

A diagram showing a globe with a red arrow curving around it, pointing from the top left towards the bottom right. The word "Apollo" is written in a stylized, bold, italicized font across the globe.

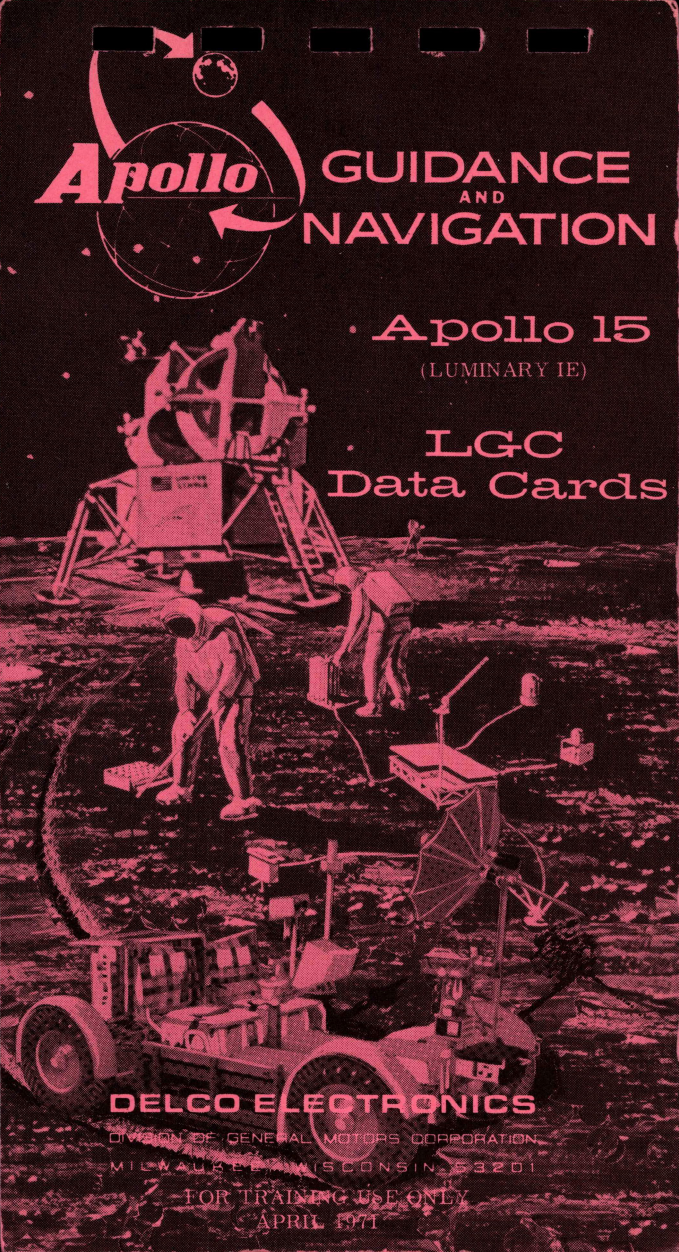
Apollo

GUIDANCE AND NAVIGATION

Apollo 15

(LUMINARY IE)

**LGC
Data Cards**

A black and white photograph of the Apollo 15 lunar surface. In the background, the Lunar Module (LM) is visible. Two astronauts in full spacesuits are working on the surface. One astronaut is in the foreground, using a tool. Another astronaut is further back, near some equipment. A Lunar Roving Vehicle (LRV) is in the lower foreground, equipped with various instruments and a large antenna. The ground is covered in rocks and dust.

DELCO ELECTRONICS

DIVISION OF GENERAL MOTORS CORPORATION
MILWAUKEE, WISCONSIN 53201

FOR TRAINING USE ONLY
APRIL 1971

BLOCK II BASIC INSTRUCTIONS

INSTRUC- TION	ORDER CODE	DESCRIPTION	INSTRUC- TION	ORDER CODE	DESCRIPTION
AD K	06.	ADD K	LXCH E	02.2	EXCHANGE L AND E
ADS E	02.6	ADD TO STORAGE E	MASK K	07.	MASK WITH K
AUG E	12.4	AUGMENT E	MP K	17.	MULTIPLY K
BZF F	11.2 11.4 11.6	BRANCH ON ZERO TO FIXED F	MSU E	12.0	MODULAR SUBTRACT E
BZMF F	16.2 16.4 16.6	BRANCH ON ZERO OR MINUS TO FIXED F	NOOP	03.0000	NO OPERATION (E)
CA K	03.	CLEAR AND ADD K	NOOP	TCF I+1	NO OPERATION (F)
CAE E	03.	CLEAR AND ADD E	OVSF	05.4000	OVERFLOW SKIP; TS A
CAF F	03.	CLEAR AND ADD F	QXCH E	12.2	EXCHANGE Q AND E
CCS E	01.0	COUNT, COMPARE, AND SKIP ON E	RAND H	10.2	READ AND "AND" H
COM	04.0000	COMPLEMENT A	READ H	10.0	READ H
CS K	04.	CLEAR AND SUBTRACT K	RELINT	00.0003	RELEASE INHIBIT INTERRUPT
CYL	.0022	CYCLE LEFT	RESUME	05.0017	RESUME INTERRUPTED PROGRAM
CYR	.0020	CYCLE RIGHT	RETURN	00.0002	RETURN; TCQ
DAS E	02.0	DOUBLE ADD TO STORAGE E	ROR H	10.4	READ AND "OR" H
DCA K	13.	DOUBLE CLEAR AND ADD K	RXOR H	10.6	READ AND EXCLUSIVE "OR" H
DCS K	14.	DOUBLE CLEAR AND SUBTRACT K	SR	.0021	SHIFT RIGHT
DCOM	14.0001	DP COMPLEMENT A, L	SU E	16.0	SUBTRACT E
DDOUBL	02.0001	DP DOUBLE A, L	TCAA	05.4005	TRANSFER CONTROL TO ADDRESS IN A; TS Z
DIM E	12.6	DIMINISH E	TC K	00.	TRANSFER CONTROL TO K
DOUBLE	06.0000	DOUBLE A	TCF F	01.2 01.4 01.6	TRANSFER CONTROL TO FIXED F
DTCB	05.2006	DP TRANSFER CONTROL BOTH BANKS	TS E	05.4	TRANSFER TO STORAGE E
DV E	11.0	DIVIDE BY E	WAND H	10.3	WRITE AND "AND" H
DXCH E	05.2	DOUBLE EXCHANGE A, L WITH E, E + 1	WOR H	10.5	WRITE AND "OR" H
EDOP	.0023	EDIT OPERAND	WRITE H	10.1	WRITE H
EXTEND	0.0006	EXTEND	XCH E	05.6	EXCHANGE A AND E
INCR E	02.4	INCREMENT E	ZL	02.2007	ZERO L; LXCH ZERO
INDEX E	05.0	INDEX NEXT BASIC INSTRUCTION WITH E	ZQ	12.2007	ZERO Q; QXCH ZERO
INDEX K	15.	INDEX NEXT EXTRA- CODE INSTRUCTION WITH K			
INHINT	00.0004	INHIBIT INTERRUPT			

VERB CODES

00		54	MARK X OR Y-RETICLE
01	DISPLAY OCTAL COMP 1 IN R1	55	INCREMENT LGC TIME (DECIMAL)
02	DISPLAY OCTAL COMP 2 IN R1	56	TERMINATE TRACKING (P20+P25)
03	DISPLAY OCTAL COMP 3 IN R1	57	PERMIT LANDING RADAR UPDATES
04	DISPLAY OCTAL COMP 1,2 IN R1, R2	58	INHIBIT LANDING RADAR UPDATES
05	DISPLAY OCTAL COMP 1,2,3, IN R1,R2,R3	59	COMMAND LR TO POSITION 2
06	DISPLAY DECIMAL (R1 OR R1,R2 OR R1,R2, R3)	60	DISPLAY VEHICLE ATTITUDE RATES (FDAI)
07	DISPLAY DP DECIMAL (R1,R2) (TESTS ONLY)	61	DISPLAY DAP FOLLOWING ATTITUDE ERRORS (FDAI)
08		62	DISPLAY TOTAL ATTITUDE ERRORS WITH RESPECT TO NOUN 22 (FDAI)
09		63	SAMPLE RADAR ONCE PER SECOND (R04)
10		64	REQUEST S-BAND ANTENNA ROUTINE (R05)
11	MONITOR OCTAL COMP 1 IN R1	65	SET FLAG TO DISABLE U, V JETS DURING DPS BURNS
12	MONITOR OCTAL COMP 2 IN R1	66	VEHICLES ARE ATTACHED. MOVE THIS VEHICLE STATE VECTOR TO OTHER VEHICLE STATE VECTOR
13	MONITOR OCTAL COMP 3 IN R1	67	DISPLAY W MATRIX
14	MONITOR OCTAL COMP 1,2 IN R1, R2	68	DISABLE TERRAIN MODEL
15	MONITOR OCTAL COMP 1,2,3 IN R1,R2,R3		
16	MONITOR DECIMAL IN R1 OR R1,R2 OR R1, R2, R3	69	CAUSE RESTART
17	MONITOR DP DECIMAL (R1,R2) (TEST ONLY)	70	UPDATE LIFTOFF TIME (P27)
18		71	UNIVERSAL UPDATE-BLOCK ADR (P27)
19		72	UNIVERSAL UPDATE-SINGLE ADR (P27)
20		73	UPDATE LGC TIME (OCTAL) (P27)
21	LOAD COMPONENT 1 INTO R1	74	INITIALIZE ERASABLE DUMP VIA DOWNLINK (V74)
22	LOAD COMPONENT 2 INTO R2	75	ENABLE U AND V JET FIRINGS DURING DPS BURNS
23	LOAD COMPONENT 3 INTO R3	76	MINIMUM IMPULSE COMMAND MODE (DAP)
24	LOAD COMPONENT 1,2 INTO R1,R2	77	RATE COMMAND AND ATTITUDE HOLD MODE (DAP)
25	LOAD COMPONENT 1,2,3 INTO R1, R2, R3	78	LR SPURIOUS RETURN TEST START (R77)
26		79	LR SPURIOUS RETURN TEST STOP (R77)
27	DISPLAY FIXED MEMORY	80	UPDATE LEM STATE VECTOR
28		81	UPDATE CSM STATE VECTOR
29		82	REQUEST ORBIT PARAM DISPLAY (R30)
30	REQUEST EXECUTIVE	83	REQUEST REND PARAM DISPLAY (R31)
31	REQUEST WAITLIST	84	
32	RECYCLE PROGRAM	85	DISPLAY RR LOS AZIMUTH AND ELEVATION
33	PROCEED WITHOUT DSKY INPUTS	86	
34	TERMINATE FUNCTION	87	
35	TEST LIGHTS	88	
36	REQUEST FRESH START	89	REQUEST RENDEZVOUS FINAL ATTITUDE ROUTINE (R63)
37	CHANGE PROGRAM (MAJOR MODE)	90	REQUEST RENDEZVOUS OUT OF PLANE DISPLAY (R36) (NON AVE G)
38		91	DISPLAY BANK SUM (POO ONLY)
39		92	OPERATE IMU PERFORMANCE TEST (P07)
40	ZERO CDU-S (SPECIFY N20 OR N72)	93	ENABLE W MATRIX INITIALIZATION
41	COARSE ALIGN CDU (SPECIFY N20 OR N72)	94	
42	FINE ALIGN IMU	95	NO UPDATE OF EITHER STATE VECTOR (P20 OR P22)
43	LOAD IMU ATT ERROR METERS	96	INTERRUPT INTEGRATION AND GO TO P00
44	TERMINATE RR CONTINUOUS DESIGNATE (V41N72 OPTION 2)	97	PERFORM ENGINE FAIL PROCEDURE (R40)
45		98	
46		99	PLEASE ENABLE ENGINE IGNITION
47	INITIALIZE AGS (R47)		
48	REQUEST DAP DATA LOAD ROUTINE (R03)		
49	REQUEST CREW DEFINED MANEUVER ROUTINE (R62)		
50	PLEASE PERFORM		
51			
52	MARK X-RETICLE		
53	MARK Y-RETICLE		

NOUN CODES

DATA DISPLAYED		COMPONENTS & SCALING		RESTRIC- TIONS (SEE CODE)
00				
01	SPECIFY MACHINE ADDRESS (FRACT.)	3 COMP	.XXXXX	
02	SPECIFY MACHINE ADDRESS (WHOLE)	3 COMP	XXXXX.	
03	SPECIFY MACHINE ADDRESS (DEGREES)	3 COMP	XXX.XX DEG	
04	ANGULAR ERROR/DIFFERENCE	1 COMP	XXX.XX DEG	
05	ANGULAR ERROR/DIFFERENCE	1 COMP	XXX.XX DEG	
06	OPTION CODE	3 COMP	OCTAL ONLY	
07	ECADR OF WORD TO BE MODIFIED	3 COMP	OCTAL ONLY	
	ONES FOR BITS TO BE MODIFIED		OCTAL	
	1 TO SET OR 0 TO CLEAR SELECTED BITS		OCTAL	
LOADING NOUN 07 WILL SET OR CLEAR SELECTED BITS IN ANY ERASABLE REGISTER				
08	ALARM DATA	3 COMP	OCTAL ONLY	
09	ALARM CODES	3 COMP	OCTAL ONLY	
10	CHANNEL TO BE SPECIFIED	1 COMP	OCTAL ONLY	
11	TIG OF CSI	3 COMP	00XXX. HRS 000XX. MIN 0XX.XX SEC	A3
12	OPTION CODES (USED BY EXTENDED VERBS ONLY)	2 COMP	OCTAL ONLY	
13	TIG OF CDH	3 COMP	00XXX. HRS 000XX. MIN 0XX.XX SEC	A3
14	CHECKLIST (USED INTERNALLY BY EXTENDED VERBS ONLY) (NOUN 25's PASTED AFTER DISPLAY)	3 COMP	XXXXXX.	C
15	INCREMENT MACHINE ADDRESS	1 COMP	OCTAL ONLY	
16	TIME OF EVENT (USED BY EXTENDED VERBS ONLY)	3 COMP	00XXX. HRS 000XX. MIN 0XX.XX SEC	A3
17				
18	AUTO MANEUVER TO FDAI BALL ANGLES	3 COMP	XXX.XX DEG	
19				
20	PRESENT ICDU ANGLES (Y, P, R) (OG, IG, MG)	3 COMP	XXX.XX DEG	
21	PIPA PULSES	3 COMP	XXXXX. X, Y, Z PULSES	
22	DESIRED ICDU ANGLES (Y, P, R) (OG, IG, MG)	3 COMP	XXX.XX DEG	
23				
24	DELTA TIME FOR LGC CLOCK	3 COMP	000XX. HRS 000XX. MIN 0XX.XX SEC	A3
25	CHECKLIST (USED WITH V50)	3 COMP	XXXXXX.	
26	PRIORITY/DELAY, ADRES, BBCON	3 COMP	OCTAL ONLY	
27	SELF TEST ON/OFF SWITCH	1 COMP	XXXXXX.	
28				
29				
30				
31				
32	TIME FROM PERIGEE	3 COMP	00XXX. HRS 000XX. MIN 0XX.XX SEC	A3
33	TIME OF IGNITION (TIG)	3 COMP	00XXX. HRS 000XX. MIN 0XX.XX SEC	A3
34	TIME OF EVENT	3 COMP	00XXX. HRS 000XX. MIN 0XX.XX SEC	A3
35	TIME FROM EVENT	3 COMP	00XXX. HRS 000XX. MIN 0XX.XX SEC	
36	TIME OF LGC CLOCK	3 COMP	00XXX. HRS 000XX. MIN 0XX.XX SEC	A3
37	TIG OF TPI	3 COMP	00XXX. HRS 000XX. MIN 0XX.XX SEC	A3
38	TIME OF STATE VECTOR BEING INTEGRATED	3 COMP	00XXX. HRS 000XX. MIN 0XX.XX SEC	A5
39				
40	TIME FROM IGNITION/CUTOFF VG DELTA V (ACCUMULATED)	3 COMP	XXBXX MIN/SEC XXXXX.X FT/SEC XXXXX.X FT/SEC	C

NOUN CODES (CONT)

DATA DISPLAYED		COMPONENTS & SCALING		RESTRIC- TIONS
41	TARGET AZIMUTH, ELEVATION	2 COMP	XXX.XX DEG XX.XXX DEG	E
42	APOGEE ALTITUDE PERIGEE ALTITUDE DELTA V (REQUIRED)	3 COMP	XXXX.X NAUT MI XXXX.X NAUT MI XXXX.X FT/SEC	A
43	LATITUDE (+NORTH), LONGITUDE (+EAST), ALTITUDE	3 COMP	XXX.XX DEG XXX.XX DEG XXXX.X NAUT MI	A
44	APOGEE ALTITUDE PERIGEE ALTITUDE TFF	3 COMP	XXXX.X NAUT MI XXXX.X NAUT MI XXBXX MIN/SEC	C
45	MARKS, TFI OF NEXT/LAST BURN, MGA	3 COMP	XXXXX. XXBXX MIN/SEC XXX.XX DEG	C
46	AUTOPILOT CONFIGURATION CHANNEL BIT FAILURE PROTECTION WORD	2 COMP	OCTAL ONLY OCTAL ONLY	
47	LM WEIGHT CSM WEIGHT	2 COMP	XXXXX. LBS XXXXX. LBS	A
48	GIMBAL PITCH TRIM (+ONLY) GIMBAL ROLL TRIM (+ONLY)	2 COMP	XXX.XX DEG XXX.XX DEG	A
49	DELTA R DELTA V RADAR DATA SOURCE CODE	3 COMP	XXXX.X NAUT MI XXXX.X FT/SEC XXXXX.	A
51	S-BAND ANTENNA ANGLES PITCH, YAW	2 COMP	XXX.XX DEG XXX.XX DEG	A
52	CENTRAL ANGLE OF ACTIVE VEHICLE	1 COMP	XXX.XX DEG	A
54	RANGE RANGE RATE THETA	3 COMP	XXX.XX NAUT MI XXXX.X FT/SEC XXX.XX DEG	A
55	NO. OF APSIDAL CROSSINGS ELEVATION ANGLE CENTRAL ANGLE OF PASSIVE VEHICLE	3 COMP	XXXXX. XXX.XX DEG XXX.XX DEG	A
56	RR LOS AZIMUTH RR LOS ELEVATION	2 COMP	XXX.XX DEG XXX.XX DEG	A
58	PERIGEE ALTITUDE (POST TPI) DELTA V (TPI) DELTA V (TPF)	3 COMP	XXXX.X NAUT MI XXXX.X FT/SEC XXXX.X FT/SEC	A
59	DELTA VEL. LOS - FWD/AFT (+FWD) - RT/LEFT (+RT) - UP/ON (+DN)	3 COMP	XXXX.X FT/SEC	A
60	FORWARD VELOCITY (+ALWAYS) ALTITUDE RATE (+INCREASING) COMPUTED ALTITUDE	3 COMP	XXXX.X FT/SEC XXXX.X FT/SEC XXXXX. FT	A
61	TIME TO GO IN BRAKING PHASE TIME FROM IGNITION CROSS RANGE DISTANCE	3 COMP	XXBXX MIN/SEC XXBXX MIN/SEC XXXXX. NAUT MI	C
62	INERTIAL VELOCITY (ABS. VALUE) TIME FROM IGNITION DELTA V (ACCUMULATED)	3 COMP	XXXX.X FT/SEC XXBXX MIN/SEC XXXXX. FT/SEC	C
63	LR ALTITUDE MINUS COMPUTED ALTITUDE RATE COMPUTED ALTITUDE	3 COMP	XXXXX. FT XXXXX. FT/SEC XXXXX. FT	A
64	TIME LEFT FOR REDESIGNATION -LPD ANGLE ALTITUDE RATE (+INCREASING) COMPUTED ALTITUDE	3 COMP	XXBXX SEC-DEG XXXXX. FT/SEC XXXXX. FT	C
65	SAMPLED LGC TIME (FETCHED IN INTERRUPT)	3 COMP	XXXXX. FT/SEC XXXXX. FT 00XXX. HRS 000XX. MIN 0XX.XX SEC	A3
66	LR SLANT RANGE LR POSITION	2 COMP	XXXXX. FT +0000X	C
67	LR VX LR VY LR VZ	3 COMP	XXXXX. FT/SEC XXXXX. FT/SEC XXXXX. FT/SEC	
68	SM Z-AXIS RANGE TO LANDING SITE TIME TO GO IN BRAKING PHASE ABSOLUTE VALUE OF VELOCITY	3 COMP	XXXXX. NAUT MI XXBXX MIN/SEC XXXXX. FT/SEC	C

NOUN CODES (CONT)

	DATA DISPLAYED		COMPONENTS & SCALING	RESTRIC- TIONS
69	LANDING SITE CORRECTION Z-COMP Y-COMP X-COMP	3 COMP	XXXXX. FEET XXXXX. FEET XXXXX. FEET	
70	AOT DETENT CODE/STAR CODE (BEFORE MARK)	3 COMP	OCTAL ONLY 00XXX	B
71	AOT DETENT CODE/STAR CODE (AFTER MARK)	3 COMP	OCTAL ONLY 00XXX	*B
72	RR 360 - TRUNNION ANGLE RR SHAFT ANGLE	2 COMP	XXX.XX DEG XXX.	
73	NEW RR360 - TRUNNION ANGLE NEW RR SHAFT ANGLE	2 COMP	XXX.XX DEG XXX.XX DEG	
74	TIME FROM IGNITION YAW AFTER VEHICLE RISE PITCH AFTER VEHICLE RISE	3 COMP	XXBXX MIN/SEC XXX.XX DEG XXX.XX DEG	C
75	DELTA ALTITUDE CDH DELTA TIME (CDH - CSI OR TPI - CDH DELTA TIME (TPI - CDH OR TPI - NOMTPI)	3 COMP	XXXX.X NAUT MI XXBXX MIN/SEC	C
76	DESIRED HORIZ. VEL. DESIRED RAD. VEL. CROSS-RANGE DIST.	3 COMP	XXBXX MIN/SEC XXXX.X FT/SEC X.OXX.X FT/SEC XXXX.X NAUT MI	
77	TIME TO ENGINE CUTOFF VG (BODY) ABSOLUTE VALE OF VELOCITY	3 COMP	XXBXX MIN/SEC XXXX.X FT/SEC XXXX.X FT/SEC	C
78	RR RANGE RR RANGE RATE TIME FROM IGNITION	3 COMP	XXX.XX NAUT/MI XXXX.X FT/SEC XXBXX MIN/SEC	
79	CURSOR ANGLE SPIRAL ANGLE POSITION CODE	3 COMP	XXX.XX DEG XXX.XX DEG XXXXX.	A
80	DATA INDICATOR OMEGA	2 COMP	XXXXX. XXX.XX DEG	
81	DELTA V (LV) ---(+FWD), (+RT), (+DN)	3 COMP	XXXX.X FT/SEC	A
82	DELTA V (LV) ---(+FWD), (+RT), (+DN)	3 COMP	XXXX.X FT/SEC	
83	DELTA V (BODY) ---(+UP), (+RT), (+FWD)	3 COMP	XXXX.X FT/SEC X, Y, Z	A A
84	DELTA V (OTHER VEH)	3 COMP	XXXX.X FT/SEC X, Y, Z	A
85	VG (BODY) ---(+UP), (+RT), (+FWD)	3 COMP	XXXX.X FT/SEC X, Y, Z	A
86	VG (LV) ---(+FWD), (+RT), (+DN)	3 COMP	XXXX.X FT/SEC X, Y, Z	A
87	BACKUP OPTICS LOS AZIMUTH (+RT) BACKUP OPTICS LOS ELEVATION (+UP)	2 COMP	XXX.XX DEG XXX.XX DEG	
88	HALF UNIT SUN OR PLANET VECTOR	3 COMP	.XXXXX (X, Y, Z)	A
89	LANDMARK LATITUDE (+NORTH) LONGITUDE/2 (+EAST) ALTITUDE	3 COMP	XX.XXX DEG XX.XXX DEG XXX.XX NAUT MI	A
90	Y Y DOT PSI	3 COMP	XXX.XX NAUT MI XXXX.X FT/SEC XXX.XX DEG	A
91	ALTITUDE VELOCITY FLIGHT PATH ANGLE	3 COMP	XXXXX. NAUT MI XXXXX. FT/SEC XXX.XX DEG	
92	DESIRED THRUST PERCENTAGE (OF 10,500 LBS - DPS RATED) ALTITUDE RATE (+INCREASING) COMPUTED ALTITUDE	3 COMP	XXXXX. % XXXX.X FT/SEC XXXXX. FT	
93	DELTA GYRO ANGLES	3 COMP	XX.XXX DEG X, Y, Z	

NOUN CODES (CONT)

DATA DISPLAYED		COMPONENTS & SCALING			RESTRIC- TIONS
94	VGX (BODY) ALTITUDE RATE COMPUTED ALTITUDE	3 COMP	XXXX.X XXXX.X XXXXX.	FT/SEC FT/SEC FEET	C
95	SPARE				
96	SPARE				
97	SYSTEM TEST INPUTS	3 COMP	XXXXX.		
98	SYSTEM TEST RESULTS AND INPUTS	3 COMP	XXXXX. .XXXXX XXXXX.		
99	WMATRIX RMS ERROR IN POSITION RMS ERROR IN VELOCITY RMS IN BIAS	3 COMP	XXX.XX XXXX.X XX.XXX	FEET FT/SEC RADIANS	A
RESTRICTION CODE					
A	DECIMAL ONLY	C	NO LOAD DECIMAL ONLY		
B	OCTAL ONLY	D	NO LOAD OCTAL ONLY		
A3	DECIMAL ONLY MUST LOAD 3 COMPONENTS	E	SYSTEM TEST ONLY		

NOUN STORAGE REGISTER NAMES

CODE	REGISTER(S)	CODE	REGISTER(S)	CODE	REGISTER(S)
00		57		92	THRDISP
01	(SPECIFY ADDRESS)	58	POSTTPI		HDOTDISP
02	(SPECIFY ADDRESS)		DELVTPI		HCALC1
03	(SPECIFY ADDRESS)		DELVTPF	93	OGC,+1,+2
04	DSPTM1	59	DV LOS,+2,+4	94	VGBODY
05	DSPTM1	60	FORVEL	95	HDOTDISP
06	OPTION2,+1		HDOT DISP	96	HCALC
07	XREG, YREG, ZREG		HCALC1	95	
08	ALMCADR,+1,+2	61	TTFDISP	96	
09	FAILREG,+1,+2		TTOGO	97	DSPTM1,+1,+2
10	(SPECIFY CHANNEL)		OUT OF PLN	98	DSPTM2,+1,+2
11	TCSI,+1	62	ABVEL	99	WWPOS
12	OPTIONX,+1		TTOGO		WWVEL
13	TCDH,+1		DVTOTAL		WWBIAS
14	DSPTMX,+1,+2	63	DELTAH		
15	(INCREMENT ADDRESS)		HDOTDISP		
16	DSPTMX,+1,+2		HCALC1		
17		64	FUNNYDSP		
18	FDAIX, Y, Z		HDOTDISP		
19			HCALC		
20	CDUX, Y, Z	65	SAMPTIME,+1		
21	PIPAX, Y, Z	66	RSTACK+6		
22	THETAD,+1,+2		CHANNEL 33		
23		67	RSTACK,+2,+4		
24	DSPTM2+1,+2	68	RANGE DSP		
25	DSPTM1,+1,+2		TTFDISP		
26	DSPTM1,+1,+2		ABVEL		
27	SMODE	69	DLANDZ		
28			DLANDY		
29			DLANDX		
30		70	AOTCODE,+1,+2		
31		71	AOTCODE,+1,+2		
32	-TPER,+1	72	CDUT		
33	TIG,+1		CDUS		
34	DSPTM1,+1	73	TANG,+1		
35	TTOGO,+1	74	TTOGO		
36	TIME2, TIME1		YAW		
37	TTPI,+1		PITCH		
38	TET,+1	75	DIFFALT		
39			T1TOT2		
40	TTOGO		T2TOT3		
	VGDISP	76	ZDOTD		
	DVTOTAL		RDOTD		
41	DSPTM1,+1		XRANGE		
42	HAPO	77	TTOGO		
	HPER		VGBODY+2		
	VGDISP		ABVEL		
43	LAT	78	DNRRANGE		
	LONG		DNRRDOT		
	ALT		TTOTIG		
44	HAPOX	79	CURSOR		
	HPERX		SPIRAL		
	TFF		POSCODE		
45	TRKMKCNT	80	DATAGOOD		
	TTOGO		OMEGAD		
	+ MGA	81	DELVLVC,+2,+4		
46	DAPDATR1	82	DELVLVC,+2,+4		
	CHANBKUP	83	DELVIMU,+2,+4		
47	LEMMASS	84	DELVOV,+2,+4		
	CSMMASS	85	VGBODY,+2,+4		
48	PITTIME	86	DELVLVC,+2,+4		
	ROLLTIME	87	AZ		
49	R22DISP		EL		
	R22DISP+2	88	STARAD,+2,+4		
	WHCHREAD	89	LANDLAT		
50			LANDLONG		
51	ALPHASB		LANDALT		
	BETASB	90	RANGE		
52	ACTCENT		RRATE		
54	RANGE		RTHETA		
	RRATE	91	P21ALT		
	RTHETA		P21VEL		
55	NN		P21GAM		
	ELEV				
	CENTANG				
56	RR-AZ				
	RR-ELEV				

CHECKLIST CODES

(Used with V50N25)

RI CODE		ACTION TO BE EFFECTED
00013	KEY IN	NORMAL OR GYRO COARSE ALIGN (P52)
00014	PROCEED	DO FINE ALIGNMENT ROUTINE (R51, P63, P57)
	ENTER	BYPASS FINE ALIGN ROUTINE (P63) OR, DO LANDING SITE DETERMINATION (P57 OPTION 2)
00015	PERFORM	CELESTIAL BODY ACQUISITION (R51, P51)
00016	PROCEED	DO IMU ALIGN WITH NON-REJECTED DATA (R51, P51)
00062	SWITCH	LGC POWER DOWN (P06)
00201	SWITCH	RR MODE SWITCH TO LGC (P20, P22, R04)
00203	SWITCH	GUIDE CONTROL TO PGNCs, MODE TO AUTO, THROTTLE CONTROL TO AUTO (P12, P42, P71) (P40, P63, P70)
00205	PERFORM	MANUAL ACQUISITION OF RR (R23)
00500	SWITCH	LR ANTENNA TO POSITION 1 (P63)

NOTE: SWITCH DENOTES: CHANGE POSITION
OF A CONSOLE SWITCH
PERFORM DENOTES: START OR END
OF A TASK
KEY IN: DENOTES KEY IN OF DATA
THRU THE DSKY

OPTION CODES

THE SPECIFIED OPTION CODES WILL BE IN COMPONENT R1 IN CONJUNCTION
WITH FLASHING V04 N06 OR V04 N12 (FOR EXTENDED VERBS) TO REQUEST
THE ASTRONAUT TO LOAD INTO COMPONENT R2 THE OPTION HE DESIRES.

R ₁ OPTION CODE	PURPOSE	INPUT FOR R2
00001	SPECIFY IMU ORIENTATION	1 = PREF, 2 = NOM
00002	SPECIFY VEHICLE	3 = REFSMMAT, 4 = LANDSITE (P52)
00003	SPECIFY TRACKING ATTITUDE	1 = THIS 2 = OTHER (P21, R30)
00004	SPECIFY RADAR	1 = PREFERRED, 2 = OTHER (R63)
00006	SPECIFY RR COARSE ALIGN OPTION	1 = RR 2 = LR (R04)
00010	SPECIFY ALIGNMENT MODE	1 = LOCKON 2 = CONTINUOUS DESIGNATE (V41 N72)
00012	SPECIFY CSM ORBIT ORBIT OPTION	0 = ANYTIME 1 = REFSMMAT+G (P57) 2 = TWO BODIES 3 = ONE BODY + G 1 = NO ORBIT CHANGE 2 = CHANGE ORBIT TO PASS OVER LM (P22)

ALARM CODES

CODE	TYPE	SET BY
00111	MARK MISSING	AOTMARK
00112	MARK OR MARK REJECT NOT BEING ACCEPTED	AOTMARK
00113	NO INBITS	AOTMARK
00115	NO MARKS IN LAST PAIR TO REJECT	AOTMARK
00206	ZERO ENCODE NOT ALLOWED WITH COARSE ALIGN + GIMBAL LOCK	IMU MODE SWITCHING
00207	ISS TURNON REQUEST NOT PRESENT FOR 90 SEC	T4RUPT
00210	IMU NOT OPERATING	IMU MODE SW
00211	COARSE ALIGN ERROR	IMU/2, R02, P51, P57
00212	PIPA FAIL BUT PIPA IS NOT BEING USED	IMU MODE SWITCH
00213	IMU NOT OPERATING WITH TURN-ON REQUEST	IMU MODE SWITCH,
00214	PROGRAM USING IMU WHEN TURNED OFF	T4RUPT
00217	BAD RETURN FROM STALL ROUTINES	T4RUPT
00220	BAD REFSMMAT	P51, P52, P57
00401	DESIRED GIMBAL ANGLES YIELD GIMBAL LOCK	R47, R02
00402	FINDCDW NOT CONTROLLING ATTITUDE	INF, ALIGN, IMU/2
00404	TWO STARS NOT AVAILABLE IN ANY DETENT	FINDCDUW
00405	TWO STARS NOT AVAILABLE	R59, LUNAR SURFACE
00421	W-MATRIX OVERFLOW	P52
00501	P RADAR ANTENNA OUT OF LIMITS	INTEGRV
00502	BAD RADAR GIMBAL ANGLE INPUT	R23
00503	P RADAR ANTENNA DESIGNATE FAIL	V41N72
00510	RADAR AUTO DISCRETE NOT PRESENT	R21, NON-P IN V41 N72
00511	LR NOT IN POSITION 2 OR REPOSITIONING	R25
00514	P RR GOES OUT OF AUTO MODE WHILE IN USE	SERVICER
00515	RR CDU FAIL DISCRETE PRESENT	P20
00520	RADARUPT NOT EXPECTED AT THIS TIME	R25
00522	LR POSITION CHANGE	RADAR READ
00523	P LR ANTENNA FAIL TO ACHIEVE POSITION 2	RADAR READ
00525	P DELTA THETA GREATER THAN 3 DEGREES	SERVICER, V60
00526	P RANGE GREATER THAN 400 NAUTICAL MILES	NON-P IN V60)
00527	P LOS NOT IN MODE 2 COVERAGE WHILE ON	R22
00530	P LOS NOT IN MODE 2 COVERAGE ON LUNAR	P20, P22
00600	IMAGINARY ROOTS ON FIRST ITERATION	R21, R24
00601	PERIGEE ALTITUDE CSI LT PMIN 1	R24 (20)
00602	PERIGEE ALTITUDE CDH LT PMIN 2	R21
00603	CSI TO CDH TIME LT TMIN12	P32, P72
00604	CDH TO TPI TIME LT TMIN 23 OR COMPUTED	P32, P72
00605	CDH TIME GREATER THAN INPUT TPI TIME	P32, P72
00606	NUMBER OF ITERATIONS EXCEEDS LOOP MAXIMUM	P32, P72
00611	DV EXCEEDS MAXIMUM	P32, P72
00701	NO TIG FOR GIVEN ELEV ANGLE	P34, P74
00777	ILLEGAL OPTION CODE SELECTED	P57
01102	PIPA FAIL CAUSED THE ISS WARNING	T4RUPT
01105	LGC SELF TEST ERROR	SELF CHECK
01106	DOWNLINK TOO FAST	T4RUPT
01107	UPLINK TOO FAST	T4RUPT
01301	PHASE TABLE FAILURE, ASSUME	RESTART
01406	ERASABLE MEMORY IS SUSPECT	INTERPRETER
01407	ARCSIN-ARCCOS ARGUMENT TOO LARGE	DESCENT GUIDANCE
01410	BAD RETURN FROM ROOTPSRS	EQS. (P63)
01412	VG INCREASING (ACCUMULATED DELTAV GT.	S40.8
01466	90 DEGREES AWAY FROM DESIRED THRUST	DESCENT EQNS
01520	VECTOR)	P63
01600	UNINTENTIONAL OVERFLOW IN GUIDANCE	P66
01601	DESCENT IGNITION ALGORITHM NOT COVERGING	V37
01703	INSUF. THROTTLING BETWEEN SKIPPED THROTS	IMU 4
01706	V37 REQUEST NOT PERMITTED AT THIS TIME	OPT PREALIGN CALIB
	OVERFLOW IN DRIFT TEST	IMU 4 (LEM)
		MIDTOAVE
		P40, P42

ALARM CODES (CONT)

CODE	TYPE	SET BY
02001	JET FAILURES HAVE DISABLED Y-Z TRANSLATION	DAP
02002	JET FAILURES HAVE DISABLED X TRANSLATION	DAP
02003	JET FAILURES HAVE DISABLED P ROTATION	DAP
02004	JET FAILURES HAVE DISABLED U-V ROTATION	DAP
03777	ICDU FAIL CAUSED THE ISS WARNING	T4RUPT
04777	ICDU, PIPA FAILS CAUSED THE ISS WARNING	T4RUPT
07777	IMU FAIL CAUSED THE ISS WARNING	T4RUPT
10777	IMU, PIPA FAILS CAUSED THE ISS WARNING	T4RUPT
13777	IMU, ICDU FAILS CAUSED THE ISS WARNING	T4RUPT
14777	IMU, ICDU, PIPA FAILS CAUSED THE ISS WARNING	T4RUPT
20105	AOTMARK SYSTEM IN USE	AOTMARK
20430	ACCELERATION OVERFLOW IN INTEGRATION	ORBITAL INTEGRATION
20607	NO SOLUTION FROM TIME THETA OR TIME-RADIUS	TIMETHET, TIMERAD
21103	UNUSED CSS BRANCH EXECUTED	ABORT
21204	WAITLIST, VARDELAY, FIXDELAY, OR LONGCALL CALLED WITH ZERO OR NEGATIVE DELTA-TIME	WAITLIST ROUTINES
21302	SQRT CALLED WITH NEGATIVE ARGUMENT	INTERPRETER
21406	BAD RETURN FROM ROOTPSRS	IGNITION ALGORITHM (P63)
21501	KEYBOARD AND DISPLAY ALARM DURING INTERNAL USE (NBSUB)	PINBALL
31104	DELAY ROUTINE BUSY	EXEC
31201	EXECUTIVE OVERFLOW-NO VAC AREAS	EXECUTIVE
31202	EXECUTIVE OVERFLOW-NO CORE SETS	EXECUTIVE
31203	WAITLIST OVERFLOW-TOO MANY TASKS	WAITLIST
31206	SECOND JOB ATTEMPTS TO GO TO SLEEP	PINBALL
31207	NO VAC AREA FOR MARKS	AOTMARK
31210	TWO PROGRAMS USING DEVICE AT SAME TIME	IMU MODE SWITCH
31211	ILLEGAL INTERRUPT OR EXTENDED VERB	AOTMARK
31502	TWO PRIO DISPLAYS WAITING	DSP INTERFACE
32000	DAP STILL IN PROGRESS AT NEXT TIMES 5 RUPT	DAP
V05N09E	FAIL REG CALL	
R1-XXXXX	(FIRST ALARM TO OCCUR AFTER LAST RESET)	
R2-XXXXX	(SECOND ALARM TO OCCUR AFTER LAST RESET)	
R3-XXXXX	(ALARM WHICH OCCURRED LAST)	

LGC PROGRAMS AND MAJOR ROUTINES

NUMBER	TITLE
<u>SERVICE</u>	
P00	LGC IDLING
P06	PGNCS POWER
P07	SYSTEMS TEST (NON-FLIGHT)
<u>ASCENT</u>	
P12	POWERED ASCENT GUIDANCE
<u>COAST</u>	
P20	RENDEZVOUS NAVIGATION
P21	GROUND TRACK DETERMINATION
P22	RR LUNAR SURFACE NAVIGATION
P25	PREFERRED TRACKING ATTITUDE
P27	LGC UPDATE
<u>PRETHRUSTING</u>	
P30	EXTERNAL DELTA V
P32	CO-ELLIPTIC SEQUENCE INITIATION (CSI)
P33	CONSTANT DELTA ALTITUDE (CDH)
P34	TRANSFER PHASE INITIATION (TPI)
P35	TRANSFER PHASE MIDCOURSE (TPM)
<u>THRUST</u>	
P40	DPS THRUSTING
P41	RCS THRUSTING
P42	APS THRUSTING
P47	THRUST MONITOR
<u>ALIGNMENTS</u>	
P51	IMU ORIENTATION DETERMINATION
P52	IMU REALIGN
P57	LUNAR SURFACE ALIGNMENT
<u>DESCENT & LANDING</u>	
P63	LANDING MANEUVER BRAKING PHASE
P64	LANDING MANEUVER: APPROACH PHASE
P66	RATE OF DESCENT LANDING (ROD)
P68	LANDING CONFIRMATION

LGC PROGRAMS AND MAJOR ROUTINES (CONT)

NUMBER	TITLE
<u>ABORTS AND BACKUPS</u>	
P70	DPS ABORT
P71	APS ABORT
P72	CSM CO-ELLIPTIC SEQUENCE INITIATION (CSI) TARGETING
P73	CSM CONSTANT DELTA ALTITUDE (CDH) TARGETING
P74	CSM TRANSFER PHASE INITIATION (TPI) TARGETING
P75	CSM TRANSFER PHASE MIDCOURSE (TPM) TARGETING
P76	TARGET DELTA V
P77	CSM TARGET DELTA V
P79	GUIDED RCS BURN (E-MEMORY PROG)
<u>ROUTINES</u>	
	TITLE
R00	FINAL AUTOMATIC REQUEST TERMINATE
R01	ERASABLE AND CHANNEL MODIFICATION ROUTINE
R02	IMU STATUS CHECK
R03	DIGITAL AUTOPILOT DATA LOAD
R04	RR/LR SELF TEST
R05	S BAND ANTENNA
R09	R10/R11/R12 SERVICE
R10	LANDING ANALOG DISPLAYS
R11	ABORT DISCRETES MONITOR
R12	DESCENT STATE VECTOR UPDATE
R13	LANDING AUTO MODES MONITOR
R20	LR/RR READ
R21	RR DESIGNATE
R22	RR DATA READ
R23	RR MANUAL ACQUISITION
R24	RR SEARCH
R25	RR MONITOR
R29	POWERED FLIGHT RR DESIGNATE
R30	ORBIT PARAMETER DISPLAY
R31	RENDEZVOUS PARAMETER DISPLAY
R33	LGC/CMC CLOCK SYNCHRONIZATION
R36	OUT-OF-PLANE RENDEZVOUS DISPLAY
R40	DPS/APS THRUST FAIL
R41	STATE VECTOR INTEGRATION (MID TO AVE)
R47	AGS INITIALIZATION
R50	COARSE ALIGN
R51	INFLIGHT FINE ALIGN
R52	AUTO OPTICS POSITIONING
R53	INFLIGHT SIGHTING MARK

LGC PROGRAMS AND MAJOR ROUTINES (CONT)

NUMBER	TITLE
R54	SIGHTING DATA DISPLAY
R55	GYRO TORQUING
R56	TERMINATE TRACKING
R57	MARKRUPT
R58	CELESTIAL BODY DEFINITION
R59	LUNAR SURFACE SIGHTING MARK
R60	ATTITUDE MANEUVER
R61	PREFERRED TRACKING ATTITUDE
R62	CREW DEFINED MANEUVER
R63	RENDEZVOUS FINAL ALTITUDE
R65	FINE PREFERRED TRACKING ATTITUDE
R76	EXTENDED VERB INTERLOCK
R77	LR SPURIOUS TEST

FLAGWORD BITS- ALPHABETICAL LIST

ABTTGFLG	B7	FW9	FSPASFLG	B10	FW0
ACCOKFLG	B3	FW13	GLOKFAIL	B14	FW3
ACC4-2FL	B11	FW13	GMBDRVSW	B10	FW6
ACMODFLG	B13	FW2	GUESSW	B2	FW1
ALTSCALE	B9	FW12	HFALFLG	B13	FW11
ANTENFLG	B12	FW12	HFLSHFLG	B1	FW11
AORBSFLG	B5	FW5	IDLEFLAG	B7	FW7
AORBTFLG	B10	FW13	IGNFLAG	B13	FW7
APSESW	B5	FW8	IMPULSW	B9	FW2
APSFALG	B13	FW10	IMUSE	B8	FW0
ASTNFLAG	B12	FW7	INFINFLG	B7	FW8
ATTFLAG	B1	FW6	INITALGN	B2	FW8
AUTOMODE	B2	FW12	INTFLAG	B14	FW10
AUTR1FLG	B1	FW13	INTYPFLG	B4	FW3
AUTR2FLG	B2	FW13	ITSWICH	B15	FW7
AUXFLAG	B2	FW6	JSWITCH	B14	FW0
AVEGFLAG	B5	FW7	LETABORT	B9	FW9
AVEMIDSW	B1	FW9	LMOONFLG	B11	FW8
AVFLAG	B5	FW2	LOKONSW	B5	FW0
CALCMAN2	B2	FW2	LOSCMFLG	B12	FW2
CALCMAN3	B3	FW2	LRALTFLG	B5	FW12
CDESFLAG	B15	FW12	LRBYPASS	B15	FW11
CMOONFLG	B12	FW8	LRINH	B8	FW11
COGAFLAG	B4	FW8	LRPOSFLG	B6	FW12
CONTRLFL	B2	FW10	LRVELFLG	B8	FW12
CSMDKFLG	B13	FW13	LUNAFLAG	B12	FW3
CULTFLAG	B7	FW3	MANUFLAG	B14	FW7
DBSELFLG	B4	FW13	MGLVFLG	B2	FW5
DBSL2FLG	B5	FW13	MIDAVFLG	B2	FW9
DESIGFLG	B10	FW12	MIDFLAG	B13	FW0
DIDFLAG	B14	FW1	MIDI1FLAG	B3	FW9
DIMOFALG	B1	FW3	MKOVFLAG	B3	FW4
DMENFLG	B9	FW5	MOONFLAG	B12	FW0
DRIFTDFL	B8	FW13	MRKIDFLG	B15	FW4
DRIFTFLG	B15	FW2	MRKNVFLG	B9	FW4
DSKYFLAG	B15	FW5	MRUPTFLG	B5	FW4
D60R9FLG	B2	FW3	MUNFLAG	B8	FW6
ENGONFLG	B7	FW5	MWAITFLG	B11	FW4
ERADFLAG	B13	FW1	NEEDLFLG	B4	FW0
ETPIFLAG	B7	FW2	NEED2FLG	B15	FW0
FINALFLG	B6	FW2	NEWIFLG	B13	FW8
FLAP	B8	FW9	NJETSFLG	B15	FW1
FLPC	B12	FW9	NODOFLAG	B1	FW2
FLPI	B11	FW9	NODOP07	B11	FW3
FLRCS	B10	FW9	NOLRREAD	B10	FW11
FLT59FLG	B4	FW9	NORMSW	B10	FW7
FLUNDISP	B10	FW9			
FLVR	B14	FW9			
FREEFLAG	B3	FW0			
FRSTIME	B4	FW1			

FLAGWORD BITS - ALPHABETICAL LIST (CONT)

NORRMON	B4	FW5	RRDATAFL	B4	FW12
NOTERFLG	B11	FW1	RRNBSW	B6	FW0
NOTHROTL	B12	FW5	RRRSFLAG	B3	FW12
NOUPFLAG	B6	FW1	RVSF	B9	FW7
NPGNCSFL	B1	FW10	R04FLAG	B9	FW3
NRMNVFLG	B8	FW4	R10FLAG	B2	FW0
NRMIDFLG	B13	FW4	R12RDFLG	B3	FW11
NRUPTFLG	B4	FW4	R61FLAG	B10	FW1
NTARGFLG	B3	FW6	R77FLAG	B11	FW5
NWAITFLG	B10	FW4	SLOPESW	B3	FW1
			SNUFFER	B13	FW5
ORBWFLAG	B6	FW3	SOLNSW	B3	FW5
ORDERSW	B6	FW8	SRCHOPTN	B14	FW2
OURRCFLG	B12	FW13	STATEFLG	B5	FW3
PDSPFLAG	B14	FW5	STEERSW	B11	FW2
PFRAFFLG	B4	FW2	SURFFLAG	B8	FW8
PINBRFLG	B6	FW4	SWANDISP	B11	FW7
POOHFLAG	B15	FW3	S32.1F1	B15	FW6
PRECIFLG	B8	FW3	S32.1F2	B14	FW6
PRIODFLG	B14	FW4	S32.1F3A	B13	FW6
PRONVFLG	B7	FW4	S32.1S3B	B12	FW6
PSTHIGAT	B11	FW11	TFFSW	B1	FW7
PULSEFLG	B15	FW13	TRACKFLG	B5	FW1
P21FLAG	B11	FW0	TURNONFL	B1	FW12
P25FLAG	B9	FW0	ULLAGFLG	B6	FW13
P66PROFL	B1	FW0	UPDATFLG	B7	FW1
P7071FLG	B13	FW9	UPLOCKFL	B4	FW7
QUITFLAG	B5	FW9	USEQRFLG	B14	FW13
RCDUFAL	B7	FW12	VEHUPFLG	B8	FW1
RCDUOFLG	B13	FW12	VELDATA	B7	FW11
REDFLAG	B6	FW6	VERIFLAG	B3	FW7
REFSMFLG	B13	FW3	VFAIFLG	B14	FW11
REINTFLG	B7	FW10	VFLAG	B10	FW3
REMODFLG	B14	FW12	VFLSHFLG	B2	FW11
RENDWFLG	B1	FW5	VINTFLAG	B3	FW3
REPOSMON	B11	FW12	VXINH	B12	FW11
RHCSCFLG	B7	FW13	V37FLAG	B6	FW7
RNDVZFLG	B7	FW0	V67FLAG	B8	FW7
RNGEDATA	B4	FW11	V82EMFLG	B2	FW7
RNGSCFLG	B10	FW5	XDELVFLG	B8	FW2
RODFLAG	B12	FW1	XDSPFLAG	B1	FW4
ROTFLAG	B6	FW9	XORFLG	B9	FW11
RPQFLAG	B15	FW8	XOVINFLG	B9	FW13
			ZOOMFLAG	B8	FW5
			3AXISFLG	B6	FW5
			360SW	B1	FW8

FLAGWORD 0

(LOC. 0074)

	BIT	SET	CLEAR
NEED2FLG	15	DISPLAY DAP RATES ON FDAI NEEDLES	DISPLAY ATT. ERRORS (SEE BIT 4)
JSWITCH	14	INTEGRATION OF W MATRIX	INTEGRATION OF STATE VECTOR
MIDFLAG	13	INTEGRATION WITH SECONDARY BODY AND SOLAR PERTURBATIONS	INTEGRATION WITHOUT SOLAR PERTURBATIONS
MOONFLAG	12	MOON IS SPHERE OF INFLUENCE	EARTH IS SPHERE OF INFLUENCE
P21FLAG	11	USE BASE VECTORS ALREADY CALCULATED	1ST PASS--CALCULATE BASE VECTORS
FSPASFLG	10	FIRST PASS THROUGH REPOSITION ROUTINE	NOT FIRST PASS THROUGH REPOSITION ROUTINE
P25FLAG	9	P25 OPERATING	P25 NOT OPERATING
IMUSE	8	IMU IN USE	IMU NOT IN USE
RNDVZFLG	7	P20 RUNNING (RADAR IN USE)	P20 NOT RUNNING (RADAR NOT IN USE)
RRNBSW	6	RADAR TARGET IN NB COORDINATES	RADAR TARGET IN SM COORDINATES
LOKONSW	5	RADAR LOCK-ON DESIRED	RADAR LOCK-ON NOT DESIRED
NEEDLFLG	4	TOTAL ATTITUDE ERROR DISPLAYED	A/P FOLLOWING ERROR DISPLAYED
FREEFLAG	3	USED BY P51-53 TEMPORARY IN MANY ROUTINES AND BY LUNAR AND SOLAR EPHEMERIDES	
R10FLAG	2	R10 OUTPUTS DATA TO ALTITUDE & ALTITUDE RATE METERS ONLY	R10 OUTPUTS TO FORWARD & LATERAL VELOCITY CROSSPOINTER PLUS ALT/ALT RATE
P66PROFL	1	CONTINUE P66 HORIZONTAL VELOCITY NULLING	STOP P66 HORIZONTAL VELOCITY NULLING

FLAGWORD 1

(LOC. 0075)

	BIT	SET	CLEAR
NJETSFLG	15	TWO JET RCS BURN	FOUR JET RCS BURN
DIDFLAG	14	INERTIAL DATA IS AVAILABLE	PERFORM DATA DISPLAY INITIALIZATION FUNCTION
ERADFLAG	13	COMPUTE REARTH FISCHER ELLIPSOID	USE CONSTANT REARTH PAD RADIUS
RODFLAG	12	IF IN P66, NORMAL OPERATION CONTINUES RESTART CLEARS FLAG	IF IN P66, REINITIALIZA- TION IS PERFORMED
NOTERFLG	11	TERRAIN MODEL INHIBITED	TERRAIN MODEL PERMITTED
R61FLAG	10	RUN R61 LEM	RUN R65 LEM
SPARE	9		
VEHUPFLG	8	CSM STATE VECTOR BEING UPDATED	LM STATE VECTOR BEING UPDATED
UPDATFLG	7	UPDATING BY MARKS ALLOWED	UPDATING BY MARKS NOT ALLOWED
NOUPFLAG	6	NEITHER CSM NOR LM STATE VECTOR MAY BE UPDATED	EITHER STATE VECTOR MAY BE UPDATED
TRACKFLG	5	TRACKING ALLOWED	TRACKING NOT ALLOWED
FRSTIME	4	FIRST TIME THROUGH PREPOSITION	NOT FIRST TIME THROUGH PREPOSITION
SLOPESW	3	ITERATE WITH BIAS METHOD IN ITERATOR	ITERATOR WITH REGULAR FALS METHOD IN ITERATOR
GUESSW	2	NO STARTING VALUE FOR ITERATION EXISTS	STARTING VALUE FOR ITERATION EXISTS
SPARE	1		

FLAGWORD 2

(LOC. 0076)

NAME	BIT	SET	CLEAR
DRIFTFLG	15	T3RUPT CALLS GYRO COMPENSATION	T3RUPT DOES NO GYRO COMPENSATION
SRCHOPTN	14	RADAR IN AUTOMATIC SEARCH OPTION (R24)	RADAR NOT IN AUTOMATIC SEARCH OPTION
ACMODFLG	13	MANUAL ACQUISITION BY RENDEZVOUS RADAR	AUTO ACQUISITION BY RENDEZVOUS RADAR
LOSCMFLG	12	LINE OF SIGHT BEING COMPUTED (R21)	LINE OF SIGHT NOT BEING COMPUTED
STEERSW	11	SUFFICIENT THRUST IS PRESENT	INSUFFICIENT THRUST IS PRESENT
SPARE	10		
IMPULSW	9	MINIMUM IMPULSE BURN (CUTOFF TIME SPECIFIED)	STEERING BURN (NO CUTOFF TIME YET AVAILABLE)
XDELVFLAG	8	EXTERNAL DELTAV VG COMPUTATION	LAMBERT (AIMPOINT) VG COMPUTATION
ETPIFLAG	7	ELEVATION ANGLE SUPPLIED FOR P34, P74	TPI TIME SUPPLIED FOR P34, P74 TO COMPUTE ELEVATION
FINALFLG	6	LAST PASS THROUGH RENDEZVOUS PROGRAM COMPUTATIONS	INTERIM PASS THROUGH RENDEZVOUS PROGRAM COMPUTATIONS
AVFLAG	5	LM IS ACTIVE VEHICLE	CSM IS ACTIVE VEHICLE
PFRATFLG	4	PREFERRED ATTITUDE COMPUTED	PREFERRED ATTITUDE NOT COMPUTED
CALCMAN3	3	NO FINAL ROLL	FINAL ROLL IS NECESSARY
CALCMAN2	2	PERFORM MANEUVER STARTING PROCEDURE	BYPASS STARTING PROCEDURE
NODOFLAG	1	V37 NOT PERMITTED	V37 PERMITTED

FLAGWORD 3

(LOC. 0077)

NAME	BIT	SET	CLEAR
POOHFLAG	15	INHIBIT BACKWARD INTEGRATION	ALLOW BACKWARD INTEGRATION
GLOKFAIL	14	GIMBAL LOCK HAS OCCURRED	NOT IN GIMBAL LOCK
REFSMFLG	13	REFSMMAT GOOD	REFSMMAT NO GOOD
LUNAFLAG	12	LUNAR LAT-LONG	EARTH LAT-LONG
NODOP07	11	SYSTEM TESTS NOT ALLOWED	SYSTEM TESTS ALLOWED
VFLAG	10	LESS THAN TWO STARS IN FIELD OF VIEW	TWO STARS IN FIELD OF VIEW
R04FLAG	9	ALARM 521 SUPPRESSED	ALARM 521 ALLOWED
PRECIFLG	8	NORMAL INTEGRATION IN P00	ENGAGES 4-TIME STEP (P00) LOGIC IN INTEGRATION
CULTFLAG	7	STAR OCCULTED	STAR NOT OCCULTED
ORBWFLAG	6	W MATRIX VALID FOR ORBITAL NAVIGATION	W MATRIX INVALID FOR ORBITAL NAVIGATION
STATEFLG	5	PERMANENT STATE VECTOR UPDATED	PERMANENT STATE VECTOR NOT UPDATED
INTYPFLG	4	CONIC INTEGRATION	ENCKE INTEGRATION
VINTFLAG	3	CSM STATE VECTOR BEING INTEGRATED	LM STATE VECTOR BEING INTEGRATED
D60R9FLG	2	DIMENSION OF W IS 9 FOR INTEGRATION	DIMENSION OF W IS 6 FOR INTEGRATION
DIMOFLEG	1	W MATRIX IS TO BE USED	W MATRIX IS NOT TO BE USED

FLAGWORD 4

(LOC. 0100)

NAME	BIT	SET	CLEAR
MRKIDFLG	15	MARK DISPLAY IN ENDIDLE	NO MARK DISPLAY IN ENDIDLE
PROIDFLG	14	PRIORITY DISPLAY IN ENDIDLE	NO PRIORITY DISPLAY IN ENDIDLE
NRMIDFLG	13	NORMAL DISPLAY IN ENDIDLE	NO NORMAL DISPLAY IN ENDIDLE
SPARE	12		
MWAITFLG	11	HIGHER PRIORITY DISPLAY OPERATING WHEN MARK DISPLAY INITIATED	NO HIGHER PRIORITY DISPLAY OPERATING WHEN MARK DISPLAY INITIATED
NWAITFLG	10	HIGHER PRIORITY DISPLAY OPERATING WHEN NORMAL DISPLAY INITIATED	NO HIGHER PRIORITY DISPLAY OPERATING WHEN NORMAL DISPLAY INITIATED
MRKNVFLG	9	ASTRONAUT USING KEYBOARD WHEN MARK DISPLAY INITIATED	ASTRONAUT NOT USING KEYBOARD WHEN MARK DISPLAY INITIATED
NRMNVFLG	8	ASTRONAUT USING KEYBOARD WHEN NORMAL DISPLAY INITIATED	ASTRONAUT NOT USING KEYBOARD WHEN NORMAL DISPLAY INITIATED
PRONVFLG	7	ASTRONAUT USING KEYBOARD WHEN PRIORITY DISPLAY INITIATED	ASTRONAUT NOT USING KEYBOARD WHEN PRIORITY DISPLAY INITIATED
PINBRFLG	6	ASTRONAUT HAS INTERFERED WITH EXISTING DISPLAY	ASTRONAUT HAS NOT INTERFERED WITH EXISTING DISPLAY
MRUPTFLG	5	MARK DISPLAY INTERRUPTED BY PRIORITY DISPLAY	MARK DISPLAY NOT INTERRUPTED BY PRIORITY DISPLAY
NRUPTFLG	4	NORMAL DISPLAY INTERRUPTED BY PRIORITY OR MARK DISPLAY	NORMAL DISPLAY NOT INTERRUPTED BY PRIORITY OR MARK DISPLAY
MKOVFLAG	3	MARK DISPLAY OVER NORMAL	NO MARK DISPLAY OVER NORMAL
SPARE	2		
XDSPFLAG	1	MARK DISPLAY NOT TO BE INTERRUPTED	NO SPECIAL MARK INFORMATION

FLAGWORD 5

(LOC. 0101)

NAME	BIT	SET	CLEAR
DSKYFLAG	15	DISPLAYS SENT TO DSKY	NO DISPLAYS TO DSKY
PDSPFLAG	14	R60 DOES PRIORITY DISPLAY AND IS RESTART PROTECTION	R60 DOES NORMAL DISPLAY AND IS NOT RESTORED
SNUFFER	13	U,V, JETS DISABLED DURING DPS BURNS (V65)	U,V, JETS ENABLED DURING DPS BURNS (V75)
NOTHROTL	12	INHIBIT FULL THROTTLE	PERMIT FULL THROTTLE
R77FLAG	11	R77 IS ON, SUPPRESS ALL RADAR ALARMS AND TRACKER FAILS	R77 IS NOT ON
RNGSCFLG	10	SCALE CHANGE HAS OCCURRED DURING RR READING	NO SCALE CHANGE HAS OCCURRED DURING RR READING
DMENFLG	9	DIMENSION OF W IS 9 FOR INCORPORATION	DIMENSION OF W IS 6 FOR INCORPORATION
ZOOMFLAG	8	THROTTLE UP HAS OCCURRED IN P63	THROTTLE UP HAS NOT YET OCCURRED IN P63
ENGONFLG	7	ENGINE TURNED ON	ENGINE TURNED OFF
3AXISFLG	6	MANEUVER SPECIFIED BY THREE AXES	MANEUVER SPECIFIED BY ONE AXIS - R60 CALLS VECPPOINT
AORBSFLG	5	P-AXIS COUPLES B3A, A1F OR A3R, B1L PREFERRED	P-AXIS COUPLES A4R, B2L OR B4F, A2A PREFERRED
NORRMON	4	BYPASS RR GIMBAL MONITOR	PERFORM RR GIMBAL MONITOR
SOLNSW	3	LAMBERT DOES NOT CONVERGE, OR TIME- RAD NEARLY CIRCULAR	LAMBERT CONVERGES OR TIME-RADIUS NON-CIRCULAR
MGLVFLAG	2	LOCAL VERTICAL CO- ORDINATES COMPUTED	MIDDLE GIMBAL ANGLE COMPUTED
RENDWFLG	1	W MATRIX VALID FOR RENDEZVOUS NAVIGATION	W MATRIX INVALID FOR RENDEZVOUS NAVIGATION

FLAGWORD 6

(LOC. 0102)

NAME	BIT	SET	CLEAR
S32.1F1	15	DELTA V AT CSI TIME ONE EXCEEDS MAX	DVT1 LESS THAN MAX
S32.1F2	14	FIRST PASS OF NEWTON ITERATION	REITERATION OF NEWTON
S32.1F3A	13	BIT 13 AND BIT 12 FUNCTION AS AN ORDERED PAIR (13, 12) INDICATING THE POSSIBLE OCCURRENCE OF 2 NEWTON ITERATIONS FOR S32.1 IN THE PROGRAM IN THE FOLLOWING ORDER. (0, 1) (I.E. BIT 13 RESET, BIT 12 SET) = FIRST NEWTON ITERATION BEING DONE (0, 0) = FIRST PASS OF NEWTON ITERATION (1, 1) = 50 FT/SEC STAGE OF SECOND NEWTON ITERATION (1, 0) = REMAINDER OF NEWTON ITERATION.	
S32.1F3B	12		
SPARE	11	SUCCEEDING PASS	FIRST PASS THRU
GIMDRVSW	10	TRIMGIMB OVER	TRIMGIMB NOT OVER
SPARE	9	2-PHASE GUIDANCE I.E.	ONE-PHASE GUIDANCE I.E.
MUNFLG	8	SERVICER CALLS MUNRVG	SERVICER CALLS CALCRVG
SPARE	7		
REDFLAG	6	LANDING SITE REDESIGNATION PERMITTED	LANDING SITE REDESIG- NATION NOT PERMITTED
SPARE	5		
SPARE	4		
NTARGFLG	3	ASTRONAUT DID OVERWRITE DELTA OR TPM (P34, P35)	ASTRONAUT DID NOT OVERWRITE DELTA VELOCITY
AUXFLAG	2	PROVIDING IDLEFLAG IS NOT SET, SERVICER WILL EXERCISE DVMON ON ITS NEXT PASS	SERVICER WILL SKIP DVMON ON ITS NEXT PASS EVEN IF IDLEFLAG IS NOT SET, IT WILL THEN SET AUX FLAG
ATTFLAG	1	LM ATTITUDE EXISTS IN MOON-FIXED COORDINATES	NO LM ATTITUDE AVAILABLE IN MOON- FIXED COORDINATES

FLAGWORD 7

(LOC. 0103)

NAME	BIT	SET	CLEAR
ITSWICH	15	P34-TPI TIME TO BE COMPUTED	TPI HAS BEEN COMPUTED
MANUFLAG	14	ATTITUDE MANEUVER GOING DURING RR SEARCH	NO ATTITUDE MANEUVER DURING RR SEARCH
IGNFLAG	13	TIG HAS ARRIVED	TIG HAS NOT ARRIVED
ASTNFLAG	12	ASTRONAUT HAS OKAYED IGNITION	ASTRONAUT HAS NOT OKAYED IGNITION
SWANDISP	11	LANDING ANALOG DISPLAYS ENABLED	LANDING ANALOG DISPLAYS SUPPRESSED
NORMSW	10	UNIT NORMAL INPUT TO LAMBERT	LAMBERT COMPUTES ITS OWN UNIT NORMAL
RVSF	9	DO NOT COMPUTE FINAL STATE VECTOR IN TIME THETA	COMPUTER FINAL STATE VECTOR IN TIME-THETA
V67FLAG	8	ASTRONAUT OVERWRITE W-MATRIX INITIAL VALUES	ASTRONAUT DOES NOT OVERWRITE W-MATRIX INITIAL VALUES
IDLEFLAG	7	NO DV MONITOR	CONNECT DV MONITOR
V37FLAG	6	AVERAGE G (SERVICER) RUNNING	AVERAGE G (SERVICER) OFF
AVEGFLAG	5	AVERAGE G (SERVICER) DESIRED	AVERAGE G (SERVICER) NOT DESIRED
UPLOCKFL	4	K-KBAR-K FAIL	NO K-KBAR-K FAIL
VERIFLAG	3	CHANGED WHEN V33E OCCURS	AT END OF P27
V82EMFLG	2	MOON VICINITY	EARTH VICINITY
TFFSW	1	CALCULATE TPERIGEE	CALCULATE TFF

FLAGWORD 8

(LOC. 0104)

NAME	BIT	SET	CLEAR
RPQFLAG	15	RPQ NOT COMPUTED RPQ=VECTOR BETWEEN SECONDARY BODY AND PRIMARY BODY	RPQ COMPUTED
SPARE	14		
NEWIFLG	13	FIRST PASS THROUGH INTEGRATION	SUCCEEDING ITERATION OF INTEGRATION
CMOONFLG	12	PERMANENT CSM STATE IN LUNAR SPHERE	PERMANENT CSM STATE IN EARTH SPHERE
LMOONFLG	11	PERMANENT LM STATE IN LUNAR SPHERE	PERMANENT LM STATE IN EARTH SPHERE
FLUNDISP	10	CURRENT GUIDANCE DISPLAYS INHIBITED	CURRENT GUIDANCE DISPLAYS PERMITTED
SPARE	9		
SURFFLAG	8	LM ON LUNAR SURFACE	LM NOT ON LUNAR SURFACE
INFINFLG	7	NO CONIC SOLUTION (CLOSURE THROUGH INFINITY REQUIRED)	CONIC SOLUTION EXISTS
ORDERSW	6	ITERATOR USES 2ND ORDER MINIMUM MODE	ITERATOR USES 1ST ORDER STANDARD MODE
APSESW	5	R DESIRED OUTSIDE PERICENTER-APOCENTER RANGE IN TIME-RADIUS	R DESIRED INSIDE PERICENTER-APOCENTER RANGE IN TIME-RADIUS
COGAFLAG	4	NO CONIC SOLUTION- TOO CLOSE TO RECTI- LINEAR (COGA OVERFLWS)	CONIC SOLUTION EXISTS (COGA DOES NOT OVERFLOW)
SPARE	3		
INITALGN	2	INITIAL PASS THRU P57	SECOND PASS THRU P57
360SW	1	TRANSFER ANGLE NEAR 360 DEGREES	TRANSFER ANGLE NOT NEAR 360 DEGREES

FLAGWORD 9

(LOC. 0105)

NAME	BIT	SET	CLEAR
SPARE	15		
FLVR	14	VERTICAL RISE (ASCENT GUIDANCE)	NON-VERTICAL RISE
P7071FLG	13	P70 OR P71 IS USING ASCENT GUIDANCE	P12 IS USING ASCENT GUIDANCE EQUATIONS
FLPC	12	NO POSITION CONTROL (ASCENT GUIDANCE)	POSITION CONTROL
FLPI	11	PRE-IGNITION PHASE (ASCENT GUIDANCE)	REGULAR GUIDANCE
FLRCS	10	RCS INJECTION MODE (ASCENT GUIDANCE)	MAIN ENGINE MODE
LETABORT	9	ABORT PROGRAMS ARE ENABLED	ABORT PROGRAMS ARE NOT ENABLED
FLAP	8	APS CONTINUED ABORT AFTER DPS STAGING (ASCENT GUIDANCE)	APS ABORT IS NOT A CONTINUATION
ABTTGFLG	7	J2, K2 PARAMETERS USED FOR ABORT TARGETING	J1, K1 PARAMETERS USED FOR ABORT TARGETING
ROTFLAG	6	P70 AND P71 WILL FORCE VEHICLE ROTATION IN PREFERRED DIRECTION	P70 AND P71 WILL NOT FORCE VEHICLE ROTA- TION IN THE PREFERRED DIRECTION
QUITFLAG	5	DISCONTINUE INTEGR	CONTINUE INTEGRATION
FLT59FLG	4	LUNAR SURFACE PROCEDURE USED	NORMAL MARKS TO BE USED DURING INFLITE ALGN
MID1FLG	3	INTEGRATE TO TDEC	INTEGRATE TO THE THEN- PRESENT TIME
MIDAVFLG	2	INTEGRATION ENTERED FROM ONE OF MIDTOAV PORTALS	INTEGRATION WAS NOT ENTERED VIA MIDTOAV
AVEMIDSW	1	AVETOMID CALLING FOR W MATRIX INTEGR	NO AVETOMID W. INTEGR ALLOW SET UP RN, VN, PIPTIME

FLAGWORD 10

(LOC. 0106)

NAME	BIT	SET	CLEAR
SPARE	15		
INTFLAG	14	INTEGRATION IN PROGRESS	INTEGRATION NOT IN PROGRESS
AP\$FLAG	13	ASCENT STAGE	DESCENT STAGE
SPARE	12		
SPARE	11		
SPARE	10		
SPARE	9		
SPARE	8		
REINTFLG	7	INTEGRATION ROUTINE TO BE RESTARTED	INTEGRATION ROUTINE NOT TO BE RESTARTED
SPARE	6		
SPARE	5		
SPARE	4		
SPARE	3		
CONTRLFL	2	DAP CONTROLLING VEHICLE ATTITUDE	DAP NOT CONTROLLING VEHICLE ATTITUDE
NPGNCSBT	1	LAST ACTIVE DAP PASS DONE WITH AN AGS INDICATION	LAST ACTIVE PASS DONE WITH A PGNC INDICATION

FLAGWORD II

(LOC. 0107)

NAME	BIT	SET	CLEAR
LRBYPASS	15	BYPASS ALL LANDING RADAR UPDATES (R12)	DO NOT BYPASS LANDING RADAR UPDATES
VFAILFLG	14	LANDING RADAR VEL FAILED REASONABLE TEST	LANDING RADAR VEL PASSED REASONABLE TEST
HFAILFLG	13	LANDING RADAR ALT FAILED REASONABLE TEST	LANDING RADAR ALT PASSED REASONABLE TEST
VXINH	12	(R12) IF Z VELOCITY DATA UNREASONABLE BY- PASS X VELOCITY UP- DATE ON NEXT PASS	UPDATE X AXIS VELOCITY
PSTHIGAT	11	PAST HIGATE	PREHIGATE
NOLRREAD	10	(R12) LANDING RADAR REPOSITIONING BY- PASS UPDATE	LR NOT REPOSITIONING
XORFLG	9	(R12) BELOW LIMIT, INHIBIT X AXIS OVERRIDE	ABOVE LIMIT, DO NOT INHIBIT X AXIS OVERRIDE
LRINH	8	LANDING RADAR UPDATES PERMITTED BY ASTRONAUT	LANDING RADAR UPDATES INHIBITED BY ASTRONAUT
VELDATA	7	(R12) LR VELOCITY MEASUREMENT MADE	LR VELOCITY MEASUREMENT NOT MADE
SPARE			
SPARE	5		
RNGEDATA	4	(R12) LR ALTITUDE MEASUREMENT MADE	LR ALTITUDE MEASUREMENT NOT MADE
R12RDFLG	3	WAIT UNTIL ALL VEL READS DONE BEFORE R12 PROCESSING	ALLOW R12 PROCESSING OF VEL DATA, LR VEL READ DONE
VFLSHFLG	2	LR VELOCITY FAIL LAMP SHOULD BE FLASHING (R12)	LR VELOCITY FAIL LAMP SHOULD NOT BE FLASHING
HFLSHFLC	1	LR ALTITUDE FAIL LAMP SHOULD BE FLASHING (R12)	LR ALTITUDE FAIL LAMP SHOULD NOT BE FLASHING

FLAGWORD 12 (RADMODES)

(LOC. 0110)

NAME	BIT	SET	CLEAR
CDESFLAG	15	CONTINUOUS DESIGNATE. LGC COMMANDS RR REGARDLESS OF LOCK-ON	LGC CHECKS FOR LOCK-ON WHEN ANTENNA BEING DESIGNATED
REMODFLG	14	CHANGE IN ANTENNA MODE HAS BEEN REQUESTED, I.E. REMODE	NO REMODE REQUESTED OR OCCURRING
RCDUOFLG	13	RR CDU-S BEING ZEROED	RR CDU-S NOT BEING ZEROED
ANTENFLG	12	RR ANTENNA MODE IS MODE 2	RR ANTENNA IN MODE 1
REPOSOMON	11	REPOSITION MONITOR. RR REPOSITION IS TAKING PLACE	NO REPOSITION TAKING PLACE
DESIGFLG	10	RR DESIGNATE RE- QUESTED OR IN PROGRESS	RR DESIGNATE NOT RE- QUESTED OR IN PROGRESS
ALTSCALE	9	LR ALTITUDE READING IS ON HIGH SCALE	LR ALTITUDE READING IS ON LOW SCALE
LRVELFLG	8	LR VELOCITY DATA FAIL	NO LR VELOCITY DATA FAIL
RCDUFAIL	7	RR CDU FAIL HAS NOT OCCURRED	RR CDU FAIL OCCURRED
LRPOSFLG	6	LANDING RADAR POSITION 2	LANDING RADAR POSITION 1
LRALTFLG	5	LR ALTITUDE DATA FAIL. COULD NOT BE READ SUCCESSFULLY	NO LR ALTITUDE DATA FAIL
RRDATAFL	4	RR DATA FAIL. DATA COULD NOT BE READ SUCCESSFULLY	NO RR DATA FAIL
RRRSFLG	3	RR RANGE READING ON THE HIGH SCALE	RR RANGE READING ON THE LOW SCALE
AUTOMODE	2	RR NOT IN AUTO MODE. AUTO MODE DISCRETE IS NOT PRESENT	RR IN AUTO MODE
TURNONFL	1	RR TURN-ON SEQUENCE IN PROGRESS. (ZERO CDUS. FIX ANTENNA MODE)	NO RR TURN-ON SEQUENCE IN PROGRESS

FLAGWORD 13 (DAPBOOLS)

(LOC. 0111)

NAME	BIT	SET	CLEAR
PULSEFLG (PULSES)	15	MINIMUM IMPULSE COMMAND MODE. IN ATTITUDE HOLD (V76)	NOT IN MINIMUM IMPULSE COMMAND MODE (V77)
USEQRFLG (USEQRJTS)	14	GIMBAL UNUSABLE USE JETS ONLY	TRIM GIMBAL MAY BE USED
CSMDKFLG (CSMDOCKD)	13	CSM DOCKED. USE BACKUP DAP	CSM NOT DOCKED TO LM
OURRCFLG (OURRCBIT)	12	CURRENT DAP PASS IS RATE COMMAND	CURRENT DAP PASS IS NOT RATE COMMAND
ACC4-2FL (ACC40R2X)	11	4 JET X-AXIS TRANSLA- TION REQUESTED	2 JET X-AXIS TRANSLA- TION REQUESTED
AORBTFLG (AORBTRAN)	10	B-SYSTEM FOR X-TRANS- LATION	A-SYSTEM FOR X-TRANS- LATION (PREFERRED)
XOVINFLG (XOVINHIB)	9	X-AXIS OVERRIDE LOCKED OUT	X-AXIS OVERRIDE ONLY
DRIFTDFL (DRIFTBIT)	8	ASSUME ZERO OFFSET DRIFTING FLIGHT	USE OFFSET ACCELERATION ESTIMATE
RHCSCFLG (RHCSCALE)	7	NORMAL RHC SCALING REQUESTED	FINE RHC SCALING REQUESTED
ULLAGFLG (ULLAGER)	6	ULLAGE REQUESTED BY MISSION PROGRAM	NO INTERNAL ULLAGE REQUESTED
DBSL2FLG	5	5 DEG. DB SELECTED BY CREW	1.0 OR 0.3 DEG. DB SELECTED BY CREW
DBSELFLG (DBSELECT)	4	MAXIMUM DEADBAND SELECTED BY CREW (1.0 DEGREES)	MINIMUM DEADBAND SELECTED BY CREW (0.3 DEGREES)
ACCOKFLG (ACCSOKAY)	3	CONTROL AUTHORITY VALUES FROM 1/ACCS USABLE	RESTART OR FRESH START SINCE LAST 1/ACCS OUTPUTS SUSPECT
AUTR2FLG (AUTORATE 2)	2	THESE FLAGS ARE USED TOGETHER TO INDICATE ASTRO- NAUT CHOSEN KALCMANU MANEUVER RATES (0,0) = (BIT 2, BIT 1) = 0.2 DEG/SEC (0,1) = 0.5 DEG/SEC	
AUTR1FLG (AUTRATE 1)	1	(1,0) = 2.0 DEG/SEC (1,1) = 10.0 DEG/SEC	

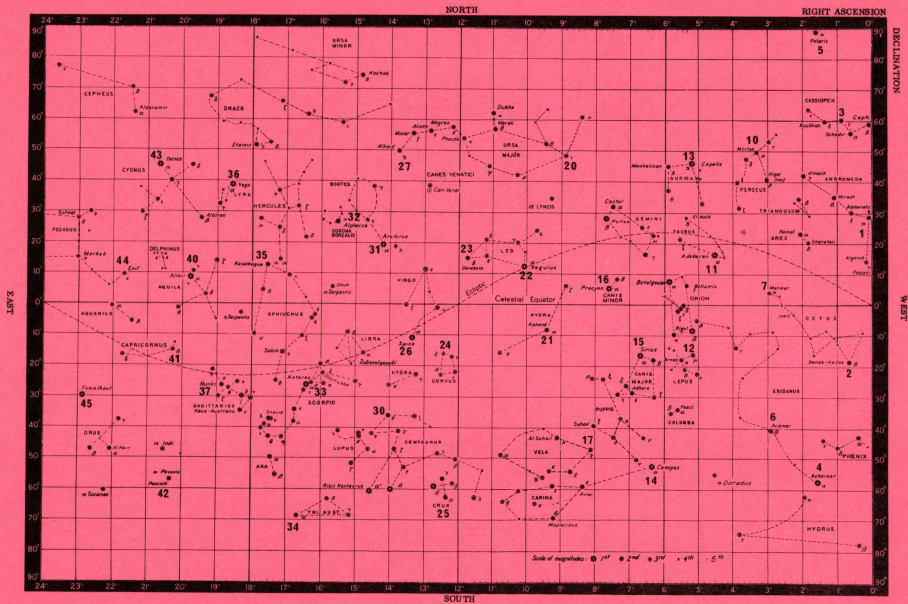
LOCATION RCSFLAGS

(FLAGS INTERNAL TO DAP)

NAME	BIT	SET	CLEAR
YZTACK	1	FIRST LEG OF TACKING PATTERN FOR Y OR Z TRANSLATION WITH A JET FAILURE.	SECOND LEG OF TACKING PATTERN.
DACFLAG1	2	ENABLE IMU ERROR COUNTERS. DAC'S HAVE BEEN ZEROED. USED IN CONJUNCTION WITH BIT 3 IN ATTITUDE-ERROR DISPLAY ROUTINE.	COUNTERS PRESUMED OK.
DACFLAG2	3	IMU ERROR COUNTERS SHOULD BE DISABLED IN ORDER TO ZERO DAC'S. USED IN CONJUNCTION WITH BIT 2 IN ATTITUDE-ERROR DISPLAY ROUTINE.	COUNTERS PRESUMED OK.
DSPLYALT	4	DISPLAY ATTITUDE ERRORS.	COMPUTE TOTAL ATTITUDE ERRORS WHEN NEEDED.
CALLGMBL	5	REQUESTS SETTING OF GIMBAL-DRIVE BITS IN CHANNEL 12 (I.E., PERFORM ACDT + C12).	DO NOT SET GIMBAL-DRIVE BITS IN CHANNEL 12 (I.E., DO NOT PERFORM ACDT + C12).
	6, 7, 8	NOT USED	
JUSTIN	9	RHC STICK OUT OF DETENT ON LAST PASS.	RHC STICK NOT OUT OF DETENT ON LAST PASS.
PBIT	10	DIRECT RATE MODE OF MANUAL RATE COMMAND REQUIRED IN P AXIS.	DIRECT RATE NOT REQUIRED IN P AXIS.
QRBIT	11	DIRECT RATE MODE OF MANUAL RATE COMMAND REQUIRED IN Q, R AXES.	DIRECT RATE NOT REQUIRED IN Q, R AXES.
SKIPP	12	PERFORM CONTROL OF P AXIS IN NEXT PASS.	SKIP CONTROL OF P AXIS IN NEXT PASS.
ACCSET	13	A JOB TO DO 1/ACCS HAS BEEN SET UP SINCE THE LAST FRESH START OR RESTART.	SET UP A JOB IN DAPIDLER TO DO 1/ACCS.
	14, 15	NOT USED	

MISC. DAPFLAGS

NAME	SET	CLEAR
ALLOWGTS	THRUST OFFSET SMALL ENOUGH TO USE GTS FOR ATTITUDE CONTROL.	THRUST OFFSET TOO LARGE TO USE GTS FOR ATTITUDE CONTROL.
SKIPU SKIPV	EXERCISE CONTROL FOR INDICATED "AXIS"	SKIP CONTROL FOR INDICATED "AXIS"
COTROLER	INDICATOR OF CONTROL SYSTEM EMPLOYED IN CURRENT DAP PASS: = 0 INDICATES GTS: LM-ALONE CASE. > 0 INDICATES GTS: CSM-DOCKED CASE. < 0 INDICATES RCS.	
INGTS	GTS PRESENTLY CONTROLLING ATTITUDE.	RCS PRESENTLY CONTROLLING ATTITUDE.



STAR/PLANET LIST

OCTAL STAR CODE	NAME	VIS. MAG.	RIGHT ASCENSION (HR. MIN.)	DECLINATION (DEG. MIN.)
1	ALPHA ANDROMEDAE (ALPHERATZ)	2.1	0 06	+28 53
2	BETA CETI (DIPHDA)	2.2	0 42	-18 11
3	GAMMA CASSIOPEIAE (NAVI)	2.2	0 54	+60 27
4	ALPHA ERIDANI (ACHERNAR)	0.6	1 36	-57 25
5	ALPHA URSAE MINORIS (POLARIS)	2.1	1 58	+89 06
6	THETA ERIDANI (ACAMAR)	3.4	2 57	-40 26
7	ALPHA CETI (MENKAR)	2.8	3 00	+03 56
10	ALPHA PERSEI (MIRFAK)	1.9	3 22	+49 44
11	ALPHA TAURI (ALDEBARAN)	1.1	4 34	+16 26
12	BETA ORIONIS (RIGEL)	0.3	5 12	-08 15
13	ALPHA AURIGAE (CAPELLA)	0.2	5 13	+45 57
14	ALPHA CARINAE (CANOPUS)	-0.9	6 23	-52 40
15	ALPHA CANIS MAJORIS (SIRIUS)	-1.6	6 44	-16 40
16	ALPHA CANIS MINORIS (PROCYON)	0.5	7 37	+05 19
17	GAMMA VELORIUM (REGOR)	1.9	8 08	-47 14
20	IOTA URSAE MAJORIS (DNOCES)	3.1	8 50	+48 30
21	ALPHA HYDRAE (ALPHARD)	2.2	9 26	-08 30
22	ALPHA LEONIS (REGULUS)	1.3	10 06	+12 09
23	BETA LEONIS (DENEbola)	2.2	11 47	+14 46
24	GAMMA CORVI (GIENAH)	2.8	12 13	-17 20
25	ALPHA CRUCIS (ACRUX)	1.6	12 24	-62 49
26	ALPHA VIRGINIS (SPICA)	1.2	13 23	-10 58
27	ETA URSAE MAJORIS (ALKAIID)	1.9	13 46	+49 30
30	THETA CENTAURI (MENKENT)	2.3	14 04	-36 11
31	ALPHA BOOTIS (ARCTURUS)	0.2	14 14	+19 22
32	ALPHA CORONAE BOREALIS (ALPHECCA)	2.3	15 33	+26 50
33	ALPHA SCORPII (ANTARES)	1.2	16 27	-26 21
34	ALPHA TRIANGULI AUSTR. (ATRIA)	1.9	16 43	-68 56
35	ALPHA OPHIUCHI (RASALHAGUE)	2.1	17 33	+12 35
36	ALPHA LYRAE (VEGA)	0.1	18 36	+38 45
37	SIGMA SAGITTARII (NUNKI)	2.1	18 53	-26 20
40	ALPHA AQUILAE (ALTAIR)	0.9	19 49	+08 46
41	BETA CAPRICORNI (DABIH)	3.2	20 19	-14 54
42	ALPHA PAVONIS (PEACOCK)	2.1	20 23	-56 51
43	ALPHA CYGNI (DENEb)	1.3	20 40	+45 09
44	EPISILON PEGASI (ENIF)	2.5	21 42	+09 42
45	ALPHA PICIS AUSTRINUS (FOMALHAUT)	1.3	22 56	-29 49
46	SUN			
47	EARTH			
50	MOON			
00	PLANET			

STAR	NO.	STAR	NO.	STAR	NO.
ACAMAR	6	CANOPUS	14	MIRFAK	10
ACHERNAR	4	CAPELLA	13	NAVI	3
ACRUX	25	DABIH	41	NUNKI	37
ALDEBARAN	11	DENEb	43	PEACOCK	42
ALKAIID	27	DENEbola	23	PROCYON	16
ALPHARD	21	DIPHDA	2	POLARIS	5
ALPHECCA	32	DNOCES	20	RASALHAGUE	35
ALPHERATZ	1	ENIF	44	REGOR	17
ALTAIR	40	FOMALHAUT	45	REGULUS	22
ANTARES	33	GIENAH	24	RIGEL	12
ARCTURUS	31	MENKAR	7	SIRIUS	15
ATRIA	34	MENKENT	30	SPICA	26
				VEGA	36

LGC COUNTER INTERRUPTS

LGC MEMORY
LOCATION
(COUNTER)

	NAME	REMARKS	SCALE	RANGE
0024	TIME 2	STORES MOST SIGNIFICANT TIME WORD	INCREMENTS EACH 163.84 SEC	OVERFLOWS EACH 31D, 1H, 39M, 14.56B
0025	TIME 1	STORES LEAST SIGNIFICANT TIME WORD	INCREMENTS EACH 0.01 SEC	OVERFLOWS EACH 163.84 SEC
0026	TIME 3	TIME COUNTER FOR T-3RUPT	INCREMENTED EACH 10 MS	
0027	TIME 4	TIME COUNTER FOR T-4RUPT	INCREMENTED EACH 10 MS	
0030	TIME 5	TIME COUNTER FOR REACTION CONTROL	INCREMENTED EACH 10 MS	
0031	TIME 6	TIME COUNTER FOR REACTION CONTROL	DECREMENTED 0.625 MS	
0032	CDU X	COUNTS $\pm \Delta \theta$ PULSES FROM X INERTIAL CDU	39.55 SEC/ COUNT	$\pm 180^\circ$
0033	CDU Y	COUNTS $\pm \Delta \theta$ PULSES FROM Y INERTIAL CDU	39.55 SEC/ COUNT	$\pm 180^\circ$
0034	CDU Z	COUNTS $\pm \Delta \theta$ PULSES FROM Z INERTIAL CDU	39.55 SEC/ COUNT	$\pm 180^\circ$
0035	CDU T	COUNTS $\pm \Delta \theta$ PULSES FROM RADAR TRUNNION CDU	39.55 SEC/ COUNT	$\pm 70^\circ$
0036	CDU S	COUNTS $\pm \Delta \theta$ PULSES FROM RADAR SHAFT CDU	39.55 SEC/ COUNT	$\pm 180^\circ$
0037	PIPA X	COUNTS $\pm \Delta \theta$ PULSES FROM X PIPA	1.0 CM/SEC/ COUNT	± 16383
0040	PIPA Y	COUNTS $\pm \Delta \theta$ PULSES FROM Y PIPA	1.0 CM/SEC/ COUNT	± 16383 CM/SEC
0041	PIPA Z	COUNTS $\pm \Delta \theta$ PULSES FROM Z PIPA	1.0 CM/SEC/ COUNT	± 16383 CM/SEC
0042	Q-RHCCTR	COUNTS PITCH $\pm \Delta \theta$ PULSES FROM RHC	3.82 COUNTS/ DEG	$\pm 11^\circ$
0043	P-RHCCTR	COUNTS YAW $\pm \Delta \theta$ PULSES FROM RHC	3.82 COUNTS? DEG	$\pm 11^\circ$
0044	R-RHCCTR	COUNTS ROLL $\pm \Delta \theta$ PULSES FROM RHC	3.82 COUNTS/ DEG	$\pm 11^\circ$
0045	INLINK	CONVERTS SERIAL UPLINK DATA INTO PARALLEL INFORMATION		
0046	RNRAD	CONVERTS SERIAL RADAR DATA INTO PARALLEL INFORMATION		
0047	GYROCMD	OUTPUT PULSES TO SELECTED GYRO	.625 SEC/ COUNT	$\pm 4.0^\circ$
0050	CDUXCMD	OUTPUT PULSES TO X (OUTER) CDU	158.2 SEC/ COUNT	$\pm 16.88^\circ$
0051	CDUYCMD	OUTPUT PULSES TO Y (INNER) CDU	158.2 SEC/ COUNT	$\pm 16.88^\circ$
0052	CDUZCMD	OUTPUT PULSES TO Z (MIDDLE) CDU	158.2 SEC/ COUNT	$\pm 16.88^\circ$
0053	CDUTCMD	OUTPUT PULSES TO TRUNNION CDU	39.55 SEC/ COUNT .5667 PPS/ COUNT	$\pm 16.88^\circ$ ± 200 FPS

LGC COUNTER INTERRUPTS (CONT)

LGC MEMORY
LOCATION
(COUNTER)

NAME

REMARKS

SCALE

RANGE

0054	CDUSCMD	OUTPUT PULSES TO SHAFT CDU	158.2 SEC/ COUNT .5667 FPS/ COUNT	$\pm 16.88^{\circ}$ ± 200 FPS
0055	THRUST	THRUST DRIVE FOR METER DISPLAY AND ENGINE CONTROL	3 LBS/COUNT	9450 LBS
0060	ALTM	OUTPUT PULSES TO ATTITUDE AND ALTITUDE RATE METERS	2.345 FT/ COUNT 0.5 FPS/ COUNT	0-60000 FT ± 500 FPS

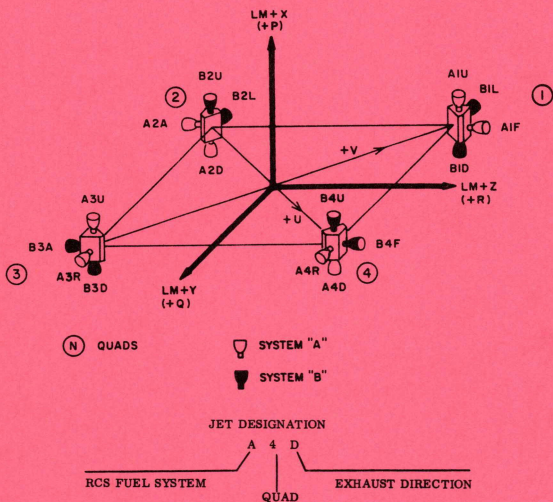
CHANNEL 14 GYRO SELECT

BITS	9	8	7	GYRO	9	8	7	GYRO
	0	0	0	-	1	0	0	-
	0	0	1	+X	1	0	1	-X
	0	1	0	+Y	1	1	0	-Y
	0	1	1	+Z	1	1	1	-Z

CHANNEL 13 RADAR DATA SELECT

A	B	C	FUNCTION	A	B	C	FUNCTION
0	0	0	NONE	1	0	0	LR X VELOCITY
0	0	1	RR RANGE	1	0	1	LR Y VELOCITY
0	1	0	RR RANGE RATE	1	1	0	LR Z VELOCITY
0	1	1	NONE	1	1	1	LR RANGE

LM RCS JET CONTROL AXES



The P, Q & R axis designations are used with rotations and the X, Y & Z designations are used with translations. U & V are used with both.

The astronaut can disable jets on each QUAD only in pairs and according to RCS fuel systems.

LM DAP JET SELECTION — ROTATION

+YAW

1. A4R - B2L - A1F - B3A
2. A1F - B3A
3. A4R - B2L
4. A4R - B3A
5. B2L - B3A
6. B2L - A1F
7. A4R - A1F

-YAW

1. B1L - A3R - A2A - B4F
2. B1L - A3R
3. A2A - B4F
4. A3R - A2A
5. B1L - A2A
6. B1L - B4F
7. A3R - B4F

+ ROLL

(+V)

B4U - A2D
B4U
A2D

(+U)

B1D - A3U
B1D
A3U

- ROLL

(-V)

B2U - A4D
B2U
A4D

(-U)

A1U - B3D
B3D
A1U

+PITCH

(-V)

B2U - A4D
B2U
A4D

(+U)

B1D - A3U
B1D
A3U

-PITCH

(+V)

B4U - A2D
B4U
A2D

(-U)

A1U - B3D
B3D
A1U

*For Roll & Pitch, a combination of the U-V lists will be selected.

LM DAP JET SELECTION — TRANSLATION

(X-POLICY SELECTED IN DAP LOAD)

+X

1. B1D - B3D - A4D - A2D
2. B1D - B3D
3. A4D - A2D

-X

1. A1U - A3U - B2U - B4U
2. B2U - B4U
3. A1U - A3U

+Y

1. B1L - B2L
B2L - B4F/A2A*
B1L - A1F/B3A*

-Y

1. A4R - A3R
A3R - B3A/A1F*
A4R - B4F/A2A*

+Z

1. B3A - A2A
B3A - A3R/B1L*
A2A - B2L/A4R*

-Z

1. A1F - B4F
B4F - A4R/B2L*
A1F - B1L/A3R*

*These are alternate translation policies that result in a tacking maneuver. Two jets alternate (/) on-off, the third remains on.

LM AUTOPILOT CONFIGURATION DATA (NOUN46)

DAP DATA LOADED INTO COMPONENT R1 UPON REQUEST BY FLASHING V01 N46

R1 = ABCDE

R1

VEHICLE CONFIGURATION	X-TRANSLATION JET SELECT	MAX MANUAL MANEUVER RATE (ROTATION)	ATTITUDE DEADBAND	AUTOMATIC MANEUVER RATE (ROTATION)
1 = ASCENT	0 = 2 JET RCS A	0 = 4.0 DEG/SEC	0 = ± 0.3 DEG	0 = 0.2 DEG/SEC
2 = DESCENT		1 = 20.0 DEG/ SEC	1 = ± 1.0 DEG	1 = 0.5 DEG/SEC
3 = DOCKED	1 = 2 JET RCS B		2 = ± 5.0 DEG	2 = 2.0 DEG/SEC
	2 = 4 JET RCS A			3 = 10.0 DEG/SEC
	3 = 4 JET RCS B			
DIGIT A	DIGIT B	DIGIT C	DIGIT D	DIGIT E

RADMODES - CH 33 CORRELATION

BIT	RADMODES DESCRIPTION	CHANNEL 33 DESCRIPTION
15	CONTINUOUS DESIGNATE	
14	REMODE	
13	RR ZERO	
12	RR MODE (ANTENNA)	
11	MONITOR REPOSITION	
10	DESIGNATE	
9	LR HIGH SCALE	LR RANGE LOW SCALE
8	LR VELOCITY DATA FAIL	LR VELOCITY DATA GOOD
7	RR CDU FAIL	CHANNEL 30 RR CDU FAIL
6	LR ANTENNA POSITION #2	LR ANTENNA POSITION 1
5	LR POSITION DATA GOOD	LR DATA GOOD
4	RR DATA GOOD	RR DATA GOOD
3	RR HIGH SCALE	RR RANGE LOW SCALE
2	RR AUTO MODE	RR POWER ON/AUTO
1	RR TURN-ON	

IMODES 30 - CH 30 CORRELATION

BIT	IMODES 30 DESCRIPTION	CHANNEL 30 (INV. LOGIC) DESCRIPTION
15	ISS TEMP IN LIMITS	ISS TEMP IN LIMITS
14	ISS TURN ON REQUEST	ISS TURN ON REQUEST
13	IMU FAIL	IMU FAIL
12	ICDU FAIL	ICDU FAIL
11	IMU CAGE	IMU CAGE
10	PIPA FAIL	
9	IMU OPERATING	IMU OPERATE
8	SECOND TURN ON SAMPLE	
7	FIRST TURN ON SAMPLE	
6	IMU BEING INITIALIZED	
5	PIPA FAIL INHIBIT (PROGRAM CAUTION)	
4	IMU FAIL INHIBIT	
3	ICDU FAIL INHIBIT	
2	TURN ON DELAY SEQUENCE FAIL	
1	PIPA FAIL INHIBIT (ISS WARNING)	

IMODES 33 - CH 32 & 33 CORRELATION

BIT	IMODES 33 DESCRIPTION	CHANNELS 32 & 33 (INVERTED LOGIC) CHANNEL DESCRIPTION
14	PROCEED KEY PRESSED	32 PROCEED KEY PRESSED
13	PIPA FAIL	33 PIPA FAIL
12	DOWNLINK TOO FAST	33 DOWNLINK TOO FAST
11	UPLINK TOO FAST	33 UPLINK TOO FAST
6	ENABLE DAP	
1	LAMPTTEST IN PROGRESS	

LGC CHANNEL ASSIGNMENTS

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	CHANNEL
							*14 RCS BID	*13 RCS A1U	*10 RCS A2D	*9 RCS B2U	*6 RCS B3D	*5 RCS A3U	*2 RCS A4D	*1 RCS B4U	5
							*16 RCS B1L	*4 RCS A4R	*8 RCS A3R	*12 RCS B2L	*11 RCS A2A	*15 RCS A1F	*3 RCS B4F	*7 RCS B3A	6
RELAY ADRS 4	RELAY ADRS 3	RELAY ADRS 2	RELAY ADRS 1	RELAY BIT 11	RELAY BIT 10	RELAY BIT 9	RELAY BIT 8	RELAY BIT 7	RELAY BIT 6	RELAY BIT 5	RELAY BIT 4	RELAY BIT 3	RELAY BIT 2	RELAY BIT 1	10
	ENGINE OFF	ENGINE ON			CAUTION RESET	TEST CONNECTOR OUT		OPERATOR VN ERROR LAMP	FLASH	KEY REL LAMP	TEMP CAUTION LAMP	UPLINK ACTY LAMP	COMPUTER ACTY LAMP	ISS WARNING	11
ISS TURNON DELAY COMPLETE	RRENABLE AUTO TRK	LR POS 2 COM-MAND	+ROLL GIMBAL TRIM	-ROLL GIMBAL TRIM	+PITCH GIMBAL TRIM	-PITCH GIMBAL TRIM	DISPLAY INERTIAL DATA		ENABLE IMU ERROR COUNTER	ZERO IMU CDU	COARSE ALIGN ENABLE		ENABLE RR ERROR COUNTER	ZERO RRCDU	12
ENABLE T6RUPT	RESET TRAP 32	RESET TRAP 31B	RESET TRAP 31A	ENABLE STANDBY	TEST ALARMS	RHC READ	ENABLE RHC CTR	DNLNK WD ORD		UNUSED	RADAR ACTY	RADAR a	RADAR b	RADAR c	13
DRIVE CDUX	DRIVE CDUY	DRIVE CDUZ	DRIVE CDU T	DRIVE CDU S	GYRO ACTY	GYRO MINUS	GYRO a	GYRO b	GYRO ENABLE		THRUST DRIVE	ALT METER	ALT RATE	UNUSED	14
										KEY 5M	KEY 4M	KEY 3M	KEY 2M	KEY 1M	15
								DESCENT -	DESCENT +	MARK REJECT	MARK Y	MARK X			16
TEMP IN LIMITS	ISSTURNON REQUEST	IMU FAIL	ICDU FAIL	IMU CAGE	G N CONT OF S/C	IMU OPER		RRCDU FAIL	DISPLAY INERTIAL DATA REQ	AUTO THROTTLE	ABORT STAGE (APS)	ENGINE ARMED	UNUSED	ABORT (DPS)	30 *
ATTCONTROL OUT OF DETENT	AUTO STABILIZATION	ATT HOLD	-Z TRANS	+Z TRANS	-Y TRANS	+Y TRANS	-X TRANS	+X TRANS	-AZ (LPD) -RMI	+AZ (LPD) +RMI	-YMI	+YMI	-EL (LPD) -PMI	+EL (LPD) +PMI	31 *
	PROCEED				APPARENT GIMBAL FAIL	GIMBOFF	T 10-11 FAIL	T 9-12 FAIL	T 13-15 FAIL	T 14-16 FAIL	T 6-7 FAIL	T 1-3 FAIL	T 5-8 FAIL	T 2-4 FAIL	32 *
OSC ALARM	COMPUTER WARNING	PIPA FAIL	DNLNK TOO FAST	UPLINK TOO FAST	BLOCK UPLINK	LR RANG LO SCALE	LR VEL DAT, GOOD	LR POS 2	LR POS 1	LR ALT DAT, GOOD	RR DATA GOOD	RR RANGE LO SCALE	RR PWR ON AUTO		33 *
						SCALAR DOUBLE FREQ	SCALAR FAIL	COUNTER FAIL	VOLTAGE FAIL	NITE WATCHMAN FAIL	RUPTLOC FAIL	TC TRAP FAIL	PARITY FAIL E-MEM	PARITY FAIL (BOTH)	77
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	

OUTPUTS

INPUTS

BITS WITHIN DARK LINES
ARE PGNCs EXTERNAL INTERFACES

*INVERTED LOGIC

NOTES

