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Custodian: R. Ebbett

REDLINES ARE
PHASE II MARKUPS
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APPROVED:

System: R. N. Yarnell
N. Yarnell

Subsystem: G. McNutt
G. McNutt

R. Ebbett
R. Ebbett

Principal Investigator: Charles W. Hord
C. Hord

JET PROPULSION LABORATORY

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FUNCTIONAL REQUIREMENT

GALILEO ORBITER

ULTRAVIOLET SPECTROMETER SUBSYSTEM

▌Denotes changes

1.0 SCOPE

This document establishes the functional requirements of the Galileo Orbiter Ultraviolet Spectrometer Subsystem (UVS) which is used to provide spectral measurements in the spectral range of 1150 to 4300 Å.

Byte, Bit*	Description
9,4	F channel high voltage status: 0 - On I - Off
9,5	N Channel high voltage status: 0 - On I - Off
9,6	G channel high voltage status: 0 - On I - Off
9,7-8	Integration Time: 00 - Short (2 msec) 01 - Long (6 msec) 10 - Short (1 msec) 11 - Long (4 msec
10,1	Mode: 0 - Grating scanning 1 - Fixed grating
10, 2-3	Wavelength Monitored: PHASE 2, ALWAYS 00 00 - First position monitored (or scanning if Mode - 0) 01 - Second position monitored 10 - Third position monitored 11 - Fourth position monitored
10,4	Motor Grating: 0 - Motor control grating #1 1 - Motor control grating #2
10,5	Microprocessor Control: 0 - UVS not under microprocessor control (Coldstart mode) 1 - UVS under microprocessor control

*Bit numbering conventions are per GLL-3-280

Figure 4. UVS Telemetry Data Format and Description (cont'd)

13) STIM - Used to control the stimulus lamp operation.

14) LIMB OR - Used to override the limb sensor.

15) INT Time-A - Used by cold start logic to set the data integration time.

16) INT TIME B - Used by cold start logic to set the data integration time.

4.3.2.2 Output to Motor Control Logic

The motor control logic contains a stepping motor and defraction grating system which is used in conjunction with channel selection to acquire data in various modes. When in microprocessor control, the software generates four outputs as listed below. The first three parameters are also inputs to the digital status for inclusion into the data stream.

1) Motor Grating Select - This parameter selects the alternate motor control LED and photocell control combination

2) Flyback - This parameter causes the motor to step to position zero (shortest wavelength).

3) Up/Down - This parameter changes direction of the motor.

4) Step - This parameter causes the motor controller to advance the motor to the next grating position.

4.3.2.3 Output to UVS Bus Adapter

All output to the UVS reply line is effected using Direct Memory Access. Telemetry data originates in the cold start logic data memory; there is no software interface with this data. The UVS bus adapter and microprocessor system provide for access to the program memory per the requirements of GLL-3-270. This provides for output to the reply line of functions such as memory readout, LRS AND PHASE II RTS.

4.3.3 Software Processing Requirements

This section describes the functional requirements which are placed on the microprocessor software. Paragraphs 4.3.3.2 through 4.3.3.7 are required for any set of software loaded into the UVS program memory. Paragraph 4.3.3.8, Representative Modes, describes the general capabilities of one set of prototype software and is included here to indicate types of modes which can be generated under software control.

4.3.3.1 Microprocessor POR

The instrument power on sets the microprocessor control to the load state.

4.3.3.8 Representative Software Controlled Modes

Based upon prototype software and preliminary science requests, the following general types of modes have been shown feasible. These are not the only modes possible within the fixed input and output constraints. Likewise, it may not be possible to include every mode listed in a single UVS RAM program load. They are briefly described here to illustrate the general level of complexity and flexibility which can be accommodated.

4.3.3.8.1 Fixed Wavelength Modes AND MINI-SCAN

The fixed wavelength modes are nominally used to continuously collect data from commanded single detector (F, G. or N) with the defraction grating cycling between the desired set of wavelengths. One full scan of data is acquired at each position for the following commandable mode subsets.

1) Single wavelength, continuous

2) Two wavelengths, alternating 1,2,1,2..

3) Three wavelengths, alternating 1,2,3,2,1,2,...

4) Four wavelengths, alternating 1,2,3,4,3,2,1,2...

4.3.3.8.2 Scan Modes

The scan modes normally step the defraction grating one position after each data sample. A full data scan (528 samples) is acquired before cycling to the next desired sensor. The grating is normally stepped from the top to bottom to top position in a sawtooth manner. Possible subsets of this mode are:

1) Single detector only (F, G, or N)

2) Cycle between any two detectors:

F and G

F and N

G and N

3) Cycle between all three detectors (F, G, and N)

4.3.4 Reprogramming Requirements

In order to meet the full UVS Science objectives, it is required that flexibility be maintained which allows program modification in response to new science requests, both before and after launch.

4.3.4.1 Program Design Restrictions

All changes to a new program version shall be restricted by:

1) Instrument design as reflected in this FR.

2) Spacecraft interface requirements as defined in GLL-3-270.

3) Command structure per GLL-3-290.

4) Telemetry structure per GLL-3-280.

4.3.4.2 Development Environment

A software development environment necessary to generate new UVS flight programs shall be maintained throughout the mission.

4.3.4.3 Change control and Validation

All software changes shall be subject to project change control. UVS shall provide support necessary to validate changes prior to loading onboard the spacecraft.

4.4 Operation

The operation of the instrument consists of grating control, data handling, status multiplexing and instrument command and mode control. The functions are sequential and are determined by the desired mode of operation. The mode of operation is selected by command, as delineated in GLL-3-290, Command Structure and Assignments and shown for reference only in Figure 5. Data taking is to be synchronous with other selected instruments and the sync signal is S/C clock supplied by the CDS through the 1802 bus adapter. UVS bus transaction addresses are delineated in GLL-3-270, Data System Intercommunication Requirements, and are shown for reference only in Figure 6. The State diagram is shown in Figure 7.

4.4.1 Modes of Operation

4.4.1.1. Small Step Scan Mode → MINI

This mode of operation shall be used to take a complete spectral scan of any channel in 4-1/3 s, utilizing small grating steps ~~and short integration times~~. any number of detector. and any

4.4.1.2 Large Step Scan Mode

REMOVE

This mode shall be used to take a complete spectral scan of any channel in 4-1/3 s, utilizing large grating steps and long integration times.

4.4.1.3 Combination Scan Mode

This mode shall be used to scan more than one or two channel(s) in sequential~~ly~~. 4⅓ sec periods.

4.4.1.4 Fixed Wavelength Mode

grating position

This mode shall be used to sample a fixed point in the spectrum. for the entir
^ 4⅓ Sec period

4.4.1.5 Selected Position Wavelength Mode

REMOVE

This mode shall be used to sequentially sample selected wavelengths in the spectrum

ADD:

Phase II Real Time Science (RTS) Modes

The above modes shall be available for either LRS or RTS operating PHase II formats. In RTS Formats, the UVS data will be sampled from the same output buffer in the Cold Start logic - by the CDS - and ~~integrated~~ summed in that CDS buffer for periods prescribed by the Selected Telemetry format, generally one half hour, one hour or 24 hours. Use of the Phase II "SELECT/DESELECT" command can also control the integration time in the CDS buffer. The UVFLUSH command will be used to control movement of the data to the multi-use buffer and subsequent zeroing of the UVS CDS buffer. "SELECT/DESELECT" only controls whether the buffer is transfered, not the integration activity in the CDS buffer.

SEE PHASE II DIAGRAM

BIT* / BYTE	1	2	3	4	5	6	7	8
1	NUMBER OF STEPS IN MINISCAN							
2	Mode	F H.V. Over-ride	N H.V. Over-ride	G H.V. Over-ride	Change Grating	Motor Direc-tion	Wavelength Position	
3	F Channel	N Channel	G Channel	H.V.	Stim. Lamp	Limb Override	Integration Times	
4	Initial Position							
5	Second Position							MSB of initial position
6	Third Position							
7	Fourth Position							

Byte, Bit*	Description
1, 1-8	Number of steps in miniscan VALUE IS A REFERENCE TO AN INTERNAL LOOK-UP TABLE
2, 1	Mode: 0 = Scanning mode 1 = Fixed wavelength mode

*Bit numbering conventions are per GLL-3-290

Figure 5. UVS Command (34UVS) Format and Description

Galileo UVS Phase II Software Version 6.1

- ***Version 6.1*** **Command Definitions**

Byte\Bit	1	2	3	4	5	6	7	8
Byte 1	Even Scans (i.e. 0, 2, 4, ...) Low order byte of a two byte look-up table pointer indication the number of steps to mini-scan during even science frames.							
Byte 2	Mode	F HV Override	N HV Override	G HV Override	Change Grating	Motor Direction	*Don't Care*	*Don't Care*
Byte 3	F Channel	N Channel	G Channel	HV Off / ~On	Stim Lamp	Limb Override	Int. Time MSB	Int. Time LSB
Byte 4	Least Significant 8 Bits of Initial Position Delta (Bit 3 through 10)							
Byte 5	Odd Scans (i.e. 0, 2, 4, ...) Low order byte of a two byte look-up table pointer indication the number of steps to mini-scan during odd science frames.						Init. Pos. MSB	Init. Pos. Bit 2
Byte 6	0	0	0	0	0	Sign 0 = Pos. 1 = Neg.	Delta MSB	Delta MSB - 1
Byte 7	LSByte of Delta - *Both Modes* (8 Bits) (Set to zero if you do not want any delta between the science frames)							

Byte, Bit*	Description.
2, 2	F channel high voltage override: 0 = High voltage operation normal. 1 = High voltage override on
2, 3	N channel high voltage override: 0 = High voltage operation normal. 1 = High voltage override on
2, 4	G channel high voltage override: 0 = High voltage operation normal. 1 = High voltage override on
2, 5	Change motor control grating: 0 = No change 1 = Switch
2, 6	PHASE II = DON'T CARE = (Ø) mini Scan position #0,1,2,3 Motor direction: This bit must be set = 1
2, 7-8	Wavelength positions to be measured in fixed mode: 00 = First position (on scan if Mode = 0) 01 = Second positions 10 = Third positions 11 - Fourth positions
3, 1	F channel select: 0 = Off 1 - On
3, 2	N channel select: 0 = Off 1 = On

*Bit numbering conventions are per GLL-3-290

Figure 5. UVS Command (34UVS) Format and Description (cont'd)

Byte, Bit*	Description
3, 3	G Channel select: 0 = Off 1 = On
3, 4	High voltage 0 = On for selected channel 1 = Off
3, 5	Stimulus lamp: 0 = Off 1 = On
3, 6	Limb sensor override: 0 = Override Off 1 = Override On
3, 7	Integration time: 00 = F channel short (~2 msec) 01 = F channel long (~6 msec) 10 = G or N channel short (~1 msec 11 = G or N channel long (~4 msec)
4, 1-8	
5, 1-8	See diagram
6, 1-8	
7, 1-8	

*Bit numbering conventions are per GLL-3-290

Figure 5. UVS Command (34UVS) Format and Description (cont'd)