



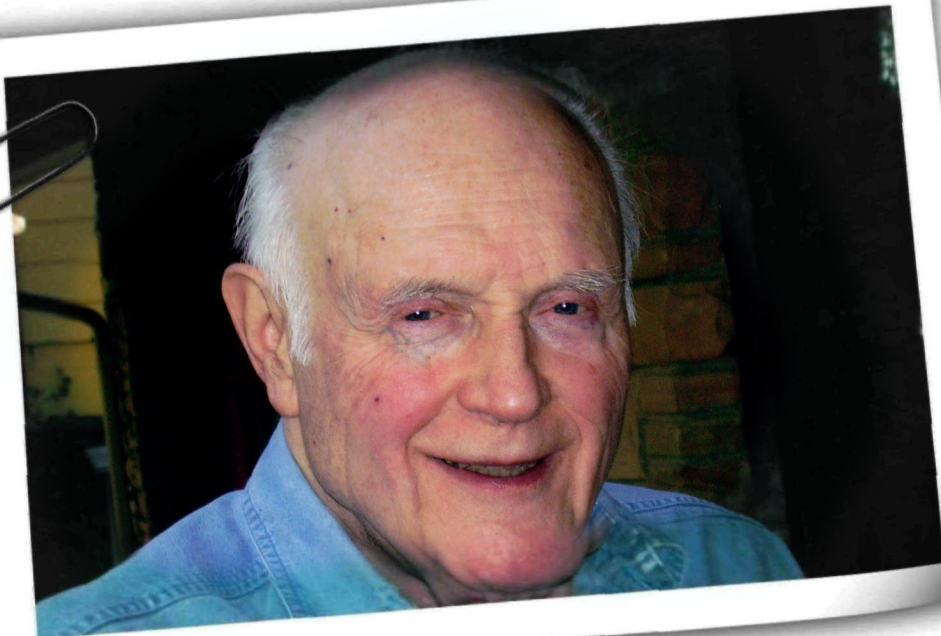
NORTRONICS®

**audio
magnetic heads**



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MAGNETIC SCIENCES

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Joe Dundovic, founder and chief engineer/designer of Nortronics

magnetic recording in today's world

from an original recording session to home entertainment that makes our lives more enjoyable ...

from the live, color television transmissions from the moon to a classroom and the wide variety of teaching aids that improve mans' knowledge ...

from machines that improve mans' standard of living to devices that make our life safer ...

from the communications tools of voice and data that hopefully keep our world at peace ...

from the countless applications of magnetic recording and to the thousands of innovators that have made it work, we reaffirm, "... the future of magnetic recording — and magnetic heads — depends not so much on what we can do, as what we can think of doing".



NORTRONICS

TO JOHN FRENCH
WITH BEST REGARDS
Joe Dundovic
1-28-03



*John French accepting the last head manufactured
by Nortronics from company founder Joe Dundovic.*

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DESIGN DIGEST

Application factors to consider for audio magnetic heads

The theory of magnetic recording is discussed in detail in a number of textbooks on the subject (see bibliography — page 96.) Typical circuits for recording apparatus can also be found in numerous publications, however, there are application factors not always presented that pose questions to the designer. Therefore, in the pages that follow we have listed and discussed briefly those that are most frequently asked of Nortronics. These are listed in two general areas:

MAGNETIC HEAD CONSIDERATIONS AND RECORD/ PLAYBACK CIRCUIT CONSIDERATIONS.

I. MAGNETIC HEAD CONSIDERATIONS

A. RECORD/PLAYBACK HEADS

1. LOW FREQUENCY RESPONSE

All playback heads have a maximum wavelength or minimum low frequency response, sometimes called "contour effect". The low frequency cutoff is determined by three factors as shown in Figure 1:

1. Length of pole across the head face
2. Length of face window
3. Shape of lamination behind head face

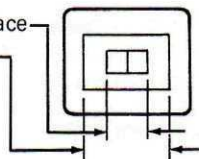


Fig. 1

The longest wavelength the play head can respond to is equal to the mean of the window and pole lengths. High tape speeds such as 15 ips or 30 ips on professional recorders pose severe problems to play head designs since the longest wavelengths may run up to 1-inch, requiring open head faces and very long poles. These are more expensive and also require external magnetic shielding against hum pickup from motors and transformers.

NORTRONICS offers four basic head types to permit optimizing the low frequency performance and hum shielding for a particular tape speed and transport application.

1. **Standard Heads.** Models B2H, B2Q, B1HY, G1H, G1HY, A2H, A1HC, A2Q, A1QC, etc. They have excellent hum shielding and low frequency response suitable for tape speeds of 7.5 ips and below. Low in cost, the standard heads are excellent for general purpose voice applications. Cutoff frequency 50 Hz at 7.5 ips.
2. **Premium Heads.** Models P-B2H, P-B2Q, P-B1HY, P-G1H, P-A2H, P-A2Q, etc. Shielding, hum pickup, and low-frequency cutoff are similar to the Standard Heads. However, pole tips are specially contoured to give smoother response curve for music reproduction, plus finer laminations for better high frequency response. Cutoff is 50 Hz at 7.5 ips or 25 Hz at 3.75 ips.

3. **WP-Series Heads.** Models WP-B2H, WP-B2Q, WP-B1HY. These heads have longer poles and windows for extended and smoother low frequency response. Cutoff is 25 Hz at 7.5 ips and 50 Hz at 15 ips. Fine laminations give excellent high frequency response.

4. **Studio Series and PR Professional Series.** For the ultimate in superb low and high frequency response. Extra long pole pieces and window openings give extremely smooth and extended low frequency performance. Cutoff frequency is 25 Hz at 15 ips and 50 Hz at 30 ips. Supplemental shielding against hum fields is recommended, although the heads do have integral case shields.

Typical low frequency response curves are shown in Figures 2 and 3.

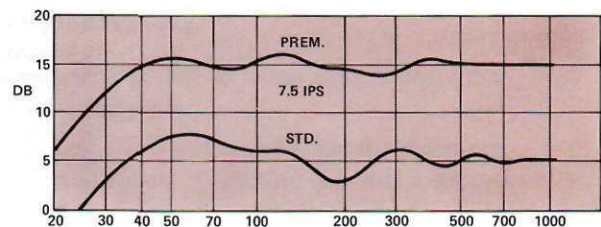


Fig. 2 — Low Frequency playback response, Standard and Premium heads, 7.5 ips.

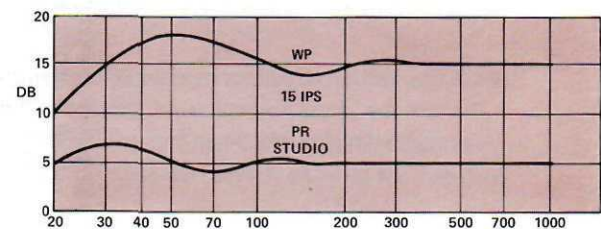


Fig. 3 — Low frequency playback response, WP, PR and Studio Series heads, 15 ips.

2. TAPE WRAP

It is important that a head have sufficient tape wrap around its nose and enough tape tension to insure good oxide-to-gap contact. Hyperbolic face contour is used on most NORTRONICS heads to reduce the tape contact area for a given degree of tape wrap, giving greater unit pressure in grams per cm² between the tape surface and head face. Only one head style, the "A-Combo" has a cylindrical face which requires pressure pads or very high tape tension.

Wrap Angle for hyperbolic heads typically can run between 5 and 10 degrees on a side. Figure 4 shows a head with tape wrap included angle of 165° or 7.5° drop back per side. The drawing can be used to make up a card or plastic template to hold against the head to check and adjust the tape wrap.

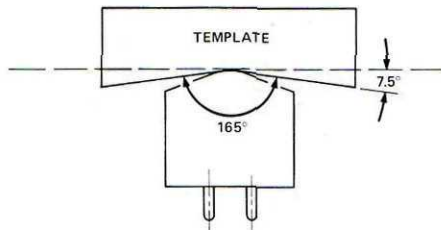


Fig. 4 — Tape wrap angle.

Wear Pattern can be used to verify the actual tape wrap to insure balanced tape wrap on both sides of gap line, and also the Zenith (face parallel to tape guides) which can cause variation in wrap from top to bottom of contact area. Use DYKEM™ Sheet Metal Layout Blueing obtainable in Aerosol cans from industrial hardware stores. Spray it on a cotton swab and then apply to the head nose. Then run tape or film across head until the dye is worn off. (Do not use your alignment tape!)

3. HIGH FREQUENCY RESPONSE

The high frequency or short-wavelength response of a playback head is determined by the gap length and also by the type of tape. (This assumes the self-resonant frequency is above the highest needed frequency as discussed in the section on "Self Resonance".)

A rule of thumb is that the playback gap should be between 1/10 and 1/4 the wavelength of the highest reproduced frequency. The longer gap of 1/4-wavelength will produce a gap loss of no more than 1 dB at the shortest wavelength. A shorter gap than necessary will gain very little in high frequency response, but will reduce the head sensitivity and degrade the signal-to-noise ratio. Typical recommended gap sizes are 200 micro-inches (200-U) for 15 ips, 100-U for 7.5 ips, 50-U for 3.75 ips, and 50-U for 1.875 ips.

Record gap size is not critical, as recording is done with only the "trailing edge" of the gap. Record-only heads have wider gaps to reduce head inductance and improve flux penetration into the tape oxide. Typical record gaps are 500-U for 1/4-inch tape and 200-U for cassettes.

4. AZIMUTH, GAP AND SPACING LOSSES

The high frequency losses from an improperly azimuthed head are proportional to the wavelength of the signal, the track width of the head, and angle of mis-azimuth. A wide track head will be much more critical than one with a narrow track. This is one reason the cassette and 8-track systems with their 20-mil tracks can produce such good high frequency response at slow tape speeds.

To calculate gap, azimuth, and spacing losses the curve and formulae below can be used:

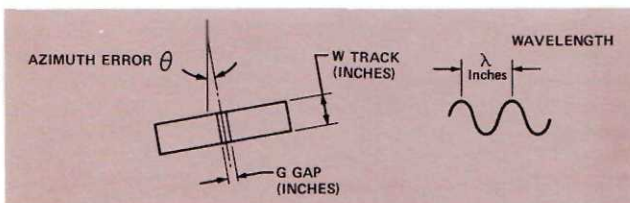


Fig. 5A

CALCULATED GAP LOSSES AT 1-7/8 IPS TAPE SPEED

Gap	1 kHz	5 kHz	10 kHz	15 kHz
100-U	-.1 dB	-1.2 dB	-4.5 dB	-13 dB
80-U	0	-.8 dB	-2.5 dB	-7 dB
50-U	0	-.5 dB	-1.2 dB	-2.5 dB
40-U	0	-.4 dB	-1.0 dB	-1.8 dB

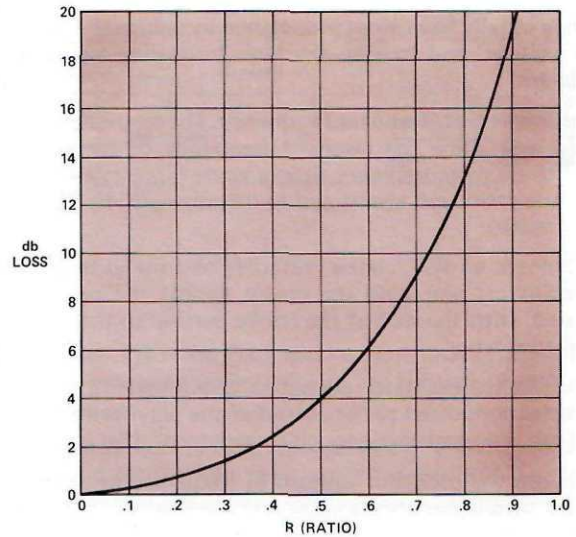


Fig. 5B

1. Gap Loss Calculation:

$$R = \frac{G}{\lambda} \quad \lambda = \frac{\text{IPS}}{\text{HZ}} \quad \text{Wavelength}$$

"What is the playback gap which gives a 3 dB loss at 10 kHz at a tape speed of 3.75 ips?"

$R = .44$ (from graph at 3 dB)

$$\lambda = \frac{3.75}{10,000} = .000375 \text{ in.}$$

$$G = R \lambda = .44 \lambda = .000165 \text{ in. (165 micro-in.)}$$

2. Azimuth Loss Calculation:

$$R = \frac{W \tan \theta}{\lambda}$$

"What is the azimuth misalignment which will give a 5 dB loss at 5 kHz at 1 ips with track width of .020?"

$R = .55$ (from graph at 5 dB)

$$\lambda = \frac{1}{5000} = .0002 \text{ in.}$$

$$\tan \theta = \frac{\lambda R}{W} = \frac{.0002 \times .55}{.020} = .0055$$

$$\theta = 19 \text{ MIN}$$

3. Spacing Loss Calculation:

$$\text{Spacing loss in dB} = 20 \log_{10} \left(e - \frac{2 \pi d}{\lambda} \right) = 54.6 \frac{d}{\lambda}$$

where d = spacing between gap and tape
 λ = wavelength

"What is the playback signal loss in dB on an application with .0001 in. space between gap and tape on a 5 kHz signal at 3.75 ips?"

$$\text{wavelength } \lambda = \frac{3.75}{5000} = .00075$$

$$\text{dB loss} = 54.6 \frac{.0001}{.00075} = 7.3 \text{ dB}$$

5. SELF-RESONANT FREQUENCY

It is very important, for a playback head, to choose a head inductance which, in association with its own distributed capacitance and shunt circuit capacitance, will result in a resonant frequency equal to, or above the maximum playback frequency. Typical top frequencies for various playback head inductances are 15 kHz for 800 mHy, 25 kHz for 200 mHy, 35 kHz for 100 mHy, and 80 kHz for 20 mHy. This is particularly critical for the Master Playback Head on a high speed duplicator where the play frequencies may run 8 or 16 times normal. Record heads are not such a problem,

as they usually have a low inductance to reduce the required bias voltage, and to ease the high frequency equalization problems.

Measurement of Resonant Frequency. The method described below will allow the resonant frequency of the playback head to be measured very simply while it is installed on the tape transport and connected to its preamplifier. Procedure is as follows:

1. Connect an R.F. choke (100 μ Hy to 1 mHy) to an audio oscillator, and hold the choke against the pole of the head, with the axis of the choke parallel to the direction of tape travel.
2. Adjust the oscillator output to give a reading on a voltmeter connected to the output of the playback amplifier. Keep the level low enough to avoid amplifier saturation.
3. Sweep the oscillator upward in frequency until the output signal goes thru a peak and then falls off. The peak frequency is resonance.

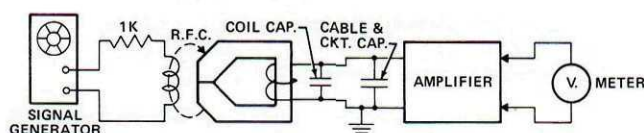


Fig. 6

4. If the peak reading occurs below the maximum operating frequency, change to a play head with lower inductance. Cable capacitance can sometimes be lowered to achieve small changes in resonant frequency.

6. CROSSTALK REJECTION

Crosstalk is the interchannel coupling between adjacent channels of a multichannel tape system. There are several types of Crosstalk:

1. **Transformer Crosstalk.** The figure given in the head specifications is usually called "Transformer Crosstalk Rejection", and is measured at 1 kHz by applying 1.0 volt rms to one coil of the head and measuring the signal picked up by the other coil. Typical rejection ratios run between 50 dB and 60 dB and they will vary somewhat with frequency. Care should be taken to place an electrostatic shield between the terminals and cables at high frequencies during measurements to prevent erroneous poor readings.

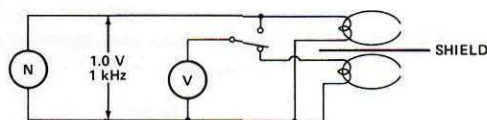


Fig. 7

2. **Record Crosstalk** is the signal recorded by an inactive channel of the record head when the adjacent channel is recording. To check for this, make a saturation level recording on one channel while only bias is being applied to the inactive channel. (Lack of bias will reduce record sensitivity and effectively eliminate the crosstalk.) Playback with a monophonic (single-channel) head on the active and inactive tracks and compare the two signals.
3. **Playback Crosstalk** can be checked by recording a saturation level signal on one channel only, with bias disconnected from the other (inactive) channel. Take playback readings on two channels of the multi-channel play head,

and the ratio of active to inactive readings is the Playback Crosstalk Rejection. The input loading on the active track will affect the reading on the inactive track, with maximum reading from a shorted coil and minimum from an open active coil; circulating current in active coil induces additional crosstalk signal in other coil.

4. **Adjacent Channel Crosstalk.** This is a signal picked up directly from a recorded track on the tape by a closely spaced adjacent head channel. It can become troublesome with low-frequency long wavelength signals on stereo or quad systems which have only 12-mils spacing between recorded tracks. Tight-fitting windows in the face shields surrounding the playback head poles keep this crosstalk to an acceptable level.

NOTE: Transformer Crosstalk gives a figure which is very close to the combined worst-state condition of Record and Playback crosstalk. For this reason it is the most commonly used.

7. COIL PHASING AND POLARITY

The coils of record, play, and erase heads are consistently wired to produce a predictable **phase** relationship (A.C. excitation) or **polarity** (D.C. excitation.) For example, the coils of a multichannel head are wired so they produce in-phase magnetic fields on the face poles when the coils are connected in parallel and excited from an A.C. source.

A.C. Phase Check. It is possible to verify the relative phasing of the coils on a multi-channel head by exciting the head pole faces with coil and observing the Lissajous pattern from the exciting and picked up voltages as displayed on an oscilloscope. A reversed coil will flip the pattern 90 degrees. This method does not work well with double-gap erase heads or for specifying absolute phasing between various heads (see Fig. 8).

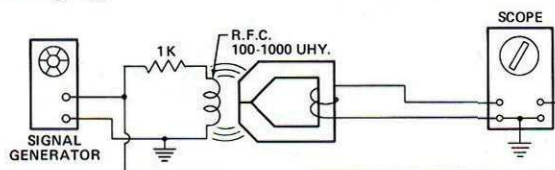


Fig. 8

D.C. Polarity Check. A more versatile test or specification is to apply a D.C. current to the head coil and note the North and South poles on the head face poles, using a magnetic compass. Procedure is as follows:

1. Remove the case from compass needle and cut the dial

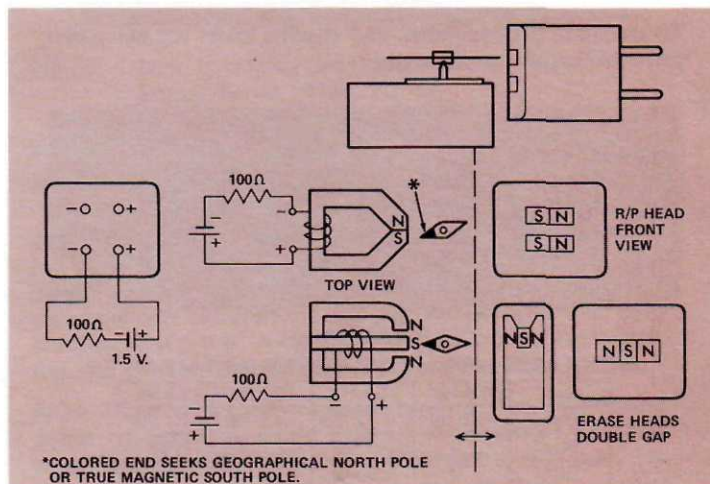


Fig. 9

with a scissors so it is smaller in diameter than the needle. This will allow the point of the needle to be brought up close to the face of a head. Place on a wood or plastic block.

2. Connect a 1.5-volt dry cell to the head pins thru a 100-ohm resistor, with polarity as specified on the head drawing.
3. With the coil excited, move the head face up to the colored (true magnetic South seeking) point of the compass needle, leaving about 1-mm space. The point will move to the South side of the head gap. Double-gap erase heads or Z-Combo heads will have one polarity for the center pole and the other polarity for the two outside poles.

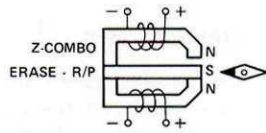


Fig. 10

B. ERASE HEADS

NORTRONICS Erase Heads are of three basic types of core construction:

1. **Metal Core Erase.** Type SEQ, SEH, MEF, B2EH, B1EF, A2H, A2Q, A1HC, etc. for 1/4-inch tape, shown on pages 29, 39, 40, 50, 51, 52, 59, 64. These are low in cost and are available in a variety of case styles and mountings. They have good efficiency up to 60 kHz and can operate at frequencies up to and including 100 kHz, and also with D.C. excitation.
2. **Metal/Ferrite Hybrid Core Erase.** Types PR-B1EF, PR-B2EH, PR-B2EQ and PC-B4-EQ "PRO" series for 1/4-inch tape, shown on pages 28, 32, 60 and 61. STE types for 1/2, 1-inch, and 2-inch tape, shown on pages 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 and 24. These are double-gap erase heads with ferrite center "I" core and laminated Hi-Mu "C" cores, giving the long life and high efficiency of ferrite plus the smooth tape contact surface of polished metal. They are recommended for professional studio recorders which require great depth of erasure and efficient low-power operation at frequencies up to 250 kHz.
3. **Ferrite Core.** Types H805004 and H806036 1-inch full-width ferrite erase. Types W1ER and W2ER single and two-channel erase heads for Cassette recorders. These are extremely efficient erase heads capable of being operated at frequencies as high as 500 kHz for use on high speed duplicators. They are of double-gap all-ferrite construction. See pages 25 and 87.

Application: Metal-Core Erase Heads

Always use a coupling capacitor between the secondary winding of the oscillator transformer and the erase head. If the capacitor is large, about ten times the series-resonance value, it will have little effect upon the erase head voltage, which will then be equal to the transformer voltage. Reducing the capacitance value will begin to increase the erase voltage until a maximum of approximately 1.5 times the transformer voltage is reached at exact resonance. This gives a measure of control of the erase head voltage so it can be set on the recommended nominal value. The head will erase the specified 60 dB at voltages (or currents) 15% above or below the nominal.

The erase voltage will be proportional to the frequency. A head requiring 40 volts at 60 kHz will need 67 volts to produce the same erase current and degree of erasure at 100 kHz. Typical erase circuits are shown in Figure 11.

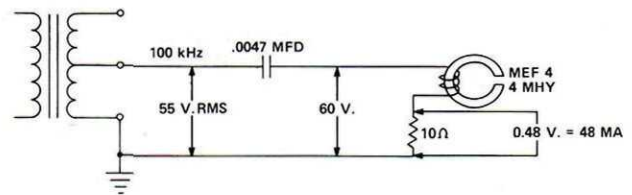


Fig. 11

Application: PR-series Professional erase heads for 1/4-inch tape; STE-series Studio erase heads for 1/2-inch, 1-inch, and 2-inch tape

These superior quality heads are capable of erasing saturated recordings down to the noise level of virgin tape. Dual gap construction and highly efficient core structure require very low power consumption for full erasure.

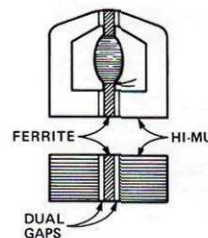


Fig. 12

The hybrid core design features an efficient, long wearing ferrite center I-core and laminated Hi-Mu metal side E-cores for smooth tape contact. The resulting two-material core structure combines the advantages of both ferrite and metal, without the disadvantages.

Excitation. The voltage and current values given in the specification tables are the nominal figures required to produce a minimum erasure of 70 dB from a saturated 400 Hz recording. The heads should be operated within a tolerance range of $\pm 20\%$ of nominal to insure the 70 dB erasure and prevent saturation of the magnetic core.

Frequency. Because of their high efficiency, these hybrid erase heads may be operated at frequencies up to 250 kHz. Current requirement will remain fixed, but the voltage must be increased proportional to the frequency. Power dissipation will also go up in proportion to frequency.

Power. At 100 kHz the power requirement of the PR-B1EF full-track erase head is approximately 0.7 watts, and the PR-B2EH 2-track and STE Studio erase heads will use about 0.25 watts per channel. To calculate the power, multiply the rms voltage and current (volt-amperes), and then divide by the "Q", which is approximately 7. It is quite important for an energized erase head to be properly "heat-sinked" by securely mounting it to a metal bracket and nest. Also, the movement of tape across the head face serves to carry away the generated heat, reducing temperature rise. These precautions are more important for the multi-track heads operating at higher frequencies.

Saturation. The hybrid erase heads will saturate, causing driving waveform distortion and loading if the head current is increased more than 20% above the nominals given. An ideal way to adjust the drive on a particular head is to increase the voltage until distortion is detected on an oscilloscope, then reduce the drive by 10%.

Coupling. It is recommended that a coupling capacitor be inserted between the erase head and its driver in order to prevent low frequency noise from being coupled to the head and then recorded on the tape, and also to permit a degree of control over the voltage being applied to the head.

The curve (Fig. 13) shows the variation in head voltage, E_h , as a function of the coupling capacitor, C_c . The head voltage

reaches a peak of 7 times E_s when the capacitor resonates with the head, at a value of C_{Cr} . (A very low value of E_s must be used to run such a curve to keep the head voltage from reaching saturation.)

It is important to stay out of the unstable region, where a transient can flip the head into saturation, thereby lowering its inductance and holding it in the saturation mode. C_c should be chosen to be either less than the resonating value, C_{Cr} , or greater than 5 times C_{Cr} , thereby permitting the head voltage to be adjusted to a value somewhere between the supply voltage and 4 times supply. The voltage regulation of the driver will, of course, have an effect on E_h as C_c is varied. Often E_s will drop sharply as the head current increases near resonance, causing an apparent flattening of the peak on the curve.

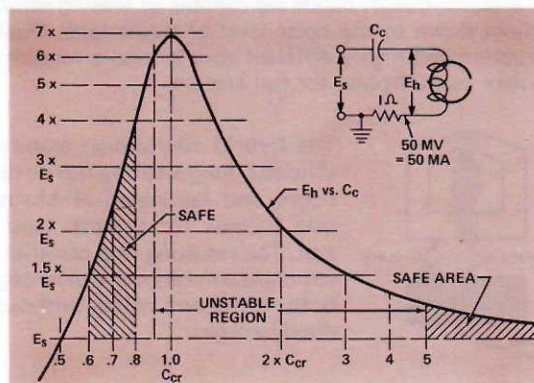


Fig. 13

C. Z COMBO® HEADS

"Z-Combo" heads have combination erase and R/P elements in the same housing. They are sometimes called "Three-in-one" heads. Erase and R/P functions are combined in one core structure with closely spaced erase and R/P gaps. They are available in a number of different track widths, in single or two-channels, and different case sizes. Types are Z-R1LC, Z-W1LC, Z-W1R, Z-W2RK, Z-J2L, and Z-J2H.

Z-Combo heads are particularly suited for use with "extended tip" poles for use against hard surfaces such as film, cards or drums. The close spacing of erase and R/P gaps makes practical the combined functions, where conventional combo or separate heads would not work. It also reduces the time delay or distance between erase and record.

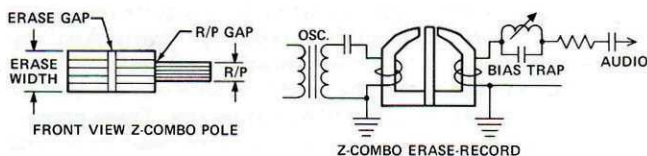


Fig. 14

Construction differs from conventional R/P heads with the addition of a center "I" core which is common to both the erase and R/P functions. The Erase C-core and R/P C-core each have their own coil. When the erase coil is energized with high frequency power from the erase/bias oscillator, enough leakage flux flows to the record side of the head to provide high frequency bias. Erase current is usually adjusted to the value which gives optimum (peak) bias at 1 kHz recording. The single-gap erase head is not as effective as the double-gap heads, limiting the degree of erasure to about 50 dB.

It is sometimes helpful to place a bias trap in the audio

driver circuit to cause the R/P coil to look into a high impedance at the bias frequency. This will prevent bias voltages induced in the record coil by the erase coil from causing circulating currents which increase the effective bias flux at the record gap, necessitating a reduction in erase current to prevent overbiasing. In other words, we wish to maintain maximum erase current for good erasure without overbiasing. (D.C. can be used for erase and bias on Z-Combo heads—see section on D.C. BIAS).

Erase/bias voltage may be varied by adjusting the D.C. supply voltage to the oscillator, or by the size of the coupling capacitor to the erase coil. Tuning of the bias trap, if used, will also affect the bias.

D. HIGH SPEED DUPLICATORS

In duplication of tapes at high speeds all of the frequencies on the Master playback tapes and the Slave recorded tapes are increased by exactly the ratio of the duplicator to normal speeds. Equalization of both play and record amplifiers must be shifted up the spectrum in frequency in the same fashion. Fig. 15 below shows the Master Play equalization and the Slave Record equalization for 1x (100-10,000 Hz), 2x (200-20,000 Hz), and 4x (400-40,000 Hz). Response curves are the same, but are changed in location to follow the new frequencies. The shaded areas show the range of adjustment for the equalization controls to compensate for variations in tape, master speed, master quality, etc.

Head Impedances must be scaled down to ease record driving at the higher frequencies, and to keep play head resonance out beyond the highest operating frequency. (See section on **Self Resonant Frequency** for measuring play head resonance.) Record head inductances can be 2, 5, or 10 mhy, and Play head inductances can run 5, 10, or 20 mhy.

Bias Frequency for the duplicator slaves should be at least five times the highest recorded frequency, and typically run 250, 500, or 1000 Hz. T70 series bias oscillator transformers are available for these frequencies.

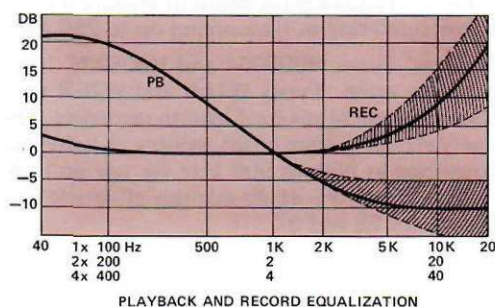


Fig. 15

Basically a duplicator consists of the same units as a conventional recorder, as shown in Fig. 16. The Master Play head feeds an equalized play amplifier which is connected to the recording amplifier. An additional power record driver may be used to drive 10 or more slave heads. The bias oscillator must supply enough power to the common bias buss to drive all the record heads. Sometimes erase heads are also used, placing additional demand on the oscillator.

Individual bias adjustments are recommended to compensate for head differences. Record currents may be individually adjusted also by replacing the fixed series 10K resistor with a variable one.

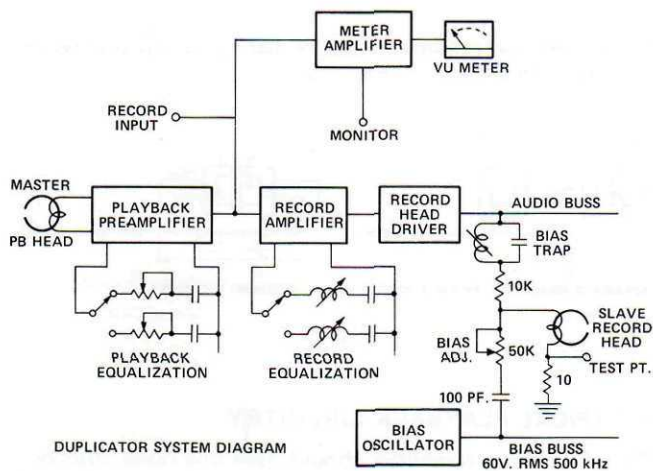


Fig. 16

II. RECORD & PLAYBACK CIRCUIT CONSIDERATIONS

A. TYPICAL RECORD CIRCUITRY

Recording consists of applying the audio signal, intermixed with the high frequency 50 to 100 kHz bias current, to the coil of the record head. Bias current is about ten times the audio current which places a zero-level signal (12 dB below sat.) on the tape. Bias level is adjusted to give maximum record sensitivity for a 1 kHz audio signal.

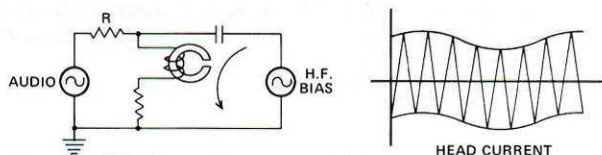


Fig. 17

Typical Record Circuitry is shown in Fig. 18. R1 controls the level of audio current fed to the record head and is adjusted to give a recorded level of zero reference when the VU meter reads zero-VU. Partial high frequency boost is created by C1 shunting R2 loaded by R3. C2 is a short circuit at the high frequencies, but below 100 Hz begins to add impedance to R3 to give a small low frequency boost. C3 and R4 give a degree of adjustment to the amount of high frequency pre-emphasis. C5 shunting R7 helps again to increase the rate of rise on the curve above 10 kHz. Alternately, instead of C5, we can shunt R7 with a series resonant circuit, C10 and L1 to give a greater amount of pre-emphasis and sharper rise. Resonant frequency of C10/L1 can be adjusted by L1 to fall between 10 and 20 kHz. R12 is selected to reduce the Q, if necessary. Tape speeds other than 7.5 ips will require changes in value for C1, C3, C5 and C10. For example, slower speeds need more capacitance.

The output of the transistor amplifier is fed to the record head thru R9 and the bias trap, which keeps the bias from the transistor. C8 serves to bypass the bias, and also to filter out audio frequencies above 20 kHz which might intermodulate with the bias. Bias is coupled to the record head thru the adjustment potentiometer, R10, and C9. R11 in series with the record head permits voltage readings across it to measure the bias and recording currents.

Q1 should be able to deliver at least four times the zero level recording current without distortion. This is not a problem with record heads of 2 to 50 mhy inductance. High impedance R/P heads of 200 or 400 mhy are more difficult to drive because of limited A.C. voltage swing from Q1, especially at the highest frequencies which may be boosted

from 15 to 20 dB. A higher d.c. supply voltage may be required, plus holding down the inductance of the R/P head to 100 mhy.

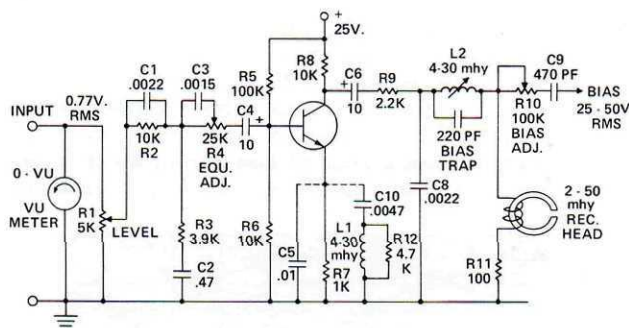


Fig. 18 — Record Equalization and Driver

IC Operational Amplifiers may be used as record head drivers, but are more critical to set up because of stability, gain, feedback, frequency response, power supply and noise considerations. Two references on IC record and play circuits include:

- LM381 Low Noise Dual Preamplifier, NATIONAL SEMICONDUCTOR CORP., AN-64 May, 1972, Byerly & Long. Gives tape head record and playback amplifier circuits.
- PIT FALLS OF THE GENERAL PURPOSE IC OPERATIONAL AMPLIFIER AS APPLIED TO AUDIO SIGNAL PROCESSING. Walter G. Jung, 1972, A.E.S. Preprint No. 893 (F-4), Audio Engineering Society, N.Y.

1. RECORDING LEVEL

The record current values given in the specifications in this catalog will place a 1 kHz signal on the tape 12 dB below tape saturation. This is also the level of the 1 kHz playback signal given in the specifications. To determine these figures follow this procedure:

1. Adjust for peak bias. A separate monitor play head is helpful.
2. Increase record current until playback signal saturates and refuses to increase further.
3. Reduce record current until play signal drops 12 dB from its maximum level. This value of record current is very close to "Zero Reference" and should cause the VU meter to read Zero-VU.

Alignment or Test Tapes have a Zero Reference Level which may be specified as "NAB Standard Reference Level" (150 NanoWebers/Meter), as "Reference Fluxivity" (200 NanoWebers/Meter), "Ampex Operating Level" (185 NanoWebers/Meter), or as "DIN Reference Level" (250 NanoWebers/M for Cassette 1.875 ips).

The above absolute tape levels can be related to each other as dB differences. Depending upon the particular test tape the VU-meter calibration will indicate the record level to produce a playback signal equal to the reference level.

Cassette recorder calibration for Zero-VU is best done at 200 nW/M as this is a safer level for distortion and is also the basis for calibration of the Dolby noise reduction system.

2. BIAS ADJUSTMENT

The bias current of a record or record/play head is normally "peaked" or adjusted to give maximum playback output from a 1 kHz recorded signal. This gives close to minimum distortion, with good high frequency response. **Overbiasing** slightly may substantially reduce the high frequencies while giving a small reduction in distortion. **Underbiasing** will

increase the high frequencies at the expense of greater distortion.

Cassette bias at 1-7/8 ips is very critical because of the shorter wavelengths, making it difficult to obtain repeatable results from 1 kHz peak bias adjustments. A superior method is to peak the bias while recording 6.3 kHz, which gives a lower value of bias than the 1 kHz peak. Then increase the bias current until the 6.3 kHz playback signal drops exactly 2.5 dB. This method gives a value of bias current which is very close to peak 1 kHz, and it can be repeated very consistently.

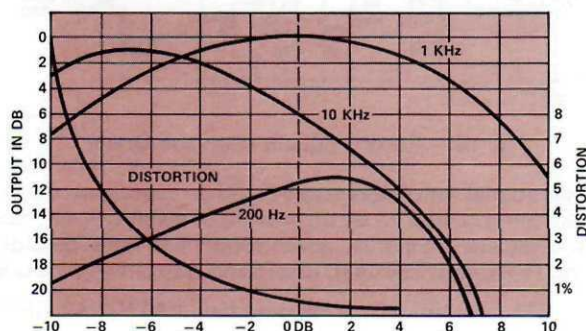


Fig. 19 - Typical 3.75 ips output curves and distortion vs. bias current. (0 dB is 1 kHz peak.)

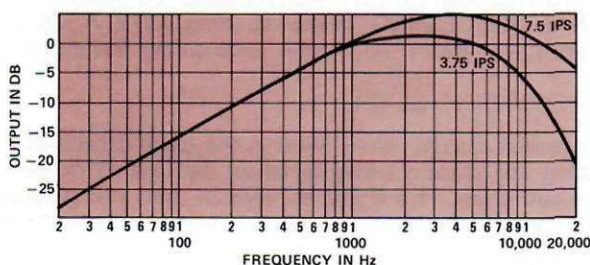


Fig. 20 - Typical constant-current unequalized Record/Play response curves run at peak 1 kHz bias.

The above method of overbiasing at a high frequency for adjusting bias is described for various tape speeds in DIN Standard No. 45512 dated March, 1974, available from USASI, 10 E. 40th St., New York, N.Y. 10016.

Erase/Bias Oscillator. The oscillator to supply erase power and record bias should operate at five or more times the highest audio frequency. Use the NORTONICS T70-T2 for 50-120 kHz, T70-T5 for 100-250 kHz, and T70-T6 for 250-1000 kHz. The push-pull circuit can deliver more power at minimum distortion. A single-ended (one transistor) oscillator may be adequate for light loads but has more second harmonic distortion in its waveform. A typical circuit is shown on page 89.

D.C. Bias Operation. It is possible to erase and apply bias with D.C. This will reduce cost by eliminating the bias oscillator. Results are inferior to those from A.C. bias and erase, but are often satisfactory for non-critical voice applications such as telephone answering recorders, dictation machines, etc. Background noise and distortion are increased for D.C. bias.

Either Z-Combo or conventional erase and R/P heads can be used with D.C. The erase head is supplied with a D.C. current equal to twice the specified nominal rms A.C. current. This is enough to leave the medium in a saturated condition. Then, D.C. bias is fed to the record coil in a polarity such as to tend to neutralize the residual flux in the medium. This bias is adjusted for peak or optimum 1 kHz recording, or else

can be set for minimum hiss or background noise while listening with a monitor play head.

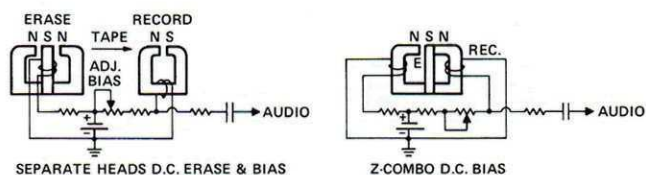


Fig. 21

B. TYPICAL PLAYBACK CIRCUITRY

The playback preamplifier should have low noise components, particularly the input transistor and its collector and emitter resistors. Equalization serves to boost the low frequency response to compensate for the falloff in playback head output as frequency is decreased. Normally the playback equalization is adjusted to give a flat play response from a prerecorded test tape. The circuit below (Fig. 22) is typical for use at 7.5 ips. Other speeds will require changes in the equalization resistance and capacitance to maintain the correct frequency response.

R2 and C2 trap TV and radio interference. C3 and R5 couple high frequency negative feedback from collector of Q2 to emitter of Q1. The impedances of C3 and R5 determine the "break point" or "transition frequency" on the response curve. For example, NAB 7.5 ips specification calls for a time constant of 50 usec. ($R \times C$) or a transition frequency

$$\text{of } 3180 \text{ Hz } \left(\frac{1}{2 \pi RC} \right)$$

Therefore, if C is .015 mfd, the value for R may be calculated as:

$$R = \frac{1}{2 \pi FC} = \frac{1}{6.3 \times 3180 \times .015 \times 10^6} = 3300 \text{ ohms}$$

$$\text{Alternately, } R = \frac{T_c}{C} = \frac{50 \times 10^6}{.015 \times 10^6} = 3300 \text{ ohms}$$

For a tape speed of 3.75 ips we have 1800 Hz and 90 usec T_c .

$$R = \frac{90}{.015} = 6000 \text{ ohms, well within the range of } R5 \text{ adjustment.}$$

The curves of Fig. 23 show the 1800 Hz and 3180 Hz transitions for 3.75 and 7.5 ips. The points are located at the intersections of the straight-line extensions of the sloped and horizontal sections on the curves.

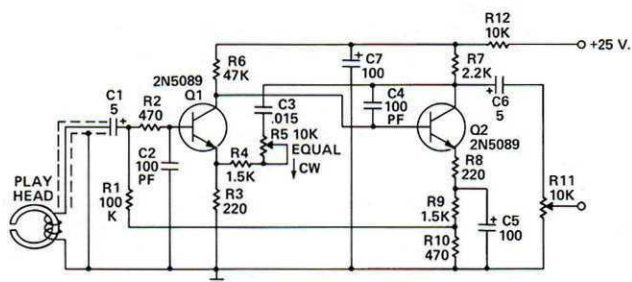


Fig. 22 - Playback Preamplifier

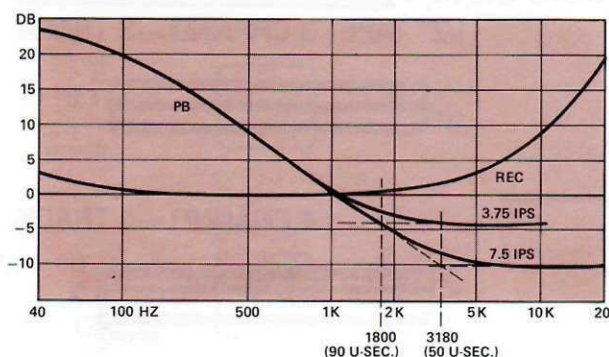


Fig. 23

C. RECORD/PLAYBACK

EQUALIZATION – FREQUENCY RESPONSE

When a record/playback frequency response is run on a magnetic tape head with **no** record or playback equalization (constant-current record, flat playback) the output response curve will look like "CC R/P" in Fig. 24. The rising output in the low frequency region is caused by the typical $d\phi/dt$ effect of a magnetic transducer. The high frequency falloff is caused by playback gap losses, core losses, and tape demagnetization at shorter wavelengths.

Standard practice to develop a flat R/P response is to **equalize** the playback and record amplifiers by **boosting** the low frequencies during playback and **boosting** the **highs** during record. (See the PB and REC curves.) This system gives the best signal-to-noise ratio, dynamic range and frequency response. Since this response condition is caused by the shorter recorded wavelengths at the higher frequencies, the groups of curves are similar for various tape speeds, but are shifted to the right or the left of the frequency spectrum for higher or lower speeds.

A slight boost is usually incorporated in the low frequencies below 100 Hz during recording to compensate for droop in play amplifier equalization.

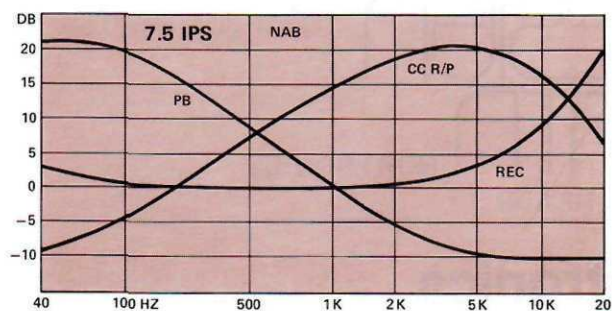


Fig. 24

Adjustments, Playback. Standard alignment or test tapes are available for most tape or film speeds. Practice is to play the test tape and trim the playback equalization until the response is flat over the spectrum. The frequency tones on the test tape have been recorded with the correct record equalization. The additive sum of all three curves on the graph should generate a flat response.

Record Equalization Adjustment. After the playback equalization has been adjusted from the test tape the record equalization is next varied to produce a flat record/play response from an audio oscillator. **Record level** during this procedure should be -10 dB from Standard Reference Level to prevent overloading at the high frequencies and erroneous results.

HOW TO SELECT AND SPECIFY

Selecting the proper head for your application can be accomplished by referring to the information below. Technical data on all Nortronics heads listed in the following index is contained on the

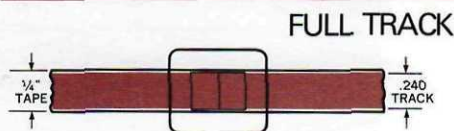
individual pages referenced. In determining the part number for your application, please refer to the step-by-step selection guide below.

1	2	3	4	5	6	7	8
DESIGNATE SERIES	DESIGNATE CASE STYLE	NUMBER OF CHANNELS	NUMBER OF TRACKS	TRACK LOCATION	ERASE ELECTRICAL CODE	R/P ELECTRICAL CODE	MOUNTING STYLE
P=Premium series XP=Extended tip—Premium PR or WP= Professional series (Standard has no prefix)	List proper letter designation from case outline drawings on each page	1=mono 2=stereo 3=3 channel 4=4 channel	H=2 track (half track) Q=4 track (quarter track) L=8 track	(mono heads only) NONE=Standard stereo offset C=Centered track Y=.020 off center (G1HY) .040 off center (B1HY)	(combo heads only) List code from specification chart	List code from specification chart	List proper mounting code shown on individual pages
EXAMPLE:							
P series	A case style	1 channels	Q tracks	C track location	4 erase code	6K electrical code	SL mounting
PREMIUM SERIES: "A" case style; 1 channel (mono); 4 track; centered track; combination erase-R/P head; No. 4 erase electrical code; No. 6K R/P electrical code; side mount with erase section to the left.							

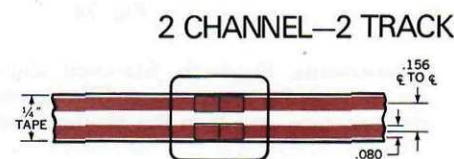
Nortronics Track Configurations

1/4" TAPE

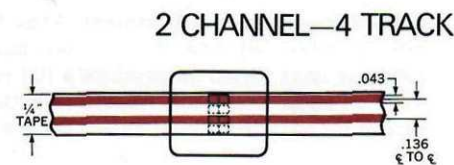
ERASE
PR-B1EF
B1EF
LMEF
SMEF
RECORD/PLAY
PR-B1F



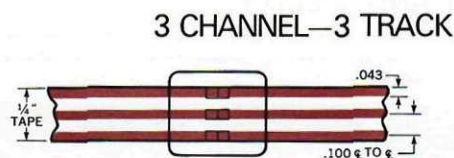
ERASE
B2EH
LSEH
SSEH
PR-B2EH
RECORD/PLAY
PR-B2H
WP-B2H
P-B2H
B2H
C2H
COMBO
P-A2H
A2H
ZJ2H



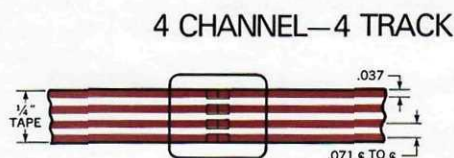
ERASE
B2EQ
SSEQ
LSEQ
RECORD/PLAY
WP-B2Q
P-B2Q
B2Q
C2Q
COMBO
P-A2Q
A2Q



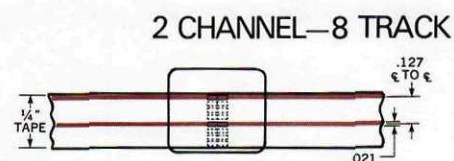
ERASE
PR-B1EF/B1EF/
SMEF/LMEF (for
erasing all 3 channels
simultaneously)
RECORD/PLAY
P-B3Q



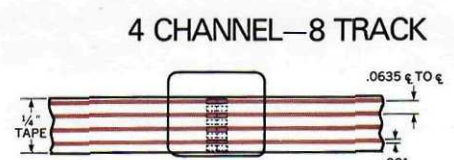
ERASE
Independent Channel
Erasure
PC-B4EQ
For erasing all 4 tracks
simultaneously
PR-B1EF
B1EF
SMEF
LMEF
RECORD/PLAY
P-B4Q
P-BQQ
BQQ
BQQN



ERASE
use PR-B1EF
B1EF
SMEF
LMEF
for erasing all tracks
simultaneously
RECORD/PLAY
B2L
P-B2L
COMBO
ZJ2L



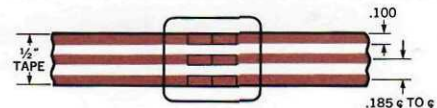
ERASE
use PR-B1EF
B1EF
SMEF
LMEF
for erasing all tracks
simultaneously
RECORD/PLAY
PC-BQL
P-BQL



STUDIO SERIES

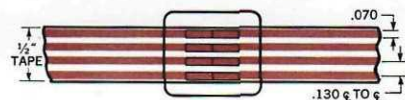
1/2" TAPE 3 CHANNEL—3 TRACK

ERASE
STE-3
RECORD
STR-3
PLAYBACK
STP-3



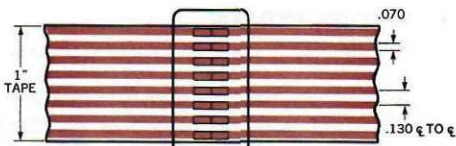
4 CHANNEL—4 TRACK

ERASE
STE-4
RECORD
STR-4
PLAYBACK
STP-4



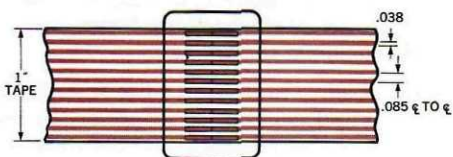
1" TAPE 8 CHANNEL—8 TRACK

ERASE
STE-8
RECORD
STR-8
PLAYBACK
STP-8



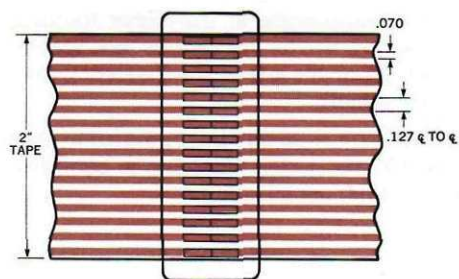
12 CHANNEL—12 TRACK

ERASE
STE-12
RECORD
STR-12
PLAYBACK
STP-12



2" TAPE 16 CHANNEL—16 TRACK

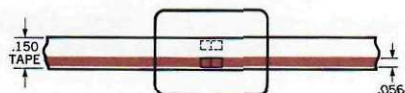
ERASE
STE-16
RECORD
STR-16
PLAYBACK
STP-16



CASSETTE

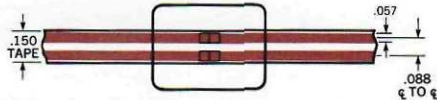
.150" TAPE 1 CHANNEL—2 TRACK

RECORD/PLAY
W1R
P-W1P



2 CHANNEL—2 TRACK

ERASE
W2ER
RECORD/PLAY
W2R
W2P
P-W2P



2 CHANNEL—4 TRACK

RECORD/PLAY



4 CHANNEL—4 TRACK

ERASE
W2ER
RECORD/
P-W4J

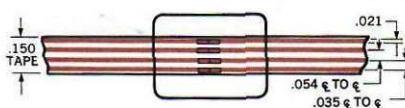


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FILM, FILMSTRIPE, DRUM, DISC, BELT OR CARD	SPECIAL PURPOSE	
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B1QC/P-B1QC	65	P-B3Q	66-67	WP-B2H	33
B2EH	40	P-B4Q/P-BQQ	62-63	WP-B2Q	53
B2EQ	40	P-BQL/PC-BQL	70-71	X-R1LC/X-R1NC	72
B2H/P-B2H	34-35	P-W1P	81	X-W1LC	74
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Although the utmost care has been taken to assure the accuracy of the specifications on the following pages, we reserve the right to make engineering changes, as required, to constantly improve a product. Further, you may note that a particular tape type or oxide

formulation may not be that called for in your design specification. We therefore recommend contacting Nortronics prior to finalizing a design to assure compliance and correlation.



RECORD



PLAY

STUDIO SERIES 4 Channel 1/2" Tape

- FERRITE CORE ERASE CONSTRUCTION ASSURES 70 DB ERASURE
- HI-MU CASES FOR MAXIMUM SHIELDING
- ALL METAL CONSTRUCTION WITH SILICON-MONOXIDE GAPS ASSURES SUPERIOR RESPONSE AND HEAD LIFE WITH NO PHASE DISTORTION
- LAMINATED CROSSTALK SHIELDING FOR MAXIMUM ISOLATION—ALLOWS SIMULTANEOUS RECORD AND PLAY ON ADJACENT CHANNELS

4 CHANNEL STUDIO SERIES HEADS

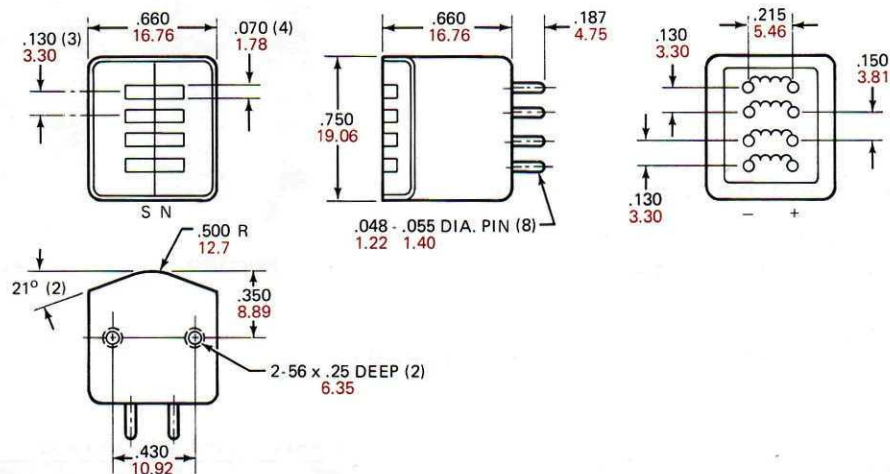
MODEL NUMBERS	ERASE		RECORD		PLAY		
	STE-4B12	STE-4B6	STR-4BN18	STR-4BN7	STP-4B32	STP-4B8	STP-4B23
Inductance @ 10 MV—1 kHz		170 μ HY					
Inductance @ 50 MV—1 kHz	1.5 MHY						
Inductance @ 100 MV—1 kHz *			4.0 MHY	4.0 MHY	100 MHY	650 MHY	8 MHY
D. C. Resistance	18 Ohms	3.0 Ohms	13 Ohms	40 Ohms	150 Ohms	650 Ohms	15 Ohms
1 kHz Impedance			30 Ohms	47 Ohms	70 Ohms	4000 Ohms	50 Ohms
120 kHz Impedance	800 Ohms						
Gap Length (Inches)	.003	.003	400 Micro	500 Micro	100 Micro	200 Micro	200 Micro
Track Width (Inches)	.080	.080	.070	.070	.070	.070	.070
Track Spacing, Center to Center (Inches)	.130	.130	.130	.130	.130	.130	.130
TYPICAL OPERATING CHARACTERISTICS USING 3M 201 TAPE, BIASED FOR PEAK 1 kHz OUTPUT AND RECORDED AT A LEVEL OF 12 dB BELOW TAPE SATURATION FOR 1 kHz.							
TYPICAL ERASE CHARACTERISTICS USING 3M 201 TAPE FOR A MINIMUM 70 dB ERASURE OF A 400 Hz SATURATION SIGNAL.							
Erase Voltage 120 kHz RMS @ 7.5 IPS	35 Volts						
Erase Voltage 60 kHz RMS @ 7.5 IPS		5 Volts					
Erase Current 120 kHz @ 7.5 IPS	28 MA						
Erase Current 60 kHz @ 7.5 IPS		80 MA					
Saturation Voltage 60 kHz		10.0 Volts					
Saturation Current 60 kHz		160 MA					
Peak Bias Voltage 120 kHz RMS @ 7.5 IPS			10 Volts				
Peak Bias Voltage 120 kHz RMS @ 15 IPS			11 Volts				
Peak Bias Voltage 180 kHz RMS @ 7.5 IPS				16 Volts			
Bias Current 120 kHz @ 7.5 IPS			5.6 MA				
Bias Current 120 kHz @ 15 IPS			6.0 MA				
Bias Current 180 kHz @ 7.5 IPS				5.3 MA			
Audio Record Current @ 7.5 IPS			.33 MA	.375 MA			
Audio Record Current @ 15 IPS			.34 MA				
1 kHz Reproduce Output @ 7.5 IPS			.30 MV		0.9 MV	2.9 MV	.30 MV
1 kHz Reproduce Output @ 15 IPS			.34 MV		1.1 MV	3.2 MV	.35 MV
10 kHz Playback Output RE 1 kHz @ 7.5 IPS			—1 dB		+3 dB	+3.0 dB	+1.0 dB
10 kHz Playback Output RE 1 kHz @ 15 IPS			—6 dB		+10 dB	+10.0 dB	+8.0 dB
15 kHz Playback Output RE 10 kHz @ 7.5 IPS					—4 dB	—4.0 dB	—5.0 dB
15 kHz Playback Output RE 10 kHz @ 15 IPS					—1.5 dB	—1.5 dB	—1.0 dB

* 7 MHY RECORD AND 70 MHY PLAYBACK MODELS ALSO AVAILABLE.

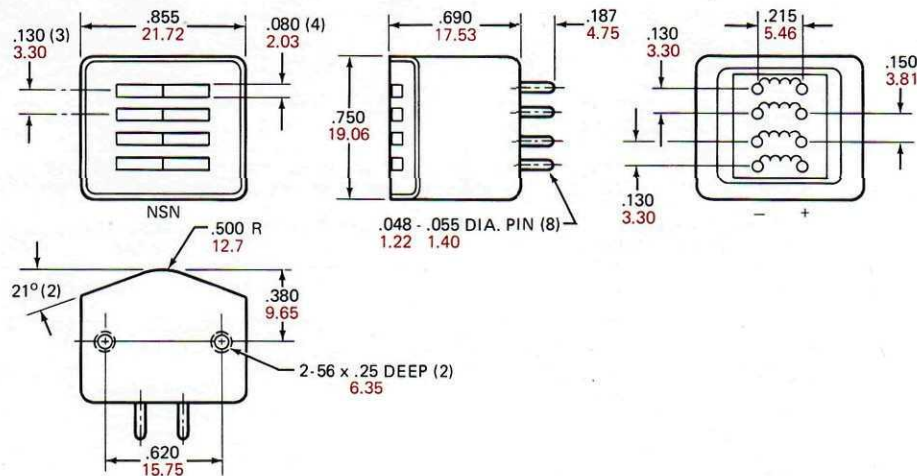
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

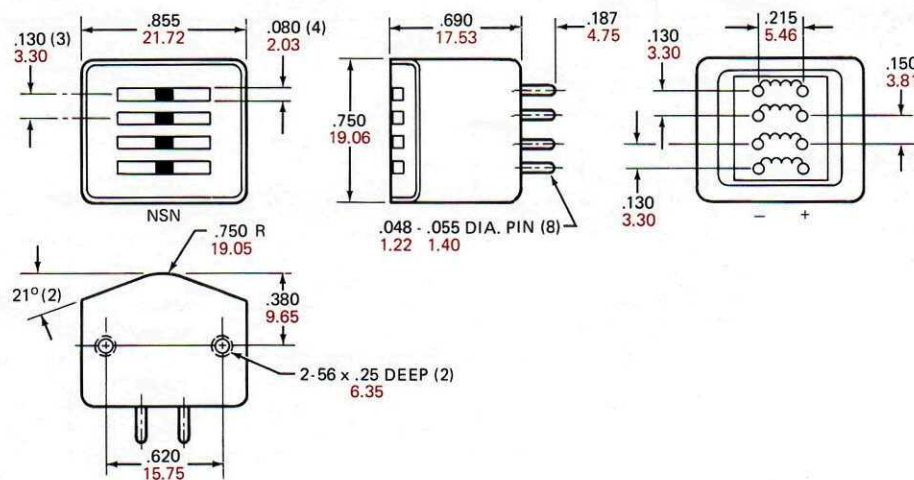
RECORD



PLAY



ERASE



NOTE: For Head Mounts see Page 23.

STUDIO SERIES 8 Channel 1" Tape

- FERRITE CORE ERASE CONSTRUCTION ASSURES 70 DB ERASURE
- HI-MU CASES FOR MAXIMUM SHIELDING
- ALL METAL CONSTRUCTION WITH SILICON-MONOXIDE GAPS ASSURES SUPERIOR RESPONSE AND HEAD LIFE WITH NO PHASE DISTORTION
- LAMINATED CROSSTALK SHIELDING FOR MAXIMUM ISOLATION—ALLOWS SIMULTANEOUS RECORD AND PLAY ON ADJACENT CHANNELS



RECORD



PLAY



ERASE

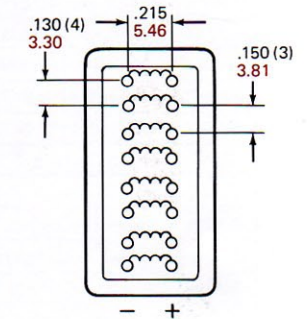
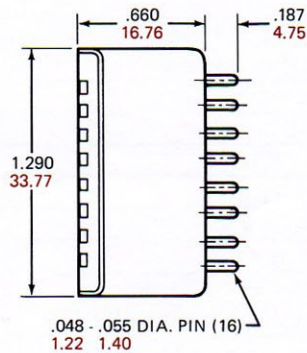
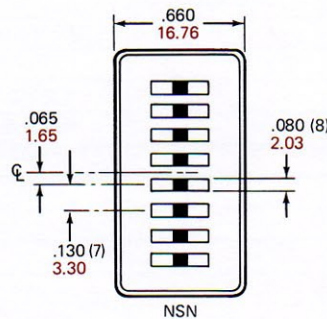
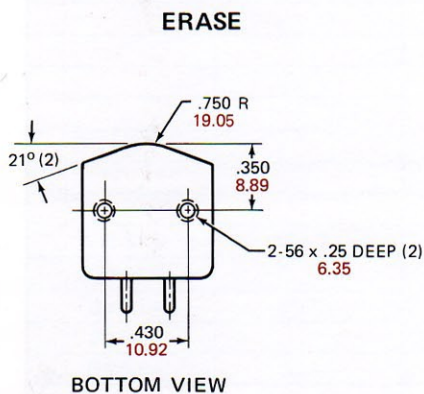
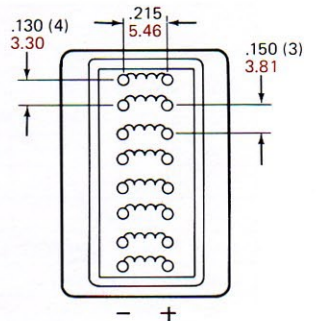
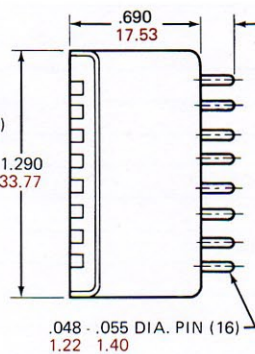
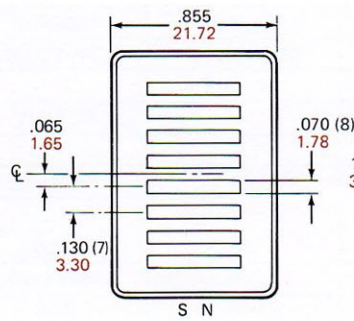
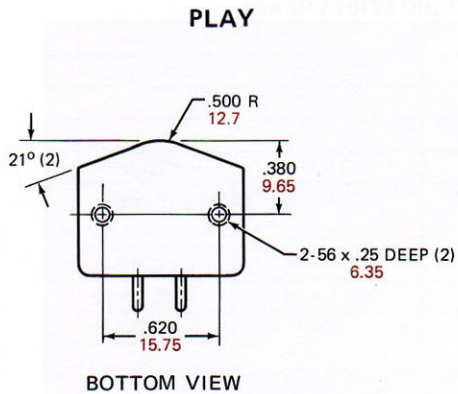
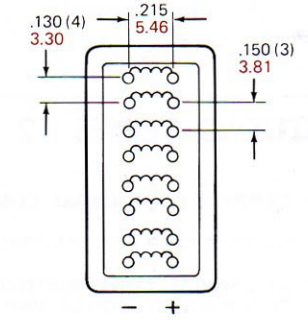
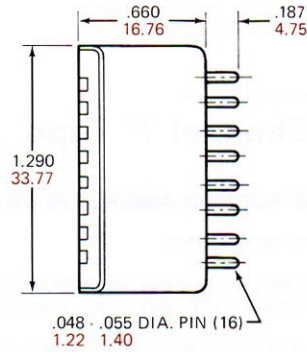
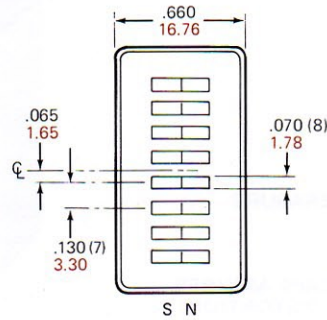
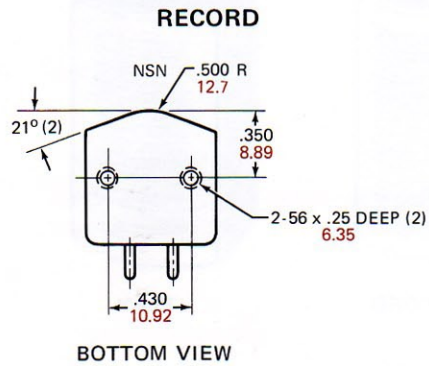
8 CHANNEL STUDIO SERIES HEADS

MODEL NUMBERS	ERASE		RECORD		PLAY		
	STE-8BN12	STE-8BN6	STR-8BN18	STR-8BN7	STP-8B32	STP-8B8	STP-8B23
Inductance @ 10 MV—1 kHz		170 μ HY					
Inductance @ 50 MV—1 kHz	1.5 MHY						
Inductance @ 100 MV—1 kHz *			4.0 MHY	4.0 MHY	100 MHY	650 MHY	8 MHY
D. C. Resistance	18 Ohms	3.0 Ohms	13 Ohms	40 Ohms	150 Ohms	650 Ohms	15 Ohms
1 kHz Impedance			30 Ohms	47 Ohms	700 Ohms	4000 Ohms	50 Ohms
120 kHz Impedance	800 Ohms						
Gap Length (Inches)	.003	.003	400 Micro	500 Micro	100 Micro	200 Micro	200 Micro
Track Width (Inches)	.080	.080	.070	.070	.070	.070	.070
Track Spacing Center to Center (Inches)	.130	.130	.130	.130	.130	.130	.130
TYPICAL OPERATING CHARACTERISTICS USING 3M 201 TAPE, BIASED FOR PEAK 1 kHz OUTPUT AND RECORDED AT A LEVEL OF 12 dB BELOW TAPE SATURATION FOR 1 kHz.							
TYPICAL ERASE CHARACTERISTICS USING 3M 201 TAPE FOR A MINIMUM 70 dB ERASURE OF A 400 Hz SATURATION SIGNAL.							
Erase Voltage 120 kHz RMS @ 7.5 IPS	35 Volts						
Erase Voltage 60 kHz RMS @ 7.5 IPS		5 Volts					
Erase Current 120 kHz @ 7.5 IPS	28 MA						
Erase Current 60 kHz @ 7.5 IPS		80 MA					
Saturation Voltage 60 kHz		10.0 Volts					
Saturation Current 60 kHz		160 MA					
Peak Bias Voltage 120 kHz RMS @ 7.5 IPS			10 Volts				
Peak Bias Voltage 120 kHz RMS @ 15 IPS			11 Volts				
Peak Bias Voltage 180 kHz RMS @ 7.5 IPS				16 Volts			
Bias Current 120 kHz @ 7.5 IPS			5.6 MA				
Bias Current 120 kHz @ 15 IPS			6.0 MA				
Bias Current 180 kHz @ 7.5 IPS				5.3 MA			
Audio Record Current @ 7.5 IPS			.33 MA	.375 MA			
Audio Record Current @ 15 IPS			.34 MA				
1 kHz Reproduce Output @ 7.5 IPS			.30 MV		0.9 MV	2.9 MV	.30 MV
1 kHz Reproduce Output @ 15 IPS			.34 MV		1.1 MV	3.2 MV	.35 MV
10 kHz Playback Output RE 1 kHz @ 7.5 IPS			-1 dB		+3 dB	+3.0 dB	+1.0 dB
10 kHz Playback Output RE 1 kHz @ 15 IPS			-6 dB		+10 dB	+10.0 dB	+8.0 dB
15 kHz Playback Output RE 10 kHz @ 7.5 IPS					-4 dB	-4.0 dB	-5.0 dB
15 kHz Playback Output RE 10 kHz @ 15 IPS					-1.5 dB	-1.5 dB	-1.0 dB

*7 MHY RECORD AND 70 MHY PLAYBACK MODELS ALSO AVAILABLE.

PHYSICAL CONFIGURATIONS

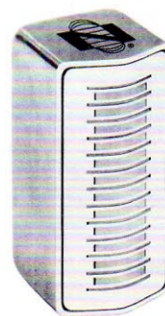
NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR



NOTE: For Head Mounts see Page 23.

STUDIO SERIES 12 Channel 1" Tape

- FERRITE CORE ERASE CONSTRUCTION ASSURES 70 DB ERASURE
- HI-MU CASES FOR MAXIMUM SHIELDING
- ALL METAL CONSTRUCTION WITH SILICON-MONOXIDE GAPS ASSURES SUPERIOR RESPONSE AND HEAD LIFE WITH NO PHASE DISTORTION
- LAMINATED CROSSTALK SHIELDING FOR MAXIMUM ISOLATION—ALLOWS SIMULTANEOUS RECORD AND PLAY ON ADJACENT CHANNELS



RECORD



PLAY

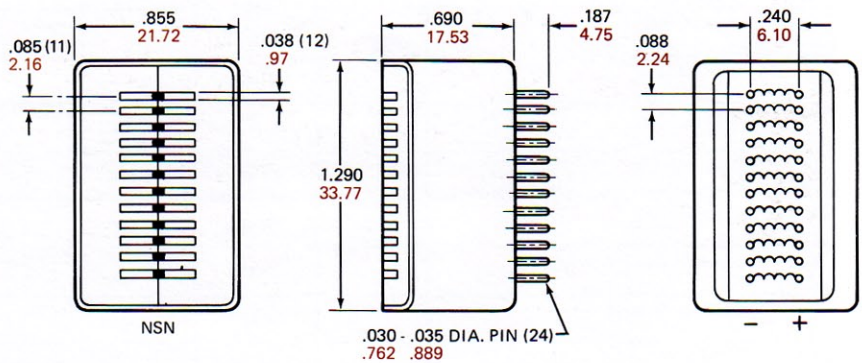
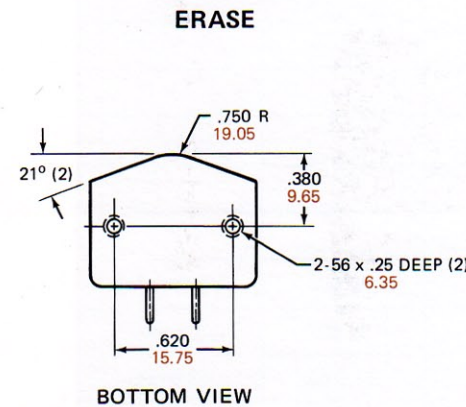
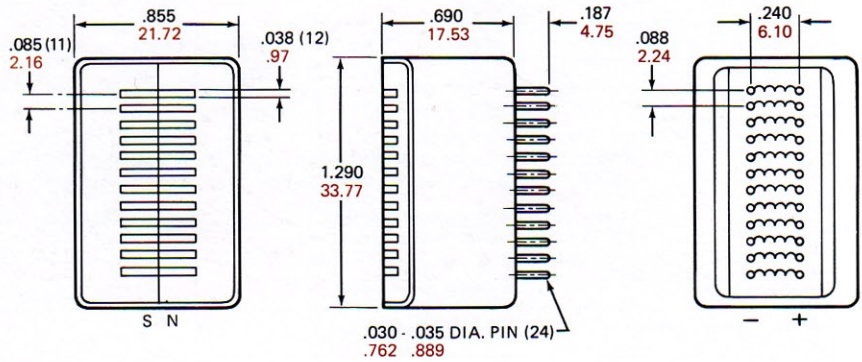
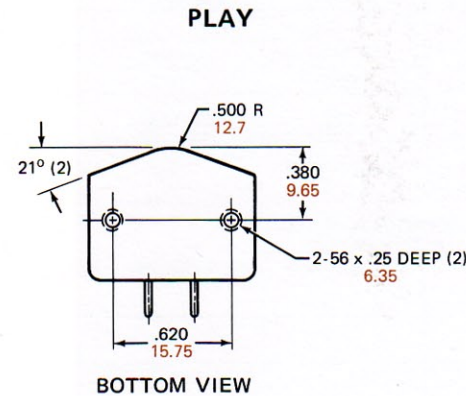
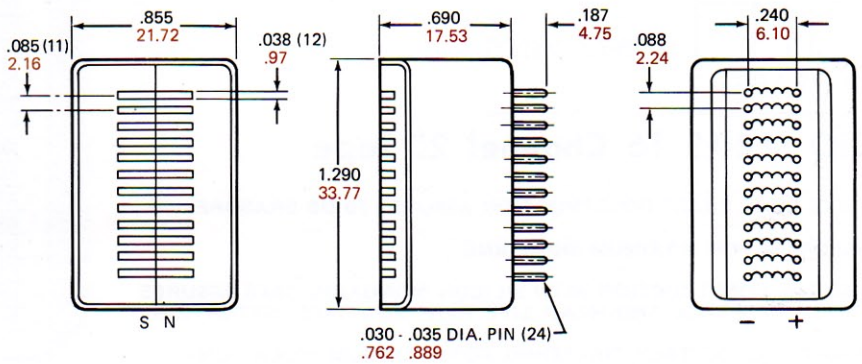
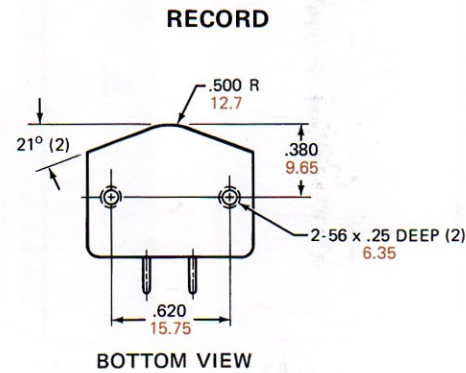
12 CHANNEL STUDIO SERIES HEADS

MODEL NUMBERS	ERASE	RECORD	PLAY	
	STE-12U19	STR-12U28	STP-12U21	STP-12U29
Inductance @ 25 MV—1 kHz	.170 MHY			
Inductance @ 50 MV—1 kHz *		4.0 MHY		
Inductance @ 100 MV—1 kHz *			650 MHY	5.0 MHY
D. C. Resistance	4.5 Ohms	15 Ohms	720 Ohms	15 Ohms
1 kHz Impedance		30 Ohms		35 Ohms
Track Spacing Center to Center (Inches)	.085	.085	.085	.085
Gap Length (Inches)	.003	400 Micro	200 Micro	200 Micro
Track Width (Inches)	.048	.038	.038	.038
<p>TYPICAL OPERATING CHARACTERISTICS USING 3M 201 TAPE, BIASED FOR PEAK 1 kHz OUTPUT AND RECORDED AT A LEVEL OF 12 dB BELOW TAPE SATURATION FOR 1 kHz.</p> <p>TYPICAL ERASE CHARACTERISTICS USING 3M 201 TAPE FOR A MINIMUM 70 dB ERASURE OF A 400 Hz SATURATION SIGNAL.</p>				
Erase Voltage 100 kHz @ 7.5 IPS	9 Volts			
Erase Voltage 60 kHz @ 7.5 IPS	5.5 Volts			
Erase Current 100 kHz @ 7.5 IPS	8.5 MA			
Erase Current 60 kHz @ 7.5 IPS	85 MA			
Saturation Voltage 60 kHz	6.5 Volts			
Saturation Current 60 kHz	100 MA			
Peak Bias Voltage 120 kHz RMS @ 7.5 IPS		9.0 Volts		
Peak Bias Voltage 120 kHz RMS @ 15 IPS		10 Volts		
Bias Current 120 kHz @ 7.5 IPS		5.2 MA		
Bias Current 120 kHz @ 15 IPS		5.6 MA		
Audio Record Current @ 7.5 IPS		.33 MA		
Audio Record Current @ 15 IPS		.34 MA		
1 kHz Reproduce Output @ 7.5 IPS			1.7 MV	0.17 MV
1 kHz Reproduce Output @ 15 IPS				0.20 MV
10 kHz Playback Output RE 1 kHz @ 7.5 IPS			+2 dB	+1.0 dB
10 kHz Playback Output RE 1 kHz @ 15 IPS				+8.0 dB
15 kHz Playback Output RE 10 kHz @ 7.5 IPS			-4 dB	-5.0 dB
15 kHz Playback Output RE 10 kHz @ 15 IPS				-1.0 dB

*7 MHY RECORD AND 70 MHY PLAYBACK MODELS ALSO AVAILABLE.

PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR



NOTE: For Head Mounts see Page 23.

STUDIO SERIES 16 Channel 2" Tape

- FERRITE CORE ERASE CONSTRUCTION ASSURES 70 DB ERASURE
- HI-MU CASES FOR MAXIMUM SHIELDING
- ALL METAL CONSTRUCTION WITH SILICON-MONOXIDE GAPS ASSURES SUPERIOR RESPONSE AND HEAD LIFE WITH NO PHASE DISTORTION
- LAMINATED CROSSTALK SHIELDING FOR MAXIMUM ISOLATION—ALLOWS SIMULTANEOUS RECORD AND PLAY ON ADJACENT CHANNELS



RECORD



PLAY



ERASE

16 CHANNEL STUDIO SERIES HEADS

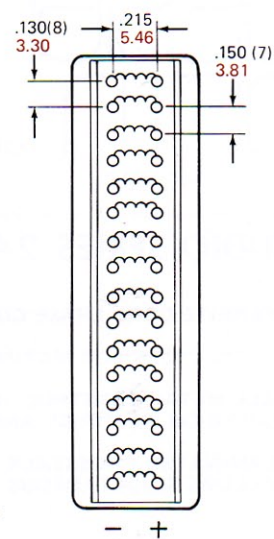
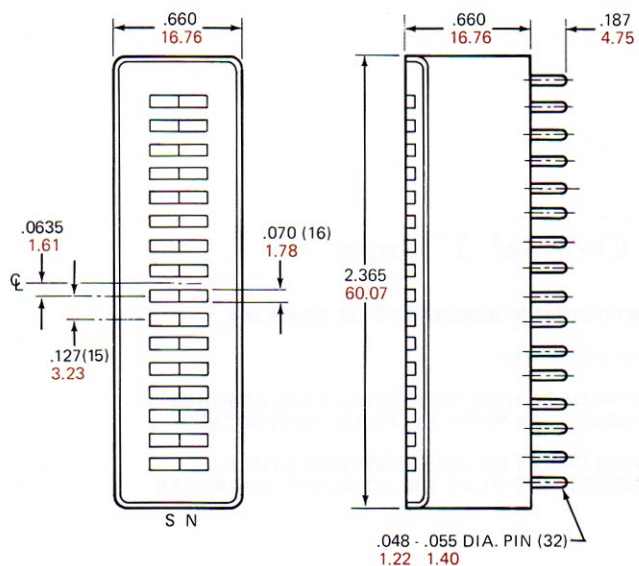
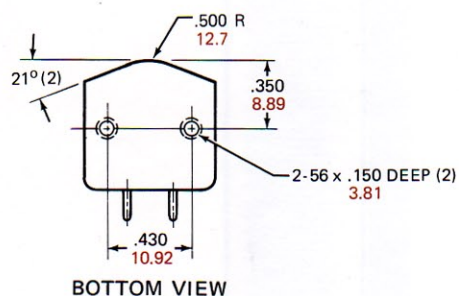
MODEL NUMBERS	ERASE		RECORD		PLAY		
	STE-16BN12	STE-16BN6	STR-16BN18	STR-16BN7	STP-16B3	STP-16B23	STP-16B8
Inductance @ 10 MV—1 kHz		170 μ HY					
Inductance @ 50 MV@1 kHz	1.5 MHY						
Inductance @ 100 MV—1 kHz*			4.0 MHY	4.0 MHY	300 MHY	8 MHY	650 MHY
D. C. Resistance	18 Ohms	3.0 Ohms	13 Ohms	40 Ohms	270 Ohms	15 Ohms	820 Ohms
1 kHz Impedance			30 Ohms	47 Ohms	2230 Ohms	50 Ohms	4000 Ohms
120 kHz Impedance	800 Ohms						
Gap Length (Inches)	.003	.003	400 Micro	500 Micro	100 Micro	200 Micro	200 Micro
Track Width (Inches)	.080	.080	.070	.070	.070	.070	.070
Track Spacing Center to Center (Inches)	.127	.127	.127	.127	.127	.127	.127
TYPICAL OPERATING CHARACTERISTICS USING 3M-201 TAPE, BIASED FOR PEAK 1 KHZ OUTPUT AND RECORDED AT A LEVEL OF 12 DB BELOW TAPE SATURATION FOR 1 KHZ.							
TYPICAL ERASE CHARACTERISTICS USING 3M-201 TAPE FOR A MINIMUM 70 DB ERASURE OF A 400 HZ SATURATION SIGNAL.							
Erase Voltage 120 kHz RMS @ 7.5 IPS	35 Volts						
Erase Voltage 60 kHz RMS @ 7.5 IPS		5 Volts					
Erase Current 120 kHz @ 7.5 IPS	28 MA						
Erase Current 60 kHz @ 7.5 IPS		80 MA					
Saturation Voltage 60 kHz		10.0 Volts					
Saturation Current 60 kHz		160 MA					
Peak Bias Voltage 120 kHz RMS @ 7.5 IPS			10 Volts				
Peak Bias Voltage 120 kHz RMS @ 15 IPS			11 Volts				
Peak Bias Voltage 180 kHz RMS @ 7.5 IPS				16 Volts			
Bias Current 120 kHz @ 7.5 IPS			9.5 Volts				
Bias Current 120 kHz @ 15 IPS			10 Volts				
Bias Current 180 kHz @ 7.5 IPS				5.3 MA			
Audio Record Current @ 7.5 IPS			.33 MA	.375 MA			
Audio Record Current @ 15 IPS			.34 MA				
1 kHz Reproduce Output @ 7.5 IPS			.30 MV		1.7 MV	.30 MV	2.9 MV
1 kHz Reproduce Output @ 15 IPS			.34 MV		2.1 MV	.35 MV	3.2 MV
10 kHz Playback Output RE 1 kHz @ 7.5 IPS			—1 dB		+3 dB	+1.0 dB	+3.0 dB
10 kHz Playback Output RE 1 kHz @ 15 IPS			—6 dB		+10 dB	+8.0 dB	+10.0 dB
15 kHz Playback Output RE 10 kHz @ 7.5 IPS					—4 dB	—5.0 dB	—4.0 dB
15 kHz Playback Output RE 10 kHz @ 15 IPS					—1.5 dB	—1.0 dB	—1.5 dB

*7 MHY RECORD AND 70 MHY PLAYBACK MODELS ALSO AVAILABLE.

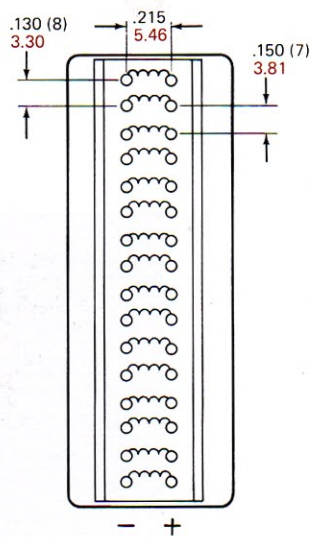
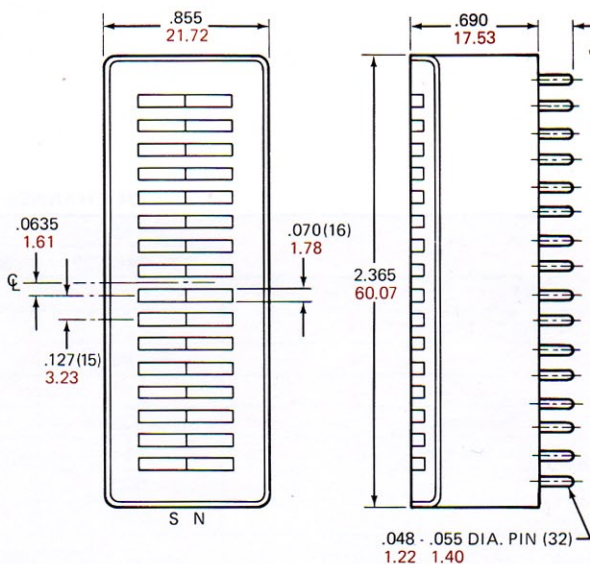
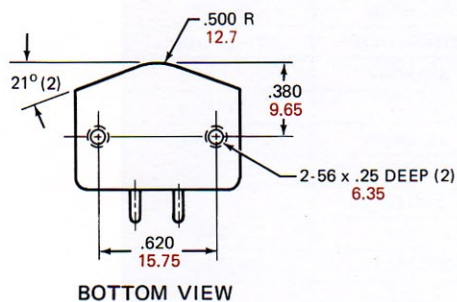
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

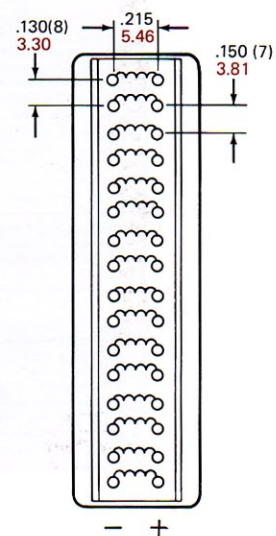
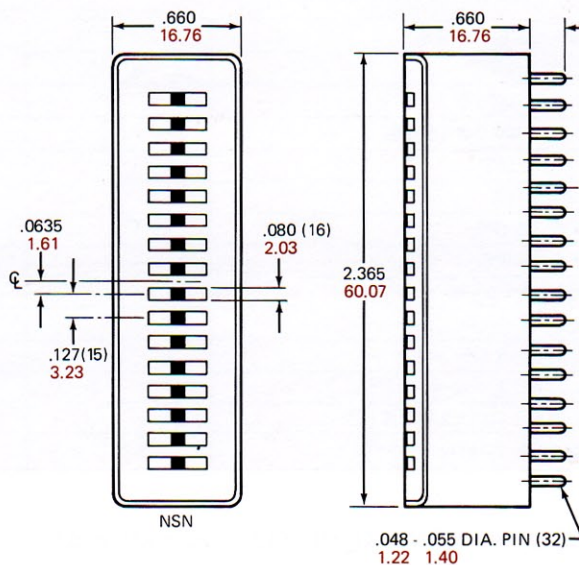
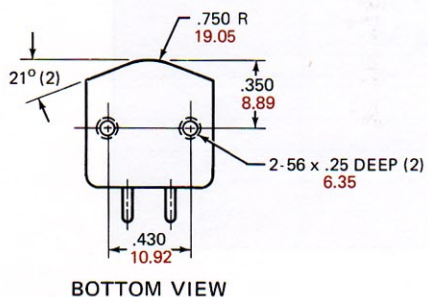
RECORD



PLAY



ERASE



NOTE: For Head Mounts see Page 13.

STUDIO SERIES 24 Channel 2" Tape

- FERRITE CORE ERASE CONSTRUCTION ASSURES 70 DB ERASURE
- HI-MU CASES FOR MAXIMUM SHIELDING
- ALL METAL CONSTRUCTION WITH SILICON-MONOXIDE GAPS ASSURES SUPERIOR RESPONSE AND HEAD LIFE WITH NO PHASE DISTORTION
- LAMINATED CROSSTALK SHIELDING FOR MAXIMUM ISOLATION—ALLOWS SIMULTANEOUS RECORD AND PLAY ON ADJACENT CHANNELS



PLAY

24 CHANNEL STUDIO SERIES HEADS

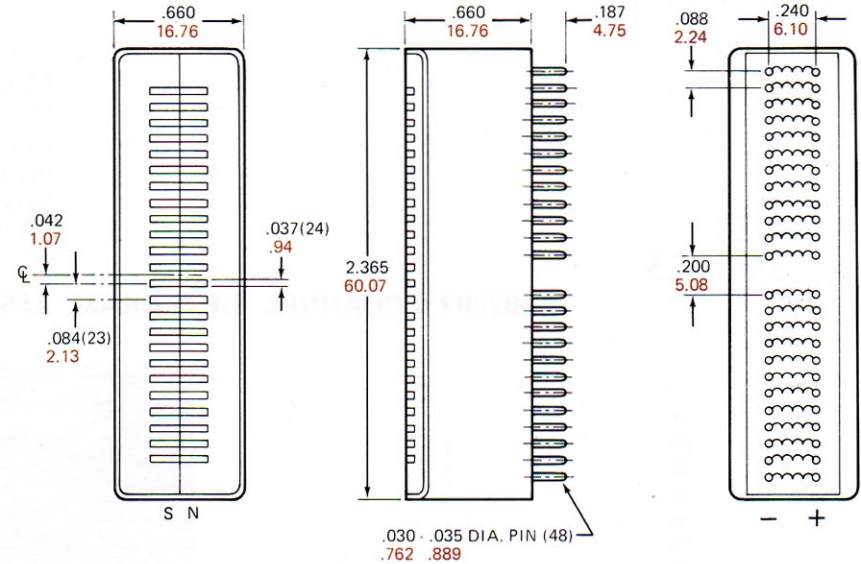
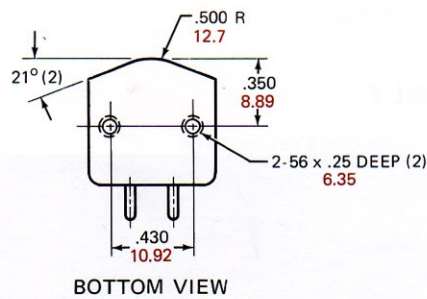
MODEL NUMBERS	ERASE	RECORD	PLAY
	STE-24UN27	STR-24UN28	STP-24U29
Inductance @ 50 MV—1 kHz *	1.0 MHY	4.0 MHY	
Inductance @ 100 MV@1 kHz *			5.0 MHY
D. C. Resistance	12 Ohms	15 Ohms	15 Ohms
1 kHz Impedance		30 Ohms	35 Ohms
120 kHz Impedance	700 Ohms	2,500 Ohms	
Track Spacing Center to Center (Inches)	.084	.084	.084
Gap Length (Inches)	.003	400 Micro	200 Micro
Track Width (Inches)	.050	.038	.038
TYPICAL OPERATING CHARACTERISTICS USING 3M-201 TAPE, BIASED FOR PEAK 1 KHZ OUTPUT AND RECORDED AT A LEVEL OF 12 DB BELOW TAPE SATURATION FOR 1 KHZ. TYPICAL ERASE CHARACTERISTICS USING 3M-201 TAPE FOR A MINIMUM 70 DB ERASURE OF A 400 HZ SATURATION SIGNAL.			
Erase Voltage 120 kHz RMS @ 7.5 IPS	22 Volts		
Erase Current 120 kHz @ 7.5 IPS	30 MA		
Peak Bias Voltage 120 kHz RMS @ 7.5 IPS		9.0 Volts	
Peak Bias Voltage 120 kHz RMS @ 15 IPS		10 Volts	
Bias Current 120 kHz @ 7.5 IPS		5.2 MA	
Bias Current 120 kHz @ 15 IPS		5.6 MA	
Audio Record Current @ 7.5 IPS		.33 MA	
Audio Record Current @ 15 IPS		.34 MA	
1 kHz Reproduce Output @ 7.5 IPS			0.17 MV
1 kHz Reproduce Output @ 15 IPS			0.20 MV
10 kHz Playback Output RE 1 kHz @ 7.5 IPS			+1.0 dB
10 kHz Playback Output RE 1 kHz @ 15 IPS			+8.0 dB
15 kHz Playback Output RE 10 kHz @ 7.5 IPS			-5.0 dB
15 kHz Playback Output RE 10 kHz @ 15 IPS			-1.0 dB

*7 MHY RECORD AND 70 MHY PLAYBACK MODELS ALSO AVAILABLE.

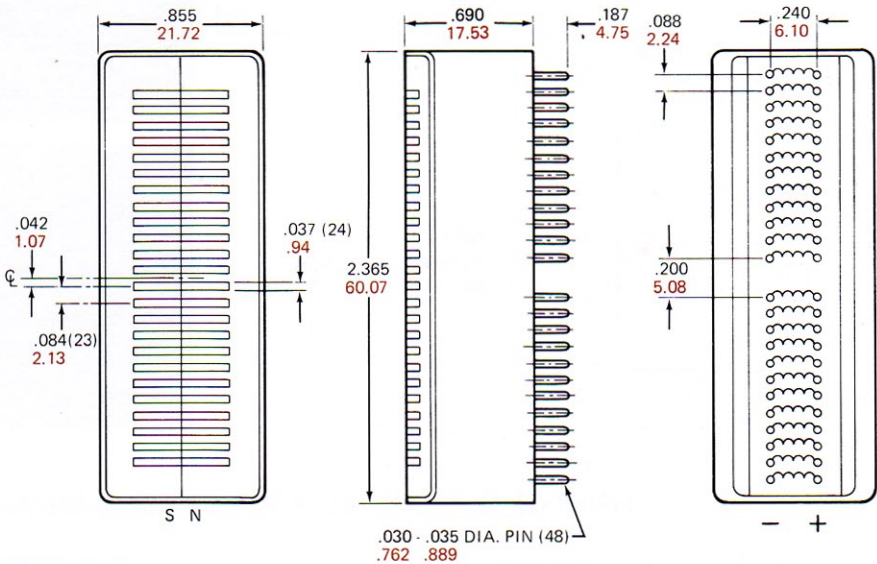
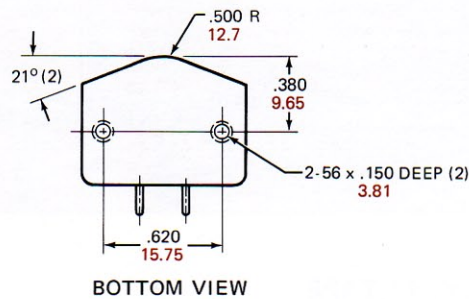
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

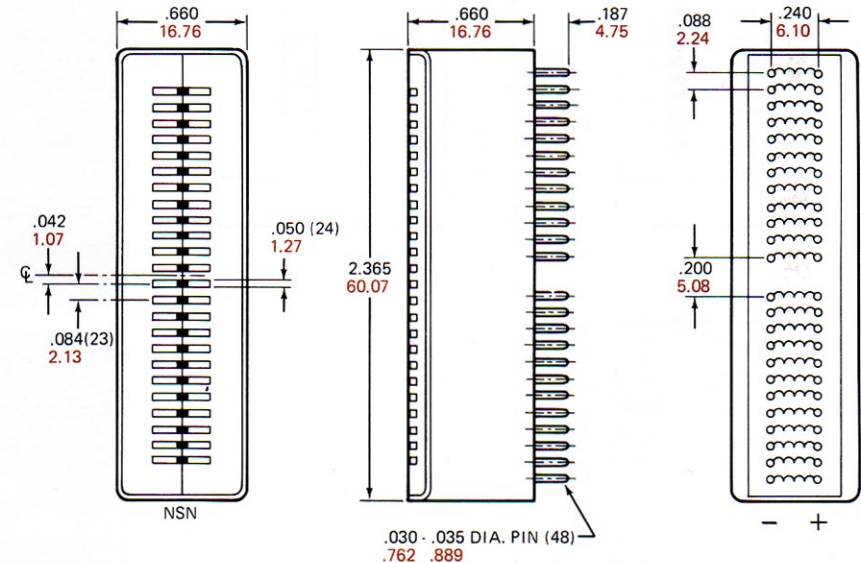
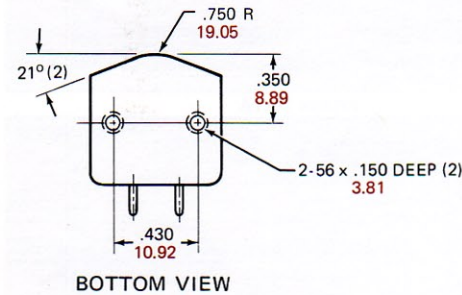
RECORD



PLAY



ERASE



NOTE: For Head Mounts see Page 23.

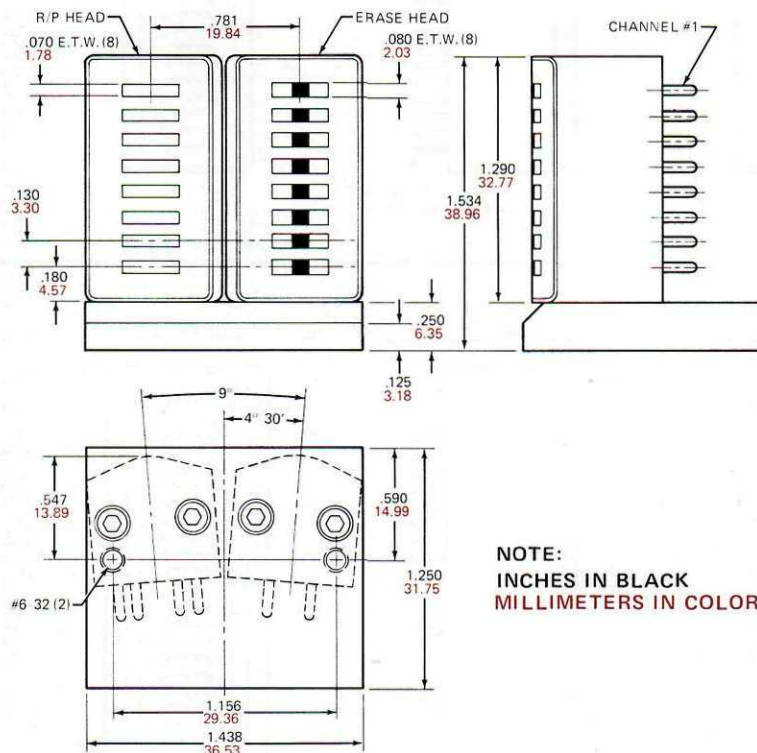
DESIGN DATA

NORTRONICS

AUDIO HEADS

STUDIO SERIES HEAD ASSEMBLIES

H802003 8 CHANNEL R/P & ERASE ASSEMBLY



- ASSEMBLIES OF AN ERASE HEAD AND DUAL COIL RECORD/PLAYBACK HEAD PRECISION MOUNTED ON A BASE PLATE
- RECORD/PLAYBACK HEAD HAS LOW IMPEDANCE RECORD WINDING AND SEPARATE HIGH IMPEDANCE PLAYBACK WINDING.

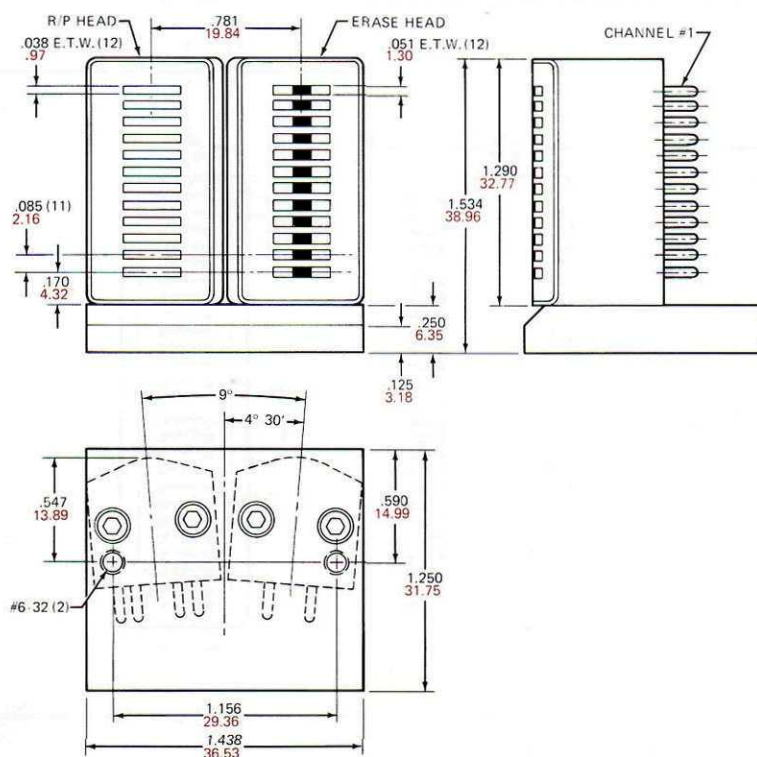
RECORD/PLAYBACK DATA

ELECTRICAL		MODEL H802003
Inductance @ 100 MV, 1 kHz, millihenrys	RECORD COIL	3.4
D.C. Resistance, ohms	RECORD COIL	35
100 kHz Impedance, ohms	RECORD COIL	2600
Inductance @ 100 MV, 1 kHz, millihenrys	PLAY COIL	50
D.C. Resistance, ohms	PLAY COIL	275
1 kHz Impedance, ohms	PLAY COIL	320
Transformer Crosstalk Play to Play, 1 kHz, dB		-50
Transformer Crosstalk Play to Play, 10 kHz, dB		-50
Gap Length, microinches		300
Track Width, inches		.070
Typical constant current record, unequalized playback characteristics on 3M 201 tape. Peak biased @ 1 kHz at a recorded level 12 dB below tape saturation @ 1 kHz		
Peak Bias Voltage, 100 kHz, volts	RMS	15 IPS
Bias Current for above, ma		8.0
Audio Record Current, ma		7.0
1 kHz Playback RE 1 kHz, MV		0.44
10 kHz Playback RE 1 kHz, dB	RMS	1.0
15 kHz Playback RE 10 kHz, dB		+9.0
		-2.0

ERASE DATA

ELECTRICAL		MODELS H802002 & H802003	
Inductance, 1 kHz @ 10 MV, millihenrys	RMS		170
D.C. Resistance, ohms			3.0
Impedance @ 60 kHz, ohms			70
Impedance @ 100 kHz, ohms			110
Track Width, inches			.080
Gap Length, inches			.003
Track Spacing, Center to Center, inches			.130
Typical characteristics for minimum of 70 dB erasure of a 400 Hz saturated signal on 3M 201 tape			
Eraser Voltage, volts	RMS	60 kHz, 7.5 IPS	100 kHz, 15 IPS
Eraser Current, ma		5.0	11.0
Saturation Voltage, volts		80	95
Saturation Current, ma		10.0	16
		160	160

H802004 12 CHANNEL R/P & ERASE ASSEMBLY, 1" TAPE



RECORD/PLAYBACK DATA

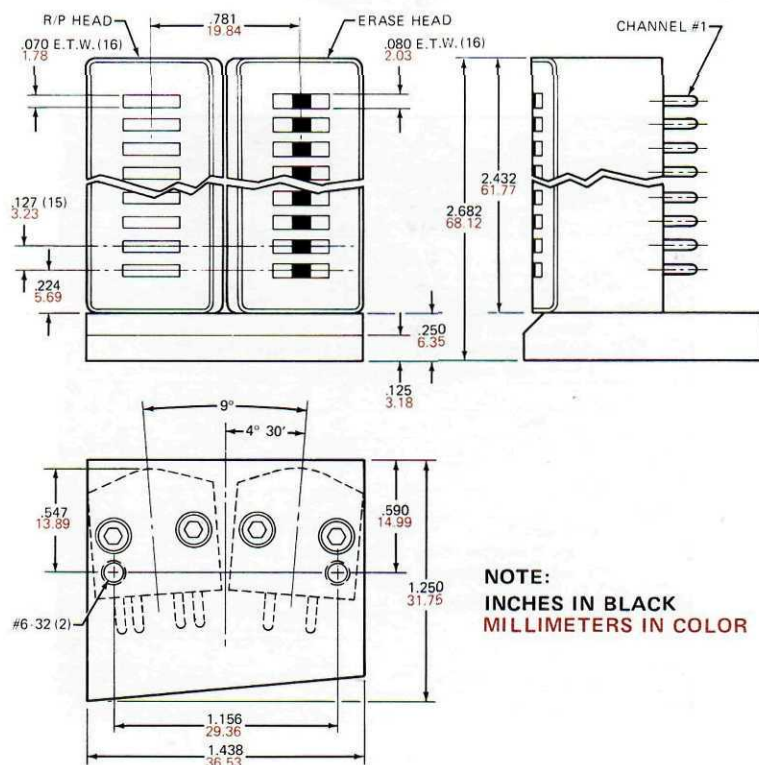
ELECTRICAL		MODEL H802004
Inductance @ 100 MV 1 kHz, millihenrys	RECORD COIL	3.5
D.C. Resistance, ohms	RECORD COIL	55
100 kHz Impedance, ohms	RECORD COIL	2600
Inductance @ 100 MV 1 kHz, millihenrys	PLAY COIL	50
D.C. Resistance, ohms	PLAY COIL	220
1 kHz Impedance, ohms	PLAY COIL	320
Transformer Crosstalk, dB	1 kHz	-50
Transformer Crosstalk, dB	10 kHz	-50
Gap Length, microinches		300
Track Width, inches		.038
Typical constant current record, unequalized playback characteristics on 3M 201 tape. Peak biased at 1 kHz at a recorded level 12 dB below tape saturation @ 1 kHz		
Peak Bias Voltage 100 kHz, volts	RMS	15 IPS
Bias Current for above, ma		7.5
Audio Record Current, ma		5.0
1 kHz Playback Output, MV		0.36
10 kHz Playback RE 1 kHz, dB	RMS	0.50
15 kHz Playback RE 10 kHz, dB		+9.0
		-2.0

ERASE DATA

ELECTRICAL		MODEL H802004
Inductance @ 25 MV 1 kHz, millihenrys		170
D.C. Resistance, ohms		4.5
Z @ 60 kHz, ohms		50
Gap Length, inches		.003
Track Width, inches		.048
Typical characteristics for 70 dB erasure of 400 Hz saturated signal on 3M 201 tape		
Eraser Voltage 60 kHz, volts	RMS	7.5 IPS
Eraser Voltage 100 kHz, volts	RMS	5.5
Eraser Current for above, ma		9.0
Head Saturation Voltage 60 kHz, volts	RMS	75
Saturation Current, ma		6.5
		100

STUDIO SERIES HEAD ASSEMBLIES

H802002 16 CHANNEL R/P & ERASE ASSEMBLY, 2" TAPE



NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

RECORD/PLAYBACK DATA

ELECTRICAL		MODEL H802003
Inductance @ 100 MV, 1 kHz, millihenrys	RECORD COIL	3.4
D.C. Resistance, ohms	RECORD COIL	35
100 kHz Impedance, ohms	RECORD COIL	2600
Inductance @ 100 MV, 1 kHz, millihenrys	PLAY COIL	50
D.C. Resistance, ohms	PLAY COIL	275
1 kHz Impedance, ohms	PLAY COIL	320
Transformer Crosstalk Play to Play, 1 kHz, dB		-50
Transformer Crosstalk Play to Play, 10 kHz, dB		-50
Gap Length, microinches		300
Track Width, inches		.070
Typical constant current record, unequalized playback characteristics on 3M 201 tape. Peak biased @ 1 kHz at a recorded level 12 dB below tape saturation @ 1 kHz		
Peak Bias Voltage, 100 kHz, volts	RMS	15 IPS
Bias Current for above, ma		8.0
Audio Record Current, ma		7.0
1 kHz Playback RE 1 kHz, MV	•RMS	0.44
10 kHz Playback RE 1 kHz, dB		1.0
15 kHz Playback RE 10 kHz, dB		+9.0
		-2.0

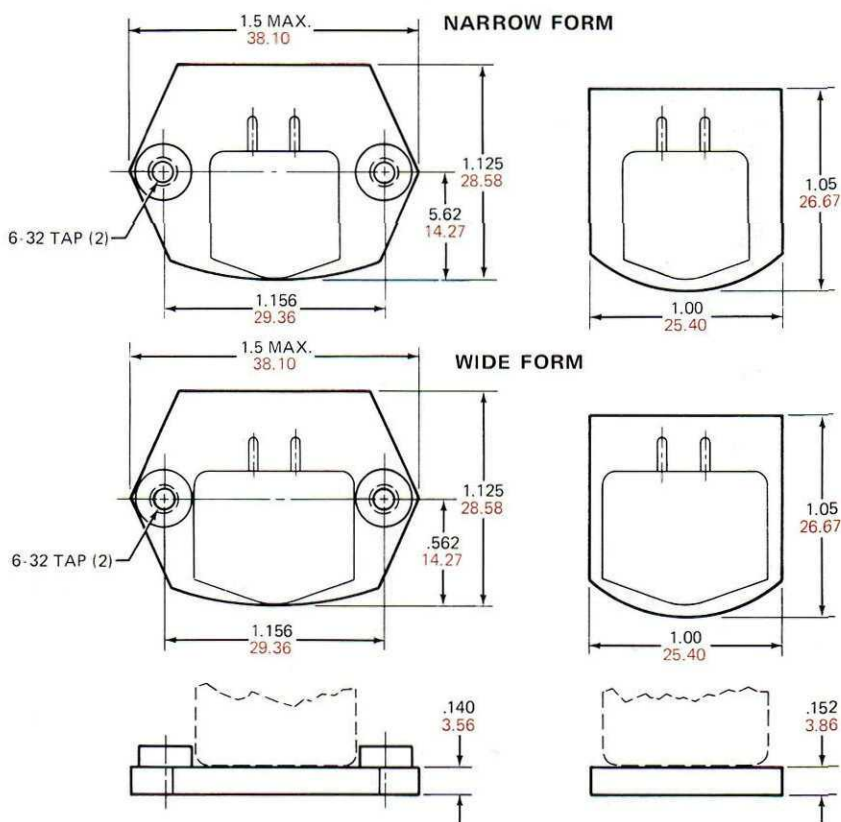
ERASE DATA

ELECTRICAL		MODELS H802002 & H802003	
Inductance, 1 kHz @ 10 MV, millihenrys	RMS	170	
D.C. Resistance, ohms		3.0	
Impedance @ 60 kHz, ohms		70	
Impedance @ 100 kHz, ohms		110	
Track Width, inches		.080	
Gap Length, inches		.003	
Track Spacing, Center to Center, inches		.130	
Typical characteristics for minimum of 70 dB erasure of a 400 Hz saturated signal on 3M 201 tape			
Erase Voltage, volts	RMS	60 kHz, 7.5 IPS	100 kHz, 15 IPS
Erase Current, ma		5.0	11.0
Saturation Voltage, volts		80	95
Saturation Current, ma		10.0	16
		160	160



STANDARD HEAD MOUNTS

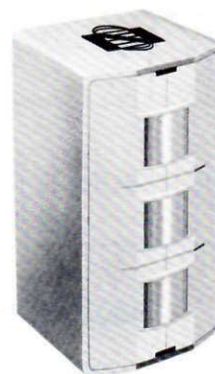
Studio Series Heads are supplied without mount, with drilled and tapped holes in base (illustrated on previous pages), or with Standard Mount shown at right. Special mounts are available. Contact us for custom requirements.



DESIGN DATA

NORTRONICS
AUDIO HEADS

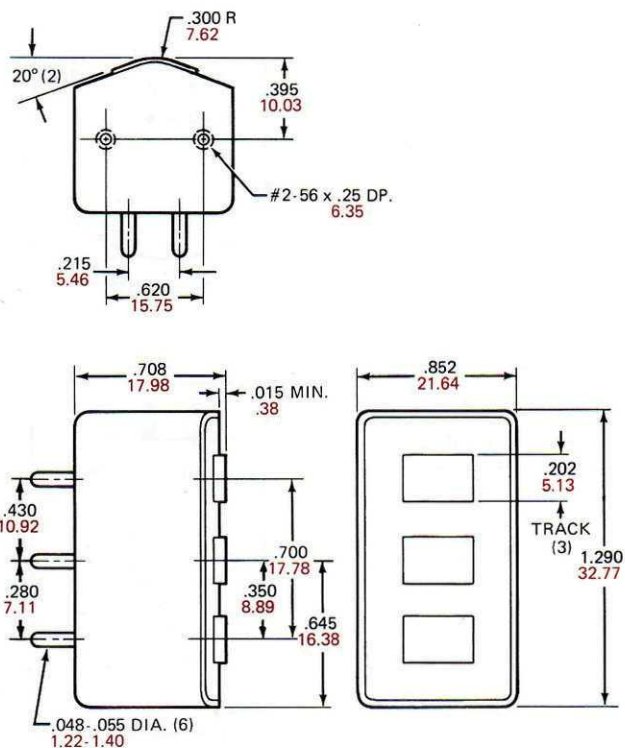
SMPTE COMPATIBLE HEADS 3 Channel, 35 mm Record Playback & Erase



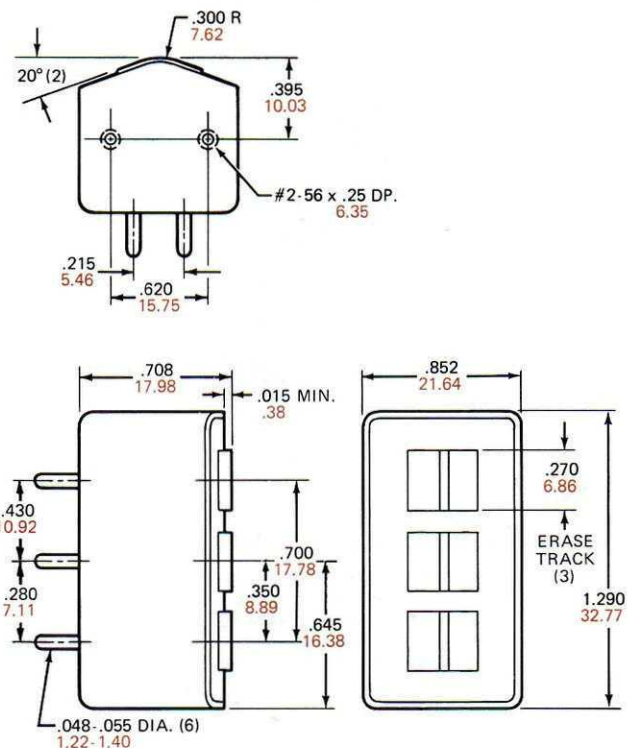
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

3 CHANNEL RECORD & PLAYBACK



3 CHANNEL ERASE



ELECTRICAL	MODEL NUMBER		
	MP3R	MP3P	MP3E
Head Function	Record	Playback	Erase
Inductance — 1 kHz - millihenrys	4.0	300	1.5
Impedance — 1 kHz - ohms	25	1900	—
Resistance, D.C., ohms	4.7	190	25
Gap Length, microinches	200	100	.003
Average 7.5 IPS constant current record/playback characteristics using 3M 150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 160 kHz, ma	12	—	50*
Bias Voltage, RMS, 160 kHz, volts	25	—	75*
Record Current, microamps	800	—	—
1 kHz Output, millivolts	—	3.7	—
10 kHz/1 kHz ratio, dB	—	+4	—
Average 4.0 IPS constant current record/playback characteristics using 3M 150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 160 kHz, ma	11	—	45*
Bias Voltage, RMS, 160 kHz, volts	22	—	70*
Record Current, microamps	700	—	—
1 kHz Output, millivolts	—	3.4	—
10 kHz/1 kHz ratio, dB	—	-4	—

*Typical erase characteristics for 70 dB erasure of a 400 Hz saturated signal on 3M 201 tape.

DESIGN DATA

NORTRONICS
AUDIO HEADS

H806036 & H805004 Full Width Erase Heads for 1" Tape Full Ferrite Core Structure



H806036

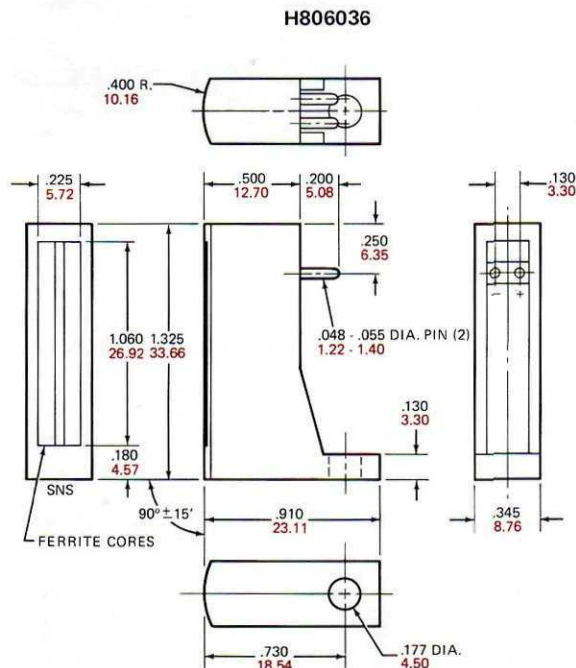


H805004

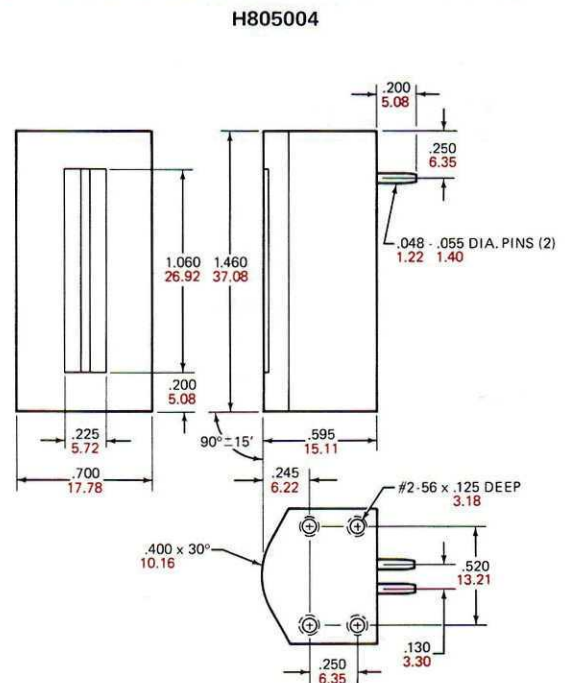
ELECTRICAL	
Inductance - 1 kHz, 50 millivolts	1.0 MHY
Resistance, D.C., ohms	8.0
Impedance - 60 kHz, ohms	400
Gap Length - Inches	.003
Track Width - Inches	1.06
Typical characteristics for 70 dB erasure of a 400 Hz saturated signal on 3M 951 tape	
Tape Speed - IPS	7.5
Erase Voltage @ 60 kHz, volts	60
Erase Current, 60 kHz, ma	150
Head Saturation, 60 kHz, volts	90
Head Saturation, 60 kHz, ma	220

PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR



BASIC HEAD CONFIGURATION – NO MOUNT



PR-B1F Full Track R/P

0.240" SINGLE CHANNEL
PROFESSIONAL SERIES



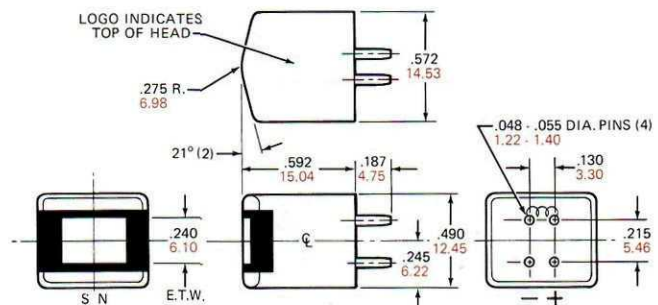
PR-B1F – PROFESSIONAL SERIES

ELECTRICAL	MODEL NUMBER								
	PR-B1F 14R	PR-B1F 11R	PR-B1F 5N	PR-B1F 8R	PR-B1F 4R	PR-B1F 9K	PR-B1F 6N	PR-B1F 7K	PR-B1F 2K
Head Function (Typical)	Record Only	Record Only	Record/ Playback	Record Only	Record Only	Playback	Record/ Playback	Playback	Playback
Inductance - 1 kHz - millihenrys	2	4	5.5	10	50	10	200	400	650
Impedance - 1 kHz - ohms	13	27	32	65	320	70	1,300	2,500	4,200
Resistance, D.C., ohms	2.4	3.35	5	10	60	15	85	195	395
Gap Length, microinches	500	500	200	500	500	100	200	100	100
Average 15.0 IPS constant current record/playback characteristics using 3M 201 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation.									
Peak Bias Current, 100 kHz, ma	14	9.3	12	4.8	.98	—	3.6	—	—
Bias Voltage, RMS, 100 kHz, volts	13	27	22	23	45	—	125	—	—
Record Current, microamps	920	565	700	360	160	—	110	—	—
1 kHz Output, millivolts	—	—	.7	—	—	.58	3.3	3.7	4.3
10 kHz/1 kHz Ratio, dB	—	—	+10	—	—	+9	+10	+10	+10
Average 7.5 IPS constant current record/playback characteristics using 3M 201 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation.									
Peak Bias Current, 100 kHz, ma	12	9	11	4.6	.93	—	3.3	—	—
Bias Voltage, RMS, 100 kHz, volts	11	25	20	22	43	—	120	—	—
Record Current, microamps	900	540	640	350	150	—	100	—	—
1 kHz Output, millivolts	—	—	.5	—	—	.55	3.0	3.5	4.0
10 kHz/1 kHz Ratio, dB	—	—	+3	—	—	+2	+1	+3	+3

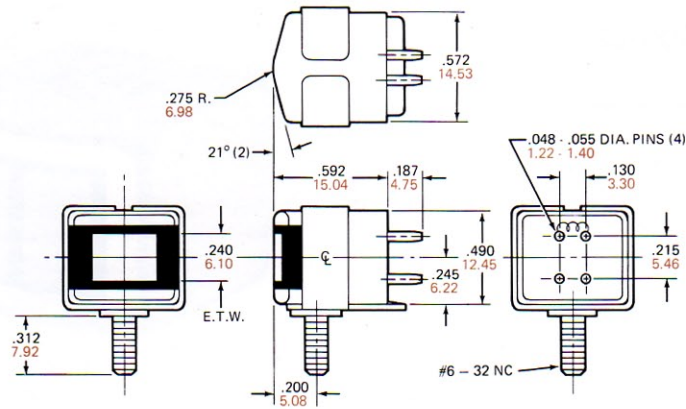
PHYSICAL CONFIGURATION

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

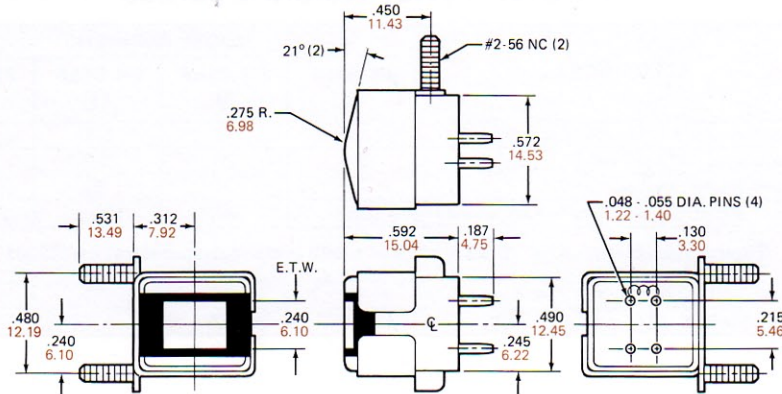
BASIC HEAD CONFIGURATION – NO MOUNT



HEAD WITH BASE MOUNT CONFIGURATION

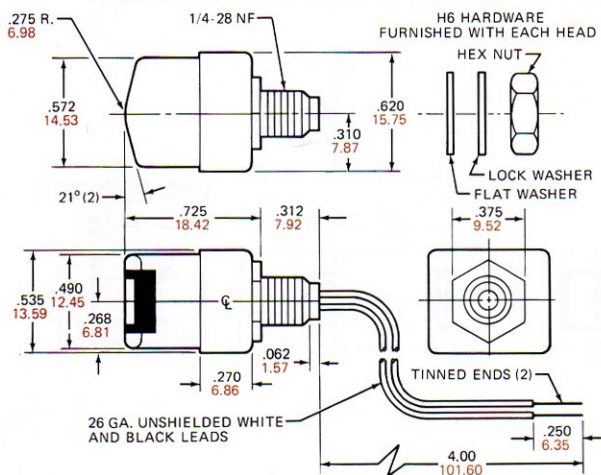


HEAD WITH SIDE MOUNT CONFIGURATION

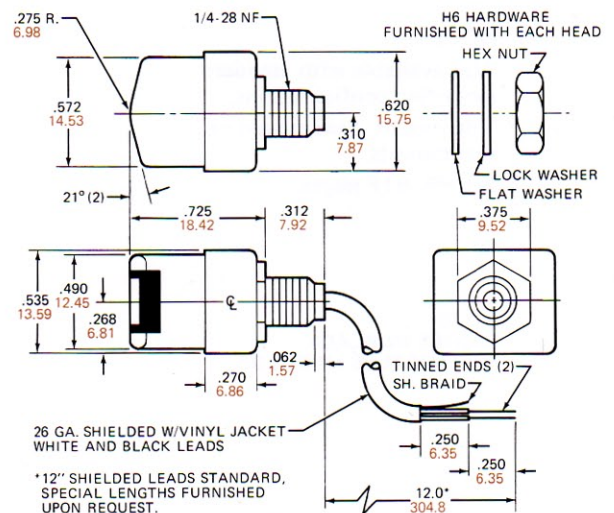


HEAD WITH REAR MOUNT CONFIGURATION

UNSHIELDED LEADS



SHIELDED LEADS





ELECTRICAL	MODEL NUMBER			
	PR-B1EF 4	PR-B1EF 9	PR-B1EF 15	PR-B1EF 17
Inductance - 1 kHz - millihenrys	1.0	1.7	.500	.120
Resistance, D.C., ohms	6.6	26	3.0	0.7
Track Width, Inches	.26	.26	.26	.26
Gap Length, Double Gap (each), Inches	.003	.003	.003	.003
Typical characteristics for 70 dB erasure of a 400 cycle saturated signal on 3M201 tape				
Erase Voltage @ 100 kHz, volts	55	70	40	17
Erase Current, ma	88	66	125	290

NOTE:
Also available with standard
mounting configurations.
Side mount, base mount or
rear mounts.
See PR-B1F pages.

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

MEF Full Track Erase



NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

NOTE:
Basic head available in "B"
size case also, see page 40

Technical drawing of a 1/2" x 1/2" x 1/8" 303 stainless steel plate. The drawing includes three views: a top view, a front view, and a side view. Dimensions are provided in inches and millimeters. Key features include a .218 R fillet, .048-.055 DIA. PIN (2), and a #6-32 THD thread.

Dimensions (inches / millimeters):

- Top View: .290 / 7.37, .260 / 6.60, .218 R, .505 / 12.83, .172 / 4.37, .048-.055 DIA. PIN (2), 1.22-1.40
- Front View: .280 / 7.11, .344 / 8.74, .200 / 5.08, #6-32 THD
- Side View: .560 / 14.22, .219 / 5.56

[illegible]

The drawings show the following dimensions:

- Top View:** Overall width .290 (7.37 mm), overall height .260 (6.60 mm), and a central slot width of .120 (3.05 mm).
- Side View:** Overall length .505 (12.83 mm), pin length .172 (4.37 mm), and a base width of .280 (7.11 mm).
- Detail View:** A rounded pin with a radius of .218 R (5.54 mm) and a diameter of .048 - .055 DIA. PIN (2) with a length of 1.22 - 1.40 mm.
- Bottom View:** Shows a 4-pin configuration with a total width of .560 (14.22 mm) and individual pin spacing of .219 (5.56 mm).

Technical drawing of the H-5 mounting hardware, showing top, side, and detail views with dimensions in inches and millimeters.

Top View:

- Overall width: .595 (15.11)
- Overall height: .260 (6.60)
- Inner width: .320 (8.13)

Side View:

- Head diameter: .218 R (5.54)
- Head height: .290 (7.40)
- Thread: 1/4-28 NF
- Thread length: .700 (17.78)
- Thread start to end of leads: .270 (6.86)
- Thread to end of leads: .375 (9.52)
- Thread to end of leads (alternative): .062 (1.57)
- Thread to end of leads (alternative): .438 (11.13)
- Thread to end of leads (alternative): .725 (18.42)
- Thread to end of leads (alternative): .560 (14.22)
- Thread to end of leads (alternative): .280 (7.11)

Detail View:

- Lead length: 4.00 (101.6)
- Lead material: WHITE/BLACK LEADS
- Tinned ends: (4) .250 (6.35)
- Lockwasher and Hex Nut assembly shown.

Labels:

- TOP
- REMOVABLE SPACER WASHER
- LOCKWASHER
- HEX NUT

Notes:

- H-5 MOUNTING HARDWARE FURNISHED WITH EACH HEAD

28 GA. SHIELDED WHITE/BLACK LEADS

SHIELDED BRAID

1/4-28 NF

.290
7.40

.218 R.
5.54

.700
17.78

.270
6.86

.375
9.52

.062
1.57

.750
19.05

12.0"
304.8

TINNED ENDS (4)

.250
6.35

.250
6.35

VINYL JACKET

LOCKWASHER

HEX NUT

*12" LEAD LENGTH STANDARD, SPECIAL LENGTHS FURNISHED UPON REQUEST.

REMOVABLE SPACER WASHER

H-5 MOUNTING HARDWARE FURNISHED WITH EACH HEAD

.560
14.22

.280
7.11

.438
11.13

.725
18.42

PR-B2H Half Track Stereo R/P

0.080" TWO CHANNEL
PROFESSIONAL SERIES



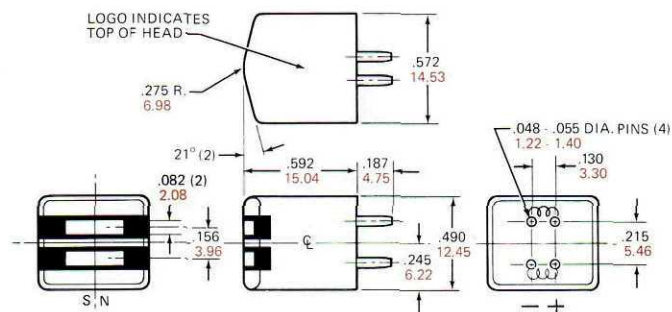
PR-B2H – PROFESSIONAL SERIES

ELECTRICAL	MODEL NUMBERS							
	PR-B2H 14R	PR-B2H 11R	PR-B2H 8R	PR-B2H 4R	PR-B2H 8K	PR-B2H 4K	PR-B2H 7K	PR-B2H 12K
Head Function (Typical)	Record Only	Record Only	Record Only	Record Only	Playback	Record/ Playback	Record/ Playback	Playback
Inductance - 1 kHz - millihenrys	2.0	4.5	10	50	20	100	400	650
Impedance - 1 kHz - ohms	18	33	68	330	130	640	2,500	4,200
Resistance, D.C., Stereo, ohms	10	15	24	95	22	100	300	400
Gap Length, microinches	500	500	500	500	100	100	100	100
1 kHz Crosstalk Rejection, dB	60	60	60	60	60	60	60	60
Average 15 IPS constant current record/playback characteristics using 3M201 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation								
Peak Bias Current, 100 kHz, ma	7.9	6.0	3.4	.67	3.5	—	1.4	—
Bias Voltage, RMS, 100 kHz, volts	7.0	19	16	32	20	—	90	—
Record Current, microamps	540	370	200	84	170	—	60	—
1 kHz Output, millivolts	—	—	—	—	.54	—	2.1	2.9
10 kHz/1 kHz ratio, dB	—	—	—	—	+10	—	+10	+10
Average 7.5 IPS constant current record/playback characteristics using 3M201 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation								
Peak Bias Current, 100 kHz, ma	7.5	5.8	3.3	.65	3.0	1.0	1.25	—
Bias Voltage, RMS, 100 kHz, volts	6.0	18	14	30	15	38	80	—
Record Current, microamps	510	360	190	82	160	105	55	—
1 kHz Output, millivolts	—	—	—	—	.48	1.1	2.0	2.5
10 kHz/1 kHz Ratio, dB	—	—	—	—	+3	+3	+3	+3

PHYSICAL CONFIGURATION

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT



Technical drawing of the 1000 Series connector showing three views: top, side, and front. Dimensions are provided in inches and millimeters.

Top View Dimensions:

- Overall width: .572 (14.53)
- Pin diameter: .275 R. (6.98)
- Pin spacing: .187 (4.75)
- Pin length: .592 (15.04)
- Pin diameter: .130 (3.30)
- Pin diameter: .048 - .055 DIA. PINS (4)
- Pin diameter: 1.22 - 1.40
- Pin diameter: .215 (5.46)
- Pin diameter: .156 (3.96)
- Pin diameter: .082 (2) (2.08)
- Pin diameter: .312 (7.92)
- Pin diameter: .200 (5.08)

Side View Dimensions:

- Overall height: .490 (12.45)
- Pin diameter: .245 (6.22)
- Pin diameter: .187 (4.75)
- Pin diameter: .130 (3.30)
- Pin diameter: .048 - .055 DIA. PINS (4)
- Pin diameter: 1.22 - 1.40
- Pin diameter: .215 (5.46)
- Pin diameter: .156 (3.96)
- Pin diameter: .082 (2) (2.08)
- Pin diameter: .312 (7.92)
- Pin diameter: .200 (5.08)

Front View Dimensions:

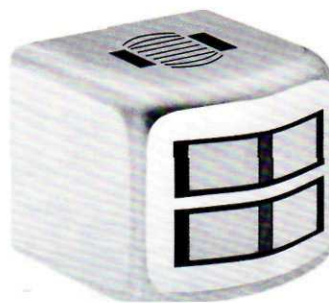
- Overall width: .572 (14.53)
- Pin diameter: .275 R. (6.98)
- Pin spacing: .187 (4.75)
- Pin length: .592 (15.04)
- Pin diameter: .130 (3.30)
- Pin diameter: .048 - .055 DIA. PINS (4)
- Pin diameter: 1.22 - 1.40
- Pin diameter: .215 (5.46)
- Pin diameter: .156 (3.96)
- Pin diameter: .082 (2) (2.08)
- Pin diameter: .312 (7.92)
- Pin diameter: .200 (5.08)

Other Features:

- LOGO INDICATES TOP OF HEAD
- 21° (2)
- #6-32 NC

[illegible]

0.100" TWO CHANNEL PROFESSIONAL SERIES



ELECTRICAL	MODEL NUMBER				
	PR-B2EH 4	PR-B2EH 5	PR-B2EH 14	PR-B2EH 15	PR-B2EH 16
Inductance - 1 kHz - millihenrys	.50	.20	.200	.500	.010
Resistance, D.C., ohms	35	25	4.0	6.5	0.2
Track Width (Inches)	.100	.100	.100	.100	.100
Gap Length, Double Gap (each), Inches	.003	.003	.003	.003	.003
Typical characteristics for 70 dB erasure of a 400 cycle saturated signal on 3M201 tape					
Erase Voltage @ 100 kHz, volts	70	46	14	24	5
Erase Current, ma	25	42	130	85	600

NOTE:

**Also available with standard mounting configurations:
Side mount, base mount or rear mounts.
See PR-B2H pages.**

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

WP-B2H Half Track Stereo R/P

0.080" TWO CHANNEL
PROFESSIONAL SERIES



WP-B2H – PROFESSIONAL SERIES

ELECTRICAL	MODEL NUMBER				
	WP-B2H 9K	WP-B2H 8K	WP-B2H 6K	WP-B2H 7K	WP-B2H 7F
Head Function (Typical)	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Playback Only
Inductance - 1 kHz - millihenrys	10	20	200	400	400
Impedance - 1 kHz - ohms	75	110	1,300	2,500	2,500
Resistance, D.C. Stereo, ohms	20	28	190	350	310
Gap Length, microinches	100	100	100	100	50
1 kHz Crosstalk Rejection, dB	50	50	50	50	50
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	2.5	1.9	.54	.38	—
Bias Voltage, RMS, 60 kHz, volts	7.0	10	35	45	—
Record Current, microamps	195	145	45	30	—
1 kHz Output, millivolts	.37	.64	1.4	2.0	2.0
10 kHz/1 kHz Ratio, dB	+1	+1	+1	+1	+5
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	2.3	1.7	.48	.33	—
Bias Voltage, RMS, 60 kHz, volts	6.0	8	30	40	—
Record Current, microamps	190	130	42	28	—
1 kHz Output, millivolts	.32	.5	1.3	1.9	1.7
10 kHz/1 kHz Ratio, dB	-9	-9	-9	-9	-8

PHYSICAL CONFIGURATION

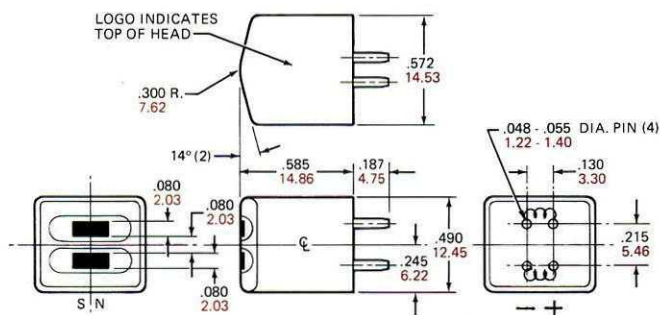
BASIC HEAD CONFIGURATION – NO MOUNT

NOTE:

Head shown no mount,
However all standard "B"
case mounts are available

NOTE:

INCHES IN BLACK
MILLIMETERS IN COLOR



DESIGN DATA

NORTRONICS
AUDIO HEADS

B2H & P-B2H Half Track Stereo R/P

.080" TWO CHANNEL



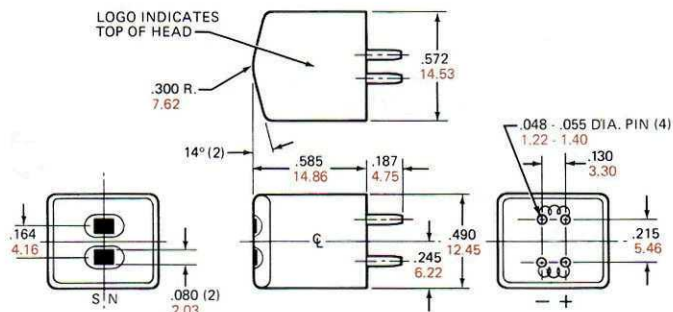
B2H – STANDARD SERIES

ELECTRICAL	MODEL NUMBER				
	B2H 8R	B2H 4K	B2H 6K	B2H 7K	B2H 2K
Head Function (Typical)	Record Only	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	10	100	200	400	800
Impedance - 1 kHz - ohms	75	650	1,300	2,650	5,000
Resistance, D.C. Stereo, ohms	28	130	245	410	720
Gap Length, microinches	500	100	100	100	100
1 kHz Crosstalk Rejection, dB	50	50	50	50	50
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	2.2	1.2	0.8	0.53	0.4
Bias Voltage, RMS, 60 kHz, volts	4.9	23	30	42	65
Record Current, microamps	135	65	60	32	25
1 kHz Output, millivolts	—	1.1	1.7	2.1	3.4
10 kHz/1 kHz Ratio, dB	—	-1	-1	-1	-1
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	2.0	1.1	0.7	0.44	0.3
Bias Voltage, RMS, 60 kHz, volts	4.5	18	25	36	45
Record Current, microamps	126	60	44	30	22
1 kHz Output, millivolts	—	0.9	1.1	1.9	2.2
10 kHz/1 kHz Ratio, dB	—	-11	-11	-11	-11

PHYSICAL CONFIGURATION

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

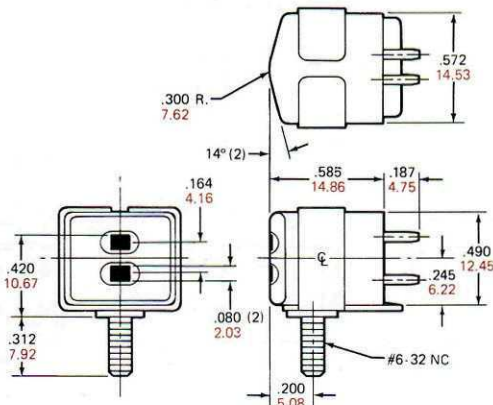
BASIC HEAD CONFIGURATION – NO MOUNT SPECIFY: NO



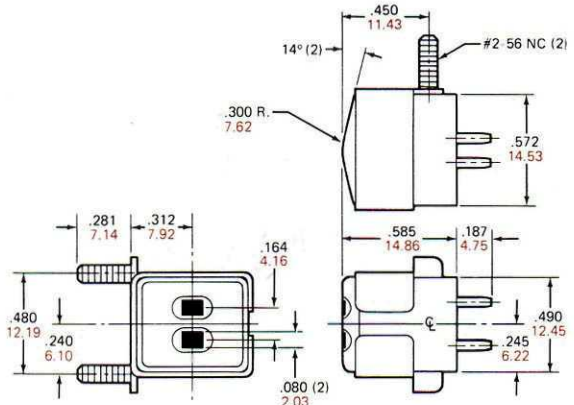
P-B2H – PREMIUM SERIES

ELECTRICAL	MODEL NUMBER								
	P-B2H 11R	P-B2H 8K	P-B2H 8R	P-B2H 4K	P-B2H 4R	P-B2H 6K	P-B2H 7K	P-B2H 7F	P-B2H 2K
Head Function (Typical)	Record Only	Record/ Playback	Record Only	Record/ Playback	Record Only	Record/ Playback	Record/ Playback	Playback Only	Playback Only
Inductance - 1 kHz - millihenrys	1.5	20	10	100	50	200	400	400	800
Impedance - 1 kHz - ohms	15	150	75	650	330	1,300	2,550	2,500	5,000
Resistance, D.C. Stereo, ohms	4	28	28	120	115	210	410	410	720
Gap Length, microinches	500	100	500	100	500	100	100	50	100
1 kHz Crosstalk Rejection, dB	50	50	50	50	50	50	50	50	50
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation									
Peak Bias Current, 60 kHz, ma	5	1.8	1.9	.65	.72	.40	.22	.25	.25
Bias Voltage, RMS, 60 kHz, volts	2	7	5	17	11.5	30	36	.35	56
Record Current, microamps	370	180	170	58	68	45	30	31	21
1 kHz Output, millivolts	—	0.5	—	1.5	—	1.8	2.4	2.5	3.6
10 kHz/1 kHz Ratio, dB	—	0	—	+1	—	+1	+1	+2	+3
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation									
Peak Bias Current, 60 kHz, ma	4	1.5	1.7	.55	.68	.30	.20	.22	.23
Bias Voltage, RMS, 60 kHz, volts	1.8	6	4.5	14	10.5	25	32	42	49
Record Current, microamps	300	150	160	51	65	40	28	30	20
1 kHz Output, millivolts	—	0.4	—	1.2	—	1.2	2.1	2	2.4
10 kHz/1 kHz Ratio, dB	—	-8	—	-9	—	-9	-9	-7	-5

BASE MOUNT CONFIGURATION SPECIFY: B

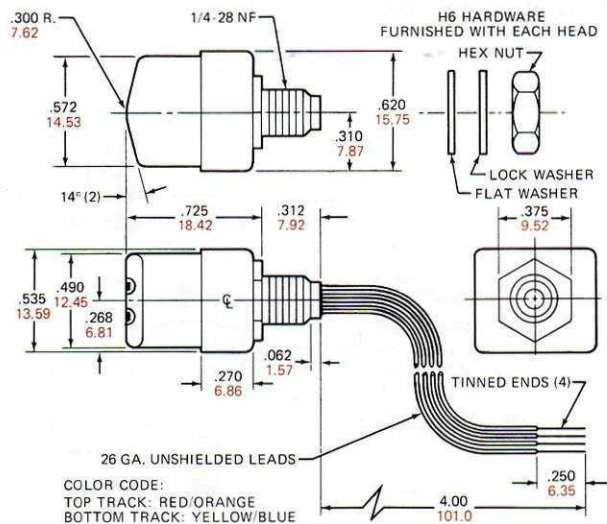


SIDE MOUNT CONFIGURATION SPECIFY: S



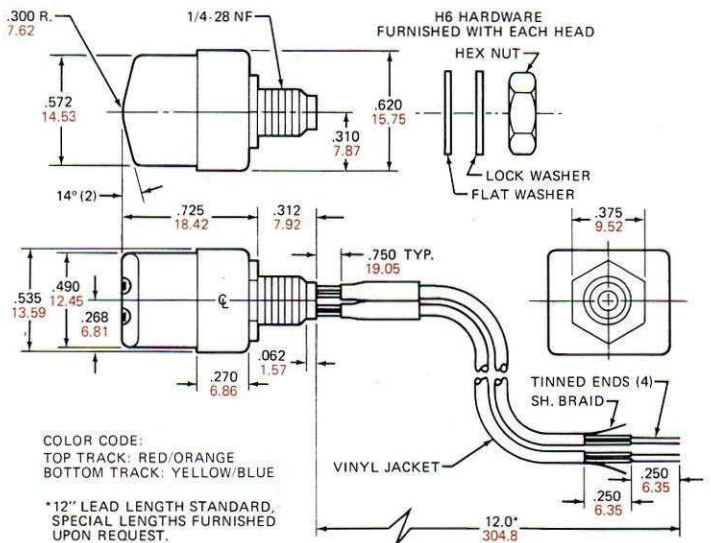
REAR MOUNT CONFIGURATION

SPECIFY: R-4U



UNSHIELDED LEADS

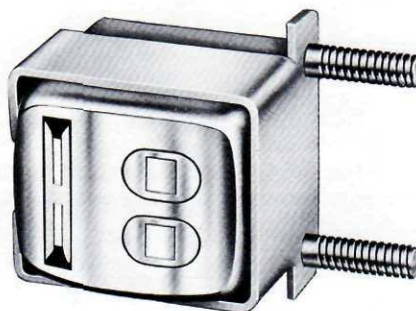
SPECIFY: R-12S



SHIELDED LEADS

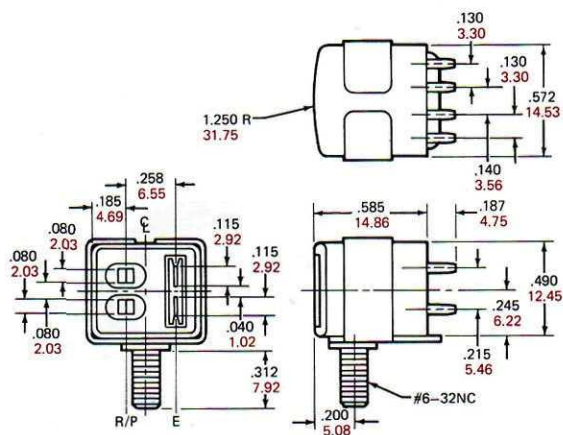
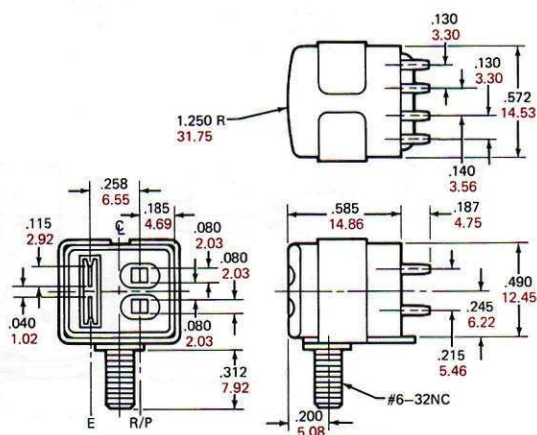
AUDIO HEADS

0.080" TWO CHANNEL



NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

SPECIFY: BR



ZJ2H & X-ZJ2H Half Track Stereo Z COMBO® Erase and R/P 0.080" TWO CHANNEL



ELECTRICAL (R/P SECTION)	MODEL NUMBERS		
	ZJ2H 44R	X-ZJ2H 46K	X-ZJ2H 356L
Head Function	Record Only	Record/Playback	Record/Playback
Inductance - 1 kHz - millihenrys	50	260	350
Resistance, D.C., ohms	100	240	350
Impedance - 1 kHz, ohms	300	1,700	3,000
Gap Length, microinches	500	100	160
ELECTRICAL (ERASE SECTION)			
Inductance - 1 kHz, millihenrys	0.8	0.9	2
Resistance, D.C., ohms	8	8	12
Average 3.75 IPS constant current record/playback characteristics using 3M 150 tape biased @ 1 kHz and recorded 12 dB below tape saturation, with R/P shunt capacitor of 200 pf. See "Z" combo application notes.			
Erase Bias Current, 60 kHz, ma	40	40	25*
Erase Bias Voltage, RMS, 60 kHz, volts	11	11	13*
Record Current, microamps	60	40	25*
1 kHz Output, millivolts	—	1.5	1.1*
10 kHz/1 kHz Ratio, dB	—	-11	-11*†

* 1.875 IPS Data

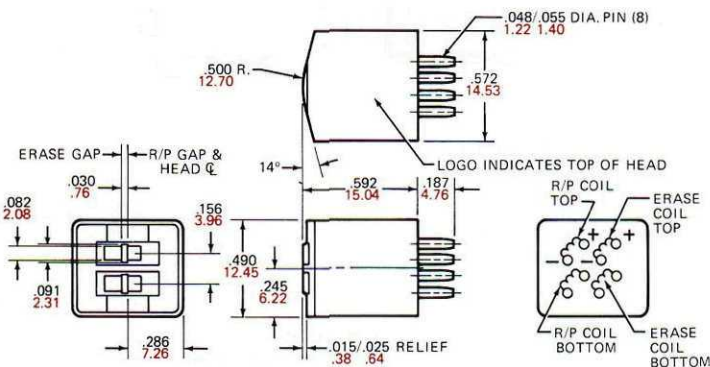
† 5 kHz/1 kHz Ratio, dB

PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

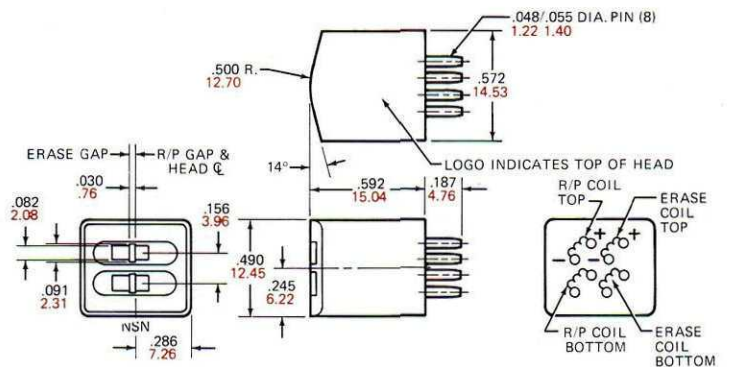
BASIC HEAD CONFIGURATION – NO MOUNT

X-ZJ2H



BASIC HEAD CONFIGURATION – NO MOUNT

Z-J2H



SEH Half Track Stereo Erase



PHYSICAL CONFIGURATIONS

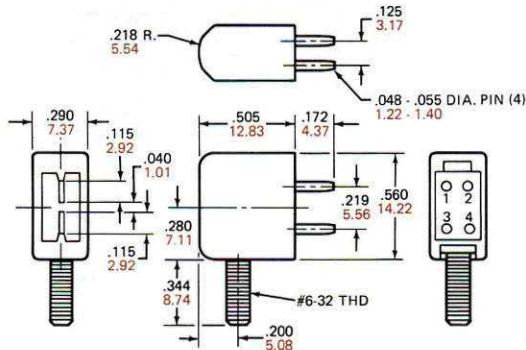
NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

ELECTRICAL	MODEL NUMBER		
	SEH 1	SEH 2	SEH 4
Inductance - 1 kHz - millihenrys	50	0.2	10
Resistance, D.C., ohms	130	1.8	27
Track Width, inches	.110	.110	.110
Gap Length, Double Gap, each	.003	.003	.003
Typical characteristics for 60 dB erasure of a 400 Hz saturated signal on 3M150 tape			
Erase Voltage - 60 kHz, volts	120	6	40
Erase Current, ma	10	120	20
Impedance - 60 kHz, ohms	12,000	55	2,500

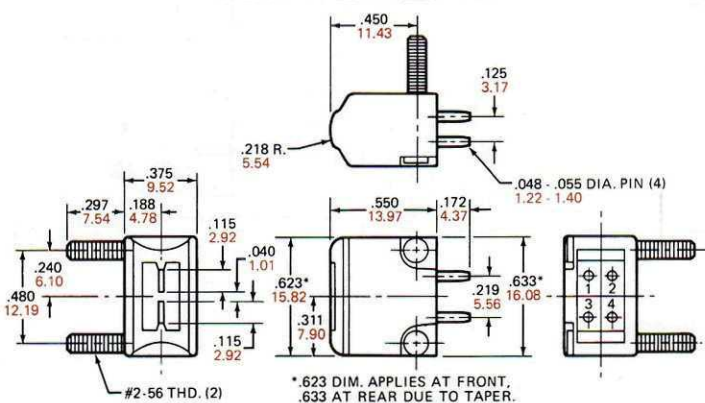
NOTE:

Head also available in "B" size case also, see page 40

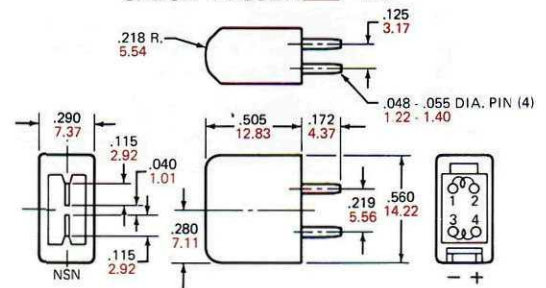
HEAD WITH BASE MOUNT CONFIGURATION SPECIFY: SSEH___-B3



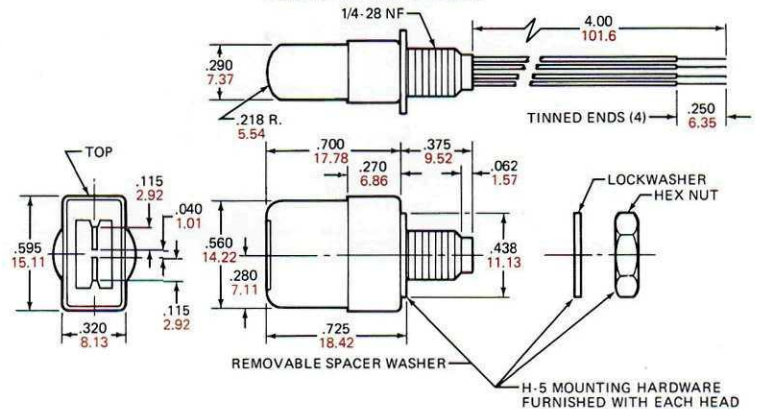
HEAD WITH SIDE MOUNT CONFIGURATION SPECIFY: LSEH___-S23



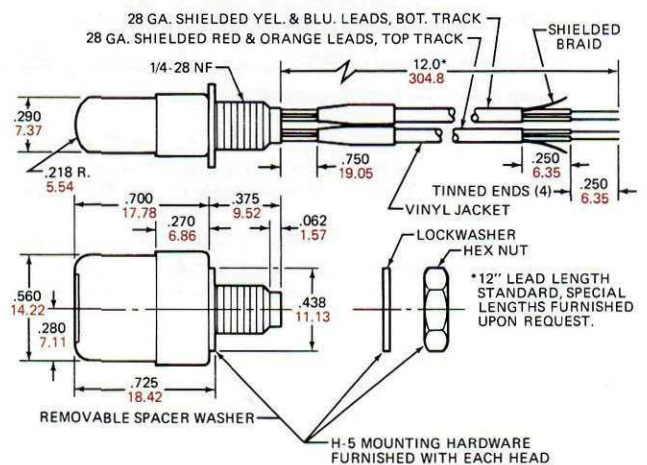
BASIC HEAD CONFIGURATION - NO MOUNT SPECIFY: SSEH___-N9



HEAD WITH REAR MOUNT CONFIGURATION SPECIFY: SSEH___-R-4U UNSHIELDED LEADS



HEAD WITH REAR MOUNT CONFIGURATION SPECIFY: SSEH___-R-12S SHIELDED LEADS



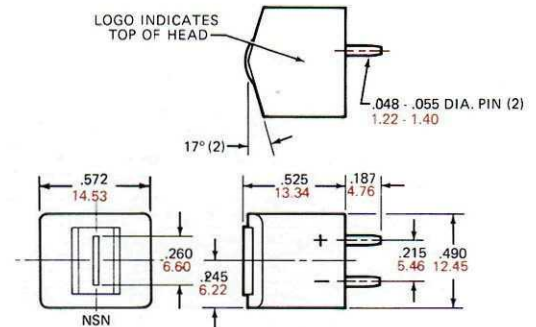
DESIGN DATA

NORTRONICS
AUDIO HEADS

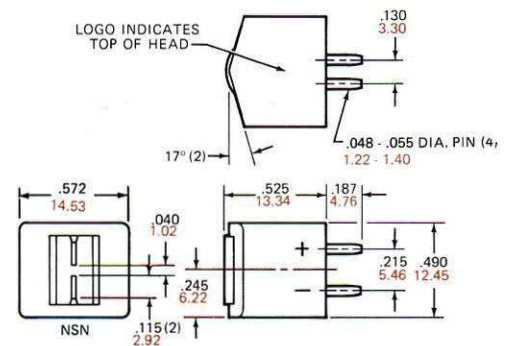
B1EF, B2EH, B2EQ "B" Case Erase Fulltrack, 2 Track Stereo, 4 Track Stereo



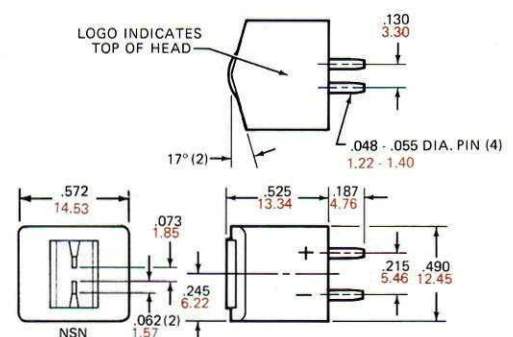
ELECTRICAL	MODEL NUMBER			
	B1EF 1	B1EF 2	B1EF 4	B1EF 9
Inductance - 1 kHz - millihenrys	40	.085	4	2.5
Resistance, D.C., ohms	88	1.3	20	17
Track Width, inches	.260	.260	.260	.260
Gap Length, Double Gap, each	.003	.003	.003	.003
Typical characteristics for 60 dB erasure of a 400 Hz saturated signal on 3M150 tape				
Erase Voltage - 60 kHz, volts	120	7	29	25
Erase Current, ma	12	300	36	40
Impedance - 60 kHz, ohms	12,000	17	810	600



ELECTRICAL	MODEL NUMBER		
	B2EH 1	B2EH 2	B2EH 4
Inductance - 1 kHz - millihenrys	50	0.2	10
Resistance, D.C., ohms	130	1.8	27
Track Width, inches	.110	.110	.110
Gap Length, Double Gap, each	.003	.003	.003
Typical characteristics for 60 dB erasure of a 400 Hz saturated signal on 3M150 tape			
Erase Voltage - 60 kHz, volts	80	4.0	36
Erase Current, ma	6	75	17
Impedance - 60 kHz, ohms	12,000	55	2,500



ELECTRICAL	MODEL NUMBER		
	B2EQ 1	B2EQ 2	B2EQ 4
Inductance - 1 kHz - millihenrys	80	0.13	10
Resistance, D.C., ohms	240	1.8	31
Track Width, inches	.062	.062	.062
Gap Length, Double Gap, each	.004	.004	.004
Typical characteristics for 60 dB erasure of a 400 Hz saturated signal on 3M150 tape			
Erase Voltage - 60 kHz, volts	120	5	25
Erase Current, ma	5	120	8
Impedance - 60 kHz, ohms	30,000	40	3,250



NOTE:
While heads are only shown as no mount,
all standard "B" case mountings are available

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR



WP-B1HY Half Track Mono R/P 0.080" SINGLE CHANNEL PROFESSIONAL SERIES

WP-B1HY – PROFESSIONAL SERIES

ELECTRICAL	MODEL NUMBER				
	WP-B1HY 9K	WP-B1HY 8K	WP-B1HY 6K	WP-B1HY 7K	WP-B1HY 2K
Head Function (Typical)	Duplicating Rec/Playback	Duplicating Rec/Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	12	20	200	400	800
Impedance - 1 kHz - ohms	75	110	1300	2500	5000
Resistance, D.C. Mono, ohms	20	28	95	138	325
Gap Length, microinches	100	100	100	100	100
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	2.5	1.9	.54	.38	.34
Bias Voltage, RMS, 60 kHz, volts	7	10	35	45	66
Record Current, microamps	195	145	45	30	28
1 kHz Output, millivolts	.37	.64	1.4	2.0	2.5
10 kHz/1 kHz Ratio, dB	+1	+1	+1	+1	+2
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	2.3	1.7	.48	.33	.30
Bias Voltage, RMS, 60 kHz, volts	6	8	30	40	58
Record Current, microamps	190	130	42	28	25
1 kHz Output, millivolts	.32	.5	1.3	1.9	2.2
10 kHz/1 kHz Ratio, dB	-9	-9	-9	-9	-8

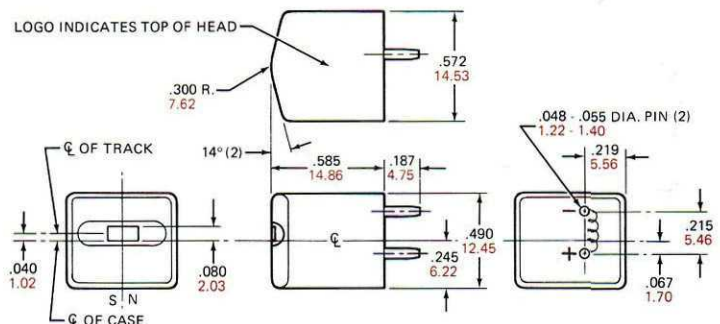
PHYSICAL CONFIGURATION

NOTES:

Head shown no mount,
however all standard "B"
case mounts are available

INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT



G1H & P-G1H Half Track Mono R/P 0.080" SINGLE CHANNEL



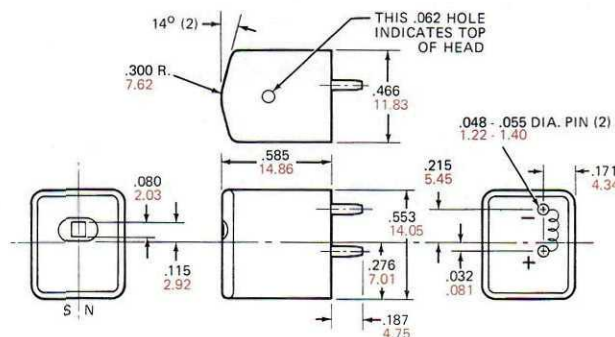
G1H – STANDARD SERIES

ELECTRICAL	MODEL NUMBER			
	G1H 4K	G1H 4R	G1H 7K	G1H 2K
Head Function	Record/ Playback	Record Only	Record/ Playback	Record/ Playback
Inductance — 1 kHz - millihenrys	100	50	400	800
Impedance — 1 kHz - ohms	650	340	2650	5000
Resistance, D.C., Mono, ohms	70	70	160	400
Gap Length, microinches	100	500	100	100
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	1.2	0.9	0.53	0.4
Bias Voltage, RMS, 60 kHz, volts	23	11	42	65
Record Current, microamps	65	63	32	25
1 kHz Output, millivolts	1.1	—	2.1	3.4
10 kHz/1 kHz ratio, dB	-1.0	—	-1.0	-1.0
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	1.1	0.85	0.44	0.3
Bias Voltage, RMS, 60 kHz, volts	18	10	36	45
Record Current, microamps	60	60	30	22
1 kHz Output, millivolts	0.9	—	1.9	2.2
10 kHz/1 kHz ratio, dB	-11	—	-11	-11

BASIC HEAD CONFIGURATION – NO MOUNT

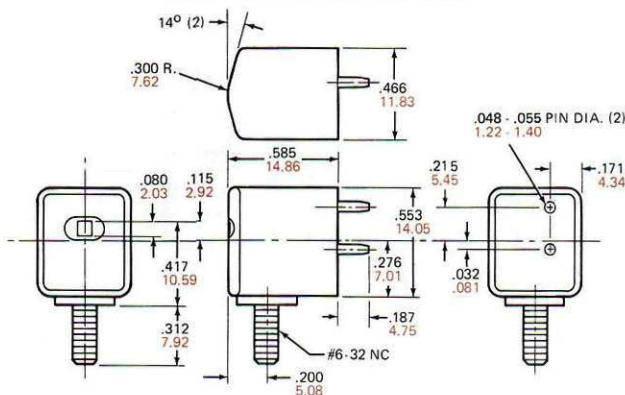
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

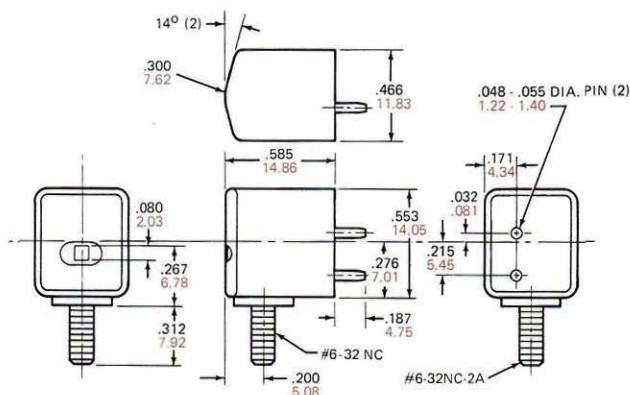


HEAD WITH BASE MOUNT CONFIGURATION

SPECIFY: -B3U
TRACK ABOVE CENTER LINE



SPECIFY: -B3D
TRACK BELOW CENTER LINE

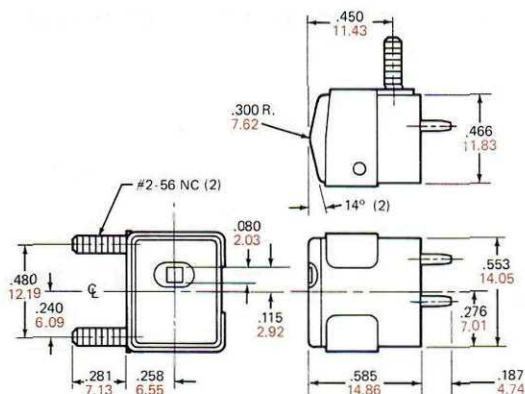


P-G1H – PREMIUM SERIES

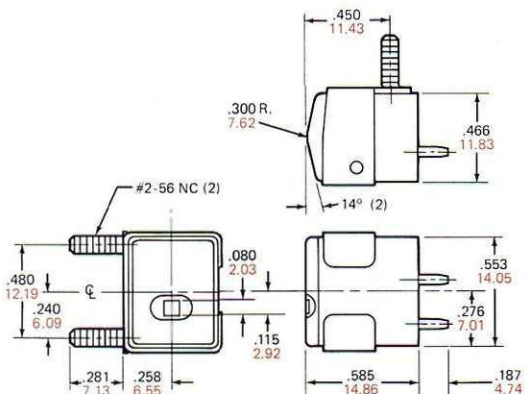
ELECTRICAL	MODEL NUMBER			
	P-G1H 4K	P-G1H 4R	P-G1H 7K	P-G1H 2K
Head Function	Record/ Playback	Record Only	Record/ Playback	Record/ Playback
Inductance – 1 kHz - millihenrys	100	50	400	800
Impedance – 1 kHz - ohms	650	320	2550	5000
Resistance, D.C., Mono, ohms	70	70	160	400
Gap Length, microinches	100	500	100	100
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	0.65	0.70	0.22	0.25
Bias Voltage, RMS, 60 kHz, volts	17	9.0	36	56
Record Current, microamps	58	75	30	21
1 kHz Output, millivolts	1.5	—	2.4	3.6
10 kHz/1 kHz ratio, dB	+1.0	—	+1.0	+3
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	0.55	0.60	0.20	0.23
Bias Voltage, RMS, 60 kHz, volts	14	8.0	32	49
Record Current, microamps	51	65	28	20
1 kHz Output, millivolts	1.2	—	2.1	2.4
10 kHz/1 kHz ratio, dB	-9	—	-9	-5

HEAD WITH SIDE MOUNT CONFIGURATION

SPECIFY: –SU
TRACK ABOVE CENTER LINE

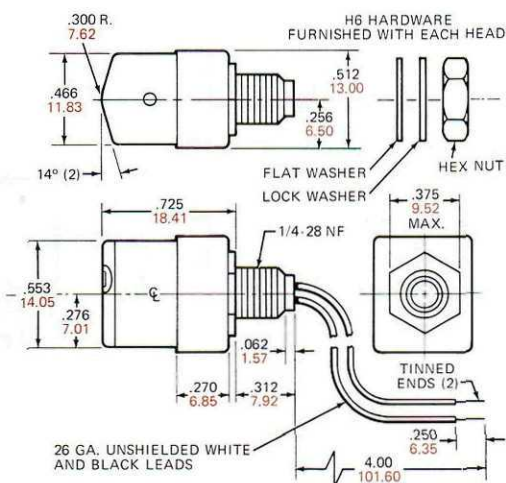


SPECIFY: –SD
TRACK BELOW CENTER LINE

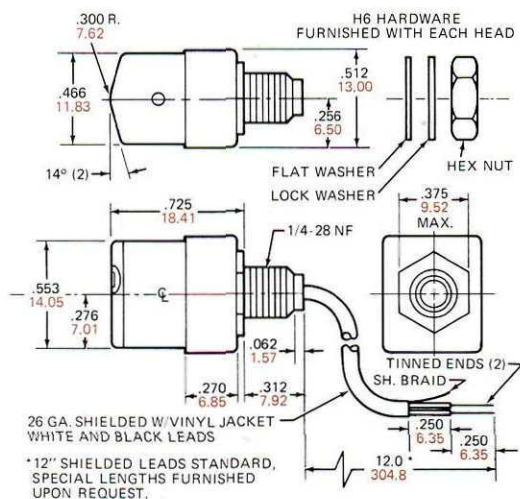


HEAD WITH REAR MOUNT CONFIGURATION

UNSHIELDED LEADS



SHIELDED LEADS



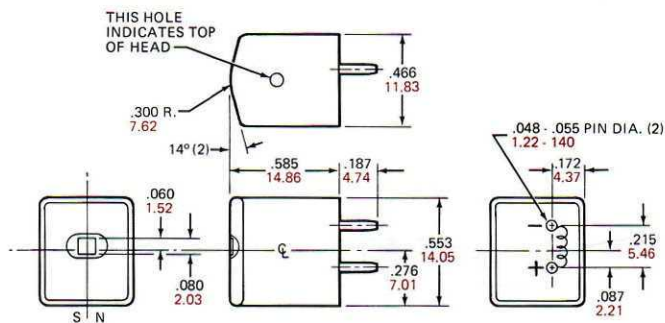
GIHY Half Track Mono R/P 0.080" SINGLE CHANNEL STANDARD SERIES



PHYSICAL CONFIGURATIONS

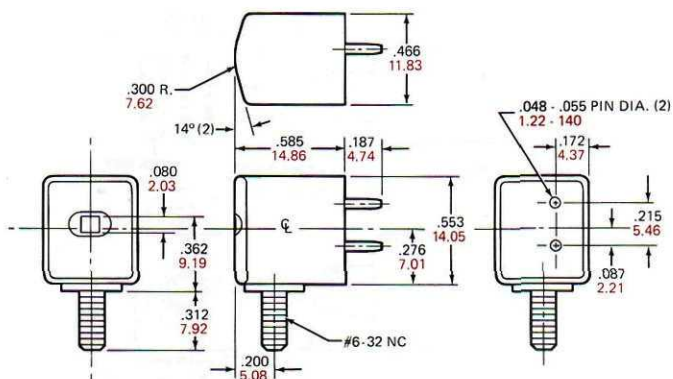
NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT

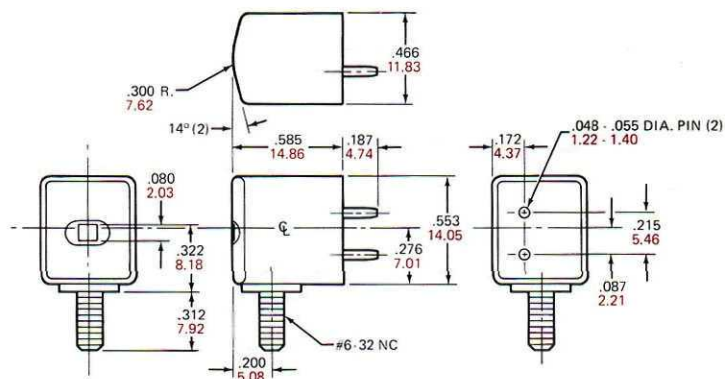


HEAD WITH BASE MOUNT CONFIGURATION

SPECIFY: -B3U
TRACK ABOVE CENTER LINE



SPECIFY: -B3D
TRACK BELOW CENTER LINE

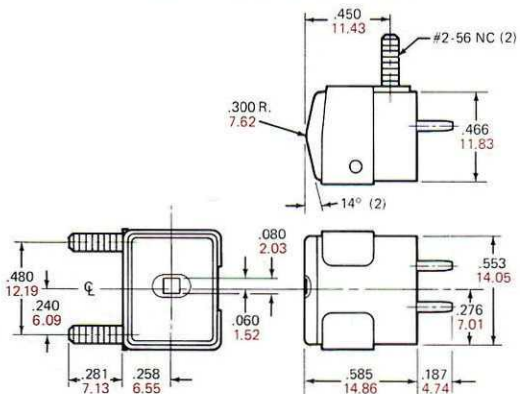


G1HY – STANDARD SERIES

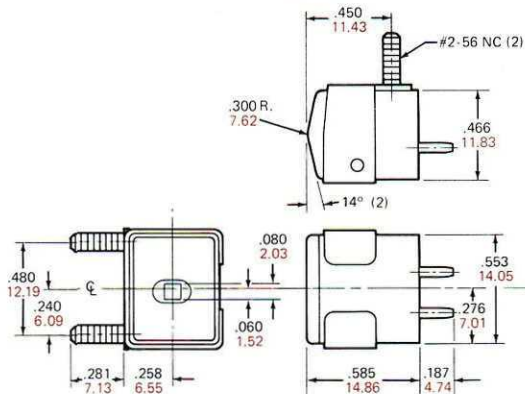
ELECTRICAL	MODEL NUMBER		
	G1HY 5L	G1HY 7K	G1HY 2K
Head Function	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	450	400	800
Impedance - 1 kHz - ohms	3,000	2650	5000
Resistance, D.C. Mono, ohms	340	410	400
Gap Length, microinches	160	100	100
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 60 kHz, ma	0.30	0.53	0.4
Bias Voltage, RMS, 60 kHz, volts	36	42	65
Record Current, microamps	24	32	25
1 kHz Output, millivolts	2.6	2.1	3.4
10 kHz/1 kHz Ratio, dB	-7	-1.0	-1.0
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 60 kHz, ma	.25	0.44	0.3
Bias voltage, RMS, 60 kHz, volts	30	36	45
Record Current, microamps	21	30	22
1 kHz Output, millivolts	2.4	1.9	2.2
10 kHz/1 kHz Ratio, dB	-12	-11	-11

HEAD WITH SIDE MOUNT CONFIGURATION

SPECIFY:-SU
TRACK ABOVE CENTER LINE

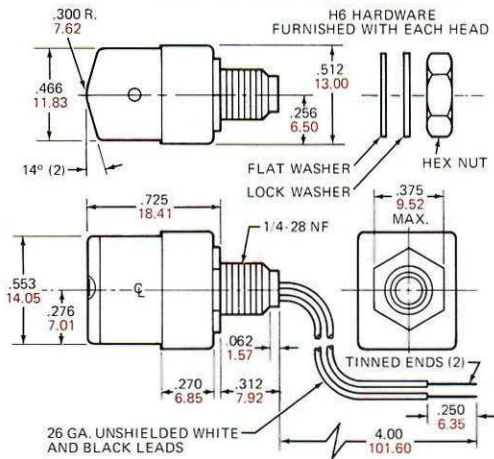


SPECIFY:—SD
TRACK BELOW CENTER LINE

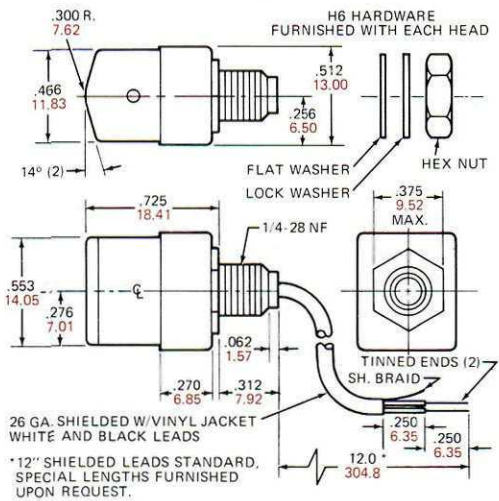


HEAD WITH REAR MOUNT CONFIGURATION

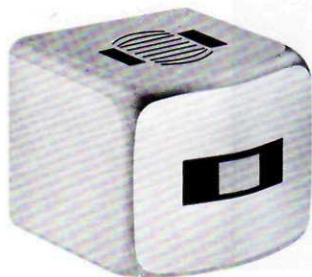
UNSHIELDED LEADS



SHIELDED LEADS



B1HC & P-B1HC Half Track Mono R/P 0.080" SINGLE CHANNEL



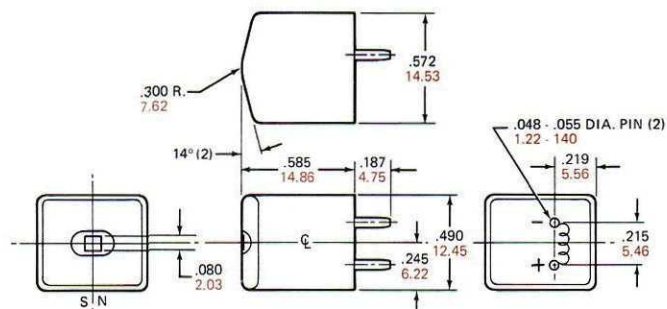
B1HC – STANDARD SERIES

ELECTRICAL	MODEL NUMBER			
	B1HC 4K	B1HC 7K	B1HC 27L	B1HC 8R
Head Function – Typical	Record/ Playback	Record/ Playback	Playback	Record Only
Inductance – 1 kHz - millihenrys	100	400	4000	10
Impedance – 1 kHz - ohms	650	2650	17,000	71
Resistance, D.C., Mono, ohms	70	180	2400	28
Gap Length, microinches	100	100	160	500
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	1.2	0.53	—	2.2
Bias Voltage, RMS, 60 kHz, volts	23	42	—	4.9
Record Current, microamps	65	32	—	135
1 kHz Output, millivolts	1.1	2.1	10.0	—
10 kHz/1 kHz ratio, dB	-1.0	-1.0	+1.0	—
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	1.1	0.44	—	2.0
Bias Voltage, RMS, 60 kHz, volts	18	36	—	4.5
Record Current, microamps	60	30	—	126
1 kHz Output, millivolts	0.9	1.9	—	—
10 kHz/1 kHz ratio, dB	-11	-11	—	—

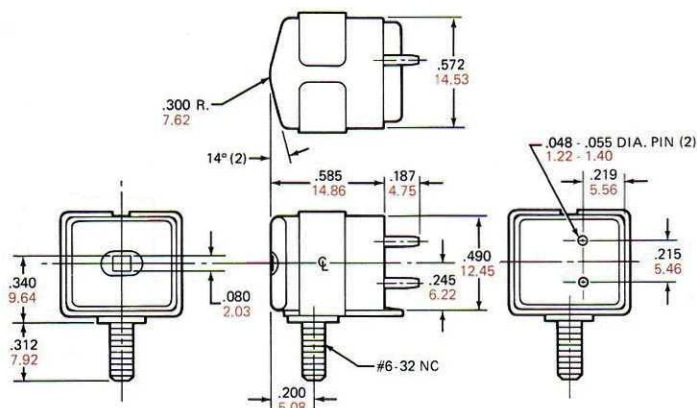
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT



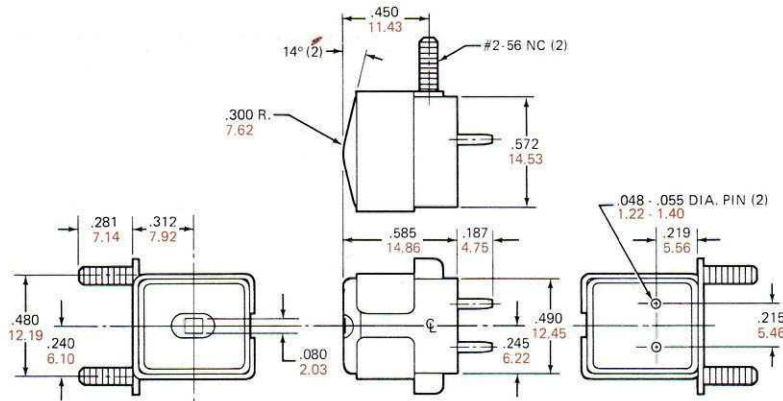
HEAD WITH BASE MOUNT CONFIGURATION



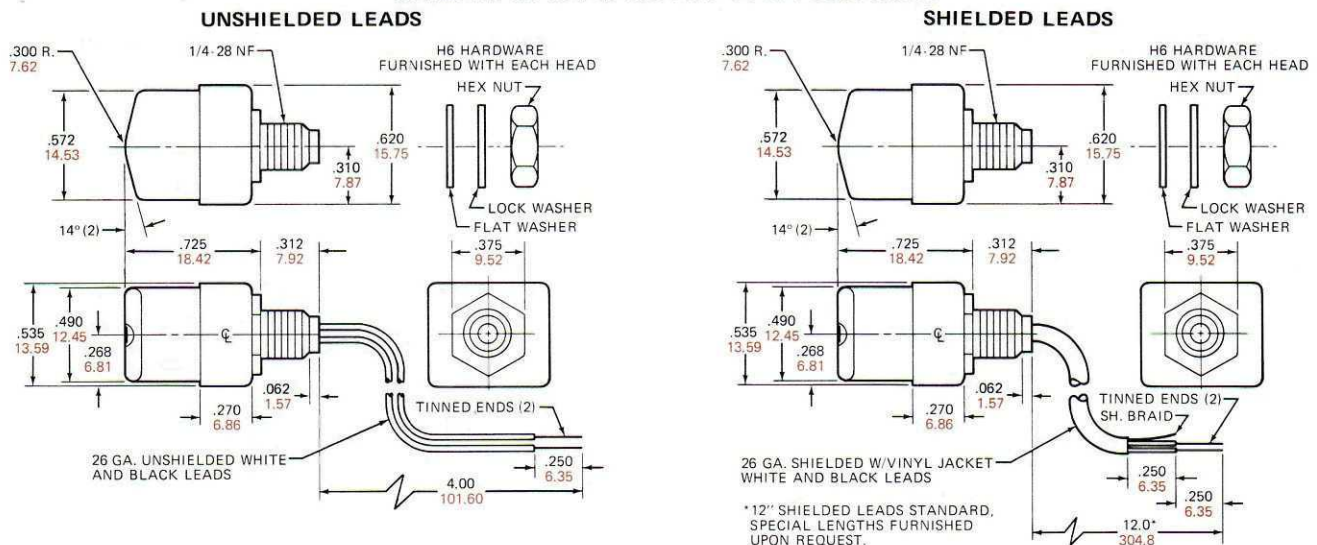
P-B1HC – PREMIUM SERIES

ELECTRICAL	MODEL NUMBER		
	P-B1HC 4K	P-B1HC 4R	P-B1HC 7K
Head Function – Typical	Record/ Playback	Record Only	Record/ Playback
Inductance – 1 kHz - millihenrys	100	50	400
Impedance – 1 kHz - ohms	650	320	2550
Resistance, D.C., Mono, ohms	70	70	160
Gap Length, microinches	100	500	100
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 60 kHz, ma	0.65	0.70	0.22
Bias Voltage, RMS, 60 kHz, volts	17	9.0	36
Record Current, microamps	58	75	30
1 kHz Output, millivolts	1.5	—	2.4
10 kHz/1 kHz ratio, dB	+1.0	—	+1.0
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 60 kHz, ma	0.55	0.60	0.20
Bias Voltage, RMS, 60 kHz, volts	14	8.0	32
Record Current, microamps	51	65	28
1 kHz Output, millivolts	1.2	—	2.1
10 kHz/1 kHz ratio, dB	-9	—	-9

HEAD WITH SIDE MOUNT CONFIGURATION



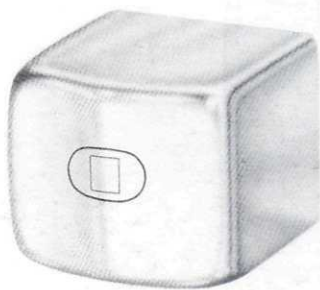
HEAD WITH REAR MOUNT CONFIGURATION



DESIGN DATA

NORTRONICS
AUDIO HEADS

B1HY & P-B1HY Half Track Mono R/P 0.080" SINGLE CHANNEL



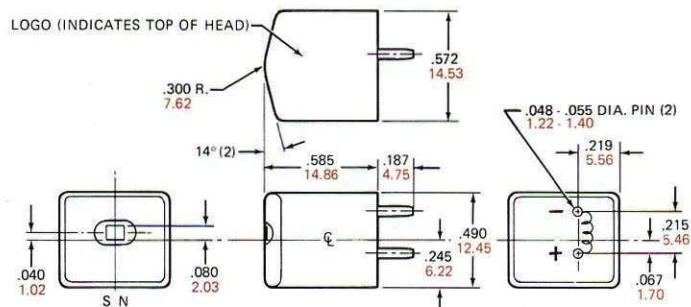
B1HY – STANDARD SERIES

ELECTRICAL	MODEL NUMBER			
	B1HY 4K	B1HY 4R	B1HY 7K	B1HY 2K
Head Function – Typical	Record/ Playback	Record Only	Record/ Playback	Record/ Playback
Inductance – 1 kHz - millihenrys	100	50	400	800
Impedance – 1 kHz - ohms	650	340	2650	5000
Resistance, D.C., Mono, ohms	70	70	180	400
Gap Length, microinches	100	500	100	100
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	1.2	0.9	0.53	0.4
Bias Voltage, RMS, 60 kHz, volts	23	11	42	65
Record Current, microamps	65	63	32	25
1 kHz Output, millivolts	1.1	—	2.1	3.4
10 kHz/1 kHz ratio, dB	-1.0	—	-1.0	-1.0
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	1.1	0.85	0.44	0.3
Bias Voltage, RMS, 60 kHz, volts	18	10	36	45
Record Current, microamps	60	60	30	22
1 kHz Output, millivolts	0.9	—	1.9	2.2
10 kHz/1 kHz ratio, dB	-11	—	-11	-11

PHYSICAL CONFIGURATIONS

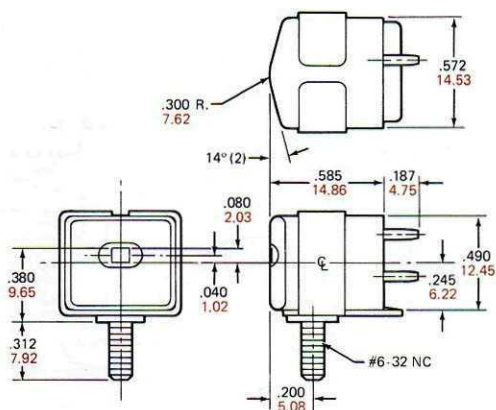
NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT

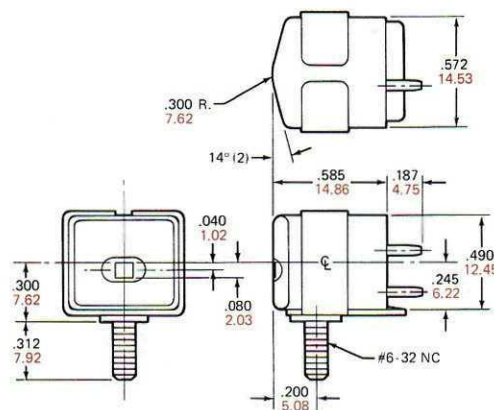


HEAD WITH BASE MOUNT CONFIGURATION

TRACK ABOVE CENTER LINE SPECIFY: BU



TRACK BELOW CENTER LINE SPECIFY: BD



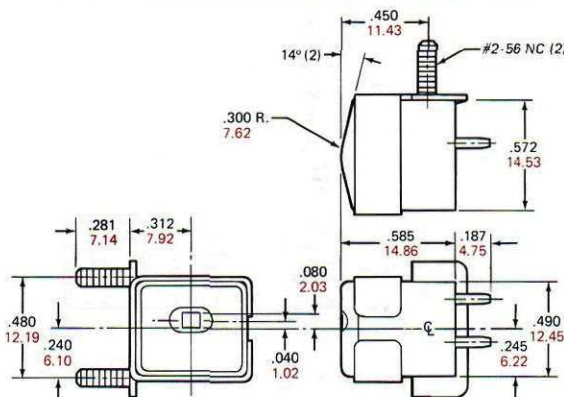
P-B1HY – PREMIUM SERIES

ELECTRICAL	MODEL NUMBER									
	P-B1HY 4K	P-B1HY 4R	P-B1HY 6K	P-B1HY 7K	P-B1HY 7F	P-B1HY 12K	P-B1HY 8K	P-B1HY 8R	P-B1HY 9K	P-B1HY 14R
Head Function – Typical	Record/ Playback	Record Only	Record/ Playback	Record/ Playback	Playback Only	Record/ Playback	Record/ Playback	Record Only	Record/ Playback	Record Only
Inductance – 1 kHz - millihenrys	100	50	200	400	400	50	20	10	10	2.0
Impedance – 1 kHz - ohms	650	320	1300	2550	2500	350	110	75	65	15
Resistance, D.C., Mono, ohms	70	70	110	160	155	50	24	28	20	5
Gap Length, microinches	100	500	100	100	50	100	100	500	100	500
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation										
Peak Bias Current, 60 kHz, ma	0.65	0.70	0.40	0.22	.25	1.3	1.9	1.9	2.9	4.3
Bias Voltage, RMS, 60 kHz, volts	17	9.0	30	36	35	16	10	5.0	7.5	3.3
Record Current, microamps	58	75	45	30	31	80	145	170	210	280
1 kHz Output, millivolts	1.5	—	1.8	2.4	2.5	0.8	.64	—	.40	—
10 kHz/1 kHz ratio, dB	+1.0	—	+1.0	+1.0	+2.0	0	+1	—	0	—
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation										
Peak Bias Current, 60 kHz, ma	0.55	0.60	0.30	0.20	.22	1.1	1.7	1.7	2.5	4.0
Bias Voltage, RMS, 60 kHz, volts	14	8.0	25	32	42	14.5	8	4.5	6.5	2.9
Record Current, microamps	51	65	40	28	31	75	130	160	200	260
1 kHz Output, millivolts	1.2	—	1.2	2.1	2.0	0.65	.5	—	.32	—
10 kHz/1 kHz ratio, dB	-9	—	-9	-9	-7	-9	-9	—	-9	—

HEAD WITH SIDE MOUNT CONFIGURATION

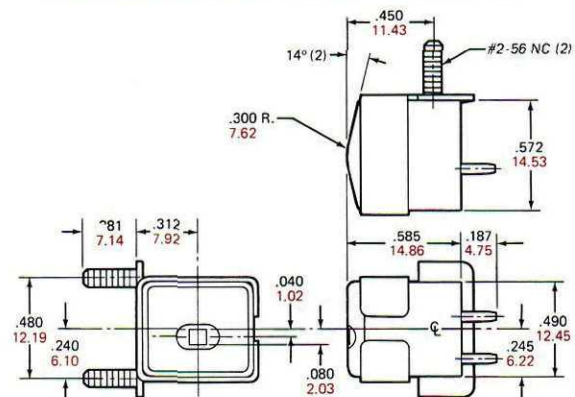
TRACK ABOVE CENTER LINE

SPECIFY: SU



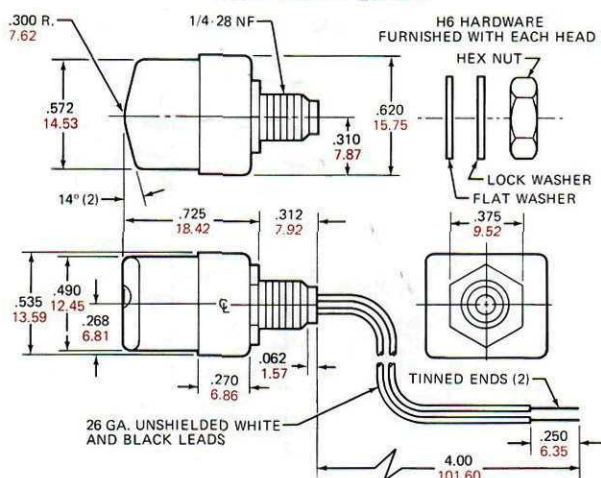
TRACK BELOW CENTER LINE

SPECIFY: SD

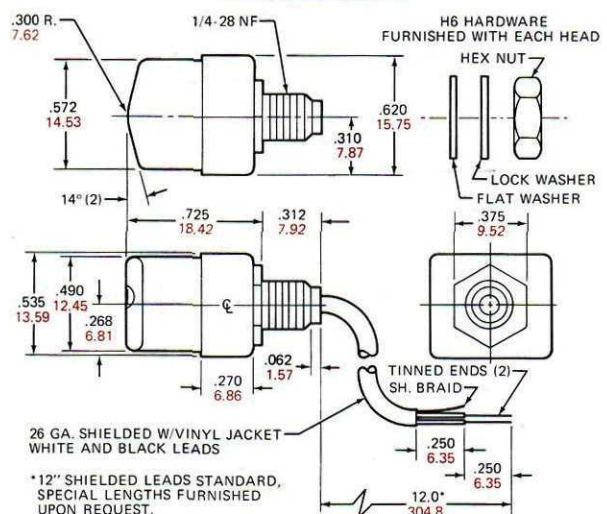


HEAD WITH REAR MOUNT CONFIGURATION

UNSHIELDED LEADS



SHIELDED LEADS



DESIGN DATA

NORTRONICS

AUDIO HEADS

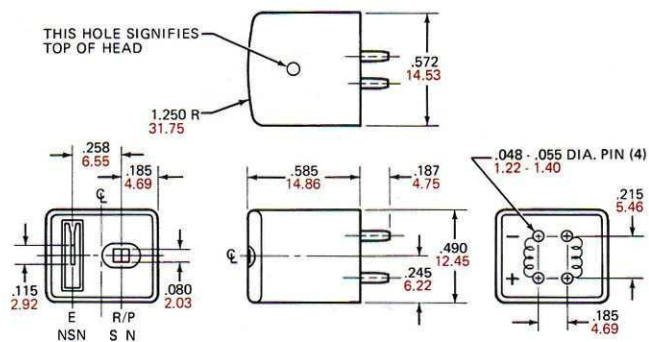
P-A1HC & A1HC Half Track Mono Combination Erase and R/P

0.080" SINGLE CHANNEL



PHYSICAL CONFIGURATIONS

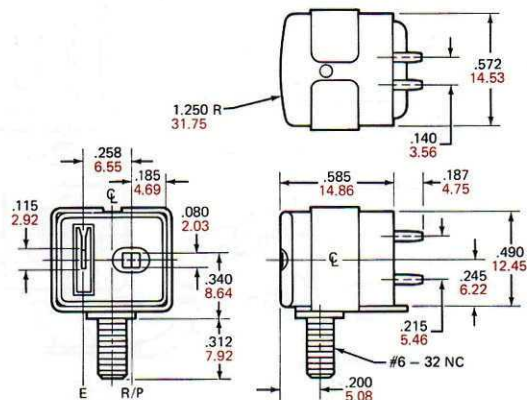
BASIC HEAD CONFIGURATION – NO MOUNT



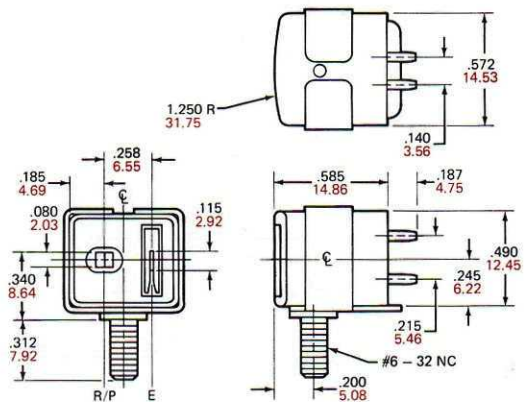
NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

HEAD WITH BASE MOUNT CONFIGURATION

SPECIFY: -BL



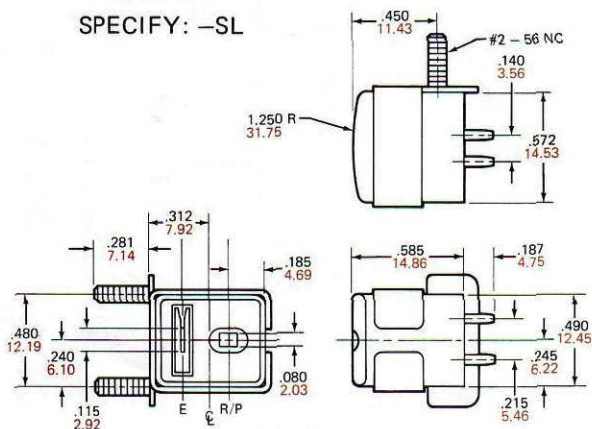
SPECIFY: -BR



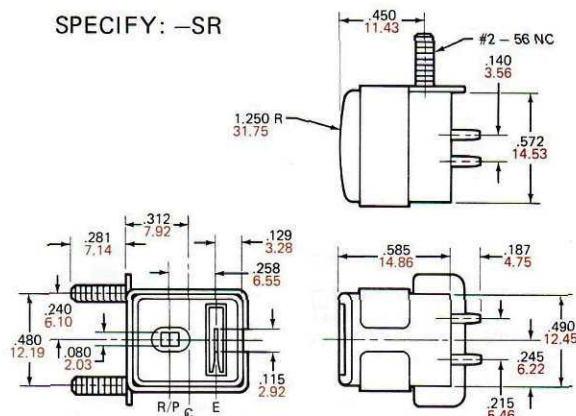
ELECTRICAL (R/P SECTION)	PREMIUM SERIES				STANDARD SERIES			
	MODEL NUMBER				MODEL NUMBER			
	P-A1HC 44K	P-A1HC 44R	P-A1HC 47K	P-A1HC 48R	A1HC 44K	A1HC 44R	A1HC 47K	A1HC 15L
Head Function	Record/ Playback	Record Only	Record/ Playback	Record Only	Record/ Playback	Record Only	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	100	50	400	10	100	50	400	450
Impedance - 1 kHz - ohms	650	320	2,550	75	650	340	2,650	3,000
Resistance, D.C., Mono, ohms	70	70	160	28	70	70	180	340
Gap Length, microinches	100	500	100	500	100	500	100	160
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation								
Peak Bias Current, 60 kHz, ma	0.65	0.70	0.22	1.7	1.2	0.9	0.53	0.30
Bias Voltage, RMS, 60 kHz, volts	17	9.0	36	4.3	23	11	42	36
Record Current, microamps	58	75	30	180	65	63	32	24
1 kHz Output, millivolts	1.5	—	2.4	—	1.1	—	2.1	2.6
10 kHz/1 kHz ratio, dB	+1.0	—	+1.0	—	-1.0	—	-1.0	-7
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation								
Peak Bias Current, 60 kHz, ma	0.55	0.60	0.20	1.5	1.1	0.85	0.44	.25
Bias Voltage, RMS, 60 kHz, volts	14	8.0	32	3.8	18	10	36	30
Record Current, microamps	51	65	28	160	60	60	30	21
1 kHz Output, millivolts	1.2	—	2.1	—	0.9	—	1.9	2.4
10 kHz/1 kHz ratio, dB	-9	—	-9	—	-11	—	-11	-12
ELECTRICAL (ERASE SECTION)								
Inductance - 1 kHz - millihenrys	10	10	10	10	10	10	10	50
Resistance, D.C., ohms	27	27	27	27	27	27	27	130
Track Width, inches	.110	.110	.110	.110	.110	.110	.110	.110
Gap Length, Double Gap, each	.003	.003	.003	.003	.003	.003	.003	.003
Typical characteristics for 60 dB erasure of a 400 Hz saturated signal on 3M150 tape								
Erase Voltage - 60 kHz, volts	40	40	40	40	40	40	40	120
Erase Current, ma	20	20	20	20	20	20	20	10
Impedance - 60 kHz, ohms	2,500	2,500	2,500	2,500	2,500	2,500	2,500	12,000

HEAD WITH SIDE MOUNT CONFIGURATION

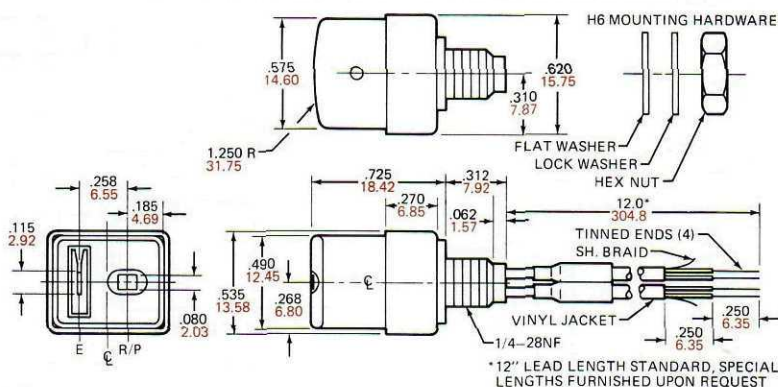
SPECIFY: -SL



SPECIFY: -SR



HEAD WITH REAR MOUNT CONFIGURATION



COLOR CODE:
ERASE: WHITE/BLACK
R/P: RED/ORANGE

MEH



PHYSICAL CONFIGURATIONS

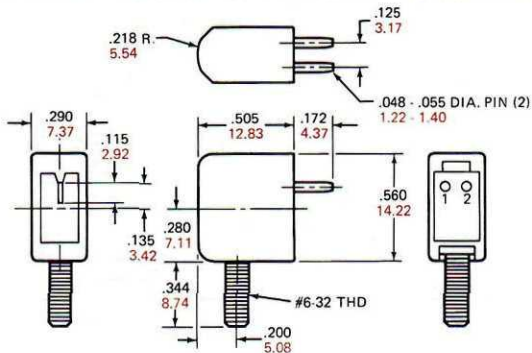
NOTE:
INCHES IN BLACK

ELECTRICAL	MODEL NUMBER		
	MEH 1	MEH 2	MEH 4
Inductance - 1 kHz - millihenrys	50	0.2	10
Resistance, D.C., ohms	130	1.8	27
Track Width, inches	.110	.110	.110
Gap Length, Double Gap, each	.003	.003	.003
Typical characteristics for 60 dB erasure of a 400 Hz saturated signal on 3M150 tape			
Erase Voltage - 60 kHz, volts	120	6	40
Erase Current, ma	10	100	20
Impedance - 60 kHz, ohms	12,000	55	2,500

NOTE: Head also available in "B" size case, see page 40

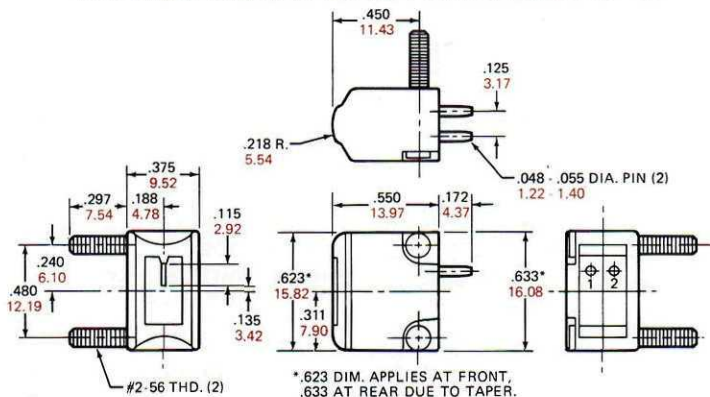
HEAD WITH BASE MOUNT CONFIGURATION

HEAD WITH BASE MOUNT CONFIGURATION
AS SHOWN TRACK UP – SPECIFY: –B3U
FOR ERASE TRACK IN LOWER POSITION SPECIFY: –B3D

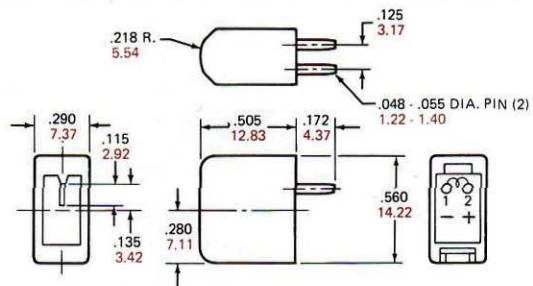


HEAD WITH SIDE MOUNT CONFIGURATION

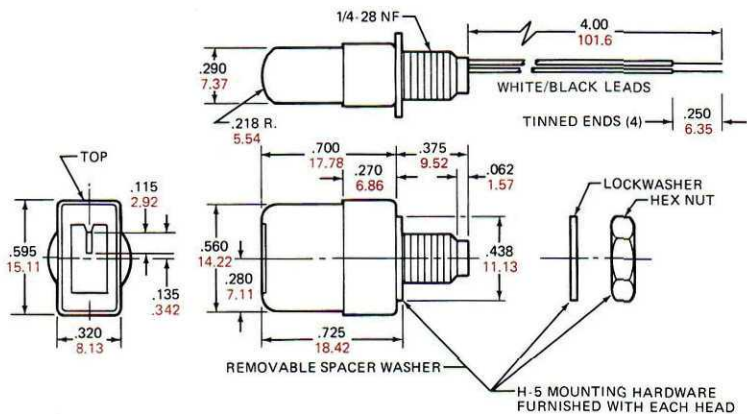
HEAD WITH SIDE MOUNT CONFIGURATION
AS SHOWN SPECIFY: -SU
FOR ERASE TRACK IN LOWER POSITION SPECIFY: -SD



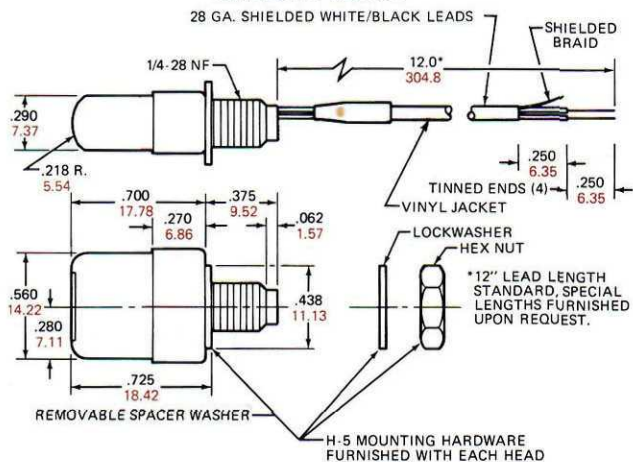
BASIC HEAD CONFIGURATION – NO MOUNT



HEAD WITH REAR MOUNT CONFIGURATION UNSHIELDED LEADS



HEAD WITH REAR MOUNT CONFIGURATION SHIELDED LEADS





WP-B2Q Quarter Track Stereo R/P

0.043" TWO CHANNEL
PROFESSIONAL SERIES

WP-B2Q – PROFESSIONAL SERIES

ELECTRICAL	MODEL NUMBER					
	WP-B2Q 8K	WP-B2Q 4K	WP-B2Q 6K	WP-B2Q 7K	WP-B2Q 7F	WP-B2Q 2K
Head Function (Typical)	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	20	100	200	400	500	800
Impedance - 1 kHz - ohms	140	750	1,300	2,500	3,300	5,000
Resistance, D.C. Stereo, ohms	30	100	190	350	315	640
Gap Length, microinches	100	100	100	100	50	100
1 kHz Crosstalk Rejection, dB	50	50	50	50	50	50
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation						
Peak Bias Current, 60 kHz, ma	1.5	.70	.46	.23	.33	.17
Bias Voltage, RMS, 60 kHz, volts	7	18	23	35	40	48
Record Current, microamps	120	45	36	27	40	17
1 kHz Output, millivolts	0.35	0.8	1.2	1.6	1.7	2.2
10 kHz/1 kHz Ratio, dB	+1	+1	+1	+1	+2	+1
3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation						
Peak Bias Current, 60 kHz, ma	1.4	.50	.41	.21	.30	.15
Bias Voltage, RMS, 60 kHz, volts	6	14	20	31	34	42
Record Current, microamps	110	40	35	26	34	17
1 kHz Output, millivolts	0.3	0.7	1.0	1.4	1.2	2.0
10 kHz/1 kHz Ratio, dB	-9	-9	-9	-9	-8	-9

PHYSICAL CONFIGURATION

NOTES:

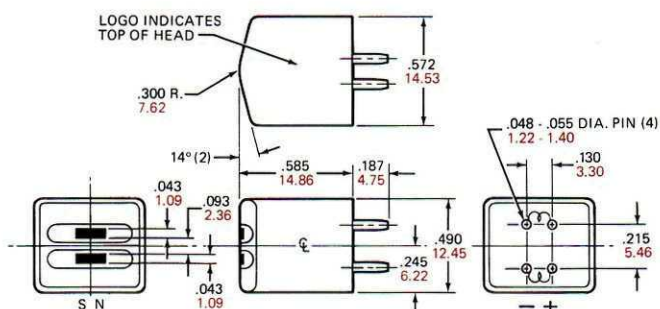
Also available with standard
mounting configurations:

Side mount, base mount or
rear mounts.

See B2Q/P-B2Q pages.

INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT



B2Q & P-B2Q Quarter Track Stereo R/P

.043" TWO CHANNEL



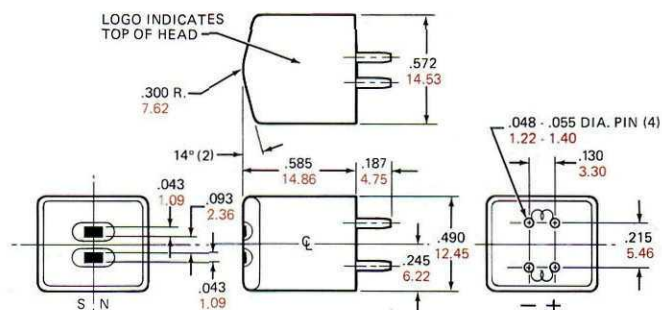
B2Q – STANDARD SERIES

ELECTRICAL	MODEL NUMBER					
	B2Q 8K	B2Q 4K	B2Q 4L	B2Q 6K	B2Q 7K	B2Q 2K
Head Function (Typical)	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	20	100	85	200	400	800
Impedance - 1 kHz - ohms	170	700	560	1,400	2,300	5,000
Resistance, D.C. Stereo, ohms	30	85	105	210	400	750
Gap Length, microinches	100	100	160	100	100	100
1 kHz Crosstalk Rejection, dB	50	50	50	50	50	50
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation						
Peak Bias Current, 60 kHz, ma	1.7	1.1	.70	.60	.42	.30
Bias Voltage, RMS, 60 kHz, volts	8.0	17	12	24	30	45
Record Current, microamps	140	48	50	31	25	21
1 kHz Output, millivolts	0.33	0.8	0.9	1.2	1.6	2.4
10 kHz/1 kHz Ratio, dB	-1	-1	-1	-1	-1	-2
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation						
Peak Bias Current, 60 kHz, ma	1.5	0.9	.60	.50	.34	.24
Bias Voltage, RMS, 60 kHz, volts	7.0	15	10	20	25	35
Record Current, microamps	130	45	50	30	22	20
1 kHz Output, millivolts	0.30	0.6	0.8	0.9	1.3	2.0
10 kHz/1 kHz Ratio, dB	-12	-11	-11	-11	-11	-10

PHYSICAL CONFIGURATION

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

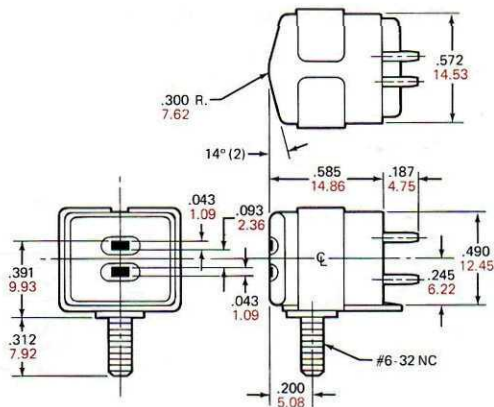
BASIC HEAD CONFIGURATION – NO MOUNT



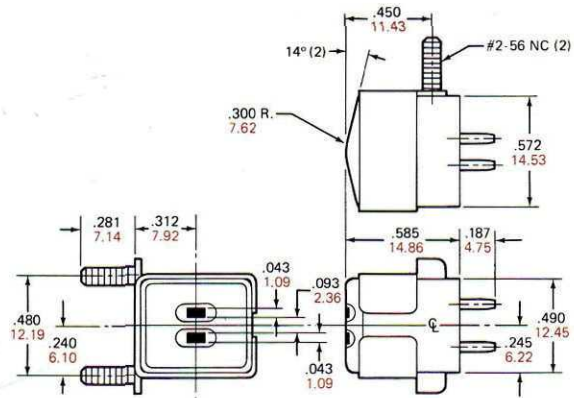
P-B2Q – PREMIUM SERIES

ELECTRICAL	MODEL NUMBER									
	P-B2Q 14R	P-B2Q 8K	P-B2Q 8F	P-B2Q 8R	P-B2Q 4R	P-B2Q 4K	P-B2Q 6K	P-B2Q 7K	P-B2Q 7F	P-B2Q 2K
Head Function (Typical)	Record Only	Record/Playback	Record/Playback	Record Only	Record Only	Record/Playback	Record/Playback	Record/Playback	Record/Playback	Record/Playback
Inductance - 1 kHz - millihenrys	2.0	20	20	10	50	100	200	400	500	800
Impedance - 1 kHz - ohms	15	170	150	70	400	650	1,300	2,500	3,300	3,800
Resistance, D.C. Stereo, ohms	6.0	32	32	32	100	100	200	400	315	750
Gap Length, microinches	500	100	50	500	500	100	100	100	50	100
1 kHz Crosstalk Rejection, dB	50	50	50	50	50	50	50	50	50	50
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation										
Peak Bias Current, 60 kHz, ma	3.5	1.7	1.6	1.3	.55	.70	.38	.25	.33	.14
Bias Voltage, RMS, 60 kHz, volts	3.1	8.0	7.0	3.5	8.0	18	21	35	40	44
Record Current, microamps	250	140	140	110	45	60	31	25	40	15
1 kHz Output, millivolts	—	0.35	0.4	—	—	0.9	1.3	1.6	1.7	2.5
10 kHz/1 kHz Ratio, dB	—	+1	+2	—	—	0	+1	+1	+2	+1
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation										
Peak Bias Current, 60 kHz, ma	3.0	1.5	1.4	1.2	.50	.50	.30	.20	.30	.12
Bias Voltage, RMS, 60 kHz, volts	2.7	7.0	6.0	3.2	7.0	13	16	25	34	37
Record Current, microamps	220	130	130	100	45	50	30	25	34	14
1 kHz Output, millivolts	—	0.3	0.3	—	—	0.7	1.0	1.4	1.2	2.0
10 kHz/1 kHz Ratio, dB	—	-9	-8	—	—	-10	-9	-9	-8	-9

BASE MOUNT CONFIGURATION

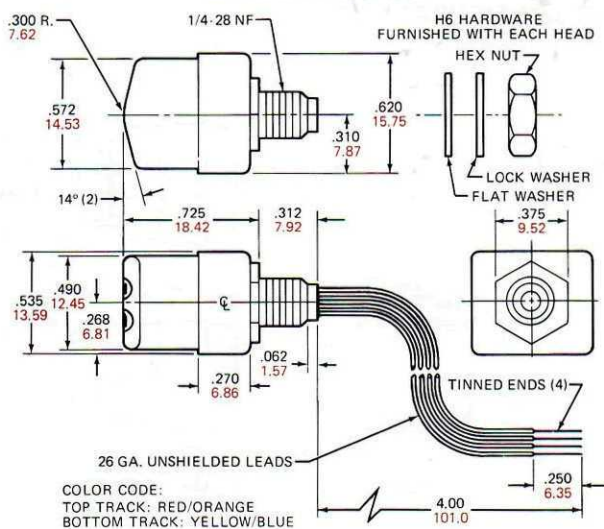


SIDE MOUNT CONFIGURATION

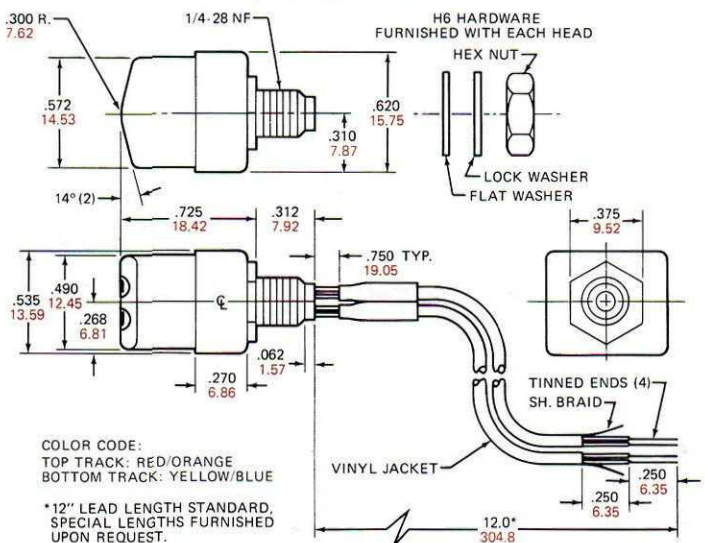


REAR MOUNT CONFIGURATION

SHIELDED LEADS



UNSHIELDED LEADS



DESIGN DATA

NORTRONICS

AUDIO HEADS

P-A2Q & A2Q

Quarter Track Stereo Combination Erase and R/P

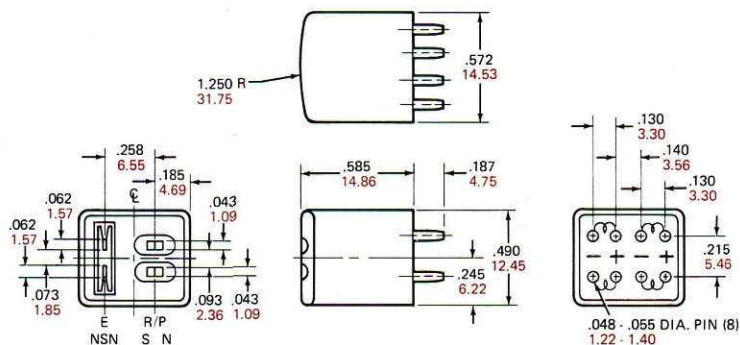
0.043" TWO CHANNEL



PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

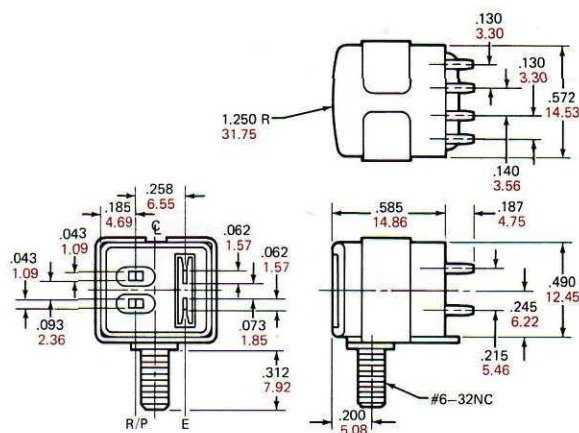
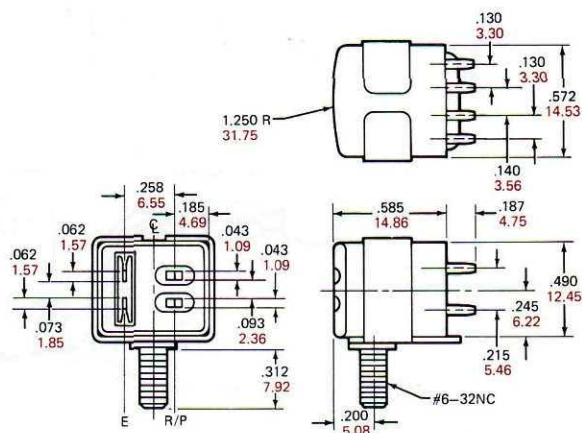
BASIC HEAD CONFIGURATION – NO MOUNT



HEAD WITH BASE MOUNT CONFIGURATIONS

SPECIFY: -BL

SPECIFY: -BR

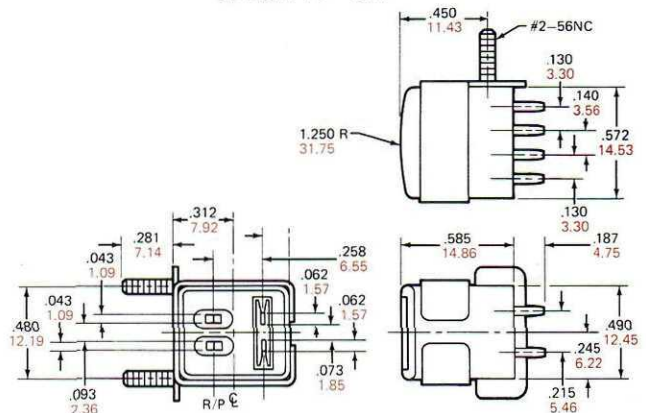
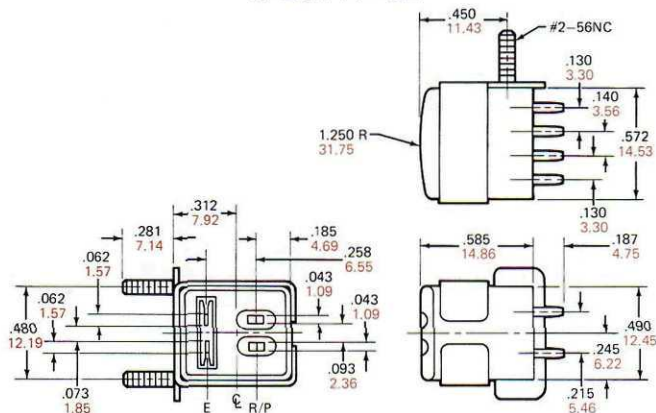


ELECTRICAL (R/P SECTION)	PREMIUM SERIES					STANDARD SERIES		
	MODEL NUMBER					MODEL NUMBER		
	P-A2Q 48R	P-A2Q 44R	P-A2Q 44K	P-A2Q 46K	P-A2Q 47K	A2Q 44K	A2Q 46K	A2Q 47K
Head Function (Typical)	Record Only	Record Only	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	10	50	100	200	400	100	200	400
Impedance - 1 kHz - ohms	70	400	650	1,400	2,500	700	1,400	2,300
Resistance, D.C. Stereo, ohms	32	100	100	210	400	100	210	400
Gap Length, microinches	500	500	100	100	100	100	100	100
1 kHz Crosstalk Rejection, dB	50	50	50	50	50	50	50	50
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation								
Peak Bias Current, 60 kHz, ma	1.3	.50	.70	.38	.25	1.1	.60	.42
Bias Voltage, RMS, 60 kHz, volts	3.5	8.0	18	21	35	17	24	30
Record Current, microamps	110	45	60	31	25	48	31	25
1 kHz Output, millivolts	—	—	0.9	1.3	1.6	0.8	1.2	1.6
10 kHz/1 kHz Ratio, dB	—	—	0	+1	+1	-1	-1	-1
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation								
Peak Bias Current, 60 kHz, ma	1.2	.45	.50	.30	.20	0.9	.50	.34
Bias Voltage, RMS, 60 kHz, volts	3.2	7.0	13	16	25	15	20	25
Record Current, microamps	100	45	50	30	25	45	30	22
1 kHz Output, millivolts	—	—	0.7	1.0	1.4	0.6	0.9	1.3
10 kHz/1 kHz Ratio, dB	—	—	-10	-9	-9	-11	-11	-11
ELECTRICAL (ERASE SECTION)								
Inductance - 1 kHz - millihenrys	10	10	10	10	10	10	10	10
Resistance, D.C., ohms	31	31	31	31	31	31	31	31
Track Width, inches	.062	.062	.062	.062	.062	.062	.062	.062
Gap Length, Double Gap, each	.003	.003	.003	.003	.003	.003	.003	.003
Typical characteristics for 60 dB erasure of a 400 Hz saturated signal on 3M150 tape								
Erase Voltage - 60 kHz, volts	40	40	40	40	40	40	40	40
Erase Current, ma	12	12	12	12	12	12	12	12
Impedance, 60 kHz, ohms	3,250	3,250	3,250	3,250	3,250	3,250	3,250	3,250

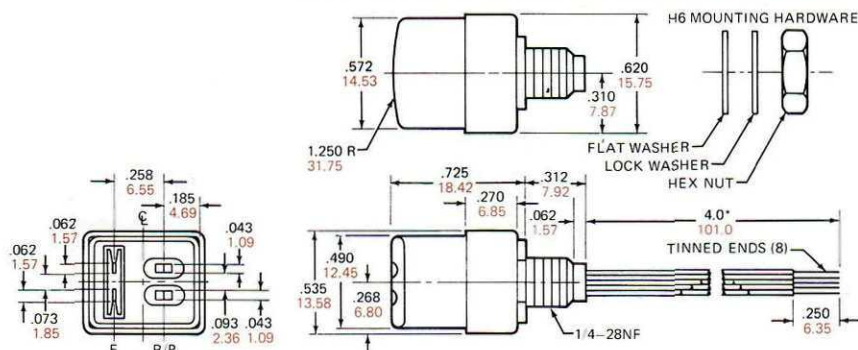
HEAD WITH SIDE MOUNT CONFIGURATIONS

SPECIFY: -SL

SPECIFY: -SR



HEAD WITH REAR MOUNT CONFIGURATION



COLOR CODE:
 TOP ERASE: WHITE/BLACK
 BOTTOM ERASE: BROWN/GREEN
 TOP R/P: ORANGE/RED
 BOTTOM R/P: YELLOW/BLUE

C2Q & P-C2Q Quarter Track Stereo R/P

0.043" TWO CHANNEL
STANDARD & PREMIUM SERIES



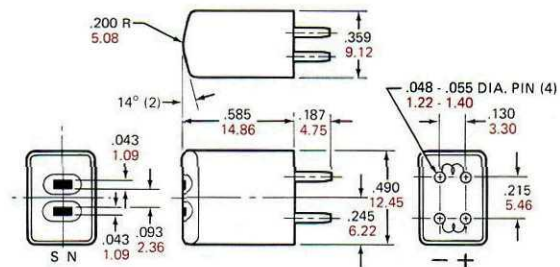
C2Q STANDARD SERIES — P-C2Q PREMIUM SERIES

ELECTRICAL	MODEL NUMBER			
	STANDARD SERIES	PREMIUM SERIES		
	C2Q 7K	P-C2Q 4K	P-C2Q 6K	P-C2Q 7K
Head Function (Typical)	Record/Playback	Record/Playback	Record/Playback	Record/Playback
Inductance - 1 kHz - millihenrys	400	100	200	400
Impedance - 1 kHz - ohms	2,300	650	1,300	2,500
Resistance, D.C. Stereo, ohms	400	100	200	400
Gap Length, microinches	100	100	100	100
1 kHz Crosstalk Rejection, dB	50	50	50	50
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	.42	.7	.38	.25
Bias Voltage, RMS, 60 kHz, volts	30	18	21	35
Record Current, microamps	25	60	31	25
1 kHz Output, millivolts	1.6	0.9	1.3	1.6
10 kHz/1 kHz Ratio, dB	-1	0	+1	+1
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	.34	.50	.30	.20
Bias Voltage, RMS, 60 kHz, volts	25	13	16	25
Record Current, microamps	22	50	30	25
1 kHz Output, millivolts	1.3	0.7	1.0	1.4
10 kHz/1 kHz Ratio, dB	-11	-10	-9	-9

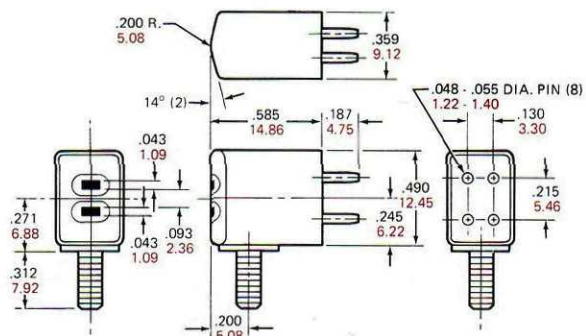
PHYSICAL CONFIGURATION

INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION — NO MOUNT



HEAD WITH BASE MOUNT CONFIGURATION



DESIGN DATA

NORTRONICS

AUDIO HEADS

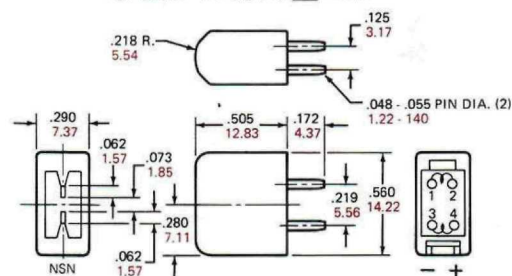
SEQ Quarter Track Stereo Erase



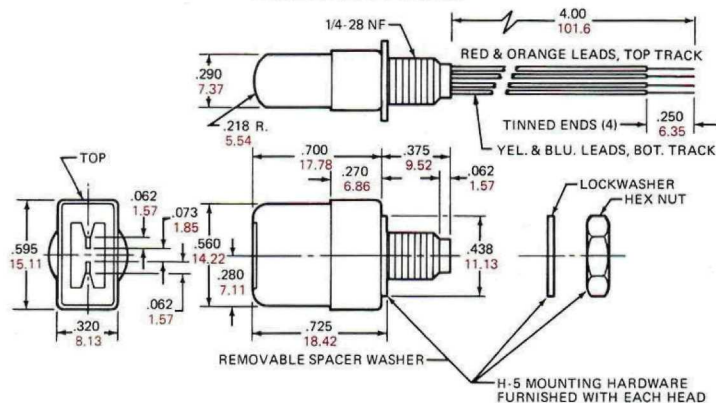
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

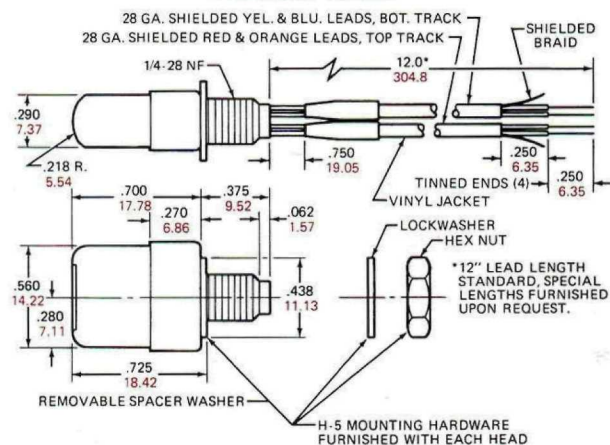
BASIC HEAD CONFIGURATION - NO MOUNT SPECIFY: SSEQ__-N9



HEAD WITH REAR MOUNT CONFIGURATION SPECIFY: SSEQ__-R-4U UNSHIELDED LEADS



HEAD WITH REAR MOUNT CONFIGURATION SPECIFY: SSEQ__-R-12S SHIELDED LEADS

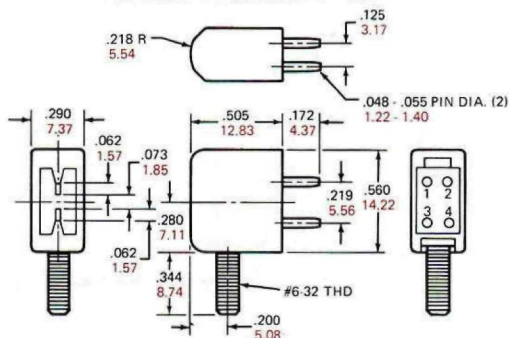


ELECTRICAL	MODEL NUMBER		
	SEQ 1	SEQ 2	SEQ 4
Inductance - 1 kHz - millihenrys	80	0.13	10
Resistance, D.C., ohms	240	1.8	31
Track Width, inches	.062	.062	.062
Gap Length, Double Gap, each	.003	.003	.003
Typical characteristics for 60 dB erasure of a 400 Hz saturated signal on 3M150 tape			
Erase Voltage - 60 kHz, volts	120	5	40
Erase Current, ma	5	120	12
Impedance - 60 kHz, ohms	30,000	40	3,250

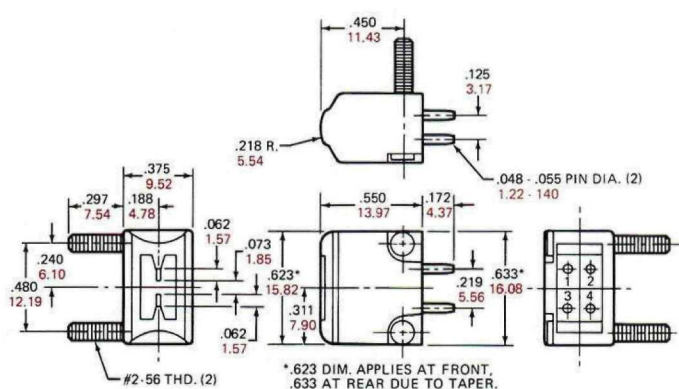
NOTES:

1. Head also available as mono-single track version, on a custom order basis—contact Nortronics
2. Head also available in "B" size case, see page 40

HEAD WITH BASE MOUNT CONFIGURATION SPECIFY: SSEQ__-B3



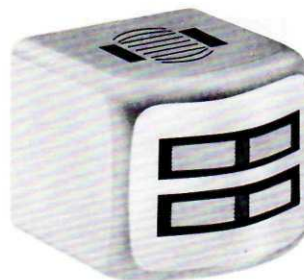
HEAD WITH SIDE MOUNT CONFIGURATION SPECIFY: LSEQ__-S23



PR-B2EQ

Quarter Track Stereo Erase

0.062" TWO CHANNEL
PROFESSIONAL SERIES



ELECTRICAL	MODEL NUMBER
	PR-B2EQ 4
Inductance - 1 kHz - millihenrys	3.0
Resistance, D.C., ohms	28
Track Width, inches	.062
Gap Length, Double Gap (each), inches	.003
Typical characteristics for 70 dB erasure of a 400 cycle saturated signal on 3M 150 tape	
Erase Voltage — 100 kHz, volts	35
Erase Current, ma	20

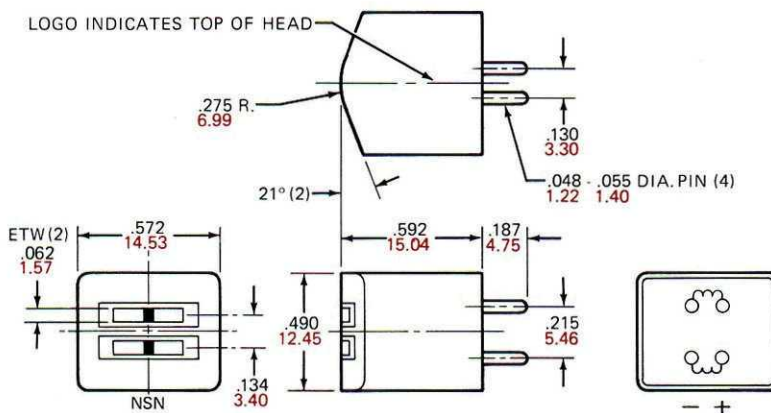
PHYSICAL CONFIGURATIONS

NOTES:

Head is shown as no mount,
however, all standard "B"
case mounts are available

INCHES IN BLACK
MILLIMETERS IN COLOR

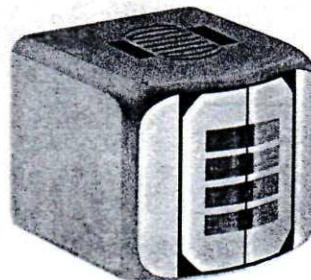
BASIC HEAD CONFIGURATION — NO MOUNT



PC-B4EQ

Quarter Track Four Channel Erase

.050" FOUR CHANNEL
PROFESSIONAL SERIES



ELECTRICAL	MODEL NUMBERS		
	PC-B4EQ	PC-B4EQ	PC-B4EQ
	2	22	8
Inductance - 1 kHz, millihenrys	0.2	0.8	8.0
Resistance, D.C., ohms	2.2	9.0	45.0
Impedance - 100 kHz, ohms	130	400	3,000
Track Width, inches	.050	.050	.050
Gap Length, Double Gap (each), inches	.003	.003	.003
Typical characteristics for 70 dB erasure of a 400 cycle saturated signal on 3M 150 tape			
Erase Voltage - 100 kHz, volts	6	13	30
Erase Current, ma	53	25	11

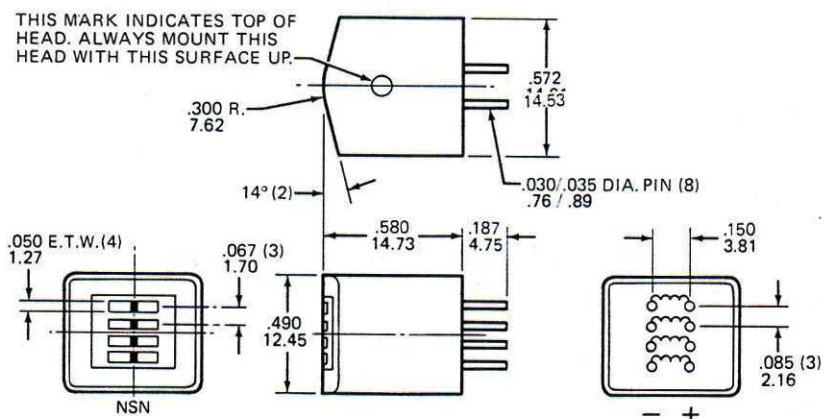
PHYSICAL CONFIGURATIONS

NOTES:

Head is shown as no mount,
however, all standard "B"
case mounts are available

INCHES IN BLACK
MILLIMETERS IN COLOR

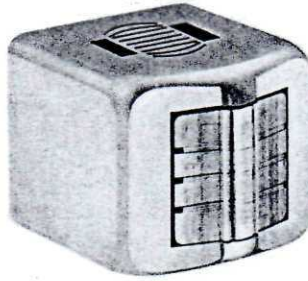
BASIC HEAD CONFIGURATION – NO MOUNT



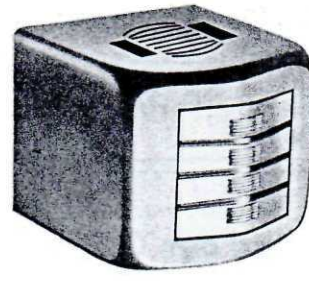
P-B4Q & P-BQQ

Four Track,
Four Channel

.042/.037" FOUR CHANNEL



P-B4Q



P-BQQ

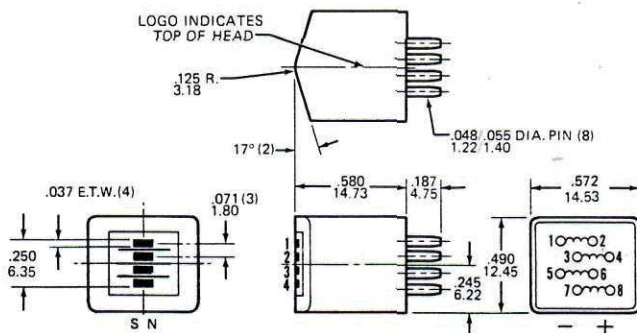
ELECTRICAL – SEE NOTE*	MODEL NUMBERS						
	B4Q P-BQQ 10R	B4Q P-BQQ 23R	P-B4Q P-BQQ 4R	P-B4Q P-BQQ 9K	P-B4Q P-BQQ 4K	P-B4Q P-BQQ 4L	P-B4Q P-BQQ 7K
Head Function	Record Only	Record Only	Record Only	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz, millihenrys	4.0	12	50	10	100	100	400
Impedance - 1 kHz, ohms	38	100	380	74	600	600	2,700
Resistance, D.C., ohms	32	55	220	40	245	245	760
Gap Length, microinches	500	500	500	100	100	160	100
Average 7.5 IPS constant current record/playback characteristics using 3M 150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation							
Peak Bias Current, 60 kHz, ma	2.9	1.5	.61	2.1	.55	.5	.2
Bias Voltage, RMS, 60 kHz, volts	3.5	5.8	9.8	5.4	17	15	32
Record Current, microamps	210	110	54	160	50	47	22
1 kHz Output, millivolts	—	—	—	.22	.7	.75	1.5
10 kHz/1 kHz Ratio, dB	—	—	—	+1	+2	0	+1
Average 3.75 IPS constant current record/playback characteristics using 3M 150 tape peak biased — 1 kHz and recorded 12 dB below tape saturation							
Peak Bias Current, 60 kHz, ma	2.6	1.35	.58	1.9	.45	.4	.17
Bias Voltage, RMS, 60 kHz, volts	3.2	5.5	9.2	4.8	15	13	27
Record Current, microamps	200	100	51	150	45	43	22
1 kHz Output, millivolts	—	—	—	.20	.6	.65	1.25
10 kHz/1 kHz Ratio, dB	—	—	—	—9	—9	—11	—9

*NOTE: Electrical data shown for Models P-BQQ. Data for Models P-B4Q similar except because of track width (.042") changes slightly. Models BQQ and BQQN also available—consult Nortronics.

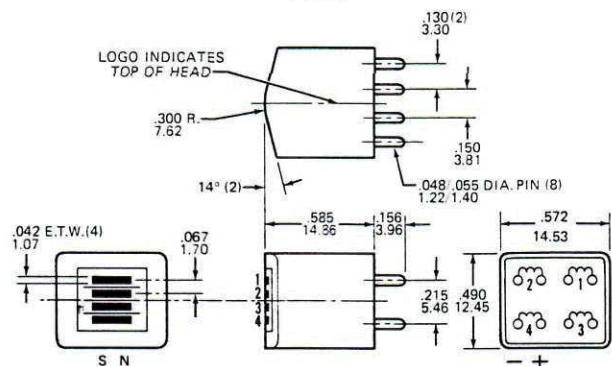
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT
P-BQQ

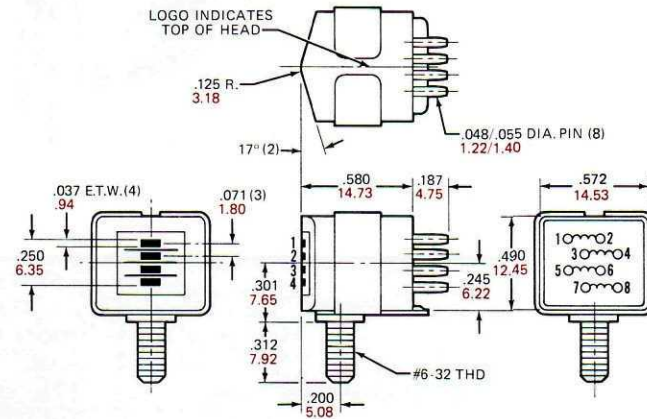


BASIC HEAD CONFIGURATION – NO MOUNT
P-B4Q



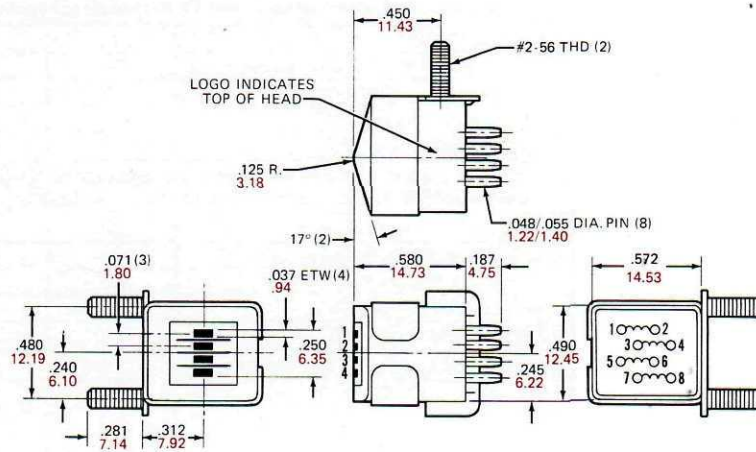
HEAD WITH BASE MOUNT CONFIGURATION

P-BQQ



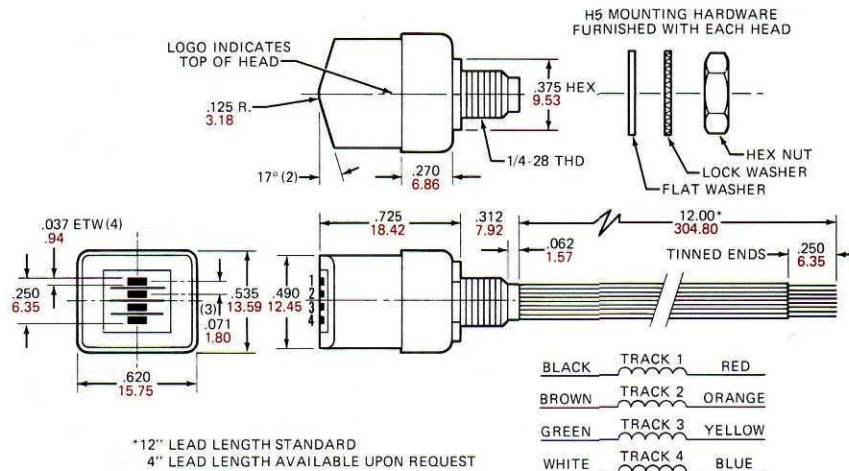
HEAD WITH SIDE MOUNT CONFIGURATION

P-BQQ



HEAD WITH REAR MOUNT CONFIGURATION

P-BQQ



P-A1QC & A1QC Quarter Track Mono Combination Erase and R/P



ELECTRICAL (R/P SECTION)	STANDARD SERIES		PROFESSIONAL SERIES	
	MODEL NUMBERS		MODEL NUMBERS	
	A1QC 17K	A1QC 47K	P-A1QC 44R	P-A1QC 46K
Head Function	Record/ Playback	Record/ Playback	Record Only	Record Playback
Inductance - 1 kHz, millihenrys	400	400	50	200
Impedance - 1 kHz - ohms	2,300	2,300	400	1,300
Resistance, D.C., mono, ohms	240	240	100	135
Gap Length, microinches	100	100	500	100
Average 7.5 IPS constant current record/playback characteristics using 3M 150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	.42	.42	.55	.38
Bias Voltage, RMS, 60 kHz, volts	30	30	8.0	21
Record Current, microamps	25	25	45	31
1 kHz Output, millivolts	1.6	1.6	—	1.3
10 kHz/ 1 kHz Ratio, dB	-1	-1	—	+1
Average 3.75 IPS constant current record/playback characteristics using 3M 150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation				
Peak Bias Current, 60 kHz, ma	.34	.34	.50	.30
Bias Voltage, RMS, 60 kHz, volts	25	25	.7	16
Record Current, microamps	22	22	45	30
1 kHz Output, millivolts	1.3	1.3	—	1.0
10 kHz/1 kHz Ratio, dB	-10	-10	—	-9
ELECTRICAL (ERASE SECTION)				
Inductance - 1 kHz, millihenrys	80	10	10	10
Resistance, D.C., ohms	240	35	35	35
Track Width, inches	.062	.062	.062	.062
Gap Length, Double Gap (each), inches	.004	.004	.004	.004
Typical characteristics for 60 dB erasure of a 400 Hz saturated signal on 3M 150 tape				
Erase Voltage @ 60 kHz, volts	120	25	25	25
Erase Current, ma	5	8	8	8
Impedance - 60 kHz, ohms	30,000	3,250	3,250	3,250

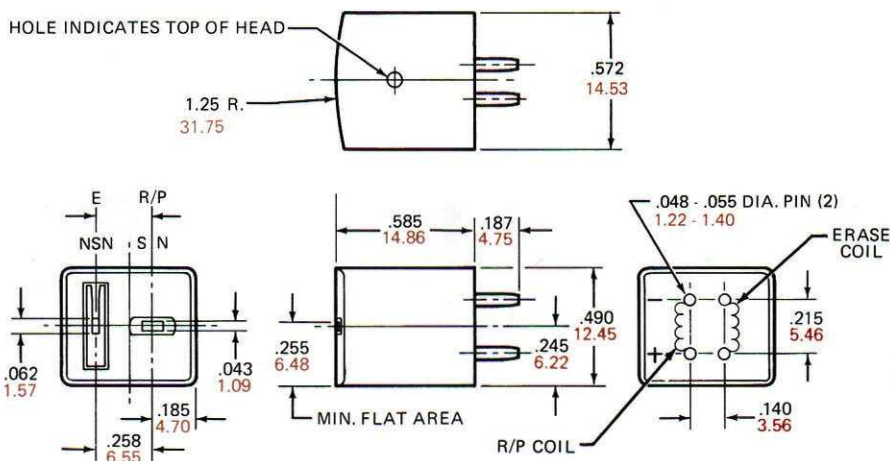
PHYSICAL CONFIGURATION

NOTES:

Head is shown no mount,
however, all standard "B"
case mounts are available

INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT





P-B1QY, P-B1QC and B1QC Quarter Track Mono R/P 0.043" SINGLE CHANNEL

	STANDARD SERIES		PROFESSIONAL SERIES		
	MODEL NUMBERS		MODEL NUMBERS		
	B1QC 4K	B1QC 7K	P-B1QC 4K	P-B1QC 4R	P-B1QY 6F
ELECTRICAL					
Head Function (Typical)	Record/ Playback	Record/ Playback	Record/ Playback	Record Only	Playback Only
Inductance - 1 kHz, millihenrys	100	400	100	50	200
Impedance - 1 kHz, ohms	700	2,300	650	400	1,400
Resistance, D.C. mono, ohms	100	240	100	100	135
Gap Length, microinches	100	100	100	500	50
Average 7.5 IPS constant current record/playback characteristics using 3M 150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	1.1	.42	.7	.50	.45
Bias Voltage, RMS, 60 kHz, volts	17	30	18	8.0	29
Record Current, microamps	48	25	60	45	32
1 kHz Output, millivolts	0.8	1.6	0.9	—	1.2
10 kHz/1 kHz Ratio, dB	-1	-1	0	—	+1
Average 3.75 IPS constant current record/playback characteristics using 3M 150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	0.9	.34	.5	.45	.40
Bias Voltage, RMS, 60 kHz, volts	15	25	13	7.0	20
Record Current, microamps	45	22	50	45	30
1 kHz Output, millivolts	0.6	1.3	0.7	—	.9
10 kHz/1 kHz Ratio, dB	-11	-11	-10	—	-7

PHYSICAL CONFIGURATIONS

NOTES:

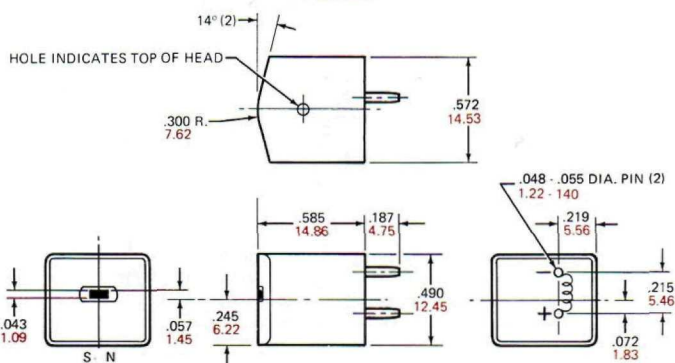
Heads are shown no mount, however, all standard "B" case mounts are available

INCHES IN BLACK

MILLIMETERS IN COLOR

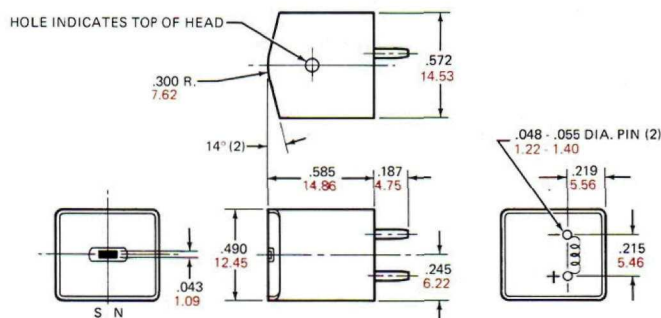
BASIC HEAD CONFIGURATION – NO MOUNT

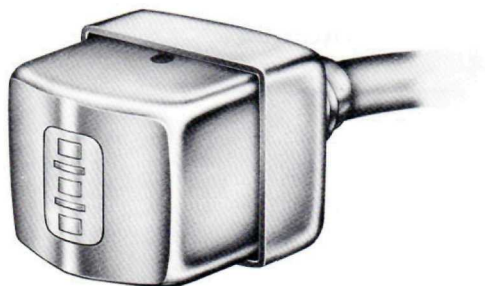
P-B1QY



BASIC HEAD CONFIGURATION – NO MOUNT

P-B1QC





P-B3Q Quarter Track R/P

0.043" THREE CHANNEL
PREMIUM SERIES

- MEETS NATIONAL ASSOCIATION OF BROADCASTERS SPECIFICATION FOR THREE CHANNELS ON 1/4" TAPE USED IN STEREO CARTRIDGE MACHINES

P-B3Q – PREMIUM SERIES

ELECTRICAL	MODEL NUMBER				
	P-B3Q 8R	P-B3Q 4R	P-B3Q 4K	P-B3Q 6K	P-B3Q 7K
Head Function (Typical)	Record Only	Record Only	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	10	50	100	200	350
Impedance - 1 kHz - ohms	70	400	650	1,300	2,200
Resistance, D.C. Stereo, ohms	32	100	100	200	800
Gap Length, microinches	500	500	100	100	100
1 kHz Crosstalk Rejection, dB	55	55	55	55	55
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	1.3	.50	.70	.38	.23
Bias Voltage, RMS, 60 kHz, volts	3.5	8.0	18	21	26
Record Current, microamps	110	45	60	31	25
1 kHz Output, millivolts	—	—	0.9	1.3	1.6
10 kHz/1 kHz Ratio, dB	—	—	0	+1	+1
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	1.2	.45	.50	.30	.18
Bias Voltage, RMS, 60 kHz, volts	3.2	7.0	13	16	21
Record Current, microamps	100	45	50	30	24
1 kHz Output, millivolts	—	—	0.7	1.0	1.3
10 kHz/1 kHz Ratio, dB	—	—	-10	-9	-9

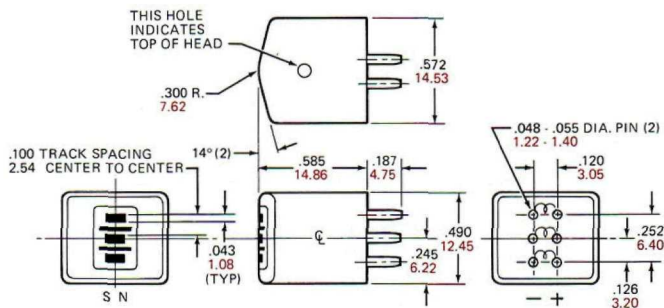
PHYSICAL CONFIGURATION

NOTES:

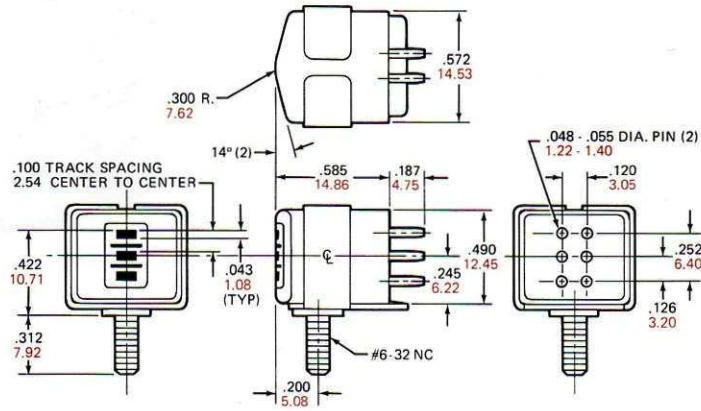
Also available for applications where size is a factor is Model P-C3Q, similar except for case width of 0.359".

INCHES IN BLACK
MILLIMETERS IN COLOR

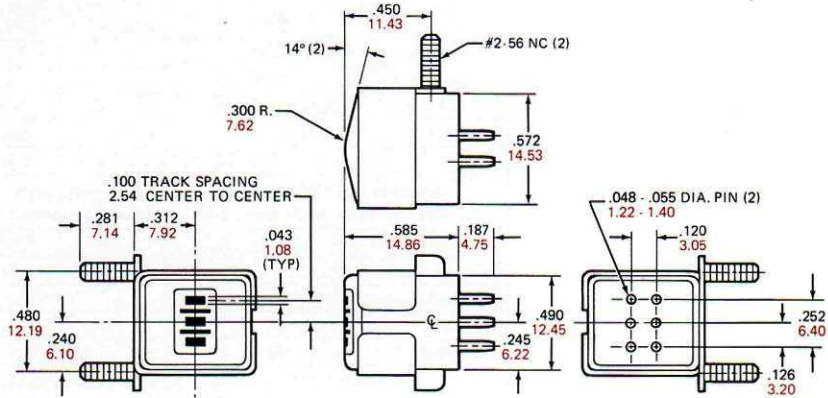
BASIC HEAD CONFIGURATION – NO MOUNT



HEAD WITH BASE MOUNT CONFIGURATION

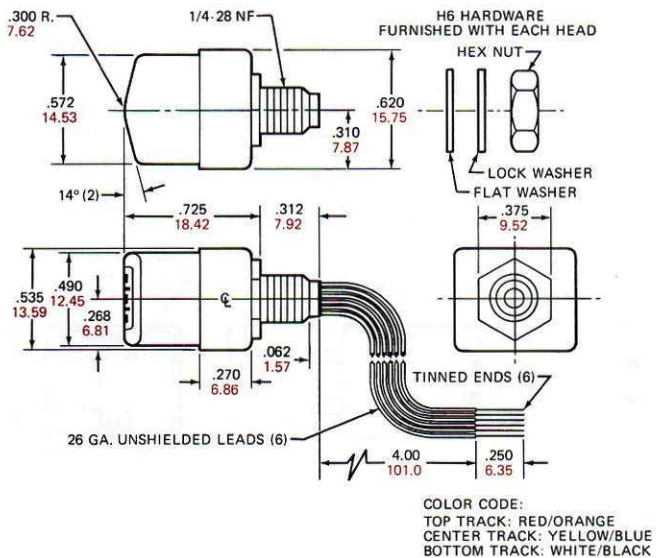


HEAD WITH SIDE MOUNT CONFIGURATION

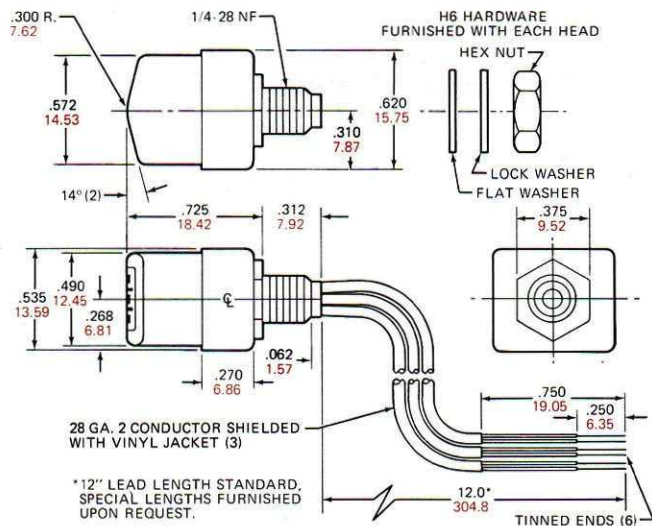


HEAD WITH REAR MOUNT CONFIGURATION

UNSHIELDED LEADS



SHIELDED LEADS



DESIGN DATA

NORTRONICS
AUDIO HEADS

E-B2L & P-B2L Eight Track Stereo R/P

.020" TWO CHANNEL



ELECTRICAL	MODEL NUMBER				
	E-B2L 7K	P-B2L 8R	P-B2L 4R	P-B2L 7K	P-B2L 8K
Head Function (Typical)	Record/ Playback	Record Only	Record Only	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	400	10	50	450	20
Impedance - 1 kHz - ohms	2,600	73	400	3,000	120
Resistance, D.C. Stereo, ohms	670	30	200	650	35
Gap Length, microinches	100	500	500	100	100
1 kHz Crosstalk Rejection, dB	48	50	50	50	50
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	.28	1.0	.45	.17	1.7
Bias Voltage, RMS, 60 kHz, volts	24	2.9	5.5	27	6
Record Current, microamps	17	85	40	18	120
1 kHz Output, millivolts	1.2	—	—	1.1	.24
10 kHz/1 kHz Ratio, dB	-2	—	—	+3	0
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	.24	—	.42	.12	—
Bias Voltage, RMS, 60 kHz, volts	21	—	5.0	24	—
Record Current, microamps	16	—	37	17	—
1 kHz Output, millivolts	0.9	—	—	1.0	—
10 kHz/1 kHz Ratio, dB	-9	—	—	-9	—

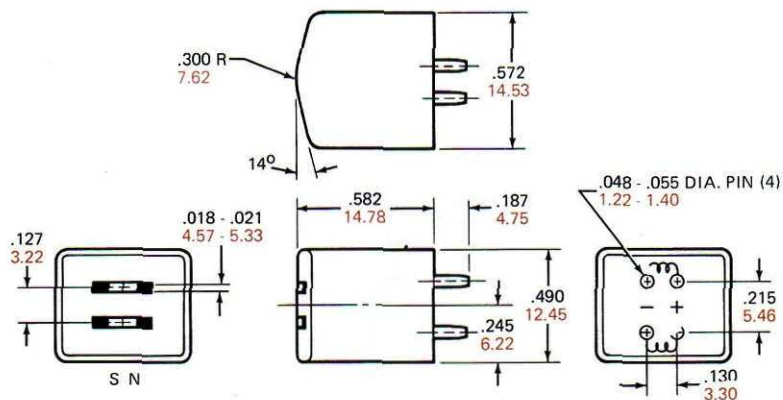
PHYSICAL CONFIGURATION

NOTES:

Head shown no mount, however all
standard "B" case mounts are available

INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT



Z-J2L Eight Track Stereo Z COMBO® Erase and R/P



ELECTRICAL (R/P SECTION)	MODEL NUMBER	
	Z-J2L 44R	Z-J2L 47K
Head Function (Typical)	Record Only	Record/ Playback
Inductance - 1 kHz - millihenrys	50	450
Resistance, D.C. stereo, ohms	150	620
Gap Length, microinches	500	100
ELECTRICAL (ERASE SECTION)		
Inductance - 1 kHz - millihenrys	14	14
Resistance, D.C. ohms	47	45
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape biased @ 1 kHz and recorded 12 dB below tape saturation, with R/P section shunt capacitor of 200 pf. See "Z" combo application notes.		
Erase Bias Current, 60 kHz, ma	4.5	12
Erase Bias Voltage, RMS, 60 kHz, volts	16	27
Record Current, microamps	50	22
1 kHz Output, millivolts	—	0.7
10 kHz/1 kHz Ratio, dB	—	-15

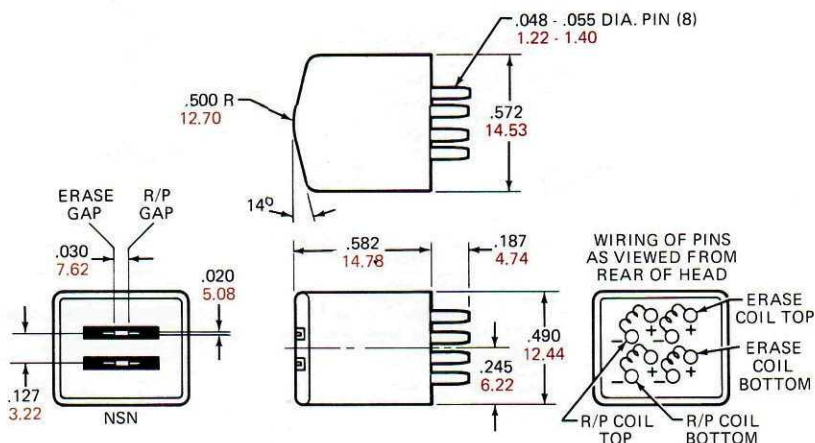
PHYSICAL CONFIGURATION

NOTES:

Head shown no mount, however all standard "B" case mounts are available

INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT





P-BQL & PC-BQL Eight Track, Four Channel R/P .021" FOUR CHANNEL

P-BQL – PREMIUM SERIES

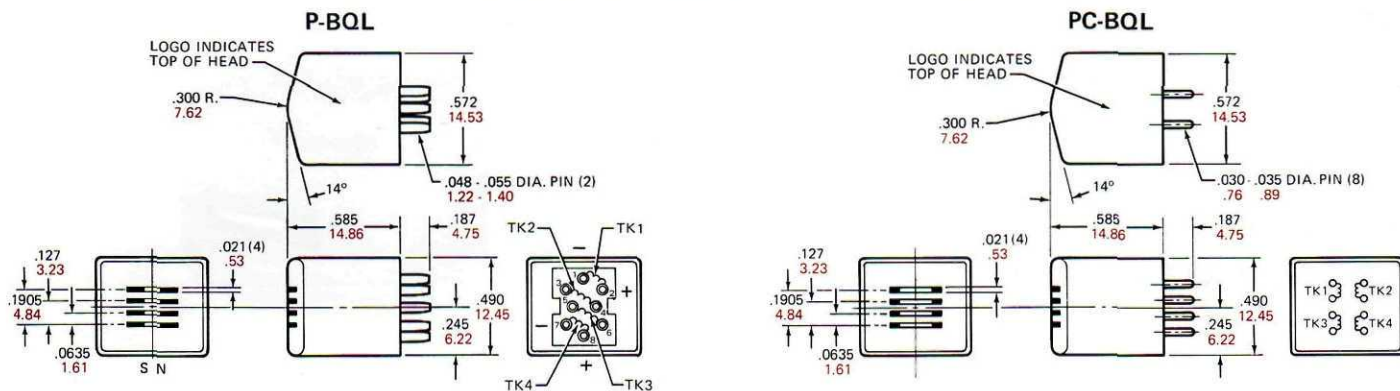
ELECTRICAL	MODEL NUMBER						
	P-BQL 14R	P-BQL 8R	P-BQL 4R	P-BQL 8K	P-BQL 4K	P-BQL 6K	P-BQL 7K
Head Function (Typical)	Record Only	Record Only	Record Only	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz, millihenrys	2.0	10	50	20	100	200	330
Impedance - 1 kHz, ohms	15	95	300	150	600	1350	2800
Resistance, D.C., ohms	15	60	230	45	270	490	760
Gap Length, microinches	500	500	500	100	100	100	100
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation							
Peak Bias Current, 100 kHz, ma	3.0	1.6	.48	1.35	.4	0.32	0.24
Bias Voltage, RMS, 100 kHz, volts	3.0	8.3	17	11	25	26	36
Record Current, microamps	200	120	50	95	42	30	24
1 kHz Output, millivolts	—	—	—	0.25	0.5	0.8	0.9
10 kHz/1 kHz Ratio, dB	—	—	—	+1	+1	+1	+1
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation							
Peak Bias Current, 100 kHz, ma	2.4	1.5	.42	1.1	.35	0.27	0.22
Bias Voltage, RMS, 100 kHz, volts	2.4	7.4	15	8.8	22	24	33
Record Current, microamps	170	110	42	76	40	28	22
1 kHz Output, millivolts	—	—	—	0.20	0.4	0.6	0.7
10 kHz/1 kHz Ratio, dB	—	—	—	-10	-10	-10	-10

PC-BQL – HIGH CROSS TALK REJECTION SERIES

ELECTRICAL	MODEL NUMBER						
	PC-BQL 14R	PC-BQL 8R	PC-BQL 4R	PC-BQL 8K	PC-BQL 4K	PC-BQL 6K	PC-BQL 7K
Head Function (Typical)	Record Only	Record Only	Record Only	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	2.0	10	50	20	100	200	320
Impedance - 1 kHz - ohms	15	95	400	150	700	1400	2600
Resistance, D. C., ohms	10	30	270	45	135	290	440
Gap Length, microinches	500	500	500	100	100	100	100
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation							
Peak Bias Current, 100 kHz, ma	3.6	1.5	0.5	1.35	0.6	0.4	0.31
Bias Voltage, RMS, 100 kHz, volts	3.5	6.0	18	11	25	35	48
Record Current, microamps	250	110	42	95	42	31	24
1 kHz Output, millivolts	—	—	—	0.22	0.5	0.6	0.75
10 kHz/1 kHz Ratio, dB	—	—	—	+1	+1	+1	+1
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation							
Peak Bias Current, 100 kHz, ma	3.0	1.4	0.45	1.23	0.55	0.3	0.24
Bias Voltage, RMS, 100 kHz, volts	3.1	5.3	16	9.8	22	31	40
Record Current, microamps	230	100	40	90	40	30	23
1 kHz Output, millivolts	—	—	—	0.20	0.4	0.5	0.5
10 kHz/1 kHz Ratio, dB	—	—	—	-8	-8	-8	-8

PHYSICAL CONFIGURATIONS

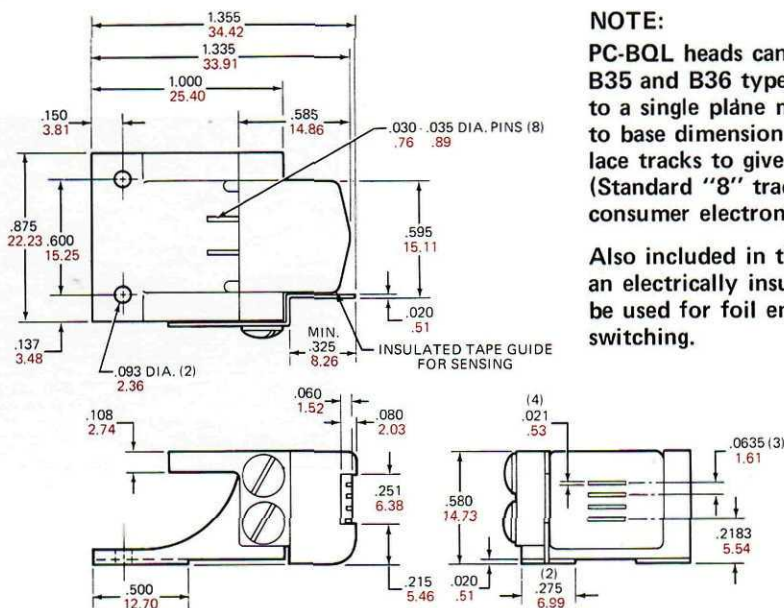
BASIC HEAD CONFIGURATIONS – NO MOUNT



NOTE: Heads are shown no mount, however all standard "B" case mounts are available.

PC-BQL WITH PRECISION MOUNTS

PC-BQL WITH PRECISION B36 MOUNT

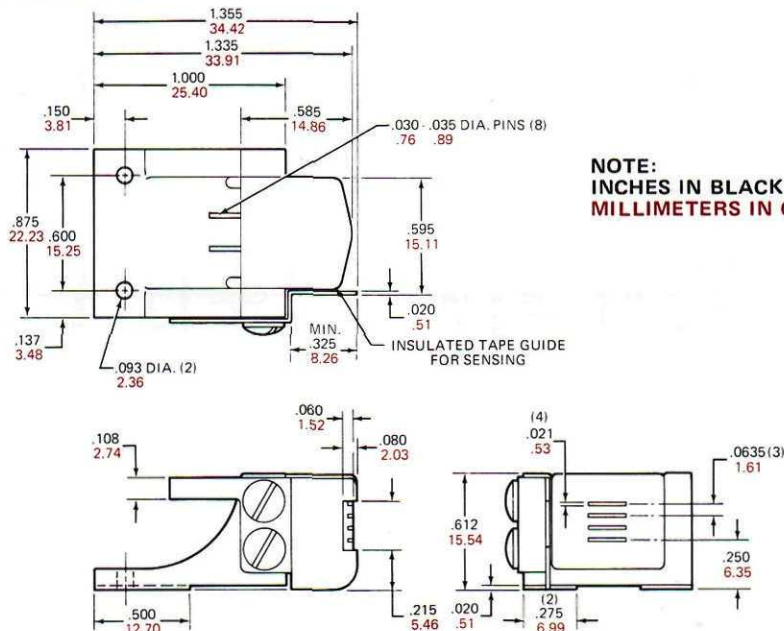


NOTE:

PC-BQL heads can be supplied with precision B35 and B36 type mounts for direct mounting to a single plane mounting surface. The track to base dimension is precision ground to inter-lace tracks to give 8 tracks on 1/4" tape. (Standard "8" track stereo or quad used in consumer electronic cartridge equipment.)

Also included in the B35 and B36 mounts is an electrically insulated tape guide that can be used for foil end of tape sensing or track switching.

PC-BQL WITH PRECISION B35 MOUNT



NOTE:

INCHES IN BLACK
MILLIMETERS IN COLOR

X-RILC & X-RINC Extended Tip R/P

.020" & .013" SINGLE CHANNEL



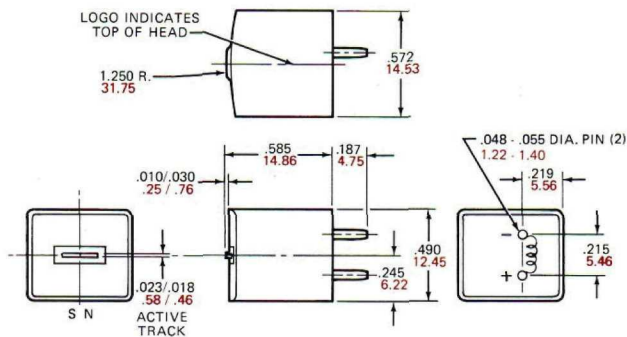
ELECTRICAL	MODEL NUMBERS	
	X-R1LC 7K	X-R1NC 10K
Head Function (Typical)	Playback	Playback
Track Width, inches	.021	.0135
Inductance - 1 kHz, millihenrys	400	500
Impedance - 1 kHz, ohms	2,500	3,500
Resistance, D.C., ohms	430	690
Gap Length, microinches	100	100
Average 3.75 IPS playback characteristics		
1 kHz Output, millivolts	0.8	0.7
10 kHz/1 kHz Ratio, dB	-6	-14

PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

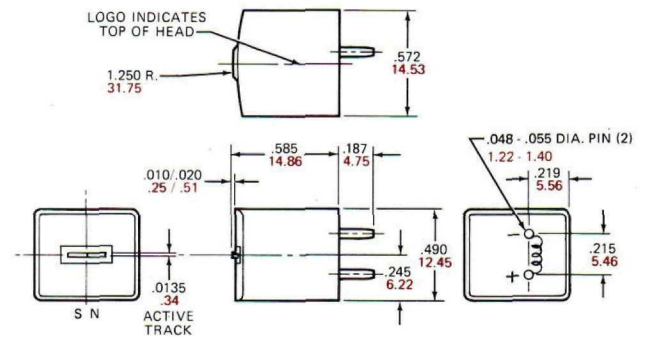
BASIC HEAD CONFIGURATION – NO MOUNT

X-R1LC



BASIC HEAD CONFIGURATION – NO MOUNT

X-R1NC



DESIGN DATA

NORTRONICS
AUDIO HEADS

XZ-RILC & XZRINC

Extended Tip

Z COMBO®

Erase & R/P

.020" & .013" SINGLE CHANNEL



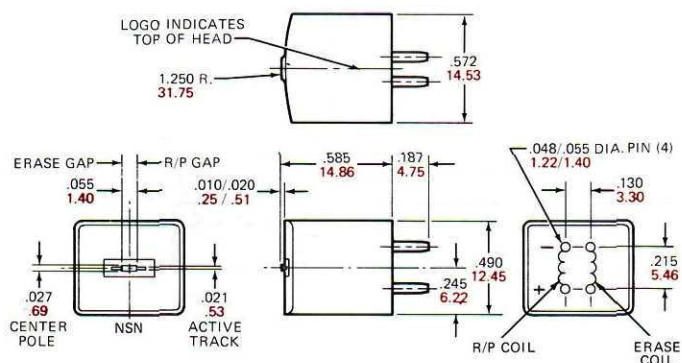
ELECTRICAL (R/P SECTION)	MODEL NUMBERS		
	XZR1LC 47K	XZR1LC 96K	XZR1NC 75K
Track Width (Nominal), inches	.021	.021	.013
Head Function (Typical)	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz, millihenrys	450	200	550
Resistance, D.C., ohms	1,000	465	1,500
Impedance, 1 kHz, ohms	3,600	1,600	4,000
Gap Length, microinches	100	100	100
ELECTRICAL (ERASE SECTION)			
Inductance, 1 kHz, millihenrys	13	8	0.6
Resistance, D.C., ohms	80	80	7.5
Average 3.75 IPS constant current record/playback characteristics using 3M 150 tape biased @ 1 kHz and recorded 12 dB below tape saturation, with R/P shunt capacitor. See Z Combo application notes.			
Erase Bias Current, 60 kHz, ma	13	20	33
Erase Bias Voltage, RMS, 60 kHz, volts	35	40	5
Record Current, microamps	22	30	30
1 kHz Output, millivolts	0.8	0.5	1.1
10 kHz/1 kHz Ratio, dB	-14	-12	-12
Shunt capacitor across R/P Coil, pf	50	50	300

PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

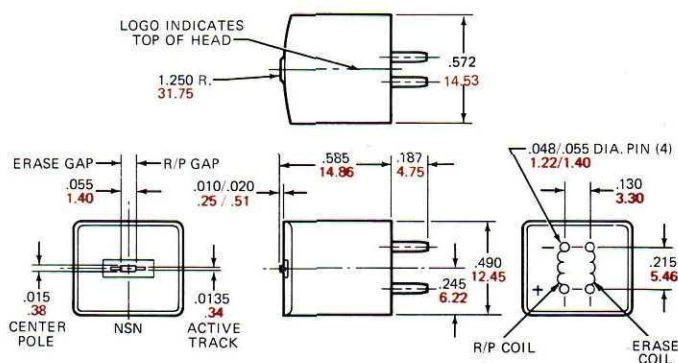
BASIC HEAD CONFIGURATION – NO MOUNT

XZ-R1LC



BASIC HEAD CONFIGURATION – NO MOUNT

XZR1NC



DESIGN DATA

NORTRONICS
AUDIO HEADS

X-W1LC Extended Tip R/P Miniature Series .021" SINGLE CHANNEL

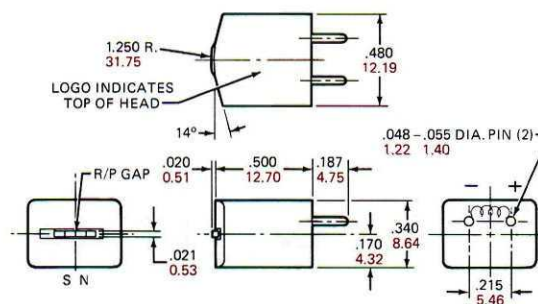


ELECTRICAL	MODEL NUMBER		
	X-W1LC 6K	X-W1LC 8R	X-W1LC 7K
Head Function (Typical)	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz, millihenrys	200	10	450
Impedance - 1 kHz, ohms	1310	70	3000
Resistance, D.C. Mono, ohms	360	60	700
Gap Length, microinches	100	500	100
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 60 kHz, ma	.6	2.5	.13
Bias Voltage, RMS, 60 kHz, volts	20	5.0	26
Record Current, microamps	30	150	25
1 kHz Output, millivolts	.50	—	.8
10 kHz/1 kHz Ratio, dB	-11	—	-9

PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATIONS – NO MOUNT



DESIGN DATA

NORTRONICS
AUDIO HEADS

X-ZW1LC
Extended Tip Z COMBO®
Erase & R/P
Miniature Series
.021" SINGLE CHANNEL

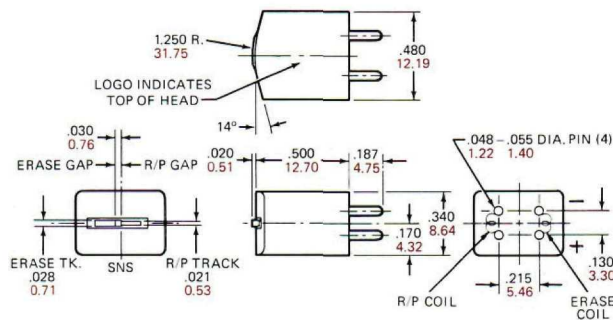


ELECTRICAL (R/P SECTION)	MODEL NUMBER	
	X-ZW1LC 96K	X-ZW1LC 47K
Head Function (Typical)	Record/ Playback	Record/ Playback
Inductance - 1 kHz, millihenrys	200	400
Resistance, D.C., ohms	415	600
Impedance, 1 kHz, ohms	1600	3000
Gap Length, microinches	100	100
ELECTRICAL (ERASE SECTION)		
Inductance, 1 kHz, millihenrys	8	10
Resistance, D.C., ohms	65	75
Average 3.75 IPS constant current record/playback characteristics using 3M211 tape biased @ 1 kHz and recorded 12 dB below tape saturation, with R/P shunt capacitor of 200 pf. See "Z" combo application notes		
Erase Bias Current, 60 kHz, ma	20	20
Erase Bias Voltage, RMS, 60 kHz, volts	30	44
Record Current, microamps	35	25
1 kHz Output, millivolts	.5	0.7
10 kHz/1 kHz Ratio, dB	-12	-14

PHYSICAL CONFIGURATION

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATIONS – NO MOUNT



Miniature Type "L" Head R/P & Erase

0.024" OR 0.042" SINGLE CHANNEL
FLUSH OR RELIEVED FACE



R/P DATA

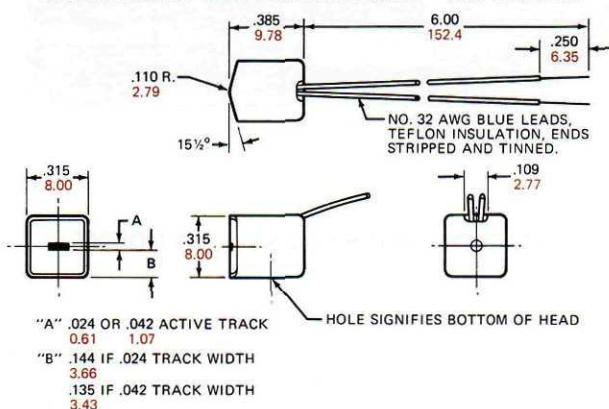
ELECTRICAL	MODEL NUMBER				
	L42R 3K 3K5	L42R 5K 5K5	L42R 8L 8L5	L24R 2K 2K5	L24R 8L 8L5
Head Function (Typical)	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz, millihenrys	250	220	80	200	40
Impedance - 1 kHz, ohms	1600	1600	500	1200	250
Resistance, D.C. Mono, ohms	460	250	125	465	130
Gap Length, microinches	100	100	160	100	160
Track Width, inches	.042	.042	.042	.024	.024
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	.23	.40	.4	.23	.45
Bias Voltage, RMS, 60 kHz, volts	24	25	9	15	5.5
Record Current, microamps	30	30	40	25	45
1 kHz Output, millivolts	1.0	1.0	1.0	1.1	.5
10 kHz/1 kHz Ratio, dB	0	0	+2	+2	+2

ERASE DATA

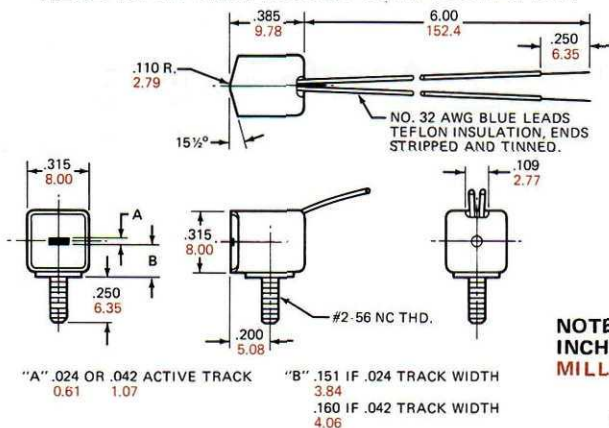
ELECTRICAL	MODEL NUMBER
	L42E 6U 6U5
Inductance @ 1 kHz, millihenrys	5
Resistance, D.C., ohms	40
Track Width, inches	.042
Typical operating characteristics for 60 dB erasure of saturated 400 CPS	
Erase Voltage @ 60 kHz, volts	32-48
Erase Current, ma, 60 kHz	28-42
Impedance @ 60 kHz, ohms	1200

PHYSICAL CONFIGURATIONS

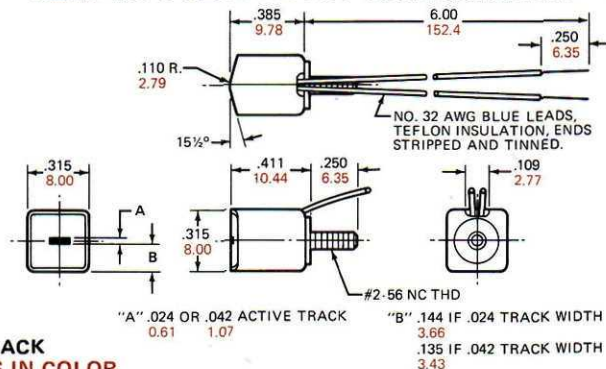
BASIC HEAD CONFIGURATION - NO MOUNT



HEAD WITH BASE MOUNT CONFIGURATION



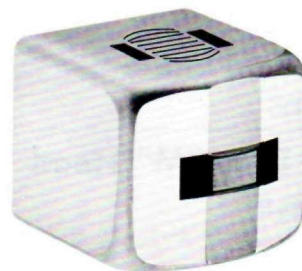
HEAD WITH REAR MOUNT CONFIGURATION



NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

B1HC & XY-C1HC Half Track Mono R/P

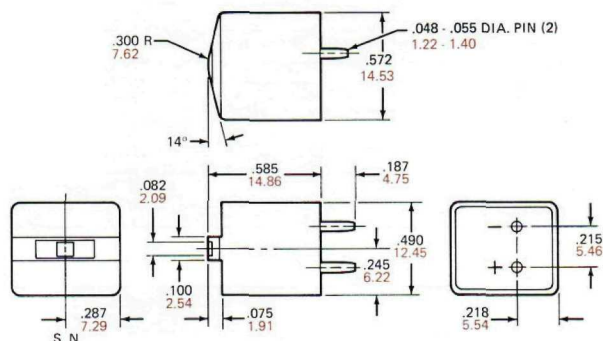
0.080" SINGLE CHANNEL
WITH RELIEVED FACE FOR
FILM/DRUM APPLICATIONS



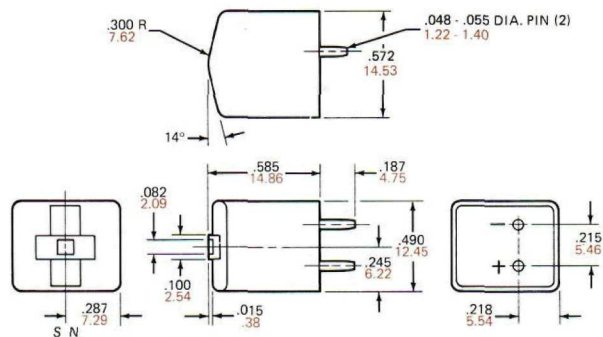
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

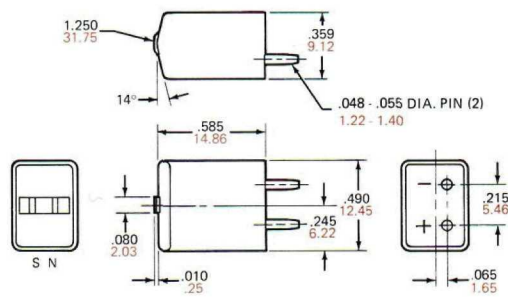
B1HC27L57-NO



B1HC27L67-NO



XY-C1HC



ELECTRICAL	MODEL NUMBER		
	XY-C1H 7K	XY-C1HC 8T	B1HC 27L
Head Function — Typical	Record/ Playback	Erase	Playback
Inductance — 1 kHz - millihenrys	400	6.0	4,000
Impedance — 1 kHz - ohms	2,650	2,000	17,000
Resistance, D.C., Mono, ohms	135	27	2,400
Gap Length, microinches	100	2,000	160
Average 7.5 IPS constant current record/playback characteristics using 3M 150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 60 kHz, ma	.6	60*	—
Bias Voltage, RMS, 60 kHz, volts	45	60*	—
Record Current, microamps	36	—	—
1 kHz Output, millivolts	2.1	—	10.0
10 kHz/1 kHz ratio, dB	-1	—	+1.0
Average 3.75 IPS constant current record/playback characteristics using 3M 150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 60 kHz, ma	.5	—	—
Bias Voltage, RMS, 60 kHz, volts	36	—	—
Record Current, microamps	35	—	—
1 kHz Output, millivolts	1.9	—	—
10 kHz/1 kHz ratio, dB	-11	—	—

*Erase data for 40 dB erasure of a 400 Hz saturated signal on 3M 150 tape

Miniature Type "M" Head R/P & Erase



PHYSICAL CONFIGURATIONS

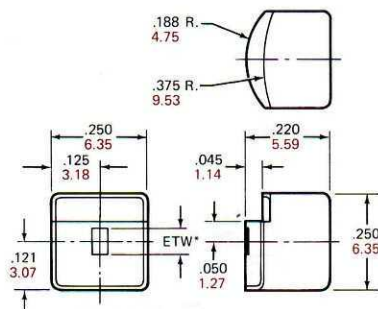
NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

FACE-RELIEF OPTION:

MINIATURE "M" HEAD WITH #3
FACE RELIEF.

To specify: Add 3 to Part # following Gap
Designator

Example: M70R4L3-NX-6U



*ETW = .070 R/P HEAD
1.78
.090 ERASE HEAD
2.29

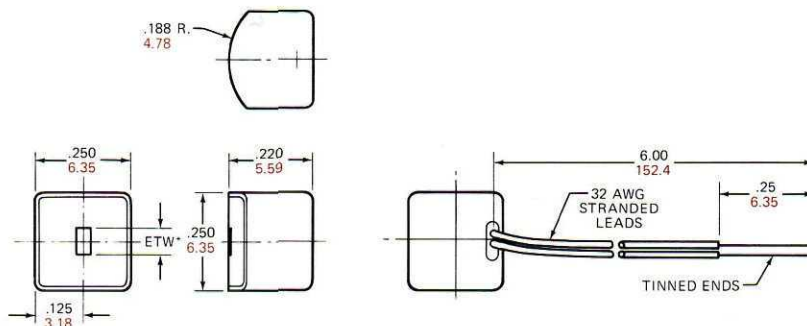
R/P DATA

ELECTRICAL	MODEL NUMBER		
	M70R3L M70R3L3	M70R4L M70R4L3	M70R5L M70R5L3
Head Function (Typical)	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz, millihenrys	95	20	200
Impedance - 1 kHz, ohms	700	150	1500
Resistance, D.C., Mono, ohms	340	80	700
Gap Length, microinches	160	160	160
Average 7.5 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 60 kHz, ma	.97	2	.6
Bias Voltage, RMS, 60 kHz, volts	16.3	9	25
Record Current, microamps	48	100	33
1 kHz Output, millivolts	1.4	.75	2.2
10 kHz/1 kHz Ratio, dB	-3	-3	-3
Average 3.75 IPS constant current record/playback characteristics using 3M150 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation			
Peak Bias Current, 60 kHz, ma	.83	1.7	.5
Bias Voltage, RMS, 60 kHz, volts	14	7.6	21
Record Current, microamps	45	85	30
1 kHz Output, millivolts	1.1	.7	1.8
10 kHz/1 kHz Ratio, dB	-15	-15	-15

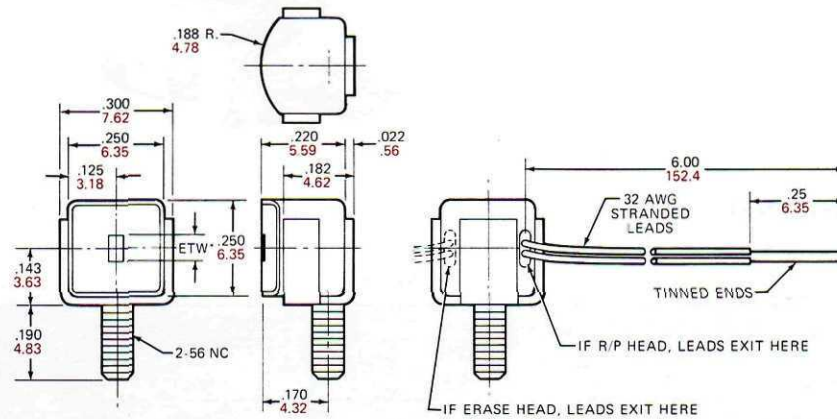
ERASE DATA

ELECTRICAL	MODEL NUMBER	
	M90E3U M90E3U3	M90E4U M90E4U3
Inductance @ 1 kHz, millihenrys	16	6
Resistance, D.C., ohms	315	83
Operating characteristics for a minimum of 45 dB erasure of saturated 400 CPS on 3M 150 tape		
Erase Voltage @ 60 kHz, volts	50	45
Erase Current, ma	12	30
Impedance, 60 kHz, ohms	4000	1500

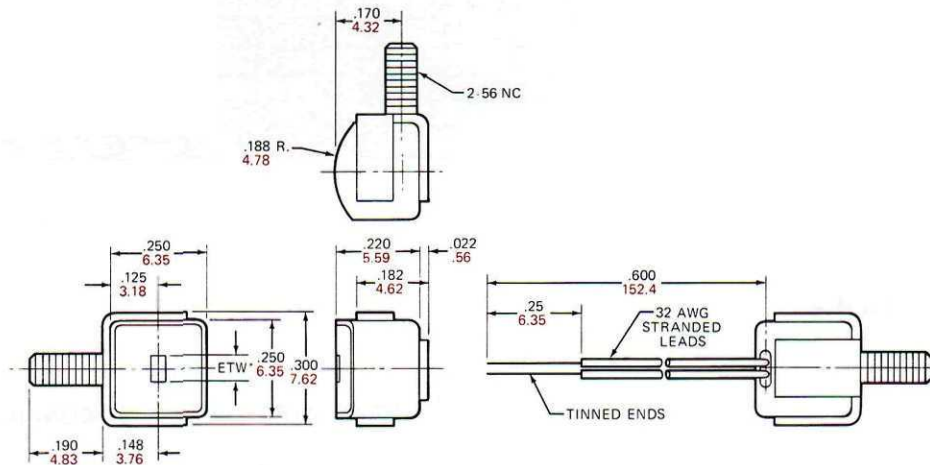
BASIC HEAD CONFIGURATIONS – NO MOUNT



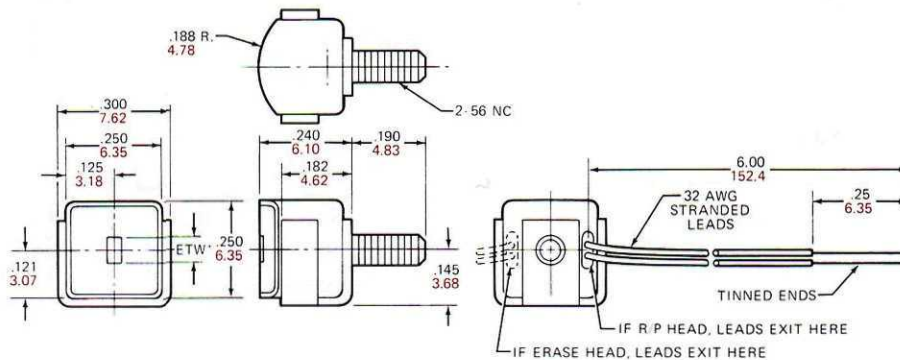
HEAD WITH BASE MOUNT CONFIGURATION



HEAD WITH SIDE MOUNT CONFIGURATION



HEAD WITH REAR MOUNT CONFIGURATION



* ETW = .070 R/P HEAD
1.78
.090 ERASE HEAD
2.29



W1R & P-W1P Cassette R/P

.056" & .057" SINGLE CHANNEL

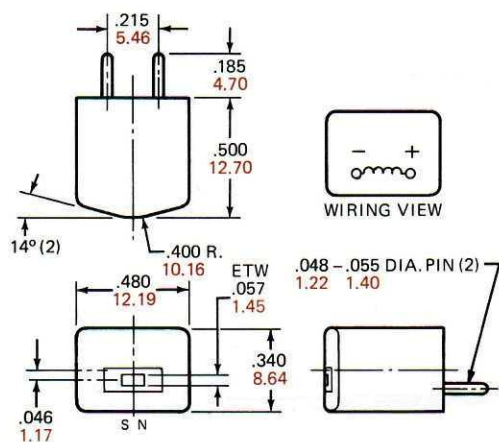
W1R

ELECTRICAL	MODEL NUMBERS				
	W1R 8N	W1R 8K	W1R 5K	W1R 4F	W1R 6F
Head Function (Typical)	Record Only	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz, millihenrys	10	20	50	80	200
Impedance - 1 kHz, ohms	75	150	300	600	1,200
Resistance, D.C., ohms	35	43	80	110	175
Gap Length, microinches	200	100	100	50	50
Average 1.875 IPS constant current record/playback characteristics using 3M 8109 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation					
Peak Bias Current, 60 kHz, ma	1.7	1.4	0.8	0.6	0.33
Bias Voltage, RMS, 60 kHz, volts	4.1	6.0	9.0	16	18
Record Current, microamps	120	100	70	52	34
1 kHz Output, millivolts	—	0.16	0.27	0.3	0.45
10 kHz/1 kHz Ratio, dB	—	-17	-16	-12	-12

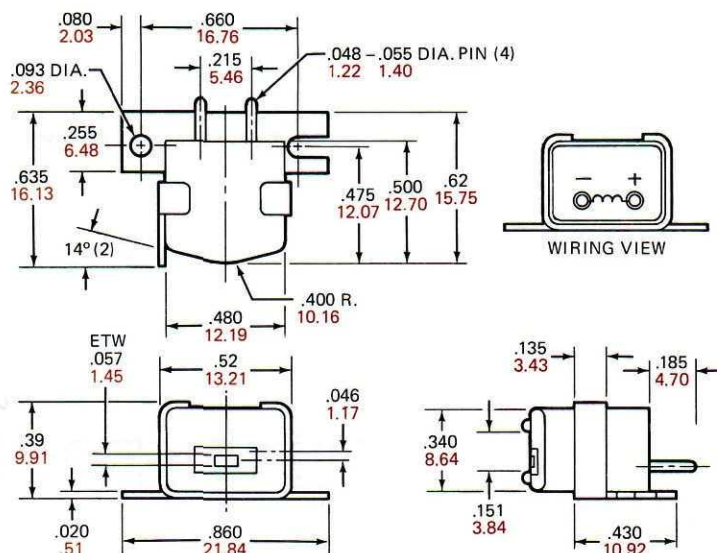
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION — NO MOUNT



HEAD WITH "A" MOUNT CONFIGURATION



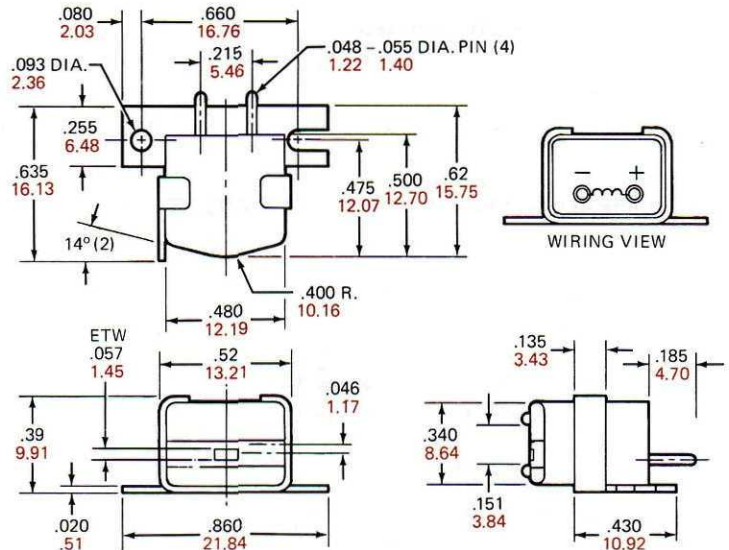
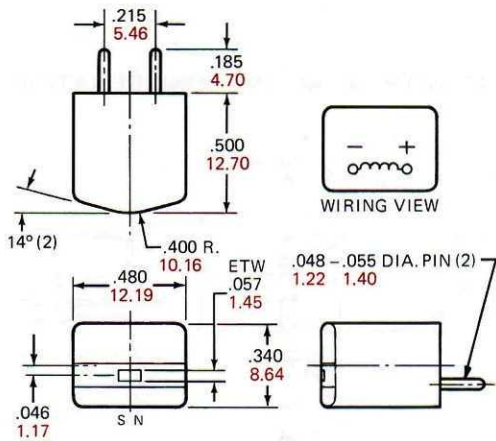
P-W1P DUPLICATING SERIES

ELECTRICAL	MODEL NUMBER						
	P-W1P 2N	P-W1P 11N	P-W1P 11F	P-W1P 9F	P-W1P 8F	P-W1P 4K	P-W1P 4F
Head Function (Typical)	Duplicating Record	Duplicating Record	Duplicating Playback	Duplicating Playback	Duplicating Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz, millihenrys	.15	2.0	2.0	10	20	100	70
Impedance - 1 kHz, ohms	1.0	20	20	65	135	500	450
Resistance, D.C. Stereo, ohms	1.0	9.0	14	28	40	178	115
Gap Length, microinches	200	200	50	50	50	100	50
Average 15 IPS constant current record/playback characteristics using 3M277 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation							
Peak Bias Current, 500 kHz, ma	10.0	2.5	—	—	—	—	—
Bias Voltage, RMS, 500 kHz, volt	4.6	15	—	—	—	—	—
Record Current, microamps	720	250	—	—	—	—	—
1 kHz Output, millivolts	—	—	0.7	0.7	1.1	—	—
10 kHz/1 kHz Ratio, dB	—	—	-9	-9	-12	—	—
Average 1.875 IPS constant current record/playback characteristics using 3M277 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation							
Peak Bias Current, 60 kHz, ma	10*	2.5	—	—	—	.18	.22
Bias Voltage, RMS, 60 kHz, volts	0.8*	1.6	—	—	—	13	15
Record Current, microamps	700	200	—	—	—	33	45
1 kHz Output, millivolts	—	—	0.04	0.09	0.15	.34	.28
10 kHz/1 kHz Ratio, dB	—	—	-9	-9	-12	-13	-9

*100 kHz bias frequency data

HEAD WITH "A" MOUNT CONFIGURATION

BASIC HEAD CONFIGURATION – NO MOUNT



DESIGN DATA

NORTRONICS

AUDIO HEADS

W2P & P-W2P Cassette R/P

0.057" TWO CHANNEL



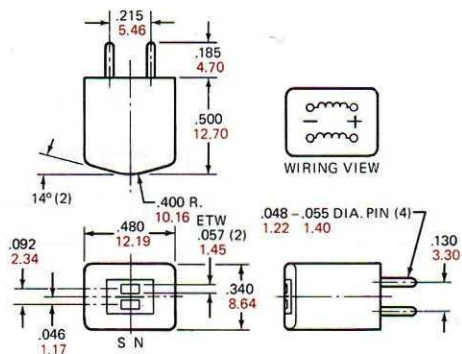
W2P

ELECTRICAL	MODEL NUMBER					
	W2P 11N	W2P 8F	W2P 8K	W2P 8N	W2P 4F	W2P 6F
Head Function (typical)	Record Only	Playback Only	Record/ Playback	Record Only	Record/ Playback	Record/ Playback
Inductance - 1 kHz - millihenrys	2.0	20	20	10	80	200
Impedance - 1 kHz, ohms	20	135	150	80	600	1200
Resistance, D.C. Stereo, ohms	9.0	45	50*	40	110	215
Gap Length, microinches	200	50	100	200	50	50
Average 15 IPS constant current record/playback characteristics using 3M277 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation						
Peak Bias Current, 500 kHz, ma	6.5	—	—	2.5	—	—
Bias Voltage, RMS, 500 kHz, volts	16	—	—	30	—	—
Record Current, microamps	200	—	—	100	—	—
1 kHz Output, millivolts	—	.75	—	—	—	—
10 kHz/1 kHz Ratio, dB	—	-16	—	—	—	—
Average 1.875 IPS constant current record/playback characteristics using 3M277 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation						
Peak Bias Current, 60 kHz, ma	3.6	—	0.7	1.0	.50	.30
Bias Voltage, RMS, 60 kHz, volts	1.7	—	4.3	3.0	11	18
Record Current, microamps	260	—	70	95	43	30
1 kHz Output, millivolts	—	.20	.22	—	.38	.50
10 kHz/1 kHz Ratio, dB	—	-9	-17	—	-12	-14

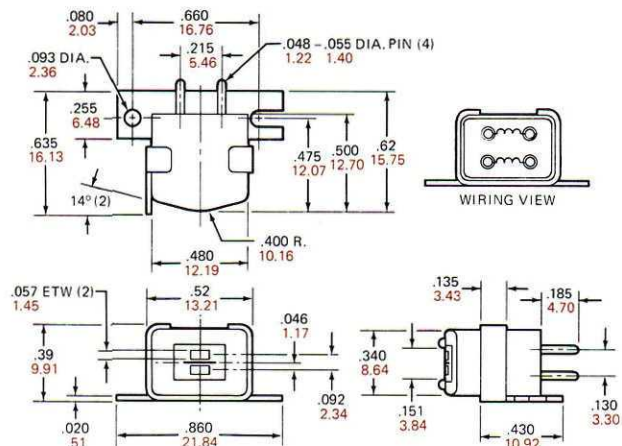
PHYSICAL CONFIGURATIONS

NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION – NO MOUNT



HEAD WITH "A" MOUNT CONFIGURATION





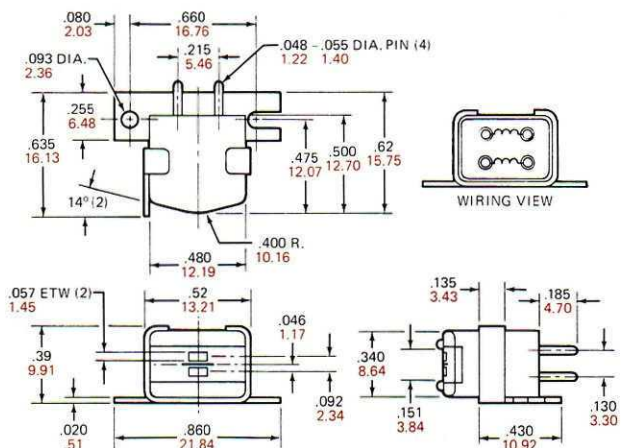
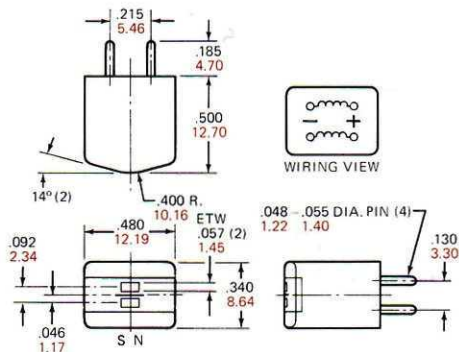
P-W2P DUPLICATING SERIES

ELECTRICAL	MODEL NUMBER						
	P-W2P 2N	P-W2P 11N	P-W2P 11F	P-W2P 9F	P-W2P 8F	P-W2P 4K	P-W2P 4F
Head Function (Typical)	Duplicating Record	Duplicating Record	Duplicating Playback	Duplicating Playback	Duplicating Playback	Record/ Playback	Record/ Playback
Inductance - 1 kHz, millihenrys	.15	2.0	2.0	10	20	100	70
Impedance - 1 kHz, ohms	1.0	20	20	65	135	500	450
Resistance, D.C. Stereo, ohms	1.0	9.0	14	40	45	178	115
Gap Length, microinches	200	200	50	50	50	100	50
Average 15 IPS constant current record/playback characteristics using 3M277 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation							
Peak Bias Current, 500 kHz, ma	10.0	2.5	—	—	—	—	—
Bias Voltage, RMS, 500 kHz, volt	4.6	15	—	—	—	—	—
Record Current, microamps	720	250	—	—	—	—	—
1 kHz Output, millivolts	—	—	0.7	0.7	1.1	—	—
10 kHz/1 kHz Ratio, dB	—	—	-9	-9	-12	—	—
Average 1.875 IPS constant current record/playback characteristics using 3M277 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation							
Peak Bias Current, 60 kHz, ma	10*	2.5	—	—	—	.18	.22
Bias Voltage, RMS, 60 kHz, volts	0.8*	1.6	—	—	—	13	15
Record Current, microamps	700	200	—	—	—	33	45
1 kHz Output, millivolts	—	—	0.04	0.09	0.15	.34	.28
10 kHz/1 kHz Ratio, dB	—	—	-9	-9	-12	-13	-9

*100 kHz bias frequency data

HEAD WITH "A" MOUNT CONFIGURATION

BASIC HEAD CONFIGURATION – NO MOUNT





P-W4J

Cassette R/P

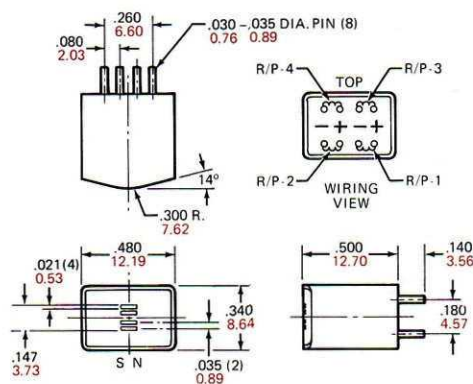
.021 " FOUR CHANNEL
PREMIUM SERIES

ELECTRICAL	MODEL NUMBER							
	P-W4J 2N	P-W4J 12N	P-W4J 11N	P-W4J 9F	P-W4J 8N	P-W4J 8K	P-W4J 8F	P-W4J 4F
Head Function (Typical)	Duplicating Record	Duplicating Record	Duplicating Record	Playback Only	Record Only	Record/ Playback	Playback Only	Record/ Playback
Inductance - 1 kHz, millihenrys	0.2	0.4	2	10	10	20	20	80
Impedance - 1 kHz, ohms	13	5	30	65	95	150	150	500
Resistance, D.C., Stereo, ohms	2.3	3.5	27	43	60	80	65	335
Gap Length, microinches	200	200	200	50	200	100	50	50
1 kHz Crosstalk Rejection, dB	60	60	67	60	58	57	57	60
Average 15 IPS constant current record/playback characteristics using 3M277 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation								
Peak Bias Current, 500 kHz, ma	17	15	5.2	—	1.3	—	—	—
Bias Voltage, RMS, 500 kHz, volts	2.6	5.0	14	—	23	—	—	—
Record Current, microamps	850	500	200	—	80	—	—	—
1 kHz Output, millivolts	—	—	—	—	—	—	—	—
10 kHz/ 1 kHz Ratio, dB	—	—	—	—	—	—	—	—
Average 1.875 IPS constant current record/playback characteristics using 3M277 tape peak biased @ 1 kHz and recorded 12 dB below tape saturation								
Peak Bias Current, 100 kHz, ma	8	6.0	3.6	—	.85	.85	—	.8
Bias Voltage, RMS 100 kHz, volts	.5	1.0	1.1	—	3.3	6.5	—	21
Record Current, microamps	800	450	190	—	75	60	—	50
1 kHz Output, millivolts	—	—	—	.056	—	.1	0.09	0.14
10 kHz/1 kHz Ratio, dB	—	—	—	-13	—	-16	-14	-14

PHYSICAL CONFIGURATIONS

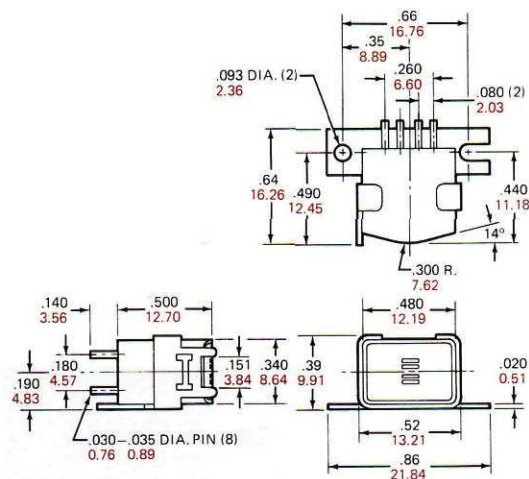
NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

BASIC HEAD CONFIGURATION — NO MOUNT



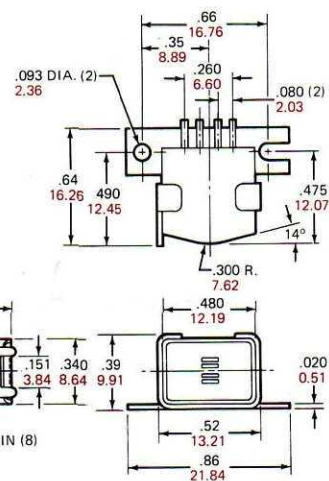
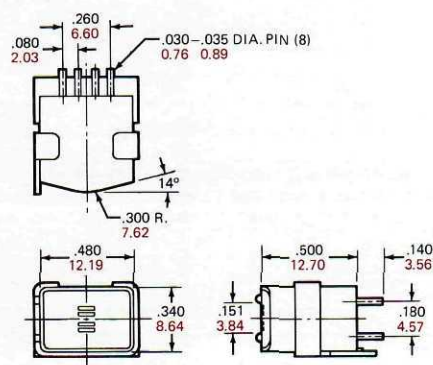
BASIC HEAD CONFIGURATION – BASE MOUNTS

"A" MOUNT STYLE

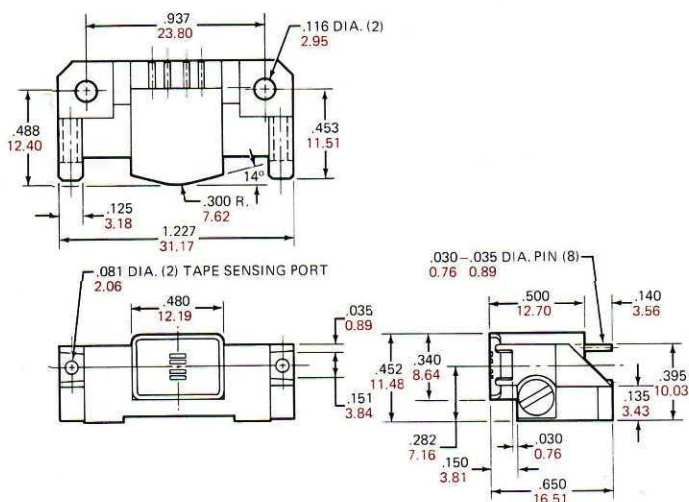


A7 MOUNT STYLE

A11 MOUNT STYLE



A3 MOUNT STYLE



DESIGN DATA

NORTRONICS
AUDIO HEADS

ZWIR & ZW2RK Cassette Z COMBO® R/P & Erase Head ONE AND TWO CHANNEL



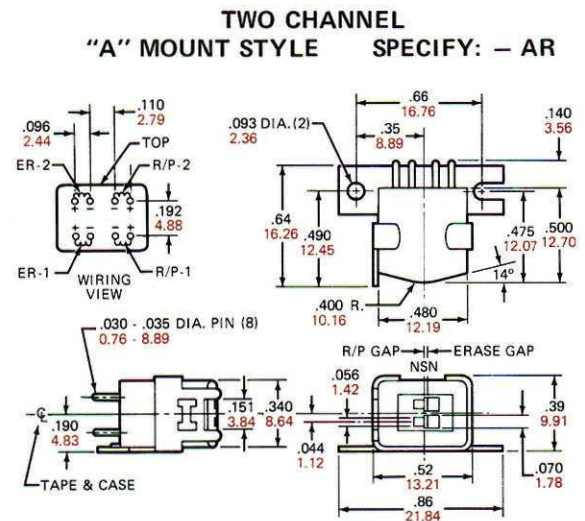
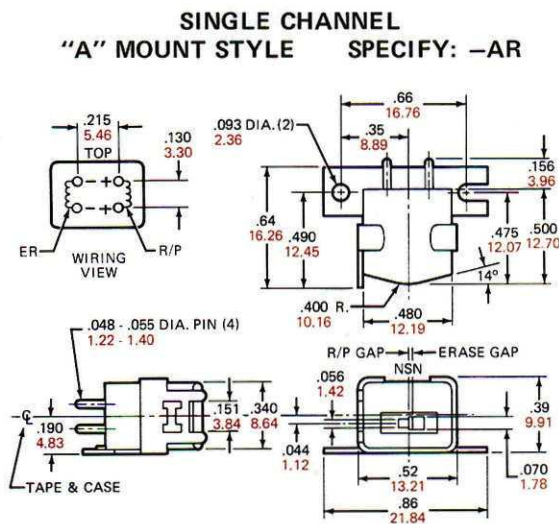
ELECTRICAL (R/P SECTION)	MODEL NUMBER			
	ZW1R ZW2RK 36F	ZW1R ZW2RK 36K	ZW1R ZW2RK 38N	ZW1R ZW2RK 48N
Head Function (Typical)	Record/ Playback	Record/ Playback	Record Only	Record Only
Inductance, 1 kHz, millihenrys	200	200	10	12
Resistance, D.C., ohms	280	480	50	62
Impedance, 1 kHz, ohms	1500	1500	90	100
Gap Length, microinches	50	100	200	200
ELECTRICAL (ERASE SECTION)				
Inductance, 1 kHz, millihenrys	2.0	2.0	2.0	12
Resistance, D.C., ohms	36	36	36	150
Average 1.875 IPS constant current record/playback characteristics using 3M277 tape biased @ 1 kHz and recorded 12 dB below tape saturation, with R/P shunt capacitor of 200 pf. See "Z" combo application notes				
Erase Bias Current, 60 kHz, ma	45	22	45	14
Erase Bias Voltage, RMS, 60 kHz, volts	21	12	38	53
Record Current, microamps	33	36	120	85
1 kHz Output, millivolts	.55	.65	—	—
10 kHz/1 kHz Ratio, dB	-12	-17	—	—

PHYSICAL CONFIGURATIONS

NOTES:

For reverse erase and R/P orientation
specify: AL mount style

INCHES IN BLACK
MILLIMETERS IN COLOR



NOTE: Uses #105029 plugs, 2 per head.

AUDIO HEADS

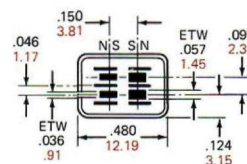


**DC22P
Cassette
Record/Playback
Monitor Head**

ELECTRICAL	MODEL NUMBER					
	W2ER 47	W2ER 9	W2ER 8	W2ER 5	W2ER 3	W2ER 4
Inductance @ 1 kHz, millihenrys	.047	.28	.37	1.0	2.0	13.0
Resistance, D.C., ohms	0.9	2.2	2.6	10	14	115
Track Width, inches	.070	.070	.070	.070	.070	.070
Gap Length, Double Gap (each)	.003	.003	.004	.003	.003	.003
Typical characteristics for 70 dB erasure of a 400 Hz saturated signal on 3M277 tape						
Erase Voltage @ 100 kHz, volts	4.0	10.0	12.0	18	22	62
Erase Current, ma	100	60	60	23	17	6.1
Impedance, 100 kHz, ohms	30	180	235	680	1400	6500

INCHES IN BLACK
MILLIMETERS IN COLOR

Record section available with a 10 mhy inductance and a 100 microinch gap. Play section available with a 100 mhy inductance and a 50 microinch gap.



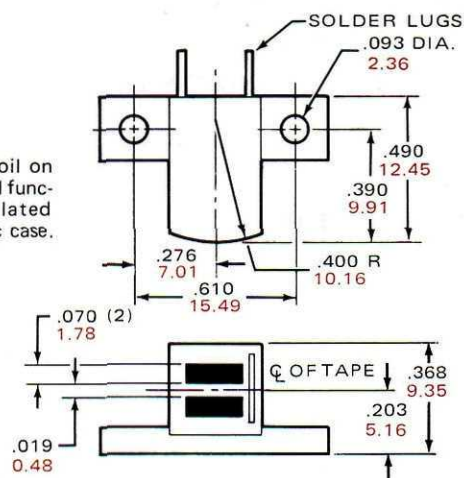
Contactor Heads/Dummy Heads

PHYSICAL CONFIGURATIONS

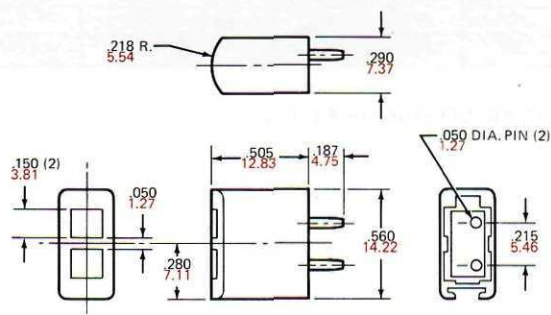
NOTE:
INCHES IN BLACK
MILLIMETERS IN COLOR

CONTACTOR HEAD — .150 TAPE MODEL WCH3

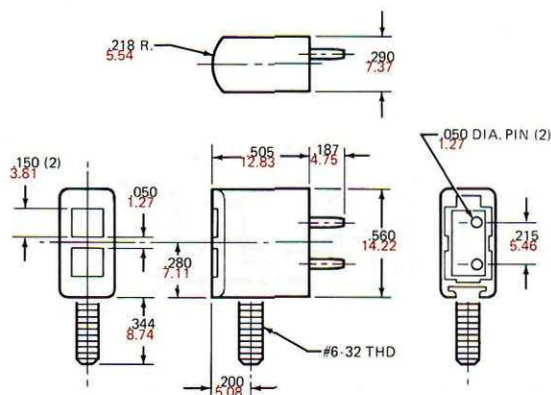
For use with metal foil on tape to actuate control functions. Has two insulated contact shoes, plastic case.



BASIC HEAD CONFIGURATION — NO MOUNT



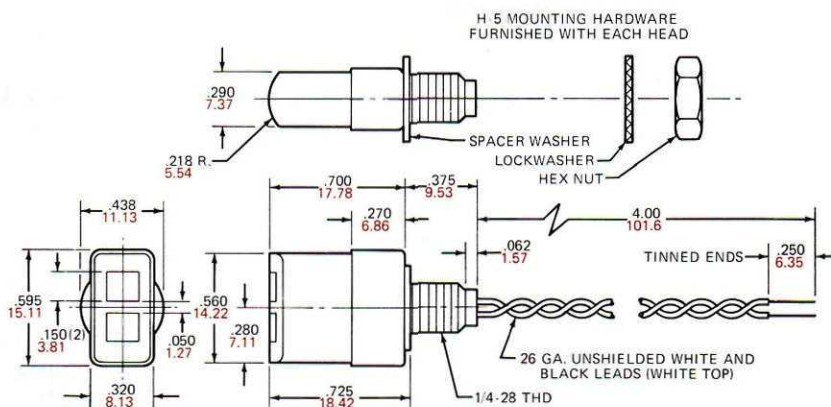
HEAD WITH BASE MOUNT CONFIGURATION



CONTACTOR HEAD — .250" TAPE MODEL CH3

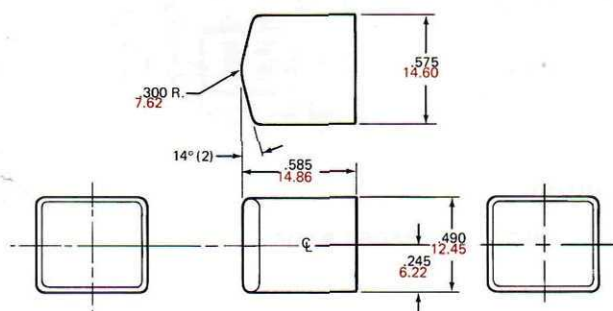
For use with metal foil on tape to actuate control functions. Has two insulated contact shoes, plastic case.

HEAD WITH REAR MOUNT CONFIGURATION



DUMMY HEADS Used to provide a tape support surface in applications where all positions of the head nest are not used. Same face finish and contour as regular heads. Supplied in standard mount configurations.

DUMMY HEAD — NO MOUNT SPECIFY: H801016



DUMMY HEAD — REAR MOUNT SPECIFY: H80103

