Shake Hands with Mister Controller Part II

An Introduction to the BLOCK II
Space Shuttle Main Engine
Controller
SSMEC

BLOCK II Main Engine Controller Introduction

[handwritten: Light ... Acceleration Safety Cutoff System]

* Block I controllers cost $6M plus the FASCOS box, approximately $700K in 1983 dollars. By 1982, 37 of the approximately 250 electrical parts used in the BLOCK I were unavailable.

* BLOCK II controllers average cost $3M in 1989 to 1994 dollars.

* BLOCK II has more functionality and better parts. *[handwritten: Same Die]*
  [handwritten: 68000, Spectateck) Off Same Die (4 per Controller, 2 per channel)]
  * 33% more inputs/outputs & spare circuits. *[handwritten: All Space Rated ('s)]*

  * 4 times memory capacity vs. BLOCK I. *[handwritten: (128 K Bytes, 64 K Words) 1W = 16 Bits]*

  * Failure Data Recorder incorporated.

  * Use of higher order language, i.e. C.
  [handwritten: # Sensors Fail "Offscale Bad" No Good Failures]

* BLOCK II does have the following differences:

  * FASCOS incorporated into the controller. *[handwritten: Launch Data Bus   Mass Memory Unit]*

  * Loading will be done up the LDB not off the MMU.

  * BIG increase in the number of the FIDS and *[handwritten: Failure ID's]* Delimiters.

  * VDT is now vehicle recorder channel, VRC. *[handwritten: variables   vehicle Recorder channel]*

  * TRW, Time Reference Word is now TREF. *[handwritten: time reference]*

  * For Block II MSB is bit 15, GOAL and BLOCK I MSB is bit 1.

BLOCK II Memory

RAM

RAM is 128k bytes of alterable volatile memory. It must be held-up either by battery or by orbiter supplied 28 VDC. This contains all of the operational program unlike the BLOCK I. Once a load is complete no other loads are required to support any vehicle or hardware testing. (Unless there is a new release of the engine software.) Enter commands will be used to execute the different sections of memory.

When a controller enters RAM from PROM it goes thru a pneumatic shutdown ending up in Post-Shutdown Standby, with Flight as the active memory configuration. Commands must then be issued to get it to C/O Standby with Ground Checkout as the active memory configuration.

PROM

PROM is 4k bytes of non-volatile, non-alterable memory. This is similar to special memory loader in BLOCK I. It contains the code required to load the operational program into RAM. When in PROM the time reference word (TREF, was TRW) is not updating. No vehicle recorder channels (VRC was VDT) are being output. What is output is a dummy vehicle recorder channel (DVDT) but this is only transmitted in response to certain PROM commands. The following data words in the DVDT are updated:

        dw 1   ID word 1
        dw 2   ID word 2
        dw 3   Engine Status Word
        dw 5   FID/Delimiter
        dw 90   Inhibit Counter/PROM Rev.
        dw 98   Current Command
        dw 99   Previous Command
        dw 100 FID/Delimter
        dw 103 Parameter
        all others will be zero.

Since the Engine Status Word and ID word 1 are being updated, when you receive a DVDT, the phase should be PROM, mode should be Standby and the memory configuration should be PROM.

Failure Data Recorder

For failure anylasis each Computer Interface Electronics contains a Failure Data Recorder, (FDR), that continously records the address bus data, memory bus data, and control line data of the DCU/CIE monitor microprocessor. The FDR consists of a 2048 by 48-bit RAM, an address counter and control logic. The FDR memory can only be read by the cross channel DCU and it must be in PROM with FDR recording inhibited.

[handwritten margin notes:] Digital Computer Unit / Computer Interface Electronics

[handwritten notes:] Logs 68,000 Bus Cycles

"A" Reads "B" Memory

"B" Reads "A" Memory

New Phase and Modes for BLOCK II

The only changes in the Phase/Mode tree from BLOCK I to BLOCK II are for Checkout, phase equal to 1, and PROM, phase equal to 7. All other phases and modes are the same as today. Reference Table XXIX.

Phase = 1 Checkout
   Mode = 0 Hydraulic Conditioning
   Mode = 1 Standby
   Mode = 2 Actuator Checkout
   Mode = 3 Engine Leak Detection
   Mode = 4 Igniter Checkout
   Mode = 5 Pneumatic Checkout
   Mode = 6 Sensor Checkout
   Mode = 7 Controller Checkout

Phase = 7 PROM
   Mode = 0 Not used
   Mode = 1 Standby
   Mode = 2 Not used
   Mode = 3 Not used
   Mode = 4 Not used
   Mode = 5 Not used
   Mode = 6 Not used
   Mode = 7 Not used

Program Configuration

This is different in BLOCK II. In BLOCK I it was the memory overlay configuration. For Block II it is the active section of memory. Reference Table XXVIII.

If equal to 1 FRT
   3 Ground Checkout
   7 FRT-2
   9 PROM
   15 Flight

       all others are not used.

BLOCK II Vehicle Recorder Channel

This is a little bit different in BLOCK II. Reference Table XXVIII. First it is now called VRC not VDT as in BLOCK I. Second since the FASCOS box is now internal to the Controller FASCOS accel's are now in the VRC. To make room for them the following changes where made to the VRC:

	BLOCK I	**BLOCK II**
dw 118	+36 VDC OE Voltage Ch. A	Vibration Ch. V1A/V2A
dw 119	+36 VDC OE Voltage Ch. B	Vibration Ch. V1B/V2B
dw 121	FASCOS Status Word	Vibration Ch. V1C/V2C

Also the Digital Selftest Words have changed, data words 111,112,113,114. Most of the same information is still contained in these data words, just formated a little different.

<ME-# INPUT WORD 15 DW 111>

Bit Postion Goal	Block II	Data/Status
01	MSB 15	Bleed Valve Solenoid A Energized
02	14	Fuel System Purge Solenoid A Energized
03	13	Pogo System Purge Solenoid A Energized
04	12	Preburner S/D Purge Solenoid A Energized
05	11	Emergency S/D Solenoid A Energized
06	10	HPOP IMSL Purge Solenoid A Energized
07	09	Group 1A (Sensor Checkout) Switch
08	08	Group 2A (Propellant Drop Sensor) Switch
09	07	Power Off Time Exceeded B
10	06	Pull-In State of OE A Sld Pull-In/Hold Volt
11	05	PRC Overflow Test On, Channel A
12	04	Fuel Preburner Igniter A On
13	03	Oxidizer Preburner Igniter A On
14	02	Main Combustion Chamber Igniter A on
15	01	Spare
16	LSB 00	OE A Power Safety Switch On

<ME-# INPUT WORD 16 DW 112>

Bit Postion Goal	Block II	Data/Status
01	MSB 15	Bleed Valve Solenoid B Energized
02	14	Fuel System Purge Solenoid B Energized
03	13	Pogo System Purge Solenoid B Energized
04	12	Preburner S/D Purge Solenoid B Energized
05	11	Emergency S/D Solenoid B Energized
06	10	HPOP IMSL Purge Solenoid B Energized
07	09	Group 1B (Sensor Checkout) Switch
08	08	Group 2B (Propellant Drop Sensor) Switch
09	07	Power Off Time Exceeded A
10	06	Pull-In State of OE B Sld Pull-In/Hold Volt
11	05	PRC Overflow Test On, Channel B
12	04	Fuel Preburner Igniter B On
13	03	Oxidizer Preburner Igniter B On
14	02	Main Combustion Chamber Igniter B on
15	01	Spare
16	LSB 00	OE B Power Safety Switch On

<ME-# FAIL OP SV SW STATUS DW 113>

Bit Postion Goal	Block II	Data/Status
01	MSB 15	OPOV Fail-Op Servoswitch Energized
02	14	FPOV Fail-Op Servoswitch Energized
03	13	MOV Fail-Op Servoswitch Energized
04	12	MFV Fail-Op Servoswitch Energized
05	11	CCV Fail-Op Servoswitch Energized
06	10	OE A 2KHZ Excitation On
07	09	OE B 2KHZ Excitation On
08	08	Halt Exit Enabled/Disabled A
09	07	Halt Exit Enabled/Disabled B
10	06	FDR Write Inhibit A On
11	05	FDR Write Inhibit B On
12	04	Spare
13	03	Spare
14	02	Spare
15	01	Spare
16	LSB 00	Spare

<ME-# FAIL SF SV SW STATUS DW 114>

Bit Position			Data/Status
Goal		Block II	
01	MSB	15	OPOV Fail-Safe Servoswitch A Energized
02		14	FPOV Fail-Safe Servoswitch A Energized
03		13	MOV Fail-Safe Servoswitch A Energized
04		12	MFV Fail-Safe Servoswitch A Energized
05		11	CCV Fail-Safe Servoswitch A Energized
06		10	OPOV Fail-Safe Servoswitch B Energized
07		09	FPOV Fail-Safe Servoswitch B Energized
08		08	MOV Fail-Safe Servoswitch B Energized
09		07	MFV Fail-Safe Servoswitch B Energized
10		06	CCV Fail-Safe Servoswitch B Energized
11		05	Spare
12		04	Spare
13		03	Spare
14		02	Spare
15		01	Spare
16	LSB	00	Spare

There are also numerous range changes in the BLOCK II VRC.

	BLOCK I	**BLOCK II**
dw 16	460-2760 degR	150-2450 degR
dw 17	460-2760 degR	150-2450 degR
dw 18	460-2760 degR	150-2450 degR
dw 19	460-2760 degR	150-2450 degR
dw 38	+/-30 mA	+/-48 mA
dw 56	+/-30 mA	+/-48 mA
dw 81	460-2760 degR	50-650 degR
dw 90	0-50 counts	0-65535 counts
dw 91	+/-32768 counts	0-65535 counts
dw 116	0-127 gpm/pps	68-80 gpm/pps
dw 122	+/-30 mA	+/-48 mA
dw 123	+/-30 mA	+/-48 mA
dw 126	+/-30 mA	+/-48 mA

Command Changes for BLOCK II

New for BLOCK II Commands are:

Stop DCU A/B   SDCA,SDCB
DCU performs self-disqualification. Used to transition from RAM to PROM.
Places the DCU in a halted state. Requires a Reset Channel command to
bring into PROM. C-12 command.

Enter Ground Checkout   EGND
Changes Memory Active configuration to Ground Checkout. Allows ground
checkout commands to be accepted. Accepted only in C/O Standby. C-12
command.

Enter Flight   EFLT
Changes Memory Active configuration to Flight. Accepted only in C/O
Standby. C-12 command.

Enter FRT-1   EFRT
Changes Memory Active configuration to FRT-1. Allows FRT checkout
commands to be accepted. Accepted only in C/O Standby. This will also
perform the Actuator Pre-operational Conditioning Cycle, i.e. 20 msec dither.
C-12 command.

Enter FRT-2   ETWO
Changes Memory Active configuration to FRT-2. Accepted only in C/O
Standby. C-12 command.

Restore VRC   RVRC
If the source of the VRC data is DCU B, the source is returned to DCU A.
Accepted in all phase and modes. C-12 command.

Switch VRC   SVRC
If the source of the VRC data is DCU A, the source is set to DCU B. Accepted
in all phase and modes. Replaces Switch VDT in BLOCK I. C-12 command.

Activate FRT Simulation   AFRT
Activates FRT mode and initiates FRT simulation. Must be preceded by a
Enter FRT-1 or FRT-2 command. Memory Active configuration must be FRT-
1 or FRT-2. Accepted only in C/O Standby. C-3 command.

Deactivate FRT Simulation   XFRT
Deactivates FRT mode and enters Post Shutdown Standby. FRT must be
activated. Memory Active configuration must be FRT-1 or FRT-2. Accepted
in all Phase and Modes. C-3 command.

Hydraulic Conditioning   HYDC
Initiates the hydraulic conditioning sequence. See attachment section
3.2.3:2.3.9. This will also perform the Actuator Pre-operational Conditioning
Cycle, i.e. 20 msec dither. Memory Active configuration must be Ground
Checkout. Accepted only in Checkout Standby. C-3 command.

Contoller Checkout   ERCK   "Engine Redundancy Checkout"
Replaces Redun 1 and 2 checkouts in BLOCK I. Memory Active configuration
must be Ground Checkout. Accepted only in Checkout Standby. C-12
command.

RSYS
Not really a new command but there are changes in the commands available
at C-3 because rsys between C-3/4 and C-12 is being deleted. There will be a
new duplicate command for Resume at C-3, D41E#2021L. Checkout Standby
and Controller Reset commands will be C-12 only.

New BLOCK II PROM commands are:

Memory Load A/B   MLDA,MLDB
Provides a means of loading Main memory. Accepted in PROM Standby only.
C-12 command.

Reset Channel A/B   RSCA,RSCB
Brings the DCU off of a halt condition and brings it into PROM Standby.
Accepted only if DCU halted, ie halt exit bit is enabled. C-12 command.

Hello A/B   HELA,HELB
Causes two VRC's to be output. The first one is a transmission of the VRC
DPM contents, possibility a previously untransmitted VDT. This is followed
by a DVDT with dw 98 and 99 being updated. Accepted only in PROM
Standby. C-12 command.

PROM Sum Check A/B   PSCA,PSCB
A DVDT is transmitted showing dw 98 and 99 being updated.
Algorithmically combines the contents of all PROM locations except the
miscompare location and compares this calculated value to zero. A DVDT is
transmitted showing dw 98 and 99 being updated. If sum not zero then a
DVDT is transmitted with a fid for sum check failure and the sum as the
failure parameter. Accepted only in PROM Standby. C-12 Command.

IO Readout A/B   IOHA,IOHB,IOLA,IOLB,IOSA,IOSB
Gives visibility to the current input data of memory mapped I/O devices..A
DVDT is transmitted showing dw 98 and 99 being updated. This is followed
by a 128 word dump frame. There are three different IO reads, High IE, Low
IE and Input Space. Accepted in Checkout, Start Prep, Post Shutdown and
PROM Standby. C-12 command.

FDR Enable A/B   ENFA,ENFB
Resets the Failure Data Recorder inhibit, so that new bus traffic data will begin storing in the FDR. A DVDT is transmitted showing dw 98 and 99 being updated. Accepted only in PROM Standby.
C-12 command.

FDR Cross-Channel Readout A/B   ROFA,ROFB
Provides a means of dumping the opposite channel's FDR. Only dumps 42 of the 2048 48-bit FDR words at a time. A DVDT is transmitted showing dw 98 and 99 being updated and is followed by a dump frame of those 42 words.
Accepted only in PROM Standby. C-12 command.

RAM Write-Read Test A/B   RWRA,RWRB
A DVDT is transmitted showing dw 98 and 99 being updated. All RAM Address are checked by writing address dependent data throughout memory and then reading it back. It will then write an illegal instruction into each location. In this test memory is overwritten, so after completion a reload of memory is required. Accepted only in PROM Standby. C-12 command.

RAM Sum Check A/B   RSKA,RSKB
Calculates sum check values from identified RAM main memory address spaces to confirm memory status. A DVDT is transmitted showing dw 98 and 99 being updated. If sum check fails a fid is stored in the DPM but will not be seen until a DVDT is output. Accepted only in PROM Standby. C-12 command.

Exit PROM   EXPM
Causes control to pass from PROM to the program residing in RAM. This command shall be processed by both DCU's simultaneously. Acceptance of this command is contingent on successful performance of the RAM sum check function which is invoked. If sum check fails a DVDT is output and DCU stays in PROM. If sum check passes then DCU comes up thru pneumatic shutdown to post shutdown standby. Memory Active configuration will be Flight. Accepted only in PROM Standby. C-12 command.

Memory Readout A/B   MRC1,MRC2
Initiates memory Readout of DCU. Provides visibility to the contents of Main Memory by offering a means of Transmitting selectable reads via VRC. If in PROM a DVDT is transmitted showing dw 98 and 99 being updated and is followed by a 128 word dump frame. If in RAM the command works same as today. Accepted in Checkout Standby, Start Prep, Post Shutdown and PROM Standby. C-12 command.

4320

..3:2.3.8 Actuator Pre-operational Conditioning Cycle

The Actuator Pre-operational Conditioning Cycle will be performed during Purge Sequence 3, and as a prelude to Engine Leak Detection Support (open valve commands), Actuator Checkout, Emergency Shutdown Control Valve portion of Pneumatic Checkout, Hydraulic Conditioning, and FRT-1.

[IR704:4320; 1] The steps of the ~~sequence~~ 300 msec cycle shall be as follows:

(a) Delay 20 msec.

(b) Energize the fail-operational servoswitch of the selected servoactuator.

(c) Delay 20 msec.

(d) Command Channel A of the servoactuator to +3%.

(e) Delay 40 msec.

(f) Command Channel A of the servoactuator to 0%.

(g) Delay 40 msec.

(h) Command Channel A of the servoactuator to 0%.

(i) Delay 20 msec.

(j) Deenergize the fail-operational servoswitch.

(k) Delay 20 msec.

(ℓ) Command Channel B of the servoactuator to +3%.

(m) Delay 40 msec.

(n) Command Channel B of the servoactuator to 0%.

(o) Delay 40 msec.

(p) Command Channel B of the servoactuator to 0%.

(q) Delay 20 msec.

(r) Energize both fail-safe servoswitches.

(s) Delay 20 msec.

— Deenergize both fail-safe servoswitches.

(u) Delay 20 msec.

AC1
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Insert A (continued) for page 212

.2.3 : 2.3.8 _Actuator Pre-operational Conditioning Cycle (con't)_   4320

Regardless of the commanded position, due to the state of fail-safe servoswitches, the propellant valves will remain closed under pneumatic pressure. The ~~Actuator Exercise Sequence~~ is diagrammed for information only in Figure 19.
^ Actuator Pre-operational Conditioning Cycle

[IR704:4320;2]   Upon completion of the ~~exercise~~ or abnormal termination, all servoactuators shall be commanded to 0% and all servoswitches shall be deenergized. ⌐ cycle

[IR704:4320;3]   If the sequence ~~was~~ is terminated due to disqualification of hardware components, disqualification responses (3.2.1:6) shall take precedence. (E.g., if control is via Channel B servoactuators energize the fail-operational servoswitches).

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Rockwell International
Rocketdyne Division
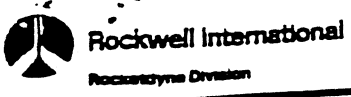
MCR CONTINUATION PAGE - SSME

SN# 4321

DESCRIPTION OF CHANGE

Weight Impact —————————

Figure 2 Actuator Pre-Operational Cycle

FAIL-OP SERVO SWITCH	ENERGIZED	
	DE-ENERGIZED	
CHANNEL A ACTUATOR COMMAND	+3%	
	0%	
	-3%	
CHANNEL B ACTUATOR COMMAND	+3%	
	0%	
	-3%	
FAILSAFE SERVO SWITCH	ENERGIZED	
	DE-ENERGIZED	

Time In Milliseconds

0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
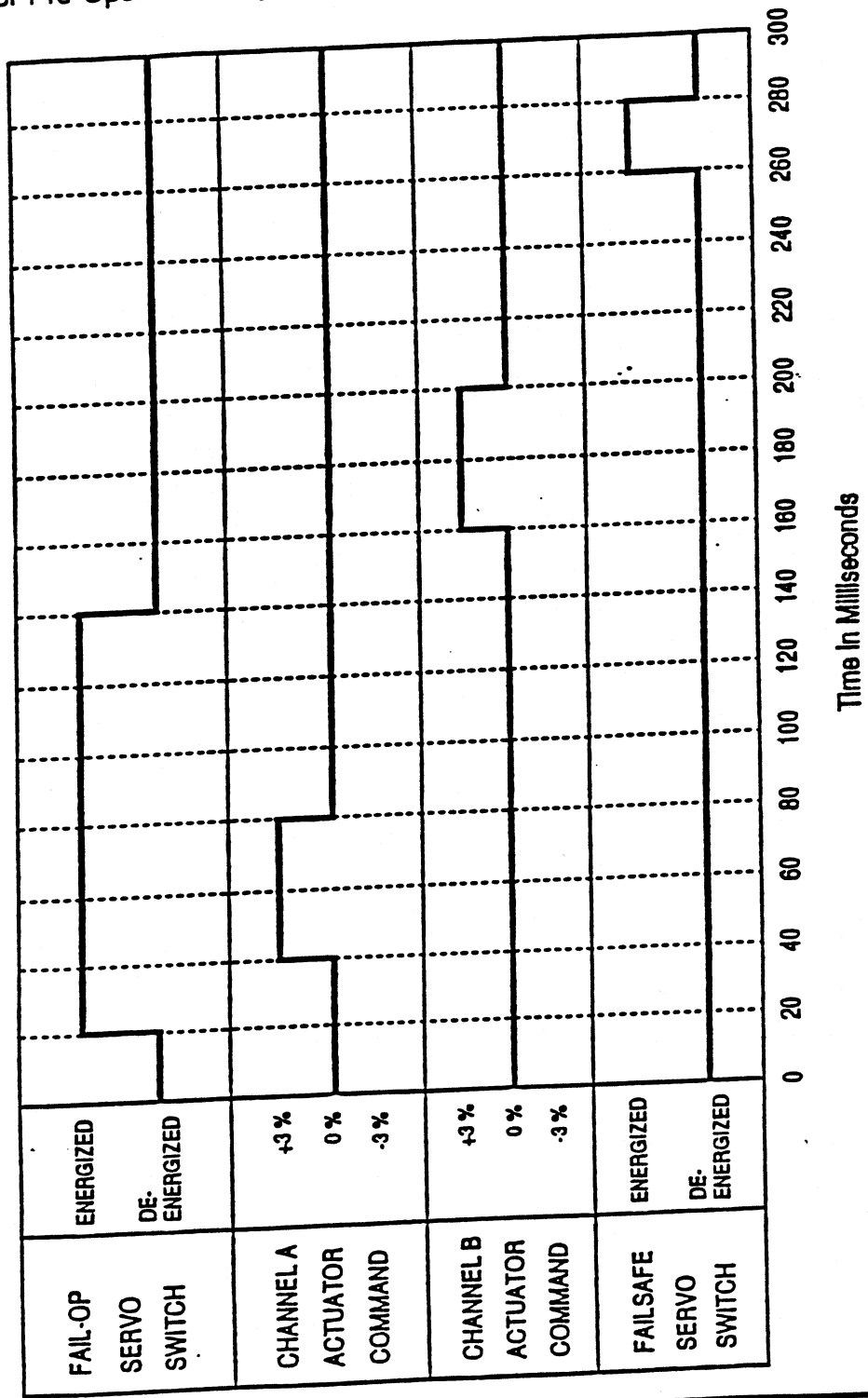
3.2.3: 2.3.9   Hydraulic Conditioning   4320

[IR704:4320;4] This sequence shall be initiated upon acceptance
of a Hydraulic Conditioning command. The sequence is as
follows:

(a) [IR704:4320;5] The Emergency Shutdown ~~Control valve~~ solenoid
    shall be energized.

(b) [IR704:4320;6] A 2.0 second delay shall occur to vent
    pneumatic pressure.

(c) [IR704:4320;7] An ~~300 msec~~ Actuator Pre-operational
    Conditioning Cycle shall be performed, per 3.2.3:2.3.8,
    on all five actuators in parallel.

(d) [IR704:4320;8] The Hydraulic Conditioning Sequence
    per Table XLI shall be performed on each actuator
    (MFV, MOV, CCV, FPOV, OPOV) in series.

(e) [IR704:4320;9] Upon completion or termination of this sequence,
    the Emergency Shutdown soleniod, fail-safe servoswitches, and
    fail-operational servoswitches shall be deenergized unless
    overridden by disqualification of hardware components (3.2.1:6).

During each major cycle of Hydraulic Conditioning mode:

(f') [IR704:4320;10] The Hydraulic Pressure shall be
     monitored to be 2650 psia or greater.

(g) [IR704:4320;11] The position of each actuator that is
    not being commanded shall be monitored to be less
    than or equal to 3% open.

Insert A (continued) for page 212

3.2.3 : 2.3.9   Hydraulic Conditioning (con't)

(A) [IR704:4320;12] A failure shall occur if either of these conditions is not met. [IR704:4320;13] If an I-response occurs as a result of a Hydraulic Pressure failure, the sequence shall be aborted and Checkout Standby entered.

The Hydraulic Conditioning sequence is diagrammed for information only in Figure 22.

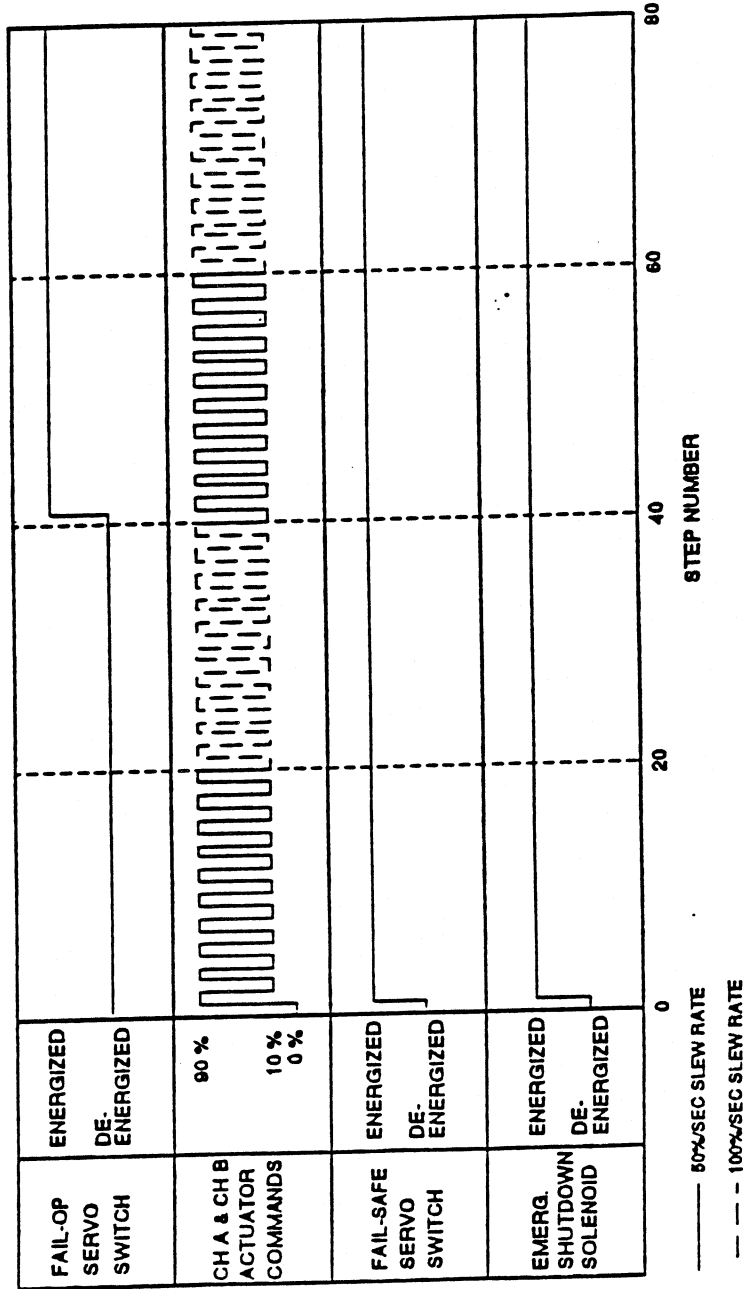Upon completion of the sequence, the Operational program will return to Checkout Standby.

DESCRIPTION OF CHANGE

Weight Impact ────────

Figure 1 Hydraulic Conditioning Module

CONDITIONING SEQUENCE
(Note 1)

STEP NO. 2 (NOTE 1) OCTAL	COMMAND POSITION (%)	SLEW RATE (% SEC)	FAIL-OP STATUS (NOTE 2) 3	FAIL-SAFE STATUS (NOTE 2) 3	TIME TO PERFORM STEP ( ) (NOTE 4)
1	90	50	D	E	1.92
2	10	50	D	E	1.72
3	90	50	D	E	1.72
4	10	50	D	E	1.72
5	90	50	D	E	1.72
6	10	50	D	E	1.72
7	90	50	D	E	1.72
10	10	50	D	E	1.72
11	90	50	D	E	1.72
12	10	50	D	E	1.72
13	90	50	D	E	1.72
14	10	50	D	E	1.72
15	90	50	D	E	1.72
16	10	50	D	E	1.72
17	90	50	D	E	1.72
20	10	50	D	E	1.72
21	90	50	D	E	1.72
22	10	50	D	E	1.72
23	90	50	D	E	1.72
24	10	50	D	E	1.72
25	90	100	D	E	0.92
26	10	100	D	E	0.92
27	90	100	D	E	0.92
30	10	100	D	E	0.92
31	90	100	D	E	0.92
32	10	100	D	E	0.92
33	90	100	D	E	0.92
34	10	100	D	E	0.92
35	90	100	D	E	0.92
36	10	100	D	E	0.92
37	90	100	D	E	0.92
40	10	100	D	E	0.92
41	90	100	D	E	0.92
42	10	100	D	E	0.92
43	90	100	D	E	0.92
44	10	100	D	E	0.92
45	90	100	D	E	0.92
46	10	100	D	E	0.92
47	90	100	D	E	0.92
50	10	100	D	E	0.92
51	90	50	E	E	1.72
52	10	50	E	E	1.72
53	90	50	E	E	1.72
54	10	50	E	E	1.72
55	90	50	E	E	1.72
56	10	50	E	E	1.72

AES

STEP NO (NOTE 1)[2] OCTAL	COMMAND POSITION (%)	SLEW RATE (% SEC)	FAIL-OP STATUS (NOTE 2)[3]	FAIL-SAFE STATUS (NOTE 2)[3]	TIME TO PERFORM STEP ( ) (NOTE 3)[4]
57	90	50	E	E	1.72
60	10	50	E	E	1.72
61	90	50	E	E	1.72
62	10	50	E	E	1.72
63	90	50	E	E	1.72
64	10	50	E	E	1.72
65	90	50	E	E	1.72
66	10	50	E	E	1.72
67	90	50	E	E	1.72
70	10	50	E	E	1.72
71	90	50	E	E	1.72
72	10	50	E	E	1.72
73	90	50	E	E	1.72
74	10	50	E	E	1.72
75	90	100	E	E	0.92
76	10	100	E	E	0.92
77	90	100	E	E	0.92
100	10	100	E	E	0.92
101	90	100	E	E	0.92
102	10	100	E	E	0.92
103	90	100	E	E	0.92
104	10	100	E	E	0.92
105	90	100	E	E	0.92
106	10	100	E	E	0.92
107	90	100	E	E	0.92
110	10	100	E	E	0.92
111	90	100	E	E	0.92
112	10	100	E	E	0.92
113	90	100	E	E	0.92
114	10	100	E	E	0.92
115	90	100	E	E	0.92
116	10	100	E	E	0.92
117	90	100	E	E	0.92
120	0	100	D E	D E	1.02

NOTES:

1. The ambient and engine conditions during the Hydraulic Conditioning Sequence are:

   (a) Ambient pressure is 13 to 15 psia and temperature is 35 to 95 degrees F.

   (b) No propellants are present in the engine.

   (c) Hydraulic supply is pressurized.

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AES

Table XLI
HYDRAULIC CONDITIONING SEQUENCE (Con't)

NOTES (con't)

2. The Step No. is always reported in VOT word 126. Upon command acceptance the Step No. is initialized to Ø. This is to prevent any Step No. misinterpretation with a previously run checkout test.

3. E = Energized ; D = Deenergized .

4. The times given are those to perform each individual step as opposed to a cumulative time. They are derived from the time it takes the valve to move to the commanded position based on the given slew rate, plus six major cycles. Also, all times have a tolerance of +/- 10 milliseconds.

4320

AES

HYDRAULIC CONDITIONING SEQUENCE

STEP	COMMAND POSITION (%)	SLEW RATE (%/SEC)	FAIL-OP STATUS	FAIL-SAFE STATUS	TIME TO PERFORM STEP (SEC)	FLUID VOLUME DISPLACED
1	90	50	D	E	1.80	0.90
2	10	50	D	E	1.60	0.80
3	90	50	D	E	1.60	0.80
4	10	50	D	E	1.60	0.80
5	90	50	D	E	1.60	0.80
6	10	50	D	E	1.60	0.80
7	90	50	D	E	1.60	0.80
8	10	50	D	E	1.60	0.80
9	90	50	D	E	1.60	0.80
10	10	50	D	E	1.60	0.80
11	90	50	D	E	1.60	0.80
12	10	50	D	E	1.60	0.80
13	90	50	D	E	1.60	0.80
14	10	50	D	E	1.60	0.80
15	90	50	D	E	1.60	0.80
16	10	50	D	E	1.60	0.80
17	90	50	D	E	1.60	0.80
18	10	50	D	E	1.60	0.80
19	90	50	D	E	1.60	0.80
20	10	50	D	E	1.60	0.80
21	90	100	D	E	0.80	0.80
22	10	100	D	E	0.80	0.80
23	90	100	D	E	0.80	0.80
24	10	100	D	E	0.80	0.80
25	90	100	D	E	0.80	0.80
26	10	100	D	E	0.80	0.80
27	90	100	D	E	0.80	0.80
28	10	100	D	E	0.80	0.80
29	90	100	D	E	0.80	0.80
30	10	100	D	E	0.80	0.80
31	90	100	D	E	0.80	0.80
32	10	100	D	E	0.80	0.80
33	90	100	D	E	0.80	0.80
34	10	100	D	E	0.80	0.80
35	90	100	D	E	0.80	0.80
36	10	100	D	E	0.80	0.80
37	90	100	D	E	0.80	0.80
38	10	100	D	E	0.80	0.80
39	90	100	D	E	0.80	0.80
40	10	100	D	E	0.80	0.80
41	90	50	E	E	1.60	0.80
42	10	50	E	E	1.60	0.80
43	90	50	E	E	1.60	0.80
44	10	50	E	E	1.60	0.80
45	90	50	E	E	1.60	0.80
46	10	50	E	E	1.60	0.80
47	90	50	E	E	1.60	0.80
48	10	50	E	E	1.60	0.80
49	90	50	E	E	1.60	0.80
50	10	50	E	E	1.60	0.80

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HYDRAULIC CONDITIONING SEQUENCE

STEP	COMMAND POSITION (%)	SLEW RATE (%/SEC)	FAIL-OP STATUS	FAIL-SAFE STATUS	TIME TO PERFORM STEP (SEC)	FLUID VOLUME DISPLACED
51	90	50	E	E	1.60	0.80
52	10	50	E	E	1.60	0.80
53	90	50	E	E	1.60	0.80
54	10	50	E	E	1.60	0.80
55	90	50	E	E	1.60	0.80
56	10	50	E	E	1.60	0.80
57	90	50	E	E	1.60	0.80
58	10	50	E	E	1.60	0.80
59	90	50	E	E	1.60	0.80
60	10	50	E	E	1.60	0.80
61	90	100	E	E	0.80	0.80
62	10	100	E	E	0.80	0.80
63	90	100	E	E	0.80	0.80
64	10	100	E	E	0.80	0.80
65	90	100	E	E	0.80	0.80
66	10	100	E	E	0.80	0.80
67	90	100	E	E	0.80	0.80
68	10	100	E	E	0.80	0.80
69	90	100	E	E	0.80	0.80
70	10	100	E	E	0.80	0.80
71	90	100	E	E	0.80	0.80
72	10	100	E	E	0.80	0.80
73	90	100	E	E	0.80	0.80
74	10	100	E	E	0.80	0.80
75	90	100	E	E	0.80	0.80
76	10	100	E	E	0.80	0.80
77	90	100	E	E	0.80	0.80
78	10	100	E	E	0.80	0.80
79	90	100	E	E	0.80	0.80
80	0	100	D	D	0.90	0.90
					96.30	64.20

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A B B R E V I A T I O N S

CONFIGURATION / PHASE / MODE		C O N D I T I O N S F O R R E J E C T I O N
CO	Checkout	CR	CR response (See Table XIV) is in effect.
ELD	Engine Leak Detection	CR2	CR2 response (See Table XIV) is in effect.
ER	Engine Ready	CCV	CCV is less than 94% open.
GCO	Ground Checkout	ENB	The associated Enable command is not in effect.
FLT	Flight	FRT	In an FRT configuration and FRT Mode is deactivated.
FRT	Flight Readiness Test	PS	Previous shutdown is a Pneumatic Shutdown.
OD	Oxidizer Dump	I	I-Response is in effect.
PSD	Post Shutdown	LIM	A qualified sensor is outside its Engine Ready limit.
Px	Purge Sequence No. x	RO	Readout A command is received while a Switch VRC command is in effect.
	where x is 1,2,3, or 4		or A Readout command requests readout of a disqualified DCU.
SB	Standby	ST	Stop DCU command indicator is set to reject command.
SP	Start Preparation	T	T-Response is in effect.
		VRC	Command is attempting to switch VRC source to disqualified DCU.

VEHICLE COMMAND	COMMAND CODE (OCTAL) (HEX)	MEMORY CONFIG.	OPERATING PHASE/MODE	CONDITIONS FOR REJECTION	F U N C T I O N
Activate FRT Simulation	@136000 ($BC00)	FRT-1, FRT-2	CO/SB	I, T	Activates FRT Mode, and initiates FRT simulation. 3.2.3:2.4.
Checkout Bleed Valve Control valve	@127400 ($AF00)	GCO	CO/SB	I, T	Enters Pneumatic Checkout mode for this valve. 3.2.3:2.3.3 and Table XXXV.
Checkout CCV	@132400 ($B500)	GCO	CO/SB	I, T	Enters Actuator Checkout mode for the CCV. 3.2.3:2.3.4 and Table XXXVI.
Checkout Emergency Shutdown Control Valve	@130000 ($B000)	GCO	CO/SB	I, T	Enters Pneumatic Checkout mode for this valve. 3.2.3:2.3.3 and Table XXXV.
Checkout FPOV	@133000 ($B600)	GCO	CO/SB	I, T	Enters Actuator Checkout mode for the FPOV. 3.2.3:2.3.4 and Table XXXVI.

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Table XXIV
VEHICLE COMMANDS AND ACCEPTANCE CRITERIA (Notes 1,2,3,4) (Continued)

VEHICLE COMMAND	COMMAND CODE (OCTAL) (HEX)	MEMORY CONFIG.	OPERATING PHASE/MODE	CONDITIONS FOR REJECTION	FUNCTION
Checkout Fuel System Purge Control Valve	@126400 ($AD00)	GCO	CO/SB	I, T	Enters Pneumatic Checkout mode for this valve. 3.2.3:2.3.3 and Table XXXV.
Checkout HPOP IMSL Purge Control Valve	@127000 ($AE00)	GCO	CO/SB	I, T	Enters Pneumatic Checkout mode for this valve. 3.2.3:2.3.3 and Table XXXV.
Checkout MFV	@131400 ($B300)	GCO	CO/SB	I, T	Enters Actuator Checkout mode for the MFV. 3.2.3:2.3.4 and Table XXXVI.
Checkout MOV	@132000 ($B400)	GCO	CO/SB	I, T	Enters Actuator Checkout mode for the MOV. 3.2.3:2.3.4 and Table XXXVI.
Checkout OPOV	@133400 ($B700)	GCO	CO/SB	I, T	Enters Actuator Checkout mode for the OPOV. 3.2.3:2.3.4 and Table XXXVI.
Checkout Pogo Precharge Control Valve	@130400 ($B100)	GCO	CO/SB	I, T	Enters Pneumatic Checkout mode for this valve. 3.2.3:2.3.3 and Table XXXV.
Checkout Preburner Shutdown Purge Control Valve	@131000 ($B200)	GCO	CO/SB	I, T	Enters Pneumatic Checkout mode for this valve. 3.2.3:2.3.3 and Table XXXV.
Checkout Standby	@116400 ($9D00)	All	CO, SP, PSD/SB, PSD/OD	I	Returns Controller to Checkout Standby without clearing failure indications. 3.2.3:1.1.2 and 3.2.3:1.2.7.
Close Emergency Shutdown Control Valve	@124400 ($A900)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode. Disables CCV servoactuator error indications, energizes Ch A and B fail-safes, and closes Emergency Shutdown Control Valve. 3.2.3:2.3.6.
Controller Checkout	@135400 ($BB00)	GCO	CO/SB	I, T	Enters Controller Checkout mode for Controller hardware tests. 3.2.3:2.3.5.

VEHICLE COMMANDS AND ACCEPTANCE CRITERIA (Notes 1,2,3,4) (Continued)

VEHICLE COMMAND	COMMAND CODE (OCTAL) (HEX)	MEMORY CONFIG.	OPERATING PHASE/MODE	CONDITIONS FOR REJECTION	FUNCTION
Controller Reset	@120000 ($A000)	All	CO, SP, PSD/SB, PSD/OD	-	Returns Controller to Checkout Standby and clears all failure indications. 3.2.3:1.1.1 and 3.2.3:1.2.7.
Deactivate All Valves (Propellant and Pneumatic)	@125400 ($AB00)	GCO	CO	-	Deenergizes all pneumatic solenoids, closes all propellant valves hydraulically, and then enters Checkout Standby. 3.2.3:2.3.7.
Deactivate FRT Simulation	@140000 ($C000)	FRT-1, FRT-2	All	FRT, I	Deactivates FRT simulation and enters Post Shutdown Standby. 3.2.3:2.4.1:2.
Enter Flight	@113000 ($9600)	All	CO/SB	I	Changes the configuration to Flight. 3.2.3:1.
Enter FRT-1	@113400 ($9700)	All	CO/SB	I, T	Changes the configuration to FRT-1. 3.2.3:2.4.
Enter FRT-2	@114000 ($9800)	All	CO/SB	I, T	Changes the configuration to FRT-2. 3.2.3:2.4.
Enter Ground Checkout	@112400 ($9500)	All	CO/SB	I, T	Changes the configuration to Ground Checkout. 3.2.3:2.
Exit PROM	@177400 ($FF00)	All	All	I	This command is reported but no other action will be taken. Acting as a PROM command (see DSCP34053988) it is used to exit from PROM and enter Flight configuration Pneumatic Shutdown.
Inhibit Igniters In FRT-1	@140400 ($C100)	FRT-1	All	FRT, T	Eliminates energization of Igniters in FRT-1 configuration, 3.2.3:2.4.1:1.1. Upon deactivation of the FRT Mode the effects of the command will be removed.
IO Readout High IE DPM A/B	@171442/ 171441 ($F322/ F321)	All	CO, SP, PSD	RO	Initiates a readout of 128 words of IE DPM, beginning with address $820100. 3.2.2:2.1.2.

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Hydraulic Conditioning   @141000 $C200   GC6   c/o SB   Initiates the hydraulic conditioning sequence. per 3.2.3:2.3.4.

VEHICLE COMMAND	COMMAND CODE (OCTAL) (HEX)	MEMORY CONFIG.	OPERATING PHASE/MODE	CONDITIONS FOR REJECTION	FUNCTION
IO Readout Input Space A/B	@171462/ 171461 ($F332/ F331)	All	CO, SP. PSD	RO	Initiates a readout of 128 words of IE DPM, beginning with address $820C00, 3.2.2:2.1.2.
IO Readout Low IE DPM A/B	@171422/ 171421 ($F312/ F311)	All	CO, SP. PSD	RO	Initiates a readout of 128 words of IE DPM, beginning with address $820000, 3.2.2:2.1.2.
Limit Control Enable	@104400 ($8900)	FLT, FRT-1, FRT-2	All	-	Enables controller initiated engine shutdown based upon Shutdown Limit Monitoring (3.2.3:5.3), or FASCOS (3.2.3:5.4).
Limit Control Inhibit	@104000 ($8800)	FLT, FRT-1, FRT-2	All	-	Inhibits controller initiated engine shutdown based upon Shutdown Limit Monitoring (3.2.3:5.3), or FASCOS (3.2.3:5.4).
Main Chamber Pressure (MCC Pc) Level	@043400- 071400 ($4700- 7300)	All	All	-	The implementation of the command codes in this range is based upon the configuration. If the configuration is Ground Checkout when the command is received, the command will be interpreted as a Set Propellant Valve Position or Set Propellant Valve Ramp Rate command. Otherwise, the command sets the MCC PC Reference Level. If the MCC Pc Reference Level is to be set, the range of commands from @043400 to @071400 will correspond to 65 to 109 percent RPL. An octal @400 represents 1 percent RPL. The range can be expanded using Operational Data.
Memory Readout A/B	@177762/ 177761 ($FFF2/ FFF1)	All	CO, SP. PSD	RO	Initiates memory readout of DCU A/B. 3.2.2:2.1.
No OP	@112000 ($9400)	All	All	-	This command is reported but no other action will be taken.

VEHICLE COMMAND	COMMAND CODE (OCTAL) (HEX)	MEMORY CONFIG.	OPERATING PHASE/MODE	CONDITIONS FOR REJECTION	FUNCTION
Open Bleed Valve Control Valve	@124000 ($AB00)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode to open this valve. 3.2.3:2.3.6.
Open CCV	@121400 ($A300)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode to open CCV. 3.2.3:2.3.6.
Open FPOV	@122000 ($A400)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode to open FPOV. 3.2.3:2.3.6.
Open Fuel System Purge Control Valve	@123000 ($A600)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode to open this valve. 3.2.3:2.3.6.
Open HPOP IMSL Purge Control Valve	@123400 ($A700)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode to open this valve. 3.2.3:2.3.6.
Open MFV	@120400 ($A100)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode to open MFV. 3.2.3:2.3.6.
Open MOV	@121000 ($A200)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode to open MOV. 3.2.3:2.3.6.
Open OPOV	@122400 ($A500)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode to open OPOV. 3.2.3:2.3.6.
Open Pogo Precharge Control Valve	@125000 ($AA00)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode to open this valve. 3.2.3:2.3.6.

VEHICLE COMMAND	COMMAND CODE (OCTAL) (HEX)	MEMORY CONFIG.	OPERATING PHASE/MODE	CONDITIONS FOR REJECTION	FUNCTION
Open Preburner Shutdown Purge Control Valve	@126000 ($AC00)	GCO	CO/SB, CO/ELD	I, T	Enters Engine Leak Detection mode to open this valve. 3.2.3:2.3.6.
Oxidizer Dump	@110400 ($9100)	FLT, FRT-1, FRT-2	PSD/SB, PSD/OD	I, PS	Starts Oxidizer Dump and maintains MOV open, ends mode by entering Post Shutdown Standby mode. 3.2.3:1.6.2.
PROM Commands	@102000/ 102400 ($8400/ 8500), @117000/ 117400 ($9E00/ 9F00), @170400- 177776 ($F100- FFFE)	N/A	N/A	N/A	These command codes have been reserved for PROM. Reference DSCP34053888. The following command codes are used by both PROM and RAM: @171421/2 ($F311/2) for IO Readout Low IE DPM B/A @171441/2 ($F321/2) for IO Readout High IE DPM B/A @171461/2 ($F331/2) for IO Readout Input Space B/A @177400 ($FF00) for Exit PROM @177761/2 ($FFF1/2) for Memory Readout B/A
Purge Sequence 1	@105400 ($8B00)	FLT, FRT-1, FRT-2	CO/SB, SP/P1, SP/P2, PSD/SB	CR, CR2, FRT, I	Enters Start Preparation phase. Purge Sequence 1 mode. Set Time Reference to zero, closes all valves. 3.2.3:1.2.1.
Purge Sequence 2	@106000 ($8C00)	FLT, FRT-1, FRT-2	CO/SB, SP/P1, SP/P2, PSD/SB	CR, CR2, FRT, I	Enters Start Preparation phase. Purge Sequence 2 mode. Open Fuel System Purge Control Valves to initiate Fuel System Purge. 3.2.3:1.2.2.
Purge Sequence 3	@106400 ($8D00)	FLT, FRT-1, FRT-2	CO/SB, SP, PSD/SB	CR, CR2, FRT, I	Enters Start Preparation phase. Purge Sequence 3 mode. Opens Bleed Valves and terminates Fuel System Purge. 3.2.3:1.2.3.
Purge Sequence 4	@107000 ($8E00)	FLT, FRT-1, FRT-2	CO/SB, SP, PSD/SB	CR, CR2, FRT, I	Enters Start Preparation phase. Purge Sequence 4 mode. Initiates Fuel System Purge during propellant recirculation. Energizes fail-safe servoswitches and commands initial position of CCV. 3.2.3:1.2.4.

VEHICLE COMMANDS AND ACCEPTANCE CRITERIA (Notes 1,2,3,4) (Continued)

VEHICLE COMMAND	COMMAND CODE (OCTAL) (HEX)	MEMORY CONFIG.	OPERATING PHASE/MODE	CONDITIONS FOR REJECTION	FUNCTION
Reset Channel A/B	@117000/ 117400 ($9E00/ 9F00) Code is not used by RAM	N/A	N/A	N/A	Only hardware accepts and implements these commands by initiating PROM Executive in DCU A/B (Reference DSCP34053988). These commands will be rejected by the RAM program as invalid codes. If hardware detects a voted Reset Channel command and the associated Halt Exit bit is enabled, a Reset Exception will be generated which initiates the PROM program.
Restore VRC	@115000 ($9A00)	All	All	VRC	If the source of the VRC data is DCU B, switch the source of the VRC data to DCU A. 3.2.2:2.2.4.
Resume	@100000 ($8000)	All	All	-	Overrides an I-response (3.2.4:4(s)) and/or Major Component Failed (3.2.4:2(e)), and resumes a checkout sequence.
Sensor Checkout and Calibration	@134000 ($B800)	GCO	CO/SB	I, T	Enters Sensor Checkout mode and calibrates selected pressure sensors. 3.2.3:2.3.
Set Propellant Valve Position	@000400- 043377 ($0100- 46FF)	GCO	All	-	Sets the targeted propellant valve position to be implemented upon execution of an Open Propellant command (i.e., Open MOV, Open MFV, etc.). 3.2.3:2.3.6.
	@043400- 064400 ($4700- 6900)	All	All	-	Implementation of the command code is same as the Main Chamber Pressure Level command.
Set Propellant Valve Ramp Rate	@064401- 071400 ($6901- 7300)	All	All	-	Implementation of the command code is same as the Main Chamber Pressure Level command.
	@071401- 077740 ($7301- 7FE0)	GCO	All	-	Sets the targeted propellant valve ramp rate to be implemented upon execution of an Open Propellant valve command (i.e., Open MOV, Open MFV, etc.), 3.2.3:2.3.6.

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Table XXIV
VEHICLE COMMANDS AND ACCEPTANCE CRITERIA (Notes 1,2,3,4) (Continued)

VEHICLE COMMAND	COMMAND CODE (OCTAL) (HEX)	MEMORY CONFIG.	OPERATING PHASE/MODE	CONDITIONS FOR REJECTION	FUNCTION
Shutdown	@116000 ($9C00)	All	All	ENB	The command will only execute shutdown if the phase is Start Preparation, Start, or Mainstage. 3.2.3:1.5.
Shutdown Enable	@105000 ($8A00)	FLT, FRT-1, FRT-2	All	-	Acceptance of this command is a condition for acceptance of the Shutdown command. If any command is received after the Enable command other than the Shutdown command, effectivity of the Enable command will be immediately terminated for purposes of operating phase control as well as acceptance of the Shutdown command.
Shutdown Pneumatically in FRT-1	@141400 ($C300)	FRT-1	All	FRT	Initiates Pneumatic Shutdown in FRT-1. 3.2.3:2.4.1:1.1.
Simulate Channel A/B Failure	@136400/ 137000 ($BD00/ BE00)	FRT-1	All	FRT, I, T	Simulates DCU A/OE A or DCU B/OE B failure in FRT-1, 3.2.3:2.4.3.
Simulate Out-Of-Limits	@137400 ($BF00)	FRT-1, FRT-2	All	FRT, I, T	Simulates a high HPOT Discharge Temperature condition. 3.2.3:2.4.3:2.
Spark Igniter Checkout	@134400 ($B900)	GCO	CO/SB	I, T	Enters Igniter Checkout mode. 3.2.3:2.3.2.
Start	@100400 ($8100)	All	All	ENB	Initiates Start phase and terminates Fuel System Purge. 3.2.3:1.3.
Start Enable	@107400 ($8F00)	FLT, FRT-1, FRT-2	SP/P4	CCV, I LIM	Acceptance of this command is a condition for acceptance of the Start Command. Close Bleed Valves and energize Pogo Precharge Control Valves. Table XXII Part F. 3.2.3:1.2.6.
			SP/ER	CCV	Any command received after the Enable command other than the Start command, effectivity of the Enable command will be immediately terminated for purposes of operating phase control as well as acceptance of the Start command.

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Table XXIV
VEHICLE COMMANDS AND ACCEPTANCE CRITERIA (Notes 1,2,3,4) (Continued)

VEHICLE COMMAND	COMMAND CODE (OCTAL) (HEX)	MEMORY CONFIG.	OPERATING PHASE/MODE	CONDITIONS FOR REJECTION	FUNCTION
Stop DCU A/B	●111000/ 111400 ($9200/ 9300)	GCO, FRT-1, FRT-2	All	I	DCU A/B performs self-disqualification. 3.2.1:6.1. Acceptance during Checkout is necessary to support the PSE Logic/Redundancy Tests.
		FLT	CO, SP, PSD	I	
		FLT	Start, Main-stage, Shutdown	ST	DCU A/B performs self-disqualification. 3.2.1:6.1. The Stop DCU command indicator is changeable by operational data. The indicator is nominally set to reject the command.
Switch VRC	●115400 ($9800)	All	All	VRC	If the source of the VRC data is DCU A, switch the source of the VRC data to DCU B. 3.2.2:2.4.
Terminate Sequence	●110000 ($9000)	FLT, FRT-1, FRT-2	CO/SB, SP, PSD/SB, PSD/OD	CR, PS	Terminates sequence by closing all propellant valves, deenergizing all solenoids, deactivating the FRT simulation and at the completion of this mode, Post Shutdown Standby is entered. 3.2.3:1.2.7 and 3.2.3:1.6.1.

NOTES

NUMBER	
1	The acceptance criteria are as follows: (a) The voted command code must either match or be within range of one of the RAM Command Codes listed. (b) The current memory configuration must match one of the Memory Configurations listed for the RAM command selected in (a). Where "All" is listed under Memory Configuration, the command is acceptable in all memory configurations. (c) The current engine phase/mode must match one of the Operating Phase/Modes listed for the RAM command selected in (a). If a phase is listed without a specific mode then the command is acceptable in all modes of the phase. Where "All" is listed under Operating Phase/Mode, the command is acceptable in all phases and modes. (d) The current conditions must not match any of the Conditions for Rejection listed for the RAM command selected in (a).

N O T E S

NUMBER	
2	Command Codes not listed and codes listed with no acceptance criteria will be rejected.
3	During Controller Checkout and Igniter Checkout, command interrogation will not occur.
4	The following is a cross reference between the Vehicle Command Code (octal and hex) and the Command:

OCTAL COMMAND	HEX COMMAND	COMMAND DESCRIPTION
000400- 064400	0100- 6900	Set Propellant Valve Position
043400- 071400	4700- 7300	Main Chamber Pressure Level (MCC Pc)
064401- 077740	6901- 7FE0	Set Propellant Valve Ramp Rate
100000	8000	Resume
100400	8100	Start
101000	8200	Not used
101400	8300	Not used
102000	8400	Not used (Used by PROM and Block I for Memory Load A)
102400	8500	Not used (Used by PROM and Block I for Memory Load B)
103000	8600	Not used (Used by Block I for Memory Readout Computer 1)
103400	8700	Not used (Used by Block I for Memory Readout Computer 2)
104000	8800	Limit Control Inhibit
104400	8900	Limit Control Enable
105000	8A00	Shutdown Enable
105400	8B00	Purge Sequence 1
106000	8C00	Purge Sequence 2
106400	8D00	Purge Sequence 3
107000	8E00	Purge Sequence 4
107400	8F00	Start Enable
110000	9000	Terminate Sequence
110400	9100	Oxidizer Dump

NUMBER	NOTES
4	Cross reference continues:

OCTAL COMMAND	HEX COMMAND	COMMAND DESCRIPTION
111000	9200	Stop DCU A
111400	9300	Stop DCU B
112000	9400	No Op
112400	9500	Enter Ground Checkout
113000	9600	Enter Flight
113400	9700	Enter FRT-1
114000	9800	Enter FRT-2
114400	9900	Not used
115000	9A00	Restore VRC
115400	9B00	Switch VRC
116000	9C00	Shutdown
116400	9D00	Checkout Standby
117000	9E00	Not used (Used by hardware, PROM, and Block I for Reset Channel A)
117400	9F00	Not used (Used by hardware, PROM, and Block I for Reset Channel B)
120000	A000	Controller Reset
120400	A100	Open MFV
121000	A200	Open MOV
121400	A300	Open CCV
122000	A400	Open FPOV
122400	A500	Open OPOV
123000	A600	Open Fuel System Purge Control Valve
123400	A700	Open HPOP IMSL Purge Control Valve
124000	A800	Open Bleed Valve Control Valve
124400	A900	Close Emergency Shutdown Control Valve
125000	AA00	Open Pogo Precharge Control Valve
125400	AB00	Deactivate All Valves
126000	AC00	Open Preburner Shutdown Purge Control Valve

NOTES

NUMBER			
4	Cross reference continues:		

OCTAL COMMAND	HEX COMMAND	COMMAND DESCRIPTION
126400	AD00	Checkout Fuel System Purge Control Valve
127000	AE00	Checkout HPOP IMSL Purge Control Valve
127400	AF00	Checkout Bleed Valve Purge Control Valve
130000	B000	Checkout Emergency Shutdown Control Valve
130400	B100	Checkout Pogo Precharge Control Valve
131000	B200	Checkout Preburner Shutdown Purge Control Valve
131400	B300	Checkout MFV
132000	B400	Checkout MOV
132400	B500	Checkout CCV
133000	B600	Checkout FPOV
133400	B700	Checkout OPOV
134000	B800	Sensor Checkout and Calibration
134400	B900	Spark Igniter Checkout
135000	BA00	Not used (Used by Block I for FASCOS Checkout) (Was Block II Enter Flight)
135400	BB00	Controller Checkout (Used by Block I for Engine Redundancy Checkout)
136000	BC00	Activate FRT Simulation (Used by Block I for Enter FRT) (Was Block II Enter FRT-1)
136400	BD00	Simulate Channel A Failure
137000	BE00	Simulate Channel B Failure
137400	BF00	Simulate Out-Of-Limits
140000	C000	Deactivate FRT Simulation (Used by Block I for Exit FRT) (Was Block II Exit FRT)
140400	C100	Inhibit Igniters in FRT-1 (Was Block II Enter FRT-2)
141000	C200	Not used Hyd. Conditioning
141400	C300	Shutdown Pneumatically in FRT-1
170400-177776	F100-FFFE	Reserved for PROM (Exceptions: 171421/2, 171441/2, 171461/2, 171441/2, 177400, 177761/2)
171421/2	F311/2	IO Readout Low IE DPM B/A (Also used by PROM)
171441/2	F321/2	IO Readout High IE DPM B/A (Also used by PROM)
171461/2	F331/2	IO Readout Input Space B/A (Also used by PROM)
177400	FF00	Exit PROM (Also used by PROM) (Used by Block I for Exit Special Memory Loader)
177761/2	FFF1/2	Memory Readout B/A (Also used by PROM)

TABLE XXVIII
STANDARD VEHICLE DATA TABLE (VDT)   (NOTE 1)

DATA (NOTE 2)	DATA WORD (Note 3)	FULL SCALE RANGE		SCALE FACTOR (Note 4)	PRECISION OF DATA (Note 5)	NOTES
Identification Word No. 1	1					6
Identification Word No. 2	2					7
Engine Status Word	3					
Time Reference	4	0-65535	major cycle counts		20 msec	8
Failure Identification Word	5					9
MCC Pc	6	0-3500	psia	F3	$\pm2\%$ FS	10,12
Fuel Flowrate	7	0-24000	gpm	F0	$\pm1\%$ FS	10,13
Oxidizer Flowrate (Calculated)	8	0-7000	gpm	F2	N/A	13
LPFP Discharge Pressure	9	0-300	psia	F6	$\pm2\%$ FS	10
LPFP Discharge Temp	10	30-55	R	F9	$\pm2\%$	10
Preburner Pump Disch Temp Ch A	11	160-230	R	F7	$\pm2\%$	
HPOT Secondary Seal Cavity Press Ch A	12	0-300	psia	F6	$\pm2\%$ FS	
HPOT Secondary Seal Cavity Press Ch B	13	0-300	psia	F6	$\pm2\%$ FS	
HPFP Coolant Liner Press Ch A	14	0-4500	psia	F2	$\pm2\%$ FS	
HPFP Coolant Liner Press Ch B	15	0-4500	psia	F2	$\pm2\%$ FS	
HPFT Discharge Temp Ch A	16	150-2450	R	F3	$\pm2\%$	
HPFT Discharge Temp Ch B	17	150-2450	R	F3	$\pm2\%$	
HPOT Discharge Temp Ch A	18	150-2450	R	F3	$\pm2\%$	
HPOT Discharge Temp Ch B	19	150-2450	R	F3	$\pm2\%$	
HPOP IMSL Purge Pressure Ch A	20	0-600	psia	F5	$\pm2\%$	
HPOP IMSL Purge Pressure Ch B	21	0-600	psia	F5	$\pm2\%$	
MCC Pc Ch A	22	0-3500	psia	F3	$\pm2\%$	10,12
MCC Pc Ch B	23	0-3500	psia	F3	$\pm2\%$	10,12
MFV Actuator Position	24	0-100	%	F8	$\pm1\%$ FS	21
MOV Actuator Position	25	0-100	%	F8	$\pm1\%$ FS	21
CCV Actuator Position	26	0-100	%	F8	$\pm1\%$ FS	21
FPOV Actuator Position	27	0-100	%	F8	$\pm1\%$ FS	21
OPOV Actuator Position	28	0-100	%	F8	$\pm1\%$ FS	21
HPFP Discharge Pressure	29	0-9500	psia	F1	$\pm2\%$ FS	
HPOP Discharge Pressure	30	0-7000	psia	F2	$\pm2\%$ FS	
Fuel Preburner Chamber Press	31	0-7000	psia	F2	$\pm2\%$ FS	
Hydraulic System Pressure Ch B	32	0-4000	psia	F2	$\pm2\%$ FS	
PBP Discharge Pressure	33	0-9500	psia	F1	$\pm2\%$ FS	
Fuel Flowrate Sensor A1	34	0-24000	gpm	F0	$\pm1\%$ FS	13
MCC Pc Sensor A2	35	0-3500	psia	F3	$\pm2\%$ FS	12
MCC Pc Sensor A1	36	0-3500	psia	F3	$\pm2\%$ FS	12

DATA (NOTE 2)	DATA WORD (Note 3)	FULL SCALE RANGE		SCALE FACTOR (Note 4)	PRECISION OF DATA (Note 5)	NOTES
Fuel Flowrate	37	0-24000	gpm	F0	±1% FS	10,13,14
MFV Servovalve Current	38	-48/+48	ma	F9	±2% FS	21
MCC Pc	39	0-3500	psia	F3	±2% FS	10,12,14
MFV Actuator Position	40	0-100	%	F8	±1% FS	14,21
MOV Actuator Position	41	0-100	%	F8	±1% FS	14,21
CCV Actuator Position	42	0-100	%	F8	±1% FS	14,21
FPOV Actuator Position	43	0-100	%	F8	±1% FS	14,21
OPOV Actuator Position	44	0-100	%	F8	±1% FS	14,21
HPFP Discharge Pressure	45	0-9500	psia	F1	±2% FS	14
HPOP Discharge Pressure	46	0-7000	psia	F2	±2% FS	14
Fuel Preburner Chamber Press	47	0-7000	psia	F2	±2% FS	14
Hydraulic System Press Ch B	48	0-4000	psia	F2	±2% FS	14
PBP Discharge Pressure	49	0-9500	psia	F1	±2% FS	14
Fuel Flowrate Sensor A1	50	0-24000	gpm	F0	±1% FS	13,14
MCC Pc Sensor B2	51	0-3500	psia	F3	±2% FS	12
MCC Pc Sensor B1	52	0-3500	psia	F3	±2% FS	12
Fuel System Purge Press Ch A	53	0-600	psia	F5	±2% FS	
Fuel System Purge Press Ch B	54	0-600	psia	F5	±2% FS	
Preburner Pump Disch Temp Ch B	55	160-230	R	F7	±2% FS	
Selectable Entry (MOV Servovalve Current)	56	-48/+48	ma	F9	±2% FS	15,21
Pogo Precharge Pressure Ch A	57	0-1500	psia	F4	±2% FS	
Pogo Precharge Pressure Ch B	58	0-1500	psia	F4	±2% FS	
MOV Hydraulic Temp Ch A	59	360-760	R	F5	±2%	
MOV Hydraulic Temp Ch B	60	360-760	R	F5	±2%	
MFV Hydraulic Temp Ch A	61	360-760	R	F5	±2%	
MFV Hydraulic Temp Ch B	62	360-760	R	F5	±2%	
Pogo RIV Position	63	0-100	%	F8	±3% FS	
Fuel Bleed Valve Position	64	0-100	%	F8	±3% FS	
Oxidizer Bleed Valve Position	65	0-100	%	F8	±3% FS	
Input Power Bus A	66	0-250	Vac	F7	±3% FS	
Input Power Bus B	67	0-250	Vac	F7	±3% FS	
Antiflood Valve Position Ch A	68	0-100	%	F8	±3% FS	
Antiflood Valve Position Ch B	69	0-100	%	F8	±3% FS	
LPOP Discharge Pressure Ch A	70	0-600	psia	F5	±2% FS	
LPOP Discharge Pressure Ch B	71	0-600	psia	F5	±2% FS	
Emergency Shutdown Press Ch A	72	0-1500	psia	F4	±2% FS	
Emergency Shutdown Press Ch B	73	0-1500	psia	F4	±2% FS	
FPB S/D Purge Pressure	74	0-1500	psia	F4	±2% FS	
OPB S/D Purge Pressure	75	0-1500	psia	F4	±2% FS	

DATA (NOTE 2)	DATA WORD (Note 3)	FULL SCALE RANGE		SCALE FACTOR (Note 4)	PRECISION OF DATA (Note 5)	NOTES
Oxidizer Tank Pressurant Press	76	0-7000	psia	F2	±2% FS	
MCC Fuel Injection Pressure	77	0-4500	psia	F2	±2% FS	
MCC Coolant Pressure	78	0-7000	psia	F2	±2% FS	
Controller Internal Pressure Ch A or B	79	0-50	psia	F9	±2% FS	16
Controller Internal Temp Ch A or B	80	140-760	R	F5	±2%	16
MCC Coolant Temp	81	50-650	R	F3	±2%	
LPFP Shaft Speed	82	0-20000	rpm	F0	±1% FS	17
LPOP Shaft Speed	83	0-6000	rpm	F2	±1% FS	17
Command Controlling MFV	84	0-100	%	F8		
Command Controlling MOV	85	0-100	%	F8		
Command Controlling CCV	86	0-100	%	F8		
Command Controlling FPOV	87	0-100	%	F8		
Command Controlling OPOV	88	0-100	%	F8		
Selectable Entry (Fuel Flowrate Sensor B1)	89	0-24000	gpm	F0	±1% FS	15
Selectable Entry (I-response Count)	90	0-65535	counts			8,15
Selectable Entry (Failure Counter)	91	0-65535	counts			8,15
Selectable Entry (LPFP Disch Pressure Ch A)	92	0-300	psia	F6	±2% FS	15
Selectable Entry (LPFP Disch Temp Ch A)	93	30-55	R	F9	±2% FS	15
Selectable Entry (Pc Ref)	94	0-3500	psia	F3		15,18
Selectable Entry (Mixture Ratio)	95	0-16		F11		15,18
HPFP Shaft Speed Ch A	96	0-45000	rpm	F-1	±1% FS	17
HPFP Shaft Speed Ch B	97	0-45000	rpm	F-1	±1% FS	17
Vehicle Command	98					19
Vehicle Command	99					19
Failure Identification Word (List)	100-102					9
Failure Parameter Value (List)	103-105					9
Selectable Entry (MFV Actuator Position)	106	0-100	%	F8	±1% FS	15,21
Selectable Entry (MOV Actuator Position)	107	0-100	%	F8	±1% FS	15,21
Selectable Entry (CCV Actuator Position)	108	0-100	%	F8	±1% FS	15,21

DATA (NOTE 2)	DATA WORD (Note 3)	FULL SCALE RANGE		SCALE FACTOR (Note 4)	PRECISION OF DATA (Note 5)	NOTES
Selectable Entry (FPOV Actuator Position)	109	0-100	%	F8	±1% FS	15,21
Selectable Entry (OPOV Actuator Position)	110	0-100	%	F8	±1% FS	15,21
Selectable Entry (Input Word 15)	111					15
Selectable Entry (Input Word 16)	112					15
Selectable Entry (Note 23)	113					15,23
Selectable Entry (Fail-Safe Servoswitch Status)	114					15,23
Selectable Entry (Calculated C2 Value)	115	0-4.0		F13		15
Selectable Entry (Calculated Kf Value*300,000)	116	68-80	gpm/pps	F-10		15,26
Selectable Entry (OPOV Command Upper Limit)	117	0-100	%	F8	±1% FS	15
Selectable Entry (Vibration Channels V1A/V2A)	118	0-20	Grms	F2/ F2	±3% FS	15,25
Selectable Entry (Vibration Channels V1B/V2B)	119	0-20	Grms	F2/ F2	±3% FS	15,25
Selectable Entry (MCC LOX Dome Temp)	120	110-610	R	F5	±2%	15
Selectable Entry (Vibration Channels V1C/V2C)	121	0-20	Grms	F2/ F2	±3% FS	25
Selectable Entry (CCV Servovalve Current)	122	-48/+48	ma	F9	±2% FS	15,21
Selectable Entry (FPOV Servovalve Current)	123	-48/+48	ma	F9	±2% FS	15,21
Selectable Entry (Fuel Flowrate Sensor A2)	124	0-24000	gpm	F0	±1% FS	15
Selectable Entry (Fuel Flowrate Sensor B2)	125	0-24000	gpm	F0	±1% FS	15
Selectable Entry (OPOV Servovalve Current)	126	-48/+48	ma	F9	±2% FS	15,21,22
Selectable Entry (LPFP Disch Press Ch B)	127	0-300	psia	F6	±2% FS	15
Selectable Entry (LPFP Disch Temp Ch B)	128	30-55	R	F9	±2% FS	15

Notes:

1. Vehicle Data Tables shall be transmitted at a rate of 25 VDTs per second. Data transmission may be interrupted for cases specified in paragraph 3.2.2:2.2.2.

2. Parameter sampling for single entry data is within 20 msec of transmission initiation, paragraph 3.2.2:2.2.1. Sampling rate for multi-entry parameters is per paragraph 3.2.2:2.2.1.

3. Order of data transmission is same as data word order in table.

4. Scale factors indicated shall represent the data scaling per the following:

   Fk: applies to scaled data. "k" is the location of the binary (fractional) point to the left of the least significant bit (LSB) when the parameter value is expressed in the listed engineering units.

   e.g. F0 = Binary point is at (immediately to the right of) the LSB; The word is an integer.
         F15 = Binary point is at (immediately to the right of) the MSB (i.e., sign bit).

   Scale factor in terms of physical units of controller inputs is as defined in Table VII.

   All VDT words will be represented in two's complement notation except for those which do not have a scale factor.

5. Precisions stated for data are desired values. Final precision values are determined by hardware performance. Ranges of sensors depicted in table are for information only.

6. Bits 15-5   (MSB=15) Of Identification Word 1 may be altered by
                       memory load only.
   Bits 15-10 (MSB=15) 6 MSB will have nominal binary code of
                       %101010.
   Bits 9-7   (MSB=15) Vehicle number

Code	Vehicle
% 000	Not Used
% 001	Columbia OV-102
% 010	Challenger OV-099
% 011	Discovery OV-103
% 100	Atlantis OV-104
% 101	Endeavor OV-105 (Default Value)
% 110	Single Engine
% 111	Spare

\ +368

   Bits 6-5   (MSB=15) Engine Position.

Code	Position
% 00	Not Used
% 01	Center (Default Value)
% 10	Left
% 11	Right

   Bit 4   (MSB=15) Is loaded as a zero in both DCUs at software
                       load;
                       In DCU A remains zero after software
                       load;
                       In DCU B is set to one; See 3.2.1:1.3.

   Bits 3-0   (MSB=15) Memory Configuration
                       (updated by software)

Code	Memory Configuration
% 0000	Not Used
% 0001	FRT-1
% 0011	Ground Checkout
% 0111	FRT-2
% 1001	PROM
% 1111	Flight
All Others	Not Used

1010 Reserved /4404

7. Identification Word 2 is the one's complement of Identification Word 1. It is altered per the same requirements as Identification Word 1.

8. Counts are 16-bit unsigned integers.

9. Failure Identification Word and Failure Parameter values are defined in 3.2.4, Table XIV, and Table XV.

10. These control values are generated per 3.2.3:4.4.2.

11. Deleted.

12. MCC Pc Definitions:

VDT Word	Content
6	MCC Pc control value based on valid MCC Pc measurements used during the current VDT major cycle. For computation of Control Parameters, see 3.2.3:4.4.2.
22	Average of the most recent MCC Pc Channel A measurements (independent of qualification).
23	Same as word 22 except Channel B.
35-36	MCC Pc sensor A2 and A1 data values used during the current VDT major cycle.

39   Same as word 6 except for previous (non-VDT) major cycle.

51-52   MCC Pc sensor B2 and B1 data values used during the previous (non-VDT) major cycle.

13. Usable range of flow data shall extend from 6% of full scale to 100% of full scale.

14. Data Words No. 37 and 39-50 are the same as the previous entries for the parameters of data words no. 7,6 and 24-34 respectively, i.e., 20 msec older sampling.

15. These selectable entry parameters shall be alterable by requirements of 3.2.5:2.

16. Nominal entry is sensor channel A. Channel B is selectable by operational data constant alterable at memory load only. Selection of a channel remains in effect until the operational data constant is updated.

17. Usable range of speed data shall extend from 3% of full scale to 100% of full scale.

18. VDT Words 94 and 95 will be changed during sensor checkout (see Table VIII, Part B).

19. Data words 98 and 99 are a push-down list for vehicle commands. Commands are entered into data word 98, pushed down by subsequent command to data word 99, then off list. For Memory Readout, data word 98 contains the Starting Address command.

20. Deleted

21. Actuator Definitions:

VDT Word	Content
24-28	Current major cycle data from the in-control servoactuator channel.
40-44	Previous major cycle data from the in-control servoactuator channel.
106-110	Current major cycle data from the servoactuator channel not in control.
38,56 122,123,126	Current major cycle data from the in-control servoactuator channel. If neither servoactuator channel is controlling the actuators, then Channel B values will be reported.

22. The VDT word 126 is used for a selectable entry when Component Checkout is not enabled. During Component Checkout Word 126 is the Checkout Test Step Number, with F0 binary scaling.

23. The following is the format of the VDT words 113 and 114:

INPUT	BIT	LOGIC	DATA
113	15	0	OPOV Fail-Op Servoswitch Energized
	14	0	FPOV Fail-Op Servoswitch Energized
	13	0	MOV Fail-Op Servoswitch Energized
	12	0	MFV Fail-Op Servoswitch Energized
	11	0	CCV Fail-Op Servoswitch Energized
	10	0	OE A 2khz Excitation On
	09	0	OE B 2khz Excitation On
	08	0	Halt Exit Enabled/Disabled A
	07	0	Halt Exit Enabled/Disabled B
	06	0	FDR A Recording Inhibited
	05	0	FDR B Recording Inhibited
114	15	0	OPOV Fail-Safe Servoswitch A Energized
	14	0	FPOV Fail-Safe Servoswitch A Energized
	13	0	MOV Fail-Safe Servoswitch A Energized
	12	0	MFV Fail-Safe Servoswitch A Energized
	11	0	CCV Fail-Safe Servoswitch A Energized
	10	0	OPOV Fail-Safe Servoswitch B Energized
	09	0	FPOV Fail-Safe Servoswitch B Energized
	08	0	MOV Fail-Safe Servoswitch B Energized
	07	0	MFV Fail-Safe Servoswitch B Energized
	06	0	CCV Fail-Safe Servoswitch B Energized

24. Deleted

25. Two accelerometer channel values are packed into one VDT word.
The 8 MSBs of V1 will be placed in the upper byte, while the 8
MSBs of V2 will be placed in the lower byte. When the
accelerometer channel values are not packed into a VDT word each
value is scaled F10.

26. Kf is synonymous with the calculated C1 Fuel Flowrate scaling
coefficient specified in Note 5 of Table XXXIV. Kf is multiplied
by 300,000 in order that Block II can emulate the value
transmitted by Block I.

DATA (NOTE 2)	DATA WORD (Note 3)	FULL SCALE RANGE	SCALE FACTOR (Note 4)	PRECISION OF DATA (Note 5)	NOTES
					6
Identification Word No. 1	1				7
Identification Word No. 2	2				
Engine Status Word	3				
Time Reference	4	0-65535 major cycle counts		20 msec	8
					9
Failure Identification Word	5				
MFV S/V Current Ch A	6	-48 to 48 ma	F9	+2% FS	
MOV S/V Current Ch A	7	-48 to 48 ma	F9	+2% FS	
CCV S/V Current Ch A	8	-48 to 48 ma	F9	+2% FS	
FPOV S/V Current Ch A	9	-48 to 48 ma	F9	+2% FS	
OPOV S/V Current Ch A	10	-48 to 48 ma	F9	+2% FS	
MFV S/V Current Ch A (Previous)	11	-48 to 48 ma	F9	+2% FS	
MOV S/V Current Ch A (Previous)	12	-48 to 48 ma	F9	+2% FS	
CCV S/V Current Ch A (Previous)	13	-48 to 48 ma	F9	+2% FS	
FPOV S/V Current Ch A (Previous)	14	-48 to 48 ma	F9	+2% FS	
OPOV S/V Current Ch A (Previous)	15	-48 to 48 ma	F9	+2% FS	
6% Model Check (Opening)	16	-1 to +101 %	F8		
6% Model Check (Closing)	17	-1 to +101 %	F8		
10% Model Check (Opening)	18	-1 to +101 %	F8		
10% Model Check (Closing)	19	-1 to +101 %	F8		
HPOP IMSL Purge Pressure Ch A	20	0-600 psia	F5	+2% FS	
HPOP IMSL Purge Pressure Ch B	21	0-600 psia	F5	+2% FS	
Input Word 15 (Previous)	22				
Fail-Op Servoswitches Status (Previous)	23				11
MFV Actuator Position Ch A	24	0-100 %	F8	+1% FS	
MOV Actuator Position Ch A	25	0-100 %	F8	+1% FS	
CCV Actuator Position Ch A	26	0-100 %	F8	+1% FS	
FPOV Actuator Position Ch A	27	0-100 %	F8	+1% FS	
OPOV Actuator Position Ch A	28	0-100 %	F8	+1% FS	
Input Word 16 (Previous)	29				11
Fail-Safe Servoswitches Status (Previous)	30				
Hydraulic System Pressure Ch B (Previous)	31	0-4000 psia	F2	+2% FS	
Hydraulic System Pressure Ch B	32	0-4000 psia	F2	+2% FS	

DATA (NOTE 2)	DATA WORD (Note 3)	FULL SCALE RANGE		SCALE FACTOR (Note 4)	PRECISION OF DATA (Note 5)	NOTES
MFV S/V Current Ch B	33	-48 to 48	ma	F9	±2% FS	
MOV S/V Current Ch B	34	-48 to 48	ma	F9	±2% FS	
CCV S/V Current Ch B	35	-48 to 48	ma	F9	±2% FS	
FPOV S/V Current Ch B	36	-48 to 48	ma	F9	±2% FS	
OPOV S/V Current Ch B	37	-48 to 48	ma	F9	±2% FS	
Input Word 7	38					
Input Word 7 (Previous)	39					
MFV Actuator Position Ch A (Previous)	40	0-100	%	F8	±1% FS	
MOV Actuator Position Ch A (Previous)	41	0-100	%	F8	±1% FS	
CCV Actuator Position Ch A (Previous)	42	0-100	%	F8	±1% FS	
FPOV Actuator Position Ch A (Previous)	43	0-100	%	F8	±1% FS	
OPOV Actuator Position Ch A (Previous)	44	0-100	%	F8	±1% FS	
MFV Latching D/A Output Ch A	45	0-100	%	F8	±2% FS	
MOV Latching D/A Output Ch A	46	0-100	%	F8	±2% FS	
CCV Latching D/A Output Ch A	47	0-100	%	F8	±2% FS	
FPOV Latching D/A Output Ch A	48	0-100	%	F8	±2% FS	
OPOV Latching D/A Output Ch A	49	0-100	%	F8	±2% FS	
MFV Latching D/A Output Ch A (Previous)	50	0-100	%	F8	±2% FS	
MOV Latching D/A Output Ch A (Previous)	51	0-100	%	F8	±2% FS	
CCV Latching D/A Output Ch A (Previous)	52	0-100	%	F8	±2% FS	
FPOV Latching D/A Output Ch A (Previous)	53	0-100	%	F8	±2% FS	
OPOV Latching D/A Output Ch A (Previous)	54	0-100	%	F8	±2% FS	
RVDT/LVDT Excitation Amplitude Ch B (Previous)	55	0-20	Vpp	F10		
RVDT/LVDT Excitation Amplitude Ch A	56	0-20	Vpp	F10		
Pogo Precharge Pressure Ch A	57	0-1500	psia	F4	±2% FS	
Pogo Precharge Pressure Ch B	58	0-1500	psia	F4	±2% FS	
MOV Hydraulic Temp Ch A	59	360-760	R	F5	±2% FS	
MFV S/V Current Ch B (Previous)	60	-48 to 48	ma	F9	±2% FS	

DATA (NOTE 2)	DATA WORD (Note 3)	FULL SCALE RANGE		SCALE FACTOR (Note 4)	PRECISION OF DATA (Note 5)	NOTES
MFV Hydraulic Temp Ch A	61	360-760	R	F5	±2% FS	
MOV S/V Current Ch B (Previous)	62	-48 to 48	ma	F9	±2% FS	
CCV S/V Current Ch B (Previous)	63	-48 to 48	ma	F9	±2% FS	
FPOV S/V Current Ch B (Previous)	64	-48 to 48	ma	F9	±2% FS	
OPOV S/V Current Ch B (Previous)	65	-48 to 48	ma	F9	±2% FS	
Input Power Bus A	66	0-250	Vac	F7	±3% FS	
Input Power Bus B	67	0-250	Vac	F7	±3% FS	
Actuator Command for Channel Under Test (Previous)	68	-1 to +101	%	F8		
Step Number (Previous)	69	0-35	counts			8
MFV Latching D/A Output Ch B	70	0-100	%	F8	±2% FS	
MOV Latching D/A Output Ch B	71	0-100	%	F8	±2% FS	
Emergency Shutdown Press Ch A	72	0-1500	psia	F4	±2% FS	
Emergency Shutdown Press Ch B (Previous)	73	0-1500	psia	F4	±2% FS	
FPB S/D Purge Pressure	74	0-1500	psia	F4	±2% FS	
OPB S/D Purge Pressure	75	0-1500	psia	F4	±2% FS	
CCV Latching D/A Output Ch B	76	0-100	%	F8	±2% FS	
FPOV Latching D/A Output Ch B	77	0-100	%	F8	±2% FS	
OPOV Latching D/A Output Ch B	78	0-100	%	F8	±2% FS	
MFV Latching D/A Output Ch B (Previous)	79	0-100	%	F8	±2% FS	
MOV Latching D/A Output Ch B (Previous)	80	0-100	%	F8	±2% FS	
CCV Latching D/A Output Ch B (Previous)	81	0-100	%	F8	±2% FS	
FPOV Latching D/A Output Ch B (Previous)	82	0-100	%	F8	±2% FS	
OPOV Latching D/A Output Ch B (Previous)	83	0-100	%	F8	±2% FS	
Command Controlling MFV	84	-1 to +101	%	F8		
Command Controlling MOV	85	-1 to +101	%	F8		
Command Controlling CCV	86	-1 to +101	%	F8		
Command Controlling FPOV	87	-1 to +101	%	F8		
Command Controlling OPOV	88	-1 to +101	%	F8		
Channel Determination Flag (1 = Ch A)	89	0 or 1				
I-response Count	90	0-65535	counts			8
Failure Counter	91	0-65535	counts			8

TABLE XXVIIIA
ACTUATOR CHECKOUT VEHICLE DATA TABLE (VDT) (NOTE 1)

DATA (NOTE 2)	DATA WORD (Note 3)	FULL SCALE RANGE		SCALE FACTOR (Note 4)	PRECISION OF DATA (Note 5)	NOTES
MFV Actuator Position Ch B (Previous)	92	0-100	%	F8	±1% FS	
MOV Actuator Position Ch B (Previous)	93	0-100	%	F8	±1% FS	
CCV Actuator Position Ch B (Previous)	94	0-100	%	F8	±1% FS	
FPOV Actuator Position Ch B (Previous)	95	0-100	%	F8	±1% FS	
OPOV Actuator Position Ch B (Previous)	96	0-100	%	F8	±1% FS	
Actuator Command for Channel Under Test	97	-1 to +101	%	F8		
Vehicle Command	98					10
Vehicle Command	99					10
Failure Test No. (List)	100-102					9
Failure Parameter Value (List)	103-105					9
MFV Actuator Position Ch B	106	0-100	%	F8	±1% FS	
MOV Actuator Position Ch B	107	0-100	%	F8	±1% FS	
CCV Actuator Position Ch B	108	0-100	%	F8	±1% FS	
FPOV Actuator Position Ch B	109	0-100	%	F8	±1% FS	
OPOV Actuator Position Ch B	110	0-100	%	F8	±1% FS	
Input Word 15	111					
Input Word 16	112					
Fail-Op Servoswitch Status	113					11
Fail-Safe Servoswitch Status	114					11
Ch A Fail-Safe Lockup Delta Position (Opening)	115	0-100	%	F8	±1% FS	
Ch A Fail-Safe Lockup Delta Position (Closing)	116	0-100	%	F8	±1% FS	
Fail-Op Switchover Delta Position	117	0-100	%	F8	±1% FS	
OE +29 Voltage Ch A	118	0-34.3	Vdc	F9	±3% FS	
OE +24 Voltage Ch B	119	0-34.3	Vdc	F9	±3% FS	

TABLE XXVIIIA
ACTUATOR CHECKOUT VEHICLE DATA TABLE (VDT) (NOTE 1)

DATA (NOTE 2)	DATA WORD (Note 3)	FULL SCALE RANGE	SCALE FACTOR (Note 4)	PRECISION OF DATA (Note 5)	NOTES
Ch B Fail-Safe Lockup Delta Position (Opening)	120	0-100 %	F8	±1% FS	
Ch B Fail-Safe Lockup Delta Position (Closing)	121	0-100 %	F8	±1% FS	
Current Command minus Current Latching D/A	122	-2 to 2 %	F8	±1% FS	12
Previous Command minus Previous Latching D/A	123	-2 to 2 %	F8	±1% FS	12
Previous Command minus Current Position	124	-100 to 100 %	F8	±1% FS	12
Previous Command minus Current Position (Previous)	125	-100 to 100 %	F8	±1% FS	12
Step Number	126	0-35 counts			8
Stop Check (Full Open)	127	-1 to +101 %	F8	±1% FS	
Stop Check (Full Closed)	128	-1 to +101 %	F8	±1% FS	

Notes:

1. Vehicle Data Tables shall be transmitted at a rate of 25 VDTs per second. Data transmission may be interrupted for cases specified in paragraph 3.2.2:2.2.2.

2. Parameter sampling for single entry data is within 20 msec of transmission initiation, paragraph 3.2.2:2.2.1. Sampling rate for multi-entry parameters is per paragraph 3.2.2:2.2.1.

3. Order of data transmission is same as data word order in table.

4. Scale factors indicated shall represent the data scaling per the following:

   Fk: applies to scaled data. "k" is the location of the binary (fractional) point to the left of the least significant bit (LSB) when the parameter value is expressed in the listed engineering units.

   e.g. F0 = Binary point is at (immediately to the right of) the LSB; The word is an integer.
   F15 = Binary point is at (immediately to the right of) the MSB (i.e., sign bit).

   Scale factor in terms of physical units of controller inputs is as defined in Table VII.

   All VDT words will be represented in two's complement notation except for those which do not have a scale factor.

5. Precisions stated for data are desired values. Final precision values are determined by hardware performance. Ranges of sensors depicted in table are for information only.

6. Bits 15-5   (MSB=15) Of Identification Word 1 may be altered by
                         memory load only.
    Bits 15-10 (MSB=15) 6 MSB will have nominal binary code of
                         %101010.
    Bits 9-7   (MSB=15) Vehicle number

Code	Vehicle
% 000	Not Used
% 001	Columbia OV-102
% 010	Challenger OV-099
% 011	Discovery OV-103
% 100	Atlantis OV-104
% 101	Endeavor OV-105 (Default Value)	4368
% 110	Single Engine
% 111	Spare

    Bits 6-5   (MSB=15) Engine Position.

Code	Position
% 00	Not Used
% 01	Center (Default Value)
% 10	Left
% 11	Right

    Bit 4   (MSB=15) Is loaded as a zero in both DCUs at software
                         load;
                         In DCU A remains zero after software
                         load;
                         In DCU B is set to one; See 3.2.1:1.3.

    Bits 3-0   (MSB=15) Memory Configuration
                         (updated by software)

Code	Memory Configuration
% 0000	Not Used
% 0001	FRT-1
% 0011	Ground Checkout
% 0111	FRT-2
% 1001	PROM 1010 Reserved	4404
% 1111	Flight
All others	Not Used

7. Identification Word 2 is the one's complement of Identification Word 1. It is altered per the same requirements as Identification Word 1.

8. Counts are 16-bit unsigned integers.

9. Failure Identification Word and Failure Parameter values are defined in 3.2.4, Table XIV, and Table XXXVI.

10. Data words 98 and 99 are a push-down list for vehicle commands. The first command is entered into data word 98, pushed down by a subsequent command to data word 99, then off list. For Memory Readout, data word 98 contains the Starting Address command.

11. The following is the format of the VDT words 23, 30, 113, and 114:

DATA WORD	BIT	LOGIC	DATA
23 & 113	15	0	OPOV Fail-Op Servoswitch Energized
	14	0	FPOV Fail-Op Servoswitch Energized
	13	0	MOV Fail-Op Servoswitch Energized
	12	0	MFV Fail-Op Servoswitch Energized
	11	0	CCV Fail-Op Servoswitch Energized
	10	0	OE A 2khz Excitation On
	09	0	OE B 2khz Excitation On
	08	0	Halt Exit Enabled/Disabled A
	07	0	Halt Exit Enabled/Disabled B
	06	0	FDR A Recording Inhibited
	05	0	FDR B Recording Inhibited

TABLE XXVIIIA
ACTUATOR CHECKOUT VEHICLE DATA TABLE (VDT) (NOTE 1)

30 & 114	15	0	OPOV Fail-Safe Servoswitch A Energized
	14	0	FPOV Fail-Safe Servoswitch A Energized
	13	0	MOV Fail-Safe Servoswitch A Energized
	12	0	MFV Fail-Safe Servoswitch A Energized
	11	0	CCV Fail-Safe Servoswitch A Energized
	10	0	OPOV Fail-Safe Servoswitch B Energized
	09	0	FPOV Fail-Safe Servoswitch B Energized
	08	0	MOV Fail-Safe Servoswitch B Energized
	07	0	MFV Fail-Safe Servoswitch B Energized
	06	0	CCV Fail-Safe Servoswitch B Energized

12. VDT words 122-125 shall be continuously updated throughout Actuator Checkout as applicable to the actuator channel in control.

Table XXIX
ENGINE STATUS WORD (ESW)

BITS	DEFINITION	COMMENTS
15	Load Mode	0 = Not in Load Mode. 1 = Load Mode (Only used by PROM)
14-13	Command Status of last command received since last VDT transmission per Table XXIII.	0 = No command received since last VDT transmission, or voted command is the same as the last voted command. 1 = Command failed voting. 2 = Command voted but rejected, incompatible with phase/mode or invalid code. 3 = Command accepted.
12	Channel 3 Status, per Table XXIII.	0 = OK, 1 = Failed
11	Channel 2 Status, per Table XXIII.	0 = OK, 1 = Failed
10	Channel 1 Status, per Table XXIII.	0 = OK, 1 = Failed
09	FRT Status	0 = Normal Operation, 1 = FRT Mode
08	Limit Control Status	0 = Inhibited, 1 = Enabled
07-05	Phase	0 is not used, 1 for Checkout, 2 for Start Preparation, 3 for Start, 4 for Mainstage, 5 for Shutdown, 6 for Post Shutdown, 7 Reserved for PROM.
04-02	Mode	Depends on Phase as shown on next page.
01-00	Self-Test Status	0 Not Used 1 = Engine OK 2 = Major Component Failed 3 = Shutdown Limit Exceeded

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Table XXIX
ENGINE STATUS WORD (ESW) (Continued)

MODE (BITS 4-2) BY PHASE

PHASE   MODE DEFINITION

Hydraulic Conditioning

Checkout   0 ~~Not Used,~~   1 = Standby,
            2 = Actuator Checkout,   3 = Engine Leak Detection,
            4 = Igniter Checkout,   5 = Pneumatic Checkout,
            6 = Sensor Checkout,   7 = Controller Checkout.

Start   0 Not Used,   1 = Purge Sequence 1,
Prep.   2 = Purge Sequence 2,   3 = Purge Sequence 3,
            4 = Purge Sequence 4,   5 Not Used,
            6 = Engine Ready,   7 Not Used.

Start   0 Not Used,   1 = Start Initiation,
            2 = Thrust Buildup,   3 Not Used,
            4 Not Used,   5 = Fixed Density,
            6 Not Used,   7 Not Used.

Main-   0 Not Used,   1 = Normal Control,
stage   2 = Thrust Limiting,   3 = Electrical Lockup,
            4 = Hydraulic Lockup,   5 = Fixed Density,
            6 Not Used,   7 Not Used.

Shutdown   0 Not Used,   1 Not Used
            2 = Throttling to zero, 3 = Propellant Valves Closed,
            4 = Fail-Safe Pneumatic, 5 Not Used,
            6 Not Used,   7 Not Used.

Post   0 Not Used,   1 = Standby,
Shutdown   2 = Oxidizer Dump,   3 Not Used,
            4 Not Used,   5 Not Used,
            6 Not Used,   7 = Terminate Sequence

CHECKOUT	START PREPARATION	START

STANDBY

A waiting mode of controller operation during which active engine control sequence operations are not in progress. Monitoring functions which do not affect engine hardware configuration are continually active during this mode. Such functions include processing of vehicle commands, status update, and controller Self-Test.

ACTUATOR CHECKOUT

Actuators are being tested.

ENGINE LEAK DETCTION

Actuators are commanded opened and closed in support of Test/Flight facility operations.

PURGE SEQUENCE NO. 1

First purge sequence of the Start Preparation phase. Functions include Oxidizer System Purge and ISP operation.

PURGE SEQUENCE NO. 2

Second purge sequence of Start Preparation phase. Functions include Fuel System Purge Operation.

PURGE SEQUENCE NO. 3

Third purge sequence of Start Preparation phase. Functions include propellant recirculation.

PURGE SEQUENCE NO. 4

Fourth purge sequence of Start Preparation phase. Functions include Fuel System Purge after propellant drop and activation of Fail-Safe valves.

START INITIATION

Initial functions associated with the Start Sequences are in progress. These include all functions prior to ignition confirmed.

THRUST BUILDUP
Ignition has been detected, the MCC Pc control loop has been closed, and MCC Pc pressure is building up.

FIXED DENSITY
A constant fuel density is used in fuel flowrate computations.

CHECKOUT	START PREPARATION	START

IGNITER CHECKOUT

Igniters are being tested. Normal major cycle processing is suspended.

PNEUMATIC CHECKOUT

Pneumatic valves are being tested.

SENSOR CHECKOUT

Sensors are being tested and selected pressure sensors are calibrated.

CONTROLLER CHECKOUT

Controller components are being tested. Normal major cycle processing is suspended.

ENGINE READY

The ready stage of Start Preparation in which proper engine pressure/temperature conditions for Start have been attained and other criteria for Start have been satis- fied. Functions include a continuation of Purge Sequence No. 4 functions.

Hydraulic Conditioning

Exercises the hydraulic System and servoactuators.

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MAINSTAGE	SHUTDOWN	POST SHUTDOWN

STANDBY

A waiting mode of controller operation with functions identical to those of Checkout Standby (with conditional exception of Bleed Valve as specified in 3.2.3:1.6).

NORMAL CONTROL

Mixture ratio control has been initiated. MCC Pc Pressure control is operating normally.

ELECTRICAL LOCKUP

Engine propellant valves are electrically held in a fixed configuration as exists at initiation of this mode. All control loop computations are suspended. Shutdown Limit monitoring and actuator monitoring are maintained.

THROTTLING TO ZERO THRUST

Shutdown is at a stage where open-loop valve reference scheduling is in progress.

This is the normal mode of Post-Shutdown entered after completion of the Shutdown phase.

MAINSTAGE	SHUTDOWN	POST SHUTDOWN

HYDRAULIC LOCKUP

All Fail-safe valves are deactivated to hydraulically hold the propellant valves in a fixed configuration as exists at initiation of this mode. Engine Limit monitoring and sensor monitoring are maintained. All control loop computations are suspended.

THRUST LIMITING

Mode initiated whenever OPOV position command is limited for at least 3 consecutive major cycles. Control loop computations, Shutdown Limit Monitoring, and sensor monitoring are retained.

FIXED DENSITY

A constant fuel density is used in fuel flowrate computations.

PROPELLANT VALVES CLOSED

The shutdown sequence is in the stage following closure of all liquid propellant valves. Shutdown purge and safety sequences are in progress.

FAIL-SAFE PNEUMATIC

Fail-Safe pneumatic shutdown is in progress.

OXIDIZER DUMP

The Oxidizer Dump sequence is being performed.

TERMINATE SEQUENCE

Termination of a purge or dump sequence by command from the VEEI is in progress. All valves are being closed. All solenoid and servoswitch valves are then being deenergized.

Honeywell

SPACE SYSTEMS GROUP

CLEARWATER, FL   CAGE CODE 09128

Part I

SPECIFICATION NO. | DSCP34053988   REV D |

DATE   12/04/90

TABLE I

DUMMY VEHICLE DATA TABLE (DVDT) FORMAT (See Note)

WORD #	VRC	DPM	ADDRESS	CONTENTS
1			$820600	Idw1
2			$820602	Idw2
3			$820604	Esw
5			$820608	Fn
90			$8206B2	PrmRev
98			$8206C2	CurCom
99			$8206C4	PreCom
100			$8206C6	Fn
103			$8206CC	Fp
111			$8206DC	ALdStat
113			$8206E0	BLdStat

NOTE: All location not specified in the DVDT are zero.

TABLE II

PROM COMMANDS

COMMAND CODE (NOTE 1)	COMMAND NAME
$8300	Memory Load A and B (Note 2)
$8400	Memory Load A (Note 2)
$8500	Memory Load B (Note 2)
$9200	Stop DCU A
$9300	Stop DCU B
$9400	No Operation
$9E00	Reset Channel A (Note 5)
$9F00	Reset Channel B (Note 5)
$F102	Hello A
$F101	Hello B
$F202	PROM Sum Check A
$F201	PROM Sum Check B
$F3X2	IO Readout A (Note 3)
$F3X1	IO Readout B (Note 3)
$F502	FDR Enable A
$F501	FDR Enable B
$F602	FDR Cross-Channel Readout A
$F601	FDR Cross-Channel Readout B
$F702	RAM Write-Read Test A
$F701	RAM Write-Read Test B
$F802	RAM Sum Check A
$F801	RAM Sum Check B
$FF00	Exit PROM
$FFF2	Memory Readout A (Note 4)
$FFF1	Memory Readout B (Note 4)

FD TABLE

FD   NOMENCLATURE

```
D41E#09413 ME-# SENSOR UNDER TEST          DW 94
D41E#09513 ME-# SENSOR INDEX               DW 95
D41E#11513 ME-# SELECTABLE ENTRY           DW115        BLOCK 2 ONLY
D41E#11613 ME-# SELECTABLE ENTRY           DW116        BLOCK 2 ONLY
D41E#11713 ME-# SELECTABLE ENTRY           DW117        BLOCK 2 ONLY
D41E#11813 ME-# SELECTABLE ENTRY           DW118
D41E#11913 ME-# SELECTABLE ENTRY           DW119
D41E#12113 ME-# SELECTABLE ENTRY           DW121        BLOCK 2 ONLY
D41E#12213 ME-# SELECTABLE ENTRY           DW122        BLOCK 2 ONLY
D41E#12313 ME-# SELECTABLE ENTRY           DW123        BLOCK 2 ONLY
D41E#12413 ME-# SELECTABLE ENTRY           DW124        BLOCK 2 ONLY
D41E#12513 ME-# SELECTABLE ENTRY           DW125        BLOCK 2 ONLY
D41E#12713 ME-# SELECTABLE ENTRY           DW127        BLOCK 2 ONLY
D41E#12813 ME-# SELECTABLE ENTRY           DW128        BLOCK 2 ONLY
D41E#2021L ME-# RESUME CMD                               BLOCK 2 ONLY C-3
D41E#50813 ME-# COMMAND REJECT VTF-01
D41E#50823 ME-# COMMAND REJECT IMP-10
D41E#50913 ME-# CHANNEL 1 STATUS ERROR     DW 3         BLOCK 2 ONLY
D41E#50923 ME-# CHANNEL 2 STATUS ERROR     DW 3         BLOCK 2 ONLY
D41E#50933 ME-# CHANNEL 3 STATUS ERROR     DW 3         BLOCK 2 ONLY
D41E#51513 ME-# HFID DUPLICATE
D41E#72513 ME-# C/O STP NO-SEL ENTRY       DW126
D72V060513 EIU 1 CIA 1 FAIL
D72V060613 EIU 1 CIA 2 FAIL
D72V060713 EIU 1 SEC PWR SUPPLY 1 FAIL
D72V060813 EIU 1 SEC PWR SUPPLY 2 FAIL
D72V060913 EIU 1 SEC PWR SUPPLY 1OR2 FAIL
D72V061213 EIU 1 OI BUFFER FAIL
D72V062513 EIU 2 CIA 1 FAIL
D72V062613 EIU 2 CIA 2 FAIL
D72V062713 EIU 2 SEC PWR SUPPLY 1 FAIL
D72V062813 EIU 2 SEC PWR SUPPLY 2 FAIL
D72V062913 EIU 2 SEC PWR SUPPLY 1OR2 FAIL
D72V063213 EIU 2 OI BUFFER FAIL
D72V064513 EIU 3 CIA 1 FAIL
D72V064613 EIU 3 CIA 2 FAIL
D72V064713 EIU 3 SEC PWR SUPPLY 1 FAIL
D72V064813 EIU 3 SEC PWR SUPPLY 2 FAIL
D72V064913 EIU 3 SEC PWR SUPPLY 1OR2 FAIL
D72V065213 EIU 3 OI BUFFER FAIL
D75V4020A1 PCM DYNAMIC WRAPAROUND MDM OF01A
D75V4020B1 PCM DYNAMIC WRAPAROUND MDM OF01B
D75V4021A1 PCM DYNAMIC WRAPAROUND MDM OF02A
D75V4021B1 PCM DYNAMIC WRAPAROUND MDM OF02B
D75V4022A1 PCM DYNAMIC WRAPAROUND MDM OF03A
D75V4022B1 PCM DYNAMIC WRAPAROUND MDM OF03B
D75V4024A1 PCM DYNAMIC WRAPAROUND MDM OA01A
D75V4024B1 PCM DYNAMIC WRAPAROUND MDM OA01B
D75V4025A1 PCM DYNAMIC WRAPAROUND MDM OA02A
D75V4025B1 PCM DYNAMIC WRAPAROUND MDM OA02B
D75V4026A1 PCM DYNAMIC WRAPAROUND MDM OA03A
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FD TABLE

FD   NOMENCLATURE

D75V4026B1	PCM DYNAMIC WRAPAROUND MDM OA03B		
E41C#721D3	ME-# MFV S/V CURRENT	DW 38	
E41C#722D3	ME-# MOV S/V CURRENT	DW 56	
E41C#723D3	ME-# CCV S/V CURRENT	DW122	
E41C#724D3	ME-# FPOV S/V CURRENT	DW123	
E41C#725D3	ME-# OPOV S/V CURRENT	DW126	
E41D#136D3	ME-# VIB CHAN V1A	DW118	BLOCK 2 ONLY
E41D#137D3	ME-# VIB CHAN V2A	DW118	BLOCK 2 ONLY
E41D#138D3	ME-# VIB CHAN V1B	DW119	BLOCK 2 ONLY
E41D#139D3	ME-# VIB CHAN V2B	DW119	BLOCK 2 ONLY
E41D#140D3	ME-# VIB CHAN V1C	DW121	BLOCK 2 ONLY
E41D#141D3	ME-# VIB CHAN V2C	DW121	BLOCK 2 ONLY
E41H#024B1	ME-# MFV ACTUATOR POSITION	DW 24	
E41H#024D3	ME-# MFV ACTUATOR POSITION	DW 24	
E41H#025B1	ME-# MOV ACTUATOR POSITION	DW 25	
E41H#025D3	ME-# MOV ACTUATOR POSITION	DW 25	
E41H#026B1	ME-# CCV ACTUATOR POSITION	DW 26	
E41H#026D3	ME-# CCV ACTUATOR POSITION	DW 26	
E41H#027B1	ME-# FPOV ACTUATOR POSITION	DW 27	
E41H#027D3	ME-# FPOV ACTUATOR POSITION	DW 27	
E41H#028B1	ME-# OPOV ACTUATOR POSITION	DW 28	
E41H#028D3	ME-# OPOV ACTUATOR POSITION	DW 28	
E41H#040D3	ME-# MFV ACTUATOR POS (PREV)	DW 40	
E41H#041D3	ME-# MOV ACTUATOR POS (PREV)	DW 41	
E41H#042D3	ME-# CCV ACTUATOR POS (PREV)	DW42	
E41H#043D3	ME-# FPOV ACT POS (PREV)	DW 43	
E41H#044D3	ME-# OPOV ACT POS (PREV)	DW 44	
E41H#060D3	ME-# MFV COMMANDED POSITION	DW 84	
E41H#061D3	ME-# FUEL BLEED VLV POSITION	DW 64	
E41H#062D3	ME-# OXID BLEED VLV POSITION	DW 65	
E41H#063D3	ME-# POGO RECIRN ISLN V POS	DW 63	
E41H#084D3	ME-# MFV ACT POS CH B	DW106	
E41H#085D3	ME-# MOV ACT POS CH B	DW107	
E41H#086D3	ME-# CCV ACT POS CH B	DW108	
E41H#087D3	ME-# FPOV ACT POS CH B	DW109	
E41H#088D3	ME-# OPOV ACT POS CH B	DW110	
E41H#104D3	ME-# ANTI-FLOOD VLV POS CH A	DW 68	
E41H#105D3	ME-# ANTI-FLOOD VLV POS CH B	DW 69	
E41H#113D3	ME-# MOV COMMANDED POSITION	DW 85	
E41H#114D3	ME-# CCV COMMANDED POSITION	DW 86	
E41H#115D3	ME-# FPOV COMMANDED POSITION	DW 87	
E41H#116D3	ME-# OPOV COMMANDED POSITION	DW 88	
E41H#117D3	ME-# OPOV CMD LIMIT	DW117	
E41J#090D3	ME-# INH COUNTER/PROM REV	DW 90	
E41J#091D3	ME-# HARD FAIL COUNTER	DW 91	
E41J#501B1	ME-# STANDARD BIT PATTERN	DW 1	
E41J#501D3	ME-# STANDARD BIT PATTERN	DW 1	
E41J#503B1	ME-# PROGRAM CONFIG	DW 1	
E41J#503D3	ME-# PROGRAM CONFIG	DW 1	
E41J#504B1	ME-# IMAGE STD BIT PATRN	DW 2	
E41J#504D3	ME-# IMAGE STD BIT PATRN	DW 2	

FD TABLE

FD   NOMENCLATURE

E41J#506B1 ME-#	IMAGE PROGRAM CONFIG	DW 2
E41J#506D3 ME-#	IMAGE PROGRAM CONFIG	DW 2
E41J#508B1 ME-#	COMMAND STATUS	DW 3
E41J#508D3 ME-#	COMMAND STATUS	DW 3
E41J#509B1 ME-#	CHANNEL STATUS	DW 3
E41J#509D3 ME-#	CHANNEL STATUS	DW 3
E41J#512B1 ME-#	PHASE IN EFFECT	DW 3
E41J#512D3 ME-#	PHASE IN EFFECT	DW 3
E41J#513B1 ME-#	OPERATING MODE	DW 3
E41J#513D3 ME-#	OPERATING MODE	DW 3
E41J#514B1 ME-#	SELF TEST STATUS	DW 3
E41J#514D3 ME-#	SELF TEST STATUS	DW 3
E41J#515B1 ME-#	HARD FAILURE ID CODE	DW 5
E41J#515D3 ME-#	HARD FAILURE ID CODE	DW 5
E41J#516B1 ME-#	FAIL DELIMITER CODE	DW 5
E41J#516D3 ME-#	FAIL DELIMITER CODE	DW 5
E41J#517D3 ME-#	FAILURE ID CODE	DW100
E41J#518D3 ME-#	FAILURE DELIM CODE	DW100
E41J#519D3 ME-#	FAILURE ID CODE	DW101
E41J#520D3 ME-#	FAILURE DELIM CODE	DW101
E41J#521D3 ME-#	FAILURE ID CODE	DW102
E41J#522D3 ME-#	FAILURE DELIM CODE	DW102
E41J#551B1 ME-#	VEHICLE NUMBER	DW 1
E41J#551D3 ME-#	VEHICLE NUMBER	DW 1
E41J#552B1 ME-#	ENGINE POSITION	DW 1
E41J#552D3 ME-#	ENGINE POSITION	DW 1
E41J#553B1 ME-#	IMAGE VEHICLE NUMBER	DW 2
E41J#553D3 ME-#	IMAGE VEHICLE NUMBER	DW 2
E41J#554B1 ME-#	IMAGE ENGINE POS	DW 2
E41J#554D3 ME-#	IMAGE ENGINE POS	DW 2
E41J#556D3 ME-#	FPB IGN CH A	DW111
E41J#557D3 ME-#	OPB IGN CH A	DW111
E41J#558D3 ME-#	MCC IGN CH A	DW111
E41K#201BL ME-#	NO-OP CMD	
E41K#202BL ME-#	RESUME CMD	
E41K#203BL ME-#	START CMD	
E41K#204BL ME-#	SHUTDOWN CMD	
E41K#205BL ME-#	EXECUTE LOAD CMD	
E41K#206BL ME-#	MEMORY LOAD A	
E41K#207BL ME-#	MEMORY LOAD B	
E41K#210BL ME-#	LIMIT CONTROL INHIBIT CMD	
E41K#211BL ME-#	LIMIT CONTROL ENABLE CMD	
E41K#212BL ME-#	SHUTDOWN ENABLE CMD	
E41K#213BL ME-#	PURGE SEQUENCE 1 CMD	
E41K#214BL ME-#	PURGE SEQUENCE 2 CMD	
E41K#215BL ME-#	PURGE SEQUENCE 3 CMD	
E41K#216BL ME-#	PURGE SEQUENCE 4 CMD	
E41K#217BL ME-#	START ENABLE CMD	
E41K#218BL ME-#	TERMINATE SEQUENCE CMD	
E41K#219BL ME-#	OXIDIZER DUMP CMD	
E41K#221BL ME-#	CHECKOUT STANDBY CMD	

BLOCK 1 ONLY

FD TABLE

FD   NOMENCLATURE

```
E41K#222BL ME-# RESET CHANNEL A CMD
E41K#223BL ME-# RESET CHANNEL B CMD
E41K#224BL ME-# CONTROLLER RESET CMD
E41K#225BL ME-# OPEN MFV CMD
E41K#226BL ME-# OPEN MOV CMD
E41K#227BL ME-# OPEN CCV CMD
E41K#228BL ME-# OPEN FPOV CMD
E41K#229BL ME-# OPEN OPOV CMD
E41K#230BL ME-# OPEN FUEL SYSTEM PURGE VLV
E41K#231BL ME-# OPN HPOP IMSL PRG VLV CMD
E41K#232BL ME-# OPEN BLD VLV CMD
E41K#233BL ME-# CLOSE EMSD VLV CMD
E41K#234BL ME-# OPEN POGO PRCHG VLV CMD
E41K#235BL ME-# DEACTV ALL VLVS (PROP&PNEU)
E41K#236BL ME-# FUEL SYS PRG VLV C/O CMD
E41K#237BL ME-# HPOT ISP VLV C/O CMD
E41K#246BL ME-# SENSOR CAL AND CHECKOUT CMD
E41K#247BL ME-# SPARK IGNITER CHECKOUT CMD
E41K#248BL ME-# CONTROLLER C/O CMD
E41K#249BL ME-# ACTIVATE FRT SIM CMD
E41K#253BL ME-# DEACTIVATE FRT SIM CMD
E41K#254BL ME-# SWITCH VRC CMD
E41K#255BL ME-# OPEN PB SHUTDOWN PRG VLV CMD
E41K#256BL ME-# EXIT MEMORY LOADER CMD           BLOCK 1 ONLY
E41K#257BL ME-# TEST INVALID CMD REJECT CMD
E41K#258BL ME-# TEST INVALID BCH REJECT CMD
E41K#259BL ME-# TERMINATE LOAD CMP A WD 1 CMD    BLOCK 1 ONLY
E41K#260BL ME-# TERMINATE LOAD CMP A WD 2 CMD    BLOCK 1 ONLY
E41K#261BL ME-# TERMINATE LOAD CMP B WD 1 CMD    BLOCK 1 ONLY
E41K#262BL ME-# TERMINATE LOAD CMP B WD 2 CMD    BLOCK 1 ONLY
E41K#263BL ME-# C/O PB SHUTDOWN PRG VLV CMD
E41K#264BL ME-# CHECKOUT FASCOS CMD              BLOCK 1 ONLY
E41K#265BL ME-# 65% RPL CMD
E41K#300BL ME-# 100% RPL CMD
E41K#309BL ME-# 109% RPL CMD
E41K#310BL ME-# INHIBIT IGNITERS IN FRT-1 CMD
E41K#315BL ME-# MEMORY READOUT CH A CMD          BLOCK 2 ONLY
E41K#316BL ME-# MEMORY READOUT CH B CMD          BLOCK 2 ONLY
E41K#317BL ME-# EXIT PROM CMD                    BLOCK 2 ONLY
E41K#318BL ME-# STOP DCU A CMD                   BLOCK 2 ONLY
E41K#319BL ME-# STOP DCU B CMD                   BLOCK 2 ONLY
E41K#322BL ME-# ENTER GND C/O CONFIG CMD         BLOCK 2 ONLY
E41K#323BL ME-# ENTER FLT CONFIG CMD             BLOCK 2 ONLY
E41K#324BL ME-# ENTER FRT 1 CONFIG CMD           BLOCK 2 ONLY
E41K#325BL ME-# ENTER FRT 2 CONFIG CMD           BLOCK 2 ONLY
E41K#326BL ME-# RESTORE VRC CMD                  BLOCK 2 ONLY
E41K#327BL ME-# SHTDN PNEU IN FRT CMD            BLOCK 2 ONLY
E41K#328BL ME-# HELLO B CMD                      BLOCK 2 ONLY
E41K#329BL ME-# HELLO A CMD                      BLOCK 2 ONLY
E41K#330BL ME-# PROM SUM CHECK B CMD             BLOCK 2 ONLY
E41K#331BL ME-# PROM SUM CHECK A CMD             BLOCK 2 ONLY
```

                          FD TABLE

FD   NOMENCLATURE

E41K#332BL	ME-# IO READOUT B-LOW HALF CMD	BLOCK 2 ONLY
E41K#333BL	ME-# IO READOUT A-LOW HALF CMD	BLOCK 2 ONLY
E41K#334BL	ME-# IO READOUT B-HIGH HALF CMD	BLOCK 2 ONLY
E41K#335BL	ME-# IO READOUT A-HIGH HALF CMD	BLOCK 2 ONLY
E41K#336BL	ME-# IO READOUT B INPUT SPACE CMD	BLOCK 2 ONLY
E41K#337BL	ME-# IO READOUT A INPUT SPACE CMD	BLOCK 2 ONLY
E41K#338BL	ME-# FDR ENABLE B CMD	BLOCK 2 ONLY
E41K#339BL	ME-# FDR ENABLE A CMD	BLOCK 2 ONLY
E41K#340BL	ME-# FDR CROSS-CH READOUT B CMD	BLOCK 2 ONLY
E41K#341BL	ME-# FDR CROSS-CH READOUT A CMD	BLOCK 2 ONLY
E41K#342BL	ME-# RAM WRITE-READ TEST B CMD	BLOCK 2 ONLY
E41K#343BL	ME-# RAM WRITE-READ TEST A CMD	BLOCK 2 ONLY
E41K#344BL	ME-# RAM SUM CHECK B CMD	BLOCK 2 ONLY
E41K#345BL	ME-# RAM SUM CHECK A CMD	BLOCK 2 ONLY
E41K#346BL	ME-# TERMINATE LOAD WORD 1 CMD	BLOCK 2 ONLY
E41K#347BL	ME-# TERMINATE LOAD WORD 2 CMD	BLOCK 2 ONLY
E41K0#96XL	MPS E-# FASCOS/MEMORY BU PWR CMD A	
E41K0#97XL	MPS E-# FASCOS/MEMORY BU PWR CMD B	
E41K0#98XL	MPS E-# FASCOS/MEMORY BU PWR CMD C	
E41M#001P8	ME-# IDENT WORD 1 DW 1	
E41M#002P8	ME-# IDENT WORD NO 2 DW 2	
E41M#003P8	ME-# ENGINE STATUS WORD DW 3	
E41M#005P8	ME-# FAILURE IDENT WORD DW 5	
E41M#076D3	ME-# VEHICLE COMMAND DW 98	
E41M#077D3	ME-# VEHICLE COMMAND DW 99	
E41M#078P3	ME-# HARD FAILURE TEST NO DW100	
E41M#079P3	ME-# HARD FAILURE TEST NO DW101	
E41M#080P3	ME-# HARD FAILURE TEST NO DW102	
E41M#081D3	ME-# HARD FAILURE PRMTR VAL DW103	
E41M#082D3	ME-# HARD FAILURE PRMTR VAL DW104	
E41M#083D3	ME-# HARD FAILURE PRMTR VAL DW105	
E41M#096P3	ME-# DST REG 1A DW111	BLOCK 1 ONLY
E41M#097P3	ME-# DST REG 2A DW112	BLOCK 1 ONLY
E41M#098P3	ME-# DST REG 1B DW113	BLOCK 1 ONLY
E41M#099P3	ME-# DST REG 2B DW114	BLOCK 1 ONLY
E41M#121P3	ME-# FASCOS STATUS WORD DW121	BLOCK 1 ONLY
E41M#132P3	ME-# INPUT WORD 15 DW111	BLOCK 2 ONLY
E41M#133P3	ME-# INPUT WORD 16 DW112	BLOCK 2 ONLY
E41M#134P3	ME-# FAIL OP SV SW STATUS DW113	BLOCK 2 ONLY
E41M#135P3	ME-# FAIL SF SV SW STATUS DW114	BLOCK 2 ONLY
E41P#008B1	ME-# HPFT COOLANT PRESS CH A DW 14	
E41P#008D3	ME-# HPFT COOLANT PRESS CH A DW 14	
E41P#009B1	ME-# HPFT COOLANT PRESS CH B DW 15	
E41P#009D3	ME-# HPFT COOLANT PRESS CH B DW 15	
E41P#014B1	ME-# HPOT I-SEAL PGE P CH A DW 20	
E41P#014D3	ME-# HPOT I-SEAL PGE P CH A DW 20	
E41P#015B1	ME-# HPOT I-SEAL PGE P CH B DW 21	
E41P#015D3	ME-# HPOT I-SEAL PGE P CH B DW 21	
E41P#016B1	ME-# MCC PRESSURE CH A DW 22	
E41P#016D3	ME-# MCC PRESSURE CH A DW 22	
E41P#017B1	ME-# MCC PRESSURE CH B DW 23	

FD TABLE

FD   NOMENCLATURE

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E41P#017D3 ME-# MCC PRESSURE CH B          DW 23
E41P#018B1 ME-# LPFT DISCH PRESS (AVG)     DW 9
E41P#018D3 ME-# LPFT DISCH PRESS (AVG)     DW 9
E41P#023B1 ME-# MCC PRESSURE (AVG)         DW 6
E41P#023D3 ME-# MCC PRESSURE (AVG)         DW 6
E41P#029D3 ME-# HPFT DISCHARGE PRESS       DW 29
E41P#030D3 ME-# HPOT DISCHARGE PRESS       DW 30
E41P#031B1 ME-# FUEL PREBNR CHMBR PRESS    DW 31
E41P#031D3 ME-# FUEL PREBNR CHMBR PRESS    DW 31
E41P#033D3 ME-# HPOT BST STG DISCH P       DW 33
E41P#035D3 ME-# MCC PRESSURE A2            DW 35
E41P#036D3 ME-# MCC PRESSURE A1            DW 36
E41P#039D3 ME-# MCC PRESS (AVG-PREV)       DW 39
E41P#045D3 ME-# HPFT DIS PRESS (PREV)      DW 45
E41P#046D3 ME-# HPOT DISCH PRESS (PREV)    DW 46
E41P#047D3 ME-# FL PRBNR CHMBR PR (PREV)   DW47
E41P#048D3 ME-# HYD SYS PR CHB (PREV)      DW 48
E41P#049D3 ME-# HPOT BST STG DIS P (PREV)  DW49
E41P#051B1 ME-# HPOT SEC SEAL CAV P CHA    DW 12
E41P#051D3 ME-# HPOT SEC SEAL CAV P CHA    DW 12
E41P#052D3 ME-# MCC PRESSURE B1            DW 52
E41P#053D3 ME-# HPOT SEC SEAL CAV P CH B   DW13
E41P#053D3 ME-# HPOT SEC SEAL CAV P CH B   DW13
E41P#054B1 ME-# HYDRAULIC SYS PRESS CH B   DW32
E41P#054D3 ME-# HYDRAULIC SYS PRESS CH B   DW32
E41P#055D3 ME-# POGO PRECHG PRESS CH A     DW 57
E41P#056D3 ME-# POGO PRECHG PRESS CH B     DW 58
E41P#057D3 ME-# FUEL SYS PGE PRESS CH A    DW 53
E41P#058D3 ME-# FUEL SYS PGE PRESS CH B    DW 54
E41P#059D3 ME-# OXID PREBNR PGE PRESS      DW 75
E41P#064D3 ME-# LPOT DISCH PRESS CH A      DW 70
E41P#065D3 ME-# LPOT DISCH PRESS CH B      DW 71
E41P#066D3 ME-# MCC FUEL INJECTOR PRESS    DW 77
E41P#067D3 ME-# MCC COOLANT PRESSURE       DW 78
E41P#068D3 ME-# OX TK PRESSURANT PRESS     DW 76
E41P#069D3 ME-# CONTROLLER INTL PRESS      DW 79
E41P#092D3 ME-# LPFP DISCH PRESS CH A      DW 92
E41P#094D3 ME-# PC REFERENCED             DW 94
E41P#106D3 ME-# FUEL PREBURN PGE PRESS     DW 74
E41P#107D3 ME-# EMERG SHT DN PRESS CH A    DW 72
E41P#108D3 ME-# EMERG SHT DN PRESS CH B    DW 73
E41P#124D3 ME-# MCC PRESSURE B2            DW 51
E41P#127D3 ME-# LPFP DISCH PRESS CH B      DW127
E41Q#100D3 ME-# CALC C2 VALUE             DW115
E41Q#101D3 ME-# CALCULATED KF VALUE       DW116
E41R#006D3 ME-# HPFT SHAFT SPEED CH A      DW 96
E41R#007D3 ME-# HPFT SHAFT SPEED CH B      DW 97
E41R#021B1 ME-# FUEL FLOWRATE (AVG)        DW 7
E41R#021D3 ME-# FUEL FLOWRATE (AVG)        DW 7
E41R#022D3 ME-# OXIDIZER FLOWRATE (CALC)   DW 8
E41R#034D3 ME-# FUEL FLOWRATE CH A         DW 34
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                              FD TABLE

    FD   NOMENCLATURE

E41R#037D3	ME-#	FUEL FLOWRATE(AVG-PREV)	DW 37
E41R#050D3	ME-#	FUEL FLOWRATE CHA(PREV)	DW 50
E41R#072D3	ME-#	LPFT SHAFT SPEED	DW 82
E41R#073D3	ME-#	LPOT SHAFT SPEED	DW 83
E41R#089D3	ME-#	FUEL FLOWRATE CH B1	DW 89
E41R#102D3	ME-#	FUEL FLOWRATE CH A2	DW124
E41R#103D3	ME-#	FUEL FLOWRATE CH B2	DW125
E41S0#92E1	MPS-E#	AC POWER NO 1 ON CMD	
E41S0#93E1	MPS-E#	AC POWER NO 2 ON CMD	
E41S0#95E1	MPS-E#	HEATER POWER ON CMD	BLOCK 1 ONLY
E41T#010B1	ME-#	HPFTT DISCH TEMP CH A	DW 16
E41T#010D3	ME-#	HPFTT DISCH TEMP CH A	DW 16
E41T#011B1	ME-#	HPFTT DISCH TEMP CH B	DW 17
E41T#011D3	ME-#	HPFTT DISCH TEMP CH B	DW 17
E41T#012B1	ME-#	HPOTT DISCH TEMP CH A	DW 18
E41T#012D3	ME-#	HPOTT DISCH TEMP CH A	DW 18
E41T#013B1	ME-#	HPOTT DISCH TEMP CH B	DW 19
E41T#013D3	ME-#	HPOTT DISCH TEMP CH B	DW 19
E41T#019B1	ME-#	LPFT DISCH TEMP (AVG)	DW 10
E41T#019D3	ME-#	LPFT DISCH TEMP (AVG)	DW 10
E41T#020B1	ME-#	PBP DISCH TEMP CH A	DW 11
E41T#020D3	ME-#	PBP DISCH TEMP CH A	DW 11
E41T#070D3	ME-#	MCC COOLANT TEMP	DW 81
E41T#071D3	ME-#	CONTROLLER IE TEMP	DW 80
E41T#093D3	ME-#	LPFP DISCH TEMP CH A	DW 93
E41T#109D3	ME-#	MOV HYD TEMP CH A	DW 59
E41T#110D3	ME-#	MOV HYD TEMP CH B	DW 60
E41T#111D3	ME-#	MFV HYD TEMP CH A	DW 61
E41T#112D3	ME-#	MFV HYD TEMP CH B	DW 62
E41T#120D3	ME-#	MCC LOX DOME TEMP	DW120
E41T#125D3	ME-#	PBP DISCH TEMP CH B	DW 55
E41T#128D3	ME-#	LPFP DISCH TEMP CH B	DW128
E41T#150A1	ME-#	CONTROLLER PS TEMPERATURE	
E41T#151A1	ME-#	OPOV LOX SUPPLY LINE TEMP #1	
E41T#152A1	ME-#	OPOV LOX SUPPLY LINE TEMP #2	
E41T#153A1	ME-#	MFV DOWNSTREAM TEMP #1	
E41T#154A1	ME-#	MFV DOWNSTREAM TEMP #2	
E41T#155A1	ME-#	AFV DOWNSTREAM TEMP #1	
E41T#156A1	ME-#	AFV DOWNSTREAM TEMP #2	
E41U#095D3	ME-#	MIXTURE RATIO	DW 95
E41V#074D3	ME-#	CONTROLLER BUS NO1 V	DW 66
E41V#075D3	ME-#	CONTROLLER BUS NO2 V	DW 67
E41V#118D3	ME-#	+36 VDC OE VOLT CH A	DW118 BLOCK 1 ONLY
E41V#119D3	ME-#	+36 VDC OE VOLT CH B	DW119 BLOCK 1 ONLY
E41W#004B1	ME-#	TIME REFERENCE	DW 4
E41W#004D3	ME-#	TIME REFERENCE	DW 4
E41X#401D3	ME-#	BLEED VLV A ENBL	DW111 BLOCK 2 ONLY
E41X#402D3	ME-#	FUEL SYS PRG A ENBL	DW111 BLOCK 2 ONLY
E41X#403D3	ME-#	POGO PRECHG A ENBL	DW111 BLOCK 2 ONLY
E41X#404D3	ME-#	PRBNR S/D PRG A ENBL	DW111 BLOCK 2 ONLY
E41X#405D3	ME-#	EMERG S/D A ENBL	DW111 BLOCK 2 ONLY

FD TABLE

FD   NOMENCLATURE

E41X#406D3	ME-#	HPOP IMSL PRG A ENB	DW111	BLOCK 2 ONLY
E41X#407D3	ME-#	GR 1A (SNSR CHECKOUT)	DW111	BLOCK 2 ONLY
E41X#408D3	ME-#	GR 2A(PROP DROP)	DW111	BLOCK 2 ONLY
E41X#409D3	ME-#	PWR OFF TIME B	DW111	BLOCK 2 ONLY
E41X#410D3	ME-#	OE A PULL/HOLD VOLT	DW111	BLOCK 2 ONLY
E41X#411D3	ME-#	PRC OVFL TEST CH A	DW111	BLOCK 2 ONLY
E41X#412D3	ME-#	OE A PWR SAFETY ON	DW111	BLOCK 2 ONLY
E41X#413D3	ME-#	BLEED VLV B ENBL	DW112	BLOCK 2 ONLY
E41X#414D3	ME-#	FUEL SYS PRG B ENBL	DW112	BLOCK 2 ONLY
E41X#415D3	ME-#	POGO PRECHG B ENBL	DW112	BLOCK 2 ONLY
E41X#416D3	ME-#	PRBNR S/D PRG B ENB	DW112	BLOCK 2 ONLY
E41X#417D3	ME-#	EMERG S/D B ENBL	DW112	BLOCK 2 ONLY
E41X#418D3	ME-#	HPOP IMSL PRG B ENB	DW112	BLOCK 2 ONLY
E41X#419D3	ME-#	GR 1B (SNSR CHECKOUT)	DW112	BLOCK 2 ONLY
E41X#420D3	ME-#	GR 2B (PROP DROP)	DW112	BLOCK 2 ONLY
E41X#421D3	ME-#	PWR OFF TIME A	DW112	BLOCK 2 ONLY
E41X#422D3	ME-#	OE B PULL/HOLD VOLT	DW112	BLOCK 2 ONLY
E41X#423D3	ME-#	PRC OVRFL TEST B	DW112	BLOCK 2 ONLY
E41X#424D3	ME-#	FPB IGN CH B	DW112	BLOCK 2 ONLY
E41X#425D3	ME-#	OPB IGN CH B	DW112	BLOCK 2 ONLY
E41X#426D3	ME-#	MCC IGN CH B	DW112	BLOCK 2 ONLY
E41X#427D3	ME-#	OE B PWR SAFETY ON	DW112	BLOCK 2 ONLY
E41X#428D3	ME-#	OPOV F/O ENBL	DW113	BLOCK 2 ONLY
E41X#429D3	ME-#	FPOV F/O ENBL	DW113	BLOCK 2 ONLY
E41X#430D3	ME-#	MOV F/O ENBL	DW113	BLOCK 2 ONLY
E41X#431D3	ME-#	MFV F/O ENBL	DW113	BLOCK 2 ONLY
E41X#432D3	ME-#	CCV F/O ENBL	DW113	BLOCK 2 ONLY
E41X#433D3	ME-#	OE A 2KHZ EXC ON	DW113	BLOCK 2 ONLY
E41X#434D3	ME-#	OE B 2KHZ EXC ON	DW113	BLOCK 2 ONLY
E41X#435D3	ME-#	HALT EXIT A	DW113	BLOCK 2 ONLY
E41X#436D3	ME-#	HALT EXIT B	DW113	BLOCK 2 ONLY
E41X#437D3	ME-#	FDR A INHIBITED	DW113	BLOCK 2 ONLY
E41X#438D3	ME-#	FDR B INHIBITED	DW113	BLOCK 2 ONLY
E41X#439D3	ME-#	OPOV F/S A ENBL	DW114	BLOCK 2 ONLY
E41X#440D3	ME-#	FPOV F/S A ENBL	DW114	BLOCK 2 ONLY
E41X#441D3	ME-#	MOV F/S A ENBL	DW114	BLOCK 2 ONLY
E41X#442D3	ME-#	MFV F/S A ENBL	DW114	BLOCK 2 ONLY
E41X#443D3	ME-#	CCV F/S A ENBL	DW114	BLOCK 2 ONLY
E41X#444D3	ME-#	OPOV F/S B ENBL	DW114	BLOCK 2 ONLY
E41X#445D3	ME-#	FPOV F/S B ENBL	DW114	BLOCK 2 ONLY
E41X#446D3	ME-#	MOV F/S B ENBL	DW114	BLOCK 2 ONLY
E41X#447D3	ME-#	MFV F/S B ENBL	DW114	BLOCK 2 ONLY
E41X#448D3	ME-#	CCV F/S B ENBL	DW114	BLOCK 2 ONLY
E41X#502B1	ME-#	VDT SOURCE IS CHANNEL B	DW 1	
E41X#502D3	ME-#	VDT SOURCE IS CHANNEL B	DW 1	
E41X#505B1	ME-#	VDT SOURCE IS CHANNEL A	DW 2	
E41X#505D3	ME-#	VDT SOURCE IS CHANNEL A	DW 2	
E41X#507B1	ME-#	MEMORY LOAD MODE ENBLED	DW 3	
E41X#507D3	ME-#	MEMORY LOAD MODE ENBLED	DW 3	
E41X#510B1	ME-#	FRT IN CONTROL	DW 3	
E41X#510D3	ME-#	FRT IN CONTROL	DW 3	

FD TABLE

FD	NOMENCLATURE		
E41X#511B1	ME-# LIMIT CONTROL ENBLED	DW 3	
E41X#511D3	ME-# LIMIT CONTROL ENBLED	DW 3	
E41X#556D3	ME-# FPB IGN CH A	DW111	BLOCK 2 ONLY
E41X#557D3	ME-# OPB IGN CH A	DW111	BLOCK 2 ONLY
E41X#558D3	ME-# MCC IGN CH A	DW111	BLOCK 2 ONLY
EIU1	ENGINE INTERFACE UNIT 1		
EIU2	ENGINE INTERFACE UNIT 2		
EIU3	ENGINE INTERFACE UNIT 3		
GECP0160A	ORB AFT INTERFACE PRESS IND		
GECP0660A	ORB AFT INTERFACE PRESS IND		
GECP2300A	ORB AFT INTERFACE PRESS IND		
GECP5A07A	ORB AFT I/F PRESS IND		
GECT0120A	ORB AFT INTERFACE TEMP IND		
GECT0630A	ORB AFT I/F TEMP PROBE #1 IND		
GECT4310A	ORB AFT INTERFACE TEMP MONITOR IND		
GECT8A97A	ORB AFT I/F TEMP MON. IND		
GGNP1034A	MPENG GN2 PRG OUT PRESS		
GGNP1139A	MPENG GN2 PRG OUT PRESS (R)		
GGNX1003E	MP ENG GN2 SCR #1 ON IND		
GGNX1103E	MP ENG GN2 SCR #2 ON IND		
GLHX0003E	LH2 SYSTEM HARDWIRE SAFING IND		
GLOX0003E	SYSTEM HARDWIRE SAFE ACTIVATED		
GMT	GREENWICH MEAN TIME		
JTOY	JULIAN TIME OF YEAR		
N006DPSR	DPS CON 1 TO CON 4 REMCON		
N007DPSR	DPS CON 1 TO CON 5 REMCON		
N008DPSR	DPS CON 1 TO CON 6 REMCON		
N03IS010E	LOX REPL TERMINATION IN PROGRESS		
N03IS078E	ORBITER AT OPF		
N03IS079E	ORBITER AT VAB		
N03IS080E	ORBITER AT PAD		
N03IS162D	GLS EVENT COMPLETED		
N03IS284D	MILESTONE		
N03IS499D	RSYS CHANGE GRP. OWNER 91 AND 92		
N03IS500D	RSYS CHANGE GRP. OWNER 93 AND 94		
N41H1720A	PERCENT WET LH2 100.3 LIQ SENS		
N41H1770A	ET-LO2 PERCENT FULL CALCULATION		
N72IV013D	PRIME GPC INDICATOR		
N72IV014D	GPC 1 MEMORY CONFIG		
N72IV015D	GPC 2 MEMORY CONFIG		
N72IV016D	GPC 3 MEMORY CONFIG		
N72IV017D	GPC 4 MEMORY CONFIG		
N72IV018D	GPC 5 MEMORY CONFIG		
N72IV019D	GPC 1 OPS		
N72IV020D	GPC 2 OPS		
N72IV021D	GPC 3 OPS		
N72IV022D	GPC 4 OPS		
N72IV023D	GPC 5 OPS		
N72IV024D	GPC 1 MAJOR FUNCTION		
N72IV025D	GPC 2 MAJOR FUNCTION		
N72IV026D	GPC 3 MAJOR FUNCTION		

                              FD TABLE

FD   NOMENCLATURE

N72IV027D   GPC 4 MAJOR FUNCTION
N72IV028D   GPC 5 MAJOR FUNCTION
N72IV029D   LDB1 CONTROL GPC
N72IV030D   LDB2 CONTROL GPC
N72IV037D   DOWNLIST X SOURCE (GPC#)
N72IV048E   SSME-1C LAST COMMAND ACCEPTED
N72IV049E   SSME-2L LAST COMMAND ACCEPTED
N72IV050E   SSME-3R LAST COMMAND ACCEPTED
N72IV053E   LDB1 POLLING
N72IV054E   LDB2 POLLING
N72IV057D   OCF STATUS
N72IV058D   GPC/MMU ADDRESS OR PATCH ID
N72IV059D   C-TO-C EVENT CONTROL BLOCK
N72IV060D   GPC STATUS WORD
N72IV061D   NUMBER OF MISCOMPARES
N72IV080E   SSMEC/ STATIONKEEPING
N72IV093D   FRT 2 LOADED AT EC PWR DN   BLOCK 1 ONLY
N72IV094D   SSME BLEED VALVE OPEN
N72IV098D   MDM FAILURE BYPASS
N72IV100D   DEU 1 ASSIGNMENT PSEUDO
N72IV101D   DEU 2 ASSIGNMENT PSEUDO
N72IV102D   DEU 3 ASSIGNMENT PSEUDO
N72IV103D   DEU 4 ASSIGNMENT PSEUDO
N72IV116E   EC-1 AC POWER ON ERRED
N72IV117E   EC-1 AC POWER OFF ERRED
N72IV118E   EC-2 AC POWER ON ERRED
N72IV119E   EC-2 AC POWER OFF ERRED
N72IV120E   EC-3 AC POWER ON ERRED
N72IV121E   EC-3 AC POWER OFF ERRED
N72IV122E   EC-X HEATER POWER ON ERRED   BLOCK 1 ONLY
N72IV123E   EC COOLING DATA PATH FAILURE ERRED
N72IV124E   EC COOLING FAILURE ERRED
N72IV134E   EC-1 NON ZERO FID ERRED
N72IV135E   EC-2 NON ZERO FID ERRED
N72IV136E   EC-3 NON ZERO FID ERRED
N72IV139D   OPS CONC 2 SYS MGR MSG
N72IV141E   EIU 1 POWER STATUS CHANGE ERRED
N72IV142E   EIU 2 POWER STATUS CHANGE ERRED
N72IV143E   EIU 3 POWER STATUS CHANGE ERRED
N72IV145E   ME 1 PWR UP/DWN SEQUENCE EEP
N72IV146E   ME 2 PWR UP/DWN SEQUENCE EEP
N72IV147E   ME 3 PWR UP/DWN SEQUENCE EEP
N72IV148E   ME 1 CHECKOUT EEP
N72IV149E   ME 2 CHECKOUT EEP
N72IV150E   ME 3 CHECKOUT EEP
N72IV172E   EIU-1 OI BITE BIT 5 ERRED
N72IV173E   EIU-1 OI BITE BIT 6 ERRED
N72IV174E   EIU-1 OI BITE BIT 7 ERRED
N72IV175E   EIU-1 OI BITE BIT 8 ERRED
N72IV176E   EIU-1 OI BITE BIT 9 ERRED
N72IV177E   EIU-2 OI BITE BIT 5 ERRED

                                    FD TABLE

FD   NOMENCLATURE

N72IV178E   EIU-2 OI BITE BIT 6 ERRED
N72IV179E   EIU-2 OI BITE BIT 7 ERRED
N72IV180E   EIU-2 OI BITE BIT 8 ERRED
N72IV181E   EIU 2 OI BITE BIT 9 ERRED
N72IV182E   EIU-3 OI BITE BIT 5 ERRED
N72IV183E   EIU-3 OI BITE BIT 6 ERRED
N72IV184E   EIU-3 OI BITE BIT 7 ERRED
N72IV185E   EIU-3 OI BITE BIT 8 ERRED
N72IV186E   EIU-3 OI BITE BIT 9 ERRED
N72IV190E   SRB POLLING INTERRUPTION ERRED
N72IV191E   OPERATOR ACTION DISCRETE/OPS CONC3
N72IV192E   OPERATOR ACTION DISCRETE/OPS CONC4
N72IV193E   OPERATOR ACTION DISCRETE/OPS CONC5
N72IV195E   RSYS GROUP 30 BUSY
N72IV196E   RSYS GROUP 31 BUSY
N72IV197E   RSYS GROUP 32 BUSY
N72IV198E   EC-1 PSE TEMP OUT OF LIMIT ERRED
N72IV199E   EC-2 PSE TEMP OUT OF LIMIT ERRED
N72IV200E   EC-3 PSE TEMP OUT OF LIMIT ERRED
N72IV201E   EC-1 IE TEMP OUT OF LIMIT ERRED
N72IV202E   EC-2 IE TEMP OUT OF LIMIT ERRED
N72IV203E   EC-3 IE TEMP OUT OF LIMIT ERRED
N72IV204E   ME-1 DATA PATH FAILURE ERRED
N72IV205E   ME-2 DATA PATH FAILURE ERRED
N72IV206E   ME-3 DATA PATH FAILURE ERRED
N72IV207E   EIU-1 OI BITE ERRED
N72IV208E   EIU-2 OI BITE ERRED
N72IV209E   EIU-3 OI BITE ERRED
N72IV220E   EIU-1 OI BITE BIT 12 ERRED
N72IV221E   EIU-2 OI BITE BIT 12 ERRED
N72IV222E   EIU-3 OI BITE BIT 12 ERRED
N72IV226E   OPS MODE RECALL EEP
N72IV227E   I/O RESET EEP
N72IV242E   FASCOS POWER ON   BLOCK 1 ONLY
NLHK0009X   RECOVER FROM REVERT
NLHK0010X   STOP FLOW
NLHK0012X   AUTO FILL
NLHK0013X   REPLENISH
NLHK0015X   AUTO DRAIN
NLHK0017X   PRE CHILLDOWN OPERATION COMPLETE
NLHK0019X   RECOVER FROM STOP FLOW
NLHK0029X   LIFTOFF PSEUDO
NLHK0030X   CHILLDOWN COMPLETE
NLHK0031X   SLO FILL TO 2% COMPLETE
NLHK0032X   FAST FILL TO 98% COMPLETE
NLHK9998X   REVERT REQUEST
NLOK0105X   START DRAIN
NLOK0200X   TERMINAL COUNT SAFING FLAG
NLOK0401X   XFER LINE VEH CHILLDOWN COMPLETE
NLOK0403X   ORBITER CHILLDOWN COMPLETE
NLOK0404X   SLOW FILL COMPLETE

FD TABLE

FD   NOMENCLATURE

V41T1428A1 MPS LH2 17IN FEED MANF DISC TEMP
V41T1528A1 MPS LO2 17IN FEED MANF DISC TEMP A
V41X1#04E1 MPS ME# LH2 PREVLV (PV4) OP IND A
V41X1#05X1 MPS ME-# LH2 PREVLV (PV4) CL IND
V41X1#06X1 MPS ME-# LH2 PREVLV (PV4)OP IND B
V41X1#34X1 MPS E# LO2 PREVLV (PV1) OP IND
V41X1#35E1 MPS E# LO2 PREVLV (PV1) CL IND
V41X1#58E1 MPS E# HE ISO VLV A (LV1) OP PWR
V41X1#59E1 MPS E# HE ISO VLV B (LV2) OP PWR
V58P0115A1 HYDR SYS 1 SUPPLY PRESS B
V58P0215A1 HYDR SYS 2 SUPPLY PRESS B
V58P0315A1 HYDR SYS 3 SUPPLY PRESS B
V58X1136E1 HYD SYS 1 ME/TVC ISLN V OP IND
V58X1136XL HYD SYS 1 ME/TVC ISLN V OP IND
V58X1236E1 HYD SYS 2 ME/TVC ISLN V OP IND
V58X1236XL HYD SYS 2 ME/TVC ISLN V OP IND
V58X1336E1 HYD SYS 3 ME/TVC ISLN V OP IND
V58X1336XL HYD SYS 3 ME/TVC ISLN V OP IND
V72K0051X1 MPS ENG LIMIT CONTROL NO 1 ENABLE
V72K0052XL MPS ENG LIMIT CONTROL NO 2 ENABLE
V72K0053XL MPS ENG LIMIT CONTROL NO 3 ENABLE
V72K0061XL MPS ENG LIMIT CONTROL NO 1 INHIBIT
V72K0062XL MPS ENG LIMIT CONTROL NO 2 INHIBIT
V72K0063XL MPS ENG LIMIT CONTROL NO 3 INHIBIT
V72K0071XL MPS ENG LIMIT CONTROL NO 1 AUTO
V72K0072XL MPS ENG LIMIT CONTROL NO 2 AUTO
V72K0073XL MPS ENG LIMIT CONTROL NO 3 AUTO
V72K0081XL MPS PRPLT DUMP SEQUENCE START A
V72K0082XL MPS PRPLT DUMP SEQUENCE START B
V72K0083XL MPS PRPLT DUMP SEQUENCE STOP A
V72K0084XL MPS PRPLT DUMP SEQUENCE STOP B
V72K0085XL MPS PRPLT DUMP BKUP LH2 VLV OPEN A
V72K0086XL MPS PRPLT DUMP BKUP LH2 VLV OPEN B
V72K0087XL MPS PRPLT DUMP BKUP LH2 VLV CL A
V72K0088XL MPS PRPLT DUMP BKUP LH2 VLV CL B
V72K0091XL MPS ME-1 SHUTDOWN CMD A
V72K0092XL MPS ME-1 SHUTDOWN CMD B
V72K0093XL MPS ME-2 SHUTDOWN CMD A
V72K0094XL MPS ME-2 SHUTDOWN CMD B
V72K0095XL MPS ME-3 SHUTDOWN CMD A
V72K0096XL MPS ME-3 SHUTDOWN CMD B
V72M0600P3 EIU 1 BSR-OI
V72M0620P3 EIU 2 BSR-OI
V72M0640P3 EIU 3 BSR-OI
V72P0040CL MPS E1 MAIN CHMBR-PR/CMPT
V72P0041CL MPS E2 MAIN CHMBR-PR/CMPT
V72P0042CL MPS E3 MAIN CHMBR-PR/CMPT
V72S0097E1 EIU 1 RPC A ON/OFF
V72S0099E1 EIU 2 RPC B ON/OFF
V72S0102E1 EIU 3 RPC C ON/OFF
V72S7160E1 GPC NO 1 BUS A POWER ON CMD

FD TABLE

FD   NOMENCLATURE

V72S7166E1 GPC NO 2 BUS B POWER ON CMD
V72S7172E1 GPC NO 3 BUS C POWER ON CMD
V72S7175E1 GPC NO 4 BUS A POWER ON CMD
V72S7181E1 GPC NO 5 BUS B POWER ON CMD
V72U0614D3 EIU 1 ID WD 1 SYNC PATTERN A
V72U0616D3 EIU 1 SYNC PATTERN B WD 2
V72U0617D3 EIU 1 WORD COUNT WD 2
V72U0619D3 EIU 1 COLUMN PARITY WD
V72U0634D3 EIU 2 ID WD 1 SYNC PATTERN
V72U0636D3 EIU 2 SYNC PATTERN B WD 2
V72U0637D3 EIU 2 WORD COUNT WD 2
V72U0639D3 EIU 2 COLUMN PARITY WD
V72U0654D3 EIU 3 ID WD SYNC PATTERN A
V72U0656D3 EIU 3 SYNC PATTERN B WD 2
V72U0657D3 EIU 3 WORD COUNT WD 2
V72U0659D3 EIU 3 COLUMN PARITY WD
V72X0030XL MPS E1 STATUS/RED LITE ON
V72X0031XL MPS E2 STATUS/RED LITE ON
V72X0032XL MPS E3 STATUS/RED LITE ON
V72X0035XL MPS E1 STATUS/AMBER LITE ON
V72X0036XL MPS E2 STATUS/AMBER LITE ON
V72X0037XL MPS E3 STATUS/AMBER LITE ON
V72X0601D3 EIU 1 MIA 1 FAIL
V72X0602D3 EIU 1 MIA 2 FAIL
V72X0603D3 EIU 1 MIA 3 FAIL
V72X0604D3 EIU 1 MIA 4 FAIL
V72X0605D3 EIU 1 CIA 1 FAIL
V72X0606D3 EIU 1 CIA 2 FAIL
V72X0607D3 EIU 1 SEC PWR SUPPLY 1 FAIL
V72X0608D3 EIU 1 SEC PWR SUPPLY 2 FAIL
V72X0609D3 EIU 1 SEC PWR SUPPLY 1OR2 FAIL
V72X0610D3 EIU 1 S(SECONDARY) FAIL
V72X0611D3 EIU R(REPEAT) FAIL
V72X0621D3 EIU 2 MIA 1 FAIL
V72X0622D3 EIU 2 MIA 2 FAIL
V72X0623D3 EIU 2 MIA 3 FAIL
V72X0624D3 EIU 2 MIA 4 FAIL
V72X0625D3 EIU 2 CIA 1 FAIL
V72X0626D3 EIU 2 CIA 2 FAIL
V72X0627D3 EIU 2 SEC PWR SUPPLY 1 FAIL
V72X0628D3 EIU 2 SEC PWR SUPPLY 2 FAIL
V72X0629D3 EIU 2 SEC PWR SUPPLY 1OR2 FAIL
V72X0630D3 EIU 2 S(SECONDARY) FAIL
V72X0631D3 EIU 2 R (REPEAT) FAIL
V72X0641D3 EIU 3 MIA 1 FAIL
V72X0642D3 EIU 3 MIA 2 FAIL
V72X0643D3 EIU 3 MIA 3 FAIL
V72X0644D3 EIU 3 MIA 4 FAIL
V72X0645D3 EIU 3 CIA 1 FAIL
V72X0646D3 EIU 3 CIA 2 FAIL
V72X0647D3 EIU 3 SEC PWR SUPPLY 1 FAIL

FD TABLE

FD   NOMENCLATURE

V72X0648D3 EIU 3 SEC PWR SUPPLY 2 FAIL
V72X0649D3 EIU 3 SEC PWR SUPPLY 1OR2 FAIL
V72X0650D3 EIU 3 S(SECONDARY) FAIL
V72X0651D3 EIU 3 R(REPEAT) FAIL
V73S2001E1 DEU NO 1 POWER ON
V73S2011E1 DEU NO 2 POWER ON
V73S2021E1 DEU NO 3 POWER ON
V73S2051E1 DEU NO 4 POWER ON
V75S2157E1 AFT DED SIG COND POWER AB2-ON
V75W3516D1 MTU-PCM VOTED MET HOUR
V75W3517D1 MTU-PCM VOTED MET MINUTE
V75W3518D1 MTU-PCM VOTED MET SECOND
V76X4400E1 PCA E-1 FASCOS/MEM B/U PWR RPCA ON
V76X4401E1 PCA E-1 FASCOS/MEM B/U PWR RPCB ON
V76X4402E1 PCA E-2 FASCOS/MEM B/U PWR RPCB ON
V76X4403E1 PCA E-2 FASCOS/MEM B/U PWR RPCC ON
V76X4404E1 PCA E-3 FASCOS/MEM B/U PWR RPCA ON
V76X4405E1 PCA E-3 FASCOS/MEM B/U PWR RPCC ON
V90Q8001C1 MAJOR MODE CODE
V90U1948C1 COMMANDED SSME THROTTLE SETTING
V90W1970C1 PREDICTED SSME C/O TIME IN MET
V90W8380C1 COUNTDOWN TIME (TBO TIME)
V90X8382X1 LAUNCH SEQUENCE ABORT FLAG
V90X8389X1 ENGINE SHUTDOWN VERIFICATION HOLD
V90X8393X1 LPS GO FOR AUTO SEQ START HOLD
V90X8394X1 LPS GO FOR ENGINE START HOLD
V90X8395X1 R/S SEQ SSME GO FOR LAUNCH HOLD
V90X8561X1 MECO CONFIRMED FLAG
V90X8569X1 MECO COMMAND FLAG
V90X8667X1 RS COUNTDOWN HOLD FLAG
V90X8670X1 ME-1 PAD DATA PATH FAIL HOLD
V90X8671X1 ME-2 PAD DATA PATH FAIL HOLD
V90X8672X1 ME-3 PAD DATA PATH FAIL HOLD
V90X8679X1 ME-1 CONTROL FAIL HOLD
V90X8680X1 ME-2 CONTROL FAIL HOLD
V90X8681X1 ME-3 CONTROL FAIL HOLD
V90X8771X1 UNCOMMANDED ENGINE SHUTDOWN ABORT
V90X8773X1 ME-1 LOW CHAMBER PRESSURE ABORT
V90X8774X1 ME-2 LOW CHAMBER PRESSURE ABORT
V90X8775X1 ME-3 LOW CHAMBER PRESSURE ABORT
V91Q1710CX GPC 1 TMP SOURCE
V91Q1711CX GPC 2 TMP SOURCE
V91Q1712CX GPC 3 TMP SOURCE
V91Q1713CX GPC 4 TMP SOURCE
V91Q1714CX GPC 5 TMP SOURCE
V91X2813XX EIU1/P4 DATA BYPASS(HFE INPUT)
V91X2817XX EIU2/P4 DATA BYPASS(HFE INPUT)
V91X2821XX EIU3/P4 DATA BYPASS(HFE INPUT)
V91X2920X_ FA1 MDM RETURN WORD BYPASS (HFE)
V91X2921X_ FA2 MDM RETURN WORD BYPASS (HFE)
V91X2922X_ FA3 MDM RETURN WORD BYPASS (HFE)

                                    FD TABLE

FD   NOMENCLATURE

V91X2923X_ FA4 MDM RETURN WORD BYPASS (HFE)
V91X2927XX EIU1/P1 DATA BYPASS(HFE INPUT)
V91X2928XX EIU1/P1 DATA BYPASS(MFE INPUT)
V91X2930XX EIU2/P1 DATA BYPASS(HFE INPUT)
V91X2931XX EIU2/P1 DATA BYPASS(MFE INPUT)
V91X2933XX EIU3/P1 DATA BYPASS(HFE INPUT)
V91X2934XX EIU3/P1 DATA BYPASS(MFE INPUT)
V91X7936XX GPC 1 BUS 14 MASK
V91X7937XX GPC 1 BUS 15 MASK
V91X7941XX GPC 1 BUS 16 MASK
V91X7942XX GPC 1 BUS 17 MASK
V91X7971XX GPC 2 BUS 14 MASK
V91X7972XX GPC 2 BUS 15 MASK
V91X7975XX GPC 2 BUS 16 MASK
V91X7976XX GPC 2 BUS 17 MASK
V91X8025XX GPC 3 BUS 14 MASK
V91X8026XX GPC 3 BUS 15 MASK
V91X8039XX GPC 3 BUS 16 MASK
V91X8040XX GPC 3 BUS 17 MASK
V91X8069XX GPC 4 BUS 14 MASK
V91X8070XX GPC 4 BUS 15 MASK
V91X8073XX GPC 4 BUS 16 MASK
V91X8074XX GPC 4 BUS 17 MASK
V91X8140XX GPC 5 BUS 14 MASK
V91X8141XX GPC 5 BUS 15 MASK
V91X8144XX GPC 5 BUS 16 MASK
V91X8145XX GPC 5 BUS 17 MASK
V92U5085CX DEU 1 MF
V92U5086CX DEU 1 DISPLAY ID
V92U5087CX DEU 2 MF
V92U5088CX DEU 2 DISPLAY ID
V92U5089CX DEU 3 MF
V92U5090CX DEU 3 DISPLAY ID
V92U5091CX DEU 4 MF
V92U5092CX DEU 4 DISPLAY ID
V95X1202X1 ME-1 COMMAND PATH FAIL FLAG
V95X1203X1 ME-2 COMMAND PATH FAIL FLAG
V95X1204X1 ME-3 COMMAND PATH FAIL FLAG
V95X1207X1 MPS E1 FAIL FLAG
V95X1208X1 MPS E2 FAIL FLAG
V95X1209X1 MPS E3 FAIL FLAG
V98J2213C1 ME-1 PHASE IN EFFECT BFS
V98J2233C1 ME-2 PHASE IN EFFECT BFS
V98J2253C1 ME-3 PHASE IN EFFECT BFS
V98P2100C1 C ENGINE PC BFS
V98P2110C1 L ENGINE PC BFS
V98P2120C1 R ENGINE PC BFS
V98U2001C1 CMD THROTTLE BFS
V98U2202C1 ME-1 COMMAND STATUS BFS
V98U2204C1 ME-1 CHANNEL STATUS BFS
V98U2212C1 ME-1 OPER MODE WITHIN PHASE BFS

                              FD TABLE

FD   NOMENCLATURE

V98U2215C1 ME-1 SELF TEST STATUS BFS
V98U2222C1 ME-2 COMMAND STATUS BFS
V98U2224C1 ME-2 CHANNEL STATUS BFS
V98U2232C1 ME-2 OPER MODE WITHIN PHASE BFS
V98U2235C1 ME-2 SELF TEST STATUS BFS
V98U2242C1 ME-3 COMMAND STATUS BFS
V98U2244C1 ME-3 CHANNEL STATUS BFS
V98U2252C1 ME-3 OPER MODE WITHIN PHASE BFS
V98U2255C1 ME-3 SELF TEST STATUS BFS
V98U2408C1 MAJOR MODE BFS
V98W1390C1 ME-1 TIME REFERENCE BFS
V98W1391C1 ME-2 TIME REFERENCE BFS
V98W1392C1 ME-3 TIME REFERENCE BFS
V98W1888C1 TIME TO MAIN ENGINE CUTOFF BFS
V98X0643X1 BFS ENGAGED BFS
V98X0821X1 EIU 1 PRIMARY PORT BFS
V98X0824X1 EIU 1 SECONDARY PORT BFS
V98X0826X1 EIU 2 PRIMARY PORT BFS
V98X0828X1 EIU 2 SECONDARY PORT BFS
V98X0831X1 EIU 3 PRIMARY PORT BFS
V98X0832X1 EIU 3 SECONDARY PORT BFS
V98X2201X1 ME-1 MEMORY LOAD STATUS BFS
V98X2207X1 ME-1 FRT STATUS BFS
V98X2208X1 ME-1 LIMIT CONTROL INH/ENA BFS
V98X2221X1 ME-2 MEMORY LOAD STATUS BFS
V98X2227X1 ME-2 FRT STATUS BFS
V98X2228X1 ME-2 LIMIT CONTROL INH/ENA BFS
V98X2241X1 ME-3 MEMORY LOAD STATUS BFS
V98X2247X1 ME-3 FRT STATUS BFS
V98X2248X1 ME-3 LIMIT CONTROL INH/ENA BFS
V98X2752X1 TRKG PASS STAT-TRKG FC STNG 1 BFS
V98X3545X1 AS32 MECO CMD BFS
V98X3546X1 AS33 MECO CONFIRMED BFS
V99J4668C1 TEST STATUS MESSAGE (ACTV/CPLT)
V99J4670C1 TEST FAIL STEP NUMBER
V99J4671C1 TEST FAIL REPONSE WORD VALUE
V99U4692C1 BCE STAT REG (32 BITS)