	<b>Application Data TM/TC</b> <b>Data Definition Template</b>	Doc.No.: EPM-OHB-LI-0039
		Issue: 4      Date: 30.04.2010
		Rev.: -      Date: -
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# **Application Data** **TM/TC Data Definition** **Template**

## **for the** **European Physiology Modules Facility** **(EPM)**

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- / ESA

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## Distribution List

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<b>Issue/Rev.</b>	<b>Date</b>	<b>Affected Section / Para / Page</b>	<b>Change Reason / Description</b>
Draft	29/03/00	ALL	Initial Issue
1/-	08/06/01		Major change description: The housekeeping data reporting is streamlined in order to reduce the load on the embedded controller and on the MMI. Thus only one kind of report is established. This report contains now the check evaluation status from the embedded controllers. The related command and the related telemetry packets are adapted to this concept. TC and TM synchronization marker are now different in order to allow determination of the structure by any application
		Section 4.1.6	Housekeeping Value Check Status introduced
		Section 4.9	CRC routine specified
		Section 5.1	Command Execution Report Generation Flag introduced in Telecommand Structure.
		Section 5.2.3.5	The "Get Current Bulk Housekeeping Data Set" command acquires now the bulk housekeeping data report. The option to get raw data is deleted.
		Section 6.2.3	Bulk housekeeping data report content includes now Housekeeping Value Check Status and number of housekeeping values. Current bulk housekeeping data report and current raw data housekeeping data report are deleted.
		Section 6.2.4	File Packet parameter specified
		Section 7.2.4.1	Execution status aborted introduced in SM process status message i
		Section 10	Selftest identification section appended
		Section 11	Configuration files introduced
1/A	31/01/02		Major change description: Test commands are introduced. Message identifications are implemented. File packet and Plain Text Parameter are refined. File transfer status message introduced.
		Section 3.1	Range for sub-system unit ID's defined
		Section 4.2	High and low word introduced for 32 bit word transfer
		Section 4.4	Rules for use of parameter type byte array and alphanumeric introduced
		Section 4.6.	Subsystem Identification length is 8 bit as already reflected in all data structures, Subsystem ID "ALL" introduced

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Issue/Rev.	Date	Affected Section / Para / Page	Change Reason / Description
2/-	05/06/02	Section 4.13 Section 4.17 Section 5 Section 5.2.2.1  Section 5.2.2.2 Section 5.2.3 Section 5.2.3.7 Section 5.2.3.8 Section 5.2.5.1  Section 5.5 Section 6.1  Section 6.2.1.1 Section 6.2.2.1  Section 6.2.3.1 Section 6.2.4.1  Section 6.5 Section 7  Section 7.1.5 Section 7.1.9  Section 7.2.2.1  Section 7.2.4.1  Section 7.2.6 Section 8.2.2  Section 4	Details on use of destination field Data alignment and fill bytes regulated Details on telecommand sequence counter Response over RS-485 of time set explained, command renamed to Set Subsystem Time in order to distinguish from the Set System Time command of the facility, allowed Command Source adapted accordingly Test Command: Activate/deactivate time status report generation introduced Command Parameter detailed Details on telemetry destination parameter Test Command: Error message simulation Details on parameter "Addressee" of the Send File command Section on Test Commands introduced Clarification on Subsystem ID, Subsystem Unit ID and SW Task ID. Spare 2 introduced in order to avoid fill bytes for double word aligned user data. Plain Test Packet Parameter changed Time Status Report shall be sent to LTU via LAN Spare octets are set to 0x16 File Packet Parameter changed, File page introduced in order to distinguish pages from segments, file page maximum size is 8 Mbyte, Maximum file size to LTU is 100 MB. Section on Test Telemetry introduced SW-Task ID Field implemented in all messages Message identifier implemented for all standard messages Clarification on Subsystem Unit ID Unused bytes in messages shall be set to 0x16 Software Error Message Data distinguishes between Software Errors and Watchdog timeout Message type for SM process aborted is set to 2 (warning) File Transfer Control Messages introduced Selftest status "cancelled" introduced Standards and Application Layer Structures are now documented in EPM-OHB-SP-0005 Definition of "kilo" and "Mega" for bit and byte related units

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Issue/Rev.	Date	Affected Section / Para / Page	Change Reason / Description
3/-	15/11/02	Section 5.1	TC Structure is given in AD2
		Section 5.2.1	Mode change commands for main unit shall be implemented on one unit
		Section 5.2.2.1	Coarse time is GPS time
		Section 5.2.3.3	HRD Data rate is given in kbit/s
		Section 5.2.3.7	Detailed regulation on the use of the telemetry destination parameter
		Section 6.1	TM Structure is given in AD2
		Section 6.2.3.1	Clarification on HK-Data insertion into packet
		Section 7.1	Message Structure is given in AD2
		Section 7.2.2.1	Details on insertion of filename for software errors
		Section 7.2.3.2	Communication Status Message defined
		Section 7.2.4.1	Message name for ID 0x0403 is SM process aborted
		Section 7.2.5.2	Command check violation messages are level 2 messages
		Section 7.2.5.2	Parameter mismatch identifier deleted, transfer failed identifier added
		Section 7.2.6.1	Message names for ID 0x0601 to 0x0603
		Section 8.1.1.1	Field content is described in AD2
		Section 8.1.2.1	Field content is described in AD2
		Section 8.1.5	Power given in Watt
		Section 8.1.6	Power given in Watt
		Section 8.1.9	Time interval is 5 seconds
		Section 8.1.10	Time interval is 5 seconds, rate is given in kbit/s
		All	Command Source Columbus MTL deleted
		Section 1.1	Purpose extended to use in other documents
		Section 5.2.3.3	Limits set to 3000 kBit/s
		Section 5.2.3.4	Details on Set bulk HK data a generation cycle command
		Section 5.3.2.6	TBC removed
		Section 5.2.3.7	Data path identifier as parameter introduced, details on use of destination field
		Section 5.2.4.1	Note on SCP processing added
		Section 5.2.5	File Transfer Commands standardized
		Section 5.3.2.1	Note on link to selftest description added
		Section 6.2.1.1	Parameter updated according to type alphanumeric with intrinsic length information
		Section 6.2.3.1	Content of HK packet reflects mode transitions, the deletion of octets in AD2 and the valid bit in check instructions, position of check instructions is given in words

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Issue/Rev.	Date	Affected Section / Para / Page	Change Reason / Description
4/-	30.04.2010	Section 6.2.4	File Transfer packet standardized
		Section 6.3.2.1	Selftest report TM ID is 0x0601
		Section 6.3.2.2	Monitoring reference table report TM ID is 0x0602
		Section 6.5.1.1	Evaluation of TC sequence counter deleted
		Section 7.2.1.1	Details on generation of mode change message added
		Section 7.2.2.2	HK OOL message can support double
		Section 7.2.3.2	Group byte of communication status message is set to 0x03
		Section 7.2.5	Command execution messages extended
		Section 7.2.6	File transfer messages extended
		Section 8.1	Standardized HK-data extended, Engineering unit and HK-Value Number inserted
		Section 11	Configuration sheet description is part of EPM-OHB-MAN-0004
		General	Pagination standardized
		Section 2.2	COL-RIBRE-ICD-0091 added to reference documents and documents issues updated
		Section 5	Data load packages no longer applicable for EPM telecommands
		Section 5.2.5	Note added describing the limitation due to maximum command length.
		Sections 5.2.5.1, 5.2.5.2, 5.2.5.3, 5.2.5.4, 5.2.5.5, 5.2.5.7, 5.2.5.8 and 5.2.5.9	Added maximum number of words to be used for parameters
		Section 12	Added XSM to list of abbreviation

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## 1. INTRODUCTION

### 1.1 Purpose and Scope

This TM/TC Data Definition Plan Template has been established in order to describe the telecommands and telemetry packets of the EPM Science Modules.

The **SM-developer** shall use the document as basis to establish the **SM Application Data Definition**.

The **SM-developer** shall complete the document. Any gray marked area has to be filled by the **SM-developer**.

The Application Data Definition will be prepared on the basis of the Application Data TM/TC Data Definition Template.

The Application Data Definition serves as input to the following documents:

- EPM internal ICD
- MSM Ground Segment ICD
- Columbus ICD
- EGSE ICD
- On board User Manual
- Payload and GSE User Manual

Input templates are provided electronically for:

- Telecommands
- Telemetry packages
- Messages
- HK and Status-Data Items including checks
- Procedures residing on embedded controllers (SCPs)
- Selftests
- Displays

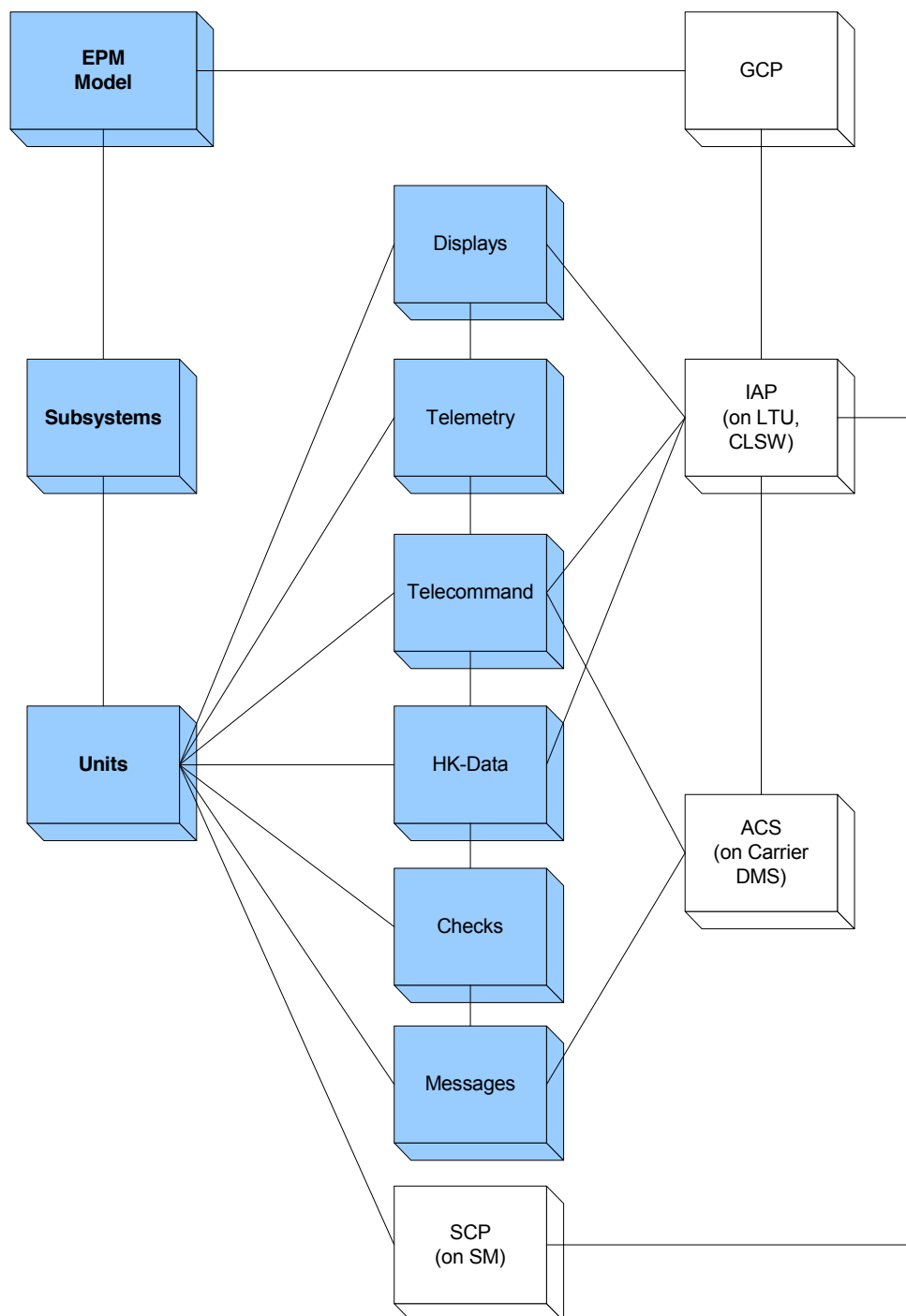
This document is applicable to Science Module Software Versions:

Computer Software Configuration Item	Version Number
Embedded Controller	00.00.00/00
Man Maschine Interface	00.00.00/00
Ground Processing S/W	00.00.00/00
EGSE S/W	00.00.00/00
Unit 1	
Unit 2	

**Table 1-1: Applicable Software Versions**

The document contains all telecommand, telemetry, message and housekeeping data definitions of the **SM**. Each main chapter presents the general structure, completely standardized entities, partially standardized entities and **SM** unique entities.

This section presents the major EPM S/W entities and their interrelationship. The major entities are shown in Figure 1-1.



**Figure 1-1: EPM S/W Entity Relationship**

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The entities can be subdivided in three classes:

1. Entities that identify hardware (bold letters), the ID of these entities is part of any response package
2. Basic Entities that are related to units of subsystems
3. Procedures (white boxes), that are related to models (GCP) or individual units

Each EPM model consists of several subsystems (1 to n relation) and each subsystem can be composed of several units. Telecommands, housekeeping data, runtime checks on housekeeping data, messages, telemetry packets and displays belong to a unit. Science Processes (SCP) belongs to units of Science Modules.

All these entities are interrelated. Telecommands can generate telemetry that is displayed in the corresponding display. Telecommands can also change housekeeping data. Housekeeping data may undergo several onboard checks, e.g. depending on the operational mode and may generate messages in case of violations. Messages may also be generated by other checks and can introduce corrective actions (automatic command scripts, ACS). These ACS consist of several telecommands.

The guided crew procedures (GCP) belong to the model. They can include several interactive automatic procedures (IAP). IAPs use telecommands and related housekeeping data for command execution verification and control the display. IAPs can also include ACS and SCP. Both are called by dedicated commands to Carrier DMS or Science Module, respectively.

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## 2. DOCUMENTS

### 2.1 Applicable Documents

This document shall be read in conjunction with the documents listed hereafter, which form part of this document to the extent specified herein. In case of a conflict between any provisions of this document and the provisions of the documents listed hereafter, the content of the contractually higher document shall be considered as superseding.

<i>Doc. Ref.</i>	<i>Doc. No.</i>	<i>Issue</i>	<i>Rev.</i>	<i>Title</i>
<b>AD1</b>	EPM-OHB-RQ-0001	4	-	Science Module Interface Requirement Document (SMIRD)
<b>AD2</b>	EPM-OHB-SP-0005	4	-	EPM Standard Protocols Definition

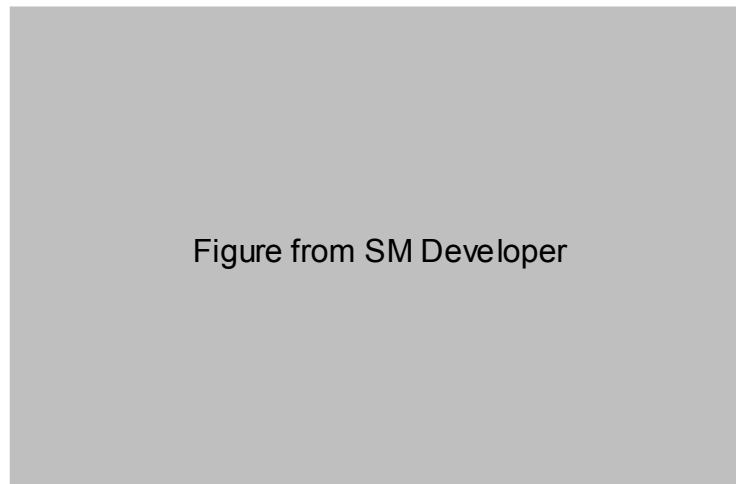
### 2.2 Reference Documents

<i>Doc. Ref.</i>	<i>Doc. No.</i>	<i>Issue</i>	<i>Rev.</i>	<i>Title</i>
<b>RD1</b>	EPM-OHB-RP-0003	5	A	EPM Design Report
<b>RD2</b>	COL-RIBRE-ICD-0091	1	-	Columbus To Payload Data Management System Interface Control Document



### 3. OVERVIEW

This section provides a description of the **SM** system including EGSE and test hardware and software required for scientific validation.



**Figure 3-1: **SM** overall overview**

Table: 3-1 lists the units and the Unit ID's of the **SM**.

Unit	Unit ID
Unit 1	
Unit 2	

**Table: 3-1: Unit ID's**

Possible values are 1 to 254.

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## 4. STANDARDS

The following denominations are used for the bit field types:

- Nibble              4 bits
- Byte, Octet      8 bits
- Word              16 bits
- Double-Word   32 bits

For bit or byte rates

- k means: times 1024
- M means times 1048576 (1024 X 1024)

AD2 provides all standard coding for EPM control fields.

### 4.1 Agreements about Bit Numbering

In accordance with the ESA convention the following bit-numbering system is used:

- the MSB (most significant bit) has the bit number 0
- the LSB (least significant bit) has the bit number 7 (octet) or 15 (word) or 31 (double-word)

### 4.2 Coding of double words

Corresponding to the ESA Standards, double-words (32 bits) are transferred in the following way:

Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B	Word Significance	
1		Octet 0 (MS Byte)								Octet 1								High Word
2		Octet 2								Octet 3 (LS Byte)								Low Word

Byte 0 is the most significant byte within the 32-bit address, byte 3 the least significant byte.  
The high word is transmitted first.

#### 4.3 Coding of application data identifier

In order to provide a selection criterion and grouping of application data identifier all 16 bit identifier shall be coded in the following way:

Field ID	<div>Bit #</div> <div>Word #</div>	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
	S	B															B
ID	1	Identifier Group									ID in Identifier Group						

#### 4.4 Data alignment and fill bytes

According to AD1, any EPM telecommand shall be aligned to words, any telemetry shall be aligned to double words and any internal structure shall be aligned to double words.

If fill bytes are required, these bytes shall be set to 0x16.

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## 5. TELECOMMANDS

The EPM commanding concept is based on the rule that the commanding from the Laptop on board and from the FRC is exactly identical. This concerns the EPM Mission Database as well as the data protocols. The EPM EGSE thus provides a dedicated LAN interface where the EPM internal protocol is running. This ensures a common look and feel for the crew and the ground operator and that exactly the same MMI SW is used on ground and on board.

It is assumed that only the FRC will fully operate EPM and that other locations in the ground station have only to fulfill maintenance tasks.

The telecommand support of Columbus and SPOE items is limited:

- there is no telecommand sequence support, commands from ground have a maximum length of 124 octets and the CCSDS header will be removed for EPM application layer software,
- the command link allows only 8 commands per second and
- the link has to be shared with Columbus and all other facilities.

EPM supports telecommand sequences from ground. For all other sources each command is sent as stand-alone packet.

The sequence counter is maintained by each command source individually. Thus the combination of command source and sequence counter allows unique identification of the command.

### 5.1 EPM Application Layer Telecommand Structure

The EPM internal telecommand structure is given in AD 2.

## 5.2 Completely standardized telecommands

### 5.2.1 Mode Control

Group Identifier	0x01
Use	Mode Management

The mode change commands for a subsystem shall be implemented on one SM-Unit, only.

#### 5.2.1.1 Change to Check-Out Mode

This command changes to the check-out mode. All SM individual settings shall be performed during execution of this command, e.g. deactivation of devices.

This mode shall allow safe reset or deactivation. The command does not have any parameters.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0101
Allowed as time tagged command	Yes
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	Yes
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Current Mode	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-1: Change to check-out mode command properties**

### 5.2.1.2 Change to Nominal Mode

This command changes to the nominal mode. All SM individual settings shall be performed during execution of this command, e.g. activation of devices.

The command does not have any parameters.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0102
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	No
Test Mode	Yes
Wait-On Sync	Yes
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Current Mode	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-2: Change to nominal mode command properties**

### 5.2.1.3 Change to Set-up Mode

This command changes to the Setup mode. All SM individual settings shall be performed during execution of this command, e.g. activation of devices.

The command does not have any parameters.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0103
Allowed as time tagged command	Yes
Modes	
Check-out	No
Setup Mode	No
Nominal Mode	Yes
Test Mode	No
Wait-On Sync	Yes
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Current Mode	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-3: Change to set-up command properties**

#### 5.2.1.4 Change to Test Mode

This command changes to the test mode. All SM individual settings shall be performed during execution of this command, e.g. activation of devices

The command does not have any parameters.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0104
Allowed as time tagged command	No
Modes	
Check-out	Yes
Setup Mode	No
Nominal Mode	Yes
Test Mode	No
Wait-On Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Current Mode	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-4: Change to test mode command properties**



### 5.2.1.5 Change to Wait-On-Sync Mode

This command changes to the Wait-On Sync mode. All SM individual settings shall be performed during execution of this command, e.g. activation of devices. Furthermore it shall be verified that a SM procedure to be executed after pulse receipt has been chosen by command.

The command does not have any parameters.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0105
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	No
Wait-On Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Current Mode	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-5: Change to wait-on-sync mode command properties**

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## 5.2.2 Time Handling

Group Identifier	0x02
Use	Time Management

### 5.2.2.1 Set Sub-System Time

The command sets the time of the addressed sub-system. The command is sent from the SMSC as broadcast command. The Subsystem ID is set to "ALL". The subsystem unit is set to 0. The SM internal time synchronization is initialized during execution of this command.

The command also initiates the transfer of time packet over RS-485 link to the SMSC (Application Data Type 0x54, as described in EPM Standard Protocols Definition, EPM-OHB-SP-0005).

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0201
Allowed as time tagged command	No
<b>Modes</b>	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	No
<b>Command Sources</b>	
Columbus CC	No
FRC	No
USOC	No
FCC	No
SMSC	Yes
LTU	No
HRF	No
<b>Changed housekeeping data</b>	
Timer Status	
<b>Related Reports</b>	
Time Status Report	
<b>Units</b>	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-6: Set Subsystem Time command properties**

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The command has one parameter, the EPM Coarse Time. This double word gives the time (UTC) in elapsed seconds from a defined epoch.

The defined epoch is GPS time, i.e. midnight 5-6 January 1980.

Param #	Type	<div>Bit #</div> <div>Word #</div>	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
			S															S
1	LU	1	B	EPM Coarse Time (High Word (#1))														B
		2		EPM Coarse Time (Low Word (#2))														

**Table 5-7: Set Subsystem Time command parameters**

### 5.2.2.2 Activate/deactivate time status report generation

The command regulates the generation of the time status report in the test mode. It can only be executed in the Test Mode.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0202
Allowed as time tagged command	Yes
Modes	
Check-out	No
Setup Mode	No
Nominal Mode	No
Test Mode	Yes
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	No
USOC	No
FCC	No
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Time Status Report	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-8: Activate/deactivate time status report generation command properties**

The command has one parameter.

- Word: Enable/disable time status report generation  
Check: Selection 0xff = YES, 0x00 = NO

Param #	Type	Word #	Bit #	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
1	U	1		S															B
Enable/disable time status report generation																			

**Table: 5-9: Activate/deactivate time status report generation command parameter**

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### 5.2.3 System and Resource Management

Group Identifier	0x03
Use	System and Resource Management

#### 5.2.3.1 Set maximum power consumption for external devices

The command sets the maximum power consumption for external devices.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0301
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	Yes
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-10: Set the maximum power consumption for external device command properties**

The command has one parameter.

- Word Maximum power consumption for external devices in Watt  
Check: Range 0 to 190 Watt

Param #	Type	Bit # Word #	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
			S															S
1	u	1	B	Maximum power consumption for externally devices														B

**Table 5-11: Set the maximum power consumption for external device parameters**

### 5.2.3.2 Set LAN Application Data Rate

The command sets the application data rate budget on LAN.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0302
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	Yes
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
LAN Net Application Data Rate	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-12: Set LAN application data rate command properties**

The command has one parameter.

Parameter:

- Word: LAN Application Data Rate in kbit/s  
Range: 0 to 1000 kbit/s

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	u	1	LAN Application Data Rate															

**Table: 5-13 Set LAN application data rate generation cycle parameters**

### 5.2.3.3 Set HRD Application Data Rate

The command sets the application data rate budget on HRD.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0303
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	Yes
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
HRD Net Application Data Rate	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-14: Set HRD application data rate command properties**

The command has one parameter.

Parameter:

- Word: HRD Application Data Rate in kbit/s  
Range: 0 to 3000 kbit/s

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	u	1	HRD Application Data Rate															

**Table 5-15: Set HRD application data rate generation cycle parameters**

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#### 5.2.3.4 Set bulk housekeeping data generation cycle

The command sets the generation rate of the cyclic bulk housekeeping data packet.

The command shall initiate the generation of a bulk housekeeping data report immediately.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0304
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	Yes
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
SM HK Acquisition Rate	
Related Reports	
Bulk housekeeping data report	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-16: Set bulk housekeeping data generation cycle command properties**

The command has one parameter.

Parameter:

- Word: HK generation cycle  
Range: 2 to 30 seconds

Param #	Type	Bit # Word #	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
			S															S
1	u	1	B	HK generation cycle														B

**Table 5-17: Set bulk housekeeping data generation cycle parameters**



### 5.2.3.5 Get bulk housekeeping data set

The command shall generate the bulk housekeeping data set of the addressed unit.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0305
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	Yes
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Bulk housekeeping data Report	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-18: Get housekeeping data command properties**

### 5.2.3.6 Activate/deactivate corrective action

The command can suspend the execution of autonomous corrective actions for a given time or reactivate the corrective action execution immediately.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0306
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	Yes
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Corrective action enable/disable status	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-19: Activate/Deactivate corrective action command properties**

The command has two parameters.

- Word: Enable/disable corrective action execution  
Check: Selection 0xff = YES, 0x00 = NO
- Word: Suspension time in seconds  
Check: Range from 0 to 600

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	U	1		Enable/disable corrective action execution														
2	U	2		Suspension time														

**Table: 5-20: Activate/Deactivate corrective action command parameter**

### 5.2.3.7 Telemetry start/stop

The Telemetry start/stop command shall start/stop data transfer to the telemetry links.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0307
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	Yes
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-21: Telemetry start/stop command properties**

The command has four parameters.

1. Word: Telemetry identifier  
Check: Selection of all SM defined telemetry identifier, 0xFFFF reserved for any telemetry packet for a specific Subsystem ID
2. Word: Telemetry destinations for the telemetry identifier  
Check: Selection of destinations (as defined in AD2) except internal , this is a bitfield, several destinations can be commanded at once if the telemetry is down linked.
3. Data path that is used for transfer  
Possible values for Science Modules are:

Ethernet TCP/IP internal	0x0002
RS-485 Main	0x0050
USB TCP/IP	0x0031
4. Word: Enable/disable sending for the packet to given destination  
Check: Selection 0xff = YES, 0x00 = NO

Param #	Type	Bit # Word #	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
			S B															S B
1	U	1		Telemetry identifier														
2	U	2		Telemetry destination														
3	U	3		Data path														
4	U	4		Enable/disable sending														

**Table: 5-22: Telemetry start/stop command parameters**

Science Modules have to implement SM specific commands to control direct data transfer between Science Modules. The EPM TM header supports direct data exchange over the internal Ethernet. The telemetry destination has to be set to internal and the receiver subsystem and subsystem unit has to be set.

### 5.2.3.8 Error message simulation command

The command issues a message with the ID passed in the command parameter. It is used for test purposes only. The command can only be executed in the testmode.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0308
Allowed as time tagged command	Yes
Modes	
Check-out	No
Setup Mode	No
Nominal Mode	No
Test Mode	Yes
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	No
USOC	No
FCC	No
SMSC	No
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table 5-23: Error message simulation command properties**

The command has one parameter.

1. Word: Message Identifier of the message that is generated.

Param #	Type	<div>Bit #</div> <div>Word #</div>	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
			S															S
			B															B
1	U	1	Message Identifier															

**Table: 5-24: Error message simulation command parameter**

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#### 5.2.4 Procedure control

Group Identifier	0x04
Use	Procedure Execution Management

##### 5.2.4.1 Start/Stop Science Module Process Execution

The Start/Stop SM process command shall start/stop processes running on a SM. The command is also used to set the processes that shall run after receipt of the synchronization pulse.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0401
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	No
SMSC	No
LTU	No
HRF	No
Changed housekeeping data	
SM Process Identifier	
Related Reports	
SM Telemetry	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-25: Start/stop SM process command properties**

The command has two parameters:

1. Word: SM process identifier  
Check: Selection of all SM defined process identifier (not 0)
2. Word: Start/Stop procedure  
Check: Selection 0xff = Start, 0x00 = Stop, 0x05 Start after receipt of synchronization pulse (only allowed in Wait-On-Sync-Mode)

Param #	Type	<div>Bit #</div> <div>Word #</div>	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
			S															S
			B															B
1	U	1	SM process identifier															
2	U	2	Start /Stop procedure															

**Table: 5-26: Start/stop SM process command parameters**

*Note: The ID of the currently executed SM process is part of the housekeeping data. The SCPs and there ID's are described in Section 9. The IAP provides a dedicated instruction to call SCPs. This instruction used the name of the SCP and converts it to the ID given in Section 9.*

*Commands to start scripts residing on an embedded system by name needs to be implemented as SM unique commands. These are not standardized and thus are not supported by the CLSW.*

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### 5.2.5 File transfer

Group Identifier	0x05
Use	File Transfer

The file management commands are described in detail in AD2. File and directory names are transferred as data type “alphanumeric” (format instructions as defined in AD2).

*Note: The format instructions denotes “alphanumeric”. This is a structure consisting of a 16bit unsigned and a string (no terminator). The 16bit unsigned gives the length of the succeeding string in bytes. All name parameters given in this section are alphanumeric type in this sense. They include an implicit preceding unsigned length field. Alphanumeric fields are word aligned. Unused bytes are set to 0x16.*

Based on type and number of further command parameters a string is limited by the overall maximum command length of 124 bytes (payload ground command packet length, specified in RD2). The resulting size restriction for each command is described individually in the following sections.

#### 5.2.5.1 Downlink File

The addressed unit generates a File TM stream with destination field set to FRC, USOC or USOC & FRC upon receipt of a DOWNLINK file command.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0501
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
File packet	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-27: Downlink file process command properties**



The command has three parameters:

1. Word: Addressee of the file (Byte 0: Subsystem ID, Byte 1 Subsystem Unit ID)  
Check: Selection 0x0002 = FRC, 0x0004 = USOC, 0x0006 = FRC & USOC
2. Alphanumeric: Full filename of the sender (including drive and path)  
Check: Size from 1 to maximum length according to selected file system
3. Alphanumeric: Full filename of the receiver (including drive and path)  
Check: Size from 1 to maximum length according to selected file system

Param #	Type	<div>Bit #</div> <div>Word #</div>	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
			S															S
1	u	1	B															B
		2		Destination of Telemetry														
2	s	X		Length														
		X+1		Filename of sender														
		N																
3	s	X		Length														
		X+1		Filename of receiver														
		N																

**Table: 5-28: Downlink file command parameters**

The overall number of words used for all parameters may not exceed 34 words, i.e. N must be equal or less 34.

*Note: The filename length also depends on the file system that is selected, see AD 2.*

### 5.2.5.2 Send File

The command sends a file.

The addressed unit generates a File TM stream with destination field set to INTERNAL upon receipt of a Send File command. The receiver subsystem and receiver subsystem ID are set according to the first parameter of the command.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0502
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
File packet	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-29: Send file process command properties**

The command has three parameters:

1. Word: MSB Byte identifies SUBSYSTEM of the Receiver, LS Byte identifies receiver subsystem unit
2. Alphanumeric: Full filename of the sender (including drive and path)  
Check: Size from 1 to maximum length according to selected file system
3. Alphanumeric: Full filename of the receiver (including drive and path)  
Check: Size from 1 to maximum length according to selected file system

Param #	Type	<div>Bit #</div> <div>Word #</div>	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
			S															S
1	u	1	B	Subsystem/Subsystem Unit														
2	s	2		Length														
		X		Filename of sender														
		X+1																
3	s	N		Length														
				Filename of receiver														

**Table: 5-30: Send file command parameters**

The overall number of words used for all parameters may not exceed 34 words, i.e. N must be equal or less 34.

*Note: The filename length also depends on the file system that is selected, see AD 2.*

### 5.2.5.3 Copy File

The Copy File command copies a file locally.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0503
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-31: Copy file process command properties**

The command has two parameters:

1. Alphanumeric: Full filename of the source file (including drive and path)  
Check: Size from 1 to maximum length according to selected file system
2. Alphanumeric: Full filename of the destination filename (including drive and path)  
Check: Size from 1 to maximum length according to selected file system

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	s	1	Length Source Filename															
		X																
		X+1																
2	s	X+1	Length Destination Filename															
		X																
		N																

**Table: 5-32: Copy file command parameters**

The overall number of words used for all parameters may not exceed 34 words, i.e. N must be equal or less 34.

*Note: The filename length also depends on the file system that is selected, see AD 2.*

#### 5.2.5.4 Delete File

The Delete File command deletes a file.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0504
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-33: Delete file process command properties**

The command has one parameter:

1. Alphanumeric: Full filename of the source file (including drive and path)  
Check: Size from 1 to maximum length according to selected file system

Param #	Type	<div>Bit #</div> <div>Word #</div>	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
			S															S
1	s	1	<div>Length</div> <div>Source Filename</div>															
		X																

**Table: 5-34: Delete file command parameters**

The overall number of words may not exceed 34 words, i.e. X must be equal or less 34.

*Note: The filename length also depends on the file system that is selected, see AD 2.*

#### 5.2.5.5 Rename File/Directory

The Rename File/Directory command renames a file or directory locally.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0505
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-35: Rename file/directory process command properties**



The command has two parameters:

1. Alphanumeric: Full filename of the source file (including drive and path) or directory name  
Check: Size from 1 to maximum length according to selected file system
2. Alphanumeric: Full filename of the destination filename (including drive and path) or directory name  
Check: Size from 1 to maximum length according to selected file system

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	s	1	Length Old Name															
		X																
		X+1																
2	s	X+1	Length New Name															
		N																

**Table: 5-36: Rename file/directory command parameters**

The overall number of words used for all parameters may not exceed 34 words, i.e. N must be equal or less 34.

*Note: The filename length also depends on the file system that is selected, see AD 2.*

### 5.2.5.6 List Directory

The List Directory Command generates a Directory Listing of the current working directory.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0506
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Directory Listing	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-37: List directory process command properties**

### 5.2.5.7 Change Directory

The Change Directory command changes the current working directory to the directory given in the command.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0507
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-38: Change directory process command properties**

The command has one parameter:

1. Alphanumeric: Directory name (including drive and path)  
Check: Size from 1 to 200

Param #	Type	<div>Bit # Word #</div>	M															L
			S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	S
1	s	1	Length Directory Name															
		X																

**Table: 5-39: Change directory command parameters**

The overall number of words used may not exceed 34 words, i.e. X must be equal or less 34.

*Note: The filename length also depends on the file system that is selected, see AD 2.*

### 5.2.5.8 Make Directory

The Make Directory command generates a new directory.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0508
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-40: Make directory process command properties**

The command has one parameter:

1. Alphanumeric: Directory name (including drive and path)  
Check: Size from 1 to 200

Param #	Type	<div>Bit # Word #</div>	M															L
			S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	S
1	s	1	Length Directory Name															
		X	B															

**Table: 5-41: Make directory command parameters**

The overall number of words used may not exceed 34 words, i.e. X must be equal or less 34.

*Note: The filename length also depends on the file system that is selected, see AD 2.*

### 5.2.5.9 Remove Directory

The Remove Directory command deletes the selected directory.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0509
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-42: Remove directory process command properties**

The command has one parameter:

1. Alphanumeric: Directory name (including drive and path)  
Check: Size from 1 to 200

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	s	1	Length Directory Name															
		X																

**Table: 5-43: Remove directory command parameters**

The overall number of words used may not exceed 34 words, i.e. X must be equal or less 34.

*Note: The filename length also depends on the file system that is selected, see AD 2.*



#### 5.2.5.10 Cancel File Transfer

The CANCEL File Transfer command stops a file transfer.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x050A
Allowed as time tagged command	No
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-44: Cancel file transfer process command properties**

The command has one parameter:

1. Double word: The parameter is a long unsigned. It is the coarse start time of the file transfer to be cancelled.

Param #	Type	<div>Bit #</div> <div>Word #</div>	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
			S															S
			B															B
1	lu	1	File transfer start coarse time (High Word (#1))															
		2	File transfer start coarse time (Low Word (#2))															

**Table: 5-45: Cancel file transfer command parameters**

### 5.3 Partially standardized telecommands

#### 5.3.1 Memory Management

Group Identifier	0x06
Use	Memory Management

##### 5.3.1.1 Patch

This command is used to write data to dedicated memory areas. Code and tables shall be protected. The command shall implement to states:

- Patch to predefined safe memory areas
- Patch to any memory area, this shall be possible only by disabling the protection

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0601
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	No
Test Mode	Yes
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
Columbus MTL	No
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-46: Patch command properties**

Parameters to be defined by the SM-Developer

Param #	Type	<div>Bit #</div> <div>Word #</div>	<div>M</div> <div>S</div> <div>B</div>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	<div>L</div> <div>S</div> <div>B</div>
1		1																
2		2																

**Table: 5-47: Patch command parameters**

### 5.3.1.2 Dump

This command is used to dump data from memory areas.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0602
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
Columbus MTL	No
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Dump Report	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-48: Dump command properties**

Parameters to be defined by the SM-Developer

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1		1																
2		2																

**Table: 5-49: Dump command parameters**

### 5.3.2 Selftests and Monitoring

Group Identifier	0x07
Use	Health and Status Data Management

#### 5.3.2.1 Selftest

This command is used to initialize selftests.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0701
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	No
Nominal Mode	No
Test Mode	Yes
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
Columbus MTL	No
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Selftest Status	
Related Reports	
Selftest report	
Units	
SM Unit 1	Yes/No
SM Unit 1	Yes/No

**Table: 5-50: Selftest command properties**

Parameters to be defined by the SM-Developer

Param #	Type	<div>Bit #</div> <div>Word #</div>	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1		1																
2		2																

**Table 5-51: Selftest command parameters**

*Note: Selftest identifier and their names are defined in Section 10.*

|

### 5.3.2.2 Generate monitoring reference table report

The command generates the monitoring reference table report.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0702
Allowed as time tagged command	Yes
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	Yes
USOC	Yes
Columbus MTL	No
FCC	Yes
SMSC	Yes
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
Monitoring reference table report	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

**Table: 5-52: Generate monitoring reference table command properties**

Parameters to be defined by the SM-Developer

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1		1																
2		2																

**Table: 5-53: Generate monitoring reference table command parameters**



## 5.4 Science Module unique telecommands

### 5.4.1 Power Management

Group Identifier	0x08
Use	Power Management

### 5.4.2 Set-up

Group Identifier	0x09
Use	Set-up Management

Further groups are TBD by SM-Developer.

## 5.5 Telecommands for Test Support

The implementation of Telecommands for test support is an option.

### 5.5.1 Closed Loop Tests

Group Identifier	0x0F
Use	Test Support

#### 5.5.1.1 Echo TC

The TC Echo command can be used for closed loop tests. The implementation by a Science Module is an option. The LTU supports the generation of the command and the processing of the corresponding response for different EPM subsystems and subsystem units. The command generates a TC Echo Packet. The application data of the TC Echo Packet are the telecommand itself.

ESID	ASSIGNED DURING SM INTEGRATION
Command ID	0x0F01
Allowed as time tagged command	Yes
Modes	
Check-out	No
Setup Mode	No
Nominal Mode	No
Test Mode	Yes
Wait-On-Sync	No
Command Sources	
Columbus CC	No
FRC	No
USOC	No
Columbus MTL	No
FCC	No
SMSC	No
LTU	Yes
HRF	No
Changed housekeeping data	
Related Reports	
TC Echo Packet	
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No

Table 5-54: TC Echo command properties

Command parameters are of type: byte array (format identification b). Thus the length of the command can vary.

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## 6. TELEMETRY

The Carrier DMS will add the CCSDS header to any telemetry that is sent over the medium rate data link (LAN) to Columbus. The same format shall be used for the application data of the high rate data link.

### 6.1 EPM Application Layer Telemetry Structure

The telemetry format is given in AD2.

|

## 6.2 Completely standardized telemetry

Telemetry is called completely standardized if a CLSW service decodes the data for crew display or a SMSC service processes the data.

### 6.2.1 General purpose Telemetry

Group Identifier	0x01
Use	General purpose

#### 6.2.1.1 Plain text packet

The plain text telemetry package contains ASCII code text.

ESID	ASSIGNED DURING SM INTEGRATION
Telemetry ID	0x0101
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	Yes
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No
Display	CLSW Plain Text Display

**Table 6-1: Plain text Report properties**

The data structure is:

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	s	1	Length Text															
		2																
		n																

**Table 6-2: Plain text Report parameters**

If the transferred text does not fill up the packet to 4 byte aligned structure, the structure shall be filled with spare bytes as described in Section 4.4.

## 6.2.2 Time Handling

Group Identifier	0x02
Use	Time Management

### 6.2.2.1 Time Status Report

The Time Status report is used to check the synchronization in EPM that is based on a time pulse. The time pulse is generated each second. The report does not contain any application data. The report shall be generated in the test mode upon activation by command, only. The Science Module shall generate the report after receipt of each time pulse or if the pulse is not available after each second increment. This shall be done by software with high accuracy.

The Time Status Report shall be sent to the CLSW on the LTU via LAN.

The SMSC also generates a report after each time pulse. The LTU receives the packet and compares the time of the TM header with the time of its own packet and calculates the time difference between both time stamps of the packets.

ESID	ASSIGNED DURING SM INTEGRATION
Telemetry ID	0x0201
Modes	
Check-out	No
Setup Mode	No
Nominal Mode	No
Test Mode	Yes
Wait-On-Sync	No
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No
Display	None

**Table 6-3: Time Report properties**

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### 6.2.3 System and Resource Management

Group Identifier	0x03
Use	System and Resource Management

#### 6.2.3.1 Bulk housekeeping data report

ESID	ASSIGNED DURING SM INTEGRATION
Telemetry ID	0x0301
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	Yes
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No
Display	CLSW HK-Display

**Table 6-4: Bulk housekeeping data report properties**

The general structure of the user words is:

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	u	1	Number of Housekeeping Data Values															
2	u	2	Word position of HK Value Check Status List (X)															
3	u	3	Not used															
4	u	4	Not used															
5	u	5	HK-Value 1:								Current Mode							
6	u		HK-Value 2:								Next Mode							
7	u		HK-Value 3:								Timer Status							
8	u		HK-Value 4:								Corrective Action Enable/disable							
9	u		HK-Value 5:								File Transfer Status							
	u	X	HK Value Check Status for HK-Value 1 and Value 2															
	u	X+1	HK Value Check Status for HK-Value 3 and Value 4															
		n	Spare Word or octets (set to 0x16)															

*In packet but not included in Qinetiq description.*

*Already included in Qinetiq description of GRIP HK data.*

*Additional bytes that come after GRIP HK data.*

**Table 6-5: General structure of the user words of the bulk housekeeping data report**

Housekeeping Data Parameter type and positions shall be taken from Chapter 8.  
Spare octets are set to 0x16.

The housekeeping value check status is an octet that codes the runtime check results. It is used to regulate the displays on the MMI, e.g. color change in case of non-nominal values.

Note: HK checks are applied to HK-Value/Mask combination. E.g., checks of individual bits of status registers are supported. In this case the entire register is placed into the Bulk Housekeeping Data Report Telemetry Packet but several checks can be applied to the register.

Different checks can be applied for different operational modes. The mode information in the header of the telemetry packet indicates the operational mode at the time the packet has been generated. The housekeeping value check status is not affected, if a mode change has occurred between the HK-data set provision and the packet generation.

Bit #	Value	Bit Set	Bit Not Set
7 (LSB)	HK Check Status	At least one check has failed	All checks successful
6	Warning	Report as warning	No warning report
5	Error	Report as error	No error report
4	Message Generation	Enabled	Disabled
3	Compare Check	Compare Check has failed	Ok
2	Minimum	Minimum check failed	Ok
1	Maximum	Maximum check failed	Ok
0 (MSB)	Data Validity	Data Valid	Data Invalid

**Table 6-6: Housekeeping Value Check Status**

The housekeeping check status list is part of each housekeeping data report.

The Data Validity can be used to signal that data are timeout (no new data available) or not acquired in the current operational mode.

For a minimum violation of an valid analogue value that has been reported as warning, where message generation is still active the housekeeping value check status is 10101011/b.

#### 6.2.4 File transfer

Group Identifier	0x04
Use	File Transfer Management

File transfer is described in detail in AD2.

##### 6.2.4.1 File packet

ESID	ASSIGNED DURING SM INTEGRATION
Telemetry ID	0x0401
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No
Display	None

**Table 6-7: File packet report properties**



The general structure of the user words is:

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	u	1	Seq. Flag															
2	u	2	Secondary Header Sequence Counter															
3	u	3	Length of file data															
4	u	4	Spare = 0															
5	lu	5	File Size															
		6																
6	lu	7	File Transfer Start Coarse Time															
		8																
7			File Data															

**Table 6-8: General structure of a file packet**

The first packet of a file transfer contains the file names for source and destination. The packet is called File Transfer Init Packet. Its structure is:

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	u	1	Seq. Flag = 1															
2	u	2	Secondary Header Sequence Counter = 0															
3	u	3	Length of file data = 0															
4	u	4	Spare = 0															
5	lu	5	File Size															
		6																
6	lu	7	File Transfer Start Coarse Time															
		8																
7	String	9	Source File Name (NULL terminated with fill bytes)															
		X																
8	String	X+1	Destination File Name (NULL terminated with fill bytes)															
		N																

**Table 6-9: File Transfer Init Packet**

The last packet of a file transfer is called File Transfer Completion packet. It does not contain any file data. Its format is:

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	u	1	Seq. Flag = 2															
2	u	2	Secondary Header Sequence Counter = Number of packets															
3	u	3	Length of file data = 0															
4	u	4	Spare = 0															
5	lu	5	File Size															
		6																
6	lu	7	File Transfer Start Coarse Time															
		8																

**Table 6-10: File Transfer Completion Packet**

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#### 6.2.4.2 Directory Listing

ESID	ASSIGNED DURING SM INTEGRATION
Telemetry ID	0x0402
Modes	
Check-out	No
Setup Mode	Yes
Nominal Mode	No
Test Mode	No
Wait-On-Sync	No
Units	
SM Unit 1	Yes/No
SM Unit 2	Yes/No
Display	None

**Table 6-11: Directory Listing report properties**

Param #	Type	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
1	u	1		Seq. Flag														
2	u	2		Secondary Header Sequence Counter														
3	String	3		Current Working Directory Name (NULL terminated with fill bytes)														
		..																
		103																
4	u	104		0x1616														
5	Dir Item	105		Directory Item # 1														
		126																
..																		
X+5	Dir Item	22*x+104		Directory Item # X														
		22*x+104																

**Table 6-12: Directory Listing Packet**

A Directory Listing TM-packet can contain a maximum of 24 Directory Item Structures.  
The Directory Item Structure is:

Field ID	Bit #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
	Word #																
Dir. Item	1	Item Name (NULL terminated with fill bytes)															
	2																
	..																
	..																
	..																
	16	Item Size															
	17																
	18																
	19	Last Change Coarse Time															
	20																
	21																
	22	Item Attribute															

**Table 6-13: Directory Item Structure**

## 6.3 Partially standardized telemetry

### 6.3.1 Memory Management

Group Identifier	0x05
Use	Memory Management

#### 6.3.1.1 Dump Report

ESID	ASSIGNED DURING SM INTEGRATION
Telemetry ID	0x0501
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	No
Units	
SM Unit 1	Yes/No
SM Unit 1	Yes/No
Display	SM Display

**Table 6-14: Dump report properties**

Parameters to be defined by the SM-Developer

### 6.3.2 Selftests and Monitoring

Group Identifier	0x06
Use	Health and Status Data Management

#### 6.3.2.1 Selftest report

ESID	ASSIGNED DURING SM INTEGRATION
Telemetry ID	0x0601
Modes	
Check-out	Yes
Setup Mode	No
Nominal Mode	No
Test Mode	Yes
Wait-On-Sync	No
Units	
SM Unit 1	Yes/No
SM Unit 1	Yes/No
Display	SM Display

**Table 6-15: Selftest report properties**

Parameters to be defined by the SM-Developer

### 6.3.2.2 Monitoring reference table report

ESID	ASSIGNED DURING SM INTEGRATION
Telemetry ID	0x0602
Modes	
Check-out	Yes
Setup Mode	Yes
Nominal Mode	Yes
Test Mode	Yes
Wait-On-Sync	No
Units	
SM Unit 1	Yes/No
SM Unit 1	Yes/No
Display	SM Display

**Table 6-16: Selftest report properties**

Parameters to be defined by the SM-Developer

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## 6.4 Science Module unique telemetry

Further groups are TBD by SM-Developer.



## 6.5 Telemetry for Test Support

The implementation of Telecommands for test support is an option.

### 6.5.1 Closed Loop Tests

Group Identifier	0x0F
Use	Test Support

#### 6.5.1.1 TC Echo Packet

The TC Echo Packet has TM group identifier 0x0F. It is generated if a Echo TC command is received. The Telemetry ID is 0x0F01. The user words are a complete copy of the telecommand itself.

ESID	ASSIGNED DURING SM INTEGRATION
Telemetry ID	0x0F01
Modes	
Check-out	No
Setup Mode	No
Nominal Mode	No
Test Mode	Yes
Wait-On-Sync	No
Units	
SM Unit 1	Yes/No
SM Unit 1	Yes/No
Display	CLSW Closed Loop Dialog

**Table 6-17: TC Echo Packet properties**

The application data is the complete copy of the Echo TC command that initiates the generation of the packet.

## 7. MESSAGES

### 7.1 EPM Message Structure

The message format is given in AD2.

### 7.2 Completely standardized messages

#### 7.2.1 Mode Control

Group Identifier	0x01
Use	Mode Management

##### 7.2.1.1 Mode Change Message

Each change of an operational mode shall be documented by a mode change message the mode change message format is given in Table 7-1

Field ID	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
EPM Msg. Head.	1	Message Type =5								EPM Subsystem-ID							
	2	Message Identifier															
	3	EPM Subsystem Unit Message Counter															
	4	EPM Subsystem Unit ID								SW Task ID							
	5	EPM Coarse Time (High Word (#1))															
	6	EPM Coarse Time (Low Word (#2))															
	7	EPM Fine Time															
	8	Spare 1															
EPM Msg Data	9	Previous Mode								Current Mode							
	10	Not used															
	11																
	12																
	13																
	14																

**Table 7-1: EPM Mode Change Message Format**

The message identifier is 0x0101 for this message.

Previous Mode and Current mode are inserted by the application.

The mode change message is generated if the new mode is reached. The mode transition is indicated in the housekeeping data packet.

## 7.2.2 Monitoring

Group Identifier	0x02
Use	Monitoring

### 7.2.2.1 Software Errors

The control of the Software itself for valid entries in tables and valid code shall be performed for any access to a table and code shall be protected by a checksum. Furthermore a SW watchdog shall control each task.

These messages contain the Software Module Name of the Module that generates the message. The file extension is omitted. If the filename (without extension) is less than 10 character the unused characters shall be set to blank.

In case of invalid entries the following software message shall be generated:

Field ID	Bit #	M															L
	Word #	S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	S
EPM Msg. Head.	1	B	Message Type = 3							EPM Subsystem-ID							
	2	Message Identifier															
	3	EPM Subsystem Unit Message Counter															
	4	EPM Subsystem Unit ID							SW Task ID								
	5	EPM Coarse Time (High Word (#1))															
	6	EPM Coarse Time (Low Word (#2))															
	7	EPM Fine Time															
	8	Spare 1															
EPM Msg Data	9	Software Module Name (ASCII)															
	10																
	11																
	12																
	13																
	14	Line Number															

**Table 7-2: EPM Message Format for software errors**

The predefined message identifiers for SM's are listed in Table 7-3.

Message Identifier	Description	Name	Corrective Action	Display
0x0201	Fatal software error, or code or table cannot be used	Fatal SW Error	Self reset of the computer	CLSW Msg Display

**Table 7-3 Predefined message identifier for software errors checks**

In case of watchdog timeout the following software message shall be generated:

Field ID	Bit #	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
	Word #	S	B														S
EPM Msg. Head.	1	Message Type = 3								EPM Subsystem-ID							
	2	Message Identifier															
	3	EPM Subsystem Unit Message Counter															
	4	EPM Subsystem Unit ID								SW Task ID							
	5	EPM Coarse Time (High Word (#1))															
	6	EPM Coarse Time (Low Word (#2))															
	7	EPM Fine Time															
	8	Spare 1															
EPM Msg Data	9	Software Module Name (ASCII) of supervising task															
	10																
	11																
	12																
	13																
	14	Task ID of non-responding task															

**Table 7-4: EPM Message Format for software errors**

The predefined message identifiers for SM's are listed in Table 7-5.

Message Identifier	Description	Name	Corrective Action	Display
0x0202	Watchdog timeout by a specific task	SW Watchdog timeout	Self reset of the computer	CLSW Msg Display

Table 7-5 Predefined message identifier for watchdog checks

### 7.2.2.2 HK/Status Out of limit message

If an out-of limit situation is detected the following message format shall be used.

Field ID	Bit #	M															L
	Word #	S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	S
EPM Msg. Head.	1	B	Message Type							EPM Subsystem-ID							
	2		Message Identifier														
	3		EPM Subsystem Unit Message Counter														
	4		EPM Subsystem Unit ID							SW Task ID							
	5		EPM Coarse Time (High Word (#1))														
	6		EPM Coarse Time (Low Word (#2))														
	7		EPM Fine Time														
	8		Spare 1														
EPM Msg Data	9		Current HK/status value														
	10																
	11																
	12																
	13		HK/status value identifier														
	14		Check instruction identifier														

**Table 7-6: EPM Message Format for OOL messages**

The MSB of the inserted current HK value is the MSB of word 9. E.g. a unsigned will be inserted in word 9, a long unsigned in words 9 and 10. Unused words are set to 0x1616.

The message type shall be:

Warning: 2 as long as the violation is uncritical

Error : 3 if the violation becomes critical

Info: 1 if a value leaves an OOL condition and normal operation is re-established

The SM's also uses the message for resource violations.

The predefined message identifiers for SM's are listed in Table 7-7.

Message Identifier	Description	Name	Corrective Action	Display
0x0203	HK value is lower than lowest limit	HK too low	-	CLSW Msg Display
0x0204	HK value is higher than highest limit	HK too high	-	CLSW Msg Display
0x0205	Resource allocation violation of the thermal budget of external devices	Thermal budget	SM deactivation	CLSW Msg Display
0x0206	Resource allocation violation of the LAN application data rate budget	LAN Rate budget	Stop TM on LAN	CLSW Msg Display
0x0207	Resource allocation violation of the HRD application data rate budget	HRD Rate budget	Stop TM on HRD	CLSW Msg Display
0x0208	Status value is not nominal	Status not nominal	-	CLSW Msg Display

**Table 7-7 Predefined message identifier for HK checks**

SM developer can define individual message identifier for each SM specific check.

### 7.2.3 System and Resource Management

Group Identifier	0x03
Use	System and Resource Management

#### 7.2.3.1 Configuration change message

The configuration change message format is shown in Table 7-8.

Field ID	Bit #	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L	
	Word #	S															S	
EPM Msg. Head.	1	B	Message Type = 4							EPM Subsystem-ID							B	
	2		Message Identifier															
	3		EPM Subsystem Unit Message Counter															
	4		EPM Subsystem Unit ID							SW Task ID								
	5		EPM Coarse Time (High Word (#1))															
	6		EPM Coarse Time (Low Word (#2))															
	7		EPM Fine Time															
	8		Spare 1															
EPM Msg Data	9		Previous Configuration ID															
	10		Current Configuration ID															
	11		Not used															
	12																	
	13																	
	14																	

**Table 7-8: EPM Configuration Change Message Format**

The coding of configuration ID's is TBD.

The message identifier is 0x0301.

### 7.2.3.2 Communication Status Message

The communication status message format is shown in Table 7-9.

Field ID	Bit #	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
	Word #	S B															S B
EPM Msg. Head.	1	Message Type=1 or 2								EPM Subsystem-ID							
	2	Message Identifier															
	3	EPM Subsystem Unit Message Counter															
	4	EPM Subsystem Unit ID								SW Task ID							
	5	EPM Coarse Time (High Word (#1))															
	6	EPM Coarse Time (Low Word (#2))															
	7	EPM Fine Time															
	8	Spare 1															
EPM Msg Data	9	Connected EPM Subsystem-ID								Connected EPM Subsystem Unit ID							
	10	Connection Type								Not used							
	11	Not used															
	12																
	13																
	14																

**Table 7-9: EPM Communication Status Message**

The connection type shall be coded in a one byte:

- Ethernet LAN (external)      0x01
- Ethernet TCP/IP internal      0x02
- RS-485 Main      0x51
- RS-485 Redundant      0x52
- RS-422      0x21
- RS-422 Time Sync      0x22
- USB      0x31

Table 7-10 provides a list of predefined SM procedure status messages.

Message Identifier	Description	Name	Message Type	Display
0x0301	Communication started	Communication Start	1	CLSW Msg Display
0x0302	Communication terminated nominally	Communication Stop	1	CLSW Msg Display
0x0303	Communication aborted	Communication aborted	2	CLSW Msg Display

**Table 7-10 Predefined message identifier for communication status**



## 7.2.4 Procedure control

Group Identifier	0x04
Use	Procedure Control

### 7.2.4.1 SM process Status Message

Table 7-11 shows the format for the SM process Start/stop/abort message.

Field ID	Bit #	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
	Word #	S															S
EPM Msg. Head.	1	Message Type=1 or 2								EPM Subsystem-ID							
	2	Message Identifier															
	3	EPM Subsystem Unit Message Counter															
	4	EPM Subsystem Unit ID								SW Task ID							
	5	EPM Coarse Time (High Word (#1))															
	6	EPM Coarse Time (Low Word (#2))															
	7	EPM Fine Time															
	8	Spare 1															
EPM Msg Data	9	SM Process ID															
	10	Not used															
	11																
	12																
	13																
	14																

**Table 7-11: EPM SM Process Execution Message**

The SM Process Identifier shall be coded in a word.

Table 7-12 provides a list of predefined SM procedure status messages.

Message Identifier	Description	Name	Message Type	Display
0x0401	SM process started	SM Proc. Start	1	CLSW Msg Display
0x0402	SM process terminated nominally	SM Proc. Stop	1	CLSW Msg Display
0x0403	SM process aborted	SM Proc. Aborted	2	CLSW Msg Display

**Table 7-12 Predefined message identifier for SM process status**

## 7.2.5 Command Execution

Group Identifier	0x05
Use	Command Execution Verification

### 7.2.5.1 Command execution message

The fields of the EPM Message header are filled like for any message in EPM. The message type for command execution messages is 6 and the message identifier indicates whether the command has been successfully executed or has been rejected.

The command execution message is always generated by the command interpreter after command execution or as command rejection messages by tasks that transfer commands but do not succeed in transferring in a predefined time. Table 7-13 provides an overview of the command execution message structure.

Field ID	Bit #	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L
	Word #	S															S
EPM Msg. Head.	1	Message Type=6								EPM Subsystem-ID							
	2	Message Identifier															
	3	EPM Subsystem Unit Message Counter															
	4	EPM Subsystem Unit ID								SW Task ID							
	5	EPM Coarse Time (High Word (#1))															
	6	EPM Coarse Time (Low Word (#2))															
	7	EPM Fine Time															
	8	Spare 1															
EPM Msg Data	9	Command Source								EPM TC Subsystem-ID							
	10	EPM TC Sequence Counter															
	11	EPM Procedure ID															
	12	EPM Procedure Sequence Counter															
	13	EPM Command ID															
	14	0 or Message identifier of Command check violation (Tab. 7-15)															

**Table 7-13: EPM Message Format for command execution message**

The Command Source, the EPM Subsystem-ID, the TC sequence counter, the procedure ID, the procedure sequence counter and the command ID are copies from the telecommand under analysis. The EPM TC Subsystem-ID is the addressee of the telecommand; the EPM Subsystem-ID in the message header specifies the generator/sender of the message. This can be the Carrier DMS if it cannot transfer a telecommand to the addressed system.

The message identifier gives the Execution/Rejection Status. Values are:

- Execution successful      0x0500
- Command rejected      0x05FF

The command check violation identifier is the identifier of the corresponding command check violation message that is generated if a command check fails or 0 if the command has been executed properly.

### 7.2.5.2 Command check violation

The fields of the EPM Message header are filled like for any message in EPM. The message type is 2, thus these are warning messages.

In case of invalid fields or parameters a standard EPM message will document which field/parameter has an invalid value.

Field ID	Bit #	M															L
	Word #	S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	S
EPM Msg. Head.	1	Message Type=2								EPM Subsystem-ID							
	2	Message Identifier															
	3	EPM Subsystem Unit Message Counter															
	4	EPM Subsystem Unit ID								SW Task ID							
	5	EPM Coarse Time (High Word (#1))															
	6	EPM Coarse Time (Low Word (#2))															
	7	EPM Fine Time															
	8	Spare 1															
EPM Msg Data	9	Command Source								EPM TC Subsystem-ID							
	10	EPM TC Sequence Counter															
	11	EPM Procedure ID															
	12	EPM Procedure Sequence Counter															
	13	EPM Command ID															
	14	Field/Parameter Number															

**Table 7-14: EPM Message Format for command check violation**

The Command Source, the EPM Subsystem-ID, the TC sequence counter, the procedure ID, the procedure sequence counter and the command ID are copies from the telecommand under analysis.

The EPM TC Subsystem-ID is the addressee of the telecommand; the EPM Subsystem-ID in the message header specifies the generator of the message. This can be the Carrier DMS if it detects an invalid synchronization marker, an invalid length or an invalid check sum.

The field/parameter number identifies the field/parameter where a failure is detected. This is:

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- 1 for command source
- 2 for EPM Subsystem-ID
- 3 for time tag
- 4 for time of the time tag already expired
- 5 for EPM Subsystem Unit-ID
- 6 for TC sequence violation (only Carrier DMS)
- 7 for TC procedure sequence violation (only Carrier DMS)
- 8 for Command Identifier
- 9 for EPM Check Sum Flag
- 10 for EPM Check Sum
- 11 Command priority
- 13 for CCSDS Check sum (only Carrier DMS)
- 14 for CCSDS packet length (only Carrier DMS)
- 15 for Number of valid user bytes
- 16 for synchronization marker
- 17 for operational mode admission
- 25 + n for the (n-1) telecommand parameter

Dedicated SM message identifiers are used for checks that can only be performed during run time and individual checks. The messages identifiers for standard checks are defined by EPM. The predefined message identifiers for EPM are listed in Table 7-15.

Message Identifier	Possible Field/Param. #	Description	Name	Corrective Action	Display
0x0501	17	TC not allowed in current mode	Invalid Mode	-	CLSW Msg Display
0x0502	3	TC not allowed as time tagged TC	TT violation	-	CLSW Msg Display
0x0503	15	Invalid length of TC	Invalid length	-	CLSW Msg Display
0x0504	8	TC does not exist	Unknown identifier	-	CLSW Msg Display
0x0505	>= 25	Parameter range out of limits	Range check	-	CLSW Msg Display
0x0506	>= 25	Parameter is not in the selection list	Selection check	-	CLSW Msg Display
0x0507	9 or 11	Header field invalid	Header Check	-	CLSW Msg Display
0x0508	8	No memory available for requested report	SP memory	-	CLSW Msg Display
0x0509	10	The check sum is not correct	Check sum	-	CLSW Msg Display
0x050A	16	The synchronization marker is not correct	Sync marker	-	CLSW Msg Display
0x050B	1	The TC is not allowed from this command source	Command Source	-	CLSW Msg Display
0x050C		Deleted			
0x050D	2	Illegal Subsystem ID	Illegal Subsystem ID		CLSW Msg Display
0x050E	5	Illegal Subsystem Unit ID	Illegal Subsystem Unit ID	-	CLSW Msg Display
0x050F	2 or 5	Transfer to next node failed	Transfer failed	-	CLSW Msg Display
0x0510	4	Time tag time is in the past	Predefined Time Invalid	-	CLSW Msg Display
0x0511	3	Scheduler is full	Schedule overload	-	CLSW Msg Display
0x0512	6 or 7	Command Sequence is corrupted	Sequence corrupted	-	CLSW Msg Display
0x0513	8	Command not allowed in current mode transition	Mode transition	-	CLSW Msg Display
0x0514	>= 25	Item does not exist	Item existence	-	CLSW Msg Display
0x0550 – 0x05EF	SM defined	SM unique messages	SM defined	-	CLSW Msg Display

**Table 7-15 Predefined message identifier for command checks**

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The “Mode Transition” violation is used for commands that cannot be executed in the transition between current mode and next mode. This is the case if a subsystem unit is deactivated during mode transition. E.g. if a Windows PC is shutdown during mode transition from NOMINAL to CHECK-OUT, then all commands to the PC are not executed although the current mode is still NOMINAL.

The “Item Existence” violation can happen in the frame of execution of file management commands , if a file, directory or device does not exist, or in the frame of execution of SM process or self test commands, if the ID does not exist.

The checks on existence of file items is only performed on sender side for file management commands.

The range from 0x0550 to 0x05EF is reserved for SM unique messages. This can be specific runtime checks, e.g. a power switch command execution is refused due to exceed of total power budget although all parameter passed successful the static command checks.

## 7.2.6 File transfer control

Group Identifier	0x06
Use	File Transfer Control

### 7.2.6.1 File Transfer Status Message

Table 7-16 shows the format for the File transfer Start/stop/abort/timeout message.

Field ID	Bit # Word #	M S B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	L S B
EPM Msg. Head.	1	Message Type=1 or 2								EPM Subsystem-ID							
	2	Message Identifier															
	3	EPM Subsystem Unit Message Counter															
	4	EPM Subsystem Unit ID								SW Task ID							
	5	EPM Coarse Time (High Word (#1))															
	6	EPM Coarse Time (Low Word (#2))															
	7	EPM Fine Time															
	8	Spare 1															
EPM Msg Data	9	Sender Subsystem-ID								Sender Subsystem Unit ID							
	10	Receiver Subsystem-ID								Receiver Subsystem Unit ID							
	11	File Transfer Start Coarse Time (from Sender)															
	12																
	13	0x1616															
	14	0x1616															

**Table 7-16: EPM File Transfer Status Message**

Table 7-17 provides a list of predefined File Transfer Status messages.

Message Identifier	Description	Name	Message Type	Display
0x0601	File Transfer started	File Transfer Start	1	CLSW Msg Display
0x0602	File Transfer terminated nominally	File Transfer. Stop	1	CLSW Msg Display
0x0603	File Transfer aborted	File Transfer. Aborted	2	CLSW Msg Display
0x0604	File Receive timeout message	File Receive Timeout	2	CLSW Msg Display
0x0605	File does not exist	File existence	2	CLSW Msg Display
0x0606	Directory does not exist	Directory existence	2	CLSW Msg Display
0x0607	Device does not exist	Device existence	2	CLSW Msg Display

**Table 7-17 Predefined message identifier for File Transfer status**



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### 7.3 Partially standardized messages

Reserved.

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## 7.4 Science Module unique messages

Further groups are TBD by SM-Developer.

## 8. HOUSEKEEPING AND STATUS DATA

The HK-Values Number as described in the HK-Data report Section 6.2.3.1 is used to identify the HK-values in this section. The type can be status or analogue measurement.

### 8.1 Completely standardized housekeeping data

The byte position 0 refers to the first byte of Word 5 in the bulk housekeeping data report (Section 6.2.3.1).

#### 8.1.1 Mode Control

Group Identifier	0x01
Use	Mode Management

##### 8.1.1.1 Current Mode

Housekeeping value ID	0x0101
Type	status
Format	u
Engineering Unit	-
Units	
HK-Value Number SM Unit 1	1
HK-Value Number SM Unit 2	1

**Table 8-1: Current Mode Status properties**

The mode coding is described in AD2.

##### 8.1.1.2 Next Mode

Housekeeping value ID	0x0102
Type	status
Format	u
Engineering Unit	-
Units	
HK-Value Number SM Unit 1	2
HK-Value Number SM Unit 2	2

**Table 8-2: Next Mode Status properties**

This is the next mode that the system will enter. This is typically the commanded mode or the next mode that is automatically entered due to internal automatisms (e.g. failure reaction or branch after startup.)

### 8.1.2 Time Handling

Group Identifier	0x02
Use	Time Management

#### 8.1.2.1 Timer Status

Housekeeping value ID	0x0201
Type	status
Format	U
Engineering Unit	-
Units	
HK-Value Number SM Unit 1	3
HK-Value Number SM Unit 2	3

**Table 8-3: Timer Status properties**

The coding of the timer status is described AD2.

### 8.1.3 System and Resource Management

Group Identifier	0x03
Use	System and Resource Management

### 8.1.4 Corrective action enable/disable status

The current status of corrective action enable/disable shall be reported in the bulk housekeeping data.

Housekeeping value ID	0x0301
Type	status
Format	u
Engineering Unit	-
Units	
HK-Value Number SM Unit 1	4
HK-Value Number SM Unit 2	4

**Table 8-4: Corrective action enable/disable Status properties**

### 8.1.5 File Transfer Status

Housekeeping value ID	0x0302
Type	status
Format	u
Engineering Unit	-
Units	
HK-Value Number SM Unit 1	5
HK-Value Number SM Unit 2	5

**Table 8-5: File Transfer Status properties**

Values are

- No file transfer                      0x00
- File transfer terminated            0x01
- Currently executed                0x02
- Cancelled                            0x10

#### 8.1.6 Current power consumption of rack-mounted devices

Word: Maximum power consumption for rack-mounted devices in Watt

#### 8.1.7 Current power consumption of external devices

Word: Maximum power consumption for externally devices in Watt

#### 8.1.8 LAN Net Application Data Rate

The LAN Net Application Data Rate shall be coded in one word and transmitted via the critical housekeeping data. It identifies the net application data transfer. The value shall give the net rate in kbit/s measured over the last 5 seconds.

#### 8.1.9 HRD Net Application Data Rate

The HRD Net Application Data Rate shall be coded in one word and transmitted via the critical housekeeping data. It identifies the net application data transfer. The value shall give the net rate in kbit/s measured over the last 5 seconds.

#### 8.1.10 Procedure control

Group Identifier	0x04
Use	Procedure Execution Management

SM current active SM Process Identifier

Values are

- Not executed      0x00
- Execution terminated      0x01
- Currently executed      0x02
- No malfunction detected      0x04
- Malfunction detected      0x08
- Cancelled      0x10



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### 8.2.8 Hk&Status data identification and report table identifier

The file/table identifier of the currently used Hk&Status data identification and report table shall be reported in the bulk housekeeping data packet.

TBD by SM-Developer.

### 8.2.9 Monitoring reference table identifier

The file/table identifier of the currently used Monitoring Reference table shall be reported in the bulk housekeeping data packet.

TBD by SM-Developer.



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### 8.3 Science Module unique housekeeping data

Further groups are TBD by SM-Developer.

## 9. PROCEDURES

The **SM-Developer** specifies the Science Processes and ID's. These SCP's can be called by command.

Science Process	ID of SCP
SCP # 1	
SCP #2	

**Table 9-1: Science Process Identification**

## 10. SELFTESTS

The **SM-Developer** specifies the Selftests and ID's. The selftests can be initialised by command.

Selftest	ID of Selftest
Selftest# 1	
Selftest #2	

**Table 10-1: Selftest Identification**

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## 11. CONFIGURATION FILES

Configuration file layout description will become part of a separate document, since the CLSW, FCC or SMSC process these data.

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## 12.ABBREVIATIONS AND ACRONYMS

ACS	Automatic Command Scripts
AD	Applicable Document
AD	Architectural Design
ADD	Architectural Design Document
ADP	Acceptance Data Package
AIT	Assembly, Integration and Test
AIV	Assembly, Integration and Verification
APM	Attached Pressurized Module
APID	Application Process Identifier
ASW	Application SoftWare
BDC	Baseline Data Collection
BOB	Break-Out Box
BSW	Basic SoftWare
CAM	Commercial, Aviation, and Military (equipment)
CASE	Computer Aided Software Engineering
CARRIER DMS	Carrier Data Management System
CCB	Configuration Control Board
CCI	Crew Command Interface
CCSDS	Consultative Committee on Space Data Systems
CDR	Critical Design Review
CLSW	Carrier control Laptop SoftWare
CM	Configuration Management
COTS	Commercial Of-The-Shelf software
CPAH	Columbus Payload Accommodation Handbook
CSCI	Computer Software Configuration Item
CSV	Comma Separated Value
CPU	Central Processing Unit
DaSS	Data Services System
DD	Detailed Design
DDD	Detailed Design Document
DMS	Data Management System
DRD	Documents Requirements Description
DRL	Document Requirement List
EAC-TM	European Astronaut Centre Training Model
EGSE	Electronic Ground Support Equipment
ESID	EPM Software item IDentifier
ESW	EPM Facility SoftWare

FDIR	Failure Detection, Isolation, and Recovery
FFPT	Full Function and Performance Test
FM	Flight Model
FRC	Facility Responsible Centre
FST	Facility Science Team
GCP	Guided Crew Procedure
GM	Ground Model
GSE	Ground Support Equipment
HK	HouseKeeping data
HRDL	High Rate Data Link
HRF	Human Research Facility
IAP	Interactive Automatic crew Procedure
ICD	Interface Control Document
IDE	Integrated Development Environment
I/F	InterFace
IMS	Inventory Management System
I/O	Input/Output
ISS	International Space Station
JSC	Johnson Space Center
KSC	Kennedy Space Center
LAN	Local Area Network
LOS	Loss Of Signal
LTU	LapTop computer Unit
Mbps	Mega bit Per Second
Mbyte	Mega byte
MI	Mission Increment
MIPS	Million Instructions Per Second
MMI	Man Machine Interface
MTL	Master TimeLine
ODF	Operations Data File
OM	Operation and Maintenance
OOL	Out-Of-Limit
ORU	On-orbit Replaceable Unit
OS	Operating System

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OSTP	Onboard Short-Term Plan
PA	Product Assurance
PC	Portable Computer (Laptop)
P/L	PayLoad
PLSS	PayLoad Software Specification
PUI	Programme Unique Identifier
RD	Reference Document
SCP	SCience Process
SCOE	Special Check-Out Equipment
SDE	Software Development Environment
SFPT	Short Function and Performance Test
SID	Software item IDentifier
SM	Science Module
SMIRD	Science Module Interface Requirements Document
SPLC	Standard Payload Computer
SPOE	Standard Payload Outfitting Equipment
SR	Software Requirements
SRB	Software Review Board
SRD	System Requirements Document
S/S	Sub-System
SW	SoftWare
SwRD	SoftWare Requirements Document
SWRU	SoftWare Replaceable Unit
SWVCD	SoftWare Verification Control Document
TBC	To Be Confirmed
TBD	To Be Defined
TC	TeleCommand
TM	Telemetry
TM/TC	Telemetry and Telecommand
TR	Transition
UDP	Utility Distribution Panel
UHB	User Home Base
UR	User Requirements
USOC	User Support and Operations Center
UTC	Universal Time Correlated
XSM	Extended Science Module