

# **ROSETTA ROSINA**

## **DPU – S/C Housekeeping Packets**

**ROS-TUB-SP-02/3.0**

**Revision 3.0**

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## Document Change Record

Rev.	Date	Pages	Description
1.0	18.04.00	All	First Issue
1.1	02.05.00	11-21	HK conversion formulas added
1.2	07.06.00	3-7 3-8	SID numbers changed Standard DPU Packetblock changed
1.3	22.06.00	3-8	Standard DPU Packetblock changed
1.4	14.07.00	8	DPU Status of Standard DPU Packetblock changed
1.5	01.09.00	3,5..7, 18..19	Correct error in extended RTOF Packetblock
2.0	19.03.01	All	FM Version
2.1	05.06.01	3-7 11,16,23 11-24 7, 24	Update packet length and data rate Add status values for DFMS, RTOF, COPS Update calibration data Add monitoring packet
2.2	11.06.01	11 18,21 16 22	Add MEP CEM DTA Move MC_GCU_TEMP_TANK_#2 from std. to ext. HK Add ETS Status and Address bits Add NOE Status
2.3	13.06.01	12 17	Add DFMS ISC FIL Emission Status Add RTOF FEC Status bits
2.4	04.07.01	8-25 17	Add RSDB name column Change RTOF Filament Status
2.5 FS	06.11.01	20,22,25, 26,28	Replace WCS parameters by ETS Light
3.0	19.04.02	All All 10-12	Add RSDB detailed parameter names Update calibration factors Add detailed parameters in DPU HK

## 1. Packet Types and SIDs

Mode No.	Average Data Rate (bits/s)	Peak Data Rate (bits/s)	Polling Period (s)	Packet Size (words)	SID	Description
D2	7	35	16	24 35	1 17	Std. DPU HK every 1 min Ext. DPU HK every 5 min
D3	140	140	4	35	17	Ext. DPU HK every 4 s
D4	280	560	1	35	17	Ext. DPU HK every 2 s
D5	140	140	4	35	17	Ext. DPU HK every 4 s
S1T	35	184	16	123 190	5 21	Std. RTOF HK every 1 min Ext. RTOF HK every 5 min
S1 1L 1G 1I 1	43	220	16	152 226	13 29	Std. RTOF+COPS HK every 1 min Ext. RTOF+COPS HK every 5 min
E1	880	880	4	226	29	Ext. RTOF+C HK every 4 s
G1	1472	3520	1	190	21	Ext. RTOF HK every 2 s
S2T	34	180	16	114 180	3 19	Std. DFMS HK every 1 min Ext. DFMS HK every 5 min
S2 2 3	42	216	16	143 216	11 27	Std. DFMS+COPS HK every 1 min Ext. DFMS+COPS HK every 5 min
E2	864	864	4	216	27	Ext. DFMS+C HK every 4 s
G2	1440	2880	1	180	19	Ext. DFMS HK every 2 s
S4 4	70	365	16	242 371	15 31	Std. D+R+C HK every 1 min Ext. D+R+C HK every 5 min
E4	1460	1460	4	371	31	Ext. D+R+C HK every 4 s
G4	2920	5840	1	371	31	Ext. D+R+C HK every 2 s
S5 5M 5	15	71	16	53 71	9 25	Std. COPS HK every 1 min Ext. COPS HK every 5 min
E5	284	284	4	71	25	Ext. COPS HK every 4 s
G5	568	1136	1	71	25	Ext. COPS HK every 2 s

Note: Gx Modes are for Ground Test only!

Max. average HK data rate during normal operation is 70 bits/s (mode 4).

Max. average HK data rate in emergency situation is 1460 bits/s (mode E4).

Monitoring packet SID 32 is sent with every std. or ext. HK packet (every 2/4s or 1min.)!

## 2. HK Packet Definitions

Each HK Packet consists of one or several HK Packetblocks defined in 3.

### 2.1 Standard DPU HK Packet, SID = 1, Length 24 words (YRNP1001)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	1
002	46		Standard DPU Packetblock	

### 2.2 Extended DPU HK Packet, SID = 17, Length 35 words (YRNP1002)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	17
002	46		Standard DPU Packetblock	
048	22		Extended DPU Packetblock	

### 2.3 Standard DFMS HK Packet, SID = 3, Length 114 words (YRND1001)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	3
002	46		Standard DPU Packetblock	
048	180		Standard DFMS Packetblock	

### 2.4 Extended DFMS HK Packet, SID = 19, Length 180 words (YRND1002)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	19
002	46		Standard DPU Packetblock	
048	22		Extended DPU Packetblock	
070	180		Standard DFMS Packetblock	
250	110		Extended DFMS Packetblock	

### 2.5 Standard RTOF HK Packet, SID = 5, Length 123 words (YRNR1001)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	5
002	46		Standard DPU Packetblock	
048	198		Standard RTOF Packetblock	

### 2.6 Extended RTOF HK Packet, SID = 21, Length 190 words (YRNR1002)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	21
002	46		Standard DPU Packetblock	
048	22		Extended DPU Packetblock	
070	198		Standard RTOF Packetblock	
268	112		Extended RTOF Packetblock	

### 2.7 Standard COPS HK Packet, SID = 9, Length 53 words (YRNC1001)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	9
002	46		Standard DPU Packetblock	
048	58		Standard COPS Packetblock	

### 2.8 Extended COPS HK Packet, SID = 25, Length 71 words (YRNC1002)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	25
002	46		Standard DPU Packetblock	
048	22		Extended DPU Packetblock	
070	58		Standard COPS Packetblock	
128	14		Extended COPS Packetblock	

### 2.9 Standard DFMS + COPS HK Packet, SID = 11, Length 143 words (YRNG1001)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	11
002	46		Standard DPU Packetblock	
048	180		Standard DFMS Packetblock	
228	58		Standard COPS Packetblock	

### 2.10 Extended DFMS + COPS HK Packet, SID = 27, Length 216 words (YRNG1002)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	27
002	46		Standard DPU Packetblock	

048	22		Extended DPU Packetblock	
070	180		Standard DFMS Packetblock	
250	110		Extended DFMS Packetblock	
360	58		Standard COPS Packetblock	
418	14		Extended COPS Packetblock	

### 2.11 Standard RTOF + COPS HK Packet, SID = 13, Length 152 words (YRNG1003)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	13
002	46		Standard DPU Packetblock	
048	198		Standard RTOF Packetblock	
246	58		Standard COPS Packetblock	

### 2.12 Extended RTOF + COPS HK Packet, SID = 29, Length 226 words (YRNG1004)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	29
002	46		Standard DPU Packetblock	
048	22		Extended DPU Packetblock	
070	198		Standard RTOF Packetblock	
268	112		Extended RTOF Packetblock	
380	58		Standard COPS Packetblock	
438	14		Extended COPS Packetblock	

### 2.13 Standard DFMS + RTOF + COPS HK Packet, SID = 15, Length 242 words (YRNG1005)

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	15
002	46		Standard DPU Packetblock	
048	180		Standard DFMS Packetblock	
228	198		Standard RTOF Packetblock	
426	58		Standard COPS Packetblock	

**2.14 Extended DFMS + RTOF + COPS HK Packet, SID = 31, Length 371 words (YRNG1006)**

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	31
002	46		Standard DPU Packetblock	
048	22		Extended DPU Packetblock	
070	180		Standard DFMS Packetblock	
250	110		Extended DFMS Packetblock	
360	198		Standard RTOF Packetblock	
558	112		Extended RTOF Packetblock	
670	58		Standard COPS Packetblock	
728	14		Extended COPS Packetblock	

**2.15 Monitoring Packet, SID = 32, Length 3 words (YRNG1007)**

Position	Bytes	Bits	Name	Data
000	1		Pad field	0
001	1		SID	32
002	4		Monitoring Packetblock	

### 3. HK Packetblock Definitions

#### 3.1 Standard DPU Packetblock, Length 23 words

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAP101: NRNDP101	1		DPU Std. HK Header	0xD0
	NRNDP102	1		S/W Version	Fixed value
002	NRNAP102	2		HK frame counter	Counter 0..65535
004	NRNAP103	2		DPU Cmd counter	Counter 0..65535
006	NRNAP104	2		DPU Cmd Error counter	Counter 0..65535
008	NRNAP105: NRNDP183	1		WD Counter	Counter 0..255
	NRNDP184	1		Latch-Up Counter	Counter 0..255
010	NRNAP106: NRNDP103	1		Timer Sync counter	Counter 0..255
		1		DPU Status	
	NRNDP104		7	I/F Crossing enabled	0 = Off, 1 = On
	NRNDP105		6	DM test	0 = Off, 1 = On
	NRNDP106		5	PM test	0 = Off, 1 = On
	NRNDP107		4	EEPROM test	0 = Off, 1 = On
	NRNDP182		3	Test type	0, 1
	NRNDP180		2	Latch-Up detect	0 = Off, 1 = On
	NRNDP181		1	Main / Redundant	0 = Red, 1 = Main
	NRNDP108		0	Science data enable	0 = Off, 1 = On
012	NRNAP001: NRNDP001	2		DPU power status	
	NRNDP002		15	Spare	
	NRNDP003		14	Status SRAM 2	0 = Off, 1 = On
	NRNDP004		13	Status SRAM 1	0 = Off, 1 = On
	NRNDP005		12	Status Stat EEPROM	0 = Off, 1 = On
	NRNDP006		11	Status I/F COPS	0 = Off, 1 = On
	NRNDP007		10	Status I/F RTOF	0 = Off, 1 = On
	NRNDP008		9	Status I/F DFMS	0 = Off, 1 = On
	NRNDP009		8	Status EEPROM	0 = Off, 1 = On
	NRNDP00A		7	Sensitivity DSP	0 = Low, 1 = High
	NRNDP00B		6	Sensitivity SRAM 2	0 = Low, 1 = High
	NRNDP00C		5	Sensitivity SRAM 1	0 = Low, 1 = High
	NRNDP00D		4	Sensitivity Stat EEPROM	0 = Low, 1 = High
	NRNDP00E		3	Sensitivity I/F COPS	0 = Low, 1 = High
	NRNDP00F		2	Sensitivity I/F RTOF	0 = Low, 1 = High
	NRNDP010		1	Sensitivity I/F DFMS	0 = Low, 1 = High
	NRNDP010		0	Sensitivity EEPROM	0 = Low, 1 = High
014	NRNAP108: NRNDP109	1		DPU Processor load	1..100 Percent
		1		DPU Self test status:	
	NRNDP10A		7	Processor self test	0 = Ok, 1 = Error
	NRNDP10B		6	PM self test	0 = Ok, 1 = Error
	NRNDP10C		5	EEPROM self test	0 = Ok, 1 = Error



	NRNDP10D		4	SRAM 1 self test	0 = Ok, 1 = Error
	NRNDP10E		3	SRAM 2 self test	0 = Ok, 1 = Error
	NRNDP10F		2	Stat EEPROM self test	0 = Ok, 1 = Error
	NRNDP110		1..0	Sensor I/F self test	0 = Ok, 1 = DFMS Error, 2 = RTOF Error, 3 = COPS Error
016	NRNAP109: NRNDP118	1		PM Error Count 1	Counter 0..255
	NRNDP119	1		PM Error Count 2	Counter 0..255
018	NRNAP002	2		PM Error status	Hex value
020	NRNAP003	4		PM Error address	Hex value
024	NRNAP10D: NRNDP11A	1		DM Error Count 1	Counter 0..255
	NRNDP11B	1		DM Error Count 2	Counter 0..255
026	NRNAP080	2		DM Error status	Hex value
028	NRNAP081	4		DM Error address	Hex value
032	NRNAP10E: NRNDP11C	1		EEPROM Error Count 1	Counter 0..255
	NRNDP11D	1		EEPROM Error Count 2	Counter 0..255
034	NRNAP004:	2		Sensor HK & power status	
	NRNDP111		15	COPS HK Status	0 = Off, 1 = On
	NRNDP112		14	RTOF HK Status	0 = Off, 1 = On
	NRNDP113		13	DFMS HK Status	0 = Off, 1 = On
	NRNDP011		12.. 9	Spare	
	NRNDP012		8	COPS Transc. Enable	0 = Disabled, 1 = Enabled
	NRNDP013		7	COPS Main Power	0 = Off, 1 = On
	NRNDP014		6	COPS Red. Power	0 = Off, 1 = On
	NRNDP015		5	RTOF Transc. Enable	0 = Disabled, 1 = Enabled
	NRNDP016		4	RTOF Main Power	0 = Off, 1 = On
	NRNDP017		3	RTOF Red. Power	0 = Off, 1 = On
	NRNDP018		2	DFMS Transc. Enable	0 = Disabled, 1 = Enabled
	NRNDP019		1	DFMS Main Power	0 = Off, 1 = On
	NRNDP01A		0	DFMS Red. Power	0 = Off, 1 = On
036	NRNAP10A: NRNDP114	1		Used memory PM	1..100 Percent
	NRNDP115	1		Used memory DM	1..100 Percent
038	NRNAP10B: NRNDP116	1		DPU S/W mode	Mode No.
		1		DPU S/W function:	
	NRNDP117		7	Compression function	0 = Off, 1 = On
	NRNDP185		6	DFMS FIFO function	0 = Off, 1 = On
	NRNDP186		5	RTOF FIFO function	0 = Off, 1 = On
	NRNDP187		4	COPS FIFO function	0 = Off, 1 = On
	NRNDP188		3	DPU FIFO function	0 = Off, 1 = On
	NRNDP189		2	Spare	
	NRNDP18A		1	Spare	
	NRNDP18B		0	Spare	
040	NRNAP10F:	1		DPU S/W processes:	

	NRNDP18C		7	DPU function	0 = Off, 1 = On
	NRNDP18D		6	ProcessCmd	0 = Off, 1 = On
	NRNDP18E		5	SensorSend	0 = Off, 1 = On
	NRNDP18F		4	SensorReceive	0 = Off, 1 = On
	NRNDP190		3	SensorScience	0 = Off, 1 = On
	NRNDP191		2	Spare	
	NRNDP192		1	Spare	
	NRNDP193		0	Spare	
	NRNDP194	1		DPU S/W status	Hex value
042	NRNAP10C	2		Cmd Error Status	Hex value
044	NRNAP180	2		Spare	

### 3.1 Extended DPU Packetblock, Length 11 words

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAP111: NRNDP120	1		DPU Ext. HK Header	0xE0
	NRNDP121	2		Gaida Dust Flux	
	NRNDP122	1		Cmd Check Length	Value
004	NRNAP112	2		Ext. Status	
	NRNDP123		15.. 9	Spare	
	NRNDP124		8	COPS Direct Cmd	0 = Off, 1 = On
	NRNDP125		7	RTOF Direct Cmd	0 = Off, 1 = On
	NRNDP126		6	DFMS Direct Cmd	0 = Off, 1 = On
	NRNDP127		5	Spare	
	NRNDP128		4	Spare	
	NRNDP195		3	Spare	
	NRNDP196		2	Spare	
	NRNDP129		1	Function Running	0 = Stopped, 1 = Running
	NRNDP12A		0	Cmd. Check Active	0 = Off, 1 = On
006	NRNAP113	4		Command 1	Hex value
010	NRNAP114	4		Command 2	Hex value
014	NRNAP115	4		Command 3	Hex value
018	NRNAP181: NRNDP197	1		Scrubbing Cnt PM	Counter 0..255
	NRNDP198	1		Scrubbing Cnt DM	Counter 0..255
020	NRNAP116: NRNDP199	1		Compression Unit	
	NRNDP19A	1		Compression Mode	

### 3.2 Standard DFMS Packetblock, Length 90 words

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAD101: NRNDD100	1		DFMS Std HK Header	0xC4
		1		DFMS Flags	
	NRNDD101		7	Command Error	0 = Off, 1 = On
	NRNDD102		6	HV Safe	0 = Off, 1 = On
	NRNDD103		5	HV Reduced	0 = Off, 1 = On
	NRNDD104		4	IS Heater	0 = Off, 1 = On
	NRNDD105		3	GCU 1	0 = Off, 1 = On
	NRNDD106		2	GCU 2	0 = Off, 1 = On
	NRNDD107		1	NOP	0 = Off, 1 = On
	NRNDD108		0	Cover Disable	0 = Off, 1 = On
002	NRNAD103	2		DFMS HK counter	Counter 0..65535
004	NRNAD104	2		DFMS Cmd counter	Counter 0..65535
006	NRNAD105	2		DFMS Cmd Error cnt	Counter 0..65535
008	NRNAD106	2		DFMS Cmd Error pos	Hex value
010	NRNAD107	2		DFMS Science counter	Counter 0..65535
012	NRNAD108	2		DFMS Science Error counter	Counter 0..65535
014	NRNAD109	2		DFMS Science Error position	Hex value
016	NRNAD10A:	2		DFMS S/W mode	
	NRNDD180		15	Spare	0 = Off, 1 = On
	NRNDD181		14	Spare	0 = Off, 1 = On
	NRNDD182		13	HK_FIL_MCP_RDH	0 = Off, 1 = On
	NRNDD183		12	HK_GCU_COV_ISH	0 = Off, 1 = On
	NRNDD184		11.. 8	DFMS mode	Mode No.
	NRNDD185		7	DMOD_HVOP	0 = Off, 1 = On
	NRNDD186		6	Spare	0 = Off, 1 = On
	NRNDD187		5	DMOD_ISH	0 = Off, 1 = On
	NRNDD188		4	DMOD_RDH	0 = Off, 1 = On
	NRNDD189		3	DMOD_MCP	0 = Off, 1 = On
	NRNDD18A		2	DMOD_FIL	0 = Off, 1 = On
	NRNDD18B		1	DMOD_COV	0 = Off, 1 = On
	NRNDD18C		0	DMOD_GCU	0 = Off, 1 = On
018	NRNAD10B:	2		DFMS S/W status	
	NRNDD18D		15	Function active	0 = Off, 1 = On
	NRNDD18E		14	Set volt active	0 = Off, 1 = On
	NRNDD18F		13	Execution active	0 = Off, 1 = On
	NRNDD190		12	Monitoring	0 = Off, 1 = On
	NRNDD191		11	Gain adjustment	0 = Off, 1 = On
	NRNDD192		10	Peakfit	0 = Off, 1 = On

	NRNDD193		9	Spare	0 = Off, 1 = On
	NRNDD194		8..0	DFMS status	Hex value
020	NRNAD10C	2		Leda/CEM Accu Time	
022	NRNAD10D	2		Accu/Scan Counts	Dec value
024	NRNAD10E	2		Mode Table	Dec value
026	NRNAD10F	2		Sequence Table	Dec value
028	NRNAD110	2		Spare 2	
030	NRNAD111	2		Spare 3	
032	NRNAD112	2		MEP I MEP	$A = (\text{value} * -1.493\text{e-}4) + 1.089\text{e-}3$
034	NRNAD113	2		MEP I Float	$A = (\text{value} * -7.4717\text{e-}5) + 5.44\text{e-}4$
036	NRNAD114	2		MEP MG	$V = (\text{value} * 6.957\text{e-}3) - 0.112$
038	NRNAD115	2		MEP ISB	$V = (\text{value} * 0.0277) - 0.113$
040	NRNAD116	2		MEP GCU PIn 1	$P [\text{bar}] = (\text{Vmon}[\text{V}] * 5 \text{ bar/V}) - 0.25$ $\text{Vmon}[\text{V}] = ((-6.175\text{e-}4[\text{V/Count}] * \text{Value}) + 0.0045\text{V})$
042	NRNAD117	2		MEP GCU I 1	$I [\text{A}] = (\text{Vmon}[\text{V}] * 0.1813\text{A/V})$
044	NRNAD118	2		MEP GCU POut 1	$p(\text{mbar}) = \exp[(\text{Vmom}[\text{V}] - 2.8426)/0.6085]$ $\text{Vmon}[\text{V}] = ((-6.175\text{e-}4[\text{V/Count}] * \text{Value}) + 0.0045\text{V})$
046	NRNAD119	2		MEP GCU PIn 2	$P [\text{bar}] = (\text{Vmon}[\text{V}] * 5,1 \text{ bar/V} - 3)$ $\text{Vmon}[\text{V}] = ((-6.175\text{e-}4[\text{V/Count}] * \text{Value}) + 0.0045\text{V})$
048	NRNAD11A	2		MEP GCU I 2	$I [\text{A}] = (\text{value} * 0.1874\text{A/V})$
050	NRNAD11B	2		MEP GCU POut 2	$p(\text{mbar}) = \exp[(\text{Vmon}[\text{V}] - 2.8426)/0.6085]$ $\text{Vmon}[\text{V}] = ((-6.175\text{e-}4[\text{V/Count}] * \text{Value}) + 0.0045\text{V})$
052	NRNAD11C	2		MEP GCU Temp 11	$T[^\circ\text{C}] = 155.12 * \text{Vmon}[\text{V}] - 158.03$ $\text{Vmon}[\text{V}] = ((-6.175\text{e-}4[\text{V/Count}] * \text{Value}) + 0.0045\text{V})$
054	NRNAD11D	2		MEP GCU Temp 12	$T[^\circ\text{C}] = 326.93 * \text{Vmon}[\text{V}] - 269.11$ $\text{Vmon}[\text{V}] = ((-6.175\text{e-}4[\text{V/Count}] * \text{Value}) + 0.0045\text{V})$
056	NRNAD11E	2		MEP GCU Temp 21	$T[^\circ\text{C}] = 154.87 * \text{Vmon}[\text{V}] - 160.79$ $\text{Vmon}[\text{V}] = ((-6.175\text{e-}4[\text{V/Count}] * \text{Value}) + 0.0045\text{V})$
058	NRNAD11F	2		MEP GCU Temp 22	$T[^\circ\text{C}] = 328.34 * \text{Vmon}[\text{V}] - 268.53$ $\text{Vmon}[\text{V}] = ((-6.175\text{e-}4[\text{V/Count}] * \text{Value}) + 0.0045\text{V})$
060	NRNAD120	2		MEP CEM I	$\mu\text{A} = (\text{value} * 2.46\text{e-}3)$
062	NRNAD121	2		MEP CEM ANA HG	$\text{nA} = (\text{value} * 0.01321) + 49.92263$
064	NRNAD122	2		MEP MOT I	$A = (\text{value} * -3.458\text{e-}4) + 2.52\text{e-}3$
066	NRNAD123	2		MEP HALL Counter	Dec value
068	NRNAD124	2		MEP MOT Counter	Dec value
070	NRNAD125:	2		MEP MOT Status	
	NRNDD10C		15	Spare	
	NRNDD10D		14	TP_ALEB	0 = Off, 1 = On
	NRNDD10E		13	Illegal Code	1 = Off, 0 = On
	NRNDD10F		12	Comp	0 = Off, 1 = On
	NRNDD120		11	Spare	
	NRNDD121		10	Hall C	0 = Off, 1 = On
	NRNDD122		9	Hall B	0 = Off, 1 = On

	NRNDD123		8	Hall A	0 = Off, 1 = On
	NRNDD124		7..6	Spare	
	NRNDD125		5..4	Cover LV	0 = 100%, 1 = 75%, 2 = 50%, 3 = 25%
	NRNDD126		3..2	Spare	
	NRNDD127		1	Cover Closed	1 = Off, 0 = On
	NRNDD128		0	Cover Open	1 = Off, 0 = On
072	NRNAD126	2		MEP DAC THR	$V=(value* - 6.175e-4)$
074	NRNAD127	2		MEP HVCEM DAC	$V = (value * 4.681e-1)$
076	NRNAD128	2		MEP HVCEM I	$mA=(value* -3.028e-3) + 0.01$
078	NRNAD129	2		MEP HVACC DAC	$V = (value * - 1.00908) -5.82237$
080	NRNAD12A	2		MEP HVACC I	$mA=(value* -4.567e-3) -0.046672$
082	NRNAD12B	2		MEP IS Temp	$^{\circ}C = (value * -0.0459) - 0.9552$
084	NRNAD12C	2		MEP HVACC ERR	$V=(value* -1.539e-3) -0.015702$
086	NRNAD12D	2		MEP HVCEM ERR	$V=(value* -1.5435e-3) -0.15$
088	NRNAD12E	2		MEP CEM GND	$V = (-6.175e-4 * Value) + 0.0045$
090	NRNAD12F: NRNDD12A	2	13.. 0	ISC FIL 1 Bias	$V = (value * 0.01351) - 0.641$
	NRNDD129		15,1 4	ISC FIL Emission	0 = 2 $\mu$ A, 1 = 20 $\mu$ A, 2 = SUB, 3 = 200 $\mu$ A
092	NRNAD130: NRNDD12D	2	13.. 0	ISC FIL 2 Bias	$V = (value * 0.01365) - 0.425$
	NRNDD12C		14	ISC HVx Status	0 = Off, 1 = On
	NRNDD12B		15	ISC TLx Status	0 = Off, 1 = On
094	NRNAD131: NRNDD130	2	13.. 0	ISC FIL 1 E	$\mu A = ((value * -6.175e-4) + 4.5e-3) * Y$ Y : 2 $\mu$ A $\equiv$ 0.491 20 $\mu$ A $\equiv$ 4.975 SUB $\equiv$ 0.491 200 $\mu$ A $\equiv$ 49.94
	NRNDD12F		14	ISC SLx Status	0 = Off, 1 = On
	NRNDD12E		15	ISC SEx Status	0 = Off, 1 = On
096	NRNAD132: NRNDD133	2	13.. 0	ISC FIL 1 I	$A = (value * -1.004e-4) + 0.0646$
	NRNDD132		14	ISC FIL1 Enable	0 = Off, 1 = On
	NRNDD131		15	ISC FIL2 Enable	0 = Off, 1 = On
098	NRNAD133	2		ISC FIL 2 E	$\mu A = ((value * -6.175e-4) + 4.5e-3) * Y$ Y : 2 $\mu$ A $\equiv$ 0.485 20 $\mu$ A $\equiv$ 4.994 SUB $\equiv$ 0.485 200 $\mu$ A $\equiv$ 49.582
100	NRNAD134	2		ISC FIL 2 I	$A = (value * 9.837e-5) + 0.1483$
102	NRNAD135	2		ISC ERP	$V = (value * 0.01926) - 1.525$
104	NRNAD136	2		ISC IRP1	$V = (value * 0.01917) + 0.019$
106	NRNAD137	2		ISC IRP2	$V = (value * 0.01948) + 0.225$
108	NRNAD138	2		ISC ISP	$V = (value * 4.095e-2) - 1.023$
110	NRNAD139	2		ISC SLL VMON	$V = (value * 0.1235) - 0.9$
112	NRNAD13A	2		ISC SLR VMON	$V = (value * 0.1235) - 0.9$
114	NRNAD13B	2		ISC SES VMON	$V = (value * 0.3705) -2.7$
116	NRNAD13C	2		ISC SEB VMON	$dV = (value * -6.175e-3) + 4.5e-2$
118	NRNAD13D	2		ISC TLR VMON	$V = (value * 0.247) - 1.8$
120	NRNAD13E	2		ISC TLL VMON	$V = (value * 0.247) - 1.8$

122	NRNAD13F	2		ASP E HVB DAC	$V = (\text{value} * -8.9454e-1)$
124	NRNAD140	2		ASP E HVB I	$\text{mA} = (\text{value} * 3.942e-3) - 1.215e-1$
126	NRNAD141	2		ASP E FDP DAC	$V = (\text{value} * -7.2348e-1) + 5.038$
128	NRNAD142	2		ASP D VREF	$V = (\text{value} * 1.205e-3)$
130	NRNAD143	2		ASP D ESS2 DAC	$V = (\text{value} * -2.4176e-1) - 2.707e-1$
132	NRNAD144	2		ASP D ESS1 DAC	$V = (\text{value} * -2.4261e-1) - 2.363e-1$
134	NRNAD145	2		ASP D Z2Q DAC	$V = (\text{value} * 0.2444) - 1.278e-1$
136	NRNAD146	2		ASP C ESAI DAC	$V = (\text{value} * -0.06596656)$
138	NRNAD147	2		ASP C ESAO DAC	$V = (\text{value} * 0.06596656)$
140	NRNAD148	2		ASP C ESAIT DAC	$V = (\text{value} * 1.2054e-3)$
142	NRNAD149	2		ASP C Z1QV DAC	$V = (\text{value} * 0.065320) - 7.515e-2$
144	NRNAD14A	2		ASP A HP DAC	$V = (\text{value} * -2.5256e-2) - 1.061e-1$
146	NRNAD14B	2		ASP A RQ DAC	$V = (\text{value} * -1.2191e-2) + 2.635e-2$
148	NRNAD14C	2		ASP A MP DAC	$V = (\text{value} * -2.5278e-2) - 7.18e-2$
150	NRNAD14D	2		ASP A CEM DAC	$V = (\text{value} * -1.2274e-2) + 0.3112$
152	NRNAD150	2		ASP B MAG Temp	$^{\circ}\text{C} = (\text{value} * -1.2048e-2) + 26.6$
154	NRNAD152	2		FDP MCP Back 1	$V = (\text{value} * 0.0866) - 0.4685$
156	NRNAD153	2		FDP MCP Back 2	$V = (\text{value} * 0.0856) - 0.4611$
158	NRNAD154	2		FDP RDP Temp	$^{\circ}\text{C} = (\text{value} * 9.2e-3) + 2.6$
160	NRNAD155	2		FDP LEDA Temp	$^{\circ}\text{C} = (\text{value} * -0.0374) + 275$
162	NRNAD156	2		FDP Cup Out	$V = (\text{value} * 3.662e-4)$
164	NRNAD157	2		FDP Low Range Status	On (1)= Low Off (0)= Medium or High
166	NRNAD158	2		FDP Medium Range Status	On (1)= Medium Off (0)= Low or High
168	NRNAD159	2		FDP MCP FRONT	$V = (\text{value} * -0.475) + 1.7$
170	NRNAD15A	2		FDP FDP-C I	$\text{mA} = (\text{value} * 0.00667)$
172	NRNAD15B	2		FDP Cup Rep V	
174	NRNAD15C	2		FDP Status	
	NRNDD134		15.. 12	Spare	
	NRNDD135		11	FDP STAT MCP HV Ena	0 = Off, 1 = On
	NRNDD136		10	FDP STAT MCP HV Red	0 = Off, 1 = On
	NRNDD137		9	FDP STAT HV Safe	1 = Off, 0 = On
	NRNDD138		8	FDP STAT ACC BSY	0 = Off, 1 = On
	NRNDD139		7..2	Spare	
	NRNDD13A		1	FDP Cup Rep E	0 = Off, 1 = On
	NRNDD13B		0	FDP STAT RDP Ht	0 = Off, 1 = On
176	NRNAD15D	2		Spare 1	
178	NRNAD15E	2		Spare 2	

## 3.3 Extended DFMS Packetblock, Length 55 words

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAD160: NRNDD160	1		DFMS Ext HK Header	0xE4
	NRNDD161	1		Spare	
002	NRNAD161	2		MEP A Temp	$T = 1/(m1 + m2 \cdot \ln(R_{therm}) + m3 \cdot (\ln(R_{therm}))^2 + m4 \cdot (\ln(R_{therm}))^3) - 273.15$ $R_{therm} (k\Omega) = V_{mon} \cdot 18.7 / (5.0 - V_{mon})$ $V_{mon}[V] = ((-6.175e-4[V/Count] \cdot Value) + 0.0045V)$ $m1 = 2.5045216012e-3$ $m2 = 2.391487732e-4$ $m3 = 2.718710822e-6$ $m4 = 1.1700865307e-7$
004	NRNAD162	2		MEP N Temp	$T = 1/(m1 + m2 \cdot \ln(R_{therm}) + m3 \cdot (\ln(R_{therm}))^2 + m4 \cdot (\ln(R_{therm}))^3) - 273.15$ $R_{therm} (k\Omega) = V_{mon} \cdot 18.7 / (5.0 - V_{mon})$ $V_{mon}[V] = ((-6.175e-4[V/Count] \cdot Value) + 0.0045V)$ $m1 = 2.5045216012e-3$ $m2 = 2.391487732e-4$ $m3 = 2.718710822e-6$ $m4 = 1.1700865307e-7$
006	NRNAD163	2		MEP MOT Temp	$^{\circ}C = (value \cdot 0.02939) - 2.0$
008	NRNAD164	2		MEP D REF RED	$V = (value \cdot -1.5435e-3) - 0.15$
010	NRNAD165	2		MEP E REF RED	$V = (value \cdot -1.551e-3)$
012	NRNAD166	2		MEP CEM ANA LG	$V = (value \cdot -0.30867) + 7.35541$
014	NRNAD167	2		MEP DAC STIM AMP	$fC = (value \cdot 2.442e-2)$
016	NRNAD168	2		MEP VREF	$V = (value \cdot -1.551e-3)$
018	NRNAD169	2		MEP G Temp	$T = 1/(m1 + m2 \cdot \ln(R_{therm}) + m3 \cdot (\ln(R_{therm}))^2 + m4 \cdot (\ln(R_{therm}))^3) - 273.15$ $R_{therm} (k\Omega) = V_{mon} \cdot 18.7 / (5.0 - V_{mon})$ $V_{mon}[V] = ((-6.175e-4[V/Count] \cdot Value) + 0.0045V)$ $m1 = 2.5045216012e-3$ $m2 = 2.391487732e-4$ $m3 = 2.718710822e-6$ $m4 = 1.1700865307e-7$
020	NRNAD16A	2		ISC SLL RMON	$V = (value \cdot 0.1235) - 0.9$
022	NRNAD16B	2		ISC SLR RMON	$V = (value \cdot 0.1235) - 0.9$
024	NRNAD16C	2		ISC SES RMON	$V = (value \cdot 0.3705) - 2.7$
026	NRNAD16D	2		ISC SEB RMON	$dV = (value \cdot -6.175e-3) + 4.5e-2$
028	NRNAD16E	2		ISC TLR RMON	$V = (value \cdot 0.247) - 1.8$
030	NRNAD16F	2		ISC TLL RMON	$V = (value \cdot 0.247) - 1.8$
032	NRNAD170	2		MEP H Temp	$^{\circ}C = (value \cdot -9.4358e-3) + 20.176$
034	NRNAD171	2		ISC HV RMON	$V = (value \cdot 0.6916) - 5$
036	NRNAD172	2		ISC SEB DMON	$V = (value \cdot -6.175e-4) + 4.5e-3$
038	NRNAD173	2		ISC SES DMON	$V = (value \cdot -6.175e-4) + 4.5e-3$



040	NRNAD174	2		ISC SLR DMON	$V = (\text{value} * -6.175e-4) + 4.5e-3$
042	NRNAD175	2		ISC SLL DMON	$V = (\text{value} * -6.175e-4) + 4.5e-3$
044	NRNAD176	2		ISC TLR DMON	$V = (\text{value} * -6.175e-4) + 4.5e-3$
046	NRNAD177	2		ISC TLL DMON	$V = (\text{value} * -6.175e-4) + 4.5e-3$
048	NRNAD178	2		ISC HV DMON	$V = (\text{value} * -6.175e-4) + 4.5e-3$
050	NRNAD179	2		ISC PWR DMON	$V = (\text{value} * -6.175e-4) + 4.5e-3$
052	NRNAD17A	2		ISC HV VMON	$V = (\text{value} * 0.6916) - 5$
054	NRNAD17B	2		ISC HV I	$\text{mA} = (\text{value} * -4.137e-3) + 0.03$
056	NRNAD17C	2		ASP C_ESAC_DAC	$V = (\text{value} * 0.06596656)$
058	NRNAD17D	2		ASP E HVB MON	$V = (\text{value} * 0.93556274)$
060	NRNAD17E	2		ASP E FDP ERR	$V = (\text{value} * -2.3635e-3)$
062	NRNAD17F	2		ASP D Z2QV ERR	$\text{mA} = (\text{value} * 1.7726e-3)$
064	NRNAD180	2		ASP D Z2QH ERR	$\text{mA} = (\text{value} * -1.7726e-3)$
066	NRNAD181	2		ASP D ESS2 ERR	$\text{mA} = (\text{value} * 1.7726e-3)$
068	NRNAD182	2		ASP D ESS1 ERR	$\text{mA} = (\text{value} * 1.7726e-3)$
070	NRNAD183	2		ASP C ESAO ERR	$\text{mA} = (\text{value} * 1.7726e-3)$
072	NRNAD184	2		ASP C ESAI ERR	$\text{mA} = (\text{value} * -1.7726e-3)$
074	NRNAD185	2		ASP C Z1QV ERR	$\text{mA} = (\text{value} * 1.7726e-3)$
076	NRNAD186	2		ASP C Z1QH ERR	$\text{mA} = (\text{value} * 1.7726e-3)$
078	NRNAD187	2		ASP A CEM ERR	$V = (\text{value} * 3.662e-4)$
080	NRNAD188	2		ASP A HP ERR	$V = (\text{value} * 3.662e-4)$
082	NRNAD189	2		ASP A RQ ERR	$V = (\text{value} * 3.662e-4)$
084	NRNAD18A	2		ASP A MP ERR	$V = (\text{value} * 3.662e-4)$
086	NRNAD18B	2		ASP B ESA Temp	$^{\circ}\text{C} = (\text{value} * -1.2048e-2) + 2.86e1$
088	NRNAD18C	2		ASP B ASP Temp	$^{\circ}\text{C} = (\text{value} * -4.8384e-2) + 2.9e1$
090	NRNAD18D	2		ASP B 15V Mon	$V = (\text{value} * 2.3174e-3)$
092	NRNAD18E	2		ASP Status	
	NRNDD13F		15.. 14	ASP Cmd Count	Dec value
	NRNDD140		13.. 7	Spare	
	NRNDD141		6	ASP STAT HV On	0 = Off, 1 = On
	NRNDD142		5	ASP STAT HV Red	0 = Off, 1 = On
	NRNDD143		4	ASP STAT Ena-A	0 = Off, 1 = On
	NRNDD144		3	ASP STAT Ena-C	0 = Off, 1 = On
	NRNDD145		2	ASP STAT Ena-D	0 = Off, 1 = On
	NRNDD146		1	ASP STAT Ena-E	0 = Off, 1 = On
	NRNDD147		0	ASP STAT HV Safe	0 = Off, 1 = On
094	NRNAD18F	2		FDP Ground	$V = (\text{value} * 3.662e-4)$
096	NRNAD190	2		FDP -5V	$V = (\text{value} * 7.324e-4)$
098	NRNAD191	2		FDP +5V	$V = (\text{value} * 7.324e-4)$
100	NRNAD192	2		FDP +7.5V	$V = (\text{value} * 1.145e-3)$
102	NRNAD193	2		FDP -7.5V	$V = (\text{value} * 1.145e-3)$
104	NRNAD194	2		REF43 Temp	$^{\circ}\text{C} = (\text{value} * 0.1927) - 273.16$
106	NRNAD195	2		Spare 1	
108	NRNAD196	2		Spare 2	

### 3.4 Standard RTOF Packetblock, Length 99 words

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAR101: NRNDR100	1		RTOF Std. HK Header	0xC8
		1		MC Data Retpath	
	NRNDR195		7	Cmd Error	0 = Off, 1 = On
	NRNDR101		6..2	Spare	
	NRNDR102		1	ETS Light Path	0 = Off, 1 = On
	NRNDR103		0	ETS Path	0 = Off, 1 = On
002	NRNAR103	2		RTOF HK counter	Counter 0..65535
004	NRNAR104	2		RTOF Cmd counter	Counter 0..65535
006	NRNAR105	2		RTOF Cmd Error counter	Counter 0..65535
008	NRNAR106	2		RTOF Cmd Error position	Hex value
010	NRNAR107	2		RTOF Science counter	Counter 0..65535
012	NRNAR108	2		RTOF Science Error counter	Counter 0..65535
014	NRNAR109	2		RTOF Science Error position	Hex value
016	NRNAR10A	2		RTOF S/W mode	
	NRNDR180		15	Spare	0 = Off, 1 = On
	NRNDR181		14	HK_ET5	0 = Off, 1 = On
	NRNDR182		13	HK_ETL	0 = Off, 1 = On
	NRNDR183		12	HK_GCU_COV	0 = Off, 1 = On
	NRNDR184		11.. 8	RTOF mode	Mode No.
	NRNDR185		7	RMOD_HVOP	0 = Off, 1 = On
	NRNDR186		6	RMOD_ET5	0 = Off, 1 = On
	NRNDR187		5	RMOD_ETL	0 = Off, 1 = On
	NRNDR188		4	RMOD_EX	0 = Off, 1 = On
	NRNDR189		3	RMOD_MCP	0 = Off, 1 = On
	NRNDR18A		2	RMOD_FEC	0 = Off, 1 = On
	NRNDR18B		1	RMOD_COV	0 = Off, 1 = On
	NRNDR18C		0	RMOD_GCU	0 = Off, 1 = On
018	NRNAR10B	2		RTOF S/W status	
	NRNDR18D		15	Function active	0 = Off, 1 = On
	NRNDR18E		14	Set volt active	0 = Off, 1 = On
	NRNDR18F		13	Execution active	0 = Off, 1 = On
	NRNDR190		12	Monitoring	0 = Off, 1 = On
	NRNDR191		11	Spare	0 = Off, 1 = On
	NRNDR192		10	Spare	0 = Off, 1 = On
	NRNDR193		9	Spare	0 = Off, 1 = On
	NRNDR194		8..0	RTOF status	Hex value
020	NRNAR10C	2		Mode number	Dec value
022	NRNAR10D	2		Status Bits 1	
	NRNDR106		15	PSU 9kV	0 = Off, 1 = On
	NRNDR107		14	PSU 70V	0 = Off, 1 = On
	NRNDR108		13	PSU Ion MCP	0 = Off, 1 = On

	NRNDR109		12	PSU Gas MCP	0 = Off, 1 = On
	NRNDR10A		11	PSU HM Power	0 = Off, 1 = On
	NRNDR10B		10	PSU Pulser	0 = Off, 1 = On
	NRNDR110		9	ETSL Ram Test Active	0 = Off, 1 = On
	NRNDR111		8	ETSL Ram Test Status	0 = Off, 1 = On
	NRNDR112		7	ETSL Ram Test Data	Dec value
	NRNDR10D		6	ETS Ram Test Active	0 = Off, 1 = On
	NRNDR10E		5	ETS Ram Test Status	0 = Off, 1 = On
	NRNDR10F		4	ETS Ram Test Data	Dec value
	NRNDR10C		3..0	Spare	
24	NRNAR10E	2		ETS/L Lower Read Address	Hex value
26	NRNAR10F	2		ETS/L Upper Read Address	Hex value
28	NRNAR110	2		Status Bits 2	
	NRNDR113		15.. 13	Spare	
	NRNDR196		12	ETSL Lower Range	0 = Off, 1 = On
	NRNDR197		11	ETSL Upper Range	0 = Off, 1 = On
	NRNDR114		10	FEC Fil 2 Gas	0 = Off, 1 = On
	NRNDR115		9	FEC Fil 1 Gas	0 = Off, 1 = On
	NRNDR173		8	FEC Fil 2 Ion	0 = Off, 1 = On
	NRNDR174		7	FEC Fil 1 Ion	0 = Off, 1 = On
	NRNDR116		6	FEC I Status	0 = Ion, 1 = Gas
	NRNDR117		5	FEC EH Ion	0 = Off, 1 = On
	NRNDR118		4	FEC EH Gas	0 = Off, 1 = On
	NRNDR119		3	ETS/L LRA Bit 16	Hex value
	NRNDR11A		2	ETS/L URA Bit 16	Hex value
	NRNDR11B		1	ETS Lower Range	0 = Off, 1 = On
	NRNDR11C		0	ETS Upper Range	0 = Off, 1 = On
030	NRNAR111	2		Sequence number	Dec value
032	NRNAR112	2		MC_FEC_ION_FIHEAT_I	I = value * 0.2651 [mA]
034	NRNAR113	2		MC_FEC_GAS_FIHEAT_I	I = value * 0.2013 [mA]
036	NRNAR114	2		MC_FEC_ION_REP_V_#A	V = value * -0.0371 -0.0894
038	NRNAR115	2		MC_FEC_ION_REP_V_#B	V = value * -0.037 -0.1574
040	NRNAR116	2		MC_FEC_GAS_REP_V_#A	V = value * -0.0371 -0.271
042	NRNAR117	2		MC_FEC_GAS_REP_V_#B	V = value * -0.0372 -0.2382
044	NRNAR118	2		MC_FEC_ION_FIL_V	V = value * 0.0327 -176.02
046	NRNAR119	2		MC_FEC_GAS_FIL_V	V = value * 0.0313 -168.53
048	NRNAR11A	2		MC_FEC_GAS_FIL_I	I = value * 0.0852 -0.6257 [uA]
050	NRNAR11B	2		MC_FEC_ION_ENT1_V	V = value * 0.0133 -54.068
052	NRNAR11C	2		MC_FEC_ION_ENT1_I	I = value * 0.0851 + 0.133 [uA]
054	NRNAR11D	2		MC_FEC_GAS_TRAP_V	V = value * -0.0149 + 0.0486
056	NRNAR11E	2		MC_FEC_HVVG_V	U = value * 5.1e-3 -0.0256 [V]
058	NRNAR11F	2		MC_FEC_HEAT_VG_V	U = value * 5.1e-3 -0.0257 [V]
060	NRNAR120	2		MC_FEC_TEMP	T = value * 0.060 - 273 [°C]
062	NRNAR121	2		MC_GCU_POW_#1	V = (value * 0.001) -0.0058

064	NRNAR122	2		MC_GCU_POW_#2	$V = (\text{value} * 0.001) + 0.0019$
066	NRNAR123	2		MC_GCU_#1_I	$V = (\text{value} * 366e-6)$
068	NRNAR124	2		MC_GCU_#2_I	$V = (\text{value} * 366e-6)$
070	NRNAR125	2		MC_GCU_OUT_PRES_#1	$V = (\text{value} * 366e-6)$
072	NRNAR126	2		MC_GCU_OUT_PRES_#2	$V = (\text{value} * 366e-6)$
074	NRNAR127	2		MC_GCU_TEMP_PIRANI_#1	$V = (\text{value} * 366e-6)$
076	NRNAR128	2		MC_GCU_TEMP_PIRANI_#2	$V = (\text{value} * 366e-6)$
078	NRNAR129	2		MC_GEX_TEMP	$V = (\text{value} * 366e-6)$
080	NRNAR12A	2		MC_HM_PW	$V = (\text{value} * 0.0037) - 0.4095$
082	NRNAR12B	2		MC_HM_DEL	$V = (\text{value} * 0.0037) - 0.2594$
084	NRNAR12C	2		MC_HM_TEMP	$V = (\text{value} * 366e-6)$
086	NRNAR12D	2		MC_MOT_TOR	$V = (\text{value} * 0.001) - 0.058$
088	NRNAR12E	2		MC_MOT_TEMP	$^{\circ}\text{C} = (\text{value} * -0.038) + 277.37$
090	NRNAR12F	2		MC Motor Position	
	NRNDR11D		15	Motor On	0 = Off, 1 = On
	NRNDR11E		14	Motor Positioning	0 = Off, 1 = On
	NRNDR11F		13.. 12	Velocity	0 = 5Hz, 1 = 10Hz, 2 = 20Hz, 3 = 40Hz
	NRNDR120		11	Open Switch	0 = Off, 1 = On
	NRNDR121		10	Closed Switch	0 = Off, 1 = On
	NRNDR122		9	Hall Error	0 = Off, 1 = On
	NRNDR123		8	Hall Error Fatal	0 = Off, 1 = On
	NRNDR124		7..0	Motor Position	Dec value
092	NRNAR130	2		MC Power State 2	
	NRNDR125		15	ETSL VDD On	0 = Off, 1 = On
	NRNDR126		14	ETSL VDD Off	0 = Off, 1 = On
	NRNDR127		13	ETSL VCC On	0 = Off, 1 = On
	NRNDR128		12	ETSL VCC Off	0 = Off, 1 = On
	NRNDR129		11	Heater Gas On	0 = Off, 1 = On
	NRNDR12A		10	Heater Gas Off	0 = Off, 1 = On
	NRNDR12B		9	Heater Ion On	0 = Off, 1 = On
	NRNDR12C		8	Heater Ion Off	0 = Off, 1 = On
	NRNDR12D		7	Motor Hall Enable	0 = Off, 1 = On
	NRNDR12E		6	Motor Hall Disable	0 = Off, 1 = On
	NRNDR12F		5	Motor Direction Open	0 = Off, 1 = On
	NRNDR130		4	Motor Direction Close	0 = Off, 1 = On
	NRNDR131		3	Motor Power On	0 = Off, 1 = On
	NRNDR132		2	Motor Power Off	0 = Off, 1 = On
	NRNDR133		1	Motor High Torque On	0 = Off, 1 = On
	NRNDR134		0	Motor High Torque Off	0 = Off, 1 = On
094	NRNAR131	2		MC Pulser State	
	NRNDR135		15	Gas Pulser On	0 = Off, 1 = On
	NRNDR136		14	Gas Pulser Off	0 = Off, 1 = On
	NRNDR137		13	HM Pulser On	0 = Off, 1 = On
	NRNDR138		12	HM Pulser Off	0 = Off, 1 = On
	NRNDR139		11	Ion Pulser On	0 = Off, 1 = On

	NRNDR13A		10	Ion Pulser Off	0 = Off, 1 = On
	NRNDR13B		9..0	Spare	
096	NRNAR132	2		MC Power State 6	
	NRNDR13C		15.. 10	Spare	
	NRNDR13D		9	Disable ETS LU	0 = Off, 1 = On
	NRNDR13E		8	Enable ETS LU	0 = Off, 1 = On
	NRNDR13F		7	ETS VCA On	0 = Off, 1 = On
	NRNDR140		6	ETS VCA Off	0 = Off, 1 = On
	NRNDR141		5	ETS VDD On	0 = Off, 1 = On
	NRNDR142		4	ETS VDD Off	0 = Off, 1 = On
	NRNDR143		3	ETS VCC On	0 = Off, 1 = On
	NRNDR144		2	ETS VCC Off	0 = Off, 1 = On
	NRNDR145		1	ETS VSH/VE On	0 = Off, 1 = On
	NRNDR146		0	ETS VSH/VE Off	0 = Off, 1 = On
098	NRNAR133	2		MC Power State 8	
	NRNDR147		15	GCU 1 On	0 = Off, 1 = On
	NRNDR148		14	GCU 1 Off	0 = Off, 1 = On
	NRNDR149		13	GCU 2 On	0 = Off, 1 = On
	NRNDR14A		12	GCU 2 Off	0 = Off, 1 = On
	NRNDR14B		11	GCU 1 Valve On	0 = Off, 1 = On
	NRNDR14C		10	GCU 1 Valve Off	0 = Off, 1 = On
	NRNDR14D		9	GCU 2 Valve On	0 = Off, 1 = On
	NRNDR14E		8	GCU 2 Valve Off	0 = Off, 1 = On
	NRNDR14F		7	FEC VCC On	0 = Off, 1 = On
	NRNDR150		6	FEC VCC Off	0 = Off, 1 = On
	NRNDR151		5	FEC VDD On	0 = Off, 1 = On
	NRNDR152		4	FEC VDD Off	0 = Off, 1 = On
	NRNDR153		3	FEC Heater VG On	0 = Off, 1 = On
	NRNDR154		2	FEC Heater VG Off	0 = Off, 1 = On
	NRNDR155		1	FEC HV VG On	0 = Off, 1 = On
	NRNDR156		0	FEC HV VG Off	0 = Off, 1 = On
100	NRNAR134	2		MC_ETSL_TEMP	$V = (\text{value} * 366\text{e-}6)$
102	NRNAR135	2		MC_ETS_TEMP_CLK	$V = (\text{value} * 366\text{e-}6)$
104	NRNAR136	2		MC_ETS_TEMP_DIG	$V = (\text{value} * 366\text{e-}6)$
106	NRNAR137	2		PSDC_ELBI	$V = (\text{value} * -0.0062)$
108	NRNAR138	2		PSDC_ELAI	$V = (\text{value} * -0.0062)$
110	NRNAR139	2		PSDC_GRI	$V = (\text{value} * -0.0062)$
112	NRNAR13A	2		PSDC_BPI	$V = (\text{value} * -0.0062)$
114	NRNAR13B	2		PSDC_GRG	$V = (\text{value} * -0.00619)$
116	NRNAR13C	2		PSDC_BP_G	$V = (\text{value} * -0.0062)$
118	NRNAR13D	2		HV1_SL_G	$V = (\text{value} * -1.0271) + 110.5$
120	NRNAR13E	2		HV1_A2_G	$V = (\text{value} * -0.506) + 42.568$
122	NRNAR13F	2		HV1_A1_G	$V = (\text{value} * -0.2561) + 48.511$
124	NRNAR140	2		HV1_SL_I	$V = (\text{value} * -1.0122) + 44.499$
126	NRNAR141	2		HV1_A2_I	$V = (\text{value} * -0.5089) + 35.088$
128	NRNAR142	2		HV1_A1_I	$V = (\text{value} * -0.2566) + 20.022$
130	NRNAR143	2		HV2_P_G	$V = (\text{value} * -0.1258) + 2.7606$

132	NRNAR144	2		HV2_P_I	$V = (\text{value} * -0.1261) + 5.0041$
134	NRNAR145	2		HV1_D	$V = (\text{value} * -0.5088) + 31.123$
136	NRNAR146	2		HV2_HM3	$V = (\text{value} * -0.1294) - 1.2232$
138	NRNAR147	2		HV1_R1	$V = (\text{value} * -0.1268) + 3.0101$
140	NRNAR148	2		HV1_R2	$V = (\text{value} * 0.2765) - 2175.6$
142	NRNAR149	2		HV1_RL	$V = (\text{value} * 0.5594) - 4371.5-$
144	NRNAR14A	2		HV1_HM1	$V = (\text{value} * 0.2777) - 2156.2$
146	NRNAR14B	2		HV2_HM2	$V = (\text{value} * 0.0393) + 308.38$
148	NRNAR14C	2		HV1_HML	$V = (\text{value} * 0.5207) - 4123$
150	NRNAR14D	2		HV2_M_I	$V = (\text{value} * -0.7818) - 14.283$
152	NRNAR14E	2		HV2_M_G	$V = (\text{value} * -0.7695) + 47.787$
154	NRNAR14F	2		PSDC_E2_I	$V = (\text{value} * -0.0062)$
156	NRNAR150	2		PSDC_Temp_BP_I	TBD
158	NRNAR151	2		PSDC_Temp_BP_G	$T = (\text{value} * -1.831e-2) - 50$ [°C]
160	NRNAR152	2		PSU_Temp_MCP_I	TBD
162	NRNAR153	2		PSU_Temp_MCP_G	TBD
164	NRNAR154	2		PSU_Temp_HV1	$T = (\text{value} * -0.0089) - 9$ [°C]
166	NRNAR155	2		PSU_Temp_LVPS	$T = (\text{value} * -0.0089) - 9$ [°C]
168	NRNAR156	2		ETSL Status 1	
	NRNDR157		15	ETSL Ion Pulser Status	0 = Off, 1 = On
	NRNDR158		14	ETSL Gas Pulser Status	0 = Off, 1 = On
	NRNDR198		13	ETSL Sync Status	0 = Int, 1 = Ext
	NRNDR159		12	ETSL Calib. Trigger Status	0 = Off, 1 = On
	NRNDR15A		11	ETSL Data Readout Status	0 = Off, 1 = On
	NRNDR15B		10	ETSL Acquisition Status	0 = Off, 1 = On
	NRNDR15C		9	ETSL DTS Status Cancel	0 = Event, 1 = Extraction
	NRNDR15D		8	ETSL DTS Status	0 = Off, 1 = On
	NRNDR15E		7..6	ETSL Input Status	0 = Ion, 1 = Calibrator, 2 = Gas, 3 = Gas
	NRNDR199		5	ETSL Cal. Power Status	0 = Off, 1 = On
	NRNDR19A		4	ETSL ADC HIRM Status	0 = Off, 1 = On
	NRNDR19B		3	ETSL RAM Threshold	0 = Low, 1 = High
	NRNDR19C		2	ETSL FIFO Threshold	0 = Low, 1 = High
	NRNDR19D		1	ETSL Latchup Enabled	1 = Off, 0 = On
	NRNDR19E		0	ETSL Latchup Detected	0 = Off, 1 = On
170	NRNAR197	1		ETSL Status 2	
	NRNDR1B1		7	ETSL ADC Power Status	0 = Off, 1 = On
	NRNDR1B2		6	ETSL ADC Threshold	0 = High, 1 = Low

	NRNDR1B3		5..4	ETSL ML Mode	0 = Adapt, 1 = ML31, 2 = ML63, 3 = ML255
	NRNDR1B4		3..0	Spare	
	NRNDR1B5	1		ETSL Threshold Level	0 = 5.5mV, 1= 8mV, 2 = 12mV, 3 = 16.7mV, 4 = 20mV, 5= 23.4mV, 6 = 26.6mV, 7 = 33.4mV
172	NRNAR198	2		ETSL Extraction Delay	$t = (\text{Value} * 26.5\text{ns}) + 158.5$
174	NRNAR199	2		ETSL ToF	$t = (\text{Value} * 26.5\text{ns}) + 26.5$
176	NRNAR19A	2		ETSL Cal. Start Delay	$t = (\text{Value} * 26.5\text{ns}) + 26.5 + 141$
178	NRNAR19B	2		ETSL Cal. Pulse Height	$V = (\text{value} * 2.266 \text{ mV}) + 3.3659 \text{ mV}$
180	NRNAR19C	2		ETSL Cal. Pulse Width	$t = (\text{value} * 1.44 \text{ ns}) - 112.47 \text{ ns}$
182	NRNAR157	2		ETS Status 1	
	NRNDR15F		15	ETS Ion Pulser Status	0 = Off, 1 = On
	NRNDR160		14	ETS Gas Pulser Status	0 = Off, 1 = On
	NRNDR161		13	ETS Synchronization Status	0 = Int, 1 = Ext
	NRNDR162		12	ETS Calib. Trigger Status	0 = Off, 1 = On
	NRNDR163		11	ETS Data Readout Status	0 = Off, 1 = On
	NRNDR164		10	ETS Acquisition Status	0 = Off, 1 = On
	NRNDR165		9	ETS DTS Status Cancel	0 = Event, 1 = Extraction
	NRNDR166		8	ETS DTS Status	0 = Off, 1 = On
	NRNDR167		7..6	ETS Input Status	0 = Ion, 1 = Calibrator, 2 = Gas, 3 = Gas
	NRNDR168		5	ETS Cal. Power Status	0 = Off, 1 = On
	NRNDR169		4	ETS ADC HIRM Status	0 = Off, 1 = On
	NRNDR16A		3	ETS RAM Threshold	0 = Low, 1 = High
	NRNDR16B		2	ETS FIFO Threshold	0 = Low, 1 = High
	NRNDR16C		1	ETS Latchup Enabled	1 = Off, 0 = On
	NRNDR16D		0	ETS Latchup Detected	0 = Off, 1 = On
184	NRNAR158	1		ETS Status 2	
	NRNDR16E		7	ETS ADC Power Status	0 = Off, 1 = On
	NRNDR16F		6	ETS ADC Threshold	0 = High, 1 = Low
	NRNDR170		5..4	ETS ML Mode	0 = Adapt, 1 = ML31, 2 = ML63, 3 = ML255
	NRNDR171		3..0	Spare	
	NRNDR172	1		ETS Threshold Level	0 = 5.5mV, 1= 8mV, 2 = 12mV, 3 = 16.7mV, 4 = 20mV, 5= 23.4mV, 6 = 26.6mV, 7 = 33.4mV
186	NRNAR159	2		ETS Extraction Delay	$t = (\text{Value} * 26.5\text{ns}) + 158.5$
188	NRNAR15A	2		ETS ToF	$t = (\text{Value} * 26.5\text{ns}) + 26.5$
190	NRNAR15B	2		ETS Cal. Start Delay	$t = (\text{Value} * 26.5\text{ns}) + 26.5 + 141$
192	NRNAR15C	2		ETS Cal. Pulse Height	$V = (\text{value} * 2.314 \text{ mV}) + 4.928 \text{ mV}$
194	NRNAR15D	2		ETS Cal. Pulse Width	$t = (\text{value} * 1.2615 \text{ ns}) - 51.728 \text{ ns}$
196	NRNAR15E	2		Spare	

### 3.5 Extended RTOF Packetblock, Length 56 words

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAR160: NRNDR1A0	1		RTOF Ext. HK Header	0xE8
	NRNDR1A1	1		Spare	
002	NRNAR161	2		MC_FEC_PVCC_V	$U = \text{value} * 1e-3 - 0.0156 \text{ [V]}$
004	NRNAR162	2		MC_FEC_MVCC_V	$U = \text{value} * -7e-4 + 0.003 \text{ [V]}$
006	NRNAR163	2		MC_FEC_PVDD_V	$U = \text{value} * 3.1e-3 + 0.0497 \text{ [V]}$
008	NRNAR164	2		MC_FEC_MVDD_V	$U = \text{value} * -2.8e-3 + 0.1508 \text{ [V]}$
010	NRNAR165	2		MC_GCU_TEMP_TANK_#1	$V = (\text{value} * 366e-6)$
012	NRNAR166	2		MC_GCU_TEMP_TANK_#2	$V = (\text{value} * 366e-6)$
014	NRNAR167	2		MC_GCU_IN_PRES_#1	$V = (\text{value} * 366e-6)$
016	NRNAR168	2		MC_GCU_IN_PRES_#2	$V = (\text{value} * 366e-6)$
018	NRNAR169	2		MC_GEX_PVCC	$V = (\text{value} * 0.001) - 0.0058$
020	NRNAR16A	2		MC_GEX_VD	$V = \text{value} * 0.0083 - 0.0417 \text{ [V]}$
022	NRNAR16B	2		MC_IEX_PVCC	$V = (\text{value} * 0.001) - 0.0058$
024	NRNAR16C	2		MC_IEX_VD	$V = \text{value} * 0.0083 - 0.0417 \text{ [V]}$
026	NRNAR16D	2		MC_HM_PVCA	$V = (\text{value} * 0.001) - 0.0038$
028	NRNAR16E	2		MC_HM_VD	$V = (\text{value} * 0.0083) - 0.0478$
030	NRNAR16F	2		MC_ETSL_PVCC	$V = (\text{value} * 0.0011) - 0.467$
032	NRNAR170	2		MC_ETSL_MVCA	$V = (\text{value} * -7e-4) + 6.1e-3$
034	NRNAR171	2		MC_ETSL_PVDD	$V = (\text{value} * 3.1e-3) - 1.26e-2$
036	NRNAR172	2		MC_ETSL_MVDD	$V = (\text{value} * -2.8e-3) + 6.8e-3$
038	NRNAR173	2		MC_MOT_PVCC	$V = (\text{value} * 0.0009) - 0.0327$
040	NRNAR174	2		MC_OMC_SW_OPEN	
042	NRNAR175	2		MC_OMC_SW_CLOSED	
044	NRNAR176	2		MC_HEAT_ION_VG	$V = (\text{value} * 0.0051) - 0.036$
046	NRNAR177	2		MC_HEAT_GAS_VG	$V = (\text{value} * 0.0052) - 0.0362$
048	NRNAR178	2		MC_ETS_33V	$V = (\text{value} * 366e-6)$
050	NRNAR179	2		MC_ETS_PVCA	$V = (\text{value} * 366e-6)$
052	NRNAR17A	2		MC_ETS_MVCA	$V = (\text{value} * 366e-6)$
054	NRNAR17B	2		MC_ETS_VE	$V = \text{value} * 0.0014 - 0.001 \text{ [V]}$
056	NRNAR17C	2		MC_ETS_PVDD	$V = \text{value} * 0.0031 - 0.0093 \text{ [V]}$
058	NRNAR17D	2		MC_ETS_MVDD	$V = \text{value} * -0.0032 + 0.1103 \text{ [V]}$
060	NRNAR17E	2		MC_ETS_VSH	$V = \text{value} * 0.0096 + 0.0747 \text{ [V]}$
062	NRNAR17F	2		MC_ETSL_PVCA	$V = (\text{value} * 1.1e-3) - 0.467$
064	NRNAR180	2		MC_Spare	
066	NRNAR181	2		PSU_+5_Val	$V = (\text{value} * -0.001488)$
068	NRNAR182	2		PSU_-5_Val	$V = (\text{value} * -0.001428)$
070	NRNAR183	2		PSU_+15_Val	$V = (\text{value} * -0.00458)$
072	NRNAR184	2		PSU_-15_Val	$V = (\text{value} * -0.004415)$
074	NRNAR185	2		PSU_+24_Val	$V = (\text{value} * -0.006954)$
076	NRNAR186	2		PSU_+8_Val	$V = (\text{value} * -0.0014792)$
078	NRNAR187	2		PSU_+5_Add_Val	$V = (\text{value} * -0.0014798)$
080	NRNAR188	2		PSU_+40_Val	$V = (\text{value} * -0.0174) - 0.4234$



082	NRNAR189	2		PSU_+70_Val	$V = (\text{value} * -0.0107) + 4.173$
084	NRNAR18A	2		PSU_+5_Cur	$I = \text{value} * -0.4383 + 30 \text{ [mA]}$
086	NRNAR18B	2		PSU_-5_Cur	$I = \text{value} * -0.1508 -28.016 \text{ [mA]}$
088	NRNAR18C	2		PSU_+15_Cur	$I = \text{value} * -0.1133 -16.502 \text{ [mA]}$
090	NRNAR18D	2		PSU_-15_Cur	$I = \text{value} * -0.0553 -24.715 \text{ [mA]}$
092	NRNAR18E	2		PSU_+24_Cur	$I = \text{value} * -0.1285 + 33.042 \text{ [mA]}$
094	NRNAR18F	2		PSU_+40/70_Cur	$I = \text{value} * -0.0174 -0.4234 \text{ [mA]}$
096	NRNAR190	2		PSU_+5_Add_Cur	$I = \text{value} * -0.0571 + 3.4918 \text{ [mA]}$
098	NRNAR191	2		PSU_+8_Cur	$I = \text{value} * -0.0254 + 5.663 \text{ [mA]}$
100	NRNAR192	4		ETSL NOE	
			31.. 25	Spare	
	NRNDR1A5		24.. 17	NOE High value	Dec value
			16.. 9	Spare	
	NRNDR1A6		8..1	NOE Low value	Dec value
	NRNDR1A7		0	NOE Status	0 = Continuous, 1 = NOE
104	NRNAR193	2		ETS NOE High	
			15.. 9	Spare	
	NRNDR1A2		8..1	NOE High value	Dec value
106	NRNAR194	2		ETS NOE Low	
			15.. 9	Spare	
	NRNDR1A3		8..1	NOE Low value	Dec value
	NRNDR1A4		0	NOE Status	0 = Continuous, 1 = NOE
108	NRNAR195	2		Spare 1	
110	NRNAR196	2		Spare 2	

### 3.6 Standard COPS Packetblock, Length 29 words

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAC101: NRNDC101	1		COPS Std. HK Header	0xCC
		1		Range Status	
	NRNDC001		7	Command Error	0 = Off, 1 = On
	NRNDC002		6	Spare	
	NRNDC003		5..4	Filament Ion Range	0 = Low, 1 = Medium, 2 = High
	NRNDC004		3..2	Microtip Ion Range	0 = Low, 1 = Medium, 2 = High
	NRNDC005		1	Filament Emission Range	0 = Low, 1 = High
	NRNDC006		0	Microtip Emission Range	0 = Low, 1 = High
002	NRNAC102	2		COPS HK counter	Counter 0..65535
004	NRNAC103	2		COPS Cmd counter	Counter 0..65535
006	NRNAC104	2		COPS Cmd Error counter	Counter 0..65535
008	NRNAC105	2		COPS Cmd Error position	Hex value
010	NRNAC106	2		COPS HK Error counter	Counter 0..65535
012	NRNAC107	2		COPS S/W mode	Mode No.
	NRNDC120		15	Spare	0 = Off, 1 = On
	NRNDC121		14	Spare	0 = Off, 1 = On
	NRNDC122		13	Spare	0 = Off, 1 = On
	NRNDC123		12	Spare	0 = Off, 1 = On
	NRNDC124		11.. 8	COPS mode	Mode No.
	NRNDC125		7	Spare	0 = Off, 1 = On
	NRNDC126		6	Spare	0 = Off, 1 = On
	NRNDC127		5	Spare	0 = Off, 1 = On
	NRNDC128		4	Spare	0 = Off, 1 = On
	NRNDC129		3	CMOD_OP_RG	0 = Off, 1 = On
	NRNDC12A		2	CMOD_OP_NG	0 = Off, 1 = On
	NRNDC12B		1	CMOD_RG	0 = Off, 1 = On
	NRNDC12C		0	CMOD_NG	0 = Off, 1 = On
014	NRNAC108	2		COPS S/W status	Hex value
	NRNDC12D		15	Function active	0 = Off, 1 = On
	NRNDC12E		14	Set volt active	0 = Off, 1 = On
	NRNDC12F		13	Execution active	0 = Off, 1 = On
	NRNDC130		12	Monitoring	0 = Off, 1 = On
	NRNDC131		11	Spare	0 = Off, 1 = On
	NRNDC132		10	Spare	0 = Off, 1 = On
	NRNDC133		9	Spare	0 = Off, 1 = On
	NRNDC134		8..0	COPS status	Hex value
016	NRNAC109	4		Pressure NG	Pressure in mbar, floating point
020	NRNAC10A	4		Pressure RG	Pressure in mbar, floating point
024	NRNAC10B	4		Calib. factor / Offset NG	Floating point value
028	NRNAC10C	4		Calib. factor / Offset RG	Floating point value
032	NRNAC10D	2		Active Filament/Microtips	

	NRNDC10B		15.. 8	Microtips Array	MT 8..1: 0 = On, 1 = Off
	NRNDC10A		7..6	DPU MT Ion Range	0 = Low, 1 = Medium, 2 = High
	NRNDC10C		5	DPU MT Emission Range	0 = Low, 1 = High
	NRNDC10D		4	Filament	0 = Left, 1 = Right
	NRNDC135		3..2	DPU Fil Ion Range	0 = Low, 1 = Medium, 2 = High
	NRNDC136		1	DPU Fil. Emission Range	0 = Low, 1 = High
	NRNDC137		0	DPU Function	0 = NG, 1 = RG
034	NRNAC10E	2		Mode Table	Dec value
036	NRNAC10F	2		Ion I Filament	$pA = ((value * 2.8096e9) - 0.3529e12) * Y$ Y : Ion Low $\equiv 1.0e-11$ , Ion Medium $\equiv 1.0e-9$ , Ion High $\equiv 1.0e-7$
038	NRNAC110	2		Ion I Microtip	$pA = ((value * 2.8096e9) - 0.3529e12) * Y$ Y : Ion Low $\equiv 1.0e-11$ , Ion Medium $\equiv 1.0e-9$ , Ion High $\equiv 1.0e-7$
040	NRNAC111	2		Emission I Filament	$\mu A = (value * 2.7803e3) * Y$ Y : Immi Low $\equiv (1/470e3)$ . Immi High $\equiv (1/10e3)$
042	NRNAC112	2		Emission I Microtip	$\mu A = (value * 2.7315e3) * Y$ Y : Immi Low $\equiv (1/470e3)$ . Immi High $\equiv (1/10e3)$
044	NRNAC113	2		AnodeGrid V Filament	$V = (value * 2.729e-1)$
046	NRNAC115	2		AnodeGrid V Microtip	$V = (value * 2.7095e-1)$
048	NRNAC116	2		Filament I	$A = (value * 3.067e-4)$
050	NRNAC117	2		Extraction V Microtip	$V = (value * 2.6997e-2)$
052	NRNAC118	2		Total Emission I Microtip	$mA = (value * 2.4851e-3)$
054	NRNAC119	2		+12V I	$mA = (value * 1.3755e-1)$
056	NRNAC11A	2		Spare	

### 3.7 Extended COPS Packetblock, Length 7 words

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAC11B: NRNDC110	1		COPS Ext. HK Header	0xEC
	NRNDC111	1		Spare	
002	NRNAC11C	2		Electr. Temp	$^{\circ}\text{C} = (\text{value} * 4.196\text{e-}1) - 273.15$
004	NRNAC11D	2		Sensor Temp	$^{\circ}\text{C} = (\text{value} * 4.196\text{e-}1) - 273.15$
006	NRNAC11E	2		+12V Filament	$V = (\text{value} * 6.9861\text{e-}3)$
008	NRNAC11F	2		-12V Filament	$V = (\text{value} * 6.9324\text{e-}3) - \text{HK+12\_F}$
010	NRNAC120	2		+12V Microtip	$V = (\text{value} * 6.9861\text{e-}3)$
012	NRNAC121	2		-12V Microtip	$V = (\text{value} * 6.9324\text{e-}3) - \text{HK+12\_M}$

### 3.8 Monitoring Packetblock, Length 2 words

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAC180: NRNDC180	1		Monitoring HK Header	0xFF
	NRNDC181	1		Spare	
002	NRNAC181: NRNDC182	1		Pressure	mmmmeeee [mbar] (0xFF if n.a.)
	NRNDC183	1		Pressure Gradient	mmmmeeee [mbar/s] (0xFF if n.a.)