ENVTEC 164 a

EADS ASTRIUM	GOMOS	Ref : PO.MA.MAT.GM.17 Issue : 2 Rev. : 9 Date : 13/10/03 Page : i

Title

GOMOS FM

INSTRUMENT OPERATIONS MANUAL

	Nom et Function	Date	Signature
Prepared by :	**J.M. CAUJOLLE** **R. FRAISSE**	**13/10/03**	
Verified by :			
Approved by :			
Authorized by :			
Application authorized by :			

Document type	Nb WBS	Keywords :

DOCUMENT CHANGE LOG

Issue/ Revision	Date	Modification Nb	Modified pages	Observations
2 rev8	12/04/01		268 600 A6.75, A6.86	description of ICU patch (correction of NCR 3297) Modification of ICU patch in reset Correction of typos: - RTC_TaskOverrun - Table 5 for Add frame
2 rev9	13/10/03		114, 115, 278, 279, 600, 602A, 602B	Modification of SFM thermal monitoring; Adding of 2 patches (ICU critical anomalies, INIT position for nominal ICU)

To enter Initiation submode in Heater, the SFM must be unlocked. If the SFM is locked, the pointing function is inhibited and the hereafter descriptions are not applicable.

The Initiation phase consists of three steps (assuming a start from sun shade position, i.e. -45° in SFM frame).

- Positive rotation of the stepper motor at 14 steps/sec (~ 0.1 deg/sec) during 15 sec,
- negative rotation to reach and detect the reference position microswitch (-46° in SFM frame),
- positive rotation at 14 steps/sec during 21 sec.

Due to an anomaly on the nominal ICU ("voice-coil command saturation") occured during summer 2003, the duration of this positive rotation is increased, for the nominal ICU only to 327s instead of 21s in order to finish out of the critical azimut area.

The SFM fine stage orientation is controlled during the mirror motion.

The initiation phase duration from the Sun Shade position (nominal case) is lower than 2 min.

At the end of this phase, the SFM coarse stage is at -43.5° ± 0.5°.

The Initiation phase duration from any position (non nominal case) is given by

$T(sec) = 15 + 636 \times (\sin(angle + 1.5°) - \sin(-46°)) + 21$

The worst case duration is 780 sec (on-board time out : 900 sec) and corresponds to a SFM initial position at 26° (end stop microswitch).

Then Rest submode is entered.

The SFM coarse stage stands in its latest orientation. It is no longer controlled (stepper motor is off).The SFM fine stage is controlled to its zero orientation.

The Rest submode lasts until either protection or transition to another mode is requested.

The braking submode is used at the interruption of any submode involving the stepper motor (except Initiation).The speed of the stepper motor is reduced to zero, while the SFM fine stage is controlled relatively to the coarse stage orientation.

On protect request (by dedicated MCMD), the Parking submode is entered. The SFM is driven by the stepper motor to the sunshade position with a specific restricted speed, while the SFM fine stage is controlled relatively to the coarse stage orientation.

The coarse stage orientation obtained after an INITIATION in Heater mode (until SFA CALIBRATION is run) is not accurate because of the microswitch lack of precision (0.5 degree). The SFA CALIBRATION submode is in charge of calibrating the orientation of the mirror. The calibration is lost as soon as the instrument is back to Standby or Standby/Refuse (pointing off).

On calibration request (by dedicated MCMD), the SFM fine stage is controlled to its zero orientation, and the coarse stage orientation is adjusted until the current in the fine stage actuators (voice-coils) is zero. When the current is zero, the coarse stage position estimate is stored and then used as an offset for software compensation of the next stepper-motor position estimates. The submode is autonomously switched to Rest at the end of the calibration phase.

The calibration worst case duration is 10 sec monitored by on-board time-out.

The typical calibration duration is 3 sec.

In HEATER mode, the transmission of source packet is inhibited, whatever the submode is.

4.1.2.6 HEATER / REFUSE mode

The mode description is the same as in HEATER mode except that mode switching MCMD's other than Reset Commanding and Standby are no longer executed.

4.1.3 AUXILIARY modes

4.1.3.1 Pause mode

The objectives of the Pause mode are :

- preparation of an observation sequence by updating operational parameters,
- loading of the observation program,
- ability to switch immediately to any of the measurement modes with some limitations.

The limitations are detailed in chapter 7 for Pause MCMD.

The active SW functions are listed in table 4.1.1/2.

In Pause mode, the pointing application can be in the following submodes :

- Rest,
- SFA Calibration,
- Braking.

The submode transitions are described on figure 4.1.3.1/1. The Rest, Braking and SFA calibration are as defined in Heater mode.

The source packet transmission is inhibited during the whole mode.

The Pause mode is automatically reached at the end of a Measurement mode. However, Pause can be used to interrupt a current measurement phase.

Most of mode transitions involve a sequence of actions on ICU and other units (e.g. switching power on or off, starting or stopping monitoring)

The mode management function implements the calling of these global sequences while the Instrument configuration function (see 9.3.4) implements the elementary actions.

9.3.3 Monitoring and Anomaly management

The function implements a centralized approach to deal with anomalies.

There are two kinds of anomaly :

- an SW failure (software or hardware error), eg. task overrun
- an instrument parameter monitoring anomaly, eg. temperature out of nominal range.

Both kinds of anomalies are processed in the same way (some special processing is added for anomalies raised by the Pointing application; see below). First, the SW component that detects the anomaly reports it in the history using a Complementary Failure entry for a S/W failure, or a Limit Exceeding entry for a monitoring anomaly. Some anomalies may also require other special processing to be done immediately, such as switching units off. Next, the anomaly is "raised". The subsequent events depend on the properties of the anomaly.

Each anomaly has the following properties:

- it is recoverable or unrecoverable, indicating if the system should be able to recover or not,
- it has an associated category, which is one of A, B, or C with A being least severe,
- it may be critical for either the ICU itself, or the SFA; this is called the criticality of the anomaly and can take the values ICU, SFA, or None.

"A" category means that no corrective action is triggered.

"B" category means that a transition to Heater/Refuse is triggered.

"C" category means that a transition to Standby/Refuse is triggered.

All monitoring anomalies are considered to be recoverable. Only failure anomalies can be unrecoverable.

The category associated with an anomaly can be changed using the SET ANOMALY CATEGORY macrocommand. The recoverable or unrecoverable property of an anomaly and the criticity are fixed and cannot be changed by macrocommand.

When an anomaly is "raised", the following is done. First, if the anomaly is unrecoverable:

- set the SW Health in the telemetry header,
- set the bit 11 in the RBI status,
- set the RBI to "enter wait state".

Next, if the category is not A (and whether the anomaly is recoverable or not):

- record in a dedicated variable the anomaly of highest category that has occurred in the current RTC cycle.

If the anomaly is ICU critical (and whatever the category) or if a B / C anomaly occurs in Standby/Refuse or transition to Standby/Refuse, the S/W requests the PMC via the ICU message field to switch off instrument equipment using EQSOL and switch off ICU (action 4). Following the instrument in-orbit behaviour, a patch has been developped in summer 2003 to replace all ICU critical anomalies to non-ICU critical anomaly.

If the anomaly is SFA critical, the S/W requests switching the pointing function off.

Raising recoverable category A anomalies thus has no effect (unless they are ICU critical), and such anomalies are recorded only in the history, as for anomalies that are of lower category than the highest-category anomaly in the same RTC cycle.

In each RTC cycle, the RTC task transmits the recorded highest-category anomaly (if any) to the Mode Change task. However, if mode changes are disabled for this anomaly or for the entire category, a mode change is not requested, the anomaly is just cleared. Mode changes are enabled or disabled for anomalies and categories with the macrocommands ENABLE AUTONOMOUS SWITCHING and INHIBIT AUTONOMOUS SWITCHING. The anomaly is nevertheless reported, whatever the status of the autonomous switching is.

The changes in anomaly category are not protected and it is possible to have a race between the occurrence of an anomaly and a concurrent MCMD that changes its category. The effective category may be either the old one or the new one.

The Pointing application can raise a number of anomalies. These anomalies are processed in the ordinary way, as described above, but in addition they usually cause the Pointing application to return to a "safer" submode.

9.3.4 Instrument configuration management

This function is in charge of :

- performing unit ON/OFF switching
- configuring the units according to the contents of HEATER and REDUNDANCY DEFINITION MCMDs
- 1553 bus addressing according to SDE sub-unit master/slave selection
- performing the Non Nominal Telemetry and Spy processing

12.1 PROCEDURE : P-D-N-01

OBJECTIVE : Transition from **OFF to RESET/WAIT mode** with ICU in RESET state

IOM REFERENCE : See section 9.2.2 for the patch description

IOM REFERENCE : See section 9.2.2 for the patch description

INITIAL CONDITIONS :

CONSTRAINTS :

Step	Actions	Commands/Telemetry	
		Name	Parameter Value
1	Apply power to ICU		
2	Wait 1s		
3	Switch DBU ON		
4	Wait 5s		
5	Send "Status Read" instruction to RBI		
	• Check RBI status value		HEX8000 (RESET)
6	Perform patch of the interruption mask update according to P-D-N-20		
7	Perform patch of the ICU critical anomaly update		
8	If configuration is ICU A (nominal), then perform the patch of the INIT phase position		

PROCEDURE : P-D-N-03 (cont'd)

Step	Actions	Commands/Telemetry	
		Name	**Parameter Value**
9	Send Set Monitoring MCMD	ZD012001	
		D.810007	D7204
		D.810010	X'0002'
		D.810011	FM020
		D.810012	Dec 3000
		D.810013	Dec 1172
10	Send Set Monitoring MCMD	ZD012001	
		D.810007	D7219
		D.810010	X'0002'
		D.810011	FM020
		D.810012	Dec 3000
		D.810013	Dec 1172
11	Redundancy change from SATU1 to SATU2	ZD011001	
		D.090010	A
		D.090011	A
		D.090013	SDE2
12	CCD parameters modification (in flight only):	P-D-C-50	
	DMSA1_USL	D.A00009	Hex 13
		D.A00011	Dec 69
	DMSA2_USL	D.A00009	Hex 19
		D.A00011	Dec 68
	DMSB1_USL	D.A00009	Hex 1F
		D.A00011	Dec 71
	DMSB2_USL	D.A00009	Hex 25
		D.A00011	Dec 72
	DMFP2_USP	D.A00009	Hex 29
		D.A00011	Dec 5

PROCEDURE : P-D-N-03 (cont'd)

13	Fetch RTT Format (BOA parameter : Hex '3')		
	Verify parameter updates from steps 7,8,9,10	D9422	0.02
		D9426	0.02
		D9427	0.08
		D9428	0.08
		D9429	0.08
		D9430	0.02
		D9432	20
		D9433	20
		D9434	20
		D9435	20
		D9436	20
		D9438	10
		D9442	20
		D9445	5
		D9446	2
		D9447	20
		D2714	Hex B77
		D2715	Hex 960
		D2720	3
		D8622	NOMINAL
		D8623	NOMINAL
		D8627	MASTERSDE2
		D8305	Dec 69
		D8405	Dec 68
		D8311	Dec 71
		D8411	Dec 72
		D8402	Dec 5

NB: Values of steps 7, 12 and 13 which need to be changed are overwritten by the CTI table application.