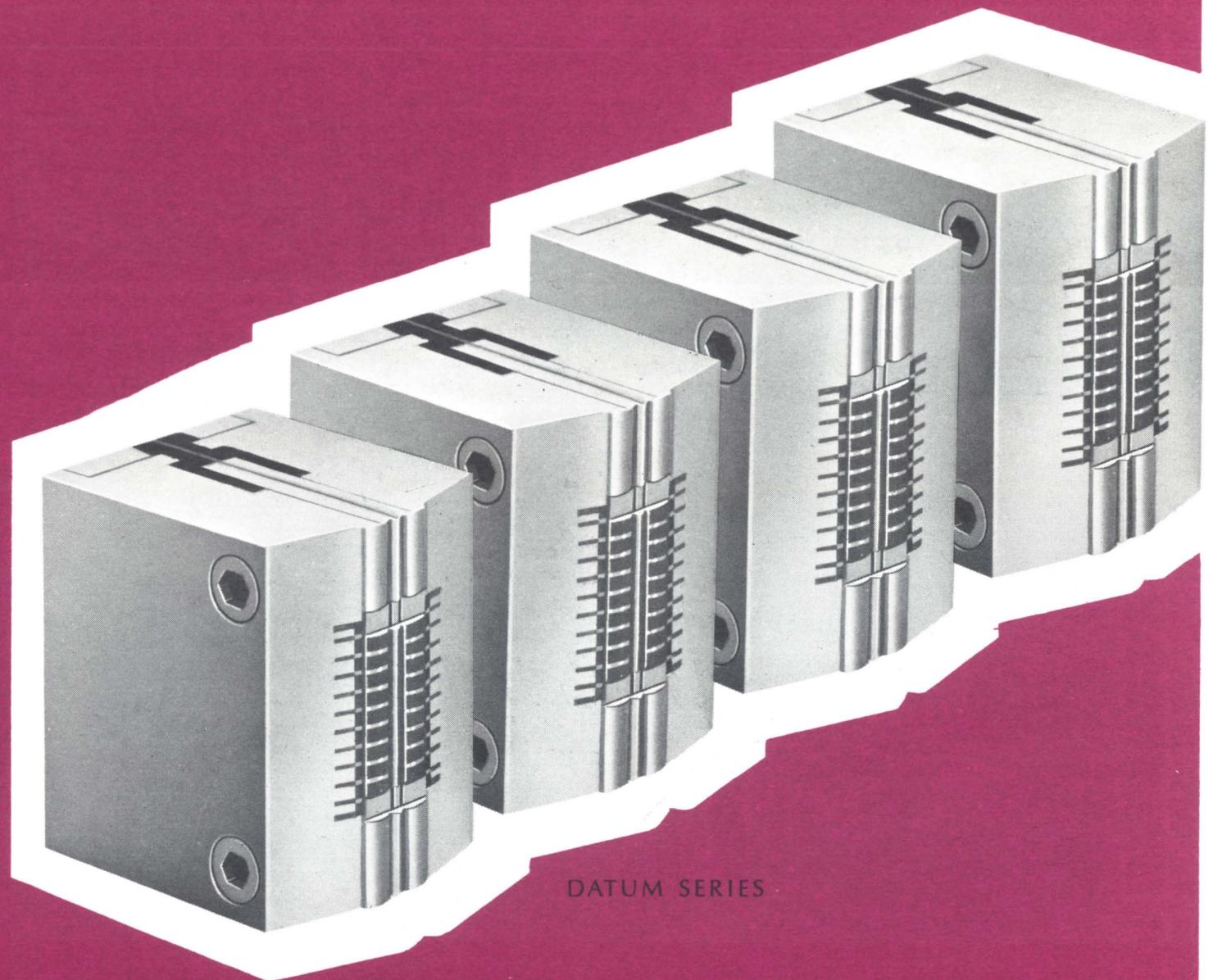


Nortronics®/world leader in magnetic heads

HEADS FOR DIGITAL APPLICATIONS



DATUM SERIES

IBM COMPATIBLE HEADS

7 AND 9 CHANNEL • SINGLE AND DUAL GAPS
READ/WRITE AND READ AFTER WRITE

FLYING HEADS • MINI-DIGITAL HEADS



**NORTRONICS
COMPANY, INC.**

8101 Tenth Avenue North • Minneapolis, Minn. 55427
Telephone: (612) 545-0401

THE CREDENTIALS OF NORTRONICS

Nortronics, the world's most experienced manufacturer of magnetic heads, has an enviable fifteen year record of building heads on a mass production basis, controlling tight tolerances, meeting rigid delivery schedules, and competing effectively in domestic and off-shore markets.

Our substantial investment in facilities and equipment is matched by a superior reservoir of engineering and production talent. Nortronics is unique in its industry in not merely assembling heads, but controlling the entire production process from raw material to finished goods.

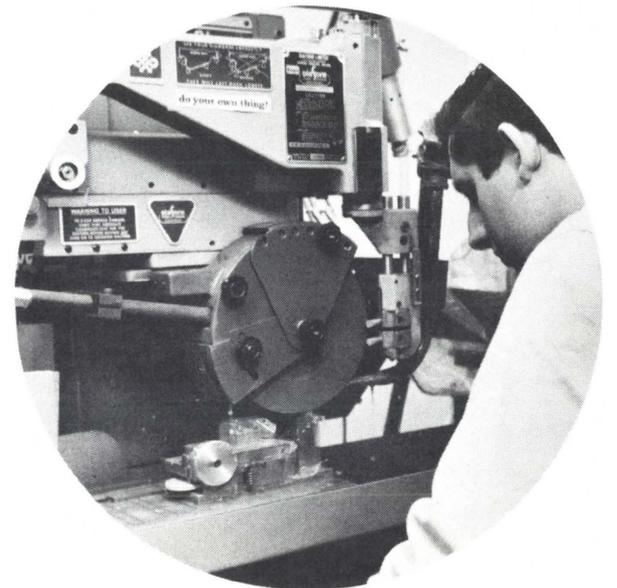
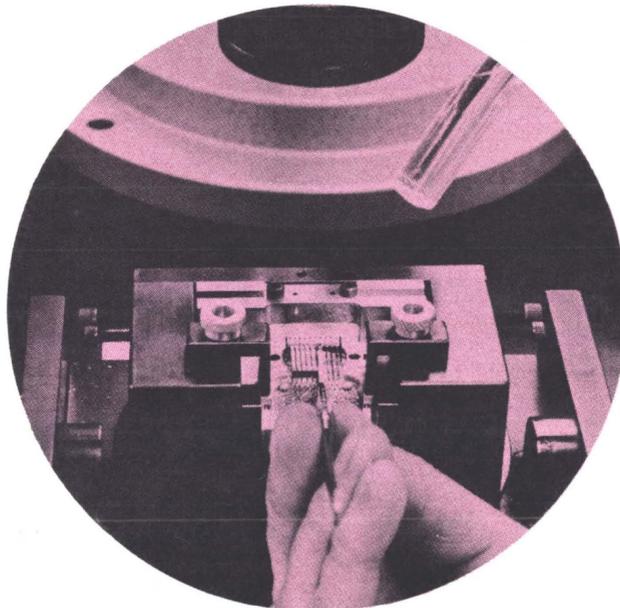
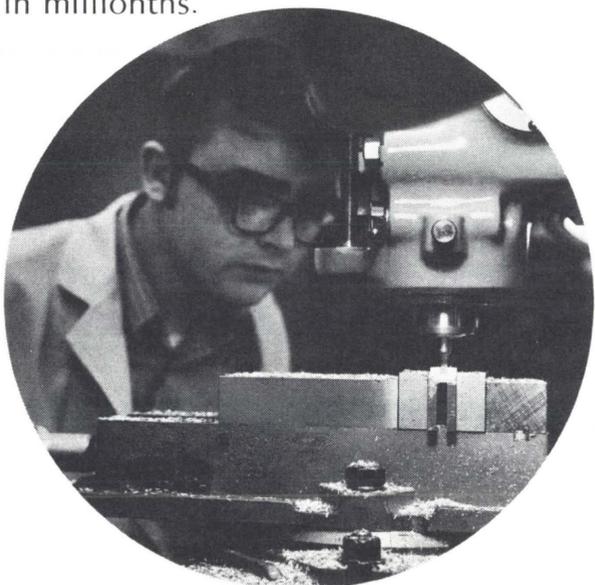
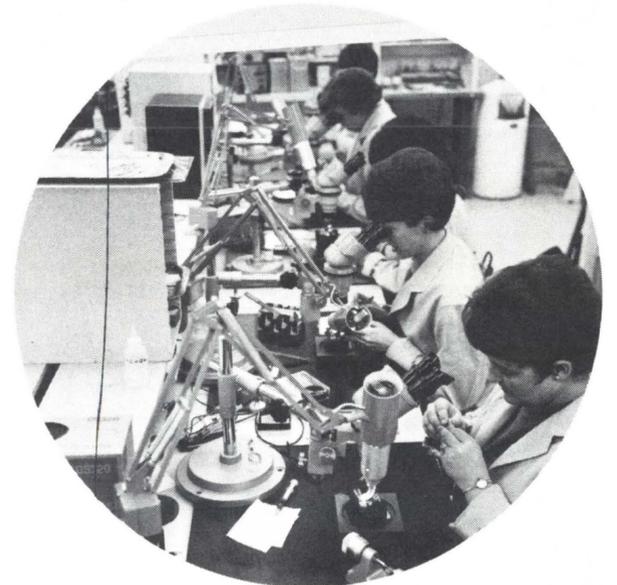
Objective observers recognize the significance of Nortronics' controlling its own in-plant tool and die making facilities, as well as a high precision gauging capability (through our subsidiary, Minnetech Labs). Nortronics designs and produces its own tooling and equipment, to assure the maintenance of tolerances tighter than can be achieved on commercially available machinery—for example, center sections lapped flat within 20 millionths, direct digital read-outs in millionths.

Nortronics was a pioneer in vacuum gap deposition, resulting in better gap definition and higher resolution at the frequencies demanded by the computer industry. In-house cycle testing and facilities for annealing of lamination materials result in the optimum balance between electrical properties and material hardness, providing excellent performance characteristics and extended head life.

Nortronics has a substantial roster of achievements in head engineering and production. Our experience in the audio industry is unmatched; our innovative and imaginative accomplishments give us virtual command of the mini-digital market; and we offer a highly reliable and competitive stance in IBM-compatible 7 and 9 channel precision heads.

Flying heads are the most recent focus of the attention of the Nortronics research and development department, and your inquiry for these heads is invited.

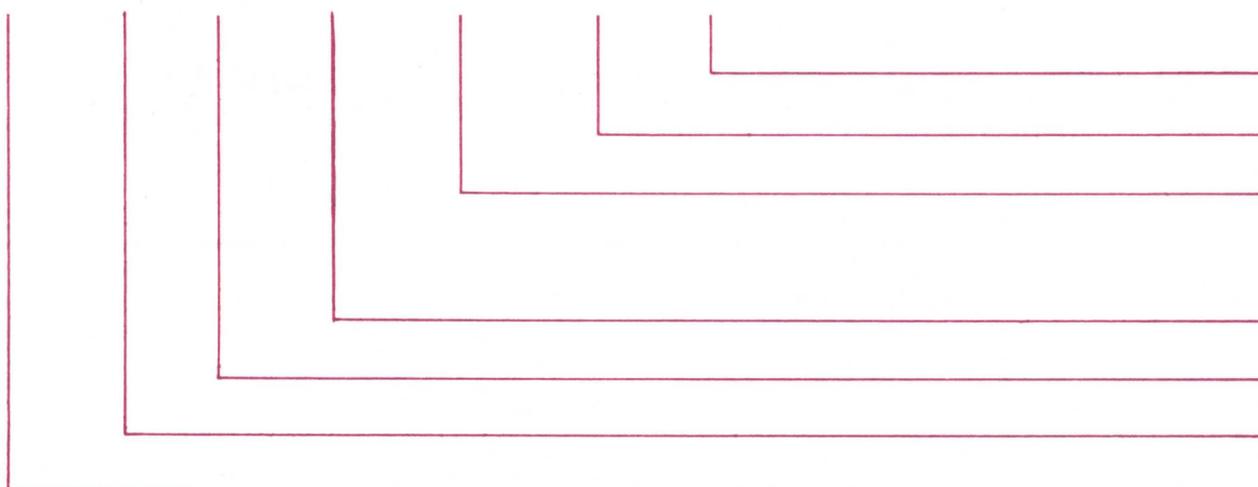
The Marketing Engineering Department is available to assist you in determining the head best suited to your application.



DATUM SERIES NOMENCLATURE

The following coding system describes the new Datum series seven and nine channel heads:

D 9 2 B 06 E 1



Erase Electrical Code

Indicates Piggy-Back Erase

Electrical Code

Includes: Gap, Write Current, Output, Lamination, Crosstalk, Shield, etc.

External Form and Nominal Track Width

Number of Gaps (Single or Dual)

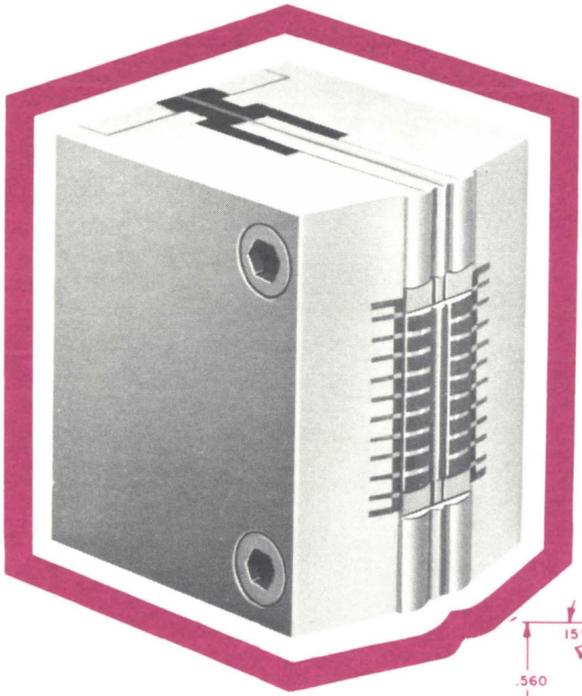
Number of Channels (Seven or Nine)

Series Designator (Datum)

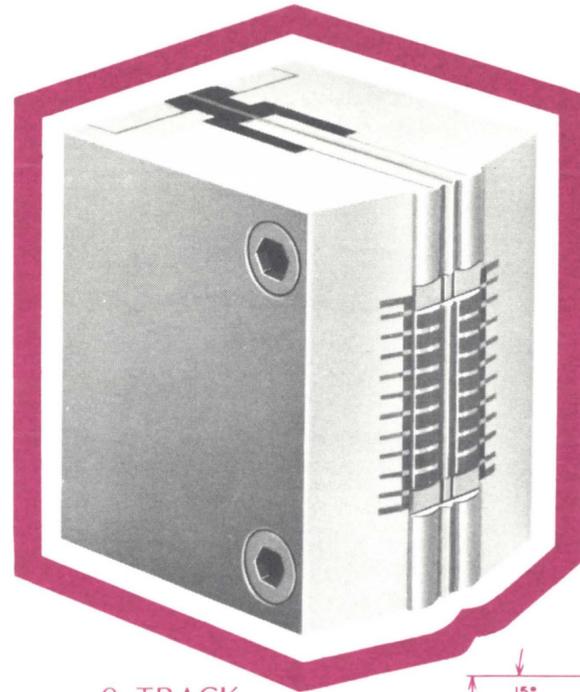
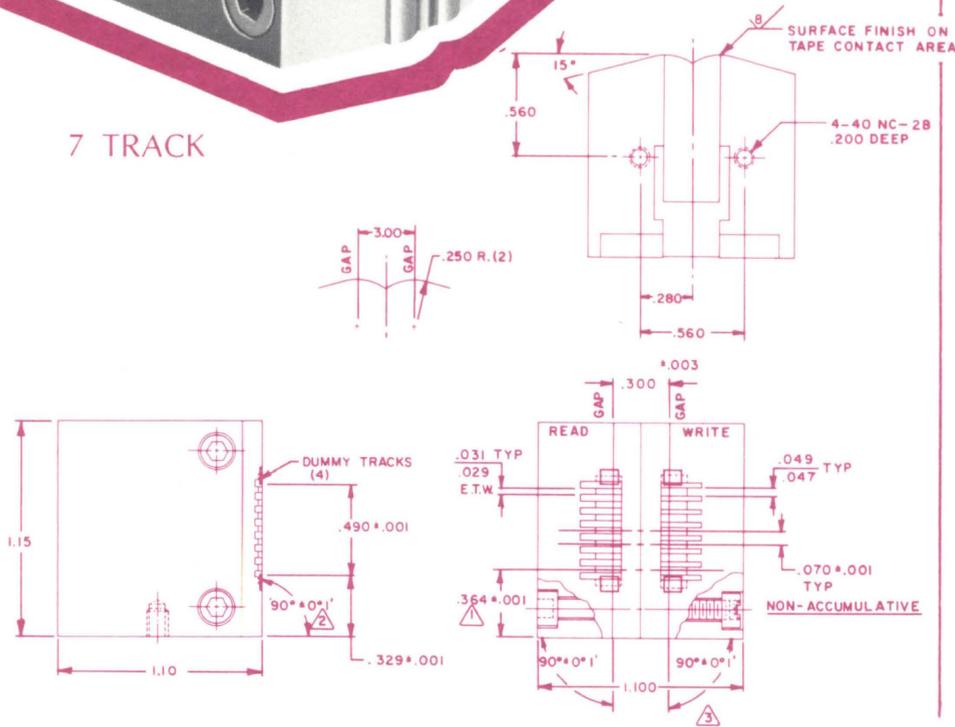
DIGITAL HEADS

- IBM-Compatible
- Write and read on 1/2" computer tape
- Medium and high density formats
- Densities up to 3200 fci, speeds to 150 ips

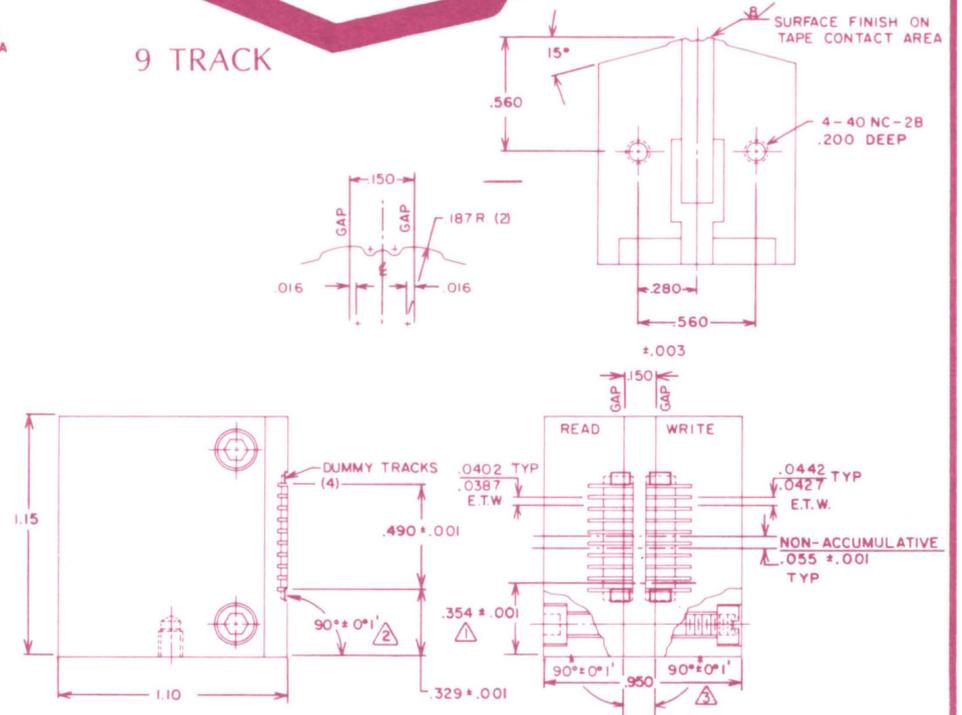
Datum Series • Dual Gap READ AFTER WRITE



7 TRACK



9 TRACK

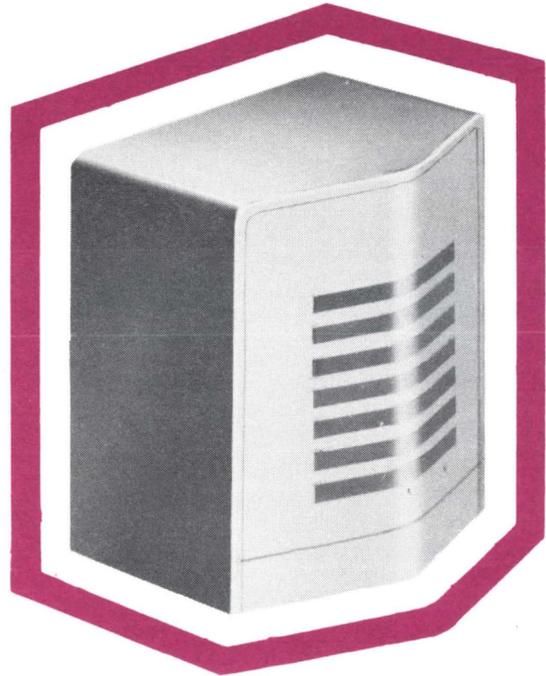


	7 TRACK		9 TRACK	
	MEDIUM DENSITY	HIGH DENSITY	MEDIUM DENSITY	
MODEL	D72D08	D92C04	D92C05	
Density	800 BPI (NRZI)	3200 fci (PE)	800 BPI (NRZI)	
Gap Length	Write 500 u in. Read 250 u in.	Write 100 u in. Read 100 u in.	Write 250 u in. Read 200 u in.	
I _s Saturation Current Write current required for 95% of maximum 800 BPI output	17 ma 0-Peak 1/2 winding	60-80 ma 0-Peak 1/2 winding	17 ma 0-Peak 1/2 winding	
I _w Operating Current	25 ma 0-Peak at 3200 fci 1/2 winding 2 u s rise time 10-90%	70 ma 0-Peak at 3200 fci 1/2 winding 0.3 u s rise time 10-90%	25 ma 0-Peak at 800 BPI 1/2 winding 2 u s rise time 10-90%	
Read Output at 800 BPI into 10K + 100 pf	27 mv P-P at 112.5 ips	21 mv P-P at 112.5 ips	36 mv P-P at 112.5 ips 9.5 mv P-P at 30 ips	
Resolution (Ratio of output signals after 5 passes of prerecorded tape)	800 BPI = 85% min. 200 BPI with I _w 25 ma	3200 fci = 36% min. 200 BPI with I _w 70 ma	800 BPI = 85% min. 200 BPI with I _w 25 ma	
Self Erasure—Read only output after 10 passes as a % of read while write at 800 BPI	90% min.	90% min.	90% min.	
Electrical Skew at 800 BPI at 112.5 ips Read Standard Tape Write only	1.33 u s max. 1.33 u s max.	1.33 u s max. 1.33 u s max.	1.33 u s max. 1.33 u s max.	
Crossfeed (Write to Read) Feedthrough to any read track relative to 800 BPI output of that track. With tape stopped, shield in place, normal write current I _w , normal load, worst case write phasing.	3%	3%	3%	
Adjacent Channel Crosstalk Crosstalk signal of erased track compared to written output of that track at 800 BPI with other tracks written worst case.	2% max.	2% max.	2% max.	
Inductance at 1 khz—Write 1/2 coil Read	3 mh max. 3.5 mh nom.	.24 mh max. 1 mh nom.	3 mh max. 3.5 mh nom.	
D. C. Resistance— Write Read	8 ohms/leg max. 35 ohms max.	2 ohms/leg max. 15 ohms max.	8 ohms/leg max. 35 ohms max.	
Gap Depth	.012" minimum	.012" minimum	.012" minimum	
Tape Wrap	10° each side of head assembly	10° each side of head assembly	10° each side of head assembly	
Tape Contact Surface	No voids or epoxy exceeding .0015" in vertical section.	No voids or epoxy exceeding .0015" in vertical section.	No voids or epoxy exceeding .0015" in vertical section.	
D. C. Erase	Available for erasure in-contact or non-contact with oxide surface.	Available for erasure in-contact or non-contact with oxide surface.	Available for erasure in-contact or non-contact with oxide surface.	

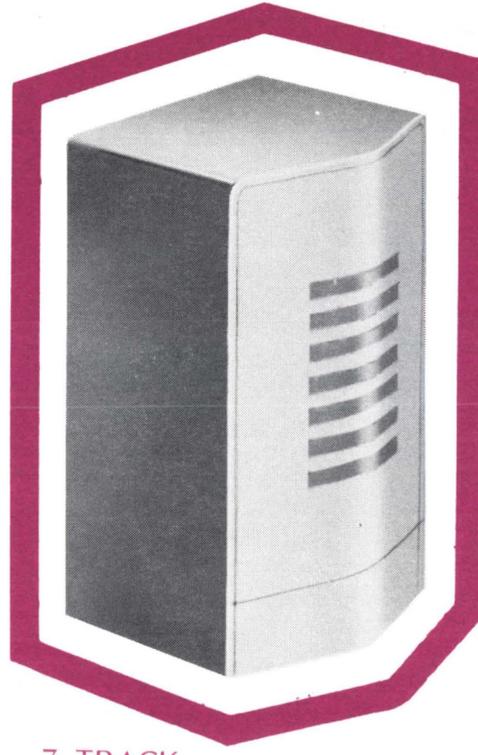
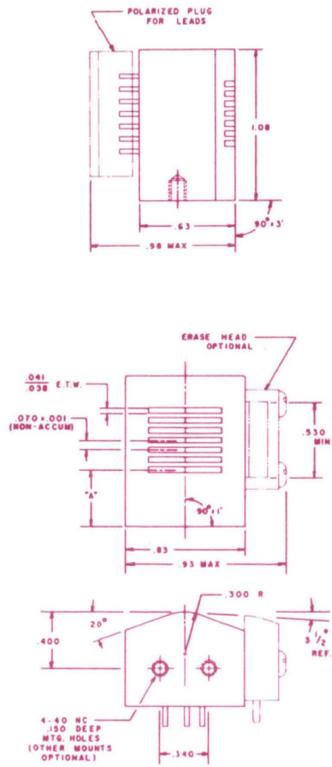
DIGITAL HEADS

- IBM-Compatible
- Write and read on 1/2" computer tape
- Medium and high density formats
- Densities up to 3200 fci, speeds to 150 ips

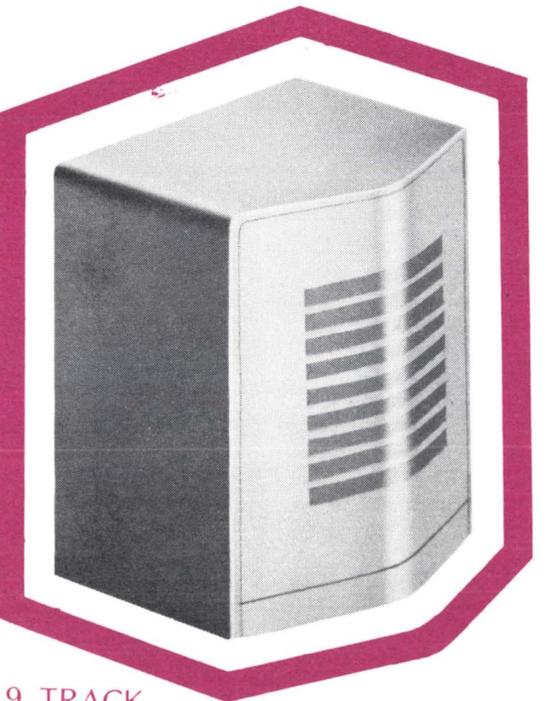
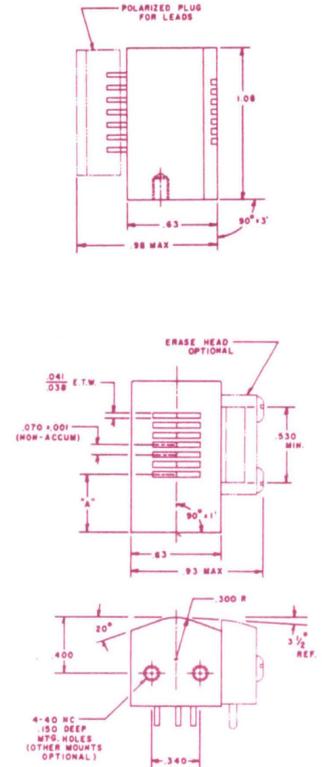
Datum Series • Single Gap READ, WRITE, READ AFTER WRITE



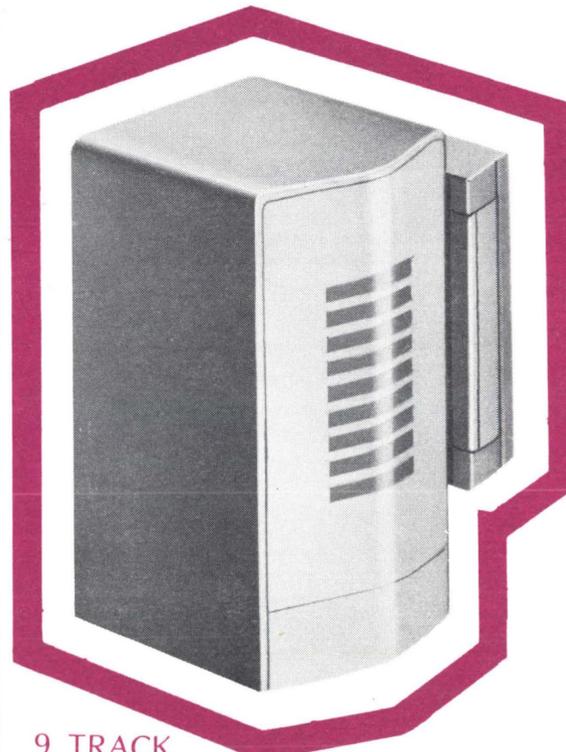
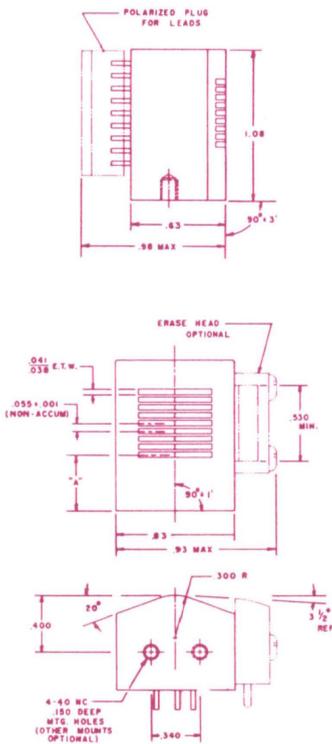
7 TRACK



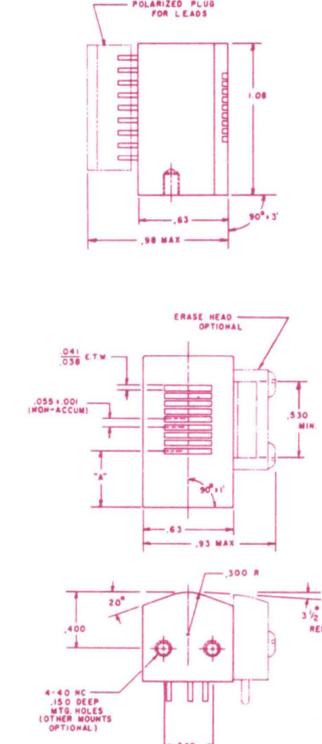
7 TRACK



9 TRACK



9 TRACK

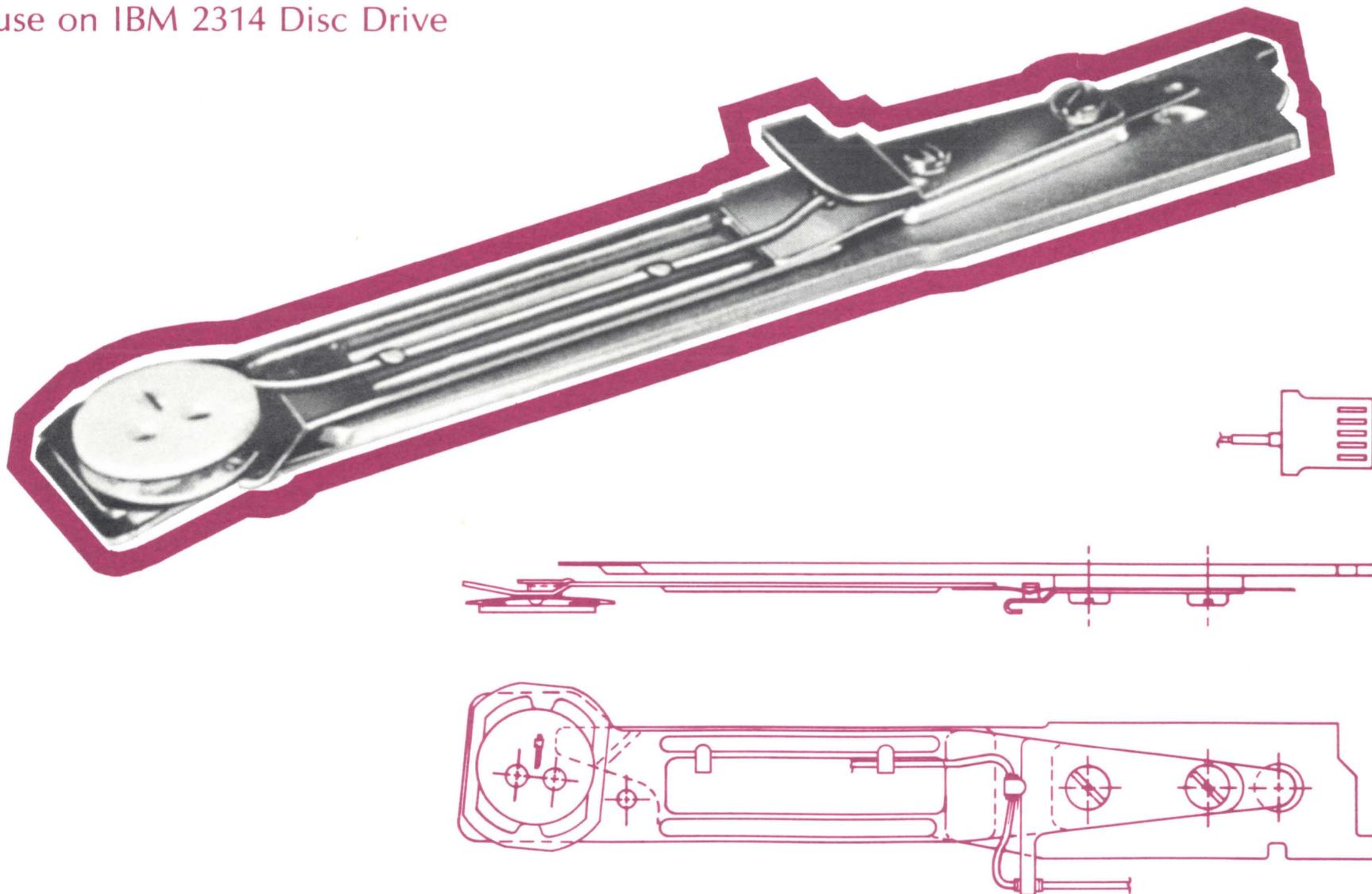


MODEL	7 TRACK HEADS			9 TRACK HEADS			
	D71A03	D71A07	D71B02	D91A03	D91A07	D91B02	D91B06
Density	800 BPI	800 BPI	200 BPI	800 BPI	800 BPI	200 BPI	3200 fci
I _s Saturation Write Current 0-Peak 1/2 Coil Current required for 90% of maximum 800 BPI output	11 ma	11 ma	4.5 ma	11 ma	11 ma	4.5 ma	5.3 ma
I _w Operating Current	16.5 ma	16 ma	6.7 ma	16.5 ma	16 ma	6.7 ma	5.8 ma
Read Output in mv P-P at indicated density	5.8 mv @ 15 ips	6.6 mv @ 15 ips 25 mv @ 60 ips 48 mv @ 120 ips	2 mv @ 1 1/8 ips	5.8 mv @ 15 ips	6.6 mv @ 15 ips 25 mv @ 60 ips 48 mv @ 120 ips	2 mv @ 1 1/8 ips	5 mv @ 7 1/2 ips
Resolution 800 BPI output 200 BPI output	85% min.	85% min.	85% min.	85% min.	85% min.	85% min.	85% min.
Self Erasure—Output after 10 passes related to Read while Write Output @ 800 BPI	90% min.	90% min.	90% min.	90% min.	90% min.	90% min.	90% min.
Crosstalk with adjacent channels written worst case	23 db.	37 db.	21 db.	22 db.	36 db.	20 db.	20 db.
Inductance @ 1 khz—1/2 coil whole coil	.83 mh 3.2 mh	1.7 mh 6.7 mh	6.4 mh 26 mh	.9 mh 3.5 mh	1.8 mh 7.3 mh	7 mh 28 mh	14 mh 55 mh
D. C. Resistance—1/2 coil	14 ohms	30 ohms	60 ohms	14 ohms	30 ohms	60 ohms	75 ohms
Gap Depth—inches	.012 min.	.012 min.	.012 min.	.012 min.	.012 min.	.012 min.	.012 min.
D. C. Erase	Available for erase in-contact or non-contact with oxide surface.						

Note: Crosstalk of 30 db minimum is available on all models.

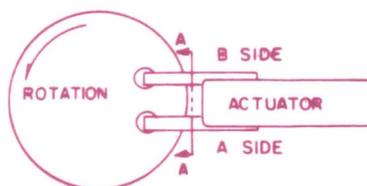
FLYING HEAD ASSEMBLY Dynamically tested to assure compliance with the specifications.

For use on IBM 2314 Disc Drive



The flying head assembly is a single channel type for use on the IBM 2314 Disc Drive or other manufacturer's equivalent units. Four configurations of this assembly are required for a typical disc drive as indicated in diagram "A." A unit for an eleven disc pack requires five heads of each configuration, or a total of twenty heads.

CONFIGURATION FORMAT
(IBM 2314 TYPE DISC DRIVE)



SPECIFICATIONS:

Recording Density: 2200 BPI at a disc speed of 2400 RPM

Write Current: 35ma 0 to peak per leg on tracks 000 to 127; 28ma 0 to peak per leg on tracks 128 to 200

Saturation Current: 27-32ma 0 to peak per leg on track 000
20-26ma 0 to peak per leg on track 200

Erase Current: 40ma DC

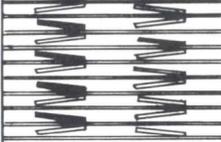
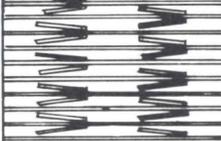
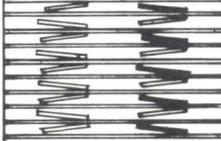
Head Load: 390 ± 25 grams

R/W Core Width: .0070 + .0000
- .0005

Read Output:

At	1.25 MHz	2.50 MHz
Track 000	9mV p-pmax	6mV p-pmax
Track 200	3mV p-pmin	1.1mV p-pmin

Resolution: Track 200: 33% min.
Measured by the 2.5 MHz output as a percentage of the 1.25 MHz output.

CONFIGURATION	IBM PART NUMBER	NORTRONICS PART NUMBER	VIEW A-A ROTATION
 A-UP	2250960	H808001	
 A-DOWN	2250961	H808002	
 B-UP	2250962	H808003	
 B-DOWN	2250963	H808004	

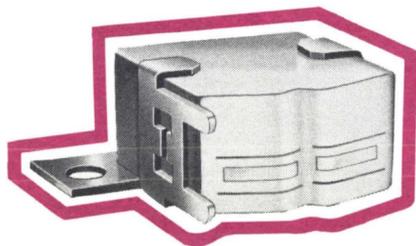
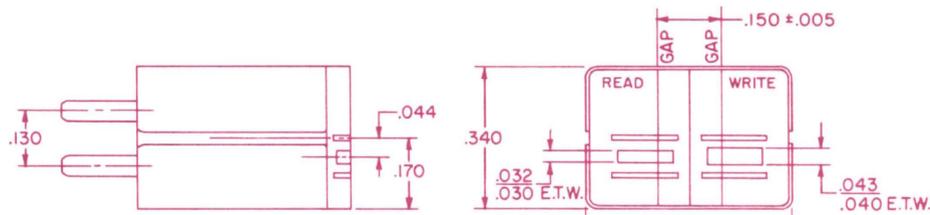
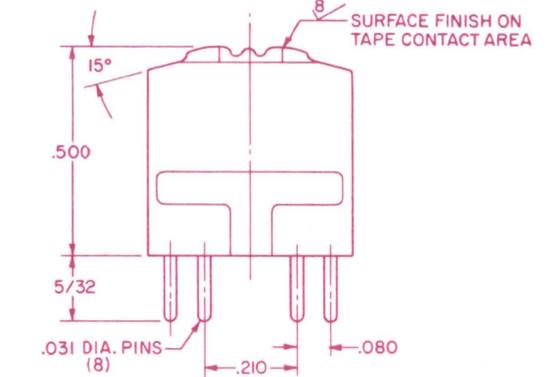
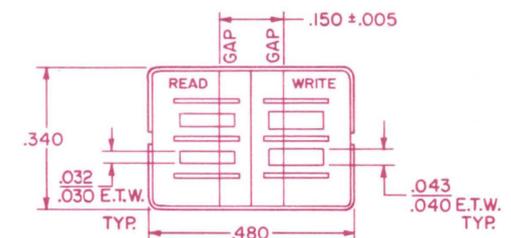
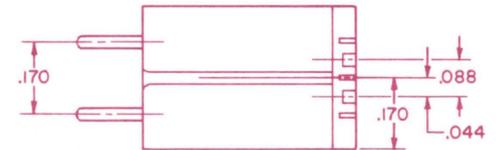
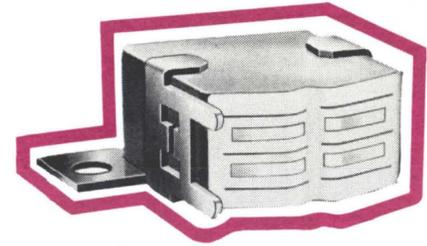
MINI-DIGITAL HEADS

- For calculators, input/output systems, terminal systems, and peripheral equipment
- Wide range of 1/4" and cassette formats
- Specifications and read/write data based on tests using 3M 870 tape

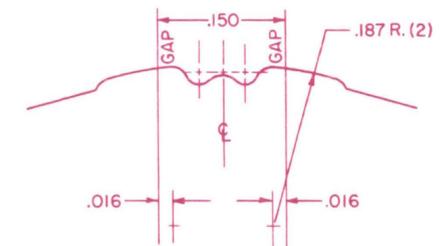
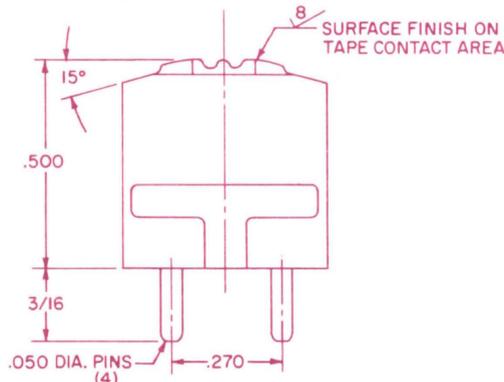
dual gap—read after write

1 and 2 channels—cassette (.150") format

MODEL	2 Channels 1 Channel	HIGH DENSITY	MEDIUM DENSITY
		WR2R10K WR1R10K	WR2R21N WR1R21N
Density		3200 fci	800 BPI
Gap Length		Write 100 u in. Read 100 u in.	Write 200 u in. Read 200 u in.
I _s Saturation Current Write current required for 95% of maximum 800 BPI output		12 ma O-Peak	3.5 ma O-Peak
I _w Operating Current at rated density		12 ma O-Peak	5 ma O-Peak
Read Output at 3 3/4 ips into 10K + 100pf		2.0 mv Pk-Pk 3200 fci	4.5 mv Pk-Pk 800 BPI
Self Erasure—Read only output after 10 passes as a % of read while write at 800 BPI		90% min.	90% min.
Crossfeed (Write to Read) Feedthrough to any read track relative to output of that track. With tape stopped, normal write current I _w , normal load.		18 db	18 db
Adjacent Channel Crosstalk Crosstalk signal of erased track compared to written output of that track at normal density.		45 db min.	45 db min.
Inductance at 1 khz—Write coil	Write	250 uhy	3 mhy
	Read	17 mhy	20 mhy
D. C. Resistance—	Write	2 ohms	12 ohms
	Read	60 ohms	70 ohms
Gap Depth		.012 min.	.012 min.



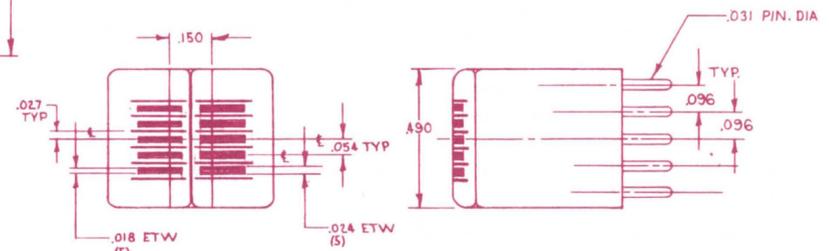
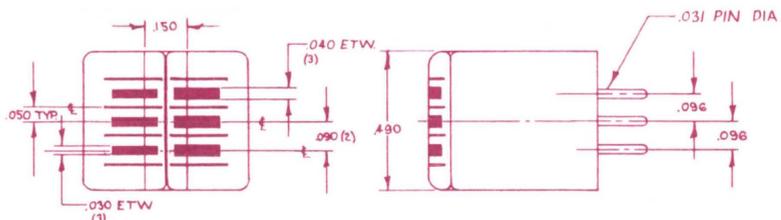
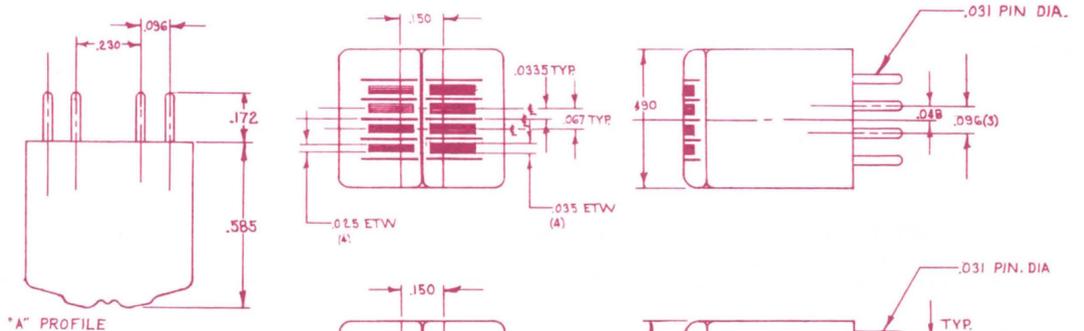
2 after part number indicates cylindrical radius.
3 after part number indicates dual hyperbolic face.



3, 4 and 5 channels — 1/4" format

Typical Characteristics:
3M8109 Tape — 10 ips — 800 FRI
All ones NRZI, 15 micro second rise time

	SK-750 3 channels	SK-751 4 channels	SK-752 5 channels
Gap lengths	200 u in.	200 u in.	200 u in.
Write current (I _s for 100% read out)	12 ma, O-P	12 ma, O-P	12 ma, O-P
Read voltage (For 100% signal)	5 mv, P-P	4 mv, P-P	3 mv, P-P
Crossfeed, write/read	18 db	18 db	18 db
Crosstalk, interchannel	40 db	40 db	40 db

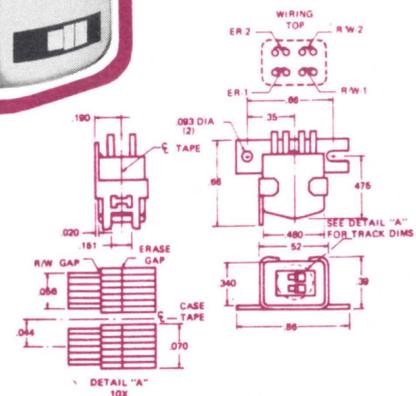
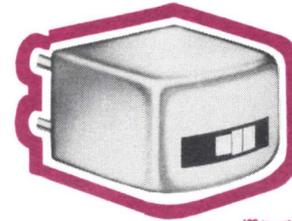
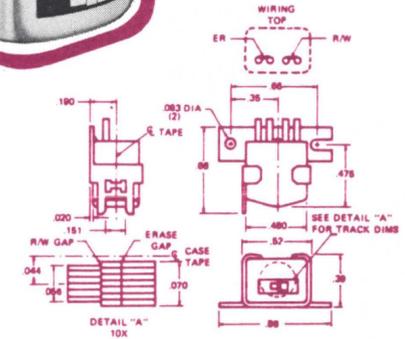
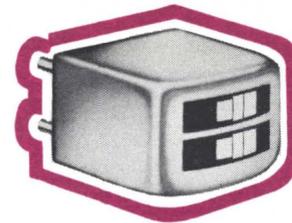


MINI-DIGITAL HEADS

- Nortronics offers unique capability for designing and producing to special size and format requirements.
- NRZ Digital Read/Write Data at 3.75 ips, 400 BPI, based on tests using 3M 272 tape.

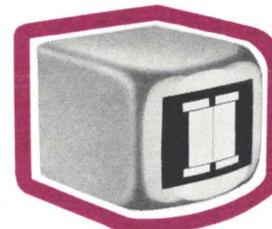
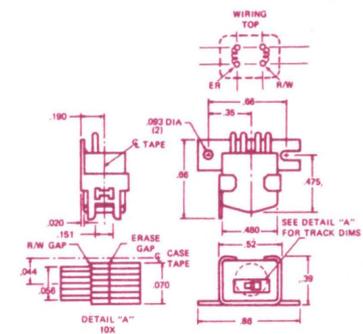
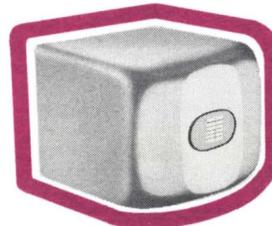
tunnel write

SINGLE TRACK MODEL NO.	PRE-ERASE ENTIRE TRACK			PRE-ERASE TRACK EDGES ONLY
	ZW1R38N		ZW1R48N	
DUAL TRACK MODEL NO.	ZW2RK38N	ZW2R36F	ZW2RK48N	ZW2RL48N
Tape Width (inches)	.150	.150	.150	.150
No. of Tracks on Tape:	2	2	2	2
Track Width Read/Write (inches)	.056	.056	.056	.056
Channel Spacing, Dual Channel Heads Center-to-Center	.088	.088	.088	.088
Gap Spacer	0.2 Mil	0.05 Mil	0.2 Mil	0.2 Mil
R/W Inductance, 1KHZ	10 Mhy	200 Mhy	10 Mhy	10 Mhy
R/W Resistance, Ohms	48	290	48	48
R/W Gap	200 U-in	50 U-in	200 U-in	200 U-in
Erase Inductance	2.5 Mhy	2.5 Mhy	15 Mhy	10 Mhy
Erase D.C. Resistance	40 Ohms	40 Ohms	150 Ohms	150 Ohms
60 KHZ Erase Voltage	40 RMS	20 RMS	80 RMS	—
60 KHZ Erase Current	50 MA	30 MA	18 MA	—
D.C. Erase Current	70 MA	70 MA	25 MA	20 MA
Write Current P-P	7 MA	1.3A MA	7 MA	7 MA
Read Output P-P 200 BPI	3.6 MV	9.0 MV	3.6 MV	3.6 MV
Maximum Read Packing Density	800 BPI	1600 BPI	800 BPI	800BPI



card reader

MODEL NUMBER	RIF8S	BIHC4R	BIHC1R
Tape Width (Inches)	—	—	—
Number of Tracks on Tape	—	—	—
Number of Channels in Head	1	1	1
Track Width (Inches)	0.25-0.10	.080	.080
Channel Spacing Center to Center (Inches)	—	—	—
Gap Spacer	1.0 Mil	0.5 Mil	0.5 Mil
Inductance, 1 KHZ	6 Mhy	50 Mhy	700 Mhy
Resistance, D.C. (Ohms)	10	66	
Saturation Current—ma. to Produce 90% Peak Output @ 200 BPI (Measured Zero to Peak, Alternate Polarity)	5	1.5	0.4
Write Current—ma. 150% Saturation Current @ 200 BPI	7.5	3.0	0.6
Read Output—mv. P-P (Open Circuit)			
NRZI @ 200 BPI	11.5	12	48
15 ips.	40	48	160
Read Output—mv. P-P 800 BPI Ref. 200 BPI.	85% min	85% min	85% min



APPLICATION NOTES: Special considerations apply to magnetic heads operating in contact with magnetic oxide stripes on the surface of relatively stiff and hard materials such as plastic credit cards and paper cards. Lack of attention to these points can cause erratic results, dropouts of signals, loss of high frequency resolution, and excessive head wear and friction.

Relieved face heads are recommended for these applications; or the head may be made with an extended track, which eliminates the need for face grinding. Head tracks are always narrower than the oxide card stripe, so intimate contact between the gap and the surface is maintained as the pole tip wears down, giving machine-to-machine interchangeability. Warping or deformation of the card have less effect upon relieved track heads because the pole tip can't lose contact with the oxide.

Write head electrical parameters are a function of the writing speed and the pole-to-oxide spacing caused by dirt or overlay. For example, at 210 bpi or 420 flux reversals per inch and with practical card speeds up to 20 inches per second, the .150-track write head might have an inductance of 1 to 5 mhy and a gap spacer of 1 to 5 mils.

Read head gap is controlled by the bit spacing and typically could range between 1/10 and 1/4 of the 5 mil bit spacing. Inductance should be high for good signal output but not so high as to result in ringing or loading by the input amplifier.

The .080-track read head might have an inductance of 20 to 100 mhy, and a gap spacer of 0.5 to 1.25 mils. For slow speed reading, below 2 ips., higher inductance read heads up to 700 mhy will give better output.