

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886

Telephone: 978-692-4764

Fax: 781-981-0590

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TO: Distribution
FROM: Hans F. Hinteregger, Arthur E. Niell, Alan R. Whitney
SUBJECT: Proposed revision of headstack specifications

Revised Specification

In order to improve Mark 4 and VLBA read and write performance, particularly at track data rates of 9 Mbps and 18 Mbps, we recommend the following revisions to the specifications for headstack procurement:

1. Reduce the number of turns from 48 to 35;
2. Reduce the minimum initial depth-of-gap from 25 to 12 micrometers;
3. Increase the minimum SNR at 4.4 MHz for 160 ips from 20 to 21 dB.

Headstacks meeting this updated specification are available from Metrum as part number 16827574-002; no part number is yet available from Spin Physics.

Rationale for New Specification

The primary reason for reducing turns is to reduce high-speed read crosstalk by at least 6 dB at frequencies well below resonance by halving the inductance of the heads. This is crucial for successful playback at 280 ips and has the additional beneficial effect of increasing the resonance frequency by a factor of 1.4 for any given head-interface capacitance.¹

The reduction in turns is expected to reduce head response proportionally, that is by approximately 3 dB. Haystack has recently procured two reduced-turns headstacks from Metrum with the standard 25 μ m depth-of-gap, which were delivered with an average of 22 dB SNR at 160 ips².

The new minimum 12 micrometer initial depth-of-gap specification will achieve at least 1 dB, and more likely 2-3 dB, net increase in SNR in spite of the 3 dB loss due to turns reduction. Also, for an efficient low-depth-of-gap head, the frequency-independent gap-reluctance dominates; this reduces the rolloff of

¹ We also expect the head interface capacitance to be greatly reduced in the new 280-ips read-only interface design. While moving the resonant frequency out of the passband is most important for playback, this will also reduce write-crosstalk.

² The reduced-turn (35 turns/head) headstacks recently delivered from Metrum averaged \sim 22 dB for both stacks. The worst channels had SNRs of 21.0 and 20.3 dB and the best channels had SNRs of 23.7 and 23.4 dB.

head-efficiency with increasing frequency so that only ~ 1 dB of frequency-dependent loss is expected at 8-9 MHz.

With the combination of experience from the reduced-turns Metrum headstack and the expected SNR increase due to the shallower initial depth-of-gap, the new specification of 21 dB at 160 ips will actually maintain minimum (and perhaps even slightly improve) performance at 160 ips while drastically improving read-crosstalk performance crucial to playback at 280 ips.

Experience with Reduced-Turns Headstacks

Operational performance on the Haystack correlator of the Metrum reduced-turns headstacks at 80 and 160 ips has been quite satisfactory, with PER somewhat better at 160 ips, as would be expected with this design³.

Tests of these headstacks writing at 320 ips and reading at 280 will be performed in the near future and are expected to yield significantly superior results than with headstacks procured to the old specifications. Results of testing at these higher speeds will be made available as soon they are completed; an addendum to the new specification stating minimum read performance at 280 ips is expected.

Details and supporting documentation for these recommendations are included in Mark 4 memos 284, 285 and 286.

Summary

Though tests at 280 ips and 320 ips have not yet been completed on headstacks built to these updated specifications, it is clear that performance at 80 ips and 160 ips is entirely satisfactory and that performance at the higher speeds will be dramatically better. We therefore recommend that strong consideration be given to procuring headstacks to this updated specification. Results with higher-speed writing and reading will be made available as soon as they are available.

³ In contrast, the standard-turn heads have interface resonances at ~ 7.8 MHz and read more poorly at 160 ips than at 80 ips.