

CM SOFTWARE

COLOSSUS 3
(ARTEMIS REV 72)

CM DSKY

COMPUTER PROGRAMS

COMPUTER ROUTINES

VERB CODES

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ALARM CODES

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FLAGWORD BIT ASSIGNMENTS

IMODES30 AND IMODES33

OPTMODES

RCSFLAGS

DAPDATR1 AND DAPDATR2

CHANNEL BIT ASSIGNMENTS

COMPUTER PROGRAM DESCRIPTION

CM DSKY

UPLINK ACTY Light

1. Is energized by the first character of a digital UPLINK message received by the AGC.
2. Is energized during the Rendezvous Navigation program (P20) when the Tracking Attitude routine (R61) detects that a gimbal angle or pointing angle change of greater than 10 degrees is required to align the CSM to the desired attitude and that the V50 N18 flag is not set.
3. Is energized in the TLI INITIATE/CUTOFF program (P15) during the 10-second interval when the S-IVB Injection Sequence Start bit (Channel 12, bit 13) is set. It is deenergized at the end of the 10-second interval.

NO ATT Light — is energized when the AGC is in the Operate mode and there is no inertial reference; that is, the ISS is off, caged, or in the Coarse Align mode.

STBY Light — is energized when the AGC is in the Standby mode and deenergized when the AGC is in the Operate mode.

KEY REL Light

1. Energized when:
 - a. An internal display comes up while astronaut has the DSKY.
 - b. An astronaut keystroke is made when an internal flashing display is currently on the DSKY.
 - c. The astronaut makes a keystroke on top of (his own) Monitor Verb Display.
2. Deenergized when:
 - a. Astronaut relinquishes DSKY by hitting KEY REL button.
 - b. Astronaut terminates his current sequence normally, for example,
 - (1) With final ENTR of a load sequence.
 - (2) The ENTR of a response to a flashing display.
 - (3) The ENTR of an extended verb request.

OPR ERR Light — is energized when the DSKY operator performs an improper sequence of key depressions. The light is deenergized by pressing the RSET button.

TEMP Light — The AGC receives a signal from the IMU when the stable member temperature is in the range 126.3° F to 134.3° F. In the absence of this signal, the TEMP light on the DSKY is actuated.

GIMBAL LOCK Light — is energized when the middle gimbal angle exceeds ± 70 degrees from its zero position. When the middle gimbal angle exceeds ± 85 degrees from its zero position, the AGC automatically commands the Coarse Align mode in the ISS to prevent gimbal oscillation (except when the S-IVB is attached). The NO ATT light will then be energized.

PROG Light — The program alarm actuates the PROG light on the DSKY. A program alarm is generated under a variety of situations.

RESTART Light — In the event of a RESTART during operation of a program, a latch is set in the AGC which maintains the RESTART light on the DSKY until the latch is manually reset by pressing RSET.

TRACKER Light

1. The presence of an Optics CDU Fail signal will cause the TRACKER light to be energized.
2. In addition, the TRACKER light is energized during the Rendezvous Navigation program (P20) when the Rendezvous Data Processing routine (R22) reads VHF range data via the VHF DATA link but the DATA GOOD discrete is missing.
3. It is deenergized if the DATA GOOD discrete is present after reading VHF range data and by keying in V88E (shuts off the VHF range data processing section of R22).
4. It is deenergized when the conditions of 1 above no longer exist.

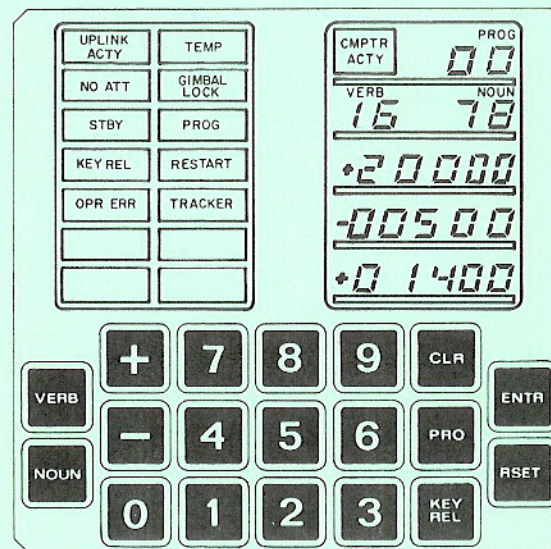
CM DSKY (CONTINUED)

COMP ACTY Light — is energized when the AGC is occupied with an internal sequence.

Display Panel — consists of 24 electroluminescent sections. Each section is capable of displaying any decimal character or remaining blank, except the three sign sections. These display a plus sign, a minus sign, or a blank. The numerical sections are grouped to form three data display registers, each of five numerical characters; and three control display registers, each of two numerical characters. The data display registers are referred to as R1, R2, R3. The control display registers are known as VERB, NOUN, and PROGRAM.

Keyboard — contains the following buttons:

1. VERB — pushing this button indicates that the next two numerical characters keyed in are to be interpreted as the Verb Code.
2. NOUN — pushing this button indicates that the next two numerical characters keyed in are to be interpreted as the Noun Code.
3. + and — — are sign keys used for sign convention and to identify decimal data.
4. 0 - 9 — are numerical keys.
5. CLR — Used during a data loading sequence to clear or blank the data display register (R1, R2, R3) being used. It allows the operator to reload the data word.
6. PRO — This pushbutton performs two functions:
 - a. When the AGC is in a Standby mode, pressing this button will put the AGC in the Operate mode, turn off the STBY light, and automatically select Routine 00 in the AGC.
 - b1. When the AGC is in the Operate mode but Program 06 is not selected, pressing the button will provide the "Proceed" function. If the proceed button is pressed when VERB lights contain 21, 22, or 23, the action is rejected and the OPR ERR light is energized.
 - b2. When the AGC is in the Operate mode and Program 06 is selected, pressing the button will put the AGC in the Standby mode and turn on the STBY light.
7. ENTR — is used in three ways:
 - a. To direct the AGC to execute the Verb/Noun code now appearing on the Verb/Noun lights.
 - b. To direct the AGC to accept a data word just loaded.
 - c. In response to a "please perform" request.
8. RSET — turns off alarm conditions on the DSKY providing the alarm condition has been corrected.



LIST OF PROGRAMS FOR PROGRAM COLOSSUS

PHASE	PROGRAM	PROGRAM TITLE
Pre launch and Service	00	AGC Idling
	01	Prelaunch or Service-Initialization
	02	Prelaunch or Service-Gyrocompassing
	03	Prelaunch or Service-Optical Verification of Gyrocompassing
	06	AGC Power Down
	07	System Test
Boost	11	Earth Orbit Insertion Monitor
	15	TLI Initiate/Cutoff
Coast	20	Universal Tracking
	21	Ground Track Determination
	22	Orbital Navigation
	23	Cislunar Midcourse Navigation
	24	Rate Aided Optics Tracking
	27	AGC Update
	29	Time-of-Longitude
Pre-thrusting	30	External Delta V
	31	CSM Height Adjustment Maneuver (HAM)
	32	CSM Coelliptic Sequence Initiation (CSI)
	33	CSM Constant Delta Altitude (CDH)
	34	CSM Transfer Phase Initiation (TPI) Targeting
	35	CSM Transfer Phase Midcourse (TPM) Targeting
	36	CSM Plane Change (PC) Targeting
	37	Return to Earth
Thrusting	40	SPS
	41	RCS
	47	Thrust Monitor
Alignment	51	IMU Orientation Determination
	52	IMU Realign
	53	Backup IMU Orientation Determination
	54	Backup IMU Realign
Entry	61	Entry—Preparation
	62	Entry—CM/SM Separation and Preentry Maneuver
	63	Entry—Initialization
	64	Entry—Post 0.05G
	65	Entry—Upcontrol
	66	Entry—Ballistic
	67	Entry—Final Phase
Pre-thrusting	72	LMCoelliptic Sequence Initiation (CSI)
	73	LMConstant Delta Altitude (CDH)
Other Vehicle	74	LM Transfer Phase Initiation (TPI) Targeting
	75	LM Transfer Phase (Midcourse) Targeting
	76	LM Target Delta V
	77	CSM Target Delta V
	79	Rendezvous Final Phase

LIST OF ROUTINES FOR PROGRAM COLOSSUS

ROUTINE	ROUTINE TITLE
00	Final Automatic Request Terminate
01	Erasable and Channel Modification Routine
02	IMU Status Check
03	Digital Autopilot Data Load
05	S-Band Antenna
07	MINKEY Controller
21	Rendezvous Tracking Sighting Mark
22	Rendezvous Tracking Data Processing
23	Backup Rendezvous Tracking Sighting Mark
30	Orbit Parameter Display
31	Rendezvous Parameter Display Routine No. 1
33	AGC/LGC Clock Synchronization
34	Rendezvous Parameter Display Routine No. 2
36	Rendezvous Out-of-Plane Display Routine
40	SPS Thrust Fail
41	State Vector Integration (MID to AVE)
50	Coarse Align
52	Automatic Optics Positioning
53	Sighting Mark
54	Sighting Mark Display
55	Gyro Torquing
56	Alternate LOS Sighting Mark
57	Optics Calibration
60	Attitude Maneuver
61	Tracking Attitude
62	Crew-Defined Maneuver
63	Rendezvous Final Attitude
67	Universal Tracking Rotation

LIST OF VERBS USED IN PROGRAM COLOSSUS

REGULAR VERBS

00	Not in use
01	Display Octal Component 1 in R1
02	Display Octal Component 2 in R1
03	Display Octal Component 3 in R1
04	Display Octal Components 1, 2 in R1, R2
05	Display Octal Components 1, 2, 3 in R1, R2, R3
06	Display decimal in R1 or R1, R2 or R1, R2, R3
07	Display DP decimal in R1, R2 (test only)
08	Spare
09	Spare
10	Spare
11	Monitor Octal Component 1 in R1
12	Monitor Octal Component 2 in R1
13	Monitor Octal Component 3 in R1
14	Monitor Octal Components 1, 2 in R1, R2
15	Monitor Octal Components 1, 2, 3 in R1, R2, R3
16	Monitor decimal in R1 or R1, R2 or R1, R2, R3
17	Monitor DP decimal in R1, R2 (test only)
18	Spare
19	Spare
20	Spare
21	Load Component 1 into R1
22	Load Component 2 into R2
23	Load Component 3 into R3
24	Load Components 1, 2 into R1, R2
25	Load Components 1, 2, 3 into R1, R2, R3
26	Spare
27	Display Fixed Memory
28	Spare
29	Spare
30	Request EXECUTIVE
31	Request WAITLIST
32	Recycle program
33	Proceed without DSKY inputs
34	Terminate function
35	Test lights
36	Request FRESH START
37	Change program (major mode)
38	Spare
39	Spare
EXTENDED VERBS	
40	Zero ICDCU
41	Coarse align CDU's (specify N20 or N91)
42	Pulse torque gyros
43	Load IMU attitude error needles (test only)
44	Set Surface flag
45	Reset Surface flag
46	Establish G & N autopilot control
47	Move LM state vector into CM state vector
48	Request DAP Data Load routine (R03)
49	Start automatic attitude maneuver

LIST OF VERBS USED IN PROGRAM COLOSSUS

50	Please perform
51	Please mark
52	Mark on offset landing site
53	Please perform COAS mark
54	Request Rendezvous Backup Sighting Mark routine (R23)
55	Increment AGC time (decimal)
56	Terminate tracking (P20)
57	Request display of full track flag (FULTKFLG)
58	Reset Stick flag and set V50 N18 flag
59	Please calibrate
60	Set astronaut total attitude (N17) to present attitude
61	Display DAP following attitude errors (Mode 1)
62	Display total attitude errors with respect to Noun 22 (Mode 2)
63	Display total astronaut attitude error with respect to Noun 17 (Mode 3)
64	Request S-Band Antenna routine (R05)
65	Optical verification of prelaunch alignment
66	Vehicles are attached. Move this vehicle state vector to other vehicle.
67	Start W-matrix RSS error display
68	Spare
69	Cause RESTART
70	Update liftoff time (P27)
71	Start AGC update; block address (P27)
72	Start AGC update; single address (P27)
73	Start AGC update; AGC time (P27)
74	Initialize erasable dump via DOWNLINK
75	Backup liftoff
76	Spare
77	Spare
78	Update prelaunch azimuth
79	Spare
80	Enable LM state vector update
81	Enable CSM state vector update
82	Request Orbit Parameter display (R30)
83	Request Rendezvous Parameter display No. 1 (R31)
84	Spare
85	Request Rendezvous Parameter display No. 2 (R34)
86	Reject Rendezvous Backup Sighting Mark
87	Set VHF Range flag
88	Reset VHF Range flag
89	Request Rendezvous Final Attitude maneuver (R63)
90	Request Out of Plane Rendezvous display (R36)
91	Display BANKSUM
92	Spare
93	Enable W matrix initialization
94	Perform Cislunar Attitude maneuver
95	Spare
96	Terminate integration and go to P00
97	Please perform engine-fail (R40)
98	Spare
99	Please Enable Engine Ignition

LIST OF NOUNS USED IN PROGRAM COLOSSUS

00	Not in use	
01	Specify address (fractional)	.XXXXX fractional .XXXXX fractional .XXXXX fractional
02	Specify address (whole)	XXXXX. integer XXXXX. integer XXXXX. integer
03	Specify address (degree)	XXX.XX deg XXX.XX deg XXX.XX deg
04	Spare	
05	Angular error/difference	XXX.XX deg
06	Option code ID Option code	Octal Octal
07	CHANNEL/FLAGWORD/ERASABLE OPERATOR	
	ECADR	
	BIT ID	Octal
	Action	Octal
08	Alarm data	
	ADRES	
	BBANK	Octal
	ERCOUNT	Octal
09	Alarm codes	
	First	Octal
	Second	Octal
	Last	Octal
10	Channel to be specified	Octal
11	TIG of CSI	00XXX. h 000XX. min 0XX.XX s
12	Option code (extended verbs only)	Octal Octal
13	TIG of CDH	00XXX. h 000XX. min 0XX.XX s
14	Specified inertial velocity at TLI cutoff (VI C/O)	XXXXX.ft/s
15	Increment address	Octal
16	Time of event (used by extended verbs only)	00XXX. h 000XX. min 0XX.XX s
17	Astronaut total attitude	R XXX.XX deg P XXX.XX deg Y XXX.XX deg

LIST OF NOUNS USED IN PROGRAM COLOSSUS

18	Desired automaneuver FDAI ball angles	R XXX.XX deg P XXX.XX deg Y XXX.XX deg
19	Spare	
20	Present ICDU angles	R (OG) XXX.XX deg P (IG) XXX.XX deg Y (MG) XXX.XX deg
21	PIPA's	X XXXXX. pulses Y XXXXX. pulses Z XXXXX. pulses
22	Desired ICDU angles	R (OG) XXX.XX deg P (IG) XXX.XX deg Y (MG) XXX.XX deg
23	Spare	
24	Delta time for AGC clock	00XXX. h 000XX. min 0XX.XX s
25	CHECKLIST (used with V50)	XXXXX.
26	PRIO/DELAY, ADRES, BBCON	Octal Octal Octal
27	Self-test on/off switch	XXXXX.
28	Spare	
29	XSM launch azimuth	XXX.XX deg
30	Target codes	XXXXX. XXXXX. XXXXX.
31	Time of rendezvous W matrix initialization	00XXX. h 000XX. min 0XX.XX s
32	Time from perigee	00XXX. h 000XX. min 0XX.XX s
33	Time of ignition (GETI)	00XXX. h 000XX. min 0XX.XX s
34	Time of event	00XXX. h 000XX. min 0XX.XX s
35	Time from event	00XXX. h 000XX. min 0XX.XX s
36	Time of AGC clock	00XXX. h 000XX. min 0XX.XX s

LIST OF NOUNS USED IN PROGRAM COLOSSUS

37	Time of ignition (TPI)	00XXX. h 000XX. min 0XX.XX s
38	Time of state being integrated	00XXX. h 000XX. min 0XX.XX s
39	Delta time for transfer	00XXX. h 000XX. min 0XX.XX s
40 *	Time from ignition/cutoff (TFI/TFC) VG Delta V (accumulated)	XX b XX min/s XXXX.X ft/s XXXXX.X ft/s
41	Target Azimuth Elevation	XXX.XX deg XX.XXX deg
42	Apocenter altitude Pericenter altitude Delta V (required)	XXXX.X nmi XXXX.X nmi XXXX.X ft/s
43	Latitude Longitude Altitude	XXX.XX deg (+ north) XXX.XX deg (+ east) XXXXX.X nmi
44 *	Apocenter altitude Pericenter altitude TFF	XXXX.X nmi XXXX.X nmi XX b XX min/s
45 *	Marks (VHF/optics) Time from ignition of next burn Middle gimbal angle	XX b XX marks XX b XX min/s XXX.XX deg
46	DAP configuration	Octal Octal
47	CSM weight LM weight	XXXXX. lbs XXXXX. lbs
48	Gimbal pitch trim Gimbal yaw trim	XXX.XX deg XXX.XX deg
49	Delta R Delta V VHF or optics code	XXX.XX nmi XXXXX.X ft/s 0000X.
50 *	Splash error Perigee TFF	XXXXX.X nmi XXXXX.X nmi XX b XX min/s
51	S-band antenna angles (RHO) (GAMMA)	XXX.XX deg XXX.XX deg
52	Central angle of active vehicle	XXX.XX deg
53	Range Range rate Phi	XXX.XX nmi XXXXX.X ft/s XXX.XX deg

* Display cannot be changed via data load (that is, V25 NXXE, and so forth)

LIST OF NOUNS USED IN PROGRAM COLOSSUS

54	Range Range rate Theta	XXX.XX nmi XXXXX.X ft/s XXX.XX deg
55	Perigee code Elevation angle Central angle of passive vehicle	0000X XXX.XX deg XXX.XX deg
56	Reentry angle Delta V	XXX.XX deg XXXXX.X ft/s
57	Spare	
58	Pericenter altitude (post TPI) Delta V (TPI) Delta V (TPF)	XXXXX.X nmi XXXXX.X ft/s XXXXX.X ft/s
59	Delta V LOS 1 Delta V LOS 2 Delta V LOS 3	XXXXX.X ft/s XXXXX.X ft/s XXXXX.X ft/s
60	GMAX VPRED GAMMA EI	XXX.XX g XXXXX. ft/s XXX.XX deg (+ above)
61	Impact Latitude Longitude Heads up/down	XXX.XX deg (+ north) XXX.XX deg (+ east) +/- 00001
62	Inertial velocity magnitude Altitude rate Altitude above pad radius	XXXXX. ft/s XXXXX. ft/s XXXXX.X nmi
63 *	Range from EI altitude to splash Predicted inertial velocity Time from EI altitude	XXXXX.X nmi XXXXX. ft/s XX b XX min/s
64	Drag acceleration Inertial velocity Range to splash	XXX.XX g XXXXX. ft/s XXXXX.X nmi (+ is overshoot)
65	Sampled AGC time (fetched in interrupt)	00XXX. h 000XX. min 0XX.XX s
66	Commanded bank angle Crossrange error Downrange error	XXX.XX deg XXXXX.X nmi (+ south) XXXXX.X nmi (+ overshoot)
67	Range to target Present latitude Present longitude	XXXXX.X nmi (+ overshoot) XXX.XX deg (+ north) XXX.XX deg (+ east)
68	Commanded bank angle Inertial velocity Altitude rate	XXX.XX deg XXXXX. ft/s XXXXX. ft/s
69	Commanded bank angle Drag level Exit velocity	XXX.XX deg XXX.XX g XXXXX. ft/s

* Display cannot be changed via data load (that is, V25NXXE, and so forth)

LIST OF NOUNS USED IN PROGRAM COLOSSUS

70	Celestial body code (before mark) Landmark data Horizon data	Octal Octal Octal
71	Celestial body code (after mark) Landmark data Horizon data	Octal Octal Octal
72	Spare	
73	Altitude Velocity Flight path angle	XXXXXXb. nmi XXXXXX. ft/s XXX.XX deg
74	Commanded bank angle Inertial velocity Drag acceleration	XXX.XX deg XXXXXX. ft/s XXX.XX g
75 *	Delta altitude (CDH) Delta time (CDH-CSI or TPI-CDH) Delta time (TPI-CDH or TPI-NOMTPI)	XXXXX.X nmi XX b XX min/s XX b XX min/s
76	Spare	
77	Spare	
78	GAMMA RHO OMICRON	XXX.XX deg XXX.XX deg XXX.XX deg
79	P20 rotation rate P20 deadband	X.XXXX deg/s XXX.XX deg
80 *	Time from ignition/cutoff Velocity to be gained Delta V (accumulated)	XX b XX min/s XXXXXX. ft/s XXXXXX. ft/s
81	Delta VX (LV) Delta VY (LV) Delta VZ (LV)	XXXXX.X ft/s XXXXX.X ft/s XXXXX.X ft/s
82	Delta VX (LV) Delta VY (LV) Delta VZ (LV)	XXXXX.X ft/s XXXXX.X ft/s XXXXX.X ft/s
83	Delta VX (body) Delta VY (body) Delta VZ (body)	XXXXX.X ft/s XXXXX.X ft/s XXXXX.X ft/s
84	Delta VX (LV of other vehicle) Delta VY (LV of other vehicle) Delta VZ (LV of other vehicle)	XXXXX.X ft/s XXXXX.X ft/s XXXXX.X ft/s
85	VGX (body) VGY (body) VGZ (body)	XXXXX.X ft/s XXXXX.X ft/s XXXXX.X ft/s
86	Delta VX (LV) Delta VY (LV) Delta VZ (LV)	XXXXXX. ft/s XXXXXX. ft/s XXXXXX. ft/s
87	Mark data Shaft angle Trunnion angle	XXX.XX deg XX.XXX deg
88	Celestial body unit vector	X .XXXXX Y .XXXXX Z .XXXXX

*Display cannot be changed via data load (that is, V25NXXE, and so forth)

LIST OF NOUNS USED IN PROGRAM COLOSSUS

89	Landmark latitude Landmark longitude/2 Landmark altitude	XX.XXX deg (+ north) XX.XXX deg (+ east) XXX.XX nmi
90	Rendezvous out of plane parameters Y (Active) YDOT (Active) YDOT (Passive)	 XXX.XX nmi XXXXX.X ft/s XXXXX.X ft/s
91	Present optics angles Shaft Trunnion	 XXX.XX deg XX.XXX deg
92	New optics angles Shaft Trunnion	 XXX.XX deg XX.XXX deg
93	Delta gyro angles	X XX.XXX deg Y XX.XXX deg Z XX.XXX deg
94	Alternate LOS Shaft angle Trunnion angle	 XXX.XX deg XX.XXX deg
95	Time from ignition (cutoff) VG (P15) VI (P15)	XXbXX min/s XXXXXX. ft/s XXXXXX. ft/s
96	Y (CSM) YDOT (CSM) YDOT (LM)	XXX.XX nmi XXXXX.X ft/s XXXXX.X ft/s
97	System test inputs	XXXXX. XXXXX. XXXXX.
98	System test results and input	XXXXX. .XXXXX XXXXX.
99	RSS of position error RSS of velocity error RSS option code	XXXXXX. ft XXXXX.X ft/s XXXXXX.

LIST OF ALARM CODES USED WITH V05 N09
FOR PROGRAM COLOSSUS

CODE	PURPOSE	SET BY
00110	No mark since last mark reject	SXTMARK
00113	No inbits (Channel 16)	SXTMARK
00114	Mark made but not desired	SXTMARK
00115	Optics torque request with switch not at CMC	Extended verb optics CDU
00116	Optics switch altered before 15-second ZERO time elapsed	T4RUPT
00117	Optics torque request with optics not available	Extended verb optics CDU
00120	Optics torque request with optics not ZEROED	T4RUPT
00121	Optics CDU's no good at time of mark	SXTMARK
00205	Bad PIPA reading	SERVICER
00206	Zero encode not allowed with coarse align + gimbal lock	IMU mode switch
00207	ISS turn-on request not present for 90 seconds	T4RUPT
00210	IMU not operating	IMU mode switch, IMU-2 R02, P51, P53
00211	Coarse align error-drive > 2 degrees	IMU mode switch
00212	PIPA fail but PIPA is not being used	IMU mode switch, T4RUPT
00213	IMU not operating with turn-on request	T4RUPT
00214	Program using IMU when turned off	T4RUPT
00217	Bad return from Stall routines	P51, P53
00220	IMU not aligned (no REFSMMAT)	R02
00401	Desired gimbal angles yield Gimbal Lock	Fine Align, IMU-2, R61
00402	* Second MINKEY pulse torque must be done	P52
00404	* Target out of view (trunnion angle > 90 degrees)	R52
00405	* Two stars not available	P52, P54
00406	Rendezvous navigation not operating	R23
00421	W-Matrix overflow	INTEGRV
00600	* Imaginary roots on first interation	P31, P32, P72
00601	* Perigee altitude after CSI < 85 nmi earth orbit, 35,000 feet moon orbit	P31, P32, P72
00602	* Perigee altitude after CDH < 85 nmi earth orbit, 35,000 feet moon orbit	P31, P32, P72
00603	* CSI to CDH time < 10 minutes	P31, P32, P72
00604	* CDH to TPI time < 10 minutes	P31, P32, P72
00605	* Number of iterations exceeds loop maximum	P31, P32, P72, P37
00606	* DV exceeds maximum	P31, P32, P72
00611	* No TIG for given elevation angle	P33, P34, P73, P74
00612	* State vector in wrong sphere of influence	P37
00613	* Reentry angle out of limits	P37
00777	PIPA fail caused ISS warning	T4RUPT
01102	AGC self-test error	SELF-CHECK
01105	Downlink too fast	T4RUPT
01106	Uplink too fast	T4RUPT
01107	Phase table failure; assume erasable memory is destroyed	RESTART
01301	ARCSIN-ARCCOS argument too large	INTERPRETER
01407	VG increasing	S40.8
01426	** IMU unsatisfactory	P61, P62
01427	** IMU reversed	P61, P62
01520	V37 request not permitted at this time	V37
01600	Overflow in Drift Test	Optical Prealignment Calibration
01601	Bad IMU torque	Optical Prealignment Calibration
01703	Insufficient time for integration, TIG was slipped	R41

LIST OF ALARM CODES USED WITH V05 N09
FOR PROGRAM COLOSSUS

CODE	PURPOSE	SET BY
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, ICDO fails caused the ISS warning	T4RUPT
14777	IMU, ICDO, PIPA fails caused the ISS warning	T4RUPT
20430	Integration abort due to subsurface state vector	All calls to integration
20607	No solution from Time-Theta or Time-Radius	TIMETHET, TIMERAD
20610	Lambda less than unity	P37
21204	Negative or zero WAITLIST call	WAITLIST
21206	Second job attempts to go to sleep via Keyboard and Display program	PINBALL
21210	Two programs using device at same time	IMU Mode Switch
21302	SQRT called with negative argument	INTERPRETER
21501	Keyboard and Display alarm during internal use (NVSUB)	PINBALL
21502	Illegal flashing display	GOPLAY
21521	PO1 illegally selected	P01
31104	Delay routine busy	EXECUTIVE
31201	Executive overflow—no VAC areas available	EXECUTIVE
31202	Executive overflow—no core sets available	EXECUTIVE
31203	WAITLIST overflow—too many tasks	WAITLIST
31211	Illegal interrupt of Extended Verb	SXTMARK, P23

2XXXX—Indicates a go-to-routine 00 type abort.

3XXXX—Indicates a bailout type abort.

Note: For V05 N09 Displays:

R1—XXXXX (first alarm to occur after last reset).

R2—XXXXX (second alarm to occur after last reset).

R3—XXXXX (most recent alarm).

Depressing the RSET key on the DSKY will set R1 and R2 to zero, but not affect R3.

*This alarm is displayed without the astronaut having to key in V05 N09E. An astronaut DSKY response is required by this alarm.

**This alarm is displayed without the astronaut having to key in V05 N09E. No DSKY response is required by this alarm.

LIST OF OPTION CODES USED WITH V04 N06/N12
FOR PROGRAM COLOSSUS

(The specified option codes will be displayed in R1 in conjunction with Flashing V04 N06/N12 to request the astronaut to load into R2 the option he desires.)

CODE	PURPOSE	INPUT FOR R2	PROGRAMS
00001	Specify IMU orientation	1 = preferred, 2 = nominal, 3 = REFSMMAT, 4 = landing site	P50's
00002	Specify vehicle	1 = this vehicle, 2 = other vehicle	P21, R30, P29
00004	Specify FULTKFLG setting	0 = Full, VHF and optics 1 = Partial, VHF or optics	P20
00007	Specify propulsion system	1 = SPS, 2 = RCS	P37
00024	Specify P20 mode	0 = Rendezvous, (Vecpoint) 1 = Celestial body, (Vecpoint) 2 = Rotate 4 = Rendezvous, (3-axis) 5 = Celestial body, (3-axis)	P20

LIST OF CHECKLIST REFERENCE CODES USED WITH V50 N25
FOR PROGRAM COLOSSUS

CODE	ACTION TO BE EFFECTED
00013	Key in coarse alignment option
00014	Key in fine alignment option
00015	Perform celestial body acquisition
00016	Key in Terminate Mark sequence
00017	Perform MINKEY rendezvous sequence
00020	Perform MINKEY PC pulse torquing
00041	Switch CM/SM separation to UP
00062	Key in AGC power down
00202	Perform GNCS automatic maneuver
00204	Key in SPS gimbal trim test option

NOTES: Switch—denotes change position of a console switch
Perform—denotes start or end of a task
Key In—denotes key-in of data through the DSKY

FLAGWORD BIT ASSIGNMENTS (ALPHABETICAL)
FOR COLOSSUS

ADVTRK	FW8	B10	MIDAVFLG	FW9	B2
AMOONFLG	FW0	B2	MIDFLAG	FW0	B13
APSESW	FW8	B5	MKOVFLG	FW4	B3
ASTNFLAG	FW7	B12	MOONFLAG	FW0	B12
ATTCHFLG	FW7	B2	MRKIDFLG	FW4	B15
AUTOSEQ	FW10	B7	MRKNVFLG	FW4	B9
AVEGFLAG	FW1	B1	MRUPTFLG	FW4	B5
AVEMIDSW	FW9	B1	MWAITFLG	FW4	B11
AVFLAG	FW2	B5	NEEDLFLG	FW0	B9
AZIMFLAG	FW11	B8	NEWIFLG	FW8	B13
BURNFLAG	FW10	B10	NEWLMFLG	FW8	B14
CALCMAN2	FW2	B2	NEWTFLAG	FW5	B10
CMDAPARM	FW6	B12	NJETSFLG	FW1	B15
CMOONFLG	FW8	B12	NODOFLAG	FW2	B1
CM/DSTBY	FW6	B2	NODOP01	FW1	B12
COGAFLAG	FW8	B4	NORFHOR	FW0	B11
COMPUTER	FW5	B8	NORMSW	FW7	B10
CSISFLAG	FW11	B6	NOSWITCH	FW6	B7
CULTFLAG	FW3	B7	NRMIDFLG	FW4	B13
CYC61FLG	FW0	B4	NRMNVFLG	FW4	B8
D6OR9FLG	FW3	B2	NRUPTFLG	FW4	B4
DAPBIT1	FW6	B15	NWAITFLG	FW4	B10
DAPBIT2	FW6	B14	N22ORN17	FW9	B6
DIMOFFLAG	FW3	B1	ORBWFLAG	FW3	B6
DMENFLG	FW5	B9	ORDERSW	FW8	B6
DRIFTFLG	FW2	B15	PCFLAG	FW10	B1
DSKYFLAG	FW5	B15	PCMANFLG	FW10	B15
EGSW	FW6	B8	PDSPFLAG	FW4	B12
ENG2FLAG	FW1	B11	PFRATFLG	FW2	B4
ENGONFLG	FW5	B7	PINBRFLG	FW4	B6
ENTRYDSP	FW6	B13	POOFLAG	FW3	B9
ERADFLAG	FW1	B13	PRECIFLG	FW3	B8
ETPIFLAG	FW2	B7	PRIODFLG	FW4	B14
FINALFLG	FW2	B6	PRONVFLG	FW4	B7
FIRSTFLG	FW2	B7	PTV93FLG	FW10	B4
FREEFLAG	FW0	B3	P21FLAG	FW2	B12
FULTKFLG	FW10	B2	P22MKFLG	FW3	B11
F2RTE	FW0	B5	P24FLAG	FW9	B14
GAMDIFSW	FW6	B11	P24MKFLG	FW2	B3
GLOKFAIL	FW3	B14	P29FLAG	FW0	B1
GONEBY	FW7	B8	P35FLAG	FW10	B8
GONEPAST	FW6	B10	QUITFLAG	FW9	B5
GRRBKFLG	FW5	B5	RANGFLAG	FW10	B9
GUESSW	FW1	B2	REFSMFLG	FW3	B13
GYMDIFSW	FW6	B1	REINTFLG	FW10	B13
HAFLAG	FW11	B7	REJCTFLG	FW10	B12
HDSUPFLG	FW10	B11	RELVELSW	FW6	B9
HIND	FW6	B6	RENDWFLG	FW5	B1
IDLEFAIL	FW1	B6	RETROFLG	FW5	B14
IGNFLAG	FW7	B13	RNDVZFLG	FW0	B7
IMPULSW	FW2	B9	RPOFLAG	FW8	B15
IMUSE	FW0	B8	RVSW	FW7	B9
INCORFLG	FW5	B11	R21MARK	FW2	B14
INFINFLG	FW8	B7	R22CAFLG	FW9	B7
INRLSW	FW6	B5	R31FLAG	FW9	B4
INTFLAG	FW10	B14	R53FLAG	FW0	B6
INTYPFLG	FW3	B4	R67FLAG	FW8	B2
ITSWICH	FW7	B14	SAVECFLG	FW9	B10
JSWITCH	FW0	B14	SKIPVHF	FW2	B10
KNOWNFLG	FW6	B8	SLOPESW	FW1	B3
LATSW	FW6	B4	SLOWFLG	FW5	B13
LMOONFLG	FW8	B11	SOLNSW	FW5	B3
LUNAFLAG	FW3	B12	SOURCFLG	FW9	B8
MANEUFLG	FW10	B5	STATEFLG	FW3	B5
MARKFLG	FW1	B4	STEERSW	FW2	B11
MAXDBFLG	FW9	B12	STIKFLAG	FW1	B14
MID1FLAG	FW9	B3			

FLAGWORD BIT ASSIGNMENTS (ALPHABETICAL)
FOR COLOSSUS

STRULLSW	FW6	B13	VERIFLAG	FW7	B3
SURFFLAG	FW8	B8	VFLAG	FW3	B10
SWTOVER	FW9	B15	VHFRFLAG	FW9	B9
S32.1F1	FW11	B15	VINTFLAG	FW3	B3
S32.1F2	FW11	B14	VNFLAG	FW4	B2
S32.1F3A	FW11	B13	V37FLAG	FW7	B6
S32.1F3B	FW11	B12	V50N18FL	FW3	B15
TARG1FLG	FW1	B10	V59FLAG	FW5	B12
TARG2FLG	FW1	B9	V82EMFLG	FW9	B13
TERMIFLG	FW7	B15	V94FLAG	FW9	B11
TFFSW	FW7	B1	V96ONFLG	FW8	B3
TIMRFLAG	FW7	B11	XDELVFLG	FW2	B8
TPIMNFLAG	FW10	B3	XDSPFLAG	FW4	B1
TRACKFLG	FW1	B5	ZMEASURE	FW0	B10
UPDATFLG	FW1	B7	.05GSW	FW6	B3
UPLOCKFL	FW7	B4	22DSPFLG	FW2	B13
UTFLAG	FW8	B9	360SW	FW8	B1
VEHUPFLG	FW1	B8	3AXISFLG	FW5	B6

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

(FLAGWORD 0) E Address 74

Bit	Name	1	0
1	P29FLAG	First pass through P29.	Subsequent pass through P29.
2	AMOONFLG	State vector in lunar sphere at MIDTOAVE.	State vector in earth sphere at MIDTOAVE.
3	FREEFLAG	(Temporary flag used in many routines.)	
4	CYC61FLG	KALCMANU computes maneuver time.	KALCMANU executes maneuver.
5	F2RTE	In time critical mode.	Not in time critical mode.
6	R53FLAG	V51 initiated.	V51 not initiated.
7	RNDVZFLG	P20 rendezvous option running.	P20 rendezvous option not running.
8	IMUSE	IMU in use.	IMU not in use.
9	NEEDLFLG	Total attitude error displayed.	A/P following error displayed.
10	ZMEASURE	Measurement planet and primary planet different.	Measurement planet and primary planet same.
11	NORFHOR	Far horizon.	Near horizon.
12	MOONFLAG	Moon is sphere of influence.	Earth is sphere of influence.
13	MIDFLAG	Integration with solar perturbations.	Integration without solar perturbations.
14	JSWITCH	Integration of W matrix.	Integration of state vector.
15	Not Used		

(FLAGWORD 1) E Address 75

Bit	Name	1	0
1	AVEGFLAG	AVERAGEG (SERVICER) to continue.	AVERAGEG (SERVICER) to cease.
2	GUESSW	No starting value for iteration exists.	Starting value for iteration exists.
3	SLOPESW	Iterate with bias method in iterator.	Iterate with Regula Falsi method in iterator.
4	MARKFLG	Mark accepted. Mark reject is ok.	No mark accepted.
5	TRACKFLG	Tracking allowed.	Tracking not allowed.
6	IDLEFAIL	Inhibit R40.	Enable R40 (engine fail).
7	UPDATFLG	Updating by marks allowed.	Updating by marks not allowed.
8	VEHUPFLG	CSM state vector being updated.	LM state vector being updated.
9	TARG2FLG	Sighting landmark.	Sighting star.
10	TARG1FLG	Sighting LM.	Not sighting LM.
11	ENG2FLAG	RCS burn.	SPS burn.
12	NODOP01	P01 not allowed.	P01 allowed.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

(FLAGWORD 1) (Continued)

Bit	Name	1	0
13	ERADFLAG	EARTH—compute Fischer ellipsoid radius. MOON—use mean Lunar radius.	EARTH—use Launch site radius. MOON—use RLS for lunar radius.
14	STIKFLAG	RHC control or MGA $> 75^\circ$ and P20 track inhibited.	AGC control and MGA $< 75^\circ$
15	NJETSFLG	Two-jet RCS burn.	Four-jet RCS burn.

(FLAGWORD 2) E Address 76

Bit	Name	1	0
1	NODOFLAG	V37 not permitted.	V37 permitted.
2	CALCMAN2	Perform maneuver starting procedure.	Bypass starting procedure.
3	P24MKFLG	New mark from SXT mark.	No marking done.
4	PFRATFLG	Preferred attitude computed.	Preferred attitude not computed.
5	AVFLAG	LM is active vehicle.	CSM is active vehicle.
6	FINALFLG	Last pass through rendezvous program computations.	Interim pass through rendezvous program computations.
7	FIRSTFLG	First pass through S40.9.	Succeeding pass through S40.9.
	ETPIFLAG	Elevation angle supplied for P34/74.	TPI time supplied for P34/P74.
8	XDELVFLG	External Delta V VG computation.	Lambert (AIMPOINT) VG computation.
9	IMPULSW	Minimum impulse burn (cutoff time specified).	Steering burn (no cutoff time yet available).
10	SKIPVHF	Disregard radar read because of software or hardware RESTART.	Radar read to proceed normally.
11	STEERSW	Steering to be done (P40). Calculate time to SIVB cutoff (P15).	Steering omitted (P40). Calculate time to SIVB ignition (P15).
12	P21FLAG	Succeeding pass through P21, use base vector for calculation.	First pass through P21, calculate base vector.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

(FLAGWORD 2) (continued)

Bit	Name	1	0
13	22DPSFLG	Display DR, DV.	Do not display DR, DV.
14	R21MARK	Rendezvous optics marking active.	Rendezvous optics marking not active.
15	DRIFTFLG	T3RUPT calls gyro compensation.	T3RUPT does no gyro compensation.

(FLAGWORD 3) E Address 77

Bit	Name	1	0
1	DIM0FLAG	W matrix is to be used.	W matrix is not to be used.
2	D6OR9FLG	Dimension of W is 9 for integration.	Dimension of W is 6 for integration.
3	VINTFLAG	CSM state vector being integrated.	LM state vector being integrated.
4	INTYPFLG	Conic integration.	Encke integration.
5	STATEFLG	Permanent state vector being updated.	Permanent state vector not being updated.
6	ORBWFLAG	W matrix valid for orbital navigation.	W matrix invalid for orbital integration.
7	CULTFLAG	Star occulted.	Star not occulted.
8	PRECIFLG	CSPREC, LEMPREC, or INTEGRVS called.	INTEGRV called.
9	POOFLAG	Inhibit backwards integration.	Allow backwards integration.
10	VFLAG	Less than two stars in the field of view.	Two stars in the field of view.
11	P22MKFLG	P22/P24 downlinked mark data was just taken.	P22/P24 downlinked mark data not just taken.
12	LUNAFLAG	Lunar latitude-longitude.	Earth latitude-longitude.
13	REFSMFLG	REFSMMAT good.	REFSMMAT no good.
14	GLOKFAIL	Desired middle gimbal angle exceeds 60° .	Desired middle gimbal angle is less than 60° .
15	V50N18FL	Enable R60 attitude maneuver.	Inhibit R60 attitude maneuver.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

(FLAGWORD 4) E Address 100		(FLAGWORD 5) E Address 101	
Bit	Name	1	0
1	XDSPFLAG	Mark display not to be interrupted.	No special mark information.
2	VNFLAG	VNFLASH display	GOFFLASH display
3	MKOVFLAG	Mark display over normal display.	No mark display over normal display.
4	NRUPTFLG	Normal display interrupted by priority or mark display.	Normal display not interrupted by priority or mark display.
5	MRUPTFLG	Mark display interrupted by priority display.	Mark display not interrupted by priority display.
6	PINBRFLG	Astronaut has interfered with existing display.	Astronaut has not interfered with existing display.
7	PRONVFLG	Astronaut using keyboard when priority display initiated.	Astronaut not using keyboard when priority display initiated.
8	NRMNVFLG	Astronaut using keyboard when normal display initiated.	Astronaut not using keyboard when normal display initiated.
9	MRKNVFLG	Astronaut using keyboard when mark display initiated.	Astronaut not using keyboard when mark display initiated.
10	NWAITFLG	Higher priority display operating when normal display initiated.	No higher priority display operating when normal display initiated.
11	MWAITFLG	Higher priority display operating when mark display initiated.	No higher priority display operating when mark display initiated.
12	PDSPFLAG	Cannot interrupt priority display.	
13	NRMIDFLG	Normal display in ENDIDLE.	No normal display in ENDIDLE.
14	PRIODFLG	Priority display in ENDIDLE.	No priority display in ENDIDLE.
15	MRKIDFLG	Mark display in ENDIDLE.	No mark display in ENDIDLE.

(FLAGWORD 5) E Address 101

Bit	Name	1	0
1	RENDWFLG	W matrix valid for rendezvous navigation.	W matrix invalid for rendezvous navigation.
2	Not Assigned		
3	SOLNSW	Lambert does not converge, or time-radius nearly circular.	Lambert converges or time-radius noncircular.
4	Not Assigned		
5	GRRBKFLG	Backup liftoff received.	Backup liftoff not received.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

(FLAGWORD 5) (continued)

Bit	Name	1	0
6	3AXISFLG	Maneuver specified by three axes.	Maneuver specified by one axis.
7	ENGONFLG	Engine turned on.	Engine turned off.
8	COMPUTER	Not used in program.	Not used in program.
9	DMENFLG	Dimension of W is 9 for incorporation.	Dimension of W is 6 for incorporation.
10	NEWTFLAG	New longitude iteration. Skip display.	Display normal.
11	INCORFLG	First incorporation.	Second incorporation.
12	V59FLAG	Calibrating for P23.	Normal marking for P23.
13	SLOWFLG	P37 transearth coast slowdown is desired.	Slowdown is not desired.
14	RETROFLG	P37 premaneuver orbit is retrograde.	Orbit is not retrograde.
15	DSKYFLAG	Displays sent to DSKY.	No displays to DSKY.

(FLAGWORD 6) E Address 102

Bit	Name	1	0
1	GYMIDFSW	CDU differences and body rates computed.	CDU differences and body rates not computed.
2	CM/DSTBY	ENTRY DAP activated.	ENTRY DAP not activated.
3	.05GSW	Drag over 0.05 g	Drag less than 0.05 g.
4	LATSW	Downlift not inhibited.	Downlift inhibited.
5	INRLSW	Initial roll V(LV) attitude not held.	Initial roll V(LV) attitude held.
6	HIND	Iterating of HUNTEST calculation to be done after range prediction.	Iterating of HUNTEST calculations to be omitted after range prediction.
7	NOSWITCH	Lateral roll maneuver inhibited in ENTRY.	Lateral roll maneuver permitted in ENTRY.
8	KNOWNFLG	Landmark known.	Landmark unknown.
	EGSW	In final entry phase.	Not in final entry phase.
9	RELVELSW	Targeting uses earth-relative velocity.	Targeting uses inertial velocity.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

(FLAGWORD 6) (continued)

Bit	Name	1	0
10	GONEPAST	Lateral control calculations to be omitted.	Lateral control calculations to be done.
11	GAMDIFSW	Calculate GAMDOT.	GAMDOT not to be calculated.
12	CMDAPARM	Allow ENTRY firings and calculations.	Inhibit ENTRY firings and control functions.
13	ENTRYDSP	Do ENTRY display via ENTRYVFN.	Omit ENTRY display.
	STRULLSW	Do STEERULL.	Do ULAGEOFF only.
14	DAPBIT2	B14 0 1 0 1	DAP selection indicator.
15	DAPBIT1	B15 0 0 1 1	
		A/P None RCS TVC Saturn	

(FLAGWORD 7) E Address 103

Bit	Name	1	0
1	TFFSW	Calculate TPERIGEE.	Calculate TFF.
2	ATTCHFLG	LM, CM attached.	LM, CM not attached.
3	VERIFLAG	Changed when V33E occurs at end of P27.	
4	UPLOCKFL	K-K fail.	No K-K fail.
5	Not Assigned		
6	V37FLAG	AVERAGEG (SERVICER) running.	AVERAGEG (SERVICER) off.
7	Not Assigned		
8	GONEBY	Passed target.	Approaching target.
9	RVSF	Do not compute final state vector in time-theta.	Compute final state vector in time-theta.
10	NORMSW	Unit normal input to Lambert.	Lambert computes its own unit normal.
11	TIMRFLAG	CLOKTASK operating.	CLOKTASK inoperative.
12	ASTNFLAG	Astronaut has OKed ignition.	Astronaut has not OKed ignition.
13	IGNFLAG	TIG has arrived.	TIG has not arrived.
14	ITSWICH	Accept next Lambert TPI search solution.	Test Lambert answer against limits.
15	TERMIFLG	Terminate R52.	Do not terminate R52.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

(FLAGWORD 8) E Address 104

Bit	Name	1	0
1	360SW	Transfer angle near 360 degrees.	Transfer angle not near 360 degrees.
2	R67FLAG	R67 rotation active.	R67 rotation inactive.
3	V96ONFLG	P00 integration has been inhibited by V96	P00 integration is proceeding regularly.
4	COGAFLAG	No conic solution, too close to rectilinear (COGA overflows).	Conic solution exists, (COGA does not overflow.)
5	APSESW	RDESIRED outside of PERICENTER-APOCENTER range in time-radius.	RDESIRED inside of PERICENTER-APOCENTER range in time-radius.
6	ORDERSW	Iterator uses second order minimum mode.	Iterator uses first order standard mode.
7	INFINFLG	No conic solution (closure through infinity required).	Conic solution exists.
8	SURFFLAG	LM on lunar surface.	LM not on lunar surface.
9	UTFLAG	P20 option 1,2, or 5 selected.	P20 option 0 or 4 selected.
10	ADVTRK	Advance ground track sighting wanted.	No advanced ground track.
11	LMOONFLG	Permanent LM state vector in lunar sphere.	Permanent LM state vector in earth sphere.
12	CMOONFLG	Permanent CSM state vector in lunar sphere.	Permanent CSM state vector in earth sphere.
13	NEWIFLG	First pass through integration.	Succeeding iteration of integration.
14	NEWLMFLG	Delay rate computation after new landmark update.	Delay completed.
15	RPQFLAG	RPQ not computed. (RPQ = vector between secondary body and primary body.)	RPQ computed.

(FLAGWORD 9) E Address 105

Bit	Name	1	0
1	AVEMIDSW	AVETOMID calling for W matrix integration. Do not overwrite RN, VN, PIPTIME.	No AVETOMID W matrix integration. Allow setup of RN, VN, PIPTIME.
2	MIDAVFLG	Integration entered from one of MIDTOAV portals.	Integration was not entered via MIDTOAV.
3	MID1FLAG	Integrate to TDEC.	Integrate to the then-present time.
4	R31FLAG	R31 selected (V83).	R34 selected (V85).
5	QUITFLAG	Terminate and exit from integration.	Continue integration.
6	N22ORN17	Compute total attitude errors with respect to N22 (V62).	Compute total attitude errors with respect to N17 (V63).

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

(FLAGWORD 9) (continued)

Bit	Name	1	0
7	R22CAFLG	R22 is processing an optics mark.	R22 is not processing an optics mark.
8	SOURCFLG	Source of input data is from VHF radar.	Source of input data is from optics mark.
9	VHFRFLAG	Allow R22 to accept range data.	Stop acceptance of range data.
10	SAVECFLG	P23 display and data storage after mark is done.	P23 display and data storage before mark is done.
11	V94FLAG	V94 allowed during P23.	V94 not allowed.
12	MAXDBFLG	Maximum A/P deadband selected.	Minimum A/P deadband selected.
13	V82EMFLG	Moon vicinity.	Earth vicinity.
14	P24FLAG	P24 operating.	P24 not operating.
15	SWTOVER	Switchover has occurred.	No switchover yet

(FLAGWORD 10) E Address 106

Bit	Name	1	0
1	PCFLAG	Plane change maneuver being targeted.	Not plane change targeting.
2	FULTKFLG	Optics or VHF marks being taken.	Optics and VHF marks being taken.
3	TPIMNFLAG	TPI targeting complete.	TPI targeting not complete.
4	PTV93FLG	W matrix to be initialized after maneuver.	W matrix initialized
5	MANEUF LG	No mark incorporation since targeting completed.	Mark incorporated.
6	Not Assigned		
7	AUTOSEQ	MINKEY auto-rendezvous.	Manual rendezvous.
8	P35FLAG	MCC targeting completed.	MCC targeting not completed.
9	RANGFLAG	Range \leq 327.67 nmi.	Range $>$ 327.67 nmi.
10	BURNFLAG	CSM performed burn.	LM performed burn.
11	HDSUPFLG	Heads-up tracking attitude.	Heads-down tracking attitude.
12	REJCTFLG	Reject mark data being processed by R22.	No mark rejected.
13	REINTFLG	Restartable integration in process.	No restartable integration in process.
14	INTFLAG	Integration in process.	Integration not in process.
15	PCMANFLG	Maneuver is post plane change or P79.	Not post plane change or P79 maneuver.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

(FLAGWORD 11) E Address 107

Bit	Name	1	0
1-5	Not Assigned		
6	CSISFLAG	Multiple CSI targeting.	Not multiple CSI.
7	HAFLAG	Height adjustment targeting.	Not height adjustment maneuver.
8	AZIMFLAG	Three-axis tracking maneuver.	Vecpoint tracking maneuver.
9-11	Not Assigned		
12	S32.1F3B	(Bits 12 and 13 function as an ordered pair (13, 12) indicating the possible occurrence of two Newton iterations for S32.1: (0, 0) – First pass of second Newton iteration, (0, 1) – First Newton iteration being done, (1, 0) – Remainder of second Newton iteration, (1, 1) – 50 ft/s stage of second Newton iteration.)	
13	S32.1F3A		
14	S32.1F2	First pass of Newton iteration.	Reiteration of Newton.
15	S32.1F1	Delta V at CSI Time 1 exceeds maximum.	Delta V at CSI Time 1 less than maximum.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

IMODES30, a flag whose individual bits are used to control the monitoring of IMU functions associated with Channel 30 (and in a few cases Channel 33).

Bit	Meaning
15	Last sampled value of Channel 30, Bit 15 (0 if IMU temperature within limits).
14	Last sampled value of Channel 30, Bit 14 (0 if ISS has been turned on or commanded to be turned on).
13	Last sampled value of Channel 30, Bit 13 (0 if an IMU fail indication has been produced).
12	Last sampled value of Channel 30, Bit 12 (0 if an IMU CDU fail indication has been produced).
11	Last sampled value of Channel 30, Bit 11 (0 if an IMU cage command has been produced by crew).
10	Last sampled value of Channel 33, Bit 13 (0 if a PIPA fail indication has been produced), having the same value as Bit 13 of IMODES33.
9	Last sampled value of Channel 30, Bit 9 (0 if IMU has been turned on and operating with no malfunctions).
8	Bit used to control the IMU turn-on sequencing.
7	Bit used to control the IMU turn-on sequencing.
6	Bit is set to 1 to indicate that IMU initialization is being carried out. No Verb 37 inputs will be processed while bit is equal to 1 and alarm 01520g is generated.
5	Bit is set to 1 to inhibit the generation of program alarm 0212g if a PIPA fail signal (Bit 13 of Channel 33) is produced.
4	Bit is set to 1 to inhibit generation of an ISS warning based on receipt of an IMU fail signal.
3	Bit is set to 1 to inhibit generation of an ISS warning based on receipt of an IMU CDU fail signal.
2	Bit is set to 1 to indicate failure of the turn-on delay sequence for IMU turn-on (alarm 0207g is also generated).
1	Bit is set to 1 to inhibit generation of an ISS warning based on receipt of a PIPA fail signal (Bit 13 of Channel 33).

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

IMODES33, a flag whose individual bits are used to control the monitoring of functions associated with Channel 33 (and other items).

Bit	Meaning
15	Not assigned.
14	Last sampled value of Channel 32, Bit 14 (0 if a Proceed command is given using the PRO button).
13	Last sampled value of Channel 33, Bit 13 (0 if a PIPA fail has been produced).
12	Last sampled value of Channel 33, Bit 12 (0 if a telemetry end pulse has been rejected because the downlink rate is too fast).
11	Last sampled value of Channel 33, Bit 11 (0 if an uplink bit has been rejected because the uplink rate is too fast).
10-7	Not assigned.
6	Bit is set to 1 to indicate that IMU use for vehicle attitude information should not be attempted.
5	Bit is set to 1 in IMU Zeroing routine external to T4RUPT while zeroing is taking place (for an interval of about 8.22 seconds).
4-2	Not assigned.
1	Bit is set to 1 when a Verb 35 ("lamp test") is received, and reset to 0 about 5 seconds later.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

OPTMODES, a flag whose individual bits are used to control the performance of optics functions within the T4RUPT package.

Bit	Meaning
15-11	Not Assigned
10	Bit is set to 1 to indicate that zeroing of optics has been completed since the last FRESH START or RESTART (both of which set the bit to 0). If an attempt is made to drive the optics and this bit is found to be zero, alarm 0120g is generated (but computation proceeds).
9	Not assigned.
8	Not assigned.
7	Last sampled value of Channel 30, Bit 7 (0 if an optics CDU fail indication has been generated by the optics CDU hardware), if Bit 2 of this word is 0, a Tracker alarm (Bit 8 of DSPTAB + 11) is generated if this bit has a 1 to 0 transition. Bit is set to 1 by a FRESH START or RESTART.
6	Not assigned.
5	Last sampled value of Channel 33, Bit 5 (0 if Optics Mode switch is set to CMC). Also may be value of C31FLWRD, Bit 5 if backup indicator is used.
4	Last sampled value of Channel 33, Bit 4 (0 if Optics Zero switch set to Zero). If Bits 5-4 = 112, the Optics Mode switch has been set to Manual. Also may be value of C31FLWRD, Bit 4 if backup indicator is used.
3	Bit is set to 1 when the Optics Zero switch is changed to Zero to indicate that zeroing of the optics is in progress.
2	If bit is 1, then a switch out of Zero Optics mode will cause alarm 0116g to be generated (if switched to Manual, a "grace period" of about 5.3 seconds is provided before the optics-zeroing time counter is reset, during which time a switchback to optics zeroing can be made). Bit remains 1 for about 16.2 seconds, and is then reset to 0 (at the same time that Bit 10 of this word is set to 1, and Bit 2 of this word is set to 0).
1	Bit is set to 1 to inhibit generation of Tracker alarm (Bit 8 of DSPTAB + 11) if Bit 7 of this word goes from 1 to 0. Bit is set and reset at the same time as Bit 3.
	Not assigned.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

RCSFLAGS, a flag whose individual bits are used in monitoring the RCS DAP.

Bit	Meaning
15	Bit is set to 1 to indicate that a high rate (2 deg/s) automaneuver is in progress. Bit is reset to 0 to indicate that a high rate automaneuver is not in progress.
14	Bit is set to 1 if rate estimates are not good and a repeat of the rate filter initialization is required. Bit is reset to 0 if the G & N is in control and the IMU data is usable. Approximately 1 second after the bit is reset to 0 the rate filter initialization is complete.
13	Bit is set to 1 if the rate damping has not been completed on the roll axis. Bit is reset to 0 if the rate damping on the roll axis has been completed.
12	Bit is set to 1 if the rate damping has not been completed on the pitch axis. Bit is reset to 0 if the rate damping has been completed on the pitch axis.
11	Bit is set to 1 if the rate damping has not been completed on the yaw axis. Bit is reset to 0 if the rate damping has been completed on the yaw axis.
10,9	If either or both bits have been set to 1, there has been a change in the RHC roll command since the last DAP cycle. If both bits are reset to 0, it implies that no change in the RHC roll command has occurred since the last DAP cycle.
8,7	If either or both bits have been set to 1, there has been a change in RHC yaw command since the last DAP cycle. If both bits are reset to 0, it implies that no change in the RHC yaw command has occurred since the last DAP cycle.
6,5	If either or both bits have been set to 1, there has been a change in the RHC pitch command since the last DAP cycle. If both bits are reset to 0, it implies that no change in the RHC pitch command has occurred since the last DAP cycle.
4	Bit is set to 1 to indicate that the AK values should be updated. Bit is reset to 0 to indicate that the Needle Drive routine should be processed with the AK values which have been previously acquired.
3,2	If (Bit 3, Bit 2) = (1,1) or (1,0), it is necessary to follow the initialization path of the Needle Drive routine.
	If (Bit 3, Bit 2) = (0, 1), it is necessary to follow Pass 2 of the Needle Drive routine.
	If (Bit 3, Bit 2) = (0, 0), it is necessary to follow Pass 3 and greater paths of the Needle Drive routine.
1	Bit is set to 1 to indicate that the initial pass path in the T6 program should not be followed. Bit is reset to 0 if the T6 program should be initialized.

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

C31FLWRD, a flag used to determine if the channel representations of the CMC Mode switch, SC CONTROL switch and OPTICS ZERO switch are to be used or if backup indicators are to be used. Octal representation is AXXDX where:

A VALUE

0 or 4	Bits 13, 14, 15 of Channel 31 are valid
1	CMC Control FREE
2	CMC Control HOLD
3	CMC Control AUTO
5	SCS Control FREE
6	SCS Control HOLD
7	SCS Control AUTO

D VALUE

0 or 4	Bits 4, 5 of Channel 33 are valid
1 or 5	Optics Mode CMC
2 or 6	Optics Mode ZERO
3 or 7	Optics Mode Manual

C31FLWRD Switch override can be activated by:

V21N01E
374E
AXXDXE

FLAGWORD BIT ASSIGNMENTS FOR COLOSSUS

DAPDATR1, a flagword for RCS-CSM DAP interface.

Bits	15-13	12-10	9-7	6-4	3-1
	CONFIG	XTAC	XTBD	DB	RATE
15-13	CONFIG:	Configuration			
		0	No DAP or ENTRY DAP		
		1	CSM		
		2	CSM/LM		
		3	CSM/SIVB		
		6	CSM/LM Ascent Stage Only		
12-10	XTAC:	X-translation using Quads AC			
		0	No AC		
		1	Use AC		
9-7	XTBD:	X-translation using Quads BD			
		0	No BD		
		1	Use BD		
6-4	DB:	Deadband			
		0	± 0.5 degree		
		1	± 5.0 degrees		
3-1	RATE:	Response to RHC, automatic maneuvers			
		0	0.05 degree/second		
		1	0.2 degree/second		
		2	0.5 degree/second		
		3	2.0 degrees/second		

DAPDATR2, a flagword for RCS-CSM DAP interface.

Bits	15-13	12-10	9-7	6-4	3-1
	AC-Roll	Quad A	Quad B	Quad C	Quad D
15-13	AC-Roll:	Roll jet selection			
		0	Use BD Roll		
		1	Use AC Roll		
12-10, 9-7, 6-4, 3-1	A, B, C, D Quad fails				
		0	Quad Failed		
		1	Quad OK		

CHANNEL BIT ASSIGNMENTS (CM)

INPUT CHANNEL 3

Bit 1-14 Contains the HIGH ORDER SCALER: 23.3 hours = maximum capacity in increments of 5.12 seconds.

INPUT CHANNEL 4

Bits 1-14 Contains the LOW ORDER SCALER: 5.12 seconds = maximum capacity in increments of 1/3,200 second.

OUTPUT CHANNEL 5

BIT	JET DESIGNATION SM QUAD NO./CM RING NO.	SM COMMAND TRANS/ROT	CM COMMAND
1	C-3/1-3	+X/+P	+P
2	C-4/2-4	-X/-P	-P
3	A-3/2-3	-X/+P	+P
4	A-4/1-4	+X/-P	-P
5	D-3/2-5	+X/+Y _W	+Y _W
6	D-4/1-6	-X/-Y _W	-Y _W
7	B-3/1-5	-X/+Y _W	+Y _W
8	B-4/2-6	+X/-Y _W	-Y _W

OUTPUT CHANNEL 6

BIT	JET DESIGNATION SM QUAD NO./CM RING NO.	SM COMMAND TRANS/ROT	CM COMMAND
1	B-1/1-1	+Z/+R	+R
2	B-2/1-2	-Z/-R	-R
3	D-1/2-1	-Z/+R	+R
4	D-2/2-2	+Z/-R	-R
5	A-1	+Y/+R	
6	A-2	-Y/-R	
7	C-1	-Y/+R	
8	C-2	+Y/-R	

CHANNEL BIT ASSIGNMENTS (CM)

OUTPUT CHANNEL 11

BIT	Assignment
1	ISS Warning
2	Light Computer Activity Lamp
3	Light Uplink Activity Lamp
4	Light Temp Caution Lamp
5	Light Keyboard Release Lamp
6	Flash Verb and Noun Lamps
7	Light Operator Error Lamp
8	Spare
9	Test Connector Outbit
10	Caution Reset
11	Spare
12	Spare
13	Engine On/Off (1-On, 0-Off)
14	Spare
15	Spare

OUTPUT CHANNEL 12

BIT	Assignment
1	Zero Optics CDU's
2	Enable Optics CDU Error Counters
3	Not Used
4	Coarse Align Enable
5	Zero IMU CDU's
6	Enable IMU CDU Error Counters
7	Spare
8	TVC Enable
9	Enable SIVB Takeover
10	Zero Optics
11	Disengage Optics DAC
12	Spare
13	SIVB Injection Sequence Start
14	SIVB Cutoff
15	ISS Turn-on Delay Complete

OUTPUT CHANNEL 13

BIT	Assignment
1	Range Unit Select c
2	Range Unit Select b
3	Range Unit Select a
4	Range Unit Activity
5	Not Used
6	Block Inlink
7	Downlink Word Order Code Bit
8	Not Used
9	Spare
10	Test Alarms
11	Enable Standby
12	Reset Trap 31-A
13	Reset Trap 31-B
14	Reset Trap 32
15	Enable T6RUPT

NOTE:

Channel 13 Range Unit Selection: Bits 1 through 4 are assigned control functions for sampling of the VHF range link. These bits must contain 1001_g in order to obtain control.

CHANNEL BIT ASSIGNMENTS (CM)

OUTPUT CHANNEL 14

BIT	
1	Not Used
2	Spare
3	Spare
4	Spare
5	Not Used
6	Gyro Enable
7	Gyro Select b
8	Gyro Select a
9	Gyro Sign (1 = minus)
10	Gyro Activity
11	Drive CDU S
12	Drive CDU T
13	Drive CDU Z
14	Drive CDU Y
15	Drive CDU X

Channel 14-Gyro Selection

a	b	Gyro
0	0	—
0	1	X
1	0	Y
1	1	Z

INPUT CHANNEL 15

BIT	
1	Key codes from Main DSKY
2	Key codes from Main DSKY
3	Key codes from Main DSKY
4	Key codes from Main DSKY
5	Key codes from Main DSKY
6-15	Spares

INPUT CHANNEL 16

BIT	
1	Key codes from Navigation DSKY
2	Key codes from Navigation DSKY
3	Key codes from Navigation DSKY
4	Key codes from Navigation DSKY
5	Key codes from Navigation DSKY
6	Mark button
7	Mark Reject button
8-15	Spares

<u>DSKY KEY</u>	<u>INPUT KEYCODE</u>
0	10000
1	00001
2	00010
3	00011
4	00100
5	00101
6	00110
7	00111
8	01000
9	01001
VERB	10001
NOUN	11111
ENTER	11100
ERROR RESET	10010
CLEAR	11110
KEY RELEASE	11001
+	11010
-	11011

CHANNEL BIT ASSIGNMENTS (CM)

INPUT CHANNEL 30

BIT	
1	Ullage Thrust Present
2	CM/SM Separate
3	SPS Ready
4	SIVB Separate, Abort
5	Liftoff
6	Guidance Reference Release
7	Optics CDU Fail
8	Spare
9	IMU Operate
10	S/C Control of Saturn
11	IMU Cage
12	IMU CDU Fail
13	IMU Fail
14	ISS Turn-On Request
15	Temperature in Limits

NOTE:

All of the input signals in Channel 30 are inverted; that is, a ZERO bit indicates that the discrete is ON.

INPUT CHANNEL 31

BIT	
1	+Pitch Manual Rotation
2	-Pitch Manual Rotation
3	+Yaw Manual Rotation
4	-Yaw Manual Rotation
5	+Roll Manual Rotation
6	-Roll Manual Rotation
7	+X Translation
8	-X Translation
9	+Y Translation
10	-Y Translation
11	+Z Translation
12	-Z Translation
13	Hold Function
14	Free Function
15	G & N Autopilot Control

NOTE:

All of the input signals in Channel 31 are inverted; that is, a ZERO bit indicates that the discrete is ON.

INPUT CHANNEL 32

BIT	
1	+Pitch Minimum Impulse
2	-Pitch Minimum Impulse
3	+Yaw Minimum Impulse
4	-Yaw Minimum Impulse
5	+Roll Minimum Impulse
6	-Roll Minimum Impulse
7	Spare
8	Spare
9	Spare
10	Spare
11	LM Attached
12	Spare
13	Spare
14	Proceed (Standby button)
15	Spare

NOTE:

All of the input signals in Channel 32 are inverted; that is, a ZERO bit indicates that the discrete is ON.

CHANNEL BIT ASSIGNMENTS (CM)

INPUT CHANNEL 33

BIT

1	Spare
2	Range Unit Data Good
3	Spare
4	Zero Optics
5	CMC Control
6	Not Used
7	Not Used
8	Spare
9	Spare
10	Block Uplink Input*
11	Uplink Too Fast
12	Downlink Too Fast
13	PIPA Fail
14	AGC Warning
15	AGC Oscillator Alarm

*This bit reads ONE when accept uplink signal is present at interface.

NOTE:

All of the input signals in Channel 33 are inverted; that is, a ZERO bit indicates that the discrete is ON.

INPUT CHANNEL 77 – (RESTART MONITOR)

BIT

1	Parity Fail (E or F)
2	Parity Fail (E memory)
3	TC Trap
4	RUPT Lock
5	Nightwatchman
6	Voltage Fail
7	Counter Fail
8	Scalar Fail
9	Scalar Double Frequency Alarm