

# Mark 5 Newsletter

MIT Haystack Observatory

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The Mark 5 Newsletter is issued from time to time to keep users informed regarding features, plans, problems, solutions and workarounds. All back issues of the Mark 5 Newsletter are available at the Mark 5 web site at [www.haystack.edu/mark5](http://www.haystack.edu/mark5). We invite input from anyone on subjects we should discuss or questions that need answers; please send them to [mark5@haystack.mit.edu](mailto:mark5@haystack.mit.edu).

## Contents of this Issue

1. New Mark5A software release 2.5x
2. Check/update firmware on your Mark 5A I/O Interface Board
3. Disk-module labeling
4. Aluminum connector holddown clamps
5. Threadlock on module disk-mounting screws
6. Washers and Threadlock on chassis-backplane guidepins
7. Comparing costs of various disk sizes
8. Recording on disks previously recorded with older Mark 5P software

### 1. New Mark 5A software release 2.5x

A new updated Mark5A tar file (dated 4 September 2003) is now available on Haystack's Mark 5 web pages (see <http://web.haystack.edu/Mark5/UpdateMark5.html>). Note that this update requires a new version of the Mark5Update script (dated 2 September 2003); the old version (2 June 2003) won't work. This new Mark5Update script contains several necessary changes, including editing /etc/rc.d/rc.local to accommodate the renamed Jungo driver ('windrvr6' instead of 'windrvr').

The 'DTS\_id?' query with this version will return '2.5x' for command set revision, that is version 2.5 with extensions (x). Except for 'play', 'scan\_play', and 'replaced\_blks' however, this version closely complies with Mark 5A command set version 2.6 (see <http://web.haystack.mit.edu/mark5/software.html>).

### 2. Check/update firmware versions on your Mark 5A I/O Interface Board

Each Mark 5A I/O interface board contains two Xilinx FPGA's (field-programmable arrays), one for the Input Section and one for the Output Section. The firmware for each of these Xilinx chips is stored on an accompanying PROM. Since the Mark 5A design has evolved over time, it is important to check the current version of the firmware your system(s) and make sure they are up to date.

To check the current software/firmware versions, use the 'DTS\_id?' query, as in the following example (with the Field System, the corresponding query is 'mark5=DTS\_id?'):

```
> DTS_id?  
!DTS_id? 0 : Mark5A : 2003y202d10h : 1 : mark5-21 : 1 : 1 : 2.5x : 0xb8 : 0x19 ;
```

The response to the 'DTS\_id?' query in this example shows

mark5-21 – machine serial number

2.5x – current Mark5A software version (2.5 with extensions), dated 2003y202d10h

0xb8 – current firmware version of Input Section of the I/O interface board is hex ‘b8’  
0x19 – current firmware version of Output Section of the I/O interface board is hex ‘19’

On the firmware web site (<ftp://web.haystack.mit.edu/pub/mark5/proms/>) the corresponding files for Input Section version ‘b8’ are ‘ibaxb8.cmd’, ‘ibaxb8.isc’ and ‘ibaxb8.mcs’; likewise, the corresponding files for Output section version ‘19’ are ‘obax19.cmd’, ‘obax19.cmd’ and ‘obax19.mcs’. The hex version number increments from one version to the next.

Which versions should you have?

*At stations:* versions ‘ibaxb4’ and ‘obax17’ and higher fix all known recording/playback performance and reliability problems. Version ‘ibaxb7’ or higher is required for proper operation of ‘in2net’. Version ‘obax19’ or higher is needed to activate the 0x400 bit in the ‘status’ query (indicates that the StreamStor board can’t keep up on recording, which should never happen under normal circumstances).

*At correlators:* versions ‘obax18’ and higher implement fill-pattern replacement for lost data, which is important for correlation with slow/bad disks in an ‘8-pack’ module.

How do I update my firmware?

Upgrading I/O board firmware requires downloading new firmware through a ‘JTAG’ interface on the I/O board (there is a separate JTAG interface for Input and Output Sections). This requires a special Xilinx "Parallel Cable" (Model DLC7 Part Number HW-PC4) and "Parallel Cable Fly Leads" (Part Number HW-FLYLEADS) available for US\$110 from any Xilinx distributor. Detailed instructions for loading of the updated firmware onto the I/O board is given in file ‘programming.txt’ at <ftp://web.haystack.mit.edu/pub/mark5/proms/>. The files ‘iba.cmd’ and ‘oba.cmd’ always maintain symbolic links to the latest versions.

### **3. Disk-Module labeling**

Now that more and more Mark 5 disk modules are being purchased and used, it is increasingly important that they be labeled properly, both hard (paper) labeling and electronic labeling. Details of module labeling are given in the memo “Mark 5 Disk-Module Labeling and Management” available at <http://web.haystack.mit.edu/mark5/operations.html>. The following is excerpted from this memo:

#### VSN Format

Each ‘8-pack’ module is assigned a permanent 8-character VSN just like VLBA/Mark 4 tape. Module VSN’s are of 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](mailto: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 and numerals 0-9 in any order 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.

Examples: ‘MPI-0123’, ‘H3-07154’

## VSN Labeling

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

1. *'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)><sup>1</sup>/<max data rate(Mbps)><sup>2</sup>' 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.
2. *Permanent electronic 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.
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 label<sup>3</sup> 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).

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

<sup>2</sup> 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 at a data rate higher than this number.

<sup>3</sup> A template for printing the Conditioning/Problem label is available for download at [www.haystack.edu/mark5/downloads](http://www.haystack.edu/mark5/downloads)

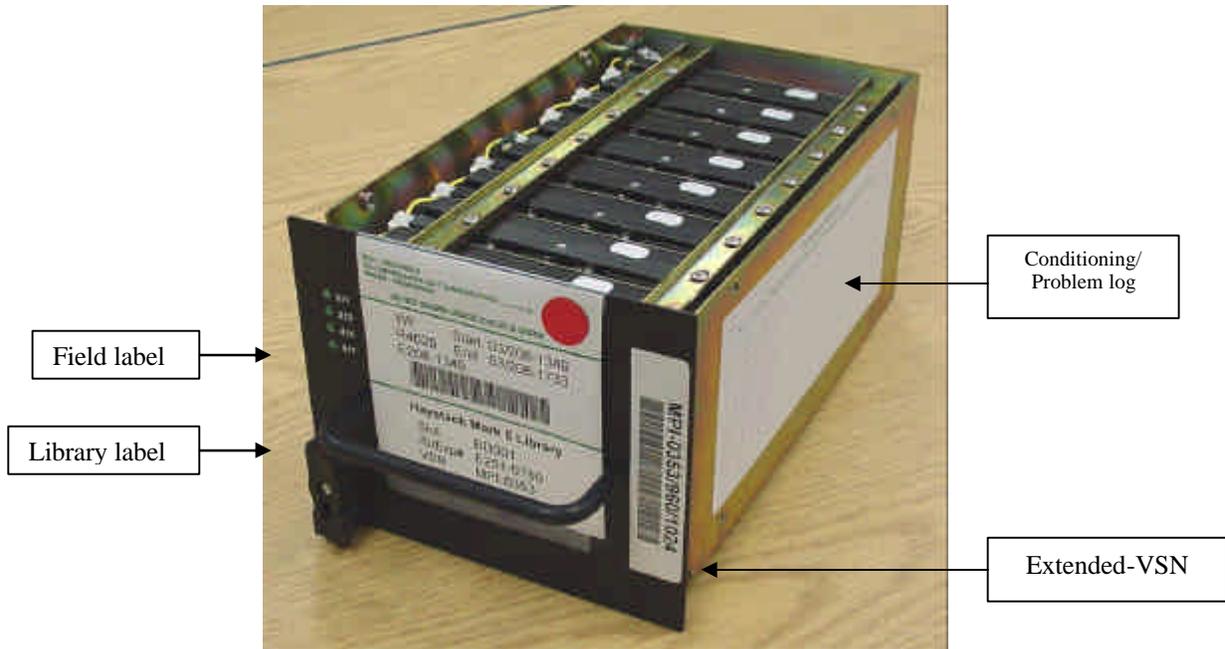


Figure 1: '8-pack' module showing sample front-panel labels

### 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.

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

#### 4. Aluminum connector holddown clamps

An aluminum clamp has been designed to fit over the 200-pin connector on the module backplane to prevent flexing of the connector and to relieve stress on the solder joints (see Figure 4). Earlier modules do not have this clamp installed; these modules will be retrofitted with clamps when they pass through a correlator<sup>4</sup>. Later modules have these clamps installed when purchased.

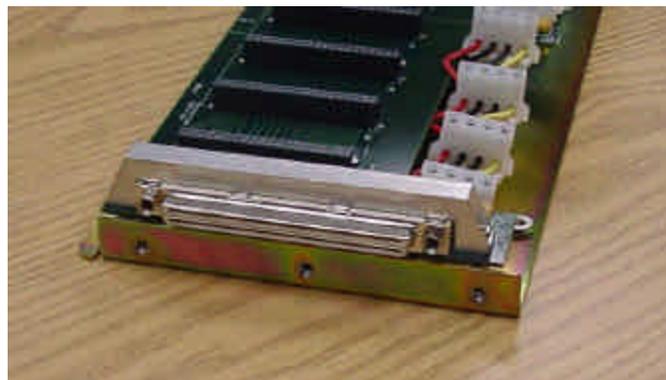


Figure 4: Connector clamp installed over 200-pin module backplane connector

#### 5. Threadlock on module disk-mounting screws

Several instances have been brought to our attention where disk mounting screws in a disk module have become loose during shipment. Therefore, *we strongly recommend that all disk-mounting screws be secured with a threadlock solution (Loctite or similar) when they are installed.*

#### 6. Washers and Threadlock on chassis-backplane guidepins

The guidepins on the Mark 5 chassis backplane are designed to properly guide the 200-pin mating connector on the disk module into proper position *before* they make contact. The manufacturer-supplied guidepins have proven slightly too short in a few cases. There, Conduant recommends that a *single* washer of ~0.7mm thickness (0.029 inches) be installed over the guidepin threads before screwing it into the backplane. A threadlocking solution (Loctite or similar) is recommended when installing these guidepins since they may be subjected to stress and jostling.

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<sup>4</sup> These clamps can be installed without disassembling a module with the use of hex-head bolts and a ball-hex driver tool.

## **7. Comparing costs of various disk sizes**

Calculating the relative total costs of disk-modules with various sizes of disks is not completely straightforward. We need to take into account both the total cost of the module, including disks and empty module, plus expected shipping expenses over the lifetime of the module:

$(\text{Initial module cost} + \text{lifetime shipping cost}) / (\text{total GB in module}) = \text{total cost/GB}$

Though some of the newest high-capacity disks are somewhat more expensive on a \$/GB basis than the models they supersede, the total \$/GB cost of a module may not be higher. Since the cost of an empty module is ~\$250, about \$30/disk should be added to the cost of a single disk when calculating the initial cost of a module.

Typical module shipping cost may be \$50/shipment with perhaps 50 shipments over the lifetime of the module.

For example, a standalone 120GB disk selling at \$100 costs ~\$0.83/GB, with an installed cost of ~\$130/disk; total initial module cost is then ~\$1040. Adding \$2500 lifetime-shipping costs raises the total lifetime cost to ~\$3540 or ~\$3.7/GB.

On the other hand, a standalone 250 GB disk selling for \$300 costs ~\$1.2/GB, with an installed cost of ~\$330; total initial module cost is then ~\$2640. Adding \$2500 lifetime-shipping costs raises the total lifetime cost to ~\$5140 or \$2.6/GB.

Of course, there are sometimes other factors, such as whether you can efficiently fill a disk pack on each use. But this sort of simple analysis gives one a good idea of rough lifetime costs for a disk module and may be useful when trying to decide which disks to buy.

## **8. Recording on disks previously recorded with older Mark 5P software**

When recording disk modules on Mark 5A systems that were previously used on the obsolete Mark 5P systems, it is necessary to run the standalone 'SSErase' program before the module will properly record on the Mark 5A system (i.e. a 'reset=erase' command alone can lead to confusing indications when 'scan\_checks' are issued on newly recorded data – don't ask why!). A couple of instances of recording problems have been reported that have apparently encountered this problem, which is due to a format change which prevents older Mark 5P-formatted disks from recording on Mark 5A systems. This problem will not occur with Mark5A software versions dated 16 May 2003 or later.