



INSTITUT FÜR  
DATENVERARBEITUNGSANLAGEN



TECHNISCHE UNIVERSITÄT  
BRAUNSCHWEIG

---

# ROSETTA ROSINA

## DPU – S/C Science Data Packets

ROS-TUB-SP-03/2.2

Revision 2.2

31.10.2003

Prepared by  
Björn Fiethe

## Document Change Record

Rev.	Date	Pages	Description
1.0	20.04.00	All	First Issue
1.1	01.09.00	3	Packet length for D2, R1..3 changed
2.0	19.04.02	All	Completely revised for FS
2.1	20.12.02	3,4,8-	Update HK in science data
2.2	31.10.03	All	Update science types, add compression types

## 1. Science Data Sets

Each Science Data Set consists of one or several Science Packets defined in 2.  
All values are in TM-words (16 bits).

### 1.1 DFMS

Type No.	Type Ident.	Name	Length	Packet Count	Usage	Description
-	0x00	MCP Leda Mask	256	1	Internal Test	Read Leda Mask bits
-	0x01	MCP Leda Row A	1024	1	Internal Test	Read Leda Row A only
-	0x02	MCP Leda Row B	1024	1	Internal Test	Read Leda Row B only
-	0x03	MCP Leda Peak	2	1	Internal Test	Read Leda Peak Data only
-	0x05	CEM Single Data	4	1	Internal Test	Read CEM Data once
D1	0x81	MCP Leda Dual Raw	2062	2	Test + Calibration	14 HK + 2048 LEDA (A+B)
D7	0x87	MCP Leda 12bit	398	1	12bit data compr.	14 HK + 384 LEDA
D20	0x20	MCP Scan Wavelet Compressed	Max. 26426	Max. 13	Full or single spectrum	X * 14 HK (uncompressed) + Compr. Header + (X * 2048 / C) LEDA (X = no. of scans, C = compr. factor)
D2X	0x22.. 0x2F	MCP Scan LOG Reduction of Bits	Max. 103800	Max. 51	Full or single spectrum	X * 14 HK (uncompressed) + (X * 2048 * N / 32) LEDA (X = no. of scans, N = no. of bits)
D40	0x40	CEM Raw, Average, or Repetitive	Max. 814	1	Single spectrum	14 HK + (4 * Y) CEM (Y = No. of data points)
D42	0x42	FAR Raw, Average, or Repetitive	Max. 414	1	Single spectrum	14 HK + (2 * Y) FAR (Y = No. of data points)
D60	0x60	MCP Scan lossless Compressed	Max. 103800	Max. 51	Full or single spectrum	X * 14 HK (uncompressed) + Compr. Header + (X * 2048 / C) LEDA (X = no. of scans, C = compr. factor)

### 1.2 RTOF

Type No.	Type Ident.	Name	Length	Packet Count	Usage	Description
R20	0x14	ETS Full Raw	Max. 393385	Max. 193	Test + Calibration	160 HK + 9 Header + X*3 ETS
R21	0x15	ETSL Full Raw	Max. 393385	Max. 193	Test + Calibration	160 HK + 9 Header + X*3 ETSL
R22	0x16	ETS Select Raw	16369	8	300 mass * 18 points	160 HK + 9 Hd. + 16200 ETS
R23	0x17	ETSL Select Raw	16369	8	300 mass * 18 points	160 HK + 9 Hd. + 16200 ETL
R24	0x18	ETS Wavelet Compressed	Max. 98304	Max. 48	Full spectrum	160 HK + 9 Header + Compr. Header + X ETS (depends on compr. factor)
R25	0x19	ETSL Wavelet Compressed	Max. 98304	Max. 48	Full spectrum	160 HK + 9 Header + Compr. Header + X ETSL (depends on compr. factor)
R84	0x54	ETS Lossless Compressed	Max. 393385	Max. 193	Full spectrum	160 HK + 9 Header + Compr. Header + X ETS (depends on compr. factor)
R85	0x55	ETSL Lossless Compressed	Max. 393385	Max. 193	Full spectrum	160 HK + 9 Header + Compr. Header + X ETS (depends on compr. factor)

### 1.3 COPS

Type No.	Type Ident.	Name	Length	Packet Count	Usage	Description
C1	0x01	Full Pressure	304	1	Detailed Pressure	150 * NG Pressure every 2s

## 2. Science Packet Definitions

### 2.1 DFMS Science Packet

Position	Bytes	Bits	Name	Data
000	1		DFMS Science Header	0x84
001	1		Type Identifier	
002	2	15	Last Packet Status	1 = Last Packet
		14..0	Packet Count	0 = First Packet
004	2.. 4092		HK + Science Data	DFMS Science HK data only in first packet

### 2.2 RTOF Science Packet

Position	Bytes	Bits	Name	Data
000	1		RTOF Science Header	0x88
001	1		Type Identifier	
002	2	15	Last Packet Status	1 = Last Packet
		14..0	Packet Count	0 = First Packet
004	2.. 4092		HK + Science Data	RTOF Science HK data only in first packet

### 2.3 COPS Science Packet

Position	Bytes	Bits	Name	Data
000	1		COPS Science Header	0x8C
001	1		Type Identifier	
001	2	15	Last Packet Status	1 = Last Packet
		14..0	Packet Count	0 = First Packet
004	4		Dummy word	-
008	4.. 600		Pressure Data	32-bit IEEE Floating Point (bit 31: sign, bit 30..23: exponent, bit 22..0: 1.fraction)

### 3. Science Housekeeping Definitions

A set of science related HK data is transmitted at the beginning of each Science Data Set.

#### 3.1 DFMS Science HK Data, Length 14 words

Position	Bytes	Bits	Name	Data
000	2		Mass * 100	
002	2		Measurement Mode	
004	2		Voltage flags 1	
		15..14	MG	0 = Off, 1 = Ok, 2 = Low, 3 = High
		13..12	ISB	0 = Off, 1 = Ok, 2 = Low, 3 = High
		11..10	ISP	0 = Off, 1 = Ok, 2 = Low, 3 = High
		9..8	IRP1	0 = Off, 1 = Ok, 2 = Low, 3 = High
		7..6	IRP2	0 = Off, 1 = Ok, 2 = Low, 3 = High
		5..4	ERP	0 = Off, 1 = Ok, 2 = Low, 3 = High
		3..2	FIL 1 Bias	0 = Off, 1 = Ok, 2 = Low, 3 = High
		1..0	FIL 2 Bias	0 = Off, 1 = Ok, 2 = Low, 3 = High
006	2		Voltage flags 2	
		15..14	FIL 1 Emi	0 = Off, 1 = Ok, 2 = Low, 3 = High
		13..12	FIL 2 Emi	0 = Off, 1 = Ok, 2 = Low, 3 = High
		11..10	SLL	0 = Off, 1 = Ok, 2 = Low, 3 = High
		9..8	SLR	0 = Off, 1 = Ok, 2 = Low, 3 = High
		7..6	SES	0 = Off, 1 = Ok, 2 = Low, 3 = High
		5..4	SEB	0 = Off, 1 = Ok, 2 = Low, 3 = High
		3..2	TLL	0 = Off, 1 = Ok, 2 = Low, 3 = High
		1..0	TLR	0 = Off, 1 = Ok, 2 = Low, 3 = High
008	2		Voltage flags 3	
		15..14	VACC Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		13	FAR Repeller Enable	0 = Off, 1 = On
		12..0	ESA C DAC	Raw value
010	2		Voltage flags 4	
		15..14	ESS1 Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		13..12	ESS2 Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		11..10	RQ Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		9..8	MP Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		7..6	HP Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		5..4	Z1Q Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		3..2	Z2Q Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		1..0	HVFDP Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
012	2		Voltage flags 5	
		15	GCU Heater 1	0 = Off, 1 = On
		14	GCU Heater 2	0 = Off, 1 = On
		13	Cover Close	0 = Off, 1 = On
		12	Cover Open	0 = Off, 1 = On
		11..10	MCP Front	0 = Off, 1 = Ok, 2 = Low, 3 = High
		9..8	MCP Back1	0 = Off, 1 = Ok, 2 = Low, 3 = High
		7..6	MCP Back2	0 = Off, 1 = Ok, 2 = Low, 3 = High
		5..4	CEM HV Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High

		3..2	CEM REP Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
		1..0	CEM THR Dac	0 = Off, 1 = Ok, 2 = Low, 3 = High
014	2		ESAO DAC	Raw value
016	2		ESAI DAC	Raw value
018	2		MAG Temp	Raw value
020	2		GCU 1 Pout (if active) or Cover Position	Raw value
022	2		GCU 2 Pout (if active) or Motor Position	Raw value
024	2		LEDA or FAR offset setting	Raw value
026	2		Gain Step	

### 3.2 RTOF Science HK Data, Length 160 words

For correct X,Y values of HK data calculation see RTOF documentation!

Pos	RSDB	Byte	Bit	Name	Data
000	NRNAR101: NRNDR100	1		RTOF Science 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	Peakfit	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	Cover near open	0 = Off, 1 = On
			2	Cover near close	0 = Off, 1 = On
			1	OS Heat mode	0 = Off, 1 = On
			0	SS Heat mode	0 = Off, 1 = On
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* X [mA]
034	NRNAR113	2		MC_FEC_GAS_FIHEAT_I	I = value * X [mA]
036	NRNAR114	2		MC_FEC_ION_REP_V_#A	V = value * X
038	NRNAR115	2		MC_FEC_ION_REP_V_#B	V = value * X
040	NRNAR116	2		MC_FEC_GAS_REP_V_#A	V = value * X
042	NRNAR117	2		MC_FEC_GAS_REP_V_#B	V = value * X
044	NRNAR118	2		MC_FEC_ION_FIL_V	V = value * X



046	NRNAR119	2		MC_FEC_GAS_FIL_V	V = value * X
048	NRNAR11A	2		MC_FEC_GAS_FIL_I	I = value * X [uA]
050	NRNAR11B	2		MC_FEC_ION_ENT1_V	V = value * X
052	NRNAR11C	2		MC_FEC_ION_ENT1_I	I = value * X [uA]
054	NRNAR11D	2		MC_FEC_GAS_TRAP_V	V = value * X
056	NRNAR11E	2		MC_FEC_HVVG_V	U = value * X [V]
058	NRNAR11F	2		MC_FEC_HEAT_VG_V	U = value * X [V]
060	NRNAR120	2		MC_FEC_TEMP	T = value * X [°C]
062	NRNAR121	2		MC_GCU_POW_#1	V = (value * X) - Y
064	NRNAR122	2		MC_GCU_POW_#2	V = (value * X) + Y
066	NRNAR123	2		MC_GCU_#1_I	V = (value * 366e-6)
068	NRNAR124	2		MC_GCU_#2_I	V = (value * 366e-6)
070	NRNAR125	2		MC_GCU_OUT_PRES_#1	V = (value * 366e-6)
072	NRNAR126	2		MC_GCU_OUT_PRES_#2	V = (value * 366e-6)
074	NRNAR127	2		MC_GCU_TEMP_PIRANI_#1	V = (value * 366e-6)
076	NRNAR128	2		MC_GCU_TEMP_PIRANI_#2	V = (value * 366e-6)
078	NRNAR129	2		MC_GEX_TEMP	V = (value * 366e-6)
080	NRNAR12A	2		MC_HM_PW	V = (value * X) + Y
082	NRNAR12B	2		MC_HM_DEL	V = (value * X) + Y
084	NRNAR12C	2		MC_HM_TEMP	V = (value * 366e-6)
086	NRNAR12D	2		MC_MOT_TOR	V = (value * X) + Y
088	NRNAR12E	2		MC_MOT_TEMP	°C = (value * X) + Y
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 = (value * 366e-6)
102	NRNAR135	2		MC_ETS_TEMP_CLK	V = (value * 366e-6)
104	NRNAR136	2		MC_ETS_TEMP_DIG	V = (value * 366e-6)
106	NRNAR137	2		PSDC_ELB_I	V = (value * X)
108	NRNAR138	2		PSDC_ELA_I	V = (value * X)
110	NRNAR139	2		PSDC_GR_I	V = (value * X)
112	NRNAR13A	2		PSDC_BP_I	V = (value * X)
114	NRNAR13B	2		PSDC_GR_G	V = (value * X)
116	NRNAR13C	2		PSDC_BP_G	V = (value * X)
118	NRNAR13D	2		HV1_SL_G	V = (value * X) + Y
120	NRNAR13E	2		HV1_A2_G	V = (value * X) + Y

122	NRNAR13F	2		HV1_A1_G	$V = (\text{value} * X) + Y$
124	NRNAR140	2		HV1_SL_I	$V = (\text{value} * X) + Y$
126	NRNAR141	2		HV1_A2_I	$V = (\text{value} * X) + Y$
128	NRNAR142	2		HV1_A1_I	$V = (\text{value} * X) + Y$
130	NRNAR143	2		HV2_P_G	$V = (\text{value} * X) + Y$
132	NRNAR144	2		HV2_P_I	$V = (\text{value} * X) + Y$
134	NRNAR145	2		HV1_D	$V = (\text{value} * X) + Y$
136	NRNAR146	2		HV2_HM3	$V = (\text{value} * X) + Y$
138	NRNAR147	2		HV1_R1	$V = (\text{value} * X) + Y$
140	NRNAR148	2		HV1_R2	$V = (\text{value} * X) + Y$
142	NRNAR149	2		HV1_RL	$V = (\text{value} * X) + Y$
144	NRNAR14A	2		HV1_HM1	$V = (\text{value} * X) + Y$
146	NRNAR14B	2		HV2_HM2	$V = (\text{value} * X) + Y$
148	NRNAR14C	2		HV1_HML	$V = (\text{value} * X) + Y$
150	NRNAR14D	2		HV2_M_I	$V = (\text{value} * X) + Y$
152	NRNAR14E	2		HV2_M_G	$V = (\text{value} * X) + Y$
154	NRNAR14F	2		PSDC_E2_I	$V = (\text{value} * X)$
156	NRNAR150	2		PSDC_Temp_BP_I	TBD
158	NRNAR151	2		PSDC_Temp_BP_G	$T = (\text{value} * X) + Y [^{\circ}\text{C}]$
160	NRNAR152	2		PSU_Temp_MCP_I	TBD
162	NRNAR153	2		PSU_Temp_MCP_G	TBD
164	NRNAR154	2		PSU_Temp_HV1	$T = (\text{value} * X) + Y [^{\circ}\text{C}]$
166	NRNAR155	2		PSU_Temp_LVPS	$T = (\text{value} * X) + Y [^{\circ}\text{C}]$
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	$t = (\text{Value} * X) + Y$

174	NRNAR199	2		ETSL ToF	$t = (\text{Value} * X) + Y$
176	NRNAR19A	2		ETSL Cal. Start Delay	$t = (\text{Value} * X) + Y$
178	NRNAR19B	2		ETSL Cal. Pulse Height	$V = (\text{value} * X) + Y$
180	NRNAR19C	2		ETSL Cal. Pulse Width	$t = (\text{value} * X) + Y$
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		Sent Commands Counter	
198	NRNAR160: NRNDR1A0	1		RTOF Ext. HK Header	0xE8
	NRNDR1A1	1		Spare	
200	NRNAR161	2		MC_FEC_PVCC_V	$U = \text{value} * 1\text{e-}3 - 0.0156 \text{ [V]}$
202	NRNAR162	2		MC_FEC_MVCC_V	$U = \text{value} * -7\text{e-}4 + 0.003 \text{ [V]}$
204	NRNAR163	2		MC_FEC_PVDD_V	$U = \text{value} * 3.1\text{e-}3 + 0.0497 \text{ [V]}$
206	NRNAR164	2		MC_FEC_MVDD_V	$U = \text{value} * -2.8\text{e-}3 + 0.1508 \text{ [V]}$
208	NRNAR165	2		MC_GCU_TEMP_TANK_#1	$V = (\text{value} * 366\text{e-}6)$
210	NRNAR166	2		MC_GCU_TEMP_TANK_#2	$V = (\text{value} * 366\text{e-}6)$
212	NRNAR167	2		MC_GCU_IN_PRES_#1	$V = (\text{value} * 366\text{e-}6)$
214	NRNAR168	2		MC_GCU_IN_PRES_#2	$V = (\text{value} * 366\text{e-}6)$
216	NRNAR169	2		MC_GEX_PVCC	$V = (\text{value} * 0.001) - 0.0058$
218	NRNAR16A	2		MC_GEX_VD	$V = \text{value} * 0.0083 - 0.0417 \text{ [V]}$
220	NRNAR16B	2		MC_IEX_PVCC	$V = (\text{value} * 0.001) - 0.0058$

222	NRNAR16C	2		MC_IEX_VD	V = value * 0.0083 -0.0417 [V]
224	NRNAR16D	2		MC_HM_PVCA	V = (value * 0.001) -0.0038
226	NRNAR16E	2		MC_HM_VD	V = (value * 0.0083) -0.0478
228	NRNAR16F	2		MC_ETSL_PVCC	V = (value * 0.0011) -0.467
230	NRNAR170	2		MC_ETSL_MVCA	V = (value * -7e-4) +6.1e-3
232	NRNAR171	2		MC_ETSL_PVDD	V = (value * 3.1e-3) -1.26e-2
234	NRNAR172	2		MC_ETSL_MVDD	V = (value * -2.8e-3) +6.8e-3
236	NRNAR173	2		MC_MOT_PVCC	V = (value * 0.0009) -0.0327
238	NRNAR174	2		MC_OMC_SW_OPEN	
240	NRNAR175	2		MC_OMC_SW_CLOSED	
242	NRNAR176	2		MC_HEAT_ION_VG	V = (value * 0.0051) -0.036
244	NRNAR177	2		MC_HEAT_GAS_VG	V = (value * 0.0052) -0.0362
246	NRNAR178	2		MC_ETS_33V	V = (value * 366e-6)
248	NRNAR179	2		MC_ETS_PVCA	V = (value * 366e-6)
250	NRNAR17A	2		MC_ETS_MVCA	V = (value * 366e-6)
252	NRNAR17B	2		MC_ETS_VE	V = value * 0.0014 -0.001 [V]
254	NRNAR17C	2		MC_ETS_PVDD	V = value * 0.0031 -0.0093 [V]
256	NRNAR17D	2		MC_ETS_MVDD	V = value * -0.0032 + 0.1103 [V]
258	NRNAR17E	2		MC_ETS_VSH	V = value * 0.0096 + 0.0747 [V]
260	NRNAR17F	2		MC_ETSL_PVCA	V = (value * 1.1e-3) -0.467
262	NRNAR180	2		MC_Spare	
264	NRNAR181	2		PSU_+5_Val	V = (value * -0.001488)
266	NRNAR182	2		PSU_-5_Val	V = (value * -0.001428)
268	NRNAR183	2		PSU_+15_Val	V = (value * -0.00458)
270	NRNAR184	2		PSU_-15_Val	V = (value * -0.004415)
272	NRNAR185	2		PSU_+24_Val	V = (value * -0.006954)
274	NRNAR186	2		PSU_+8_Val	V = (value * -0.0014792)
276	NRNAR187	2		PSU_+5_Add_Val	V = (value * -0.0014798)
278	NRNAR188	2		PSU_+40_Val	V = (value * -0.0174) -0.4234
280	NRNAR189	2		PSU_+70_Val	V = (value * -0.0107) + 4.173
282	NRNAR18A	2		PSU_+5_Cur	I = value * -0.4383 + 30 [mA]
284	NRNAR18B	2		PSU_-5_Cur	I = value * -0.1508 -28.016 [mA]
286	NRNAR18C	2		PSU_+15_Cur	I = value * -0.1133 -16.502 [mA]
288	NRNAR18D	2		PSU_-15_Cur	I = value * -0.0553 -24.715 [mA]
290	NRNAR18E	2		PSU_+24_Cur	I = value * -0.1285 + 33.042 [mA]
292	NRNAR18F	2		PSU_+40/70_Cur	I = value * -0.0174 -0.4234 [mA]
294	NRNAR190	2		PSU_+5_Add_Cur	I = value * -0.0571 + 3.4918 [mA]
296	NRNAR191	2		PSU_+8_Cur	I = value * -0.0254 + 5.663 [mA]
298	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
302	NRNAR193	2		ETS_NOE_High	

			15.. 9	Spare	
	NRNDR1A2		8..1	NOE High value	Dec value
304	NRNAR194	2		ETS NOE Low	
			15.. 9	Spare	
	NRNDR1A3		8..1	NOE Low value	Dec value
	NRNDR1A4		0	NOE Status	0 = Continuous, 1 = NOE
306	NRNAR195	2		Spare 1	
308	NRNAR196	2		Spare 2	
310		4		ETS/L Start time	S/C time in sec.
311		4		ETS/L Stop time	S/C time in sec.
312		2		Dummy	Fill bytes