



# Nortronics

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# HEAD SPECS

## RECORD/PLAY, RECORD, AND ERASE HEADS

### SPECIFICATIONS

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

#### DESCRIPTION.

NORTRONICS magnetic tape heads are designed to offer highest quality performance and long dependable service. As the chief exponent and largest manufacturer of laminated core heads, NORTRONICS now offers a completely new line, with heads available in either PREMIUM or STANDARD laminated versions. NORTRONICS is also including the new "COMBO" heads which combine Record/Play/Erase into one head.

The STANDARD versions offer improved high frequency performance over that of the conventional solid-core heads, plus the added features of hyperbolic all-metal face and precision deposited quartz gaps.

The PREMIUM series is a fully professional line of tape heads giving unsurpassed performance for broadcast, studio and exacting semi-professional applications. Long life and extended high frequency response at slower tape speeds are among the benefits of the features listed below:

- Fine laminated, precision-lapped, low loss core structures.
- Deposited quartz gaps, resulting in exceptionally clean sharp gap edges.
- Hyperbolic face contour gives intimate tape-to-gap contact without need for pressure pads, but is designed to allow use with pressure pads as well.
- Highly polished all-metal faces, greatly reduce oxide build-up and the need for frequent head cleaning.
- Compatible mechanically and electrically with older model NORTRONICS heads.
- Superbly shielded against external magnetic fields.

The "Combo" series heads combine all of the features of the Premium series above, except the hyperbolic face contour. This series has a Record/Play Head and an Erase Head in one case.

#### MOUNTING STYLES.

The wide variety of available mounting styles, track types and impedances make it possible to find a NORTRONICS head to suit almost any audio application. Your new NORTRONICS head is supplied in two basic mounting styles, NO MOUNT and REAR MOUNT. REAR MOUNT heads have a rear mounting stud with 12-inch shielded wires. NO MOUNT heads have no brackets, screws or wires attached to them and are used directly in several popular brands of tape recorders. When required, NO MOUNT heads may be quickly adapted to SIDE MOUNT and BASE MOUNT styles by using the proper NORTRONICS Quik-Kit which is available where you purchased your NORTRONICS tape head. Complete, detailed instructions are included with each Quik-Kit. The six basic Quik-Kits used for adapting NO MOUNT heads are:

QK-18 - Adapts all Erase heads listed to SIDE MOUNT styles	
QK-19 - Adapts all Erase heads listed to BASE MOUNT styles	
QK-20 - Adapts R/P heads	{ 3000 Thru 3049 } to SIDE MOUNT styles
	{ 3100 Thru 3149 }
	{ 3200 Thru 3249 }
QK-21 - Adapts R/P heads	{ 3000 Thru 3049 } to BASE MOUNT styles
	{ 3100 Thru 3149 }
	{ 3200 Thru 3249 }
QK-38 - Adapts all other R/P heads listed to SIDE MOUNT styles	
QK-66 - Adapts all other R/P heads listed to BASE MOUNT styles	

#### REPLACEMENT OR CONVERSION.

NORTRONICS heads are the ideal selection for replacement of existing heads, converting to 2 or 4-track stereophonic sound and for installation on new tape equipment. In the majority of cases, replacements will be made on a direct basis. For example, a 2-track stereo head will be used to replace a worn 2-track stereo head. It is often possible to interchange head types to modernize equipment or for special applications. An example of this would be substituting a 4-track stereo head for a 2-track stereo head to bring the recorder up to date or substituting a Full track monophonic head for a 2-track monophonic head to make a recorder suitable for broadcast pur-

poses. In such interchanges, it is important to bear in mind that mechanical and electrical compatibility is required between head types to avoid operating difficulties.

#### LAMINATED vs. SOLID CORE HEADS.

Heads for magnetic tape recorders are generally manufactured with either laminated or solid metal cores. Excellent heads can be made in either type and NORTRONICS produces both but specializes in laminated heads because the unexcelled quality and superior performance of this type head is demanded in ever increasing numbers by knowledgeable audiophiles, serious tape enthusiasts, and original equipment manufacturers for use in their best recorders. The NORTRONICS heads featuring professional type laminated core structures with ultra-fine gaps result in magnificent playback frequency response. At a tape speed of 7.5 ips, a flat response from 50 to 15,000 cps is readily attainable, with useful output down to 30 cps and up to 20,000 cps. At a speed of 3.75 ips, the response is flat from 50 to 10,000 cps with useful output down to 30 cps and up to 15,000 cps.

Misinformation regarding laminated heads has been generally distributed to the public by sources which should be better informed. No special talent is required of a tape head manufacturer who attempts a critique of laminated design if that manufacturer is incapable of producing such a design or is unwilling to do so because of the high quality control standards required; for the demands made on a manufacturer of laminated heads are great and varied.

Laminated heads are more expensive to construct because permissible tolerances are considerably tighter, materials used are costlier and rigid tests must be made at each production level. The grinding, lapping and polishing operations require a high degree of skill and equipment of specialized design. After the head is completely finished, it must go through a further series of final checks and tests before it is approved for release. Any head which fails to pass through the stringent checks of Final Testing is automatically rejected. The end result is a laminated head of superior design . . . a superlative product of such exacting quality, it is literally capable of bringing out the best possible performance of any tape recorder with which it is used.

Laminated heads have clearly demonstrable advantages over solid core types which more than justify the extra care and expense required to manufacture them. As stated before, excellent heads can be made in either type and NORTRONICS produces BOTH. The major advantages of laminated design are lower eddy current and hysteresis losses in the core at high audio frequencies during playback. Drop-off in high frequencies is actually due to both the gap effect and core losses. As a result of the reduced core losses in laminated heads, the output at high frequencies is correspondingly greater than that obtained from an equivalent solid core head with the same size gap. Consequently, with the tape speeds in current popular use (7.5 and 3.75 ips), laminated heads can use a wider gap for improved recording characteristics while attaining essentially the same playback frequency response as solid core heads. In addition, because of the improved efficiency and sensitivity of laminated heads, a greater depth of metal can be left on the pole faces of the head. This insures longer operating life before wear makes replacement necessary. Despite anything you might have heard to the contrary, TAPE HEADS DO WEAR OUT!

At the present stage of the tape recording art, the finest heads available are of laminated design. NORTRONICS is continuously engaged in an extensive research program covering a wide area of interest to constantly improve the performance and quality of its products while still maintaining a sensible price structure. Several design concepts utilizing a new approach to materials not presently being used in the production of magnetic tape heads are currently undergoing evaluation. These materials require novel processing techniques and some of them hold great promise for the future. You may be sure that when any improvements either in head design or the materials used in those designs are ready to be moved from Research to Production, NORTRONICS will produce them.

# TAPE HEAD SPECIFICATIONS



1000 THRU 1049  
1200 THRU 1249



1050 THRU 1099  
1250 THRU 1299



1800 THRU 1849  
2000 THRU 2049



1850 THRU 1899  
2050 THRU 2099



2600 THRU 2649



3000 THRU 3049  
3200 THRU 3249



3050 THRU 3099  
3250 THRU 3299



3100 THRU 3149



3150 THRU 3199



4100 THRU 4149



4150 THRU 4199



4950 THRU 4999



5600 THRU 5649



5650 THRU 5699



NEW HYPERBOLIC FACE available on all R/P heads. Gives improved tape to gap contact on recorders not requiring pressure pads.

SEE TABLE BELOW CHART FOR ADDITIONAL MOUNTING STYLES — — CROSS REFERENCE ON BACK OF BOTTOM SHEET

NORTRONICS MODEL NO.	REAR MOUNT	HEAD DESCRIPTION	HEAD FUNCTION	APPLI- CATION (see notes)	1 KC INDUCTANCE (millihenrys)	1 KC IMPEDANCE (ohms)	MAXIMUM BIAS FREQUENCY (kilacycles)	DC RESISTANCE (ohms)	GAP SPACER (mils)	TRACK WIDTH (inches)	TRACK SPACING Center-to-Center (inches)	1 KC CROSS TALK REJECTION (db)	Average 7.5 IPS constant-current r/p characteristics, using 3M190 Tape, peak biased at 1 KC, & recorded 12db below tape saturation				
													60KC BIAS (milliamperes)	BIAS VOLTAGE RMS 60 KC (volts)	RECORD CURRENT (uA)	1 KC OUTPUT (millivolts)	100KC RATIO (db)
1000	1050	STANDARD 4-TRACK STEREO Hyperbolic Metal Face Laminated Cores	Record/Play	1	800	5000	80	700	0.1	.043	.136	55	0.30	25	2.4	+2	
1001	1081		Record/Play	2	400	2500	100	390	0.1	.043	.136	55	0.42	35	1.8	-3	
1002	1082		Record/Play	5	100	650	140	70	0.1	.043	.136	55	1.1	70	0.8	-3	
1200	1250		Record/Play	1	800	5000	80	700	0.1	.043	.136	55	0.16	45	2.6	+2	
1201	1251		Record/Play	2	400	2500	100	390	0.1	.043	.136	55	0.25	35	1.8	+1	
1202	1252	PREMIUM 4-TRACK STEREO Hyperbolic Metal Face Laminated Cores	Record/Play	5	100	650	140	90	0.1	.043	.136	55	0.65	60	0.9	+1	
1203	1253		Record Only	6	50	320	250	90	0.5	.043	.136	55	0.70	18	60	-	
1205	1255		Record Only	3	200	1300	120	390	0.5	.043	.136	55	0.26	20	38	-	
1207	1257		Record/Play	4	200	1300	120	200	0.1	.043	.136	55	0.40	25	50	+1	
1800	1850		STANDARD 2-TRACK STEREO Hyperbolic Metal Face Laminated Cores	Record/Play	1	800	5000	60	720	0.1	.080	.160	55	0.4	30	3.4	-1
1801	1851	Record/Play		2	400	2500	100	410	0.1	.080	.160	55	0.6	45	2.2	-1	
1802	1852	Record/Play		5	100	650	100	130	0.1	.080	.160	55	1.1	80	1.1	-3	
2000	2050	Record/Play		1	800	5000	60	720	0.1	.080	.160	55	0.25	30	3.6	+3	
2001	2051	Record/Play		2	400	2500	100	410	0.1	.080	.160	55	0.33	40	2.4	+1	
2002	2052	PREMIUM 2-TRACK STEREO Hyperbolic Metal Face Laminated Cores	Record/Play	5	100	650	100	70	0.1	.080	.160	55	0.80	20	80	+1	
2003	2053		Record Only	6	50	320	200	130	0.5	.080	.160	55	0.70	9	75	-	
2600	2600		Record/Play	1	800	5000	60	400	0.1	.080	.160	55	0.25	30	3.6	+3	
2601	2601		Record/Play	2	400	2500	100	165	0.1	.080	.160	55	0.33	40	2.4	+2	
2602	2602		Record/Play	5	100	650	100	70	0.1	.080	.160	55	0.80	20	80	+1	
2603	2603	PREMIUM 2-TRACK MONO Hyperbolic Metal Face Laminated Cores	Record Only	6	50	320	200	70	0.5	.080	.160	55	0.70	9	75	-	
3000	3050		Record/Play	1	800	5000	60	400	0.1	.080	.160	55	0.4	30	3.4	-1	
3001	3051		Record/Play	2	400	2500	100	165	0.1	.080	.160	55	0.6	45	2.2	-1	
3002	3052		Record/Play	5	100	650	100	70	0.1	.080	.160	55	1.1	80	1.1	-3	
3100	3150		2-TRACK MONO (Center Track) Cylindrical Metal Face - Solid Cores	Record/Play	1	1000	6300	60	625	0.16	.090	.090	55	0.65	22	5.0	-9
3101	3151	Record/Play		2	400	2500	80	350	0.16	.090	.090	55	0.8	25	3.0	-9	
3210	3250	Record/Play		1	800	5000	60	400	0.1	.080	.160	55	0.25	30	3.6	+3	
3211	3251	Record/Play		2	400	2500	100	165	0.1	.080	.160	55	0.33	40	2.4	+2	
3202	3252	Record/Play		5	100	650	100	70	0.1	.080	.160	55	0.80	20	80	+1	
3203	3253	PREMIUM FULL-TRACK Hyperbolic Metal Face Laminated Cores	Record Only	6	50	320	200	200	0.16	.260	.260	55	0.70	9	75	-	
4100	4150		Record/Play	2	250	1500	60	200	0.5	.260	.260	55	0.9	40	4.0	0	
4101	4151		Record Only	6	70	400	100	125	0.5	.260	.260	55	1.2	20	100	-	
4950	4950		Record/Play	5	40	250	150	125	0.16	.024	.024	55	0.65	8	50	0.45	0
5601	5651		PREMIUM 4-CHANNEL Hyperbolic Metal Face Laminated Cores	Record Only	6	50	320	220	130	0.5	.037	.071	38	0.6	7	60	-
5602	5652	Record/Play		5	90	600	220	100	0.1	.037	.071	38	0.7	15	60	-	
5603	5653	Record/Play		2	370	2200	80	690	0.1	.037	.071	38	0.3	30	34	1.4	0

APPLICATION NOTES:

1. High-impedance general-purpose Record/Play or Playback Only head for vacuum-tube circuits.
2. Medium-impedance Record/Play head for vacuum-tube or transistor circuits.
3. Medium-impedance Record Only head for vacuum-tube circuits.
4. Medium-low-impedance Record/Play for transistor circuits.
5. Low-impedance Record/Play for transistor circuits.
6. Low-impedance Record Only for vacuum-tube or transistor circuits.

# "COMBO" HEAD SPECIFICATIONS



MODEL NO.	HEAD DESCRIPTION	HEAD FUNCTION	EQUIVALENT HEAD SPECIFICATION REFERENCE
6000	4-TRACK STEREO Metal Face "COMBO"	Erase, Record/Play	Record/Play = 1201 Erase = 1400
6001		Erase, Record Only	Record/Play = 1203 Erase = 1400
6002		Erase, Record/Play	Record/Play = 1201 Erase = 1401
6003	Erase, Record/Play	Erase, Record/Play	Record/Play = 1000 Erase = 1402
6025	4-TRACK MONO Metal Face "COMBO" Center Track	Erase, Record/Play	Record/Play = 1000 Erase = 1402
6100	2-TRACK STEREO Metal Face "COMBO"	Erase, Record/Play	Record/Play = 2001 Erase = 2201
6125	2-TRACK MONO Metal Face "COMBO" Center Track	Erase, Record/Play	Record/Play = 2601 Erase = 3601

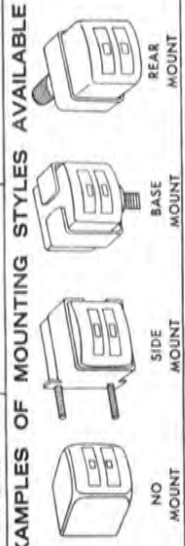
# ERASE HEAD SPECIFICATIONS



MINIATURE # 4950 and 5350  
For magnetic drum and discs,  
film strips and miniature re-  
corders, 5/16" x 5/16" x 3/8" with  
all metal face.

1400 THRU 1449 1450 THRU 1499 2200 THRU 2249 2250 THRU 2299 3600 THRU 3649 3650 THRU 3699 4400 THRU 4449 4450 THRU 4499 5350 THRU 5399

NORTONICS MODEL NO.	ADDITIONAL MOUNTING STYLES	
	NO MOUNT	BASE MOUNTS
ALL ERASE	QUIK-KIT 18	QUIK-KIT 19
3000 THRU 3049 3100 THRU 3149 3200 THRU 3249	QUIK-KIT 20	QUIK-KIT 21
ALL OTHER RECORD/PLAY RECORD ONLY PLAY ONLY	QUIK-KIT 38	QUIK-KIT 66



TYPICAL DIMENSIONS	
<p>1000 THRU 1049 1200 THRU 1249 1800 THRU 1849 2000 THRU 2049 2600 THRU 2649 4100 THRU 4149 5600 THRU 5649 6000 THRU 6049 6100 THRU 6149</p>	<p>3000 THRU 3049 3200 THRU 3249 3150 THRU 3199</p>
<p>1400 THRU 1449 2200 THRU 2249 3600 THRU 3649 4400 THRU 4449</p>	<p>1450 THRU 1499 2250 THRU 2299 3650 THRU 3699 4450 THRU 4499</p>
<p>4950 THRU 4999 5350 THRU 5399</p>	

NORTONICS MODEL NO.	HEAD DESCRIPTION	1 KC INDUCTANCE (millihenrys)	60 KC IMPEDANCE (ohms)	OPERATING ERASE CURRENT* (milliamperes)	DC RESISTANCE (ohms)	60 KC OPERATING VOLTAGE (volts)
1400	4-TRACK STEREO ERASE Full Metal Face	80	30,000	3-5	270	90-150
1401		10	2,800	10-15	40	28-42
1402		.13	40	80-140	2	3-6
2201	2-TRACK STEREO ERASE Full Metal Face	80	25,000	4.5-7.0	205	100-150
2202		.20	50	100-150	2	5-8
3600	2-TRACK MONO ERASE Full Metal Face	80	25,000	4.5-7.0	205	100-150
3601		.20	50	100-150	2	5-8
4400	FULL-TRACK MONO ERASE Full Metal Face	40	12,000	10-15	88	100-150
4401		3.6	1,000	32-48	25	32-48
5350	MINIATURE	5	1,200	28-42	38	32-48

\*For 60 db erasure of saturated tape. Voltages shown are RMS. All specifications subject to change without notice.

# CROSS REFERENCE TABLE FOR NORTRONICS HEADS

## NO MOUNT HEADS\*

Distr. Head No.	Interchangeable With These Nortronics Heads			
	OEM Head No.	Obsolete Head Nos.		
<b>4-TRACK STEREO</b>				
1000	B2Q2K-N	CSQ2K-N	TLB2K	TLB2
1001	B2Q7K-N	CSQ7K-N	TLB7K	TLB7
1002	B2Q4K-N	CSQ4K-N	TLB4K	TLB4
1200	PB2Q2K-N			
1201	PB2Q7K-N			
1202	PB2Q4K-N			
1203	PB2Q4R-N			
1205	PB2Q7R-N			
1207	PB2Q6K-N			
1400	SEQ1-N	SE50-1		
1401	SEQ4-N	SE50-4		
1402	SEQ2-N			
<b>2-TRACK STEREO</b>				
1800	B2H2K-N	TLA3L-N	TLD-LH3	TLD-S3
1801	B2H7K-N	TLA4L-N		
1802	B2H4K-N	TLA5L-N		
2000	PB2H2K-N			
2001	PB2H7K-N			
2002	PB2H4K-N			
2003	PB2H4R-N			
2200	SEH1-N	SE-100-2		
2201	SEH4-N	SE-100-4		
2202	SEH2-N			
<b>2-TRACK MONO</b>				
2600	PB1HY2K-N	SLA3L-N		
2601	PB1HY7K-N	SLA4L-N		
2602	PB1HY4K-N	SLA5L-N		
2603	PB1HY4R-N	SLA5R-N		
3000	G1H2K-N	SLS1L-N		
3001	G1H7K-N	SLS3L-N		
3002	G1H4K-N	SLS4L-N		
3100	GMH1L-N	SCS1		
3101	GMH3L-N	SCS3		
3200	PG1H2K-N			
3201	PG1H7K-N			
3202	PG1H4K-N			
3203	PG1H4R-N			
3600	MEH1-N	ME-100-2		
3601	MEH4-N	ME-100-4		
3602	MEH2-N			
<b>FULL TRACK MONO</b>				
4100	SLFH3L-N			
4101	SLFH4R-N			
4400	MEF1-N	ME-250-2		
4401	MEF4-N	ME-250-1		
<b>MINIATURE</b>				
—				
—				
<b>4-CHANNEL</b>				
5601	BQQ4R-N			
5602	BQQ4K-N			
5603	BQQ3K-N			

## REAR MOUNT HEADS

Distr. Head No.	Interchangeable With These Nortronics Heads			
	OEM Head No.	Obsolete Head Nos.		
<b>4-TRACK STEREO</b>				
1050	B2Q2K-R-12S	CSQ2K-R	TLB2K-R	TLB2-R
1051	B2Q7K-R-12S	CSQ7K-R	TLB7K-R	TLB7-R
1052	B2Q4K-R-12S	CSQ4K-R	TLB4K-R	TLB4-R
1250	PB2Q2K-R-12S			
1251	PB2Q7K-R-12S			
1252	PB2Q4K-R-12S			
1253	PB2Q4R-R-12S			
1255	PB2Q7R-R-12S			
1257	PB2Q6K-R-12S			
1450	SEQ1-R-12S	SE50-1-R		
1451	SEQ4-R-12S	SE50-4-R		
1452	SEQ2-R-12S			
<b>2-TRACK STEREO</b>				
1850	B2H2K-R-12S	TLA3L-R	TLD-LH3-R	TLD-S3-R
1851	B2H7K-R-12S	TLA4L-R		
1852	B2H4K-R-12S	TLA5L-R		
2050	PB2H2K-R-12S			
2051	PB2H7K-R-12S			
2052	PB2H4K-R-12S			
2053	PB2H4R-R-12S			
2250	SEH1-R-12S	SE-100-2-R		
2251	SEH4-R-12S	SE-100-4-R		
2252	SEH2-R-12S			
<b>2-TRACK MONO</b>				
—				
—				
—				
—				
3050	G1H2K-R-12S	SLS1L-R		
3051	G1H7K-R-12S	SLS3L-R		
3052	G1H4K-R-12S	SLS4L-R		
3150	GMH1L-R-12S	SCS1-R		
3151	GMH3L-R-12S	SCS3-R		
3250	PG1H2K-R-12S	KMH1L-R		
3251	PG1H7K-R-12S	KMH3L-R		
3252	PG1H4K-R-12S	KMH4L-R		
3253	PG1H4R-R-12S			
3650	MEH1-R-12S	ME-100-2-R		
3651	MEH4-R-12S	ME-100-4-R		
3652	MEH2-R-12S			
<b>FULL TRACK MONO</b>				
4150	SLFH3L-R-12S			
4151	SLFH4R-R-12S			
4450	MEF1-R-12S	ME-250-2-R		
4451	MEF4-R-12S	ME-250-1-R		
<b>MINIATURE</b>				
4950	L24R8L5-R-12S			
5350	L42E-R-12S			
<b>4-CHANNEL</b>				
5651	BQQ4R-R-12S			
5652	BQQ4K-R-12S			
5653	BQQ3K-R-12S			

## "COMBO" HEADS

Distr. Head No.	Interchangeable With These Nortronics Heads	
	OEM Head No.	Obsolete Head Nos.
6000	PA2Q17K-N	
6001	PA2Q14R-N	
6002	PA2Q47K-N	
6025	A1QC22K-N	
6003	A2Q22K-N	
6100	PA2H47K-N	
6125	PA1HC47K-N	

\*Any of above No Mount heads may be adapted to Side Mount or Base Mount styles by using the proper NORTRONICS Quik-Kit. See table under "Additional Mounting Styles" on the specifications side of this sheet.

Form No. 7079D  
7-1-64  
Printed in USA  
Sheet 2 of 2



# Nortronics®

RECORD/PLAY  
AND  
RECORD ONLY

## Magnetic Tape Heads

### RECORD/PLAY AND RECORD ONLY

### GENERAL INSTRUCTIONS

#### 1. INTRODUCTION.

1-1. The following instructions will tell you how to correctly install and adjust your new NORTRONICS RECORD/PLAY (R/P) or RECORD ONLY tape head. If the instructions are followed, there should be no problem in making an installation which is capable of equalling or exceeding the original performance of the recorder.

#### 2. EXAMINING ORIGINAL R/P HEAD.

2-1. If the new head is to replace an existing R/P head, do not remove the original head until a preliminary examination has been made. After removing head cover plates and whatever else might be necessary to completely expose the heads, carefully study the original arrangement before attempting to remove the head or any wires. If there is any doubt as to

which is the erase head and which is the R/P head, thread a reel of tape on the recorder and put the machine in the PLAY mode. The first head the tape passes over after leaving the supply reel is the erase head. The second head the tape passes over is the R/P head. If the recorder uses three or more heads, consult the instruction manual or other information pertaining to the recorder to determine the function of the various heads. In the usual 3-head arrangement, the first head the tape passes over is the erase head, the second is the record head, and the third is the playback head.

2-2. If the new head is a replacement for a 2-track monophonic or 4-track stereophonic R/P head, place the recorder so the transport is in a HORIZONTAL position. This will serve as a reference point. Looking squarely at the FACE of the heads, observe whether the erase head is on the right or left side of the R/P head. Jot down this information. The reason for this is to determine which portion of the tape should cover the pole piece(s) of the R/P head. This procedure is not necessary for 2-track stereo or Full Track R/P heads as they both cover the full width of the tape.

2-3. Erase Head on RIGHT Side of R/P Head. If the R/P head is a 2-track mono type then the pole piece should be even with the bottom edge of the tape. If the R/P head is a 4-track stereo type then the pole piece closest to the transport plate should be even with the bottom edge of the tape.

2-4. Erase Head on LEFT Side of R/P Head. If the R/P head is a 2-track mono type then the pole piece should be even with the top edge of the tape. If the R/P head is a 4-track stereo type then the pole piece furthest from the transport plate should be even with the top edge of the tape.

#### 3. CHECKING WIRING OF ORIGINAL R/P HEAD.

3-1. No Mount Monophonic Heads. A mono head will have only two wires: a ground wire and a "hot" wire. It is not necessary to determine which is which since there is no polarity to the NORTRONICS monophonic heads.

3-2. No Mount Stereophonic Heads. A stereo head will have four wires: a ground wire and a "hot" wire for each of the two channels. In this case, the function of the wires must be known before they are disconnected from the original head to assure proper phasing of the two channels and to make certain the wires for each channel are connected properly when the new head is installed. It would be a good idea to make a sketch of the original wiring arrangement that shows (1) the color of each wire, (2) which wires are for the upper and lower channels of the head, (3) the location of the wires on the pins of the original head, and (4) which are the ground wires for each channel. Follow each wire to determine if it is grounded or not. Those not grounded are the "hot" wires. In most cases the wires for each channel will be paired; that is, the ground and "hot" wires will be either twisted together or in the form of a shielded cable. If the wires are not paired in any manner and it is impossible to tell which "hot" wire is paired with which ground wire, a VOM, Ohmmeter, or VTVM with resistance ranges may be used to identify the ground wire for each channel. Proceed as follows: Be certain the line cord supplying power to the recorder is NOT plugged in. Put the machine in the RECORD mode. If there is a Mono 1, Mono 2, Stereo Record selector switch, set it for Stereo Record. The VOM, Ohmmeter, or VTVM should be set to read "ohms" on the X1 scale. Fasten a lead from the meter to one of the wires on the rear of the R/P head and touch the other meter lead to a bare metal spot on the transport of the recorder. Note the meter reading for that particular wire on your sketch. Repeat this procedure with the three remaining wires on the rear of the R/P head, noting on your sketch each time the resistance reading obtained. The two lowest resistance readings are the ground wires for the stereo R/P head. In most cases, the ground wires will give a zero reading, indicating no resistance between the ground wire and the transport of the recorder.

3-3. Rear Mount Heads. The instructions given above for checking the original wiring on No Mount R/P heads can be used for Rear Mount heads with this exception: Since the wires come from inside the head and it is not possible to see which wire is connected to which pin on the head, trace

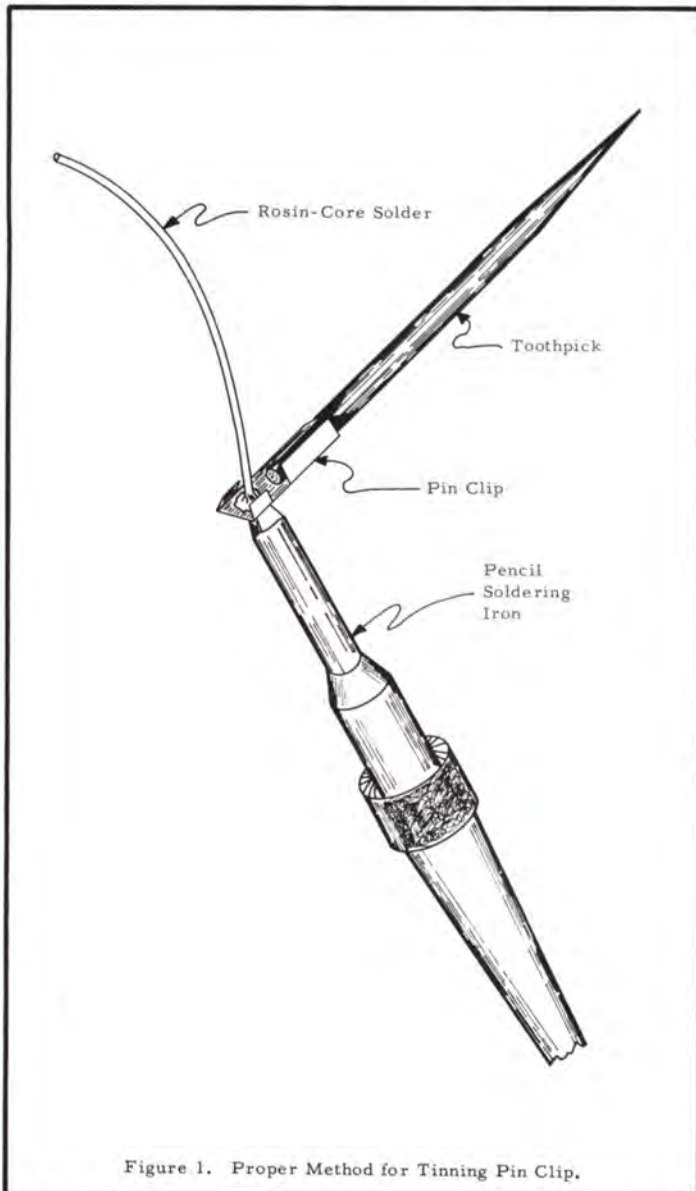


Figure 1. Proper Method for Tinning Pin Clip.

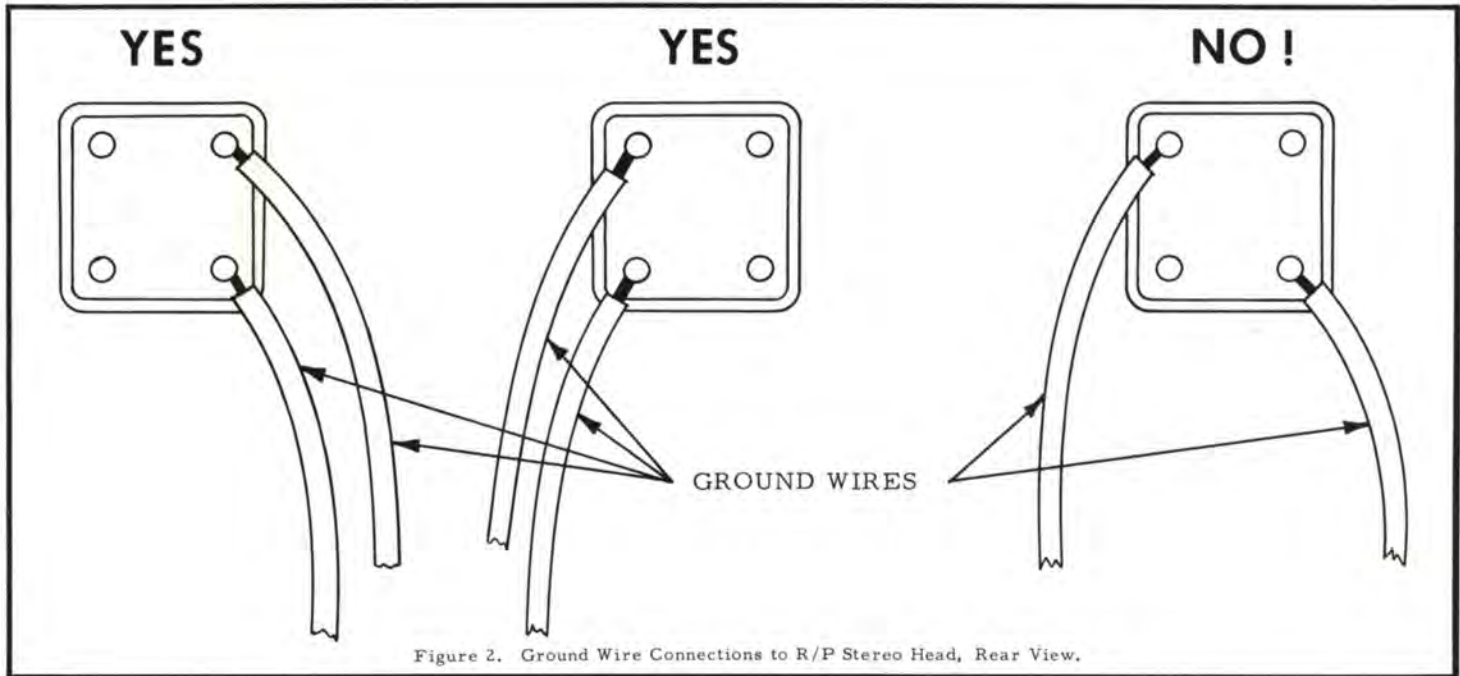


Figure 2. Ground Wire Connections to R/P Stereo Head, Rear View.

these wires to the terminal strip, plug, or whatever type of connector the wires are soldered to and make your sketch. Do not overlook jotting down the color of each wire.

#### 4. REMOVING ORIGINAL R/P HEAD.

4-1. After making the above notations, the R/P head can be removed. The wires originally connected to a No Mount head may be re-used if sufficient length exists to solder pin clips to them and slide the pin clips onto the terminal pins of the new head. Otherwise, the wires supplied with your new NORTRONICS head should be used. If the original wires are soldered to clips which are then pressed onto the pins of the head, carefully slide the clips from the pins with long-nose pliers. If these clips have also been soldered to the pins of the head, cut the wires from the clips if they are long enough for re-use. Handle these wires with care, as they are usually quite fine and cannot stand much flexing or strain. If the original head is a Rear Mount type, unsolder the wires from the connector they are soldered to as the wires coming from inside the new Rear Mount head must be soldered in their place.

4-2. Remove the old No Mount or Rear Mount R/P head from the recorder and install the new head in its place.

#### 5. CONNECTING WIRES TO NEW R/P HEAD.

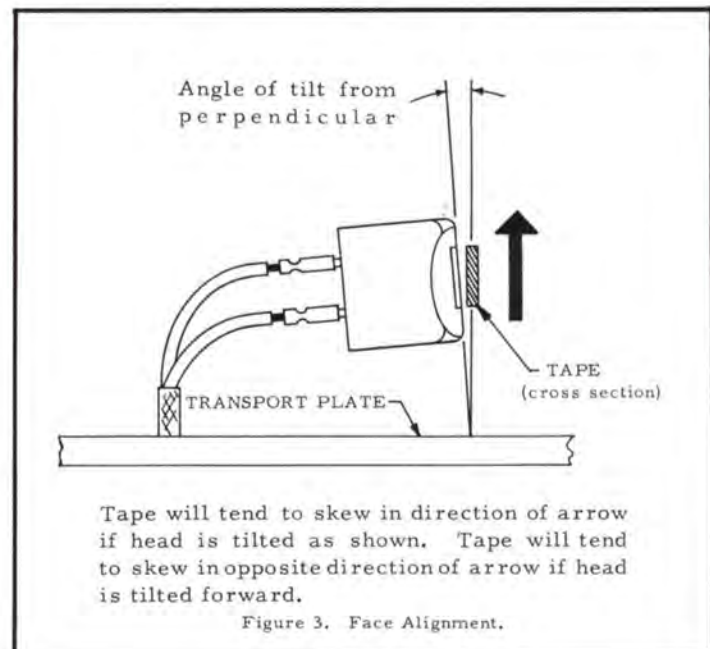
5-1. No Mount Heads. If new wires are required due to the original wires being too short for re-use, these wires should be installed at this point. Regardless of whether the original wires are being re-used or new wires have been installed, you must use pin clips to connect the wires to the terminal pins of the head. **DO NOT SOLDER THE WIRES DIRECTLY TO THE HEAD TERMINAL PINS!** A certain amount of care is required when soldering wires to the pin clips to prevent flux and solder from flowing into the portion of the pin clip that grips the head terminal pin. One method that works quite well is to slide the pin clip over the end of a toothpick. Tilt the toothpick down to prevent flux and solder from flowing into the gripping portion of the clip. Tin the end of the clip (see Figure 1), then tin the end of the wire to be connected to it. Lay the tinned wire over the tinned end of the clip and touch the iron to the bottom of the clip end. Leave the iron in contact with the clip just long enough for the solder to melt and flow around the end of the wire, making a good joint. The pin clips are connected to the head by sliding them onto the head terminal pins with long-nose pliers. On all NORTRONICS stereo heads, the top two pins of the head are for the upper channel and the bottom two pins are for the lower channel. Refer to your notations or sketch of the wire designations and connect the pin clips to the correct terminals on the head. Make certain before actually connecting the pin clips that you have the ground wires for both channels on the **SAME SIDE** of the head. Refer to Figure 2. If this connection is not made properly, the two channels will be out of phase with each other.

5-2. Rear Mount Heads. The wires coming from inside the new Rear Mount head must be soldered to the same connector used by the original wires. No pin clips are required. Before soldering these wires it is necessary to identify the **TOP** of the Rear Mount head. The top of all

NORTRONICS Rear Mount R/P heads may be identified by one of several markings. The name "NORTRONICS" may be stamped or labeled, there may be a dot of paint or the head model number may be stamped on top of the head. It is important to know which is the top and which is the bottom of a Rear Mount head because the wires are color coded for identification.

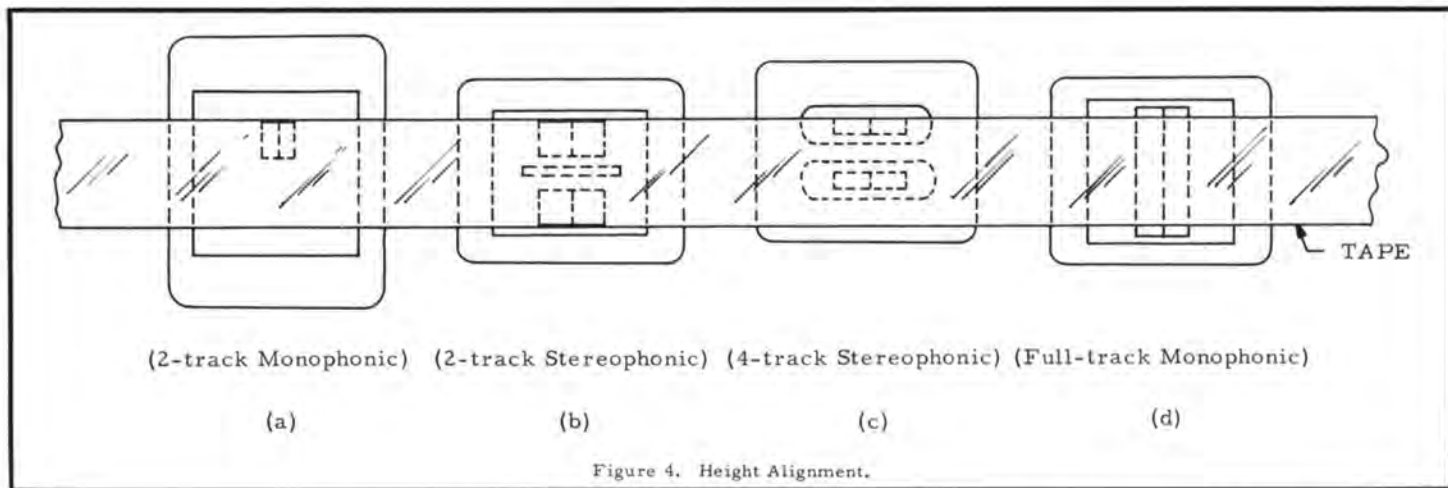
5-3. Two different wire color codings are used on NORTRONICS Rear Mount heads. System 1: The red and black wires are connected to the upper channel of the head. Black is the ground wire. The white and black wires are connected to the lower channel of the head. Black is the ground wire. System 2: The red and orange wires are connected to the upper channel of the head. Orange is the ground wire. The yellow and blue wires are connected to the lower channel of the head. Blue is the ground wire.

5-4. Refer to your notations or sketch of the wire designations and solder the wires to the original connector. Since the new wires are considerably longer than actually needed in most cases, cut the wires to the proper length but give yourself a sufficient amount of slack to allow for stripping and tinning the wires, plus an extra margin for safety to insure adequate wire length. Strip and tin the wires. Push up the shield covering the wires about 1 or 2 inches so there is no danger of the shield contacting the tinned wires or connector.



Tape will tend to skew in direction of arrow if head is tilted as shown. Tape will tend to skew in opposite direction of arrow if head is tilted forward.

Figure 3. Face Alignment.



## 6. HEAD ADJUSTMENTS.

6-1. There are three adjustments which must be made to the new head in order for it to operate properly once it is installed on the recorder. These adjustment instructions apply to BOTH No Mount and Rear Mount R/P heads.

6-2. **Face Alignment.** The face of the head should not be tilted forward or backward. If the head is tilted, the tape will tend to ride up or down on the head face in operation, depending on the angle of tilt. Refer to Figure 3. Check the FACE alignment by threading a reel of tape on the recorder and putting the machine in the PLAY mode. Observe the action of the tape. It should move in a straight line across the face of the heads with no tendency to wander up or down. If it does wander, the FACE alignment must be adjusted so the tape travels in a straight path across the face of the head. Since there are numerous ways in which this adjustment can be made, refer to the recorder literature and adjust the FACE alignment of the head by whatever means the machine provides. In some older machines there is no provision for making this adjustment. Leave the tape on the recorder.

6-3. **Height Alignment.** The height of the head must be adjusted so the pole piece(s) are covered by the proper portion of the tape. If this is not done, a weak signal and cross-talk from other tracks may result. This is particularly critical in the 4-track stereo R/P heads.

6-4. ALL NORTRONICS R/P HEADS EXCEPT THE FULL TRACK TYPE should be aligned for HEIGHT so the top edge of the tape is even with the top edge of the pole piece. Refer to Figure 4. Obviously, if your head installation is the type where the pole piece is covered by the bottom part of the tape, then the pole piece edge should be even with the bottom edge of the tape. Make this adjustment visually, using whatever means the recorder provides. Be very careful to avoid changing the FACE alignment made previously. Check your adjustment by putting the recorder in the PLAY mode and observing the action of the tape. Check first to make certain the FACE alignment has not been disturbed. If the recorder has a pressure pad to hold the tape against the face of the head, it may be necessary to hold it back to see if the pole piece is even with the proper edge of the tape. If so, the HEIGHT alignment is correct.

6-5. IN THE CASE OF THE FULL TRACK R/P HEAD, the pole piece is wider than the tape. This head should be aligned for HEIGHT so the pole piece extends an equal amount beyond the top and bottom edges of the tape. Remove the tape from the recorder.

6-6. **Azimuth Alignment.** Refer to Figure 5. The pole piece gap of the R/P head must be at right angles to the edge of the tape for maximum high frequency response from pre-recorded tapes and to assure compatibility between tapes made on one recorder and played on another. For professional AZIMUTH alignment, the NORTRONICS AT-100 Alignment Tape or other high quality tape specifically made for AZIMUTH alignment is required.

6-7. Before attempting AZIMUTH alignment, check to see what method is provided by the recorder for accomplishing this. There may be an offset screw or nut which is tightened or loosened to permit the head to be rocked from side-to-side, thus providing a wide latitude of adjustment for the gap of the head. In the case of Rear Mount heads, AZIMUTH alignment is usually accomplished by slightly loosening the nut holding the mounting stud of the head to its bracket and rotating the head with your fingers. Make certain when doing this that the HEIGHT alignment made previously is not changed.

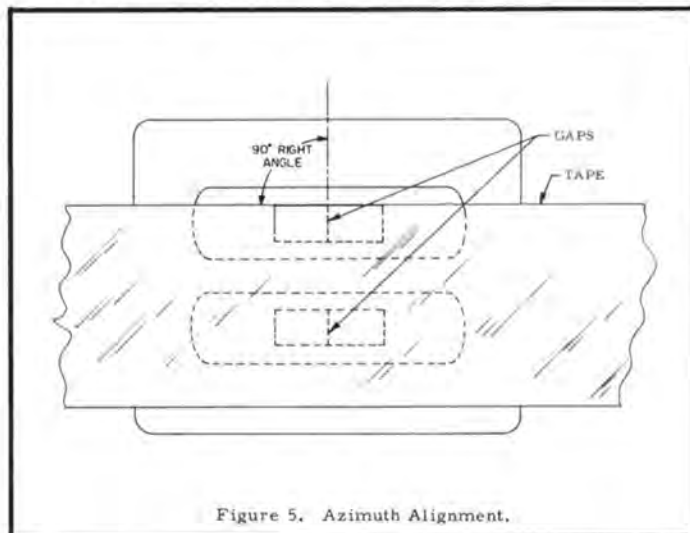
6-8. After determining the method used to accomplish AZIMUTH align-

ment, thread the alignment tape on the recorder and set the tone control (if any) to maximum treble. If an oscilloscope, VOM, VTVM, or other voltmeter with AC ranges is not available, the head must be azimuthed by playing the tape and listening to it carefully while slowly rocking the head from side-to-side, using whatever means the recorder provides for doing this. The head is properly azimuthed when the constant-tone high frequency signals (7500 cps or 10,000 cps) recorded on the alignment tape sound the loudest and most brilliant. Because of the limited sensitivity of the human ear at high frequencies, the azimuth alignment tape and voltmeter method is the preferred professional approach. Should the recorder be equipped with a VU meter that can be switched to monitor the playback output, it may be used instead of the voltmeter. In this case, adjust the playback gain control until the VU meter reads approximately half scale while playing the alignment tape. Adjust the head until a maximum reading is indicated on the meter.

6-9. If a voltmeter is available, connect it across the playback amplifier output of the recorder. Play the alignment tape. Set the voltmeter on a range scale that will permit you to adjust the playback gain control until the voltmeter reads approximately half scale. Adjust the head until a maximum reading is indicated on the voltmeter. If necessary, either reduce the playback gain control as the voltmeter approaches full scale or switch the voltmeter to the next highest range.

6-10. If the recorder has separate heads for recording and playing back, it will be necessary to align AZIMUTH on both heads, regardless of which one is replaced. Since these recorders are generally of the professional or semi-professional type, only the azimuth alignment tape and voltmeter method will be discussed. Most recorders of this type also have separate record and playback amplifiers which allow the tape to be played back while being recorded. For this type of recorder, thread the azimuth alignment tape on the machine and connect the voltmeter to the playback amplifier output. Play the alignment tape. Adjust the playback gain control until the voltmeter reads approximately half scale, then adjust the playback head until a maximum reading is indicated on the voltmeter.

6-11. Remove the azimuth alignment tape from the recorder and replace it with a reel of blank tape. Connect an audio sine-wave signal generator to the recorder input and set the generator to 7500 cps. Make certain the



recorder is set for the 7.5 ips speed and that the machine is in the RECORD mode. Adjust the record level control to produce a low level record signal (about -7 to -10 VU if the level indicator is a VU meter, or with the magic eye indicator about 1/3 closed if this type of indicator is used). While monitoring the output of the playback amplifier with the voltmeter, adjust the RECORD head until a maximum reading is indicated on the voltmeter. Remember when doing this that there will be a slight delay from the time the adjustment is made until it is indicated on the voltmeter because of the time lag while the tape travels from the record to the playback head. This procedure will line up the gap of the record head with the previously aligned gap of the playback head.

6-12. Some recorders with separate record and playback heads use a combination record/playback amplifier with a switch to select Record or Play but do not permit both modes to be used simultaneously. For this type of recorder, align the AZIMUTH of the playback head as described above in Paragraph 6-10. When this has been done, turn off all power to the recorder. Remove the plugs connecting the record and playback heads to the electronics of the recorder and transpose them; that is, insert the plug for the record head into the playback head jack and the plug for the playback head into the record head jack. Turn on the power to the recorder. With the voltmeter connected to the output of the playback amplifier, play the azimuth alignment tape. Adjust the record head for maximum output on the voltmeter as already described. The gap of the record head is now lined up with the gap of the previously aligned playback head. Turn off the power to the recorder and re-connect the plugs for the record and playback heads as they were originally.

#### 7. PRESSURE PAD INFORMATION.

7-1. If the recorder uses a pressure pad, it should be inspected periodically.

When a tape head is replaced on a recorder, the pressure pad usually needs replacement as well. Examine it carefully. Excess wear will cause the pad to bear unevenly against the face of the new head and this will reduce optimum performance from the recorder. In addition, even though the old pad may not be excessively worn, tape squeal will result if the felt is hardened or glazed by particles of oxide which have become embedded in it. If either of these conditions exist or the pad is otherwise in generally poor condition, it should be replaced.

7-2. The primary function of a pressure pad is to provide intimate contact between the gap in the head pole piece(s) and the oxide coating on the tape. The pad should cover the width of the tape from top to bottom and should rest squarely on the face of the head with the center of the pad as near to the center of the head as possible. The amount of tension exerted by the arm on which the pressure pad is mounted should be such that the pad holds the tape firmly but gently against the face of the head. It should not smash the tape against the head! If it does, excessive head wear, tape squeal and wow or flutter will result. Many complaints of low or no output, improper balance between channels of a stereo tape head, excessive wow and flutter, tape squeal, and rapid head wear are directly traceable to pressure pads which are worn, hardened or glazed, and improperly installed (location of pad, tension applied, etc.).

#### 8. FINAL TESTING.

8-1. Make a final, over-all check of the installation by trying the machine in both the RECORD and PLAY modes. Replace the head cover plate and whatever else might have been removed from the recorder in the reverse order of their removal. This completes the installation of your new NORTRONICS R/P head.

USE THE SPACE BELOW FOR YOUR SKETCHES AND NOTES

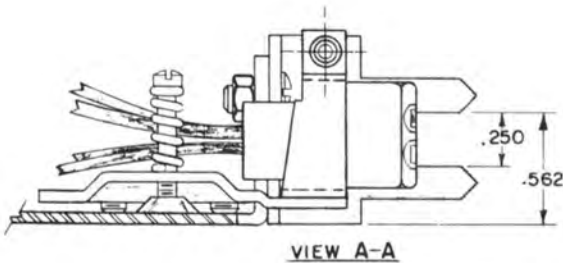
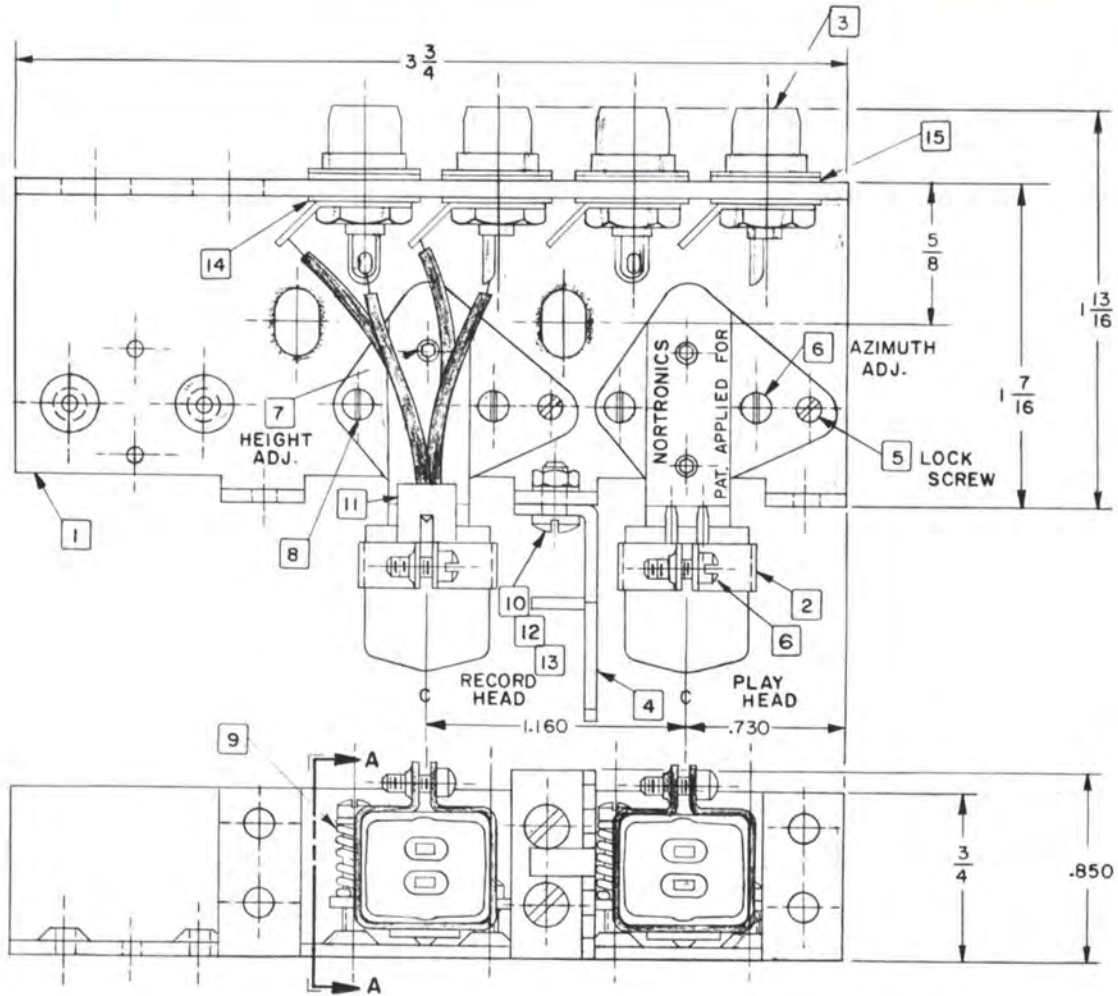
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MINNEAPOLIS 27, MINNESOTA  
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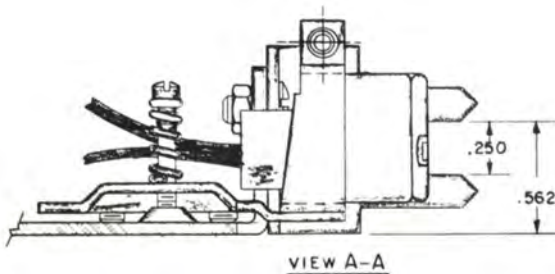
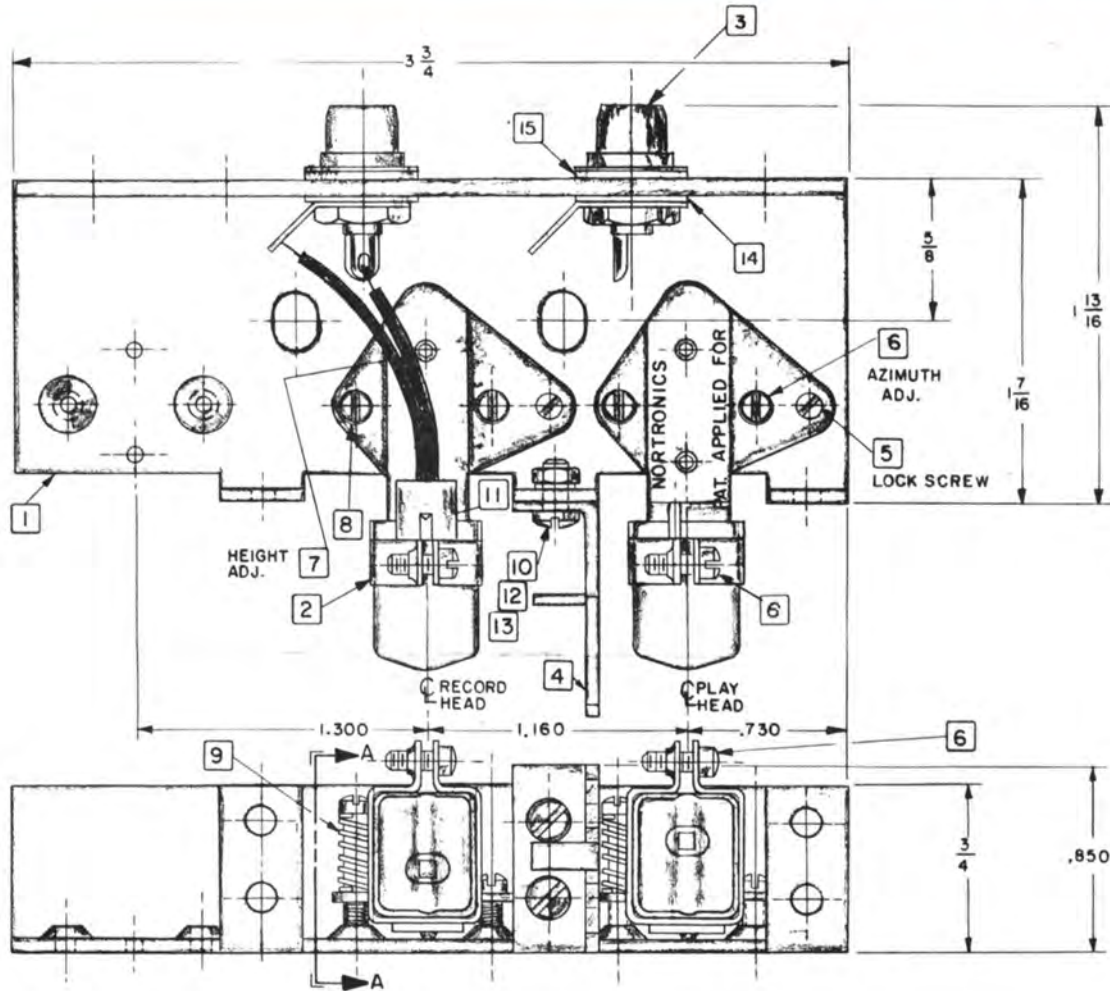
THE NORTRONICS COMPANY, INC. 8101 TENTH AVENUE NORTH MINNEAPOLIS, MINNESOTA 54427



15	4	115-56	SHOULDER WASHER
14	4	115-55	FLAT INSULATING WASHER
13	2	116-3	4-40 HEX NUT
12	2	115-4	#4 INT TOOTH LOCKWASHER
11	2	139-111	PLUG AND CABLE ASSY.
10	2	119-6	4-40 X 1/4 LG. BINDING HD. SCREW
9	2	148-13	SPRING, COMPRESSION
8	2	119-27	2-56 X 1/2 LG. FIL. HD. SCREW
7	4	119-56	4-40 X 3/16 LG. CONE PT. SET SCREW
6	4	119-44	2-56 X 1/4 LG. FIL. HD. SCREW
5	2	119-72	4-40 X 5/16 LG. CUP PT. SET SCREW
4	1	173-16	TAPE GUIDE & CARTRIDGE STOP
3	4	105-21	PHONO JACK
2	2	500-156	CLAMP & BRACKET ASS'Y "B"
1	1	123-38	BASE CHANNEL
ITEM	QTY.	PART NO.	DESCRIPTION



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7	4	119-61	4-40 X 1/8 LG. CONE PT. SET SCREW
6	4	119-41	2-56 X 3/16 LG. FIL. HD. SCREW
5	2	119-72	4-40 X 5/16 LG. CUP PT. SET SCREW
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2	2	500-155	CLAMP & BRACKET ASSY. "G"
1	1	123-38	BASE CHANNEL

Form No. 7186  
6-25-64  
Printed in USA



# Nortronics®

RECORD/PLAY  
AND  
RECORD ONLY

## Magnetic Tape Heads

### RECORD/PLAY AND RECORD ONLY

### GENERAL INSTRUCTIONS

#### 1. INTRODUCTION.

1-1. The following instructions will tell you how to correctly install and adjust your new NORTRONICS RECORD/PLAY (R/P) or RECORD ONLY tape head. If the instructions are followed, there should be no problem in making an installation which is capable of equalling or exceeding the original performance of the recorder.

#### 2. EXAMINING ORIGINAL R/P HEAD.

2-1. If the new head is to replace an existing R/P head, do not remove the original head until a preliminary examination has been made. After removing head cover plates and whatever else might be necessary to completely expose the heads, carefully study the original arrangement before attempting to remove the head or any wires. If there is any doubt as to

which is the erase head and which is the R/P head, thread a reel of tape on the recorder and put the machine in the PLAY mode. The first head the tape passes over after leaving the supply reel is the erase head. The second head the tape passes over is the R/P head. If the recorder uses three or more heads, consult the instruction manual or other information pertaining to the recorder to determine the function of the various heads. In the usual 3-head arrangement, the first head the tape passes over is the erase head, the second is the record head, and the third is the playback head.

2-2. If the new head is a replacement for a 2-track monophonic or 4-track stereophonic R/P head, place the recorder so the transport is in a HORIZONTAL position. This will serve as a reference point. Looking squarely at the FACE of the heads, observe whether the erase head is on the right or left side of the R/P head. Jot down this information. The reason for this is to determine which portion of the tape should cover the pole piece(s) of the R/P head. This procedure is not necessary for 2-track stereo or Full Track R/P heads as they both cover the full width of the tape.

2-3. Erase Head on RIGHT Side of R/P Head. If the R/P head is a 2-track mono type then the pole piece should be even with the bottom edge of the tape. If the R/P head is a 4-track stereo type then the pole piece closest to the transport plate should be even with the bottom edge of the tape.

2-4. Erase Head on LEFT Side of R/P Head. If the R/P head is a 2-track mono type then the pole piece should be even with the top edge of the tape. If the R/P head is a 4-track stereo type then the pole piece furthest from the transport plate should be even with the top edge of the tape.

#### 3. CHECKING WIRING OF ORIGINAL R/P HEAD.

3-1. No Mount Monophonic Heads. A mono head will have only two wires: a ground wire and a "hot" wire. It is not necessary to determine which is which since there is no polarity to the NORTRONICS monophonic heads.

3-2. No Mount Stereophonic Heads. A stereo head will have four wires: a ground wire and a "hot" wire for each of the two channels. In this case, the function of the wires must be known before they are disconnected from the original head to assure proper phasing of the two channels and to make certain the wires for each channel are connected properly when the new head is installed. It would be a good idea to make a sketch of the original wiring arrangement that shows (1) the color of each wire, (2) which wires are for the upper and lower channels of the head, (3) the location of the wires on the pins of the original head, and (4) which are the ground wires for each channel. Follow each wire to determine if it is grounded or not. Those not grounded are the "hot" wires. In most cases the wires for each channel will be paired; that is, the ground and "hot" wires will be either twisted together or in the form of a shielded cable. If the wires are not paired in any manner and it is impossible to tell which "hot" wire is paired with which ground wire, a VOM, Ohmmeter, or VTVM with resistance ranges may be used to identify the ground wire for each channel. Proceed as follows: Be certain the line cord supplying power to the recorder is NOT plugged in. Put the machine in the RECORD mode. If there is a Mono 1, Mono 2, Stereo Record selector switch, set it for Stereo Record. The VOM, Ohmmeter, or VTVM should be set to read "ohms" on the X1 scale. Fasten a lead from the meter to one of the wires on the rear of the R/P head and touch the other meter lead to a bare metal spot on the transport of the recorder. Note the meter reading for that particular wire on your sketch. Repeat this procedure with the three remaining wires on the rear of the R/P head, noting on your sketch each time the resistance reading obtained. The two lowest resistance readings are the ground wires for the stereo R/P head. In most cases, the ground wires will give a zero reading, indicating no resistance between the ground wire and the transport of the recorder.

3-3. Rear Mount Heads. The instructions given above for checking the original wiring on No Mount R/P heads can be used for Rear Mount heads with this exception: Since the wires come from inside the head and it is not possible to see which wire is connected to which pin on the head, trace

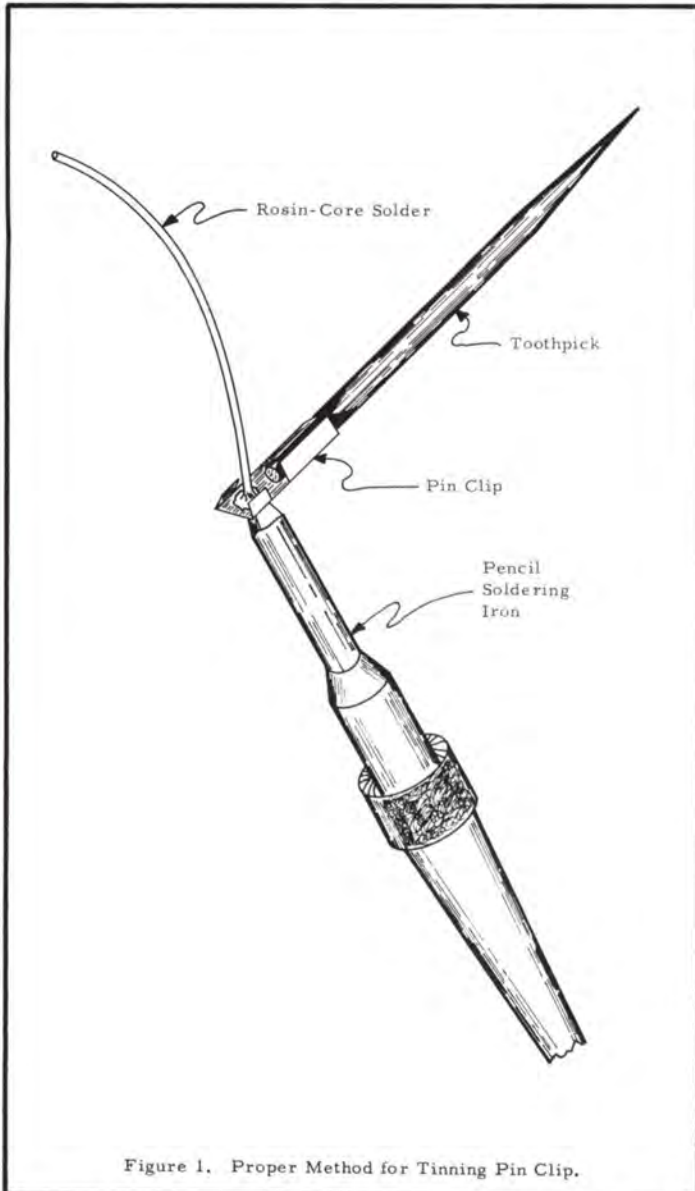


Figure 1. Proper Method for Tinning Pin Clip.

If You Didn't Get This From My Site,  
Then It Was Stolen From...

www.SteamPoweredRadio.Com

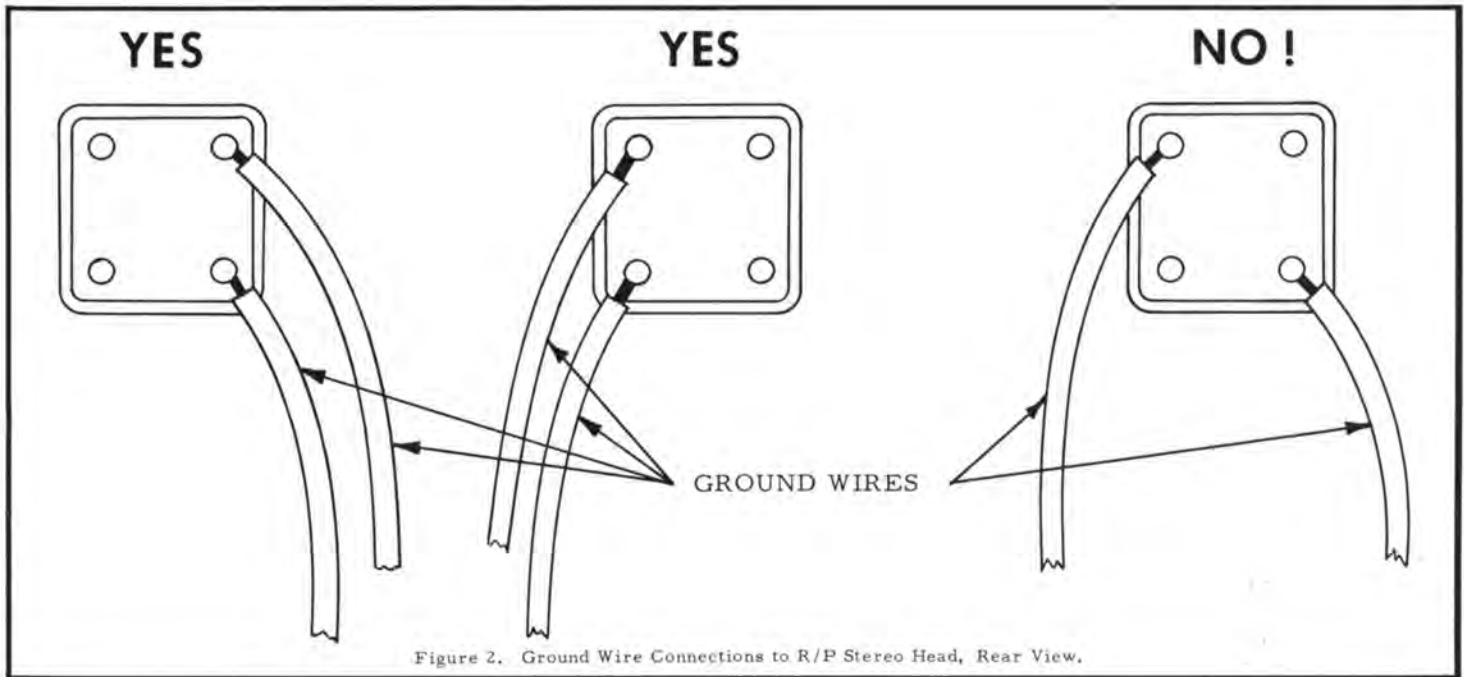


Figure 2. Ground Wire Connections to R/P Stereo Head, Rear View.

these wires to the terminal strip, plug, or whatever type of connector the wires are soldered to and make your sketch. Do not overlook jotting down the color of each wire.

#### 4. REMOVING ORIGINAL R/P HEAD.

4-1. After making the above notations, the R/P head can be removed. The wires originally connected to a No Mount head may be re-used if sufficient length exists to solder pin clips to them and slide the pin clips onto the terminal pins of the new head. Otherwise, the wires supplied with your new NORTRONICS head should be used. If the original wires are soldered to clips which are then pressed onto the pins of the head, carefully slide the clips from the pins with long-nose pliers. If these clips have also been soldered to the pins of the head, cut the wires from the clips if they are long enough for re-use. Handle these wires with care, as they are usually quite fine and cannot stand much flexing or strain. If the original head is a Rear Mount type, unsolder the wires from the connector they are soldered to as the wires coming from inside the new Rear Mount head must be soldered in their place.

4-2. Remove the old No Mount or Rear Mount R/P head from the recorder and install the new head in its place.

#### 5. CONNECTING WIRES TO NEW R/P HEAD.

5-1. No Mount Heads. If new wires are required due to the original wires being too short for re-use, these wires should be installed at this point. Regardless of whether the original wires are being re-used or new wires have been installed, you must use pin clips to connect the wires to the terminal pins of the head. **DO NOT SOLDER THE WIRES DIRECTLY TO THE HEAD TERMINAL PINS!** A certain amount of care is required when soldering wires to the pin clips to prevent flux and solder from flowing into the portion of the pin clip that grips the head terminal pin. One method that works quite well is to slide the pin clip over the end of a toothpick. Tilt the toothpick down to prevent flux and solder from flowing into the gripping portion of the clip. Tin the end of the clip (see Figure 1), then tin the end of the wire to be connected to it. Lay the tinned wire over the tinned end of the clip and touch the iron to the bottom of the clip end. Leave the iron in contact with the clip just long enough for the solder to melt and flow around the end of the wire, making a good joint. The pin clips are connected to the head by sliding them onto the head terminal pins with long-nose pliers. On all NORTRONICS stereo heads, the top two pins of the head are for the upper channel and the bottom two pins are for the lower channel. Refer to your notations or sketch of the wire designations and connect the pin clips to the correct terminals on the head. Make certain before actually connecting the pin clips that you have the ground wires for both channels on the **SAME SIDE** of the head. Refer to Figure 2. If this connection is not made properly, the two channels will be out of phase with each other.

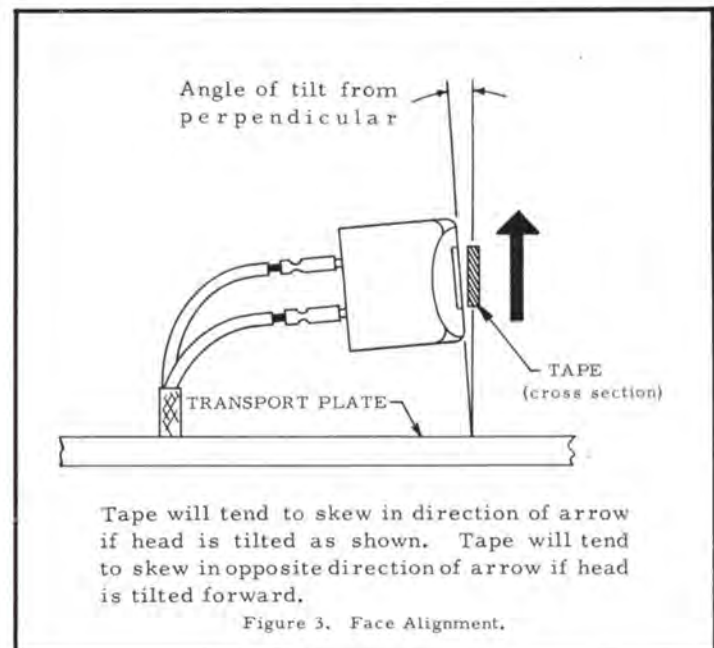
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NORTRONICS Rear Mount R/P heads may be identified by one of several markings. The name "NORTRONICS" may be stamped or labeled, there may be a dot of paint or the head model number may be stamped on top of the head. It is important to know which is the top and which is the bottom of a Rear Mount head because the wires are color coded for identification.

5-3. Two different wire color codings are used on NORTRONICS Rear Mount heads. System 1: The red and black wires are connected to the upper channel of the head. Black is the ground wire. The white and black wires are connected to the lower channel of the head. Black is the ground wire. System 2: The red and orange wires are connected to the upper channel of the head. Orange is the ground wire. The yellow and blue wires are connected to the lower channel of the head. Blue is the ground wire.

See addendum (page 4) for 3 & 4 channel heads.

5-4. Refer to your notations or sketch of the wire designations and solder the wires to the original connector. Since the new wires are considerably longer than actually needed in most cases, cut the wires to the proper length but give yourself a sufficient amount of slack to allow for stripping and tinning the wires, plus an extra margin for safety to insure adequate wire length. Strip and tin the wires. Push up the shield covering the wires about 1 or 2 inches so there is no danger of the shield contacting the tinned wires or connector.



Tape will tend to skew in direction of arrow if head is tilted as shown. Tape will tend to skew in opposite direction of arrow if head is tilted forward.

Figure 3. Face Alignment.

The new NORTRONICS Head may require a different recording current from the old head, so that the record level indicator must be operated at a different location for best recordings. The new position may be determined by making several tests recordings at various levels to find the one which gives maximum signal level on the tape without distortion.

(2) To Measure the audio record current in the head, insert a 1000 ohm resistor in series with the head in the same manner described previously in E. Disable the bias oscillator by removing the oscillator tube or else the bias current will mask the record current. Feed a 1000 c.p.s. test signal into the recording amplifier and adjust the re-

ording level until the VU-meter or other indicator shows normal recording level. Check the voltage across the resistor with a sensitive a.c. VTVM. A reading of 0.050-volts (50 millivolts) indicates a record current of 0.050 MA.

(3) Specifications. The value of record current shown in the Specification Table is that required to place a 1 kc. signal on the tape at a level of 12 db. below the saturation level. Saturation is defined as that recorded signal which gives the highest possible playback level from the tape, neglecting distortion. Normal average recording levels are usually run at about 12 db. below saturation. (This is often used as a 0 db. reference point) The VU-meter on the recorder should read about 0-VU with the specified amount of 1 kc. record current passing through the record head.

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## SUPPLEMENTAL INSTRUCTIONS FOR ERASE HEADS

I MOUNTING AND ADJUSTING THE ERASE HEAD. The new erase head is usually placed and mounted in the same position as the previous head. The head should be mounted firmly on the deck, and the face should be parallel to the tape guides and also to the face of the record head. Azimuth adjustment is not needed for erase heads.

a. Track Alignment. It is important that the tracks of the erase head line up with and cover the tracks of the record head. Otherwise the entire width of the recorded track will not be erased. The track of the erase head is wider than that of the record head to give a certain amount of overlap.

b. Poor Erasure will be caused by improper track alignment or by insufficient erase current. Paragraph VII discusses the problem of low erase current and what to do about it.

II PIN CONNECTIONS. Pin clips are furnished with your erase head to make connections to the coils. Solder the leads to the clips and then place the clips on the pins of the head. It is not advisable to solder directly to the pins as this may cause an open coil to develop.

III IMPEDANCE, VOLTAGE, AND CURRENT. The important factor in an erase head is the ampere-turns required for erasure. This is a constant for a given type of head -- full track, 1/2-track, etc. A high impedance head is wound with more turns of wire than a low-impedance head, thus requiring less current at a higher voltage. Conversely, the low impedance head requires less voltage and more current. NORTRONICS heads are available in two impedance types to match a wide variety of tape recorders. It is important to use the correct head for your particular recorder.

IV DETERMINING THE PROPER ERASE HEAD. It is very helpful to know both the a.c. erase voltage of the recorder and the frequency of the bias (erase) oscillator. For example, a head which operates at a voltage of 100 volts a.c. at a frequency of 60 kc. will operate at about 50 volts at a frequency of 30 kc. This is because the a.c. impedance of the head at 60 kc. is twice the impedance at 30 kc., so twice the voltage is required to force the same current through the head. In other words, the impedance is directly proportional to the frequency.

a. Measuring Voltage. To measure the erase voltage of your recorder use an a.c. vacuum-tube-voltmeter or a good multimeter. Some of the cheaper multimeter will not measure such high frequencies accurately. If you are not certain of the oscillator frequency it is best to check the erase current in the head as described in Par. V.

Most tape recorders use an oscillator frequency between 50 and 70 kc. Data is given in the instruction sheets for all erase heads, and for oscillator frequencies of 40 kc. and 60 kc. Voltages to give the same erase currents at other frequencies will be in proportion to the voltages for 40 and 60 kc.

b. Correct Impedance. Choose the head with the proper impedance for your erase voltage. In general, for voltages below 70 volts at 60 kc. select the lower impedance head. For voltages over 70 volts use the high impedance head. These are approximate figures.

V MEASURING ERASE CURRENT. Pull the clip, or unsolder the lead from the ground pin of the erase head (one channel only on a stereo head). Place a 100 ohm 1/2-watt resistor between the ground pin and the ground lead. Measure the voltage across the 100 ohm resistor with an a.c. VTVM or Multimeter while the head is erasing. A voltage reading of 1.0 Volt will indicate a current of 10 Milliamperes. Other readings will indicate in proportion -- 0.5 Volts for 5 MA., etc.

VI EXCESSIVE ERASE CURRENT. If the erase head is too low in impedance for the tape recorder it will draw excessive current, loading down the oscillator, dropping the bias voltage, and also causing possible overheating of the head. Actually, even though the head may become somewhat uncomfortably warm to the touch after extended operation (over ten minutes) it may nevertheless be operating normally. When in doubt, take a current measurement to make certain that the head is operating at or near the current range specified.

Erase current may be reduced by placing a dropping capacitor in series with the "hot" terminal of the head, right at the terminal connection. The value of this mica or ceramic may fall between 50 and 470 mmf. It should be less than the size required to resonate the head since resonance will actually increase the current. A resistor may be used instead of the capacitor to limit the current.

VII INSUFFICIENT ERASE CURRENT. Poor erasure of strongly recorded signals will result from insufficient erase current. If a weak residual signal remains on the tape after erasing with a carefully positioned head, then we must try to increase the head current.

It is possible to increase the erase current slightly by placing a small mica or ceramic capacitor in series with the "hot" pin in order to resonate the head. The capacitor causes the effective impedance to be lowered and permit more current for the same voltage. Use a capacitor between 100 and 470 mmf., trying different values in order to find the value which gives the most erase current. Insert the capacitor right next to the pin.

If erasure is still incomplete even with the resonating capacitor, then go to the lower impedance erase head. If you are already using the lower impedance head then it may be wise to reconnect the erase head to feed it through a small capacitor directly from the plate of the oscillator tube. This type of connection should use the high impedance head to avoid loading down of the oscillator. Set the capacitor value to give the right current.

# SUPPLEMENTAL INSTRUCTIONS FOR R/P HEADS

## A. HEAD IMPEDANCE.

(1) Description of Impedance. High impedance record/play heads might be considered to be those of 0.5-Henry and above in inductance. Those from 0.1 to 0.5 HY. are medium impedance, and those below 0.1 HY. are low impedance. The actual 1-kc. impedance value in ohms is equal to the inductance of the head in Henrys multiplied by 6,280.

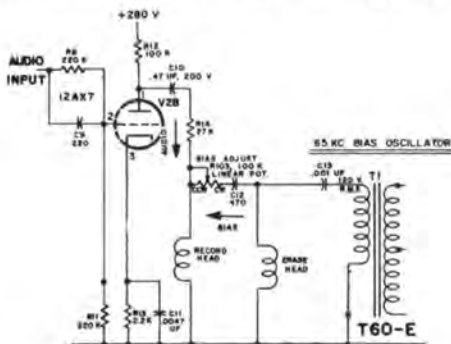
(2) Effect of Impedance. High impedance heads are wound with more turns of wire and have more inductance than the low impedance heads. Consequently the high impedance head requires a higher bias voltage, but a lower value of bias and record current than the low impedance head. Fortunately the exact value of bias current is not very critical, and the amount tends to be self-adjusting when the new recording head is placed in the circuit. If a high impedance head is replaced with one of lower impedance which needs more bias current, the new head will automatically draw more bias because of its lower impedance. The reverse also holds true when the higher impedance is substituted for the lower.

In general, for playback purposes a high impedance head is desirable because of the larger output voltage. Recording heads favor the low impedances because of the lower bias voltage required, and reduced trouble from long, shielded leads. Record/play heads are compromises, but do an excellent job in both applications.

(3) Replacement vs. Impedance. In most replacement applications minor differences in head impedance are not very important. The high impedance NORTRONICS R/P heads will generally replace the heads in most tape recorders. Exceptions are some machines which have special low impedance bias or recording circuits, such as the Magenecord, Webcor, Eicor, and Berlant Concertone. On these machines the NORTRONICS heads may be used for playback, but some changes are required in the circuits to permit recording. If you wish to send a copy of the circuit diagram of your recording amplifier to the Customer Service Department of NORTRONICS, suggestions will be made regarding the changes.

## B. METHODS FOR ADJUSTING BIAS.

In most recorders the bias and audio currents are fed simultaneously to the recording head through isolation resistors and capacitors. Some recording amplifiers such as the NORTRONICS RA-100 have an adjustable bias current control which permits the bias to be set to any desired value. The figure shows a fairly typical shunt-feed record circuit taken from the RA-100. The audio record current is fed from the plate of V2B thru the 27K isolation resistor, R14. The 65 kc. bias voltage is taken from across the erase head and fed to the record head thru the 470 mmf. C-12, and the 100K bias adjust pot., which allow the high frequency bias to pass but prevent the low frequency audio from leaking off through the oscillator coil.



Typical sample recording circuit, showing audio driver tube for recording head, and bias oscillator transformer feeding the erase head and the record head.

The bias pot. is omitted in most tape recorders. To increase the bias current, raise the value of C-12 by changing it, or by shunting it with another capacitor of a similar value. Bias is reduced by lowering C-12. More or less resistance in series with C-12 will also reduce or increase bias. You may wish to insert a 100K linear taper bias pot. to allow easier adjustment of bias.

## C. IMPROPER BIAS.

The bias current will usually adjust itself to approximately the correct value when the new NORTRONICS head is installed. When in doubt, the actual value of bias should be measured and adjusted as described below.

(1) Insufficient Bias Current will result in distortion during the recording of medium or moderately high levels on the tape. Another symptom is a tendency toward shrillness during playback of a signal recorded with low bias.

(2) Excessive Bias Current will result in a noticeable drop in high frequency response during playback of the tape recorded with the high bias. No harmful effects will be obtained, of course, on playback of commercial pre-recorded tapes. The drop in highs is caused by the self-erasing effect of the bias on the higher audio frequencies during recording.

## D. OPTIMUM BIAS.

In general, the slight drop in high frequency response caused by excessive bias is to be preferred over the increase in distortion which results from insufficient bias current during recording. A higher bias gives a better signal-to-noise ratio, and a wider dynamic range due to the fact that stronger signals can be recorded on to the tape without distortion. Therefore, when in doubt it is always better to over bias rather than to under bias.

Peak Bias is usually considered to be optimum, and is that value which gives maximum output upon playback of a 1 kc. recorded signal. The 1 kc. audio record current in the head is held constant, and the bias current is adjusted to that which gives maximum playback output. This is most easily determined when a separate playback or monitor head is used so that the playback output can be measured while recording. The actual peak bias value is rather broad, and values between 25% below and 25% above are satisfactory since the change in sensitivity is negligible.

The bias values given in the instruction sheets are those recommended for peak operation. The optimum peak bias current varies from head to head in the same model, and will fall somewhere within the limits specified for the particular model. When in doubt, adjust for the correct peak bias as described in the above paragraph. In many cases the adjustment of bias is such a difficult task, involving circuit changes on the machine, that it is best to leave it alone, especially if it is on the high side of peak. The advantages of the higher bias will often outweigh the reduced high frequency response, which will be compensated for by the superior high frequency of the NORTRONICS heads on playback.

## E. MEASUREMENT OF BIAS CURRENT.

(1) Meter. To measure bias current an A.C. voltmeter with a low scale of 0-3 volts or smaller is required. A VTVM or Multimeter type is satisfactory, although some of the cheaper multimeters may not read accurately at the high bias frequencies. A 1000 ohm resistor is placed in series with the ground lead of the recording head, and the bias voltage drop across the resistor is measured. A reading of 0.5 volts a.c. indicates a bias current in the head of 0.5 milliamperes (MA.).

(2) Connections. First unsolder or cut the ground lead from the terminal lug of the recording head channel being checked. Then solder the 1000 ohm resistor (1/2-watt) between the ground lead and the terminal clip on the ground pin of the head. Be careful to avoid soldering directly on the pin as an open coil may result. It is best to remove the pin clip from the head while soldering.

(3) Measurement. Next clip the voltmeter across the resistor and measure the a.c. voltage while the tape recorder is in the "Recording" position. The reading in volts will indicate the bias current in milliamperes.

## F. AUDIO CURRENT.

(1) Level Indicator. The audio recording current in the head fluctuates widely during the making of a recording. A record level meter (VU), neon lamp, or "magic eye" is used to indicate the recording level. The main consideration is that the peaks of audio power are not allowed to drive the tape into saturation, thereby causing a distorted recording.