

Mark 5A Disk-Module Labeling and Management Procedures

Prepared by Alan R. Whitney
MIT Haystack Observatory
22 June 2004

1. Introduction

This memo explains Mark 5 ‘8-pack’ disk module management procedures from creation through usage at stations and correlators. Each ‘8-pack’ module may be loaded with up to 8 individual disks, but for purposes of management the module is treated as a single unit in almost exactly the same way that individual tapes are treated. The primary complication with module management is that the total data capacity and maximum data-rate capability may vary from module to module, due to both the number and capacity of individual disks in the module.

Figure 1 shows an ‘8-pack’ module as it might appear after recording data at a station, including all labeling, and is a useful reference as you read through this memo. Each module is labeled with a unique permanent VSN (similar to tape). The field (experiment) label, correlator-library labels and colored-dot labeling are identical to tape.

2. VSN Assignment, Labeling and Registration

Each ‘8-pack’ module is assigned a permanent 8-character VSN just like VLBA/Mark 4 tape. Modules may be assembled with disks at any site that has a Mark 5A/B system available to test the assembled module. Instructions for assembling and testing modules are provided separately.

2.1 VSN Format

Module VSN’s are constructed in the form “owner-serial#” where ‘owner’ is an owner ID and ‘serial#’ is a character module ‘serial number’ within that owner’s inventory. The ‘-’ character separating the owner-ID and serial number indicates the disks are ATA parallel-interface disks; a ‘+’ in this position will indicate ATA serial-interface disks when these become available; other available special characters are reserved for future use in this position.

Owner-ID: Each owner may choose an owner-ID of his/her choosing, but it must be coordinated with the central coordinator (Jon Romney at NRAO <jromney@nrao.edu>) to prevent duplicates and it must allow a serial# range sufficient to cover, without duplication, that owner’s expected number of modules. *The owner-ID is constructed from characters A-Z (numerals not allowed) and is from 2 to 6 characters in length.*

Serial number: For a given owner-ID, serial numbers start with ‘1’ (with leading zeroes as necessary) and increment by one for each subsequent module; only characters 0-9 are allowed.

Examples: ‘MPI-0123’, ‘HA-07154’

2.2 VSN Labeling

VSN Labeling: Each module is permanently labeled in three ways:

1. *Electronic ‘Extended-VSN’ label:* The extended-VSN is written into a permanent area on the disks using Mark 5A ‘VSN’ command. The extended-VSN can then be read by any Mark 5 system on which it is mounted and is not affected by normal erasure of the disks. The procedure for writing the extended-VSN to a module is given in the memo “Mark 5A Disk-Module Assembly, Test and Conditioning” (available at <http://web.haystack.mit.edu/mark5/operations.html>).

2. *Printed 'Extended-VSN' label:* A permanent adhesive-backed label is attached along the **right side of the front panel**, as shown in Figure 1. Printed on the label is an 'extended-VSN' of the form '<VSN>/<total capacity(GB)>¹/<max data rate(Mbps)>²', in both text and barcode form. **For uniformity, the label should read from top to bottom.** If this label cannot be printed and attached when the module is assembled, it will be done at the first appearance of the module at a correlator.
3. *Printed 'track' label:* Until the NRAO 'track' program is updated to specifically handle the new front-panel VSN label, a 'track'-compatible label is attached to the rear panel of the module (see Figure 2). **This label contains the 8-character VSN followed by a single <space> character** that is required by 'track' when scanning the bar-code.
4. *Conditioning/problem log:* This large label³ is attached to the right side of the module and provides space for **manual notation of conditioning passes and any problems** encountered with the module (see Figure 3). Notation should also be made if the configuration of the disks is changed in any way. If the label on the right side fills up, start a new label on the left side, leaving the original in place.

If the capacity or capability of the disks changes, the paper and electronic labels must be updated (but using the same VSN), and the module must be re-registered with 'track' (see Section 2.3).



Figure 1: '8-pack' module showing sample front-panel labels

2.3 Module Registration

Each module should be entered into the NRAO 'track' when it is created or modified. The rear-panel 'track label' is used for this purpose.

¹ The <total capacity(GB)> is calculated as the capacity of the *smallest* disk times the number of disks.

² For current generation of disks, max data rate is calculated as $128 * n$, where n is the number of disks in the module. The module should not be used to record or playback a data rate higher than this number.

³ A template for printing the Conditioning/Problem label is available for download at <http://web.haystack.mit.edu/mark5/downloads.html>

In the future, we expect the ‘track’ program will be enhanced to log the following information about each disk module:

1. Extended-VSN (from front-panel barcode label)
2. (Optional) Disk serial numbers and capacities

In the future, this information might be sent directly from a Mark 5 system in which the module is mounted.



Figure 2: 'track' label on rear of module

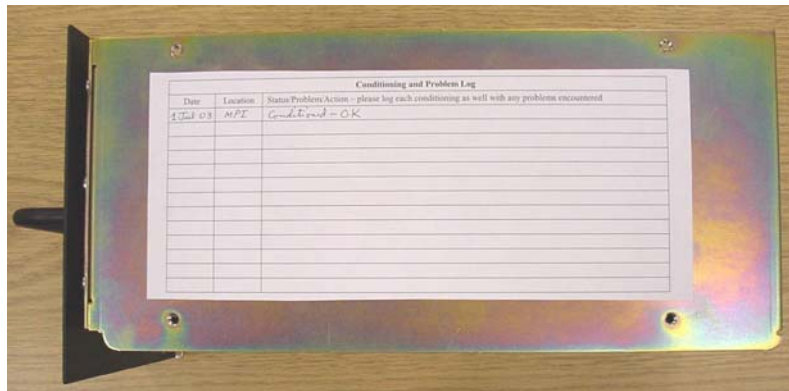


Figure 3: Conditioning and problem log (recommend that conditioning time be indicated – not done here)

3. Station Procedures and Labels

For the most part, ‘8-pack’ disk modules are managed just like tapes at a station.

3.1 Unpacking and Inspection

For every module received at a station:

1. Log the receipt of the module into ‘track’ by scanning the rear barcode⁴.
2. Remove the two-piece metal module shipping cover from each module and inspect carefully for any damage; report any damage to the correlator.

⁴ If you do not have a bar-code reader, you can manually enter ‘<VSN>’ (8-char VSN followed by a space and four periods) into track.

3.2a Module Pre-testing (not yet implemented; go to Section 3.2b)

Prior to an experiment, each module should be inserted into a Mark 5 system and tested using an automated procedure to do the following (not yet implemented):

1. Read and display the following information:
 - a. Extended-VSN ('VSN?;' query to Mark 5A)
 - b. Disk serial numbers ('disk_serial?' query to Mark 5A.
 - c. Current status (choose one) [not yet implemented]
 - i. Last action was recording, at site
 - ii. Last action was playback, at correlator
 - iii. Last action was erasure.
2. Check the consistency of the extended-VSN with the actual number of disks and capacity; if inconsistent, require an update of extended-VSN before proceeding.
3. If last action was playback, erase and go to step 6.
4. If module is already erased, go to step 6.
5. If last action was recording, abort; a special procedure is required to erase the module.
6. Using a simple pre-supplied procedure, write and read test-vector generator data (generated on the Mark 5A I/O card) to test for proper module operation.
7. If testing is successful, erase the module.

After a successful test and erasure, a green dot should be applied over any existing dot and 'OK' should be written by hand in the field label position; this writing will be later covered by the normal field label. If the test fails, 'Bad' should be written in the field label position; failed modules will require further attention.

3.2b Module conditioning

Following the module pretest, it should be conditioned to remove any sectors which may have become bad during shipping. This will assure maximum performance during the subsequent recording during an experiment. Use the standalone program SSErase as follows:

```
SSErase -m 0 -c 1 &
```

-m sets the msglev (range -1 to 3, default 1), and -c sets conditioning (0 for FALSE, 1 TRUE, default FALSE). With msglev set to 0, debug prints about every minute to show what's happening. If the module is 'protected', SSErase will ask permission to proceed. Conditioning an 8-pack of eight 120-Gbyte disks take about 157 minutes and eight 200-Gbyte disks about 286 minutes; and sixteen 200-Gbyte disks, 465 minutes. Disk-performance statistics are also gathered during conditioning; they should be examined for any disks that stand out from the norm as they may be substandard or failing.

Note 1: *Conditioning does not affect the VSN; the VSN does not have to be rewritten after conditioning.*

Note 2: **Write a notation on the Conditioning/Problem label indicating the date and place of conditioning, as well as how long the conditioning pass took. The length of time required by the conditioning pass is one indicator of the health of the disks in the module.**

3.3 Module Labeling at Station

Each module is labeled with a 'field label' in the same way as tape, including use of red adhesive dots to indicate recorded data, as shown in Figure 1.

3.4 Module Shipping

The following procedures should be used when shipping a module:

1. Attach the two-piece shipping cover to each module (see Figure 4). These covers not only help to protect the disks, but also prevent debris from getting inside the module and into the large multi-pin connector. The covers also provide some protection from prying eyes en route (customs, etc). **The shipping covers must be attached with screws.**
2. Log the shipment into 'track' using a barcode reader to scan the 'track' barcode label on the rear of the module.
3. Ship the module(s) in special padded shipping box (see Figure 5). The outside of the shipping box should have attached at least one label indicating the station and experiment number(s) or name(s) corresponding to the data on the enclosed disk module(s).



Dimensions (cm) with shipping covers:
'Box': 14H x 16.9W x 19D
Front panel extends additional 3mm on top and sides (but not bottom).
Handle: 12W x 3.8D; centered on FP
Ejector: 5.5H x 1.7W; centered 2 from L, 3 from bottom edge of FP; Extends 2.2 from front panel.

Figure 4: Module with shipping covers installed



Figure 5: Disk-module shipping box

4. Correlator Procedures

For the most part, '8-pack' disk modules are also managed just like tapes at the correlator.

4.1 Unpacking and Inspection

For every module received at the correlator:

1. Log the receipt of the module into 'track'.
2. Log the module into the correlator library and apply a library label as appropriate.
3. Remove the two-piece metal module shipping cover from each module and inspect carefully for any damage.

4.2 Module Release and Shipping

Release of the module after correlation is handled exactly like tape, *except that modules are shipped from the correlator unerased*. To summarize the procedure:

1. Yellow adhesive dots are applied to the labels of released modules (covering any existing dot).
2. Immediately before placing in shipping boxes, the old label carriers are removed (along with the old field and library labels), a new blank carrier is applied and a yellow dot is attached (covering green dot printed on label) to indicate the module is unerased.
3. Attach shipping covers with screws.
4. Ship in special shipping boxes, up to two modules per box (see Section 3.5).
5. Log the shipment into 'track'.

5. 'Colored-Dot' Management (optional)

Colored adhesive dot management is similar to tape. The purpose of the dots is to indicate a quickly understood and unambiguous module status. The meaning of the dots is as follows:

Green – erased (empty); ready to record

Red – recorded or recording; applied at a station

Yellow – released but unerased; applied at correlator

6. Barcode Label Printing and Reading

All barcodes are Code 3 of 9 with check character; this is compatible with the barcode labels currently printed on Mark4/VLBA tapes and allows the current barcode scanners to be used without reconfiguration. The Code 3 of 9 character set is 'A-Z', '0-9', '-.\$/+%' plus space.

6.1 Label Printing

Each correlator and station may optionally have the capability to print any of the labels defined in this memo. The use of an inexpensive dedicated consumer label printer is suggested. As an example, we have procured a Dymo Turbo 330 LabelWriter (Figure 6) for ~\$200 which prints a single high-quality label in about 5 seconds using a special thermal paper at a cost of ~\$0.07 per label. The labels appear to be very durable and smudgeproof. The following label stock may be used (others may also be suitable):

Field and library labels – Currently, field labels and library labels are not printed on the Dymo printer, but rather in the same manner and with the same software as used for tapes. In the future, they may be printed on the Dymo printer; Dymo stock 30321 (35mm x 89mm, 1.4" x

3.5”) is suitable for this purpose. **Note: The barcode printed on the field label is always written with a trailing space plus a Code 39 check character.**

VSN labels – Before printing the VSN labels, the VSN must be electronically written to the module (see memo “Mark 5A Disk-Module Assembly, Test and Conditioning” available at <http://web.haystack.mit.edu/mark5/operations.html>). The front-panel and rear-panel VSN labels may be printed on the Dymo printer using Haystack-supplied template files available at <http://web.haystack.mit.edu/mark5/downloads.html>. Either Dymo label stock 30321 (35mm x 89mm) or 30256 (59mm x 102mm) may be used. Carefully follow the instructions that accompany the template files. Due to the crinkly paint finish on the module front panel, it is important that a permanent-adhesive label be used. The front-panel label may also be printed with a Linux-based program available from Dave Graham at MPI (p062gra@mpifr-bonn.mpg.de). In the future, the ‘track’ program will be modified to use the front-panel label, so that the rear-panel label will not be needed. **Note: The barcode on the extended-VSN label placed on the front of the disk module contains the extended-VSN, followed by a Code 39 check character; there is no space character following the extended-VSN.**

‘Track labels’ – **Note: The barcode on ‘track’ labels attached to the rear of the disk module contain the 8-character VSN, followed by a trailing space, followed by a Code 39 check character.**

6.2 Label Reading

In our experience, a good quality handheld laser scanning reader is needed to read barcode labels of highly variable qualities and densities. The particular unit that Haystack uses is one of the LS 4000i Series handheld readers (Figure 6) from Symbol Technologies, which sells for ~\$500. Less expensive units may also be satisfactory but have not been tested. Typically, such readers are available with serial, USB or ‘wedge’ interfaces (which go between keyboard and computer). For convenience, the barcodes necessary to set up the LS4000i reader to read Mark 5 disk-module labels are reproduced in Figure 7. Scan them in the order shown to set up the reader to the required configuration; if the reproduction of the barcodes in Figure 7 is not of sufficiently high quality, scan the codes directly from the reader instruction manual.



Figure 6: Dymo Labelwriter Turbo 330 printer and LS4000i handheld barcode reader



Set All Defaults



Enable Code 39 Check Digit



**Transmit Code 39 Check Digit
(Enable)**



Scan Options



<DATA> <SUFFIX>



Enter

Figure 7: Scan these barcodes in the order shown to configure the LS4000i barcode reader