



## Metalogic Technical Document TRIM and Robotic Tape Libraries

Relative to Supervisor version 45.450.20  
Last updated July 12, 1999

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### Introduction

This note describes the enhancements currently available in Metalogics TRIM software that support the DSI and Storagetek Automated Tape Library systems on Unisys A-Series and Clearpath systems. There are many variants of the hardware available to customers but these TRIM interfaces provide additional functionality by communicating only with the software components of both systems.

It should be noted that this is a working document and revisions would be applied on a regular basis. Updated versions will be made available on the Metalogic web-site and upon request.

In the case of Storagetek tape subsystems, currently available from Unisys, TRIM interfaces only with the Unisys CSC Library 2.1 (version 43.015) or greater. This CSC software, written by the University of Washington, emulates the Unisys TAPESERVER interface which is driven through a MCP interface; this is discussed in more detail later. The software currently supports many variants of the Storagetek systems (e.g. Nearline, TimeberWolf, Powderhorn) using various drive technologies such as DLT4000, DLT7000. However, it should be noted but TRIM is no longer compatible with sites using the older CSC software (version 2 or earlier) which used StorageTek's own proprietary interface and is totally different from the TAPESERVER implementation.

With DSI systems, as far as is known, TRIM will interface directly to their TapeManager software, irrespective of software version.

It cannot be emphasized strongly enough that the basic TRIM package already supports a variety of Cartridge Tape Library (CTL) systems, **without specific enhancement**, because TRIM receives tape scratch, creation and usage notices directly from the MCP as with conventional tape subsystems. This means that, as to the operating system itself, such CTL systems appears to the TRIM software in the same way as any other tape subsystem. Therefore, the following TRIM activities still apply:

- Tape creations/scratches are captured in real-time
- Auto-purging and purge protection using Metalogics own TAPEMANAGER
- OPAL scripts used to generate database reports will work without recompilation or modification
- LOGREADER utility will check for and process any "missed" cartridge creations in the event of a restart
- TRIM rules will operate as before with the usual expiration and movement controls
- Daily reports and TP CONFIRM phases operate as normal
- Full TP interrogate/modify command functionality

The following notes describe both general and specific enhancements to TRIM for both DSI and StorageTek systems. Much of the information that follows has not yet been applied to the Metalogic TRIM reference manual, but is readily available in the METANOTES files that are included with every software release.

**Implementation**

To enable TRIM support for DSI and Storagetek automated tape libraries, two changes to Supervisor must be applied. A Supervisor option, SILO, must be set using the OP command; from a COMS Supervisor window enter:

```
TT SO + SILO
```

The behaviour of the SILO option is controlled by the setting of a MAGUS configuration variable called **TL\_SILOKIND**. This variable is NOT directly configurable from SUPERVISOR and can only be changed with the Metalogic INSTALL utility. Its value controls whether the TRIM enhancements for DSI or UNISYS/Storagetek robotic tape libraries are supported.

With reference to the DSI software, some previous knowledge of how their software functions is required to understand the different modes of operation. There are four possible settings:

TL_SILOKIND mode	Description
UNISYS	TRIM provides additional enhancements for the Unisys CSCLIB version 2.1 software, as used by the various StorageTek ATL systems currently available on Clearpath and A-Series.
DSI	This setting provides enhancements for the DSI Cartridge Tape Library. By default, all tape assignments are passed through to the DSI CSCLIB library by Metalogics TAPEMANAGER, for processing by DSI's own TAPEMANAGER library. A TM STATUS will show the operational mode as ACTIVE.  In all the DSI settings it is assumed that Metalogic's own TAPEMANAGER library is SL-ed to the TAPEMANAGER function; this is necessary to support auto-purging and purge protection facilities provided by TRIM.
DSI_SERIALNO	This setting is similar to DSI, except that tape assignment requests are only passed to the DSI library if a tape serial number has already been assigned in the request.  If a tape has both a SERIALNO and SCRATCHPOOL assignment, the SCRATCHPOOL setting is automatically removed.
DSI_NOTM	This setting allows the DSI TAPEMANAGER to still run in ACTIVE mode but any tape assignment requests will NOT be passed to the DSI software by Metalogic's TAPEMANAGER.

Using the INSTALL utility, the TL\_SILOKIND configuration variable should be changed from Cande using a privileged usercode. For example, to implement support for Unisys/Storagetek ATLs:

```
U META/INSTALL TL_SILOKIND=UNISYS
```

In all the above DSI cases, the Metalogic TAPEMANAGER will only pass through control and tape assignment requests to the DSI TAPEMANAGER. If no DSI mode is active, Metalogic's TAPEMANAGER will not forward any requests to the DSI software.

Tape purge requests are NEVER passed to DSI software regardless of the operating mode.

Once the SILO option has been set and the TL\_SILOKIND variable established, both SUPERVISOR (via TT QUIT SUPERVISOR) and TAPEMANAGER (via SEND TM QUIT) **must** be restarted for the new mode to apply. Supervisor will restart automatically but TAPEMANAGER must be restarted using the SEND TM START command. A TT WS response will always show the current mode of Supervisor's CTL support, if applicable.

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## General enhancements for robot tape systems

Several major enhancements have been made to TRIM to support these robot systems. This is not a definitive list but the more important changes are discussed below.

TRIM now supports all currently known tape densities though the retention of this information in the METATAPELIB database needs some explanation. The DENSITY field of a tape entry in the database is numeric and stores two subsets of values. The first set includes the values 1250, 6250, 38000 and 11000 which are actual density settings still used on many old and new Unisys systems.

The second subset includes the integer value of the density attribute for the tape. For example, a value of 8 for DENSITY means 36TRK, 9 is FMTDDS2, 10 is QIC1000, 11 is FMTDDS3, 12 is FMT128TRK, 13 is FMTDLT3, 14 is FMTDLT6, 15 is FMTDLT10, 16 is FMTDLT20 and 17 is FMTDLT35. It should be noted that this is only of importance to the OPAL DENSITY attribute in the TAPEDB context.

Attributes in the PER and TAPEDB contexts have been updated to reflect these changes and a new attribute DENSITYID will return the DENSITY mnemonic e.g. BPI1250, FMTDLT35, FMT128TRK etc. The normal responses to TP interrogation and TP FIND SCR commands will always show the correct density.

With the arrival of large capacity tape drives which can hold very large databases on a single reel, it is now very likely for database audit dumps to be created whilst an on-line dump is still running. In earlier TRIM releases, if rules were being used to "link" the audits with the master database dump, this would cause the audit to become linked to a **previous** database dump. This was because the TRIM system only received the tape creation notice once the on-line dump was complete. Although this problem relies on the customer using "linked" rules, this is a very common of handling database dumping and Metalogic decided to address this important issue in the following way.

Instead of just tracking tape creation at the time the label notice was produced, TRIM will now detect specific LOG VOLUME events for new tapes which have just been opened for output. A "raw" tape entry is written into the TRIM database, which will be assigned a creation date and time for the tape reflecting the **actual open time**. Although termed "raw", rules are applied automatically applied and the tape entry is virtually complete except that job and task name attributes are marked as "TAPE\_IN\_USE".

When a tape creation notice is generated by the MCP the job and task attributes are updated in the TRIM database entry but the creation date and time is NOT changed. The event entries in the TAPELOG will appear as:

```
01:39:15 Evt: CREATED [000026] DEV99021A by FLEX
01:30:18 Evt: NEW VOL [000026] DEV99021A by FLEX
```

In the above example, the response for a TP 26 command would show the true creation time to be 01:30:18 whereas earlier TRIM systems would have shown a time of 01:39:15. This important change protects the linking mechanism by allowing any potential new linkees to always have a master tape to which they can link.

Where an application creating the tape is aborted before completion, the "raw" entry will remain in the database unless the caller does a programmatic CLOSE with PURGE. An example of this is a normal COPY JOB which was terminated before any files were copied to the tape; here, MCP automatically purges the tape as part of its clean-up.

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For both DSI and StorageTek systems, a simple TP interrogation will also return whether the cartridge is currently present in a library:

TP 44

```
----- METATAPELIB: MT [000044] -----
Volume : DEV99117A/FILE000
Cycle   : 1                               Reel      : 1
Version : 0                               Density   : FMTDLT35
Owner   : FLEX
Location : TAPE RACK                      Sent date  : 27/04/1999 at 04:30:00
Creation info: 01:30:25 on 27/04/1999
Savefactor : 30                           REGISTERED in CTL
Host info  : CPMCP1 #1215
Expiry date is UNKNOWN
Volume last accessed : 01:30:25 on 27/04/1999
Created by task 9962 : *LIBRARY/MAINTENANCE
Owned by job no 9961 : DUMP/DEV99117A
Usage count : 38 times
Backup refs : 97                           Approx tape : 194.92 feet

Marked as : VOLUMED
Rule info  : FAMILYMANAGER
Notes     : MERGE 99103 123901
```

The most important enhancement for both DSI and Storagetek systems is the GETSCRATCH function, which is discussed in the next section.

### OPAL GETSCRATCH attribute function

The implementation of the GETSCRATCH attribute allows the control and allocation of scratch tapes, optionally designated by density and scratchpool. This feature allows a SUPERVISOR OPAL program to allocate the FIRST eligible tape belonging to a selected subset of tapes and assign it for "future use".

GETSCRATCH has the following syntax and expects two string parameters:

```
----- GETSCRATCH ----- (<density>, <scratch pool>) -----
```

The <density> string should conform to one of the following known Unisys density values:

```
200, 1600, 6250, 38000, 1250, 11000, 36TRK, DDS2
QIC1000, DDS3, 128TRK, DLT3, DLT6, DLT10, DLT20, DLT35
```

The <scratch pool> parameter should be a valid scratch pool name up to 17 characters in length: if longer, the string is truncated. The reason that <density> is a string is to allow MX=WAITING OPAL programs, scanning for REQUIRES MT waiting entries, to easily extract any specified density from the RSVP directly into the GETSCRATCH attribute. Both parameters can be empty strings.

If a tape is found that matches the given <density> and <scratchpool>, GETSCRATCH will return the serialnumber as a string. If no matching tape is found, GETSCRATCH will return one of the following error strings:

```
ERR:INVALID DENSITY
ERR:DB OFFLINE
ERR:DB OPENERR
ERR:NO SERIALS
```

Once a tape has been "assigned" by the GETSCRATCH attribute, it is not "unassigned" until the tape has been used for output. Until this time, the assigned tape can be tracked by using several new variants of the TP command. In particular, assigned status can viewed using the TP ASSIGNED or TP SCRATCH find commands. For tapes that have been assigned for too long a period, the TP <serial> UNASSIGN command can be used to revert assigned tapes to their normal scratch state.

During assignment, several tape attributes are changed: the ASSIGNED flag in the database entry is set to TRUE, and the attributes ASSIGNDATE and ASSIGNTIME are set to the date and time of assignment. Because these attributes are available to OPAL programs, it is possible to monitor for tapes that remain assigned over a long period of time. An example OPAL is available in the OPALS/TPDB file called:

```
TPDB_ASSIGNPOLL
```

For example, GETSCRATCH could be used to determine a scratch tape for mounting on a CTL subsystem. Such mount requests can take time to be satisfied so the use of GETSCRATCH avoids the possibility of collisions by marking tapes as assigned and, therefore, ineligible for other assignments.

The following OPAL code handles a REQUIRES MT waiting entry of the form:

```
---Job---Task-Pri---Elapsed----- 5 WAITING ENTRIES -----
8892\ 8893 50      1:55 *LIBRARY/MAINTENANCE
      LOGDUMP/FILE000 REQUIRES MT #1 (DLT3) SCRATCHPOOL=DLTPOOL1
```

This code will automatically assign the serial number of the tape returned by GETSCRATCH to the waiting entry using the FA SERIALNO command.

Once an assigned tape has been processed by an application, the assignment status is removed: the ASSIGNED, ASSIGNDATE and ASSIGNTIME attributes are all set back to null values.

An example OPAL, called TPDB\_SILOW, may be found in the OPALS/TPDB source file available on the Metalogic release CD:

```

TT DEFINE + SITUATION TPDB_SILOW(MX=W):
  (RSVP Incl " REQUIRES " And Decat(RSVP,"REQUIRES ",1) Incl "MT " And
  %%% IMPORTANT: Put your list of valid scratchpools in the following list
  RSVP INCL {"SCRATCHPOOL=DLT7","SCRATCHPOOL=STK"} And
  Not RSVP Incl "]" #")          % Not got a SERIALNO already
  Or
  (RSVP Hdis "NO FILE " And (RSVP Incl "(MT)" And Not
  RSVP Incl "FIND ON "))

TT DEFINE + ODTSEQUENCE TPDB_SILOW(MX):
  %For SILO sites using StorageTek libraries
  %This ODTs is triggered for NO FILE(1) and REQUIRES MT(2) conditions
  % (1)... Uses TAPENAMESERIALS to get best serialno match
  % (2)... Uses GETSCRATCH, passing waiting entry SCRATCHPOLL and
  %      DENSITY extracted from the RSVP (if present)
  % Doing the FA SERIALNO triggers the StorageTek to handle mounting.
  If RSVP Hdis "NO FILE " Then
    Odt(MIXNO,"FA SERIALNO=",TAPENAMESERIALS("("&USER&")"&
    Head(Decat(RSVP,"NO FILE ",1),Not " "))
  ELSE
  BEGIN
    Store("POOL",Head(Decat(RSVP,"SCRATCHPOOL=",1),Alpha));
    Store("DEN",Empty);
    If RSVP Incl "(" And RSVP Incl ")" Then      % Got a density
      Store("DEN",Decat(Decat(RSVP,""),4),(" ",1));
    Store("SN", GETSCRATCH(Getstr("DEN"),Getstr("POOL")));
    IF Getstr("SN") Hdis "ERR:" Then
      DISPLAY("NO AVAILABLE SCRATCH FOR ",MIXNO,,GETSTR("SN"))
    ELSE
      Odt(MIXNO,"FA SERIALNO=""",Getstr("SN"),"");
  END;

TT WHEN TPDB_SILOW DO TPDB_SILOW

```

This OPAL detects waiting entries for both input and output tapes. For output tape requests which have the appropriate scratch pool, the ODTSequence will automatically FA the serialnumber of a suitable scratch/PGOK tape changing the status of the waiting entry. This change is detected by both DSI and CSCLIB software and will automatically initiate tape mounts.

### DSI-specific enhancements

Similar to the interfaces provided by Supervisor and TRIM, DSI offers a variety of interfaces into their tape management software. In particular, a large subset of commands using the TM prefix can provide useful information about the status of tapes in the library and the hardware itself.

Using standard Supervisor interfaces, TRIM can use the same TM command set to provide user communication with the DSI hardware from Supervisor COMS windows or Remotespos and OPAL programs. In particular, the Opal KEYIN function can capture TM responses and automatically process information in OPAL scripts; for example, see the DSI\_INVENT script which uses the TM LIST INVENT command to return inventory information from the robot and compare the information held in the METATAPELIB database.

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Also applicable to OPAL, several new attributes for the TAPEDB context are available:

```
CARTINSILO
CARTSLOT
CARTLIBRARYID
```

These attributes allow any TAPEDB OPAL program to check if an individual cartridge is present in the library and can return its slot number or library identifier (if multiple systems are present). These attributes are of particular importance for handling automatic tape ejection for cartridges that need to be moved to secure offsite locations.

When a TM command is used or a cartridge attribute referenced for the first time, SUPERVISOR invokes a subtask called DSIHANDLER, which handles linkage to the DSI libraries to satisfy the request. Any reference to the CART attributes within an OPAL script, as described above, causes the calling Supervisor slot to appear with a status of WAIT SILO in the response to a WHEN ? command. This status is only temporary, as soon as DSIHANDLER has processed the request, the WHEN will continue as normal.

A new variant of the DELINK command allows the graceful delinking of Supervisor from the DSI system libraries, CSCLIB and TAPELIBRARYSUPP:

```
TT DELINK DSI
```

Further OPAL attributes are also planned in the near future which will allow TRIM or Supervisor to track the status of DSI hardware e.g. whether a door is open or closed, specific slots are occupied.

### Working with DSI libraries

Several Metalogic customers are now using DSI software with TRIM in an effective manner, controlling offsite movement and tape library inventory using OPAL scripts. There are example scripts in the standard OPALs files provided on the Metalogic release CD:

```
(METASOFT) OPALS/TPDB
```

There are example scripts, whose names are prefixed by DSI\_, which provide examples of an inventory check (DSI\_INVENT) and for handling tape export lists (DSI\_EXPORT).

It is strongly recommended that TRIM rules are used to control tape expiration and movement; in particular to assist with off-site storage if required. By using a default location of say, DSI\_ROBOT, to signify that a cartridge should remain in the library any OPAL script handling the export can automatically generate an export by checking the current location of the tape from the database.

Although the DSI software can handle the automatic mounting of scratch tapes from the library to a drive by detecting the waiting entry, it may be better for Supervisor to provide this facility where the TRIM database is being used. An example, OPAL, TPDB\_SILOW, shows how the GETSCRATCH function can be used for waiting entries requiring output tapes with a SCRATCHPOOL assignment. To ensure that only tapes from the DSI robot are loaded, all the tapes used by the robot would need to be SN-ed or PG-ed with a SCRATCHPOOL assigned.

By necessity, requirements will vary from site to site but these example scripts are a good basis for local customisation.



## Working with Storagetek libraries

The automated handling of Storagetek libraries is quite similar to that of DSI; once a waiting entry has been modified to pick up a specific tape (using the FA SERIALNO command), the CSCLIB software automatically initiates a mount of the specified cartridge. It is not necessary for Supervisor to action a SEND TS MOUNT command. Again, it is very important that TRIM rules are used to control tape expiration and movement.

In practice, the TPDB\_SILOW Opal example, described in the GETSCRATCH section, is a good start for handling most ATL-based silo requests whether input or output. As usually recommended by Unisys, adopting a SCRATCHPOOL strategy is a good way of controlling cartridge usage especially where mixed tape environments prevail.

As with DSI, there example OPALS files on the Metalogic CD, (METASOFT)OPALS/TPDB, which can be used for handling off-site tape movement. In practice, a very small number of highly customisable OPALS, in particular TPDB\_SILOW and TPDB\_EJECT, are sufficient for automating ATL operation.

The TPDB\_SILOW Opal has been discussed earlier. The TPDB\_EJECT OPALs assume that an offsite tape movement would be necessary for cartridges whose **pending location** was currently set to a value other than STORAGETEK or SCRATCHPOOL. These OPALs would usually be executed after the daily reports phase and before TP CONFIRM:

```
TT DEFINE + SITUATION TPDB_EJECT(TAPEDB=PENDING):
    % This OPAL checks for tapes moving to an off-site location and
    % will issue TK <serial> EJECT commands where needed.
    % 1. It MUST be run between the TPDB_DAILYREPORTS and CONFIRM phases
    %    since pending locations are being checked.
    % 2. The implementation assumes that TRIM rules have been set up
    %    for all cartridges that are resident in the silo have a
    %    LOCATION of STORAGETEK. This may be changed by the site.
    REPORTED And
    Not PENDINGLOCATION Hdis {"STORAGETEK", "SCRATCH POOL"} AND
    LOCATION Hdis "STORAGETEK" And
    CARTINSILO                % This takes time, check it last

TT DEFINE + ODTSEQUENCE TPDB_EJECT(TAPEDB):
    If Not LASTEVAL And SUM ("COUNT", 1) > 0 Then
        Odt ("TT TK ", SERIALNO, " EJECT")
    Else
        If Get ("COUNT") > 0 Then
            DISPLAY ("Cartridges queued for EJECT: ", Get ("COUNT"))
        Else
            DISPLAY ("No cartridges EJECTed for off-site movement");

TT EVAL TPDB_EJECT DO TPDB_EJECT
```

Each pending offsite tape is ejected using the TK EJECT command.