Agnikul Data Stripping Document V1.5.6

Version no	Change Log	Revision Made By	Date
V1.0		Meenakshi	6/10/2022
V1.1	Added Data format description in Agnikul Word Format. Incorporates changes according to range safety requirement (meeting: 13/10/2022)	Meenakshi	14/10/2022
V1.2	Added IMU Status section	Meenakshi	31/10/2022
V1.2.1	Corrected parameter size and parameter ID in GNSS ECEF Message Note Section (Page 54)	Meenakshi	01/12/2022
V1.3	1. Added 2 FTS analog Parameter 2. Changed Parameter ID location for Avionics Battery voltage monitoring 3. Removed Avionics Battery current monitoring Parameter 4. Added & Updated FTS Digital signal monitorings 5. Added Gimbal Actuator Status Section 6. Added Parameters ID values	Meenakshi	17/03/2022
V1.4.0	1. Change in Parameter ID and Parameter in Flight computer package. Instead of Yaw, pitch & roll Euler rate values , quaternion values are allocated.	Meenakshi	20/06/2023
V1.4.1	1. Timestamp changes: millisecond resolution is 0.1 ms instead of 1 ms	Meenakshi	18/07/2023
V1.4.2	1. Change in Parameter ID and Parameter in Payload package. Instead of Yaw, pitch & roll Euler rate values, quaternion values are allocated.	Meenakshi	27/07/2023

V1.4.3	1. Updated Reserved parameter in IMU process in FC section	Meenakshi	31/07/2023
V1.4.4	1. Added parameter IDs 2. Added Command List 3. Added Fault IDs status for EC & FC	Meenakshi	25/09/2023
V1.4.5	1. Added EC & FC command and sequence feedback in reserved parameter 2. Added CDT timer in FC @50 Hz frequency 3. Added FC Status & EC Status	Meenakshi	26/09/2023
V1.4.6	1. Parameter-67 ID data format changed 2. Replaced EC_Reserved_3 parameter with EC_Valve Status	Meenakshi	02/10/2023
V1.5.0	1. ETH_4 : Parameter-29 ID to Parameter-35 ID and Parameter-38 ID : Parameter description is updated 2. ETH_2 : P_VALS_IGS : Valve status description is updated 3. ETH_7 : Parameter-55 ID & Parameter-58 ID : Updated as torque data instead of current data 4. ETH_11 : Changed Parameter-174 ID to P_IMUT_GYRO-Y 5. ETH_12 : Updated description of Parameter-88 ID & replaced Parameter-89 ID from Reserved to P_GUID_IMUCOUNT_FC 6. ETH_16 : Changed Parameter-99 ID & Parameter-100 ID to Reserved. Updated data in Parameter-125 ID to Parameter-134 ID 7. ETH_21 & ETH_22 : Updated data of Parameter-162 ID to Parameter-166 ID 8. Updated Parameter ID values according to V2.4 9. Added EC Valve Status V1.0 10. Updated Command List according to V4.6 11. Added FC Status V1.1 12. Updated FC & EC faults Ids according to Fault ID V1.6	Meenakshi	21/12/2023
V1.5.1	1. Updated Command List according to V4.7 2. Updated Flight Measurement Plan according to V2.1	Meenakshi	22/12/2023
V1.5.2	1. Updated Agnikul Word arrangement version no.	Meenakshi	4/02/2024
V1.5.3	1. Updated Parameter-45_ID & Parameter-46_ID 2. Updated conversion document version number	Meenakshi	6/03/2024
V1.5.4	1. Updated units for Parameter-74_ID, Parameter-75_ID, Parameter-76_ID, Parameter-146_ID, Parameter-147_ID, Parameter-148_ID, Parameter-62_ID, Parameter-97_ID	Kevin	
V1.5.5	1. Parameter name changed for following ID P_RESERVED_1 - 43, P_RESERVED_2- 44	sivasundari	10.03.2024

	P_CH3_CH5_Status-120, P_CH7_CH10_Status- 121 P_CDT_Time_11-154, P_CDT_Time_12- 166, P_CDT_Time_14- 179, P_CDT_Time_18-221, Command ID, EC Fault ID , FC Fault ID , sequence ID, EC status ID and FC status ID. - List of parameter changed is tabulated in **annexure 1**		
V1.5.6	Data type of parameters are changed. And new EC status bit has been assigned for engine ignition status	sivasundari	15.03.2024

- **List of Documents & its version number used in this stripping document V1.5.4 are as follows:**

S.No.	Sheet name	Version number
1	Flight Measurement Plan	V2.0
2	IRIG_PCM1	V1.5
3	PCM1_Frame_Format	V1.5.1
4	Agnikul Word Arrangement	V3.0
5	Agnikul Data Summary	V2.2
6	Agnikul Data Conversion Formula	V1.9
7	Agnikul : Status Data Description	V1.3
8	Agnikul : Command IDs	V1.7

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10. IMU Status: (P_IMU_STATUS_M & P_IMU_STATUS_PLD)
11. Gimbal Actuators Status : P_EMGA_STATUS_V1.0
12. Parameters ID values allocation (Parameter IDs V2.4) :
13. Command List with IDs : P_CMD_EC & P_CMD_FC (Command_IDs_V4.6)
14. EC Status : P_EC_STATUS_V1.1
15. Valve Status : P_EC_VALVE_STATUS
16. EC Fault Status with IDs : (Fault Ids V1.5)
17. FC Status : (P_FC_STATUS_ V1.5)
18. FC Fault Status with IDs : (Fault Ids V1.5)

ACRONYMS & ABBREVIATIONS

UNITS:

mA	milliAmpere
A	Ampere
V	Volt
s	second
ms	milliseconds
deg C	degree Celsius
mbar	millibar
g	acceleration due to gravity
m	metre
mm	millimetre
m/s	metre per second
deg	degree
Km/hr	Kilometre per hour
Kg	Kilogram
kN	kilo Newton

ABBREVIATIONS:

MSB	Most Significant Byte
LSB	Least Significant Byte
Msb	Most Significant Bit
Lsb	Least Significant Bit
bps	bits per second
EC	Engine Computer
FC	Flight Computer
CRC	Cyclic Redundancy Check
IFG	Interframe Gap

Data Representation - Conventions:

IMPORTANT

1. **BYTE 0 & BIT 0 is the Least Significant BYTE / BIT in a word.**
2. **Floating Point data Encoding is according to IEEE Standard For Normalised Single - Precision Floating Point Numbers (32 bits) :**
   - **1 Bit for Sign**
   - **8 Bits of Exponent**
   - **23 Bits of Mantissa**
3. **“Reserved “ means reserved for future extensions according to requirement**

1. Scope of the document

This document describes the flight measurement plan (FMP) of Agnikul for the mission and also the PCM frame configuration sent out by the telemetry module. In addition, this document also describes the position of the flight data (Agnikul Word Format) in the PCM frame configuration for the range safety and flight monitoring purposes.

2. Vehicle Configuration

Agnibaan SOrTeD is a suborbital tech demonstrator, which is a pressure fed stage powered by an engine of 5.87 kN thrust. The vehicle is configured based on the stage 2 engine of the orbital vehicle Agnibaan. The details of Agnibaan SOrTeD are given in table 1.

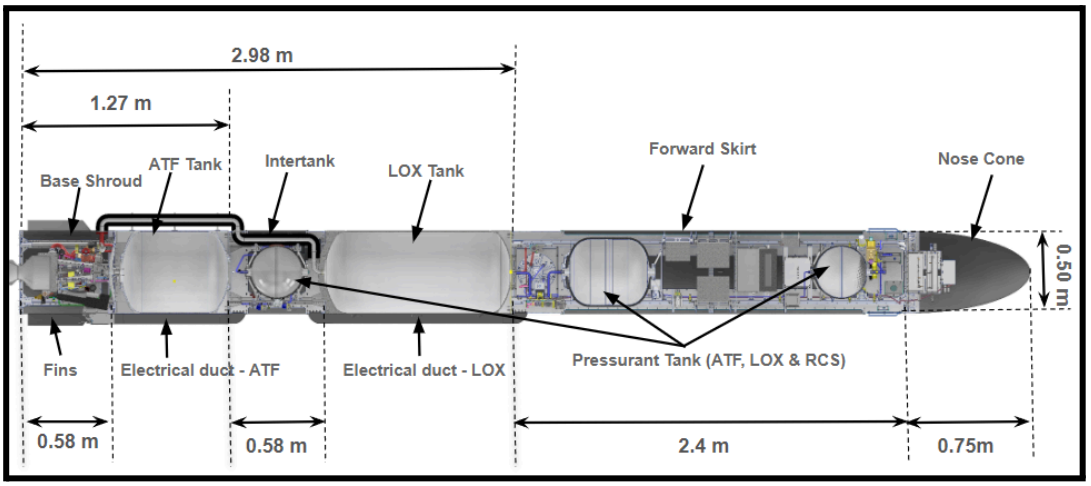

Fig1: Agnibaan SOrTeD

Configuration V3.5C	
Vehicle Height (mm)	6225
Vehicle Diameter (mm)	500
L/D ratio	12.45
Thrust Vector Control	+/- 4.5° conic angle - 2 plane gimbaling
Roll Control	Cold gas thrusters for Roll control
Engine	1 X Agnilet Semi-Cryo Engine - pressure fed system
Propellants	LOX / Aviation Turbine Fuel (ATF)
Sea level Thrust (N)	6215.5
Mass flow rate (kg/s)	3.313

Dry mass (kg)	339.4
Propellant mass (kg)	233
Flight burn time (s)	70.33
Lift off T/W ratio	1.1

Table 1: Configuration details of Agnibaan SOrTeD

3. Agnibaan SOrTeD High level Telemetry Specification

3.1. The PCAMi 1000/CHS/03A is a three user module chassis. The three modules are as follows

3.1.1. The Controller Module is a PCAMi-1000/BCU-04 module which generates the PCM Pre-modulation signal.

3.1.2. PCAMi 1000/EBM 102 is a Gigabit Ethernet Bus Monitor module. This module accepts Ethernet UDP packets on a defined port address. The EBM 102 can monitor multiple packets simultaneously. The Ethernet packets are embedded to the PCM stream by the BCU 04 controller module.

3.1.3. PCAMi 1000/DVID 02 is a Digital Video acquisition module. The video is acquired using the HDMI interface. The acquired video is compressed using H.264 compression. The compressed video data is embedded to the PCM stream by the BCU 04 controller module.

3.1.4. The high level specifications are mentioned below

Table 2: Specifications of Telemetry Module

Specification	**Value**
Input	Ethernet TCP/IP & Analog data from Camera
Output	Serial PCM Data
Data rate (bps)	1998848
Code	Bi-Ph-L
Word Length	16 bits per word
Frame Length	976 words per minor Frame
Frame Sync Pattern	FE6B2840
SFID word location	1

Transmitter Frequency	2200 to 2300 MHz. For this mission 2237.5 or 2259 MHz which ever is acceptable
Tuning step	100 KHz
Output power	2 W, 1 W each in 2 ports
Modulation	FM
Modulating frequency	For this mission 2 MHZ Max
Deviation	3 MHz
Spurious	-60 dBc
Camera	Go Pro 7 camera
Antenna Gain	2 dB nominal -15 dB for 95 % coverage

3.2. Physical location of the antenna on the vehicle:

There are a total 10 antennas (4FTS + 2 GNSS + 2 Telemetry + 2 Tracking). The structure is divided into 4 sections by vertical stiffener. So three antennas are placed in 2 sections and 2 antennas are placed in other 2 sections. The angle between the antennas where 3 antennas are placed is 25 degree and whereas for 2 antennas it is 45 degree

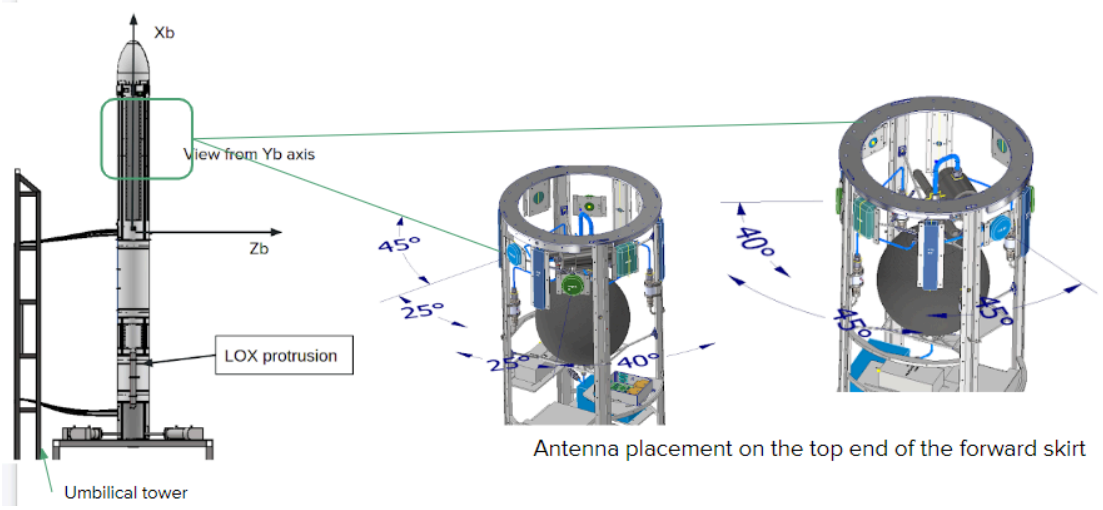

Figure 2: Antenna placement on the forward skirt of the vehicle

4. Parameters sent through telemetry

Total number of analog parameters = 44
Total number of digital parameters (digital communication - RS422) = 51
Total number of digital parameters (digital high-low signal) = 36
Resolution range for analog parameters = 8 to 16 bit
Resolution range for digital parameters (digital communication - RS422) = 8 to 32 bits
Sampling rate range = 1 to 2000 Hz (except FFT sensor)
Sampling rate for most of the analog parameters = 4 to 2000 KHz

Data generated (Data round off to 8bit/16 bit/32 bit) = 805,560 bps
Data generated + parameter id (8 bit) = 1,115,336 bps
Total Timestamp head (Secondary Header) = 202,528 bps
Total Primary Header = 50,632 bps
Total overheads (Primary header + Timestamp + parameter id) = 562,936 bps
Total data rate (without camera data) = 1,470,944 bps
Total PCM overheads = 6,144 bps
Camera Data rate = 521,760 bps

Total Telemetry data rate with camera data = 1,998,848 bps

5. Data packet format (Ethernet TCP/IP packet format with Agnikul Data arrangement)

The data packetization format for the parameters being sent through telemetry is shown in *Figure 5* and the customised packet design format is detailed in *Table 1*

Figure 3: Agnibaan SOrTeD data packetization format.

Ethernet Header	IP Header	TCP header	Primary Header	Secondary Header	Packet Body 1	Packet Body 2	Packet Body 3	Packet Body .N	CRC	IFG

Ethernet Fields:

a. Ethernet Header -
b. IP Header - 20 bytes
c. TCP Header - 20 bytes
d. Data field:
    i. Primary Header
    ii. Secondary Header
    iii. Packet Body
e. CRC - Cyclic Redundancy check
f. IFG - Interframe Gap

6. Agnikul Flight Measurement Plan V2.0

Note: Highlighted Data are Range Safety requirement

*** Some parameters might be added or reduced as per Mission requirements

S.No.	Avionics Package which is responsible for sending Data to Telemetry unit	Parameter ID Designation	Parameter ID	Description	Data Size (in bits)	Frequency (Hz)	Unit of Measurement	Data Type	Range Safety Requirements
1	Engine Package	Parameter-1 ID	P_C_PT_LOX_inj	LOX Injection Pressure to Engine	14	2000	bar	Analog	FALSE
2	Engine Package	Parameter-2 ID	P_F_PT_ATF_inj	ATF Injection Pressure to Engine	14	2000	bar	Analog	FALSE
3	Engine Package	Parameter-3 ID	P_E_PT_CC_1	Engine Chamber Pressure	14	2000	bar	Analog	TRUE
4	Engine Package	Parameter-4 ID	P_M_PT_inj	Methane Injection Pressure to Engine	14	2000	bar	Analog	FALSE
5	Engine Package	Parameter-5 ID	P_G_PT_inj	Gaseous Oxygen Injection Pressure to Engine	14	2000	bar	Analog	FALSE
6	Engine Package	Parameter-6 ID	P_I_PT_1	Igniter Chamber Pressure	14	2000	bar	Analog	TRUE
7	Engine Package	Parameter-7 ID	P_I_PT_2	Redundant Igniter Chamber pressure	14	2000	bar	Analog	TRUE
8	Engine Package	Parameter-8 ID	P_R_PT_RCS_2	RCS Thruster Injection Pressure	14	2000	bar	Analog	FALSE
9	Engine Package	Parameter-9 ID	P_VALS_IGS	MOV, MFV position status and Spark plug Status **(refer sheet Parameter ID: P_VALS_IGS_V1.0)**	8	500	-	Digital	FALSE
10	Engine Package	Parameter-10 ID	P_F_PT_ATF_Press_Tank	ATF Pressurant tank pressure	16	200	bar	Analog	FALSE
11	Engine Package	Parameter-11 ID	P_F_PT_ATF_Tank	ATF tank Pressure	16	200	bar	Analog	FALSE
12	Engine Package	Parameter-12 ID	P_F_PT_ATF_Press	ATF Pressurant pressure before pressurant valve	16	200	bar	Analog	FALSE
13	Engine Package	Parameter-13 ID	P_C_PT_LOX_Press_Tank	LOX Pressurant tank pressure	16	200	bar	Analog	FALSE
14	Engine Package	Parameter-14 ID	P_C_PT_LOX_Tank	LOX tank Pressure	16	200	bar	Analog	FALSE
15	Engine Package	Parameter-15 ID	P_C_PT_LOX_Press	LOX Pressurant pressure before pressurant valve	16	200	bar	Analog	FALSE
16	Engine Package	Parameter-16 ID	P_R_PT_RCS_1	RCS Pressurant tank Pressure	16	200	bar	Analog	FALSE

17	Engine Package	Parameter-17 ID	P_C_LS_LOX_Tank	Liquid Oxygen Tank level	16	200	mbar	Analog	FALSE
18	Engine Package	Parameter-18 ID	P_FTS&TTDS_M	FTS (P) Chain & Tracking Transponder Digital Status monitoring (refer table **Parameter ID: P_FTS&TTDS_M_V1.0)**	16	100	V	Digital	TRUE
19	Engine Package	Parameter-19 ID	P_FTSD_R	FTS (R) Chain Digital Status monitoring (refer table **Parameter ID: P_FTSD_R_V1.0)**	16	100	V	Digital	TRUE
20	Engine Package	Parameter-20 ID	P_TTPS_2	Tracking Transponder pulse signal	8	100	-	pulse signal	FALSE
21	Engine Package	Parameter-21 ID	P_ITSM_A1	ITS (P): TCD battery T/M	8	100	V	Analog	FALSE
22	Engine Package	Parameter-22 ID	P_ITSM_A2	ITS (P): Squelch Monitoring Live	8	100	V	Analog	FALSE
23	Engine Package	Parameter-23 ID	P_ITSM_A3	ITS (P): SSM_1 Live	8	100	V	Analog	FALSE
24	Engine Package	Parameter-24 ID	P_ITSM_A4	ITS (P): SSM_2 Live	8	100	V	Analog	FALSE
25	Engine Package	Parameter-25 ID	P_ITSM_A5	ITS (P): +5V1 TM	8	100	V	Analog	FALSE
26	Engine Package	Parameter-26 ID	P_ITSM_A6	ITS (P): +/-5V3 TM	8	100	V	Analog	FALSE
27	Engine Package	Parameter-27 ID	P_ITSM_A7	ITS (P): 28V TM	8	100	V	Analog	FALSE
28	Engine Package	Parameter-28 ID	P_SARBM_A1	SARB (P) Analog Status Monitoring	8	100	V	Analog	FALSE
29	Engine Package	Parameter-29 ID	P_ITSR_A1	ITS (R): +5V2 TM	8	100	V	Analog	FALSE
30	Engine Package	Parameter-30 ID	P_ITSR_A2	ITS (R): 28V TM	8	100	V	Analog	FALSE
31	Engine Package	Parameter-31 ID	P_ITSR_A3	ITS (R): +/-5V3 TM	8	100	V	Analog	FALSE
32	Engine Package	Parameter-32 ID	P_ITSR_A4	ITS (R): +5V1 TM	8	100	V	Analog	FALSE
33	Engine Package	Parameter-33 ID	P_ITSR_A5	ITS (R): SSM_2 Live	8	100	V	Analog	FALSE
34	Engine Package	Parameter-34 ID	P_ITSR_A6	ITS (R): SSM_1 Live	8	100	V	Analog	FALSE
35	Engine Package	Parameter-35 ID	P_ITSR_A7	ITS (R): Squelch Monitoring Live	8	100	V	Analog	FALSE
36	Engine Package	Parameter-36 ID	P_SARBR_A1	SARB (R) Analog Status Monitoring	8	100	V	Analog	FALSE
37	Engine Package	Parameter-37 ID	P_ITSM_A8	ITS (P): +5V2 TM	8	100	V	Analog	FALSE

38	Engine Package	Parameter-38 ID	P_ITSR_A8	ITS (R): TCD battery T/M	8	100	V	Analog	FALSE
39	Engine Package	Parameter-39 ID	P_DESTM	Main DEST battery voltage MON	8	100	V	Analog	FALSE
40	Engine Package	Parameter-40 ID	P_DESTR	Redundant DEST battery voltage MON	8	100	V	Analog	FALSE
41	Engine Package	Parameter-41 ID	P_AB_TS	Health measurement for Avionics battery (temperature sensing)	8	100	deg C	Analog	FALSE
42	Engine Package	Parameter-42 ID	P_AB_VS	Health measurement for Avionics battery (voltage sensing)	8	100	V	Analog	FALSE
43	Engine Package	Parameter-43 ID	P_C_RTD_inj	LOX_Injection Temperature to Engine	16	4	deg C	Analog	FALSE
44	Engine Package	Parameter-44 ID	P_F_RTD_inj	ATF Injection Temperature to Engine	16	4	deg C	Analog	FALSE
45	Engine Package	Parameter-45 ID	P_CH3_CH5_Status	ATF Pressurant tank Temperature	16	4	NIL	Analog	FALSE
46	Engine Package	Parameter-46 ID	P_CH7_CH10_Status	RCS Pressurant tank Temperature	16	4	NIL	Analog	FALSE
47	Engine Package	Parameter-47 ID	P_C_RTD_LOX_Press_Tank	LOX Pressurant tank Temperature	16	4	deg C	Analog	FALSE
48	Engine Package	Parameter-48 ID	P_FS_TM_1	Temperature data validation at Forward skirt level	`16	4	deg C	Analog	FALSE
49	Engine Package	Parameter-49 ID	P_FS_Acc_1	Vibration data validation at forward skirt level (FFT Data) **(refer table Parameter ID: P_FS_Acc_1_V1.0)**	336	1	g	Analog	FALSE
50	Engine Package	Parameter-50 ID	P_CMD_EMGA-PL_E1	Stroke length command from Engine Computer for Pitch Gimbal Actuator	16	100	deg	Digital - RS422	FALSE
51	Engine Package	Parameter-51 ID	P_CMD_EMGA-YL_E1	Stroke length command from Engine Computer for Yaw Gimbal Actuator	16	100	deg	Digital - RS422	FALSE
52	Engine Package	Parameter-52 ID	P_EMGA-P_E1	Stroke length feedback from Pitch Gimbal Actuator	16	100	deg	Digital - RS422	FALSE
53	Engine Package	Parameter-53 ID	P_EMGA-Y_E1	Stroke length feedback from Yaw Gimbal Actuator	16	100	deg	Digital - RS422	FALSE
54	Engine Package	Parameter-54 ID	P_EMGAV_P_E1	Pitch Gimbal Actuator Voltage data	8	100	V	Digital - RS422	FALSE
55	Engine Package	Parameter-55 ID	P_EMGAA_P_E1	Pitch Gimbal Actuator Torque data	8	100	N	Digital - RS422	FALSE
56	Engine Package	Parameter-56 ID	P_EMGAT_P_E1	Pitch Gimbal Actuator Temperature data	8	100	deg C	Digital - RS422	FALSE
57	Engine Package	Parameter-57 ID	P_EMGAV_Y_E1	Yaw Gimbal Actuator Voltage data	8	100	V	Digital - RS422	FALSE

58	Engine Package	Parameter-58 ID	P_EMGAA_Y_E1	Yaw Gimbal Actuator Torque data	8	100	N	Digital - RS422	FALSE
59	Engine Package	Parameter-59 ID	P_EMGAT_Y_E1	Yaw Gimbal Actuator Temperature data	8	100	deg C	Digital - RS422	FALSE
60	Engine Package	Parameter-60 ID	P_EMGA_STATUS	Gimbal Actuator health status and error **refer table Parameter ID: P_EMGA_STATUS_V1.0)**	32	100	-	Digital - RS422	FALSE
61	Engine Package	Parameter-61 ID	P_EC_TS	Health parameter (Temperature) for Engine Computer	8	4	deg C	Digital - I2C	FALSE
62	Engine Package	Parameter-62 ID	P_EC_CS	Health parameter (Current) for Engine Computer	8	4	A	Digital - I2C	FALSE
63	Engine Package	Parameter-63 ID	P_EC_VS	Health parameter (Voltage) for Engine Computer	8	4	V	Digital - I2C	FALSE
64	Engine Package	Parameter-64 ID	P_EC_SEQ	There are several sequences executed by the Engine computer. Sequence ID of particular sequence is executed by EC with timestamp is captured by telemetry unit **(refer table Parameter ID: P_EC_SEQ_V1.0)**	8	50	-	Digital - Ethernet	FALSE
65	Engine Package	Parameter-65 ID	P_CMD_EC	Engine computer will give command to particular valves to open or close based on command id or sequence id received from Flight computer **(refer table Parameter ID: Command_IDs_V4.6)**	8	50	-	Digital - Ethernet	FALSE
66	Engine Package	Parameter-66 ID	P_EC_SEQ_FB	EC package executed some sequence its feedback status will come under this parameter	8	50	-	Digital - Ethernet	FALSE
67	Engine Package	Parameter-67 ID	P_EC_CMD_FB	EC package executed some commands, its feedback status will come under this parameter	32	50	-	Digital - Ethernet	FALSE
68	Engine Package	Parameter-68 ID	P_EC_VALVE_STATUS	Valves Status bits **(refer table P_EC_VALVE_STATUS_V1.0)**	32	50	-	Digital - Ethernet	FALSE
69	Engine Package	Parameter-69 ID	P_EC_FAULT_STATUS	Fault ID raised by Engine Computer **(refer table Parameter ID: P_EC_FAULT_STATUS_V1.5)**	8	1000	-	Digital - Ethernet	FALSE

70	Engine Package	Parameter-70 ID	P_EC_STATUS	Engine Computer status ID. **(refer table Parameter ID: P_EC_STATUS_V1.1)**	32	1000	-	Digital - Ethernet	FALSE
71	Flight Package	Parameter-167 ID	P_CDT_Time_11	CDT Timer Value with IMU data @500 Hz	32	500	ms	Digital - Ethernet	TRUE
72	Flight Package	Parameter-71 ID	P_IMUR-X_M	Vehicle Angular rate data (X-axis) in Body Frame - Main FC IMU	32	500	deg/s	Digital - RS422	TRUE
73	Flight Package	Parameter-72 ID	P_IMUR-Y_M	Vehicle Angular rate data (Y-axis) in Body Frame - Main FC IMU	32	500	deg/s	Digital - RS422	TRUE
74	Flight Package	Parameter-73 ID	P_IMUR-Z_M	Vehicle Angular rate data (Z-axis) in Body Frame - Main FC IMU	32	500	deg/s	Digital - RS422	TRUE
75	Flight Package	Parameter-74 ID	P_IMUA-X_M	Vehicle Acceleration (X-axis) in Body Frame - Main FC IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	500	m/s^2	Digital - RS422	TRUE
76	Flight Package	Parameter-75 ID	P_IMUA-Y_M	Vehicle Acceleration (Y-axis) in Body Frame - Main FC IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	500	m/s^2	Digital - RS422	TRUE
77	Flight Package	Parameter-76 ID	P_IMUA-Z_M	Vehicle Acceleration (Z-axis) in Body Frame - Main FC IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	500	m/s^2	Digital - RS422	TRUE
78	Flight Package	Parameter-77 ID	P_IMU_STATUS_M	IMU status bytes for gyro, accelerometer , inclinometer & AUX measurement	32	500	-	Digital - RS422	TRUE
79	Flight Package	Parameter-171 ID	P_IMU_datagram_counter	IMU Datagram Counter	32	500	-	Digital - RS422	FALSE
80	Flight Package	Parameter-172 ID	P_numOfDataInvalid	Count of invalid Data	32	500	-	Digital - RS422	FALSE
81	Flight Package	Parameter-173 ID	P_IMU_proc_delta_packet_count	IMU Process Delta packet number	32	500	-	Digital - RS422	FALSE
82	Flight Package	Parameter-174 ID	P_IMUT_GYRO-Y	IMU Gyroscope Y-axis temperature data	32	500	deg C	Digital - RS422	FALSE
83	Flight Package	Parameter-167 ID	P_CDT_Time_12	CDT Timer Value with GNC data @100 Hz	32	100	ms	Digital - Ethernet	TRUE
84	Flight Package	Parameter-78 ID	P_GNC_POS-X_FC	Vehicle position (X-axis) in LPI Frame	32	100	m	Digital - Ethernet	TRUE
85	Flight Package	Parameter-79 ID	P_GNC_POS-Y_FC	Vehicle position (Y-axis) in LPI Frame	32	100	m	Digital - Ethernet	TRUE
86	Flight Package	Parameter-80 ID	P_GNC_POS-Z_FC	Vehicle position (Z-axis) in LPI Frame	32	100	m	Digital - Ethernet	TRUE

87	Flight Package	Parameter-81 ID	P_GNC_VEL-X_FC	Vehicle velocity (X-axis) in LPI Frame	32	100	m/s	Digital - Ethernet	TRUE
88	Flight Package	Parameter-82 ID	P_GNC_VEL-Y_FC	Vehicle velocity (Y-axis) in LPI Frame	32	100	m/s	Digital - Ethernet	TRUE
89	Flight Package	Parameter-83 ID	P_GNC_VEL-Z_FC	Vehicle velocity (Z-axis) in LPI Frame	32	100	m/s	Digital - Ethernet	TRUE
90	Flight Package	Parameter-84 ID	P_GNC_Q1_FC	Vehicle measured Quaternion q1	32	100	NA	Digital - Ethernet	TRUE
91	Flight Package	Parameter-85 ID	P_GNC_Q2_FC	Vehicle measured quaternion q2	32	100	NA	Digital - Ethernet	TRUE
92	Flight Package	Parameter-86 ID	P_GNC_Q3_FC	Vehicle measured quaternion q3	32	100	NA	Digital - Ethernet	TRUE
93	Flight Package	Parameter-87 ID	P_GNC_Q0_FC	Vehicle measured quaternion q0	32	100	NA	Digital - Ethernet	TRUE
94	Flight Package	Parameter-88 ID	P_NAV_IMUCOUNT_FC	Counter of the IMU Datagram used	32	100	NA	Digital - Ethernet	FALSE
95	Flight Package	Parameter-89 ID	P_GUID_IMUCOUNT_FC	Total IMU packet counts used for Guidance time	32	100	NA	Digital - Ethernet	FALSE
96	Flight Package	Parameter-90 ID	P_CMD_EMGA-PA_E1	Engine deflection command for pitch from Flight Computer	16	100	deg	Digital - Ethernet	FALSE
97	Flight Package	Parameter-91 ID	P_CMD_EMGA-YA_E1	Engine deflection command for yaw from Flight Computer	16	100	deg	Digital - Ethernet	FALSE
98	Flight Package	Parameter-92 ID	P_CMD_RCS	Commanded RCS Valve State **(refer table Parameter ID: P_CMD_RCS_V1.0)**	8	100	-	Digital - Ethernet	FALSE
99	Flight Package	Parameter-167 ID	P_CDT_Time_14	CDT Timer Value with GNC Guidance data @10 Hz	32	10	ms	Digital - Ethernet	TRUE
100	Flight Package	Parameter-93 ID	P_CMD_Q1	Commanded Quaternion q1	32	10	NA	Digital - Ethernet	TRUE
101	Flight Package	Parameter-94 ID	P_CMD_Q2	Commanded Quaternion q2	32	10	NA	Digital - Ethernet	TRUE
102	Flight Package	Parameter-95 ID	P_CMD_Q3	Commanded Quaternion q3	32	10	NA	Digital - Ethernet	TRUE
103	Flight Package	Parameter- 168 ID	P_Delta_Q1	Delta Quaternion q1 body error	32	10	NA	Digital - Ethernet	TRUE
104	Flight Package	Parameter- 169 ID	P_Delta_Q2	Delta Quaternion q2 body error	32	10	NA	Digital - Ethernet	TRUE
105	Flight Package	Parameter- 170 ID	P_Delta_Q3	Delta Quaternion q3 body error	32	10	NA	Digital - Ethernet	TRUE
106	Flight Package	Parameter-96 ID	P_FC_TS	Health parameter (Temperature) for Flight Computer	8	4	deg C	Digital - I2C	FALSE
107	Flight Package	Parameter-97 ID	P_FC_CS	Health parameter (Current) for Flight Computer	8	4	A	Digital - I2C	FALSE
108	Flight Package	Parameter-98 ID	P_FC_VS	Health parameter (Voltage) for Flight Computer	8	4	V	Digital - I2C	FALSE

109	Flight Package	Parameter-99 ID	P_Reserved_1	Reserved	8	1	-	-	FALSE
110	Flight Package	Parameter-100 ID	P_Reserved_1	Reserved	8	1	-	-	FALSE
111	Flight Package	Parameter-101 ID	P_GNSS_PPS	GNSS pulse signal	8	1	-	Digital - RS422	FALSE
112	Flight Package	Parameter-102 ID	P_GNSS_GGA_LAT	GNSS GGA : Datum corrected Lattitude	32	1	deg min	Digital - RS422	FALSE
113	Flight Package	Parameter-103 ID	P_GNSS_GGA_LONG	GNSS GGA : Datum corrected Longitude	32	1	deg min	Digital - RS422	FALSE
114	Flight Package	Parameter-104 ID	P_GNSS_GGA_QI&HDOP	GNSS GGA : Quality indicator & HDOP	16	1	-	Digital - RS422	FALSE
115	Flight Package	Parameter-105 ID	P_GNSS_GGA_ALT	GNSS GGA : Datum and mean sea corrected altitude	32	1	m	Digital - RS422	FALSE
116	Flight Package	Parameter-106 ID	P_GNSS_GGA_GEOSEP	GNSS GGA : Geoidal separation (mean sea corrections)	16	1	m	Digital - RS422	FALSE
117	Flight Package	Parameter-107 ID	P_GNSS_VTG_SP&MI	GNSS VTG : Speed over ground in Km/hr & Mode indicator	32	1	speed in km/hr	Digital - RS422	FALSE
118	Flight Package	Parameter-108 ID	P_GNSS_GLL_LAT	GNSS GLL : Datum corrected Lattitude	32	1	deg min	Digital - RS422	FALSE
119	Flight Package	Parameter-109 ID	P_GNSS_GLL_LONG	GNSS GLL : Datum corrected Longitude	32	1	deg min	Digital - RS422	FALSE
120	Flight Package	Parameter-110 ID	P_GNSS_GLL_UTC	GNSS GLL : UTC Timestamp	32	1	hr:min:sec	Digital - RS422	FALSE
121	Flight Package	Parameter-111 ID	P_GNSS_GLL_STAT&MI	GNSS GLL : Status: Data valid or not valid Mode indicator : Autonomous , GNSS solution with corrections from SBAS satellites & Data not valid	8	1	-	Digital - RS422	TRUE
122	Flight Package	Parameter-112 ID	P_GNSS_GSA_MODE	GNSS GSA : Mode indicator	8	1	-	Digital - RS422	FALSE
123	Flight Package	Parameter-113 ID	P_GNSS_GSA_PRN_1	GNSS GSA : PRN number of satellite used for position fix	32	1	-	Digital - RS422	FALSE
124	Flight Package	Parameter-114 ID	P_GNSS_GSA_PRN_2	GNSS GSA : PRN number of satellite used for position fix	32	1	-	Digital - RS422	FALSE
125	Flight Package	Parameter-115 ID	P_GNSS_GSA_DOPVAL	GNSS GSA : PDOP, HDOP, VDOP values	32	1	-	Digital - RS422	TRUE
126	Flight Package	Parameter-116 ID	P_GNSS_ECEF_UTC	GNSS: UTC Time in ECEF Frame	32	1	hr:min:sec	Digital - RS422	TRUE
127	Flight Package	Parameter-117.0 ID	P_GNSS_ECEF_FHPOS_X	GNSS : position (X axis) in ECEF Frame (First half 32 bit)	32	1	m	Digital - RS422	TRUE
128	Flight Package	Parameter-117.1 ID	P_GNSS_ECEF_LHPOS_X	GNSS : position (X axis) in ECEF Frame (Last half 32 bit)	32	1	m	Digital - RS423	TRUE
129	Flight Package	Parameter-118.0 ID	P_GNSS_ECEF_FHPOS_Y	GNSS : position (Y axis) in ECEF Frame (First half 32 bit)	32	1	m	Digital - RS424	TRUE

130	Flight Package	Parameter-118.1 ID	P_GNSS_ECEF_LHPOS_Y	GNSS : position (Y axis) in ECEF Frame (Last half 32 bit)	32	1	m	Digital - RS425	TRUE
131	Flight Package	Parameter-119.0 ID	P_GNSS_ECEF_FHPOS_Z	GNSS : position (Z axis) in ECEF Frame (First half 32 bit)	32	1	m	Digital - RS426	TRUE
132	Flight Package	Parameter-119.1 ID	P_GNSS_ECEF_LHPOS_Z	GNSS : position (Z axis) in ECEF Frame (Last half 32 bit)	32	1	m	Digital - RS427	TRUE
133	Flight Package	Parameter-120 ID	P_GNSS_ECEF_VEL_X	GNSS : velocity (X axis) in ECEF Frame	32	1	m/s	Digital - RS422	TRUE
134	Flight Package	Parameter-121 ID	P_GNSS_ECEF_VEL_Y	GNSS : velocity (Y axis) in ECEF Frame	32	1	m/s	Digital - RS422	TRUE
135	Flight Package	Parameter-122 ID	P_GNSS_ECEF_VEL_Z	GNSS : velocity (Z axis) in ECEF Frame	32	1	m/s	Digital - RS422	TRUE
136	Flight Package	Parameter-123 ID	P_G1_P	Control gain constant - 1 (Pitch)	32	1	-	Digital - Ethernet	FALSE
137	Flight Package	Parameter-124 ID	P_G2_P	Control gain constant - 2 (Pitch)	32	1	-	Digital - Ethernet	FALSE
138	Flight Package	Parameter-125 ID	P_G1_Y	Control gain constant - 1 (Yaw)	32	1	-	Digital - Ethernet	FALSE
139	Flight Package	Parameter-126 ID	P_G2_Y	Control gain constant - 2 (Yaw)	32	1	-	Digital - Ethernet	FALSE
140	Flight Package	Parameter-127 ID	P_IMUT_GYRO-X	IMU Gyroscope X-axis temperature data	32	1	deg C	Digital - RS422	FALSE
141	Flight Package	Parameter-128 ID	P_IMUT_GYRO-Z	IMU Gyroscope Z- axis temperature data	32	1	deg C	Digital - RS422	FALSE
142	Flight Package	Parameter-129 ID	P_IMUT_INCLN-X	IMU Inclinometer X- axis temperature data	32	1	deg C	Digital - RS422	FALSE
143	Flight Package	Parameter-130 ID	P_IMUT_INCLN-Y	IMU Inclinometer Y- axis temperature data	32	1	deg C	Digital - RS422	FALSE
144	Flight Package	Parameter-131 ID	P_IMUT_INCLN-Z	IMU Inclinometer Z- axis temperature data	32	1	deg C	Digital - RS422	FALSE
145	Flight Package	Parameter-132 ID	P_IMUT_ACC-X	IMU Accelerometer X- axis temperature data	32	1	deg C	Digital - RS422	FALSE
146	Flight Package	Parameter-133 ID	P_IMUT_ACC-Y	IMU Accelerometer Y- axis temperature data	32	1	deg C	Digital - RS422	FALSE
147	Flight Package	Parameter-134 ID	P_IMUT_ACC-Z	IMU Accelerometer Z- axis temperature data	32	1	deg C	Digital - RS422	FALSE
148	Flight Package	Parameter-135 ID	P_FC_FAULT_STATUS	Fault ID raised by Flight Computer **(refer table Parameter ID: P_FC_FAULT_STATUS_V1.5)**	8	1000	-	Digital - Ethernet	TRUE
149	Flight Package	Parameter-136 ID	P_FC_STATUS	Flight Computer send status like GO-NO GO status, ALS feedback, LMP status sent by flight computer comes under this parameter. **(refer table Parameter ID: P_FC_STATUS_V1.0)**	32	1000	-	Digital - Ethernet	TRUE

150	Flight Package	Parameter-137 ID	P_FC_SEQ	There are several sequences run by flight computer. Sequence ID or particular sequence is generated by FC and send to respective computer for execution ; same sequence id with timestamp is captured by telemetry unit also **(refer table Parameter ID: P_FC_SEQ_V1.0)**	8	50	-	Digital - Ethernet	FALSE
151	Flight Package	Parameter-138 ID	P_CMD_FC	Any command ID send by Flight Computer to respective computers **(refer table Parameter ID: P_CMD_FC : Command_IDs_V4.6)**	8	50	-	Digital - Ethernet	FALSE
152	Flight Package	Parameter-139 ID	P_FC_SEQ_FB	FC Sequence Feedback	32	50	-	Digital - Ethernet	FALSE
153	Flight Package	Parameter-140 ID	P_FC_CMD_FB	FC Command Feedback	32	50	-	Digital - Ethernet	FALSE
154	Flight Package	Parameter-141 ID	P_CDT_Time_18	CDT Timer Value with GNC Guidance data @50 Hz	32	50	-	Digital - Ethernet	FALSE
155	Flight Package	Parameter-142 ID	P_FC_AUX_STATUS	Avionics packages Power status , File uploading & downloading status & phase ids	32	50	-	Digital - Ethernet	FALSE
156	Payload Package	Parameter-143 ID	P_IMUR-X_PLD	Payload : Vehicle Angular rate data (X-axis) in Body Frame - Redundant IMU	32	500	deg/s	Digital - RS422	FALSE
157	Payload Package	Parameter-144 ID	P_IMUR-Y_PLD	Payload : Vehicle Angular rate data (Y-axis) in Body Frame - Redundant IMU	32	500	deg/s	Digital - RS422	FALSE
158	Payload Package	Parameter-145 ID	P_IMUR-Z_PLD	Payload : Vehicle Angular rate data (Z-axis) in Body Frame - Redundant IMU	32	500	deg/s	Digital - RS422	FALSE
159	Payload Package	Parameter-146 ID	P_IMUA-X_PLD	Payload : Vehicle Acceleration (X-axis) in Body Frame - Redundant IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	500	m/s^2	Digital - RS422	FALSE
160	Payload Package	Parameter-147 ID	P_IMUA-Y_PLD	Payload : Vehicle Acceleration (Y-axis) in Body Frame - Redundant IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	500	m/s^2	Digital - RS422	FALSE
161	Payload Package	Parameter-148 ID	P_IMUA-Z_PLD	Payload : Vehicle Acceleration (Z-axis) in Body Frame - Redundant IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	500	m/s^2	Digital - RS422	FALSE

162	Payload Package	Parameter-149 ID	P_IMU_STATUS_PLD	Payload : IMU status bytes for gyro, accelerometer , inclinometer & Temperature ic status	32	500	-	Digital - RS422	FALSE
163	Payload Package	Parameter-150 ID	P_GNC_POS-X_PLD	Vehicle position (X axis) in LPI Frame calculated by Payload	32	100	m	Digital - Ethernet	TRUE
164	Payload Package	Parameter-151 ID	P_GNC_POS-Y_PLD	Vehicle position (Y axis) in LPI Frame calculated by Payload	32	100	m	Digital - Ethernet	TRUE
165	Payload Package	Parameter-152 ID	P_GNC_POS-Z_PLD	Vehicle position (Z axis) in LPI Frame calculated by Payload	32	100	m	Digital - Ethernet	TRUE
166	Payload Package	Parameter-153 ID	P_GNC_VEL-X_PLD	Vehicle velocity (X-axis) in LPI Frame calculated by Payload	32	100	m/s	Digital - Ethernet	TRUE
167	Payload Package	Parameter-154 ID	P_GNC_VEL-Y_PLD	Vehicle velocity (Y-axis) in LPI Frame calculated by Payload	32	100	m/s	Digital - Ethernet	TRUE
168	Payload Package	Parameter-155 ID	P_GNC_VEL-Z_PLD	Vehicle velocity (Z-axis) in LPI Frame calculated by Payload	32	100	m/s	Digital - Ethernet	TRUE
169	Payload Package	Parameter-156 ID	P_GNC_Q1_PLD	Vehicle measured Quaternion q1	32	100	NA	Digital - Ethernet	FALSE
170	Payload Package	Parameter-157 ID	P_GNC_Q2_PLD	Vehicle measured quaternion q2	32	100	NA	Digital - Ethernet	FALSE
171	Payload Package	Parameter-158 ID	P_GNC_Q3_PLD	Vehicle measured quaternion q3	32	100	NA	Digital - Ethernet	FALSE
172	Payload Package	Parameter-159 ID	P_GNC_Q0_PLD	Vehicle measured quaternion q0	32	100	NA	Digital - Ethernet	FALSE
173	Payload Package	Parameter-160 ID	P_NAV_IMUCOUNT_PLD	Counter of the IMU Datagram used	32	100	NA	Digital - Ethernet	FALSE
174	Payload Package	Parameter-161 ID	P_GUID_IMUCOUNT_PLD	Total IMU packet counts used for Guidance time	32	100	NA	Digital - Ethernet	FALSE
175	Payload Package	Parameter-162 ID	P_IMUT_GYRO-X_PLD	IMU Gyroscope X-axis Temperature data for Payload	8	4	deg C	Digital - RS422	FALSE
176	Payload Package	Parameter-163 ID	P_IMUT_GYRO-Y_PLD	IMU Gyroscope Y-axis Temperature data for Payload	8	4	deg C	Digital - RS422	FALSE
177	Payload Package	Parameter-164 ID	P_IMUT_GYRO-Z_PLD	IMU Gyroscope Z-axis Temperature data for Payload	8	4	deg C	Digital - RS422	FALSE
178	Payload Package	Parameter-165 ID	P_PLD_STATUS	Payload Status bits	8	1	-	Digital - Ethernet	FALSE
179	Payload Package	Parameter-166 ID	P_PLD_FAULT_STATUS	Payload Fault Status	8	1	-	Digital - Ethernet	FALSE
180	Telemetry Package	BCU_3.3V Data	P_TMPCU_P3.3V	Health parameter: 3.3V of Telemetry Processing Unit	16	2	V	Digital - TTL	FALSE
181	Telemetry Package	BCU_5V Data	P_TMPCU_P5V	Health parameter: 5V of Telemetry Processing Unit	16	2	V	Digital - TTL	FALSE

182	Telemetry Package	BCU_P8V Data	P_TMPCU_P8V	Health parameter: +8V of Telemetry Processing Unit	16	2	V	Digital - TTL	FALSE
183	Telemetry Package	BCU_N8V Data	P_TMPCU_N8V	Health parameter: -8V of Telemetry Processing Unit	16	2	V	Digital - TTL	FALSE
184	Telemetry Package	BCU_Temperature Data	P_TMPCU_TEMP	Health parameter: Temperature of Telemetry Processing Unit	16	2	deg C	Digital - TTL	FALSE
185	Telemetry Package	BCU_PWRUP_COUNT	P_TMPCU_PWRUP_COUNT	Health parameter: power up count of Telemetry Processing Unit	16	2	-	Digital - TTL	FALSE

7. PCM Frame Configuration:

Frame Length (Word per minor frame)	:	976
Sub-frame Size (Minor frames per major frame)	:	64
Word Length(Bits per word)	:	16
Major frame frequency	:	2
Bit rate (bps)	:	1998848
Data Polarity	:	Normal
Synchronisation pattern	:	FE6B2840
Synchronisation bits	:	32
SFID pos	:	1
Bits per minor frame	:	15616
SFID Alignment	:	0
PCM Code(PMF)	:	BIPH-L
PCM Code(TTL)	:	NRZ-L
PCM Code(RS422)	:	NRZ-L
PMF Level	:	0.500000
Fill Pattern	:	ABCD

8. Internal packetization format V2.4E :

Table 5: Agnibaan SOrTeD - Internal Packet Format

Data size = 8/16/32 bits					
Fields		**Sub fields**	**Size (in bits)**	**Size (in bytes)**	**Comments**
Primary Header		Channel ID	2		
		Parameter Count	6		max. 64
			8	1	
Secondary Header		Parameter Timestamp	32	4	look for 32 bit timestamp
Packet Body		Parameter ID	8		
		Data	8/16/32		variable data size
		Total	16/24/40	2/3/5	

9. Agnikul Word Format :

9.1. Primary Header : (refer Table 5)

- Channel ID : 2 bits
- Parameter Count : 6 bits (Range: 0 to 63)

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Channel ID [7: 6]		Parameter Count [5:0]					

Bit 7 to Bit 6 : Channel ID

Bit 7	Bit6	Channel ID	Channel
0	0	0	Engine DAQ
0	1	1	Engine Computer
1	0	2	Flight Computer
1	1	3	Payload Computer

Bit 5 to Bit 0 : Parameter count

9.2. Secondary Header : (refer Table 5)

- Timestamp : 32 bits

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16	Bit 15
Hours [31:27]					Minutes [26:21]						Seconds [20:15]					
Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		
Milliseconds [14:0]																

lsb

Bit 31 to Bit 27 : 5 bits for Hours (range (in decimal value) 0 to 23)
Bit 26 to Bit 21 : 6 bits for Minutes (range (in decimal value) 0 to 59)
Bit 20 to Bit 15 : 6 bits for Seconds (range (in decimal value) 0 to 59)
Bit 14 to Bit 0 : 15 bits for Milliseconds (range (in decimal value) 0 to 9999)

Note : millisecond = millisecond in decimal / 10 .
For eg : 9999 corresponds to 999.9 ms and 1 corresponds to 0.1 ms.

9.3. **Packet Body :** (refer Table 5)

9.3.1. Parameter ID:

- 8 bits

9.3.2. Parameter Data :

refer to individual sections based on data frequency and respective package computers.

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9.4. Engine Package: Data Acquisition Data

9.4.1. 2000 Hz frequency data:

Data type is **16 bit unsigned integer** from which Bit 15 & Bit 14 is allocated for data at 1ms time interval and 0.5 ms time interval identification (timestamp resolution is 1 ms). Remaining 14 bits are allocated for parameter data (applicable for parameters mentioned in below table).

S.No.	Parameter ID Designator	Parameter ID	Description	Actual Data Size (in bits)	Data Type	Frequency (Hz)
ETH_1	**Parameter-1 ID**	P_C_PT_LOX_inj	LOX Injection Pressure to Engine	14	uint16_t	2000
ETH_1	**Parameter-2 ID**	P_F_PT_ATF_inj	ATF Injection Pressure to Engine	14	uint16_t	2000
ETH_1	**Parameter-3 ID**	P_E_PT_CC_1	Engine Chamber Pressure	14	uint16_t	2000
ETH_1	**Parameter-4 ID**	P_M_PT_inj	Methane Injection Pressure to Engine	14	uint16_t	2000
ETH_1	**Parameter-5 ID**	P_G_PT_inj	Gaseous Oxygen Injection Pressure to Engine	14	uint16_t	2000
ETH_1	**Parameter-6 ID**	P_I_PT_1	Igniter Chamber Pressure	14	uint16_t	2000
ETH_1	**Parameter-7 ID**	P_I_PT_2	Redundant Igniter Chamber pressure	14	uint16_t	2000
ETH_1	**Parameter-8 ID**	P_R_PT_RCS_2	RCS Thruster Injection Pressure	14	uint16_t	2000

9.4.1.1. Data Format:

msb **lsb**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
T.I.[15:14]					Parameter Data [13:0]										

Bit 15 to Bit 14 -

Bit 15	Bit 14	Time Indicator (T.I.) Encrypted Information
0	0	Data at 0.5 ms time interval
0	1	Invalid
1	0	Invalid
1	1	Data at 1 ms time interval

Bit 13 to Bit 0 - 14 bit Parameter Data (parameter mentioned in above table)

9.4.2. 500 Hz frequency data:

Data type is **8 bit unsigned integer** from which

- Bit 0 is allocated for Digital Data ID: P_C_LS_MOV (MOV position status)
- Bit 1 is allocated for Digital Data ID: P_F_LS_MFV (MFV position status)
- Bit 2 is allocated for Digital Data ID: P_IGS_ST (Spark plug Status)
- Bit 3 to Bit 7 is Reserved
  (applicable for parameters mentioned in below table).

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_2	Parameter-9 ID	P_VALS_IGS	MOV, MFV position status and Spark plug Status	8	uint8_t	500

9.4.2.1. Data Format:

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved [7:0]					P_IGS_ST [2]	P_F_LS_MFV [1]	P_C_LS_MOV [0]

Bit 7 to Bit 3 - Reserved Bits

Bit 2 - Spark plug Status (Digital Data ID: **P_IGS_ST**)

Bit 2	Spark Plug Encrypted Information
0	Ignition OFF
1	Ignition ON

Bit 1 - MFV position status (Digital Data ID: **P_F_LS_MFV**)

Bit 1	Valve Encrypted Information
0	Valve status : CLOSE
1	Valve status : OPEN

Bit 0 - MOV position status (Digital Data ID: **P_C_LS_MOV**)

Bit 0	Valve Encrypted Information
0	Valve status : CLOSE
1	Valve status : OPEN

9.4.3. 200 Hz frequency data:

Data type is 16 bit unsigned integer. All 16 bits are allocated to parameter data (applicable for parameters mentioned in below table).

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_3	Parameter-10 ID	P_F_PT_ATF_Press_Tank	ATF Pressurant tank pressure	16	uint16_t	200
ETH_3	Parameter-11 ID	P_F_PT_ATF_Tank	ATF tank Pressure	16	uint16_t	200
ETH_3	Parameter-12 ID	P_F_PT_ATF_Press	ATF Pressurant pressure before pressurant valve	16	uint16_t	200
ETH_3	Parameter-13 ID	P_C_PT_LOX_Press_Tank	LOX Pressurant tank pressure	16	uint16_t	200
ETH_3	Parameter-14 ID	P_C_PT_LOX_Tank	LOX tank Pressure	16	uint16_t	200
ETH_3	Parameter-15 ID	P_C_PT_LOX_Press	LOX Pressurant pressure before pressurant valve	16	uint16_t	200
ETH_3	Parameter-16 ID	P_R_PT_RCS_1	RCS Pressurant tank Pressure	16	uint16_t	200
ETH_3	Parameter-17 ID	P_C_LS_LOX_Tank	Liquid Oxygen Tank level	16	uint16_t	200

9.4.3.1. Data Format:

msb **lsb**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

Bit 15 to Bit 0 : Parameter Data (refer above table for Parameter ID)

9.4.4. 100 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Identification Name	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_4	Parameter-18 ID	P_FTS&TTDS_M	FTS (P) Chain & Tracking Transponder Digital Status monitoring	Mentioned in below table	16	uint16_t	100

ETH_4	**Parameter-19 ID**	P_FTSD_R	FTS (R) Chain Digital Status monitoring	Mentioned in below table	16	uint16_t	100
ETH_4	**Parameter-20 ID**	P_TTPS_2	Tracking Transponder pulse signal	TRACK_PRF	8	uint8_t	100
ETH_4	**Parameter-21 ID**	P_ITSM_A1	ITS (P): TCD battery T/M	TCM_BVM	8	uint8_t	100
ETH_4	**Parameter-22 ID**	P_ITSM_A2	ITS (P): Squelch Monitoring Live	TCM_Squelch	8	uint8_t	100
ETH_4	**Parameter-23 ID**	P_ITSM_A3	ITS (P): SSM_1 Live	TCM_SS1	8	uint8_t	100
ETH_4	**Parameter-24 ID**	P_ITSM_A4	ITS (P): SSM_2 Live	TCM_SS2	8	uint8_t	100
ETH_4	**Parameter-25 ID**	P_ITSM_A5	ITS (P): +5V1 TM	TCM_+5V1	8	uint8_t	100
ETH_4	**Parameter-26 ID**	P_ITSM_A6	ITS (P): +/-5V3 TM	TCM_+/-5V3	8	uint8_t	100
ETH_4	**Parameter-27 ID**	P_ITSM_A7	ITS (P): 28V TM	TCM_28V	8	uint8_t	100
ETH_4	**Parameter-28 ID**	P_SARBM_A1	SARB (P) Analog Status Monitoring	SARBM-Analog	8	uint8_t	100
ETH_4	**Parameter-29 ID**	P_ITSR_A1	ITS (R): +5V2 TM	TCR_+5V2	8	uint8_t	100

ETH_4	**Parameter-30 ID**	P_ITSR_A2	ITS (R): 28V TM	TCR_28V	8	uint8_t	100
ETH_4	**Parameter-31 ID**	P_ITSR_A3	ITS (R): +/-5V3 TM	TCR_+/-5V3	8	uint8_t	100
ETH_4	**Parameter-32 ID**	P_ITSR_A4	ITS (R): +5V1 TM	TCR_+5V1	8	uint8_t	100
ETH_4	**Parameter-33 ID**	P_ITSR_A5	ITS (R): SSM_2 Live	TCR_SS2	8	uint8_t	100
ETH_4	**Parameter-34 ID**	P_ITSR_A6	ITS (R): SSM_1 Live	TCR_SS1	8	uint8_t	100
ETH_4	**Parameter-35 ID**	P_ITSR_A7	ITS (R): Squelch Monitoring Live	TCR_Squelch	8	uint8_t	100
ETH_4	**Parameter-36 ID**	P_SARBR_A1	SARB (R) Analog Status Monitoring	SARBR-Analog	8	uint8_t	100
ETH_4	**Parameter-37 ID**	P_ITSM_A8	ITS (P): +5V2 TM	TCM_+5V2	8	uint8_t	100
ETH_4	**Parameter-38 ID**	P_ITSR_A8	ITS (R): TCD battery T/M	TCR_BVM	8	uint8_t	100
ETH_4	**Parameter-39 ID**	P_DESTM	Main DEST battery voltage MON	DM_BVM	8	uint8_t	100
ETH_4	**Parameter-40 ID**	P_DESTR	Redundant DEST battery voltage MON	DR_BVM	8	uint8_t	100

ETH_4	**Parameter-41 ID**	P_AB_TS	Health measurement for Avionics battery (temperature sensing)	P_AB_TS	8	uint8_t	100
ETH_4	**Parameter-42 ID**	P_AB_VS	Health measurement for Avionics battery (voltage sensing)	P_AB_VS	8	uint8_t	100

9.4.4.1. Data Format:

- 16 bit Data : Parameter-18 ID (P_FTS&TTDS_M) & Parameter-19 ID (P_FTSD_R)

msb **lsb**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

a. **Parameter-18 ID (P_FTS&TTDS_M) :** Data type - uint16_t bits allocation . All FTS Digital status data is high/ low signal, so each bit represents each respective digital status.

S.No.	Parameter ID	Parameter Description	Data Bit no	Digital Data Status ID	Identification Name	FTS Digital Status Description	Unit of Measurement	Data Type
1	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 0	P_ARMP_D1	ARMP_D1	CMS Status Main ARM Plug	Volts	Digital
2	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 1	P_ITSM_D2	TCM_RSA	SAFE/ARM relay status for T/M	Volts	Digital
3	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 2	P_ITSM_D3	TCM_RD	Destruct relay status for T/M	Volts	Digital
4	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 3	P_ITSM_D4	TCM_OSA	SAFE command OCI output for T/M	Volts	Digital
5	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 4	P_ITSM_D5	TCM_DHA	Decoder Health status OCI T/M	Volts	Digital
6	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 5	P_ITSM_D6	TCM_OL	LPST enable/disable status OCI output for T/M	Volts	Digital
7	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 6	P_ITSM_D7	TCM_OD	Destruct command OCI output for T/M	Volts	Digital
8	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 7	P_ITSM_D8	TCM_INT/EXT	ITS INT/EXT STATUS	Volts	Digital
9	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 8	P_CEUM_D1	CEUM_RSA	Prime S/A Relay Status	Volts	Digital
10	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 9	P_CEUM_D2	CEUM_RD	Prime Destruct Relay Status	Volts	Digital
11	P_FTS&TTDS_M	FTS (P) Chain:	Bit 10	P_CEUM_D3	CEUM_RBAT	Prime Battery ON/OFF	Volts	Digital

		Digital Status				Relay Status		
12	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 11	P_RSR 1	NA	Reserved	Volts	Digital
13	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 12	P_RSR 2	NA	Reserved	Volts	Digital
14	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 13	P_RSR 3	NA	Reserved	Volts	Digital
15	P_FTS&TTDS_M	FTS (P) Chain: Digital Status	Bit 14	P_SARBM_D1	SARBM_DM	SARB (P): SARB (P) Digital Status Monitoring	Volts	Digital
16	P_FTS&TTDS_M	Tracking Transponder : Digital Status	Bit 15	P_TT_DS1	TRACK_DM	TT : Tracking Transponder Digital Status	Volts	Digital

b. Parameter-19 ID (P_FTSD_R) : Data type - uint16_t bits allocation . All FTS Digital status data is high/ low signal, so each bit represents each respective digital status.

S.No.	Parameter ID	Parameter Description	Data Bit no	FTS Digital Status Data ID	Identification Name	FTS Digital Status Description	Unit of Measurement	Data Type
1	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 0	P_ARMR_D1	ARMR_D1	CMS Status Redundant ARM Plug	Volts	Digital
2	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 1	P_ITSR_D2	TCR_RSA	SAFE/ARM relay status for T/M	Volts	Digital
3	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 2	P_ITSR_D3	TCR_RD	Destruct relay status for T/M	Volts	Digital
4	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 3	P_ITSR_D4	TCR_OSA	SAFE command OCI output for T/M	Volts	Digital
5	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 4	P_ITSR_D5	TCR_DHA	Decoder Health status OCI T/M	Volts	Digital
6	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 5	P_ITSR_D6	TCR_OL	LPST enable/disable status OCI output for T/M	Volts	Digital
7	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 6	P_ITSR_D7	TCR_OD	Destruct command OCI output for T/M	Volts	Digital
8	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 7	P_ITSR_D8	NA	Reserved	Volts	Digital
9	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 8	P_CEUR_D1	CEUR_RSA	Redundant S/A Relay Status	Volts	Digital
10	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 9	P_CEUR_D2	CEUR_RD	Redundant Destruct Relay Status	Volts	Digital
11	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 10	P_CEUR_D3	NA	Reserved	Volts	Digital
12	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 11	P_RSR 4	NA	Reserved	Volts	Digital
13	P_FTSD_R	FTS (R) Chain:	Bit 12	P_RSR 5	NA	Reserved	Volts	Digital

		Digital Data Status						
14	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 13	P_RSR 6	NA	Reserved	Volts	Digital
15	P_FTSD_R	FTS (R) Chain: Digital Data Status	Bit 14	P_SARBR_D1	SARBR_DM	SARB (R): SARB (R) Digital Status Monitoring	Volts	Digital
16	P_FTSD_R	Reserved	Bit 15	Reserved	NA	Reserved	-	-

- 8 bit Data : applicable for Parameter-20 ID to Parameter-42 ID

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [7:0]							

Bit 7 to Bit 0 : Parameter Data

9.4.5. 4 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_5	**Parameter-43 ID**	P_C_RTD_inj	LOX_Injection Temperature to Engine	16	uint16_t	4
ETH_5	**Parameter-44 ID**	P_F_RTD_inj	ATF Injection Temperature to Engine	16	uint16_t	4
ETH_5	**Parameter-45 ID**	P_CH3-CH5_Status	Channel 3 (RTD status) & Channel 5 (RTD status)	16	uint16_t	4
ETH_5	**Parameter-46 ID**	P_CH7-CH10_Status	Channel 7 (RTD status) & Channel 10 (thermocouple status)	16	uint16_t	4
ETH_5	**Parameter-47 ID**	P_C_RTD_LOX_Press_Tank	LOX Pressurant tank Temperature	16	uint16_t	4
ETH_5	**Parameter-48 ID**	P_FS_TM_1	Temperature data validation at Forward skirt level	16	uint16_t	4

9.4.5.1. Data Format:

msb **lsb**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

Bit 15 to Bit 0 : Parameter Data (refer above table for Parameter ID)

9.4.6. 1 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_6	Parameter-49 ID	P_FS_Acc_1	Vibration data validation at forward skirt level (FFT Data)	336	uint16_t	1

9.4.6.1. Data Format:

msb **lsb**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ACCR_FREQ_ID [15:10]						ACCR Data [9:0]									

ACCR_FREQ_ID Bit 15 to Bit 10	Frequency [Hz]	10 bit Accelerometer data w.r.t frequency (Bit 9 to Bit 0)
1	20	ACCR Data_1
2	25.198421	ACCR Data_2
3	31.74802104	ACCR Data_3
4	40	ACCR Data_4
5	50.396842	ACCR Data_5
6	63.49604208	ACCR Data_6
7	80	ACCR Data_7
8	100.793684	ACCR Data_8
9	126.9920842	ACCR Data_9
10	160	ACCR Data_10
11	201.587368	ACCR Data_11
12	253.9841683	ACCR Data_12

13	320	ACCR Data_13
14	403.174736	ACCR Data_14
15	507.9683366	ACCR Data_15
16	640	ACCR Data_16
17	806.3494719	ACCR Data_17
18	1015.936673	ACCR Data_18
19	1280	ACCR Data_19
20	1612.698944	ACCR Data_20
21	2031.873347	ACCR Data_21

9.5. Engine Package: Engine Computer data

9.5.1. 100 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_7	Parameter-50 ID	P_CMD_EMGA-PL_E1	Stroke length command from Engine Computer for Pitch Gimbal Actuator	16	uint16_t	100
ETH_7	Parameter-51 ID	P_CMD_EMGA-YL_E1	Stroke length command from Engine Computer for Yaw Gimbal Actuator	16	uint16_t	100
ETH_7	Parameter-52 ID	P_EMGA-P_E1	Stroke length feedback from Pitch Gimbal Actuator	16	uint16_t	100
ETH_7	Parameter-53 ID	P_EMGA-Y_E1	Stroke length feedback from Yaw Gimbal Actuator	16	uint16_t	100
ETH_7	Parameter-54 ID	P_EMGAV_P_E1	Pitch Gimbal Actuator Voltage data	8	uint8_t	100
ETH_7	Parameter-55 ID	P_EMGAA_P_E1	Pitch Gimbal Actuator Torque data	8	uint8_t	100
ETH_7	Parameter-56 ID	P_EMGAT_P_E1	Pitch Gimbal Actuator Temperature data	8	uint8_t	100
ETH_7	Parameter-57 ID	P_EMGAV_Y_E1	Yaw Gimbal Actuator Voltage data	8	uint8_t	100
ETH_7	Parameter-58 ID	P_EMGAA_Y_E1	Yaw Gimbal Actuator Torque data	8	uint8_t	100
ETH_7	Parameter-59 ID	P_EMGAT_Y_E1	Yaw Gimbal Actuator Temperature data	8	uint8_t	100

ETH_7	Parameter-60 ID	P_EMGA_STATUS	Gimbal Actuator health status and error	32	uint32_t	100

9.5.1.1. Data Format:

- 16 bit Data

msb **lsb**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

Bit 15 to Bit 0 : Parameter Data

- 8 bit Data

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [7:0]							

Bit 7 to Bit 0 : Parameter Data (refer above table for respective Parameter ID)

- 32 bit Data : (for P_EMGA_STATUS look into the Gimbal Actuator Status list)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
Parameter Data [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

lsb

Bit 31 to Bit 0 : Parameter Data

9.5.2. 4 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_8	Parameter-61 ID	P_EC_TS	Health parameter (Temperature) for Engine Computer	8	uint8_t	4
ETH_8	Parameter-62 ID	P_EC_CS	Health parameter (Current) for Engine Computer	8	uint8_t	4
ETH_8	Parameter-63 ID	P_EC_VS	Health parameter (Voltage) for Engine Computer	8	uint8_t	4

9.5.2.1. Data Format:

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [7:0]							

Bit 7 to Bit 0 : Parameter Data (refer above table for respective Parameter ID)

9.5.3. 50 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_9	**Parameter-64 ID**	P_EC_SEQ	There are several sequences executed by the Engine computer. Sequence ID of particular sequence is executed by EC with timestamp is captured by telemetry unit	8	uint8_t	50
ETH_9	**Parameter-65 ID**	P_CMD_EC	Engine computer will give command to particular valves to open or close based on command id or sequence id received from Flight computer	8	uint8_t	50
ETH_9	**Parameter-66 ID**	P_EC_SEQ_FB	EC package executed some sequence its feedback status will come under this parameter	8	uint8_t	50
ETH_9	**Parameter-67 ID**	P_EC_CMD_FB	EC package executed some commands, its feedback status will come under this parameter	32	uint32_t	50
ETH_9	**Parameter-68 ID**	P_EC_VALVE_STATUS	Valves Status bits **(refer table P_EC_VALVE_STATUS_V1.0)**	32	uint32_t	50

9.5.3.1. Data Format :

- 8 bit Data : Parameter-64 ID to Parameter-66 ID

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [7:0]							

Bit 7 to Bit 0 : Parameter Data (refer above table for respective Parameter ID)

- 32 bit Data : Parameter-68 ID

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
Parameter Data [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

lsb

Bit 31 to Bit 0 : 32 bit parameter data for Valves Status (**refer table P_EC_VALVE_STATUS_V1.0)** & feedbacks

9.5.4. 1000 Hz frequency data :

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_10	**Parameter-69 ID**	P_EC_FAULT_STATUS	Fault ID raised by Engine Computer	8	uint8_t	1000
ETH_10	**Parameter-70 ID**	P_EC_STATUS	Engine Computer status ID	32	uint32_t	1000

9.5.4.1. Data Format :

- 8 bit Fault ID : Range of Fault ID - 1 to 255
  Refer P_EC_FAULT_STATUS_V1.5 table

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Fault ID [7:0]							

Bit 7 to Bit 0 : 8 bit Fault ids raised by engine computer

- 32 bit Engine Status ID : **refer P_EC_STATUS_V1.1 table**

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
STATUS ID [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
STATUS ID [15:0]															

lsb

Bit 31 to Bit 0 : 32 bit Engine Status ID

9.6. Flight Computer Package: Flight Computer

9.6.1. 500 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_11	**Parameter-167 ID**	P_CDT_Time_11	CDT Timer Value with IMU data @500 Hz (counter value in ms)	32	int32_t	500
ETH_11	**Parameter-71 ID**	P_IMUR-X_M	Vehicle Angular rate data (X-axis) in Body Frame - Main FC IMU	32	float	500
ETH_11	**Parameter-72 ID**	P_IMUR-Y_M	Vehicle Angular rate data (Y-axis) in Body Frame - Main FC IMU	32	float	500
ETH_11	**Parameter-73 ID**	P_IMUR-Z_M	Vehicle Angular rate data (Z-axis) in Body Frame - Main FC IMU	32	float	500
ETH_11	**Parameter-74 ID**	P_IMUA-X_M	Vehicle Acceleration (X-axis) in Body Frame - Main FC IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	float	500
ETH_11	**Parameter-75 ID**	P_IMUA-Y_M	Vehicle Acceleration (Y-axis) in Body Frame - Main FC IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	float	500
ETH_11	**Parameter-76 ID**	P_IMUA-Z_M	Vehicle Acceleration (Z-axis) in Body Frame - Main FC IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	float	500
ETH_11	**Parameter-77 ID**	P_IMU_STATUS_M	IMU status bytes for gyro, accelerometer , inclinometer & AUX measurement	32	uint32_t	500
ETH_11	**Parameter-171 ID**	P_IMU_datagram_counter	IMU Datagram Counter	32	uint32_t	500
ETH_11	**Parameter-172 ID**	P_numOfDataInvalid	Count of invalid Data	32	uint32_t	500
ETH_11	**Parameter-173 ID**	P_IMU_proc_delta_packet_count	IMU Process Delta packet number	32	uint32_t	500

ETH_11	Parameter-174 ID	P_IMUT_GYRO-Y	IMU Gyroscope Y axis temperature data	32	uint32_t	500

9.6.1.1. Data Format:

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
Parameter Data [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

lsb

Bit 31 to Bit 0 : Parameter Data of parameters mentioned in above list.

Note : CDT value is in millisecond (ms) . It basically gives counter value.

9.6.2. 100 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_12	Parameter-167.0 ID	P_CDT_Time_12	CDT Timer Value with GNC data @100 Hz (counter value in ms)	32	int32_t	100
ETH_12	Parameter-78 ID	P_GNC_POS-X_FC	Vehicle position (X-axis) in LPI Frame	32	float	100
ETH_12	Parameter-79 ID	P_GNC_POS-Y_FC	Vehicle position (Y-axis) in LPI Frame	32	float	100
ETH_12	Parameter-80 ID	P_GNC_POS-Z_FC	Vehicle position (Z-axis) in LPI Frame	32	float	100
ETH_12	Parameter-81 ID	P_GNC_VEL-X_FC	Vehicle velocity (X-axis) in LPI Frame	32	float	100
ETH_12	Parameter-82 ID	P_GNC_VEL-Y_FC	Vehicle velocity (Y-axis) in LPI Frame	32	float	100
ETH_12	Parameter-83 ID	P_GNC_VEL-Z_FC	Vehicle velocity (Z-axis) in LPI Frame	32	float	100

ETH_12	**Parameter-84 ID**	P_GNC_Q1_FC	Vehicle measured Quaternion q1	32	float	100
ETH_12	**Parameter-85 ID**	P_GNC_Q2_FC	Vehicle measured quaternion q2	32	float	100
ETH_12	**Parameter-86 ID**	P_GNC_Q3_FC	Vehicle measured quaternion q3	32	float	100
ETH_12	**Parameter-87 ID**	P_GNC_Q0_FC	Vehicle measured quaternion q0	32	float	100
ETH_12	**Parameter-88 ID**	P_NAV_IMUCOUNT_FC	Counter of the IMU Datagram used	32	uint32_t	100
ETH_12	**Parameter-89 ID**	P_GUID_IMUCOUNT_FC	Total IMU packet counts used for Guidance time	32	uint32_t	100

9.6.2.1. Data Format:

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
Parameter Data [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

msb **lsb**

Bit 31 to Bit 0: Parameter Data of parameters mentioned in above list.

Note : CDT value is in millisecond (ms) . It basically gives counter value.

9.6.3. 100 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_13	**Parameter-90 ID**	P_CMD_EMGA-PA_E1	Engine deflection command for pitch from Flight Computer	16	int16_t	100
ETH_13	**Parameter-91 ID**	P_CMD_EMGA-YA_E1	Engine deflection command for yaw from Flight Computer	16	int16_t	100
ETH_13	**Parameter-92 ID**	P_CMD_RCS	Commanded RCS Valve State	8	uint8_t	100

9.6.3.1. Data Format:

- 16 bit Command:

msb **lsb**

Bit 15	Bit	Bit 13	Bit	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

	14		12												
Gimbal Actuator Command [15:0]															

Bit 15 to Bit 0 : Gimbal Actuator Command

- 8 bit RCS valve command:

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved [7:4]				RCS 4	RCS 3	RCS 2	RCS 1

Bit 7 to Bit 4 - Reserved Bits

Bit 3 - RCS valve 4 (Valve ID: **R_EV_RCS_4**)

Bit 2	**RCS valve 4 Command**
0	VALVE OPEN
1	VALVE CLOSE

Bit 2 - RCS valve 3 (Valve ID: **R_EV_RCS_3**)

Bit 2	**RCS valve 3 Command**
0	VALVE OPEN
1	VALVE CLOSE

Bit 1 - RCS valve 2 (Valve ID: **R_EV_RCS_2**)

Bit 2	**RCS valve 2 Command**
0	VALVE OPEN
1	VALVE CLOSE

Bit 0 - RCS valve 1 (Valve ID: **R_EV_RCS_1**)

Bit 2	**RCS valve 1 Command**
0	VALVE OPEN
1	VALVE CLOSE

S.No.	Parameter ID	Parameter Description	Data Bit no	RCS Valve ID	Valve Description	Frequency	Data Type
1	P_CMD_RCS	Commanded RCS	Bit 0	R_EV_RCS_1	Command given to RCS	100	Digital

		Valve State			valve 1		
2	P_CMD_RCS	Commanded RCS Valve State	Bit 1	R_EV_RCS_2	Command given to RCS valve 2	100	Digital
3	P_CMD_RCS	Commanded RCS Valve State	Bit 2	R_EV_RCS_3	Command given to RCS valve 3	100	Digital
4	P_CMD_RCS	Commanded RCS Valve State	Bit 3	R_EV_RCS_4	Command given to RCS valve 4	100	Digital
5	P_CMD_RCS	Commanded RCS Valve State	Bit 4 to Bit 7	-	Reserved	100	-

9.6.4. 10 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_14	**Parameter-167.1 ID**	P_CDT_Time_14	CDT Timer Value with GNC data @10 Hz	32	int32_t	10
ETH_14	**Parameter-93 ID**	P_CMD_Q1	Commanded Quaternion q1	32	float	10
ETH_14	**Parameter-94 ID**	P_CMD_Q2	Commanded Quaternion q2	32	float	10
ETH_14	**Parameter-95 ID**	P_CMD_Q3	Commanded Quaternion q3	32	float	10
ETH_14	**Parameter- 168 ID**	P_Delta_Q1	Delta Quaternion q1 body error	32	float	10
ETH_14	**Parameter- 169 ID**	P_Delta_Q2	Delta Quaternion q2 body error	32	float	10
ETH_14	**Parameter- 170 ID**	P_Delta_Q3	Delta Quaternion q3 body error	32	float	10

9.6.4.1. Data Format:

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
Parameter Data [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

lsb

Bit 31 to Bit 0 : Parameter Data

Note : CDT value is in millisecond (ms). It basically gives counter value.

9.6.5. 4 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_15	Parameter-96 ID	P_FC_TS	Health parameter (Temperature) for Flight Computer	8	uint8_t	4
ETH_15	Parameter-97 ID	P_FC_CS	Health parameter (Current) for Flight Computer	8	uint8_t	4
ETH_15	Parameter-98 ID	P_FC_VS	Health parameter (Voltage) for Flight Computer	8	uint8_t	4

9.6.5.1. Data Format:

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [7:0]							

Bit 7 to Bit 0 : Parameter Data

9.6.6. 1 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_16	Parameter-99 ID	P_RESERVED_1	Reserved	8	uint8_t	1
ETH_16	Parameter-100 ID	P_RESERVED_2	Reserved	8	uint8_t	1
ETH_16	Parameter-101 ID	P_GNSS_PPS	GNSS pulse signal	8	uint8_t	1
ETH_16	Parameter-102 ID	P_GNSS_GGA_LAT	GNSS GGA : Datum corrected Latitude	32	uint32_t	1
ETH_16	Parameter-103 ID	P_GNSS_GGA_LONG	GNSS GGA : Datum corrected Longitude	32	uint32_t	1
ETH_16	Parameter-104 ID	P_GNSS_GGA_QI&HDOP	GNSS GGA : Quality indicator & HDOP	16	uint16_t	1
ETH_16	Parameter-105 ID	P_GNSS_GGA_ALT	GNSS GGA : Datum and mean sea corrected altitude	32	uint32_t	1
ETH_16	Parameter-106 ID	P_GNSS_GGA_GEOSEP	GNSS GGA : Geoidal separation (mean sea corrections)	16	uint16_t	1
ETH_16	Parameter-107 ID	P_GNSS_VTG_SP&MI	GNSS VTG : Speed over ground in Km/hr & Mode	32	uint32_t	1

			indicator			
ETH_16	**Parameter-108 ID**	P_GNSS_GLL_LAT	GNSS GLL : Datum corrected Latitude	32	uint32_t	1
ETH_16	**Parameter-109 ID**	P_GNSS_GLL_LONG	GNSS GLL : Datum corrected Longitude	32	uint32_t	1
ETH_16	**Parameter-110 ID**	P_GNSS_GLL_UTC	GNSS GLL : UTC Timestamp	32	uint32_t	1
ETH_16	**Parameter-111 ID**	P_GNSS_GLL_STAT&MI	GNSS GLL : Status: Data valid or not valid Mode indicator : Autonomous , GNSS solution with corrections from SBAS satellites & Data not valid	8	uint8_t	1
ETH_16	**Parameter-112 ID**	P_GNSS_GSA_MODE	GNSS GSA : Mode indicator	8	uint8_t	1
ETH_16	**Parameter-113 ID**	P_GNSS_GSA_PRN_1	GNSS GSA : PRN number of satellite used for position fix	32	uint32_t	1
ETH_16	**Parameter-114 ID**	P_GNSS_GSA_PRN_2	GNSS GSA : PRN number of satellite used for position fix	32	uint32_t	1
ETH_16	**Parameter-115 ID**	P_GNSS_GSA_DOPVAL	GNSS GSA : PDOP, HDOP, VDOP values	32	uint32_t	1
ETH_16	**Parameter-116 ID**	P_GNSS_ECEF_UTC	GNSS: UTC Time in ECEF Frame	32	uint32_t	1
ETH_16	**Parameter-117.0 ID**	P_GNSS_ECEF_FHPOS_X	GNSS : position (X axis) in ECEF Frame (First half 32 bit)	32	int32_t	1
ETH_16	**Parameter-117.1 ID**	P_GNSS_ECEF_LHPOS_X	GNSS : position (X axis) in ECEF Frame (Last half 32 bit)	32	int32_t	1
ETH_16	**Parameter-118.0 ID**	P_GNSS_ECEF_FHPOS_Y	GNSS : position (Y axis) in ECEF Frame (First half 32 bit)	32	int32_t	1
ETH_16	**Parameter-118.1 ID**	P_GNSS_ECEF_LHPOS_Y	GNSS : position (Y axis) in ECEF Frame (Last half 32 bit)	32	int32_t	1
ETH_16	**Parameter-119.0 ID**	P_GNSS_ECEF_FHPOS_Z	GNSS : position (Z axis) in ECEF Frame (First half 32 bit)	32	int32_t	1
ETH_16	**Parameter-119.1 ID**	P_GNSS_ECEF_LHPOS_Z	GNSS : position (Z axis) in ECEF Frame (Last half 32 bit)	32	int32_t	1
ETH_16	**Parameter-120 ID**	P_GNSS_ECEF_VEL_X	GNSS : velocity (X axis) in ECEF Frame	32	int32_t	1
ETH_16	**Parameter-121 ID**	P_GNSS_ECEF_VEL_Y	GNSS : velocity (Y axis) in ECEF Frame	32	int32_t	1
ETH_16	**Parameter-122 ID**	P_GNSS_ECEF_VEL_Z	GNSS : velocity (Z axis) in ECEF Frame	32	int32_t	1
ETH_16	**Parameter-123 ID**	P_G1_P	Control gain constant - (Pitch)	32	float	1

ETH_16	**Parameter-124 ID**	P_G2_P	Control gain constant - (Pitch)	32	float	1
ETH_16	**Parameter-125 ID**	P_G1_Y	Control gain constant - 1 (Yaw)	32	float	1
ETH_16	**Parameter-126 ID**	P_G2_Y	Control gain constant - 2 (Yaw)	32	float	1
ETH_16	**Parameter-127 ID**	P_IMUT_GYRO-X	IMU Gyroscope X-axis temperature data	32	float	1
ETH_16	**Parameter-128 ID**	P_IMUT_GYRO-Z	IMU Gyroscope Z- axis temperature data	32	float	1
ETH_16	**Parameter-129 ID**	P_IMUT_INCLN-X	IMU Inclinometer X- axis temperature data	32	float	1
ETH_16	**Parameter-130 ID**	P_IMUT_INCLN-Y	IMU Inclinometer Y- axis temperature data	32	float	1
ETH_16	**Parameter-131 ID**	P_IMUT_INCLN-Z	IMU Inclinometer Z- axis temperature data	32	float	1
ETH_16	**Parameter-132 ID**	P_IMUT_ACC-X	IMU Accelerometer X- axis temperature data	32	float	1
ETH_16	**Parameter-133 ID**	P_IMUT_ACC-Y	IMU Accelerometer Y- axis temperature data	32	float	1
ETH_16	**Parameter-134 ID**	P_IMUT_ACC-Z	IMU Accelerometer Z- axis temperature data	32	float	1

9.6.6.1. Data Format:

- For Parameter-99 ID (P_IMUT_M), Parameter-100 ID (P_IMUV_M) & Parameter-101 ID (P_GNSS_PPS) :

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [7:0]							

Bit 7 to Bit 0 : Parameter Data

Note : For GNSS GGA Message :

GGA Message	Field	Parameter Data Format	Prescaler	Actual Data (Param Data / prescaler)
GNSS_GGA_LAT	Latitude	xxxxxxxx	10,000	xxxx.xxxx
GNSS_GGA_LONG	Longitude	yyyyyyyyy	10,000	yyyyy.yyyy
GNSS_GGA_QI&HDOP	QI - Quality Indicator	q	1	q
	HDOP - Horizontal Dilution Of Precision	hhh	10	hh.h

GNSS_GGA_ALT	Altitude (s = Altitude sign (+/-)) {s = 0 (+ve) or s = 1 (-ve)}	saaaaaaaaa	100	aaaaaaa.aa
GNSS_GGA_GEOSEP	Geoidal separation (s = +/- sign)	sbbbb	10	bbb.b

- For Parameter-102 ID (P_GNSS_GGA_LAT)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
a	P_GNSS_GGA_LAT [31:16]														
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
P_GNSS_GGA_LAT [15:0]															

lsb

Bit 31 : ‘a’ signify latitude direction

Bit 31	**"a"**
0	North
1	South

Bit 30 to Bit 0 : GNSS GGA Message Latitude (refer above GGA **Note section**)

- For Parameter-103 ID (P_GNSS_GGA_LONG)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
b	P_GNSS_GGA_LONG [31:16]														
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
P_GNSS_GGA_LONG [15:0]															

lsb

Bit 31 : ‘b’ signify longitude direction

Bit 31	**"b"**
0	East
1	West

Bit 30 to Bit 0 : GNSS GGA Message Longitude (refer above GGA **Note section**)

- For Parameter-104 ID (P_GNSS_GGA_QI&HDOP)

msb **lsb**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
GGA_QI [15:10]						GGA_HDOP [9:0]									

Bit 15 to Bit 10 : GNSS GGA message Quality Indicator

QI value (Bit 15 to Bit 10)	**Description**
0	No fix
1	GNSS Fix Available without SBAS corrections
2	GNSS Fix Available with SBAS corrections
x	Invalid Data

Bit 9 to Bit 0 : GNSS GGA Message Horizontal Dilution Of Precision. (HDOP) (refer above GGA **Note section**)

- For Parameter-105 ID (P_GNSS_GGA_ALT)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
s	P_GNSS_GGA_ALT [31:16]														
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
P_GNSS_GGA_ALT [15:0]															

lsb

Bit 31 : s = Altitude sign (+/-)

Bit 31	**"s" indicates**
0	positive altitude value
1	negative altitude value

Bit 31 to Bit 10 : GNSS GGA Message Altitude (refer above GGA **Note section**)

- For Parameter-106 ID (P_GNSS_GGA_GEOSEP)

msb **lsb**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
s	P_GNSS_GGA_GEOSEP [31:16]														

Bit 15 : s = Geoidal separation sign (+/-)

Bit 15	"s" indicates
0	positive Geoidal separation value
1	negative Geoidal separation value

Bit 14 to Bit 0 : GNSS GGA Message Altitude (refer above GGA **Note section**)

Note : For GNSS VTG Message :

VTG Message	Field	Parameter Data Format	Prescaler	Actual Data (Param Data / prescaler)
GNSS_VTG_SP&MI	Speed	sssssss	100	sssss.ss
	Mode Indicator	a	1	a

- For Parameter-107 ID (P_GNSS_VTG_SP&MI)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
MI [31:30]		VTG_SPEED [29:16]													
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
VTG_SPEED [15:0]															

lsb

Bit 31 to Bit 30 : MI - Mode Indicator

MI (Bit 31 to Bit 30)	Description
0	Invalid
1	Autonomous mode
2	GNSS solution with corrections from SBAS satellites
3	Data not valid.

Bit 29 to Bit 0 : GNSS VTG Message Speed (refer above VTG **Note section**)

Note : For GNSS GLL Message :

GLL Message	Field	Parameter Data Format	Prescaler	Actual Data (Param Data / prescaler)
GNSS_GLL_LAT	Latitude	xxxxxxxx	10,000	xxxx.xxxx
GNSS_GLL_LONG	Longitude	yyyyyyyyy	10,000	yyyyy.yyyy
GNSS_GLL_UTC	UTC Time	hhmmssss	100	hhmmss.ss
GNSS_GLL_STAT&MI	STATUS	a	1	a
	Mode Indicator (MI)	b	1	b

- For Parameter-108 ID (P_GNSS_GLL_LAT)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
a	P_GNSS_GLL_LAT [31:16]														
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
P_GNSS_GLL_LAT [15:0]															

lsb

Bit 31 : 'a' signify latitude direction

Bit 31	"a"
0	North
1	South

Bit 30 to Bit 0 : GNSS GLL Message Latitude (refer above GLL **Note section**)

- For Parameter-109 ID (P_GNSS_GLL_LONG)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
b	P_GNSS_GLL_LONG [31:16]														
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
P_GNSS_GLL_LONG [15:0]															

lsb

Bit 31 : 'b' signify longitude direction

Bit 31	"b"
0	East
1	West

Bit 30 to Bit 0 : GNSS GLL Message Longitude (refer above GLL **Note section**)

- For Parameter-110 ID (P_GNSS_GLL_UTC)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
P_GNSS_GLL_UTC [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
P_GNSS_GLL_UTC [15:0]															

lsb

Bit 31 to Bit 0 : GNSS GLL Message UTC Time of position fix (refer above GLL **Note section**)

- For Parameter-111 ID (P_GNSS_GLL_STAT&MI)

msb

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved [8:3]						MI [2:1]		STATUS

lsb

Bit 8 to Bit 3 : Reserved bits

Bit 2 to Bit 1 : GNSS GLL Message Mode Indicator (MI) (refer above GLL **Note section**)

MI (Bit 2 to Bit 1)	Description
0	Invalid
1	Autonomous mode
2	GNSS solution with corrections from SBAS satellites
3	Data not valid.

Bit 0 : GNSS GLL Message Status of GLL Data (refer above GLL **Note section**)

Bit 0	STATUS
0	Data valid
1	Data Not valid

Note : For GNSS GSA Message :

GSA Message	Field	Parameter Data Format	Prescaler	Actual Data (Param Data / prescaler)
GNSS_GSA_MODE	Mode of operation	a	1	a
	Mode Indicator (MI)	b	1	b
GNSS_GSA_PRN_1	PRN no. of Satellite 1 to 6	c	1	c

GNSS_GSA_PRN_2	PRN no. of Satellite 6 to 12	c	1	c
GNSS_GSA_DOPVAL	PDOP	ppp	10	pp.p
	HDOP	hhh	10	hh.h
	VDOP	vvv	10	vv.v

- For Parameter-112 ID (P_GNSS_GSA_MODE)

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
a	MI [6:0]						

Bit 7 : Mode of operation could be manual or automatic

Mode Bit 7	"a" Description
0	Automatic mode
1	Manual mode

Bit 6 to Bit 0 : Mode indicator

MI (Bit 6 to Bit 0)	Description
0	Fix not available
1	2D position fix or Altitude hold mode
2	3D position fix.
x	Invalid

- For Parameter-113 ID (P_GNSS_GSA_PRN_1)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
GNSYS_ID [31:30]		s1 [29:25]					s2 [24:20]					s3 [19:15]			
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
s3	s4 [14:10]					s5 [9:5]					s6 [4:0]				

lsb

Bit 31 to Bit 30 : GNSS System / Constellation ID

GNSYS_ID (Bit 31 to Bit 30)	Description
0	GPS
1	GLONASS
2	SBAS

3	NavIC

Bit 29 to Bit 0: Satellite Identification

Max 12 satellite used for position fix:

1. GPS : Satellite Identification value = PRN value = 1 to 32
2. GLONASS : Satellite Identification value = 1 to 32
   SV ID = Satellite Identification value + 64 = 65 to 96
3. SBAS : Satellite Identification value = 1 to 19 ;
   SV ID = Satellite Identification value + 32 = 33 to 51
   PRN number = SV ID + 87
4. NavIC (IRNSS) : Satellite Identification value = PRN value = 1 to 15

Allocated Bits		**Range of Satellite number**			
	GNSYS_ID ->	0	1	2	3
	Satellite used for pos fix	**GPS**	**GLONASS**	**SBAS**	**NavIC (IRNSS)**
Bit 29 to Bit 25	s1	1 to 32	1 to 32	1 to 19	1 to 15
Bit 24 to Bit 20	s2	1 to 32	1 to 32	1 to 19	1 to 15
Bit 19 to Bit 15	s3	1 to 32	1 to 32	1 to 19	1 to 15
Bit 14 to Bit 10	s4	1 to 32	1 to 32	1 to 19	1 to 15
Bit 9 to Bit 5	s5	1 to 32	1 to 32	1 to 19	1 to 15
Bit 4 to Bit 0	s6	1 to 32	1 to 32	1 to 19	1 to 15

- For Parameter-114 ID (P_GNSS_GSA_PRN_2)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
GNSYS_ID [31:30]		s7 [29:25]					s8 [24:20]					s9 [19:15]			
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
s3	s10 [14:10]					s11 [9:5]					s12 [4:0]				

lsb

Bit 31 to Bit 30 : GNSS System / Constellation ID

GNSYS_ID (Bit 31 to Bit 30)	**Description**
0	GPS
1	GLONASS

2	SBAS
3	NavIC

Bit 29 to Bit 0: Satellite Identification

Max 12 satellite used for position fix:

5. GPS : Satellite Identification value = PRN value = 1 to 32
6. GLONASS : Satellite Identification value = 1 to 32

   SV ID = Satellite Identification value + 64 = 65 to 96
7. SBAS : Satellite Identification value = 1 to 19 ;

   SV ID = Satellite Identification value + 32 = 33 to 51

   PRN number = SV ID + 87
8. NavIC (IRNSS) : Satellite Identification value = PRN value = 1 to 15

Allocated Bits		**Range of Satellite number**			
	GNSYS_ID ->	0	1	2	3
	Satellite used for pos fix	**GPS**	**GLONASS**	**SBAS**	**NavIC (IRNSS)**
Bit 29 to Bit 25	s7	1 to 32	1 to 32	1 to 19	1 to 15
Bit 24 to Bit 20	s8	1 to 32	1 to 32	1 to 19	1 to 15
Bit 19 to Bit 15	s9	1 to 32	1 to 32	1 to 19	1 to 15
Bit 14 to Bit 10	s10	1 to 32	1 to 32	1 to 19	1 to 15
Bit 9 to Bit 5	s11	1 to 32	1 to 32	1 to 19	1 to 15
Bit 4 to Bit 0	s12	1 to 32	1 to 32	1 to 19	1 to 15

- For Parameter-115 ID (P_GNSS_GSA_DOPVAL)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
GNSYS_ID [31:30]		GSA PDOP [29:20]										GSA HDOP [19:16]			
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
GSA HDOP [16:10]						GSA VDOP [9:0]									

lsb

Bit 31 to Bit 30 : GNSS System / Constellation ID

GNSYS_ID (Bit 31 to Bit 30)	**Description**

0	GPS
1	GLONASS
2	SBAS
3	NavIC

Bit 29 to Bit 20 : PDOP value (refer above GSA **Note section**)

Bit 19 to Bit 10 : HDOP value (refer above GSA **Note section**)

Bit 9 to Bit 0 : VDOP value (refer above GSA **Note section**)

Note : For GNSS ECEF Message

ECEF Message	Field	Parameter Data Format	Prescaler	Actual Data (Param Data / prescaler)
GNSS_ECEF_UTC	UTC Time in ECEF Frame	hhmmssss	100	hhmmss.ss
GNSS_ECEF_POS_X	64 Bit position - X axis	sxxxxxxxxxx	100	sxxxxxxxx.xx
GNSS_ECEF_POS_Y	64 Bit position - Y axis	syyyyyyyyyy	100	syyyyyyyy.yy
GNSS_ECEF_POS_Z	64 Bit position - Z axis	szzzzzzzzzz	100	szzzzzzzz.zz
GNSS_ECEF_VEL_X	32 Bit velocity - X axis	sxxxxxxxx	100	sxxxxxx.xx
GNSS_ECEF_VEL_Y	32 Bit velocity - Y axis	syyyyyyyy	100	syyyyyy.yy
GNSS_ECEF_VEL_Z	32 Bit velocity - Z axis	szzzzzzzz	100	szzzzzz.zz

Note:
In the above fields data ‘s’ represents the sign (+/-) bit.

64 bit GNSS_ECEF_POS_X :

1. GNSS_ECEF_POS_X [63:32] = P_GNSS_ECEF_FHPOS_X [31:0] (parameter data)
2. GNSS_ECEF_POS_X [31:0] = P_GNSS_ECEF_LHPOS_X [31:0] (parameter data)

64 bit GNSS_ECEF_POS_Y :

3. GNSS_ECEF_POS_Y [63:32] = P_GNSS_ECEF_FHPOS_Y [31:0] (parameter data)
4. GNSS_ECEF_POS_Y [31:0] = P_GNSS_ECEF_LHPOS_Y [31:0] (parameter data)

64 bit GNSS_ECEF_POS_Z :

5. GNSS_ECEF_POS_Z [63:32] = P_GNSS_ECEF_FHPOS_Z [31:0] (parameter data)
6. GNSS_ECEF_POS_Z [31:0] = P_GNSS_ECEF_LHPOS_Z [31:0] (parameter data)

- 32 bit Parameter Data format applicable for Parameter-116 ID to Parameter-122 ID .

msb

Bit	Bit	Bit	Bit	Bit	Bit	Bit	Bit	Bit	Bit	Bit	Bit	Bit	Bit	Bit	Bit

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Parameter Data [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

lsb

Bit 31 to Bit 0 : Parameter Data.

a. For Parameter-116 ID (P_GNSS_ECEF_UTC) (refer above ECEF **Note section**)
b. For Parameter-117.0 ID (P_GNSS_ECEF_FHPOS_X) & Parameter-117.1 ID (P_GNSS_ECEF_LHPOS_X) refer above ECEF **Note section.**
c. For Parameter-118.0 ID (P_GNSS_ECEF_FHPOS_Y) & Parameter-118.1 ID (P_GNSS_ECEF_LHPOS_Y) refer above ECEF **Note section.**
d. For Parameter-119.0 ID (P_GNSS_ECEF_FHPOS_Z) & Parameter-119.1 ID (P_GNSS_ECEF_LHPOS_Z) refer above ECEF **Note section.**
e. For Parameter-120 ID (P_GNSS_ECEF_VEL_X) refer above ECEF **Note section.**
f. For Parameter-121 ID (P_GNSS_ECEF_VEL_Y) refer above ECEF **Note section.**
g. For Parameter-122 ID (P_GNSS_ECEF_VEL_Z) refer above ECEF **Note section.**

- 32 bit Parameter Data format applicable for Parameter-123 ID to Parameter-134 ID .

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
Parameter Data [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

lsb

Bit 31 to Bit 0 : Parameter Data.

9.6.7. 1000 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_17	**Parameter-135 ID**	P_FC_FAULT_STATUS	Fault ID raised by Flight Computer	8	uint8_t	1000
ETH_17	**Parameter-136 ID**	P_FC_STATUS	Flight Computer send status like GO-NO GO status, ALS feedback, LMP status sent by flight computer comes under this parameter.	32	uint32_t	1000

9.6.7.1. Data Format:

- 8 bit Fault ID : Range of Fault ID - 1 to 255

(The exact list of Fault IDs with description will be shared later.)

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Fault ID [7:0]							

Bit 7 to Bit 0 : 8 bit Fault ids raised by Flight computer

- 32 bit Flight computer Status ID : The exact list of Status IDs with description will be shared later.

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
STATUS ID [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
STATUS ID [15:0]															

lsb

Bit 31 to Bit 0 : 32 bitFlight Computer Status ID

9.6.8. 50 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_18	**Parameter-137 ID**	P_FC_SEQ	There are several sequences run by a flight computer. Sequence ID or particular sequence is generated by FC and send to respective computer for execution ; same sequence id with timestamp is captured by telemetry unit also	8	uint8_t	50
ETH_18	**Parameter-138 ID**	P_CMD_FC	Any command ID send by Flight Computer to respective computers	8	uint8_t	50
ETH_18	**Parameter-139 ID**	P_FC_SEQ_FB	Reserved 32 bit parameter for Flight Computer	32	uint32_t	50
ETH_18	**Parameter-140 ID**	P_FC_CMD_FB	Reserved 32 bit parameter for Flight Computer	32	uint32_t	50
ETH_18	**Parameter-141 ID**	P_CDT_Time_18	CDT Timer Value with IMU data @50 Hz (counter value in ms)	32	int32_t	50
ETH_18	**Parameter-142 ID**	P_FC_AUX_STATUS	Avionics packages Power status , File uploading & downloading status & phase ids	32	uint32_t	50

9.6.8.1. Data Format:

- 8 bit Data : Parameter-137 ID & Parameter-138 ID

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [7:0]							

Bit 7 to Bit 0 : Parameter Data (refer above table for respective Parameter ID)

- 32 bit Data : Parameter-139 ID to Parameter-142 ID

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
Parameter Data [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

lsb

Bit 31 to Bit 0 : 32 bit parameter data

9.7. Payload Package: Payload Computer

9.7.1. 500 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_19	Parameter-143 ID	P_IMUR-X_PLD	Payload : Vehicle Angular rate data (X-axis) in Body Frame - Redundant IMU	32	float	500
ETH_19	Parameter-144 ID	P_IMUR-Y_PLD	Payload : Vehicle Angular rate data (Y-axis) in Body Frame - Redundant IMU	32	float	500
ETH_19	Parameter-145 ID	P_IMUR-Z_PLD	Payload : Vehicle Angular rate data (Z-axis) in Body Frame - Redundant IMU	32	float	500
ETH_19	Parameter-146 ID	P_IMUA-X_PLD	Payload : Vehicle Acceleration (X-axis) in Body Frame - Redundant IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	float	500
ETH_19	Parameter-147 ID	P_IMUA-Y_PLD	Payload : Vehicle Acceleration (Y-axis) in Body Frame - Redundant IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	float	500
ETH_19	Parameter-148 ID	P_IMUA-Z_PLD	Payload : Vehicle Acceleration (Z-axis) in Body Frame - Redundant IMU (with reference to 1 g = 9.80665 m/s^2, Standard Gravity)	32	float	500
ETH_19	Parameter-149 ID	P_IMU_STATUS _PLD	Payload : IMU status bytes for gyro, accelerometer , inclinometer & Temperature ic status	32	uint32_t	500

9.7.1.1. Data Format:

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
Parameter Data [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

lsb

Bit 31 to Bit 0 : Parameter Data of parameters mentioned in above list.

9.7.2. 100 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_20	Parameter-150 ID	P_GNC_POS-X_PLD	Vehicle position (X axis) in LPI Frame calculated by Payload	32	float	100
ETH_20	Parameter-151 ID	P_GNC_POS-Y_PLD	Vehicle position (Y axis) in LPI Frame calculated by Payload	32	float	100
ETH_20	Parameter-152 ID	P_GNC_POS-Z_PLD	Vehicle position (Z axis) in LPI Frame calculated by Payload	32	float	100
ETH_20	Parameter-153 ID	P_GNC_VEL-X_PLD	Vehicle velocity (X-axis) in LPI Frame calculated by Payload	32	float	100
ETH_20	Parameter-154 ID	P_GNC_VEL-Y_PLD	Vehicle velocity (Y-axis) in LPI Frame calculated by Payload	32	float	100
ETH_20	Parameter-155 ID	P_GNC_VEL-Z_PLD	Vehicle velocity (Z-axis) in LPI Frame calculated by Payload	32	float	100
ETH_20	Parameter-156 ID	P_GNC_Q1_PLD	Vehicle measured Quaternion q1	32	float	100
ETH_20	Parameter-157 ID	P_GNC_Q2_PLD	Vehicle measured quaternion q2	32	float	100
ETH_20	Parameter-158 ID	P_GNC_Q3_PLD	Vehicle measured quaternion q3	32	float	100
ETH_20	Parameter-159 ID	P_GNC_Q0_PLD	Vehicle measured quaternion q0	32	float	100
ETH_20	Parameter-160 ID	P_NAV_IMUCOUNT_PLD	Counter of the IMU Datagram used	32	uint32_t	100
ETH_20	Parameter-161 ID	P_GUID_IMUCOUNT_PLD	Total IMU packet counts used for Guidance time	32	uint32_t	100

9.7.2.1. Data Format:

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
Parameter Data [31:16]															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [15:0]															

lsb

Bit 301 to Bit 0: Parameter Data of parameters mentioned in above list.

9.7.3. 4 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_21	Parameter-162 ID	P_IMUT_GYRO-X_PLD	IMU Gyroscope X-axis Temperature data for Payload	8	uint8_t	4
ETH_21	Parameter-163 ID	P_IMUT_GYRO-Y_PLD	IMU Gyroscope Y-axis Temperature data for Payload	8	uint8_t	4
ETH_21	Parameter-164 ID	P_IMUT_GYRO-Z_PLD	IMU Gyroscope Z-axis Temperature data for Payload	8	uint8_t	4

9.7.3.1. Data Format:

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [7:0]							

Bit 7 to Bit 0 : Parameter Data

9.7.4. 1 Hz frequency data:

S.No.	Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
ETH_22	Parameter-165 ID	P_PLD_STATUS	Payload Status bits	8	uint8_t	1
ETH_22	Parameter-166 ID	P_PLD_FAULT_STATUS	Payload Fault Status	8	uint8_t	1

9.7.4.1. Data Format:

msb **lsb**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter Data [7:0]							

Bit 7 to Bit 0 : Parameter Data

Note : Payload Status & Fault status details share later

9.8. Telemetry Processing Unit: Telemetry Computer

9.8.1. Telemetry Health Parameters:

Parameter ID Designator	Parameter ID	Description	Data Size (in bits)	Data Type	Frequency (Hz)
BCU_3.3V Data	P_TMPCU_P3.3V data	Health parameter: 3.3V of Telemetry Processing Unit	16	uint16_t	2
BCU_5V Data	P_TMPCU_P5V data	Health parameter: 5V of Telemetry Processing Unit	16	uint16_t	2
BCU_P8V Data	P_TMPCU_P8V data	Health parameter: +8V of Telemetry Processing Unit	16	uint16_t	2
BCU_N8V Data	P_TMPCU_N8V data	Health parameter: -8V of Telemetry Processing Unit	16	uint16_t	2
BCU_Temperature Data	P_TMPCU_TEMP data	Health parameter: Temperature of Telemetry Processing Unit	16	uint16_t	2
BCU_PWRUP_COUNT	P_TMPCU_PWRUP_COUNT data	Health parameter: power up count of Telemetry Processing Unit	16	uint16_t	2

9.8.2. Video Data in PCM Frame:

Block 1----------> PCM Word Address : 424
No of Occurrences : 5
Block 2----------> PCM Word Address : 444
No of Occurrences : 46
Block 3----------> PCM Word Address : 604
No of Occurrences : 8
Block 4----------> PCM Word Address : 639
No of Occurrences : 34
Block 5----------> PCM Word Address : 688
No of Occurrences : 46
Block 6----------> PCM Word Address : 833
No of Occurrences : 23
Block 7----------> PCM Word Address : 883
No of Occurrences : 34
Block 8----------> Word Address : 932
No of Occurrences : 39

10. IMU Status: (P_IMU_STATUS_M & P_IMU_STATUS_PLD)

msb

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
Gyrometer Status								Accelerometer Status							
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Inclinometer Status								Temperature error							

lsb

Bit 31 to Bit 24:

Bits	Gyroscope STATUS bit Information	Comment
Bit 24	0=OK, 1=X-channel	Bits 0-2 will flag the overload channel(s) Bits 0-2 will flag the error channel(s)
Bit 25	0=OK, 1=Y-channel	
Bit 26	0=OK, 1=Z-channel	
Bit 27	0=OK, 1=Error in measurement-channel	
Bit 28	0=OK, 1=Overload	
Bit 29	0=OK, 1=Outside operating conditions	
Bit 30	0=OK, 1=Start-Up	
Bit 31	0=OK, 1=System integrity error	

Bit 23 to Bit 16:

Bits	Accelerometer STATUS bit Information	Comment
Bit 16	0=OK, 1=X-channel	Bits 0-2 will flag the overload channel(s) Bits 0-2 will flag the error channel(s)
Bit 17	0=OK, 1=Y-channel	
Bit 18	0=OK, 1=Z-channel	
Bit 19	0=OK, 1=Error in measurement-channel	
Bit 20	0=OK, 1=Overload	
Bit 21	0=OK, 1=Outside operating conditions	
Bit 22	0=OK, 1=Start-Up	
Bit 23	0=OK, 1=System integrity error	

Bit 15 to Bit 8:

Bits	Inclinometer STATUS bit Information	Comment
Bit 8	0=OK, 1=X-channel	Bits 0-2 will flag the overload channel(s) Bits 0-2 will flag the error channel(s)
Bit 9	0=OK, 1=Y-channel	
Bit 10	0=OK, 1=Z-channel	
Bit 11	0=OK, 1=Error in measurement-channel	
Bit 12	0=OK, 1=Overload	
Bit 13	0=OK, 1=Outside operating conditions	
Bit 14	0=OK, 1=Start-Up	
Bit 15	0=OK, 1=System integrity error	

Bit 7 to Bit 0: Temperature error

Bits	Temperature sensor STATUS bit Information	Comment
Bit 8	0=OK, 1=X-channel	Bits 0-2 will flag the overload channel(s) Bits 0-2 will flag the error channel(s)
Bit 9	0=OK, 1=Y-channel	
Bit 10	0=OK, 1=Z-channel	
Bit 11	0=OK, 1=Error in measurement-channel	
Bit 12	0=OK, 1=Overload	
Bit 13	0=OK, 1=Outside operating conditions	
Bit 14	0=OK, 1=Start-Up	
Bit 15	0=OK, 1=System integrity error	

11. Gimbal Actuators Status : P_EMGA_STATUS_V1.0

ETH_7	**Parameter-60 ID**	P_EMGA_STATUS	Gimbal Actuator health status and error	32	uint32_t	100

Pitch & Yaw Gimbal Actuator Status					
Parameter ID Designator	**Parameter ID**	**Description**	**Data Size**	**Bit no.**	**Status Description**
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	0	Relative Humidity sensor value greater than threshold "ovHumi"
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	1	Temperature sensor value greater than threshold "ovTemp"
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	2	Emergency shutdown condition met, motor disabled
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	3	Supply voltage is greater than upper limit
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	4	Actuator position is beyond retracted limit "spMin"
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	5	Actuator position is beyond extended limit "spMax"
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	6	Actuator has run against retracted physical stop
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	7	Actuator has run against extended physical stop
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	8	Supply voltage has been below the lower limit
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	9	Supply voltage has been above the upper limit
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	10	Bridge driver fault has occurred
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	11	HARDWARE.TXT contained errors upon startup
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	12	CONFIG.TXT contained errors upon startup
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	13	Critical errors found in configuration files, motor disabled
Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	14	Supply voltage is lower than lower limit

Parameter-60 ID	P_EMGA_STATUS	Pitch Gimbal Actuator health status & error	uint32_t	15	Error caused CPU warm reset
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	16	Relative Humidity sensor value greater than threshold "ovHumi"
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	17	Temperature sensor value greater than threshold "ovTemp"
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	18	Emergency shutdown condition met, motor disabled
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	19	Supply voltage is greater than upper limit
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	20	Actuator position is beyond retracted limit "spMin"
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	21	Actuator position is beyond extended limit "spMax"
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	22	Actuator has run against retracted physical stop
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	23	Actuator has run against extended physical stop
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	24	Supply voltage has been below the lower limit
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	25	Supply voltage has been above the upper limit
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	26	Bridge driver fault has occurred
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	27	HARDWARE.TXT contained errors upon startup
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	28	CONFIG.TXT contained errors upon startup
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	29	Critical errors found in configuration files, motor disabled
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	30	Supply voltage is lower than lower limit
Parameter-60 ID	P_EMGA_STATUS	Yaw Gimbal Actuator health status & error	uint32_t	31	Error caused CPU warm reset

12. Parameters ID values allocation (Parameter IDs V2.4) :

ETH Channel	Parameter String	Parameter Enum
ETH_2	P_VALS_IGS	2
ETH_4	P_TTPS_2	3
ETH_4	P_ITSM_A1	4
ETH_4	P_ITSM_A2	5
ETH_4	P_ITSM_A3	6
ETH_4	P_ITSM_A4	7
ETH_4	P_ITSM_A5	8
ETH_4	P_ITSM_A6	9
ETH_4	P_ITSM_A7	10
ETH_4	P_SARBM_A1	11
ETH_4	P_ITSR_A1	12
ETH_4	P_ITSR_A2	13
ETH_4	P_ITSR_A3	14
ETH_4	P_ITSR_A4	15
ETH_4	P_ITSR_A5	16
ETH_4	P_ITSR_A6	17
ETH_4	P_ITSR_A7	18
ETH_4	P_SARBR_A1	19
ETH_4	P_ITSM_A8	20
ETH_4	P_ITSR_A8	21
ETH_4	P_DESTM	22
ETH_4	P_DESTR	23
ETH_4	P_AB_TS	24
ETH_4	P_AB_VS	25
ETH_7	P_EMGAV_P_E1	26
ETH_7	P_EMGAA_P_E1	27
ETH_7	P_EMGAT_P_E1	28
ETH_7	P_EMGAV_Y_E1	29

ETH_7	P_EMGAA_Y_E1	30
ETH_7	P_EMGAT_Y_E1	31
ETH_8	P_EC_TS	32
ETH_8	P_EC_CS	33
ETH_8	P_EC_VS	34
ETH_9	P_EC_SEQ	35
ETH_9	P_CMD_EC	36
ETH_9	P_EC_SEQ_FB	37
ETH_10	P_EC_FAULT_STATUS	38
ETH_13	P_CMD_RCS	39
ETH_15	P_FC_TS	40
ETH_15	P_FC_CS	41
ETH_15	P_FC_VS	42
ETH_16	P_RESERVED_1	43
ETH_16	P_RESERVED_2	44
ETH_16	P_GNSS_PPS	45
ETH_16	P_GNSS_GLL_STAT_n_MI	46
ETH_16	P_GNSS_GSA_MODE	47
ETH_17	P_FC_FAULT_STATUS	48
ETH_18	P_FC_SEQ	49
ETH_18	P_CMD_FC	50
ETH_21	P_IMUT_GYRO-X_PLD	51
ETH_21	P_IMUT_GYRO-Y_PLD	52
ETH_21	P_IMUT_GYRO-Z_PLD	53
ETH_22	P_PLD_STATUS	54
ETH_22	P_PLD_FAULT_STATUS	55
None	P_FILE_CMD	56
None	P_CMD_CRIO	57
None	Reserved id	58
None	P_SEQ_CRIO_FB	59
None	Reserved id	60
ETH_1	P_C_PT_LOX_inj	100
ETH_1	P_F_PT_ATF_inj	101

ETH_1	P_E_PT_CC_1	**102**
ETH_1	P_M_PT_inj	**103**
ETH_1	P_G_PT_inj	**104**
ETH_1	P_I_PT_1	**105**
ETH_1	P_I_PT_2	**106**
ETH_1	P_R_PT_RCS_2	**107**
ETH_3	P_F_PT_ATF_Press_Tank	**108**
ETH_3	P_F_PT_ATF_Tank	**109**
ETH_3	P_F_PT_ATF_Press	**110**
ETH_3	P_C_PT_LOX_Press_Tank	**111**
ETH_3	P_C_PT_LOX_Tank	**112**
ETH_3	P_C_PT_LOX_Press	**113**
ETH_3	P_R_PT_RCS_1	**114**
ETH_3	P_C_LS_LOX_Tank	**115**
ETH_4	P_FTS_n_TTDS_M	**116**
ETH_4	P_FTSD_R	**117**
ETH_5	P_C_RTD_inj	**118**
ETH_5	P_F_RTD_inj	**119**
ETH_5	P_F_RTD_ATF_Press_Tank	**120**
ETH_5	P_R_RTD_RCS	**121**
ETH_5	P_C_RTD_LOX_Press_Tank	**122**
ETH_5	P_FS_TM_1	**123**
ETH_6	P_FS_Acc_1	**124**
ETH_7	P_CMD_EMGA_PL_E1	**125**
ETH_7	P_CMD_EMGA_YL_E1	**126**
ETH_7	P_EMGA_P_E1	**127**
ETH_7	P_EMGA_Y_E1	**128**
ETH_13	P_CMD_EMGA_PA_E1	**129**
ETH_13	P_CMD_EMGA_YA_E1	**130**
ETH_16	P_GNSS_GGA_QI_n_HDOP	**131**
ETH_16	P_GNSS_GGA_GEOSEP	**132**
None	P_CRIO_HEALTH_STATUS	**133**
ETH_7	P_EMGA_STATUS	**150**

ETH_9	P_EC_CMD_FB	**151**
ETH_9	P_EC_VALVE_STATUS	**152**
ETH_10	P_EC_STATUS	**153**
ETH_11	P_CDT_Time_11	**154**
ETH_11	P_IMUR_X_M	**155**
ETH_11	P_IMUR_Y_M	**156**
ETH_11	P_IMUR_Z_M	**157**
ETH_11	P_IMUA_X_M	**158**
ETH_11	P_IMUA_Y_M	**159**
ETH_11	P_IMUA_Z_M	**160**
ETH_11	P_IMU_STATUS_M	**161**
ETH_11	P_IMU_datagram_counter	**162**
ETH_11	P_numOfDataInvalid	**163**
ETH_11	P_IMU_proc_delta_packet_count	**164**
ETH_11	P_IMUT_GYRO-Y	**165**
ETH_12	P_CDT_Time_12	**166**
ETH_12	P_GNC_POS_X_FC	**167**
ETH_12	P_GNC_POS_Y_FC	**168**
ETH_12	P_GNC_POS_Z_FC	**169**
ETH_12	P_GNC_VEL_X_FC	**170**
ETH_12	P_GNC_VEL_Y_FC	**171**
ETH_12	P_GNC_VEL_Z_FC	**172**
ETH_12	P_GNC_Q1_FC	**173**
ETH_12	P_GNC_Q2_FC	**174**
ETH_12	P_GNC_Q3_FC	**175**
ETH_12	P_GNC_Q0_FC	**176**
ETH_12	P_NAV_IMUCOUNT_FC	**177**
ETH_12	P_GUID_IMUCOUNT_FC	**178**
ETH_14	P_CDT_Time	**179**
ETH_14	P_CMD_Q1	**180**
ETH_14	P_CMD_Q2	**181**
ETH_14	P_CMD_Q3	**182**
ETH_14	P_Delta_Q1	**183**

ETH_14	P_Delta_Q2	**184**
ETH_14	P_Delta_Q3	**185**
ETH_16	P_GNSS_GGA_LAT	**186**
ETH_16	P_GNSS_GGA_LONG	**187**
ETH_16	P_GNSS_GGA_ALT	**188**
ETH_16	P_GNSS_VTG_SP_n_MI	**189**
ETH_16	P_GNSS_GLL_LAT	**190**
ETH_16	P_GNSS_GLL_LONG	**191**
ETH_16	P_GNSS_GLL_UTC	**192**
ETH_16	P_GNSS_GSA_PRN_1	**193**
ETH_16	P_GNSS_GSA_PRN_2	**194**
ETH_16	P_GNSS_GSA_DOPVAL	**195**
ETH_16	P_GNSS_ECEF_UTC	**196**
ETH_16	P_GNSS_ECEF_FHPOS_X	**197**
ETH_16	P_GNSS_ECEF_LHPOS_X	**198**
ETH_16	P_GNSS_ECEF_FHPOS_Y	**199**
ETH_16	P_GNSS_ECEF_LHPOS_Y	**200**
ETH_16	P_GNSS_ECEF_FHPOS_Z	**201**
ETH_16	P_GNSS_ECEF_LHPOS_Z	**202**
ETH_16	P_GNSS_ECEF_VEL_X	**203**
ETH_16	P_GNSS_ECEF_VEL_Y	**204**
ETH_16	P_GNSS_ECEF_VEL_Z	**205**
ETH_16	P_G1_P	**206**
ETH_16	P_G2_P	**207**
ETH_16	P_G1_Y	**208**
ETH_16	P_G2_Y	**209**
ETH_16	P_IMUT_GYRO-X	**210**
ETH_16	P_IMUT_GYRO-Z	**211**
ETH_16	P_IMUT_INCLN-X	**212**
ETH_16	P_IMUT_INCLN-Y	**213**
ETH_16	P_IMUT_INCLN-Z	**214**
ETH_16	P_IMUT_ACC-X	**215**
ETH_16	P_IMUT_ACC-Y	**216**

ETH_16	P_IMUT_ACC-Z	**217**
ETH_17	P_FC_STATUS	**218**
ETH_18	P_FC_SEQ_FB	**219**
ETH_18	P_FC_CMD_FB	**220**
ETH_18	P_CDT_Time	**221**
ETH_18	P_FC_AUX_STATUS	**222**
ETH_19	P_IMUR_X_PLD	**223**
ETH_19	P_IMUR_Y_PLD	**224**
ETH_19	P_IMUR_Z_PLD	**225**
ETH_19	P_IMUA_X_PLD	**226**
ETH_19	P_IMUA_Y_PLD	**227**
ETH_19	P_IMUA_Z_PLD	**228**
ETH_19	P_IMU_STATUS_PLD	**229**
ETH_20	P_GNC_POS_X_PLD	**230**
ETH_20	P_GNC_POS_Y_PLD	**231**
ETH_20	P_GNC_POS_Z_PLD	**232**
ETH_20	P_GNC_VEL_X_PLD	**233**
ETH_20	P_GNC_VEL_Y_PLD	**234**
ETH_20	P_GNC_VEL_Z_PLD	**235**
ETH_20	P_GNC_Q1_PLD	**236**
ETH_20	P_GNC_Q2_PLD	**237**
ETH_20	P_GNC_Q3_PLD	**238**
ETH_20	P_GNC_Q0_PLD	**239**
ETH_20	P_NAV_IMUCOUNT_PLD	**240**
ETH_20	P_GUID_IMUCOUNT_PLD	**241**

13. Command ID List : P_CMD_EC & P_CMD_FC (Command_IDs_V4.7)

Command String	Command Number
EC_CMD_STARTS	1
EC_CMD_TELEM_CONN	2
EC_CMD_TELEM_DISCONN	3
EC_CMD_CRIO_CONN	4
EC_CMD_CRIO_DISCONN	5
EC_CMD_ATS_CONN	6
EC_CMD_ATS_DISCONN	7
EC_CMD_GIMBAL_DISABLE	8
EC_CMD_GIMBAL_ENABLE	9
EC_CMD_GIMBAL_ACT_INIT	10
EC_CMD_LOAD_CALIB	11
EC_CMD_LOAD_FAULT_FILE	12
EC_CMD_LOAD_SEQ_FILE	13
EC_CMD_RESERVED_1	14
EC_CMD_POWEROFF	15
EC_CMD_REBOOT	16
EC_CMD_LOCK	17
EC_CMD_VALVE_CMD_STARTS	18
C_EV_LOX_PRESS_ON	19
C_EV_LOX_VENT_ON	20
R_EV_RCS_1_ON	21
R_EV_RCS_2_ON	22
R_EV_RCS_3_ON	23
R_EV_RCS_4_ON	24
C_EV_LOX_FILL_ON	25
VALVE_NOT_CONNECTED_ON	26
F_EV_ATF_FILL_ON	27
C_EPV_MOV_ON	28
F_EPV_MFV_ON	29

F_EV_ATF_VENT_ON	30
F_EV_ATF_PRESS_ON	31
C_EV_LOX_PRS_fill_ON	32
F_EV_ATF_PRS_fill_ON	33
R_EV_RCS_PRS_fill_ON	34
N_EPV_VP2_ON	35
G_EPV_6_ON	36
M_EPV_5_ON	37
N_EPV_VP1_ON	38
C_EV_LOX_PRESS_OFF	39
C_EV_LOX_VENT_OFF	40
R_EV_RCS_1_OFF	41
R_EV_RCS_2_OFF	42
R_EV_RCS_3_OFF	43
R_EV_RCS_4_OFF	44
C_EV_LOX_FILL_OFF	45
VALVE_NOT_CONNECTED_OFF	46
F_EV_ATF_FILL_OFF	47
C_EPV_MOV_OFF	48
F_EPV_MFV_OFF	49
F_EV_ATF_VENT_OFF	50
F_EV_ATF_PRESS_OFF	51
C_EV_LOX_PRS_fill_OFF	52
F_EV_ATF_PRS_fill_OFF	53
R_EV_RCS_PRS_fill_OFF	54
N_EPV_VP2_OFF	55
G_EPV_6_OFF	56
M_EPV_5_OFF	57
N_EPV_VP1_OFF	58
EC_CMD_VALVE_CMD_ENDS	59
EC_CMD_START_DAQ	60
EC_CMD_STOP_DAQ	61
EC_CMD_STOP_SEQ	62

EC_CMD_GIMBAL_MON_MODE	63
EC_CMD_VEH_DAT_COM_CONN	64
EC_CMD_VEH_DAT_COM_DISCONN	65
EC_CMD_LAUNCH_ST_GO_NOGO	66
EC_CMD_ENDS	80
FC_CMD_RESET_ERROR_COUNTERS	81
FC_CMD_VEH_DAT_COM_CONN	82
FC_CMD_VEH_DAT_COM_DISCONN	83
FC_CMD_LAUNCH_ST_GO_NOGO	84
FC_CMD_LIFT_OFF_CHECK	85
FC_CMD_ALS_GO_NOGO_CHECK	86
PHASE_CMD_STARTS	100
PHASE_ALS_A1	101
PHASE_ALS_A2	102
PHASE_ALS_A3	103
PHASE_4	104
PHASE_5	105
PHASE_6	106
PHASE_7	107
PHASE_8	108
PHASE_9	109
PHASE_10	110
PHASE_11	111
PHASE_12	112
PHASE_13	113
PHASE_14	114
PHASE_15	115
PHASE_16	116
PHASE_17	117
PHASE_18	118
PHASE_19	119
PHASE_20	120
PHASE_21	121

PHASE_22	**122**
PHASE_23	**123**
PHASE_24	**124**
PHASE_25	**125**
PHASE_26	**126**
PHASE_27	**127**
PHASE_28	**128**
PHASE_29	**129**
PHASE_30	**130**
PHASE_31	**131**
PHASE_32	**132**
PHASE_33	**133**
PHASE_34	**134**
PHASE_35	**135**
PHASE_36	**136**
PHASE_37	**137**
PHASE_38	**138**
PHASE_39	**139**
PHASE_40	**140**
PHASE_41	**141**
PHASE_42	**142**
PHASE_43	**143**
PHASE_44	**144**
PHASE_45	**145**
PHASE_46	**146**
PHASE_47	**147**
PHASE_48	**148**
PHASE_49	**149**
PHASE_CMD_ENDS	**150**
FC_CMD_TELEM_CONN	**151**
FC_CMD_TELEM_DISCONN	**152**
FC_CMD_CRIO_CONN	**153**
FC_CMD_CRIO_DISCONN	**154**

FC_CMD_ATS_CONN	**155**
FC_CMD_ATS_DISCONN	**156**
FC_CMD_EC_CONN	**157**
FC_CMD_EC_DISCONN	**158**
FC_CMD_ETX_ATPL_RX_START	**159**
FC_CMD_ETX_ATPL_RX_STOP	**160**
FC_CMD_GUID_START	**161**
FC_CMD_GUID_STOP	**162**
FC_CMD_NAV_SELFALIGN	**163**
FC_CMD_NAV_STRAPDOWN	**164**
FC_CMD_GYRO_BIAS_UPDATE	**165**
FC_CMD_NAV_STOP	**166**
FC_CMD_CTRL_START	**167**
FC_CMD_CTRL_STOP	**168**
FC_CMD_GIMB_EXE	**169**
FC_CMD_GIMB_STP	**170**
FC_CMD_IMU_START	**171**
FC_CMD_IMU_STOP	**172**
FC_CMD_GUID_LOAD_TRAJ	**173**
FC_CMD_GNSS_START	**174**
FC_CMD_GNSS_STOP	**175**
FC_CMD_GIMB_MEAN	**176**
FC_CMD_START_6DOF	**177**
FC_CMD_STOP_6DOF	**178**
FC_CMD_RELAY_STARTS	**180**
FC_CMD_GPIO_1_OUT_OFF	**181**
FC_CMD_GPIO_2_OUT_OFF	**182**
FC_CMD_FC_VP_EN_OFF	**183**
FC_CMD_ECU_EN_OFF	**184**
FC_CMD_PP_EN_OFF	**185**
FC_CMD_IMU_EN_OFF	**186**
FC_CMD_TT_EN_OFF	**187**
FC_CMD_GA_EN_OFF	**188**

FC_CMD_CAM_EN_OFF	189
FC_CMD_TMT_EN_OFF	190
FC_CMD_TMP_EN_OFF	191
FC_CMD_GNSS_EN_OFF	192
FC_CMD_GPIO_1_OUT_ON	193
FC_CMD_GPIO_2_OUT_ON	194
FC_CMD_FC_VP_EN_ON	195
FC_CMD_ECU_EN_ON	196
FC_CMD_PP_EN_ON	197
FC_CMD_IMU_EN_ON	198
FC_CMD_TT_EN_ON	199
FC_CMD_GA_EN_ON	200
FC_CMD_CAM_EN_ON	201
FC_CMD_TMT_EN_ON	202
FC_CMD_TMP_EN_ON	203
FC_CMD_GNSS_EN_ON	204
FC_CMD_POWEROFF	205
FC_CMD_REBOOT	206
FC_CMD_LOCK	207
FC_CMD_START_ALS	208
FC_CMD_LOAD_FM_FILE	209
FC_CMD_LOAD_SEQ_FILE	210
FC_CMD_LOAD_HOLD_ACTION_FILE	211
FC_CMD_LOAD_GUID_GAIN_FILE	212
FC_CMD_LOAD_GUID_TRAJ_FILE	213
FC_CMD_KILL_FH	214
FC_CMD_KILL_SIXDOF	215
FC_CMD_ACC_BIAS_UPDATE	216
CRIO_CMD_STARTS	220
N_EPV_MP1_OFF	221
N_EPV_GP1_OFF	222
SPARK_PLUG_OFF	223
G_EPV_1_OFF	224

G_EPV_DRAIN_OFF	**225**
M_EPV_DRAIN_OFF	**226**
N_EPV_MP1_ON	**227**
N_EPV_GP1_ON	**228**
SPARK_PLUG_ON	**229**
G_EPV_1_ON	**230**
G_EPV_DRAIN_ON	**231**
M_EPV_DRAIN_ON	**232**
N_EPV_MP2_ON	**233**
N_EPV_MP2_OFF	**234**
N_EPV_GP2_ON	**235**
N_EPV_GP2_OFF	**236**
P_UT_BS_DISCONN	**237**
FC_LIFTOFF_GO	**238**
E_UT_Q3Q4_DISCONN	**239**

14. EC Status : P_EC_STATUS_V1.1

Engine Package Status V1.1							
Parameter ID Designator	**Parameter ID**	**Data Size**	**Bit no.**	**Status Bit Enum**	**Status Description**	**Status : 1 (ON)**	**Status : 0 (OFF)**
Parameter-70 ID	P_EC_STATUS	uint32_t	0	EC_STATUS_ERX	Ethernet Receiver Process Status	Alive	Dead
Parameter-70 ID	P_EC_STATUS	uint32_t	1	EC_STATUS_GC	Gimbal Controller Process Status	Alive	Dead
Parameter-70 ID	P_EC_STATUS	uint32_t	2	EC_STATUS_DTXRX	Data Transceiver Process Status	Alive	Dead
Parameter-70 ID	P_EC_STATUS	uint32_t	3	EC_STATUS_SEQ	Sequencer Process Status	Alive	Dead
Parameter-70 ID	P_EC_STATUS	uint32_t	4	EC_STATUS_TIM	Timer Process Process Status	Alive	Dead
Parameter-70 ID	P_EC_STATUS	uint32_t	5	EC_STATUS_ETX	Ethernet Transmitter Process Status	Alive	Dead
Parameter-70 ID	P_EC_STATUS	uint32_t	6	EC_STATUS_FM	Fault Monitor Process Status	Alive	Dead

Parameter-70 ID	P_EC_STATUS	uint32_t	7	EC_STATUS_HOLD	CDT Status	HOLD	Release
Parameter-70 ID	P_EC_STATUS	uint32_t	8	EC_STATUS_FC_RX_CONN	Connection from FC exists	Connected	Not Connected
Parameter-70 ID	P_EC_STATUS	uint32_t	9	EC_STATUS_FC_TX_CONN	Connection to FC exists	Connected	Not Connected
Parameter-70 ID	P_EC_STATUS	uint32_t	10	EC_STATUS_MCRC_TX_CONN	Connection to MCRC exists	Connected	Not Connected
Parameter-70 ID	P_EC_STATUS	uint32_t	11	EC_STATUS_TELEM_TX_CONN	Connection to Telemetry exists	Connected	Not Connected
Parameter-70 ID	P_EC_STATUS	uint32_t	12	EC_STATUS_SEQ_ONGOING	Sequence is Ongoing	Sequence Ongoing	Idle
Parameter-70 ID	P_EC_STATUS	uint32_t	13	EC_STATUS_DAQ_HB	DAQ Heartbeat that will blink when DAQ loop is running	NA	NA
Parameter-70 ID	P_EC_STATUS	uint32_t	14	EC_STATUS_PTP_OFFSET	PTP sync status	Synced	Not in Sync
Parameter-70 ID	P_EC_STATUS	uint32_t	15	EC_STATUS_ATS_CONN	ATS connection status	Connected	Not Connected
Parameter-70 ID	P_EC_STATUS	uint32_t	16	EC_STATUS_RES_1	Reserved status	Reserved	Reserved
Parameter-70 ID	P_EC_STATUS	uint32_t	17	EC_STATUS_GIM_MON_MODE	Gimbal mode: Monitor mode	Reserved	Reserved
Parameter-70 ID	P_EC_STATUS	uint32_t	18	EC_STATUS_GIM_CMD_MODE	Gimbal mode: command mode	Reserved	Reserved
Parameter-70 ID	P_EC_STATUS	uint32_t	19	ENG_IGN_CONF	Engine ignition confirmation	Reserved	Reserved
Parameter-70 ID	P_EC_STATUS	uint32_t	20	Reserved	Reserved	Reserved	Reserved
Parameter-70 ID	P_EC_STATUS	uint32_t	21	Reserved	Reserved	Reserved	Reserved
Parameter-70 ID	P_EC_STATUS	uint32_t	22	CPU CORE 1 Usage	CPU core 1 memory percentage stage : 00 : 0 to 25% 01 : 26 to 50 % 10 : 51 to 75 % 11 : 76 to 100 %	NA	NA
Parameter-70 ID	P_EC_STATUS	uint32_t	23				
Parameter-70 ID	P_EC_STATUS	uint32_t	24	CPU CORE 2 Usage	CPU core 2 memory percentage stage : 00 : 0 to 25% 01 : 26 to 50 % 10 : 51 to 75 %	NA	NA
Parameter-70 ID	P_EC_STATUS	uint32_t	25				

					11 : 76 to 100 %		
Parameter-70 ID	P_EC_STATUS	uint32_t	26	Phase ID (0 to 63)	NA	NA	NA
Parameter-70 ID	P_EC_STATUS	uint32_t	27				
Parameter-70 ID	P_EC_STATUS	uint32_t	28				
Parameter-70 ID	P_EC_STATUS	uint32_t	29				
Parameter-70 ID	P_EC_STATUS	uint32_t	30				
Parameter-70 ID	P_EC_STATUS	uint32_t	31				

15. Valve Status : P_EC_VALVE_STATUS

P_EC_VALVE_STATUS_V1.0					
Parameter ID Designator	**Parameter ID**	**Description**	**Data Size**	**Bit no.**	**Valve State Description**
Parameter-68 ID	P_EC_VALVE_STATUS	C_EV_LOX_PRESS_V1T	uint32_t	0	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	C_EV_LOX_VENT_V2W	uint32_t	1	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	R_EV_RCS_1_V3W	uint32_t	2	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	R_EV_RCS_2_V4W	uint32_t	3	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	R_EV_RCS_3_V5W	uint32_t	4	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	R_EV_RCS_4_V6W	uint32_t	5	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	C_EV_LOX_FILL_V13T	uint32_t	6	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	N_EPV_VP2_V12T	uint32_t	7	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	F_EV_ATF_FILL_V11CW	uint32_t	8	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	C_EPV_MOV_V10T	uint32_t	9	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	F_EPV_MFV_V9T	uint32_t	10	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	F_EV_ATF_VENT_V8W	uint32_t	11	OPEN = 0 ; CLOSE = 1

Parameter-68 ID	P_EC_VALVE_STATUS	F_EV_ATF_PRESS_V7W	uint32_t	12	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	C_EV_LOX_Press_fill_V14T	uint32_t	13	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	F_EV_ATF_Press_fill_V16T	uint32_t	14	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	R_EV_RCS_press_fill_V15T	uint32_t	15	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	VAL17_FB	uint32_t	16	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	G_EPV_6	uint32_t	17	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	M_EPV_5	uint32_t	18	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	N_EPV_VP1	uint32_t	19	OPEN = 0 ; CLOSE = 1
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	20	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	21	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	22	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	23	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	24	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	25	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	26	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	27	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	28	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	29	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	30	NA
Parameter-68 ID	P_EC_VALVE_STATUS	Reserved	uint32_t	31	NA

16. EC Fault Status with IDs : (Fault Ids V1.6)

Fault Source	Category	Fault ID raised	Fault ID value	Fault Description
Engine Computer	Sensor fault	ERR_UT_C_PT_LOX_inj	1	LOX Injection Pressure to Engine crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_C_PT_LOX_inj	2	LOX Injection Pressure to Engine crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_F_PT_ATF_inj	3	ATF Injection Pressure to Engine crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_F_PT_ATF_inj	4	ATF Injection Pressure to Engine crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_E_PT_CC_1	5	Engine Chamber Pressure upper threshold
Engine Computer	Sensor fault	ERR_LT_E_PT_CC_1	6	Engine Chamber Pressure lower threshold
Engine Computer	Sensor fault	ERR_UT_M_PT_inj	7	Methane Injection Pressure to Engine upper threshold
Engine Computer	Sensor fault	ERR_LT_M_PT_inj	8	Methane Injection Pressure to Engine lower threshold
Engine Computer	Sensor fault	ERR_UT_G_PT_inj	9	Gaseous Oxygen Injection Pressure to Engine upper threshold
Engine Computer	Sensor fault	ERR_LT_G_PT_inj	10	Gaseous Oxygen Injection Pressure to Engine lower threshold
Engine Computer	Sensor fault	ERR_UT_I_PT_1	11	Igniter Chamber Pressure crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_I_PT_1	12	Igniter Chamber Pressure crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_I_PT_2	13	Redundant Igniter Chamber pressure crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_I_PT_2	14	Redundant Igniter Chamber pressure crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_R_PT_RCS_2	15	RCS Thruster Injection Pressure crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_R_PT_RCS_2	16	RCS Thruster Injection Pressure crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_F_PT_ATF_Press_Tank	17	ATF Pressurant tank pressure crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_F_PT_ATF_Press_Tank	18	ATF Pressurant tank pressure crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_F_PT_ATF_Tank	19	ATF tank Pressure crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_F_PT_ATF_Tank	20	ATF tank Pressure crosses lower threshold

Engine Computer	Sensor fault	ERR_UT_F_PT_ATF_Press	21	ATF Pressurant pressure before pressurant valve crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_F_PT_ATF_Press	22	ATF Pressurant pressure before pressurant valve crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_C_PT_LOX_Press_Tank	23	LOX Pressurant tank pressure crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_C_PT_LOX_Press_Tank	24	LOX Pressurant tank pressure crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_C_PT_LOX_Tank	25	LOX tank Pressure crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_C_PT_LOX_Tank	26	LOX tank Pressure crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_C_PT_LOX_Press	27	LOX Pressurant pressure before pressurant valve crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_C_PT_LOX_Press	28	LOX Pressurant pressure before pressurant valve crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_R_PT_RCS_1	29	RCS Pressurant tank Pressure crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_R_PT_RCS_1	30	RCS Pressurant tank Pressure crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_C_LS_LOX_Tank	31	Liquid Oxygen Tank level crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_C_LS_LOX_Tank	32	Liquid Oxygen Tank level crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_C_RTD_inj	33	LOX_Injection Temperature to Engine crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_C_RTD_inj	34	LOX_Injection Temperature to Engine crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_F_RTD_inj	35	ATF Injection Temperature to Engine crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_F_RTD_inj	36	ATF Injection Temperature to Engine crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_F_RTD_ATF_Press_Tank	37	ATF Pressurant tank Temperature crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_F_RTD_ATF_Press_Tank	38	ATF Pressurant tank Temperature crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_R_RTD_RCS	39	RCS Pressurant tank Temperature crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_R_RTD_RCS	40	RCS Pressurant tank Temperature crosses lower threshold
Engine Computer	Sensor fault	ERR_UT_C_RTD_LOX_Press_Tank	41	LOX Pressurant tank Temperature crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_C_RTD_LOX_Press_Tank	42	LOX Pressurant tank Temperature crosses lower threshold
Engine Computer	Sensor fault	ERR_ALS_C_PT_LOX_inj	43	LOX Injection Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_F_PT_ATF_inj	44	ATF Injection Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_E_PT_CC_1	45	Engine Chamber Pressure check failed during ALS

Engine Computer	Sensor fault	ERR_ALS_M_PT_inj	46	Methane Injection Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_G_PT_inj	47	Gaseous Oxygen Injection Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_I_PT_1	48	Igniter Chamber Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_I_PT_2	49	Redundant Igniter Chamber Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_R_PT_RCS_2	50	RCS Thruster Injection Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_F_PT_ATF_Press_Tank	51	ATF Pressurant tank Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_F_PT_ATF_Tank	52	ATF tank Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_F_PT_ATF_Press	53	ATF Pressurant pressure (before pressurant valve) check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_C_PT_LOX_Press_Tank	54	LOX Pressurant tank Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_C_PT_LOX_Tank	55	LOX tank Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_C_PT_LOX_Press	56	LOX Pressurant pressure (before pressurant valve) check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_R_PT_RCS_1	57	RCS Pressurant tank Pressure check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_C_LS_LOX_Tank	58	Liquid Oxygen Tank level check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_C_RTD_inj	59	LOX_Injection Temperature to Engine check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_F_RTD_inj	60	ATF Injection Temperature (to Engine) check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_F_RTD_ATF_Press_Tank	61	ATF Pressurant tank Temperature check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_R_RTD_RCS	62	RCS Pressurant tank Temperature check failed during ALS
Engine Computer	Sensor fault	ERR_ALS_C_RTD_LOX_Press_Tank	63	LOX Pressurant tank Temperature check failed during ALS
Engine Computer	Valve fault	ERR_OP_C_LS_MOV	64	LOX tank to Thrust Chamber Inlet Plumbing System valve feedback : error state - open
Engine Computer	Valve fault	ERR_CL_C_LS_MOV	65	LOX tank to Thrust Chamber Inlet Plumbing System valve feedback : error state - closed
Engine Computer	Ignition fault	ERR_ON_IGNFB	66	Ignition feedback : error state - ON
Engine Computer	Ignition fault	ERR_OFF_IGNFB	67	Ignition feedback : error state - OFF
Engine Computer	Sensor fault	ERR_UT_AB_TS	68	Temperature of Avionics battery (temperature sensing) crosses upper threshold
Engine Computer	Sensor fault	ERR_UT_AB_VS	69	Voltage sensing of Avionics battery crosses upper threshold
Engine Computer	Sensor fault	ERR_LT_AB_VS	70	Voltage sensing of Avionics battery crosses lower threshold

Engine Computer	Gimbal Actuator Fault	ERR_INCR_CMD_EMGA-PL_E1	71	Stroke length command from Engine Computer for Pitch Gimbal Actuator received incorrect command
Engine Computer	Gimbal Actuator Fault	ERR_INCR_CMD_EMGA-YL_E1	72	Stroke length command from Engine Computer for Yaw Gimbal Actuator received incorrect command
Engine Computer	Gimbal Actuator Fault	ERR_UT_EMGA-P_E1	73	Stroke length feedback from Pitch Gimbal Actuator crosses upper threshold
Engine Computer	Gimbal Actuator Fault	ERR_LT_EMGA-P_E1	74	Stroke length feedback from Pitch Gimbal Actuator crosses lower threshold
Engine Computer	Gimbal Actuator Fault	ERR_UT_EMGA-Y_E1	75	Stroke length feedback from Yaw Gimbal Actuator crosses upper threshold
Engine Computer	Gimbal Actuator Fault	ERR_LT_EMGA-Y_E1	76	Stroke length feedback from Yaw Gimbal Actuator crosses lower threshold
Engine Computer	Gimbal Actuator Fault	ERR_UT_EMGAV_P_E1	77	Pitch Gimbal Actuator Bus Voltage crosses upper threshold
Engine Computer	Gimbal Actuator Fault	ERR_LT_EMGAV_P_E1	78	Pitch Gimbal Actuator Bus Voltage crosses lower threshold
Engine Computer	Gimbal Actuator Fault	ERR_UT_EMGATQ_P_E1	79	Pitch Gimbal Actuator Motor Torque feedback crosses upper threshold
Engine Computer	Gimbal Actuator Fault	ERR_LT_EMGATQ_P_E1	80	Pitch Gimbal Actuator Motor Torque feedback crosses lower threshold
Engine Computer	Gimbal Actuator Fault	ERR_UT_EMGAT_P_E1	81	Pitch Gimbal Actuator Temperature data crosses upper threshold
Engine Computer	Gimbal Actuator Fault	ERR_LT_EMGAT_P_E1	82	Pitch Gimbal Actuator Temperature data crosses lower threshold
Engine Computer	Gimbal Actuator Fault	ERR_UT_EMGAV_Y_E1	83	Yaw Gimbal Actuator Bus Voltage data crosses upper threshold
Engine Computer	Gimbal Actuator Fault	ERR_LT_EMGAV_Y_E1	84	Yaw Gimbal Actuator Bus Voltage data crosses lower threshold
Engine Computer	Gimbal Actuator Fault	ERR_UT_EMGATQ_Y_E1	85	Yaw Gimbal Actuator Motor Torque crosses upper threshold
Engine Computer	Gimbal Actuator Fault	ERR_LT_EMGATQ_Y_E1	86	Yaw Gimbal Actuator Motor Torque crosses lower threshold
Engine Computer	Gimbal Actuator Fault	ERR_UT_EMGAT_Y_E1	87	Yaw Gimbal Actuator Temperature data crosses upper threshold
Engine Computer	Gimbal Actuator Fault	ERR_LT_EMGAT_Y_E1	88	Yaw Gimbal Actuator Temperature data crosses lower threshold
Engine Computer	Engine Package Health Fault	ERR_UT_EC_TS	89	Engine Computer Temperature crosses upper threshold
Engine Computer	Engine Package Health Fault	ERR_LT_EC_TS	90	Engine Computer Temperature crosses lower threshold
Engine Computer	Engine Package Health Fault	ERR_UT_EC_CS	91	Engine Computer current crosses upper threshold
Engine Computer	Engine Package Health Fault	ERR_LT_EC_CS	92	Engine Computer current crosses lower threshold
Engine Computer	Engine Package Health Fault	ERR_UT_EC_VS	93	Engine Computer voltage crosses upper threshold

Engine Computer	Engine Package Health Fault	ERR_LT_EC_VS	94	Engine Computer voltage crosses lower threshold
Engine Computer	Software faults	ERR_PR_GNRC_SW_SFT_FLT	95	Generic software : soft fault
Engine Computer	Software faults	ERR_PR_GNRC_SW_HRD_FLT	96	Generic software : hard fault
Engine Computer	Software faults	ERR_PR_ETHRC_IPC_FAIL	97	Ethernet Receiver process : IPC Failure
Engine Computer	Software faults	ERR_PR_ETHRC_INVAL_CLN	98	Ethernet Receiver process : Unknown client connected
Engine Computer	Software faults	ERR_PR_ETHRC_FC_DISC	99	Ethernet Receiver process : FC Disconnected
Engine Computer	Software faults	ERR_PR_ETHRC_INVAL_DAT	100	Ethernet Receiver process : Unknown Bytes/data
Engine Computer	Software faults	ERR_PR_ETHRC_TIMEOUT	101	Ethernet Receiver process : Timeout
Engine Computer	Software faults	ERR_PR_ETHRC_PRDEAD	102	Ethernet Receiver process : Process Dead
Engine Computer	Software faults	ERR_PR_ETHTR_IPC_FAIL	103	Ethernet Transmitter process : IPC Failure
Engine Computer	Software faults	ERR_PR_ETHTR_FC_CONFAIL	104	Ethernet Transmitter process : Conn to FC Failed
Engine Computer	Software faults	ERR_PR_ETHTR_CRIO_CONFAIL	105	Ethernet Transmitter process : Conn to CRIO Failed
Engine Computer	Software faults	ERR_PR_ETHTR_TMP_CONFAIL	106	Ethernet Transmitter process : Conn to Telem Failed
Engine Computer	Software faults	ERR_PR_ETHTR_FC_SEND_FAIL	107	Ethernet Transmitter process : Send to FC Failed
Engine Computer	Software faults	ERR_PR_ETHTR_CRIO_SEND_FAIL	108	Ethernet Transmitter process : Send to CRIO Failed
Engine Computer	Software faults	ERR_PR_ETHTR_TMP_SEND_FAIL	109	Ethernet Transmitter process : Send to Telem Failed
Engine Computer	Software faults	ERR_PR_ETHTR_PRDEAD	110	Ethernet Transmitter process : Process Dead
Engine Computer	Software faults	ERR_PR_TIM_IPC_FAIL	111	Timer process : IPC Failure
Engine Computer	Software faults	ERR_PR_TIM_ATSCONN_FAIL	112	Timer process : Conn to ATS Failed
Engine Computer	Software faults	ERR_PR_TIM_ATS_DISC	113	Timer process : ATS Disconnected
Engine Computer	Software faults	ERR_PR_TIM_ATSSEND_FAIL	114	Timer process : Send to ATS Failed
Engine Computer	Software faults	ERR_PR_TIM_PRDEAD	115	Timer process : Process Dead
Engine Computer	Software faults	ERR_PR_GACRTL_IPC_FAIL	116	Gimbal Controller process : IPC Failure
Engine Computer	Software faults	ERR_PR_GACRTL_UART_TMOUT	117	Gimbal Controller process : UART Timeout
Engine Computer	Software faults	ERR_PR_GACRTL_ACTINIT_FAIL	118	Gimbal Controller process : Actuator Init Failure
Engine Computer	Software faults	ERR_PR_GACRTL_PARSE_ERR	119	Gimbal Controller process : Parsing Error
Engine Computer	Software faults	ERR_PR_GACRTL_CSUM_ERR	120	Gimbal Controller process : Checksum Error
Engine Computer	Software faults	ERR_PR_GACRTL_PRDEAD	121	Gimbal Controller process : Process Dead
Engine Computer	Software faults	ERR_PR_DATTRC_IPC_FAIL	122	Data Transceiver process : IPC Failed
Engine Computer	Software faults	ERR_PR_DATTRC_LDCAL_FAIL	123	Data Transceiver process : Load Calibration Failed
Engine Computer	Software faults	ERR_PR_DATTR_INVAL_PHID	124	Data Transceiver process : Invalid Phase id

Engine Computer	Software faults	ERR_PR_DATTRC_SPICSUM_FAIL	125	Data Transceiver process : SPI Checksum Failed
Engine Computer	Software faults	ERR_PR_DATTRC_SPI_UNREC	126	Data Transceiver process : SPI Couldn't recover
Engine Computer	Software faults	ERR_PR_DATTRC_PRDEAD	127	Data Transceiver process : Process Dead
Engine Computer	Software faults	ERR_PR_ENSEQEXE_IPC_FAIL	128	Engine Sequence Executor process : IPC Failed
Engine Computer	Software faults	ERR_PR_ENSEQEXE_LDSEQ_FAIL	129	Engine Sequence Executor process : Load Seq Failed
Engine Computer	Software faults	ERR_PR_ENSEQEXE_INVAL_CMD_SEQ	130	Engine Sequence Executor process : Invalid Command/Sequence
Engine Computer	Software faults	ERR_PR_ENSEQEXE_GENERR	131	Engine Sequence Executor process : Generic Error
Engine Computer	Software faults	ERR_PR_ENSEQEXE_CDT_MAX	132	Engine Sequence Executor process : CDT Got exceeded
Engine Computer	Software faults	ERR_PR_ENSEQEXE_INVAL_SIG	133	Engine Sequence Executor process : Out of signals
Engine Computer	Software faults	ERR_PR_ENSEQEXE_PRDEAD	134	Engine Sequence Executor process : Process Dead
Engine Computer	Software faults	ERR_PR_FLTMON_IPC_FAIL	135	Fault Monitor process : IPC Failure
Engine Computer	Software faults	ERR_PR_FLTMON_FLTID_NA	136	Fault Monitor process : Fault ID not found
Engine Computer	Software faults	ERR_PR_FLTMON_PRDEAD	137	Fault Monitor process : Process Dead
Engine Computer	Software faults	ERR_PR_GNRC_PTP_OFFSET	138	PTP offset
Engine Computer	Software faults	ERR_PR_FLTMON_LDF_FAIL	139	Fault Monitor process: Load File

17. FC Status : (P_FC_STATUS_ V1.1)

Flight Package Status V1.1							
Parameter ID Designator	**Parameter ID**	**Data Size**	**Bit no.**	**Status Bit Enum**	**Status Description**	**Status : 1 (ON)**	**Status : 0 (OFF)**
Parameter-136 ID	P_FC_STATUS	uint32_t	0	STATUS_PROCESS_GNSS	GNSS Process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	1	STATUS_PROCESS_FAULT_MONITOR	Fault Monitor Process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	2	STATUS_PROCESS_CONTROL	Control process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	3	STATUS_PROCESS_NAVIGATION	Navigation process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	4	STATUS_PROCESS_GUIDANCE	Guidance process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	5	STATUS_PROCESS_ESE	Engine Sequence executor process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	6	STATUS_PROCESS_MCRCSE	MCRC sequence executor process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	7	STATUS_PROCESS_IMU	IMU process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	8	STATUS_PROCESS_SEQ	Sequencer process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	9	STATUS_PROCESS_ETHT	Ethernet Transmitter process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	10	STATUS_PROCESS_ETHR	Ethernet Receiver process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	11	STATUS_PROCESS_TIMER	Timer process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	12	STATUS_PROCESS_DTXRX	Data Transceiver process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	13	STATUS_PROCESS_SIX_DOF	Six DOF process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	14	STATUS_PROCESS_FILEHANDLER	File handler process status	Alive	Dead
Parameter-136 ID	P_FC_STATUS	uint32_t	15	STATUS_LCC_TO_FC_CONN	Connection from LCC to FC	Connected	Not Connected

Parameter-136 ID	P_FC_STATUS	uint32_t	16	STATUS_FC_TO_LCC_CONN	Connection to LCC from FC	Connected	Not Connected
Parameter-136 ID	P_FC_STATUS	uint32_t	17	STATUS_EC_TO_FC_CONN	Connection to FC from EC	Connected	Not Connected
Parameter-136 ID	P_FC_STATUS	uint32_t	18	STATUS_FC_TO_EC_CONN	Connection to EC from FC	Connected	Not Connected
Parameter-136 ID	P_FC_STATUS	uint32_t	19	STATUS_PTP_OFFSET	Sync status	Synced	Not synced
Parameter-136 ID	P_FC_STATUS	uint32_t	20	STATUS_TELEMETRY_CONN	Connection to Telemetry	Connected	Not connected
Parameter-136 ID	P_FC_STATUS	uint32_t	21	STATUS_ATS_CONN	Connection to ATS	Connected	Not connected
Parameter-136 ID	P_FC_STATUS	uint32_t	22	STATUS_LMP_DETECTION	LMP detection is success	Disconnected	Connected
Parameter-136 ID	P_FC_STATUS	uint32_t	23	STATUS_LMP_1	LMP bit 1	HIGH	LOW
Parameter-136 ID	P_FC_STATUS	uint32_t	24	STATUS_LMP_2	LMP bit 2	HIGH	LOW
Parameter-136 ID	P_FC_STATUS	uint32_t	25	STATUS_LAUNCH_INDICATION	Launch indication status	Lifted off	not yet lifted off
Parameter-136 ID	P_FC_STATUS	uint32_t	26	STATUS_FC_IFACE_HB	Blinks when communicating with the Interface board.	NA	NA
Parameter-136 ID	P_FC_STATUS	uint32_t	27	STATUS_HOLD	Becomes high when hold occurs.	HOLD	Running
Parameter-136 ID	P_FC_STATUS	uint32_t	28	STATUS_SEQ_ACTIVE	Sequence active status	Sequence is active	sequence is inactive
Parameter-136 ID	P_FC_STATUS	uint32_t	29	STATUS_FC_GO	Completion of all the FC checks to set GO	Ready to GO	Not ready to GO
Parameter-136 ID	P_FC_STATUS	uint32_t	30	STATUS_ALS_INITIATED	Indication of ALS start	ALS start	ALS not started
Parameter-136 ID	P_FC_STATUS	uint32_t	31	STATUS_LIFTOFF_CONFIRM	Indication of vehicle lift off	Lift off happened	Lift off not happened

18. FC Fault Status with IDs : (Fault Ids V1.6)

Fault Source	Category	Fault ID raised	Fault ID value	Fault Description
Flight Computer	Flight Computer : IMU Fault	ERR_UT_IMUR_X_M	1	Main IMU : Vehicle Angular rate data (X-axis) in Body Frame crosses upper threshold
Flight Computer	Flight Computer : IMU Fault	ERR_LT_IMUR_X_M	2	Main IMU : Vehicle Angular rate data (X-axis) in Body Frame crosses lower threshold
Flight Computer	Flight Computer : IMU Fault	ERR_UT_IMUR_Y_M	3	Main IMU : Vehicle Angular rate data (Y-axis) in Body Frame crosses upper threshold
Flight Computer	Flight Computer : IMU Fault	ERR_LT_IMUR_Y_M	4	Main IMU : Vehicle Angular rate data (Y-axis) in Body Frame crosses lower threshold
Flight Computer	Flight Computer : IMU Fault	ERR_UT_IMUR_Z_M	5	Main IMU : Vehicle Angular rate data (Z-axis) in Body Frame crosses upper threshold
Flight Computer	Flight Computer : IMU Fault	ERR_LT_IMUR_Z_M	6	Main IMU : Vehicle Angular rate data (Z-axis) in Body Frame crosses lower threshold
Flight Computer	Flight Computer : IMU Fault	ERR_UT_IMUA_X_M	7	Main IMU : Vehicle Acceleration (X-axis) in Body Frame crosses upper threshold
Flight Computer	Flight Computer : IMU Fault	ERR_LT_IMUA_X_M	8	Main IMU : Vehicle Acceleration (X-axis) in Body Frame crosses lower threshold
Flight Computer	Flight Computer : IMU Fault	ERR_UT_IMUA_Y_M	9	Main IMU : Vehicle Acceleration (Y-axis) in Body Frame crosses upper threshold
Flight Computer	Flight Computer : IMU Fault	ERR_LT_IMUA_Y_M	10	Main IMU : Vehicle Acceleration (Y-axis) in Body Frame crosses lower threshold
Flight Computer	Flight Computer : IMU Fault	ERR_UT_IMUA_Z_M	11	Main IMU : Vehicle Acceleration (Z-axis) in Body Frame crosses upper threshold
Flight Computer	Flight Computer : IMU Fault	ERR_LT_IMUA_Z_M	12	Main IMU : Vehicle Acceleration (Z-axis) in Body Frame crosses upper threshold
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_POS_X_FC	13	Vehicle position (X-axis) in LPI Frame crosses upper threshold
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_POS_X_FC	14	Vehicle position (X-axis) in LPI Frame crosses lower threshold
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_POS_Y_FC	15	Vehicle position (Y-axis) in LPI Frame crosses upper threshold
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_POS_Y_FC	16	Vehicle position (Y-axis) in LPI Frame crosses lower threshold

Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_POS_Z_FC	17	Vehicle position (Z-axis) in LPI Frame crosses upper threshold
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_POS_Z_FC	18	Vehicle position (Z-axis) in LPI Frame crosses lower threshold
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_VEL_X_FC	19	Vehicle velocity (X-axis) in LPI Frame crosses upper threshold
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_VEL_X_FC	20	Vehicle velocity (X-axis) in LPI Frame crosses lower threshold
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_VEL_Y_FC	21	Vehicle velocity (Y-axis) in LPI Frame crosses upper threshold
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_VEL_Y_FC	22	Vehicle velocity (Y-axis) in LPI Frame crosses lower threshold
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_VEL_Z_FC	23	Vehicle velocity (Z-axis) in LPI Frame crosses upper threshold
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_VEL_Z_FC	24	Vehicle velocity (Z-axis) in LPI Frame crosses lower threshold
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_PR_FC	25	Fault-1
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_PR_FC	26	Fault-2
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_YR_FC	27	Fault-3
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_YR_FC	28	Fault-4
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_RR_FC	29	Fault-5
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_RR_FC	30	Fault-6
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_PA_FC	31	Fault-7
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_PA_FC	32	Fault-8
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_YA_FC	33	Fault-9
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_YA_FC	34	Fault-10
Flight Computer	Flight Computer : GNC Fault	ERR_UT_GNC_RA_FC	35	Fault-11
Flight Computer	Flight Computer : GNC Fault	ERR_LT_GNC_RA_FC	36	Fault-12

Flight Computer	Gimbal Actuator Fault	ERR_SNTFAIL_CMD_EMGA_PA_E1	37	Fault-13
Flight Computer	Gimbal Actuator Fault	ERR_RVDFAIL_CMD_EMGA_PA_E1	38	Fault-14
Flight Computer	Gimbal Actuator Fault	ERR_SNTFAIL_CMD_EMGA_YA_E1	39	Fault-15
Flight Computer	Gimbal Actuator Fault	ERR_RVDFAIL_CMD_EMGA_YA_E1	40	Fault-16
Flight Computer	RCS Command Fault	ERR_NTR_CMD_RCS	41	Commanded RCS Valve wrong command fault
Flight Computer	Flight Computer :	ERR_SNTFAIL_CMD_PA	42	Fault-17
Flight Computer	Flight Computer :	ERR_RVDFAIL_CMD_PA	43	Fault-18
Flight Computer	Flight Computer :	ERR_SNTFAIL_CMD_YA	44	Fault-19
Flight Computer	Flight Computer :	ERR_RVDFAIL_CMD_YA	45	Fault-20
Flight Computer	Flight Computer :	ERR_SNTFAIL_CMD_RA	46	Fault-21
Flight Computer	Flight Computer :	ERR_RVDFAIL_CMD_RA	47	Fault-22
Flight Computer	Flight Computer : Health Fault	ERR_UT_FC_TS	48	Flight Computer Temperature crosses upper threshold
Flight Computer	Flight Computer : Health Fault	ERR_LT_FC_TS	49	Flight Computer Temperature crosses lower threshold
Flight Computer	Flight Computer : Health Fault	ERR_UT_FC_CS	50	Flight Computer current crosses upper threshold
Flight Computer	Flight Computer : Health Fault	ERR_LT_FC_CS	51	Flight Computer current crosses lower threshold
Flight Computer	Flight Computer : Health Fault	ERR_UT_FC_VS	52	Flight Computer voltage crosses upper threshold
Flight Computer	Flight Computer : Health Fault	ERR_LT_FC_VS	53	Flight Computer voltage crosses lower threshold
Flight Computer	Software faults	ERR_PR_GNRC_SW_SFT_FLT	54	Generic software : soft fault
Flight Computer	Software faults	ERR_PR_GNRC_SW_HRD_FLT	55	Generic software : hard fault
Flight Computer	Software faults	ERR_PR_GN_DATR_TO	56	GNSS process : Data Read Timeout
Flight Computer	Software faults	ERR_PR_GN_INVAL_DAT	57	GNSS process : Incorrect data
Flight Computer	Software faults	ERR_PR_GN_PARSE_ERR	58	GNSS process : Parsing Error
Flight Computer	Software faults	ERR_PR_GN_IPC_FAIL	59	GNSS process : IPC (inter process communication) Failure

Flight Computer	Software faults	ERR_PR_GN_INVAL_CMD	60	GNSS process : Invalid command
Flight Computer	Software faults	ERR_PR_GN_PRDEAD	61	GNSS process : Process Dead
Flight Computer	Software faults	ERR_PR_IMU_DATR_TO	62	IMU process : Data Read Timeout
Flight Computer	Software faults	ERR_PR_IMU_INVAL_DAT	63	IMU process : Incorrect data
Flight Computer	Software faults	ERR_PR_IMU_INVAL_CMD	64	IMU process : Invalid command
Flight Computer	Software faults	ERR_PR_IMU_IPC_FAIL	65	IMU process : IPC (inter process communication) Failure
Flight Computer	Software faults	ERR_PR_IMU_PRDEAD	66	IMU process : Process Dead
Flight Computer	Software faults	ERR_PR_EC_SEQEXE_GEN_FAULT	67	Engine Sequence Executor process : General Fault
Flight Computer	Software faults	ERR_PR_EC_SEQEXE_PRDEAD	68	Engine Sequence Executor process : Process Dead
Flight Computer	Software faults	ERR_PR_MCRC_SEQEXE_GEN_FAULT	69	MCRC Seq Executor process : General Fault
Flight Computer	Software faults	ERR_PR_MCRC_SEQEXE_PRDEAD	70	MCRC Seq Executor process : Process Dead
Flight Computer	Software faults	ERR_PR_GUID_LDTRJ_FAIL	71	Guidance process : Load Trajectory Failed
Flight Computer	Software faults	ERR_PR_GUID_INVAL_CMD	72	Guidance process : Invalid Command
Flight Computer	Software faults	ERR_PR_GUID_IPC_FAIL	73	Guidance process : IPC (inter process communication) Failure
Flight Computer	Software faults	ERR_PR_GUID_PRDEAD	74	Guidance process : Process Dead
Flight Computer	Software faults	ERR_PR_NAV_MATHERR	75	Navigation process : Math Error
Flight Computer	Software faults	ERR_PR_NAV_INVAL_CMD	76	Navigation process : Invalid Command
Flight Computer	Software faults	ERR_PR_NAV_IPC_FAIL	77	Navigation process : IPC (inter process communication) Failure
Flight Computer	Software faults	ERR_PR_NAV_PRDEAD	78	Navigation process : Process Dead
Flight Computer	Software faults	ERR_PR_CTRL_MATHERR	79	Control process : Math Error
Flight Computer	Software faults	ERR_PR_CTRL_INVAL_CMD	80	Control process : Invalid command
Flight Computer	Software faults	ERR_PR_CTRL_IPC_FAIL	81	Control process : IPC (inter process communication) Failure

Flight Computer	Software faults	ERR_PR_CTRL_LDGI_FAIL	82	Control process : Loaded Gains Failed
Flight Computer	Software faults	ERR_PR_CTRL_LDTRJ_FAIL	83	Control process : Loaded Gimbal Trajectory Failed
Flight Computer	Software faults	ERR_PR_CTRL_PRDEAD	84	Control process : Process Dead
Flight Computer	Software faults	ERR_PR_6DOF_LDCSV_FAIL	85	six Dof process : Load CSV Failed
Flight Computer	Software faults	ERR_PR_6DOF_IPC_FAIL	86	six Dof process : IPC (inter process communication) Failure
Flight Computer	Software faults	ERR_PR_6DOF_MATHERR	87	six Dof process : Math Error
Flight Computer	Software faults	ERR_PR_6DOF_PRDEAD	88	six Dof process : Process Dead
Flight Computer	Software faults	ERR_PR_ETHRC_IPC_FAIL	89	Ethernet Receiver process : IPC (inter process communication) Failure
Flight Computer	Software faults	ERR_PR_ETHRC_INVAL_CLN	90	Ethernet Receiver process : Unknown client connected
Flight Computer	Software faults	ERR_PR_ETHRC_EC_DISC	91	Ethernet Receiver process : EC Disconnected
Flight Computer	Software faults	ERR_PR_ETHRC_CRIO_DISC	92	Ethernet Receiver process : CRIO Disconnected
Flight Computer	Software faults	ERR_PR_ETHRC_INVAL_DAT	93	Ethernet Receiver process : Unknown Bytes/data
Flight Computer	Software faults	ERR_PR_ETHRC_PRDEAD	94	Ethernet Receiver process : Process Dead
Flight Computer	Software faults	ERR_PR_ETHTR_IPC_FAIL	95	Ethernet Transmitter process : IPC (inter process communication) Failure
Flight Computer	Software faults	ERR_PR_ETHTR_EC_CONFAIL	96	Ethernet Transmitter process : Conn to EC Failed
Flight Computer	Software faults	ERR_PR_ETHTR_CRIO_CONFAIL	97	Ethernet Transmitter process : Conn to CRIO Failed
Flight Computer	Software faults	ERR_PR_ETHTR_TMP_CONFAIL	98	Ethernet Transmitter process : Conn to Telem Failed
Flight Computer	Software faults	ERR_PR_ETHTR_EC_SEND_FAIL	99	Ethernet Transmitter process : Send to EC Failed
Flight Computer	Software faults	ERR_PR_ETHTR_CRIO_SEND_FAIL	100	Ethernet Transmitter process : Send to CRIO Failed
Flight Computer	Software faults	ERR_PR_ETHTR_TMP_SEND_FAIL	101	Ethernet Transmitter process : Send to Telemetry Failed

Flight Computer	Software faults	ERR_PR_ETHTR_PRDEAD	102	Ethernet Transmitter process : Process Dead
Flight Computer	Software faults	ERR_PR_TIM_IPC_FAIL	103	Timer process : IPC (inter process communication) Failure
Flight Computer	Software faults	ERR_PR_TIM_ATSCONN_FAIL	104	Timer process : Conn to ATS Failed
Flight Computer	Software faults	ERR_PR_TIM_ATS_DISC	105	Timer process : ATS Disconnected
Flight Computer	Software faults	ERR_PR_TIM_ATSSEND_FAIL	106	Timer process : Send to ATS Failed
Flight Computer	Software faults	ERR_PR_TIM_PRDEAD	107	Timer process : Process Dead
Flight Computer	Software faults	ERR_PR_DATTRC_IPC_FAIL	108	Data Transcevier process : IPC (inter process communication) Failure
Flight Computer	Software faults	ERR_PR_DATTRC_SYNC_FAIL	109	Data Transceiver process : SPI Sync word not found
Flight Computer	Software faults	ERR_PR_DATTRC_PRDEAD	110	Data Transceiver process : Process Dead
Flight Computer	Software faults	ERR_PR_SEQ_LDCSV_FAIL	111	Sequencer process : Load sequencer CSV Failed
Flight Computer	Software faults	ERR_PR_SEQ_IPC_FAIL	112	Sequencer process : IPC (inter process communication) Failure
Flight Computer	Software faults	ERR_PR_SEQ_CDT_UT	113	Sequencer process : CDT Exceeded the trigger time
Flight Computer	Software faults	ERR_PR_SEQ_INVAL_CMD_SEQ	114	Sequencer process : Invalid Command/Sequence
Flight Computer	Software faults	ERR_PR_SEQ_PRDEAD	115	Sequencer process : Process Dead
Flight Computer	Software faults	ERR_PR_FLTMON_IPC_FAIL	116	Fault Monitor process : IPC (inter process communication) Failure
Flight Computer	Software faults	ERR_PR_FLTMON_FLTID_NA	117	Fault Monitor process : Fault ID not found
Flight Computer	Software faults	ERR_PR_FLTMON_PRDEAD	118	Fault Monitor process : Process Dead
Flight Computer	Software faults	ERR_PR_IMU_SW_SFT_FLT	119	Fault-23
Flight Computer	Software faults	ERR_PR_GNSS_PRERR	120	Fault-24
Flight Computer	Software faults	ERR_PR_IMU_SW_HRD_FLT	121	Fault-25
Flight Computer	Software faults	ERR_PR_GUID_SW_HRD_FLT	122	Fault-26

Flight Computer	Software faults	ERR_PR_NAV_SW_HRD_FLT	123	Fault-27
Flight Computer	Software faults	ERR_PR_CTRL_SW_HRD_FLT	124	Fault-28
Flight Computer	Software faults	ERR_PR_6DOF_SW_HRD_FLT	125	Fault-29
Flight Computer	Software faults	ERR_PR_6DOF_INVAL_CMD	126	Fault-30
Flight Computer	Software faults	ERR_PR_FLH_TX_FAIL	127	Fault-31
Flight Computer	Software faults	ERR_PR_FLH_IPC_FAIL	128	Fault-32
Flight Computer	Software faults	ERR_PR_FLH_INVAL_CMD	129	Fault-33
Flight Computer	Software faults	ERR_PR_GNRC_NO_GO	130	Fault-34

Annexure 1: Changes made in Version V1.5.5

Type	Reference sheet	list of parameter modified in document	ID
Command ID	SO_vehicle_enum_mapV1.0 - Meenakshi - Command_ID_V4.10	VALVE_NOT_CONNECTED_ON	26
		N_EPV_VP2_ON	35
		VALVE_NOT_CONNECTED_OFF	46
		N_EPV_VP2_OFF	55
		EC_CMD_GIMBAL_MON_MODE	63
		EC_CMD_VEH_DAT_COM_CONN	64
		EC_CMD_VEH_DAT_COM_DISCONN	65
		EC_CMD_LAUNCH_ST_GO_NOGO	66
		EC_CMD_ENDS	80
		FC_CMD_RESET_ERROR_COUNTER	81
		FC_CMD_VEH_DAT_COM_CONN	82
		FC_CMD_VEH_DAT_COM_DISCONN	83
		FC_CMD_LAUNCH_ST_GO_NOGO	84
		FC_CMD_LIFT_OFF_CHECK	85
		FC_CMD_ALS_GO_NOGO_CHECK	86
		PHASE_CMD_ENDS	150
		P_UT_BS_DISCONN	237
		FC_LIFTOFF_GO	238
		E_UT_Q3Q4_DISCONN	239
EC_Fault_ID	SO_vehicle_enum_mapV1.0 - Meenakshi-EC_Fault_ID_V1.3	ERR_PR_GNRC_PTP_OFFSET	138
		ERR_PR_FLTMON_LDF_FAIL	139
EC_Status_ID	EC_status_bits_V1.2	EC_STATUS_MCRC_TX_CONN	10
		EC_STATUS_ATS_CONN	15
		EC_STATUS_RES_1	16
		EC_STATUS_GIM_MON_MODE	17
		EC_STATUS_GIM_CMD_MODE	18
Parameter ID	SO_vehicle_enum_mapV1.0 - Meenakshi-Telemetry_parameter_IDs_V1. 25	P_RESERVED_1	43
		P_RESERVED_2	44
		P_CDT_Time_11	154
		P_CDT_Time_12	166

		P_CDT_Time_14	179
		P_CDT_Time_18	221
FC Status	FC_status_bits_V1.2	STATUS_FC_GO	29
		STATUS_ALS_INITIATED	30
		STATUS_LIFTOFF_CONFIRM	31
FC_Faults_ID	SO_vehicle_enum_mapV1.0 - Meenakshi - EC_Fault_ID_V1.2	ERR_UT_GNC_PR_FC	25
		ERR_LT_GNC_PR_FC	26
		ERR_UT_GNC_YR_FC	27
		ERR_LT_GNC_YR_FC	28
		ERR_UT_GNC_RR_FC	29
		ERR_LT_GNC_RR_FC	30
		ERR_UT_GNC_PA_FC	31
		ERR_LT_GNC_PA_FC	32
		ERR_UT_GNC_YA_FC	33
		ERR_LT_GNC_YA_FC	34
		ERR_UT_GNC_RA_FC	35
		ERR_LT_GNC_RA_FC	36
		ERR_SNTFAIL_CMD_EMGA_PA_E1	37
		ERR_RVDFAIL_CMD_EMGA_PA_E1	38
		ERR_SNTFAIL_CMD_EMGA_YA_E1	39
		ERR_RVDFAIL_CMD_EMGA_YA_E1	40
		ERR_SNTFAIL_CMD_PA	42
		ERR_RVDFAIL_CMD_PA	43
		ERR_SNTFAIL_CMD_YA	44
		ERR_RVDFAIL_CMD_YA	45
		ERR_SNTFAIL_CMD_RA	46
		ERR_RVDFAIL_CMD_RA	47
		ERR_PR_IMU_SW_SFT_FLT	119
		ERR_PR_GNSS_PRERR	120
		ERR_PR_IMU_SW_HRD_FLT	121
		ERR_PR_GUID_SW_HRD_FLT	122
		ERR_PR_NAV_SW_HRD_FLT	123
		ERR_PR_CTRL_SW_HRD_FLT	124
		ERR_PR_6DOF_SW_HRD_FLT	125

		ERR_PR_6DOF_INVAL_CMD	126
		ERR_PR_FLH_TX_FAIL	127
		ERR_PR_FLH_IPC_FAIL	128
		ERR_PR_FLH_INVAL_CMD	129
		ERR_PR_GNRC_NO_GO	130

Annexure 2 : Changes made in V1.5.6

Telemetry channel	Parameter ID Designator	Parameter ID	Current Data type	Changed data type
Eth11	p-167	P_CDT_time_11	Uint32_t	int32_t
ETH_11	**Parameter-71 ID**	P_IMUR-X_M	Uint32_t	float
ETH_11	**Parameter-72 ID**	P_IMUR-Y_M	Uint32_t	float
ETH_11	**Parameter-73 ID**	P_IMUR-Z_M	Uint32_t	float
ETH_11	**Parameter-74 ID**	P_IMUA-X_M	Uint32_t	float
ETH_11	**Parameter-75 ID**	P_IMUA-Y_M	Uint32_t	float
ETH_11	**Parameter-76 ID**	P_IMUA-Z_M	Uint32_t	float
Eth12	p-167.0	P_CDT_time_12	Uint32_t	int32_t
Eth14	p-167.1	P_CDT_time_14	Uint32_t	int32_t
ETH_16	**Parameter-117.0 ID**	P_GNSS_ECEF_FHPOS_X	Uint32_t	int32_t
ETH_16	**Parameter-117.1 ID**	P_GNSS_ECEF_LHPOS_X	Uint32_t	int32_t
ETH_16	**Parameter-118.0 ID**	P_GNSS_ECEF_FHPOS_Y	Uint32_t	int32_t
ETH_16	**Parameter-118.1 ID**	P_GNSS_ECEF_LHPOS_Y	Uint32_t	int32_t
ETH_16	**Parameter-119.0 ID**	P_GNSS_ECEF_FHPOS_Z	Uint32_t	int32_t
ETH_16	**Parameter-119.1 ID**	P_GNSS_ECEF_LHPOS_Z	Uint32_t	int32_t
ETH_16	**Parameter-120 ID**	P_GNSS_ECEF_VEL_X	Uint32_t	int32_t
ETH_16	**Parameter-121 ID**	P_GNSS_ECEF_VEL_Y	Uint32_t	int32_t
ETH_16	**Parameter-122 ID**	P_GNSS_ECEF_VEL_Z	Uint32_t	int32_t
ETH_13	**Parameter-90 ID**	P_CMD_EMGA-PA_E1	float	int16_t

ETH_13	**Parameter-91 ID**	P_CMD_EMGA-YA_E1	float	int16_t
ETH_18	**Parameter-141 ID**	P_CDT_Time_18	Uint32_t	int32_t
ETH_19	**Parameter-143 ID**	P_IMUR-X_PLD	Uint32_t	float
ETH_19	**Parameter-144 ID**	P_IMUR-Y_PLD	Uint32_t	float
ETH_19	**Parameter-145 ID**	P_IMUR-Z_PLD	Uint32_t	float
ETH_19	**Parameter-146 ID**	P_IMUA-X_PLD	Uint32_t	float
ETH_19	**Parameter-147 ID**	P_IMUA-Y_PLD	Uint32_t	float
ETH_19	**Parameter-148 ID**	P_IMUA-Z_PLD	Uint32_t	float