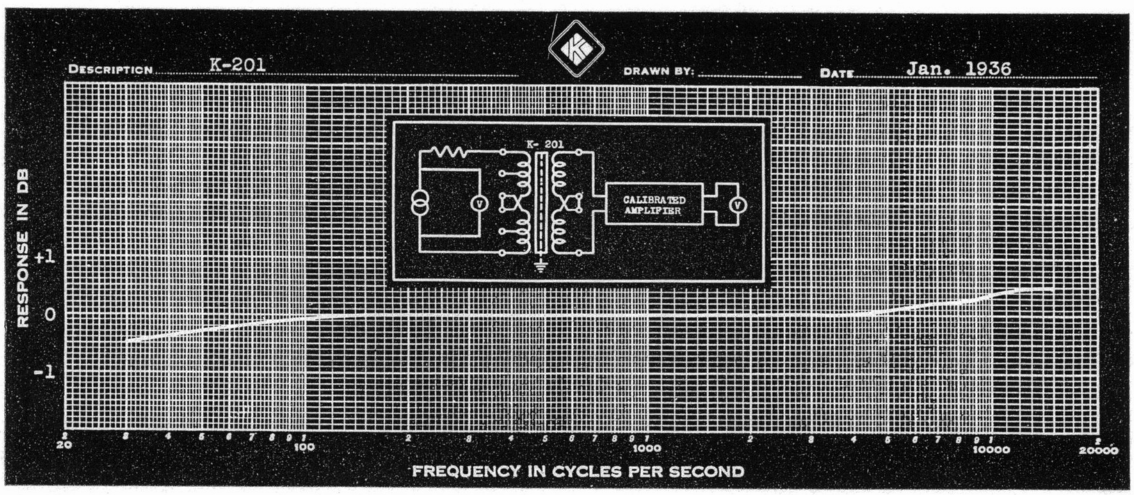
A high quality transformer of this type is the product of the correlation of these design considerations. The Kenyon Transformer Co., Inc., sincerely believes that this has been done successfully in transformer K-201.



Bottom Mounting

SPECIAL APPLICATIONS

The audio engineer may encounter the necessity for coupling impedances not provided for on the multiple line primary. The examples given below are for his guidance in estimating the performance of K-201 under different operating conditions. As a basis for this estimate, let us consider the factors controlling the low frequency and the high frequency response of a line to grid transformer. In order to insure good low frequency response, the primary inductance is kept to a maximum. The primary reactance is proportional to frequency and primary inductance. When the primary reactance is three times the value of the impedance of the line from which the transformer works, a loss of ½ DB occurs. This loss is caused by the shunting effect of the primary which draws current for internal losses. The power represented by this current is not available for transfer to the secondary. The high frequency response is governed by three factors: leakage reactance, distributive capacity, and mutual capacity. Leakage reactance is like a small reactor between primary and secondary; distributive capacity is like a large number of small condensers shunted from turn to turn in the windings; mutual capacity is like a condenser connected from the high impedance side of the windings to the electrostatic shield or to the core. The voltage appearing on the grids is that which appears across the lumped value of distributive and mutual



capacity. In any circuit which contains capacity and inductance, there is a frequency at which this combination resonates. The impedance of a series resonant circuit is determined by the losses which occur in the inductor and in the capacitor. If the losses in these branches of the circuit are sufficiently low the impedance of the components at resonance will be higher than the natural impedance of the secondary of the transformer. This means that the voltage appearing across the capacitor will be greater than that normally appearing across the secondary. When a condition such as this occurs, it produces a resonant peak in the frequency characteristic curve. At frequencies higher than this resonant point the lumped capacity effects act as a shunt across the secondary. When this shunt impedance is of the order of the impedance of the secondary, it produces a loss which is proportional to frequency. If the losses in the leakage reactance and the capacity are great enough the impedance of the components of the resonant circuit will be less than the natural impedance of the secondary of the transformer. When this is true, the voltage appearing across the capacity at resonance will be less than that normally appearing across the secondary. A resonant dip in the frequency response is the result of such a condition.

With these facts in mind, we will proceed to estimate the frequency response under various conditions other than those for which the unit was designed. Suppose a 10 ohm line is connected to the terminals rated for 50 ohms. The primary reactance is sufficient so that the shunting effect on a 50 ohm line causes a loss of only ½ DB at 30 cycles. As reactance (inductance being constant) is directly proportional to frequency, we see that there is sufficient primary reactance to insure a loss of only ½ DB at one-fifth the frequency (6 cycles) when the input impedance is 10 ohms. Since the primary impedance is reduced, the secondary impedance will be reduced by a corresponding ratio. When this occurs the relative effect of resonant conditions in the secondary, or of shunting capacity, is decreased. This indicates improved high frequency response (a loss of slightly less than ½ DB at 15,000 cycles).

Now let us suppose it is necessary to couple a 1000 ohm line to push pull grids. The opposite reasoning from that shown above will follow in this case. The primary reactance at 30 cycles is only ½ as great as necessary to insure a maximum loss of ½ DB. Since reactance is proportional to frequency, it will be great enough at 60 cycles to insure this maximum loss of ½ DB. Since primary and secondary impedance have been increased by this mismatch the relative effect of resonant conditions or capacity shunting will have been increased also. The high frequency response will be seriously impaired over 5000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response curve illustrated was made at a level of − 90 DB.

Primary Impedance — 50, 125, 200 (balanced) 250, 333 and 500 ohms (balanced)

Secondary Impedance — 160,000 ohms (total sec.)

Maximum Level — + 28 DB

Minimum Level — − 90 DB

Pri. Inductance —
8 hy at 30 cycles at − 90 DB
10 hy at 30 cycles at − 50 DB
15 hy at 30 cycles at zero level
18 hy at 60 cycles with 10 volts applied

Coil Structure — Hum cancellation type composed of inductively, capacitively, and magnetically balanced sections.

Core Material — High-permeability alloy.

Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc.. cancels the effects of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a heavy high-permeability cast case.

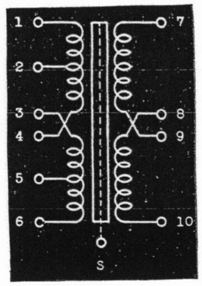
Primary D.C. (balanced) — 60 MA.

Primary D.C. Resistance — 61 ohms.

Electrostatic Shielding — Copper shield between primary and secondary minimizes electrostatic coupling.

Insulation Test Voltage — 750 volts.

Terminal Arrangement



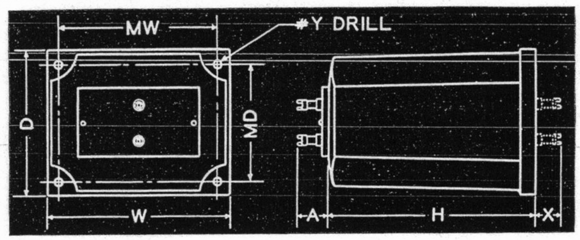
PRIMARY TERMINALS:
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

ELECTROSTATIC SHIELD:
Terminal "S" connects to shield between primary and secondary and to core. The core is insulated from case.

SECONDARY TERMINALS:
Grids — 7 and 10
Cathode return — join 8 and 9

MECHANICAL SPECIFICATIONS

Transformer K-201 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-201

Casting Type T1

Approx. Weight .... 3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾"	3½"	3⅛"	2 13/16"	2 7/16"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair, or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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New York, N. Y.

Cable Address:
SIMONTRICE-NEW YORK

Printed in U.S.A.

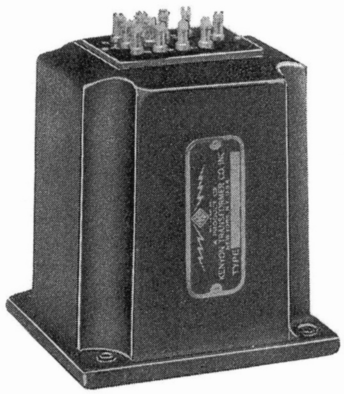
KENYON

LABORATORY STANDARD
» » Line to Grid Transformer

TYPE K-202 **List Price. . . .$25.00**

GENERAL APPLICATIONS

Transformer K-202 is designed to operate from a dynamic microphone or parallel mixer to the grid of a single tube operated class A. The primary is provided with a Multiple Low Impedance Line arrangement which provides for input sources of 7.5, 17, 30 or 67 ohms. This unit will develop the frequency response specified below at any level from − 90 DB to + 26 DB.



Top Mounting

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

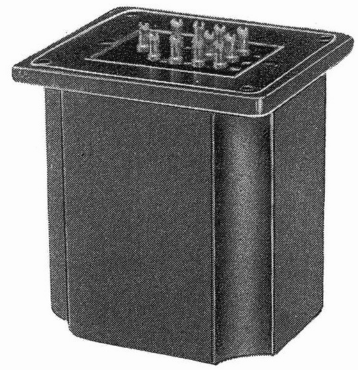
Radio frequency pickup and stray voltages of a longitudinal character may be amplified many times in a pre-amplifier before reaching the output of the main amplifier. This results in noisy reproduction and distortion. A complete electrostatic shield between windings is the best precaution against interference of this type. The Kenyon Transformer Co., Inc., has designed this unit with a copper shield between primary and secondary. This provides a perfect barrier to any such interference.

The coil construction of this unit is of the type frequently referred to as hum cancellation, hum bucking, or self shielding. The core is of a shape approaching toroidal, with identical coils so arranged that any stray audio or radio frequency fields induce equal and opposite voltages in each coil. Since these coils are connected in series the voltages cancel with the effective net result of no interference pickup. This unit is further shielded by a cast high permeability case which reduces electromagnetic pickup by 18 DB.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with all input transformers is essential to the audio engineer who selects and uses them. We are, therefore, presenting the following data for his guidance and information.

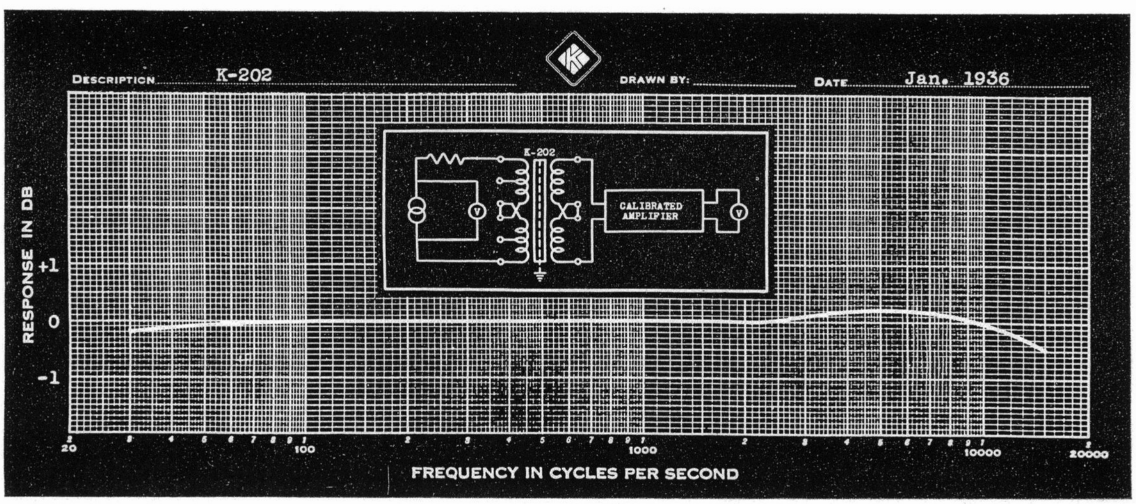
It will make the following considerations clearer if we first look at the equivalent circuit diagram of a transformer operated from a low impedance line to a high impedance grid. Let us assume we are working from a line whose impedance is 67 ohms. An equivalent circuit for this would be a generator whose internal impedance is zero with a 67 ohm resistor in series with it. The primary of the transformer would be connected at the end of this series resistor. Now the equivalent circuit diagram of the transformer would consist of three sections. First there would be an inductance shunted directly across the line. This represents the primary inductance of the transformer. In series with the line would be another inductance which represents the leakage reactance of the transformer. Shunted across the line, after this leakage inductance, is a condenser. This condenser represents the combined effect of the input capacity of the grid, mutual capacity of the transformer and distributive capacity of the transformer. The factors which limit high frequency or low frequency response may be seen immediately by a glance at such a simplifie dequivalent diagram.



Bottom Mounting

It will be seen that a loss will occur at low frequencies when primary reactance ($2\pi \times f \times$ primary inductance) decreases to a value of the same order as the resistance in series with the generator. This loss is caused by the exciting current which flows in the primary of the transformer. (Core loss being negligible exciting current is directly proportional to primary inductance). Any current of this sort which flows causes a voltage drop in the series resistor. This means that the impressed primary voltage is decreased by the amount of this drop.

The causes of the loss of high frequency response are a little more complicated than those for low frequency response as may be seen from the diagram. Leakage reactance and capacity are arranged in a series circuit. Since the grid impedance of the following tube is very high, leakage reactance will have no effect until the shunt capacity starts to draw current. At the higher frequencies the reactance of this shunt capacity decreases and the current through it increases in a like manner. This current causes a drop through the leakage reactance and thus a loss of transmitted secondary voltage. An effect such as this causes high frequency response to fall off gradually as frequency is increased. If the values of the capacity and inductance are such that resonance occurs within the audio range the effect on frequency response is more or less indeterminate. If the losses in the resonant branches are low, the voltage appearing across each of them will be greater than the voltage that normally appears across the secondary of the transformer. This indicates a peak in the frequency response. Conversely, if the losses are high the voltage appearing across each branch is less than that normally appearing across the secondary and a dip in the frequency response will result.



The A.C. permeability of all core materials decreases as the flux density decreases. The output of a dynamic microphone is only a few micro-volts. This extremely low voltage induces a flux density of the order of a fraction of a gausse in the core of a transformer. Because of the low level at which this unit operates and the low resultant density it has been necessary to use the best available alloy core material to provide sufficient inductance for the rated low frequency response. The primary of K-202 was designed with sufficient inductance to provide a maximum low frequency loss of ½ DB at 30 cycles when operated at a level of minus 90 DB. By proper coil design the factors controlling high frequency response have been kept to such a value that the maximum loss at 15,000 cycles is ½ DB.

SPECIAL APPLICATIONS

It is often necessary to use a transformer for some purpose other than for which it was designed. The following information is provided for the guidance of the audio engineer in the use of this unit in special applications.

Suppose it is necessary to couple a 3.7 ohm source to a single grid.The 3.7 ohm source should be connected to the terminals rated for 7.5 ohms. The grid connections should be made as rated. The primary reactance at 30 cycles with a 7.5 ohm generator is sufficient to cause a loss of ½ DB at 30 cycles. When the generator impedance is cut in half, only one half of the primary reactance is necessary to maintain the same response. Since reactance (inductance constant) is directly proportional to frequency, the frequency response will fall off only one half DB at 20 cycles. As previously noted the high frequency response of such a unit is governed largely by resonant conditions in the secondary, or by the shunting effect of mutual and distributive capacity. The relative effect of these limiting factors decreases with secondary impedance. It would be impossible to give an exact figure for this effect without careful measurement under actual operating conditions. It may be said however that the high frequency response will be at least as good as rated for a 7.5 ohm source.

Suppose it is desired to couple a source of 125 ohms impedance to a single grid. The 125 ohm source would be connected to the terminals rated for 67 ohms. The secondary would be connected in the standard manner. The primary winding has sufficient reactance to insure a loss of ½ DB at 30 cycles, when working out of a generator whose impedance is 67 ohms. When working out of a generator whose impedance is 125 ohms, the primary reactance will be only one half as great as is necessary to maintain 30 cycle response. This indicates a loss of 1 DB at 30 cycles or ½ DB at 60 cycles. As previously noted, the high frequency response is governed by the relative effect of leakage reactance, distributive capacity, and mutual capacity. This effect is proportional to the secondary impedance, which has been increased. The response of this unit under these conditions will be seriously impaired above 5000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response curve illustrated was made at a level of − 90 DB.

Primary Impedance — 7.5, 17, 30 (balanced), or 67 ohms (balanced)

Secondary Impedance — 75,000 ohms

Maximum Level — + 26 DB

Minimum Level — − 90 DB

Pri. Inductance —
1.0 hy at 30 cycles at − 90 DB
1.2 hy at 30 cycles at − 50 DB
1.75 hy at 60 cycles with 5 volts applied

Coil Structure — Hum cancellation type composed of symmetrical sections balanced for inductance, capacity, and resistance.

Core Material — High-permeability alloy

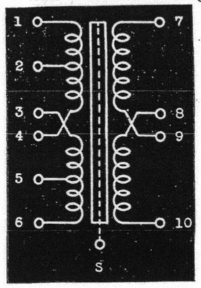
Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc., cancels the effects of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a high permeability cast case.

Primary D.C. Resistance — 2 ohms (total pri.)

Electrostatic Shielding — Copper shield between primary and secondary minimizes electrostatic coupling.

Insulation Test Voltage — 750 volts

Terminal Arrangement



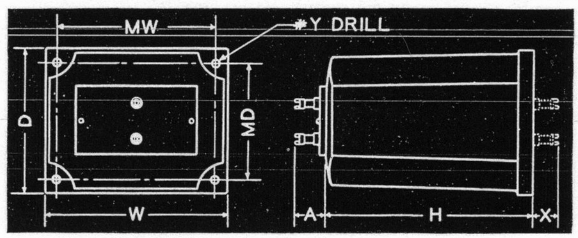
PRIMARY TERMINALS:
7.5 ohms — connect to 2 and 4, join 2 to 3 and 4 to 5
17 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
30 ohms — connect to 2 and 5, join 3 to 4
67 ohms — connect to 1 and 6, join 3 to 4

ELECTROSTATIC SHIELD
Terminal S connects to shield between primary and secondary and to core. The core is insulated from the case.

SECONDARY TERMINALS:
Grid — connect to 10
Cathode return — connect to 7
Join — 8 and 9

MECHANICAL SPECIFICATIONS

Transformer K-202 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-202
Casting Type T1
Approx. Weight .... 3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾″	3½″	3⅛″	2 13/16″	2 7/16″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair, or replacement must be shipped prepaid. This guaranty is effective for a period of five years from the date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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 Printed in U.S.A.

KENYON

LABORATORY STANDARD
« « Line to Grid Transformer

TYPE K-203

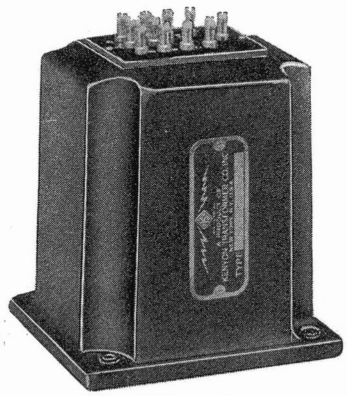
List Price $18.00

GENERAL APPLICATIONS

Transformer K-203 is designed to operate from a transmission line to the grid of a single tube (Class A).

The primary is the Kenyon Multiple Line with numerous impedance terminations ranging from 50 to 500 ohms.

ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING



Top Mounting

Radio frequency pickup and stray voltages of a longitudinal character may be amplified many times before reaching the final stage. This results in noisy reproduction and distortion. A complete electrostatic shield between windings is the best precaution against interference of this type. The Kenyon Transformer Co., Inc. has designed this unit with a copper shield between primary and secondary. This provides a perfect barrier to any such interference. The coil construction of this unit is of the type, frequency referred to as hum cancellation, hum bucking, or self-shielding. The core is of a shape approaching torroidal with identical coils so arranged that any stray audio or radio frequency fields induce equal and opposite voltages in each coil. Since these coils are connected in series, the voltages cancel with the effective net result of no interference pickup.

K-203 is shielded by a cast high permeability case which further reduces electromagnetic pickup by 18 DB.

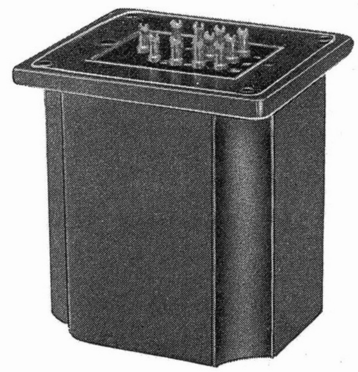
DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with all low level input transformers is essential to the audio frequency engineer who selects and uses them. The following data are presented for his guidance and information.

K-203 is designed to work at the medium audio levels; that is from − 30 DB to + 26 DB. It is similar in all other respects to type K-200. Type K-200 is provided with sufficient primary inductance to operate satisfactorily at levels down to − 90 DB. This adds extra expense to the construction of the unit.

It may be desired to use input transformers at the medium audio levels where the primary inductance at the much lower levels is unimportant. Since a unit of this sort may be manufactured at a reduction in cost, this reduction in cost is passed on to the consumer for applications for which K-203 will be fitted.

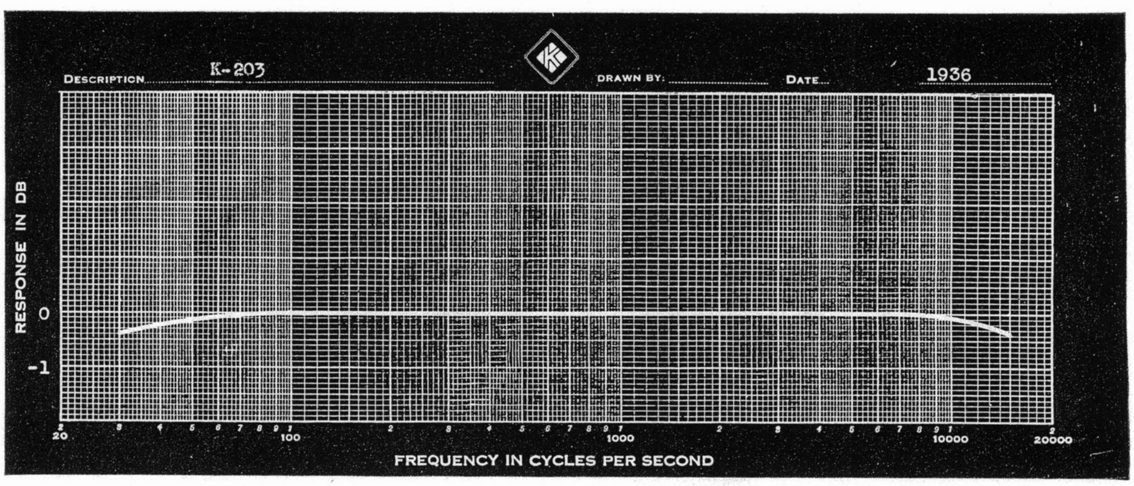
It will be easier to see what happens in an input transformer if we draw a simplified equivalent diagram of it. Let us assume we are working out of a 500 ohm line to the grid of a Class A tube. A 500 ohm line may be represented as a generator whose internal impedance is zero with a 500 ohm resistor in series with it. The primary of the coupling transformer may be represented as an inductance shunted across the line after this 500 ohm resistor. In series with the line will be a small value of inductance which represents the leakage inductance of the transformer. Shunted across the line after this inductance will be a condenser. This represents the lumped effect of the distributed capacity in the transformer, mutual capacity in the transformer, and the interelectrode capacity of the following tube.



Bottom Mounting

As it will be seen from this diagram, the low frequency response of the transformer will be controlled by the primary inductance. When the reactance of this inductance ($2 \pi \times f \times L$) becomes of a value of the order of 500 ohms, current will flow through the resistor in series with the generator. This current may be considered the exciting current of the transformer. It causes a voltage drop in the series resistor. The voltage available at the primary is then the generator voltage minus this drop. In order to keep low frequency response within ½ DB at 30 cycles, the reactance of the transformer primary must be at least 1500 ohms.

The calculation of high frequency response is more complicated. It will be seen from the diagram that we have a circuit with inductance and capacitance in series. The voltage which is applied to the grid of the following tube appears across the capacitance. The grid impedance for all practical purposes may be assumed as infinite. The only current flowing in the secondary will be caused by the lumped capacity effects. Thus, leakage reactance will be effective only at frequencies where the reactance of the shunting condenser is low enough to draw up an appreciable amount of current. Under these conditions a voltage drop occurs across the leakage reactance and across the shunting capacity. The voltage available to drive the grid of the following tube is the drop occurring across the capacitance. If the value of capacity is such that its reactance is of the order of the secondary impedance, the voltage appearing across it will be less than that normally appearing across the secondary. This indicates a falling off of response at the higher frequencies. If the values of leakage reactance and capacitance are such that resonance occurs, the



effect is indeterminate. When the losses in the two resonant arms of the circuit are sufficiently low, the voltage appearing across each will be greater than that normally appearing across the secondary. This would produce a resonant peak in the frequency response. If the losses in the two resonant arms are sufficiently high, the voltage appearing across each of them is less than that normally appearing across the secondary. This creates a resonance dip in the frequency response. Transformer K-203 has been so designed that the primary has sufficient inductance to insure response within ½ DB at 30 cycles when operating at a level from − 30 to + 26 DB. The values of leakage reactance, distributive capacity, and mutual capacity have been kept to such a point that the frequency response is linear up to 15,000 cycles within plus or minus ½ DB.

SPECIAL APPLICATIONS

It is often necessary to use a transformer for some purpose other than for which it was designed. The following information is provided for the guidance of the audio engineer in the use of this unit for special applications. Suppose it is necessary to couple a 1000 ohm source to A single Class A grid. The source should be connected to the terminals rated for 500 ohms. The secondary connections would be standard. Since the primary reactance at 30 cycles is sufficient to cause a loss of only ½ DB when the generator impedance is 500 ohms, it will be seen that the reactance is not great enough when working out of a 1000 ohm source. The relative shunting effect of primary reactance in this case will be twice as great as for rated application. This would indicate a loss of approximately 1 DB at 30 cycles and ½ DB at 60 cycles. The high frequency response will be impaired by an amount much greater than the low frequency response. When the primary impedance is doubled, the secondary impedance is increased in a like ratio. When this condition exists, the effect of distributive and mutual capacity is much greater. The frequency response would be seriously impaired over 5000 cycles.

Now let us suppose it is necessary to couple a 5 ohm source to a single Class A grid. The 5 ohm source would be connected to the terminals rated for 50 ohms. The effect of this mismatch on low frequency response may be seen by considering the amount of primary reactance on the 50 ohm tap. This reactance is great enough to insure good low frequency response when working out of a 50 ohm line. When working out of a 5 ohm line, it is ten times as great as necessary to insure good response at 30 cycles. From this reasoning, we may make an approximate statement that the response will be within ½ DB down to 3 cycles. Since the primary impedance has been reduced by a ratio of 10, the secondary impedance will have been reduced in a like ratio. This means that the relative effect of distributive and mutual capacity will be reduced also. The frequency response at the high end will be as good or better than for rated applications.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB − 30 to 15,000 cycles
The frequency response curve shown below was made at a level of − 30 DB.

Primary Impedance — 50, 125, 200 (balanced)
250, 333 and 500 ohms (balanced)

Secondary Impedance — 75,000 ohms

Maximum Level — + 26 DB

Minimum Level — − 30 DB

Primary Inductance —
10 hy at 30 cycles at — 30 DB
18 hy at 30 cycles at — 10 volts applied

Coil Structure — Hum cancellation type composed of inductively, capacitively, and magnetically balanced sections.

Core Material — High-permeability alloy.

Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc., cancels the effects of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a heavy high-permeability cast case.

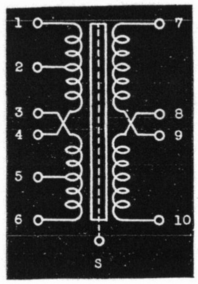
Primary D.C. (balanced) — 60 MA

Primary D.C. Resistance — 35 ohms (total pri.)

Electrostatic Shielding — Copper shield between primary and secondary minimizes electrostatic coupling.

Insulation Test Voltage — 750 volts.

Terminal Arrangement



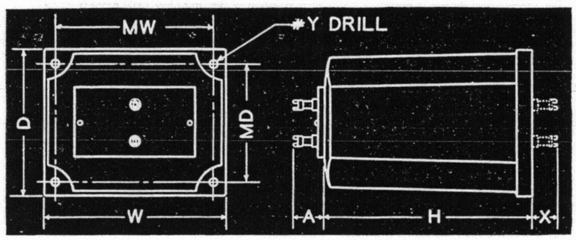
PRIMARY TERMINALS:
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

ELECTROSTATIC SHIELD:
Terminal "S" connects to shield between primary and secondary and to core. The core is insulated from the case.

SECONDARY TERMINALS:
Grid — connect to 10
Cathode return — connect to 7
Join — 8 and 9

MECHANICAL SPECIFICATIONS

Transformer K-203 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No K-203

Casting Type T1

Approx. Weight .... 3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾″	3½″	3⅛″	2$\frac{13}{16}$″	2$\frac{7}{16}$″	½″	$\frac{5}{16}$″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from the date of purchase.

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Cable Address:
SIMONTRICE-NEW YORK

KENYON

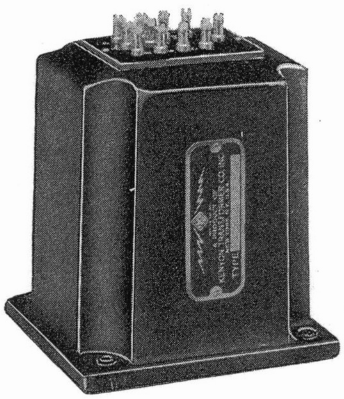
LABORATORY STANDARD
» » Line to Grid Transformer

TYPE K-204 | **List Price $12.00**

GENERAL APPLICATIONS

Transformer K-204 is designed to operate from a transmission line to the grid of a single tube. The primary is a Kenyon Multiple Line with impedance terminations ranging from 50 to 500 ohms.

ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING



Top Mounting

Radio frequency pickup and stray voltages of a longitudinal character may be amplified many times before reaching the output stage. This results in noisy reproduction and distortion. A complete electrostatic shield between windings is the best precaution against interference of this type. The Kenyon Transformer Co., Inc. has designed K-204 with copper shield between primary and secondary. This provides a perfect barrier to any such interference. The coil construction of this unit is of the type frequently referred to as hum bucking, hum cancellation, or self shielded. The core is of a shape approaching torroidal with identical coils so arranged that any stray audio or radio frequency fields induce equal and opposite voltages in each coil. Since these coils are connected in series the voltages cancel with the net effective result of no interference pickup. The unit is further shielded by a cast high permeability case which reduces electromagnetic pickup by 18 DB.

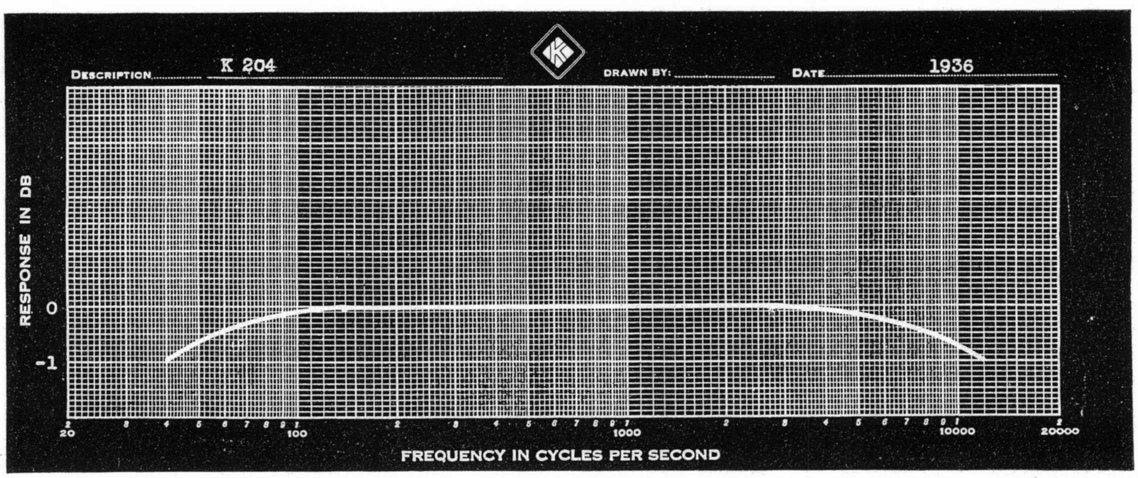
DESIGN CONSIDERATIONS

K-204 was designed to meet the demand for a medium priced input transformer with a high step-up ratio. The secondary impedance of this unit is 80,000 ohms. It was designed for operation at the medium audio levels such as will be encountered when working out of a tuner, a carbon microphone or a pickup. We believe that the audio engineer who uses input transformers will find it to his assistance to know the controlling factors in the design of such a unit. For his information the following data are presented. The simplest way to see what happens in such a transformer is to draw a simplified equivalent diagram of the transformer. Let us assume we are working from a 500 ohm line to a single class A grid. The 500 ohm line may be represented as a generator whose internal impedance is zero with a 500 ohm resistor in series with it. The primary of the transformer may be represented as an inductance shunted across the line. Following the resistor in series with the line will be a small inductance which represents the leakage inductance of the transformer. The impedance of the secondary load working into a class A grid may be considered as infinity after account is taken of the input capacity of the tube. Shunted across the line following the leakage inductance will be a capacitor. This represents the lumped effect of distributive capacity of the transformer, the mutual capacity of the transformer and the input capacity of the following tube. As may be seen from a glance at this diagram the low frequency response is determined by primary inductance. As the primary inductance decreases primary reactance decreases(primary reactance equals $2\pi \times f \times$ primary inductance) and current drawn from the generator increases. This current may be considered as exciting current of the transformer. As this current increases it causes an increased drop across the 500 ohm resistor in series with the generator. The voltage available for transfer at the primary of the transformer is the generator voltage minus the drop occurring across the resistor. In order to keep the response within 1 DB to 40 cycles the primary reactance must be at least 1000 ohms at 40 cycles. The factors governing the high frequency response are leakage reactance, and the lumped effect of capacity. It will be seen from the diagram that the leakage inductance is in series with the capacity. As the reactance of the capacity decreases additional current will flow. As this current flows it creates a voltage drop across the leakage reactance. Any drop occurring across this reactance is not available to impress upon the grid of the following tube. This signifies a loss of response at the higher frequencies. If the values of capacity and leakage reactance are such that resonance occurs the high frequency response is indeterminate.

Bottom Mounting

If the losses in the resonant branches of the circuit are low enough the voltage appearing across each branch will be greater than that normally appearing across the secondary. Since the voltage appearing across the lumped capacity effect is that applied to the grid of the succeeding tube a condition such as previously described will cause a resonance peak in the frequency response. If the losses in the resonant arms of the circuit are great enough the voltage appearing across each of them will be less than that normally appearing across the secondary of the transformer. This indicates a resonant dip in the frequency response.

Transformer K-204 has been so designed that the maximum



loss down to 40 cycles will be 1 DB. The leakage reactance and the combined effect of distributive and mutual capacity have been kept to such values that the maximum deviation from linear response up to 12,000 cycles will be plus or minus 1 DB.

SPECIAL APPLICATIONS

It is often found necessary to use a transformer for some purpose other than for which it was designed. The following information is provided for the guidance of the audio engineer in the use of this unit for special applications. Let us suppose it is necessary to couple a 10 ohm source to a single grid. The 10 ohm source should be connected to the terminals rated for 50 ohms. The secondary should be connected in standard manner. Since primary of this transformer has sufficient inductance to insure a maximum loss of 1 DB at 40 cycles when working out a 50 ohm source it will be seen that there is more than enough primary inductance when working out of a ten ohm source. The estimated frequency response would continue within 1 DB down to approximately 10 cycles. Since the primary impedance of the unit has been decreased by a ratio of 5 the secondary impedance will be decreased by a like ratio. Under these conditions the relative effect of shunting capacity will be decreased so the high frequency response will be as good or better than rated.

Now let us suppose it is necessary to couple a 1000 ohm source to a single class A grid. The 1000 ohm source would be connected to the terminals rated for 500 ohms. The secondary would be connected in the standard manner. Since the primary has sufficient inductance to cause a maximum loss of 1 DB at 40 cycles when working out of 500 ohms it will be seen that this reactance is not sufficiently great when working out of 1000 ohms. The shunting effect of primary reactance will be twice as great. This indicates a loss of 3 DB at 40 cycles or 1 DB at 80 cycles. Since the primary impedance has been increased by a ratio of two the secondary impedance has been increased by a like ratio. Under these conditions the relative shunting effect of capacity will be increased. This increase of shunting effect will impair the frequency response seriously over 5000 cycles.

K-204 may be used to couple a transmission line to push pull grids. The grid connections would be to terminals 7 and 10. The grid return would be connected to terminals 8 and 9, joined. The effect of such a connection as this at low frequencies would be no different from operation under rated conditions. The effect on high frequencies however would be to introduce an unbalanced condition between grids. The capacity from one grid to ground will be high while the capacity from the other grid to ground will be low. No serious effects will be seen up to 5000 cycles. Above this point, however, an unbalanced condition will introduce harmonic distortion. Due to this unbalanced capacity the transformer will be seen to give a rising characteristic as frequency increases.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± 1 DB 40 – 12,000 cycles
The frequency response curve shown was made at a level of – 30 DB

Primary Impedance — 50, 125, 200 (balanced) 250, 333 and 500 ohms (balanced)

Secondary Impedance — 80,000 ohms

Maximum Level — + 26 DB

Minimum Level — – 30 DB

Primary Inductance —
6 hy at 40 cycles — 30 DB
11 hy at 40 cycles — 10 volts applied

Coil Structure — Hum cancellation type composed of inductively, capacitively, and magnetically balanced sections.

Core Material — High-permeability alloy.

Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc., cancels the effects of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a heavy high-permeability cast case.

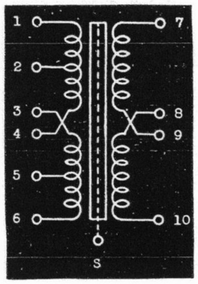
Primary D.C. (balanced) — 60 MA

Primary D.C. Resistance — 100 ohms (total pri.)

Electrostatic Shielding — Copper shield between primary and secondary minimizes electrostatic coupling.

Insulation Test Voltage — 750 volts.

Terminal Arrangement



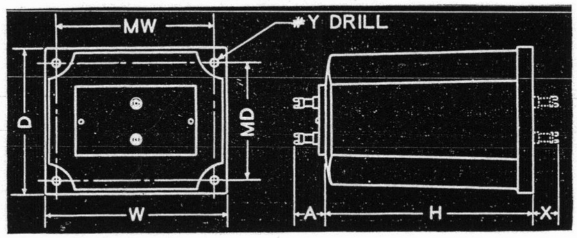
PRIMARY TERMINALS:
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

ELECTROSTATIC SHIELD:
Terminal "S" connects to shield between primary and secondary and to core. The core is insulated from the case.

SECONDARY TERMINALS:
Grid — connect to 10
Cathode return — connect to 7
Join — 8 and 9

MECHANICAL SPECIFICATIONS

Transformer K-204 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-204

Casting Type T1

Approx. Weight .... 3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾″	3½″	3⅛″	2$\frac{15}{16}$″	2$\frac{7}{16}$″	½″	$\frac{5}{16}$″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from the date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit has been discontinued.

KENYON TRANSFORMER CO., Inc.

840 Barry Street :: :: New York City

Export Department:
25 Warren Street
New York, N. Y.

Cable Address:
SIMONTRICE-NEW YORK

Printed in U.S.A.

KENYON

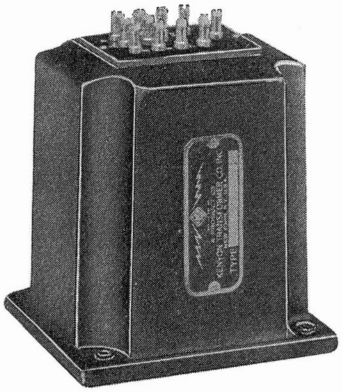
LABORATORY STANDARD
» » Line to Grid Transformer

TYPE K-205

List Price $18.00

GENERAL APPLICATIONS

Transformer K-205 is designed to operate from any low impedance source—pickup, carbon microphone, or transmission line—to push pull class A grids, e.g., push pull 56, 76, 6C6, 45, 2A3, 2A5, 6L6, 845, or 50 grids. The primary is supplied with the Kenyon Multiple Line impedance arrangement which provides for terminations varying from 50 to 500 ohms. This unit will develop the rated frequency response at any level from −30 DB to + 28 DB.



Top Mounting

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

Electrostatic shielding is very important in a unit such as type K-205 because of the great amount of gain succeeding it. Any radio frequency pick-up or interference effects of a longitudinal nature are coupled capacitively from primary to secondary. The resultant noises may be amplified as much as 130 DB if an electrostatic shield is not provided between these windings. The complete electrostatic shield incorporated between the primary and secondary coils of the type K-205 forms a perfect barrier to any interference of this type.

The coil structure employed in this transformer is of the type frequently referred to as self shielding, hum bucking, or hum cancellation. This type of construction consists of a core which approaches a toroidal shape. Identical coils are placed on each side of this core. Any stray audio or radio frequency fields which cut the windings of the unit will induce equal and opposite voltages in each of the coils. Since these coils are connected in series, the two induced voltages add to zero thus cancelling the effects of the interference voltages. The unit is further shielded by a high permeability cast case which reduces pickup by 18 DB.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with all low level input transformers is essential to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information.

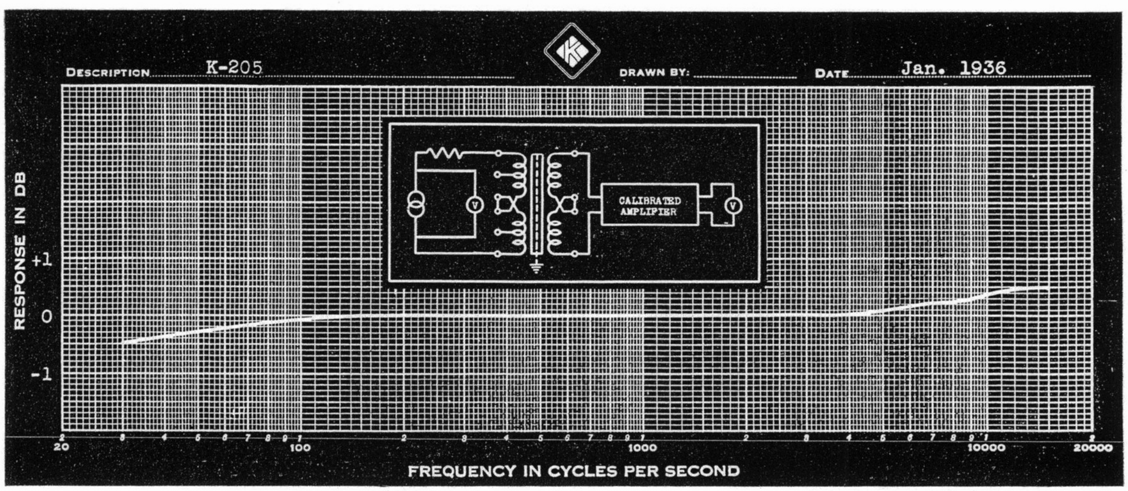
K-205 has been designed for operation at levels such as are encountered at the input to an amplifier with a medium amount of gain. At levels such as this it is not necessary to use the most expensive core material in order to obtain sufficient primary inductance to insure good low frequency response. For this reason it has been possible to reduce the price of this unit without impairing the efficiency of its operation in its intended application. With the exception of the type of core material used K-205 is identical to type K-201. The primary inductance of any transformer is directly proportional to the permeability of the core material used — all other things being constant. The permeability of all steels is effected by the AC flux density. At low levels, — 30 DB for instance, only 35 milli-volts is applied to the primary. This means that the AC flux density is only a fraction of a gausse. The permeability of the core material diminishes as the flux density diminishes. This means that in order to have sufficient inductance to provide good low frequency response a high grade of core material must be used, and the cross sectional area of the core must be kept large. Which in turn dictates extreme caution in the distribution of the windings to provide good high frequency response.

Bottom Mounting

A high quality transformer of this type is the product of the correlation of these design considerations. The Kenyon Transformer Co., Inc., sincerely believes that this has been done successfully in transformer K-205.

SPECIAL APPLICATIONS

The audio engineer may encounter the necessity for coupling impedances not provided for on the multiple line primary. The examples given below are for his guidance in estimating the performance of K-205 under different operating conditions. As a basis for this estimate, let us consider the factors controlling the low frequency and the high frequency response of a line to grid transformer. In order to insure good low frequency response, the primary inductance is kept to a maximum. The primary reactance is proportional to frequency and primary inductance. When the primary reactance is three times the value of the impedance of the line from which the transformer works, a loss of ½ DB occurs. This loss is caused by the shunting effect of the primary which draws current for internal losses. The power represented by this current is not available for transfer to the secondary. The high frequency response is governed by three factors: leakage reactance, distributive capacity, and mutual capacity. Leakage reactance is like a small reactor between primary and secondary; distributive capacity is like a large number of small condensers shunted from turn to turn in the windings;



mutual capacity is like a condenser connected from the high impedance side of the windings to the electrostatic shield or to the core. The voltage appearing on the grids is that which appears across the lumped value of distributive and mutual capacity. In any circuit which contains capacity and inductance, there is a frequency at which this combination resonates. The impedance of a series resonant circuit is determined by the losses which occur in the inductor and in the capacitor. If the losses in these branches of the circuit are sufficiently low the impedance of the components at resonance will be higher than the natural impedance of the secondary of the transformer. This means that the voltage appearing across the capacitor will be greater than that normally appearing across the secondary. When a condition such as this occurs, it produces a resonant peak in the frequency characteristic curve. At frequencies higher than this resonant point the lumped capacity effects act as a shunt across the secondary. When this shunt impedance is of the order of the impedance of the secondary, it produces a loss which is proportional to frequency. If the losses in the leakage reactance and the capacity are great enough the impedance of the components of the resonant circuit will be less than the natural impedance of the secondary of the transformer. When this is true, the voltage appearing across the capacity at resonance will be less than that normally appearing across the secondary. A resonant dip in the frequency response is the result of such a condition.

With these facts in mind, we will proceed to estimate the frequency response under various conditions other than those for which the unit was designed. Suppose a 10 ohm line is connected to the terminals rated for 50 ohms. The primary reactance is sufficient so that the shunting effect on a 50 ohm line causes a loss of only ½ DB at 30 cycles. As reactance (inductance being constant) is directly proportional to frequency, we see that there is sufficient primary reactance to insure a loss of only ½ DB at one-fifth the frequency (6 cycles) when the input impedance is 10 ohms. Since the primary impedance is reduced, the secondary impedance will be reduced by a corresponding ratio. When this occurs the relative effect of resonant conditions in the secondary, or of shunting capacity, is decreased. This indicates improved high frequency response (a loss of slightly less than ½ DB at 15,000 cycles).

Now let us suppose it is necessary to couple a 1000 ohm line to push pull grids. The opposite reasoning from that shown above will follow in this case. The primary reactance at 30 cycles is only ½ as great as necessary to insure a maximum loss of ½ DB. Since reactance is proportional to frequency, it will be great enough at 60 cycles to insure this maximum loss of ½ DB. Since primary and secondary impedance have been increased by this mismatch the relative effect of resonant conditions or capacity shunting will have been increased also. The high frequency response will be seriously impaired over 5000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response curve illustrated was made at a level of − 30 DB.

Primary Impedance — 50, 125, 200 (balanced) 250, 333 and 500 ohms (balanced)

Secondary Impedance — 160,000 ohms (total sec.)

Maximum Level — + 28 DB

Minimum Level — − 30 DB

Pri. Inductance —
8 hy at 30 cycles at − 30 DB
9 hy at 30 cycles at − 15 DB
12 hy at 30 cycles at zero level
15 hy at 60 cycles with 10 volts applied

Coil Structure — Hum cancellation type composed of inductively, capacitively, and magnetically balanced sections.

Core Material — High-permeability alloy.

Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc., cancels the effects of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a heavy high-permeability cast case.

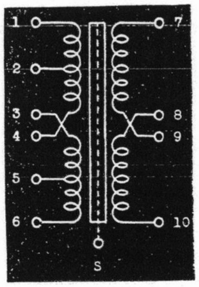
Primary D.C. (balanced) — 60 MA.

Primary D.C. Resistance — 61 ohms.

Electrostatic Shielding — Copper shield between primary and secondary minimizes electrostatic coupling.

Insulation Test Voltage — 750 volts.

Terminal Arrangement



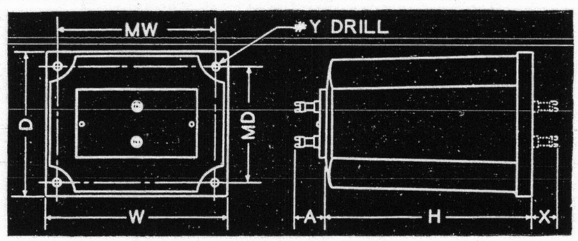
PRIMARY TERMINALS:
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

ELECTROSTATIC SHIELD:
Terminal "S" connects to shield between primary and secondary and to core. The core is insulated from case.

SECONDARY TERMINALS:
Grids — 7 and 10
Cathode return — join 8 and 9

MECHANICAL SPECIFICATIONS

Transformer K-205 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-205

Casting Type. T1

Approx. Weight . . . . 3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾"	3½"	3⅛"	2 13/16"	2 7/16"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair, or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

KENYON TRANSFORMER CO., Inc.

840 Barry Street :: :: New York City

Export Department:
25 Warren Street
New York, N. Y.

Cable Address:
SIMONTRICE-NEW YORK

KENYON

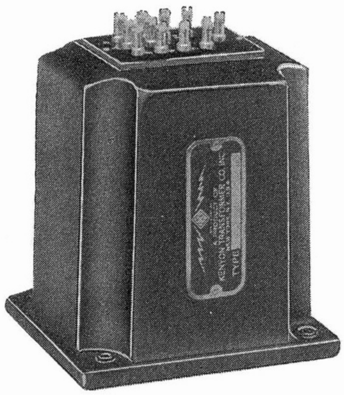
LABORATORY STANDARD
» » Interstage Transformer

TYPE K-300

List Price. . . . $22.00

GENERAL APPLICATIONS

Transformer K-300 is designed to couple a single triode plate to a single grid. The primary of this unit will work from a single 56, 76, 6C6-57-77 (triode connected) 6C5, 30, 864 or similar tube having an A.C. plate resistance of the order of 10,000 ohms. It will work into any class A grid which does not require a level greater than + 20 DB. The item is so designed that it will operate satisfactorily at any level from − 70 DB to + 20 DB.



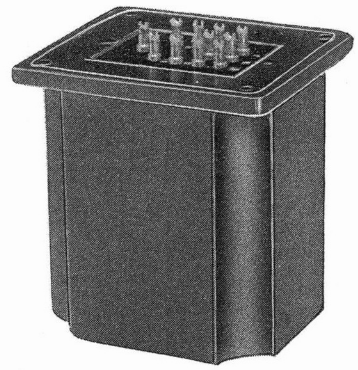
Top Mounting

The advantage of transformer coupling over resistance coupling has been questioned by some audio engineers. The justification for the use of an interstage transformer in a cascade amplifier may be seen from the following considerations. The amplification factor of any tube in a resistance coupled amplifier is reduced because of the drop in plate voltage through the plate resistor. Under the most optimistic assumption the voltage gain of a resistance coupled stage may be said to be 70% of the amplification factor of the tube. The following holds true for transformer coupling. The insertion loss of a well designed transformer such as Kenyon type K-300 will not exceed 1 DB. The full rated plate voltage may be applied to the plate of the tube so that the full amplification factor will be realized. The turns ratio, primary to secondary of transformer K-300 is 1:2. This means that the total voltage gain, due to the transformer, is two. Assuming the worst case, in which 80% of the voltage gain is wasted in transformer loss, the voltage gain of the transformer-tube combination will be .8 times the turns ratio of the transformer times the amplification factor of the tube. In other words 1.6 times the amplification factor is realized as voltage gain. The voltage gain with transformer coupling will therefore be over twice as great as with resistance coupling. Transformer coupling also has the additional important advantage of providing complete isolation between grid and plate circuits thus minimizing regeneration troubles caused by common impedances.

ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING

Radio frequency pickup and stray voltages of a longitudinal character may be amplified many times in a pre-amplifier before reaching the output of the main amplifier. This makes for noisy reproduction and distortion. The best precaution against this type of interference is a complete electrostatic shield between primary and secondary windings. The Kenyon Transformer Co., Inc., has designed this unit with a copper shield between windings thus providing a perfect barrier to any such interference.

The coil construction of this unit is of the type frequently referred to as hum cancellation, hum bucking, or self shielding. This means that the core is of a shape approaching toroidal, with identical coils on each side of the core. When this type of construction is used any stray audio or radio frequency fields induce equal and opposite voltages in each coil. Since these coils are connected in series the voltages cancel with the effective net result of no interference pickup. This unit is further shielded by a cast high permeability case which reduces pickup by 18 DB.



Bottom Mounting

DESIGN CONSIDERATIONS

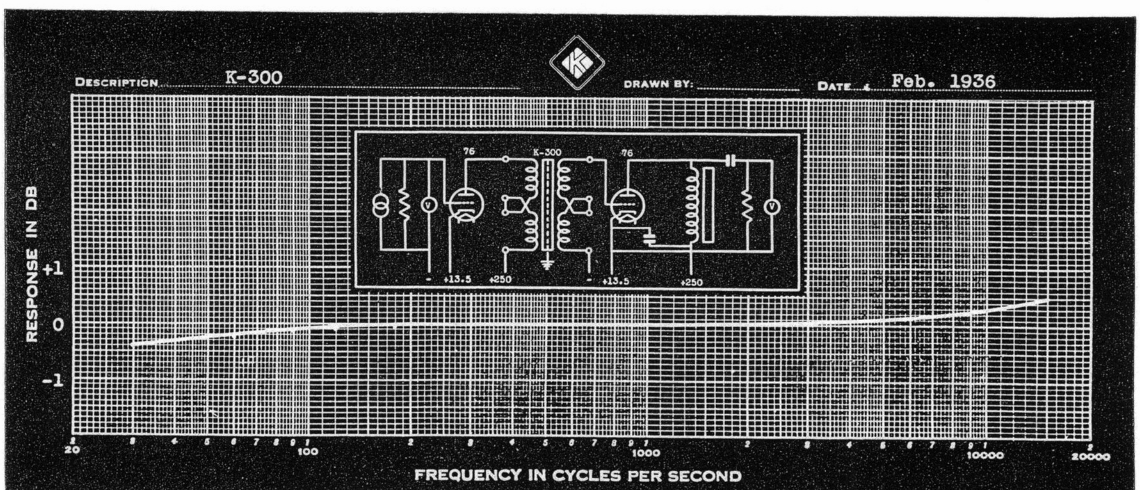
The low frequency response of this transformer is dependent upon the primary inductance which in turn is dependent on the number of turns in the primary winding, polarizing D.C., core material, and the operating level. Design considerations dictate the use of high permeability alloy core material.

The high frequency response is determined by the leakage reactance, distributive capacity, and mutual capacity of the windings. Leakage reactance acts as a small reactor in series between primary and secondary. This is kept to a minimum value by coil design. Distributive capacity appears as an infinite number of small condensers shunted from turn to turn in each of the windings. This is kept to a minimum value by maintaining a high ratio between the height and length of each coil section. Mutual capacity appears as a condenser shunted from the high impedance end of the winding to ground. This is controlled by the distribution of the windings. Leakage inductance and distributive and mutual capacity must be carefully selected and fixed at such values which will prevent resonant dips or peaks in the operating audio frequency range.

A high quality transformer of this type is the product of the correlation of these design considerations. The Kenyon Transformer Co., Inc., sincerely believes that this has been done successfully in transformer K-300.

SPECIAL APPLICATIONS

The audio engineer frequently encounters situations in which it is necessary to use a transformer for an application



other than for which the item was designed. The following information will be helpful in estimating the response characteristics which may be expected in special applications.

Suppose it is necessary to use this transformer to work out of a tube with a 20,000 ohm plate resistance and a plate current of 12 MA. The maximum plate current rating given for this item is 8 MA. As far as copper loss considerations go, it is safe to increase this to 14 MA. However, when the D.C. plate current is increased the polarizing flux density is increased in the core material, which in turn decreases the permeability of the core material.

All other factors being constant the primary inductance is directly proportional to the permeability. Three values of primary inductance with three different values of D.C. are given with this item. A rough curve of primary inductance vs. primary D.C. may be drawn from this data. It is possible to extrapolate from this curve to find the primary inductance for any plate current up to 14 MA. By this extrapolation we find that the primary inductance at 12 MA D.C. is approximately 110 hy. This means that the primary reactance (or $2 \times 3.14 \times$ frequency $\times$ inductance) is 20,000 ohms. When a transformer with an unloaded secondary is working out of a generator with an internal impedance equal to the primary reactance the response is impaired by 3 DB. This indicates that, under the previously outlined conditions, the frequency characteristic instead of being down ½ DB at 30 cycles will be down 3 DB at 30 cycles. The high frequency response in this case suffers a great deal more than the low frequency response because, while the secondary impedance is doubled, the lumped value of distributive and mutual capacity remains the same. The combination of this and leakage reactance will cause resonance peaks or dips at the higher frequencies. In this case the frequency response above 5000 cycles will be seriously impaired.

The following data is applicable when this transformer is used to couple a type 31 tube to a grid. The plate resistance of this tube is 3600 ohms. The plate current is 12 MA. From the previous calculations it may be seen that the primary inductance will be 110 hy. The primary reactance is 20,000 ohms at 30 cycles. A transformer with an unloaded secondary working out of a generator with an internal impedance of ⅓ or less of the primary reactance will be down slightly less than ½ DB at 30 cycles. This shows that the low frequency response for an application such as this would be excellent.

The reflected load on the secondary is also lower than when the unit is used for a rated application. This indicates that the comparative effect of the lumped capacity on the secondary is much less than it would be under the conditions for which the transformer was designed to operate. The high frequency response in this application will be better than rated.

ELECTRICAL SPECIFICATIONS

The following detailed electrical specifications are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
Turns Ratio — 1:2 (total pri. to total sec.)
Maximum Pri. D.C. — 8 MA
Maximum Level — + 20 DB
Minimum Level — − 70 DB
Pri. Inductance —
150 hy — 30 cycles — 8 MA D.C. in coil
190 hy — 30 cycles — 5 MA D.C. in coil
410 hy — 30 cycles — No D.C. in coil
(These inductance measurements were made with 10 volts A.C. applied to the coil)

Coil Structure — Hum cancellation type composed of inductively, capacitively, and magnetically balanced sections.

Core Material — High-permeability alloy

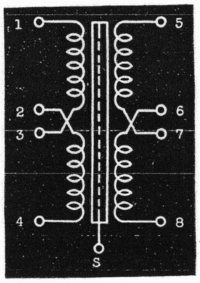
Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc., cancels the effects of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a heavy high permeability cast case.

Electrostatic Shielding — Copper shield between primary and secondary minimizes electrostatic coupling.

Primary D.C. Resistance — 4300

Insulation Test Voltage — 750 volts

Terminal Arrangement



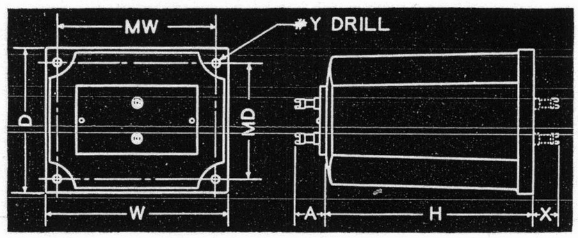
Primary Terminals:
Plate — connect to 1
B — connect to 4
Join — 2 and 3

Electrostatic Shield
Terminal S connects to shield between primary and secondary and to core. The core is insulated from case.

Secondary Terminals:
Grid — connect to 8
Cathode return — 5
Join — 6 and 7

MECHANICAL SPECIFICATIONS

Transformer K-300 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-300

Casting Type T1

Approx. Weight .... 3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾″	3½″	3⅛″	2 13/16″	2 7/16″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

KENYON TRANSFORMER Co., Inc.

840 Barry Street :: :: New York City

Export Department:
25 Warren Street
New York, N. Y.

Cable Address:
SIMONTRICE-NEW YORK

KENYON

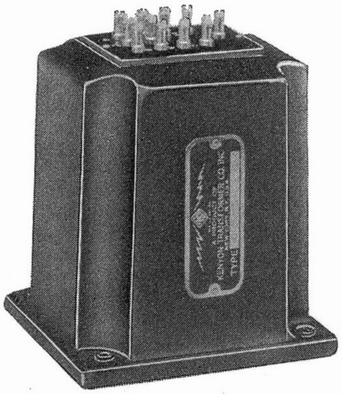
LABORATORY STANDARD
» » Interstage Transformer

TYPE K-302 **List Price. . . .$22.00**

GENERAL APPLICATIONS

Transformer K-302 is designed to couple class A push pull plates to class A push pull grids. The primary of this transformer will work out of push pull 56, 76, 6C6-77-57 (triode connected), 6C5, 30, 864, or similar tubes having an A.C. plate resistance of the order of 10,000 ohms. Any of the other triodes falling in this classification may be used.

The transformer will work into any pair of push pull grids operated class A which do not require level greater than + 22 DB, e.g., push pull 56, 76, 57, 6C6, 77, 6C5, 30, 31, 864, 45, 2A5, 10, 50, 6L6, etc., grids.



Top Mounting

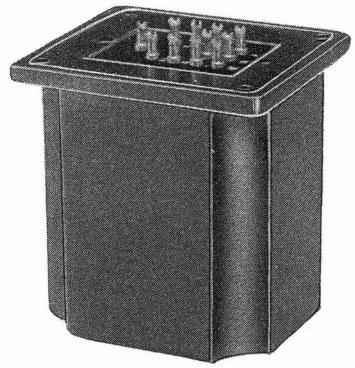
ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING

The danger of electrostatic pickup in a unit of this type is not serious. Electromagnetic pickup and crosstalk (interstage coupling) however deserve serious consideration. The former has been eliminated by a coil and core structure of the type frequently referred to as hum cancellation, hum bucking, or self shielding. This means that the core is of a shape approaching toroidal, with identical coils on each side of the core. When this type of construction is used any stray audio or radio frequency fields induce equal and opposite voltages in each coil. Since these coils are connected in series the voltages cancel with the effective net result of no interference pickup. Crosstalk has been eliminated by a cast high permeability case which also provides an additional 18 DB reduction in pickup.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with all interstage transformers is essential to the audio engineer who selects and uses them. We are, therefore, presenting the following data for his guidance and information.

It will make the following considerations clearer if we first look at the equivalent circuit diagram of a transformer operated from push-pull class A plates to push-pull class A grids. Let us assume we are working from a source whose impedance is 20,000 ohms. An equivalent circuit for this would be a generator whose internal impedance is zero with a 20,000 ohm resistor in series with it. The primary of the transformer would be connected at the end of this series resistor. The equivalent circuit diagram of the transformer would consist of three sections. First there would be an inductance shunted directly across the line. This represents the primary inductance of the transformer. In series with the line would be another inductance which represents the leakage reactance of the transformer. Shunted across the line, after this leakage inductance, is a condenser. This condenser represents the combined effect of the input capacity of the grids, mutual capacity of the transformer and distributive capacity of the transformer. The factors which limit high frequency or low frequency response may be seen immediately by a glance at such a simplified equivalent diagram. It will be seen that a loss will occur at low frequencies when primary reactance ($2\pi \times f \times$ primary inductance) decreases to a value of the same order as the resistance in series with the generator. This loss is caused by the exciting current which flows in the primary of the transformer, (core loss being negligible, exciting current is directly proportional to primary inductance).

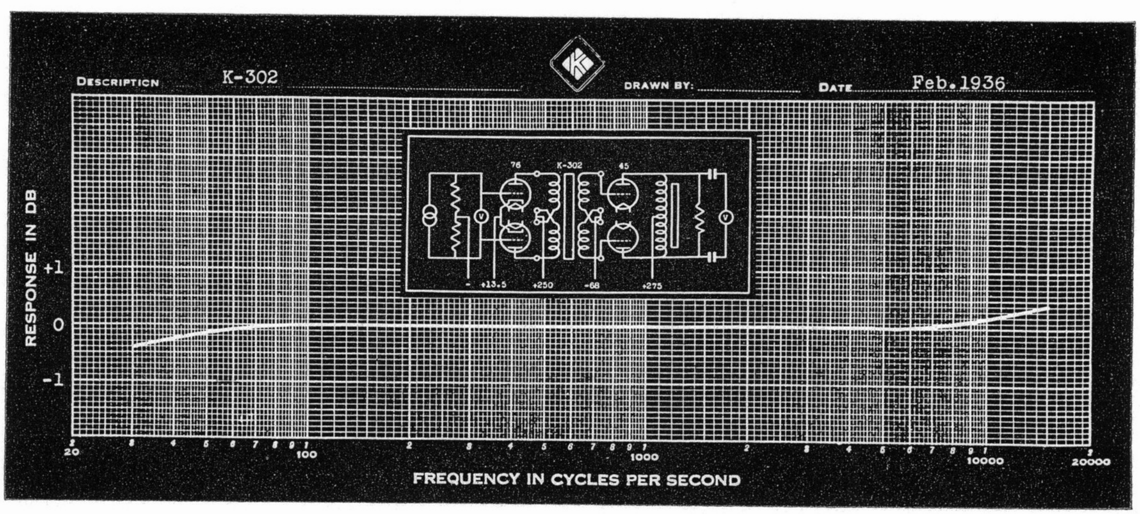


Bottom Mounting

Any current of this sort which flows causes a voltage drop in the series resistor. This means that the impressed primary voltage is decreased by the amount of this drop. The causes of the loss of high frequency response are a little more complicated than those for low frequency response as may be seen from the diagram. Leakage reactance and capacity are arranged in a series circuit. Since the grid impedance of the following tubes is very high, leakage reactance will have no effect until the shunt capacity starts to draw current. At the higher frequencies the reactance of this shunt capacity decreases and the current through it increases in a like manner. This current causes a drop through the leakage reactance and thus a loss of transmitted secondary voltage. An effect such as this causes high frequency response to fall off gradually as frequency is increased. If the values of the capacity and inductance are such that resonance occurs within the audio range the effect of frequency response is more or less indeterminate. If the losses in the resonant branches are low, the voltage appearing across each of them will be greater than the voltage that normally appears across the secondary of the transformer. This indicates a peak in the frequency response. Conversely, if the losses are high the voltage appearing across each branch is less than that normally appearing across the secondary and a dip in the frequency response will result.

SPECIAL APPLICATIONS

The following information is given for the assistance of the design engineer in estimating the approximate frequency re-



sponse which will be realized with various operating conditions other than those covered by the rated applications.

The following considerations will apply when using type K-302 to couple push pull class A triodes whose plate resistance is 20,000 ohms each to the grids of push pull class A amplifier tubes The primary of this unit has sufficient inductance so that the shunting effect of primary reactance at the lower frequencies will cause a loss of ½ DB or less when the plate resistance of the driving tubes is 10,000 ohms each. When the plate resistance of the driving tubes is doubled, the shunting effect of primary reactance is also doubled. Inductance being constant, reactance varies directly as frequency. If transformer K-302 shows a loss of ½ DB at 30 cycles under rated operating conditions, it will show a loss of ½ DB at 60 cycles when the plate resistance of the driver tubes is twice the rated resistance. The impedance ratio of this unit is 1:3.2. When the primary impedance is 20,000 the secondary impedance is 64,000. When the plate resistance of the driver tubes is doubled, the secondary impedance is also doubled and the effect of distributive and mutual capacity is doubled. This apparently indicates a loss at high frequencies. However, capacity effects have been kept to a minimum in type K-302 so that the frequency response would not be seriously impaired below 10,000 cycles.

Suppose it is desired to use triodes with a plate resistance lower than the plate resistance of the tubes for which the unit was designed. If the plate resistance of the driver triodes is 5,000 instead of 10,000 ohms, the relative shunting effect of the primary reactance at low frequencies will be cut in half. This means that the frequency response would be within ½ DB down to approximately 15 cycles. The secondary impedance, leakage reactance, and capacity effects are the limiting factors of the high frequency response. This reduction of primary load impedance and the resultant reduction of secondary impedance will result in improved high frequency response.

It is also possible to use this item as a class AB driver transformer. When operating under these conditions the driver tubes should be connected to the secondary of the transformer and the tubes to be driven should be connected to the primary,—the unit would be reversed.

Use the case of push pull 56's driving class AB 45's as an example. Since the total turns ratio of transformer K-302 is 1:1.8 the turns ratio from total secondary to one half primary is 1:3.6. The optimum value of turns ratio for a class AB driver transformer in an application such as this is 2.8:1 (primary to ½ secondary). This small discrepancy of turns ratio values will have no serious effect on the circuit except to cause a slight reduction in the power output of the 45 tubes. Since the secondary impedance of this unit is higher than that of the primary, the shunting effect on the driver tubes at the lower frequencies will be negligible down to 20 cycles. (The secondary of K-302 is used as the primary of the driver transformer as explained above). Since this unit was designed to operate into class A grids, which present a high impedance load, no interleaving of windings was necessary in order to keep leakage reactance to a minimum. This means that the leakage reactance of this transformer as a driver of class AB tubes will limit the high frequency response to approximately 10,000 cycles. High leakage reactance in a driver transformer causes poor regulation which in turn causes distortion when the grids of the class AB tubes start to draw grid current. The harmonic distortion caused by poor regulation in this application of transformer K-302 will not be serious.

A summary of this application of type K-302 indicates that it may be used as a class AB driver transformer with the following sacrifices.

1. Frequency response above 10,000 cycles.
2. The addition of a small amount of distortion over the whole range.

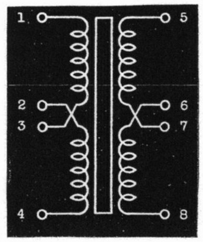
ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
Turns Ratio — 1:1.8 (total pri. to total sec.)
Maximum Level — + 22 DB
Maximum D.C./Leg — 8 MA
Maximum D.C. Unbalance/Leg — 1 MA
Pri. Inductance —
320 hy — 30 cycles — 1 volt applied
440 hy — 30 cycles — 10 volts applied
500 hy — 30 cycles — 50 volts applied
390 hy — 60 cycles — 10 volts applied

All inductance figures given above are based on no polarizing D.C. in the coil and with an A.C. voltage applied to the coil of the frequency and potential specified.

Pri. D.C. Resistance — 3500 ohms (total pri.)
Coil Structure — Hum cancellation type composed of symmetrical sections balanced for inductance, capacity and resistance.
Core Material — High permeability alloy
Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc., cancels the effects of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its winding. The unit is further shielded by high-permeability cast case.



Insulation Test Voltage — 750 volts

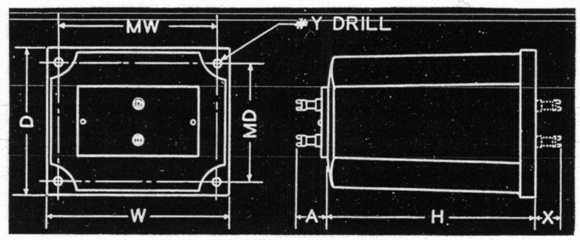
Terminal Arrangement

PRIMARY TERMINALS:
Plates — 1 and 4
B + — join 2 and 3

SECONDARY TERMINALS:
Grids — 5 and 8
Cathode return — join 6 and 7

MECHANICAL SPECIFICATIONS

Transformer K-302 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-302

Casting Type. T1

Approx. Weight . . . . 3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾″	3½″	3⅛″	2 13/16″	2 7/16″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair, or replacement must be shipped prepaid. This guaranty is effective for a period of five years from the date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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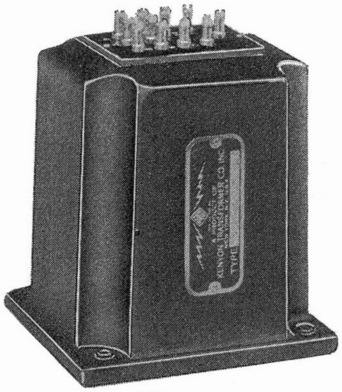
KENYON

LABORATORY STANDARD
» » Interstage Transformer

TYPE K-304 **List Price....$17.50**

GENERAL APPLICATIONS

Transformer K-304 is designed to couple a single triode plate to push pull grids operated class A. The primary of this unit will work from a single 56, 76, 6C6-57-77 (triode connected), 6C5, 30, 864 or similar tube having an A.C. plate resistance of the order of 10,000 ohms. It will work into any pair of push pull grids operated class A which do not require a level greater than plus 20 DB, e.g., push-pull 56, 76, 57, 6C6, 6C5, 30, 864, 45, 2A3, 6A3, 2A5, 10, 50, etc. This item has been designed to operate satisfactorily over a range of − 70 DB to + 20 DB.



Top Mounting

ELECTRO-MAGNETIC AND ELECTROSTATIC SHIELDING

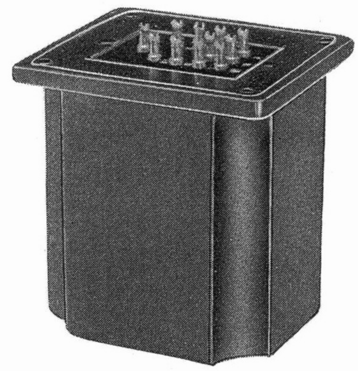
Radio frequency pickup and stray voltages of a longitudinal character may be amplified many times in the voltage amplifier before reaching the output of the main amplifier. This makes for noisy reproduction and distortion. The best precaution against this type of interference is a complete electrostatic shield between primary and secondary windings. The Kenyon Transformer Co., Inc., has designed this unit with a copper shield between windings thus providing a perfect barrier to any such interference.

The coil construction of this unit is the type frequently referred to as hum cancellation, hum bucking, or self shielding. This means that the core is of a shape approaching toroidal, with identical coils on each side of the core. When this type of construction is used any stray audio or radio frequency fields induce equal and opposite voltages in each coil. Since these coils are connected in series the voltages cancel with the effective net result of no interference pickup. This unit is further shielded by a cast high-permeability case which reduces pickup by 18 DB.

DESIGN CONSIDERATIONS

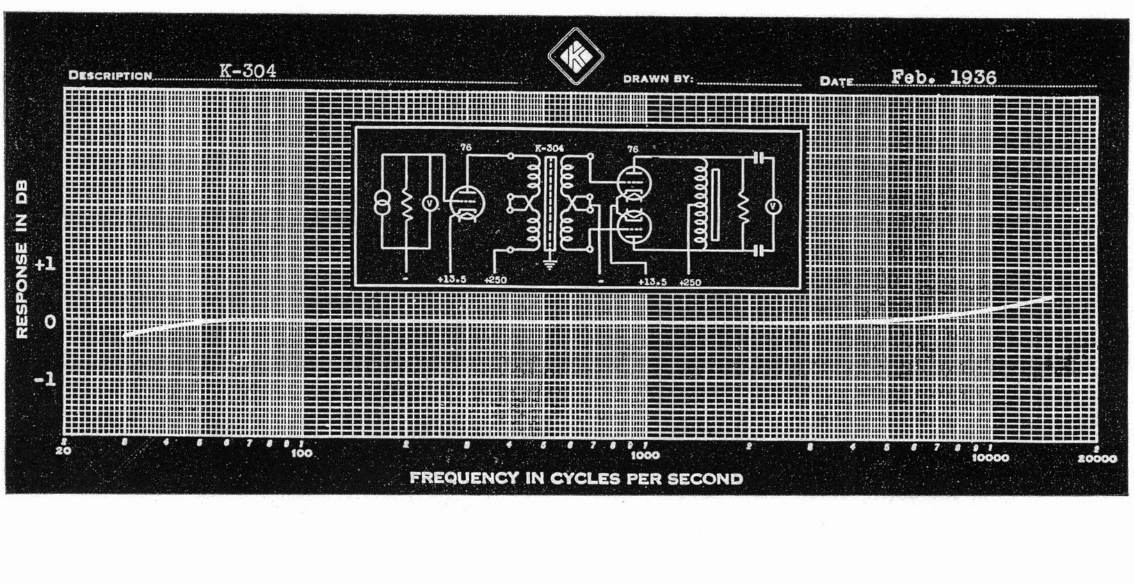
We believe that an understanding of the fundamental design considerations associated with all interstage transformers is essential to the audio engineer who selects and uses them. We are, therefore, presenting the following data for his guidance and information.

It will make the following considerations clearer if we first look at the equivalent circuit diagram of a transformer operated from a single class A plate to push pull class A grids. Let us assume we are working from a source whose impedance is 10,000 ohms. An equivalent circuit for this would be a generator whose internal impedance is zero with a 10,000 ohm resistor in series with it. The primary of the transformer would be connected at the end of this series resistor. The equivalent circuit diagram of the transformer would consist of three sections. First there would be an inductance shunted directly across the line. This represents the primary inductance of the transformer. In series with the line would be another inductance which represents the leakage reactance of the transformer. Shunted across the line, after this leakage inductance, is a condenser. This condenser represents the combined effect of the input capacity of the grids, mutual capacity of the transformer and distributive capacity of the transformer. The factors which limit high frequency or low frequency response may be seen immediately by a glance at such a simplified equivalent diagram. It will be seen that a loss will occur at low frequencies when primary reactance ($2\pi \times f \times$ primary inductance) decreases to a value of the same order as the resistance in series with the generator. This loss is caused by the exciting current which flows in the primary of the transformer (core loss being negligible, exciting current is directly proportional to primary inductance). Any current of this sort which flows causes a voltage drop in the series resistor. This means that the impressed primary voltage is decreased by the amount of this drop.



Bottom Mounting

The causes of the loss of high frequency response are a little more complicated than those for low frequency response as may be seen from the diagram. Leakage reactance and capacity are arranged in a series circuit. Since the grid impedance of the following tubes is very high, leakage reactance will have no effect until the shunt capacity starts to draw current. At the higher frequencies the reactance of this shunt capacity decreases and the current through it increases in a like manner. This current causes a drop through the leakage reactance and thus a loss of transmitted secondary voltage. An effect such as this causes high frequency response to fall off gradually as frequency is increased. If the values of the capacity and inductance are such that resonance occurs within the audio range the effect of frequency response is more or less indeterminate. If the losses in the resonant branches are low, the voltage appearing across each of them will be greater than the voltage that normally appears across the secondary of the transformer. This indicates a peak in the



frequency response. Conversely, if the losses are high the voltage appearing across each branch is less than that normally appearing across the secondary and a dip in the frequency response will result.

SPECIAL APPLICATIONS

The audio engineer frequently encounters conditions under which it is necessary to use a transformer for an application other than for which it was designed. The following data are given to assist him to estimate the frequency response he may expect from this unit under various operating conditions. Suppose it is necessary to couple a triode, with a plate resistance of 10,000 ohms and a plate current of 12 milliamperes, to push-pull grids. The maximum rated plate current for K-304 is 8 milliamperes. The maximum current as far as current density in the copper is concerned is 14 milliamperes. Values of primary inductance for various plate currents up to 8 milliamperes are given with this item. A curve of inductance versus primary D.C. may be drawn from these values. It is possible to roughly determine the primary inductance with a higher plate current by extrapolation from this curve. It is apparent from this curve that the primary inductance is approximately 130 henries. This represents an impedance of 24,000 ohms at 30 cycles. When a generator of 10,000 ohms internal impedance works into a transformer whose primary reactance is three times this internal resistance, the response suffers by approximately ½ DB. This illustrates that the low frequency response will not suffer seriously under these operating conditions. Since the plate resistance is unchanged from rated plate resistance, the high frequency response of this unit will also remain unchanged.

Let us suppose that it is necessary to operate this item from a type 31 triode. This tube has a plate resistance of 3,600 ohms, and a plate current of 14 milliamperes. The primary inductance curve indicates a value of 115 henries with 14 MA in the coil. The primary reactance is then approximately 21,500 ohms at 30 cycles. As stated above, when a generator works into the primary of a transformer whose reactance is three times as great as the internal impedance of the generator the response suffers by ½ DB. This indicates that the low frequency response in this case is excellent. In an item such as this with a high secondary impedance, the lumped effect of distributive and mutual capacity is the governing factor of the high frequency response. Since the internal impedance of the generator coupled to the primary is 3,600 ohms instead of 10,000 ohms, the secondary impedance is reduced by a corresponding ratio. This means that the comparative effect of distributive and mutual capacity is less than under the rated conditions. The high frequency response will accordingly be better than rated.

Let us take the case in which it is desired to couple a triode with an internal resistance of 20,000 ohms, and a plate current of 6 MA to the primary of type K-304. From the inductance data given with this unit, it will be seen that the primary inductance is 230 henries. The reactance of 230 henries at 30 cycles is 43,000 ohms. In this case primary reactance is only twice as great as the internal impedance of the generator. When the primary impedance is only twice as great as the generator impedance, and the secondary is unloaded, the response is impaired by 1 DB. Since the primary impedance has been increased to 20,000 ohms, the secondary impedance will also be doubled. The frequency response above 5,000 cycles will be seriously impaired.

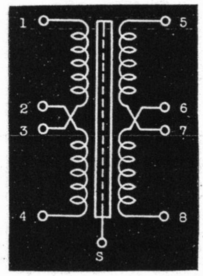
ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits:

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response characteristics illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Turns Ratio — 1:1 (total pri. to ½ sec.)
Maximum Pri. D.C. — 8 MA
Maximum Level — + 20 DB
Minimum Level — − 50 DB
Pri. Inductance —
190 hy — 30 cycles — 8 MA D.C. in coil
240 hy — 30 cycles — 5 MA D.C. in coil
320 hy — 30 cycles — no D.C. in coil
(These inductance measurements were made with ten volts A.C. applied to the coil)

Coil Structure — Hum cancellation type composed of inductively, capacitively and magnetically balanced sections.
Core Material — High-permeability alloy
Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc. cancels the effect of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a high-permeability cast case.
Electrostatic Shielding — Copper shield between primary and secondary minimizes electrostatic coupling.
Primary D.C. Resistance — 2,000 ohms
Insulation Test Voltage — 750 volts
Terminal Arrangement



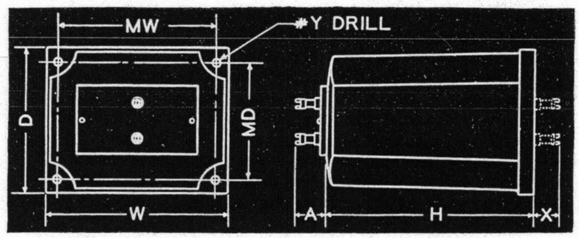
PRIMARY TERMINALS:
Plate — connect to 1
B+ connect to 4
Join 2 and 3

ELECTROSTATIC SHIELD:
Terminal S connects to shield between primary and secondary and to core. The core is insulated from case.

SECONDARY TERMINALS:
Grids — 5 and 8
Cathode return — join 6 and 7

MECHANICAL SPECIFICATIONS

Transformer K-304 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-304
Casting Type T1
Approx. Weight . . . . 3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾"	3½"	3⅛"	2 13/16"	2 7/16"	½"	5/16"	13

GUARANTY AND CONDITIONS

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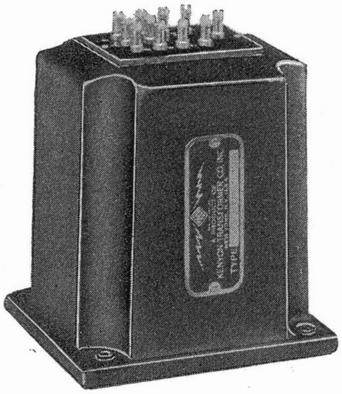
KENYON

LABORATORY STANDARD
» » Interstage Transformer

TYPE K-305 **List Price. . . .$16.00**

GENERAL APPLICATIONS

Transformer K-305 is designed to couple the plates of push pull triodes to push pull class AB 6L6's, 45's, 2A3's or 6A3's. The driving triodes should have a plate resistance in the order of 10,000 ohms and a plate current not in excess of 10 MA. Types 56, 76, or 6C5, are the recommended tubes. Any of the other popular triodes falling in this classification may be used.



Top Mounting

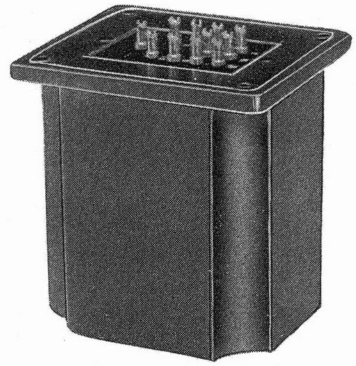
ELECTRO-MAGNETIC AND ELECTROSTATIC SHIELDING

The danger of electromagnetic or electrostatic pickup in a unit of this type is not serious. Under the worst possible conditions, however, some trouble along these lines might be experienced. With this in mind Kenyon Transformer Co., Inc., has enclosed the unit in a case of cast high-permeability material which will eliminate crosstalk and which cuts down any possibility of hum pickup by 18 DB.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with all driver transformers is essential to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information.

Good regulation is one of the most important requisites of a driver stage for class AB output tubes. When the output tubes are not drawing grid current the grid impedance is very high. This grid impedance is reflected as a plate to plate load on the driver stage. When this plate to plate load is so high that for all practical purposes it may be considered infinity, the total voltage generated in the driver tubes appears across the primary of the transformer. None of it is used as potential drop across the plate resistance of the tubes. When the output tubes begin to draw grid current their grid impedance goes down to a finite value. This in turn presents a finite load to the secondary of the driver transformer. When this load is reflected to the primary of a transformer a certain portion of the voltage generated within the driver tubes appears across the plate resistance of these tubes. The remaining portion appears across the load as presented to these tubes by the primary of the driver transformer. The design of this transformer must be such that the ratio of the voltage appearing across the primary at no load (or when the grids are not drawing grid current) to the voltage appearing across the primary at full load, (or when the grids are drawing maximum grid current) is kept to a small figure. This is primarily accomplished through the use of a step down turns ratio from primary to secondary. This turns ratio must be kept to such a value that there is still sufficient voltage across the secondary to drive the grids of the output tubes to full power output. Regulation is further improved by the use of primary and secondary windings having low D.C. resistance and low leakage reactance.



Bottom Mounting

Leakage reactance is an important factor in determining the operation of a transformer such as this because only one half of the secondary is loaded at one time. The grids of the output tubes draw current only when they are at a positive polarity. As one grid swings positive the other grid swings negative so that only one grid draws current at one time. This means that the windings of the transformer must be so constructed that the coupling between the total primary and one half of the secondary will be as good as the coupling between total primary and total secondary in a transformer used in a class A circuit.

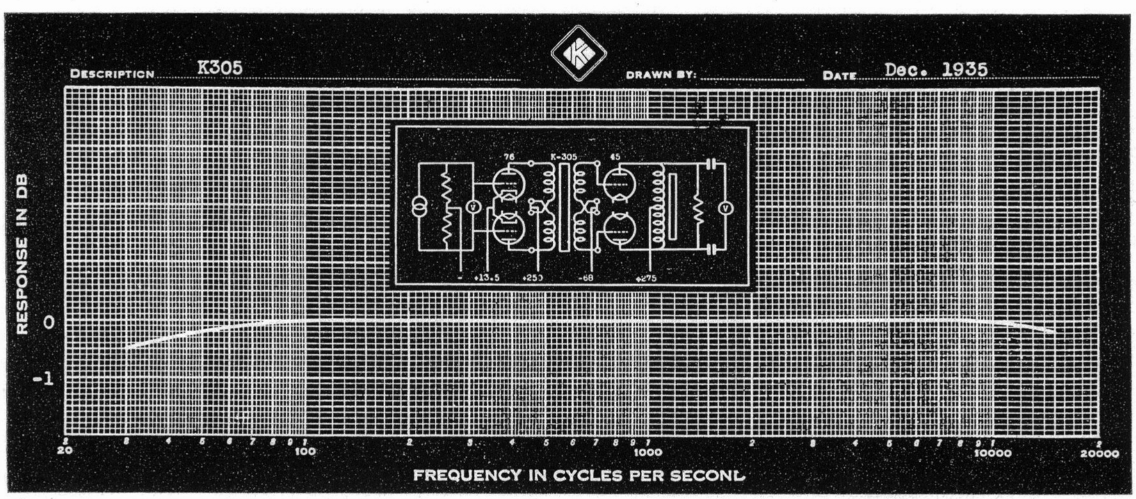
The primary inductance of a driver transformer must be kept to a value sufficiently high so that the shunting effect of primary reactance at the lowest operating frequency will not be sufficient to cause a loss in power output.

A high quality transformer of this type is the product of the correlation of these design considerations. The Kenyon Transformer Co., Inc., sincerely believes that this has been done successfully in transformer K-305.

SPECIAL APPLICATIONS

Driver transformers for class AB output stages are a very precise piece of equipment and any change of impedance ratings will cause a sacrifice in either frequency response, power output, or distortion content. However, it may be found necessary to use transformer type K-305 for applications other than for which it has been designed. The following information is given for the assistance of the audio engineer in determining those operating characteristics which may be expected.

Let us assume that it is desired to drive a class AB 45 output stage from a pair of triodes whose plate resistance is 20,000 ohms and whose plate current does not exceed 10 MA. The



primary of type K-305 has sufficient inductance so that the shunting effect on 20,000 ohms (push pull tubes with plate resistance of 10,000 ohms each) does not cause a loss of more than ½ DB at 30 cycles. When this plate resistance factor is doubled the shunting effect of the primary will also be doubled. This means that the frequency response will fall off ½ DB at 60 cycles instead of 30 cycles. The high frequency response will be improved because the effect of leakage will be minimized. This is due to the fact that the leakage reactance acts like a small reactor in series between primary and secondary. The leakage remains constant while the plate resistance has been doubled. The voltage developed across the leakage reactance (which represents a loss) will be cut in half and as a result high frequency response will be even better than rated. On the other hand the regulation will not be as good because the ratio of plate to plate load to plate resistance in the driver stage when the output tubes draw grid current has been cut in half. Poor regulation results in a flat top wave form which indicates content of higher harmonics. This increase in harmonic content may seriously impair the output of the amplifier. The only cure for this is to drive the output stage at a level low enough to prevent the harmonic content from becoming serious.

When the driver stage consists of tubes whose plate resistance is lower than the intended value for this unit the opposite line of reasoning from that employed above may be followed. The shunting effect of the primary reactance will be minimized making the low frequency response better than rated. The comparative effect of leakage reactance will be increased. If the plate resistance is only half of the rated value the effect of leakage reactance will be doubled. This means that frequency response will be impaired by ½ DB at 7500 cycles instead of 15,000 cycles. When the ratio of primary load resistance to plate resistance is increased the regulation will be better. This means that the harmonic content of the output stage will be reduced.

If the unit is used as rated to drive class A output tubes the frequency response and harmonic content will be within values as good or better than those given for its rated application. The main objection to using this unit to drive a class A output stage is that the turns ratio is step down, cutting the gain of the amplifier. However, it is possible to work this item backwards. This can be done by connecting the plates of the driver stage to the terminals used for the grid connections, by connecting B plus to the terminals for cathode return, and by connecting grids of the output stage to the plate terminals.

Since the turns ratio primary to one half secondary is 2.8 the overall turns ratio is 1.4. Impedance or inductance varies as the square of the turns ratio. Therefore the secondary inductance is equal to $\left(\frac{1}{1.4}\right)^2$ × the primary inductance or ½ the primary inductance. This indicates that the frequency response at low frequencies will be governed by a shunting effect twice as great as when the unit is used in the recommended manner. The loss at 60 cycles then will be ½ DB. If the plate resistance of the driver tubes is 10,000 ohms each the total primary impedance is 20,000 ohms. A step up turns ratio of 1:1.4 indicates that the secondary impedance will be $(1.4)^2$ × the primary impedance or 40,000 ohms. When impedances as high as this are encountered in transformer windings it is important that precautions be taken to keep the effect of distributive and mutual capacity as small as possible. It would be impossible to do this without sacrificing other characteristics more necessary to K-305 as a driver transformer. For this reason the high frequency response will be impaired above 7000 cycles in this application.

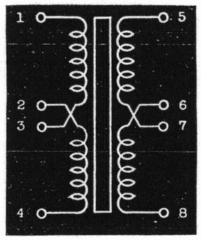
ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
Turns Ratio — 2.8:1 (total pri. to ½ sec.)
Maximum Level — + 23 DB
Minimum Level — Zero level
Maximum D.C./Leg — 10 MA
Maximum D.C. Unbalance/Leg — 1 MA
Pri. Inductance —
280 hy — 30 cycles — 20 volts applied
330 hy — 30 cycles — 75 volts applied
440 hy — 30 cycles — 180 volts applied
200 hy — 30 cycles — 10 volts applied

All inductance figures given above are based on no polarizing D.C. in coil and an A.C. voltage applied to the coil of the frequency and potential specified.

Pri. D.C. Resistance — 2500 ohms.
Coil Structure — Interleaved sections, balanced for inductance, capacity, and resistance.
Core Structure — Low-loss high-permeability silicon steel.
Electromagnetic Shielding — High-permeability cast case protects the transformer from the effects of pickup from stray electromagnetic fields.



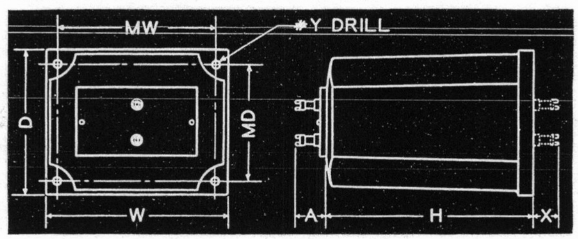
Insulation Test — 750 volts

Terminal Arrangement —
PRIMARY TERMINALS
Plates — 1 and 4
B + — join 2 and 3

SECONDARY TERMINALS
Grids — 5 and 8
Cathode return — join 6 and 7

MECHANICAL SPECIFICATIONS

Transformer K-305 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-305
Casting Type T1
Approx. Weight .... 4½ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾"	3½"	3⅛"	2 13/16"	2 7/16"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from the date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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Cable Address:
SIMONTRICE-NEW YORK

KENYON

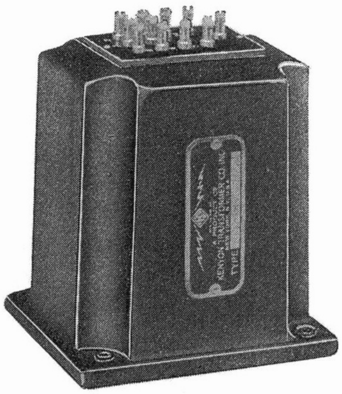
LABORATORY STANDARD
» » Interstage Transformer

TYPE K-306

List Price $18.00

GENERAL APPLICATIONS

Transformer K-306 has been designed to couple push pull 6F6's, 2A3's, or 45's to the grids of class AB_2 6L6's. The driver tubes which may be used with this transformer provide for a reserve amount of driving power under all conditions. Excellent regulation of the audio grid circuit is obtained with such a combination.



Top Mounting

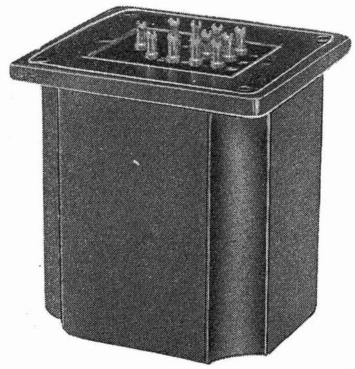
ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

Electrostatic shielding between windings of a transformer operating at a level as high as this is not necessary. Longitudinal interference pickup is not amplified to an extent to require such shielding. Interstage coupling between this transformer and the output transformer, however, might be serious. To minimize any such condition as this the unit is encased in high permeability cast housing. Electromagnetic shielding effective to the extent of 18 DB is provided by this case.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with driver transformers such as this will be of assistance to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information. The power sensitivity of the 6L6 tube is very high. Any distortion which is present in the grid circuit will therefore appear in the plate circuit amplified many times. One of the most important requirements of a good driver transformer is that it perform the function of coupling the driver tubes to the grids of the output tubes with the best possible voltage regulation. In order to accomplish this the driver tubes must have a power capacity higher than that required by the grids to be driven. The reason for this will be evident from a consideration of the impedance conditions looking into a pair of class AB grids. At low signal the grids never get to a positive potential, therefore, no grid current is drawn. At maximum signal however grids swing positive and draw grid current.

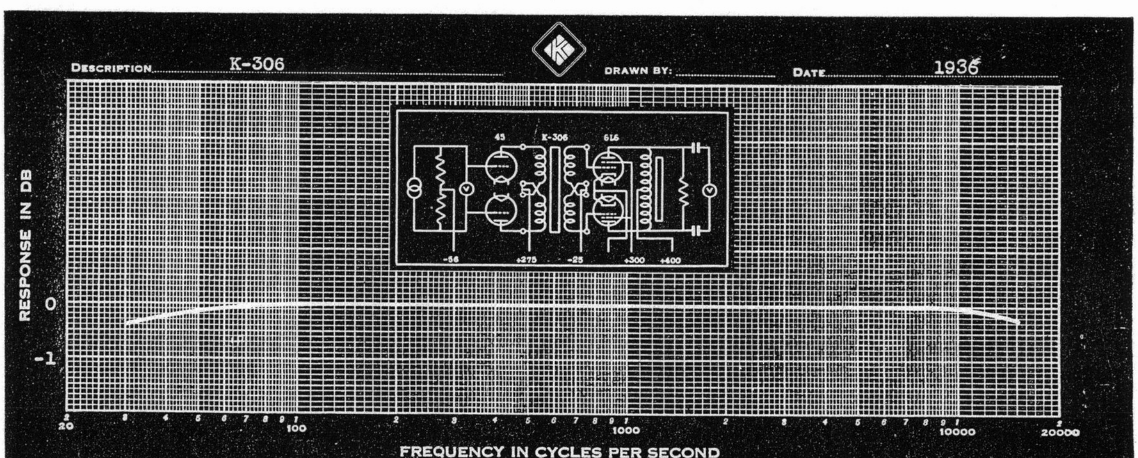
When no grid current is drawn the grid impedance may for all practical purposes be considered infinity. When grid current is drawn the grid impedance decreases to a finite value, which is often surprisingly low. If the driver tubes are capable of supplying just enough power to fulfill the driving requirements, the voltage output will drop off as the grid impedance decreases, that is when the grid impedance is infinity the total generator voltage of the tubes (driver tubes) appears across the primary of the transformer. When the finite load is reflected to these tubes a certain proportion of the generator voltage is used up as drop across the internal resistance of the tubes. If the power capacity of these tubes is very low the transformer with the proper turns ratio to minimize this voltage regulation would not supply sufficient voltage to drive class AB grids. Now, assuming that we have driver tubes with power capabilities to meet all the needs of the output circuit we must consider the effect that the driver transformer plays in such a circuit. This transformer must introduce the least possible regulation or it automatically throws away all the advantage gained by using large driver tubes. In order to realize the best conditions it is important that the effective resistance per grid circuit of the transformer be kept below 500 ohms. This means that the turns ratio of the transformer must be such that the reflected plate impedance of the driver tubes plus the winding resistance of the transformer must not be over 500 ohms. The impedance at the highest frequency to be transmitted must not exceed 700 ohms. That is, the leakage reactance of the transformer as seen in each grid circuit must be kept to such a value that when added to the reflected resistance of 500 ohms it does not bring the total up to more than 700 ohms. When these conditions are fulfilled 6L6 output tubes may be driven to full power output with only 1 or 2% distortion added by the driver stage.



Bottom Mounting

K-306 has been designed to meet these strict requirements and also deliver sufficient grid excitation so that reversed feed back may be used in the output stage for load stabilization and to minimize harmonic content.

The low frequency response of such a transformer is governed by the primary inductance. Primary reactance is directly proportional to primary inductance and frequency, that is, reactance equals $2\pi \times f \times$ inductance. The primary inductance being constant it will be seen that primary reactance will decrease directly as frequency decreases. When primary reactance decreases to such a point that it is of the same order as the plate resistance of the preceding tubes a loss occurs. This loss is caused by the flow of current in the primary (exciting current) which causes a voltage drop in the plate resistance of the tubes. This drop subtracts from the voltage available at the primary of the transformer and thus



the voltage appearing across the primary for transfer to the secondary is decreased. Transformer K-306 is so designed that the maximum loss of this kind is ½ DB at 30 cycles. The coil and core construction is such that the maximum core loss even at the low frequencies is negligible.

The high frequency loss in a transformer such as this is dependent upon three conditions: leakage reactance; distributive capacity; and mutual capacity. In the balanced windings of K-306 much care has been taken to reduce both mutual and distributive capacity so that the effects of these may be neglected. Thus the controlling factor of high frequency response is leakage reactance. In order to keep the regulation of the transformer good up to the higher frequencies leakage reactance has been made much smaller than is necessary to maintain a frequency response within ½ DB to 15,000 cycles. It will then be seen that the loss of K-306 up to 15,000 cycles will be somewhat less than ½ DB.

SPECIAL APPLICATIONS

The following information is given for the assistance of the design engineer in estimating the characteristics which may be expected under various operating conditions other than those covered by rated applications. This unit has been designed to handle sufficient reserve power so that it may be used to drive much larger output tubes than the 6L6, for instance push pull 2A3's are recommended as the driver for class B 838's or 203A's. The turns ratio of K-306 is within 15% of the correct value for such applications. While a turns ratio of 15% wrong will not produce an optimum condition in such a driver circuit, satisfactory operation in most cases will be obtained.

K-306 may be used to couple 2A3's to 805's class B with very satisfactory results. The 805's provide a power output of approximately 370 watts. It will be seen from this consideration that the unit under discussion is a very versatile driver transformer. It of course may be used to drive class AB push pull parallel 45's or 2A3's. It may also be used to drive push pull parallel class AB_2 6L6's. The transformer required for this application should have an effective impedance per grid circuit less than that supplied by K-306. The frequency response characteristics will be unchanged however except for a slight sacrifice at the higher frequencies. The amount of distortion added by this improper grid circuit impedance will not be serious. Most serious distortion occurring at the higher audio frequencies, above 10,000 cycles. The harmonics of 10,000 cycles being outside the audible range will not be serious in the output of an amplifier.

K-306 may be used as an output transformer with excellent results. Since the turns ratio, total primary to ½ secondary, is 3.15 : 1 a 500 ohm output line is obtained by connecting the secondaries in parallel. Connect 500 ohms to 5 and 8, join 5 to 6 and 7 to 8. This connection reflects a plate to plate load to the primary of 5000 ohms. This is suitable for such output tubes as 45's and 2A3's. If a 2000 ohm output line is desired the secondaries may be connected in series. The response for either of these applications will be the same at the low frequencies as for rated applications, and nearly as good at the higher frequencies.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB — 30 to 15,000 cycles
The frequency response tolerances given above will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 8000 ohms

Turns Ratio — Total primary to ½ secondary 3.15 to 1

Max. Pri. D.C. Balanced/Leg — 60 MA

Max. Pri. D.C. Unbalanced/Leg — 6 MA

Maximum Level — + 32 DB

Primary Inductance —

43 hy 30 cycles 10 volts applied
71 hy 30 cycles 100 volts applied
89 hy 30 cycles 300 volts applied
62 hy 60 cycles 100 volts applied

The inductance figures given above were determined with no polarizing D.C. in the coil.

Coil Structure — Interleaved sections balanced for inductance, capacity, and resistance.

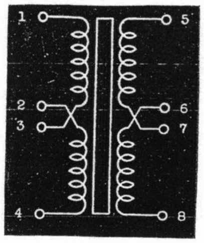
Primary D.C. Resistance — 220 ohms (Total)

Secondary D.C. Resistance — 95 ohms (Total)

Core Material — Low-loss high permeability steel

Electromagnetic Shielding — High permeability cast case protects transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement

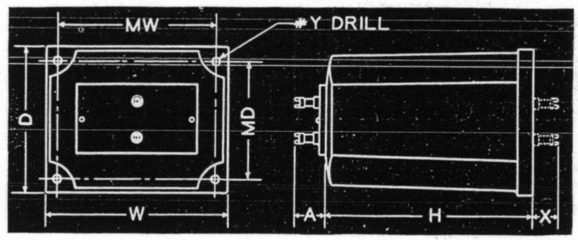


PRIMARY TERMINALS:
Plates — 1 and 4
B + — Join 2 to 3

SECONDARY TERMINALS
Grids — 5 and 8
Cathode Return — Join 6 to 7

MECHANICAL SPECIFICATIONS

Transformer K-306 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-306

Casting Type T2

Approx. Weight .... 6¼ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅛"	4"	3⅜"	3 9/32"	2 23/32"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from the date of purchase.

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Printed in U.S.A.

KENYON

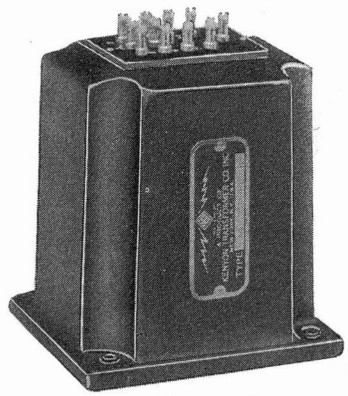
LABORATORY STANDARD
» » » Output Transformer

TYPE K-400

List Price. . . . $18.00

GENERAL APPLICATIONS

Transformer K-400 is designed to couple a single triode plate to a transmission line. The primary is designed to work from a single 56, 76, 57—6C6—77 (triode connected) 6C5, 30, 864 or similar tube whose plate resistance is of the order of 10,000 ohms. Any other triodes falling in this classification may be used. The secondary is supplied with the Kenyon Multiple Line impedance arrangement which provides for a wide range of impedance terminations ranging from 50 to 500 ohms.



Top Mounting

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

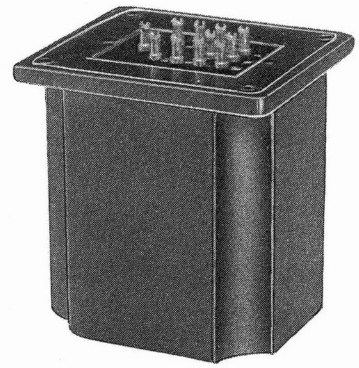
Radio frequency pick up and stray voltages of a longitudinal character may be amplified many times in succeeding stages of voltage amplification before reaching the output of the main amplifier. This makes for noisy reproduction and distortion. The best precaution against this type of interference is a complete electrostatic shield between primary and seconary windings. The Kenyon Transformer Co., Inc., has designed this unit with a copper shield between windings. This provides a perfect barrier to any such interference.

The coil construction of this unit is of the type frequently referred to as hum cancellation, hum bucking, or self shielding. This means that the core is of a shape approaching toroidal, with identical coils on each side of the core. When this type of construction is used, any stray audio or radio frequency fields induce equal and opposite voltages in each coil. Since these coils are connected in series the voltages cancel with the effective net result of no interference pickup. This unit is further shielded by a cast high-permeability case which reduces pickup by 18 DB.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with transformer K-400 is essential to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information.

The primary impedance of this unit is 20,000 ohms instead of 10,000 for a very definite reason. A load impedance equal to source impedance, as universally known, provides for maximum power transfer between the source and the load. This would seem to indicate that the plate load presented by transformer K-400 to a triode of 10,000 ohms plate resistance is twice as great as it should be. This would be true if maximum power output were the only consideration. Harmonic distortion is the other consideration which justifies this design. The voltage delivered to the load is determined by the product of the amplification factor of the tube, the grid excitation, and the ratio of plate load to the sum of plate load and plate resistance. That is $E_L = \mu E_g \dfrac{R_L}{R_L + R_P}$



Bottom Mounting

It will be seen from this equation that the larger the load resistance used the larger the denominator becomes with respect to the plate resistance. This means that small plate resistance variations have less effect on the output voltage when a large plate load is used. Since any variation of output voltage due to a changing tube characteristic results in amplitude distortion it may be seen that high plate load is beneficial in this respect. The power output loss due to this increased plate load of 20,000 ohms is less than 1 db.

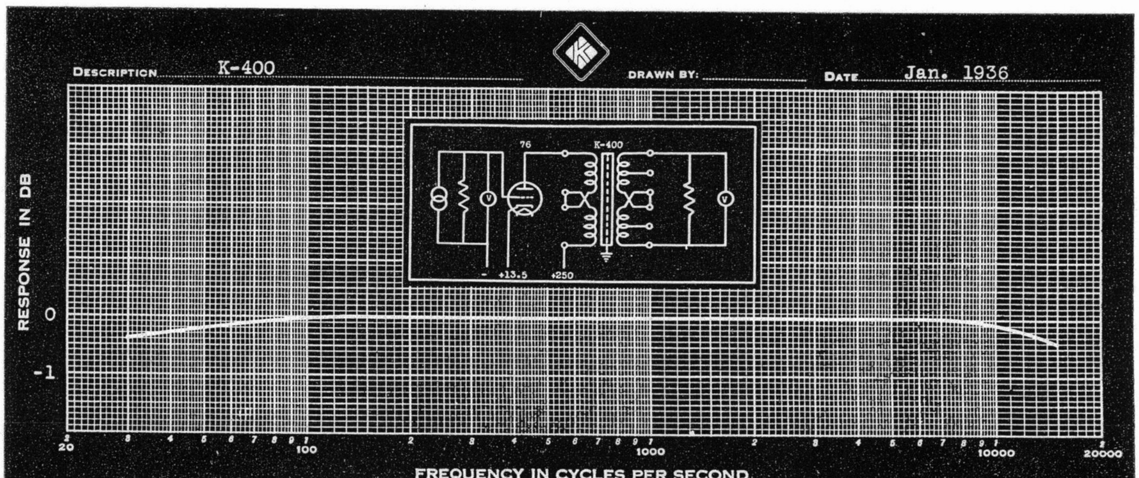
In the design of an output transformer such as this it is important to provide sufficient inductance in the primary so that the shunting effect of the primary reactance at the lower frequencies will not cause a loss. The high frequency response must be maintained through the proper construction of windings, interleaved if necessary, to keep the leakage reactance to such a figure that this reactance in series between primary and secondary will not cause a drop in voltage, thereby causing the frequency response to fall off at the higher audio frequencies.

A high quality transformer of this type is the product of the correlation of these design considerations. The Kenyon Transformer Co., Inc., sincerely believes that this has been done successfully in transformer K-400.

SPECIAL APPLICATIONS

The following data is given for the assistance of the engineer who finds it necessary to use the type K-400 in applications other than those for which it is designed.

Suppose the unit is working out of a tube having a 10,000 ohm plate resistance, and a plate current of 10 MA is flowing in the primary. A curve of inductance versus primary D. C. may be drawn from the data given. Any value lying outside this curve may be arrived at by extrapolation. The maximum safe primary current is 14 MA (as far as current density in the copper is concerned). The primary inductance at 10 MA



D.C. would be approximately 65 henries. This indicates a primary reactance only 60% as great as it should be for rated frequency response, creating a loss of ½ DB at approximately 50 cycles.

Let us suppose it is desired to use a tube having a plate resistance of 20,000 ohms. The frequency response will remain approximately as rated (within ½ DB) if the plate current is within recommended values. Distortion will be increased but may be kept within allowable limits by limiting the amount of grid excitation.

A triode of 6000 ohms plate impedance would sustain a power output loss of slightly more than 1 DB if operated into the primary of K-400. Assuming a plate current of 8 MA the primary inductance will be sufficient to insure good low frequency response. The leakage reactance effect at the higher frequencies will be greater by a ratio of 10,000 to 6,000 indicating that the loss at about 10,000 cycles will be ½ DB.

When K-400 is used as an output transformer to a line, which in turn works into a line to grid transformer it is advisable to load the line with the proper resistance if a T-pad is not used. The load resistance should have a value equivalent to the impedance value of the line. The primary of an input transformer should always be terminated since it operates into a very high impedance (the grid of a class A tube). If the primary is not terminated the plate load of the preceding output tube is undetermined and conditions detrimental to frequency response may exist.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits

Frequency Response — ± ½ DB 30 to 15,000 cycles. The frequency response characteristics illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 20,000 ohms

Secondary Impedance — 50, 125, 200 (balanced) 250, 333, and 500 (balanced) ohms

Maximum Primary D.C. — 8 MA

Maximum Level — + 20 DB

Minimum Level — − 30 DB

Primary D.C. Resistance — 1360 ohms (total)

Secondary D.C. Resistance — 37 ohms (total)

Pri. Inductance —

90 hy — 30 cycles — 8 MA D.C.
110 hy — 30 cycles — 6 MA D.C.
123 hy — 30 cycles — 5 MA D.C.
170 hy — 30 cycles — 2 MA D.C.
180 hy — 30 cycles — no D.C.
160 hy — 60 cycles — no D.C.

These inductance measurements were made with 10 volts A.C. applied across the coil.

Coil Structure — Hum cancellation type composed of symmetrical sections balanced for inductance, capacity, and resistance.

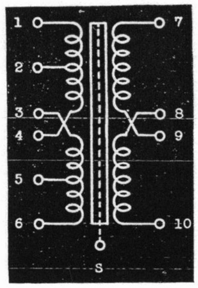
Core Material — High-permeability alloy.

Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc., cancels the effects of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a high-permeability cast case.

Electrostatic Shielding — Copper shield between primary and secondary minimizes electrostatic coupling.

Insulation Test — 750 volts.

Terminal Arrangement



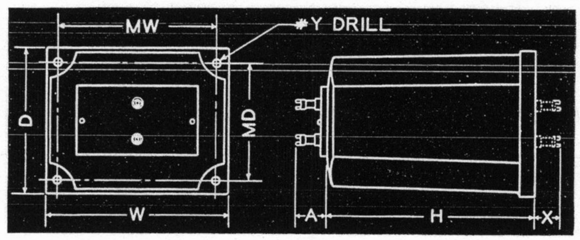
Primary Terminals
B + 7
Plate — 10
Join — 8 and 9

Electrostatic Shield
Terminal S connects to shield between primary and secondary and to core. The core is insulated from the case

Secondary Terminals
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

MECHANICAL SPECIFICATIONS

Transformer K-400 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No..K-400

Casting Type..T1

Approx. Weight....................................3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾″	3½″	3⅛″	2 13/16″	2 7/16″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from the date of purchase.

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KENYON

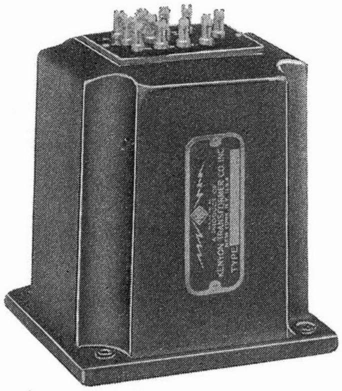
LABORATORY STANDARD
» » » Output Transformer

TYPE K-401

List Price....$18.00

GENERAL APPLICATIONS

Transformer K-401 has been designed to couple push-pull class A triodes to a transmission line. The primary will work out of push pull type 56, 76, 57-77-6C6 (triode connected), 6C5, 30, 864, or similar tubes having an A.C. plate resistance of the order of 10,000 ohms. The secondary of this transformer is provided with the Kenyon Multiple Line which provides for a wide range of impedance terminations varying from 50 to 500 ohms.



Top Mounting

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

An electrostatic shield is incorporated between the primary windings and secondary windings to prevent capacative coupling of any longitudinal radio frequency or audio frequency pick-up from the primary. This is important because gain up to 100 DB often follows a unit of this type. Any radio frequency pick-up amplified to this extent will cause distortion and overloading in succeeding stages. The copper electrostatic shield employed forms a perfect barrier to either R.F. or A.F. interference signals.

The coil structure employed in this transformer is of the type frequently referred to as self-shielding, hum-cancellation, or hum-bucking. This means that the core is of a shape approaching toroidal with identical coils on each side. Any stray field cutting the windings of this transformer will generate equal and opposite voltages in each of these coils. Since these coils are connected in series these voltages add up to zero giving a net effective result of no interference pickup. In addition to this precaution against pickup of electromagnetic interference, the unit is potted in a casting of high permeability material which further reduces pickup by 18 DB.

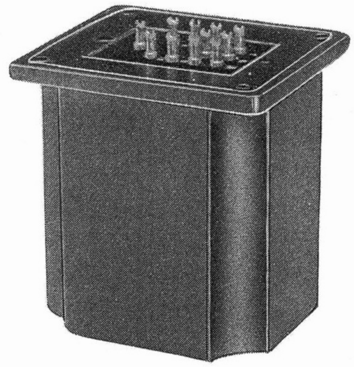
DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with low level output transformers is essential to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information.

In the design of an output transformer such as this it is important that there be enough primary inductance so that the shunting effect of the primary reactance at the lower frequencies will not cause a loss. The high frequency response must be maintained through the proper construction of windings, interleaved if necessary, to keep the leakage reactance to such a figure that this reactance, in series between primary and secondary, will not cause a drop in voltage, thereby causing the response to fall off at the higher audio frequencies.

A high quality transformer of this type is the product of the correlation of these design considerations. The Kenyon Transformer Co., Inc., sincerely believes that this has been done successfully in transformer K-401.

SPECIAL APPLICATIONS

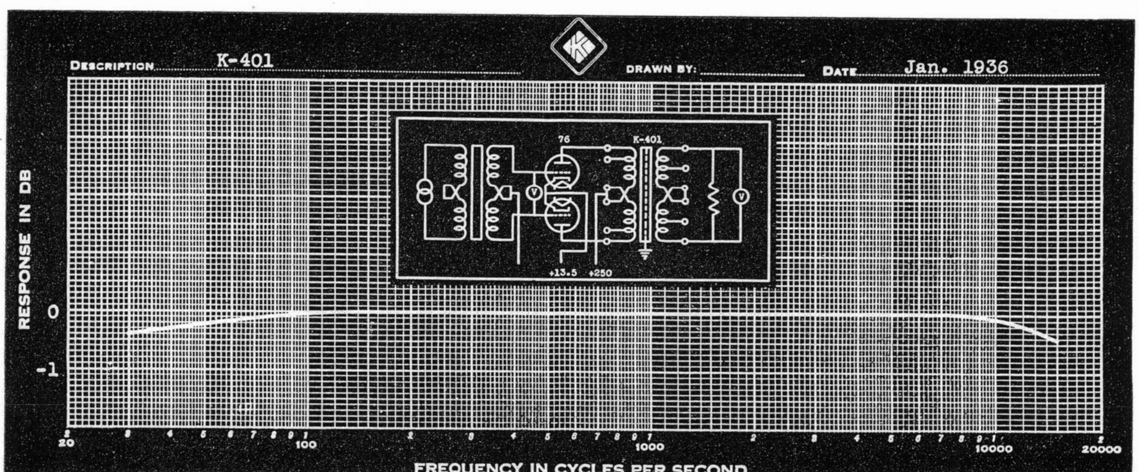


Bottom Mounting

While this unit is so constructed to make its applications numerous and to make impedance terminations variable the audio engineer may find it necessary to use it in circuits other than those for which it is rated. The following information is given to help him estimate the operating characteristics of this unit under various conditions.

Suppose it is necessary to couple push-pull 56's to a 1000 ohm line. The 1000 ohm line should be connected to terminals rated for a 500 ohm line. This means that the reflected primary load will be 40,000 ohms instead of 20,000 causing a mismatch of 2:1. This mismatch occurs because the plate resistance of each tube is 10,000 ohms. The two plates in series, as they operate in a push-pull connection, result in a total impedance of 20,000 ohms. The output power loss under this condition will not be serious. This may be calculated by assuming a generator with an internal impedance of 20,000 ohms and a load of 20,000 ohms. Assume some convenient voltage for the generator voltage and calculate the power consumed by the load. Then go through the same calculation for a generator with an internal impedance of 20,000 ohms and a load of 40,000 ohms. This shows that the total power loss is less than 2 DB. The frequency characteristic, however, suffers more than the power output. The primary of this transformer was designed with sufficient inductance so that shunting effect of primary reactance across the 20,000 ohm load would not cause a loss of more than ½ DB at 30 cycles. With a 40,000 ohm load the shunting effect will be twice as great. The low frequency response will fall off ½ DB at approximately 60 cycles, and approximately 1 DB at 30 cycles.

The leakage reactance was made such that this reactance in series with a 20,000 ohm load would not cause a loss of more than ½ DB at 15,000 cycles. With a 40,000 ohm load the relative effect of this series leakage reactance will be diminished by 50% indicating that the high frequency response will be



better than rated. The loss will be less than ½ DB.

The following considerations will hold where it is desired to couple push-pull plates, each of 20,000 ohms resistance, to 500 ohm line. The primary impedance in this case should be doubled. It is therefore necessary to double the impedance ratio of the item to secure this desired change. Since the over-all impedance ratio is 40:1 an impedance ratio of 80:1 is obtained by connecting the 500 ohm line to the terminals rated for 250 ohms. This creates a condition in which the plate impedance of the tubes is matched by the impedance of the load presented to them, thus securing maximum power output. The high and low frequency response will be effected in the same way as the example previously given.

If it is desired to couple tubes having a plate resistance of 3,600 ohms, such as type 31, to a 500 ohm line the frequency response calculation will be as follows:

The type 31 has a plate resistance of 3,600 ohms. The recommended plate load is 5,700 ohms for a single tube. The recommended plate to plate load for push pull tubes is approximately 10,000 ohms, indicating that there will be an impedance mismatch of 2:1. The calculation of power lost when the generator impedance is lower than the load impedance is the same as the case taken up in a previous example in which the generator impedance was twice the load impedance. Since the primary of this transformer was designed to have sufficient inductance to operate from a 20,000 ohm source there will be more than sufficient inductance for operation from a 7,200 ohm source. This indicates that the low frequency response will be improved by a ratio of 20,000 to 10,000. The loss will be ½ DB at approximately 15 cycles. Since the plate impedance coupled to the primary is decreased and the load impedance remains the same the effect of the leakage reactance will be approximately twice as great as with a 20,000 ohm generator. This means that the frequency response will fall off approximately 1 DB at 15,000 cycles.

When K-401 is used as an output transformer to a line, which in turn works into a line to grid transformer it is advisable to load the line with the proper resistance if a T-pad is not used. The load resistance should have a value equivalent to the impedance value of the line. The primary of an input transformer should always be terminated since it operates into a very high impedance (the grid of a class A tube). If the primary is not terminated the plate load of the preceding output tube is undetermined and conditions detrimental to good frequency response may exist.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response characteristics illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 20,000 ohms

Secondary Impedance — 50, 125, 200 (balanced), 250, 333 and 500 (balanced) ohms

Maximum Primary D.C./Leg — 8 MA

Maximum Primary D.C. Unbalance/Leg — 1 MA

Maximum Level — + 23 DB

Minimum Level — – 20 DB

Primary D.C. Resistance — 1360 ohms (total)

Secondary D.C. Resistance — 37 ohms (total)

Pri. Inductance —
250 hy — 30 cycles — 10 volts applied
310 hy — 30 cycles — 50 volts applied
380 hy — 30 cycles — 100 volts applied
200 hy — 60 cycles — 10 volts applied

All inductance figures given above are based on no polarizing D.C. in the coil and with an A.C. voltage applied to the coil of the frequency and potential specified.

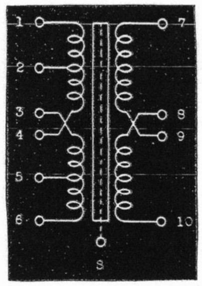
Coil Structure — Hum cancellation type composed of symmetrical sections balanced for inductance, capacity and resistance.

Core Material — High-permeability alloy

Electromagnetic Shielding — A special coil and core structure developed by the Kenyon Transformer Co., Inc., cancels the effects of pickup from stray electromagnetic fields. The transformer provides its own shielding by the construction and location of its windings. The unit is further shielded by a high-permeability cast case.

Insulation Test — 750 volts

Terminal Arrangement



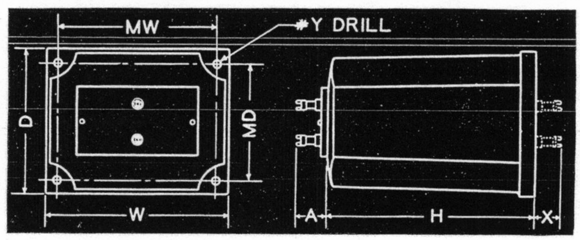
PRIMARY TERMINALS
Plates — 7 and 10
B + — join 8 and 9

ELECTROSTATIC SHIELD
Terminal S connects to shield between primary and secondary and to core. The core is insulated from the case.

SECONDARY TERMINALS
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

MECHANICAL SPECIFICATIONS

Transformer K-401 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-401

Casting Type. T1

Approx. Weight. . . . . 3¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	3¾″	3½″	3⅛″	2¹⁵⁄₁₆″	2⁷⁄₁₆″	½″	⁵⁄₁₆″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from the date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnished a revised type if the unit ordered has been discontinued.

KENYON TRANSFORMER CO., Inc.

840 Barry Street :: :: New York City

Export Department:
25 Warren Street
New York, N. Y.

Cable Address:
SIMONTRICE-NEW YORK

KENYON

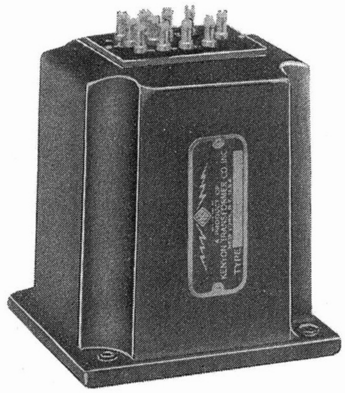
LABORATORY STANDARD
» » » Output Transformer

TYPE K-402

List Price. . . . $21.00

GENERAL APPLICATIONS

Transformer K-402 has been designed to couple push pull plates requiring a plate to plate load of 8000 ohms to a high Impedance Line or Voice Coil Line. The 8000 ohm primary is intended to operate from class A 45 or 50 tubes or class AB 2A3 tubes fixed or self biased. The load impedance presented by this transformer to the 2A3 tubes is considerably higher than the load impedance recommended for maximum power output. The use of this higher plate to plate load has the advantage of reducing the harmonic distortion which appears in the output.



Top Mounting

Two separate sets of secondary windings are provided. The main secondary is supplied with the Kenyon Multiple High Impedance Line which permits terminations of 500 to 4000 ohms. The frequency response using any impedance of this combination will be linear within ± ½ DB from 30 to 15,000 cycles. This is illustrated below by the solid curve. The second secondary is provided with the Kenyon Multiple Voice Coil Line which permits terminations of 1.8 to 15 ohms. This was primarily designed as an auxiliary winding for monitoring applications. The frequency response using any one of various voice coil loads will be maintained as shown below by the dotted curve.

Only one secondary should be loaded at one time with the rated load if the harmonic distortion generated by the associated tubes is to be kept within commercial limits. This precaution must be observed in the application of transformer K-402 unless the voice coil secondary is required for monitoring purposes. In this case the Multiple Line may be terminated with any rated load and the voice coil secondary terminated with a load equivalent to at least (ten) 10 times the rated load, e.g., if the 500 ohm winding of the Multiple Line secondary is worked into a 500 ohm line the 15 ohm secondary can be shunted with a 200 ohm line working into a monitor speaker.

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

Electrostatic shielding between windings is not necessary in an output transformer operating at a high audio level. Longitudinal interference pickup is amplified but little in a unit of this type.

Interstage coupling—cross-talk—between the output transformer and any of the other audio transformers in the amplifier is eliminated by a cast high-permeability housing. Electromagnetic shielding of 18 DB is also provided by this case.

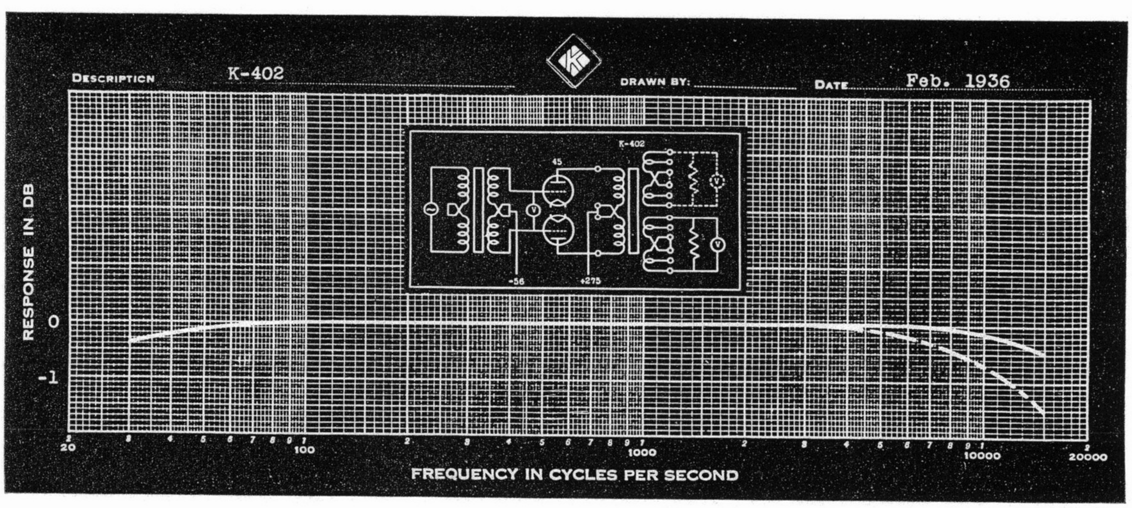
DESIGN CONSIDERATIONS

Efficiency is one of the most important considerations in the design of a unit such as K-402. There are several factors governing the efficiency of such a transformer. While 60 milliamperes is the maximum current which may flow in the primary, as much as 2.6 amperes may flow in the low impedance winding of the secondary at the maximum power rating of 12 watts. The secondary wire size must be chosen to provide low winding resistance and therefore low copper-loss. Core-loss is another factor which governs the efficiency of an output transformer. Let us suppose that the primary input is 12 watts and the flux-density in the core is such that the core-loss is 2 watts. If the input power is 12 watts the output power will be 10 watts indicating an efficiency of approximately 83%, or an insertion loss of approximately 1 DB. K-402 has a large high-permeability low-loss silicon steel core. The total insertion loss is less than 1 DB. Sufficient primary inductance is usually obtained in a transformer such as this when the A.C. flux density is kept to such a point that the core-loss is small. The high frequency response in a transformer of this type is controlled by the leakage reactance. Leakage reactance appears as a small reactor in series between primary and secondary. Leakage reactance therefore increases with frequency. The voltage appearing across the reactance consequently also increases with frequency. This means that part of the voltage applied to the primary of the transformer is wasted internally. The remaining part appears across the secondary load. Through proper coil design the leakage reactance in this unit has been kept to such a point that frequency response at 15,000 cycles is down ½ DB.

Bottom Mounting

SPECIAL APPLICATIONS

The wide range of impedance terminations available with type K-402 makes it a very flexible unit. It is possible, however, that it will be found necessary to use it for some application other than for which it was designed. The following information is provided to assist the audio engineer in estimating the frequency response under special conditions.



Suppose it is necessary to couple push pull 50 tubes to an 8000 ohm load. The 8000 ohm load would be connected to the secondary terminations rated for 4000 ohms. When the secondary load is doubled, the reflected primary load is also doubled. The effect on the output tubes would be a reduction in harmonic content, together with a slight reduction in power output. The reactance of the primary decreases as frequency decreases, so that at the lowest frequency the reactance of the primary acts as a shunt across the generator. The loss due to this action is determined by the ratio of generator and load impedance to primary reactance. Since load impedance has been doubled, the effect of this shunting action will also have been doubled (approximately). The low frequency response in this case will be down approximately ½ DB at 60 cycles and 1 DB at 30 cycles. The high frequency response will be improved because the relative effect of the leakage reactance will be less. The high frequency response of a transformer of this type depends on the ratio of the voltage developed across the leakage reactance to the voltage developed across the load. This ratio is decreased when the load impedance is increased. The loss at 15,000 cycles will be approximately ¼ DB.

Suppose it is desired to couple class AB 2A3's fixed bias to 2000 ohms and 15 ohms simultaneously. If the rated load is connected to both secondaries, the reflected primary load is ½ the rated load, or 4000 ohms. The 2A3's fixed bias should have a plate to plate load of 3000 ohms. The difference between 3000 ohms and 4000 ohms will mean a slight reduction of power output together with a reduction in harmonic content. As stated in the above example, low frequency response is governed by the ratio of primary reactance to generator and load impedance. In this case load impedance has been cut in half so that the low frequency response will be improved. Since the load impedance has been reduced, the effect of leakage reactance will be increased causing a sacrifice in the high frequency response. The estimated loss at 15,000 cycles under these operating conditions would be 1 DB.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles

This tolerance is maintained only on the Multiple High Impedance Line secondaries. The frequency response characteristics of the Multiple Voice Coil Line secondaries are illustrated. The specified performance on either set of secondary windings is dependent on maintaining a set of operating conditions within the limits set forth in these data.

Primary Impedance — 8000 ohms (Pl. to Pl.)

Secondary Impedance —

Multiple High Impedance Line — 500, 1000, 1700, 2000 (balanced), 3000, or 4000 (balanced) ohms

Multiple Voice Coil Line — 1.8, 3.75, 6.8, 7.5 (balanced), 11, or 15 (balanced) ohms

Max. Pri. D.C. Balanced/Leg — 55 MA

Max. Pri. D.C. Unbalanced/Leg — 5 MA

Max. Level — + 33 DB

Pri. Inductance —

40 hy — 10 V 30 cycles applied
80 hy — 150 V 30 cycles applied
97 hy — 300 V 30 cycles applied
70 hy — 100 V 60 cycles applied

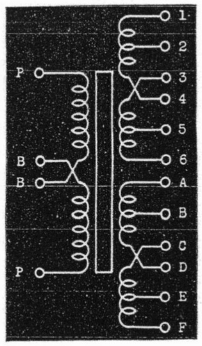
The inductance figures given above are based on no polarizing D.C. in the coil and an A.C. voltage applied to the coil of the frequency and potential specified.

Although transformer K-402 was designed primarily for operation in a balanced push pull output circuit, it can be used, with fair results to couple from a single tube requiring a plate load of 8000 ohms, e.g., working out of a single 45, 2A5, or 89 the response at 60 cycles will be down 2 DB. The high frequency response will be as shown for the push-pull application.

Core Material — Low-loss high-permeability silicon steel

Electromagnetic Shielding — High permeability cast case protects the transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement



Primary Terminals:
Plates — P – P
B + — Join B – B

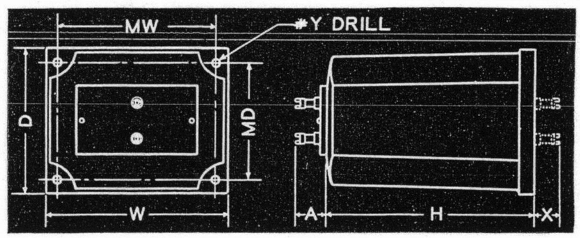
Secondary Terminals:

Multiple High Impedance Line
500 ohms — connect to 2 and 5, join 2 to 3, join 4 to 5
1000 ohms — connect to 1 and 6, join 1 to 3, join 4 to 6
1700 ohms — connect to 1 and 6, join 2 to 3
2000 ohms — connect to 2 and 5, join 3 to 4
3000 ohms — connect to 1 and 5, join 3 to 4
4000 ohms — connect to 1 and 6, join 3 to 4

Multiple Voice Coil Line
15 ohms — connect to A and F, join C to D
11 ohms — connect to A and E, join C to D
7.5 ohms — connect to B and E, join C to D
6.8 ohms — connect to A and F, join B to C
3.75 ohms — connect to A and F, join A to C, join D to F
1.8 ohms — connect to B and E, join B to C, join D to E

MECHANICAL SPECIFICATIONS

Transformer K-402 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-402

Casting Type. T2

Approx. Weight. . . . . 6¾ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅛"	4"	3⅜"	3 9/32"	2 23/32"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

KENYON TRANSFORMER Co., Inc.

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KENYON

LABORATORY STANDARD
» » » Output Transformer

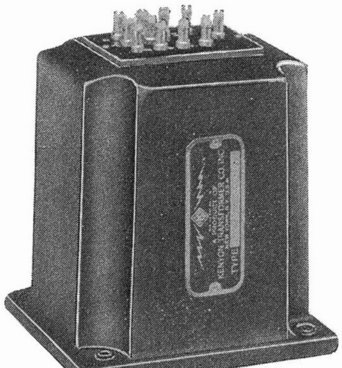
TYPE K-403

List Price. . . .$21.00

GENERAL APPLICATIONS

Transformer K-403 has been designed to couple push-pull plates requiring a plate to plate load of 8000 ohms to a transmission line or a voice coil line.

The 8000 ohm primary is intended to operate from class A or class AB type 2A3 tubes fixed or self biased or from type 45 or 50 tubes operated class A. The load impedance presented by this transformer to the 2A3 tubes is considerably higher than the load impedance recommended for maximum power output. The use of this higher plate to plate load has the advantage of reducing the harmonic distortion which appears in the output.



Top Mounting

Two separate sets of secondary windings are provided. The main secondary is supplied with the Kenyon Multiple Line which permits terminations varying from 50 to 500 ohms. The frequency response using any impedance of this combination will be linear within ± ½ DB from 30 to 15,000 cycles. This is illustrated by the solid curve below. The second secondary is provided with the Kenyon Multiple Voice Coil Line which permits terminations of 1.8 to 15 ohms. This was primarily designed as an auxiliary winding for monitoring applications. The frequency response using any one combination of voice coil loads will be maintained as shown by the dotted curve below.

Only one secondary should be loaded at one time with the rated load if the harmonic distortion generated by the associated tubes is to be kept within commercial limits. This precaution must be observed in the application of transformer K-403 unless the voice coil secondary is required for monitoring purposes. In this case the Multiple Line may be terminated with any rated load and the voice coil secondary terminated with a load equivalent to at least (ten) 10 times the rated load, e.g., if the 500 ohm winding of the Multiple Line secondary is worked into a 500 ohm line the 15 ohm secondary can be shunted with a 200 ohm line working into a monitor speaker.

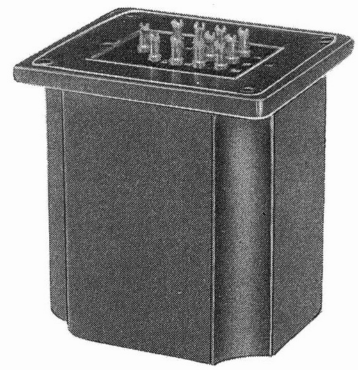
ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING

Electrostatic shielding between windings is not necessary in an output transformer operating at a high audio level. Longitudinal interference pickup is not amplified in a unit of this type.

Interstage coupling—crosstalk—between the output transformer and any of the other audio transformers in the amplifier is eliminated by a cast high-permeability housing. Electromagnetic shielding of 18 DB is also provided by this case.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with all output transformers is essential to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information.



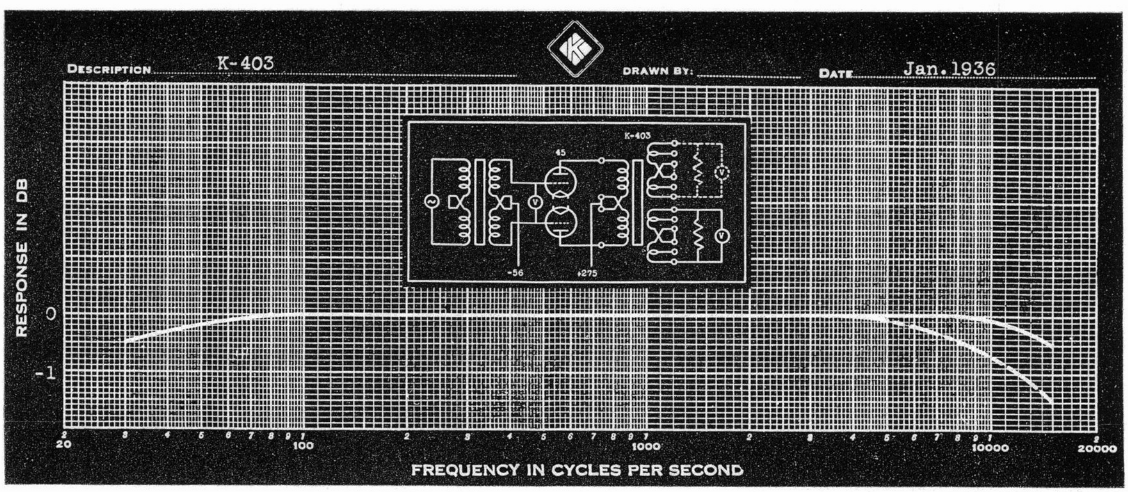
Bottom Mounting

It is important, in the design of a unit such as this, to provide sufficient copper area in all the windings to take care of the current which may flow when the low impedance taps are used. Although the maximum primary current may not exceed 70 milliamperes, the current in the 1.8 ohm tap of the voice coil winding, at the full power output of 12 watts, will be 2.6 amperes. The unit must also be so designed that with maximum power output at 30 cycles the A.C. flux density in the core will not be of such a value as to cause excessive core loss. An example of this effect follows: Assume that we have a core which weighs 4 lbs. and that the density is such that the core loss is ½ watt per lb. This will result in a transformer loss of 2 watts in steel alone. If the tubes supply an input of 12 watts to the primary only 10 watts will be available at the output, indicating a loss of approximately 1 DB. If core densities are kept to a point where this effect does not occur and if high grade silicon steel is used, there is always sufficient inductance to insure negligible effect of primary reactance at the lower frequencies. Leakage reactance is the limiting factor of the high frequency response of a unit of this type. In order to keep this to a minimum, the coil structure of type K-403 has been carefully designed so that an interleaving effect is provided.

A high quality transformer of this type is the product of the correlation of these design considerations. The Kenyon Transformer Co., Inc., sincerely believes that this has been done successfully in transformer K-403.

SPECIAL APPLICATIONS

The following information will assist the audio engineer in estimating the frequency response he may expect from this unit under various operating conditions not included in the rated applications.



If this transformer is used to couple push-pull class A triodes which require a plate to plate load of 5000 ohms, the following sacrifices in frequency response must be made. Since the primary of this unit was designed to have sufficient inductance to keep the loss at low frequencies, due to the shunting effect of primary reactance, less than ½ DB the comparative effect when the primary load is reduced from 8000 to 5000 will be less by a ratio of 8:5. This indicates that the frequency response will be down approximately ½ DB at 20 cycles instead of 30 cycles. The leakage reactance which controls the losses at high frequencies acts like a reactor in series between primary and secondary. When the primary load is decreased, the comparative effect of leakage reactance will be multiplied by a ratio of 8:5 indicating that the frequency response will fall off ½ DB at approximately 10,000 cycles.

When using tubes requiring a plate to plate load of higher than the rated load, the inverse will follow: that is, the low frequency response will be impaired by the direct ratio of the plate to plate loads, and the high frequency response will be increased by the direct ratio of the plate to plate loads. (The foregoing is based on the assumption that the plate resistance varies in the same proportion as the recommended load).

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles. This tolerance is maintained only on the Multiple Line secondaries. The frequency response characteristics of the Multiple Voice Coil Line secondaries are illustrated by the dotted curve. The specified performance on either set of secondary windings is dependent on maintaining a set of operating conditions within the limits set forth in these data.

Primary Impedance — 8000 ohms (Pl. to Pl.)

Secondary Impedance —
Multiple Line — 50, 125, 200 (balanced) 250, 333 or 500 (balanced) ohms.
Multiple Voice Coil Line—1.8, 3.75, 6.8, 7.5 (balanced) 11 or 15 (balanced) ohms

Max. Pri. D.C. Balanced/Leg — 55 MA

Max. Pri. D.C. Unbalanced/Leg — 5 MA

Max. Level — 33 DB

Pri. Inductance —

40 hy — 10 V 30 cycles applied
80 hy — 150 V 30 cycles applied
97 hy — 300 V 30 cycles applied
70 hy — 100 V 60 cycles applied

The inductance figures given above are based on no polarizing D.C. in the coil and an A.C. voltage applied to the coil of the frequency and potential specified.

Although transformer K-405 was designed primarily for operation in a balanced push-pull output circuit, it can be used with fair results to couple from a single tube requiring a plate load of 8000 ohms, e.g., working out of a single 45, 2A5, or 89 the response at 60 cycles will be down 2 DB. The high frequency response will be as shown for the push-pull application. The figures given below represent the inductance of the total primary of this transformer with various values of polarizing D.C. in the coil.

30 hy — 20 MA D.C. — 100 V 60 cycles applied
25 hy — 30 MA D.C. — 100 V 60 cycles applied
18 hy — 40 MA D.C. — 100 V 60 cycles applied

Pri. D.C. Resistance — 345 ohms (total)

Secondary D.C. Resistance
Multiple Line— 27 ohms (total)
Multiple Voice Coil Line— .35 ohms (total)

Coil Structure — Interleaved sections balanced for inductance, capacity and resistance.

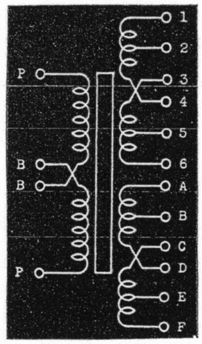
Core Material — Low-loss high-permeability silicon steel

Electromagnetic Shielding — High-permeability cast case protects the transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement

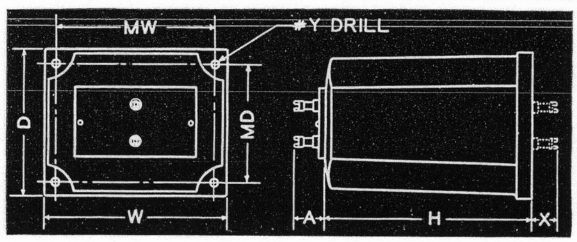
Primary Terminals:
Plates — P – P
B + — Join B – B

Secondary Terminals:
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4
15 ohms — connect to A and F, join C to D
11 ohms — connect to A and E, join C to D
7.5 ohms — connect to B and E, join C to D
6.8 ohms — connect to A and F, join B to C
3.75 ohms — connect to A and F, join A to C, join D to F
1.8 ohms — connect to B and E, join B to C, join D to E



MECHANICAL SPECIFICATIONS

Transformer K-403 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-403

Casting Type T2

Approx. Weight .... 6½ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅛″	4″	3⅜″	3 9/32″	2 23/32″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

KENYON TRANSFORMER CO., Inc.

840 Barry Street :: :: New York City

Export Department:
25 Warren Street
New York, N. Y.

Cable Address:
SIMONTRICE-NEW YORK

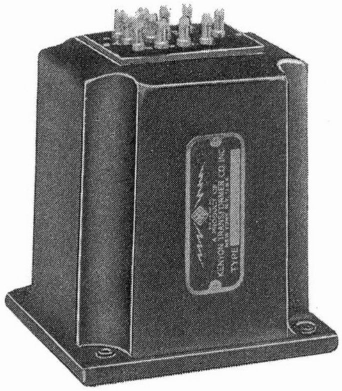
KENYON

LABORATORY STANDARD
» » » Output Transformer

TYPE K-404 **List Price....$18.00**

GENERAL APPLICATIONS

Transformer K-404 has been designed to couple push-pull plates, requiring plate to plate load of 8000 ohms, to a transmission line. The 8000 ohm primary is intended to operate from class A 45 or 50 tubes, or class AB type 2A3 tubes fixed or self biased. The load impedance presented by this transformer to the 2A3 tubes is considerably higher than the load impedance recommended for maximum power output. The use of this high plate to plate load has the advantage of reducing the harmonic distortion which appears in the output.



Top Mounting

The secondary of K-405 is provided with the Kenyon Multiple line which provides for terminations of 50 to 500 ohms.

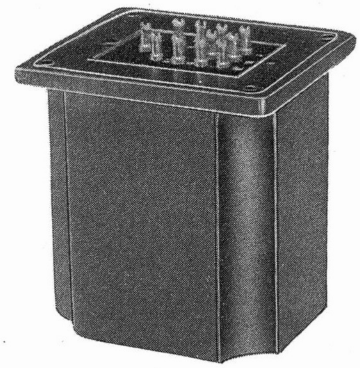
ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

Electrostatic shielding between windings is not necessary in an output transformer operating at a high audio level. Longitudinal interference pickup is amplified but little in a unit of this type. Interstage coupling—crosstalk—between the output transformer and any of the other audio transformers in the amplifier is eliminated by a cast high-permeability housing. Electromagnetic shielding of 18 DB is provided by this case.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with all output transformers is necessary to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information: An understanding of what happens in an output transformer under actual operating conditions can be seen most clearly by drawing a simplified equivalent diagram of the transformer. We will now proceed with a word picture of the diagram.

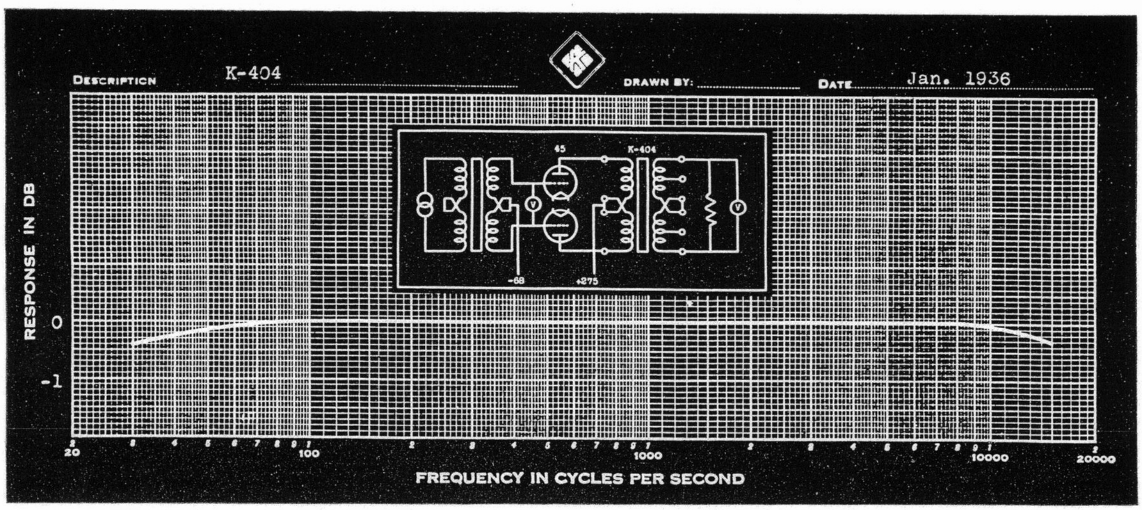
If push-pull 45's operated class A are working into the primary of an output transformer, the generator internal resistance will be approximately 3400 ohms (the plate resistance of the 45's is about 1700 ohms per tube). This may be drawn as a generator with zero impedance having a resistor of 3400 ohms in series with it. Any drop occurring across this 3400 ohms is not available as output voltage. The transformer primary is then connected to one side to the zero impedance generator, and the other side to the 3400 ohms. The primary of this transformer may be drawn as an inductance shunted across the line in parallel with a resistance shunted across the line. As the frequency decreases the reactance of this inductance decreases. When this reactance becomes of a value of the order of 3400 ohms, current flows through it (exciting current) which causes a drop in the 3400 ohm generator impedance. As this condition exists only at the lower frequencies, it may be considered as a low frequency loss. The other low frequency loss is represented by the resistor which we placed in parallel with the primary inductance. This resistor represents the core loss of the transformer. As frequency decreases (applied voltage remaining constant) the A.C. flux density in the core of the transformer increases. As the flux density increases the core loss increases. Thus at the lower frequencies the resistor shown on the schematic diagram will be decreased, drawing additional current from the generator and causing an additional power loss in the transformer which is not available for transfer to the secondary, but which is dissipated as internal heat. Leakage reactance which controls high frequency response would appear as a small reactor in series between the secondary load impedance and the generator. The reactance of this branch of the circuit will increase directly as frequency increases. Any current flowing to the load will therefore cause a drop in voltage across this reactance. As the reactance becomes higher, the drop becomes greater, and so the loss in the transformer is greater. This signifies a high frequency loss. There is one other loss which must be carefully considered in the design of an output transformer. This is copper loss which is approximately the same at all audio frequencies. If the winding resistances are not kept to the proper value, the current flowing through them will cause a loss which is dissipated in internal heat. This loss which occurs at all frequencies is usually designated as the insertion loss of the transformer. In the design of K-404, a core with a large cross-sectional area has been provided. This core is high permeability, low loss, silicon steel, so that the maximum loss at 30 cycles will not exceed ½ DB under full power output conditions. The coil structure is such that the loss due to leakage reactance never exceeds ½ DB at 15,000 cycles. The winding resistances are kept to such a point that the total insertion loss of the unit is less than 1 DB.



Bottom Mounting

SPECIAL APPLICATIONS

The following information is supplied for estimating the



frequency response characteristics of this transformer when this unit is used in circuits not covered by the rated applications.

Suppose it is necessary to couple push-pull class A 50's to a 1000 ohm load. The 1000 ohm load could be connected to the terminals rated for 500 ohms. The low frequency response of an output transformer is governed by the shunting effect of primary reactance on the generator impedance and reflected secondary load. When the secondary load is doubled the reflected primary load is also doubled. Since the primary reactance remains the same, the relative shunting effect of this reactance will be approximately doubled. This would indicate a low frequency loss of approximately ½ DB at 60 cycles and 1 DB at 30 cycles. The high frequency response is governed by the ratio of leakage reactance to generator and load impedance. Since the load impedance is doubled the relative effect of the leakage reactance will be decreased. This indicates a high frequency loss of less than ½ DB at 15,000 cycles.

Suppose it is necessary to couple push-pull 50's to a 25 ohm line. The load would be connected to the secondary terminals rated for 50 ohms. In this case the reflected load on the primary would be only one half the normal load. The relative shunting effect of primary reactance will be decreased, indicating that the low frequency response will be down ½ DB at approximately 20 cycles. It was pointed out in the previous example that the relative effect of leakage reactance was decreased as load impedance was increased. This would indicate that when load impedance is decreased the relative effect of leakage reactance is increased. The increase in the relative effect of leakage reactance in this case would cause a high frequency loss of approximately ½ DB at 8000 cycles or 1 DB at 15,000 cycles.

Assume it is desired to couple push-pull 89 tubes to a 500 ohm line. The proper plate to plate load for the 89's is approximately 10,000 ohms. The rated plate to plate load for this transformer is 8000 ohms. This mismatch would cause a slight increase of harmonic content and small increase in power output. The reflected load impedance in this case is the same as for rated applications but generator impedance is slightly higher than for the rated applications. Since the ratio of primary reactance to generator and load impedance governs the low frequency response, this slight increase in generator impedance will cause a loss of less than 1 DB at 30 cycles. When either generator or load impedance is increased, the relative effect of leakage reactance is decreased and the high frequency response is improved. The loss at 15,000 cycles will be slightly less than ½ DB.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics given below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response specifications illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 8000 ohms (Pl. to Pl.)

Secondary Impedance — 50, 125, 200 (balanced), 250, 333, or 500 (balanced) ohms

Max. Pri. D.C. Balance/Leg — 55 MA

Max. Pri. D.C. Unbalance/Leg — 5 MA

Max. Level — + 33 DB

Pri. Inductance —

40 hy — 10 V. 30 cycles applied
80 hy — 150 V. 30 cycles applied
97 hy — 300 V. 30 cycles applied
70 hy — 100 V. 60 cycles applied

The inductance figures given above have been determined with no polarizing D.C. in the coil and an A.C. voltage applied to the coil of the frequency and potential specified. Although transformer K-404 was designed primarily for operation in a balanced push-pull output circuit, it can be used, with fair results to couple from a single tube requiring a plate load of 8000 ohms, e.g., working out of a single 45, 2A5, or 89 the response at 60 cycles will be down 2 DB. The high frequency response will be as shown for the push-pull application. The figures given below represent the inductance of the total primary of this transformer with various values of polarizing D.C. in the coil.

30 hy — 20 MA D.C. — 100 V. 60 cycles applied
25 hy — 30 MA D.C. — 100 V. 60 cycles applied
18 hy — 40 MA D.C. — 100 V. 60 cycles applied

Coil Structure — Interleaved sections balanced for inductance, capacity and resistance.

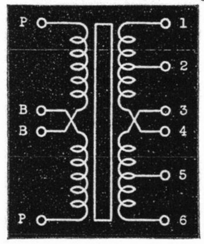
Primary D.C. Resistance — 355 ohms (total)

Secondary D.C. Resistance — 27 ohms (total)

Core Material — Low-loss high permeability silicon-steel

Electromagnetic Shielding — High permeability cast case protects the transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement

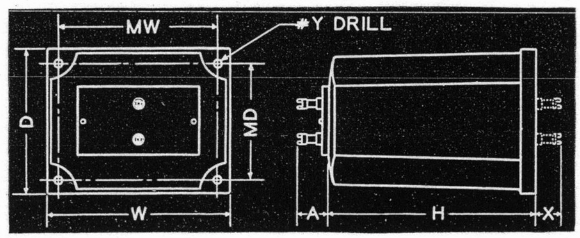


PRIMARY TERMINALS:
Plates — P – P
B + — Join B – B

SECONDARY TERMINALS:
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

MECHANICAL SPECIFICATIONS

Transformer K-404 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-404

Casting Type T2

Approx. Weight .... 6¼ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅛″	4″	3⅜″	3 9/32″	2 23/32″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair, or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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KENYON

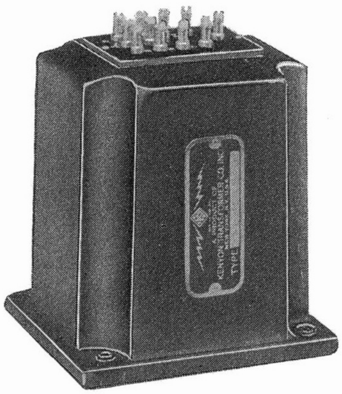
LABORATORY STANDARD
» » » Output Transformer

TYPE K-405

List Price....$18.00

GENERAL APPLICATIONS

Transformer K-405 has been designed to couple push pull plates, requiring a plate to plate load of 8000 ohms, to a voice coil line. The 8000 ohm primary is intended to operate from class A 45 or 50 tubes, or class AB type 2A3 tubes fixed or self biased. The load impedance presented by this transformer to the 2A3 tubes is considerably higher than the load impedance recommended for maximum power output. The use of this higher plate to plate load has the advantage of reducing the harmonic distortion which appears in the output. The secondary of K-405 is provided with the Kenyon Multiple Voice Coil Line which provides terminations of 1.8 to 15 ohms.



Top Mounting

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

Electrostatic shielding between windings is not necessary in an output transformer operating at a high audio level. Longitudinal interference pickup is amplified but little succeeding a unit of this type. Interstage coupling—crosstalk—between the output transformer and any of the other audio transformers in the amplifier is eliminated by a cast high-permeability housing. Electromagnetic shielding of 18 DB is provided by this case.

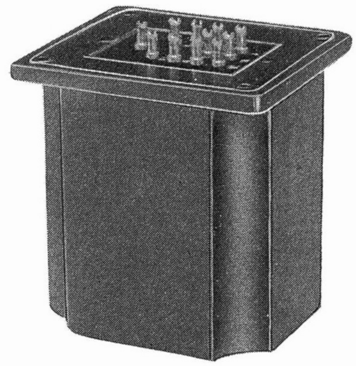
DESIGN CONSIDERATIONS

High efficiency is an important objective in the design of an output transformer. It is primarily controlled by copper and core losses. Copper loss is a function of the D.C. resistance of the windings. It is kept to a low value by the proper choice of wire sizes. Core-loss is an important factor in determining the efficiency of an output transformer. Let us assume a case in which the core weight is 4 lbs. and A.C. flux density is such that core-loss is ½ watt per lb. This represents a total core-loss of 2 watts. If the input to the transformer is 12 watts the transformer output will be only 10 watts. This is an efficiency of only 83% or an insertion loss of approximately 1 DB. In order to prevent any such loss as this K-405 is designed with a large core of high-permeability low-loss silicon steel. The total insertion loss of the unit is less than 1 DB. When an output transformer is well designed so that the A.C. flux densities at the lower frequencies are not excessive, there is always sufficient primary inductance to insure good low frequency response.

The high frequency response of an output transformer is governed by leakage reactance. Leakage reactance acts like a small reactor in series between primary and secondary, and is therefore, directly proportional to frequency. A voltage drop appears across this reactance between primary and secondary when the secondary is loaded. The ratio of this reactance to generator impedance and to load impedance determines the high frequency response. The coil structure of K-405 is so designed that this leakage reactance causes a loss not in excess of ½ DB at 15,000 cycles.

SPECIAL APPLICATIONS

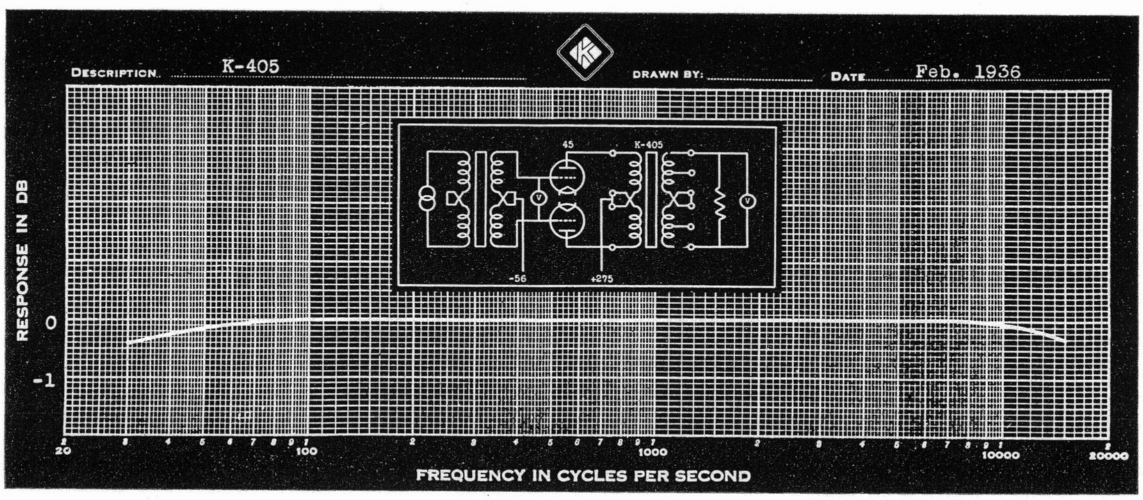
It is often found necessary to use a transformer for some application other than for which it was designed. The following examples are given to assist the audio engineer in estimating the probable frequency response under such conditions.



Bottom Mounting

Suppose it is found necessary to couple push pull 45's class A to a 30 ohm load. The load should be connected to terminals rated for 15 ohms. Low frequency response is governed by the relation of transformer primary reactance to load impedance and generator impedance. If the primary reactance is low it acts as a shunt across the generator decreasing the power output. When secondary load is doubled the reflected primary load is also doubled. This indicates that the ratio of load impedance to primary impedance is increased. When this occurs the low frequency response is impaired. Under these conditions the loss at 60 cycles will be approximately ½ DB and the loss at 30 cycles approximately 1 DB. As previously stated, high frequency response is governed by the relation of leakage reactance to generator impedance and secondary load. Since the secondary load has been increased the ratio of leakage reactance to secondary impedance is decreased. The high frequency response in this application will be better than rated.

Suppose it is necessary to couple push pull 50's to a 1 ohm load. The 1 ohm load would be connected to terminals rated for 1.8 ohms. When the secondary load is decreased the reflected primary load is decreased in a like ratio. This means that plate to plate load presented to the 50's will be slightly over 4000 ohms. A change such as this will appreciably increase the harmonic content. Since the actual load impedance is less than rated load impedance, the shunting effect of primary reactance will be decreased. Good low frequency response will be extended down to approximately 20 cycles.



The effect on the high frequency response will be detrimental, since the load impedance has been decreased. The relative effect of leakage reactance will be increased causing a loss of approximately ½ DB at 8000 cycles or 1 DB at 15,000 cycles.

The following considerations will apply if it is necessary to use push pull class A 89 triodes with this transformer. The transformer was designed to provide an 8000 ohm plate to plate load. The correct plate to plate load for these tubes is approximately 10,000 ohms. The mismatch in this case would not be very serious. The slight increase in harmonic content which would occur would be negligible. Since plate resistance of these tubes is higher than the resistance of the tubes for which the transformer was designed, the shunting effect of the primary reactance will be greater. The shunting effect, however, will not be serious. The loss at 30 cycles will be approximately 1 DB. The high frequency response will be better than rated, since the relative effect of leakage reactance has been decreased. The high frequency response will be down slightly less than ½ DB at 15,000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response specifications illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 8000 ohms (Pl. to Pl.)

Secondary Impedance — 1.8, 3.75, 6.8, 7.5 (balanced) 11, or 15 (balanced) ohms

Max. Pri. D.C. Balanced/Leg — 55 MA

Max. Pri. D.C. Unbalanced/Leg — 5 MA

Max. Level — + 33 DB

Pri. Inductance —

40 hy — 10 V 30 cycles applied
80 hy — 150 V 30 cycles applied
97 hy — 300 V 30 cycles applied
70 hy — 100 V 60 cycles applied

The inductance figures given above have been determined with no polarizing D.C. in the coil and an A.C. voltage applied to the coil of the frequency and potential specified. Although transformer K-405 was designed primarily for operation in a balanced push pull output circuit, it can be used, with fair results to couple from a single tube requiring a plate load of 8000 ohms, e.g., working out of a single 45, 2A5, or 89 the response at 60 cycles will be down 2 DB. The high frequency response will be as shown for the push pull application. The figures given below represent the inductance of the total primary of this transformer with various values of polarizing D.C. in the coil.

30 hy — 20 MA D.C. — 100 V 60 cycles applied
25 hy — 30 MA D.C. — 100 V 60 cycles applied
18 hy — 40 MA D.C. — 100 V 60 cycles applied

Coil Structure — Interleaved sections balanced for inductance, capacity and resistance.

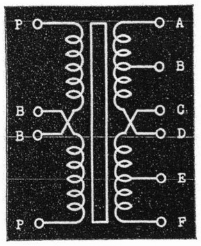
Primary D.C. Resistance — 355 ohms (total)

Secondary D.C. Resistance — .35 ohms (total)

Core Material — Low-loss high permeability silicon-steel

Electromagnetic Shielding — High permeability cast case protects the transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement

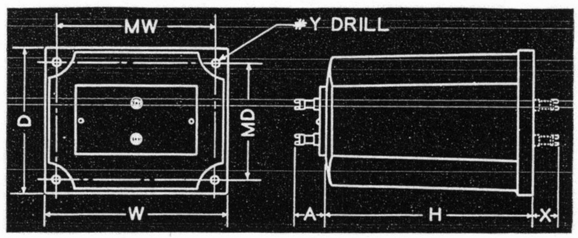


PRIMARY TERMINALS
Plates — P – P
B + — Join B – B

SECONDARY TERMINALS
15 ohms — connect to A and F, join C to D
11 ohms — connect to A and E, join C to D
7.5 ohms — connect to B and E, join C to D
6.8 ohms — connect to A and F, join B to C
3.75 ohms — connect to A and F, join A to C, join D to F
1.8 ohms — connect to B and E, join B to C, join D to E

MECHANICAL SPECIFICATIONS

Transformer K-405 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-405

Casting Type. T2

Approx. Weight. . . . . 6¼ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅛"	4"	3⅜"	3 9/32"	2 23/32"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired, or replaced, without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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Printed in U.S.A.

KENYON

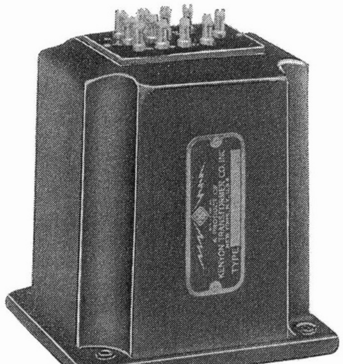
LABORATORY STANDARD
» » » Output Transformer

TYPE K-406

List Price....$21.00

GENERAL APPLICATIONS

Transformer K-406 has been designed to couple push pull plates requiring a plate to plate load of 5000 ohms or 3000 ohms to a high impedance line or a voice coil line. The 5000 ohm primary is intended to operate from push pull type 2A3, 6A3, or 45 tubes operated class AB self biased or from push pull type 6L6 or 45 tubes operated class A. The 3000 ohm primary will work out of 2A3, 6A3 or 45 tubes operated class AB fixed bias.



Top Mounting

Two separate sets of secondary windings are provided. The main secondary is supplied with the Kenyon Multiple High Impedance Line which permits terminations of 500, 1000, 1700, 2000, 3000 or 4000 ohms. The frequency response using any impedance of this combination will be linear within plus or minus ½ DB from 30 to 15,000 cycles. This is illustrated by the solid curve below. The second secondary is provided with the Kenyon Multiple Voice Coil Line which permits terminations of 1.8, 3.75, 6.8, 7.5, 11 or 15 ohms. This was primarily designed as an auxiliary winding for monitoring applications. The frequency response using any one combination of voice coil loads will be maintained as shown by the dotted curve below.

Only one secondary should be loaded at one time with the rated load if the harmonic distortion generated by the associated tubes is to be kept within commercial limits. This precaution must be observed in the application of transformer K-406 unless the voice coil secondary is required for monitoring purposes. In this case the Multiple Line may be terminated with any rated load and the voice coil secondary terminated with a load equivalent to at least (ten) 10 times the rated load, e.g., if the 500 ohm winding of the Multiple Line secondary is worked into a 500 ohm line the 15 ohm secondary can be shunted with a 200 ohm line working into a monitor speaker.

ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING

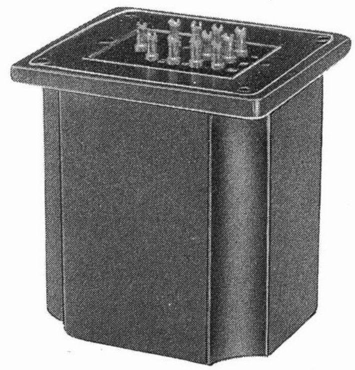
Electrostatic shielding between windings is not necessary in an output transformer operating at a high audio level. Longitudinal interference pickup is not amplified in a unit of this type.

Interstage coupling—crosstalk—between the output transformer and any of the other audio transformers in the amplifier is eliminated by a cast high-permeability housing. Electromagnetic shielding effective to the extent of 18 DB is also provided by this case.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with all output transformers is essential to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information.

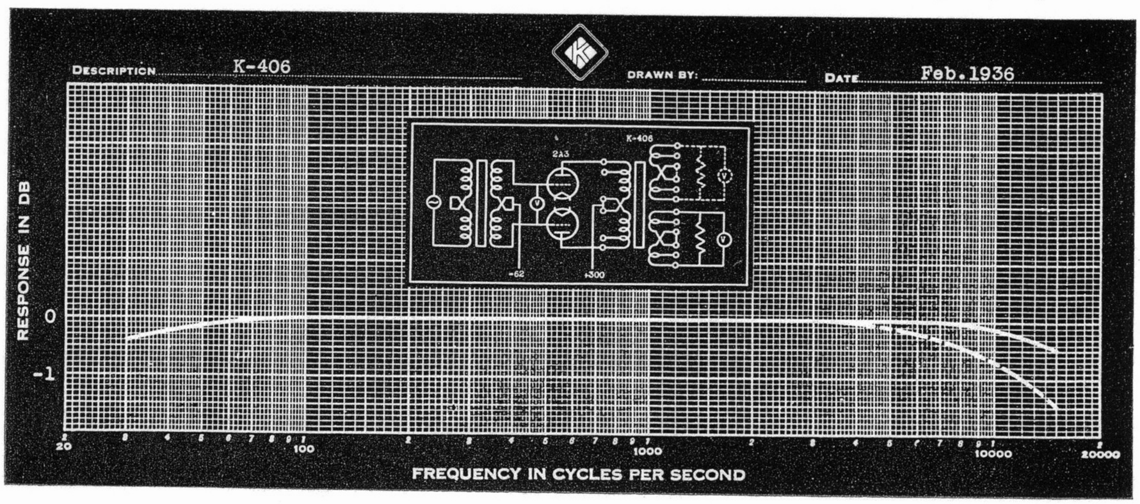
In a unit such as this, with many terminal impedances, one of the important considerations is to provide sufficient copper area in the windings to take care of the current flowing when the lowest impedance tap is used. Use the 1.8 ohm output tap as an example. Consider the case in which push pull class AB 45 tubes are driven to their maximum power output of 18 watts. The current flowing in the 1.8 ohm output winding would be determined as follows:



Bottom Mounting

The power output equals the square of the current multiplied by the impedance; that is 18 watts = $I^2 \times 1.8$ or I = 3.16 amp. A current of 3.16 amp. requires that the secondary be wound with wire having 45 times the copper area of the wire provided for the primary windings. This unit has been so designed that no matter what impedance tap is used sufficient copper area is provided to keep the insertion loss of the unit below 1 DB.

The flux density of the core material must be kept to such a point that the core loss does not become a large part of the power output. Suppose we have a core, for an output transformer, which weighs four pounds and the AC flux density of the core material is such that the core loss is ½ watt per pound. This causes a total loss of 2 watts. The steel density (other factors being constant) is inversely proportional to frequency so that at low frequencies the core density is highest. This means that at 30 cycles the output of the transformer referred to above would be two watts less than the input. This will result in a loss of 1 DB. Since the core loss of high-permeability alloys is not greatly lower than that of a good grade of silicon steel the latter is used as the core material for output transformers. When an output transformer is well designed so that AC flux densities at the lower frequencies are not excessive there is always sufficient primary inductance to insure good low frequency response. The high



frequency response of an output transformer is governed by the leakage reactance between windings. This reactance which represents a high frequency loss, is kept to a minimum by the use of an interleaved coil structure. A high quality output transformer is the product of the correlation of the design considerations given above. The Kenyon Transformer Co., Inc., sincerely believes that this has been done successfully in transformer K-406.

SPECIAL APPLICATIONS

The following information is given for the assistance of the design engineer in estimating the frequency response characteristics under various operating conditions other than those covered by the rated applications.

Let us take the case where it is desired to couple class A tubes requiring a plate to plate load of 10,000 ohms to a 500 ohm line. We will assume that the power output of these tubes is 3 watts (class A 89 triodes). The output of the transformer provides for a 500 ohm termination. The plate to plate load presented to the push pull tubes would be only 5000 ohms which represents an impedance mismatch of two. The power output will be reduced not more than 1 DB and the harmonic content will be slightly increased. The low frequency loss due to the shunting effect of the primary reactance is ½ DB at 30 cycles when this transformer is operating out of tubes requiring a plate to plate load of 5000 ohms. The shunting effect in this special case will cause a loss of ½ DB at 60 cycles. The high frequency response on the other hand will be improved because the leakage reactance acts as a small reactor inserted between primary and secondary. The voltage drop across this reactor limits the high frequency response. The relative effect of this reactor will be cut by ½ when the source impedance is doubled. The loss at 15,000 cycles will be less than ½ DB.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles.
This tolerance is maintained only on the Multiple High Impedance Line secondaries. The frequency response characteristics of the Multiple Voice Coil Line secondaries are illustrated by the dotted curve. The specified performance on either set of secondary windings is dependent on maintaining a set of operating conditions within the limits set forth in these data.

Primary Impedance — 5000 or 3000 ohms (Pl. to Pl.)

Secondary Impedance —
Multiple High Impedance Line — 500, 1000, 1700, 2000 (balanced) 3000 or 4000 (balanced) ohms.
Multiple Voice Coil Line — 1.8, 3.75, 6.8, 7.5 (balanced) 11, or 15 (balanced) ohms.

Max. Pri. D.C. Balanced/Leg — 65 MA (static) 70 MA (peak)

Max. Pri. D.C. Unbalanced/Leg — 5 MA

Maximum Level — + 35 DB

Pri. Inductance —
26 hy — 30 cycles 10 volts applied
50 hy — 30 cycles 150 volts applied
62 hy — 30 cycles 300 volts applied
44 hy — 60 cycles 100 volts applied

The inductance figures given above have been determined with no polarizing D.C. in the coil and with an A.C. voltage applied to the coil of the frequency and potential specified.

Primary D.C. Resistance — 195 ohms (total)

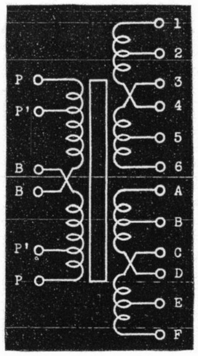
Secondary D.C. Resistance —
Multiple High Impedance Line — 175 ohms (total)
Multiple Voice Coil Line — .35 ohms (total)

Coil Structure — Interleaved sections balanced for inductance, capacity, and resistance.

Core Material — Low-loss high-permeability silicon steel.

Electromagnetic Shielding — High-permeability cast case protects the transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangements

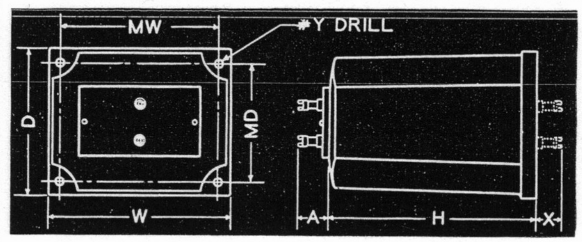


Primary Terminals:
Plates (5000 ohm plate to plate load) P — P
Plates (3000 ohm plate to plate load) P' — P'
B + — join B — B

Secondary Terminals:
500 ohms — connect to 2 and 5, join 2 to 3, join 4 to 5
1000 ohms — connect to 1 and 6, join 1 to 3, join 4 to 6
1700 ohms — connect to 1 and 6, join 2 to 3
2000 ohms — connect to 2 and 5, join 3 to 4
3000 ohms — connect to 1 and 5, join 3 to 4
4000 ohms — connect to 1 and 6, join 3 to 4
15 ohms — connect to A and F, join C to D
11 ohms — connect to A and E, join C to D
7.5 ohms — connect to B and E, join C to D
6.8 ohms — connect to A and F, join B to C
3.75 ohms — connect to A and F, join A to C, join D to F
1.8 ohms — connect to B and E, join B to C, join D to E

MECHANICAL SPECIFICATIONS

Transformer K-406 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-406

Casting Type T2

Approx. Weight . . . . 6½ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅛"	4"	3⅜"	3 9/32"	2 23/32"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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Cable Address:
SIMONTRICE-NEW YORK

Printed in U.S.A.

KENYON

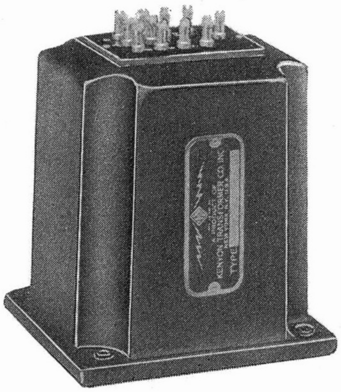
LABORATORY STANDARD
» » » Output Transformer

TYPE K-407

List Price. . . .$21.00

GENERAL APPLICATIONS

Transformer K-407 has been designed to couple push pull plates requiring a plate to plate load of 5000 ohms or 3000 ohms to a transmission line or voice coil line. The 5000 ohm primary is intended to operate from push pull type 2A3, 6A3, or 45 tubes operated class AB self biased or from push pull type 45 or 6L6 tubes operated class A. The 3000 ohm primary will work out of 2A3, 6A3, or 45 tubes operated class AB fixed bias.



Top Mounting

Two separate sets of secondary windings are provided. The main secondary is supplied with the Kenyon Multiple Line which permits terminations of 50 to 500 ohms. The frequency response using any impedance of this combination will be linear within plus or minus ½ DB from 30 to 15,000 cycles. This is illustrated by the solid curve below. The second secondary is provided with the Kenyon Multiple Voice Coil Line which permits terminations of 1.8 to 15 ohms. This was primarily designed as an auxiliary winding for monitoring applications. The frequency response using any one combination of voice coil loads will be maintained as shown by the dotted curve below.

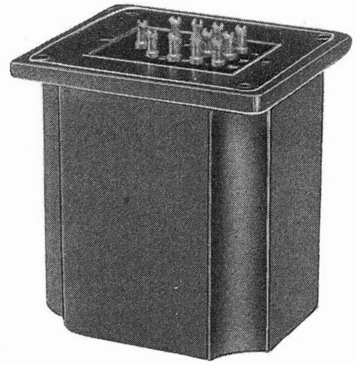
Only one secondary should be loaded at one time with the rated load if the harmonic distortion generated by the associated tubes is to be kept within commercial limits. This precaution must be observed in the application of transformer K-407 unless the voice coil secondary is required for monitoring purposes. In this case the Multiple Line may be terminated with any rated load and the voice coil secondary terminated with a load equivalent to at least (ten) 10 times the rated load, e.g., if the 500 ohm winding of the Multiple Line secondary is worked into a 500 ohm line the 15 ohm secondary can be shunted with a 200 ohm line working into a monitor speaker.

ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING

Electrostatic shielding between windings is not necessary in an output transformer operating at a high audio level. Longitudinal interference pickup is amplified but little in a unit of this type. Interstage coupling—cross-talk—between the output transformer and any of the other audio transformers in the amplifier is eliminated by cast high permeability housing. Electromagnetic shielding of 18 DB is provided by this case.

DESIGN CONSIDERATIONS

Efficiency is one of the most important considerations in the design of a unit such as K-407. It is primarily controlled by copper loss and core-loss. Copper-loss is the combined heating effects of A.C. and D.C. currents in the windings. The secondary wire size must be chosen to provide low winding resistance and therefore low copper-loss. Core-loss affects transformer efficiency at low frequencies. Suppose the primary input is 12 watts and the flux density in the core is such that the core-loss is 2 watts. The effective power output is then 10 watts, signifying an efficiency of approximately 83%, or an insertion loss of approximately 1 DB. K-407 has a large high permeability low-loss silicon steel core. The total insertion loss due to copper and steel losses is less than 1 DB. Sufficient primary inductance is usually obtained when the A.C. flux density is kept to such a point that the core-loss is small.



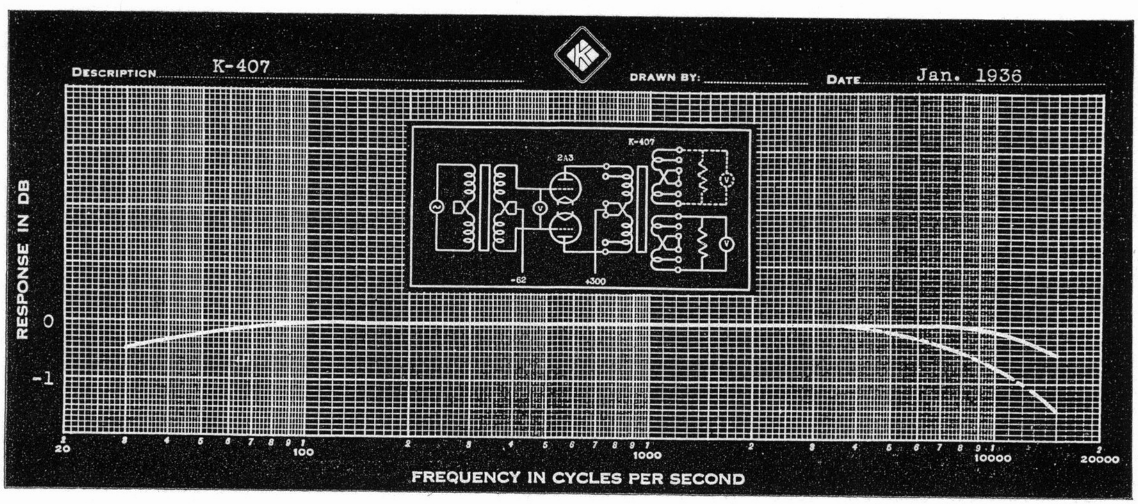
Bottom Mounting

The high frequency response in a transformer of this type is controlled by the leakage reactance. Leakage reactance appears like a small reactor in series between primary and secondary. Leakage reactance therefore increases with frequency. The voltage appearing across this reactance also increases with frequency. This means that part of the voltage applied to the primary of the transformer is wasted internally, and the other part appears across the secondary load. Through proper coil design, the leakage reactance in this unit has been kept to such a point that the frequency response up to 15,000 cycles is impaired by only ½ DB.

SPECIAL APPLICATIONS

The following information is provided for the guidance of the audio engineer who has occasion to use this transformer in a circuit not covered by the rated applications.

Suppose it is necessary to couple push pull class AB 45's to a 1,000 ohm load. The 1,000 ohm load would be connected to the terminals rated for 500 ohms. The reflected primary load is doubled when the secondary load is doubled. This will result in a sacrifice in power output and a slight reduction in harmonic distortion. The primary reactance of this transformer is sufficient to insure low frequency response



within ½ DB at 30 cycles when working out of a 5000 or 3000 ohm generator. If the secondary load is doubled the shunting effect of primary reactance is also doubled. This causes the low frequency response to be impaired. The loss at 30 cycles will be approximately 1 DB. The ratio of leakage reactance to the combined impedance of generator and load has been decreased in this application. The voltage drop across leakage reactance will be, in this case, a smaller percentage of the total generated voltage. The high frequency response will consequently be improved.

Suppose it is found necessary to couple push pull class AB 45's to a 25 ohm line. The 25 ohm load would be connected to the terminals rated for 50 ohms. This reflects a primary load of one half the rated value. The power output would be decreased and harmonic content would be increased. This increase in harmonic content may be serious. The only possible way to keep the harmonic distortion down would be to limit the amount of grid excitation. The frequency response at the low end will be improved. When secondary load is cut in half the shunting effect of primary reactance is approximately one half as great. This would indicate a good low frequency response extending to 15 cycles. The high frequency response on the contrary will be impaired. Since the ratio of leakage reactance to load impedance has been doubled the loss in voltage across the leakage reactance at higher frequencies will be twice as great. This indicates that the loss at 7500 cycles will be down approximately ½ DB or 1 DB at 15,000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical characteristics provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
This tolerance is maintained only on the Multiple Line secondaries. The frequency response characteristics of the Multiple Voice Coil Line secondaries are illustrated. The specified performance on either set of secondary windings is dependent on maintaining a set of operating conditions within the limits set forth in these data.

Primary Impedance — 5000 or 3000 ohms (pl. to pl.)

Secondary Impedance —
Multiple Line — 50, 125, 200 (balanced), 250, 333, or 500 (balanced) ohms
Multiple Voice Coil Line — 1.8, 3.75, 6.8, 7.5 (balanced) 11, or 15 (balanced) ohms

Max. Pri. D.C. Balanced/Leg — 65 MA (static)
70 MA (peak)

Max. Pri. D.C. Unbalanced/Leg — 5 MA

Maximum Level — 35 DB

Pri. Inductance —
26 hy — 30 cycles — 10 volts applied
50 hy — 30 cycles — 150 volts applied
62 hy — 30 cycles — 300 volts applied
44 hy — 60 cycles — 100 volts applied

The inductance figures given above have been determined with no polarizing D.C. in the coil and with an A.C. voltage applied to the coil of the frequency and potential specified.

Although transformer K-407 was designed primarily for operation in a balanced push pull output circuit it can be used with fair results to couple from a single tube requiring a plate load of 3000 or 5000 ohms, e.g., working out of a single 43, pentode connected, the response at 60 cycles will be down 1 DB. The high frequency response will be the same as for the push pull application.

Coil Structure — Interleaved sections balanced for inductance capacity and resistance

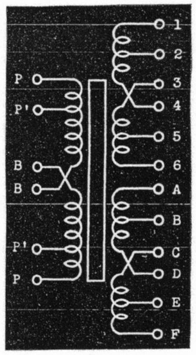
Primary D.C. Resistance — 210 ohms (total)

Secondary D.C. Resistance —
Multiple Line — 27 ohms (total)
Multiple Voice Coil Line — .4 ohms (total)

Core Material — Low-loss high permeability silicon steel

Electromagnetic Shielding — High permeability cast case protects the transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement



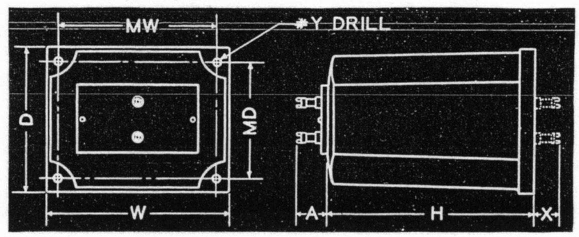
Primary Terminals
Plates (5000 ohm plate to plate load)
P — P
Plates (3000 ohm plate to plate load)
P′ — P′

Secondary Terminals — MULTIPLE LINE
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

Secondary Terminals — Multiple Voice Coil Line
15 ohms — connect to A and F, join C to D
11 ohms — connect to A and E, join C to D
7.5 ohms — connect to B and E, join C to D
6.8 ohms — connect to A and F, join B to C
3.75 ohms — connect to A and F, join A to C, join D to F
1.8 ohms — connect to B and E, join B to C, join D to E

MECHANICAL SPECIFICATIONS

Transformer K-407 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-407
Casting Type. T2
Approx. Weight .... 6¼ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅛"	4"	3⅜"	3 9/32"	2 23/32"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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Cable Address:
SIMONTRICE-NEW YORK

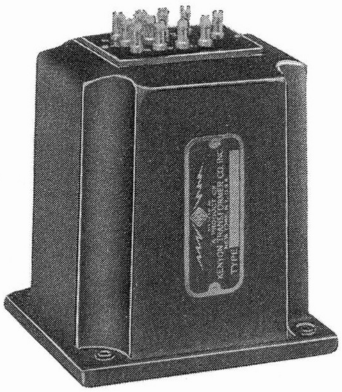
KENYON

LABORATORY STANDARD
» » » Output Transformer

TYPE K-408 **List Price....$18.00**

GENERAL APPLICATIONS

Transformer K-408 has been designed to couple push pull plates requiring a plate to plate load of 5000 ohms or 3000 ohms to a transmission line. The 5000 ohm primary is intended to operate from push pull type 2A3, 6A3, or 45 tubes operated class AB self biased, or from push pull type 45 or 6L6 tubes operated class A. The 3000 ohm primary will work out of the 2A3, 6A3, or 45 tubes operated class AB fixed bias. The secondary is provided with the Kenyon Multiple Line which provides terminations ranging from 50 to 500 ohms.



Top Mounting

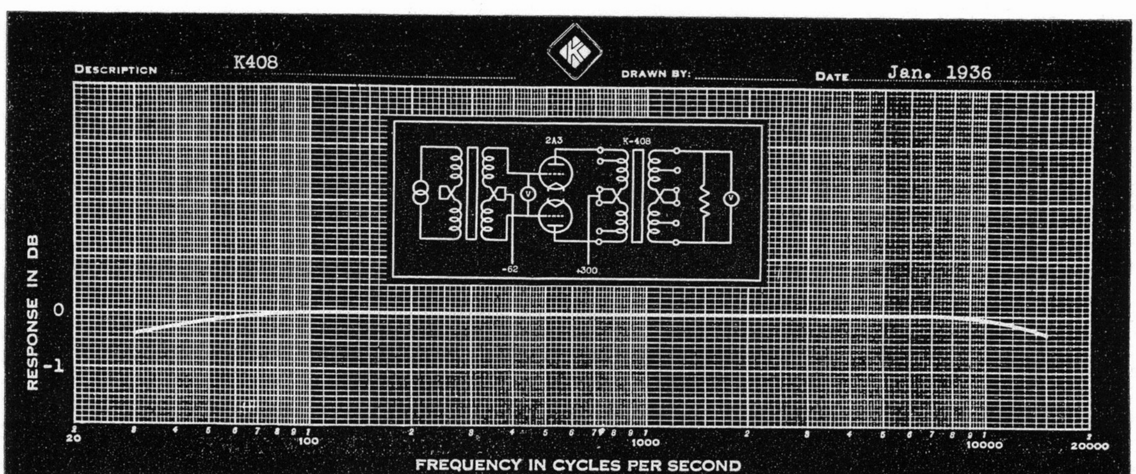
ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

Electrostatic shielding between windings is not necessary in an output transformer operating at a high audio level. Longitudinal interference pickup is amplified but little in a unit of this type. Interstage coupling—cross talk—between the output transformer and any of the other audio transformers in the amplifier is eliminated by a cast high-permeability housing. Electromagnetic shielding of 18 DB is provided by this case.

DESIGN CONSIDERATIONS

We believe that an understanding of the fundamental design considerations associated with all output transformers is necessary to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information: An understanding of what happens in an output transformer under actual operating conditions can be seen most clearly by drawing a simplified equivalent diagram of the transformer. We will now proceed with a word picture of the diagram. For the sake of simplicity let us consider the case of class A output tubes, 45's for example. The plate resistance of each tube is 1700 ohms, so the total is 3400 ohms. The turns ratio of the transformer is such that with any rated secondary load, the reflected primary load is 5000 ohms. This may be drawn as a generator with zero impedance having a resistor of 3400 ohms in series with it. Any drop occurring across this resistor is not available as output voltage. The transformer primary is then connected to one side of the zero impedance generator, and the other side to the 3400 ohms. The primary of this transformer may be drawn as an inductance shunted across the line in parallel with a resistance shunted across the line. As the frequency decreases the reactance of this inductance decreases. When this reactance becomes of a value of the order of 5000 ohms, current flows through it (exciting current) which causes a drop in the generator impedance. As this condition exists only at the lower frequencies, it may be considered as a low frequency loss. The other low frequency loss is represented by the resistor which we placed in parallel with the primary inductance. This resistor represents the core loss of the transformer. As frequency decreases (applied voltage remaining constant) the A.C. flux density in the core of the transformer increases. As the flux density increases the core loss increases. Thus at the low frequencies the resistor shown on the schematic diagram will be decreased, drawing additional current from the generator and causing an additional power loss in the transformer which is not available for transfer to the secondary but which is dissipated as internal heat. Leakage reactance which controls high frequency response would appear as a small reactor in series between the secondary load impedance and the generator. The reactance of this branch of the circuit will increase directly as frequency increases. Any current flowing to the load will therefore cause a drop in voltage across this reactance. As the reactance becomes higher, the drop becomes greater, and so the loss in the transformer is greater. This signifies a high frequency loss. There is one other loss which must be carefully considered in the design of an output transformer. This is copper loss which is approximately the same at all audio frequencies. If the winding resistances are not kept to the proper value, the current flowing through them will cause a loss which is dissipated in internal heat. This loss which occurs at all frequencies is usually designated as the insertion loss of the transformer. In the design of K-408 a core with a large cross-sectional area has been provided. This core is high permeability, low loss, silicon steel, so that the maximum loss at 30 cycles will not exceed ½ DB under full power output conditions. The coil structure is such that the loss due to leakage reactance does not exceed ½ DB at 15,000 cycles. The winding resistances are kept to such a point that the total insertion loss of the unit is less than 1 DB.

Bottom Mounting



SPECIAL APPLICATIONS

It is often found necessary to use a transformer for some purpose other than for which it was designed. The following examples are given to assist the audio engineer in estimating the probable frequency response under these conditions.

Suppose that it is necessary to couple push pull class AB 45's to a 1000 ohm load. The 1000 ohm load should be connected to the terminals rated for 500 ohms. This connection reflects a plate to plate load to the primary of twice the rated value. This will decrease the power output and the harmonic distortion. The low frequency response is also effected since it is governed by the shunting effect of primary reactance. Under normal conditions K-408 has sufficient primary reactance to cause a loss of ½ DB or less at 30 cycles. When the secondary load is doubled this shunting effect is also approximately doubled. From these considerations, it will be seen that the low frequency loss of K-408 will be approximately double that obtained under normal operation conditions, i.e., ½ DB at 60 cycles and 1 DB at 30 cycles. The high frequency response is governed by the ratio of leakage reactance to secondary load impedance and generator impedance. Since the secondary load is doubled the ratio of leakage reactance to secondary load is cut in half. This indicates a high frequency loss of slightly less than ½ DB at 15,000 cycles.

Assume a case in which it is necessary to couple class AB 45's to a 25 ohm load. The 25 ohm load will be connected to the terminals rated for 50 ohms. This reflects a primary plate to plate load of only one-half the correct value for the output tubes. The result of this mis-match may be serious since it will cause an additional amount of distortion as well as a sacrifice in power output. The distortion may be kept down by limiting grid excitation. Since the secondary load has been cut in half, the shunting effect of primary reactance has also been decreased. The loss at 20 cycles would be approximately ½ DB. The high frequency response, however, will be impaired. Since the secondary load is cut in half the ratio of leakage reactance to secondary load impedance is doubled. This indicates that the response at the higher frequencies will suffer approximately twice as much as in the rated applications. The expected frequency response under these conditions will show a loss of approximately ½ DB at 7500 cycles and approximately 1 DB at 15,000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer to practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response specifications illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 5000 or 3000 ohms

Secondary Impedance — 50, 125, 200 (balanced), 250, 333 and 500 (balanced) ohms.

Max. Pri. D.C. Balanced/Leg — 65 MA (static)
70 MA (peak)

Max. Pri. D.C. Unbalanced/Leg — 5 MA

Maximum Level — + 35 DB

Pri. Inductance —

26 hy — 30 cycles 10 volts applied
50 hy — 30 cycles 150 volts applied
62 hy — 30 cycles 300 volts applied
44 hy — 60 cycles 100 volts applied

The inductance figures given above have been determined with no polarizing D.C. in the coil and with an A.C. voltage applied to the coil of the frequency and potential specified.

Although transformer K-408 was designed primarily for operation in a balanced push pull output circuit it can be used with fair results to couple from a single tube requiring a plate load of 3000 or 5000 ohms, e.g., working out of a single 43, pentode connected, the response at 60 cycles will be down 1 DB. The high frequency response will be the same as for the push pull application. The figures given below represent the inductance of the total primary of this transformer with various values of polarizing D.C. in the coil.

22 hy — 20 MA — 60 cycles — 100 volts applied
18 hy — 30 MA — 60 cycles — 100 volts applied
13 hy — 40 MA — 60 cycles — 100 volts applied

Coil Structure — Interleaved sections balanced for inductance, capacity and resistance

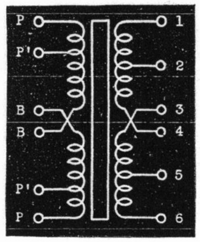
Primary D.C. Resistance — 200 ohms (total)

Secondary D.C. Resistance — 27 ohms (total)

Core Material — Low-loss high-permeability silicon steel

Electromagnetic Shielding — High permeability cast case protects the transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement

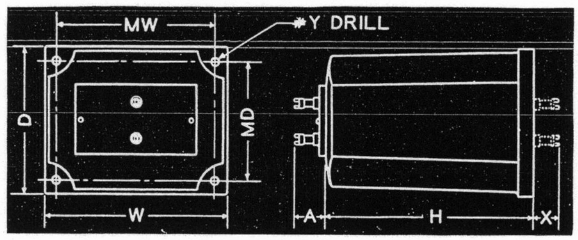


PRIMARY TERMINALS:
Plates (5000 ohms plate to plate load) — P – P
Plates (3000 ohms plate to plate load) — P′ – P′
B + — join B to B

SECONDARY TERMINALS:
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

MECHANICAL SPECIFICATIONS

Transformer K-408 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-408

Casting Type T2

Approx. Weight .... 6¼ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅛″	4″	3⅜″	3 9/32″	2 23/32″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair, or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

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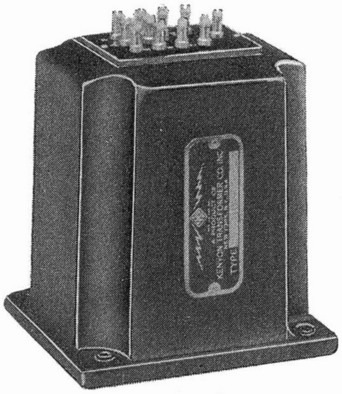
KENYON

LABORATORY STANDARD
» » » Output Transformer

TYPE K-409 **List Price. . . .$18.00**

GENERAL APPLICATIONS

Transformer K-409 has been designed to couple push-pull plates requiring a plate to plate load of 5000 or 3000 ohms to a voice coil line. The 5000 ohm primary is intended to operate from push-pull type 2A3, 6A3, or 45 tubes operated class AB self biased or from push-pull type 45 or 6L6 tubes operated class A. The 3000 ohm primary is designed to work out of 2A3, 6A3 or 45 tubes operated class AB fixed bias. The secondary is provided with the Kenyon Multiple Voice Coil Line which provides for terminations of 1.8 to 15 ohms.



Top Mounting

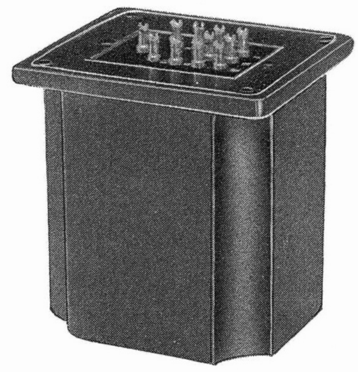
ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

Electrostatic shielding between windings is not necessary in an output transformer operating at a high audio level. Longitudinal interference pick-up is amplified but little in a unit of this type. Interstage coupling—crosstalk—between the output transformer and any of the other audio transformers in the amplifier is eliminated by cast high-permeability housing. Electromagnetic shielding of 18 DB is provided by this case.

DESIGN CONSIDERATIONS

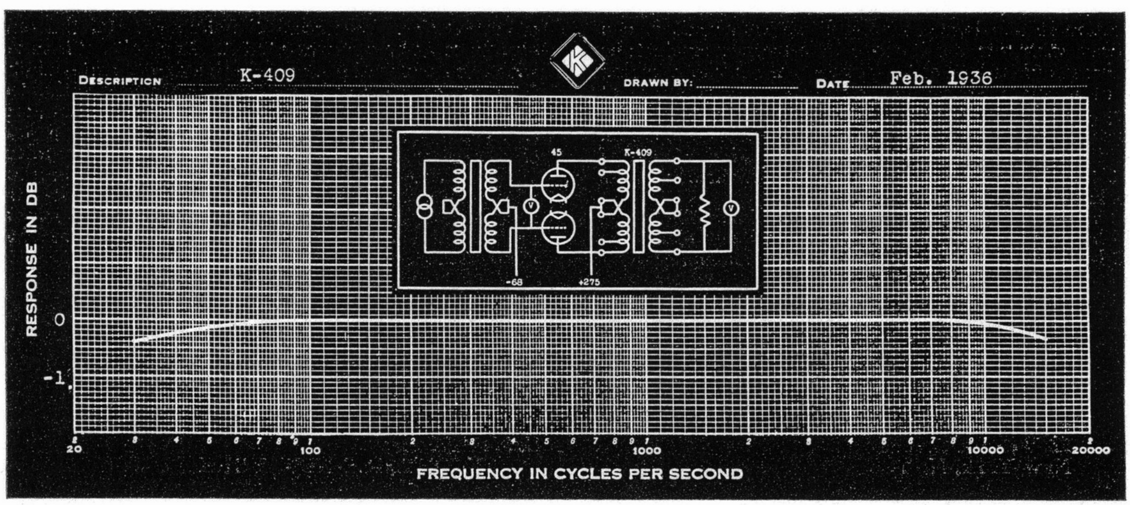
We believe that an understanding of the fundamental design considerations associated with all output transformers is necessary to the audio engineer who selects and uses them. We are therefore presenting the following data for his guidance and information: An understanding of what happens in an output transformer under actual operating conditions can be seen most clearly by drawing a simplified equivalent diagram of the transformer. We will now proceed with a word picture of the diagram. For the sake of simplicity let us consider the case of class A output tubes, 45's for example. The plate resistance of each tube is 1700 ohms, so the total is 3400 ohms. The turns ratio of the transformer is such that with any rated secondary load, the reflected primary load is 5000 ohms.

This may be drawn as a generator with zero impedance having a resistor of 3400 ohms in series with it. Any drop occurring across this resistor is not available as output voltage. The transformer primary is then connected to one side to the zero impedance generator, and the other side to the 3400 ohms. The primary of this transformer may be drawn as an inductance shunted across the line in parallel with a resistance shunted across the line. As the frequency decreases the reactance of this inductance decreases. When this reactance becomes of a value of the order of 5000 ohms, current flows through it (exciting current) which causes a drop in the generator impedance. As this condition exists only at the lower frequencies, it may be considered as a low frequency loss. The other low frequency loss is represented by the resistor which we placed in parallel with the primary inductance. This resistor represents the core loss of the transformer. As frequency decreases (applied voltage remaining constant) the A.C. flux density in the core of the transformer increases. As the flux density increases the core loss increases. Thus at the low frequencies the resistor shown on the schematic diagram will be decreased, drawing additional current from the generator and causing an additional power loss in the transformer which is not available for transfer to the secondary but which is dissipated as internal heat.



Bottom Mounting

Leakage reactance which controls high frequency response would appear as a small reactor in series between the secondary load impedance and the generator. The reactance of this branch of the circuit will increase directly as frequency increases. Any current flowing to the load will therefore cause a drop in voltage across this reactance. As the reactance becomes higher, the drop becomes greater, and so the loss in the transformer is greater. This signifies a high frequency loss. There is one other loss which must be carefully considered in the design of an output transformer. This is copper loss which is approximately the same at all audio frequencies. If the winding resistances are not kept to the proper value, the current flowing through them will cause a loss which is dissipated in internal heat. This loss which occurs at all frequencies is usually designated as the insertion loss of the transformer. In the design of K-409 a core with a large cross-sectional area has been provided. This core is high permeability, low loss, silicon steel, so that the maximum loss at 30 cycles will not exceed ½ DB under full power output conditions. The coil structure is such that the loss due to leakage reactance does not exceed ½ DB at 15,000 cycles. The winding resistances are kept to such a point that the total insertion loss of the unit is less than 1 DB.



SPECIAL APPLICATIONS

The following examples of special applications are given for the assistance of the audio engineer in estimating the frequency response characteristics of this unit when used in circuits other than those listed.

Suppose it is necessary to couple push-pull class AB 45's to a 30 ohm load. The 30 ohm load should be connected to the terminals rated for 15 ohms. This connection reflects a plate to plate load of twice the load recommended for the tubes. This will result in a decrease in power output and harmonic content. The low frequency response is governed by the relation of transformer primary reactance to load impedance and generator impedance. If the primary reactance is low it acts as a shunt across the generator, thus decreasing the power output. Since in this case the secondary load has been doubled, the relative shunting effect of primary reactance will be increased. This indicates a low frequency loss of approximately ½ DB at 60 cycles and 1 DB at 30 cycles. Since the secondary load is doubled the ratio of leakage reactance to secondary load is cut in half. The voltage lost across the leakage reactance is therefore decreased — the high frequency response has been improved. The response at 15,000 cycles will suffer by slightly less than ½ DB.

Assume a case in which it is necessary to couple class AB 45's to a 1 ohm load. The one ohm load should be connected to the terminals rated for 1.8 ohms. This reflects a plate to plate load to the primary of only ½ the rated value for the output tubes. This mismatch will reduce the power output of the tubes and increase the distortion. The distortion may be kept down by limiting the grid excitation. Since the secondary load has been cut in half, the shunting effect of primary reactance will be decreased. This indicates an improved low frequency response with a loss of less than ½ DB at 30 cycles and a loss of approximately ½ DB at 15 cycles. On the other hand, the high frequency response will be impaired. Since the secondary load is cut in half, the ratio of leakage reactance to secondary load impedance is doubled. The voltage lost in leakage reactance will also be doubled. The frequency response under these conditions will be down approximately ½ DB at 7500 cycles and approximately 1 DB at 15,000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response characteristics illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 5000 or 3000 ohms

Secondary Impedance — 1.8, 3.75, 6.8, 7.5 (balanced), 11 or 15 (balanced) ohms

Max. Pri. D.C. Balance/Leg — 65 MA (static), 70 MA (peak)

Max. Pri. D.C. Unbalance/Leg — 5 MA

Maximum Level — + 35 DB

Pri. Inductance —

26 hy — 30 cycles — 10 volts applied
50 hy — 30 cycles — 150 volts applied
62 hy — 30 cycles — 300 volts applied
44 hy — 60 cycles — 100 volts applied

All inductance figures given above have been determined with no polarizing D.C. in the coil and with an A.C. voltage applied to the coil of the frequency and potential specified.

Although transformer K-409 was designed primarily for operation in a balanced push-pull output circuit it can be used with fair results to couple from a single tube requiring a plate load of 3000 or 5000 ohms, e.g., working out of a single 43 pentode connected the response at 60 cycles will be down 1 DB. The high frequency response will be the same as for the push-pull application. The figures given below represent the inductance of the total primary of this transformer with various values of polarizing D.C. in the coil.

22 hy — 20 MA — 60 cycles — 100 volts applied
18 hy — 30 MA — 60 cycles — 100 volts applied
13 hy — 40 MA — 60 cycles — 100 volts applied

Coil Structure — Interleaved sections balanced for inductance, capacity and resistance

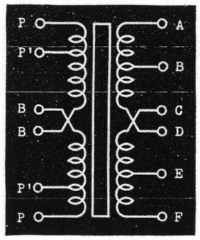
Primary D.C. Resistance — 210 ohms (total)

Secondary D.C. Resistance — .35 ohms (total)

Core Material — Low-loss high-permeability silicon-steel

Electromagnetic Shielding — High-permeability cast case protects the transformer from the effects of pickup from stray electromagnetic and electrostatic fields

Terminal Arrangement

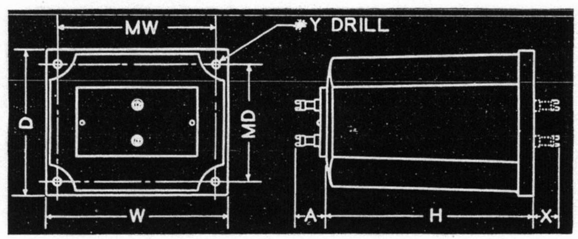


PRIMARY TERMINALS:
Plates (5000 pl. to pl. load) — P – P
Plates (3000 pl. to pl. load) — P' – P'
B + — Join B and B

SECONDARY TERMINALS:
15 ohms — connect to A and F, join C to D
11 ohms — connect to A and E, join C to D
7.5 ohms — connect to B and E, join C to D
6.8 ohms — connect to A and F, join B to C
3.75 ohms — connect to A and F, join A to C, join D to F
1.8 ohms — connect to B and E, join B to C, join D to E

MECHANICAL SPECIFICATIONS

Transformer K-409 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-409

Casting Type. T2

Approx. Weight. . . . . 6¼ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅛"	4"	3⅜"	3 9/32"	2 23/32"	½"	5/16"	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair, or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

KENYON TRANSFORMER CO., Inc.

840 Barry Street :: :: New York City

Export Department:
25 Warren Street
New York, N. Y.

Cable Address:
SIMONTRICE-NEW YORK

KENYON

LABORATORY STANDARD
» » » Output Transformer

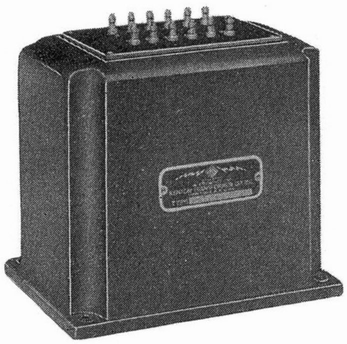
TYPE K-414

List Price. . . .$25.00

GENERAL APPLICATIONS

Transformer K-414 was designed to work out of push pull 6L6 tubes operated under the following conditions:

The total winding is a match for the 26.5 watt class AB (no grid current) condition that requires an 8500 ohm plate to plate load. There are two taps so arranged as to give a balanced winding for the 20 watt class AB (no grid current) condition that requires a 6000 ohm plate to plate load. The secondary is the Kenyon Multiple Line which offers a range of impedance terminations from 50 to 500 ohms.



Top Mounting

ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING

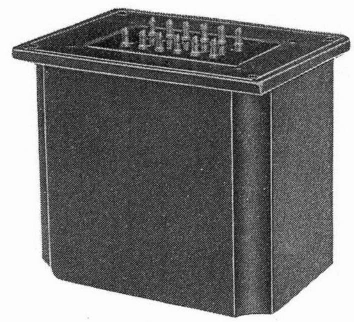
The amount of gain succeeding a unit of this type is never very great. For this reason it has been deemed unnecessary to provide electrostatic shielding between primary and secondary. Electromagnetic pickup or cross talk might prove serious in a unit operating at this level. To eliminate any such effects the unit is encased in a high permeability casting which reduces electromagnetic pickup by 18 DB.

DESIGN CONSIDERATIONS

One of the greatest advantages of the new 6L6 tube is the low distortion content of the power output. In order to realize this advantage, the output transformer must be designed to present the exact plate to plate load recommended for the various operating conditions. Impedance terminations to match any one of the various output conditions will be found in this group of transformers presented by Kenyon.

One of the primary considerations in the design of an output transformer to handle levels as high as 26.5 watts is the provision of ample copper area for full power output. While the maximum primary current of this unit will not exceed 80 or 90 milliamperes the current flowing in the lowest impedance tap of the secondary may be many times this. If sufficiently large wire is not used in the secondary, the losses occurring in the windings will impair the efficiency of the unit to a great extent. Copper loss impairs efficiency at all frequencies.

Low frequency response in an output transformer is determined by core loss and primary inductance. As an illustration of the effect of core loss let us look at an output transformer whose core weighs 8 lbs. with a flux density of such a value that the core loss is 1 watt per lb. Under these conditions if the input power to the transformer were 26½ watts, the output would be only 18½ watts. This shows an efficiency of 70% or a low frequency loss of 1½ DB. To eliminate any such losses as this, the cross sectional area of the core has been kept large, and high permeability low loss silicon steel is used as the core material. In a properly designed output transformer if A.C. flux densities are kept to a point where core loss is not excessive, there is always sufficient primary inductance to insure good low frequency response. For this reason silicon steel instead of high permeability alloy steel is used as the core material. The losses in high permeability steels are not greatly less than those in high grade silicon steels; the great advantage of the former being high permeability. Since the additional primary inductance obtainable with this high permeability is not necessary, the use of the more expensive alloy is not justified.

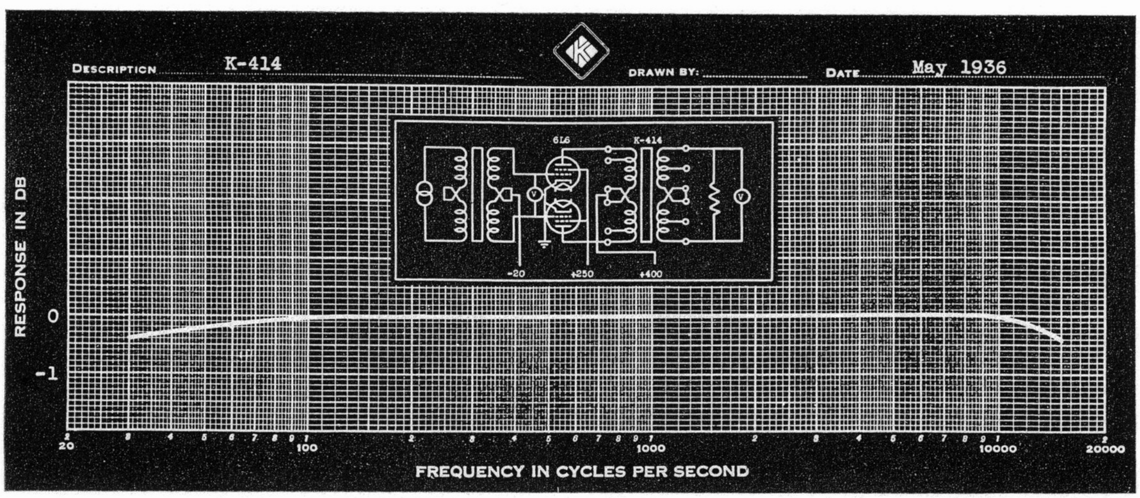


Bottom Mounting

The governing factor of high frequency response is leakage reactance. Leakage reactance acts like a small choke coil in series between primary and secondary. The impedance of this choke coil increases directly with frequency. At the higher frequencies the voltage loss across it will be greatest. The ratio of the impedance of this choke coil to generator impedance and load impedance determines the amount of loss. By proper coil design this value has been kept to such a point that the maximum high frequency loss in K-414 is ½ DB at 15,000 cycles.

SPECIAL APPLICATIONS

It is often necessary to use a transformer for some application other than that for which it was designed. To assist the audio engineer in estimating the probable frequency response under these conditions the following examples are given: Let us suppose it is necessary to couple push pull 6L6 tubes to a 1000 ohm load. If the secondary load is doubled in impedance, the impedance of the reflected primary load is also doubled. This means that the 6L6 tubes would be working into a load twice as great as recommended. The result of this will be an increase in harmonic content. The only way to keep this harmonic content to a point where it is not objectionable, is to limit the amount of grid excitation. When the secondary load is doubled, we must consider the shunting effect of primary inductance to determine what the low frequency response will be. When the primary inductance of a transformer is too low, it acts like a shunting load on the generator. This causes current to flow through the primary of the transformer which cannot be utilized for power transfer to the secondary. The degree to which this effect occurs is governed



by the ratio of primary reactance (that is $2\pi \times f \times L_p$) to generator impedance and load impedance. In this case generator impedance remains the same but load impedance has been doubled so we must consider that the shunting effect of primary reactance has been doubled also. This primary reactance as may be seen from the preceding formula is directly proportional to frequency. Since the reactance is only ½ as great as necessary to insure rated frequency response at 30 cycles, it will be of the correct value to insure ½ DB loss at 60 cycles. The probable loss at 30 cycles would be 1 DB.

As previously stated, high frequency response is governed by the ratio of leakage reactance to generator impedance and secondary load impedance. Since the secondary load has been doubled the ratio of leakage reactance to secondary load has been cut in half. This indicates that the frequency response will be better than rated at 15,000 cycles, the loss being slightly under ½ DB.

Now let us look at the case where it is desired to couple push pull 6L6 tubes to a 25 ohm load. The 25 ohm load would be connected to the terminals rated for 50 ohms. This connection reflects a primary load of ½ the recommended value. When this occurs the power output will be decreased and harmonic content will be decreased also. Since generator impedance remains the same and secondary load is cut in half, the ratio of primary reactance to generator impedance and secondary load is increased. This indicates that low frequency response will be improved. The loss at 30 cycles will be less than ½ DB and the response characteristic will continue flat on down to about 20 cycles. Since the load impedance has been cut in half the ratio of leakage reactance to load impedance has been doubled. This indicates that the effect of leakage reactance on the high frequencies will be increased. The probable loss will be ½ DB at 7500 cycles and 1 DB at 15000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response characteristic illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 6000 or 8500 ohms (pl. to pl.)

Secondary Impedance — 50, 125, 200 (balanced) 250, 333 or 500 (balanced) ohms

Max. Pri. D.C. Balanced/Leg — 70 MA (peak)
55 MA (static)

Max. Pri. D.C. Unbalanced/Leg — 7 MA

Max. Level — + 36.5

Pri. Inductance —
60 hy — 10 V 60 cycles applied
130 hy — 100 V 60 cycles applied
200 hy — 250 V 60 cycles applied

The inductance figures given above are based on no polarizing D.C. in the coil and with an A.C. voltage applied to the coil of the frequency and potential specified.

Coil Structure — Interleaved sections balanced for inductance, capacity and resistance

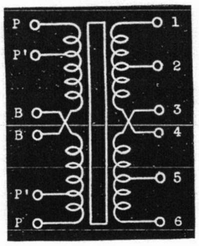
Primary D.C. Resistance — 360 ohms (total)

Secondary D.C. Resistance — 30 ohms (total)

Core Material — Low-loss high-permeability silicon steel

Electromagnetic Shielding — High-permeability casting protects transformers from the effect of pickup from stray electromagnetic and electrostatic fields

Terminal Arrangement —

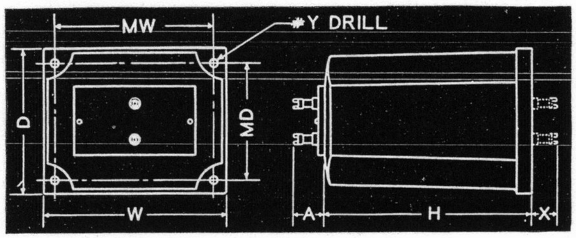


PRIMARY TERMINALS
Plates — (8500 ohm pl. to pl. load)— P – P
Plates — (6000 ohm pl. to pl. load)— P′ – P′
B + —Join B – B

SECONDARY TERMINALS
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

MECHANICAL SPECIFICATIONS

Transformer K-414 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-414

Casting Type. T3

Net Weight . . . . 12 Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅝″	5⅜″	4″	4 19/32″	3 3/16″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

KENYON TRANSFORMER CO., Inc.
840 Barry Street :: :: New York City

Export Department:
25 Warren Street
New York, N. Y.

Cable Address:
SIMONTRICE-NEW YORK

KENYON

LABORATORY STANDARD » » » Output Transformer

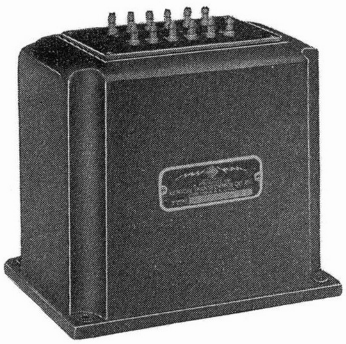
TYPE K-415

List Price. . . .$25.00

GENERAL APPLICATIONS

Transformer K-415 was designed to work out of push pull 6L6 tubes operated under the following conditions:

The total winding is a match for the 26.5 watt Class AB (no grid current) condition that requires an 8500 ohm plate to plate load. There are two taps so arranged as to give a balanced winding for the 20 watt class AB (no grid current) condition that requires a 6000 ohm plate to plate load. The secondary is a Multiple Voice Coil Line which provides a range of impedance terminations from 1.8 to 15 ohms.



Top Mounting

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

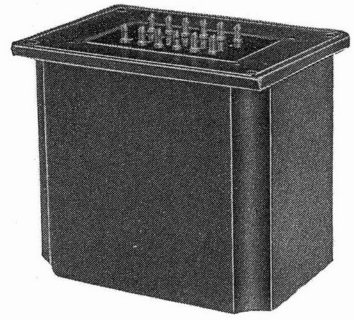
The amount of gain succeeding a unit of this type is never very great. For this reason it has been deemed unnecessary to provide electrostatic shielding between primary and secondary. Electromagnetic pickup or cross talk might prove serious in a unit operating at this level. To eliminate any such effects the unit is encased in a high permeability casting which reduces electromagnetic pickup by 18 DB.

DESIGN CONSIDERATIONS

One of the greatest advantages of the new 6L6 tube is the low distortion content of the power output. In order to realize this full advantage, the output transformer must be designed to present the exact plate to plate load recommended for the various operating conditions. Impedance terminations to match exactly any one of the various output conditions will be found in this group of transformers presented by Kenyon.

One of the primary considerations in the design of an output transformer to handle levels as high as 26.5 watts is the provision of ample copper area for full power output. While the maximum primary current of this unit will not exceed 80 or 90 milliamperes the current flowing in the lowest impedance tap of the secondary may be many times this. If sufficiently large wire is not used in both primary and secondary, the losses occurring in the windings will impair the efficiency of the unit to a great extent. Copper loss impairs efficiency at all frequencies.

Low frequency response in an output transformer is determined by core loss and primary inductance. As an illustration of the effect of core loss let us look at an output transformer whose core weighs 8 lbs. with a flux density of such a value that the core loss is 1 watt per lb. Under these conditions if the input power to the transformer were 26.5 watts, the output would be only 18.5 watts. This shows an efficiency of 70% or a low frequency loss of 1½ DB. To eliminate any such losses as this, the cross sectional area of the core has been kept large, and high permeability low loss silicon steel is used as the core material. In a properly designed output transformer if A.C. flux densities are kept to a point where core loss is not excessive, there is always sufficient primary inductance to insure good low frequency response. For this reason silicon steel instead of high permeability alloy steel is used as the core material. The losses in high permeability steels are not greatly less than those in high grade silicon steels; the great advantage of the former being high permeability. Since the additional primary inductance obtainable with this high permeability is not necessary, the use of the more expensive alloy is not justified.

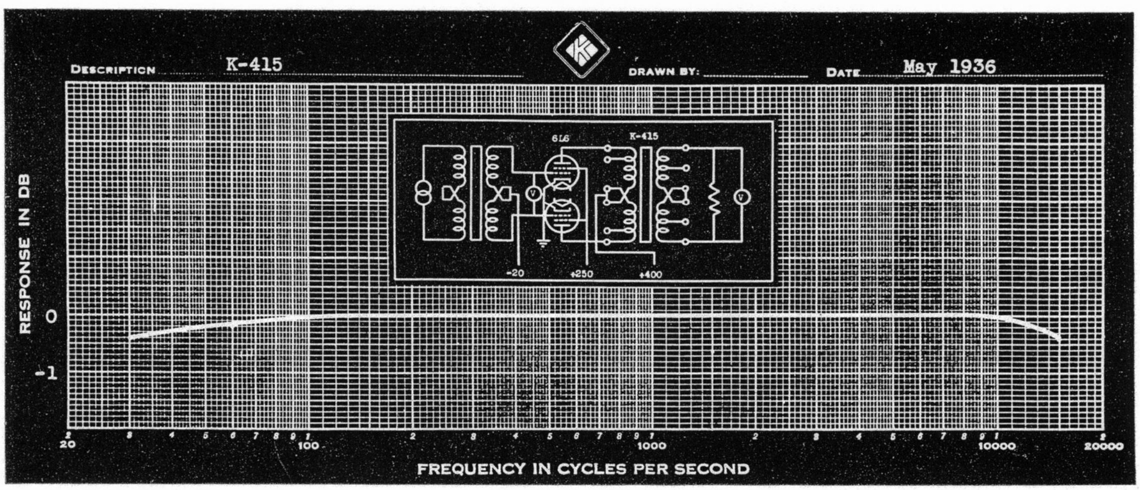


Bottom Mounting

The governing factor of high frequency response is leakage reactance. Leakage reactance acts like a small choke coil in series between primary and secondary. The impedance of this choke coil increases directly with frequency. At the higher frequencies the voltage loss across it will be greatest. The ratio of the impedance of this choke coil to generator impedance and load impedance determines the amount of loss. By proper coil design this value has been kept to such a point that the maximum high frequency loss in K-415 is ½ DB at 15,000 cycles.

SPECIAL APPLICATIONS

It is often necessary to use a transformer for some application other than that for which it was designed. To assist the audio engineer in estimating the probable frequency response under these conditions the following examples are given: Let us suppose it is necessary to couple push pull 6L6 tubes to a 30 ohm load. If the secondary load is doubled in impedance, the impedance of the reflected primary load is doubled also. This means that the 6L6 tubes would be working into a load twice as great as recommended. The result of this will be an increase in harmonic content. The only way to keep this harmonic content to a point where it is not objectionable, is to limit the amount of grid excitation. When the secondary load is doubled, we must consider the shunting effect of primary inductance to determine what the low frequency response will be. When the primary inductance of a transformer is too low, it acts like a shunt load on the generator. This causes current to flow through the primary



of the transformer which cannot be utilized for power transfer to the secondary. The degree to which this effect occurs is governed by the ratio of primary reactance (that is $2\pi \times f \times L_p$) to generator impedance and load impedance. In this case generator impedance remains the same but load impedance has been doubled so we must consider that the shunting effect of primary reactance has been doubled also. This primary reactance as may be seen from the preceeding formula is directly proportional to frequency. Since the reactance is only ½ as great as necessary to insure rated frequency response at 30 cycles, it will be of the correct value to insure ½ DB loss at 60 cycles The probable loss at 30 cycles would be 1 DB.

As previously stated, high frequency response is governed by the ratio of leakage reactance to generator impedance and secondary load impedance. Since secondary load has been doubled the ratio of leakage reactance to secondary load has been cut in half. This indicates that the frequency response will be better than rated at 15,000 cycles the loss being slightly under ½ DB.

Now let us look at the case where it is desired to couple push pull 6L6 tubes to a 1 ohm load. The 1 ohm load would be connected to the terminals rated for 1.8 ohms. This connection reflects a primary load of ½ the recommended value. When this occurs the power output will be decreased and harmonic content will be decreased also. Since generator impedance remains the same and secondary load is cut in half, the ratio of primary reactance to generator impedance and secondary load is increased. This indicates that low frequency response will be greatly improved. The loss at 30 cycles will be less than ½ DB and the response characteristic will continue flat on down to about 20 cycles. Since the load impedance has been cut in half the ratio of leakage reactance to load impedance has been doubled. This indicates that the effect of leakage reactance on the high frequencies will be increased. The probable loss will be ½ DB at 7500 cycles and 1 DB at 15000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response characteristic illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 6000 or 8500 ohms (Pl. to Pl.)

Secondary Impedance — 1.8, 3.75, 6.8, 7.5 (balanced) 11 or 15 (balanced) ohms

Max. Pri. D.C. Balanced/Leg — 70 MA (peak)
55 MA (static)

Max. Pri. D.C. Unbalanced/Leg — 7 MA

Max. Level — + 36.5 D.B.

Pri. Inductance —

60 hy — 10 V 60 cycles applied
130 hy — 100 V 60 cycles applied
200 hy — 250 V 60 cycles applied

The inductance figures given above are based on no polarizing D.C. in the coil and an A.C. voltage applied to the coil of the frequency and potential specified.

Coil Structure — Interleaved sections balanced for inductance, capacity and resistance.

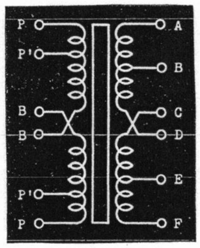
Primary D.C. Resistance — 360 ohms (total)

Secondary D.C. Resistance — .9 ohms (total)

Core Material — Low-loss high-permeability silicon steel

Electromagnetic Shielding — High-permeability cast case protects transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement —

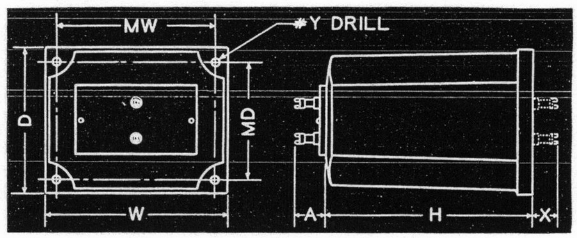


PRIMARY TERMINALS
Plates — (8500 ohm pl. to pl. load)— P – P
Plates — (6000 ohm pl. to pl. load)— P′ – P′
B + — B – B

SECONDARY TERMINALS
15 ohms — connect to A and F, join C to D
11 ohms — connect to A and E, join C to D
7.5 ohms — connect to B and E, join C to D
6.8 ohms — connect to A and F, join B to C
3.75 ohms — connect to A and F, join A to C, join D to F
1.8 ohms — connect to B and E, join B to C, join D to E

MECHANICAL SPECIFICATIONS

Transformer K-415 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No K-415

Casting Type T3

Net Weight .... 12 Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅝″	5⅜″	4″	4 19/32″	3 3/16″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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New York, N. Y.

Cable Address:
SIMONTRICE-NEW YORK

 Printed in U.S.A.

KENYON

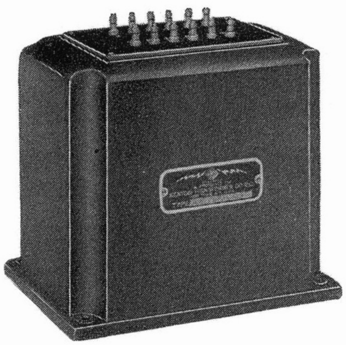
LABORATORY STANDARD
» » » Output Transformer

TYPE K-416 — **List Price....$25.00**

GENERAL APPLICATIONS

Transformer K-416 was designed to work out of push pull 6L6 tubes operated under the following conditions:

The total winding is a match for the 34 watt class AB (no grid current) condition that requires a 6600 ohm plate to plate load. There are two taps so arranged as to give a balanced winding for the 23 watt class AB (no grid current) condition that requires a 3800 ohm plate to plate load. The secondary is the Kenyon Multiple Line which provides a range of impedance terminations from 50 to 500 ohms.



Top Mounting

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

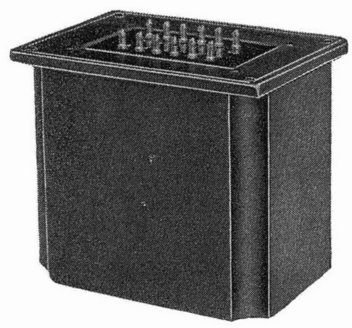
The amount of gain succeeding a unit of this type is never very great. For this reason it has been deemed unnecessary to provide electrostatic shielding between primary and secondary. Electromagnetic pickup or cross talk might prove serious in a unit operating at this level. To eliminate any such effects the unit is encased in a high permeability casting which reduces electromagnetic pickup by 18 DB.

DESIGN CONSIDERATIONS

One of the greatest advantages of the new 6L6 tube is the low distortion content of the power output. In order to realize this full advantage, the output transformer must be designed to present the exact plate to plate load recommended for the various operating conditions. Impedance terminations to match exactly any one of the various output conditions will be found in this group of transformers presented by Kenyon.

One of the primary considerations in the design of an output transformer to handle levels as high as this is the provision of ample copper area for full power output. While the maximum primary current of this unit will not exceed 85 milliamperes the current flowing in the lowest impedance tap of the secondary may be many times this. If sufficiently large wire is not used in both primary and secondary, the losses occurring in the windings will impair the efficiency of the unit to a great extent. Copper loss impairs efficiency at all frequencies.

Low frequency response in an output transformer is determined by core loss and primary inductance. As an illustration of the effect of core loss let us look at an output transformer whose core weighs 8 lbs. with a flux density of such a value that the core loss is 1 watt per lb. Under these conditions if the input power to the transformer were 34 watts, the output would be only 26 watts. This shows an efficiency of 75% or a low frequency loss of 1½ DB. To eliminate any such losses as this, the cross sectional area of the core has been kept large, and high permeability low loss silicon steel is used as the core material. In a properly designed output transformer if A.C. flux densities are kept to a point where core loss is not excessive, there is always sufficient primary inductance to insure good low frequency response. For this reason silicon steel instead of high permeability alloy steel is used as the core material. The losses in high permeability steels are not greatly less than those in high grade silicon steels; the great advantage of the former being high permeability. Since the additional primary inductance obtainable with this high permeability is not necessary, the use of the more expensive alloy is not justified.

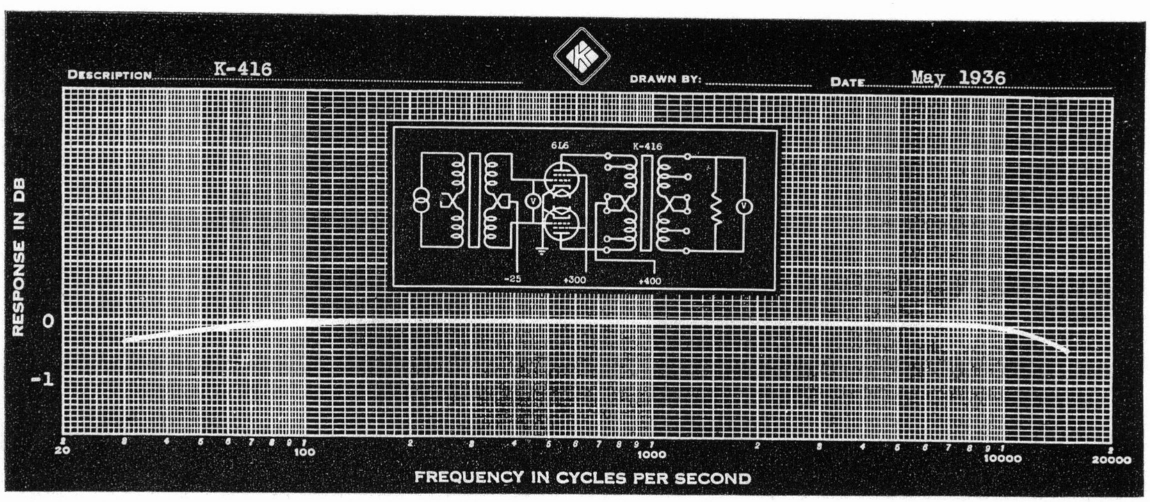


Bottom Mounting

The governing factor of high frequency response is leakage reactance. Leakage reactance acts like a small choke coil in series between primary and secondary. The impedance of this choke coil increases directly with frequency. At the higher frequencies the voltage loss across it will be greatest. The ratio of the impedance of this choke coil to generator impedance and load impedance determines the amount of loss. By proper coil design this value has been kept to such a point that the maximum high frequency loss in K-416 is ½ DB at 15,000 cycles.

SPECIAL APPLICATIONS

It is often necessary to use a transformer for some application other than that for which it was designed. To assist the audio engineer in estimating the probable frequency response under these conditions the following examples are given: Let us suppose it is necessary to couple push pull 6L6 tubes to a 1000-ohm load. If the secondary load is doubled in impedance, the impedance of the reflected primary load is also doubled. This means that the 6L6 tubes would be working into a load twice as great as recommended. The result of this will be an increase in harmonic content. The only way to keep this harmonic content to a point where it is not objectionable, is to limit the amount of grid excitation. When the secondary load is doubled, we must consider the shunting effect of primary inductance to determine what the low frequency response will be. When the primary inductance of a transformer is too low, it acts like a shunting load on the generator. This causes current to flow through the primary of the transformer which cannot be utilized for power transfer to the secondary. The degree to which this effect occurs is governed



by the ratio of primary reactance (that is $2\pi \times f \times L_p$) to generator impedance and load impedance. In this case generator impedance remains the same but load impedance has been doubled so we must consider that the shunting effect of primary reactance has been doubled also. This primary reactance as may be seen from the preceding formula is directly proportional to frequency. Since the reactance is only ½ as great as necessary to insure rated frequency response at 30 cycles, it will be of the correct value to insure ½ DB loss at 60 cycles. The probable loss at 30 cycles would be 1 DB.

As previously stated, high frequency response is governed by the ratio of leakage reactance to generator impedance and secondary load impedance. Since secondary load has been doubled the ratio of leakage reactance to secondary load has been cut in half. This indicates that the frequency response will be better than rated at 15,000 cycles the loss being slightly under ½ DB.

Now let us look at the case where it is desired to couple push pull 6L6 tubes to a 25 ohm load. The 25-ohm load would be connected to the terminals rated for 50-ohms. This connection reflects a primary load of ½ the recommended value. When this occurs the power output will be decreased and harmonic content will be decreased also. Since generator impedance remains the same and secondary load is cut in half, the ratio of primary reactance to generator impedance and secondary load is increased. This indicates that low frequency response will be greatly improved. The loss at 30 cycles will be less than ½ DB and the response characteristic will continue flat on down to about 20 cycles. Since the load impedance has been cut in half the ratio of leakage reactance to load impedance has been doubled. This indicates that the effect of leakage reactance on the high frequencies will be increased. The probable loss will be ½ DB at 7500 cycles and 1 DB at 15,000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response characteristic illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 6600 or 3800 ohms

Secondary Impedance — 50, 125, 200 (balanced) 250, 333, or 500 (balanced) ohms

Max. Pri. D.C. Balanced/Leg — 85 MA (peak) 65 MA (static)

Max. Pri. D.C. Unbalanced/Leg — 8 MA

Max. Level — + 37.6 DB

Pri. Inductance —

63 hy — 10 V 60 cycles applied
150 hy — 100 V 60 cycles applied
230 hy — 250 V 60 cycles applied

The inductance figures given above are based on no polarizing D.C. in the coil and an A.C. voltage applied to the coil of the frequency and potential specified.

Coil Structure — Interleaved sections balanced for inductance, capacity and resistance

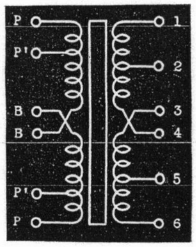
Primary D.C. Resistance — 370 ohms (total)

Secondary D.C. Resistance — 33 ohms (total)

Core Material — Low-loss high-permeability silicon steel

Electromagnetic Shielding — High-permeability cast case protects transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement

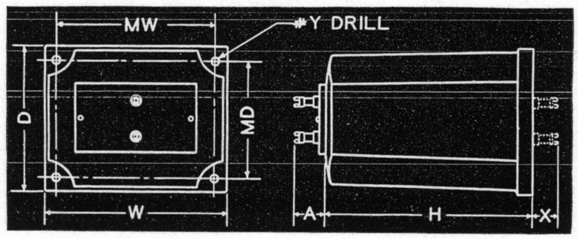


Primary Terminals
Plates — (6600 ohm pl. to pl. load)— P — P
Plates — (3800 ohm pl. to pl. load)— P′ — P′
B + — Join B — B

Secondary Terminals
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

MECHANICAL APPLICATIONS

Transformer K-416 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-416

Casting Type T3

Net Weight .... 12 Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅝″	5⅜″	4″	4 19/32″	3 3/16″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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LABORATORY STANDARD
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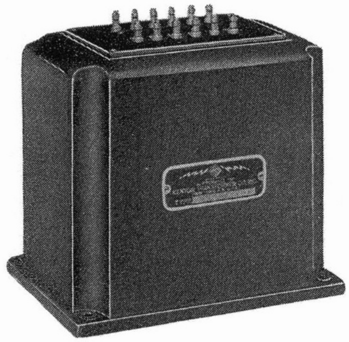
TYPE K-417

List Price. . . .$25.00

GENERAL APPLICATIONS

Transformer K-417 was designed to work out of push pull 6L6 tubes operated under the following conditions:

The total winding is a match for the 34 watt class AB (no grid current) condition that requires a 6600 ohm plate to plate load. There are two taps so arranged as to give a balanced winding for the 23 watt class AB (no grid current) condition that requires a 3800 ohm plate to plate load. The secondary is the Kenyon Multiple Voice Coil Line which provides for a range of impedance terminations from 1.8 to 15 ohms.



Top Mounting

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

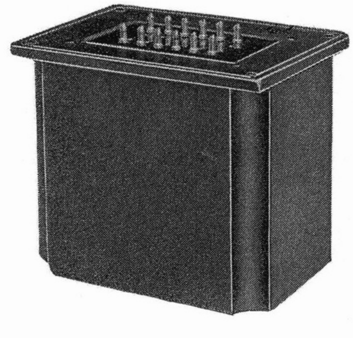
The amount of gain succeeding a unit of this type is never very great. For this reason it has been deemed unnecessary to provide electrostatic shielding between primary and secondary. Electromagnetic pickup or cross talk might prove serious in a unit operating at this level. To eliminate any such effects the unit is encased in a high permeability casting which reduces electromagnetic pickup by 18 DB.

DESIGN CONSIDERATIONS

One of the greatest advantages of the new 6L6 tube is the low distortion content of the power output. In order to realize this advantage, the output transformer must be designed to present the exact plate to plate load recommended for the various operating conditions. Impedance terminations to match exactly any one of the various output conditions will be found in this group of transformers presented by Kenyon.

One of the primary considerations in the design of an output transformer to handle levels as high as this is the provision of ample copper area for full power output. While the maximum primary current of this unit will not exceed 85 milliamperes, the current flowing in the lowest impedance tap of the secondary may be many times this. If sufficiently large wire is not used in both primary and secondary, the losses occurring in the windings will impair the efficiency of the unit to a great extent. Copper loss impairs efficiency at all frequencies.

Low frequency response in an output transformer is determined by core loss and primary inductance. As an illustration of the effect of core loss let us look at an output transformer whose core weighs 8 lbs. with a flux density of such a value that the core loss is 1 watt per lb. Under these conditions if the input power to the transformer were 34 watts, the output would be only 26 watts. This shows an efficiency of 75% or a low frequency loss of 1½ DB. To eliminate any such losses as this, the cross sectional area of the core has been kept large, and high permeability low loss silicon steel is used as the core material. In a properly designed output transformer if A.C. flux densities are kept to a point where core loss is not excessive, there is always sufficient primary inductance to insure good low frequency response. For this reason silicon steel instead of high permeability alloy steel is used as the core material. The losses in high permeability steels are not greatly less than those in high grade silicon steels; the great advantage of the former being high permeability. Since the additional primary inductance obtainable with this high permeability is not necessary, the use of the more expensive alloy is not justified.

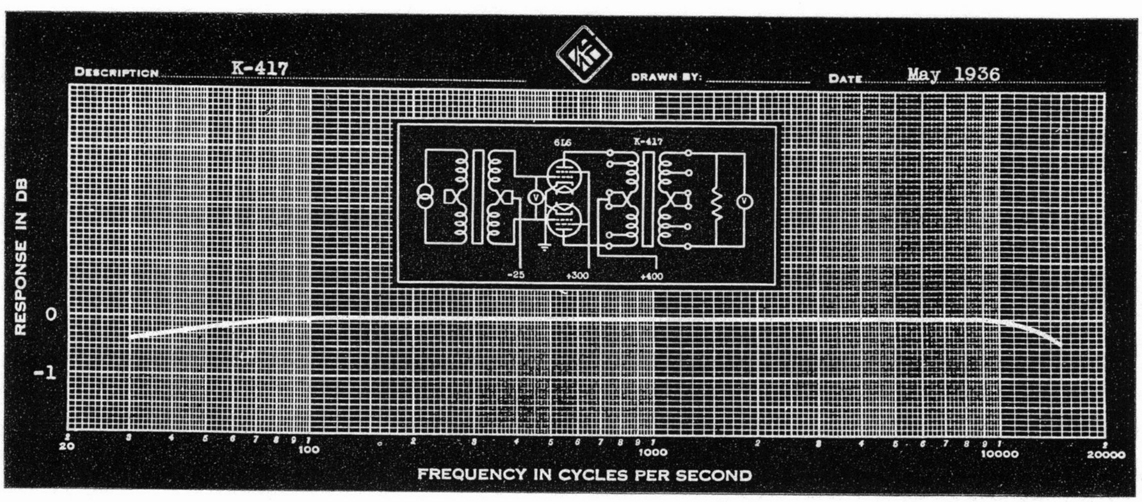


Bottom Mounting

The governing factor of high frequency response is leakage reactance. Leakage reactance acts like a small choke coil in series between primary and secondary. The impedance of this choke coil increases directly with frequency, thus at the higher frequencies the voltage loss across it will be greatest. The ratio of the impedance of this choke coil to generator impedance and load impedance determines the amount of loss. By proper coil design this value has been kept to such a point that the maximum high frequency loss in K-417 is ½ DB at 15,000 cycles.

SPECIAL APPLICATIONS

It is often necessary to use a transformer for some application other than that for which it was designed. To assist the audio engineer in estimating the probable frequency response under these conditions the following examples are given: Let us suppose it is necessary to couple push pull 6L6 tubes to a 30 ohm load. If the secondary load is doubled in impedance, the impedance of the reflected primary load is also doubled. This means that the 6L6 tubes will be working into a load twice as great as recommended. The result of this will be an increase in harmonic content. The only way to keep this harmonic content to a point where it is not objectionable, is to limit the amount of grid excitation. When the secondary load is doubled, we must consider the shunting effect of primary inductance to determine what the low frequency response will be. When the primary inductance of a transformer is too low, it acts like a shunt load on the generator. This causes current to flow through the primary of the trans-



former which cannot be utilized for power transfer to the secondary. The degree to which this effect occurs is governed by the ratio of primary reactance (that is $2\pi \times f \times L_p$) to generator impedance and load impedance. In this case generator impedance remains the same but load impedance has been doubled so we must consider that the shunting effect of primary reactance has been doubled also. This primary reactance as may be seen from the preceding formula is directly proportional to frequency. Since the reactance is only ½ as great as necessary to insure rated frequency response at 30 cycles, it will be of the correct value to insure ½ DB loss at 60 cycles. The probable loss at 30 cycles would be 1 DB.

As previously stated, high frequency response is governed by the ratio of leakage reactance to generator impedance and secondary load impedance. Since the secondary load has been doubled the ratio of leakage reactance to secondary load has been cut in half. This indicates that the frequency response will be better than rated at 15,000 cycles, the loss being slightly under ½ DB.

Now let us look at the case where it is desired to couple push pull 6L6 tubes to a 1 ohm load. The 1 ohm load would be connected to the terminals rated for 1.8 ohms. This connection reflects a primary load of ½ the recommended value. When this occurs the power output will be decreased and harmonic content will be decreased also. Since generator impedance remains the same and secondary load is cut in half, the ratio of primary reactance to generator impedance and secondary load is increased. This indicates that low frequency response will be improved. The loss at 30 cycles will be less than ½ DB and the response characteristic will continue flat on down to about 20 cycles. Since the load impedance has been cut in half the ratio of leakage reactance to load impedance has been doubled. This indicates that the effect of leakage reactance on the high frequencies will be increased. The probable loss will be ½ DB at 7500 cycles and 1 DB at 15,000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response characteristic illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 6600 or 3800 ohms

Secondary Impedance — 1.8, 3.75, 6.8, 7.5 (balanced) 11 or 15 (balanced) ohms

Max. Pri. D.C. Balanced/Leg — 85 MA (peak)
65 MA (static)

Max. Pri. D.C. Unbalanced/Leg — 8 MA

Max. Level — + 37.6 DB

Pri. Inductance —
63 hy — 10 V 60 cycles applied
150 hy — 100 V 60 cycles applied
230 hy — 250 V 60 cycles applied

The inductance figures given above are based on no polarizing D.C. in the coil and with an A.C. voltage applied to the coil of the frequency and potential specified.

Coil Structure — Interleaved sections balanced for inductance, capacity, and resistance.

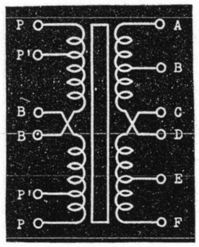
Primary D.C. Resistance — 370 ohms (total)

Secondary D.C. Resistance — 1 ohm (total)

Core Material — Low-loss high-permeability silicon steel

Electromagnetic Shielding — High-permeability cast case protects transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement

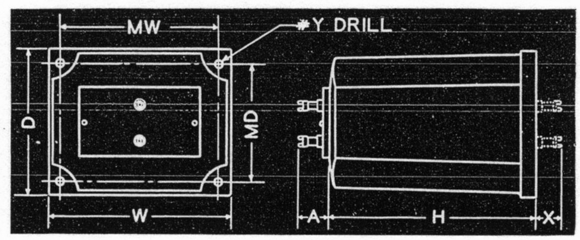


PRIMARY TERMINALS
Plates — (6600 ohm pl. to pl. load)— P – P
Plates — (3800 ohm pl. to pl. load)— P' – P'
B + — Join B – B

SECONDARY TERMINALS
15 ohms — connect to A and F, join C to D
11 ohms — connect to A and E, join C to D
7.5 ohms — connect to B and E, join C to D
6.8 ohms — connect to A and F, join B to C
3.75 ohms — connect to A and F, join A to C, join D to F
1.8 ohms — connect to B and E, join B to C, join D to E

MECHANICAL SPECIFICATIONS

Transformer K-417 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-417

Casting Type T3

Net Weight .... 12 Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅝"	5⅜"	4"	4 13/32"	3 3/16"	½"	5/16"	13

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We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

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LABORATORY STANDARD
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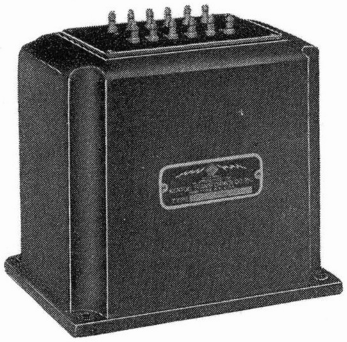
TYPE K-418 — **List Price $30.00**

GENERAL APPLICATIONS

Transformer K-418 was designed to work out of push pull 6L6 tubes operated under the following conditions:

The total winding is a match for the 40 watt class AB (grid current) condition that requires a 6000 ohm plate to plate load. There are two taps so arranged as to give a balanced winding for the 60 watt class AB (grid current) condition that requires a 3800 ohm plate to plate load. The secondary is provided with a Kenyon Multiple Line which provides a range of impedance terminations from 50 to 500 ohms.



Top Mounting

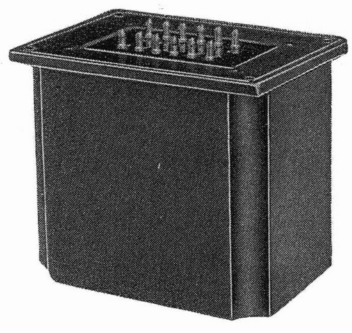
ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

The amount of gain succeeding a unit of this type is never very great. For this reason it has been deemed unnecessary to provide electrostatic shielding between primary and secondary. Electromagnetic pickup or cross talk might prove serious in a unit operating at this level. To eliminate any such effects the unit is encased in a high permeability casting which reduces electromagnetic pickup by 18 DB.

DESIGN CONSIDERATIONS

One of the greatest advantages of the new 6L6 tube is the low distortion content of the power output. In order to realize this full advantage, the output transformer must be designed to present the exact plate to plate load recommended for the various operating conditions. In this group of transformers, presented by Kenyon, impedance terminations to match exactly any one of the various output conditions will be found. One of the primary considerations in the design of an output transformer to handle levels as high as this is the provision of ample copper area for full power output. While the maximum primary current of this unit will not exceed 120 milliamperes, the current flowing in the lowest impedance tap of the secondary may be many times this. If sufficiently large wire is not used in both primary and secondary, the losses occurring in the windings will impair the efficiency of the unit to a great extent. Copper loss impairs efficiency at all frequencies.

Low frequency response in an output transformer is determined by core loss and primary inductance. As an illustration of the effect of core loss let us look at an output transformer whose core weighs 10 lbs. with a flux density of such a value that the core loss is 1 watt per lb. Under these conditions if the input power of the transformer were 40 watts, the output would be only 30 watts. This shows an efficiency of 75% or a low frequency loss of 1½ DB. To eliminate any such losses as this, the cross sectional area of the core has been kept large, and high permeability low loss silicon steel is used as the core material. In a properly designed output transformer, if A.C. flux densities are kept to a point where core loss is not excessive, there is always sufficient primary inductance to insure good low frequency response. For this reason silicon steel instead of high permeability alloy steel is used as the core material. The losses in high permeability steels are not greatly less than those in high grade silicon steels; the great advantage of the former being high permeability. Since the additional primary inductance supplied by this high permeability is not necessary, the use of the more expensive alloy is not justified.



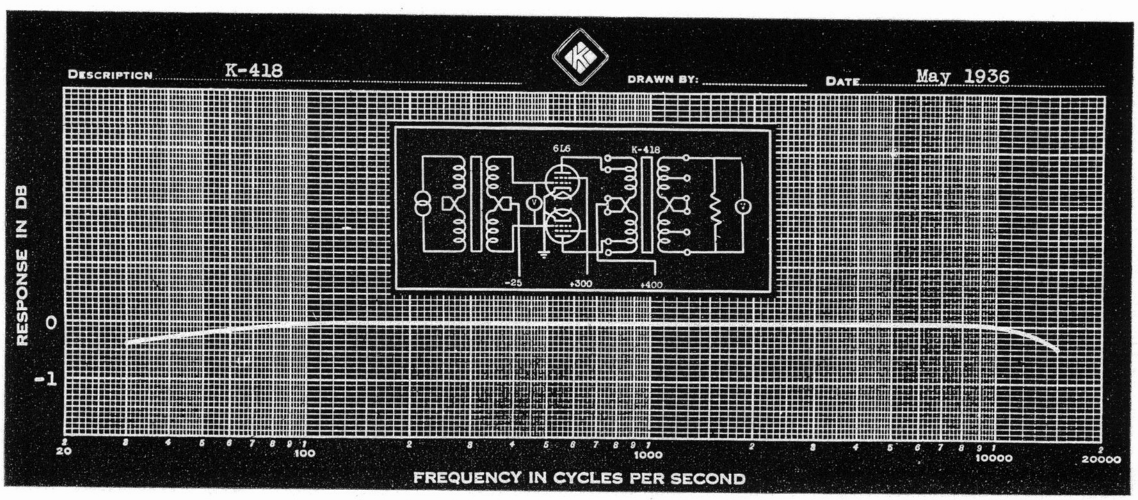
Bottom Mounting

The governing factor of high frequency response is leakage reactance. Leakage reactance acts like a small choke coil in series between primary and secondary. The impedance of this choke coil increases directly with frequency, thus at the higher frequencies the voltage loss across it will be greatest. The ratio of the impedance of this choke coil to generator impedance and load impedance determines the amount of loss. By proper coil design this value has been kept to such a point that the maximum high frequency loss in K-418 is ½ DB at 15,000 cycles.

SPECIAL APPLICATIONS

It is often necessary to use a transformer for some application other than that for which it was designed. To assist the audio engineer in estimating the probable frequency response under these conditions the following examples are given: Let us suppose it is necessary to couple push pull 6L6 tubes to a 1000-ohm load. If the secondary load is doubled in impedance, the impedance of the reflected primary load is doubled also. This means that the 6L6 tubes would be working into a load twice as great as recommended.

The result of this will be an increase in harmonic content. The only way to keep this harmonic content to a point where it is not objectionable, is to limit the amount of grid excitation. When the secondary load is doubled, we must consider the shunting effect of primary inductance to determine what the low frequency response will be. When the primary inductance of a transformer is too low, it acts like a shunting



load on the generator. This causes current to flow through the primary of the transformer which cannot be utilized for power transfer to the secondary. The degree to which this effect occurs is governed by the ratio of primary reactance (that is $2\pi \times f \times L_p$) to generator impedance and load impedance. In this case generator impedance remains the same but load impedance has been doubled so we must consider that the shunting effect of primary reactance has been doubled also. This primary reactance as may be seen from the preceding formula is directly proportional to frequency. Since the reactance is only ½ as great as necessary to insure rated frequency response at 30 cycles, it will be of the correct value to insure ½ DB loss at 60 cycles. The probable loss at 30 cycles would be 1 DB.

As previously stated, high frequency response is governed by the ratio of leakage reactance to generator impedance and secondary load impedance. Since the secondary load has been doubled the ratio of leakage reactance to secondary load has been cut in half. This indicates that the frequency response will be better than rated at 15,000 cycles, the loss being slightly under ½ DB.

Now let us look at the case where it is desired to couple push pull 6L6 tubes to a 25 ohm load. The 25 ohm load would be connected to the terminals rated for 50 ohms. This connection reflects a primary load of ½ the recommended value. When this occurs the power output will be decreased and harmonic content will be decreased also. Since generator impedance remains the same and secondary load is cut in half, the ratio of primary reactance to generator impedance and secondary load is increased. This indicates that low frequency response will be improved. The loss at 30 cycles will be less than ½ DB and the response characteristic will continue flat on down to about 20 cycles. Since the load impedance has been cut in half the ratio of leakage reactance to load impedance has been doubled. This indicates that the effect of leakage reactance on the high frequencies will be increased. The probable loss will be ½ DB at 7500 cycles and 1 DB at 15,000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response characteristic illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 6000 or 3800 ohms

Secondary Impedance — 50, 125, 200 (balanced) 250, 333, or 500 (balanced) ohms

Max. Pri. D.C. Balanced/Leg — 125 MA (peak) 60 MA (static)

Max. Pri. D.C. Unbalanced/Leg — 10 MA

Max. Level — + 40 DB

Pri. Inductance —
65 hy — 10 V 60 cycles applied
152 hy — 100 V 60 cycles applied
235 hy — 250 V 60 cycles applied

The inductance figures given above are based on no polarizing D.C. in the coil and an A.C. voltage applied to the coil of the frequency and potential specified.

Coil Structure — Interleaved sections balanced for inductance, capacity, and resistance.

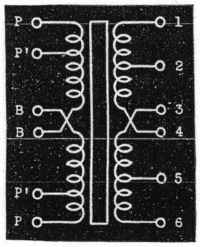
Primary D.C. Resistance — 225 ohms (total)

Secondary D.C. Resistance — 28 ohms (total)

Core Material — Low-loss high-permeability silicon steel

Electromagnetic Shielding — High-permeability cast case protects transformer from the effects of pickup from stray electromagnetic and electrostatic fields.

Terminal Arrangement

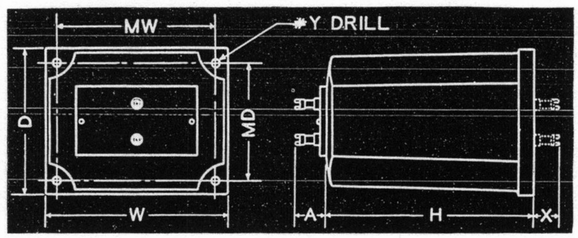


PRIMARY TERMINALS
Plates — (6000 ohm pl. to pl. load)— P – P
Plates — (3800 ohm pl. to pl. load)— P' – P'
B + — Join B – B

SECONDARY TERMINALS
50 ohms — connect to 2 and 5, join 2 to 3 and 4 to 5
125 ohms — connect to 1 and 6, join 1 to 3 and 4 to 6
200 ohms — connect to 2 and 5, join 3 to 4
250 ohms — connect to 1 and 6, join 2 to 3
333 ohms — connect to 1 and 5, join 3 to 4
500 ohms — connect to 1 and 6, join 3 to 4

MECHANICAL SPECIFICATIONS

Transformer K-418 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-418

Casting Type T4

Net Weight .... 16¼ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅝″	6″	5⅜″	5 1/32″	4 9/16″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

KENYON TRANSFORMER Co., Inc.

840 Barry Street :: :: New York City

Export Department:
25 Warren Street
New York, N. Y.

Cable Address:
SIMONTRICE-NEW YORK

KENYON

LABORATORY STANDARD
» » » Output Transformer

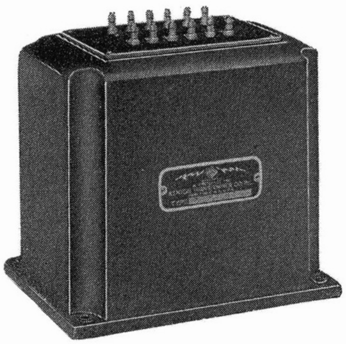
TYPE K-419

List Price....$30.00

GENERAL APPLICATIONS

Transformer K-419 was designed to work out of push pull 6L6 tubes operated under the following conditions:

The total winding is a match for the 40 watt class AB (grid current) condition that requires a 6000 ohm plate to plate load. There are two taps so arranged as to give a balanced winding for the 60 watt class AB (grid current) condition that requires a 3800 ohm plate to plate load. The secondary is a Multiple Voice Coil Line which provides a range of impedance terminations from 1.8 to 15 ohms.



Top Mounting

ELECTROSTATIC AND ELECTRO-MAGNETIC SHIELDING

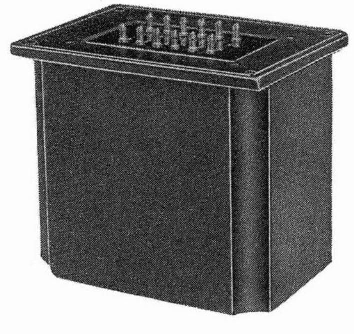
The amount of gain succeeding a unit of this type is never very great. For this reason it has been deemed unnecessary to provide electrostatic shielding between primary and secondary. Electromagnetic pickup or cross talk might prove serious in a unit operating at this level. To eliminate any such effects the unit is encased in a high permeability casting which reduces electromagnetic pickup by 18 DB.

DESIGN CONSIDERATIONS

One of the greatest advantages of the new 6L6 tube is the low distortion content of the power output. In order to take full advantage of this, the output transformer must be designed to present the exact plate to plate load recommended for the various operating conditions. Impedance terminations to match exactly any one of the various output conditions will be found in this group of transformers presented by Kenyon.

One of the primary considerations in the design of an output transformer to handle levels as high as this is the provision of ample copper area for full power output. While the maximum primary current of this unit will not exceed 120 milliamperes the current flowing in the lowest impedance tap of the secondary may be many times this. If sufficiently large wire is not used in both primary and secondary, the losses occurring in the windings will impair the efficiency of the unit to a great extent. Copper loss impairs efficiency at all frequencies.

Low frequency response in an output transformer is determined by core loss and primary inductance. As an illustration of the effect of core loss let us look at an output transformer whose core weighs 10 lbs. with a flux density of such a value that the core loss is 1 watt per lb. Under these conditions if the input power of the transformer were 40 watts, the output would be only 30 watts. This shows an efficiency of 75% or a low frequency loss of 1½ DB. To eliminate any such losses as this, the cross sectional area of the core has been kept large, and high permeability low loss silicon steel is used as the core material. In a properly designed output transformer if A.C. flux densities are kept to a point where core loss is not excessive, there is always sufficient primary inductance to insure good low frequency response. For this reason silicon steel instead of high permeability alloy steel is used as the core material. The losses in high permeability steels are not greatly less than those in high grade silicon steels; the great advantage of the former being high permeability. Since the additional primary inductance supplied by this high permeability is not necessary, the use of the more expensive alloy is not justified.



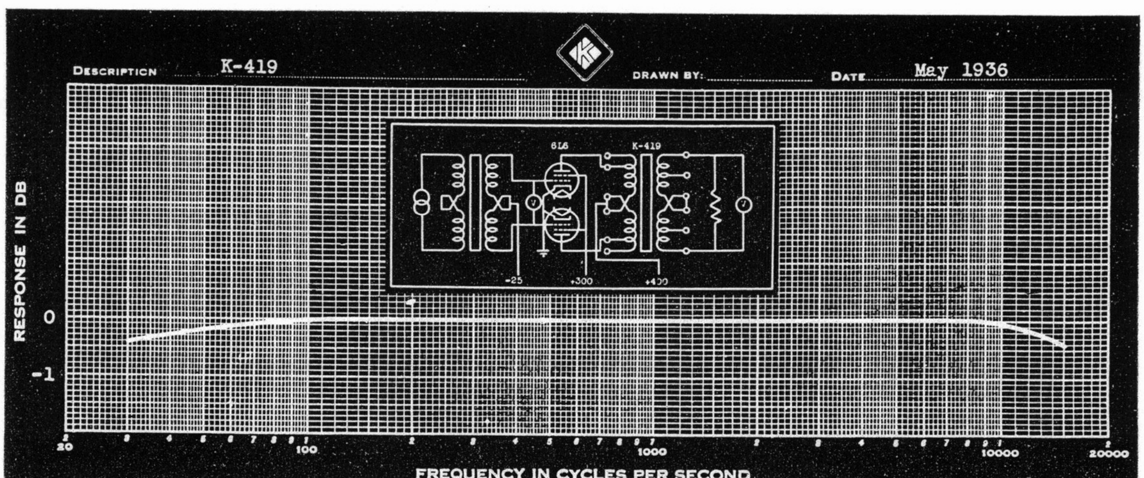
Bottom Mounting

The governing factor of high frequency response is leakage reactance. Leakage reactance acts like a small choke coil in series between primary and secondary. The impedance of this choke coil increases directly with frequency, thus at the higher frequencies the voltage loss across it will be greatest. The ratio of the impedance of this choke coil to generator impedance and load impedance determines the amount of loss. By proper coil design this value has been kept to such a point that the maximum high frequency loss in K-419 is ½ DB at 15,000 cycles.

SPECIAL APPLICATIONS

It is often necessary to use a transformer for some application other than that for which it was designed. To assist the audio engineer in estimating the probable frequency response under these conditions the following examples are given: Let us suppose it is necessary to couple push pull 6L6 tubes to a 30 ohm load. If the secondary load is doubled in impedance, the impedance of the reflected primary load is doubled also. This means that the 6L6 tubes will be working into a load twice as great as recommended.

The result of this will be an increase in harmonic content. The only way to keep this harmonic content to a point where it is not objectionable, is to limit the amount of grid excitation. When the secondary load is doubled, we must consider the shunting effect of primary inductance to determine what the low frequency response will be. When the primary inductance of a transformer is too low, it acts like a shunting load on the generator. This causes current to flow through the primary of the transformer which cannot be utilized for power transfer



to the secondary. The degree to which this effect occurs is governed by the ratio of primary reactance (that is $2\pi \times f \times L_p$) to generator impedance and load impedance. In this case generator impedance remains the same but load impedance has been doubled so we must consider that the shunting effect of primary reactance has been doubled also. This primary reactance as may be seen from the preceding formula is directly proportional to frequency. Since the reactance is only ½ as great as necessary to insure rated frequency response at 30 cycles, it will be of the correct value to insure ½ DB loss at 60 cycles. The probable loss at 30 cycles would be 1 DB. As previously stated, high frequency response is governed by the ratio of leakage reactance to generator impedance and secondary load impedance. Since the secondary load has been doubled the ratio of leakage reactance to secondary load has been cut in half. This indicates that the frequency response will be better than rated at 15,000 cycles, the loss being slightly under ½ DB.

Now let us look at the case where it is desired to couple push pull 6L6 tubes to a 1 ohm load. The 1 ohm load would be connected to the terminals rated for 1.8 ohms. This connection reflects a primary load of ½ the recommended value. When this occurs the power output will be decreased and harmonic content will be decreased also. Since generator impedance remains the same and secondary load is cut in half, the ratio of primary reactance to generator impedance and secondary load is increased. This indicates that low frequency response will be improved. The loss at 30 cycles will be less than ½ DB and the response characteristic will continue flat on down to about 20 cycles. The load impedance has been cut in half, so the ratio of leakage reactance to load impedance has been doubled. This indicates that the effect of leakage reactance on the high frequencies will be increased. The probable loss will be ½ DB at 7500 cycles and 1 DB at 15,000 cycles.

ELECTRICAL SPECIFICATIONS

The detailed electrical specifications provided below are supplied for the assistance of the audio engineer in the application of this transformer in practical audio frequency circuits.

Frequency Response — ± ½ DB 30 to 15,000 cycles
The frequency response characteristic illustrated will be maintained at any set of operating conditions within the limits set forth in these data.

Primary Impedance — 6000 or 3800 ohms

Secondary Impedance — 1.8, 3.75, 6.8, 7.5 (balanced) 11 or 15 (balanced) ohms

Max. Pri. D.C. Balanced/Leg — 125 MA (peak) 60 MA (static)

Max. Pri. D.C. Unbalanced/Leg — 10 MA

Max. Level — + 40 DB

Pri. Inductance —

65 hy — 10 V 60 cycles applied
152 hy — 100 V 60 cycles applied
235 hy — 250 V 60 cycles applied

The inductance figures given above are based on no polarizing D.C. in the coil and an A.C. voltage applied to the coil of the frequency and potential specified.

Coil Structure — Interleaved sections balanced for inductance, capacity and resistance

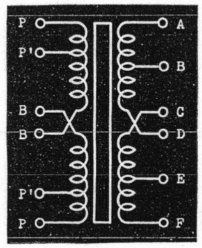
Primary D.C. Resistance — 225 ohms (total)

Secondary D.C. Resistance — .85 ohms (total)

Core Material — Low-loss high-permeability silicon steel

Electromagnetic Shielding — High-permeability cast case protects transformer from the effects of pickup from stray electromagnetic and electrostatic fields

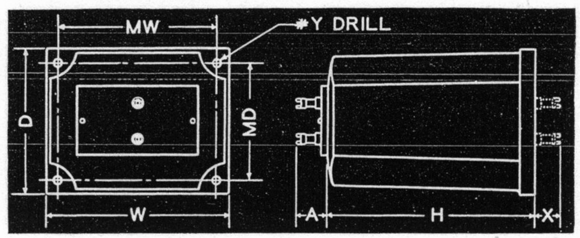
Terminal Arrangement



PRIMARY TERMINALS
Plates—(6000 ohm pl. to pl. load)
P – P
(3800 ohm pl. to pl. load) —
P′ – P′
B + — Join B – B
SECONDARY TERMINALS
15 ohms — connect to A and F, join C to D
11 ohms — connect to A and E, join C to D
7.5 ohms — connect to B and E, join C to D
6.8 ohms — connect to A and F, join B to C
3.75 ohms — connect to A and F, join A to C, join D to F
1.8 ohms — connect to B and E, join B to C, join D to E

MECHANICAL SPECIFICATIONS

Transformer K-419 can be supplied "top mounting" (with terminal lugs on top of case) or "bottom mounting" (with terminal lugs on bottom of case). TOP MOUNTING UNITS WILL BE SUPPLIED UNLESS OTHERWISE SPECIFIED.



Type No. K-419

Casting Type T4

Net Weight .... 16¼ Lbs.

Designation	H	W	D	MW	MD	A	X	Y
Dimension	4⅝″	6″	5⅜″	5 7/32″	4 9/16″	½″	5/16″	13

GUARANTY AND CONDITIONS

We have made every effort to make our operating instructions and performance characteristics clear, concise, and free of ambiguities. We unconditionally guarantee this unit to be exactly as we have represented it. Any unit not in accordance with our specifications, or defective due to material or manufacturing causes, will be repaired or replaced without charge. All material returned to this factory for inspection, repair or replacement must be shipped prepaid. This guaranty is effective for a period of five years from date of purchase.

Kenyon products are subject to continual laboratory test with resultant performance and production refinements. We accept your order with the understanding that we are authorized to furnish a revised type if the unit ordered has been discontinued.

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840 Barry Street :: :: New York City

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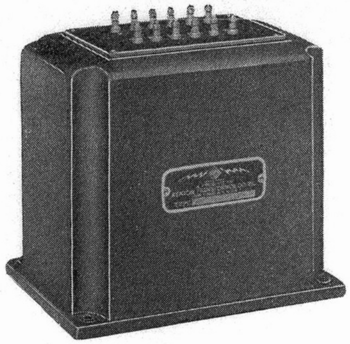
 Printed in U.S.A.

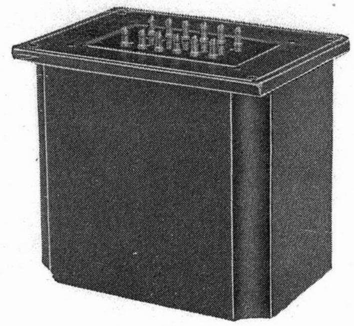
KENYON LABORATORY STANDARD Inductors and Power Transformers



Top Mounting

The Kenyon Laboratory Standard Line amplifier power equipment presented on the following pages is composed of units of new and improved design. With the increased popularity of class AB amplifiers, good regulation has become increasingly important. This factor has received primary consideration in the design of transformers and inductors. The transformers designed for class AB applications have tapped high voltage secondaries for fixed or self-bias operation as well as a tap to provide a low voltage for the fixed bias supply. Filament windings have been provided on the transformers for 2.5 volt and 6.3 volt tubes, extending the application of the units to all glass and metal tubes.

Particular care has been given to the design of the power supplies for the 6L6's—the new beam power amplifier tubes. The problem of providing the plate and screen voltages for the 6L6's and plate voltage for the driver tubes with a minimum number of units, and at the same time have sufficiently good voltage regulation, has been satisfactorily met with the rectifier circuits shown. For all operating conditions, the regulation of the plate, screen and bias supplies is within the limits recommended by the tube manufacturer.



Bottom Mounting

The chart on which the transformers are listed includes, in addition to the electrical characteristics, the application for which the units are designed together with the recommended filter system components. This provides an easy method of determining the power equipment necessary for any amplifier. All units have been designed for continuous operation under the conditions specified on the chart, with a reasonable temperature rise.

Laboratory Standard Line power components are enclosed in a cast iron case for complete electromagnetic shielding, thus reducing hum pick up from this source to a minimum. An electrostatic shield is placed between primary and secondaries of all transformers to prevent feed-back of r.f. disturbances. All coils receive a double vacuum impregnation under varnish and this, together with the fact that the complete units are poured with a humidity proof insulating compound, provides the power components with excellent protection against adverse climatic conditions.

INDUCTORS

Type	Inductance at Rated D.C.	D.C. Current	D.C. Resistance	Case	Wt.	List Price
K-500	15 Hys.	120 MA	220 ohms	T-2	6½ Lbs.	$ 8.00
K-501	15 Hys.	180 MA	90 ohms	T-3	12½ Lbs.	11.50
K-502	20 Hys.	200 MA	125 ohms	T-4	21 Lbs.	20.00
K-503	40 Hys.	60 MA	500 ohms	T-2	6½ Lbs.	8.00
K-504	15 Hys.	100 MA	350 ohms	T-1	3½ Lbs.	6.00
K-521	300 Hys.	3 MA	5,500 ohms	T-1	3½ Lbs.	9.25
K-522	400 Hys.	5 MA	3,000 ohms	T-2	5¾ Lbs.	13.00
K-523	600 Hys.	5 MA	3,000 ohms	T-2	5¾ Lbs.	20.00

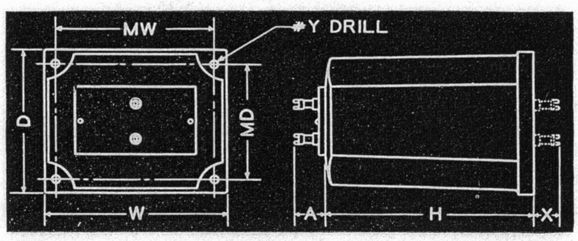
POWER TRANSFORMERS

Type No.	Secondary Volts	D.C. MA	S_1	S_2	S_3	S_4	S_5	Case	Wt.	List Price
K-600	370-0-370	90	5 V—2 A CT	2.5 V—3 A CT	2.5 V—5 A CT			T-3	13 Lbs.	$22.00
#K-601	420/360-0-360/420	165	5 V—3 A CT	2.5 V—3 A CT	2.5 V—5 A CT	2.5 V—7 A CT	6.3 V—4 A CT	T-4	20 Lbs.	25.00
#K-602	440/370-0-370/440	270	5 V—3 A CT	2.5 V—3 A CT	2.5 V—10 A CT	2.5 V—10 A CT	6.3 V—5 A CT	T-4	20 Lbs.	32.00
K-603	600-0-600	150	7.5 V—2.5 A CT	7.5 V—1.25 A CT	7.5 V—1.25 A CT	2.5 V—6 A CT		T-4	20 Lbs.	30.00
*K-604	470/370-0-370/470	230	5 V—3 A CT	2.5 V—3 A CT	2.5 V—3 A CT	6.3 V—3 A CT		T-4	20 Lbs.	28.00
*K-605	475/370-0-370/475	300	5 V—3 A CT	2.5 V—3 A CT	2.5 V—3 A CT	6.3 V—3.5 A CT		T-4	22 Lbs.	32.00
K-620	235-0-235	20	6.3 V—.5 A CT	6.3 V—1.2 A CT				T-1	3½ Lbs.	10.00
K-621	Bias Supply. See Chart.									

All primaries are tapped for 100/110/115/125 V—60 cycle operation
* Bias tap at 75 V on High Voltage Secondary
# Bias tap at 125 V on High Voltage Secondary

FILAMENT TRANSFORMERS

Type No.	Secondary Volts	Secondary Amps	Case	Wt.	List Price	Type No.	Secondary Volts	Secondary Amps	Case	Wt.	List Price
K-650	2.5 CT	14	T-2	6½ Lbs.	$7.00	K-651	6.3 CT	4	T-2	6½ Lbs.	$7.00



MECHANICAL SPECIFICATIONS

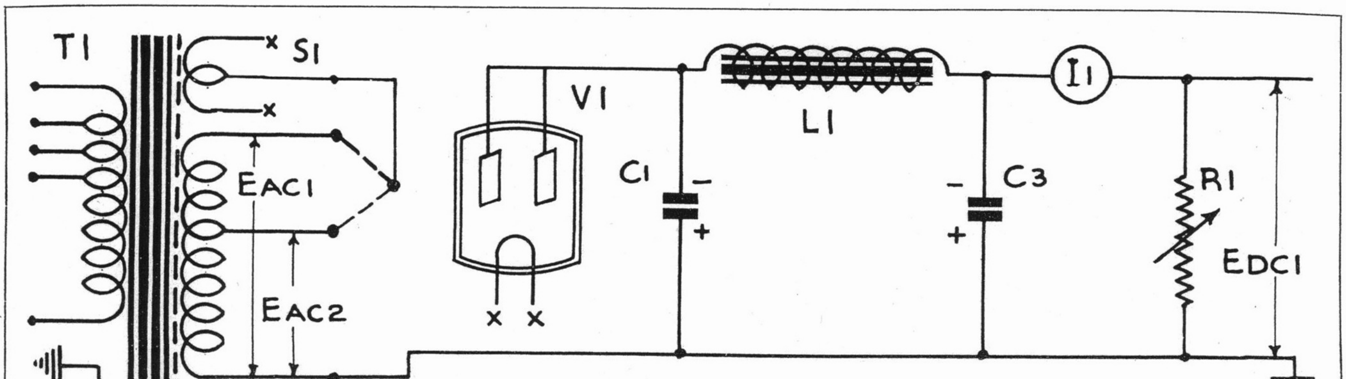
Casting Type	H	W	D	MW	MD	A	X	Y
T1	3¾	3½	3⅛	2 13/16	2 7/16	½	5/16	No. 13
T2	4⅛	4	3⅜	3 9/32	2 23/32	½	5/16	No. 13
T3	4⅝	5⅜	4	4 19/32	3 3/16	½	5/16	No. 13
T4	4⅝	6	5⅜	5 7/32	4 9/16	½	5/16	No. 13

LABORATORY STANDARD POWER TRANSFORMERS

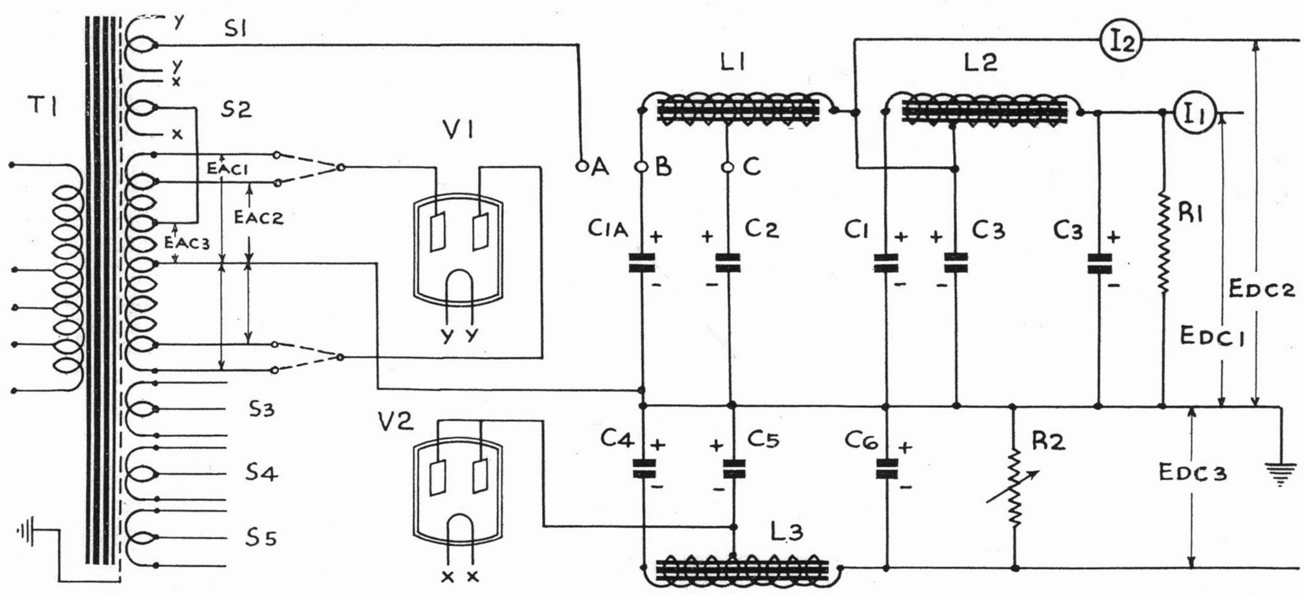
All Primaries are Tapped for 100/110/115/125 Volts—60 Cycle Operation

	K-600	K-601		K-602	K-603	K-604	K-605	K-620	K-621
TRANSFORMER APPLICATION	Class A PP-45's —89's Self Bias	Class AB PP-45's 2A3's Self Bias	Class AB PP-45's 2A3's Fixed Bias 6L6's Class A_1 Self/Fixed Bias	Class AB PP Parallel 45's—2A3's Self/Fixed Bias	Class A —50's Self Bias	Class AB_1 6L6's Self/Fixed Bias	Class AB_2 6L6's Fixed Bias	Preamplifier Supply	Bias Supply 45-2A3 50-6D5
Rectifier Circuit No.	No. 2#	No. 2*	No. 2 *°★	No. 2*	No. 2□	No. 4	No. 4	No. 3	No. 1
CHARACTERISTICS									
E_{ac1}	370	420		440	600	470	475	235	120
E_{ac2}			360	370		370	370		86
E_{ac3}			125	125		75	75		
S1	5V-2a	5V-3a		5V-3a	7.5V-2.5a	5V-3a	5V-3a	6.3V-.5a	2.5V-3a
S2	2.5V-3a	2.5V-3a		2.5V-3a		2.5V-3a	2.5V-3a	6.3V-1.2a	
S3	2.5V-5a	2.5V-5a		2.5V-10a	7.5V-1.25a	2.5V-3a	2.5V-3a		
S4		2.5V-7a		2.5V-10a	7.5V-1.25a	6.3V-3a	6.3V-3.5a		
S5		6.3V-4a		6.3V-5a	2.5V-6a				
V1	80	83	83/5Z3	83	2-81's	83	83	84	82
V2			82	82		82	82		
V3						82	82		
L1	K-500	K-500	K-501	K-502	K-500	K-501	K-501	K-520	Self-contained
L2	K-503	K-503	K-503	K-503	K-503	K-500	K-500/K-501	K-520	
L3			K-504	K-504		K-503	K-503/K-500		
L4						K-504	K-504		
C1A	1 mfd				1 mfd				
C1	1 mfd	1 mfd	1 mfd	1 mfd	1 mfd	16 mfd	16 mfd	8 mfd	1 mfd
C2	4 mfd				4 mfd	16 mfd	16 mfd		
C3	8 mfd	16 mfd	16 mfd	16 mfd	8 mfd	8 mfd	8 mfd		8 mfd
C4			1 mfd	1 mfd		5 mfd	5 mfd		
C5			2/1 mfd	2 mfd		16 mfd	16 mfd		
C6			16 mfd	16 mfd					
R1	15000	15000	15000	20000	25000	20000	20000	25000	2500
R2			2500	2500		10000	10000		
R3						1000	1000		
OUTPUT: E_{dc1} volts	300/230	325	270/230	325/260	500	−19 to −25	−20 to −25	250	−62 to −68 −38 −50
I_{dc1} amps	.020	.035	.035	.050	.035			.020	
E_{dc2} volts	330/260	360	300/250	362/290	535	265	265/280		
I_{dc2} amps	.072	.130 avg	.130 avg	.220 avg	.110	.075	.075/.125		
E_{dc3} volts			−62 or −68	−62 or −68		300	300		
I_{dc3} amps						.017 peak	.020 peak		
E_{dc4} volts						400	400		
I_{dc4} amps						.156 peak	.230 peak		
Case	T-3	T-4		T-4	T-4	T-4	T-4	T-1	T-3
Wt.	13 lb.	20 lb.		20 lb.	20 lb.	20 lb.	22 lb.	3½ lb.	13 lb.
List price	$22.00	$25.00		$32.00	$30.00	$28.00	$32.00	$10.00	$16.00

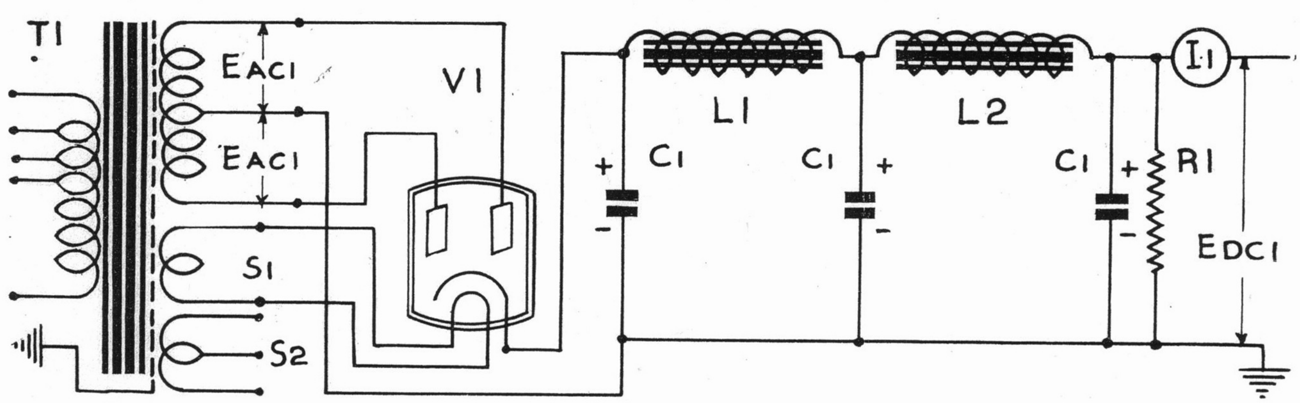
#—For Class A 45's operate circuit No. 2—condenser input self bias. $E_{dc1}=300$. Connect A to C.
For Class A 89's operate circuit No. 2—choke input self bias. $E_{dc2}=260$. Connect A to B—omit CIA.
°—For Class A, 6L6's, use 5Z3 rectifier for fixed or self bias operation. $E_{ac2}=365V$, $C_4=1$ mfd
★—Power Transformers with tapped high voltage secondary windings are designed for fixed or self bias operation. For self bias, connect plates of rectifier tube to E_{ac1}. For fixed bias, connect plates of rectifier tube to E_{ac2} and fixed bias rectifier to E_{ac3}. See Circuit No. 2.
*—Choke Input.
□—Condenser Input.



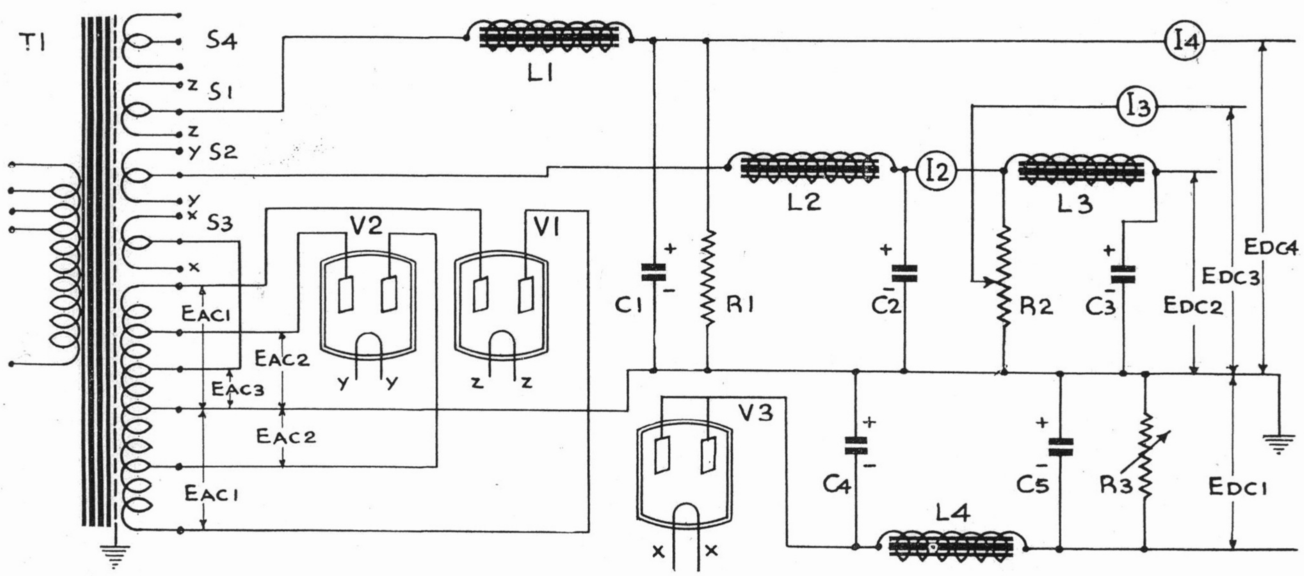
Rectifier Circuit No. 1



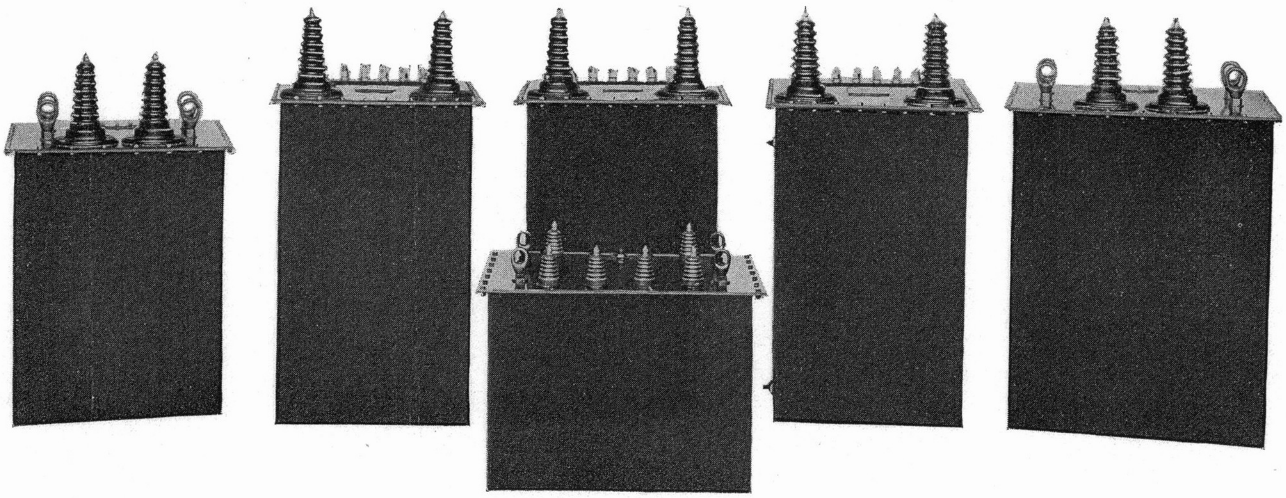
Rectifier Circuit No. 2



Rectifier Circuit No. 3



Rectifier Circuit No. 4



In addition to our standard equipment shown in this and other catalogs, the KENYON TRANSFORMER CO., Inc., is fully equipped to manufacture transformers and reactors up to 50 KVA.

If interested in special broadcast or power apparatus you are cordially invited to consult our technical and research staff.

KENYON TRANSFORMER CO., Inc.

840 Barry Street :: :: New York City

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KENYON

PORTABLE BROADCAST Transformers and Inductors

THE KENYON TRANSFORMER CO., Inc., has for some time seen the need of a small, light, compact unit for use in portable remote pick-up equipment and similar applications. This line has been designed to fill this demand. The average weight of any one of the units is twenty ounces.

This line includes parallel feed chokes, line to line, input, interstage, and output transformers which are designed for use with the different tubes more commonly used in portable equipment.

All units are electromagnetically shielded by ANNEALED high permeability alloy steel cases.

The following are the salient features:

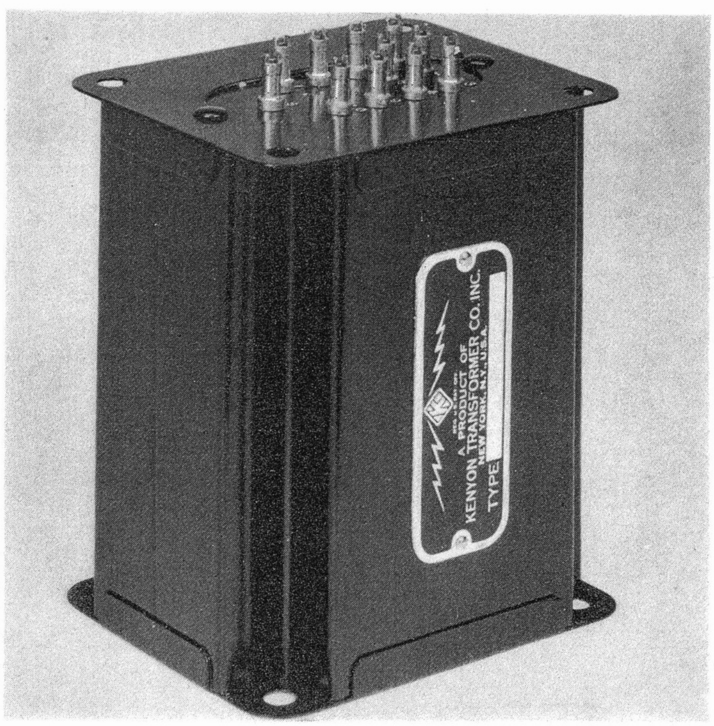
FREQUENCY RANGE: $\pm$ 1 DB—40 to 12,000 cycles

MECHANICAL:
T1 Can
Universal mounting
The base size is $2\frac{1}{16}''$ x $2\frac{1}{2}''$
Height of can $2\frac{7}{8}''$
Height over terminals $3\frac{1}{4}''$
Mounting dimensions $1\frac{19}{32}''$ x $2\frac{1}{32}''$

ELECTRICAL: Electrostatic shield between primary and secondary of all input, output, line, and microphone transformers. Shield and connection to core brought out on terminal board. Core insulated from case. Balanced windings are tested for resistance, inductance, and capacity balance. Interstage transformers are designed to carry the D.C. currents specified below. The frequency limit ($\pm$ 1 DB, 40-12,000) is maintained up to and including D.C. current value given. If extremely low frequency is desired, the use of a parallel feed choke is recommended.

The MULTIPLE line impedance arrangement is a coil structure conceived, designed and developed by the KENYON TRANSFORMER CO., Inc. All transformers in which this winding is incorporated offer balanced 200 and 500 windings with taps at 50, 125, 250 and 333 ohms.

Use is made of the latest alloys for core material, different alloys being used for the different transformers depending on their intended use. These transformers have a new type of impregnation and sealing which makes them proof against failure due to adverse climatic conditions.



KENYON

PORTABLE BROADCAST Transformers and Inductors

LINE TO LINE TRANSFORMERS

Type	Use	Frequency Response ±1 DB	Impedance Ratio	Level DB	List Price
P–100	Line to line	40-12,000	MULTIPLE line to MULTIPLE line	+20	$10.00
P–101	Dynamic microphone or low impedance pickup to line	40-12,000	10-20 or 30 ohm line to MULTIPLE line	+20	10.00

LINE TO GRID TRANSFORMERS

Type	Use	Frequency Response ±1 DB	Impedance Ratio	Level DB	List Price
P–200	Line to grid	40-12,000	MULTIPLE line to 80,000 ohms (*a*)	+20	$10.00
P–201	Dynamic microphone or low impedance pickup to grid	40-12,000	10-20 or 30 ohm line to 80,000 ohms (a)	+20	10.00

INTERMEDIATE COUPLING TRANSFORMERS

Type	Use	Frequency Response ±1 DB	Turns Ratio	Maximum D.C.	List Price
P–300	Single plate to single grid	40-12,000	2 : 1	6 MA	$ 8.00
P–301	Single plate to push pull grids	40-12,000	1 : 1 (each side)	6 MA	10.00

OUTPUT TRANSFORMERS

Type	Use	Frequency Response ±1 DB	Impedance Ratio	Level	List Price
P–400	Single plate to line	40-12,000	Plate (*c*) to MULTIPLE line	+20	$10.00
P–401	Push pull plates to line	40-12,000	Plates (*c*) to MULTIPLE line	+20	10.00

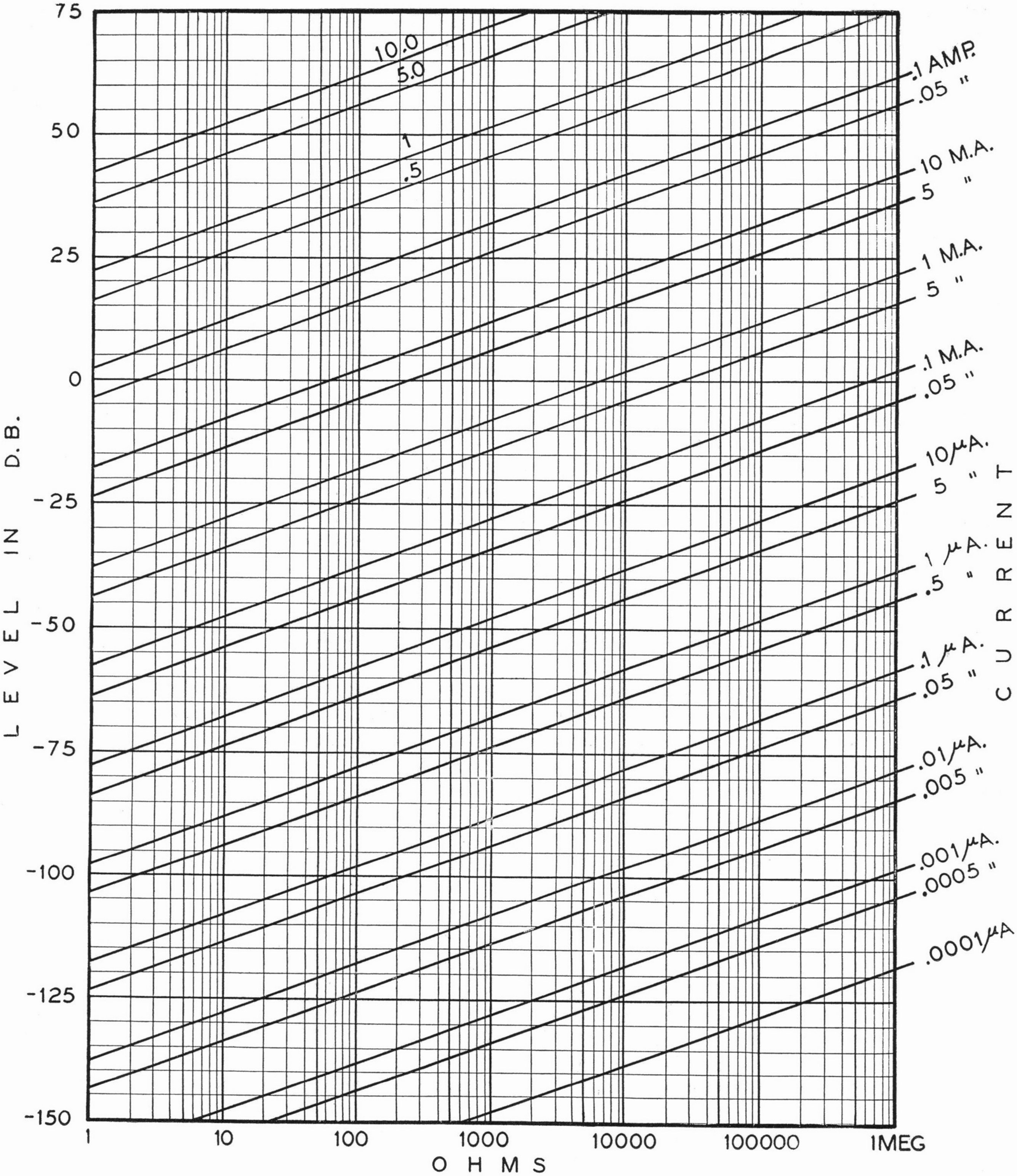
AUDIO CHOKES

Type	Use	Maximum D.C.	Inductance at rated D.C. (Henries)	D.C. Resistance	List Price
P–500	Parallel feed audio choke (split winding)	3 MA	300	6000	$8.00
P–501	Parallel feed or output audio choke (split winding)	10 MA	40	800	8.00

(*a*) Split winding—impedance refers to entire secondary.
(*c*) "Plate" refers to such tubes as 6C5, 56, 30, 846, etc., having an A.C. plate resistance of the order of 10,000 ohms.

KEN-O-GRAF

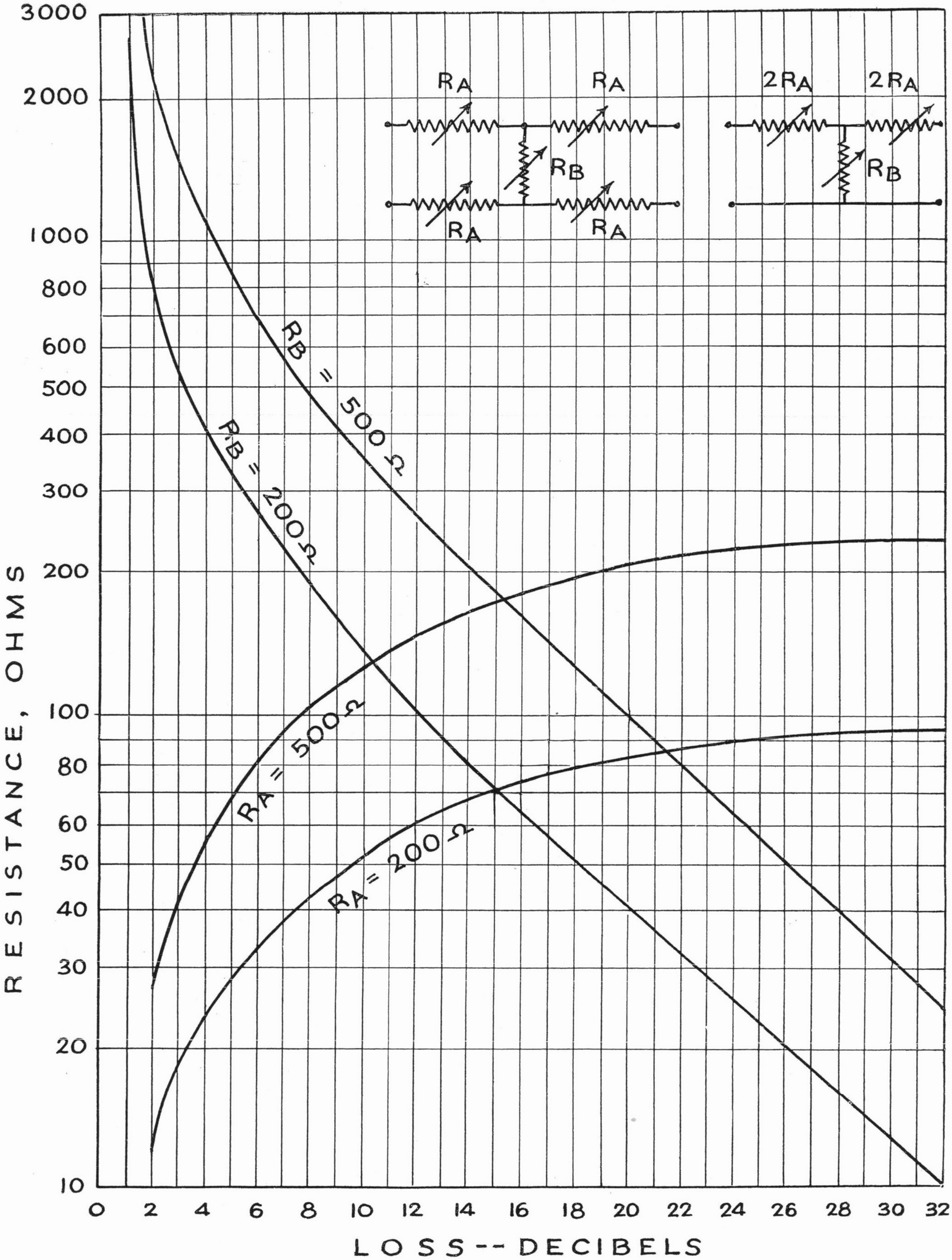
OHMS-CURRENT-DECIBELS CONVERSION GRAPH



This graph may be used to find ohms, current and level in decibels, e.g.: What is the level in decibels at 600 ohms at a current of 10 M.A.? Enter the graph at the bottom (ohms) at 600 ohms and read up to where the slanting 10 M.A. line intersects. From this point, project horizontally to the left, and read + 10 db

Based on .006 watts at zero level.

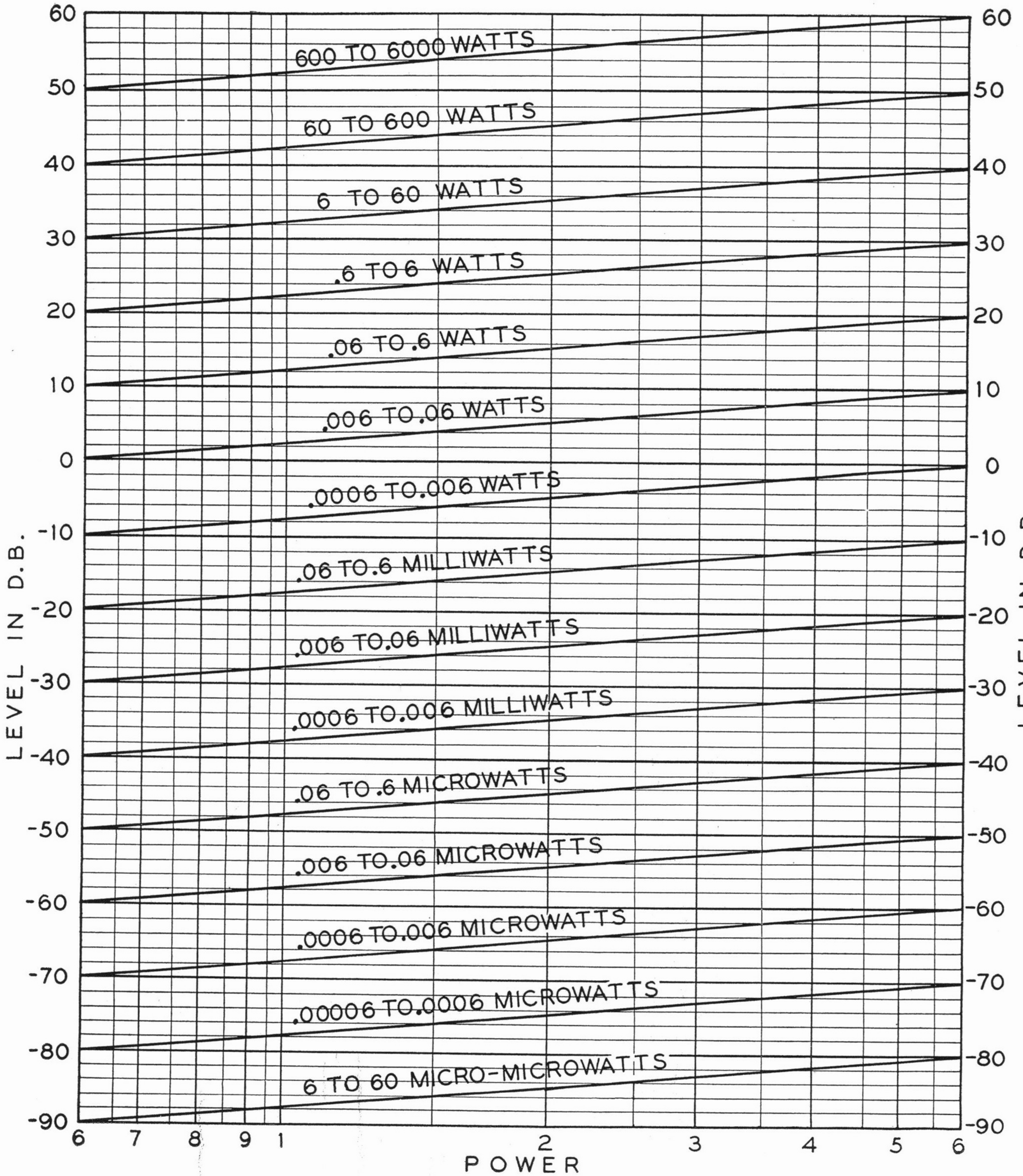
KEN-O-GRAF



Proper attenuation of audio frequencies without introducing distortion is usually accomplished with "T" or "H" pads. The above graph gives resistance values of the branches of an "H" pad for channels having an impedance of 200 or 500 ohms. The range of attenuation is from 2 to 30 db.

KEN-O-GRAF

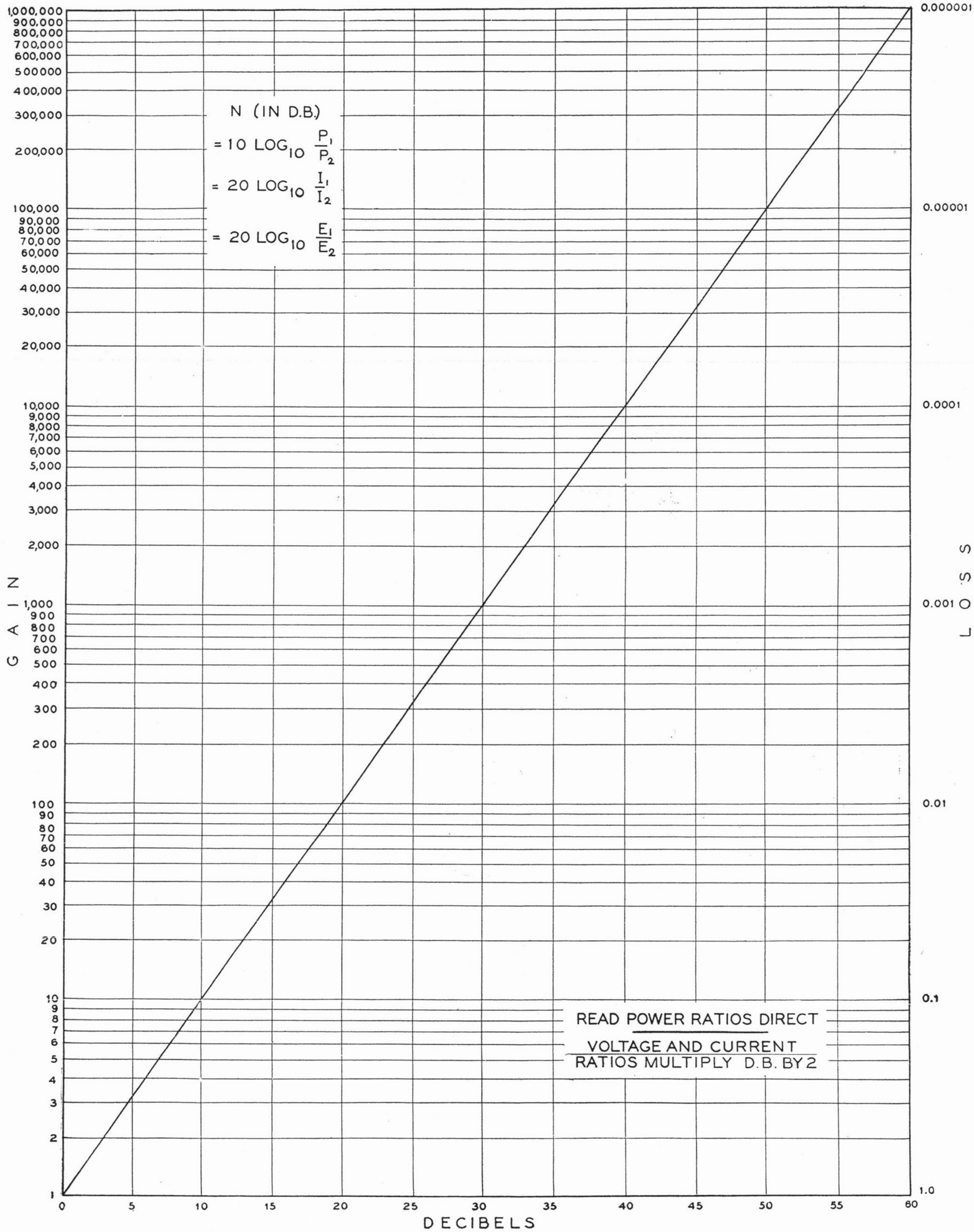
WATTS-VS-DECIBELS



Based on .006 watts at zero level.

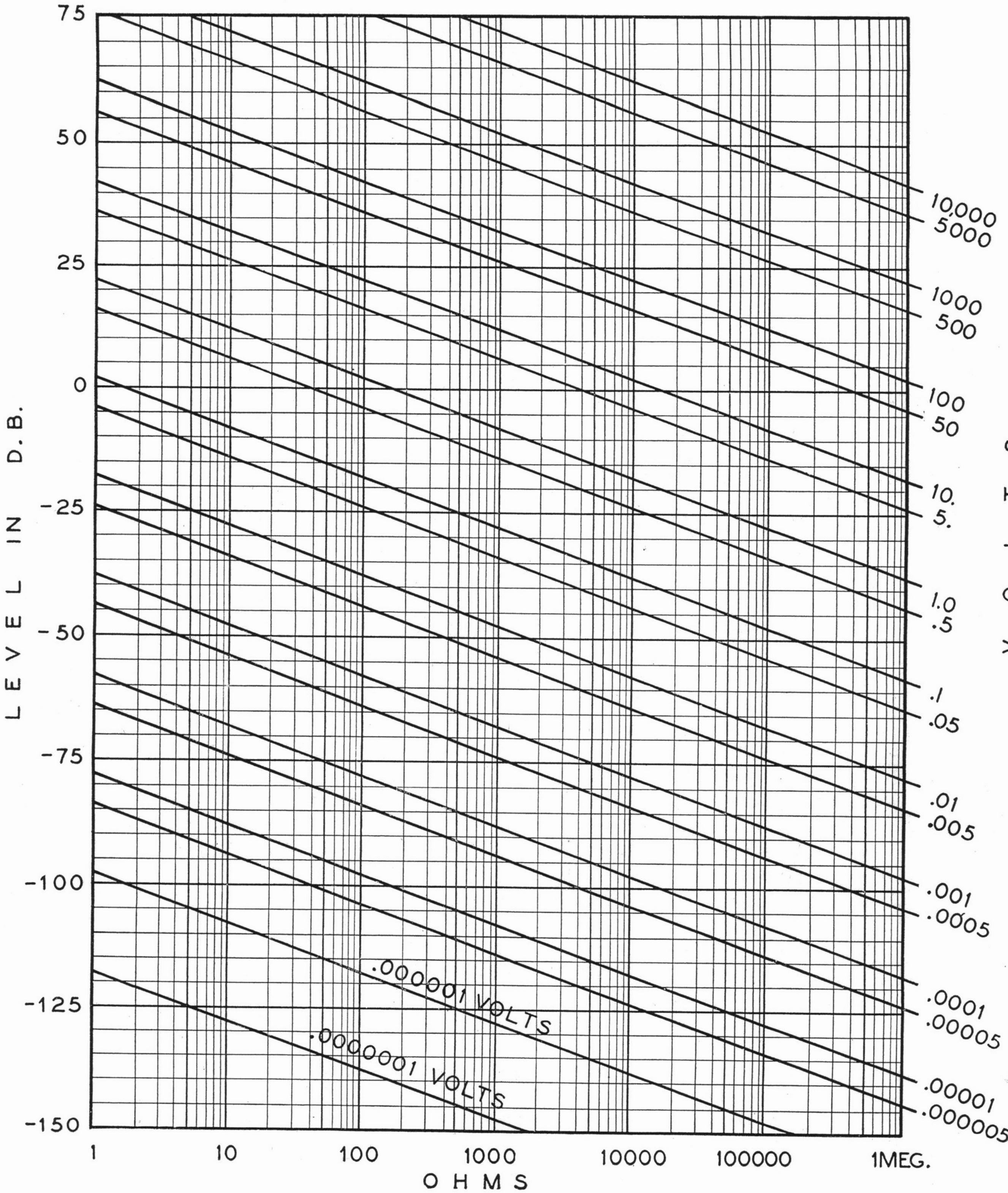
KEN-O-GRAF

CONVERTING LOSS OR GAIN INTO DECIBELS



KEN-O-GRAF

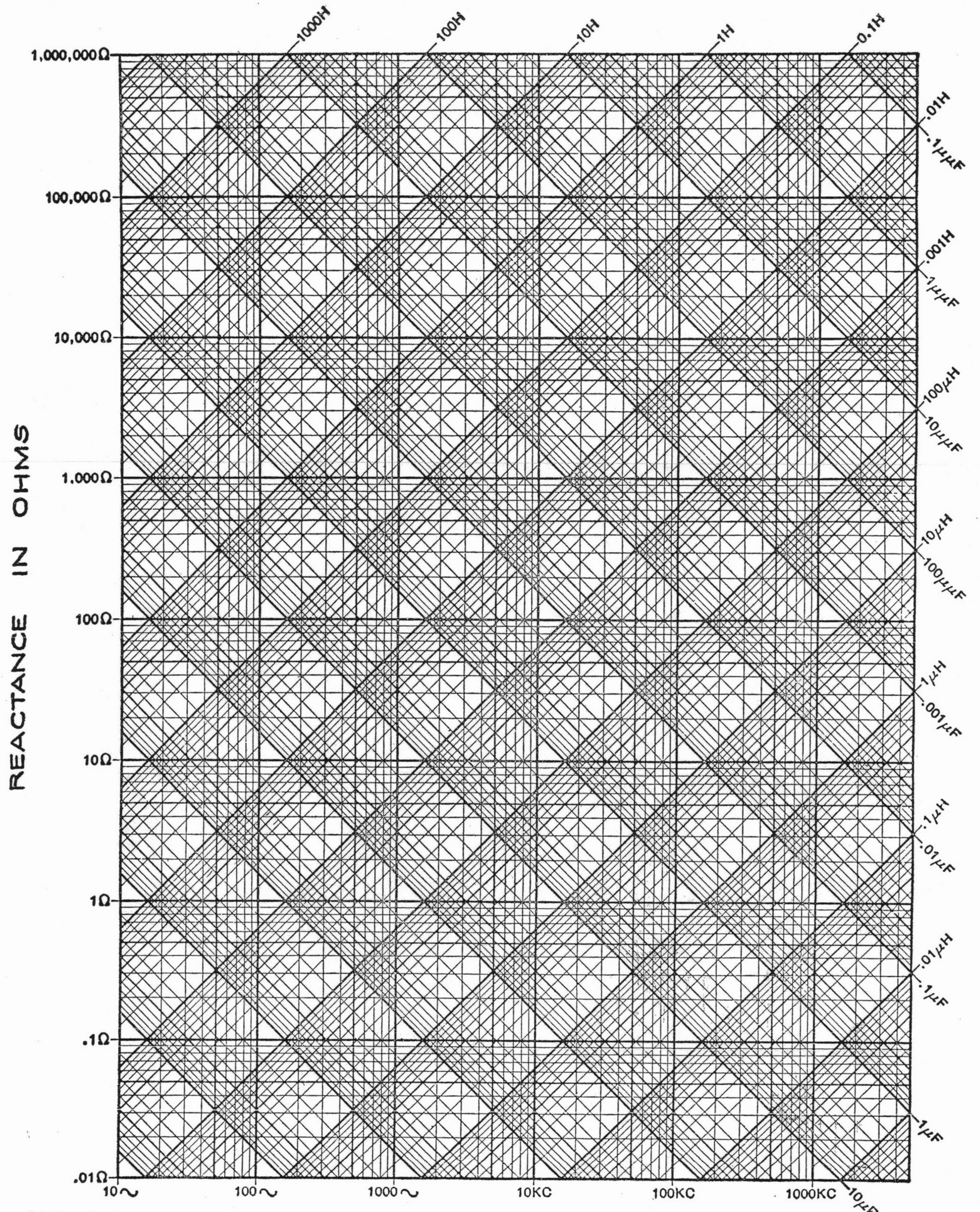
OHMS-VOLTAGE — DECIBELS CONVERSION GRAPH



This graph may be used to find ohms, volts and level in decibels, e.g.: What is the level in decibels at 500 ohms at a voltage of 1 volt? Enter the graph at the bottom (ohms) at 500 ohms and read up to where the slanting 1 volt line intersects. From this point, project horizontally to the left, and read — 5 db

Based on .006 watts at zero level.

KEN-O-GRAF



KC = kilocycles
Ω = ohms

μF = microfarads
μμF = micromicrofarads

H = henries
μH = microhenries

This graph gives the reactance of capacity or inductance values at a given frequency. It also gives the resonant frequency of any given capacity and inductance.

To find the reactance of 1 mfd. at 1000 cycles follow the 1 mfd. line (slanting UP from right to left) until it intersects the vertical line marked 1000 cycles; project horizontally to the left and read 160 ohms.

To find the reactance of 1 henry at 1000 cycles follow the 1 henry line (slanting DOWN from right to left) until it intersects the vertical line marked 1000 cycles; project horizontally to the left and read 6300 ohms.

To find the resonant frequency of 1 mfd. and 1 henry follow these lines to their intersection and project vertically to the bottom scale to read 160 cycles.

Courtesy Bell Laboratories.