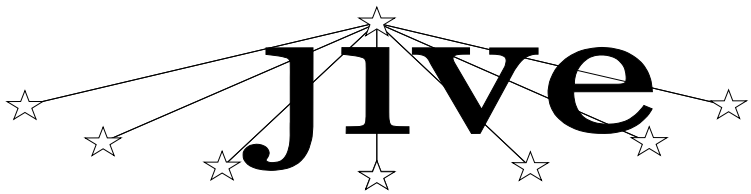

JOINT INSTITUTE FOR VLBI IN EUROPE

EVN CORRELATOR MESSAGE FORMATS

STATION UNIT MESSAGES

EVN Document 42.3

Version 2.24

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Contents

Changes in Version 2.17

Table III.10e	(Phase Calibration Module Configuration) Included new facilities in Channel Number setting.

Changes in Version 2.18

Table III.1b	(Station Unit Command Codes) Extended Table III.1 to include (mostly) internal Station Unit command codes.
Table III.63	(Stop CRM) New command description.
Table III.64	(Set Feature Set) New command description.

Changes in Version 2.19

Table III.63	(Stop CRM) Added a bit more detail about the command.

Changes in Version 2.20

Table III.2	(Action Status Message Codes) Added Scan found and SU Feature Set Action Status responses.
Table III.10f	(Delay Memory Configuration) Added description of delay model parameters.
Table III.10g	(Miscellaneous Parameters) Added description of options for the usage of the ROT/TOT offset.
Table III.16	(Position to TOT) Added option to specify full-form ROT instead of short-form ROT for the required TOT.
Table III.17	(Tape Positioned at TOT) Changed response TOT to be a full-form ROT.
Table III.20e	(New table for peak heads command) Added additional head peaking data table.
Table III.54	(Set Scan ROTs) Added optional fields for specifying allowable TOTs for tape servo range.
Table III.54a	(New optional response) Added Next Scan Found Action Status message.
Table III.64	(Set Feature Set) Filled in command details.
Table III.64a	(New response) Added SU Feature Set Action Status message.

Changes in Version 2.21

Table III.10f	(Delay Module configuration) Removed parameters from nchan onwards and descriptions thereof.
Table III.13	(Load Polynomials) Added parameters removed from Table III.10f and descriptions. Bugfix parameter replaced by Model Parameters and Sidebands.

Changes in Version 2.22

Table III.6	(SU Status) Added more detail about contents of this response.
Table III.6d	(SU General Status bits) Corrected and added detail. This field had been confused with SU State.
Table III.6e	(SU State bits) New table (was Table III.6d).

Changes in Version 2.23

Table III.64c	(Feature Set bits) Added additional details about usage of continuous BOCF.

Changes in Version 2.24

Table III.6a	(SU Status Action Status) Added missing SU-array code field.
Table III.16	(Position Tape to TOT) Corrected description of fields that need to change for alternative command forms.
Table III.64c	(Feature Set Bits) Added Auto stop CRM bit in feature set 2. Added new diagnostic control bits in feature set 3.

Appendix III. Station Unit Commands and Responses

III.1 Introduction.

This appendix contains a complete description of the commands that the Station Units support and the responses that they elicit. Currently, some of these still have to be finalised.

In this document the following abbreviations are used:

CRM	Channel Recovery Module
DCM	Delay Control Module
DIM	Data Input Module
DMM	Delay Memory Module
DPU	Data Playback Unit (the tape drive)
PCM	Phase Calibration Module
MIS	Metrum Information Storage Ltd
SU	Station Unit
SUIM	Station Unit Interface Module
TOT	Tape Observed Time, the time as recorded on the tape
TRM	Track Recovery Module

III.2 Summary of Commands.

Table III.1a and Table III.1b summarises the commands that the Station Units support and whether or not there should be a response. A more detailed description of each command follows the table, but the full details are given in later sections.

Table III.1a contains commands intended for the Station Units in particular. Note that the Command Codes all have the form `0x03xxxxxx` which corresponds to the code assigned to Station Units for Action Status and Service Request codes. The table also shows the response that is expected from the Station Unit. More details of the commands are given below. Commands given in the Table and below in *oblique* have some form of reduced functionality from the original specification. See the detailed descriptions for more information.

Table III.1b contains commands mostly intended for use internally in the Station Unit. Two of these, however, are also required for external use: Stop CRM and Set feature set. With the exception of these two, there are no detailed descriptions given for the commands in Table III.1b.

Request SU configuration	This command requests that the SU respond with an Action Status message containing the current configuration of the SU. This might include the maximum message size that it can support.
Request SU status	This command requests that the SU respond with an Action Status message containing the current status of the Station Unit. This includes items such as whether or not there is a tape mounted (and, if so, its barcode), and what the SU is currently doing.

Command	Code	Expected Response	Table Number
Request SU configuration	0x03000001	Action Status	III.3
Request SU status	0x03000002	Action Status	III.5
Configure DPU	0x03020001	none	III.7
DPU command	0x03020002	Action Status	III.8
Configure SU	0x03000003	none	III.10a to III.10g
Configure SUIM	0x03010001	none	III.11
Set error levels	0x03000004	none	III.12
Load polynomials	0x03000005	none	III.13 & III.13a
Position tape to footage	0x03000006	Action Status	III.14
Position tape to TOT	0x03000007	Action Status	III.16
Position heads	0x03000008	Action Status	III.18
Peak heads	0x03000009	Action Status	III.20a to III.20c
Request average statistics	0x0300000A	Action Status	III.22
Request tape frame header	0x0300000B	Action Status	III.24
Request tape frame	0x0300000C	Action Status	III.26
Request phase cal. data	0x0300000D	Data Message	III.28
Request sampler statistics	0x03010002	Data Message	III.30
Arm interceptor	0x03010003	none	III.32
Get interceptor data	0x03010004	Data Message	III.33
Request SUIM status	0x03010005	Action Status	III.35
Reset SUIM	0x03010006	none	III.37
Load test data into TRM	0x0300000E	none	III.38
Load test data into Delay	0x0300000F	none	III.39
Get test data from TRM	0x03000010	Data Message	III.40
Get test data from Delay	0x03000011	Data Message	III.42
Abort SU operations	0x03000012	Action Status	III.44
Reset SU peripherals	0x03000013	none	III.46
Load Xilinx code	0x03000014	Action Status	III.47 & III.47a
Freeze SU	0x03000015	none	III.49
Set SU ID	0x03000016	Action Status	III.50
Start TRM test data	0x03000017	none	III.52
Get test data from Delay by TOT	0x03000018	Data Message	III.53
Set scan ROTs	0x03000019	none	III.54
Flush TRM	0x0300001A	none	III.55
Flush DM	0x0300001B	none	III.56
SU Finish	0x0300001C	Action Status	III.57

Table III.1a: Station Unit Command Codes

Command	Code	Expected Response	Table Number
Set Tx TOT	0x03000020	none	
SOT TOT	0x03000022	none	
Set ROT	0x03000023	none	
Check ROT	0x03000024	none	
Load CRM ram data	0x03000026	none	
Load PCM ram data	0x03000027	none	
Set SW mode	0x03000028	none	
Tx end ROT	0x03000029	none	
Start CRM	0x03000030	none	
Stop CRM	0x03000031	none	III.63
Send scan data to DCM	0x03000032	none	
Freeze TRM	0x03000033	none	
Freeze DCM	0x03000034	none	
Debug SU buffs	0x03000035	none	
Set feature set	0x03000036	none	III.64

Table III.1b: Special Purpose (mostly internal) Station Unit Command Codes

Configure DPU

This command contains a series of DPU commands that are required to configure the DPU before running a job.The commands are in the same form as that required by the DPU. The Station Unit sends all commands to the DPU.

DPU command

This command contains one or more commands to be sent transparently to the DPU. The response is an Action Status message containing the DPU's response, if any.

Configure SU

This command contains the configuration data required to initially set up the Station Unit (but not the SUIM), or to change part of its current configuration. The command contains a number of Tables each setting up some aspect of the Station Unit. Not all of the tables need to be present in any one message. Typical candidates for configuration include:

- Phase calibration unit tables. These could be supplied as a number of Tables, one per channel;
- Barrel-roll sequence. This can be supplied as a single two-dimensional Table with each row giving the settings for a given TOT (or at least the low order bits of the TOT), together with a Table giving the expected contents of the auxiliary data fields for each track;
- Clock division factor. This is the amount by which the basic SYSCLK is divided before the SU sees it;
- BOCF duration and offset. The offset is supplied as a start ROT (in short form), the duration is in SYSCLK periods and the correlator frame stretch factor is given as a multiplicative factor (×1, ×2, ×4, ×8, or ×16). If the start ROT is zero, then BOCF

should be synchronised to the next SYSTICK, and should remain in synchronisation (that is, there is an integral number of correlator frames per SYSTICK second);
- Cross-bar switch settings;
- The SU-array code (identical to the Job ID).

When configuring a Station Unit from scratch it might be necessary to give several separate Configuration Command Messages, each containing part of the configuration. Note that the delay and phase polynomials are loaded separately.

Configure SUIM — This command contains the configuration data required to set up the Station Unit Interface Module.

Set error levels — This command sets the level of error reporting required, and also the number of consistent clock errors required before the internal ROT is reset. Errors from the SUIM are also included.

Load polynomials — This command contains the delay and phase polynomials for a range of ROTs. More than one set of these can be sent per job if required, but if so, each subsequent set must overlap the previous set so that they can be used as soon as the Obey ROT for that message is reached. The polynomials are supplied in a two-dimensional Table with each row containing the coefficients for a given range of ROT.

Position tape to footage — This command requests that the SU position the tape to the specified footage. The response is an Action Status message when the tape has been positioned (containing the actual footage reached), or an Action Status error message indicating that it could not be positioned for some reason.

Position tape to TOT — This command results in the tape being positioned at a requested TOT. The response is an Action Status message including the TOT reached when the tape has been positioned, or an Action Status error message indicating that it could not be positioned for some reason. A special form of the requested TOT is used to imply that the tape should be positioned at its current location.

Position heads — This command requests that the SU position the headstack(s) on the tape deck to specified positions. The response is an Action Status message containing the new head positions.

Peak heads — This command requests that the SU peak the head(s) onto particular specified tracks on the tape. The response is an Action Status message containing the new head positions, or an Action Status error message indicating that the requested tracks could not be found. The Tables also contain a timeout period for the command to complete.

Request average statistics — This command requests that the average tape error statistics be returned, the counters cleared, and a new set of statistics be accumulated. The response is an Action Status message. It is expected that this command will be given a repeat interval so that the statistics are returned at regular intervals.

Request tape frame header — This command requests that a current tape frame header be returned. Normally this command is used when reading a tape in order to ascertain what it contains. Two forms of the command are

	expected: in the first the header from a specified track is returned; and in the second the header from any good track is returned. The response is an Action Status message containing the header (including the auxiliary data field from the tape and the error flags).
Request tape frame	This command requests that an entire current tape frame be returned from a specified track and TOT (which must be within the Track Recovery Module's ram). The response is an Action Status message containing the header, or an Action Status error message indicating that it could not be found.
Request phase cal. data	This command requests that the phase calibration data be returned. The response is a Data Message containing the eight counts for each channel and the number of valid samples that where used. It is expected that this command will be given a repeat interval so that the data are returned at regular intervals.
Request sampler statistics	This command requests that the statistics from the sample state counters in the SUIM be returned. The response is a Data Message containing the four counts for each channel. It is expected that this command will be given a repeat interval so that the statistics are returned at regular intervals. It is thought that these statistics will be required at particular data times, and so the repeat interval and Obey ROT will be such as to lock the command repeats to particular data times.
Arm interceptor	This command arms the data interceptor in the SUIM ready to capture data.
Get interceptor data	This command requests that contents of the data interceptor in the SUIM be returned. The response is a Data Message containing the requested data.
Request SUIM status	This command requests that the SUIM return its current status. The response is an Action Status message.
Reset SUIM	This command initialises the serial links on the SUIM.
Load test data into TRM	This command contains a set of data to be loaded into the Track Recovery Module's ram.
Load test data into Delay	This command contains a set of data to be loaded into the Delay Memory Module's ram.
Get test data from TRM	This command requests that the data currently in the Track Recovery Module's ram be returned. The response is a Data Message containing the requested data.
Get test data from Delay	This command requests that the data currently in the Delay Memory Module's ram be returned. The response is a Data Message containing the requested data.
Abort SU operations	This command aborts all current SU operations and stops the DPU. It is used to stop jobs prematurely. When the command is complete, the response is an Action Status message containing the new SU state and the tape position (footage and TOT).
Reset peripherals	This command results in a reset being issued to all the peripherals under the control of the Station Unit's control computer.
Load Xilinx code	This command loads the code that it contains into the Xilinx chips on a single board in the Station Unit. When the code has been loaded, the response is an Action Status message indicating success

	or failure.
Freeze SU	This command is used to freeze the current SU operations (including the tape frame input processing). It is used during testing.
Set SU ID	This command is used when the EVN Processor starts up or if the Station Unit has just been powered on. It sends the Station Unit ID Code that the Station Unit should use. The response is an Action Status message containing that code, otherwise the Control Computer will assume that the Station Unit is not functioning.
Start TRM test data	This command starts the TRM transmitting previously loaded test data.
Get test data from Delay by TOT	This command is similar to Get test data from Delay, but the data are requested by TOT rather than delay dram address. The response is a Data Message containing the requested data.
Set scan ROTs	This command sets the starting and finishing ROTs for a single scan.
Flush TRM	This command flushes the TRM memory.
Flush DM	This command flushes the DM memory.
SU Finish	This command tells the Station Unit that the current job has finished. It should stop the tape and produce an SU Finished Action Status message.
Stop CRM	This is an originally internal command that made it into the outside world. It stops the CRM operations.
Set feature set	This command selects or deselects certain Station Unit software features.

In addition to the above commands, the Station Unit should also be capable of accepting Clock Messages via its normal command input.

III.3 Summary of Responses.

Table III.2 summarises the responses expected of a Station Unit. More details of each response are given following the table, but a full description is given with the command descriptions in later sections.

Message	Code	Table Number
SU configuration	0x03000001	III.4
SU status	0x03000002	III.6
Tape positioned at footage	0x03000006	III.15
Tape positioned at TOT	0x03000007	III.17
Heads positioned	0x03000008	III.19
Heads peaked	0x03000009	III.21
Average statistics	0x0300000A	III.23
Tape frame header data	0x0300000B	III.25
Tape frame data	0x0300000C	III.27
SU operations aborted	0x03000012	III.45
Xilinx code load status	0x03000014	III.48
Set SU ID status	0x03000016	III.51
Next scan found	0x03000019	III.54a*
SU Feature set	0x03000036	III.64b
SUIM status	0x03010005	III.36
DPU command response	0x03020002	III.9
SU error	0x03800001	III.58
SU finished	0x03800002	III.59 & III.60
Tape mounted	0x03800003	III.61
Tape dismounted	0x03800004	III.62

**Depends on enabled feature set*

Table III.2: Station Unit Action Status Message Codes

The Status Codes in Table III.2 have been chosen so as to match the corresponding Command Codes to which they are a response. The only exceptions being unsolicited messages which have codes of the form `0x038xxxxx`. These Action Status messages are described in more detail below.

SU configuration

This message is returned in response to a Request SU Configuration command, and should contain details of the configuration of the Station Unit. It is expected that this message will be used when the EVN Processor starts up, and at other critical times (such as the start of a Job). The information passed back could include the maximum size of message that the Station Unit allows if it decided to allow this to vary. The format contents of the parameters in this message are to be decided, but will include the hardware and software IDs of the Station Units modules, and such

	information as whether or not there is a DPU present and its ID.
SU status	This message is returned in response to a Request SU Status command. It should contain details of the current status of the Station Unit, including whether or not a tape is mounted, its barcode, and what the SU is currently doing.
Tape positioned at footage	This message is returned in response to a Position Tape at Footage command when the tape has been successfully positioned. The actual footage attained is returned.
Tape positioned at TOT	This message is returned in response to a Position Tape at TOT command when the tape has been successfully positioned. The current footage and TOT of the tape are included.
Heads positioned	This message is returned in response to a Position Heads command. It should include the new head positions.
Heads peaked	This message is returned in response to a Peak Heads command. It should include the new head positions together with an indication of whether or not the requested tracks were found.
Average statistics	This message is returned in response to a Request Average Statistics command. It should contain: (i) the tape error statistics counted over the period from the previous request (the numbers of parity errors, unexpected syncs, missing syncs, CRC errors, and bad frames discarded); (ii) the number of frames that contributed to the error statistics; (iii) the tape servo error; (iv) the current tape position (footage and TOT) and head positions if a tape is mounted; (v) the current state of the Station Unit, including what it is currently doing, and details of any errors detected during the period (including SUIM errors); (vi) the Station Unit ID; and (vii) optionally, additional diagnostic information (content to be decided).
Tape frame header data	This message is returned in response to a Request Tape Frame Header command. It should contain: (i) the requested tape frame header; (ii) the auxiliary data field; (iii) the error flags; and (iii) the current tape footage and head positions.
Tape frame data	This message is returned in response to a Request Tape Frame command. It should contain: (i) the requested tape frame; (ii) the error flags; and (iii) the current tape footage and head positions.
SU operations aborted	This is returned in response to the completion of an Abort SU Operations command. It should include the new SU state and the current tape position (footage and TOT).
Xilinx code load status	This is returned in response to the completion of a Load Xilinx Code command. It should contain the status (successful or otherwise) of the load.
Set SU ID status	This is returned in response to a Set SU ID command. It should contain the Station Unit ID sent in that command.
Scan found	This is returned in response to a Set Scan ROTs command when a scan is located. It is only returned when the feature set bit Enable Next Scan Search is set.
SUIM status	This message is returned in response to a Request SUIM Status command. It contains details of the current status of the SUIM.
DPU command response	This is returned in response to a DPU Command message that

	reads a parameter from the DPU. It should contain the value of the parameter. If there was more than one such DPU command in the Command Message, then a separate Action Status message should be returned for each.
SU error	This is an unsolicited message produced when a Station Unit detects an error condition that must be reported to the Control Computer. The levels at which various errors are reported are set by the Set Error Levels command.
SU finished	This is an unsolicited message produced by a Station Unit when it finishes its programmed operations. In normal circumstances this will be when it reaches the finishing ROT of the last scan that it has to process; however it should also be produced if the Station Unit has to finish because of an error (an error status message should have been produced first). The parameters should include an indication of why the Station Unit thinks that it has finished.
Tape mounted	This is an unsolicited message produced by a Station Unit when a tape is mounted on its associated DPU. The message should contain the barcode on the tape.
Tape dismounted	This is an unsolicited message produced by a Station Unit when a tape is dismounted on its associated DPU.

In addition to the above status responses, Station Units should be able to produce Data Messages for the following items:

Test data	Data read from the Track Recovery Module ram or from the Delay Memory Module ram (Table III.41 and Table III.43).
Phase calibration data	The quadrature components for each of the 16 channels from the Phase Calibration Unit (Table III.29).
Sampler statistics data	The sampler statistics counts from the SUIM (Table III.31).
SUIM test data	Data from the interceptor facility in the SUIM (Table III.34).

Some provision should be made for staggering the responses from the Station Units to avoid them all being put onto the LAN at the same time.

III.4 Individual Command Descriptions.

This section contains complete descriptions of individual commands. In these, the message header, with the exception of the Action code, is omitted.

Message Table Data and Auxiliary Data contents and Action Status parameters have a third column in the tables defining them which specifies the type of the data described in that row. The basic types are:

byte	A byte-sized datum (8 bits). Equivalent to C char.
char	A byte-sized datum (8 bits) used to hold an ASCII character. Equivalent to C char.
word	A 68000 word-sized integer (16 bits). Equivalent to C short int.
long	A 68000 longword-sized integer (32 bits). Equivalent to C long int.
double	An IEEE-format double-precision value (64 bits). Equivalent to C double.

The first four of these can optionally be preceded by “unsigned” to indicate that the associated type is to be regarded as an unsigned value.

III.4.1 Request SU Configuration.

The Request SU Configuration command requests that the Station Unit return its current configuration. The format of the command is shown in Table III.3.

Action code	`0x00070300`
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	`0x03000001`
Data type	`0x00000000`
Number of tables	`0x00000000`

Table III.3: Request SU Configuration Command Message Format

The response to this command must be an Action Status message containing the configuration of the Station Unit. Table III.4 shows the format of the response message.

Action code	0x00070300	
Action status	0x03000001	
Command code	0x03000001	
Station Unit ID	as assigned	unsigned long
SUCC software		unsigned long
TRM 0 id		unsigned long
TRM 0 software		unsigned long
TRM 1 id		unsigned long
TRM 1 software		unsigned long
TRM 2 id		unsigned long
TRM 2 software		unsigned long
TRM 3 id		unsigned long
TRM 3 software		unsigned long
TRM 4 id		unsigned long
TRM 4 software		unsigned long
TRM 5 id		unsigned long
TRM 5 software		unsigned long
TRM 6 id		unsigned long
TRM 6 software		unsigned long
TRM 7 id		unsigned long
TRM 7 software		unsigned long
PCM id		unsigned long
PCM software		unsigned long
CRM id		unsigned long
CRM software		unsigned long
DCM id		unsigned long
DCM software		unsigned long
DMM 0 id		unsigned long
DMM 1 id		unsigned long
DIM 0 id		unsigned long
DIM 1 id		unsigned long
DPU id		unsigned long
DPU software		unsigned long

Table III.4: SU Configuration Action Status Message Format

III.4.2 Request SU Status.

The Request SU Status command is used to obtain the current status of the Station Unit. The format of the command is shown in Table III.5.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x03000002
Data type	0x00000000
Number of tables	0x00000000

Table III.5: Request SU Status Command Message Format

The response to this command must be an Action Status message containing the current status of the Station Unit. Table III.6a and Table III.6b shows the format of the response message, and Table III.6c shows the format of an individual TRM status entry (of which there are eight).

Action code	0x00070300	
Action status	0x03000002	
Command code	0x03000002	
Station Unit ID	as assigned	unsigned long
SU-array code		unsigned long
Individual TRM stati	see below	8 records
TRM job buffers		unsigned long
CRM present		unsigned long
CRM id		unsigned long
CRM software		unsigned long
CRM health		unsigned long
CRM job buffers		unsigned long
DCM present		unsigned long
DCM id		unsigned long
DCM software		unsigned long
DCM health		unsigned long
DMM 0 id		unsigned long
DMM 1 id		unsigned long
DCM job buffers		unsigned long
PCM present		unsigned long
PCM id		unsigned long
PCM software		unsigned long
PCM health		unsigned long
PCM job buffers		unsigned long

Table III.6a: SU Status Action Status Message Format (first part)

SU general status		unsigned long
SU state		unsigned long
SU delay polynomial state		unsigned long
SU ROT running status		unsigned long
SU ROT check status		unsigned long
SU small buffers		unsigned long
SU big buffers		unsigned long
DPU		unsigned long
DPU general		unsigned long
DPU servo		unsigned long
DPU footage		unsigned long
DPU servo state		unsigned long
DPU command id		unsigned long
DPU command response		unsigned long
DPU int data		unsigned long
DPU ascii footage		char[8]
DPU ascii data		char[8]
Head positions		long[4]
Tape mounted status		unsigned long
Tape bar code		char[16]

Table III.6b: SU Status Action Status Message Format (second part)

TRM present		unsigned long
TRM id		unsigned long
TRM software		unsigned long
TRM health		unsigned long
TRM synch state		unsigned word[8]

Table III.6c: Track Recovery Module Status

TRM present is set to “TRM0” to “TRM7” as a marker for each present TRM in the message. The TRM id is as read from the micro board hardware. TRM software is filled in by the TRM micro firmware. TRM health reflects the FPGA DONE signals for the track Xilinx. Finally, TRM synch state is an array corresponding to each track in the TRM; the data are only valid during a scan and have the following definitions:

‘X’ The track is not active.

‘G’ The track output to the CRM is thought to be correctly synchronised with the required time stamp.

‘B’ The track output to the CRM is NOT correctly synchronised with the required time stamp. The validity bit is forced invalid.

‘R’ The track output to the CRM has been repaired. That is the next frame to the transmit

hardware register has been set so that the next frame transmitted will have data correctly synchronised with the required time stamp. However, the validity bit is still forced invalid; only after the TRM micro handles notification of a new track frame request can it remove the forced invalid condition.

The contents of the CRM, DCM and PCM stati are similar to the TRM status.

The SU general status field is a bitmask which is set to zero on power-up. If there is a processing problem, then a corresponding bit is set in this field. The entire field is reset after being transmitted to C^3. The bit assignments are listed in Table III.6d.

Bit	Meaning if set
0	unused
1	unused
2	PCM error
3	Read bar-code not 10 characters
4	Number of check ROT fails equals threshold (Table III.12)
5	TRM not responding to SUCC
6	ROT from DCM has fractional part not a multiple of 0x2000000 SYSCLKS
7	Reserved for DCM control task failed to queue message to TRM control task
8	DCM control task failed to queue message to CRM control task
9	DCM control task failed to queue message to ROT Queue task
10	DCM control task failed to queue message to SUIM control task
11	Create UDP socket failed
12	Socket send error
13	Reserved for create socket failed
14	Semaphore creation error
15	Semaphore get error
16	Semaphore put error
17	Semaphore ident error
18	Event flag receive error
19	Variable length queue ident error
20	Fixed length queue ident error
21	Variable length queue receive error
22	Fixed length queue receive error
23	Variable length queue send error
24	Fixed length queue send error
25	Variable length queue creation error
26	Fixed length queue creation error
27	Task ident error
28	Task suspend error
29	Task restart error
30	Task start error
31	Task creation error

Table III.6d: SU General Status Bit Definitions

The SU state field is a bitmask that is initialise to zero on power up, and is set as required. It has the the assignments listed in Table III.6e.

Bit	Meaning if set
0	Tape servo enabled

Table III.6e: SU State Bit Definitions

SU delay polynomial state is set to zero if the last request for a BOCF header calculation located the required ROT in the current delay polynomial set. It is set to 0xFFFFFFFF otherwise.

SU ROT running status is set to either zero if the ROT is not running or to 0x00000001 if it is running.

SU ROT check status is set to either zero if the ROT is not running, to 0x00000001 if it is running, or to 0x00000002 if the ROT is running but bad.

SU small buffers is the number of free small buffers in the SUCC.

SU big buffers is the number of free big buffers in the SUCC.

The DPU field is set to OFF-LINE or to ON-LINE according to the status of the DPU responses to the SUCCs polls.

DPU general is set to the last read contents of the DPU general status register.

DPU servo contains the state of the servo command to the DPU; it is one of:
1 Servo command fail
2 Servo command OK
3 Servo incomplete, DPU busy
4 Servo not required

The DPU footage field contains the last read DPU footage (surprise).

The DPU servo state is not filled in.

The DPU command ID is the task ID of the last task to send a command to the DPU.

DPU command response is TRUE if the last DPU response was valid, otherwise it is set to FALSE.

DPU int data is an integer representation of the last response received from the DPU.

DPU ASCII footage is the last read DPU footage in ASCII.

DPU ASCII data is the last response received from the DPU in ASCII.

The head positions are the head positions in units of 0·1 microns.

The Tape mounted status is set to 1 if a tape is mounted or to 0 if one is not. If there is a tape, its bar-code is returned in the Tape bar code field.

III.4.3 Configure DPU.

The Configure DPU command is used to set up the configuration of the DPU prior to reading a tape on it. It contains a single Table containing a series of DPU commands that the Station Unit should transmit to the DPU and then handle the responses. The format of the command is shown in Table III.7.

There is only one Table in the message, and it has no auxiliary data. The dimensions of the Table are (in x) the maximum length of a DPU command (in characters), and (in y) the number of commands. The allowed DPU commands are in the form of an ASCII string and have the format:

`W aa dddd<cr>`

where `W` indicates Write, `<cr>` indicates a carriage return, `aa` is an address in the range 00 to FF hex, and `dddd` is data in the range 0000 to FFFF hex. The different components of the command are separated from each other by a single space and the whole string is padded to 16 characters with binary zeros. The addresses themselves and the data are defined in the document *PBU Interface to the SU and the CCC* by Roger Cappallo (EVN 38, Mark IV Memo #196).

Only DPU commands that elicit no response from the DPU are allowed in this message.

Action code	`0x00070300`	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	`0x03020001`	
Data type	`0x01010000`	
Number of tables	`0x00000001`	
Table type	`0x01010000`	
Offset to next Table	depends on y	
Element size	`0x00000001`	
Offset to Dimensions	`0x00000018`	
Offset to Auxiliary data	`0x00000000`	
Offset to Table data	`0x00000024`	
Number of dimensions	`0x00000002`	
x size (characters)	`0x00000010`	
y size (number of commands)	as required	
DPU commands		unsigned chars

Table III.7: Configure DPU Command Message Format

There is normally no response to the Configure DPU command unless there is an error

III.4.4 DPU Command.

The DPU Command command contains one or more commands to be sent transparently to the DPU. There should only be a response if the DPU commands request it, or if there is some problem with the command itself or sending it to the DPU. The format of the command is shown in Table III.8.

There is only one Table in the message, and it has no auxiliary data. The dimensions of the Table are (in x) the maximum length of a DPU command (in characters), and (in y) the number of commands.

DPU commands are in the form of an ASCII string and have one of the formats:

```
W aa dddd<cr>
```

or

```
R aa<cr>
```

where `W` and `R` indicate Write and Read respectively, `<cr>` indicates a carriage return, `aa` is an address in the range 00 to FF hex, and `dddd` is data in the range 0000 to FFFF hex. The different components of the command are separated from each other by a single space and the whole string is padded to 16 characters with binary zeros. The addresses themselves and the data are defined in the document *PBU Interface to the SU and the CCC* by Roger Cappallo (EVN 38, Mark IV Memo #196).

Several DPU commands can be loaded into the same Table, the number of the commands being specified as the y-dimension size.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03020002	
Data type	0x01010000	
Number of tables	0x00000001	
Table type	0x01010000	
Offset to next Table	depends on y	
Element size	0x00000001	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000024	
Number of dimensions	0x00000002	
x size (characters)	0x00000010	
y size (number of commands)	as required	
DPU commands		unsigned chars

Table III.8: DPU Command Command Message Format

Write (W) commands do not in themselves automatically elicit a response from the DPU and it is not necessarily obvious which of the monitor data available should be inspected to ensure that the command was successful. Consequently it is up to the sender of the command(s) to issue appropriate Read (R) commands to obtain the necessary information. Each Read command should result in a single Action Status message being returned containing the results of the read. The form of this Action Status message (excluding the message header) is shown in Table III.9.

Action code	0x00070300	
Action status	0x03020002	
Command code	0x03020002	unsigned long
Station Unit ID	as assigned	unsigned long
Address	xx	8 unsigned chars
Address contents	xxxx	8 unsigned chars

Table III.9: DPU Command Response Action Status Message Format

The Parameters field of the Action Status message contains the original Command Code, the address

that was read from and the contents of the address. The address and its contents are returned as ascii strings representing the relevant hexadecimal values. The strings are terminated by a carriage return and then padded to eight characters with binary zeros.

III.4.5 Configure SU.

The Configure SU command contains one or more tables of configuration data for the Station Unit. Usually there is no response. The format of the command is shown in Table III.10.

Action code	`0x00070300`
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	`0x03000003`
Data type	`0x01020000`
Number of tables	as required
Tables	

Table III.10: Configure SU Command Message Format

The contents of particular tables are described below.

III.4.5.1 Data Input Module, Signal Source Specification.

The Station Unit contains two *Data Input Modules* (DIM 0 and DIM 1) each of which handles 36 signals from each of the two head stacks on the DPU. There are also 8 test signals (4 to each DIM) coming from the SUIM, and other special signal sources available. Following the DIMs are 8 *Track Recovery Modules* (TRM0 to TRM7) arranged as two groups of 4, each group taking signals from one of the DIMs. A single TRM can accept 8 inputs, and so there are a total of 64 available which must be selected from the total of 84 inputs. The selection is done by a cross-bar switch which must be configured using information provided by a table in a Configure SU command. The format of the table is shown in Table III.10a.

Table type	0x01021001	
Offset to next Table	0x00000060	
Element size	0x00000001	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size	0x00000040	
Cross-bar switch configuration		unsigned bytes

Table III.10a: DIM Cross-bar Switch Configuration Table

The cross-bar switch configuration loaded into the table consists of a 64-byte vector, one element for each output (or TRM input) with each containing the required DIM input number. The following input numbers are used:

- For DIM0 the signal sources are:
  - 0–35 Head stack signals with that number
  - 72–75 SUIM test signals 0–3
- For DIM1 the signal sources are:
  - 36–71 Head stack signals with that number
  - 76–79 SUIM test signals 4–7
- For both DIM0 and DIM1 the following special signal sources are available:
  - 80 logic high
  - 81 logic low
  - 82 VME SYSCLK signal
  - 83 pseudo-random binary sequence signal

The following restrictions apply:

- TRM0 to TRM3 (vector elements 0–31) can accept inputs only from DIM0. In addition, in VLBA mode, TRM0 can also accept the cross-track parity signals from DIM1 (inputs 36, 37, 62 and 63).
- TRM4 to TRM7 (vector elements 32–63) can accept inputs only from DIM1. In addition, in VLBA mode, TRM4 can also accept the cross-track parity signals from DIM0 (inputs 0, 1, 34 and 35).

III.4.5.2 Track Recovery Module.

The Station Unit contains eight Track Recovery Modules each of which handles eight tracks of data. These are responsible for recovering the data clock and for locating and keeping track of the frames of data off the tape, ensuring that the correct frames with the correct TOTs are presented to the *Channel Recovery Module*. Each TRM contains an amount of ram that is used to de-skew tape tracks, but it can also be loaded with test data for onwards transmission. All TRMs are basically configured identically.

The actual configuration is done by a Table in a Configure SU command. The format of this table is shown in Table III.10b.

Table type	0x01022001	
Offset to next Table	0x0000006A	
Element size	0x0000004A	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size	0x00000001	
RxParityThreshold		unsigned word
RxControl		unsigned word
TxControl		unsigned word
FrameValidityMask		unsigned word
ClockRecoveryControl		unsigned word
ActiveTracks	0 = inactive, 1 = active	unsigned bytes

Table III.10b: TRM Configuration Table

The Table consists of an image of the structure used by the Station Unit Control Computer to configure the TRMs. All of the Table data fields are two bytes long with the exception of the ActiveTracks array which is 64 single-byte entries. See the document *Module Software Addresses for the EVN/Mark IV Station Unit* (Metrum Information Storage Ltd) for the definitions of the fields other than ActiveTracks. The following notes may also be useful:

RxParityThreshold	This sets the threshold of parity errors above which an error is flagged. It is used if bit 1 of FrameValidityMask is set.
RxControl	This refers to the Rx_Control Register.
TxControl	This refers to the Tx_Control Register. Bits 0, 3 and 4 of this are obsolete test controls; Bits 5 and 6 are controlled by the TRM micro.
FrameValidityMask	This refers to the Bad Frame Mask.
ClockRecoveryControl	This controls the clock recovery chip. The following values are relevant:

Frequency (MBits/s)	ClockRecoveryControl
18·00	0x0044
9·00	0x0024
4·50	0x0064

In addition to the basic TRM configuration, it is necessary to define the expected contents of the auxiliary data fields in the tape frame headers so that the TRM can check that it is on the right tracks. A single table is used to specify these data, and its format is shown in Table III.10c.

Table type	0x01022002	
Offset to next Table	0x000020A8	
Element size	0x00002088	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size	0x00000001	
TracksToCheck		unsigned bytes
FramesPerBarrrelRollPhase		unsigned longs
AuxData		unsigned longs
Mask		unsigned longs

Table III.10c: Auxiliary Data Check Table

The Table contains four arrays defining which tracks to check (1 to check a track, 0 not to), the number of frames per barrel-roll phase, the expected contents of the auxiliary data fields as on the tape for each track and for each phase of the barrel-roll sequence (stored as two longs per data field, giving 8 bytes in total), and finally a mask used to specify which parts of the auxiliary data field are checked (the mask is ANDed with the auxiliary data field before comparison with the expected contents). The dimensions of the arrays are such that the equivalent C definitions are:

```
unsigned char TracksToCheck[64];        // 1 to check, 0 not to
unsigned long FramesPerBarrelRollPhase[16];
unsigned long AuxData[16][64][2];       // 8 bytes per field, 64
                                        // tracks, 16 phases
unsigned long Mask[2];                  // Aux data field mask
```

If there are fewer than 16 phases in the barrel-roll sequence, then the data for the previous phases should be repeated.

III.4.5.3 Channel Recovery Module.

There is one Channel Recovery Module which is responsible for extracting the channels from the tracks. This involves a multiplex or de-multiplex operation and possibly a de-barrelroll if the channels have been barrel-rolled across tracks.

The actual configuration is done by a Table in a Configure SU command. The format of this table is shown in Table III.10d.

Table type	0x01023001	
Offset to next Table	0x00000466	
Element size	0x00000448	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size	0x00000001	
Cross-track parity		unsigned word
Clock select, Mux/demux, and track frame select		unsigned word
Track frames/sec of TOT		unsigned word
Clocks between track frames		unsigned word
FramesPerBarrelRollPhase		unsigned longs
Cross-bar configuration		unsigned bytes

Table III.10d: CRM Configuration Table

Clocks between track frames specifies the dead time between bursts of transferring data between the TRM and the DMM, and it has a nominal value of 0x3A7. All of the Table data fields are two bytes long with the exception of the Frames per barrel roll phase which is an array of 16 four-byte integers and the Cross-bar configuration which is a matrix of 16 x 64 bytes defining the cross-bar switch configuration for each phase of the barrel-roll sequence.

The FramesPerBarrelRollPhase array defines the number of track frames that each of the 16 phases of the barrel-roll sequence applies to. The Cross-bar configuration is a matrix dimensioned [16][64] which defines the 64 cross-bar switch settings for each of the 16 barrel-roll phases. Each entry in the cross-bar switch settings array is for one cross-bar output and should contain the required cross-bar input number (0 to 63). If there are fewer than 16 phases in the barrel-roll sequence, then the data for the previous phases should be repeated.

III.4.5.4 Phase Calibration Module.

The Phase Calibration Module is responsible for extracting phase calibration tones embedded in the data by the receivers. Two tones can be extracted from each channel. The module needs to be loaded with tables describing the expected tones as seen in the data for each channel. The tables are addressed modulo 3200 for each possible state of the sign and magnitude bits in the data, so each channel requires four arrays each of 3200 bytes.

The actual configuration for each channel is done by a Table in a Configure SU command. The format of this table is shown in Table III.10e.

Table type	0x01025001	
Offset to next Table	0x0000322C	
Element size	0x00000001	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000020	
Offset to Table data	0x0000002C	
Number of dimensions	0x00000001	
x size	0x00003200	
Channel number	as required	unsigned long
Address	unused	unsigned long
Word count	0x00001900	unsigned long
Phase calibration table		unsigned bytes

Table III.10e: Phase Calibration Configuration Table

The values of the x size and Word count fields in the above Table assume that all of the tone data for the given channel is being loaded.

There are three items in the auxiliary data section, all of which are four-byte values. The Channel number is used as below:

$0 \leqslant$ channel number $\leqslant 15$	Load table for specified channel, Validity = 1.
channel number = 32	Load all channel tables, Validity = 1.
$16 \leqslant$ channel number $\leqslant 31$	Load table for (specified channel − 16), Validity = 0.
channel number = 33	Load all channel tables, Validity =0.

The Address field is currently unused. The Word count field specifies the total number of words (of two bytes each) that follow in the phase calibration arrays, and should be set to be equal to half the x size value. The Address and Word count fields maintains compatibility with the Tables used to load test data and Xilinx code.

The order of the data in the Phase calibration table is defined by the following structure:

```
typedef struct
{
unsigned char tab00[3200] ;
unsigned char tab01[3200] ;
unsigned char tab10[3200] ;
unsigned char tab11[3200] ;
} CHAN_TABLE ;
```

where `tab10` represents the state magnitude = 1 and sign = 0. In the Phase Calibration Module, the order of significance of addressing its ram is validity, then magnitude, and then sign.

III.4.5.5 Delay Module.

The Delay Module, as its name suggests, is responsible for delaying the data passing through it in accordance with a set of ROT-stamped polynomials loaded from the Control Computer. The polynomials are loaded using a separate command (see *Load Polynomials* later), but other information is loaded using a Configure SU command. The Table which specifies this information is an image of the internal structure used to set Delay Memory control registers from the Station Unit Control Computer together with additional parameters. Its format is shown in Table III.10f.

Table type	0x01024002	
Offset to next Table	0x0000003A	
Element size	0x0000001A	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size	0x00000001	
RotIntRate		unsigned long
SysClksPerStnClk		unsigned long
HeaderLength		unsigned word
HeaderMultiplier		unsigned word
CFrameLength		unsigned long
BOCFOffset		double

Table III.10f: Delay Memory Configuration Table

See the section *Workarounds* in *Software Notes for the JIVE/Mark IV Station Unit* (MIS) regarding the order of configuration for the SUIM and the DCM and about using the BOCFOffset to compensate for pipelines delays in the DCM/DMM. The data in the Table are the ROT interrupt rate (2000000 for a 32 MHz STNCLK), the factor to convert STN_CLKs to SYSCLKs, the Correlator Frame Header length in bits, the Header length multiplication factor (1, 2, 4 … 16), the number of bits in a Correlator Frame less the Header length, and the offset for the start of BOCF

The BOCF offset is a time in short ROT format: if it is zero, then BOCF will be synchronised to the next SYSTICK (and will remain in synchronisation), otherwise it is the offset from SYSTICK to the start of the BOCF.

III.4.5.6 Miscellaneous Parameters.

In addition to the parameters and settings required for the operation of particular hardware and hardware-related components in the Station Units, there are a number of configuration values that the Station Unit Control Computer itself needs to know. These are supplied in another Table, whose format is given in Table III.10g.

Table type	`0x01020002`	
Offset to next Table	`0x00000084`	
Element size	`0x00000050`	
Offset to Dimensions	`0x00000018`	
Offset to Auxiliary data	`0x00000000`	
Offset to Table data	`0x00000020`	
Number of dimensions	`0x00000001`	
x size	`0x00000001`	
SU-array code		unsigned long
Tape format		unsigned long
Clock rate		double
DPU acceleration		unsigned long
Initial tape direction		unsigned long
Nominal tape speed		unsigned long
Tape speed up/down factor		double
Number of heads		unsigned long
Nominal ROT/TOT offset		double
Tape servo interval		double
Tape servo maximum slew time		double
Recorded bit density		double
Scan data to scan interval		double
DPU type		unsigned long
BackupTOT		double
TOTperfoot		double

Table III.10g: Station Unit Miscellaneous Parameters

The parameters are described in more detail below:

SU-array code — The SU-array code. This is identical to the Job ID on the Control Computer.

Tape format — A code defining the tape frame header format:

1 MkIIIA
2 MkIIIAx
3 MkIV
4 MkIVA
5 VLBA

	MkIIIAx is the MkIIIA format used by the VLBA which encodes the head number into the auxiliary data field. MkIVA is MkIV with 128 tape tracks and four heads, and is not yet implemented.
Clock rate	The fraction of the nominal SYSCLK rate that is actually being used. usually in the range 0·75 to 1·0.
DPU acceleration	The acceleration of the DPU. Units are to be decided.
Initial tape direction	The initial direction of tape movement. 0 for forward, 1 for reverse.
Nominal tape speed	The nominal tape speed required. Units are 1/100 ips.
Tape speed up/down factor	The rate at which the tape is being replayed as a fraction of its record rate. For example, 2·0 if the tape is being replayed at twice its record rate.
Number of heads	The number of headstacks on the DPU.
Nominal ROT/TOT offset	The nominal offset between TOT and ROT for the tape. This is defined to be ROT − TOT and has the same units as a short-form ROT. See also the section *Workarounds* in *Software Notes for the JIVE/Mark IV Station Unit* (MIS). The usage of this value depends on the setting of the feature set bit Enable ROT/TOT Offset. It this bit is unset, the ROT/TOT offset is used to set the nominal ROT/TOT offset that is used when servoing the tape. If the bit is set, then the offset for tape servoing is obtained from the delay model (the whole delay part is used together with the current configuration), and the ROT/TOT offset value is used instead as a timestamp correction. In this latter case, the supplied value is added to the times read from tape before they are used. This is basically intended as a means of correcting the missetting of a formatter clock, and because it is only possible for this to be misset by whole seconds, the correction is constrained to be an integral number of seconds. Finer formatter clock errors must be corrected via the delay model as usual.
Tape servo interval	The interval between tape servo attempts. Units are SYSCLKs.
Tape servo max. slew time	See MIS documentation. Units are 1/100 second.
Recorded bit density	The bit density on the tape. Units are bpi.
Scan data to scan interval	See MIS documentation. Units are SYSCLKs. See also the section *Workarounds* in *Software Notes for the JIVE/Mark IV Station Unit* (MIS).
DPU type	This flag specifies the type of the DPU that is attached to the Station Unit. Currently it takes one of the values 0 for a Penny & Giles drive or 1 for a Metrum drive.
BackupTOT	This is used when locating a particular TOT on tape. The tape is read until a TOT greater than or equal to the requested TOT is found and the current footage is noted. The BackupTOT is then added to the difference between the required and actual TOTs. Units are SYSCLKs.
TOTperfoot	This is used to convert the adjusted BackupTOT into a tape footage. Units are SYSCLKs.

III.4.6 Configure SUIM.

The Configure SUIM command is used to configure the Station Unit Interface Module. The format of the command is shown in Table III.11a and Table III.11b. See the section *Workarounds* in *Software Notes for the JIVE/Mark IV Station Unit* (MIS) regarding the order of configuration for the SUIM and the DCM.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x03010001
Data type	0x01020000
Number of tables	0x00000001
Table type	0x01026001
Offset to next Table	0x000000A0
Element size	0x00000002
Offset to dimensions	0x00000018
Offset to Auxiliary data	0x00000000
Offset to Table data	0x00000020
Number of dimensions	0x00000001
x size (64 items)	0x00000040

Table III.11a: Configure SUIM Command Message Format (First Part)

There is normally no response to this command.

Clock Mode		unsigned word
Rx Control		unsigned word
Tick Generator		unsigned word
PLL Control		unsigned word
RCR Control		unsigned word
TX0 Control		unsigned word
ST1 Status		unsigned word
TX2 Control		unsigned word
ST3 Status		unsigned word
reserved		unsigned word
reserved		unsigned word
reserved		unsigned word
reserved		unsigned word
PG00 Select	see below	unsigned word
PG01 Select	see below	unsigned word
PG02 Select	see below	unsigned word
PG03 Select	see below	unsigned word
PG04 Select	see below	unsigned word
PG05 Select	see below	unsigned word
PG06 Select	see below	unsigned word
PG07 Select	see below	unsigned word
PG08 Select	see below	unsigned word
PG09 Select	see below	unsigned word
PG10 Select	see below	unsigned word
PG11 Select	see below	unsigned word
PG12 Select	see below	unsigned word
PG13 Select	see below	unsigned word
PG14 Select	see below	unsigned word
PG15 Select	see below	unsigned word
SUIM Tx Reset Count		unsigned word
SUIM Rx Hold-Off		unsigned word
Micro100		unsigned word
Tick Delay		unsigned word
Enable Bad Lock Flag		unsigned word
Rx uses DAV		unsigned word
Tx uses DAV		unsigned word
PLL Pause Count		unsigned word
spare[27]		unsigned words

Table III.11b: Configure SUIM Command Message Format (Second Part, Table Data)

The PGxx Select words are used to select gating waveforms for data channel xx. They contain a bit-mask with the meanings described in Table III.11c.

Bit	Meaning
0	0 = gating disabled, 1 = gating enabled
1	0 = direct polarity, 1 = inverted polarity
2	Pattern select (0 to 15)
3	
4	
5	

Table III.11c: Gating Waveform Select Bits

III.4.7 Set Error Levels.

The Set Error Levels command is used to set the levels at which various errors (including SUIM errors) are reported and/or the levels at which corrective actions are taken. The format of the command is shown in Table III.12.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000004	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01030007	
Offset to next Table	0x00000024	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size	0x00000001	
Check ROT fails	as required	unsigned long

Table III.12: Set Error Levels Command Message Format

Currently there is only one value in the Table:

Check ROT fails — The maximum number of check ROT failures before an error is flagged. If this number is exceeded, a bit indicating the error is set in the *Station Unit state* field in the Average Statistics Action Status message (Table III.23).

III.4.8 Load Polynomials.

The Load Polynomials command is used to load a new set of delay and phase polynomial coefficients. The coefficients replace any currently loaded. The format of the command is shown in Table III.13.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000005	
Data type	0x01020000	
Number of tables	0x00000001	
Table type	0x01024001	
Offset to next Table	depends on y	
Element size	0x00000610*	
Offset to Dimensions	0x00000018*	
Offset to Auxiliary data	0x00000024*	
Offset to Table data	0x00000038*	
Number of dimensions	0x00000002*	
x size (records)	0x00000001*	
y size (number of intervals)	as required*	
Polynomial set ID	0x00000000	unsigned long
nchan		unsigned word
k_div		unsigned word
fs		double
Model parameters		unsigned word
Sidebands		unsigned word
Interval entries		see below

*See below for these fields

Table III.13: Load Polynomials Command Message Format

It is possible for this command to contain no polynomials (only the Auxiliary data being present), in which case the Offset to Dimensions, Offset to Table data, and Element size fields all contain zero, and the Dimensions and Table data areas are unused. The Offset to Auxiliary data field then contains the value 0x00000018.

The Auxiliary data section of the table contains the Polynomial set ID followed by five other parameters used by the code that generates the delays and Correlator Frame Headers. The Polynomial set ID is for future development, and should always be zero at present. The remaining values are the

number of channels to generate headers for, the divisor specifying the fringe phase update period, the sample frequency (in samples/second), a word of model parameters (see below), and bitmask specifying the sideband for each channel.

nchan is the number of channels for which to generate correlator frame headers.

k_div is a divisor specifying the fringe phase update period relative to the SYSCLK frequency. That is, kdiv = log_2 (SYSCLK_freq / phase_rotator_clock_freq).

fs is the sample frequency in samples per second.

Model parameters are miscellaneous delay model parameters. Bits 0 – 2 are the oversampling factor (1, 2 or 4). The remaining bits are unassigned and should be set to zero.

Sidebands are a bit-mask specifying the sideband for each channel. Channel 0 is bit 0 and so on. An unset bit (0) indicates upper sideband, and a set bit (1) indicates lower sideband.

This change is not yet implemented because it needs a change in the Station Unit code.

The Table data in this command contains a number of entries, one for each ROT interval for which polynomials are provided. The format of the entry for each interval is shown in Table III.13a.

Start ROT for splines	as required			
End ROT for splines	as required			
Delay splines for channel 0	coefficient 0	coefficient 1	…	coefficient 5
"	coefficient 0	coefficient 1	…	coefficient 5
Delay splines for channel 15	coefficient 0	coefficient 1	…	coefficient 5
Phase splines for channel 0	coefficient 0	coefficient 1	…	coefficient 5
"	coefficient 0	coefficient 1	…	coefficient 5
Phase splines for channel 15	coefficient 0	coefficient 1	…	coefficient 5

Table III.13a: Format of a Single Delay/Phase Polynomial ROT Interval Entry

There are 6 delay and 6 phase spline coefficients per channel. All of the values are double precision. The ROTs are in the standard short form. There is normally no response to this command.

III.4.9 Position Tape to Footage.

The Position Tape to Footage command is used to position the tape to a particular value of the footage counter. The format of the command is shown in Table III.14.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000006	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01030001	
Offset to next Table	0x00000028	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000020	
Offset to Table data	0x00000024	
Number of dimensions	0x00000001	
x size (1 integer)	0x00000001	
Timeout in seconds	as required	unsigned long
Required footage	as required	unsigned long

Table III.14: Position Tape to Footage Command Message Format

A timeout value in seconds for the operation to complete is supplied in the Auxiliary Data area; if this is exceeded then an error should be returned. The response to this command is an Action Status message when either the footage is reached, or as close a footage as possible is attained. Its format is shown in Table III.15.

Action code	0x00070300	
Action status	0x03000006	
Command code	0x03000006	unsigned long
Station Unit ID	as assigned	unsigned long
Actual footage attained	actual footage	unsigned long

Table III.15: Tape Positioned at Footage Response Action Status Message Format

A single four-byte integer is returned containing the actual value of the tape footage counter that was reached.

III.4.10 Position Tape to TOT.

The Position Tape to TOT command requests the Station Unit to position the tape to a particular TOT, or as close to it as it can. The format of the command is shown in Table III.16.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000007	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01030002	
Offset to next Table	see below	
Element size	see below	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000020	
Offset to Table data	0x00000024	
Number of dimensions	0x00000001	
x size (1 record)	0x00000001	
Timeout in seconds	as required	unsigned long
Nominal footage	as required	unsigned long
Required TOT	as required	see below

Table III.16: Position Tape to TOT Command Message Format

A four-byte integer specifying the timeout period in seconds for the command to complete is supplied in the Auxiliary Data area. Two parameters are provided in the Table Data: a four-byte integer containing the nominal tape footage where it is expected to find the TOT; and the actual TOT required. The supplied TOT can be in either of two forms: a standard short-form ROT (basically a single double value), or a standard long-form ROT including the base date. The Station Unit differentiates between these two options by looking at the message length. A TOT value of −1·0 implies that the TOT at the current tape position is required. When a short-form TOT is supplied, the offset to the next table should be 0x00000030 and the element size should be 0x0000000C. When a long-form TOT is supplied, the offset to the next table is 0x00000034 and the x size is 0x00000010.

The response to this command is an Action Status message when either the TOT is found, or as close a TOT as possible is attained. Its format is shown in Table III.17.

Action code	`0x00070300`	
Action status	`0x03000007`	
Command code	`0x03000007`	unsigned long
Station Unit ID	as assigned	unsigned long
Actual footage attained	actual footage	unsigned long
Actual TOT located	actual TOT	long-form ROT

Table III.17: Tape Positioned at TOT Response Action Status Message Format

Two items are returned: a single four-byte integer is returned containing the actual value of the tape footage counter that was reached, and a long-from ROT value containing the actual TOT located. *Note, the base date in this field might be unreliable.*

III.4.11 Position Heads.

The Position Heads command requests the Station Unit to position the headstack(s) on the DPU to specified positions. The format of the command is shown in Table III.18.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000008	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01030003	
Offset to next Table	depends on y	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000024	
Offset to Table data	0x00000028	
Number of dimensions	0x00000002	
x size	0x00000002	
y size	number of heads	
Timeout in seconds	as required	unsigned long
Head positions	head positions	longs

Table III.18: Position Heads Command Message Format

A timeout value in seconds for the operation to complete is supplied in the Auxiliary Data area. If the timeout is exceeded then an error should be returned. The Table itself contains up to four entries one for each headstack to be moved, each consisting of two four-byte integer values. The first integer is the headstack number (starting at one) and the second is a signed value specifying the position required in units of 0·1µ. The response to this command is an Action Status message containing the new headstack positions when the heads have been moved. Its format is shown in Table III.19.

Action code	0x00070300	
Action status	0x03000008	
Command code	0x03000008	unsigned long
Station Unit ID	as assigned	unsigned long
Number of headstacks	as present	unsigned long
Headstack 1 position		long
Headstack 2 position		long
Headstack 3 position		long
Headstack 4 position		long

Table III.19: Heads Positioned Response Action Status Message Format

One value is returned for each headstack present (not just for those moved).

III.4.12 Peak Heads.

The Peak Heads command requests the Station Unit to peak the headstack(s) on the DPU onto specified tracks. The format of the command is shown in Tables III.20a, b, c, d, and (optionally) e. It takes three or four Tables that describe the heads to be moved and the expected contents of each tape track. The first two Tables are always present, and the remaining one is supplied if the tape format supports head numbers and data identifiers in the tape frame header auxiliary data fields (*i.e.*, not vanilla MkIIIA). The final table is only required if one of the Enable Peaking feature set bits is set.

A timeout value in seconds for the operation to complete is supplied in the Auxiliary Data area of the first Table. If the timeout is exceeded then an error should be returned. The Tables themselves contain the following data:

- (Table III.20a) Up to four entries one for each headstack to be peaked, each consisting of four four-byte integer values. The first integer is the headstack number (starting at one), the second is a signed value specifying the initial position required in units of 0·1µ, the third is the track number to peak that head on, and the fourth is the range (+ and − the value specified) over which the head is allowed to move in units of 0·1µ.
- (Table III.20b) An array of times specifying the range of TOTs expected on the tape tracks. Each track entry consists of two doubles specifying the starting and finishing TOTs of the range. The TOTs are in the standard short ROT format.
- (Table III.20c) An array containing the number of frames per phase of the barrel-roll sequence (16 entries), followed by an array defining the expected contents of the auxiliary data field for each of the 64 tracks for each phase of the barrel-roll sequence, followed by a mask used to specify which parts of the auxiliary data field are checked (the mask is ANDed with the auxiliary data field before comparison with the expected contents). The expected contents are provided as two unsigned long values providing 8 bytes in total, and are as the data should appear on the tape. The format of the data in these arrays matches the C definitions below. Note that if there are fewer than 16 phases in the barrel-roll sequence, then the data for the previous phases should be repeated.

```
unsigned long FramesPerBarrelRollPhase[16];

unsigned long AuxData[16][64][2];       // 8 bytes per field, 64
                                        // tracks, 16 phases
unsigned long Mask[2];                  // Aux data field mask
```

- (Table III.20e) TBD.

See *MkIV Tape Format, Recording Modes and Compatibility*, MkIV Memo 205 for the contents of auxiliary data fields in the various tape formats.

The Station Unit should attempt to peak the specified heads on the specified tracks. The arrays giving the TOT range and expected auxiliary data field contents can be used to ascertain which tracks the heads are currently positioned on. If the contents of the tracks are found to be outside of the TOT range supplied then an error Action Status message should be returned. The normal response to this command is an Action Status message containing the new headstack positions when the heads have been moved. Its format is shown in Table III.21. Note that one value is returned for each headstack present (not just for those moved).

(Note that the vanilla version of the Station Unit software ignores the expected track contents and simply peaks the heads on the closest tracks. If proper peaking is required then one of the feature set

bits Enable Peaking Track Search or Enable Peaking Multi-track Search must be set.)

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000009	
Data type	0x01030000	
Number of tables	0x00000003	
Table type	0x01030004	
Offset to next Table	depends on y	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000024	
Offset to Table data	0x00000028	
Number of dimensions	0x00000002	
x size	0x00000004	
y size	number of heads	
Timeout in seconds	as required	unsigned long
Headstack data	see below	longs

Table III.20a: Peak Heads Command Message Format (first part)

The contents of the Headstack data consist of four four-byte integers for each head to be peaked, and are shown in Table III.20d.

Table type	0x01030008	
Offset to next Table	depends on y	
Element size	0x00000008	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000024	
Number of dimensions	0x00000002	
x size	0x00000002	
y size	number of tracks	
TOT ranges		doubles

Table III.20b: Peak Heads Command Message Format (second part)

Table type	0x01030009	
Offset to next Table	0x00002068	
Element size	0x00002048	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size	0x00000001	
FramesPerBarrelRollPhase		unsigned longs
AuxData		unsigned longs
Mask		unsigned longs

Table III.20c: Peak Heads Command Message Format (third part)

Headstack number	(first = 1)	long
Initial position	(units are 0·1μ)	long
Track number to peak on		long
Allowed range of headstack movement (range is ± the value specified)	(units are 0·1μ)	long

Table III.20d: Format of Headstack Data

If either of the feature set bits Enable Peaking Track Search or Enable Peaking Multi-track Search are set, then an extra table specifying additional data is expected. The format of this is shown in Table III.20e.

Table type	0x01030020	
Offset to next Table		
Element size		
Offset to Dimensions		
Offset to Auxiliary data		
Offset to Table data		
Number of dimensions		
x size		
	TBD	

Table III.20e: Peak Heads Command Message Format (fourth and last part)

Action code	0x00070300	
Action status	0x03000009	
Command code	0x03000009	unsigned long
Station Unit ID	as assigned	unsigned long
Number of headstacks	as present	unsigned long
Headstack 1 position		long
Headstack 2 position		long
Headstack 3 position		long
Headstack 4 position		long

Table III.21: Heads Peaked Response Action Status Message Format

The contents and use of Table III.20e and the final functionality of the head peaking enabled by the Enable Peaking feature set options are still to be decided.

III.4.13 Request Average Statistics.

The Request Average Statistics command requests the Station Unit to return the tape error counts and other related data accumulated since the last such command. Typically, this command will be issued with a repeat interval to obtain regular statistics. The format of the command is shown in Table III.22.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x0300000A
Data type	0x00000000
Number of tables	0x00000000

Table III.22: Request Average Statistics Command Message Format

The response to this command is an Action Status message containing the statistics. Its format is shown in Table III.23.

Action code	0x00070300	
Action status	0x0300000A	
Command code	0x0300000A	unsigned long
Station Unit ID	as assigned	unsigned long
Station Unit state	current state	unsigned long
SUIM state	current state	unsigned long
Number of headstacks	as present	unsigned long
Headstack 1 position		unsigned long
Headstack 2 position		unsigned long
Headstack 3 position		unsigned long
Headstack 4 position		unsigned long
Current tape footage	actual footage	unsigned long
Current TOT	actual TOT	double
Current tape servo error		double
Active track map		unsigned bytes
Error counts for each track		see below

Table III.23: Average Statistics Action Status Message Format

The codes for the Station Unit state have yet to be decided. The SUIM state field is described below. The headstack position units are 0·1μ, and those for the tape servo error are SYSCLKs. The TOT is in

the standard short ROT form. The Active track map consists of 64 bytes containing either a 0 (track inactive) or a 1 (track active) for each tape track. The Error counts is an array of 64 entries (one for each track), each with the format shown in Table III.23a.

Number of frames
Parity error count
Unexpected syncs count
Missing syncs count
CRC error count
Bad frames discarded count

Table III.23a: Track Error Counts Format

All of the values are four-byte integers.

The SUIM state field consists of 32 single bit flags with the assignments listed in Table III.23b.

Bit	Assignment
0	Sampler statistics write/readback error
1	Sampler statistics write/readback error
2	Sampler statistics write/readback error
3	Sampler statistics write/readback error
4	Sampler statistics write/readback error
5	Sampler statistics write/readback error
6	Sampler statistics write/readback error
7	Sampler statistics write/readback error
8	AINTAIL write/readback error
9	AINTAIM write/readback error
10	Interceptor message length error
11	AINTAIL write/readback error
12	AINTAIM write/readback error
13	AINTAFL write/readback error
14	AINTAFM write/readback error
15	AINTSTL write/readback error
16	AINTSTM write/readback error
17	
18	
19	
20	Rx error
21	Rx not ready
22	Error echoing message
23	Clk Buffer write/readback error
24	Tx0 write/readback error
25	Tx2 write readback error
26	Tick error
27	PLL error
28	Tx fail
29	Rx general error
30	Send Reset TPSU message
31	Flag Frames Bad flag (maskable)

Table III.23b: SUIM Status Bits Assignments

III.4.14 Request Tape Frame Header.

The Request Tape Frame Header command is used to obtain a tape frame header from a single track on the tape. The format of the command is shown in Table III.24.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x0300000B	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01030005	
Offset to next Table	0x00000024	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size (1 integer)	0x00000001	
Required track number	as required	unsigned long

Table III.24: Request Tape Frame Header Command Message Format

The Table contains a single four-byte integer value which is the track number (starting at zero) from which the header is required. If the track number is supplied as 0xFFFFFFFF then a good tape frame header can be supplied from any track. The Station Unit returns a “raw” tape frame header from amongst those currently in the TRM ram. Included with the header are the following auxiliary data field and the error flags set by the TRM (these replace the sync pattern in the header). The response to this command is an Action Status message containing the header. Its format is shown in Table III.25.

Action code	0x00070300	
Action status	0x0300000B	
Command code	0x0300000B	unsigned long
Station Unit ID	as assigned	unsigned long
Track number		unsigned long
Tape frame header		unsigned words

Table III.25: Tape Frame Header Data Action Status Message Format

The Tape frame header data consists of 20 words of which only the least 9 bits are significant. Bits 0 to 7 contain the data from the header, and bit 8 is the validity bit (which is always set to invalid for a header). The track number is returned as −1 if the requested track was not available.

III.4.15 Request Tape Frame.

The Request Tape Frame command requests that the Station Unit return a complete tape frame from a single track on the tape. The format of the command is shown in Table III.26.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x0300000C	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01030006	
Offset to next Table	0x0000002C	
Element size	0x0000000C	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size (1 record)	0x00000001	
Required track number	as required	unsigned long
Required TOT	as required	double

Table III.26: Request Tape Frame Command Message Format

The Table contains a four-byte integer value which is the track number (starting at zero) from which the header is required and a double value which is the TOT required (in standard short ROT form). The Station Unit returns a complete “raw” tape frame (including the following auxiliary data field) from the track requested and with the TOT closest to that requested from amongst those currently in the TRM ram. Included with the frame are the error flags set by the TRM (these replace the sync pattern in the frame header). The response to this command is an Action Status message containing the frame. Its format is shown in Table III.27.

Action code	`0x00070300`	
Action status	`0x0300000C`	
Command code	`0x0300000C`	unsigned long
Station Unit ID	as assigned	unsigned long
Track number		unsigned long
Tape frame		unsigned words

Table III.27: Tape Frame Data Action Status Message Format

The tape frame data consists of 2500 words (for Mark III or Mark IV tapes), or 2520 words (for VLBA tapes). It includes the frame header and auxiliary data fields. Only the least 9 bits of each word are significant: of these bits 0 to 7 are the data and bit 8 is the validity. The Track number is returned as −1 if the requested track cannot be found.

III.4.16 Request Phase Calibration Data.

The Request Phase Calibration Data command requests that the Station Unit regularly returns a set of accumulated phase calibration data counts. When returned, the counts are cleared ready for the next accumulation period. The format of the command is shown in Table III.28.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x0300000D	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01035001	
Offset to next Table	0x0000001C	
Element size	0x00000000	
Offset to Dimensions	0x00000000	
Offset to Auxiliary data	0x00000018	
Offset to Table data	0x00000000	
Nominal accumulation period	as required	unsigned long

Table III.28: Request Phase Calibration Data Command Message Format

The accumulation period is specified in whole seconds of TOT. An accumulation period of zero specifies that the Station Unit cease sending the phase calibration data. For accumulation periods greater than zero, the responses to this command are Data Messages containing the phase calibration counts for each channel. The format is shown in Table III.29.

Action code	0x00020000	
Flags	0x00000000	
Obey ROT	0	
End ROT	0	
Repeat interval	0	
Data type	0x00010000	
Number of tables	0x00000001	
Table type	0x00010000	
Offset to next Table	0x00000284	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000024	
Offset to Table data	0x00000044	
Number of dimensions	0x00000002	
x size (9 integers)	0x00000009	
y size (number of channels)	0x00000010	
Station Unit ID	as assigned	unsigned long
TOT		double
ROT		double
Accumulation period		double
Frame count		unsigned long
Counts for each channel		unsigned longs

Table III.29: Phase Calibration Data Message Format

The Table contains five items in the Auxiliary Data area: the Station Unit ID (as a four-byte integer), the TOT for the counts, the ROT for the counts (both in standard short ROT form), the actual accumulation period of the counts in double precision SYSCLKs, and a count of the number of data frames that were used. The Table Data Area contains, per channel, eight four-byte counts being the counts for two tones, followed by a single four-byte value containing the number of valid samples that went into the counts. The counts can be considered to be an array as defined below. See Mark IV Memo 133 for additional details.

```
typedef struct channelcount
{
  unsigned long count of bit from LSB (0x01) of table ram
  unsigned long count of bit from     (0x02) of table ram
  unsigned long count of bit from     (0x04) of table ram
  unsigned long count of bit from     (0x08) of table ram
  unsigned long count of bit from     (0x10) of table ram
  unsigned long count of bit from     (0x20) of table ram
  unsigned long count of bit from     (0x40) of table ram
  unsigned long count of bit from MSB (0x80) of table ram
  unsigned long count of validity bits
};
```

III.4.17 Request Sampler Statistics.

The Request Sampler Statistics command requests that the Station Unit returns the current set of accumulated sampler statistics counts. Once returned, the counts are cleared ready for the next accumulation period. This command is usually issued with a repeat interval so that a regular set of sampler statistics is obtained. The format of the command is shown in Table III.30.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x03010002
Data type	0x00000000
Number of tables	0x00000000

Table III.30: Request Sampler Statistics Command Message Format

The response to this command is a Data Message containing the statistics counts for each channel. Its format is shown in Table III.31.

Action code	0x00020000	
Flags	0x00000000	
Obey ROT	0	
End ROT	0	
Repeat interval	0	
Data type	0x00020000	
Number of tables	0x00000001	
Table type	0x00020000	
Offset to next Table	0x00000140	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000024	
Offset to Table data	0x00000040	
Number of dimensions	0x00000002	
x size (4 integers)	0x00000004	
y size (number of channels)	0x00000010	
Station Unit ID	as assigned	unsigned long
TOT		double
ROT		double
Accumulation period		double
Counts for each channel		unsigned longs

Table III.31: Sampler Statistics Data Message Format

The Table contains four items in the Auxiliary Data area: the Station Unit ID (as a four-byte integer), the TOT for the counts, the ROT for the counts (both in standard short ROT form), and the accumulation period of the counts in double precision SYSCLKs. The Table Data Area contains four four-byte integer counts for each of the 16 channels: these being the number of valid counts for each of the four sampler states (order to be decided).

III.4.18 Arm Interceptor.

The Arm Interceptor command is used to ready the data interceptor in the SUIM to capture data. The format of the command is shown in Table III.32.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03010003	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01036002	
Offset to next Table	0x00000040	
Element size	0x00000002	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size (16 items)	0x00000010	
Control Register	see below	unsigned word
Channel Number	as required	unsigned word
Starting Address (lsw)	as required	unsigned word
Starting Address (msw)	as required	unsigned word
Finishing Address (lsw)	as required	unsigned word
Finishing Address (msw)	as required	unsigned word
Start Timer (lsw)	as required	unsigned word
Start Timer (msw)	as required	unsigned word
spare[8]		unsigned words

Table III.32: Arm Interceptor Command Message Format

Valid values of the Control Register for Arm Interceptor are shown below:

`0x0001` Automatic start on SYSTICK.
`0x0005` Automatic start on BOCF.

The Channel Number specifies the channel to intercept and starts at zero. The Starting and Finishing addresses are nibble addresses (4 bits), and are split into least significant and most significant words in the table. Finally, the Start Timer specifies how long to wait after the first synch pulse (SYSTICK or BOCF) in units of STN_CLOCK / 4 before starting to capture the data. There is normally no response to this command.

III.4.19 Get Interceptor Data.

The Arm Interceptor command is used to ready the data interceptor in the SUIM to capture data. The format of the command is shown in Table III.33.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03010004	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01036001	
Offset to next table	0x00000040	
Element size	0x00000002	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size (16 items)	0x00000010	
Control Register	0x0008	unsigned word
Channel Number	ignored	unsigned word
Starting Address (lsw)	as required	unsigned word
Starting Address (msw)	as required	unsigned word
Finishing Address (lsw)	as required	unsigned word
Finishing Address (msw)	as required	unsigned word
Start Timer (lsw)	ignored	unsigned word
Start Timer (msw)	ignored	unsigned word
spare[8]		unsigned words

Table III.33: Get Interceptor Data Command Message Format

See Arm Interceptor for a description of the addresses. The response to this command is a Data Message containing the captured data. Its format is shown in Table III.34.

Action code	0x00020000	
Flags	0x00000000	
Obey ROT	0	
End ROT	0	
Repeat interval	0	
Data type	0x81040000	
Number of tables	0x00000001	
Table type	0x01046001	
Offset to next table	depends on x	
Element size	0x00000001	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000020	
Offset to Table data	0x00000034	
Number of dimensions	0x00000001	
x size (bytes)	as required	
Station Unit ID	as assigned	unsigned long
Arming Data	see below	unsigned words
Data from interceptor		unsigned bytes

Table III.34: Interceptor Data Message Format

The Arming data contains the data that was passed in the Get Interceptor Command (the first 8 words excluding the spares).

III.4.20 Request SUIM Status.

The Request SUIM Status command requests the Station Unit to return the current status of the SUIM. The format of the command is shown in Table III.35.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x03010005
Data type	0x00000000
Number of tables	0x00000000

Table III.35: Request SUIM Status Command Message Format

The response to this command is an Action Status message containing the status. Its format is shown in Table III.36.

Action code	0x00070300	
Action status	0x03010005	
Command code	0x03010005	unsigned long
Station Unit ID	as assigned	unsigned long
SUIM ID		unsigned word
RXC		unsigned word
Gate 0		unsigned word
Gate 1		unsigned word
Gate 2		unsigned word
Gate 3		unsigned word
ITS0		unsigned word
STX0		unsigned word
Clock mode		unsigned word
Tick gen		unsigned word
Gate 4		unsigned word
Gate 5		unsigned word
Gate 6		unsigned word
Gate 7		unsigned word
ITS1		unsigned word
STX1		unsigned word
PLL control		unsigned word
RCC		unsigned word
Gate 8		unsigned word
Gate 9		unsigned word
Gate 10		unsigned word
Gate 11		unsigned word
ITS2		unsigned word
STX2		unsigned word
SUIM ID		unsigned word
SUIM ID		unsigned word
Gate 12		unsigned word
Gate 13		unsigned word
Gate 14		unsigned word
Gate 15		unsigned word
ITS3		unsigned word
STX3		unsigned word
SWord 1		unsigned word
SWord 2		unsigned word

Table III.36: SUIM Status Action Status Message Format

III.4.21 Reset SUIM.

The Reset SUIM command requests the Station Unit to initialise the serial links on the SUIM. The format of the command is shown in Table III.37.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x03010006
Data type	0x00000000
Number of tables	0x00000000

Table III.37: Reset SUIM Command Message Format

There is normally no response to this command.

III.4.22 Load Test Data into TRM.

The Load Test Data into TRM command requests the Station Unit to load the test data contained in the message into the TRM ram. The format of the command is shown in Table III.38.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x0300000E	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01032001	
Offset to next table	depends on x	
Element size	0x00000002	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000020	
Offset to Table data	0x0000002C	
Number of dimensions	0x00000001	
x size (words)	as required	
TRM number	as required	unsigned long
dram address	as required	unsigned long
Word count	as required	unsigned long
Test data		unsigned words

Table III.38: Load Test Data into TRM Command Message Format

The TRM number is in the range 0 to 7. The dram address defines which track and page the data are to be loaded at, and the Word count is the number of data words in the test data. The x size value in the Table header is equal to this value. TRM data are 9-bit bytes, and so one is loaded per word starting at the least significant end. There is normally no response to this command.

III.4.23 Load Test Data into Delay.

The Load Test Data into Delay command requests the Station Unit to load the test data contained in the message into the Delay Module ram. *Note that because of changes in the operation of the Delay ram, this command no longer functions.* The format of the command is shown in Table III.39.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x0300000F	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01034001	
Offset to next table	depends on x	
Element size	0x00000002	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000020	
Offset to Table data	0x0000002C	
Number of dimensions	0x00000001	
x size (words)	as required	
(unused)	0x00000000	unsigned long
dram address	as required	unsigned long
Word count	as required	unsigned long
Test data		unsigned words

Table III.39: Load Test Data into Delay Command Message Format

The (unused) field is there for compatibility with the Load Test Data into TRM command. The dram address defines where the data are to be loaded, and the Word count is the number of data words in the test data. The x size value in the Table header is equal to this value. There is normally no response to this command.

III.4.24 Get Test Data from TRM.

The Get Test Data from TRM command is used to read data from the TRM ram. The format of the command is shown in Table III.40.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000010	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01032003	
Offset to next table	0x0000002C	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size (longs)	0x00000003	
TRM number	as required	unsigned long
dram address	as required	unsigned long
Word count	as required	unsigned long

Table III.40: Get Test Data from TRM Command Message Format

The response to this command is a Data Message containing the data. Its format is shown in Table III.41.

Action code	0x00020000	
Flags	0x00000000	
Obey ROT	0	
End ROT	0	
Repeat interval	0	
Data type	0x81040000	
Number of tables	0x00000001	
Table type	0x01042001	
Offset to next table	depends on x	
Element size	0x00000002	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000020	
Offset to Table data	0x00000030	
Number of dimensions	0x00000001	
x size (words)	as requested	
Station Unit ID	as assigned	unsigned long
TRM number	as requested	unsigned long
dram address	as requested	unsigned long
Word count	as requested	unsigned long
Test data		unsigned words

Table III.41: TRM Test Data Data Message Format

The Word count field is equal to the x size.

III.4.25 Get Test Data from Delay.

The Get Test Data from Delay command is used to read data from the Delay Module ram. *Note that because of changes in the operation of the delay memory ram, this command no longer functions.* The format of the command is shown in Table III.42.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000011	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01034002	
Offset to next table	0x0000002C	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size (longs)	0x00000003	
(unused)	0x00000000	unsigned long
dram address	as required	unsigned long
Word count	as required	unsigned long

Table III.42: Get Test Data from Delay Command Message Format

The (unused) field is there for compatibility with the Get Test Data from TRM command. The response to this command is a Data Message containing the data. Its format is shown in Table III.43.

Action code	0x00020000	
Flags	0x00000000	
Obey ROT	0	
End ROT	0	
Repeat interval	0	
Data type	0x81040000	
Number of tables	0x00000001	
Table type	0x01044001	
Offset to next table	depends on x	
Element size	0x00000002	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000020	
Offset to Table data	0x00000030	
Number of dimensions	0x00000001	
x size (words)	as requested	
Station Unit ID	as assigned	unsigned long
(unused)	0x00000000	unsigned long
dram address	as requested	unsigned long
Word count	as requested	unsigned long
Test data		unsigned words

Table III.43: Delay Test Data Data Message Format

The Word count field is equal to the x size. The (unused) field is there for compatibility with the TRM Test data message.

III.4.26 Abort SU Operations.

The Abort SU Operations command requests the Station Unit to abort whatever it is currently doing, including stopping the DPU. Typically, this command is used to stop a job prematurely. The format of the command is shown in Table III.44.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x03000012
Data type	0x00000000
Number of tables	0x00000000

Table III.44: Abort SU Operations Command Message Format

The response to this command is an Action Status message containing the new SU state and the current tape position. Its format is shown in Table III.45.

Action code	0x00070300	
Action status	0x03000012	
Command code	0x03000012	unsigned long
Station Unit ID	as assigned	unsigned long
Station Unit state	current state	unsigned long
Current tape footage	actual footage	unsigned long
Current TOT	actual TOT	double

Table III.45: SU Operations Aborted Action Status Message Format

The TOT is supplied in the format of a short ROT.

III.4.27 Reset SU Peripherals.

The Reset SU Peripherals command requests the Station Unit Control Computer to issue a reset to all of the peripherals under its control. The format of the command is shown in Table III.46.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x03000013
Data type	0x00000000
Number of tables	0x00000000

Table III.46: Reset SU Peripherals Command Message Format

There is normally no response to this message.

III.4.28 Load Xilinx Code.

The Load Xilinx Code command is used to load code for the Xilinx modules in the Station Unit hardware. *Note that there is no guarantee that this command will work: the Xilinx code may be in rom in certain or all modules, and so it may not be modifiable; in particular, the effects of this command will be undone on configuration in the TRM and CRM*. The format of the command is shown in Table III.47.

Note that this command does not actually load the code to the Station Unit, that should have been done by a Load Test Data Command with an appropriate address. The Load Xilinx Code command just copies the code from ram into the Xilinx chips. Only one board can be loaded by any one message.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000014	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01038001	
Offset to next table	0x00000024	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size	0x00000001	
BoardIdent	as required	unsigned long

Table III.47: Load Xilinx Code Command Message Format

The BoardIdent field contains a value that identifies the board whose Xilinx chips are to loaded. The codes are listed in Table III.47a. Note that not all of the codes would normally be used in Load Xilinx Code commands.

The response to this command is an Action Status message indicating that the code has been loaded (or not). Its format is shown in Table III.48.

The Code load status is zero if the Xilinx code was loaded successfully, or contains a non-zero error status (to be decided) if the load failed.

BoardIdent Code	SU Board
0	TRM 0
1	TRM 1
2	TRM 2
3	TRM 3
4	TRM 4
5	TRM 5
6	TRM 6
7	TRM 7
8	DIM 0
9	DIM 1
10	CRM
11	PCM
12	DCM
13	SUIM
14	SUCC

Table III.47a: Station Unit Board Codes

Action code	`0x00070300`	
Action status	`0x03000014`	
Command code	`0x03000014`	unsigned long
Station Unit ID	as assigned	unsigned long
BoardIdent		unsigned long
Code load status		unsigned long

Table III.48: Xilinx Code Loaded Action Status Message Format

III.4.29 Freeze SU.

The Freeze SU command freezes the SU into its current state (including stopping the input frame processing); it is used in testing. The format of the command is shown in Table III.49.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x03000015
Data type	0x00000000
Number of tables	0x00000000

Table III.49: Freeze SU Command Message Format

There is normally no response to this message.

III.4.30 Set SU ID.

The Set SU ID command is used after power-up to assign a Station Unit ID code to a particular Station Unit and to check that it responds. It is the first command that will be issued to a Station Unit (the second will usually be a Request SU Configuration). The format of the command is shown in Table III.50.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000016	
Data type	0x01020000	
Number of tables	0x00000001	
Table type	0x01020001	
Offset to next Table	0x00000024	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size (1 ID code)	0x00000001	
Station Unit ID code	ID code	unsigned long

Table III.50: Set SU ID Command Message Format

The Station Unit ID code is sent as a four-byte value of which only the least-significant two bytes are relevant.

The response to this command must be an Action Status message containing the Station Unit ID code just assigned. If no response is received in a reasonable period, the Control Computer will assume that the Station Unit is inoperable. The format of the Action Status message is shown in Table III.51.

Action code	0x00070300	
Action status	0x03000016	
Command code	0x03000016	unsigned long
Station Unit ID code	ID code	unsigned long

Table III.51: Set SU ID Command Response Action Status Message Format

The Parameters field of the Action Status message contains the original Command Code and the assigned Station Unit ID passed as a four-byte value.

III.4.31 Start TRM Test Data.

The Start TRM Test Data command requests the Station Unit to start transmitting previously loaded test data from its TRM ram. The format of the command is shown in Table III.52.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000017	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01032002	
Offset to next table	0x00000028	
Element size	0x00000004	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size	0x00000002	
TRM number	as required	unsigned long
dram address	as required	unsigned long

Table III.52: Start TRM Test Data Command Message Format

There is normally no response to this command.

III.4.32 Get Test Data from Delay by TOT.

The Get Test Data from Delay by TOT command is used to read data from the Delay Module ram. It is similar to the Get Test Data from Delay command, but the data are indexed by TOT rather than by dram address. *Note that because of changes in the operation of the delay memory ram, this command no longer functions.* The format of the command is shown in Table III.53.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000018	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x01034003	
Offset to next table	0x00000034	
Element size	0x00000014	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size (records)	0x00000001	
TOT	as required	double
channel	as required	unsigned long
Word count	as required	unsigned long
Data type	as required	unsigned long

Table III.53: Get Test Data from Delay by TOT Command Message Format

The supplied TOT is in the standard short ROT form. The other parameters are the channel number (first is zero), the number of words (two bytes) to be read, and the data type code which has the value 0 for sign data, 1 for magnitude data, and 2 for validity. The response to this command is a Data Message as shown in Table III.43.

III.4.33 Set Scan ROTs.

The Set Scan ROTs command specifies the ROT at which the Station Unit should be ready to start providing data together with the ROT at which it should finish for a single scan, and, optionally, the valid TOT range for the tape servo. The first Scan ROTs command in a job must allow sufficient time between the ROT Clock starting to produce messages and the first data required. If more than one scan is to be processed, then one Starting ROT command per scan must be supplied. The format of the Command Message is shown in Table III.54.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000019	
Data type	0x01030000	
Number of tables	0x00000001	
Table type	0x0103000B	
Offset to next table	see below	
Element size	see below	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size (records)	0x00000001	
Scan starting ROT	as required	double
Scan finishing ROT	as required	double
Tape servo minimum TOT*	see below	double
Tape servo maximum TOT*	see below	double

**Presence of these fields depends on enabled feature set*

Table III.54: Set Scan ROTs Command Message Format

The supplied ROTs and TOTs are in the standard short ROT format. The format of this command is affected by the Enable Tape Servo TOT Range Load feature set bit. If it is unset then the last two fields (the two tape servo ones) are omitted and the offset to the next table is 0x00000030 and element size is 0x00000010. If the bit is set, then the last two fields must be supplied, and the offset to the next table is 0x00000040 and the element size is 0x00000020. When supplied and when the command message is ROT-queued, the Tape servo TOTs specify the permissible range for the tape servo. If the command message is not queued, these last two values are ignored. To get the servo code to use these values the feature set bit Enable Tape Servo TOT Range Check must be set. In this case, the tape servo checks that the TOT it has read from tape (after any large offset adjustment) lies within the supplied limits before using it to servo on.

The action of the Set Scan ROTs command is affected by one other feature set bit. If the Enable Next

Scan Search bit is set *and* the command is queued (*i.e.*, it has an obey ROT set) then the Station Unit will inform C^3 if a TOT is read from tape that lies within the ROTs specified in the command. This might happen, for instance, if the previous scan finishes earlier than expected. What it does then depends on the settings of the Scan Search Stop, and Scan Search Stop and Backup feature set bits. If the former is set, the DPU will be stopped; if the latter, the DPU will be stopped and then backed up; if neither are set, it will just carry on running (see the description of these bits in the Set Feature Set command for more information). Either way, the Station Unit returns a Next Scan Found Action Status message with the format shown in Table III.54a. Note that when checking for the next scan, the Station Unit checks the TOT read from tape less frequently than it does for the Position to TOT command, so the footage and TOT returned may not be exactly at the very start of the scan.

If the Set Scan ROTs command does not have an obey ROT set, then the scan ROTs are just stored as usual, but they will be used if the Enable Next Scan Search bit is set subsequently.

Action code	`0x00070300`	
Action status	`0x03000019`	
Command code	`0x03000019`	unsigned long
Station Unit ID	as assigned	unsigned long
Actual footage attained	actual footage	unsigned long
Actual TOT located	actual TOT	long-form ROT

Table III.54a: Next Scan Found Action Status Message Format

III.4.34 Flush TRM.

The Flush TRM command flushes the TRM memory. Its format is shown in Table III.55.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x0300001A
Data type	0x00000000
Number of tables	0x00000000

Table III.55: Flush TRM Command Message Format

III.4.35 Flush DM.

The Flush DM command flushes the Delay Module memory. *Note that this command is no longer available*. Its format is shown in Table III.56.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x0300001B
Data type	0x00000000
Number of tables	0x00000000

Table III.56: Flush DM Command Message Format

III.4.36 SU Finish.

The SU Finish command lets the Station Unit know that the current job has finished. Its format is shown in Table III.57.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x0300001C
Data type	0x00000000
Number of tables	0x00000000

Table III.57: SU Finish Command Message Format

The Station Unit should stop the tape moving and when ready produce an SU Finished Action Status message with an appropriate action code (see the description of this Action Status message later).

III.4.37 SU Error.

The SU Error Action Status message is an unsolicited message generated by a Station Unit when an error is detected: this includes errors produced as a result of trying to obey a command. The format of the Action Status message is shown in Table III.58.

Action code	as applicable	
Action status	0x03800001	
Command code	as applicable	unsigned long
Station Unit ID code	ID code	unsigned long
Error code	TBD	unsigned long
Error parameters	TBD	TBD

Table III.58: SU Error Action Status Message Format

The Action Code and Command Code fields should contain the action code and command code of the message that initiated the action that resulted in the error if applicable, or zero otherwise. The Error Codes and associated parameters have to be decided.

III.4.38 SU Finished.

The SU Finished Action Status message is an unsolicited message generated by a Station Unit when it has finished its preprogrammed operations. Typically this is when it has completed all of the scans that it was to process, but it is also produced when the SU has stopped because of an error, or as a result of receiving an SU Finish command. The format of the Action Status message is shown in Table III.59.

Action code	`0x00000000`	
Action status	`0x03800002`	
Command code	`0x00000000`	unsigned long
Station Unit ID code	ID code	unsigned long
Reason code	see below	unsigned long

Table III.59: SU Finished Action Status Message Format

The Reason Codes assigned so far are listed in Table III.60.

Reason Code	Meaning
1	Finish Clock Message
2	End of tape encountered
3	SU Finish command received

Table III.60: SU Finished Reason Codes

III.4.39 Tape Mounted.

The Tape Mounted Action Status message is an unsolicited message generated by a Station Unit when a tape is mounted on its associated DPU. The format of the Action Status message is shown in Table III.61.

Action code	`0x00000000`	
Action status	`0x03800003`	
Command code	`0x00000000`	unsigned long
Station Unit ID code	ID code	unsigned long
Tape bar code	as on tape	16 chars

Table III.61: Tape Mounted Action Status Message Format

III.4.40 Tape Dismounted.

The Tape Dismounted Action Status message is an unsolicited message generated by a Station Unit when a tape is dismounted from its associated DPU. The format of the Action Status message is shown in Table III.62.

Action code	0x00000000	
Action status	0x03800004	
Command code	0x00000000	unsigned long
Station Unit ID code	ID code	unsigned long
Tape bar code	as on tape	16 chars

Table III.62: Tape Dismounted Action Status Message Format

III.4.41 Stop CRM.

The Stop CRM command was originally intended only for internal use in the Station Unit, however it is needed externally in practice for correct functioning of the Station Unit. Stopping the CRM during configuration of the Station Unit prevents data flowing through it to the delay buffer and ensures that the first data clocked through to it are what is wanted. Its format is shown in Table III.63.

Action code	0x00070300
Flags	as required
Obey ROT	as required
End ROT	as required
Repeat interval	as required
Command code	0x03000031
Data type	0x00000000
Number of tables	0x00000000

Table III.63: Stop CRM Command Message Format

There is no response to this command.

III.4.42 Set Feature Set.

The Set Feature Set command is used to select or deselect certain features of the Station Unit internal software. Its format is shown in Table III.64.

Action code	0x00070300	
Flags	as required	
Obey ROT	as required	
End ROT	as required	
Repeat interval	as required	
Command code	0x03000036	
Data type	0x01020000	
Number of tables	0x00000001	
Table type	0x01020003	
Offset to next table	0x00000034	
Element size	0x00000014	
Offset to Dimensions	0x00000018	
Offset to Auxiliary data	0x00000000	
Offset to Table data	0x00000020	
Number of dimensions	0x00000001	
x size (records)	0x00000001	
Action	see below	unsigned long
Feature set 0	see below	unsigned long
Feature set 1	see below	unsigned long
Feature set 2	see below	unsigned long
Feature set 3	see below	unsigned long

Table III.64: Set Feature Set Command Message Format

The table consists of a single record containing an Action followed by four unsigned long bit-masks which specify the features to be changed by the command. The possible actions are listed in Table III.64a.

Action	**Meaning**
0x00000000	Load feature set
0x00000001	Bit set
0x00000002	Bit clear
Action Modifiers	**Meaning**
0x40000000	Print set
0x80000000	Echo set

Table III.64a: Set Feature Set Actions

Action Load feature set simply loads the feature set as specified by the following four long words.

Action Bit set does a bit-wise set of the feature set specified by the following four long words with the existing feature set in the Station Unit.

Action Bit clear does a bit-wise clear of the feature set specified by the following four long words with the existing feature set in the Station Unit.

Any of the above Actions can by modified by ORing with the optional Action Modifiers:
Print set causes the Station Unit to print out the new feature set after applying the action. This can be use to print the existing set by using the Bit set or Bit clear actions with all zeros in the four long words.
Echo set causes the Station Unit to send back a copy of the current feature set after applying the action. This can be used to request the current set by using the Bit set or Bit clear actions with all zeros in the four long words. The feature set is returned as an SU Feature Set Action Status message with the format shown in Table III.64b.

Action code	`0x00070300`	
Action status	`0x03000036`	
Command code	`0x03000036`	unsigned long
Original action		unsigned long
Feature set 0	see below	unsigned long
Feature set 1	see below	unsigned long
Feature set 2	see below	unsigned long
Feature set 3	see below	unsigned long

Table III.64b: SU Feature Set Action Status Message Format

The Feature set long-words are listed in Table III.64c.

Feature Set 0 Bit (default all set)	**Meaning if set**
`all`	existing functions
Feature Set 1 Bit (default all set)	**Meaning if set**
`all`	existing functions
Feature Set 2 Bit (default all unset)	**Meaning if set**
0 (`0x00000001`)	Continuous BOCF
1 (`0x00000002`)	C^3 control of tape servo
2 (`0x00000004`)	Enable tape servo
3 (`0x00000008`)	Enable next scan search
4 (`0x00000010`)	Scan search stop when next scan found
5 (`0x00000020`)	Scan search stop and backup when next scan found
6 (`0x00000040`)	Enable CRM servo
7 (`0x00000080`)	Enable message dump
8 (`0x00000100`)	Enable ROT/TOT offset
9 (`0x00000200`)	Enable new TOT request
10 (`0x00000400`)	Enable new TOT request sort
11 (`0x00000800`)	Enable new TOT request print
12 (`0x00001000`)	Enable tape servo TOT range check
13 (`0x00002000`)	Enable tape servo TOT range load
14 (`0x00004000`)	Enable DCM/DMM validity control
15 (`0x00008000`)	Enable peaking track search
16 (`0x00010000`)	Enable peaking multi-track search
17 (`0x00020000`)	Enable auto CRM stop at end of scan
30 (`0x40000000`)	Enable time-tag print
31 (`0x80000000`)	Enable whole delay
Feature Set 3 Bit (default all unset)	**Meaning if set**
24 (`0x01000000`)	Enable TBD 2 diagnostics
25 (`0x02000000`)	Enable TBD 1 diagnostics
26 (`0x04000000`)	Enable SU finish diagnostics
27 (`0x08000000`)	Enable task-specific buffer diagnostics
28 (`0x10000000`)	Enable big buffer diagnostics
29 (`0x20000000`)	Enable small buffer diagnostics
30 (`0x40000000`)	Enable DPU diagnostic 1 print
31 (`0x80000000`)	Enable DPU diagnostic 0 print

Table III.64c: Feature Set Bits

Individual features are described in more detail below.

Feature Set 0 These bits are intended for controlling existing Station Unit functions. They are set set to 1 on power-up, but are otherwise unused at present.

Feature Set 1 These bits are intended for controlling existing Station Unit functions. They are set set to 1 on power-up, but are otherwise unused at present.

Feature Set 2 These bits control new functionality added after the original Station Unit contract. They are set to 0 on powerup, and are described in more detail below.

Continuous BOCF	When enabled this feature gets the Station Unit to spontaneously start a dummy scan after configuration of the DCM. Subsequent scans are then all treated as seamless transitions. There is, of course, a period where the BOCF/delay model pipeline is realigned if required, but during this there should be no interruption of the BOCF header signal. Only during a reconfiguration of the DCM will there be the potential for missing BOCFs. Internally, the Station Unit lies about the end of the scan time to the DCM. If disabled, one or more BOCFs will usually be missed between scans. Note that for continuous BOCF to work it is important to set the feature bit *before* the DCM configuration of the first scan in the series. The configuration of the DCM must come *after* the SUIM has established a stable STNCLK and SYSTICK. The feature bit should remain set through out the scan series. This is important because the SU needs to perform different actions at the start and end of scans during continuous BOCF operation. If the feature bit is not set at these times then the SU reverts to the single scan operation.
C^3 control of servo	When this feature bit is set, the C^3 has the ability to control when the tape servo is applicable. Tape servo on and off is then controlled by the Enable tape servo bit.
Enable tape servo	See above.
Next scan search	If enabled, this feature results in the Set scan ROTs command doing a search for the next scan on the tape. The Station Unit then reports the first secure detection of a TOT in the scan. See the description of Set scan ROTs command for more information.
Scan search stop	If set, this bit causes the DPU to be stopped when the scan search initiated as described above locates a TOT in the scan.
Scan search backup	If set, this bit causes the DPU to be stopped and then backed up to the nominal TOT position using the parameters defined in SU Miscellaneous parameters.
CRM servo	This enables a (simplistic) servo which aims to keep the input and output pointers of the delay memory apart by half the size of the delay ram. It does this by modifying on the fly the number of clocks the CRM has between frames. To obtain sufficient accuracy for this, the ROT interrupt rate is increased internally in the DCM by a factor of 8, so don't set

	the ROT interrupt rate too high in the delay memory configuration (Table III.10f)!
Message dump	When enabled, the Station Unit will dump all received messages to its console. Normally this should be turned off!
ROT/TOT offset	When enabled, this option turns off the existing functionality of using the Nominal ROT/TOT offset in the Miscellaneous Parameters table (Table III.10g) for the tape servo. Instead, the Station Unit calculates the required ROT/TOT offset from the current configuration and the value of the whole delay component from the delay model. The Nominal ROT/TOT offset from Miscellaneous parameters is now used as a constant that is added to the time-stamps from tape. See the description of the Miscellaneous parameters table for more information.
New TOT request	If this bit is set, the TRM controlling task is forced to request headers from each active TRM when trying to get a good tape servo and the like.
TOT request sort	Controls an internal sorting choice for the above. Leave this bit unset.
TOT request print	Enables printing of verbose diagnostics for the New TOT request feature. Best left unset.
Tape servo range	When set, this bit directs the tape servo code to check that a given TOT from tape (after any large offset adjustment) is within the current permissible range.
Tape servo range load	If this bit is set, the Station Unit assumes that a ROT-queued Set Scan ROTs command has an additional pair of doubles specifying the low and high limits of the TOT range.
DCM/DMM validity	This forces the DMM (after the DCM has been configured) to set all validity bits to invalid. Just before a scan, the validity forcing is removed so that the validity bits should follow the actual data validity. At the end of the scan, the validity forcing is reintroduced.
Peaking track search	This bit is used in conjunction with a new Peak Heads Table type (0x0103020). The table includes more information than the previous one and is intended to allow the Station Unit to automatically reposition a head from the given initial position if the evidence read from the AUX data indicates the wrong tracks are being read. See the description of the Peak Heads command for more information.
Peaking multi-track	This bit is like the above one, but an internal table of AUX data from all 64 tracks is produced and used to derive a best guess of the head position. See the description of the Peak Heads command for more information.
Auto CRM stop	This bit enables an automatic Stop CRM command to the CRM at the end of each scan. It is only active if Continuous BOCF is also enabled.
Time tag print	If enabled this feature prepends a hex representation of the ROT to any diagnostic message printed on the console. Note that since such messages are processed via an internal queue

		there may be a small difference between the real queuing time and the time-stamp.
	Whole delay	In the DCM delay mechanism the delay consists of a combination of whole samples of delay and the fractional delay that is incremented every STNCLK. The original version of the software was only tested using very small delays relative to the size of the delay buffer. When this feature bit is set, the Station Unit tries to take account of the value of the initial delay when setting up the start of scan. (Note: this needs to be tested with real data!)
Feature Set 3	These bits control new functionality added after the original Station Unit contract. They are set to 0 on powerup, and are described in more detail below.	
	TBD 2 diagnostics	Enables diagnostics. Meaning to be decided.
	TBD 1 diagnostics	Enables diagnostics. Meaning to be decided.
	SU finish diagnostics	Enables diagnostics of SU Finish handling.
	Task specific buffers	Enables diagnostics of task-specific buffer handling.
	Big buffers	Enables diagnostics of big buffer handling.
	Small buffers	Enables diagnostics of small buffer handling.
	DPU 1 diagnostic	Enables printing of DPU-related diagnostics 1. Note that this may be subject to change.
	DPU 0 diagnostic	Enables printing of DPU-related diagnostics 0. Note that this may be subject to change.