MARS EXPRESS

PLANETARY FOURIER SPECTROMETER

TM_TC INTERFACE
data base

MEX-CNR-FUM 9

FUM 9

DOCUMENT CHANGE RECORD

Iss/rev.	Date	Pages affected	Description
Draft	**28/2/98**	**All**	**First draft**
IRR	**12/4/99**	**ALL**	**IRR DOCUMENT**
IPDR	**30/11/99**	**all**	**Mex.cnr.ipd**
Signature	**5/6/2000**		
EM	**15/2/2001**	**61,63**	***OpCode* replaced by *OperationCode***

FM	**04/12/2001**	**11,18**	**Meaning of DTM 7 and 8 changed**
FM	**04/12/2001**	**17**	**LW size of Autotest (DTM=0) changed**
FM	**04/12/2001**	**17**	**Size of compressed interf. corrected**
FM	**05/12/2001**	**78**	**TC(216,50) added**
FM	**10/01/2002**	**38**	**TC(216,5) parameter 4 removed**
FM	**10/01/2002**	**133**	**A6, A7 Mask_Beta A added**
FM	**10/01/2002**	**134**	**B7 Mask_Beta B added**
FM	**10/01/2002**	**131**	**A6, A7, B7 Mask_Beta A/B added**
FM	**10/01/2002**	**135**	**A6, A7, B7 Mask_Beta A/B added**
FM	**10/01/2002**	**27**	**MEDOC ACRONYM added**
FM	**10/01/2002**	**4**	**TC(216, 28) removed**
FM	**10/01/2002**	**4**	**TC(216, 29) removed**
FM	**10/01/2002**	**4**	**TC(216, 30) removed**
FM	**10/01/2002**	**4**	**TC(216, 31) removed**
FM	**10/01/2002**	**17**	**DTM 1 removed**
FM	**10/01/2002**	**17**	**DTM 3 removed**
FM	**10/01/2002**	**19**	**DTM 15 changed**
FM	**10/01/2002**	**28**	**TC(216, 28) removed**
FM	**10/01/2002**	**28**	**TC(216, 29) removed**
FM	**10/01/2002**	**28**	**TC(216, 30) removed**
FM	**10/01/2002**	**28**	**TC(216, 31) removed**
FM	**10/01/2002**	**37**	**TC(216, 28) removed**
FM	**10/01/2002**	**37**	**TC(216, 29) removed**
FM	**10/01/2002**	**37**	**TC(216, 30) removed**
FM	**10/01/2002**	**37**	**TC(216, 31) removed**
FM	**10/01/2002**	**60**	**TC(216, 28) removed**
FM	**10/01/2002**	**61**	**TC(216, 29) removed**
FM	**10/01/2002**	**62**	**TC(216, 30) removed**
FM	**10/01/2002**	**63**	**TC(216, 31) removed**
FM	**26/02/2002**	**84**	**EVENTS: Column MEDOC added**
FM	**25/06/2002**	**111**	**Event EOB – End of telemetry-block**
FM	**25/06/2002**	**14**	**MH1 Field: “Type of meas.” added**

TABLE OF CONTENT

INTRODUCTION

The Flight Model (FM) of PFS supports all standard services described in SGICD-2. The Cyclogram concept has been abandoned. As a consequence, several Telecommands have been removed. Changes from EM are listed below.

- **Added Event "PFS initialization completed".**
- **Added Event "Timestamp".**
- **Added Failure Code "Wrong length of Application Data Field in Telecommand".**
- **Added Failure Code "Wrong value of Parameter N in Telecommand".**
- **Added Service 6 (Subtypes 2, 5 and 6).**
- **Removed TC(216,1) – related to the Cyclogram.**
- **Removed TC(216,2) – related to the Cyclogram.**
- **Removed TC(216,3) – related to the Cyclogram.**
- **Removed TC(216,4) – related to the Cyclogram.**
- **Removed TC(216,6) – related to the Cyclogram.**
- **Removed TC(216,7) – related to the Cyclogram.**
- **Removed TC(216,8) – related to the Cyclogram.**
- **Removed TC(216,9) – related to the Cyclogram.**
- **Removed TC(216,35) – too common, new added Telecommands should be used.**
- **Changed TC(216,5) – changed meaning of the parameter.**
- **Changed TC(216,18) – changed length of one parameter.**
- **Changed TC(216,33) - added new parameter.**
- **Added TC(216,45).**
- **Added TC(216,46).**
- **Added TC(216,47).**
- **Added TC(216,48).**
- **Added TC(216,49).**
- **Added TC(215,100).**
- **Added TC(216,101).**
- **Added TC(216,102).**
- **Added TC(216,200).**
- **Added TC(216,205).**
- **Added TC(255,1).**
- **Changed some fields of MH1, MH2 and MH3.**
- **Changed some fields of HK Report. The HK Report size increased.**
- **Changed meaning of Data Transmission Modes 7 and 8.**
- **Corrected size of LW area of Autotest (DTM=0).**
- **Corrected size of compressed interferograms (DTM=1, DTM=3).**

1 – C0MPLIANCE MATRIX

M - mandatory
O - optional

Service 1: TC Verification			
1	**Telecommand Acceptance Report – Success**	**M**	**Yes**
2	**Telecommand Acceptance Report – Failure**	**M**	**Yes**
7	**TC Execution Completion Report – Success**	**M**	**N/A**
8	**TC Execution Completion Report – Failure**	**M**	**N/A**
Service 3: HK Reporting			
5	**Enable HK Report Packet Generation**	**M**	**Yes**
6	**Disable HK Report Packet Generation**	**M**	**Yes**
25	**HK Report Packet**	**M**	**Yes**
Service 5: Events Reporting			
1	**Normal/Progress Report**	**M**	**Yes**
2	**Error/Anomaly Report**	**M**	**Yes**
3	**Error/Anomaly Report - Ground Action**	**O**	**N/A**
4	**Error/Anomaly Report - On-board Action**	**O**	**N/A**
Service 6: Memory Management			
2	**Load Memory Using Absolute Address**	**O**	**Yes**
5	**Dump Memory Using Absolute Address**	**O**	**Yes**
6	**Memory Dump Using Absolute Address Report**	**O**	**N/A**
9	**Check Memory Using Absolute Address**	**O**	**N/A**
10	**Memory Check Using Absolute Address Report**	**O**	**N/A**
Service 9: Time Synchronization			
1	**Accept Time Update**	**M**	**Yes**
Service 17: Connection Test			
1	**Request Connection Test Response**	**M**	**Yes**
2	**Connection Test Response Report**	**M**	**Yes**
Service 20: Science Data Transfer			
1	**Enable Science Report Packet Generation on RTU Link**	**M**	**Yes**
2	**Disable Science Report Packet Generation on RTU Link**	**M**	**Yes**
3	**Science Report on RTU Link**	**M**	**Yes**
10	**Enable Sci. Report Packet Generat. on High Speed Link**	**M**	**N/A**
11	**Disable Sci. Report Packet Generat. on High Speed Link**	**M**	**N/A**
12	**Report Science Data Generation Stopped at Packet Bound**	**M**	**N/A**
13	**Science Report on High Speed Link**	**M**	**N/A**
Service 192 to 255: Private Services Payload			
216	**Payload Private Telecommand n**	**M**	**Yes**

2 – APPLICABLE DOCUMENTS

1. PFS-IRR-02	**Instrument Description**
2. PFS-IRR-03	**Instrument Performance Budgets**
3. PFS-IRR-04	**PFS Resources Budgets**
4. PFS-IRR-08	**Interface Drawings**
5. PFS-IRR-10	**PFS Data Base**
6. PFS-IRR-11	**Instruments Performance Analysis**
7. PFS-IRR-12	**Ground Operations Manual**
8. PFS-IRR-14	**Flight Operation Manual**
9. PID/URD ANNEX	**Electrical Interface Requirement Specification, Issue 0, February 1999**
10. PSS-04-106	**Packet Telemetry Standard, Issue 1, January 1988**
11. PSS-04-107	**Packet Telecommand Standard, Issue 2, April 1992**
12. ME-ESC-IF-5001	**Space/Ground Interface Control Document, Issue 2.0, December 1999**

3 - DEFINITION OF RELEVANT CONCEPTS

Acquisition:
A process when Module O obtains interferograms. Results of the Acquisition are OBDM status, OBDM MC block, SW and LW blocks stored in definite locations of DAM memory. This obvious term is explained because "Acquisition", "results of Acquisition", etc. are mentioned in this document.

Data Transmission Mode (DTM):
Type of the science information to be sent to the Earth: full interferograms, reduced resolution interferograms, full spectra, water bands, *etc*.

Data Pack:
A full set of scientific information obtained during one acquisition. The Data Pack can contain OBDM MC, status and selftest, LW and SW data. The format of Data Pack depends on the Data Transmission Mode.

Event:
The unexpected (or some expected) state of the PFS hardware and software which causes the generation of the Event Report and some actions by the DAM software.

Mass Memory:
A high capacity (32 Mbits) RAM in DAM with a Hamming processor, protecting it against single bit errors and informing DAM about double errors.

Measurement Session (Session):
The state of PFS when it makes measurements.

OBDM Command (OCOM):
A sequence of bytes which DAM sends to OBDM in order to force it to perform requested action.

OBDM Control Table:
A table of parameters which define operations of Module O.

OBDM Message (OMES):
A sequence of bytes which OBDM sends to DAM upon completion of the command.

Sleeping Mode:
The state of PFS when only DAM works, other subsystems are off. DAM is able to sent telemetry and receive telecommands.

Source Data:
According to ESA terminology, Source Data is a fragment of the scientific information contained in the Source Packet.

4 - TELEMETRY

4.1 - TELEMETRY SUBSYSTEM

DAM prepares Data Packs obtained during the Measurement Session according to the Data Transmission Mode, defined by a Telecommand:

0 result of the Autotest
2 full LW interferograms
4 reduced resolution LW and SW interferograms
5 reduced resolution LW interferograms
6 reduced resolution SW interferograms
7 full LW and partial SW interferograms (right)
8 partial LW and SW interferograms (right)
9 modules of LW and SW spectra
10 module of LW spectrum
16 module of SW spectrum
15 spectral mode for night side
17 full interferograms
18 full SW interferogram
27 full LW and partial SW interferograms (left)
28 partial LW and SW interferograms (left)

Depending on the Data Transmission Mode, the Data Pack can contain fields:
- MH1 - time of acquisition, Scanner position, OBDM status, OBDM Control Table, *etc.*
- MH2 - OBDM MC data and check sum data
- MH3 - OBDM selftest; other stuff related to Session
- SW - either SW interf., or SW spectrum, or SW part of Autotest
- LW - either LW interf., or LW spectrum, or LW part of Autotest
The full definition is given in 3.1.4.

The telemetry information is prepared according to ESA and MARS-EXPRESS mission standards. The main telemetry data unit, Source Packet, contains following fields:
- Source Packet Header
- Data Field Header
- Source Data
The Source Packet Header and the Data Field Header have predefined structure. Only the Source Data can contain private PFS information. There is no use to store headers together with the Source Data.

The Telemetry subsystem prepares only Source Data and stores them in the Mass Memory. The Source Data will be extracted from the Mass Memory, included into the Source Packet and sent to the spacecraft by the TM interface task.

Since the maximal length of the Source Data field is 4096 bytes, while the full size of the Data Pack can be as big as 40 Kbytes, the data segmentation should be used. The Telemetry subsystem cuts the Data Pack by pieces and sends these pieces as separate Source Packets. The first Source Packet of the Data Pack has Segmentation Flags equal to 01, the last Source

Packet – 10, and other Source Packets – 00. Memory dumps are also segmented. Source Packets of other categories are not segmented, their Segmentation Flags are equal to 11. The scientific information (category PRIVATE) has PID=87, all other Source Packets have PID=86. Thus, there is independent Source Packet counter for the scientific data.

DAM software uses double buffering when sending telemetry blocks. When one block is being sent to the spacecraft from the first buffer, another block is being prepared in the second buffer. And vice versa. The telemetry block is prepared according to the following algorithm:

- **Send Connection Test Reports (if any)**
- **Send TC Acceptance Reports (if any)**
- **Send Event Reports (if any)**
- **Send HK Report (if enabled and it is time to send)**
- **Send Science Reports (if enabled and there are scientific data in the Mass Memory)**

The telemetry block is completed when it is either full (riched the maximal size of 8191 words) or there is nothing to send.

Connection Test Reports, TC Acceptance Reports and Event Reports are stored in corresponding circular buffers upon reception of telecommands or critical information from sensors. The buffer of Connection Test Reports contains a set of records, each record contains two bytes: PUS and PAD of the received TC(17,1). The Telecommand subsystem adds a record to this buffer upon reception of TC(17,1). The buffer of TC Acceptance Reports contains a set of records, each record has a variable length and is able to store all possible kinds of Source Data defined for Service 1. The Telecommand subsystem adds a long record (APID, Sequence Control, PUS, PAD, Failure Code, Parameters 1-4) to this buffer upon reception of an incorrect TC or a short record (APID, Sequence Control, PUS, PAD) if the received TC is correct and the Acceptance Report is required (bit 7 of the Data Field Header is set). The bit 4 of the Data Field Header is ignored, i.e. PFS ignores requests to report about completion of execution – TM(1,7) and TM(1,8) are not used by PFS. The buffer of Event Reports contains records of variable length. If some event takes place, a corresponding record (EID, Parameters) is added to the buffer.

HK Reports are generated if they are enabled by TC(3,5), and there is time to send a HK Report. By default the period of HK report generation is set to 10 minutes. But this period can be changed by TC(216,11). Science Reports are described below.

4.2 - STRUCTURE OF THE SCIENTIFIC TELEMETRY SOURCE PACKET

As defined by [12] (ME-ESC-IF-5001), the Telemetry Source Packet has following fields:

Field name	Size[b]	Comment
Packet ID	2	Identifies the experiment
Packet Sequence Control	2	Contains Segm. Flags and packet counter
Packet Length	2	Length £ 4106 incl. Data Field Header
Data Field Header	10	Contains service stuff
Source Data	Variable	Contains PFS scientific information

The Packet ID field is costant. It contains following fields:

Field Name	Size[bit]	Value	Comment
Version Number	3	000b	Fixed by [12]
Type	1	0b	Fixed by [12]
Data Field Header Flag	1	1b	Fixed by [12]
Process ID (PID)	7	1010111b	=87d – for scientific data
Packet Category	4	1100b	Fixed by [12]

The Process ID allows to distinguish PFS Source Packets among other packets from different experiments.

The Packet Sequence Control field contains following fields:

Field Name	Size[bit]	Value	Comment
Segmentation Flags	2	01b, 00b or 10b	Fixed by [12]
Source Sequence Count	14	0..3FFFh	Packet counter

The Packet Length field contains a value which gives information about the length of both Data Field Header and Source Data. The value is given by: Packet Length = 10 + length(Source Data) - 1.

The content of Data Field Header is fixed by [12]. The Data Field Header has following structure:

Field Name	Size[bit]	Value	Comment
SCET Time	48	time	Packet creation time
PUS Version	3	000b	For scientific data
Checksum Flag	1	0b	Fixed by [12]
Spare	4	0000b	Fixed by [12]
Packet Type	8	00010100b	=20 - for scientific data
Packet Subtype	8	00000011b	=3 - for scientific data
Pad	8	00000000b	For scientific data

4.3 - STRUCTURE OF OTHER SOURCE PACKETS

Correspondence between fields of the Telemetry Source Packet can be described by the following table:

PID	Packet Cat.	PUS	Pad	Type	Subtype	Comment
86d	1 (ACK)	*	*	1	1, 2, 7, 8	TC acknowledgement
86d	4 (HK)	000b	00000000b	3	25	HK report
86d	7 (EVENT)	000b	00000000b	5	1, 2, 3, 4	Events reporting
86d	7 (EVENT)	*	*	17	2	Connection test
86d	9 (DUMP)	*	*	6	6	Memory management
87d	12 (PRIVATE)	000b	00000000b	20	3	Science report

*** - for solicited Source Packets PUS and Pad fields are taken from TM packets**

4.4 - STRUCTURE OF MH1, MH2 AND MH3 FIELDS

The field MH1 (128 bytes) is generated during each acquisition and contains common information about conditions of the acquisition, obtained from different sources. Changes from EM are highlighted.

Field name	Size[b]	Comment
Acquisition number	2	Absolute number within the Session
Acquisition time (SCET)	6	Spacecraft time (accuracy 1/8 sec)
Acquisition time (DAM)	6	DAM time (accuracy 10 msec)
Ref.Chan.Mode	1	Reference Channel Mode of Module O
Type of mesurement	1	Type of measurement referred to CalMode
SoftwareVersion	2	Date of DAM software version
Data Trans. Mode	1	Defined for the Session
Actual DTM	1	May differ for Autotest, ICM failure
Disabled subsystems	1	Data were simulated or garbage
Flags	1	Validity of OBDM HK, status, etc.
OBDM status	32	Received from OBDM or simulated
OBDM Control Table	32	Used during the measurement
ZOPDSF	2	Word offset for ZOPDSW in forward
ZOPDSR	2	Word offset for ZOPDSW in reverse
ZOPDLF	2	Word offset for ZOPDLW in forward
ZOPDLR	2	Word offset for ZOPDLW in reverse
	8	Not used
Scanner Position	1	Obtained from Scanner Status port
ICM mode	1	Current ICM mode
ICM blk_exponent for LW	2	If spectral mode, otherwise 0
ICM sum_exponent for LW	2	If spectral mode, otherwise 0
ICM blk_exponent for SW	2	If spectral mode, otherwise 0
ICM sum_exponent for SW	2	If spectral mode, otherwise 0

ICM message after LW FFT	**2**	**If spectral mode, otherwise 0**
ICM message after SW FFT	**2**	**If spectral mode, otherwise 0**
Power Status	**2**	**After completion the acquisition**
Simulation sign	**1**	**All data simulated by DAM**
Synthetic interf. sign	**1**	**OBDM sends synthetic interferograms**
Free Mass Memory	**2**	**Before Data Pack stored in MM**
Measurement Period	**2**	**Period between measurements**
Length of LW field	**2**	**Length of field in Data Pack**
Length of SW field	**2**	**Length of field in Data Pack**

The acquisition time is taken at the moment when OMES "Acquisition completed" was received.
During the Autotest the Data Pack is prepared at DTM=0 although the current DTM is different. The "Actual DTM" field in the MH1 reflects this fact.
In the case of ICM failure the Data Pack is prepared at DTM=17 although the current DTM is different. The "Actual DTM" field in the MH1 reflects this fact.

The field MH2 is generated during each acquisition and contains the measurement conditions (128 bytes) obtained from OBDM during the acquisition. The MH2 field (64 words) contains information which can be divided into 2 parts, each 32 words long. The first part contains analogue parameters acquired by ADC within a range -5V..+5V and the second part of MH2 contains the same parameters acquired by ADC within a range -10V..+10V. The last 2 words are checksum of SW and LW data areas.

Field name	Size[b]	Comment
LDpower1	**2**	**Power of Laser Diode 1 in ± 5V range**
LDpower2	**2**	**Power of Laser Diode 2 in ± 5V range**
PDpower1	**2**	**Power of Photo Diode 1 in ± 5V range**
PDpower2	**2**	**Power of Photo Diode 2 in ± 5V range**
MCcurrent	**2**	**Current of Active Motor Coil in ± 5V range**
Temperature1	**2**	**Temperature inside IB, point 1 in ± 5V range**
Temperature2	**2**	**Temperature inside IB, point 2 in ± 5V range**
Temperature3	**2**	**Temperature inside IB, point 3 in ± 5V range**
Temperature4	**2**	**Temperature inside IB, point 4 in ± 5V range**
Temperature5	**2**	**Temperature inside IB, point 5 in ± 5V range**
Temperature6	**2**	**Temperature inside IB, point 6 in ± 5V range**
Temperature7	**2**	**Temperature inside IB, point 7 in ± 5V range**
Temperature8	**2**	**Temperature inside IB, point 8 in ± 5V range**
LDtemp1	**2**	**Temperature of Laser Diode 1 in ± 5V range**
LDtemp2	**2**	**Temperature of Laser Diode 2 in ± 5V range**
SWtemp	**2**	**Temperature of SW detector in ± 5V range**
LWtemp	**2**	**Temperature of LW detector in ± 5V range**
TRWcurrent1	**2**	**Current of TRW 1 LED in ± 5V range**
TRWcurrent2	**2**	**Current of TRW 2 LED in ± 5V range**
TempA1	**2**	**Temperature PFS-A 1 in ± 5V range**
TempA2	**2**	**Temperature PFS-A 2 in ± 5V range**
SLvoltage	**2**	**Voltage of Standard Lamp in ± 5V range**
CLvoltage	**2**	**Voltage of Calibration Lamp in ± 5V range**
- not used -	**2**	

-5voltage	2	Voltage of –5V power supply in ± 5V range
+5voltage	2	Voltage of +5V power supply in ± 5V range
-15voltage	2	Voltage of –15V power supply in ± 5V range
+15voltage	2	Voltage of +15V power supply in ± 5V range
- not used -	2	
- not used -	2	
- not used -	2	
- not used -	2	
Field name	Size[b]	Comment
LDpower1(range ± 5V)	2	Power of Laser Diode 1 in ± 10V range
LDpower2	2	Power of Laser Diode 2 in ± 10V range
PDpower1	2	Power of Photo Diode 1 in ± 10V range
PDpower2	2	Power of Photo Diode 2 in ± 10V range
MCcurrent	2	Current of Active Motor Coil in ± 10V range
Temperature1	2	Temperature inside IB, point 1 in ± 10V range
Temperature2	2	Temperature inside IB, point 2 in ± 10V range
Temperature3	2	Temperature inside IB, point 3 in ± 10V range
Temperature4	2	Temperature inside IB, point 4 in ± 10V range
Temperature5	2	Temperature inside IB, point 5 in ± 10V range
Temperature6	2	Temperature inside IB, point 6 in ± 10V range
Temperature7	2	Temperature inside IB, point 7 in ± 10V range
Temperature8	2	Temperature inside IB, point 8 in ± 10V range
LDtemp1	2	Temperature of Laser Diode 1 in ± 10V range
LDtemp2	2	Temperature of Laser Diode 2 in ± 10V range
SWtemp	2	Temperature of SW detector in ± 10V range
LWtemp	2	Temperature of LW detector in ± 10V range
TRWcurrent1	2	Current of TRW 1 LED in ± 10V range
TRWcurrent2	2	Current of TRW 2 LED in ± 10V range
TempA1	2	Temperature PFS-A 1 in ± 10V range
TempA2	2	Temperature PFS-A 2 in ± 10V range
SLvoltage	2	Voltage of Standard Lamp in ± 10V range
CLvoltage	2	Voltage of Calibration Lamp in ± 10V range
- not used -	2	
-5voltage	2	Voltage of –5V power suply in ± 10V range
+5voltage	2	Voltage of +5V power suply in ± 10V range
-15voltage	2	Voltage of –15V power suply in ± 10V range
+15voltage	2	Voltage of +15V power suply in ± 10V range
SWblkMap	2	Map of SW invalid blocks
LWblkMap	2	Map of LW invalid blocks
SWcheckSum	2	SW area checksum
LWcheckSum	2	LW area checksum

The field MH3 (256 bytes) is generated only during the Autotest of Module O and contains general information related Module O.

Field name	Size[b]	Comment
Power Status	2	Obtained during the Autotest of Module O
OBDM Selftest	48	Obtained when Module O was switched on
	1	Not used
Autotest Parameter	1	Used during the Autotest
	12	Not used
LW spectral bands	64	Table of LW spectral bands
SW spectral bands	64	Table of SW spectral bands
LW spectral OpCodes	32	For the actual DTM (11..15), otherwise zeroes
SW spectral OpCodes	32	For the actual DTM (11..15), otherwise zeroes

4.5 - STRUCTURE OF THE DATA PACK

DTM=0 - result of the Autotest. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the Autotest
MH2	128	During the Autotest
MH3	256	At the Session starting/termination
0xingInt	32768	Intervals times between 0xing
SineWave	7400	It sample 13.63 full sinewave from the ref. channels
PhotoGain	480	It sample 2.72 full sinewave from the ref. channels
RefFreq	240	It change the reference freq. by 2% above

DTM=2 - full LW interferogram. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
LW	8192	LW interferogram

DTM=4 - reduced resolution LW and SW interferograms. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	16384	SW interferogram (reduced)
LW	4096	LW interferogram (reduced)

DTM=5 - reduced resolution LW interferogram. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
LW	4096	LW interferogram (reduced)

DTM=6 - reduced resolution SW interferogram. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	16384	SW interferogram (reduced)

DTM=7 - full LW and partial SW interferograms. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	18432	SW interferogram (partial) right
LW	8192	LW interferogram

DTM=8 – partial LW and SW interferograms. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	18432	SW interferogram (partial) right
LW	6144	LW interferogram (partial) right

DTM=9 – modules of LW and SW spectra. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	12384	SW spectrum (module)
LW	3696	LW spectrum (module)

DTM=10 – module of LW spectrum. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
LW	4096	LW spectrum (module)

DTM=15 – Spectral mode for night side. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	8192	2048w LW, 2048w SW (from 2048 to 4096 cm^{-1}) spectra

DTM=16 – module of SW spectrum. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	12288	SW spectrum (module)

DTM=27 - full LW and partial SW interferograms. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	18432	SW interferogram (partial) left
LW	8192	LW interferogram

DTM=28 – partial LW and SW interferograms. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	18432	SW interferogram (partial)left
LW	6144	LW interferogram (partial) left

DTM=17 – full LW and SW interferograms. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	32768	SW interferogram
LW	8192	LW interferogram

DTM=18 – full SW interferogram. The Data Pack contains following fields:

Field Name	Size[b]	Comment
MH1	128	During the acquisition
MH2	128	During the acquisition
SW	32768	SW interferogram

4.6 – PFS HOUSEKEEPING

PFS Housekeeping block is 480 bytes long (in EM it has 256 bytes) and contains following fields (changes from EM are highlighted):

Field	Length [b]	Meaning
CPU segments	2	CS, DS, SS, 00
RAM status	2	Status of RAM (zero bit means good block)
Power configuration	2	Power supply configuration
Power status	2	Power supply status
MM single-bit err	8	Counter of MMEM single-bit errors for banks 0..3
MM double-bit err	8	Counter of MMEM double-bit errors for banks 0..3

MMlistHead	**2**	**List of MM blocks: Head**
MMlistTail	**2**	**List of MM blocks: Tail**
MMlistNum	**2**	**Number of free MM blocks**
Mmpower	**1**	**Powered MM banks**
Mmstatus	**1**	**Status of MM banks (zero means good)**
OBDMtemp1	**2**	**Mod.O point 1 temperature ***
OBDMtemp2	**2**	**Mod.O point 2 temperature ***
OBDMtemp3	**2**	**Mod.O point 3 temperature ***
OBDMtemp4	**2**	**Mod.O point 4 temperature ***
OBDMtemp5	**2**	**Mod.O point 5 temperature ***
OBDMtemp6	**2**	**Mod.O point 6 temperature ***
OBDMtemp7	**2**	**Mod.O point 7 temperature ***
OBDMtemp8	**2**	**Mod.O point 8 temperature ***
OBDMtempL1	**2**	**Mod.O Laser 1 temperature ***
OBDMtempL2	**2**	**Mod.O Laser 2 temperature ***
OBDMtempD1	**2**	**Mod.O Detector 1 temperature ***
OBDMtempD2	**2**	**Mod.O Detector 2 temperature ***
OBDMfailure	**2**	**Last Mod.O failure**
SCANtemp1	**2**	**Black Body point 1 temperature ***
SCANtemp2	**2**	**Black Body point 2 temperature ***
CSckSum	**2**	**Checksum of Code Segment**
Field	**Length [b]**	**Meaning**
SCET	**4**	**Spacecraft Elapsed Time [sec]**
ClockSec	**4**	**DAM internal clock [sec]**
HKrepEnabled	**1**	**HK Reports enabled**
SciRepEnab	**1**	**Science Reports enabled**
MeasPeriod	**2**	**Period between measurements**
OBDMsleep	**1**	**Request to execute OCOM in Sleeping Mode**
OBDMrefChan	**1**	**Reference Channel Mode for Module O**
MMfull	**1**	**Sign “Mass Memory full”**
Mmrange	**1**	**Range of MM blocks to use**
DTMcalib	**1**	**DTM for calibrations**
DTMmeas	**1**	**DTM for measurements**
MMsegChk	**1**	**MM segment being checked**
MMareaChk	**1**	**MM area being checked**
CPU CS	**2**	**CPU Code Segment**
AutotestCnt	**2**	**Counter of Autotests**
CalibrNum	**2**	**Number of calibrations**
InterfNum	**2**	**Counter of measurements**
ProcessNo	**2**	**Measurement Number within a Session**
DelayCnt2	**2**	**Delay Counter [10 ms]**
SecDelayCnt	**2**	**Long Delay Counter [sec]**
	2	**Not used**
OBDMtimeout	**2**	**Timeout for OBDM command**
SCANtimeout	**2**	**Timeout for SCAN command**

ICMtimeout	2	Timeout for ICM command
PFSstate	1	PFS state
PFSmode	1	PFS mode
	1	Not used
ClockSrc	1	Source for ClockSec, timeouts, delays
ICMbias	1	Bias to be used during the compression
DisableCurr	1	Disable subsystems duing the current Session
DisableNext	1	Disable subsystems during the next Session
IgnorePOWR	1	Ignore Power events
IgnoreOBDM	1	Ignore OBDM events
IgnoreSCAN	1	Ignore SCAN events
IgnoreICM	1	Ignore ICM events
OBDMtest	1	OBDM test mode
OBDMauto	1	OBDM Autotest parameter
SimulMode	1	Simulation Mode
SCANmode	1	Scanner Mode
ICMmode	1	ICM Mode
SCANretNum	1	Number of SCAN retries
OBDMretNum	1	Number of OBDM retries
ScanPos	1	Scanner position
DPstate	1	State of Double Pendulum (from OBDM status)
DPstateM	1	State of Double Pendulum (from OBDM message)
CalMode	1	Calibration Mode
Field	**Length [b]**	**Meaning**
VersionCafe	2	Software version header
VersionDate	2	Software version date
VersionName	8	Software file name
PID8609num	2	Number of sent packets with PID=86, Pcat=9
HKperiod	2	Period of HK Report Packet generation
SCETnum	2	Number of received Time Packets
S0901num	2	Number of received TC(9,1) packets
S1701num	2	Number of received TC(17,1) packets
PID8601num	2	Number of sent packets with PID=86, Pcat=1
PID8712num	2	Number of sent packets with PID=87, Pcat=12
VoltageM5	2	Mod.O voltage –5V *
VoltageP5	2	Mod.O voltage +5V *
VoltageM15	2	Mod.O voltage –15V *
VoltageP15	2	Mod.O voltage +15V *
PID8604num	2	Number of sent packets with PID=86, Pcat=4
PID8607num	2	Number of sent packets with PID=86, Pcat=7
S1701ack	2	Number of sent ACK reports
DMAaddr	2	DMA Address register
DMAcount	2	DMA Word Count register
DMAstatReq	2	DMA Status and Request registers
DMAcomMask	2	DMA Command and Mask registers
DMAmod0	2	DMA Mode register for channel 0
DMAmod1	2	DMA Mode register for channel 1

DMAmod2	**2**	**DMA Mode register for channel 2**
DMAmod3	**2**	**DMA Mode register for channel 3**
Sec100	**2**	**Counter of 1/100 sec**
IntMask	**2**	**Masks of PICs**
IntNMI	**2**	**Counter of nonmaskable interrupts**
IntU	**2**	**Counter of spurious interrupts**
Field	**Length [b]**	**Meaning**
IntM0	**2**	**Counter of Timer 2.0 interrupts**
IntM1	**2**	**Counter of DMA EOP interrupts**
IntM2	**2**	**Counter of ICM interrupts**
IntM3	**2**	**Counter of Timer2.2 interrupts**
IntM4	**2**	**Counter of Hamming Processor requests**
IntM5	**2**	**Counter of parallel port input interrupts**
IntM6	**2**	**SecondCounter of ICM interrupts**
IntM7	**2**	**Counter of parallel port output interrupts**
IntS0	**2**	**Counter of Timer 1.0 interrupts**
IntS1	**2**	**Counter of PICS1 interrupts**
IntS2	**2**	**Counter of SCAN port output interrupts**
IntS3	**2**	**Counter of SCAN port input interrupts**
IntS4	**2**	**Counter of TC reception interrupts**
IntS5	**2**	**Counter of SCET interrupts**
IntS6	**2**	**Counter of FIFO half full interrupts**
IntS7	**2**	**Counter of glitch interrupts**
OBDMstat	**32**	**OBDM status**
OBDM HK	**128**	**OBDM Housekeeping info**
OBDMtab	**32**	**OBDM Control Table**
TCreceived	**64**	**List of received Telecommands (last 16)**

*** - if Mod.O is not working then the value is FFFF (hex) which means UNKNOWN**

PFS sends the Housekeeping block as a HK Report Packet – TM(3,25).

5- HIGH POWER COMMANDS

5.1 HIGH POWER COMMANDS TABLE (RTU OPERATED)

These commands will be operated by Satellite side upon experiment request and shall be verified by relative RSS Relay Switch Status read by PDU in PFS-P module and inserted on the Satellite TLM.
Only one Power command will be sent to the experiment with the preference to the main DC/DC power converter and result will be verified by electrical current absortion from the satellite and by internal experiment flag detailed later on this chapter.
In case of failure of the main DC/DC a command PFSMAINOFF shall be executed and the redundant DC/DC will be Powered. PFS has two complete and indipendent power sets.
The ASTRA Heater command will be actuated after launch for the entire cruise phase. We reserve to operate this command also sometimes in orbit phase if the Omod. Ib temperature approach the non operative limit.

6 - PFS TELECOMMANDS

The Telecommand subsystem consists of two independent parts: a MLC receiver and a Telecommand interpreter. The MLC receiver stores received MLCs and timestamps in a circular buffer. This part works asynchronously from the Telecommand interpreter.

6.1 - TELECOMMAND INTERPRETER

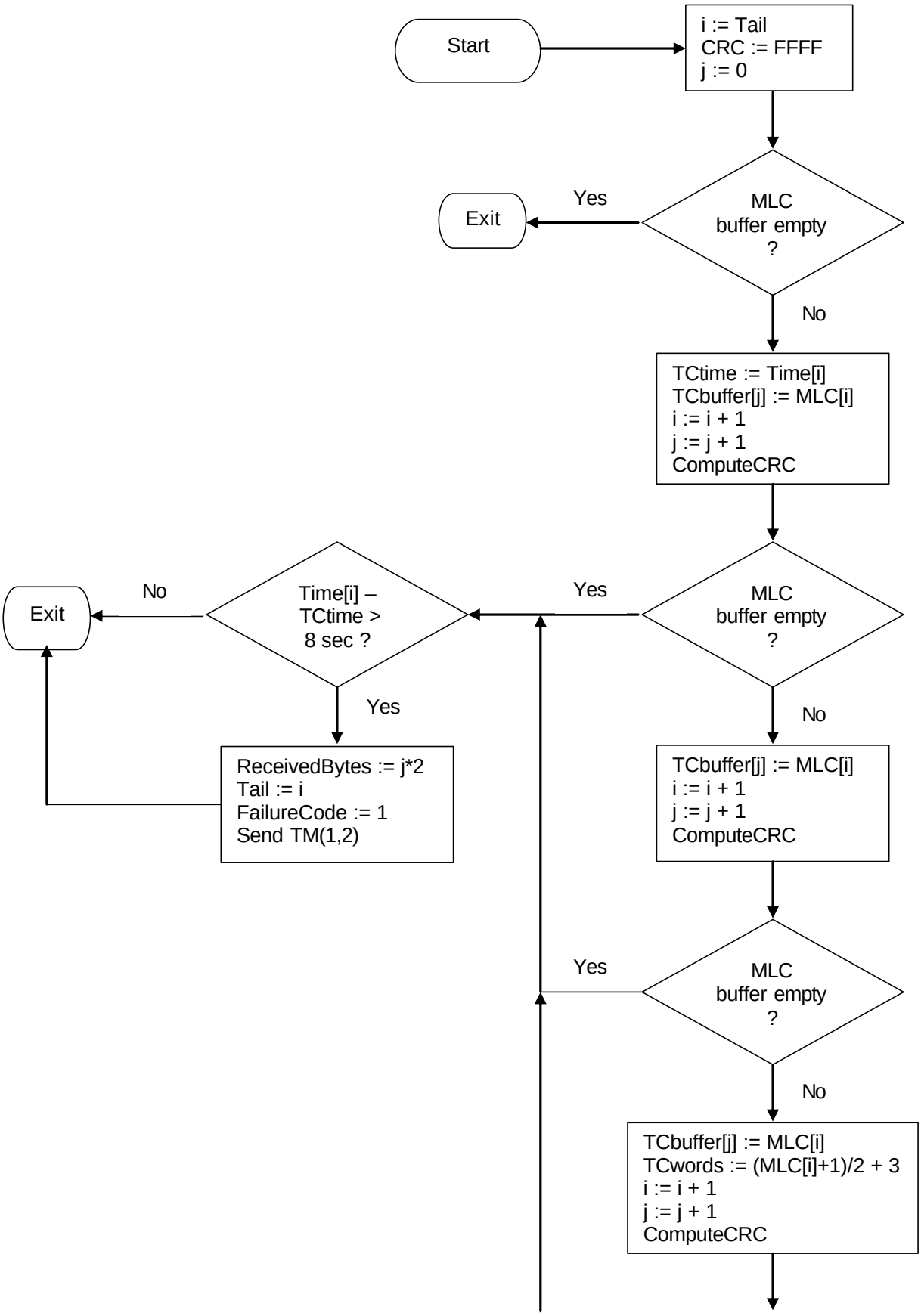
The Telecomand interpreter decodes received Telecommands, checks their validity, acknowledges them (positively or negatively) and executes most of them. The execution means that the values extracted from the Telecommand are stored into variables in the DAM memory. So, for PFS the TC Execution Reports is equal to the TC Acceptance Report: there is no situation when TC has been accepted but has not been executed. The subservice TM(1,8) is not be used by PFS.

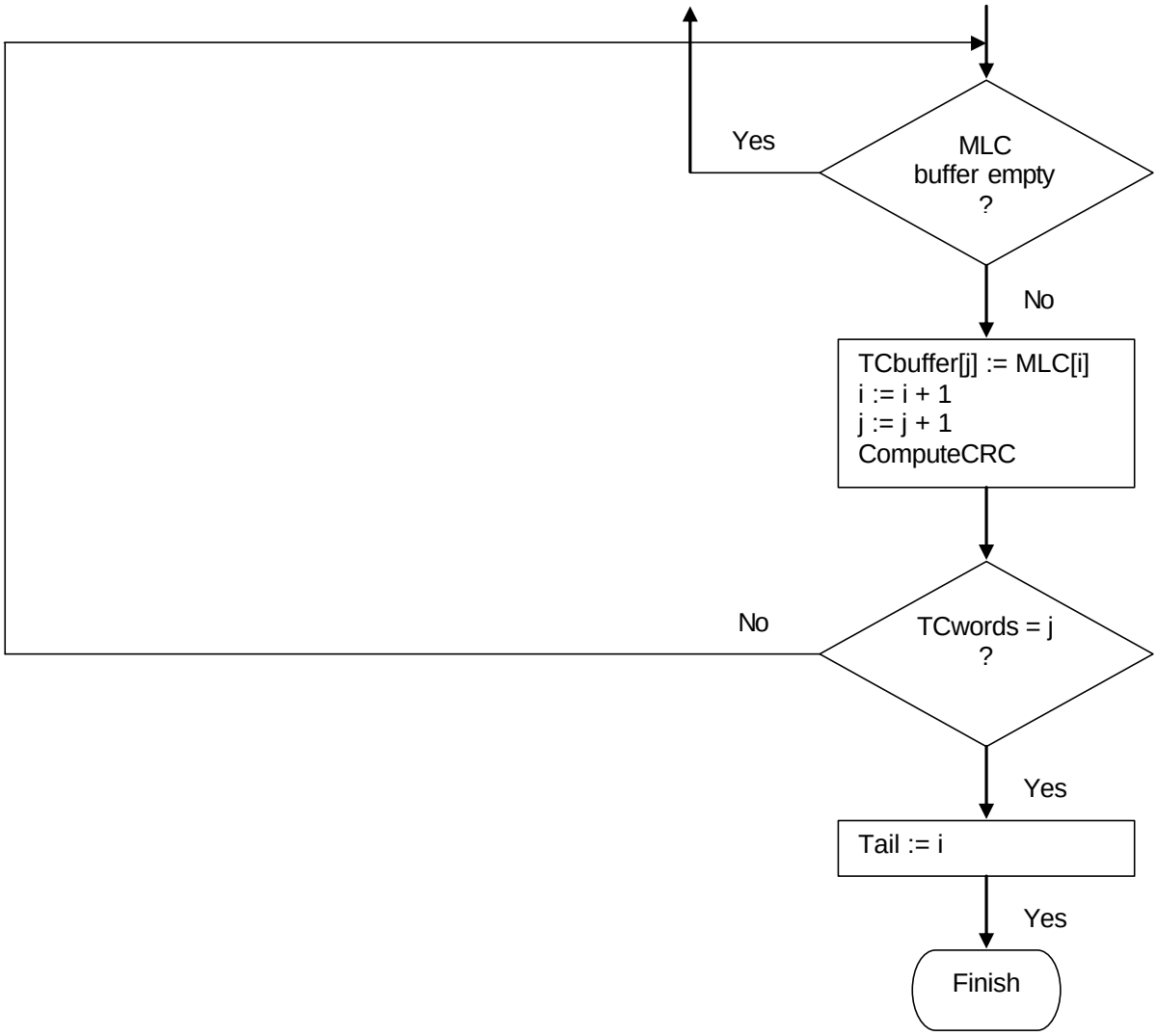
Some Telecommands (for example, "Work with Mod.O in Sleeping Mode") have delayed effect. The Telecommand interpreter sets a flag, informing that the operation must be performed at a suitable moment (for example, upon completion of a Measurement Session). Actual execution of such Telecommands is accompanied with an Event Report or exhaustive telemetry information.

The Telecommand interpreter reads MLCs and their timestamps from the circular buffer prepared by the MLC receiver and stores a Telecommand being decoded in a temporary buffer. The algorithm can be illustrated by the flow diagram on the next page.

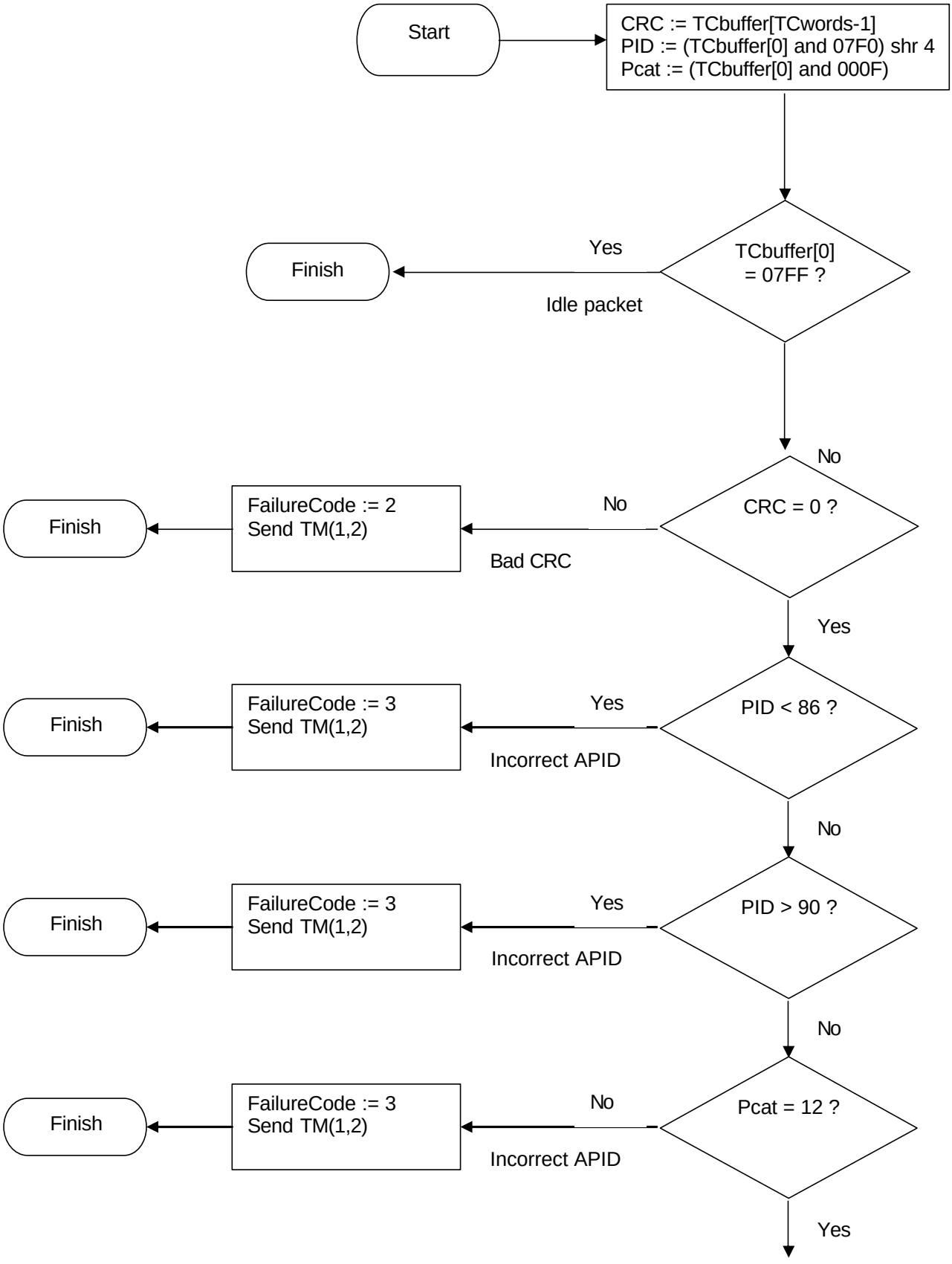
On the diagram *CRC* is a word which is assigned value FFFFh at the beginning. The procedure *ComputeCRC* computes CRC of a current MLC. *Tail* is a tail pointer of the MLC circular buffer. The MLC receiver stores MLC words (*MLC[i]*) and timestamps (*Time[i*]) in the circular buffer and advances its head pointer. The predicate *MLC buffer empty* is true when *Tail* = *Head*. The temporary pointer *i* starts at *Tail* and is advanced until a complete or incomplete (due to a timeout) Telecommand has been received. At this moment the Telecommand is discarded from the circular buffer - *Tail* is advanced by number of words in a TC packet.

After *Exit* the algorithm starts from *Start* several times until it reaches *Finish*. After this point the Telecommand decoding will be started.


Start
i := Tail
CRC := FFFF
j := 0
MLC buffer empty ?
Yes
Exit
No
TCtime := Time[i]
TCbuffer[j] := MLC[i]
i := i + 1
j := j + 1
ComputeCRC
MLC buffer empty ?
Yes
Time[i] – TCtime > 8 sec ?
No
Exit
Yes
ReceivedBytes := j*2
Tail := i
FailureCode := 1
Send TM(1,2)
No
TCbuffer[j] := MLC[i]
i := i + 1
j := j + 1
ComputeCRC
MLC buffer empty ?
Yes
No
TCbuffer[j] := MLC[i]
TCwords := (MLC[i]+1)/2 + 3
i := i + 1
j := j + 1
ComputeCRC



At this moment the whole Telecommand has been received in the buffer *TCbuffer*. The decoding of the Telecommand can be illustrated by the following flow diagram.


Start
CRC := TCbuffer[TCwords-1]
PID := (TCbuffer[0] and 07F0) shr 4
Pcat := (TCbuffer[0] and 000F)
TCbuffer[0] = 07FF ?
Yes
Idle packet
Finish
CRC = 0 ?
No
FailureCode := 2
Send TM(1,2)
No
Bad CRC
Finish
PID < 86 ?
Yes
FailureCode := 3
Send TM(1,2)
Yes
Incorrect APID
Finish
PID > 90 ?
No
FailureCode := 3
Send TM(1,2)
Yes
Incorrect APID
Finish
Pcat = 12 ?
No
FailureCode := 3
Send TM(1,2)
No
Incorrect APID
Finish
Yes

At this moment the Telecommand has correct structure, and the specific decoding takes place, depending on the Service Type and Subtype. If TC(Type,Subtype) is not implemented, an error message TC(1,2) with FailureCode=4 (Invalid Command Code) will be sent, the TC will be ignored.

PFS does not use Failure Codes 5 and 6. There is no situation when the Telecommand can not be executed (Failure Code 5). Specification of the Failure Code 6 requires knowledge of the wrong octet. Some parameters of the private PFS Telecommands are words and doublewords. It is impossible to determine, which octet of the word (doubleword) is wrong. Instead of Failure Code 6 PFS sends its own information about the wrong parameter and informs only about the number of wrong parameter. Before checking the validity of parameters PFS checks whether the length of the Application Data Field (containing all parameters) is correct. If the length is not correct, PFS sends Failure Code "Wrong length of Application Data Field in Telecommand" and does not try to analyze parameters. If the length is correct, PFS checks some parameters (for which the valid range is defined). If the value of some parameter is out of valid range, PFS sends Failure Code "Wrong parameter N in Telecommand" informing only about the number of wrong parameter. See 7.3.

6.2 - SUMMARY OF PFS TELECOMMANDS AND THEIR PARAMETERS

This table describes all parameters of PFS private Telecommands. The column "Length" here is the length of the parameter field containing the real parameter. Some parameters are grouped in one word (see description in 6.3). The column "Range" is the range of the parameter value. The column "Is checked" tells whether this parameter is checked by the on-board software. If the parameter is checked and is out of range, the Telecommand will be rejected with error "Wrong parameter".

TC (216,5) Start/terminate the Measurement Session

Parameter	Length	Range	Is checked
CalMode	1 byte	0, 2..9	Yes

TC (216,10) Change ClockSec

Parameter	Length	Range	Is checked
ClockSec Delta	2 words	any	No

TC (216,11) Set period of HK Report Packet generation

Parameter	Length	Range	Is checked
HKperiod	1 word	any	No

TC (216,12) Enable/disable subsystems

Parameter	Length	Range	Is checked
DisabledSubsys	2 bits	any	No

TC (216,13) Set/clear OBDM Test Mode

Parameter	Length	Range	Is checked
OBDMtest	1 bit	any	No

TC (216,14) Set temperature inside IB

Parameter	Length	Range	Is checked
PointNum	4 bits	any	No

Temp	1 byte	any	No

TC (216,15) Set power of laser diode

Parameter	Length	Range	Is checked
Diode	1 bit	any	No
Pow	1 byte	any	No

TC (216,16) Set temperature of laser diode/detector

Parameter	Length	Range	Is checked
Unit	2 bits	any	No
Temp	1 byte	any	No

TC (216,17) Set TRW current of laser diode

Parameter	Length	Range	Is checked
Diode	1 bit	any	No
Curr	1 byte	any	No

TC (216,18) Set gain sensors

Parameter	Length	Range	Is checked
LWgainCtrl	2 bits	any	No
SWgainCtrl	3 bits	any	No

TC (216,19) Set ADC configuration

Parameter	Length	Range	Is checked
ADCconf	4 bits	any	No

TC (216,20) Select motor coil

Parameter	Length	Range	Is checked
MCoil	1 bit	any	No

TC (216,21) Set gain Zero Crossing

Parameter	Length	Range	Is checked
Gain0x	4 bits	any	No

TC (216,22) Set period of filter

Parameter	Length	Range	Is checked
Filter	3 bits	0..5	Yes
Period	1 word	any	No

TC (216,23) Select Zero Crossing LW/SW

Parameter	Length	Range	Is checked
Select0x	1 bit	any	No

TC (216,24) Switch laser diodes

Parameter	Length	Range	Is checked
SwitchDiodes	2 bits	any	No

TC (216,25) Set Autotest parameter

Parameter	Length	Range	Is checked
OBDMauto	1 byte	any	No

TC (216,26) Change Speed Controller STOP command

Parameter	Length	Range	Is checked
CtrlStop	1 word	any	No

TC (216,27) Work with Module O in Sleeping Mode (Block and Unblock D.P.)

Parameter	Length	Range	Is checked
OperationCode	3 bits	any	No

TC (216,32) Set/clear simulation mode

Parameter	Length	Range	Is checked
SimulMode	1 bit	any	No

TC (216,33) Set ICM mode

Parameter	Length	Range	Is checked
Bias	7 bits	any	No
4Kmode	2 bits	any	No
AvSuppr	1 bit	any	No
Apod	1 bit	any	No

TC (216,34) Set source timer

Parameter	Length	Range	Is checked
ClockSrc	2 bits	0..2	Yes

TC (216,36) Set Scanner Mode

Parameter	Length	Range	Is checked
SCANmode	1 byte	any	No

TC (216,37) Set period between measurements

Parameter	Length	Range	Is checked
MeasPer	1 word	any	No

TC (216,38) Set number of SCAN retries

Parameter	Length	Range	Is checked
SCANretNum	1 byte	any	No

TC (216,39) Set number of OBDM retries

Parameter	Length	Range	Is checked
OBDMretNum	1 byte	any	No

TC (216,40) Set POWR event ignore mask

Parameter	Length	Range	Is checked
IgnorePOWR	1 byte	any	No

TC (216,41) Set SCAN event ignore mask

Parameter	Length	Range	Is checked
IgnoreSCAN	1 byte	any	No

TC (216,42) Set OBDM event ignore mask

Parameter	Length	Range	Is checked
IgnoreOBDM	1 byte	any	No

TC (216,43) Set ICM event ignore mask

Parameter	Length	Range	Is checked
IgnoreICM	1 byte	any	No

TC (216,45) Select SW filter shape

Parameter	Length	Range	Is checked
SWfltShape	1 bit	any	No

TC (216,46) Select TRW channel

Parameter	Length	Range	Is checked
TRWchan	1 bit	any	No

TC (216,47) Set DTM for measurements

Parameter	Length	Range	Is checked
DTMmeas	1 byte	See 4.1	Yes

TC (216,48) Set DTM for calibrations

Parameter	Length	Range	Is checked
DTMcalib	1 byte	See 4.1	Yes

TC (216,49) Set/clear Reference Channel Mode for Module O

Parameter	Length	Range	Is checked
OBDMrefChan	1 bit	any	No

TC (216,50) Set offset for ZOPDSW and ZOPDLW frwd and reverse

Parameter	Length	Range	Is checked
Param Number	2 bit	any	No
Offset_ZOPD	1 word	any	No

TC (216,100) Move the scanner to the specified position

Parameter	Length	Range	Is checked
ScanPos	3 bits	any	No

TC (216,101) Set number of measureme nts

Parameter	Length	Range	Is checked
MeasNum	1 word	any	No

TC (216,102) Set number of calibrations

Parameter	Length	Range	Is checked
CalibNum	1 word	any	No

TC (216,200) Reconfigure the Mass Memory

Parameter	Length	Range	Is checked
LowBank	4 bits	*LowBank* < *HighBank*	Yes
HighBank	4 bits	*LowBank* < *HighBank*	Yes

TC (216,205) Change CPU Code Segment

Parameter	Length	Range	Is checked
CS	1 bit	any	No

6.3 - PFS TELECOMMANDS

Telecommand (216,5) Start/terminate the Measurement Session

Function/Description

Depending on the Calibration Mode (*CalMode*), this Telecommand either starts or terminates
6.16 Tw wparamed e Tf 0 20ion Mode (*CalMode*
F Tw (CalMod) Tj 19.3 0 TD ... (CalMode) Tj 45.6 0 09TD /F1

Remarks

The parameter *CalMode* can have following values:

0 *Stop*: PFS completes the last measurement and switches off Module O and the Scanner.

2 *Wakeup* or *Standby Mode*: now equivalent to *Test 1*.

3 *Test 1*: PFS switches on Module O, periodically gets its status and puts voltages and temperatures measured by Module O into HK Report Packets. The Double Pendulum is not moved and can remain blocked. The Scanner is on, but is not moved. PFS sends HK Report Packets with period defined by the TC(216,11). This Calibration Mode is endless, i.e. can be changed only by a Telecommand.

5 *Test 3*: PFS switches on Module O and performs Autotest of Module O. The Double Pendulum is moved (i.e. must be unblocked before this test). The Scanner is moved after every Autotest to the next position. After 8 rotations of the Scanner (i.e. 8 Autotests of Module O) PFS automatically goes to the *Standby Mode*.

6 *Test 4*: PFS switches on Module O and acquires interferograms from calibration sources: Black Body, Calibration Lamp and Cold Space. The Double Pendulum is moved (i.e. must be unblocked before this test). The Scanner is moved after N_c measurements to the next calibration position (Black Body, Calibration Lamp, Cold Space). After 3 rotations of the Scanner (i.e. 3´N_c calibrations) PFS automatically goes to the *Standby Mode*. The number of calibrations (N_c) can be set by TC(216,102) before the test.

7 *Test 5*: PFS switches on Module O and acquires interferograms. The Double Pendulum is moved (i.e. must be unblocked before this test). The Scanner is on, but is not moved. PFS changes Gain Factors of Module O and makes N_c measurements at each Gain Factor. After 16 combinations of the Gain Factors (i.e. 16´N_c calibrations) PFS automatically goes to the *Standby Mode*. The number of calibrations (N_c) can be set by TC(216,102) before the test. The Scanner can be moved to the desired position by TC(216,100) before the test.

8 *Test 6*: PFS switches on Module O and acquires interferograms. The Double Pendulum is moved (i.e. must be unblocked before this test). The Scanner is on, but is not moved. PFS changes temperatures (from T_0 to T_0+10° with step 0.5°) of laser diodes and makes N_c measurements at each temperature. After 21 temperature steps (i.e. 21´N_c calibrations) PFS automatically goes to the *Standby Mode*. The number of calibrations (N_c) can be set by TC(216,102) before the test. T_0 is the default temperature of the corresponding laser diode which can be set by TC(216,16) before the test. The Scanner can be moved to the desired position by TC(216,100) before the test.

9 ***Measurements*: PFS switches on Module O and acquires interferograms. The Double Pendulum is moved (i.e. must be unblocked before this test). The Scanner is on, but is not moved. PFS makes N_m measurements, decrementing the counter of measurements (N_m) and automatically goes to the *Standby Mode* when N_m=0. The counter of measurements N_m can be set by TC(216,101) before the measurements.**

10 ***Single Autotest*: PFS switches on Module O and perform the autonomous test. The Scanner is off. It make a single autonomous test procedure and send the data using DTM 0. The parameter for autotest is set by TC(216,25) before starting autonomous test.**

Telecommand (216,10) Change ClockSec

Function/Description

***ClockSec* is an alternative timer. It is a double word (32-bit) counter (format PC (3,14)) which counts seconds since the DAM is switched on. This clock can be used for the starting/termination of the Measurement Session. This Telecommand is aimed to correct the value of the counter.**

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**10**
Source Data	**See below**

ClockSec Delta
Relative Time in seconds PC (10,6)
4 octets

Parameters Meaning

ClockSec Delta **The value to be added to the *ClockSec***

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping Block, which contains *ClockSec*.

Remarks

Telecommand (216,11) Set period of HK Report Packet generation

Function/Description

This Telecommand sets the period at which PFS generates HK Report Packets. If this period is not set, the default period is equal to 2 minutes.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**11**
Source Data	**See below**

HKperiod
Unsigned Integer
2 octets

Parameters Meaning

HKperiod **Period of HK Report Packet generation [sec]**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping Block, which contains *HKperiod*. The HK Report Packets are sent with different period.

Remarks

Telecommand (216,12) Enable/disable subsystems

Function/Description

This Telecommand disables subsystems: the Scanner and Module O. It should be used only for testing purposes. If the Scanner is disabled, its power supply is off, and all measurements are performed without the Scanner motion. If Module O is disabled, its power supply is off. The Scanner rotates during the measurements, but interferograms are not acquired, and DAM sends only content of its memory rather than real interferograms/spectra.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**12**
Source Data	**See below**

Not Used	*DisableO*	*DisableS*
	Boolean	Boolean
14 bits	1 bit	1 bit

Parameters Meaning

DisableO	**If set, Module O is disabled**
DisableS	**If set, the Scanner is disabled**

Parameters Values/Range

***DisableO*: 0,1**
***DisableS*: 0,1**

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping Block, which contains *DisabledSubsys*.

Remarks

Telecommand (216,13) Set/clear OBDM Test Mode

Function/Description

During the OBDM Test Mode the synthetic interferograms are taken, and the double pendulum is not moved. This Telecommand switches the flag in DAM. DAM sends to OBDM the command "Get synthetic interferograms and measurement conditions" instead of the command "Start Acquisition" if the flag OBDMtest is set.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**13**
Source Data	**See below**

Not Used	***OBDMtest***
	Boolean
15 bits	**1 bit**

Parameters Meaning

OBDMtest	**0 Normal operations**
	1 Test Mode

Parameters Values/Range

***OBDMtest*: 0,1**

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains *OBDMtest*.

Remarks

Telecommand (216,14) Set temperature inside IB

Function/Description

This Telecommand sets temperature at one of 8 points inside the IB. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**14**
Source Data	**See below**

Not Used	***PointNum***	**Not Used**	***Temp***
	Unsigned Integer		**Unsigned Integer**
12 bits	**4 bits**	**1 octet**	**1 octet**

Parameters Meaning

PointNum	**Number of point for which the temperature must be set**
Temp	**Undimensioned value derived from the temperature:** ***Temp = (Temperature[ºK] - 268ºK)/64*255***

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,15) Set power of laser diode

Function/Description

This Telecommand sets power of one of 2 laser diodes inside Module O. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**15**
Source Data	**See below**

Not Used	***Diode***	**Not Used**	***Pow***
	Enumerated		**Unsigned Integer**
15bits	**1 bit**	**1 octet**	**1 octet**

Parameters Meaning

Diode **0 set power of laser diode in SW channel**
1 set power of laser diode in LW channel

Pow **Undimensioned value derived from the power:**
Pow = Power[mW]/5.92*255 **(for SW laser diode)**
Pow = Power[mW]/5.98*255 **(for LW laser diode)**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,16) Set temperature of laser diode/detector

Function/Description

This Telecommand sets temperature of one of laser diodes or detectors inside Module O. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **16**
Source Data **See below**

Not Used	*Unit*	Not Used	*Temp*
	Enumerated		Unsigned Integer
14bits	2 bits	1 octet	1 octet

Parameters Meaning

Unit **0 set temperature of laser diode in SW channel**
1 set temperature of laser diode in LW channel
2 set temperature of detector in SW channel
3 set temperature of detector in LW channel

Temp **Undimensioned value derived from the temperature:**
Temp = (Temperature[ºK]-275ºK)/40*255 **(for SW and LW laser diodes)**
Temp = (Temperature[ºK]-200ºK)/80*255 **(for SW detector)**
Temp = (Temperature[ºK]-260ºK)/80*255 **(for LW detector)**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,17) Set TRW current of laser diode

Function/Description

This Telecommand sets TRW current of one of 2 laser diodes inside Module O. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **17**
Source Data **See below**

Not Used	*Diode*	Not Used	*Curr*
	Enumerated		Unsigned Integer
15bits	1 bit	1 octet	1 octet

Parameters Meaning

Diode **0 set TRW current of laser diode in SW channel**
1 set TRW current of laser diode in LW channel
Curr **Undimensioned value derived from the current:** ***Curr = Current[mkA]/79.57***

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,18) Set gain sensors

Function/Description

This Telecommand sets bits 0..3 of port ALPHA_A and bit 6 of port BETA_B inside OBDM. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**18**
Source Data	**See below**

Not Used	***LWgainCtrl***	***SWgainCtrl***
	Enumerated	**Enumerated**
11bits	**2 bits**	**3 bits**

Parameters Meaning

LWgainCtrl	**Bits 2 and 3 of port ALPHA_A**
SWgainCtrl	**Bits 0, 1 of port ALPHA_A and bit 6 of port BETA_A**

Parameters Values/Range

Parameter	**Value**	**Gain factor**
LWgainCtrl	**00**	**1**
	01	**2**
	10	**4**
	11	**8**
SWgainCtrl	**000**	**1**
	001	**2**
	010	**4**
	011	**8**
	100	**16**
	101	**32**
	110	**64**
	111	**128**

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,19) Set ADC configuration

Function/Description

This Telecommand sets bits 4..7 of ALPHA_A port inside OBDM. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **19**
Source Data **See below**

Not Used	*ADCconf*
	Enumerated
12bits	4 bits

Parameters Meaning

ADCconf **Bits 4..7 of ALPHA_A port in OBDM**

Parameters Values/Range

Parameter	Total Size (bit)	Bit number	Meaning	Value
ADCconf	16	A15-A4	--	--
	16	A3	Wake up ADC 1a, SW signal sampled every SW Zero Crossing Pulse (Default)	(OFF,ON)
	16	A2	Wake up ADC 1b, LW signal sampled every SW Zero Crossing Pulse (Failure)	(OFF,ON)
	16	A1	Wake up ADC 2a, LW signal sampled every LW Zero Crossing Pulse (Default)	(OFF,ON)
	16	A0	Wake up ADC 2b, SW signal sampled every LW Zero Crossing Pulse (Failure)	(OFF,ON)

LEGEND:

-- = not used

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,20) Select motor coil

Function/Description

This Telecommand sets bit 0 of BETA_A port inside OBDM. This bit selects motor which moves the Double Pendulum. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **20**
Source Data **See below**

Not Used	*MCoil*
	Enumerated
15bits	1 bit

Parameters Meaning

MCoil **Bit 0 of BETA_A port in OBDM**

Parameters Values/Range

Parameter	Total Size (bit)	Bit number	Meaning	Value
MCoil	16	A15-A1	--	--
	16	A0	Motor Coil Select	(Sec.,Prim.)

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,21) Set gain Zero Crossing

Function/Description

This Telecommand sets bits 0..3 of BETA_B port inside OBDM. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **21**
Source Data **See below**

Not Used	*Gain0x*
	Enumerated
12bits	4 bits

Parameters Meaning

Gain0x **Bits 0..3 of BETA_B port in OBDM**

Parameters Values/Range

Parameter	Total Size (bit)	Bit number	Meaning	Value
Gain0x	16	A15-A4	--	--
	16	A3,A2	LW ZeroX Gain Set (Factor 2 each step)	(1,8)
	16	A1,A0	SW ZeroX Gain Set (Factor 2 each step)	(1,8)

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,22) Set period of filter

Function/Description

This Telecommand sets period (numbe r of clock pulses) for the given filter inside Module O. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**22**
Source Data	**See below**

Not Used	***Filter***	***Period***
	Enumerated	**Unsigned Integer**
13bits	**3 bits**	**2 octets**

Parameters Meaning

Filter **0 set period of SW 0xing clock**
1 set period of LW 0xing clock
2 set period of Speed Control Loop
3 set period of Serial Converter Clock
4 set period of SW upper filter
5 set period of LW upper filter

Period **Undimensioned value derived from the frequency:**
Period = 8MHz/(150*Freq) **(for SW 0xing clock)**
Period = 8MHz/(150*Freq) **(for LW 0xing clock)**
Period = 8MHz/Freq **(for Speed Control Loop)**
Period = 8MHz/Freq **(for Serial Converter Clock)**

Period = 8MHz/(150*Freq) **(for SW upper filter)**
Period = 8MHz/(150*Freq) **(for LW upper filter)**

Parameters Values/Range

Filter **must be in range 0..5. Otherwise the Telecommand will be rejected with error: "Wrong parameter".**

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,23) Select Zero Crossing LW/SW

Function/Description

This Telecommand sets bit 4 of BETA_B port inside OBDM. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**23**
Source Data	**See below**

Not Used	***Select0x***
	Enumerated
15bits	**1 bit**

Parameters Meaning

Select0x	**Bit 4 of BETA_B port in OBDM**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,24) Switch laser diodes

Function/Description

This Telecommand sets bits 5..6 of BETA_B port inside OBDM. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**24**
Source Data	**See below**

Not Used	***SwitchDiodes***
	Enumerated
14bits	**2bits**

Parameters Meaning

SwitchDiodes	**Bits 5..6 of BETA_B port in OBDM**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,25) Set Autotest parameter

Function/Description

This Telecommand sets parameter to be used during Module O Autotest procedure.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **25**
Source Data **See below**

Not Used	*OBDMauto*
	Unsigned Integer
1 octet	1 octet

Parameters Meaning

OBDMauto **Parameter to be used during Module O Autotest procedure**

Parameters Values/Range

OBDMauto	A0	---	---
	A1	---	---
	A2,A3	Offset for ADC range	±10V=10 ; ±5V=01
	A4	---	---
	A5	Pendulum direction	rev = 1 ; 0 = frw
	A6,A7	Photodiode to use	#1 = 10 ; #2 = 11

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping Block, which contains *OBDMauto*.

Remarks

Telecommand (216,26) Change Speed Controller STOP command

Function/Description

This Telecommand sets bits 2..3 of BETA_A port inside OBDM. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the next measurement.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**26**
Source Data	**See below**

Not Used	***CtrlStop***
	Enumerated
14bits	**2bits**

Parameters Meaning

CtrlStop	**Bits 2..3 of BETA_A port in OBDM**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,27) Work with Module O in Sleeping Mode

Function/Description

This Telecommand allows to block/unblock the Double Pendulum and make Autotest of Module O. The Telecommand takes effect only in Sleeping Mode. When DAM enters the Sleeping Mode, it switches on Module O, which performs specified operations. Upon completion DAM sends Event Report, reads OBDM Selftest, Status, MC information and Autotest result (if needed) and sends Source Packet.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**27**
Source Data	**See below**

Not Used	***OperationCode***
	Enumerated
13 bits	**3 bits**

Parameters Meaning

OperationCode **0 no effect**
1 Only block
2 Only Autotest (see Note below)
3 Autotest, then block (see Note below)
4 Only unblock
5 no effect
6 Unblock, then Autotest
7 Unblock, then Autotest, then block

Note: Autotest will fail if the Double Pendulum is blocked.

Parameters Values/Range

OperationCode **values 0 and 5 are invalid and have no effect.**

Verification/Effect on Telemetry

After the successful Double Pendulum unblocking DAM generates the Event Report "Double Pendulum is unblocked". After the Autotest procedure DAM sends a Source Packet (DTM=0) with Autotest data. After the successful Double Pendulum blocking DAM generates the Event Report "Double Pendulum is blocked".

Remarks

TC (216,27) does not have immediate effect. The Telecommand interpreter only checks the validity of *OperationCode*, acknowledges TC (216,27), if it is valid and sets a flag with *OperationCode* in the DAM memory. When the DAM software starts the execution of TC (216,27), it clears the flag and gets the *OperationCode*. If another TC (216,27) with different *OperationCode* was received before the execution started, the *OperationCode* will be overwritten and the last one will take effect. This feature allows to correct a mistake (made by calibration personnel) without undesirable delay.

It is desirable to terminate the Session before blocking the Double Pendulum. Otherwise the blocking will be delayed until the termination of the Measurement Session (if in progress).

Telecommand (216,32) Set/clear simulation mode

Function/Description

This Telecommand allows to substitute real information with the simulated data (increasing sequence) in order to check how DAM processes and transfers data. It should be used only for a testing purpose.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**

Subtype **32**
Source Data **See below**

Not Used	*SimulMode*
	Boolean
15 bits	1 bit

Parameters Meaning

SimulMode **0 normal operations**
1 simulation mode

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in PFS Housekeeping Block, which contains SimulMode.

Remarks

This Telecommand has imme diate result and can be used for tests of DAM.

Telecommand (216,33) Set ICM mode

Function/Description

This Telecommand allows to use additional ICM facilities.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**33**
Source Data	**See below**

Not Used	*Bias*	*4Kmode*	*AvSuppr*	*Apod*
	Unsigned Int	Enumerated	Boolean	Boolean
5 bits	7 bits	2 bits	1 bit	1 bit

Parameters Meaning

Bias	**Bias for the interferogram compression**
4Kmode	**Mode for 4K FFT**
AvSuppr	**Average suppression during FFT**
Apod	**Apodisation during FFT**

Parameters Values/Range

Parameter	Value/Range	Usage
Bias	**0..127**	**Compression**
4Kmode	**0 4K single bank 0** **1 4K single bank 1** **2 4K single bank 2** **3 standard 4K**	**FFT**
AvSuppr	**0 do not use Average suppr.** **1 use Average suppression**	**FFT**
Apod	**0 do not use Apodisation** **1 use Apodisation**	**FFT**

Verification/Effect on Telemetry

The change can be seen in PFS Housekeeping Block, which contains *ICMmode*.

Remarks

This Telecommand has immediate result.

Telecommand (216,34) Set source timer

Function/Description

ClockSec, delay and timeout counters can be driven by interrupt signals from different sources.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**34**
Source Data	**See below**

Not Used	***ClockSrc***
	Enumerated
14 bits	**2 bit**

Parameters Meaning

ClockSrc	**0 use second 8254 timer (TMR2)** **1 use first 8254 timer (TMR1)** **2 use SCET interrupts**

Parameters Values/Range

***ClockSec* must be 0, 1 or 2. Otherwise the Telecommand will be rejected with error: "Wrong parameter".**

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping Block, which contains *ClockSrc*.

Remarks

The time resolution of 8254 timers is 10 ms when the resolution of SCET interface is 125 ms. Timer TMR2 is preferable because Timer TMR1 has a priority less than DMA interrupts, and some interrupt signals will be lost during the DMA transfer.

Telecommand (216,36) Set Scanner Mode

Function/Description

This Telecommand allows to set the mode for the Scanner.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**36**
Source Data	**See below**

Not Used	***SCANmode***
	Unsigned Integer
1 octet	**1 octet**

Parameters Meaning

SCANmode	**Mode of Scanner operations**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping block which contains *SCANmode*.

Remarks

Telecommand (216,37) Set period between measurements

Function/Description

This Telecommand allows to set period between measurements during the Measurement Session.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**37**
Source Data	**See below**

MeasPer
Unsigned Integer
2 octets

Parameters Meaning

MeasPer	**Period between measurements [sec]**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack.

Remarks

Since the acquisition time can not be less than 4 seconds, setting the MeasPer < 5 sec gives no effect: PFS will start next acquisition only after the completion of the previous one.

Telecommand (216,38) Set number of SCAN retries

Function/Description

This Telecommand allows to set the number of attempts to repeat the SCAN command. If all attempts are unsuccessful, PFS continues operations.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**38**
Source Data	**See below**

Not Used	***SCANretNum***
	Unsigned Integer
1 octet	**1 octet**

Parameters Meaning

SCANretNum	**Number of retries for SCAN command**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping block which contains *SCANretNum*.

Remarks

Telecommand (216,39) Set number of OBDM retries

Function/Description

This Telecommand allows to set the number of attempts to repeat the OBDM command. If all attempts are unsuccessful, PFS continues operations.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **39**
Source Data **See below**

Not Used	*OBDMretNum*
	Unsigned Integer
1 octet	1 octet

Parameters Meaning

OBDMretNum **Number of retries for OBDM command**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping block which contains *OBDMretNum*.

Remarks

Telecommand (216,40) Set POWR event ignore mask

Function/Description

This Telecommand allows to mask some power supply events. If event is masked, PFS does not try to change the power supply configuration and continues operations. This feature is useful only in the case of failure of power sensors.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **40**

Source Data **See below**

Not Used	*IgnorePOWR*
	Enumerated
1 octet	1 octet

Parameters Meaning

IgnorePOWR **POWR event ignore mask**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping block which contains *IgnorePOWR*.

Remarks

Telecommand (216,41) Set SCAN event ignore mask

Function/Description

This Telecommand allows to mask some Scanner events. If event is masked, PFS does not try to reset the Scanner and continues operations. This feature is useful only in the case of failure of Scanner sensors.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **41**
Source Data **See below**

Not Used	*IgnoreSCAN*
	Enumerated
1 octet	1 octet

Parameters Meaning

IgnoreSCAN **SCAN event ignore mask**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping block which contains IgnoreSCAN.

Remarks

Telecommand (216,42) Set OBDM event ignore mask

Function/Description

This Telecommand allows to mask some Module O events. If event is masked, PFS does not try to reset the Module O and continues operations. This feature is useful only in the case of failure of Module O sensors.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**42**
Source Data	**See below**

Not Used	***IgnoreOBDM***
	Enumerated
1 octet	**1 octet**

Parameters Meaning

IgnoreOBDM **OBDM event ignore mask**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the PFS Housekeeping block which contains *IgnoreOBDM*.

Remarks

Telecommand (216,43) Set ICM event ignore mask

Function/Description

This Telecommand allows to mask some ICM events. If event is masked, PFS does not try to reset ICM and continues operations. This feature is useful only in the case of failure of ICM subsystems.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**43**
Source Data	**See below**

Not Used	***IgnoreICM***
	Enumerated
1 octet	**1 octet**

Parameters Meaning

IgnoreICM	**ICM event ignore mask**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the PFS HK Report which contains *IgnoreICM*.

Remarks

Telecommand (216,45) Select SW filter shape

Function/Description

This Telecommand sets bit 7 of BETA_A port inside OBDM. This bit selects the shape of the SW filter. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the measurement.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**45**
Source Data	**See below**

Not Used	***SWfltShape***
	Enumerated
15bits	**1 bit**

Parameters Meaning

SWfltShape	**Bit 7 of BETA_A port in OBDM**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,46) Select TRW channel

Function/Description

This Telecommand sets bit 7 of BETA_B port inside OBDM. This bit selects the TRW channel. The value is stored in the OBDM Control Table to be loaded into Module O at the beginning of the measurement.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**46**
Source Data	**See below**

Not Used	***TRWchan***
	Enumerated
15bits	**1 bit**

Parameters Meaning

TRWchan	**Bit 7 of BETA_B port in OBDM**

Parameters Values/Range

TRWchan	**0 SW chanel**
	1 LW channel

Verification/Effect on Telemetry

The change can be seen in the MH1 field of the Data Pack, which contains OBDM Control Table.

Remarks

Telecommand (216,47) Set DTM for measurements

Function/Description

This Telecommand sets DTM (Data Transmission Mode) for measurements.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**47**
Source Data	**See below**

Not Used	***DTMmeas***
	Enumerated
1 byte	**1 byte**

Parameters Meaning

DTMmeas	**DTM to be used during the measurements**

Parameters Values/Range

The specified DTM (see 4.1 and 4.5) must be valid. Otherwise the Telecommand will be rejected with error: "Wrong parameter".

Verification/Effect on Telemetry

The change can be seen in the HK Report which contains *DTMmeas*.

Remarks

Telecommand (216,48) Set DTM for calibrations

Function/Description

This Telecommand sets DTM (Data Transmission Mode) for calibrations.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **48**
Source Data **See below**

Not Used	*DTMcalib*
	Enumerated
1 byte	1 byte

Parameters Meaning

DTMcalib **DTM to be used during the calibrations**

Parameters Values/Range

The specified DTM (see 4.1 and 4.5) must be valid. Otherwise the Telecommand will be rejected with error: "Wrong parameter".

Verification/Effect on Telemetry

The change can be seen in the HK Report which contains *DTMcalib*.

Remarks

Telecommand (216,49) Set/clear Reference Channel Mode for Module O

Function/Description

This Telecommand sets "Reference Channel" mode for Module O. In this mode Module O acquires the signal from the reference channel instead of interferograms.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **49**

Source Data **See below**

Not Used	*OBDMrefChan*
	Boolean
15bits	**1 bit**

Parameters Meaning

OBDMrefChan **Reference Channel Mode**

Parameters Values/Range

OBDMrefChan **0 Clear Reference Channel Mode (acquire interferograms)**
1 Set Reference Channel Mode (acquire reference channel)

Verification/Effect on Telemetry

The change can be seen in the HK Report, which contains *OBDMrefChan*.

Remarks

Telecommand (216,50) Set offset for ZOPDSW and ZOPDLW frwd and reverse

Function/Description

This Telecommand sets the offset for ZOPDSW and ZOPDLW in forward and reverse.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **50**
Source Data **See below**

Not Used	*Param Number*	*Offset_ZOPD*
	Unsigned Int	**Unsigned Int**
14 bits	**2 bits**	**1 word**

Parameters Meaning

Param Number **Number of 4 parameter that is possible to set**
Offset_ZOPD **Offset-Value to set into selected variable**

Parameters Values/Range

Param Number **0 word offset for ZOPDSW in forward (ZOPDSF)**
1 word offset for ZOPDSW in reverse (ZOPDSR)
2 word offset for ZOPDLW in forward (ZOPDLF)
3 word offset for ZOPDLW in reverse (ZOPDLR)
Offset_ZOPD **0..65534**

Verification/Effect on Telemetry

The change can be seen in the MH1 at the end of Control Table.

Remarks

Telecommand (216,100) Move the Scanner to the specified position

Function/Description

This Telecommand allows to move the Scanner to the specified position.

Structure

Process ID **86**
Packet Cat. **12 (Private)**
Type **216**
Subtype **100**
Source Data **See below**

Not Used	***ScanPos***
	Enumerated
13 bits	**3 bits**

Parameters Meaning

ScanPos **Scanner position according to the Code Disk**

Parameters Values/Range

ScanPos	**0 Black Body (initial position)** **2 Cold Space** **1 Angle +25° from Nadir** **3 Angle +12.5° from Nadir** **7 Nadir** **6 Angle -12.5° from Nadir** **4 Angle -25° from Nadir** **5 Calibration Lamp**

Verification/Effect on Telemetry

The change can be seen in the HK Report which contains *ScanPos*.

Remarks

Telecommand (216,101) Set number of measurements

Function/Description

This Telecommand allows to set the number of measurements that will be taken by the TC(216,5) with parameter equal to 9 during the measurements. The DAM software decrements this number (counter) after each measurement. The measurements are stopped when the counter is equal to 0. In order to make a new set of measurements, the counter must be set again by this Telecommand. This Telecommand can stop the measurements if the number is equal to 0.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**101**
Source Data	**See below**

MeasNum
Unsigned Integer
2 octets

Parameters Meaning

MeasNum **Number of measurements to be taken**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the HK Report which contains *MeasNum*.

Remarks

This Telecommand takes effect only when the measurements were started by TC(216,5) with parameter 9.

Telecommand (216,102) Set number of calibrations

Function/Description

This Telecommand allows to set the specified number of calibrations during Test 4, Test 5 and Test 6 started by TC(216,5). Unlike the previous Telecommand, the number is not changed during the measurements. Upon reception of the Telecommand to start calibrations (TC(216,5) with parameter 6, 7 or 8), the DAM software copies the specified number of calibrations into an internal counter and decrements this internal counter after each calibration.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**102**
Source Data	**See below**

CalibNum
Unsigned Integer
2 octets

Parameters Meaning

CalibNum	**Number of calibration measurements to be taken**

Parameters Values/Range

N/A

Verification/Effect on Telemetry

The change can be seen in the HK Report which contains *CalibNum*.

Remarks

This Telecommand takes effect only when the calibrations were started by TC(216,5) with parameter 6 (Test 4), 7 (Test 5) or 8 (Test 6).

Telecommand (216,200) Reconfigure the Mass Memory

Function/Description

This Telecommand allows to reconfigue the Mass Memory by setting the first and the last Mass Memory Bank to be used.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**200**
Source Data	**See below**

Not Used	***LowBank***	***HighBank***
	Unsigned Integer	**Unsigned Integer**
1 byte	**4 bits**	**4 bits**

Parameters Meaning

LowBank	**Number of the first Mass Memory banks to be used**
HighBank	**Number of the last Mass Memory banks to be used**

Parameters Values/Range

LowBank	**0..3**	***LowBank* < *HighBank***
HighBank	**0..3**	***LowBank* < *HighBank***

***LowBank* must be less than *HighBank*. Otherwise the Telecommand will be rejected with Error "Wrong parameter".**

Remarks

Telecommand (216,205) Change CPU Code Segment

Function/Description

The DAM software can work in both RAM and ROM depending on the CPU Code Segment. The memory load procedure, applied when the software works in RAM, can cause the software crash. In order to avoid the crash, the CPU Code Segment must be changed to ROM before the memory patch. After the patching the Code Segment must be changed to RAM.

Structure

Process ID	**86**
Packet Cat.	**12 (Private)**
Type	**216**
Subtype	**205**
Source Data	**See below**

Not Used	***CS***
	Boolean
15 bits	**1 bit**

Parameters Meaning

CS	**CPU Code Segment**

Parameters Values/Range

CS	**0 work in RAM**
	1 work in ROM

Verification/Effect on Telemetry

The change can be seen in the HK Report.

Remarks

7 – EVENTS

If something goes wrong, DAM considers this as an Event and sends an Event Report to the spacecraft. The Event Report can be also sent in order to inform PFS team that some checkpoint passed. All failures detected by DAM are considered as Events. EventInfo gives additional information about the Event.

In the case of some Events the DAM software performs operations in order to avoid the cause of the Event. But if the Event is ignored, the DAM software only sends a report and continues normal operations. The possibility to ignore the Event should be used in the case of wrong information about the failure due to the hardware damage. The Event is ignored if a corresponding bit in the Event Ignore Mask is set. There are masks for different subsystems.

7.1 - SUMMARY OF PFS EVENTS

EID	MEDOC	Severity	Event
SSTC	YPS01500	Normal	Session started by a Telecommand
SSTW		Normal	Session started by Twakeup
SSUR	YPS01600	Error	Session started by undefined reason
WOSM	YPS01502	Normal	Work with Module O in Sleeping Mode
STTC	YPS01503	Normal	Session terminated by a Telecommand
STTS		Normal	Session terminated by Tsleep
STUR	YPS01601	Error	Session terminated by undefined reason
STAB	YPS01602	Error	Session aborted
SFMM	YPS01603	Error	Session suspended by MM full signal
OMNB	YPS01604	Error	No OBDM message ‘booted’ within predefined time
OMCB	YPS01605	Error	Communication with OBDM is bad
ODPB	YPS01606	Error	Doulbe Pendulum to be moved is blocked
OMOK	YPS01505	Normal	Communication with OBDM is OK
OMNR	YPS01607	Error	No responce on the OBDM command
OMER	YPS01608	Error	Error in the OBDM message
DPUB	YPS01506	Normal	Double Pendulum is unblocked
DPBL	YPS01507	Normal	Double Pendulum is blocked
SWTS	YPS01508	Normal	SW transfer started
SWTC	YPS01509	Normal	SW transfer completed
LWTS	YPS01510	Normal	LW transfer started
LWTC	YPS01511	Normal	LW transfer completed
FP5V	YPS01609	Error	Failure of power supply for 5V detected

F15V	**YPS01610**	**Error**	**Failure of power supply for 15V detected**
FSAM	**YPS01611**	**Error**	**Failure of power supply for SAM detected**
FPUN	**YPS01612**	**Error**	**Unexpected power supply status**
SMER	**YPS01613**	**Error**	**Wrong Scanner position**
SMNR	**YPS01614**	**Error**	**No responce from Scanner within predefined time**
ISNM	**YPS01615**	**Error**	**ICM send: no message**
ISWM	**YPS01616**	**Error**	**ICM send: wrong message**
ISC2	**YPS01617**	**Error**	**ICM send: no TC in DMA channel 2**
IRNM	**YPS01618**	**Error**	**ICM recv: no message**
IRWM	**YPS01619**	**Error**	**ICM recv: wrong message**
IRC2	**YPS01620**	**Error**	**ICM recv: no TC in DMA channel 2**
DNTI	**YPS01621**	**Error**	**DAM: no Timer interrupts**
DIS4	**YPS01622**	**Error**	**DAM: IRQS4 was masked**
MMSE	**YPS01623**	**Error**	**MMEM: single error**
MMDE	**YPS01624**	**Error**	**MMEM: double error**
INIT	**YPS01512**	**Normal**	**PFS initialization completed**
TIME	**YPS01513**	**Normal**	**Timestamp**
EOB		**Normal**	**End of telemetry block**

7.2 - LIST OF PFS EVENTS

Event SSTC – Session started by a Telecommand

Function/Description

The Event "Session started by a Telecommand" means that the Measurement Session was started by a Telecommand. Since measurements, started by telecommands are performed during the on-ground calibration procedure, it is easy to identify the Telecommand, caused the Event. No Event Info is provided

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **1**
Source Data **See below**

EID-SSTC
Enumerated
2 octets

Parameters Meaning

EID-SSTC **42501**

Parameters Values/Range

N/A

Remarks

Event SSUR – Session started by undefined reason

Function/Description

The Event "Session started by undefined reason" means that the DAM software is unable to determine the cause due to an error. Only memory dumps and source codes could help to understand the situation. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-SSUR
Enumerated
2 octets

Parameters Meaning

EID-SSUR **42503**

Parameters Values/Range

N/A

Remarks

Event WOSM – Work with Module O in Sleeping Mode

Function/Description

The Event "Work with Mod.O in Sleeping Mode" means that Module O was powered ON in order to block/unblock the Double Pendulum. All interesting information is contained in the Data Pack. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**1**
Source Data	**See below**

EID-WOSM
Enumerated
2 octets

Parameters Meaning

EID-WOSM **42504**

Parameters Values/Range

N/A

Remarks

Event STTC – Session terminated by a Telecommand

Function/Description

The Event "Session terminated by a Telecommand" means that the Measurement Session was terminated by a Telecommand. Since measurements, started by telecommands are performed during the on-ground calibration procedure, it is easy to identify the Telecommand, caused the Event. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**1**
Source Data	**See below**

EID-STTC
Enumerated
2 octets

Parameters Meaning

EID-STTC **42505**

Parameters Values/Range

N/A

Remarks

Event STUR – Session terminated by undefined reason

Function/Description

The Event "Session terminated by undefined reason" means that the DAM software is unable to determine the cause due to an error. Only memory dumps and source codes could help to understand the situation. No Event Info is provided.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **2 (Error/Anomaly)**
Source Data **See below**

EID-STUR
Enumerated
2 octets

Parameters Meaning

EID-STUR **42507**

Parameters Values/Range

N/A

Remarks

Event STAB – Session aborted

Function/Description

The Event "Session aborted" means that the Session was aborted due to one of the reasons reported previously. No Event Info is provided.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **2 (Error/Anomaly)**
Source Data **See below**

EID-STAB
Enumerated
2 octets

Parameters Meaning

EID-STAB 42508

Parameters Values/Range

N/A

Remarks

Event SFMM – Session suspended by MM full signal

Function/Description

The Event "Session suspended by MM full signal" means that PFS is waiting until some amount of the Mass Memory will be available to store at least one measurement. The Session is not terminated. No Event Info is provided.

Structure

Process ID 86
Packet Cat. 7 (Event)
Type 5
Subtype 2 (Error/Anomaly)
Source Data See below

EID-SFMM
Enumerated
2 octets

Parameters Meaning

EID-SFMM 42509

Parameters Values/Range

N/A

Remarks

Event OMNB – No OBDM message ‘booted’ within predefined time

Function/Description

The Event "No OBDM message ‘booted’ within predefined time" means that there was no responce after OBDM reset. The Session was aborted. Only OBDM reset can help. The Event can be ignored. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-OMNB
Enumerated
2 octets

Parameters Meaning

EID-OMNB **42510**

Parameters Values/Range

N/A

Remarks

Event OMCB – Communication with OBDM is bad

Function/Description

The Event "Communication with OBDM is bad" means that the communication test failed after OBDM reset. The Session was aborted. Only reset of OBDM and communication interface can help. The Event can be ignored. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-OMCB
Enumerated
2 octets

Parameters Meaning

EID-OMCB **42511**

Parameters Values/Range

N/A

Remarks

Event ODPB – Doulbe Pendulum to be moved is blocked

Function/Description

The Event "Double Pendulum to be moved is blocked" means that during the Starting phase the DAM software detected (analysing the OBDM selftest) that the Double Pendulum is blocked. The Session was aborted. May be, it is a sensor failure, and OBDM reset can help. The Event can be ignored. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-ODPB
Enumerated
2 octets

Parameters Meaning

EID-ODPB 42512

Parameters Values/Range

N/A

Remarks

Event OMOK – Communication with OBDM is OK

Function/Description

The Event "Communication with OBDM is OK", as opposite to OMCB, is self-explanatory. No action needed. No Event Info is provided.

Structure

Process ID 86
Packet Cat. 7 (Event)
Type 5
Subtype 1
Source Data See below

EID-OMOK
Enumerated
2 octets

Parameters Meaning

EID-OMOK 42513

Parameters Values/Range

N/A

Remarks

Event OMNR – No responce on the OBDM command

Function/Description

The Event "No responce on the OBDM command" means that there was no OBDM message in responce to the OBDM Command after several attempts to send the OCOM and get the OMES. The Event can be ignored. Only memory dump can help. The Event Info contains only the OBDM command code.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-OMNR	OCOMcode
Enumerated	Enumerated
2 octets	2 octets

Parameters Meaning

EID-OMNR	**42514**
OCOMcode	**OBDM Command Code**

Parameters Values/Range

N/A

Remarks

Event OMER – Error in the OBDM message

Function/Description

The Event "Error in the OBDM message" means that there was always wrong responce after several attempts to send OCOM and get OMES. The Event can be ignored. Only memory dump can help. The Event Info contains only OCOM and OMES codes.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-OMER	OCOMcode	OMEScode
Enumerated	Enumerated	Enumerated
2 octets	2 octets	2 octets

Parameters Meaning

EID-OMER	**42515**
OCOMcode	**OBDM Command Code**
OMEScode	**OBDM Message Code**

Parameters Values/Range

N/A

Remarks

Event DPUB – Double Pendulum has been unblocked

Function/Description

The Event "Double Pendulum has been unblocked" means that the Telecommand to unblock the Double Pendulum has been successfully executed, and Module O reported that the Double Pendulum has been unblocked. The MH3 field of the Data Pack contains all interesting information. No Event Info is provided.

Structure

Process ID	**86**

Packet Cat. **7 (Event)**
Type **5**
Subtype **1**
Source Data **See below**

EID-DPUB
Enumerated
2 octets

Parameters Meaning

EID-DPUB **42516**

Parameters Values/Range

N/A

Remarks

Event DPBL – Double Pendulum has been blocked

Function/Description

The Event "Double Pendulum has been blocked" means that the Telecommand to block the Double Pendulum has been successfully executed, and Module O reported that the Double Pendulum has been blocked. The MH3 field of the Data Pack contains all interesting information. No Event Info is provided.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **1**
Source Data **See below**

EID-DPBL
Enumerated
2 octets

Parameters Meaning

EID-DPBL 42517

Parameters Values/Range

N/A

Remarks

Event SWTS – SW transfer started

Function/Description

The Event "SW transfer started" is used only for the software testing purposes. The Event is disabled by default. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**1**
Source Data	**See below**

EID-SWTS
Enumerated
2 octets

Parameters Meaning

EID-SWTS 42518

Parameters Values/Range

N/A

Remarks

Event SWTC – SW transfer completed

Function/Description

The Event "SW transfer completed" is used only for the software testing purposes. The Event is disabled by default. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**1**
Source Data	**See below**

EID-SWTC
Enumerated
2 octets

Parameters Meaning

EID-SWTC **42519**

Parameters Values/Range

N/A

Remarks

Event LWTS – LW transfer started

Function/Description

The Event "LW transfer started" is used only for the software testing purposes. The Event is disabled by default. No Event Info is provided.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **1**
Source Data **See below**

EID-LWTS
Enumerated
2 octets

Parameters Meaning

EID-LWTS **42520**

Parameters Values/Range

N/A

Remarks

Event LWTC – LW transfer completed

Function/Description

The Event "LW transfer completed" is used only for the software testing purposes. The Event is disabled by default. No Event Info is provided.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **1**
Source Data **See below**

EID-LWTC
Enumerated
2 octets

Parameters Meaning

EID-LWTC **42521**

Parameters Values/Range

N/A

Remarks

Event FP5V – Failure of power supply for 5V detected

Function/Description

The Event "Failure of power suppply for 5V detected" means either the DC/DC failure or the failure of a sensor inside Module P. DAM can only report about this. Event Info contains Power Status.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **2 (Error/Anomaly)**
Source Data **See below**

EID-FP5V	PowerStatus
Enumerated	Enumerated
2 octets	2 octets

Parameters Meaning

EID-FP5V **42522**
PowerStatus **Status of Power Supply obtained from Module P**

Parameters Values/Range

N/A

Remarks

Event F15V – Failure of power supply for 15V detected

Function/Description

The Event "Failure of power supply for 15V detected" means either the DC/DC failure or the failure of a sensor inside Module P. DAM overswitches 15V main/reserve lines. The Event can be ignored. Event Info contains Power Status at the moment the failure was detected.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **2 (Error/Anomaly)**
Source Data **See below**

EID-F15V	PowerStatus
Enumerated	Enumerated
2 octets	2 octets

Parameters Meaning

EID-F15V **42523**
PowerStatus **Status of Power Supply obtained from Module P**

Parameters Values/Range

N/A

Remarks

Event FSAM – Failure of power supply for SAM detected

Function/Description

The Event "Failure of power supply for SAM detected" means either the DC/DC failure or the failure of a sensor inside Module P. DAM overswitches SAM main/reserve lines. The

Event can be ignored. Event Info contains Power Status at the moment the failure was detected.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-FSAM	PowerStatus
Enumerated	Enumerated
2 octets	2 octets

Parameters Meaning

EID-FSAM	**42524**
PowerStatus	**Status of Power Supply obtained from Module P**

Parameters Values/Range

N/A

Remarks

Event FPUN – Unexpected power supply status

Function/Description

The Event "Unexpected power supply status" means either the DC/DC failure or the failure of a sensor inside Module P. DAM can only report about this. Event Info contains Power Status.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-FPUN	PowerStatus
Enumerated	Enumerated
2 octets	2 octets

Parameters Meaning

EID-FPUN **42525**
PowerStatus **Status of Power Supply obtained from Module P**

Parameters Values/Range

N/A

Remarks

Event SMER – Wrong Scanner position

Function/Description

The Event "Wrong Scanner position" means that the Scanner Status port contains some unexpected value. DAM tries to put the Scanner into the required position. The Event can be ignored. Event Info contains expected and real values in the Scanner Status port.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **2 (Error/Anomaly)**
Source Data **See below**

EID-SMER	ScanStatus
Enumerated	Enumerated
2 octets	2 octets

Parameters Meaning

EID-SMER **42526**

ScanStatus **Status of the Scanner**

Parameters Values/Range

N/A

Remarks

Event SMNR – No responce from Scanner within predefined time

Function/Description

The Event "No responce from Scanner within predefined time" means that there was no signal "Ready" after the pulse "Go" has been sent several times to the Scanner. The Event can be ignored. Event Info contains expected and real values in the Scanner Status port.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **2 (Error/Anomaly)**
Source Data **See below**

EID-SMNR	ScanStatus
Enumerated	Enumerated
2 octets	2 octets

Parameters Meaning

EID-SMNR **42527**
ScanStatus **Status of the Scanner**

Parameters Values/Range

N/A

Remarks

Event ISNM – ICM send: no message

Function/Description

The Event "ICM send: no message" means that there was no ICM responce after several attempts to reset ICM and upload the interferogram. DAM prepares Data Pack at DTM=1. The Event can be ignored. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-ISNM
Enumerated
2 octets

Parameters Meaning

EID-ISNM	**42528**

Parameters Values/Range

N/A

Remarks

Event ISWM – ICM send: wrong message

Function/Description

The Event "ICM send: wrong message" means that there was wrong ICM responce after several attempts to reset ICM and upload the interferogram. DAM prepares Data Pack at DTM=1. The Event can be ignored. No Event Info is provided.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **2 (Error/Anomaly)**
Source Data **See below**

EID-ISWM
Enumerated
2 octets

Parameters Meaning

EID-ISWM **42529**

Parameters Values/Range

N/A

Remarks

Event ISC2 – ICM send: no TC in DMA channel 2

Function/Description

The Event "ICM send: no TC in DMA channel 2" means that the DMA did not upload the interferogram after several attempts to reset ICM and upload the interferogram. DAM prepares Data Pack at DTM=1. The Event can be ignored. No Event Info is provided.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **2 (Error/Anomaly)**
Source Data **See below**

EID-ISC2
Enumerated
2 octets

Parameters Meaning

EID-ISC2 42530

Parameters Values/Range

N/A

Remarks

Event IRNM – ICM recv: no message

Function/Description

The Event "ICM recv: no message" means that there was no ICM responce during the spectrum download. DAM does not make any reparation attempt and prepares Data Pack at DTM=1. The Event can be ignored. No Event Info is provided.

Structure

Process ID 86
Packet Cat. 7 (Event)
Type 5
Subtype 2 (Error/Anomaly)
Source Data See below

EID-IRNM
Enumerated
2 octets

Parameters Meaning

EID-IRNM 42531

Parameters Values/Range

N/A

Remarks

Event IRWM – ICM recv: wrong message

Function/Description

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-IRC2
Enumerated
2 octets

Parameters Meaning

EID-IRC2 **42533**

Parameters Values/Range

N/A

Remarks

Event DNTI – DAM: no Timer interrupts

Function/Description

The Event "DAM: no Timer interrupts" means that both DAM timers dead, DAM uses S/C time for delays with the accuracy degradation to 1/8 sec. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-DNTI

Enumerated
2 octets

Parameters Meaning

EID-DNTI **42534**

Parameters Values/Range

N/A

Remarks

Event DIS4 – DAM: IRQS4 was masked

Function/Description

The Event "DAM: IRQS4 was masked" means that DAM was unable to receive Telecommands because the signal IRQS4 was masked because of some reason. The Event Info contains registers of both interrupt controllers.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **2 (Error/Anomaly)**
Source Data **See below**

EID-DIS4	PICmasks
Enumerated	Enumerated
2 octets	2 octets

Parameters Meaning

EID-DIS4 **42535**
PICmasks **Masks of both PICs**

Parameters Values/Range

N/A

Remarks

Event MMSE – MMEM: single error

Function/Description

The Event "MMEM: single error" means that the Hamming processor detected and corrected a single-bit error. Event Info contains MMEM status port and the address.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-MMSE	MMstat	Addr
Enumerated	Enumerated	Enumerated
2 octets	2 octets	2 octets

Parameters Meaning

EID-MMSE	**42536**
MMstat	**MM status port**
Addr	**Address where the error was detected**

Parameters Values/Range

N/A

Remarks

Event MMDE – MMEM: double error

Function/Description

The Event "MMEM: double error" means that the Hamming processor detected an uncorrectable double-bit error. The time correlation between the Event Report and the Telemetry Source Packet could allow to find the packet containing the error. Event Info contains MMEM status port and the address.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**
Type	**5**
Subtype	**2 (Error/Anomaly)**
Source Data	**See below**

EID-MMDE	MMstat	Addr
Enumerated	Enumerated	Enumerated
2 octets	2 octets	2 octets

Parameters Meaning

EID-MMDE	**42537**
Mmstat	**MM status port**
Addr	**Address where the error was detected**

Parameters Values/Range

N/A

Remarks

Event INIT – PFS initialization completed

Function/Description

PFS sends Event "PFS initialization completed" only once, upon completion of the initialization procedure. No action needed. No Event Info is provided.

Structure

Process ID	**86**
Packet Cat.	**7 (Event)**

Type **5**
Subtype **1**
Source Data **See below**

EID-INIT
Enumerated
2 octets

Parameters Meaning

EID-INIT **42538**

Parameters Values/Range

N/A

Remarks

Event TIME – Timestamp

Function/Description

The Event "Timestamp" accompanies (follows) other events and gives more accurate information about the moment when the considered (preceeding) Event occured.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **1**
Source Data **See below**

EID-TIME	SCET
Enumerated	CUC time
2 octets	6 octets

Parameters Meaning

EID-TIME **42539**
SCET **Spacecraft Elapsed Time PC(9,17)**

Parameters Values/Range

N/A

Remarks

Event EOB – End of telemetry-block

Function/Description

The Event "End of telemetry block" accompanies the end of telemetry block send from DAM.

Structure

Process ID **86**
Packet Cat. **7 (Event)**
Type **5**
Subtype **1**
Source Data **See below**

EID-TIME	FREE-BUF
Enumerated	Enumerated
2 octets	2 octets

Parameters Meaning

EID-EOB **42903**
FREE-BUF **0**

Parameters Values/Range

N/A

Remarks

7.3 - LIST OF PFS FAILURE CODES

Failure Code APPL – Wrong length of Application Data Field in Telecommand

Function/Description

PFS sends Failure Code "Wrong length of Application Data Field in Telecommand" in TM(1,2) if the Application Data Field (which contains all parameters) has wrong length. This can happen if incorrect parameters in the Telecommand were sent by mistake.

Structure

Process ID	**86**
Packet Cat.	**1 (Acknowledge)**
Type	**1**
Subtype	**2**
Source Data	**See below**

FID-APPL
Enumerated
2 octets

Parameters Meaning

FID-APPL	**42901**

Parameters Values/Range

N/A

Remarks

Failure Code PARN – Wrong value of parameter N in Telecommand

Function/Description

PFS sends Failure Code "Wrong value of parameter N in Telecommand" in TM(1,2) if one of the Telecommand parameters contains wrong value. PFS does not use Failure Code 6 (Data field inconsistent) because specification of this Failure Code requires knowledge of the wrong octet. Some parameters of the private PFS Telecommands are words and doublewords. It is

impossible to determine, which octet of the word (doubleword) is wrong. So, PFS sends its own information about the wrong parameter and informs only about the number of wrong parameter. Numbers of Telecommand parameters start from 1.

Structure

Process ID	**86**
Packet Cat.	**1 (Acknowledge)**
Type	**1**
Subtype	**2**
Source Data	**See below**

FID-PARN	Param Number
Enumerated	Unsigned Integer
2 octets	2 octets

Parameters Meaning

FID-PARN	**42902**
Param Number	**Number of wrong parameter**

Parameters Values/Range

N/A

Remarks

8 – OTHER SERVICES

8.1 – SUPPORT OF STANDARD SERVICES

PFS supports all standard mandatory services defined in [12].

Service 1 – TC verification

Telemetry (1,1) Telecommand Acceptance Report - Success

Structure

Packet Cat. **1 (ACK)**
Type **1**
Subtype **1**
Source Data **See below**

TC packet ID	TC Sequence Control
Unsigned integer	Unsigned integer
2 bytes	2 bytes

Parameters Meaning

TC packet ID **copy of the Packet ID fields of the TC being reported on**
TC Seq. Control **copy of the Seq. Control field of the TC being reported on**

Parameters Values/Range

N/A

Telemetry (1,2) Telecommand Acceptance Report - Failure

Structure

Packet Cat. **1 (ACK)**
Type **1**
Subtype **2**
Source Data **See below**

TC packet ID	TC Seq. Control	Failure Code	Parameters
Unsigned integer	Unsigned integer	Unsigned integer	Optional
2 bytes	2 bytes	2 bytes	Any size

Parameters Meaning

TC packet ID copy of the Packet ID fields of the TC being reported on
TC Seq. Control copy of the Seq. Control field of the TC being reported on
Failure Code Mars Express standard Failure Code (see below)
Parameters Complementary information to a specific Failure Code

Parameters Values/Range

TC packet ID N/A
TC Seq. Control N/A
Failure Code
1 - Incomplete packet
2 - Incorrect CRC
3 - Incorrect APID
4 - Invalid Command Code
42901 - Wrong lemgth of Application Data field
42902 – Wrong value of parameter N

Parameters

Failure Code	Parameter 1	Parameter 2	Parameter 3	Parameter 4
1	**Type**[1]	**Subtype**[2]	**Packet Length** [3]	**Received bytes**
2	**Type**[1]	**Subtype**[2]	**Received CRC**	**Computed CRC**
3	**Type**[1]	**Subtype**[2]		
4	**Type**[1]	**Subtype**[2]		
42901	**Type**[1]	**Subtype**[2]		
42902	**Type**[1]	**Subtype**[2]	**Param Number**	

[1] Packet Type from the received TC or zero if not available
[2] Packet Subtype from the received TC or zero if not available
[3] Packet Length from the received TC or zero if not available

Service 3 – HK reporting

Telecommand (3,5) Enable HK Report Packet Generation

Structure

Packet Cat. 12 (Private)
Type 3
Subtype 5
Source Data See below

Not used	SID
	Enumerated
1 byte	1 byte

Parameters Meaning

SID **Defines the housekeeping report type**

Parameters Values/Range

N/A

Remarks

PFS has only one type of HK report which is identified by SID=0 in the HK Report packet. PFS does not check the SID parameter in the TC(3,5) and TC(3,6).

Telecommand (3,6) Disable HK Report Packet Generation

Structure

Packet Cat. **12 (Private)**
Type **3**
Subtype **6**
Source Data **See below**

Not used	SID
	Enumerated
1 byte	1 byte

Parameters Meaning

SID **Defines the housekeeping report type**

Parameters Values/Range

N/A

Remarks

PFS has only one type of HK report which is identified by SID=0 in the HK Report packet. PFS does not check the SID parameter in the TC(3,5) and TC(3,6).

Telemetry (3,25) HK Report Packet

Structure

Packet Cat.	**4 (HK)**
Type	**3**
Subtype	**25**
Source Data	**See below**

Not used	SID	HK block
	Enumerated	
1 byte	1 byte	256 bytes

Parameters Meaning

SID	**Defines the housekeeping report type. For PFS SID=0**
HK block	**See 4.6**

Parameters Values/Range

N/A

Remarks

PFS has only one type of HK report which is identified by SID=0 in the HK Report packet. PFS does not check the SID parameter in the TC(3,5) and TC(3,6).

Service 5 – Events reporting

See Chapter 7.

Service 6 – Memory Management

Telecommand (6,2) Load Memory Using Absolute Addresses

Structure

Packet Cat. **12 (Private)**
Type **6**
Subtype **2**
Source Data **See below**

Memory ID	N	Start Address	Block Length	Data
Enumerated	Unsigned Int	Unsigned Int	Unsigned Int	Variable 2-byte string
1 byte	1 byte	4 bytes	2 bytes	Variable in 2 bytes

? - - - - - - - - Repeated N times - - - - - - - - - ?

Parameters Meaning

Memory ID **Destination memory**
N **Number of blocks to be loaded**
Start Address **Address of the first word to be loaded**
Block Length **Number of 16-bit words to be loaded**
Data **Data (16-bit words) to be loaded**

Parameters Values/Range

Memory ID **208 for PFS**
N **any**
Start Address **0..FFFEh**
Block Length **1..32768**
Data **any**

Remarks

PFS software works in RAM. During the memory load procedure the software must work in ROM. Before the memory patch the CPU Code Segment of the software must be changed to ROM, and after the memory patch the CPU Code Segment must be changed to RAM by means of TC(216,205).

Telecommand (6,5) Dump Memory Using Absolute Addresses

Structure

Packet Cat. **12 (Private)**
Type **6**
Subtype **5**
Source Data **See below**

Memory ID	N	Start Address	Length
Enumerated	Unsigned Int	Unsigned Int	Unsigned Int
1 byte	1 byte	4 bytes	2 bytes

Parameters Meaning

Memory ID **Memory to be dumped**
N **Number of blocks to be dumped**
Start Address **Address of the first word to be dumped**
Block Length **Number of 16-bit words to be dumped**

Parameters Values/Range

Memory ID **208 for PFS**
N **1 – PFS dumps only one block per Telecommand**
Start Address **0..FFFEh**
Block Length **1..7168 – maximal block size is 7Kw (to fit in one TM block)**

Service 9 – Time Synchronization

Telecommand (9,1) Accept Time Update

Structure

Packet Cat. **12 (Private)**
Type **9**
Subtype **1**
Source Data **See below**

SCET
CUC Time
6 bytes

Parameters Meaning

SCET **Spacecraft Elapsed Time PC(9,17)**

Parameters Values/Range

N/A

Service 17 – Connection Test

Telecommand (17,1) Request Connection Test Responce

Structure

Packet Cat. **12 (Private)**
Type **17**
Subtype **1**
Source Data **None**

Parameters Meaning

N/A

Parameters Values/Range

N/A

Telemetry (17,2) Connection Test Responce Report

Structure

Packet Cat. **7 (Event)**

Type 17
Subtype 2
Source Data None

Parameters Meaning

N/A

Parameters Values/Range

N/A

Service 20 – Science Data Transfer

Telecommand (20,1) Enable Science Report Packet Generation

Structure

Packet Cat. 12 (Private)
Type 20
Subtype 1
Source Data See below

Not used	PID
	Enumerated
9 bits	7 bits

Parameters Meaning

PID Process ID of the Science packet to be enabled

Parameters Values/Range

N/A

Telecommand (20,2) Disable Science Report Packet Generation

Structure

Packet Cat. **12 (Private)**
Type **20**
Subtype **2**
Source Data **See below**

Not used	PID
	Enumerated
9 bits	7 bits

Parameters Meaning

PID **Process ID of the Science packet to be disabled**

Parameters Values/Range

N/A

Telemetry (20,3) Science Report

Structure

Packet Cat. **12 (Private)**
Type **20**
Subtype **3**
Source Data **See Chapter 4**

Remarks

PFS sends Science Report packets with PID=87.

Service 216 – PFS private telecommands

See Chapter 5 and 6.

Service 255 – Coordinated Payload

Telecommand (255,1) Reset Telemetry Output Buffer

Structure

Packet Cat.	**12 (Private)**
Type	**255**
Subtype	**1**
Source Data	**None**

Parameters Meaning

N/A

Parameters Values/Range

N/A

9 – MODULE O INFORMATION

General Considerations

The OBDM Control Table defines the most critical and important parameters for the interferometer.
All the interferograms are taken according to the OBDM Control Table and normally this one should be sent at least once before the first interferogram. Nevertheless Module-O can work even if the OBDM Control Table has not been sent, in such case the measures will be done according to the Default Control Table, uploaded during the bootstrap procedure from the internal memory.

OBDM Control Table

The OBDM Control Table defines the most important parameters for the interferometer. Every parameter is represented by an hexadecimal value (size 8 Bits) which represents a real value. The short meaning of each parameter is shown on Table 1 and the relative coefficients are shown on Table 2, where you can also find the default values. In order to have the right value, one should multiply the value by the Scale Factor and after that summing the Offset. Any way someone of them are not linear, in this case is also represented the equation being used.

- T1,T8

High thermal gradients on the monoblock (the holder for the beamsplitters) can be in principle not a good start point to begin a measure, so we should reduce them. T1,T8 define the set points of the 8 individuals Temperature controllers.
Normally, in the real condition, they should be kept at 13° C.
Figure 1 shows where the Temperature readings and controllings are placed inside IB (Interferometer Block). Use figure 1 carefully because part of the mechanics is not corresponding to the truth (for example the motors are placed in the opposite direction):

- Laser 1 Power

This parameter defines the power set point for the Short Wavelength Laser Diode.
Even if the power can be changed from 0 up to 4.97 mW, normally there is an ideal value (depending on the working Temperature and on the single device) which reduces at the minimum level, the low frequency modulation due to the side lobs. The narrower emission line the better reference signal.

- Laser 2 Power

The same of Laser 1 Power but for Long Wavelength.

- Laser 1 Temp.

It defines the Temperature set point for the Short Wavelength Temperature controller.
This should be set at least 1.5° C over the average Temperature of IB for having a good stability. In our case it is set at 15° C.
This parameter is crucial for the good working of Module-O. The Temperature of Laser, more than the power, determines the presence of the side lobs and it can make them become so strong that the speed controller could fail (in this extreme case Module-O is not capable to measure at all!). In case of this very bad condition we can of course use the other reference channel, the one not used at the moment.
Temperature of Laser is also important for the spectral calibration, because the emission line wavelength changes versus Temperature for approximately 0.4 nm per 1K.

- Laser 2 Temp.

The same of Laser 1 (SW) Temperature but for Long Wavelength.

- TSW

This parameter defines the set point Temperature for the Short Wavelength detector controller and should be set between 200 K and 250 K depending on the condition. This one is important for the calibration as the detector changes the responsivity along its Temperature. Keep in mind that clearly the Temperature controlling is done at the case level. Please look at figure 1 in order to see where this controlling is placed.

- TLW

This parameter defines the set point Temperature for the Long Wavelength detector controller. Also in this case the Temperature controlling is done at the case level. Look at figure 1 to understand where it is placed.

- TRW 1

This parameter defines the current supplied to the Zero Optical Path Difference Detector for Short Wavelength. It should not be changed except when the Zero Optical Path Difference position is not centred with respect the SW interferogram.

- TRW 2

The same of TRW 1 but for LW.

- TIM20_per

This parameter defines the period of the highest cutoff frequency for the SW Zero Crossing Preamplifier Filter (8th order). The lowest cutoff frequency is fixed (500 Hz, 2nd order) and unalterable. This value should be at least twice the reference frequency in order to maintain the speed control loop within the settling time value. This is of course true only for the reference signal used for such purpose.

- TIM21_per

The same of TIM20_per but for the LW Zero Crossing Preamplifier Filter.

- TIM22_per

This parameter set the reference frequency for the speed control loop (normally 2000 Hz). Thus this value set the speed of the double pendulum and consequently also the medium sampling frequency of the reference channel used for controlling the speed.

- TIM30_per

This parameter defines the frequency used for the serial to parallel converter for the ADCs. In the normal conditions it should not be touched.

- TIM31_per

This parameter defines the period of the highest cutoff frequency for the SW Detector Preamplifier Filter (8th order). The lowest one is fixed (500 Hz, 2nd order). It should be set at 2 kHz but for the quantization error it is set at 2.2 kHz. This filter is an antialiasing filter for the SW ADCs, so it should be changed according to the speed of the double pendulum. Along the lowest cutoff frequency it also limits the bandpass of signal and noise and consequently the spectral range, too.

- TIM32_per

This parameter defines the period of the highest cutoff frequency for the LW Detector Preamplifier Filter (8th order). The lowest one is fixed (50 Hz, 2nd order). It should be set at 500 Hz but for the quantization error it is set at 513 Hz. This filter is an antialiasing filter for the LW ADCs, so it should be changed according to the speed of the double pendulum. Along the lowest cutoff frequency it also limits the bandpass of signal and noise and consequently the spectral range, too.

- MskALFA_A

- xxxxxxA1A0 These 2 bits define the gain for the SW Detector Amplifier. Gain increases by a factor 5 per step. In principle each gain should be calibrated.

- xxxxA3A2xx These 2 bits define the gain for the LW Detector Amplifier. Gain increases by a factor 2 per step. In principle each gain should be calibrated.

- xxxA4xxxx This bit turns on the ADC 1a. "1" stands for SW reference channel, "a" stands for primary ADC. The primary ADC input is connected to the relative reference channel (now SW). When this bit is set to 1, we'll have the SW interferogram sampled by SW reference channel. Normal condition requires this bit set to 1.

- xxA5xxxxx This bit turns on the ADC 1b. "1" stands for SW reference channel, "b" stands for secondary ADC. The secondary ADC input is connected to the opposite reference channel. When this bit is set to 1, we'll have the LW interferogram sampled by SW reference channel. Normal condition requires this bit set to 0. The using of this condition changes the spectral behaviour of the LW channel, since the reference channel does not belong to the same channel and the length of the double pendulum brackets is not equal for the two channels. Thus this bit should be set only in case of failure of the LW reference channel.

- xA6xxxxxx This bit turns on the ADC 2a. "2" stands for LW reference channel, "a" stands for primary ADC. The primary ADC input is connected to the relative reference channel (now LW). When this bit is set to 1, we'll have the LW interferogram sampled by LW reference channel. Normal condition requires this bit set to 1.

- A7xxxxxxx This bit turns on the ADC 2b. "2" stands for LW reference channel, "b" stands for secondary ADC. The secondary ADC input is connected to the opposite reference channel (now SW). When this bit is set to 1, we'll have the SW interferogram sampled by LW reference channel. Normal condition requires this bit set to 0. The using of this condition changes the spectral behaviour of the SW channel, since the reference channel does not belong to the same channel and the length of the double pendulum brackets is not equal for the two channels. Thus this bit should be set only in case of failure of the SW reference channel.

- MskBETA_A

- xxxxxxxA0 This bit selects the double pendulum motor being used. In case of motor or driver failure one can select the working one (if any!). By default is set the primary one.

- xxxxxxA1x This bit selects the double pendulum direction for doing the motion. Normally the motion driving is automatically set by OBDM. Much care should be taken in order to use this bit. The using of it is not recommended.

- xxxxA3A2xx When these two bits are set to 1 (both) the double pendulum is on a reset state. By default they are set to 1 but during the acquisition OBDM sets them in the right way automatically.

- **xxA4A5xxxx The setting of this two bits does not affect the blocking or unblocking procedure of the double pendulum.**
- **xA6xxxxxx The third bit (most significative bit) for the SW Gain Detector.**
- **A7xxxxxxx when is reset the SW filter shape is normal, the value 1 means SW filter changed.**

- MskBETA_B

- xxxxxxB1B0 These two bits set the gain of the SW Zero Crossing Amplifier. The step is a factor 2.

- xxxxB3B2xx These two bits set the gain of the LW Zero Crossing Amplifier. The step is a factor 2.

- xxxB4xxxx This bit selects the reference channel signal to be used as reference for the speed control loop. The default is 0 which means SW reference channel. In case of failure of this channel one can use the LW reference channel. Keep in mind that the using of the LW reference channel like a speed control reference can a little affect the speed of the double pendulum and the sampling frequency of the two channels. Thus also the highest part of the spectrum can also be a little affected.

- **xxB5xxxxx This bit, when reset, turns on the SW Laser Diode. By default it is switched off.**
- **xB6xxxxxx This bit, when reset, turns on the LW Laser Diode. By default it is switched off.**
- **B7xxxxxxx This bit select the TRW Channel. 0 for SW channel and 1 for LW channel.**

Housekeeping Information

The housekeeping information is acquired every measure and it highlights the general condition of the analog electronics in which the measure has been done. The Table 3 shows the list of the housekeeping information and the relative brief meaning.
Most of them contain the reading of the variable set by means of the OBDM Control Table. So that it is possible to evaluate the goodness of the controllers looking at the own value. Also in this case we have to represent an actual value by a decimal or hexadecimal value and Table 4 shows the coefficients table for the ±5 V range, while Table 5 shows the coefficients table for the ±10 V range. Be aware the readings which are relative to the OBDM Control Table set point. We'll not describe here again the information of each single variable whose we already talked about on top. Someone of them are new for our acknowledge and we'll give a brief description.

- PhotoD. 1 (SW)

This reading gives the amplitude of the signal coming from the SW reference channel Photodiode. This single value is often enough to say that the SW reference channel is working quite well. A value close to 0 all the time means that the SW reference channel is probably died if the LW Laser Diode has not switched off.

- PhotoD. 2 (LW)

This reading gives the amplitude of the signal coming from the LW reference channel Photodiode. This single value is often enough to say that the LW reference channel is working quite well. A value close to 0 all the time means that the LW reference channel is probably died if the LW Laser Diode has not switched off.

- Motor Current

-

o Formisano
R IFSI

ange (Min,Max)
(268,332) K
(268,332) K
(268,332) K
(268,332) K
(268,332) K
(268,332) K
(268,332) K
(268,332) K
(0,4.97) mW
(0,4.97) mW
(275,315) K
(275,315) K
(200,280) K
(260,340) K
(0,20.18) mA
(0,20.22) mA
(0,6.7) kHz
(0,6.7) kHz

MskBETA_B	**8**	**B3,B2**	**LW ZeroX Gain Set (Factor 2 each step)**	**(1,8)**
	8	**B4**	**SW or LW reference for Speed**	**(SW,LW)**
	8	**B5**	**Turn on SW Laser Diode**	**(ON,OFF)**
	8	**B6**	**Turn on LW Laser Diode**	**(ON,OFF)**
	8	**B7**	**TRW Selection**	**(SW,LW)**

Table 2: Module-O Control Table Coefficients for FM7

Name	*Details*	*Scale Factor*	*Offset*	*Default*	
T1	---	64/255 K/adu	268 K	72d	286 K
T2	---	64/255 K/adu	268 K	72d	286 K
T3	---	64/255 K/adu	268 K	72d	286 K
T4	---	64/255 K/adu	268 K	72d	286 K
T5	---	64/255 K/adu	268 K	72d	286 K
T6	---	64/255 K/adu	268 K	72d	286 K
T7	---	64/255 K/adu	268 K	72d	286 K
T8	---	64/255 K/adu	268 K	72d	286 K
Laser 1 Power	---	4.97/255 mW/adu	0 mW	87d	1.7 mW
Laser 2 Power	---	4.97/255 mW/adu	0 mW	139d	2.7 mW
Laser 1 Temp.	---	40/255 K/adu	275 K	76d	287 K
Laser 2 Temp.	---	40/255 K/adu	275 K	76d	287 K
TSW	---	80/255 K/adu	200 K	0d	200 K
TLW	---	80/255 K/adu	260 K	83d	288 K
TRW 1	---	79.137 mA/adu	0 mA	190d	15 mA
TRW 2	---	79.294 mA/adu	0 mA	189d	15 mA
TIM_20per	---	150/2 ms	---	3d	4.444 kHz
TIM_21per	---	150/2 ms	---	3d	4.444 kHz
TIM_22per	---	1/2 ms	---	1000d	2.000 kHz
TIM_30per	---	1/2 ms	---	1d	2.000MHz
TIM_31per	---	150/2 ms	---	6d	2.222 kHz
TIM_32per	---	150/2 ms	---	26d	512.8 Hz
MskALFA_A	A1,A0	5d	---	0d	1
	A3,A2	2d	---	0d	1
	A4	---	---	1	ON
	A5	---	---	0	OFF
	A6	---	---	1	ON
	A7	---	---	0	OFF
MskALFA_C	---	---	---	---	Not Used
MskBETA_A	A0	---	---	1	Primary
	A1	---	---	0	Forward
	A3,A2	---	---	11b	Reset
	A5,A4	---	---	00b	Pr. ,Sec. OFF
	A6	---	---	0	0
	A7	---	---	0	0
MskBETA_B	B1,B0	2d	---	0d	1
	B3,B2	2d	---	0d	1
	B4	---	---	0	SW Ref.
	B5	---	---	1	SW OFF
	B6	---	---	1	LW OFF
	B7	---	---	0	SW

Table 3: Module-O Housekeeping Information for FM7

Name	Size [Bits]	Brief Description	Range (Min,Max) On ±5V Range	Range (Min,Max) On ±10V Range
Laser 1 Power	12	SW Laser Power Reading	(0,2.485) mW	(0,4.97) mW
Laser 2 Power	12	LW Laser Power Reading	(0,2.485) mW	(0,4.97) mW
PhotoD 1 (SW)	12	SW Photodiode Signal	(-5,+5) V	(-10,+10) V
PhotoD 2 (LW)	12	LW Photodiode Signal	(-5,+5) V	(-10,+10) V
Motor Current	12	Active Motor Current (Not Used)	------	------
T1	12	T1 Temperature Reading inside IB	(-32,+32) K (*)	(-64,+64) K (*)
T2	12	T2 Temperature Reading inside IB	(-32,+32) K (*)	(-64,+64) K (*)
T3	12	T3 Temperature Reading inside IB	(-32,+32) K (*)	(-64,+64) K (*)
T4	12	T4 Temperature Reading inside IB	(-32,+32) K (*)	(-64,+64) K (*)
T5	12	T5 Temperature Reading inside IB	(-32,+32) K (*)	(-64,+64) K (*)
T6	12	T6 Temperature Reading inside IB	(-32,+32) K (*)	(-64,+64) K (*)
T7	12	T7 Temperature Reading inside IB	(-32,+32) K (*)	(-64,+64) K (*)
T8	12	T8 Temperature Reading inside IB	(-32,+32) K (*)	(-64,+64) K (*)
Laser 1 Temp.	12	SW Laser Temp. Reading	(-10,+10) K (*)	(-20,+20) K (*)
Laser 2 Temp.	12	LW Laser Temp. Reading	(-10,+10) K (*)	(-20,+20) K (*)
SW Det. Temp.	12	SW Detector Temp. Reading	(-20,+20) K (*)	(-40,+40) K (*)
LW Det. Temp.	12	LW Detector Temp. Reading	(-20,+20) K (*)	(-40,+40) K (*)
TRW 1	12	SW ZOPDD Current Reading	(0,41.57) mA	(0,83.14) mA
TRW 2	12	LW ZOPDD Current Reading	(0,41.56) mA	(0,83.12) mA
'PFS A1' (**)	12	LW Black Body Temp. Reading	(223,289.6) K	(223,311.8) K
'PFS A2' (**)	12	LW Black Body Temp. Reading	(223.6,291.3) K	(224.6,313.5) K
V Standard Lamp (**)	12	SW Black Body Voltage Reading	(-5,+5) V	(-10,+10) V
V Calibration Lamp.(**)	12	SW Black Body Voltage Reading	(-5,+5) V	(-10,+10) V
TOR from Phobos Detector (**)	12	TOR Voltage Reading	(-5,+5) V	(-10,+10) V
Power Supply 'O' -5 V	12	Module-O -5 V Voltage Reading	(-10,+10) V	(-20,+20) V
Power Supply 'O' +5 V	12	Module-O +5 V Voltage Reading	(-10,+10) V	(-20,+20) V
Power Supply 'O' -15 V	12	Module-O -15 V Voltage Reading	(-25.04,25.04) V	(-50.08,50.08) V

Power Supply 'O' +15 V	12	Module-O +15 V Voltage Reading	(10,25.04) V	(10,50.08) V
spare	12	Not Used	---	---
spare	12	Not Used	---	---
spare	12	Not Used	---	---
spare	12	Not Used	---	---

(*) For these data, the range and the housekeeping value are relative to the setpoint value on OBDM Control Table, thus the actual value MUST be calculated summing the two; ex. HSK = +1, SETPOINT = 22, ACTUAL = 23.
(**) These signals come from Module-C (Scanner).
Table 4: Module-O Housekeeping Coefficients Table for FM7
(-5,+5) V Range

Description	Scale Factor	Offset	Relative to OBDM Control Table ?
Laser 1 Power	-4.97/4095 mW/adu	2.485 mW	No
Laser 2 Power	-4.97/4095 mW/adu	2.485 mW	No
PhotoD 1 (SW)	10/4095 V/adu	-5 V	No
PhotoD 2 (LW)	10/4095 V/adu	-5 V	No
Motor Current	Not Used	Not Used	No
T1	64/4095 K/adu	-32 K	Yes
T2	64/4095 K/adu	-32 K	Yes
T3	64/4095 K/adu	-32 K	Yes
T4	64/4095 K/adu	-32 K	Yes
T5	64/4095 K/adu	-32 K	Yes
T6	64/4095 K/adu	-32 K	Yes
T7	64/4095 K/adu	-32 K	Yes
T8	64/4095 K/adu	-32 K	Yes
Laser 1 Temp.	20/4095 K/adu	-10 K	Yes
Laser 2 Temp.	20/4095 K/adu	-10 K	Yes
SW Det. Temp.	40/4095 K/adu	-20 K	Yes
LW Det. Temp.	40/4095 K/adu	-20 K	Yes
TRW 1	0.020309 mA/adu	-41.594 mA	No
TRW 2	0.020302 mA/adu	-41.579 mA	No
'PFS A1' Temp. (**)	0.016280 K/adu	223 K	No
'PFS A2' Temp. (**)	0.016280 K/adu	224.67 K	No
V Standard Lamp (**)	10/4095 V/adu	-5 V	No
V Calibration Lamp (**)	10/4095 V/adu	-5 V	No
TOR from Phobos Detector (**)	10/4095 V/adu	-5 V	No
Power Supply 'O' -5 V	20/4095 V/adu	-10 V	No

spare	**Not Used**	**Not Used**	**---**
spare	**Not Used**	**Not Used**	**---**

(**) These signals come from Module-C (Scanner)

Table 5: Module-O Housekeeping Coefficients Table for FM 7
(-10,+10) V Range

Description	Scale Factor	Offset	Relative to OBDM Control Table ?
Laser 1 Power	-9.94/4095 mW/adu	4.97 mW	No
Laser 2 Power	-9.94/4095 mW/adu	4.97 mW	No
PhotoD 1 (SW)	20/4095 V/adu	-10 V	No
PhotoD 2 (LW)	20/4095 V/adu	-10 V	No
Motor Current	Not Used	Not Used	No
T1	128/4095 K/adu	-64 K	Yes
T2	128/4095 K/adu	-64 K	Yes
T3	128/4095 K/adu	-64 K	Yes
T4	128/4095 K/adu	-64 K	Yes
T5	128/4095 K/adu	-64 K	Yes
T6	128/4095 K/adu	-64 K	Yes
T7	128/4095 K/adu	-64 K	Yes
T8	128/4095 K/adu	-64 K	Yes
Laser 1 Temp.	40/4095 K/adu	-20 K	Yes
Laser 2 Temp.	40/4095 K/adu	-20 K	Yes
SW Det. Temp.	80/4095 K/adu	-40 K	Yes
LW Det. Temp.	80/4095 K/adu	-40 K	Yes
TRW 1	0.040618 mA/adu	-83.188 mA	No
TRW 2	0.040604 mA/adu	-83.158 mA	No
'PFS A1' Temp. (**)	0.02170 K/adu	223 K	No
'PFS A2' Temp. (**)	0.02170 K/adu	224.67 K	No
V Standard Lamp (**)	20/4095 V/adu	-10 V	No
V Calibration Lamp (**)	20/4095 V/adu	-10 V	No
TOR from Phobos Detector (**)	20/4095 V/adu	-10 V	No
Power Supply 'O' -5 V	40/4095 V/adu	-20 V	No
Power Supply 'O' +5 V	40/4095 V/adu	-20 V	No
Power Supply 'O' -15 V	100.16/4095 V/adu	-50.08 V	No
Power Supply 'O' +15 V	100.16/4095 V/adu	-50.08 V	No
spare	Not Used	Not Used	---
spare	Not Used	Not Used	---
spare	Not Used	Not Used	---
spare	Not Used	Not Used	---

(**) These signals come from Module-C (Scanner)

T.B.N. : The coefficients on the (-10,+10) range can be computed from those of (-5,+5) range simply multiplying by 2 the offset and the scale factor, except for "PFS A1" and "PFS-A2" whose coefficients should be read on the table.

Table 6: Status Information for FM7

Name	Size [Bits]	Details	Brief Description	Range (Min,Max)
WDG_10per	16	---	Internal Use	---
WDG_11per	16	---	Internal Use	---
WDG_12per	16	---	Internal Use	---
TIM_20per	16	---	Highest Cutoff Frequency of SW ZeroX	(0,6.7) kHz
TIM_21per	16	---	Highest Cutoff Frequency of LW ZeroX	(0,6.7) kHz
TIM_22per	16	---	Speed Clock	(1.5,2.5) kHz
TIM_30per	16	---	ADCs Serial Converters Clock	(0,2) MHz
TIM_31per	16	---	Highest Cutoff Frequency of SW Detector	(0,6.7) kHz
TIM_32per	16	---	Highest Cutoff Frequency of LW Detector	(0,6.7) kHz
MskALFA_A	8	A1,A0	SW Detector Gain Set (Factor 5 each step)	(1,125)
	8	A3,A2	LW Detector Gain Set (Factor 2 per step)	(1,8)
	8	A4	Wake up ADC 1a, SW signal sampled every SW Zero Crossing Pulse (Default)	(OFF,ON)
	8	A5	Wake up ADC 1b, LW signal sampled every SW Zero Crossing Pulse (Failure)	(OFF,ON)
	8	A6	Wake up ADC 2a, LW signal sampled every LW Zero Crossing Pulse (Default)	(OFF,ON)
	8	A7	Wake up ADC 2b, SW signal sampled every LW Zero Crossing Pulse (Failure)	(OFF,ON)
MskALFA_C	8	---	Internal Use	---
MskBETA_A	8	A0	Motor Coil Select	(Sec.,Prim.)
	8	A1	Forward or Reverse Direction on DP	(For.,Rev.)
	8	A3,A2	A3,A2=11 > Reset Condition for Motors	(Norm.,Reset)
	8	A5,A4	Heaters Selection (Internal Use)	---
	8	A6	3° Bit for SW Gain Detector	(0,1)
	8	A7	Select SW Filter Shape	(Norm.,Changed)
MskBETA_B	8	B1,B0	SW ZeroX Gain Set (Factor 2 each step)	(1,8)
	8	B3,B2	LW ZeroX Gain Set (Factor 2 each step)	(1,8)
	8	B4	SW or LW reference for Speed	(SW,LW)
	8	B5	Turn on SW Laser Diode	(ON,OFF)
	8	B6	Turn on LW Laser Diode	(ON,OFF)
	8	B7	TRW Selection	(SW,LW)
	8	C2,1,0	Internal Use	---
	8	C4	0 = Pendulum Blocked	(BLK,xxx)

MskBETA_C	8	C5	0 = Pendulum Retracted	(UNBLK,xxx)
	8	C6	SW ZOPD Signal (Internal Use)	---
	8	C7	LW ZOPD Signal (Internal Use)	---
ZOPDSW	16	---	SW ZOPD Position Counter	(0,65535)
ZOPDLW	16	---	LW ZOPD Position Counter	(0,65535)
EndRight	16	---	Right Micro-Switch Counter (Normally 0)	(0,65535)
EndLeft	16	---	Left Micro-Switch Counter (Normally 0)	(0,65535)
Dummy	8	---	---	---

Following table describes commands which DAM sends to OBDM:

Code (HEX)	Data Size (byte)	Comando	Data
11H	0	Unblock pendulum	No
12H	0	Block pendulum	No
13H	0	Send selftest data	No
14H	32	Load Control Table	Control Table
15H	0	Pendulum in Initial position	No
17H	0	Start Autotest	Autotest parameters
16H	0	Send status	No
18H	0	Start Acquisition	No
19H	0	Send HouseKeeping block	No
1AH	2	Send ShortWave block	SW block number
1BH	2	Send LongWave block	LW block number
1CH	0	End of Acquisition	No
1DH	8	Set ZOPDLW/SW frw and rvs	ZOPD parameters
1EH	0	Get synt.interf. & HK	No
1FH	0	Reference channel	No

Messages which OBDM sends to DAM in response to the command are following:

Code (HEX)	Data Size (byte)	Comando	Data
11H	0	Pendulum unblocked	No
12H	0	Pendulum blocked	No
13H	48	Selftest result	Selftest data
14H	0	Control Table loaded	No
15H	0	In initial position	No
16H	0	Autotest completed	No
17H	32	OBDM status data	OBDM Status
18H	0	Acquisition completed	No
19H	128	HouseKeeping block	HK block
1AH	128	ShortWave block	SW block
1BH	128	LongWave block	LW block
1CH	0	Acquisition terminated	No
1DH	0	ZOPDLW/SW frw and rvrs loaded	ZOPD parameters
1EH	0	Synt.interf. & HK ready	No
1FH	0	Load signal from photodiode #1 in SW_data, signal from photodiode #2 in LW_data	No
2EH	0	Error in command	No
21H		Time out during pendulum unblock	
22H	0	Time out during pendulum block	No
25H	0	Time out during the moving of pendulum in initial position	No
26H	0	Time out during the Autotest	No
28H	0	Time out during the acquisition	No
2FH	0	Mechanical problems	No
99H	0	Bootstrap completed	No

Appearance of a complete OBDM message (except "Error in command") is treated by DAM as a completion (normal or abnormal) of the command execution.