

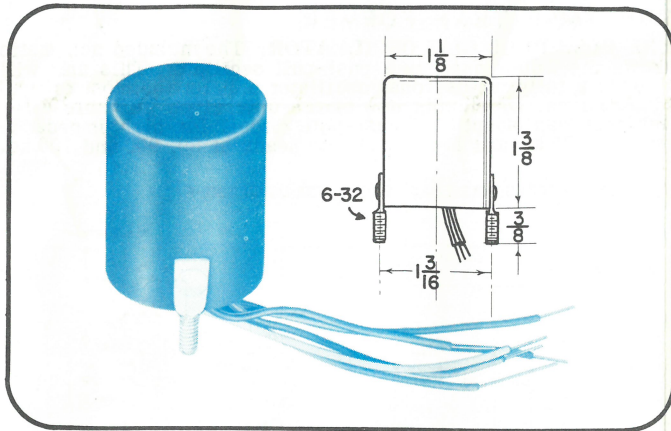
# Nortronics® BIAS AND ERASE OSCILLATOR TRANSFORMERS

T60-T2  
T60-E  
T60-F

FOR TRANSISTOR AND VACUUM TUBE CIRCUIT USE

## GENERAL INFORMATION

THE NORTRONICS COMPANY, INC. 8101 TENTH AVENUE NORTH MINNEAPOLIS, MINNESOTA 55427



### T60 SERIES TRANSFORMERS

- FERRITE E-CORE CONSTRUCTION
- GOOD REGULATION
- HIGH EFFICIENCY, HIGH Q
- WIDE FREQUENCY RANGE
- WIDE VOLTAGE RANGE

Model T60-T2 is designed primarily for use with transistors. Models T60-E and T60-F are designed for medium frequency and high frequency vacuum tube use respectively. All T60 series transformers make use of ferrite E-core construction. The outstanding performance characteristics of the T60 units will insure low tape noise on erasure and low distortion during the recording process.

### THE T60-T2 TRANSISTOR TRANSFORMER

TABLE 1

Lead Color Secondary Tap	Nominal Load Impedance	Max. Load Current Total	Voltage Under Load
Green	1.5K	35-45MA	30-40V
Yellow	6K	18-25MA	60-80V
Brown	13.5K	12-16MA	90-120V

Push-Pull Data  
with Supply Volt  
18-25VDC

PRI-L-0.13MH  
PRI-DCR 0.40 OHMS

**THE PUSH-PULL BIAS OSCILLATOR.** The included schematic shows the T60-T2 used as a push-pull oscillator. This is a somewhat preferred method of operation; the greater power reserve, improved regulation, and reduced even-harmonic generation will provide a fully professional oscillator unit for the most critical applications. By making use of the data given in table 2 the designer can adapt the push-pull circuit for either high or low impedance heads at 60 kc and also low impedance heads at 60, 80, or 100 kc.

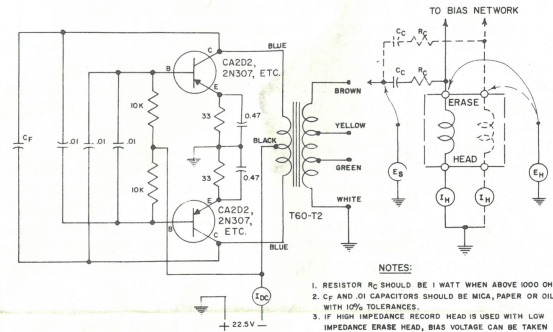
While the values shown in the table are only center-values, they will be within normal tolerances depending upon the components used, etc. For monaural use, the designer simply uses one section of the output as shown. The MEF4 being a full track head is, of course, a monaural head.

**TRANSISTORS.** Inexpensive transistors such as the Honeywell CA2D2, the Sylvania 2N307, etc., will provide performance well within transistor ratings when the supply voltage is between 18 and 25 volts. When it is desirable to make use of better temperature stabilization characteristics, silicon transistors such as the RCA 2N2270 or the Honeywell 2N1987 can be used.

**OUTPUT VOLTAGES.** The output voltage available is a function of the chosen frequency as well as the supply voltage to be used. Table 1 and table 2 can be used to determine what taps and head impedances should be used to best meet the design requirements. The supply voltage which has been chosen as 22.5 volts for table 2 data can be reduced to a value as low as 12 volts under some conditions. The designer will find it necessary to adjust bias resistors and other parameter sizes when operating at such a low voltage to insure proper erase head power.

**OPERATING FREQUENCY.** The frequency of the oscillator can be altered by the use of capacitor  $C_f$ . The reflected inductance of the load in combination with the primary inductance of the transformer in cooperation with  $C_f$  predominantly determines the operating frequency of the oscillator. In some cases the amplifier designer will find it desirable to resonate the output of the oscillator with a series capacitor  $C_c$  feeding the erase head (or heads). Under these conditions the erase head inductance and  $C_c$  will offer a purely resistive load to the secondary (and primary) of the transformer and therefore the oscillating frequency will essentially be determined by the resistive loaded, primary inductance of the transformer circuit alone. More about the use of resonant coupling will be given later.

### PUSH-PULL TRANSISTORIZED BIAS-ERASE OSCILLATOR

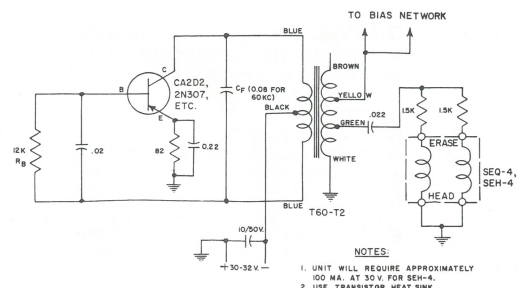


- NOTES:
1. RESISTOR  $R_b$  SHOULD BE 1 WATT WHEN ABOVE 1000 OHMS.
  2.  $C_c$  AND  $C_f$  CAPACITORS SHOULD BE MICA, PAPER OR OIL WITH 10% TOLERANCES.
  3. IF HIGH IMPEDANCE RECORD HEAD IS USED WITH LOW IMPEDANCE ERASE HEAD, BIAS VOLTAGE CAN BE TAKEN FROM HIGHER TAP.

**SINGLE-ENDED OSCILLATOR.** The single-ended oscillator shown in the other included schematic is for specific operation at 60 kc; the frequency can be varied again by changing the value of  $C_f$ . The single-ended circuit will provide adequate performance for many applications. While it is possible to obtain better regulation and more power with the push-pull unit, circuit parts economy and space requirements will often dictate use of the single unit. Resistor  $R_b$  determines the operating bias of the transistor and will determine the output power available from the oscillator within a moderate range of adjustment. Care must be taken with this adjustment to avoid exceeding the operating ranges of the transistor.

**ERASE HEAD COUPLING.** As discussed briefly above, erase heads should be coupled to the secondary of the bias transformer in the manner shown in the push-pull schematic. When capacitor  $C_c$  is chosen to series resonate with the erase head at the operating frequency, there will be an increase in voltage noted across the erase head proper. The value of this voltage is approximately equal to the output voltage of the secondary times the operating Q of the erase head (for Nortronics erase heads, the resonant voltage is between 10% and 30% higher than the secondary voltage; this is shown in table 2 where  $C_c$  is chosen to be resonant with the head). This action of resonance also provides a small amount of filtering and thus can be used to enhance the waveform applied to the bias network. It should be pointed out that if the designer chooses a capacitor  $C_c$  larger than the resonant value, the degeneration in output waveform across the head will be negligible. The use of a variable pad capacitor for  $C_c$  will permit exact resonant tuning if desired.

### SINGLE-ENDED TRANSISTORIZED BIAS-ERASE OSCILLATOR



- NOTES:
1. UNIT WILL REQUIRE APPROXIMATELY 100 MA. AT 30 V. FOR SEM-4.
  2. USE TRANSISTOR HEAT SINK.

**TABLE 2 T60-T2**

F	HEAD TYPE	C <sub>F</sub> MFD	C <sub>C</sub> MMFD	R <sub>C</sub> OHMS	TAP	I <sub>DC</sub> (MA)	E <sub>DC</sub>	E <sub>S</sub> (AC)	E <sub>H</sub> (AC)	I <sub>H</sub> /SECT (MA)
60kc	SEQ-4	.055	1500	1000	G	140	22.5	38	46	14
60kc	SEH-4	.055	1500	120	G	190	22.5	33	48	22
60kc	SEQ-1	.055	150	1000	B	170	22.5	110	125	6
60kc	SEH-1	.055	240	330	B	170	22.5	110	125	7
80kc	SEQ-4	.03	650	47	G	140	22.5	40	60	14
80kc	SEH-4	.03	1500	0	G	160	22.5	36	50	22
100kc	SEQ-4	.02	650	0	Y	200	22.5	36	60	14
100kc	SEH-4	.02	650	0	G	175	22.5	40	52	22
60kc	MEF-4	.055	1500	0	G	150	22.5	40	45	40

Along with suggested values for parameters, table 2 gives center-value operating currents and voltages that will result with four basic popular Nortronics erase heads. This data was taken with short unshielded leads coupling the oscillator to the heads. If it is necessary to use shielded leads or even long unshielded leads, it may be necessary to alter some of the capacitor and resistor sizes.

**THE T60-E TRANSFORMER**

**THE PUSH-PULL BIAS OSCILLATOR.** The included schematic shows the T60-E used as a push-pull oscillator. This unit will provide a fully professional oscillator unit for the most critical applications. By making use of the data given in table 3 the designer can adapt the push-pull circuit for high impedance heads at 40, 50, 60 or 70 kc. A low impedance winding will provide power to several low impedance heads as shown in the dashed schematic addition.

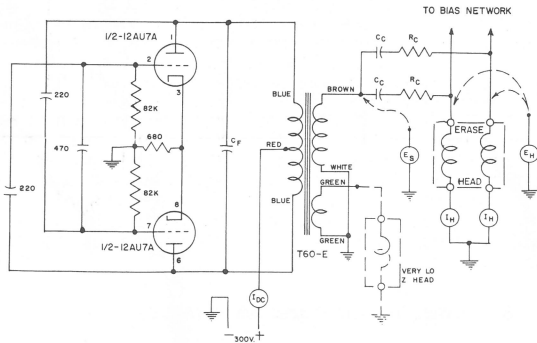
While the values shown in the table are only center-values, they will be within normal tolerances depending upon the components used, etc. For monaural use, the designer simply uses one section of the output as shown. The MEF1 being a full track head is, of course, a monaural head.

**VACUUM TUBES.** Vacuum tubes such as 12AU7A will provide performance well within dissipation ratings of the tubes when the supply voltage is under 300 volts. A tube such as the 12BH7 can supply slightly more erase power in special circuits.

**OUTPUT VOLTAGES.** The output voltage available is a function of the chosen frequency as well as the supply voltage to be used. The supply voltage which has been chosen as 300 volts for table 3 data can be reduced to a value as low as 150 volts under some conditions. The designer will find it necessary to adjust bias resistors and other parameter sizes when operating at such a low voltage to insure proper erase head power.

**OPERATING FREQUENCY.** The frequency of the oscillator can be altered by the use of capacitor C<sub>f</sub>. The reflected inductance of the load in combination with the primary inductance of the transformer in cooperation with C<sub>f</sub> predominantly determines the operating frequency of the oscillator. In some cases the amplifier designer will find it desirable to resonate the output of the oscillator with a series capacitor C<sub>c</sub> feeding the erase head (or heads). Under these conditions the erase head inductance and C<sub>c</sub> will offer a purely resistive load to the secondary (and primary) of the transformer and therefore the oscillating frequency will essentially be determined by the resistive loaded, primary inductance of the transformer circuit alone. More about the use of resonant coupling will be given later.

40KC TO 70KC BIAS-ERASE OSCILLATOR USING T60-E



**ERASE HEAD COUPLING.** As discussed briefly above, erase heads should be coupled to the secondary of the bias transformer in the manner shown in the push-pull schematic. When capacitor C<sub>c</sub> is chosen to series resonate with the erase head at the operating frequency, there will be an increase in voltage noted across the erase head proper. The value of this voltage of the secondary times the operating Q of the erase head (for Nortronics erase heads, the resonant voltage is between 10% and 30% higher than the secondary voltage; this is shown in table 3 where C<sub>c</sub> is chosen to be resonant with the head). This action of resonance also provides a small amount of filtering and thus can be used to enhance the waveform applied to the bias network.

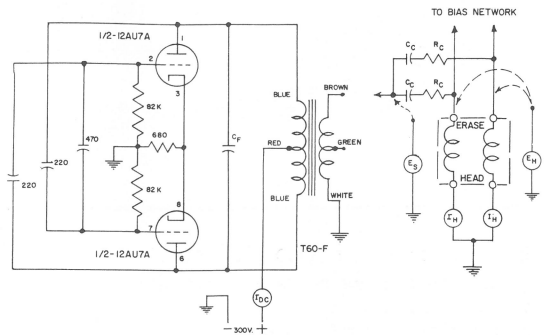
**TABLE 3 T60-E**

F	HEAD TYPE	C <sub>F</sub> MMFD	C <sub>C</sub> MMFD	R <sub>C</sub> OHMS	TAP	I <sub>DC</sub> (MA)	E <sub>DC</sub>	E <sub>S</sub> (AC)	E <sub>H</sub> (AC)	I <sub>H</sub> /SECT (MA)
40kc	SEQ-1	330	470	10k	B	10	300	120	120	6
50kc	SEQ-1	150	220	8.2k	B	9	300	125	140	6
60kc	SEQ-1	68	120	6.8k	B	8	300	125	135	6
70kc	SEQ-1	0	100	2.2k	B	7.5	300	125	140	6
40kc	SEH-1	330	470	3.9k	B	10	300	115	115	7
50kc	SEH-1	150	220	2.2k	B	8	300	130	125	7
60kc	SEH-1	47	120	2.2k	B	9	300	120	135	7
70kc	SEH-1	0	100	1k	B	9	300	120	132	7

**THE T60-F TRANSFORMER**

**THE PUSH-PULL BIAS OSCILLATOR.** The included schematic shows the T60-F used as a push-pull oscillator. This unit will provide a fully professional oscillator unit for the most critical applications. By making use of the data given in Table 4 the designer can adapt the push-pull circuit for high impedance heads at 70 kc and low impedance heads at 80, 90, and 100 kc.

70KC TO 100KC BIAS-ERASE OSCILLATOR USING T60-F



**VACUUM TUBES.** Vacuum tubes such as 12AU7A, 12AV7, or the 12AT7, will provide performance well within dissipation ratings of the tubes when the supply voltage is under 300 volts. A tube such as the 12BH7 can supply slightly more erase power in special circuits.

**OUTPUT VOLTAGES.** The output voltage available is a function of the chosen frequency as well as the supply voltage to be used. The supply voltage which has been chosen as 300 volts for Table 4 data can be reduced to a value as low as 150 volts under some conditions. The designer will find it necessary to adjust bias resistors and other parameter sizes when operating at such a low voltage to insure proper erase head power.

**OPERATING FREQUENCY.** The frequency of the oscillator can be altered by the use of capacitor C<sub>f</sub>. The reflected inductance of the load in combination with the primary inductance of the transformer in cooperation with C<sub>f</sub> predominantly determines the operating frequency of the oscillator. In some cases the amplifier designer will find it desirable to resonate the output of the oscillator with a series capacitor C<sub>c</sub> feeding the erase head (or heads). Under these conditions the erase head inductance and C<sub>c</sub> will offer a purely resistive load to the secondary (and primary) of the transformer

**TABLE 4 T60-F**

F	HEAD TYPE	C <sub>F</sub> MMFD	C <sub>C</sub> MMFD	R <sub>C</sub> OHMS	TAP	I <sub>DC</sub> (MA)	E <sub>DC</sub>	E <sub>S</sub> (AC)	E <sub>H</sub> (AC)	I <sub>H</sub> /SECT (MA)
70kc	SEQ-1	200	100	3.9k	B	12	300	150	160	6
80kc	SEQ-4	125	1000	1.5k	G	11	300	52	58	15
90kc	SEQ-4	47	470	1.5K	G	11	300	58	62	15
100kc	SEQ-4	0	470	1.5K	G	10	300	60	70	15
70kc	SEH-1	200	100	1k	B	13	300	140	150	7
80kc	SEH-4	125	1000	470	G	13	300	48	55	22
90kc	SEH-4	47	1000	470	G	12	300	49	59	22
100kc	SEH-4	0	470	470	G	11	300	50	60	22
70kc	MEF-4	200	1000	220	G	11	300	50	55	45

**ERASE HEAD COUPLING.** As discussed briefly above, erase heads should be coupled to the secondary of the bias transformer in the manner shown in the push-pull schematic. When capacitor C<sub>c</sub> is chosen to series resonate with the erase head at the operating frequency, there will be an increase in voltage noted across the erase head proper. The value of this voltage is approximately equal to the output voltage of the secondary times the operating Q of the erase head (for Nortronics erase heads, the resonant voltage is between 10% and 30% higher than the secondary voltage; this is shown in Table 4 where C<sub>c</sub> is chosen to be resonant with the head). This action of resonance also provides a small amount of filtering and thus can be used to enhance the wave form applied to the bias network.