Aspect System Housekeeping

Mai 29, 2001

Martin Fivian, Alex Zehnder

Content

Content **2**
1 Introduction **3**
2 Overview of Digital Housekeeping **3**
3 Description of Digital Housekeeping **3**
3.1 IADP_SWMD 3
3.2 IADP_SWSTAT 4
3.2.1 IADP_SCAD *4*
3.2.2 EEPROM Page Numbers *4*
3.3 IADP_RASFRMS 4
3.4 IADP_SASFRMS 5
3.5 IADP_INTCTR 5
3.6 IADP_DSPSVC1 5
3.7 IADP_HWMD 5
3.8 IADP_LIMBS 5
3.9 IADP_RASPXLS 5
3.10 IADP_SAS10LIMBS 5
3.11 IADP_SAS11LIMBS 5
3.12 IADP_SAS12LIMBS 5
3.13 IADP_RASEVTS 6
3.14 IADP_FRMSX 6
3.15 IADP_ACSCODE 6
3.16 IADP_ESCTR 6
3.17 IADP_RASACTIVE 6
3.18 IADP_LIMBX 6
3.19 IADP_PTID 6
3.20 IADP_PKTCTR 6
4 Limits **7**
4.1 OVERVIEW 7
4.2 IADP_FIFOFULL 7
4.3 IADP_FIFOFULL AND IADP_FIFOEMPTY 7
4.4 IADP_SASFRMS 8
4.5 IADP_DSPSVC1 8
4.6 IADP_SAS10LIMBS 8
4.7 IADP_SAS11LIMBS 8
4.8 IADP_SAS12LIMBS 9
4.9 IADP_ESCTR 9
4.10 IADP_RASACTIVE 9
4.11 DEPENDENCY ON ECLIPSE 9
5 Plots on ITOS **9**
5.1 IADP_LIMBS 9
5.2 IADP_SAS10LIMBS 10
5.3 IADP_SAS11LIMBS 10
5.4 IADP_SAS12LIMBS 10
5.5 IADP_ESCTR 10
5.6 IADP_RASACTIVE 10
5.7 IADP_LIMBX 10
5.8 IADP_PKTCTR 10

1 Introduction

This document describes the digital housekeeping of the aspect data processor (ADP). Once every second, a block of twenty 16bit words are sent to the IDPU. This housekeeping data contains the most important numbers, which allows to control whether the ADP is running under good conditions to acquire aspect data. All parameters, which are described in chapter 3 suppose to be displayed on a page in ITOS. For all entries containing only one bit, the value 1 means enabled. Bit number 15 is the most significant bit and bit number 0 is the least significant bit. For all other entries, the value should be displayed as a decimal value. In addition an overview page should be made, which displays the twenty values in hex numbers.

2 Overview of Digital Housekeeping

No	Mnemonics	AppID=1 Byte	Short Description
0	IADP_SWMD	994	ADP software mode
1	IADP_SWSTAT	996	ADP software status
2	IADP_RASFRMS	998	Number of RAS frames
3	IADP_SASFRMS	1000	Number of SAS frames
4	IADP_INTCTR	1002	Number of communication interrupts
5	IADP_DSPSVC1	1004	Control sum of program after ADPRESET
6	IADP_HWMD	1006	ADP hardware mode
7	IADP_LIMBS	1008	Number of SAS limbs crossing threshold
8	IADP_RASPXLS	1010	Number of RAS pixels above threshold
9	IADP_SAS10LIMBS	1012	Number of SAS10 limbs
10	IADP_SAS11LIMBS	1014	Number of SAS11 limbs
11	IADP_SAS12LIMBS	1016	Number of SAS12 limbs
12	IADP_RASEVTS	1018	Number of RAS events
13	IADP_FRMSX	1020	Number of discarded frames
14	IADP_ACSCODE	1022	Current ACS code
15	IADP_ESCTR	1024	Number of ES signals
16	IADP_RASACTIVE	1026	Number of acquired RAS images
17	IADP_LIMBX	1028	Number of discarded SAS limbs
18	IADP_PTID	1030	Parameter table ID
19	IADP_PKTCTR	1032	Number of packets written to FIFO

3 Description of Digital Housekeeping

3.1 IADP_SWMD

The ADP software mode of the housekeeping data is word number 14 of the ADP parameter table (SRADPM).

Bit No	Mnemonics	Description
15	IADP_RASNTYP	Enable n-pixel type of RAS events
14	IADP_IOWAIT	Include I/O wait state

12-11	Reserved	Used internally of ADP
10	IADP_SASSEC	SAS, every second pixel
9	IADP_SASIM8	SAS 8bit images
8	IADP_SASLI8	SAS 8bit limbs
7	IADP_RASSIM	RAS spatial summed images
6-5	IADP_ADPTEST	ADP test pattern (linear ramp)
4	IADP_RASETYP	Enable RAS time events
3	IADP_RASIM	RAS images
2	IADP_RASEV	RAS events
1	IADP_SASIM	SAS 10bit images
0	IADP_SASLI	SAS 10bit limbs

3.2 IADP_SWSTAT

The ADP software status contains the following status bits.

Bit No	Mnemonics	Description
15	IADP_FIFOFULL	ADP FIFO full
14	IADP_ES	ES signal
13	IADP_FIFOEMPTY	ADP FIFO empty
12	IADP_STOPPED	ADP stopped data taking
11-8	IADP_SCAD	SAS cadency
7-6	IADP_PARAVAR	Page of parameter EEPROM (variable)
5-4	IADP_BOOTVAR	Page of boot EEPROM (variable)
3-2	IADP_PARAREG	Page of parameter EEPROM (register)
1-0	IADP_BOOTREG	Page of boot EEPROM (register)

3.2.1 IADP_SCAD

These four bits encodes the SAS cadency. Except for the highest cadency of 128Hz, the encoding of the parameter table entry SCAD is used.

Cadency	Encoding (11-8)
128	0000
64	1111
32	1101
16	1001
8	0001

3.2.2 EEPROM Page Numbers

The bits 3-0 are the status of the hardware register after reset and bits 7-4 reflect the according software variable.

3.3 IADP_RASFRMS

The total number of RAS frame interrupts. This is an increasing number, which overflows on 16 bits.

3.4 IADP_SASFRMS

The total number of SAS frame interrupts. One SAS cycle consisting three frames from all SAS's produces one interrupt. This is an increasing number, which overflows on 16 bits.

3.5 IADP_INTCTR

The total number of ADP communication interrupts. This is a grand total of all kinds of communication interrupts between the ADP and the IDPU. The number overflows on 16 bits.

3.6 IADP_DSPSVC1

The control sum of the ADP program after ADPRESET. This number changes when running the ADP program to acquire sensor data.

3.7 IADP_HWMD

The ADP hardware mode of the housekeeping data is word number 10 of the ADP parameter table (FLAGS).

Bit No	Mnemonics	Description
15	IADP_RADJTHR	Enable RAS threshold table
14	IADP_RTSUM	Enable time summation
13	IADP_RSSUM	Enable spatial summation
12	IADP_RASTMEM	Enable time memory
11-9	IADP_RASM	RAS 1st level mode
8-6	IADP_SAS12M	SAS 12 1st level mode
5-3	IADP_SAS11M	SAS 11 1st level mode
2-0	IADP_SAS10M	SAS 10 1st level mode

3.8 IADP_LIMBS

The total number of SAS pixel values crossing the threshold. This is a total value for all three SAS's for the current frame.

3.9 IADP_RASPXLS

The total number of RAS pixels above threshold for the current frame.

3.10 IADP_SAS10LIMBS

The total number of limbs on SAS10, which are written to the telemetry packet. This is an increasing number, which overflows on 16 bits.

3.11 IADP_SAS11LIMBS

The total number of limbs on SAS11, which are written to the telemetry packet. This is an increasing number, which overflows on 16 bits.

3.12 IADP_SAS12LIMBS

The total number of limbs on SAS12, which are written to the telemetry packet. This is an increasing number, which overflows on 16 bits.

3.13 IADP_RASEVTS

The total number of RAS events, which are written to the telemetry packet. This is an increasing number, which overflows on 16 bits.

3.14 IADP_FRMSX

The total numbers of discarded frames are counted separately for SAS and RAS resp.

Byte	Mnemonics	Description
MSB	IADP_SASX	Number of discarded SAS frames
LSB	IADP_RASX	Number of discarded RAS frames

Both numbers are increasing and overflow on the byte border. The reasons for discarding a frame are:

SAS: discarded frames on beginning of ADP run (SFD) or frame overrun.

RAS: discarded frames on beginning of ADP run (RFD), earth shine or frame overrun.

3.15 IADP_ACSCODE

The current ACS code. The code 0x8080 means that there is no ACS code available. Otherwise, the MSB is the x-component and the LSB is the y-component. (see document describing the ACS code, TBD)

3.16 IADP_ESCTR

The total number of recovers from earth shine mode (fast read). This is an increasing number, which overflows on 16 bits.

3.17 IADP_RASACTIVE

The number of acquired RAS images. This is an increasing number, which overflows on 16 bits.

3.18 IADP_LIMBX

The total number of discarded SAS limbs for all three SAS's. The only discarded SAS limbs, which are counted, are due to violation of the minimum limb separation value (MISEP). The SAS limbs, which are discarded because of a limb number limit (LNL) can't be counted. IADP_LIMBX is an increasing number, which overflows on 16bits.

3.19 IADP_PTID

The ADP parameter table ID, which is word 0 of the ADP parameter table.

3.20 IADP_PKTCTR

This word has different meanings for the following conditions. In all cases, it's an increasing number, which overflows on 16 bits.

On ADP run: The total number of telemetry packets written to the FIFO.

On ADP programming: The total number of 64-word packets written to the EEPROM.

On message sending: The total number of x-word packets sent from ADP (x<=128). (TBD)

4 Limits

4.1 Overview

In the following table an overview of the limits of the housekeeping entries are given. The minimum and maximum are given as inclusive values. i.e. the lowest, and highest respectively, values are given.

For those entries, where the units are given to be "**counts/sec**", the limits apply to delta values. I.e. the difference between the previous and the actual value has to be calculated and divided by the time difference in seconds. If V(n) is the value of an entry in the n-th block and T(n) is the time of that particular block, the limits has to be applied to (V(n) – V(n-1))/(T(n) - T(n-1)). If no blocks are lost, V(n)-V(n-1) is the expression to be watch for vc0 data and (V(n)-V(n-1))/10 the according expression for vc1 data.

Mnemonics	Minimum	Maximum	Units	Comment
IADP_FIFOFULL				See below
IADP_FIFOEMPTY				See below
IADP_RASFRMS	40	120	Counts/sec	
IADP_SASFRMS	Cadency dependent	Cadency dependent		See below
IADP_INTCTR	1		Counts/sec	
IADP_DSPSVC1				See below
IADP_LIMBS	3	20		
IADP_RASPXLS	0	50		
IADP_SAS10LIMBS	Cadency dependent	Cadency dependent	Counts/sec	See below
IADP_SAS11LIMBS	Cadency dependent	Cadency dependent	Counts/sec	See below
IADP_SAS12LIMBS	Cadency dependent	Cadency dependent	Counts/sec	See below
IADP_RASEVTS	0.05	20	Counts/sec	
IADP_SASX	0	0	Counts/sec	
IADP_ESCTR	0	0.5	Counts/sec	See below
IADP_RASACTIVE	0	120	Counts/sec	See below
IADP_LIMBX	0	20	Counts/sec	
IADP_PKTCTR	0.01	1000	Counts/sec	

4.2 IADP_FIFOFULL

This flag indicates that the ADP FIFO is full. Basically, this can happen only in the case if the ADP is writing more data to the FIFO than the IDPU is able to read. The following limit should be applied:

IADP_FULL should not be high for two consecutive HK blocks. I.e. an error should be displayed if IADP_FIFOFULL is 1 for block n and block n-1.

4.3 IADP_FIFOFULL and IADP_FIFOEMPTY

The two flags IADP_FIFOFULL and IADP_FIFOEMPTY must not be set at the same time. I.e. an error should be displayed if IADP_FIFOFULL and IADP_FIFOEMPTY is 1 in the same block.

4.4 IADP_SASFRMS

The limits for this entry are SAS cadency dependent. The current cadency can be read from the HK entry IADP_SCAD (see above). In the following table the limits for the valid cadencies are given in counts per second.

Cadency	Minimum	Maximum
128	128	128
64	64	64
32	32	32
16	16	16
8	8	8

4.5 IADP_DSPSVC1

The entry IADP_DSPSVC1 contains the control sum of current ADP program after issuing an IADPRESET command. Therefore, the value depends on the loaded ADP program. For the launch configuration the control sum of the four different pages are as follows:

Page 0: 0x72AA

Page 1: 0x72AA

Page 2: 0xAF63

Page 3: 0xAF63

4.6 IADP_SAS10LIMBS

The limits for this entry are SAS cadency dependent. The current cadency can be read from the HK entry IADP_SCAD (see above). In the following table the limits for the valid cadencies are given in counts per second.

Cadency	Minimum	Maximum
128	256	1024
64	128	512
32	64	256
16	32	128
8	16	64

4.7 IADP_SAS11LIMBS

Analog to entry IADP_SAS10LIMBS.

4.8 IADP_SAS12LIMBS

Analog entry IADP_SAS10LIMBS.

4.9 IADP_ESCTR

If the aspect system is setup perfectly, one or two (moon) earthshine signal transitions should occur per revolution of the S/C (nominally 4sec). Hence, an upper limit of 0.5 transitions per seconds should be applied. For vc0 data and assuming no blocks are lost, the delta value over two blocks should not be bigger than 1 (IADP_ESCTR(n) – IADP_ESCTR(n-2) ≤ 1). For vc1 data and assuming no blocks are lost, the delta value taken from two consecutive blocks must be lower or equal 5.

4.10 IADP_RASACTIVE

In addition to the limits given in the table of section 4.1, the increase of IADP_RASACTIVE (in counts per second, i.e. the difference of two consecutive values, normalized by the time difference) should not be bigger than the increase of IADP_RASFRMS (in counts per second). I.e. the following equation has always to be satisfied:

IADP_RASACTIVE(n) – IADP_RASACTIVE(n-1) ≤

IADP_RASFRMS(n) – IADP_RASFRMS(n-1)

4.11 Dependency on Eclipse

The limits for the following values do not apply in eclipse, i.e. no limits should be applied.

Mnemonics
IADP_LIMBS
IADP_SAS10LIMBS
IADP_SAS11LIMBS
IADP_SAS12LIMBS
IADP_SASX

5 Plots on ITOS

In this section, the required plots concerning the ADP housekeeping are listed. They can be made from replays of vc0 or vc1 data or, giving a time window, they can be make online.

5.1 IADP_LIMBS

Plot IADP_LIMBS vs. time.

Since IADP_LIMBS is a constant value of 6 in the ideal case, the values can be plotted within a range given by the limits adding a margin.

5.2 IADP_SAS10LIMBS

Plot increase of IADP_SAS10LIMBS per second.

Since IADP_SAS10LIMBS is an increasing counter, a scaling analog to the one described in section 4.1 has to be implemented. Also, the range is cadency dependent (see section 4.6)

5.3 IADP_SAS11LIMBS

Analog to entry IADP_SAS10LIMBS.

5.4 IADP_SAS12LIMBS

Analog to entry IADP_SAS10LIMBS.

5.5 IADP_ESCTR

Plot increase of IADP_ESCTR per second.

A scaling according to the one described in section 4.9 has to be applied. Optionally, an averaging (or smoothing) using a bigger time window could be implemented and the calculation could be done with floating point numbers.

5.6 IADP_RASACTIVE

Plot increase of IADP_RASACTIVE per second.

A scaling according to the one described in section 4.1 has to be applied and an appropriate range has to be chosen.

5.7 IADP_LIMBX

Plot increase of IADP_LIMBX per second.

A scaling according to the one described in section 4.1 has to be applied and an appropriate range has to be chosen. Under normal circumstances, this number is not expected to grow fast. Therefore, a selectable bigger time window should be implemented.

5.8 IADP_PKTCTR

Plot increase of IADP_PKTCTR per second.

A scaling according to the one described in section 4.1 has to be applied and an appropriate range has to be chosen.