206

PROGRAM REPORT

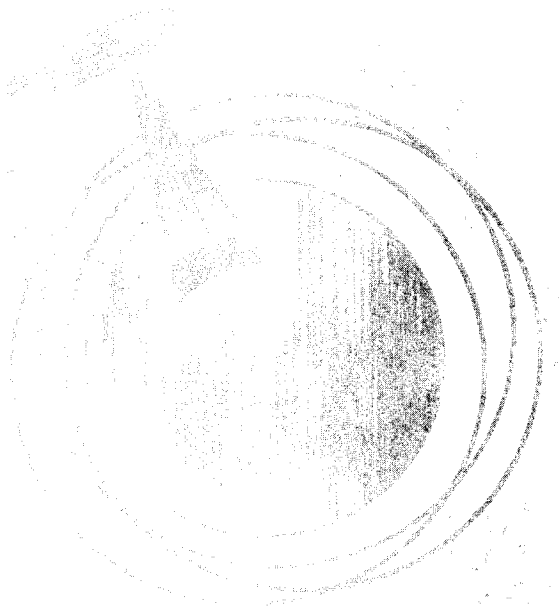
VOLUME 19

APPENDIX 37

THIS DOCUMENT CONTAINS 342 PAGES
NOVEMBER 1967

206

PROGRAM REPORT



VOLUME 19

APPENDIX 37

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APPENDIX 37

MALFUNCTION ANALYSIS

REFERENCE BOOK

DIN: 4400-33-2

PROGRAM 206

MALFUNCTION ANALYSIS REFERENCE BOOK

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

This document contains 340 pages:

MALFUNCTION ANALYSIS REFERENCE BOOK

This is a preliminary issue of the Malfunction Analysis Reference Book, and is intended for use at the Training Meetings, scheduled for the week of 4 March 1963 at the 6594th Aerospace Test Wing. The data in this book will be continually reviewed, corrected, enlarged, updated, and reissued. This issue is being published for information only and will not be updated.

OSE Report #1122-
21 February 1963

PROGRAM 206

MALFUNCTION ANALYSIS REFERENCE BOOK

Contract AF04(695)-76

Section 1.1

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GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

21 February 1963

MALFUNCTION ANALYSIS REFERENCE BOOK

Section 1.1

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23 January 1963

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract AF04(695)-76

Section 1.3

Supporting Documentation

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

Section 1.3

SUPPORTING DOCUMENTATION

This report presents a list of documents which constitute a suitable reference library to provide additional detailed information on the Program 206 vehicle.

COMMAND and CONTROL DOCUMENTS

Document No.	Title
SVS 3969	System Design Requirements for Program 206, TT&C System
SVS 4423	Command Definition Specification
SVS 4463, Rev. B	Input/Output Format Specs for C & C Computer Program
	Milestone 7 for COMMAND, CIMAGE, and COMINT
	Milestone 9
	MPES Catalog (GLOM)
	Calibration Book
	Training Documentation

SYSTEM SPECIFICATIONS

SVS 4378	206 System Design Requirements Specification
SVS 4382	Interface Specification - Agena/SV
SVS 4381	System Acceptance Specification (Field)
SVS 4380	System Acceptance Specification (In-House)
SVS 4364	EMI Supplementary Document
	SV Model Specification
SVS 4379	SV Environmental Specification
SVS 4385	Component Qualification & Acceptance Test Requirements

MALFUNCTION ANALYSIS REFERENCE BOOK

SUPPORTING DOCUMENTATION

SVS 4195 Supplemental Operational System Specification

SVS 4026 PALC II Interface Specification

SVS 4265 Electronics S/S Specification

Interface Specification - Tracking Station Program

SVS 4576 System Design Requirements

SUB-SYSTEM SPECIFICATIONS

SVS 3969 Tracking, Telemetry & Command Specification

- SVS 4122 Command Decoder Component Specification
- SVS 4290 Programmer Component Specification
- SVS 4118 Power Controller Component Specification
- SVS 4287 Antenna VHF Component Specification
- SVS 4119 Power Supply HV Component Specification
- SVS 4284 Antenna UHF Component Specification
- SVS 4281 Transmitter RF Component Specification
- SVS 4120 Pulse Position Demodulator

SVS 3699 Separation Subsystem Specification

- SVS 4390 Separation Controller Component Specification
- SVS 4395 Separation Monitor Component Specification
- SVS 4095 Separation Programmer Component Sepcification

SVS 4375 H30 Design Requirements Specification Sec. 0-84

SVS 4376 System Design Requirements H30 Satellite Sec. 0-84

SVS 3965 Orbit Correction Subsystem Specification

- SVS 3995 Orbit Correction Propulsion Component Specification
- SVS 4050 Cold Gas, Spin Subsystem Component Specification

MALFUNCTION ANALYSIS REFERENCE BOOK

SUPPORTING DOCUMENTATION

SVS 4377 Environmental Requirements H30 Satellite Sec. 0-84

SVS 3964 Attitude Sensing Subsystem Specification

- SVS 4278 Rate Gyro Package Component Specification
- SVS 4161 Control Amplitude, Roll, Pitch, Yaw Component Specification

SVS 4008 Attitude (Pneumatics) Subsystem Specification

- SVS 4012 Regulator, High Pressure Component Specification
- SVS 4011 Regulator, Low Pressure Component Specification
- SVS 4018 Transducer, High Pressure Component Specification
- SVS 4017 Transducer, Low Pressure Component Specification
- SVS 4127 Detector, Temperature Component Specification

SVS 4419 Electrical Power & Signal Distrobution S/S Specification

- SVS 4185 Battery, Operational Component Specification
- SVS 4004 Battery, Programmer Component Specification

SVS 3963 Environmental Control Subsystem Specification

- SVS 4177 Heater and Thermo Assembly Component Specification

SCHEMATIC DRAWINGS

Drawing No.	Title
242R700	Electrical Schematic Sect. 1-2-3
242R701	Electrical Schematic Sect. 4
242R702	Electrical Schematic Sect. 5
242R703	Electrical Schematic Sect. 6
242R704	Electrical Schematic Sect. 7

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 2.2

ELECTRICAL POWER and SIGNAL DISTRIBUTION

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

Section 2.2

Subsystem Description: Electrical Power & Signal Distribution

Function:

Provide for and distribute all electrical power in the vehicle.

Components Name	Wgt.	Sta Loc	Quad
Op. Battery 1	126.0	147.62	II
2	126.0	164	II
3	126.0	164	III
4	126.0	180.8	II
5	126.0	180.8	III
Prog. Backup Batt.	8.0	145	IV
Controller Pwr. Trans.	13.5	167	III
Buck Boost Regul.	10.0	165	III
Cables etc. OCV	119.95		
Cables etc. Adapt.	38.95		

Characteristic Data

Op. Battery Capacity - 400 Amp Hours
Prog. Back-up Battery Cap - 5 Amp Hours
Op. Battery Voltage 26 to 35V;
28 volts nominal
Op. Battery Temp. range 0° to 100°F

Restrictions:

Batteries can be activated and drained only once.

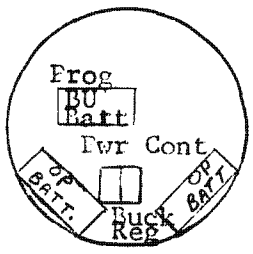
Associated Telemetry

Item	Chan-Pin
Amp Hour Meter Total	40KC-19/20/21
Voltage OCV Batt.	40KC-26
Voltage Prog. Backup Batt.	30KC-18
Current Op. Batt.(5)	30KC-20/21/22/23/24

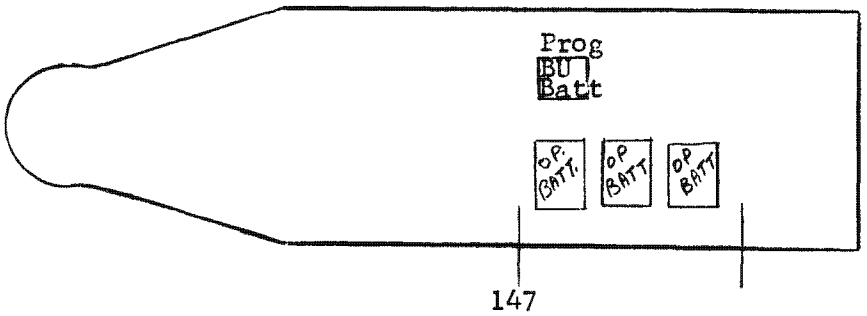
Associated Commands

Function	Type	Series

None, for Phase I



Station 147



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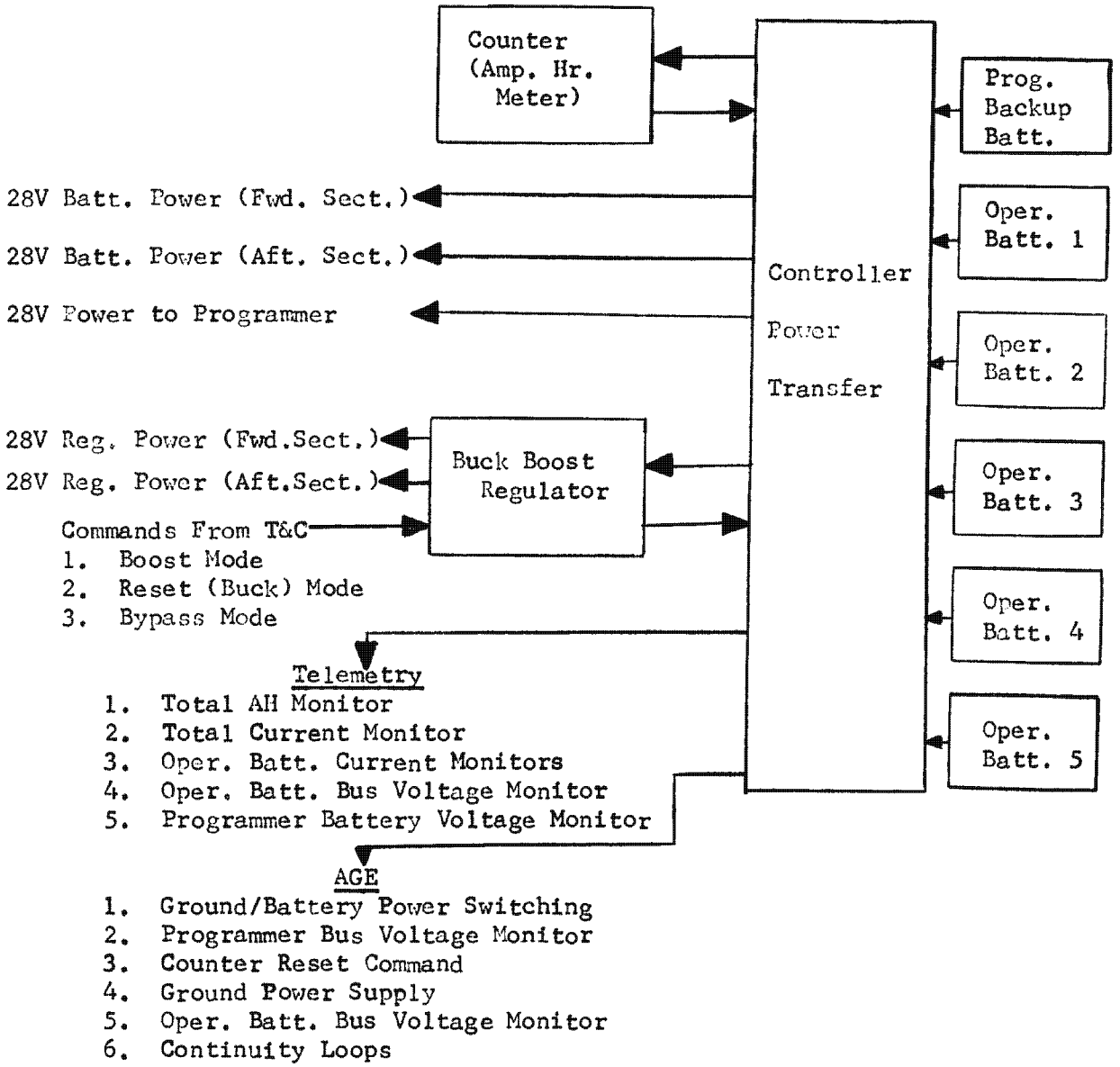
TOTAL POWER REQUIREMENTS

Subsystem	Vehicle 951-2-3	Vehicle 954
Attitude Control	780 Amp Hours	947 Amp Hours
Environmental Control	671 Amp Hours	671 Amp Hours
Tracking and Command	241 Amp Hours	251 Amp Hours
Telemetry	55 Amp Hours	55 Amp Hours
Electrical Power and Signal Distribution	64 Amp Hours	64 Amp Hours
Residue	11 Amp Hours	11 Amp Hours
Stand Time	12.5 Amp Hours	12.5 Amp Hours
	1834.5 Amp Hours	2011.5 Amp Hours



ELECTRICAL POWER AND SIGNAL DISTRIBUTION SUBSYSTEM REFERENCES

1. SVS 4378 Program System Design Specification
2. SVS 4379 Program External and Internal Environmental Design Criteria
3. SVS 3953 Component Qualification Test Requirements for Program 206
4. 389L478 Selected Parts List for Program 206
5. SVS 4364 Deviations & Additions in MIL-I-26600 as applicable to Program 206
6. SVS 4185 Battery 18 Cell Primary 28V, 5 Amp Hr.
7. SVS 4004 Battery Storage 28V, 5 Amp Hr.
8. SVS 4314 Regulator Voltage Buck Boost
9. SVS 4386 Controller Power Transfer and Counter
10. SVS 4045 Connector Ambilical - Inflight Disconnect
11. SVS 4271 Relay AGE Instrumentation Transfer
12. NCS 1586 In Flight Disconnect
13. NCS 1536 In Flight Disconnect Squib
14. 242R105 Interunit Cabling Diagram
15. 242R106 Interconnection Diagram - E.P. & S.D. Subsystem
16. 201R869 Interconnection Diagram Environmental Control Subsystem
17. 201R871 Interconnection Diagram Separation Subsystem
18. 238R414 Schematic, Electrical, Orbit Correction Subsystem
19. 241R519 Schematic, Electrical, Attitude Sensing Subsystem
20. 242R310 Interconnection Diagram Telemetry Subsystem
21. 242R311 Interconnection Diagram Tracking & Command Subsystem
22. SVS 4419 E.P.&S.D. Subsystem Design Requirements

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 2.3

ORBIT ADJUST

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

Section 2.3

Subsystem Description: Orbit Adjust

Function:

Provide precision impulse bursts to effect orbit correction, orbit maintenance, cross range maneuver and OCV deboost.

Components

Name	Wgt.	Sta Loc	Quad
N_2 Tank	15.7	201	I
Fuel Tank	18.4	170	I
Oxidizer Tank	18.4	170	IV
Engines (2)	8.9ea	222.6	CL

Characteristic Data

Initial N_2 press 5000 psia
Initial N_2 weight 9.64 lbs
Initial Fuel weight 129.7 lbs
Initial oxidizer weight 187.5 lbs
Burst pressure 500 psi
Operating press 315 psi max
Thrust, per engine 50 lbs

Restrictions

Each engine red-lined to 10 minutes total operating time.
Maximum of 6 starts per engine.
Total impulse, 60,000 lb/sec

Associated Telemetry

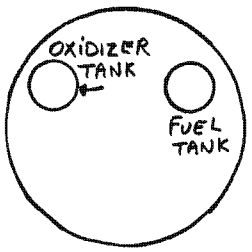
Item	Chan-Pin
Press. OCV N_2 Reg Inlet	30KC-19
Temp. OCV Oxidizer	10.5KC-14
Temp. OCV Fuel	10.5KC-20
Press. OCV Oxidizer	10.5KC-21
Press. OCV Fuel	10.5KC-22

Associated Commands

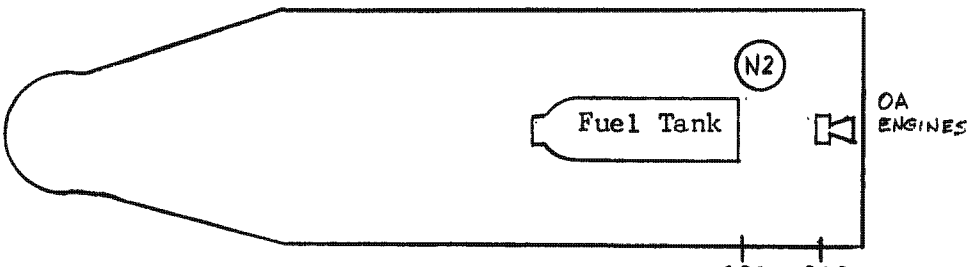
Function	Type	Series
Engines 1 & 2 On	DSPC-1	300
Engine 1 On	DSPC-1	300
Engine 2 On	DSPC-1	300
Engines Off	DSPC-5	300

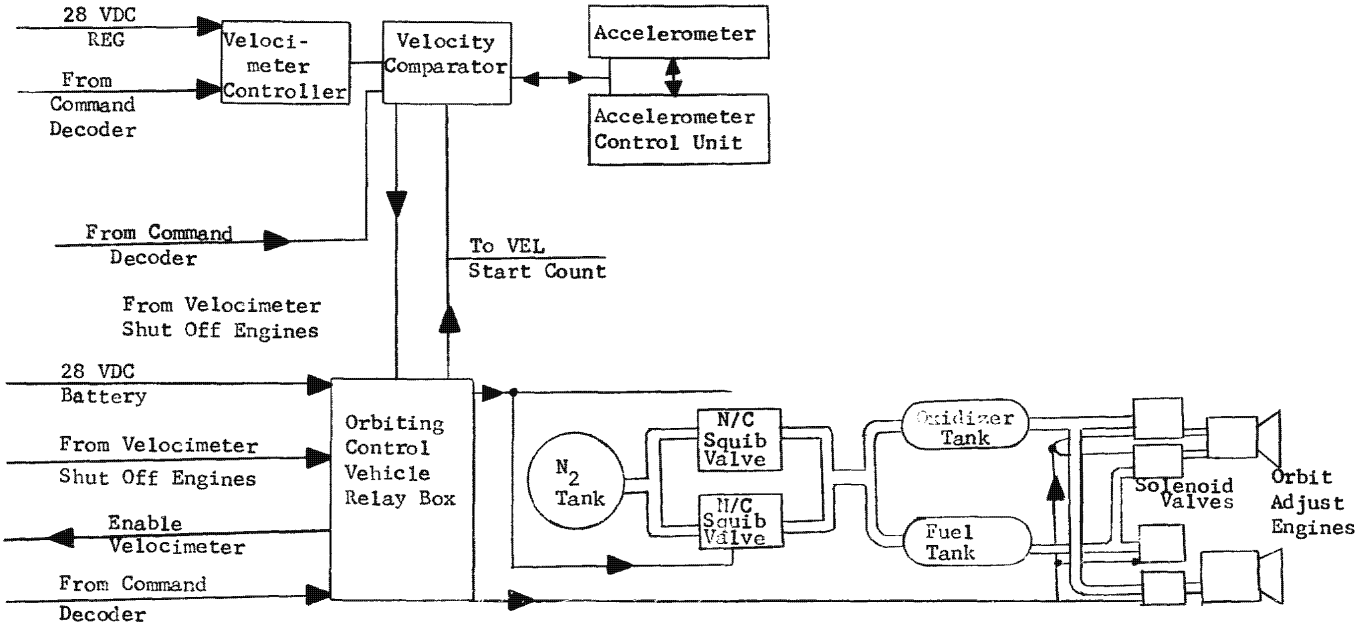
References

SVS 4423 Command Definition Spec
PL389L582G1 Component List Drawing



Station 181





Orbit Adjust Subsystem

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PROGRAM 206

MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 2.4

ATTITUDE CONTROL - PNEUMATICS

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK
Section 2.4

Subsystem Description: Attitude Control - Pneumatics

Function:

Provide calibrated pitch, yaw and roll thrust impulses for attitude stabilization.

Components

Name	Wgt.	Sta Loc	Quad
CF_4 Tanks (2)	41.5ea	217	I/IV
Hi Flow Elements	3.2	210	I-IV
Lo Flow Elements	3.2	210	I-IV

Note: Each element has nozzles for control of all three axes.

Characteristic Data

Initial cold gas pressure: 4800 psia
Initial cold gas temperature: 190°F
Initial cold gas weight: 215 lbs.
Thrust: Hi 71b Pitch & Yaw
41b Roll
Lo .8 1b Pitch & Yaw
.13 1b Roll
High Pressure regulated 0-600 psia

Restrictions

Gas supply is sufficient for ____ hours normal operation

Associated Telemetry

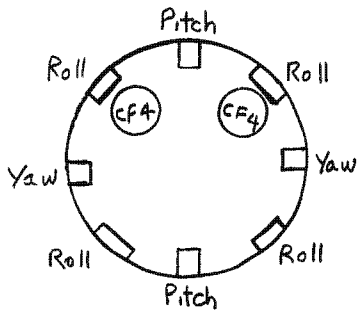
Item	Chan-Pin
Press. Cold Gas line	40KC-27
Temp. Cold Gas Line	30KC-9

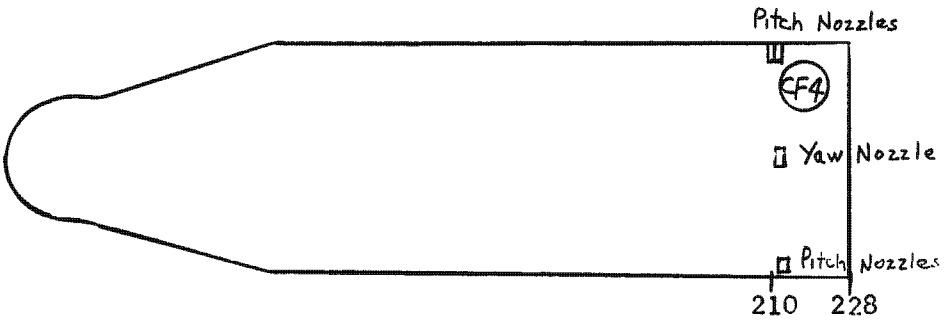
Associated Commands

Actuated by signal from Attitude Control-Electronics.

References:

Sect. 2.5 - Attitude Control - Electronics SVS
Drawing PL389L585G2 - Components List





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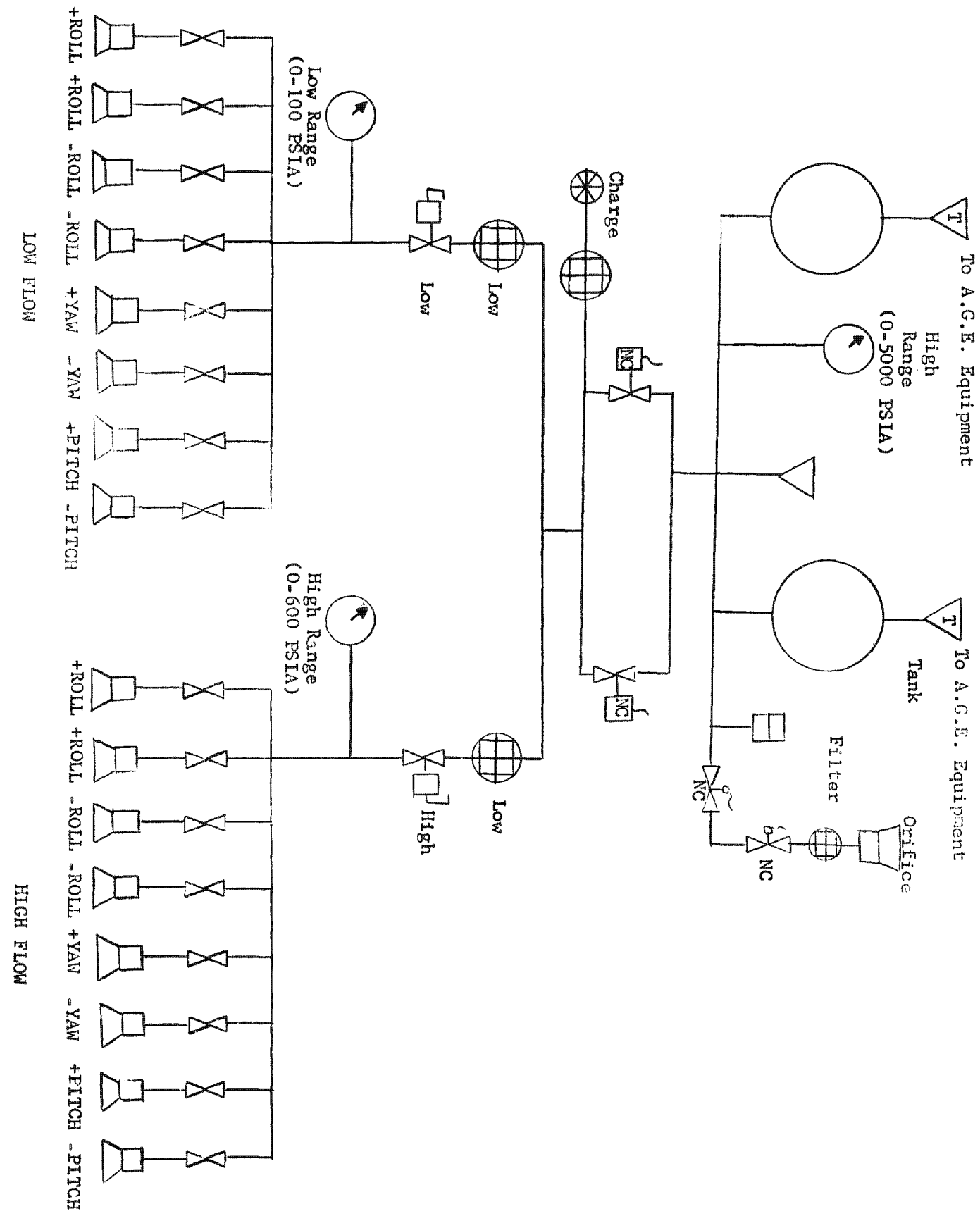

ATTITUDE CONTROL PNEUMATICS

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PROGRAM 206

MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 2.5

SUBSYSTEM DESCRIPTION: ATTITUDE CONTROL ELECTRONICS

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

Section 2.5

Subsystem Description: Attitude Control - Electronics

Function:

Sense vehicle attitude errors and rates in roll, pitch and yaw. Control the vehicle in attitude and rate about roll, pitch and yaw axis.

Components

Name	Wgt.	Sta Loc	Quad
IR Sensor (2)	4.4	220.0	II/III
IR Pre Amp (2)	4.0&4.8	204.1/194.1	II
Control Section	4.5	204.1	II
Computer Sect.	6.5	194.1	II
Compensator			
Platform	33.30	220.2	Bottom
Electronic Tars	19.4	218	Bet1&4
Summing Amplifier	2.1	202.1	III
PREDAC	6	202.1	I
Rate Gyro Pkg.	14.1	149	I&IV
Roll Maneuver Amp	4.0	132.8	IV
Roll Control Amp	6.5	132.8	I
Pitch Control Amp	6.5	164.1	I
Yaw Control Amp	6.5	164.1	IV
DC Power Supply	33.0	198.9	III
AC Power Supply	4.0	195.5	I

Characteristic Data

AC Power Supply-11.25w,Buck Boost 27.75 VDC Phase I
AC Power Supply-34.8w,Buck Boost 27.75VDC Phase II
IR Pre Amp-2.0w,2o,400cps,0.15w,±26VDC
Platform-10.5w,3o,400cps;1.75w,±26VDC
IR Sensors-9.0w AC Power,26V,400cps; Battery 1.5w,27 to 32.5VDC
Control Section - 2.45w ± 24.5VDC
Computer Section - 0.7w ± 24.5VDC
PREDAC - 0.5w,+10VDC;0.25w,Buck Boost 27.75VDC
Roll Maneuver Amp-1.23w,±24.5VDC

Associated Telemetry

Item	Chan-Pin
Gyro Roll Rate Out. Fine	2.3KC
Gyro Pitch Rate Out.Fine	3.9KC
Gyro Yaw Rate Out. Fine	3.0KC
L. H. Preamp Out.	
R. H. Preamp Out.	
Roll Att. Error	22KC-7/22
Pitch Attitude Error	22KC-8/23
Yaw Attitude Error	22KC-9/24

Restrictions

Non-Compatible Commands

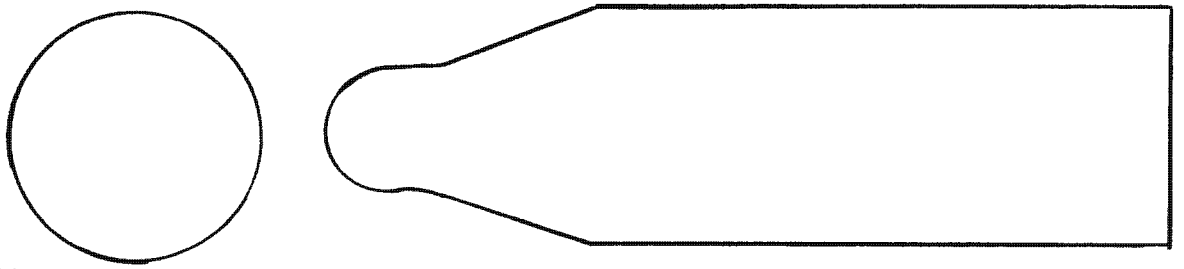
1. Hi thrust - Rate Roofs On
2. Enable Hi or Mid-Roll Rate - Coarse Limit Cycle (Roll)
3. Pitch Command - Roll Command (non-zero commands)
4. Yaw Torquing - Fine Limit Cycle(Yaw)
5. Fly Backwards - Rate Roofs On(Pitch)
6. IR Off once IR has been turned on
7. Disable ACA's once ACA's have been enabled.

Command Capability

Roll +45° to -45°
Pitch 0° or pitch down (-58°)

Associated Commands:

Function	Type	Series
Yaw,pitch,roll levels low; deadbands coarse	DSPC-4	300
Yaw level low,pitch & roll level high;yaw	DSPC-4	300
Yaw,pitch & roll levels high; deadbands coarse	DSPC-4	300



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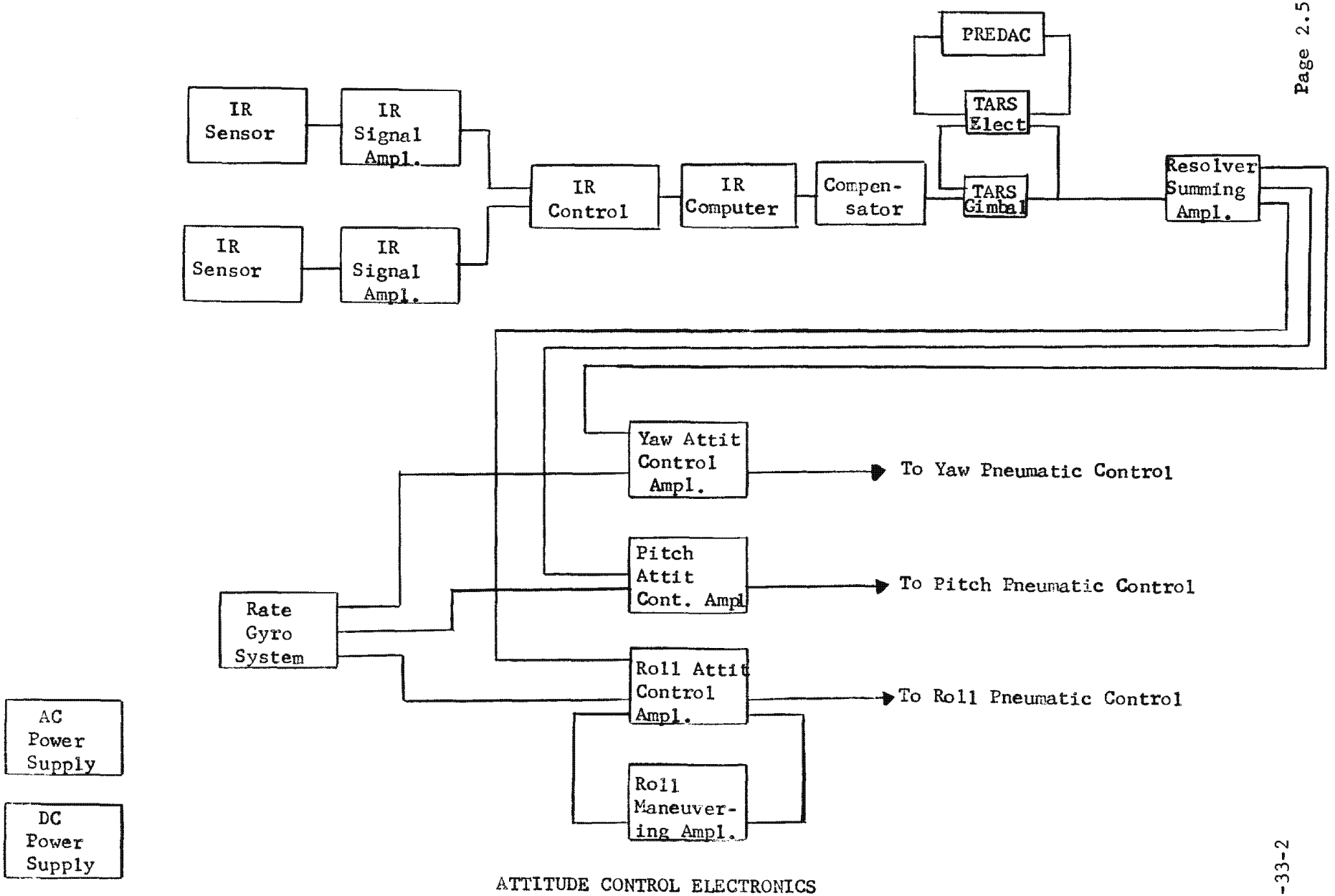

ATTITUDE CONTROL ELECTRONICS

SUBSYSTEM

ATTITUDE CONTROL (ELECTRONICS)
REFERENCES

1.	SVS 3964	Attitude Control Subsystem Specification
2.	SVS 4361	Component Specification - Mk II Scanners
3.	SVS 4347	Component Specification - Mk II Scanners
4.	SVS 4371	Component Specification - IR Electronics
5.	SVS 4372	Component Specification - IR Electronics
6.	SVS 4370	Component Specification - IR Electronics
7.	SVS 4367	Component Specification - IR Electronics
8.	SVS 4128A	Component Specification - DC Power Supply
9.	SVS 4161	Component Specification - ACA
10.	SVS 4162	Component Specification - RMA
11.	SVS 143A	Component Specification - TARS
12.	SVS 4363	Component Specification - CPS
13.	SVS 4105B	Component Specification - Compensator
14.	SVS 4374	Component Specification - PREDAC
15.	SVS 4278	Component Specification - RAGS
DIN	248E737	Power, Weight and Temperature Diagram
	248E738	Power, Weight and Temperature Diagram

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 2.6

TELEMETRY

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK
Section 2.6

Subsystem Description: Telemetry

Function:

Transmit information to the ground in both real time and delayed playback on vehicle status and events.

Components

Name	Wgt.	Sta Loc	Quad
VHF Antennas(2)	5.6	56.9	II III
Power Amplifiers(2)	2.1	74.3/78	III
Transmitters(2)	2.2	76.1/80	III
HV Power Supply(2)	2.7	77.6	IV II
SCO Bases(6)	8.2	78.9/75.3	III
Multiplexers(4)	6.5	77.4/150.0	II III
Recorder	12.3	68.4	II III

Characteristic Data

Multiplexers 40ma@28V,1120mw power, Temp. 0-160°
Power Amp. Input 300VDC, 6.3VAC, Temp. 0-160°F
Recorder Op. Temp Range 0 to 120°F
SCO Base Op. Temp. Range -10° to 160°F
Transmitter Carrier 225 to 260mc
Transmitter Temp Op. Range 0 - 160°F

Restrictions

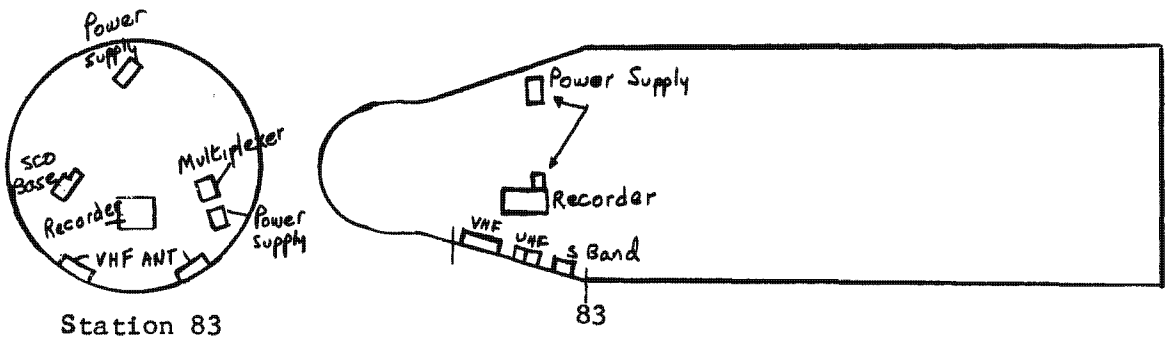
Alternate mode for command verification and vehicle clock time cannot be obtained when playback takes place.
No command inputs during powered flight.

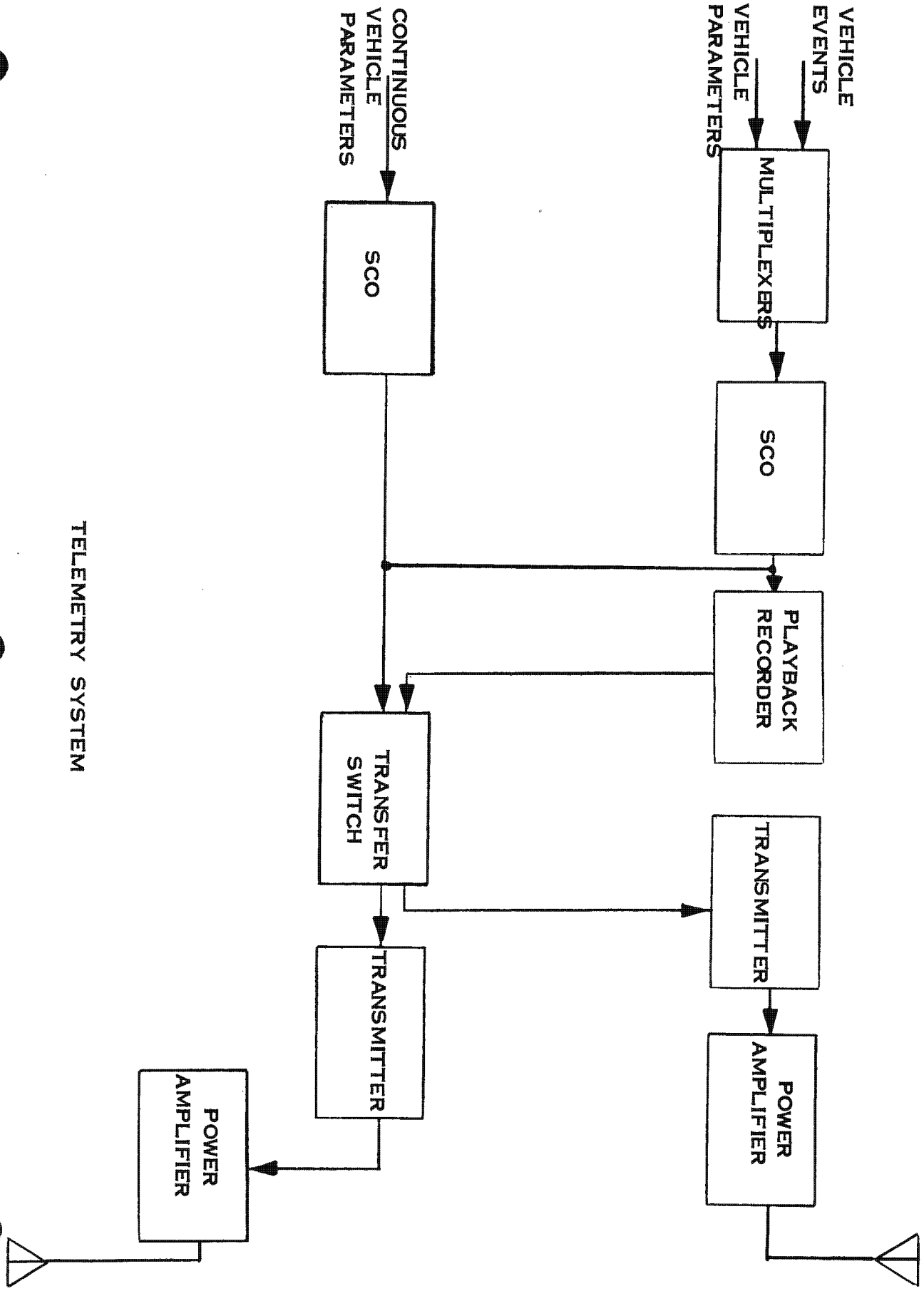
Associated Telemetry

Item	Chan-Pin
No A or B priority items	

Associated Commands

Function	Type	Series
TM Transmitters Normal Mode	RTC	0-100
TM Transmitters Reverse Mode	RTC	0-100
TM Transmitters ON	SSPC-2	200
TM Orbital Mode	DSPC-5	300
TM Powered Flight Mode	DSPC-5	300
Recorder On	DSPC-4	300
Recorder Off	DSPC-4	300





TELEMETRY SYSTEM

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TELEMETRY SUBSYSTEM REFERENCES

1. Command & Telemetry Subsystem Capability, Doc. #4533-45-1, AF-76
2. System Design Requirements for TT&C System, SVS 3969, AF-76
3. Block Diagram Telemetry Subsystem, Document #254E184, AF-76
4. VHF Telemetry Antenna, Specification SVS 4421, Program 206
5. RF Bandpass Filter, Specification SVS 4388, Program 206
6. RF Power Amplifier, Specification SVS 4284, Rev. A, Program 206
7. High Voltage Power Supply, SVS 4119, Revision A, Program 206
8. FM/TM Telemetry Transmitter, Specification SVS 4281, Rev. A, Prog. 206
9. Transfer Switch, Specification SVS 4113, Rev. B, Program 206
10. Subcarrier Oscillator Base Assembly, Specification SVS 4126, Rev. A, Program 206
11. 30 x 5 Mulitplexer, Specification SVS 4115, Rev. A, Program 206
12. 30 x 2.5 Multiplexer, Specification SVS 4116, Rev. A, Program 206
13. 90 x 1/18 Multiplexer, Specification SVS 4117A, Program 206
14. Recorder Reproducer Assembly, Specification SVS 4020-A, Program AF-76
15. Telemetry Allocations, Document #4583-12-1, Program 206

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 2.7

SUBSYSTEM DESCRIPTION: TRACKING

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

Section 2.7

Subsystem Description: Tracking

Function:

Provide tracking data for locating vehicle position and for determining ephemeris of vehicle.

Components

Name	Wgt.	Sta Loc	Quad
S-Band Beacon	12.3	76.2	III
S-Band Antenna	0.8	78.7	II-III

Characteristic Data

S-Band Verlort
- 1.4 Amps @ 28 volts
- 38 watts Power
- Operating Temperature Range 0-160°F

Associated Telemetry

Item	Chan-Pin
Temp. S-Band Beacon	30KC-6
S-Band Beacon Interrogate	30KC-7
S-Band Beacon Transmit	30KC-8

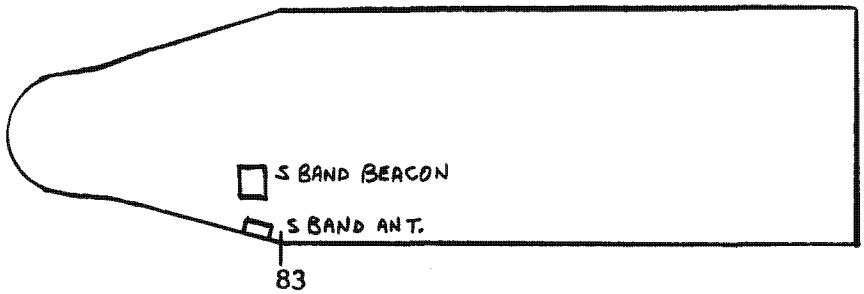
Associated Commands

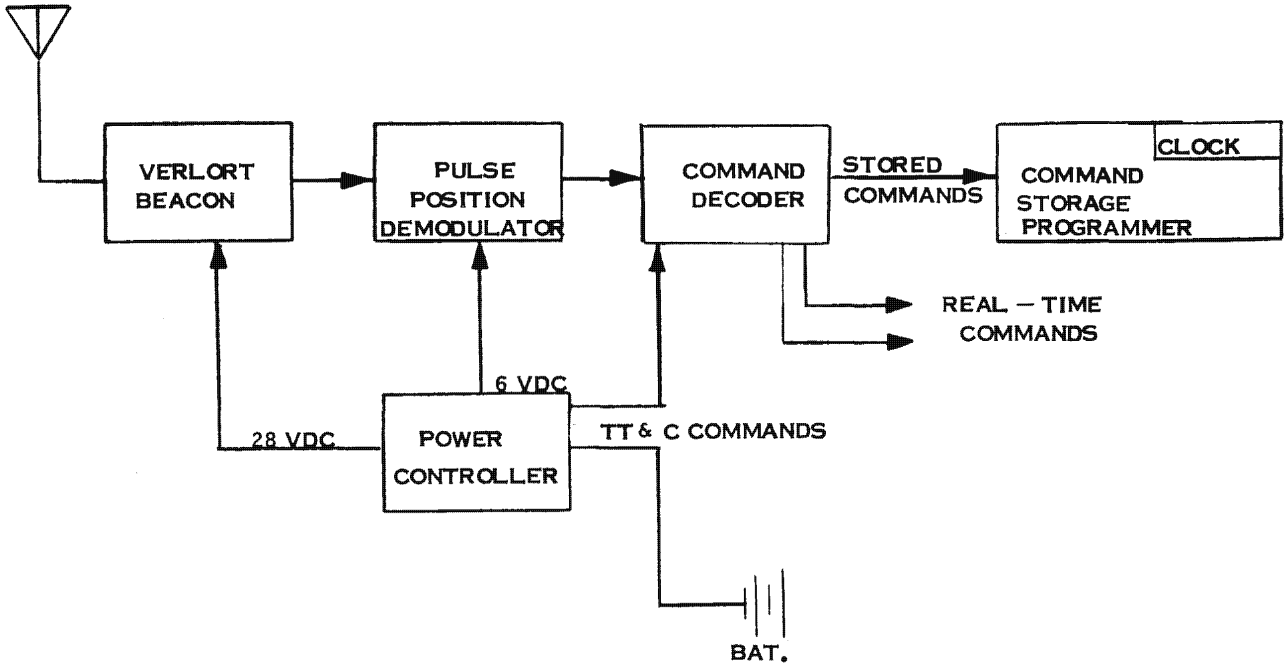
Function	Type	Series
Transmitter On	SSPC-2	200
Transmitter Off	SSPC-2	200

Restrictions

Later

Station 83





TRACKING AND COMMAND SUBSYSTEM

TRACKING SUBSYSTEM REFERENCES

1. System Design Requirements for TT&C System, Spec SVS-3969, Program 206, GE/MSD, Philadelphia, Pa.

2. S-Band Verlort Beacon, Spec SVS-4285-A, Program 206, GE/MSD Philadelphia, Pa.

3. S-Band Pulse Beacon Antenna, Spec SVS-4422, Program 206, GE/MSD, Philadelphia, Pa.

4. Changes to C&I Subsystem in 206 Vehicle, Doc. #4533-14-1, Program AF-76, GE/MSD, Philadelphia, Pa.

5. Command Format Appendix F, SVS-3969, Doc. #4411-49-5, Program AF-76, GE/MSD, Philadelphia, Pa.

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25 February 1963

PROGRAM 206

MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 2.8

COMMAND

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK
Section 2.8

Subsystem Description: Command

Function:

Provides stored and real time commands to the vehicle for controlling all subsystems from powered flight through OCV/RV Separation.

Components

Name	Wgt.	Sta Loc	Quad
S-Band Pulse Beacon Ant(2)	1.9	72	II III
S-Band Verlort Beac	12.3	76.2	III
Pulse Position Demod	2.8	78	III
6V Power Supply	3.6	152	IV
Command Decoder	49.0	183.7	I
Programmer	30.5	184	IV
Power Controller	7.2	77.9	I
Relay Box	6.7	185.6	IV

Characteristic Data

Later

Restrictions

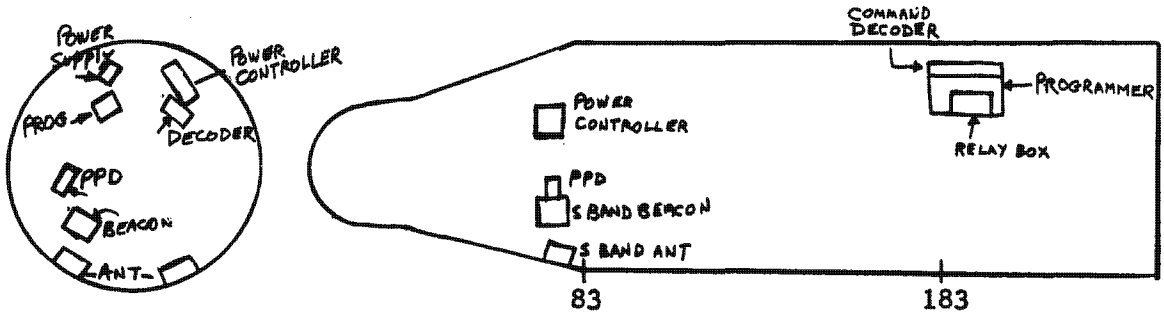
Command link is vulnerable to jamming.

Associated Telemetry

Item	Chan-Pin
Temp. S-Band Beacon	30KC-6
S-Band Beac. Interr.	30KC-7
S-Band Beac. Transmit	30KC-8
Secure Word Count	40KC-6to12
Command Verification	52.5KC/70KC
Delay Line 1&2 Full	40KC-13
Delay Line 3&4 Full	40KC-14
Delay Line Erase Mon.	7.35KC
Program Word Line	7.35KC
Vehicle Clock Time	70KC

Associated Commands

All real time and stored program commands.



Station 183

Schematic

Refer to page 2.7 - 2

COMMAND SUBSYSTEM REFERENCES

1. System Design Requirements for TT&C System, Specification SVS 3969, Program 206, GE/MSD, Philadelphia

2. Command Format - Appendix F, SVS 3969, Document #4411-49-5, Program AF-76, GE/MSD, Philadelphia

3. Changes to C&I Subsystem, in 206 Vehicle, Document #4533-14-1, Program AF-76, GE/MSD, Philadelphia

4. S-Band Pulse Beacon Antenna, Specification SVS 4422, Program 206, GE/MSD, Philadelphia

5. S-Band Verlort Beacon, Specification SVS 4285-A, Program 206, GE/MSD, Philadelphia

6. Pulse Position Demodulator, Specification SVS 4120, Program 206, GE/MSD, Philadelphia

7. Pulse Position Demodulator Performance Section of SVS 4120, Document #4498-17-5

8. Power Controller, Specification SVS 4118, Program 206, GE/MSD, Philadelphia

9. Command Decoder Relay Box, Specification SVS 4112-A, Program AF-76, GE/MSD, Philadelphia

10. Power Supply G Volt, Specification SVS 4111 Revision A, Program AF-76, GE/MSD, Philadelphia

11. Command Programmer, Specification SVS 4290, Program 206, GE/MSD, Philadelphia

12. Component Requirements for Command Decoder, Specification SVS 4122, Program 206, GE/MSD, Philadelphia

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21 February 1963

PROGRAM 206

MALFUNCTION ANALYSIS REFERENCE BOOK

Contract AF04(695)-76

Section 3.1

Operational Telemetry List

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry List

Chan.	Pin	Item	Limits % F.S. Oper'l Lo	Oper'l Hi	Critical Lo	Critical Hi	S/S Sect.	Malf. Anal. Sect.
40KC (Adapt)	12	Separation #1 1 B+ to Baroswitch 2 Baroswitch closed 3 Door ejected					2.10	5.17
	13	Separation #2 1 Baroswitch closed 2 S&A Devices 1&2 armed 3 Pin Pullers actuated					2.10	5.17
40KC	6-12	Secure Word Count	Mission Dependent				2.8	5.15
	13	Delay Line 1 & 2 full Delay Line 1 full Delay Line 2 full Delay Line 1&2 not full	95-100 = full 55-65 = full 35-45 = full 0-20 = not full				2.8	5.12
	14	Delay Line 3 & 4 full Delay Line 3 full Delay Line 4 full Delay Line 3&4 not full	95-100 = full 55-65 = full 35-45 = full 0-20 = not full				2.8	5.12
	19	Ampere Hour 0-30	Mission Dependent				2.2	5.1
	20	Ampere Hour 0-120	Mission Dependent				2.2	5.1
	21	Ampere Hour 0-480	Mission Dependent				2.2	5.1
	22	Separation #7 1 B+ to Controller 2 Hitchup Command 1(ready) 3 Agena/OCV I.F.D.					2.10	5.18
	26	Volt. OCV Battery	Mission Dependent				2.2	5.1
	27	Press. Cold Gas Line Hitchup OCV Solo					2.4	5.6

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry List

Chan.	Pin	Item	Limits % F.S. Oper'l Lo	Oper'l Hi	Critical Lo	Critical Hi	S/S Sect.	Malf. Anal. Sect.
30KC	6	Temp. S-Band Beacon					2.7	5.11/5.15/5.16
	7	S-Band Interrogate PRF 410 PRF 512 PRF 585 PRF 610 Verlort PRF 630 Prelort					2.7	5.11
	8	S-Band Transmit PRF 410 PRF 512 PRF 585 PRF 610 PRF 630					2.7	5.11
	9	Temp. Cold Gas Line					2.4	5.6/5.7
	10	Separation #4 1 Squibs 3&4 fired 2 Arm Signal Initiated 3 SV/Agena Separation					2.10	5.17/5.18
	13	Separation #5 1 Baroswitch Closure 2 Event 3&4 Occurred (break wire) 3 Transfer Signal to Separation Programmer					2.10	5.17/5.18
	14	Separation #6 1 Hitch-up Command 2 (fire Squibs 3&4 and Pre-arm Signal to Separation Programmer) 2 Hitch-up Command 3 (Arm & Transfer Signal to Separation Programmer) 3 Hitch-up Command 4 (Separation)					2.10	5.18

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry List

Chan.	Pin	Item	Limits % F.S. Oper'l Lo	Oper'l Hi	Critical Lo	Critical Hi	S/S Sect.	Malf. Anal. Sect.
30KC	17	Separation 3 1 Baroswitch closed 2 Safe and Arm Devices 3 & 4 armed 3 Pre-Arm Signal to Separation Programmer 4 Squibs 1 & 2 fired					2.10	5.17
	18	Voltage Programmer Backup Battery					2.2	5.2
	19	Press. OCV N_2 Reg. Inlet					2.3	5.3
	20	Current, Battery #1	Mission Dependent				2.2	5.1
	21	Current, Battery #2	Mission Dependent				2.2	5.1
	22	Current, Battery #3	Mission Dependent				2.2	5.1
	23	Current, Battery #4	Mission Dependent				2.2	5.1
	24	Current, Battery #5	Mission Dependent				2.2	5.1

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry List

Chan.	Pin	Item	Limits % F.S. Oper'l Lo	Oper'l Hi	Critical Lo	Critical Hi	S/S Sect.	Malf. Anal. Sect.
22KC	1,16	GFE 1-21					GFE	
	2,17	GFE 1-22					GFE	
	3,18	GFE 1-23					GFE	
	4	H 30 Continuity & Events 1 Ground Straps Cut 2 Recovery System On					2.12	5.18
	7,22	Roll Attitude Error Fine Deadband Coarse Deadband					2.5	5.5/5.7/5.8
	8,23	Pitch Attitude Error Fine Deadband Coarse Deadband					2.5	5.5/5.7/5.8
	9,24	Yaw Attitude Error Fine Deadband Coarse Deadband					2.5	5.5/5.7/5.8 5.10
	14	GFE 1-3					GFE	
	19	GFE 1-20					GFE	
	20	GFE 1-27					GFE	

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry List

Chan.	Pin	Item	Limits % F.S. Oper'l Lo	Oper'l Hi	Critical Lo	Critical Hi	S/S Sect.	Malf. Anal. Sect.
10.5KC	2,17	GFE 1-17					GFE	
	6	GFE 1-5					GFE	
	7	GFE 1-13					GFE	
	8	GFE 1-14					GFE	
	9	Temp., Vehicle Sta 84	70	78			2.9	5.16
	10	GFE 2-15					GFE	
	11	GFE 1-18					GFE	
	13	GFE 2-26					GFE	
	14	Temp., OCV Oxidizer					2.3	5.4/5.16
	16	Temp., Vehicle Sta 104.385 @ 90°	70	78			2.9	5.16
	20	Temp., OCV Fuel					2.3	5.4/5.16
	21	Press., OCV Oxidizer Hitch-up Engine not firing Engine firing					2.3	5.4
	22	Press., OCV Fuel Hitch-up Engine not firing Engine firing					2.3	5.4
	23	Temp. Vehicle Sta 104.385 @ 270°	70	78			2.9	5.16
	26	Temp. Vehicle Sta 104.385 @ 180°	70	78			2.9	5.16
	28	Environmental Panel Closed Open					2.9	5.16

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry List

Chan.	Pin	Item	Limits % F.S. Oper'l Lo	Oper'l Hi	Critical Lo	Critical Hi	S/S Sect.	Malf. Anal. Sect.
2.3KC	cont	Gyro Roll Rate Output Fine Fine Coarse					2.5	5.4/5.5/5.7
3.0	cont	Gyro Yaw Rate Output Fine Fine Coarse					2.5	5.4/5.5/5.7
3.9	cont	Gyro Pitch Rate Out. Fine Fine Coarse					2.5	5.4/5.5/5.7
7.35	cont	Delay Line Erase Mon. Delay Line 1 2 3 4					2.8	5.12/5.15
7.35	cont	Prog. Word Line Line 1 2 3 4					2.8	5.15
52.5	cont	Command Verification Accept Reject					2.8	5.15
70KC (258.5MC)	cont	Command Verification Back-up Accept Reject					2.8	5.15
70KC (248.6MC)	cont	Vehicle Clock Time	Mission Dependent				2.8	5.2/5.13
70KC (258.5MC P.F.)	cont	Vehicle Clock Time	Mission Dependent				2.8	5.2/5.13

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Re-entry 242 MC

Chan.	Pin	Item	Limits % F.S. Oper'l Lo	Oper'l Hi	Critical Lo	Critical Hi	S/S Sect.	Malf. Anal. Sect.
3.9KC	cont	Transfer OCV/RV I.F.D.					H30	
		Spin (breakwire)						
		Retro-fire (breakwire)						
		De-spin						
		Recovery Batt. #1						
		3g Switch close						
		3g Switch open						
		Parachute piston #1 fire						
		Forebody Separation						

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21 February 1963

PROGRAM 206

MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 3.2

Operational Telemetry Data

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Separation # 1

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
	40 KC			
248.6	30x5	12	5.17	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Separation # 2

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
248.6	40 KC 30x5	13	5.17 ; 5.18	

MALFUNCTION ANALYSIS REFERENCE BOOK

Item: Secure Word Count

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6	40KC(30x5)	6-12	5.14	Page

Ref: C&CS Operational Procedures (Milestone 7)

Sensor Location:

Description: There are 127 positions in the secure word plug. The selection of the position is accomplished through a secure word index register which advances one position each time the pulse position demodulator is commanded on. All engine operations and terminal separation commands must be accompanied by the correct secure word key consisting of seven bits.

An error in the secure word count as indicated by reference to the number of times that the pulse position demodulator has been commanded on might indicate a malfunction in the index register or unauthorized access to the command link. See referenced malfunction analysis.

To be read as frequently as possible; definitely, before secure command is to be used.

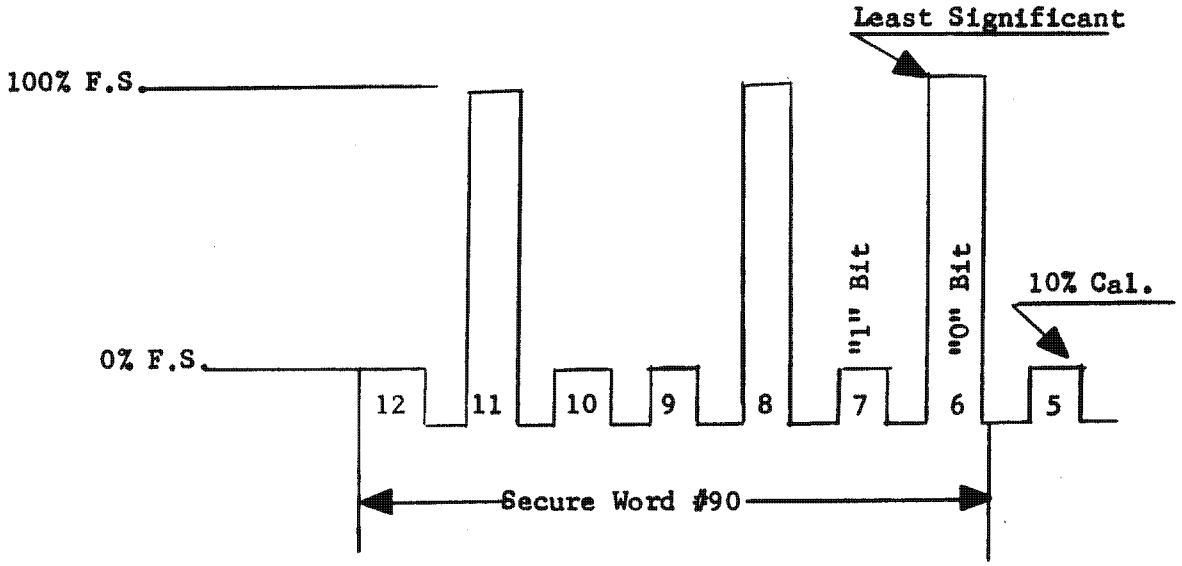
Limit: Function of number of times that pulse position demodulator has been commanded on prior to reading.

Associated Commands:

PPD ON-212, 213, 217, 218, 232, 233, 237, 238

Alternate Indicator: None

Signal Characteristic: Binary return to zero with "1" bit represented by 0% F. S. and "0" bit represented by 100% F. S. Least significant bit appears on pin 6, most significant on pin 12.



MALFUNCTION ANALYSIS REFERENCE BOOK

Item: Delay Line 1 and 2 Full

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6	40KC(30x5)	13	5.14	Page

Ref: C&CS Operational Procedures (Milestone 7)

Sensor Location: Command Decoder Sta. 183.7 Quad. I

Description: A full indication for the associated delay line is generated when the 99th word is loaded.

Normally a maximum of 98 words will be loaded into any one delay line so that a delay line full indication will indicate a malfunction. On occasion, however, the command structure might require that 99 words be loaded into a delay line so that reference should first be made to the command message before a malfunction is assumed.

Should be read whenever commands are loaded.

Critical Limit: Not applicable, see description.

Associated Commands:

Delay Line Select - RTC 1, 2

Delay Line Erase - Hybrid #501 and any combination of stored program commands which loads a line with 99 words.

Associate Indicators:

Program Word Line	7.35KC	continuous
Delay Line Erase	7.35KC	continuous
Vehicle Clock Time	70 KC	continuous

Signal Characteristics:

Delay Line 1 & 2 Not Full	0% - 20% F. S.
Delay Line 1 Full	55% - 60% F. S.
Delay Line 2 Full	35% - 45% F. S.
Delay Line 1 & 2 Full	95% - 100% F. S.

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: Delay Line 3 & 4 Full

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6	40KC(30x5)	14	5.14	Page

Ref: C&CS Operational Procedures (Milestone 7)

Sensor Location: Command Decoder Sta. 183.7 Quad. I

Description: A full indication for the associated delay line is generated when the 99th word is loaded.

Normally a maximum of 98 words will be loaded into any one delay line so that a delay line full indication will indicate a malfunction. On occasion, however, the command structure might require that 99 words be loaded into a delay line sothat reference should first be made to the command message before a malfunction is assumed.

Should be read whenever commands are loaded.

Critical Limit: Not applicable, see description.

Associated Commands:

Delay Line Select - RTC 3, 4

Delay Line Erase - Hybrid #501 and any combination of stored Program commands which loads a line with 99 words.

Associate Indicators:

Program Word Line	7.35KC	continuous
Delay Line Erase	7.35KC	continuous
Vehicle Clock Time	70 KC	continuous

Signal Characteristics:

Delay Line 3 & 4 Not Full	0% - 20% F. S.
Delay Line 3 Full	55% - 65% F. S.
Delay Line 4 Full	35% - 45% F. S.
Delay Line 3 & 4 Full	95% - 100% F. S.

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: Ampere-Hour Total

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6	40KC	19-21	5.1	Page

Sensor Location: Sta. 154 Quad. III

Description: Indicates the total battery usage up to time of readout.

Pins 19, 20, 21 should be read at same time and summed to determine total ampere-hour usage. Register resets to zero at 640 A-H and then recycles. Record of recycles should be kept since batteries have a useful life of approximately 1900 ampere-hours when buck-boost regulator is used and approximately 1575 ampere-hours without the regulator.

Provides a measure of remaining battery capability.

Should be read once per orbit.

Critical Limit: If a maximum of 26.4 ampere-hours are consumed during one orbit or significantly more than 21 amp. hrs. have been consumed on each of four or more consecutive orbits, it is assumed that a malfunction exists.

Associated Commands:

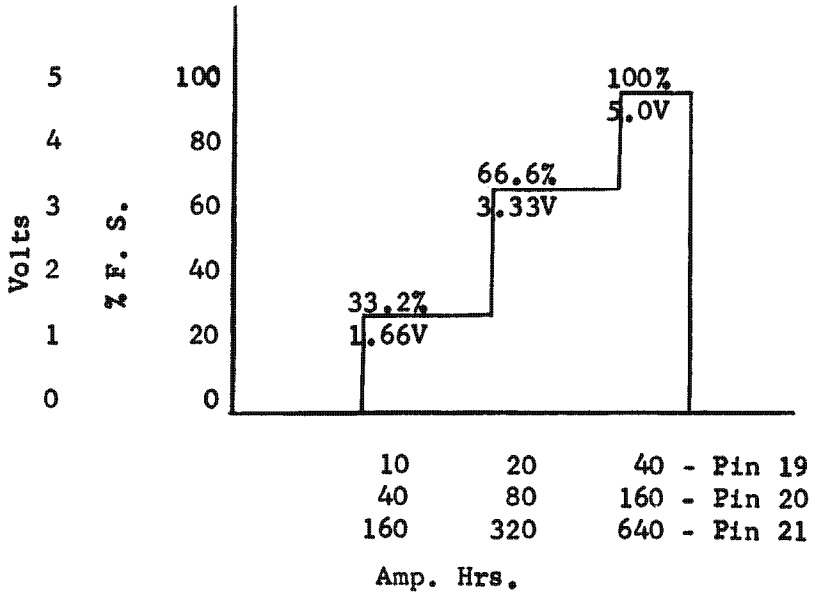
Not applicable since all commands will affect current levels.

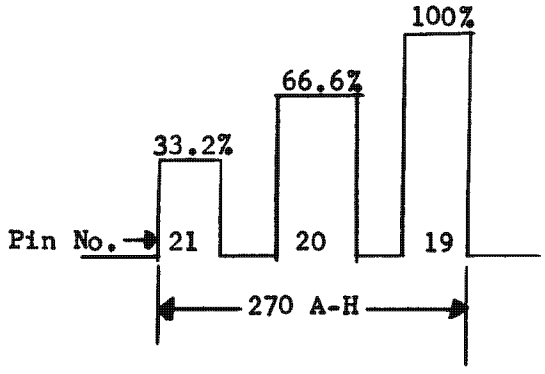
Alternate Indicators:

Voltage OCV Battery 40 KC (30 x 5) Pin 26

Current Operational Battery Total 30 KC (30 x 5) Pin 16

Current Operational Battery 1 - 5 30 KC (30 x 2.5) Pin 20-24





Sample Decomm. Trace

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: Separation #7

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6MC	40KC(30x5)	22	5.18	

Sensor Location: Separation Auxiliary Controller

Description: Monitors Separation Command #1 from Agena or Life-Boat to the Separation Auxiliary Controller and also monitors the Agena/OCV in flight disconnect.

Separation Command #1 energizes a relay (K1) in the Auxiliary Controller which provides the TM indication of this event and also triggers the silicon controlled rectifier in the separation controller associated with Disconnect #1.

Should be monitored and voice transmitted at time of occurrance.

Limit: Variations in the Signal Characteristic (below) will occur if events are not in proper sequence or if there is a malfunction associated with these events.

Associated Commands: Agena Commanding: Event 2 Command #1

Life-Boat Commanding: Event 2 E or G Tone + Secure Word + To

OCV Commanding: Event 3 Commands 344 or 370

Associated Indicators:

for Event 1 - Separation #1 Event 2 40KC Adapter Pin 12

for Event 1&3 Separation #2 Event 1&2 40KC Adapter Pin 13

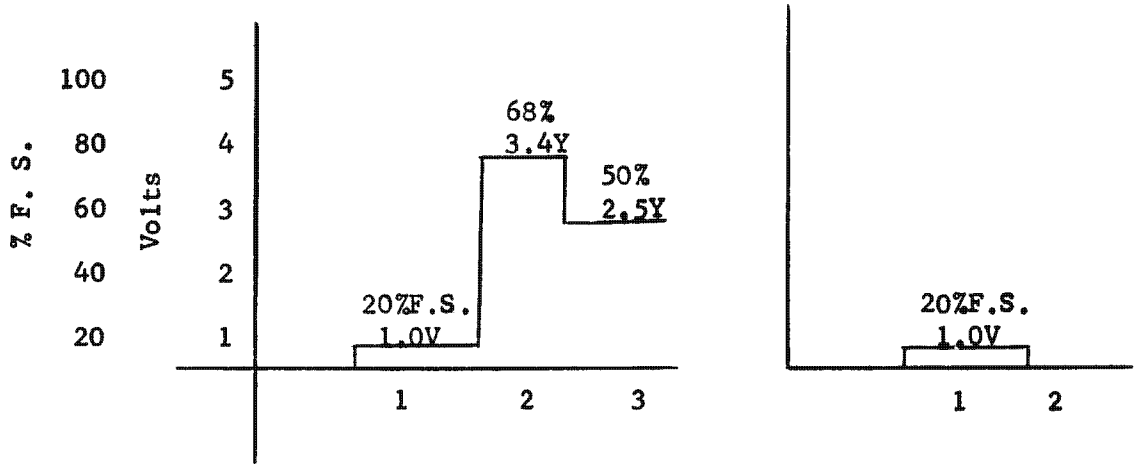
for Event 1&3 Separation #3 Event 1&4 30KC OCV Pin 17

Associated Indicators: (cont'd)

for Event 3 Separation #4 Events 30KC OCV Pin 10

for Event 2 H-30 Continuity & Events 22KC OCV Pin 4

Signal Characteristics:



Event 1 - Baroswitch Closure
2 - Command #1
3 - AG/OCV I.F.D.

Agena or Life-Boat Commanding

Event 1 - Baroswitch Closure
Event 2 - Ag&OCV I.F.D.

OCV Commanding

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry List

Item: Voltage of OCV Battery

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6MC	40KC(30x5)	26	5.1	

Sensor Location:

Description: Monitors voltage of the main battery bus. Provides, in conjunction with Ampere-Hour readings, an indication of battery condition. See battery profile below. Should be read periodically and sent via TWX to STC.

Limit:

Mission dependent however batteries are close to end of life when voltage drops below 27.0 V.

Associated Commands:

Not applicable.

Associated Indicators:

Ampere Hour totals 40KC Pins 19 - 21

Temp. of Operational Batteries 5.4KC Pins 80 - 84

Signal Characteristics:

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: Press Cold Gas Line

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6MC	40KC(30x5)	27	5.6	

Sensor Location:

Description: Measures pressure of gas used for attitude stabilization. Attitude control system will not be activated during Hitch-up phase of flight. Pressure should remain constant during this phase except for drop due to temperature drop. Tanks are heated on pad only. Attitude control system will be activated 1.2 seconds after Agena/OCV separation. After separation pressure decrease will be function of type of control commanded. Gas usage is higher during fine limit cycle. Yaw around, pitch down and other maneuvers will increase rate of usage.

Pressure readings can be used to calculate remaining impulse.

Should be read in frequently during Hitch-up and as frequently as practicable during OCV solo.

Limit: Hitch-up

OCV Solo

Associated Commands: A.C. Press On - 372

A.C. On, TM Orbital - 347

Other commands for maneuvers and limit cycles will affect rate of drop.

Associated Indicators:

Temp. Cold Gas Line 30KC Pin 9

Press Regulator Lo Output 5.4KC Pin 15

Press Regulator Hi Output 5.4KC Pin 16

Temp Cold Gas Tank @ 38°R-7.75 5.4KC Pin 35

Temp Cold Gas Tank @ 321°R-7.75 5.4KC Pin 36

Signal Characteristics:

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: Temperature, S-Band Beacon

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6MC	30KC(30x2.5)	6	5.11,5.15,5.16	

Sensor Location:

Description: Measures internal temperature of S-Band Beacon. Frequency of beacon is a function of this temperature, varying .1 MC per ^{o}C from nominal temperature of 25^{o}C (77^{o}F). Should be read whenever beacon is on and voice transmitted to STC.

Limit:

Associated Commands:

T-ON-SSPC2 Bit 31

Associated Telemetry:

S-Band Interrogate	30KC	Pin 7
S-Band Transmit	30KC	Pin 8

Signal Characteristics:

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: S-Band Interrogate

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6MC	30KC(30x2.5)	7	5.11	

Sensor Location: S-Band Beacon

Description: Output of a pulse integrator which measures pulse rate received by beacon. Provides measure of proper reception or interference when compared with rate of ground transmission. Beacon has a pulse repetition frequency (PRF) 400-1600pps when tracking only and in conjunction with programmer can accept a PRF of 400-____ when commands are transmitted. This compares to the PRF's available from Verlort and Prelort as follows:

Verlort: 410, 512, 584, 610

Prelort: 410, 512, 585, 630

Should be monitored whenever beacon is on and voice transmitted to STC.

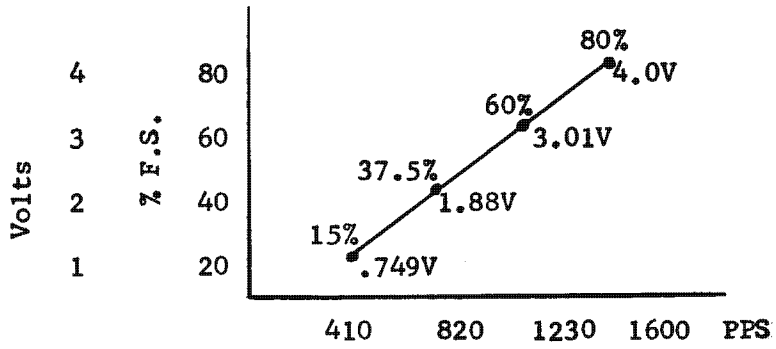
Limit: Dependent on PRF used. Compare signal to calibration curve and PRF being used.

Associated Commands: T-ON-SSPC 2 Bit 31

Associated Telemetry: Temp, S-Band Beacon 30KC Pin 6

S-Band Transmit 30KC Pin 8

Signal Characteristics:



The above curve is a nominal calibration curve. Specific calibration curve is in referenced Cal. Book. The points indicated on the curve represent calibration points.

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: S-Band Interrogate

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6MC	30KC(30x2.5)	8	5.11	

Sensor Location: S-Band Beacon

Description: Output of pulse integrator which measures pulse rate transmitted by beacon. Provides a means for determining proper beacon response to interrogation when compared to S-Band Beacon Interrogate 30KC Pin 7 and rate of ground transmission. Beacon can respond to pulse repetition frequency (PRF) of 400-1600 pulses per second when tracking only and in conjunction with programmer can accept a PRF of 400-___ pps when commands are transmitted.

Should be monitored whenever beacon is on and voice transmitted to STC.

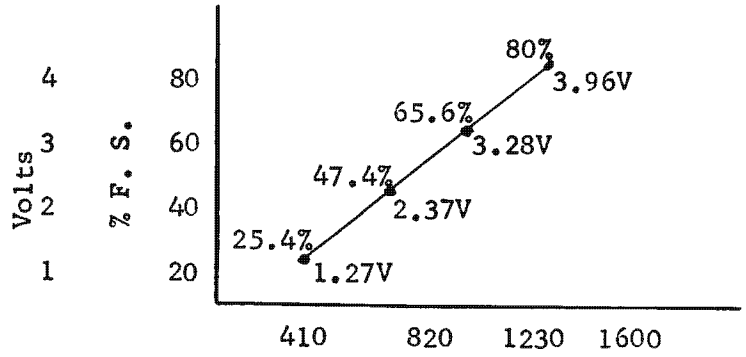
Limit: Dependent on PRF transmitted. Compare Signal to Calibration curve and PRF used.

Associated Commands: T-ON-SSPC 2 Bit 31

Associated Telemetry: Temp, S-Band Beacon 30KC Pin 6

S-Band Interrogate 30KC Pin 7

Signal Characteristics:



The above curve is a nominal calibration curve. The specific curve for the vehicle is in referenced Calibration Book. The points on the curve represent calibration points.

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: Temperature Cold Gas Line

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6	30KC(30x2.5)	9	5.6, 5.7	

Sensor Location:

Description: Gas is heated on pad to approximately 190°F but not actively heated in orbit. Temperature will decrease during mission. Used in conjunction with Pressure of Cold Gas Line 40KC Pin 27 to provide measure of Cold Gas remaining.

Should be monitored infrequently during Hitch-up phase since attitude control system is not activated. Attitude control system is activated 1.2 seconds after OCV/Agena separation.

Should be monitored as frequently as practicable during OCV Solo phase.

Limit: Mission dependent.

Associated Commands:

A. C. Press. On - 372

A. C. On, TM Orbital - 347

Other commands affecting maneuvers and limit cycles.

Associated Indicators:

Press, Cold Gas Line 40KC Pin 27
Temp Cold Gas Tank @ 38°R 5.4KC Pin 35
Temp Cold Gas Tank @ 321°R 5.4KC Pin 36

Signal Characteristics:

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: Separation #4

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6	30KC(30x2.5)	10	5.17, 5.18	

Sensor Location:

Description: Monitors 3 separation events:

Event 1 - Signal to Fire Safe & Arm Devices 3 & 4

Event 2 - Arm Signal to Separation Programmer which initiates following events.

a. closes circuit from thermal batteries to Retro programmer

b. RV telemetry internal power on

c. Recovery beacon on

d. Back-up timer on

Event 3 - OCV/Agena Separation (switch)

If OCV commands the RV/OCV separation, Event 1 occurs approximately 3 hours before separation and Event 2 occurs, 76.5 seconds before separation. If either the Agena or Life-Boat commands separation, then Event 1 occurs 77.5 seconds before separation and Event 2 occurs 2.5 seconds before separation. Agena/OCV separation will occur approximately 20 seconds after RV/OCV separation.

Limit: Variations in the Signal Characteristic (below) will occur if events are not in proper sequence or if there is a malfunction associated with these events.

Associated Commands:

Agena Commanding:	Event 1 -	Command #2
	Event 2 -	Command #3
Life-Boat Commanding:	Event 1 -	E Tone + Secure Word + T1
		- G Tone + Secure Word + T8
	Event 2 -	E Tone + Secure Word + T2
		- G Tone + Secure Word + T9
OCV Commanding:	Event 1	350 or 360
	Event 2	363 or 365
	Event 3	344 or 370

Associated Telemetry:

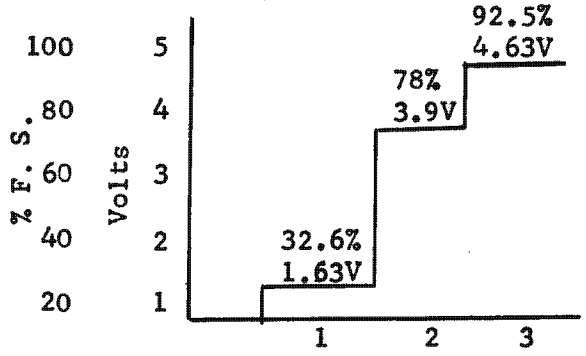
For Agena or Life-Boat Commanding

Event 1	Separation 6(Event 1)	30KC Pin 14
	Separation 5(Event 3)	30KC Pin 13
	Separation 3(Event 2)	30KC Pin 17
Event 2	Separation 6(Event 2)	30KC Pin 14
Event 3	Separation 7(Event 3)	40KC Pin 22

For OCV Commanding:

Event 1	Separation 3(Event 2)	30KC Pin 17
Event 2	None	
Event 3	Separation 7(Event 2)	40KC Pin 22

Signal Characteristics:



Event 1 - Signal to Fire S&A3&4
Event 2 - Arm Signal to Sep. Prog.
Event 3 - OCV/Agena Separation

MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: Separation #5

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6	30KC(30x2.5)	13	5.17, 5.18	

Sensor Location:

Description: Monitors 4 separation events -

Event 1-B+ to separation system (applied pre-launch)

Event 2-Baroswitch closure

Event 3-Safe & Arm Devices Fired (breakwire)

Event 4-Transfer signal to separation programmer which initiates the following:

a) thrust cone thermal batteries final

b) recovery system On (backup relay)

c) initiate in-flight disconnect squibs (1 second nominal time delay)

If OCV commands RV/OCV separation, Event 3 will occur approximately 3 hours before separation and Event 4 will occur 2.5 seconds before separation. If either the Agena or Life-Boat commands separation, then Event 3 will occur 77.5 seconds before separation and Event 4 will occur 2.5 seconds before separation.

Limit: Variations in the signal characteristics (below) will occur if events are not in proper sequence or if there is a malfunction associated with these events.

Associated Commands:

Agena Commanding: Event 3 - Command #2
Event 4 - Command #3

Life-Boat Commanding: Event 3 - E Tone + Secure Word + T1
G Tone + Secure Word + T8
Event 4 - E Tone + Secure Word + T2
G Tone + Secure Word + T9

OCV Commanding: Event 3 - 350 or 360
Event 4 - 355 or 366

Associated Telemetry:

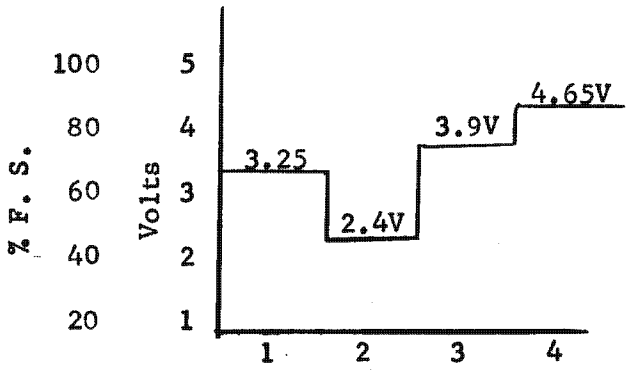
For Agena or Life-Boat Commanding

Event 2	Separation 6(Event 1)	30KC	Pin 14
	Separation 4(Event 1)	30KC	Pin 10
	Separation 3(Event 2)	30KC	Pin 17
Event 3	Separation 6(Event 2)	30KC	Pin 14

For OCV Commanding

Event 2	Separation 4(Event 1)	30KC	Pin 10
	Separation 3(Event 2)	30KC	Pin 17
Event 3	None		

Signal Characteristics:



Events
1 - B+ to Sep. Subsys.
2 - Baroswitch closed
3 - Safe&Arm devices fired(breakwire)
4 - Transfer signal to separation prog.

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30KC - 13

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MALFUNCTION ANALYSIS REFERENCE BOOK

Operational Telemetry Data

Item: Separation #6

Link	Channel	Pin	Malf. Ref.	Cal. Book Ref.
248.6	30KC (30x2.5)	14	5.18	

Sensor Location:

Description: Monitors 3 separation commands transmitted by either Agena or Life-Boat to the Separation Auxiliary Controller. Each command will be reflected by a level change. See Signal Characteristics (below).

Event 1 Monitors command #2 which energizes relay K2 in the Separation Auxiliary Controller. K2 in turn provides the TM indication of this event and triggers the silicon controlled rectifiers associated with Safe & Arm Devices, 3 & 4 squibs and the Pre-arm Signal. These events will occur 77.5 sec before separation.

Event 2 Monitors command #3 which energizes relay K3 in the Separation Auxiliary Controller. K3 in turn provides the TM indication of this event and triggers the silicon controlled rectifiers associated with the Arm & Transfer signals. These events will occur 2.5 seconds before separation.

Event 3 Monitors command #4 which energizes relay K4 in the Separation Auxiliary Controller. K4 in turn provides the TM indication of this event and in turn triggers the SCR's accociated with the pin pullers.

Limit: Variations in the Signal Characteristics (below) will occur if events are not in proper sequence, or if there is a malfunction associated with these commands.

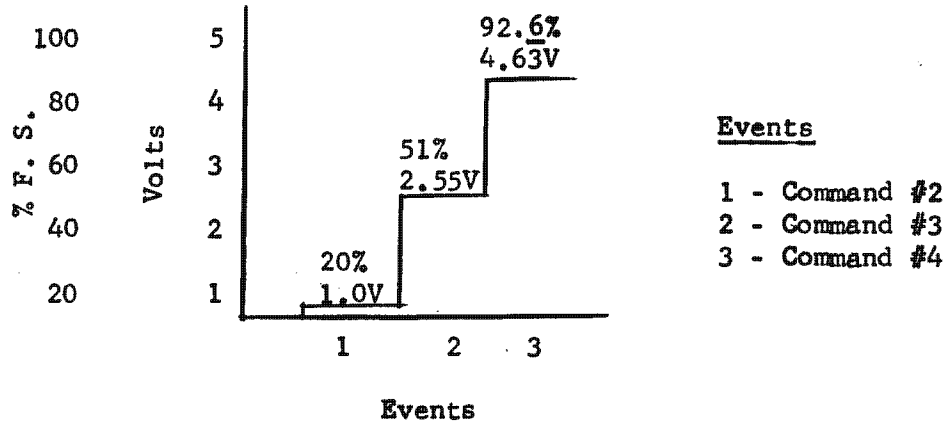
Associated Commands:

Agena Commanding:	Event 1 - Command 2
	Event 2 - Command 3
	Event 3 - Command 4
Life-Boat Commanding:	Event 1 - E Tone + Secure Word + T1
	G Tone + Secure Word + T8
	Event 2 - E Tone + Secure Word + T2
	G Tone + Secure Word + T9
	Event 3 - E Tone + Secure Word + T3
	G Tone + Secure Word + T10

Associated Telemetry:

Event 1	Separation 3(Event 2)	30KC Pin 17
	Separation 3(Event 3)	30KC Pin 17
	Separation 4(Event 1)	30KC Pin 10
	Separation 5(Event 3)	30KC Pin 13
Event 2	Separation 4(Event 2)	30KC Pin 10
	Separation 5(Event 4)	30KC Pin 13
Event 3	Separation 2(Event 3)	40KC(adapter) Pin 13

Signal Characteristics:



MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Separation #3

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
248.6	30KC (30 x 2.5)	17	5.17	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Voltage, Programmer Back-Up Battery

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
248.6	30KC (30 x 2.5)	18	5.2	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Pressure, OCV H_2 Regulator Inlet

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
248.6	30 KC (30 x 2.5)	19	5.3	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Current, Operational Batteries #1 - 5

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
248.6	30KC (30 x 2.5)	20 - 24	5.1	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-21

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	22 KC 30x5	1 & 16		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-22

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	22 KC 30x5	2 & 17		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-23

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	22 KC 30x5	3 & 18		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: H30 Continuity & Events

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	22 KC 30x5	4	5.18	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Roll Attitude Error, ACA

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	22 KC 30x5	7 & 22	5.5 ; 5.7; 5.8	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Pitch Attitude Error, ACA

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	22 KC 30x5	8 & 23	5.5 ; 5.7 5.8	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Yaw Attitude Error, ACA

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	22 KC 30x5	9 & 24	5.5 ; 5.7 5.8 ; 5.10	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-3

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	22 KC 30x5	14		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-20

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	22 KC 30x5	19		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-27

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	22 KC 30x5	20		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-17

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	10.5 KC 30x2.5	2 & 17		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-5

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	10.5 KC 30x2.5	6		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-13

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	10.5 KC 30x2.5	7		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-14

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	10.5 KC 30x2.5	8		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Temperature, Vehicle Station 84

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	10.5 KC 30x2.5	9	5.16	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 2-15

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	10.5 KC 30x2.5	10		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 1-18

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	10.5 KC 30x2.5	11		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: GFE 2-26

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	10.5 KC 30x2.5	13		

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Temperature, OCV Oxidizer (Internal)

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RI-248.6	10.5 KC 30x2.5	14	5.4 ; 5.16	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Temperature, Vehicle Station 104.385 @ 90°

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	10.5 KC 30x2.5	16	5.16	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Temperature OCV Fuel (Internal)

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	10.5 KC 30x2.5	20	5.4 ; 5.16	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Pressure, OCV Oxidizer

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5	10.5 KC	21	5.4	
RT-248.6	30x1.5			

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Pressure, OCV Fuel

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5	10.5KC	22	5.4	
RT-248.6	30x2.5			

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Temperature, Vehicle Station 104.385 @ 270°

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5	10.5 KC	23	5.16	
RT-248.6	30 x 2.5			

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Temperature, Vehicle Station 104.385 @ 180°

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5	10.5KC	26	5.16	
RT-248.6	30 x 2.5			

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Environmental Panel

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5	10.5KC	28	5.16	
RT-248.6	30x2.5			

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Vehicle Clock Time

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
248.6	70KC	Cont.	5.2, 5.13	

Reference: C&CS Operational Procedures (Milestone 7)

Alternates:

(1) none during on-orbit operation

(2) Vehicle Clock Time is carried on 258.5 MC during Powered Flight (on 70 KC continuous channel)

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Command Verification

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
258.5	70 KC	Cont.	5.15	

Reference: C&CS Operational Procedures (Milestone 7)

Limits: This is an alternate (back-up) for Command Verification on the 52.5 KC channel. No recorder playback is possible when using this back-up since it requires the playback transmitter.

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Command Verification

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
248.6	52.5 KC	Cont.	5.15	

Reference: C&CS Operational Procedures (Milestone 7)

Alternate:

Command Verification

Link	Channel	Pin
258.5	70 KC	Cont.

Limits: Recorder playback is not possible when using the alternate Command Verification

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Delay Line Erase Monitor & Program Word Line

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	7.35 KC	Cont.	5.12 & 5.15	

Reference: C&CS Operational Procedures (Milestone 7)

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Gyro Pitch Rate Output, Fine

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	3.9KC	Cont.	5.4, 5.5, 5.7	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Gyro Yaw Rate Output, Fine

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5 RT-248.6	3.0KC	Cont.	5.4, 5.5, 5.7	

MALFUNCTION ANALYSIS REFERENCE BOOK

OPERATIONAL TELEMETRY DATA

Item: Gyro Roll Rate Output, Fine

Link	Channel	Pin	Malfunction Reference	Calibration Book Ref.
PB-258.5	2.3 KC	Cont.	5.4, 5.5, 5.7	

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21 February 1963

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract AF04(695)-76

Section 3.3

Total Telemetry List

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

TOTAL TELEMETRY LIST

(to be provided later)

OSE Report #1122-
21 February 1963

PROGRAM 206

MALFUNCTION ANALYSIS REFERENCE BOOK

Contract AF04(695)-76

Section 4.1

Command Function Description

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time Label

Command: SSPC - 1 Bits 1-23

refers to series command

Purpose:

Signal Flow Sequence:

Effect On Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time Parity

Command: SSPC-1 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Word Definition Bit

Command: SSPC-1 Bit25 ("0" condition)

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Decoder Input Address

Command: SSPC-1 Bits 26-27-28

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Energize (Solenoid/Rotary Actuator)

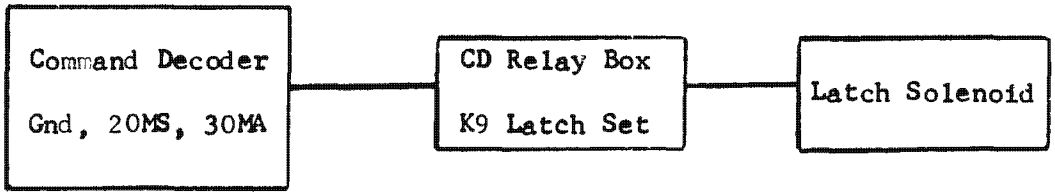
Command: SSPC-1 Bit 29 ("1"=solenoid; "0"=rotary actuator)

refers to series commands

Purpose: "1" condition - energizes solenoid release latch

"0" condition - actuator rotates

Signal Flow Sequence:



Effect On Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Recorder (ON/OFF)

Command: SSPC-1 Bit 30 ("1"=ON;"0"=OFF)

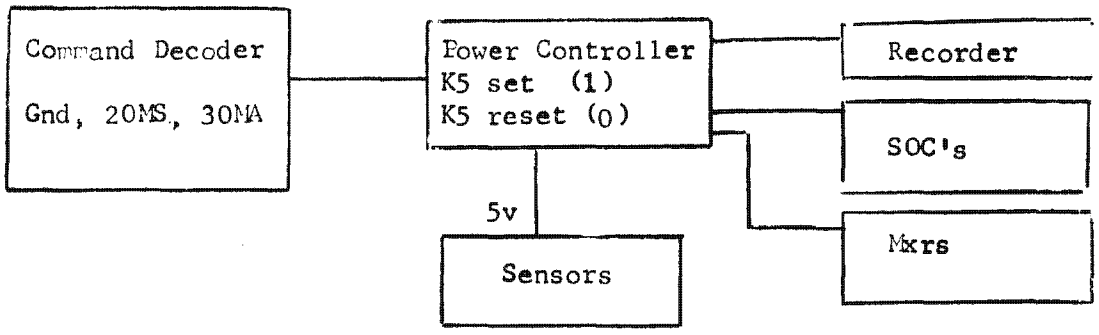
refers to series commands

Purpose:

"1" condition - +28 volts to recorder, OCV, SCO's, and multiplexers

"0" condition - turns off above

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: GFE 1-c15 (ON/OFF)

Command: SSPC-1 Bit 31 ("1"=ON ; "0"=OFF)

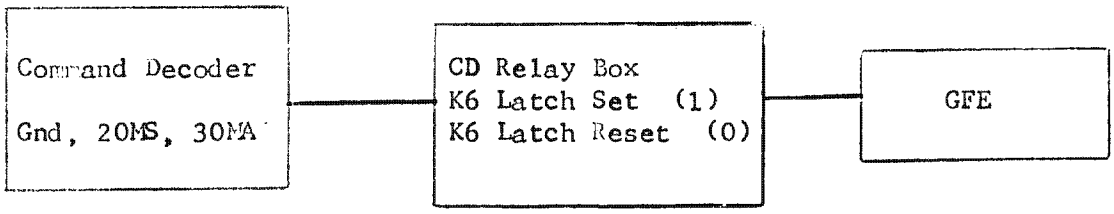
refers to series commands

Purpose:

"1" condition - applies +28 volts DC on GFE 1-c15

"0" condition - loss of above

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

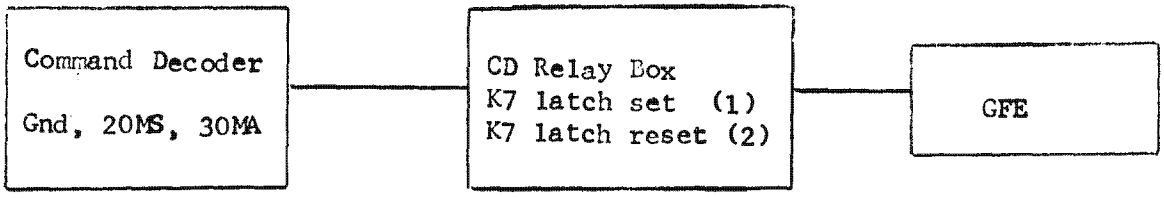
Function: GFE 1-c16 (SET/RESET)

Command: SSPC-1 Bit 32 ("1"=set; "0"=reset)

refers to series commands

Purpose:

Signal Flow Sequence:



Effect On Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Yaw Dead Band (FINE/COARSE)

Command: SSPC-1 Bit 34 ("1"=fine; "0"=coarse)

refers to series commands

Purpose:

"1" condition - selects fine dead band control

"0" condition - selects coarse dead band control

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: GFE 1-C25 (ON/OFF) - GFE 1-C24 (OFF)

Command: SSPC-½ Bit 33

refers to series commands

Purposes:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Pitch Dead Band (FINE/COARSE)

Command: SSPC-1 Bit 35 ("1"=fine; "0"=coarse)

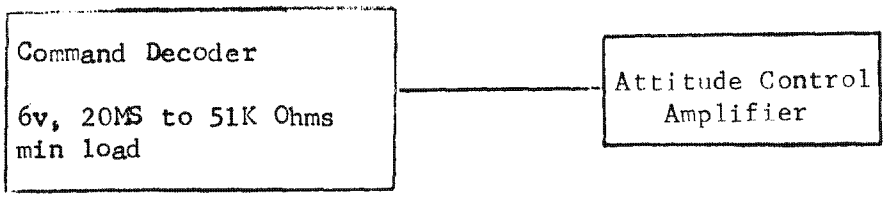
refers to series commands

Purpose:

"1" condition - selects fine dead band control

"0" condition - selects coarse dead band control

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Roll Dead Band (FINE/COARSE)

Command: SSPC-1 Bit 36 ("1"=fine; "0"=coarse)

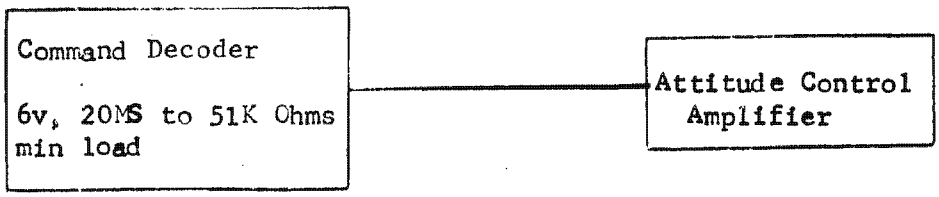
refers to series commands

Purpose:

"1" condition - selects fine dead band control

"0" condition - selects coarse dead band control

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Functional Parity

Command: SSPC-1 bit 37

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time label

Command: SSPC-2 Bits 1-23

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time Parity

Command: SSPC-2 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Decoder Input Address

Command: SSPC-2 Bits 25-26-27

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

SSPC-2/ /25-26-27

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

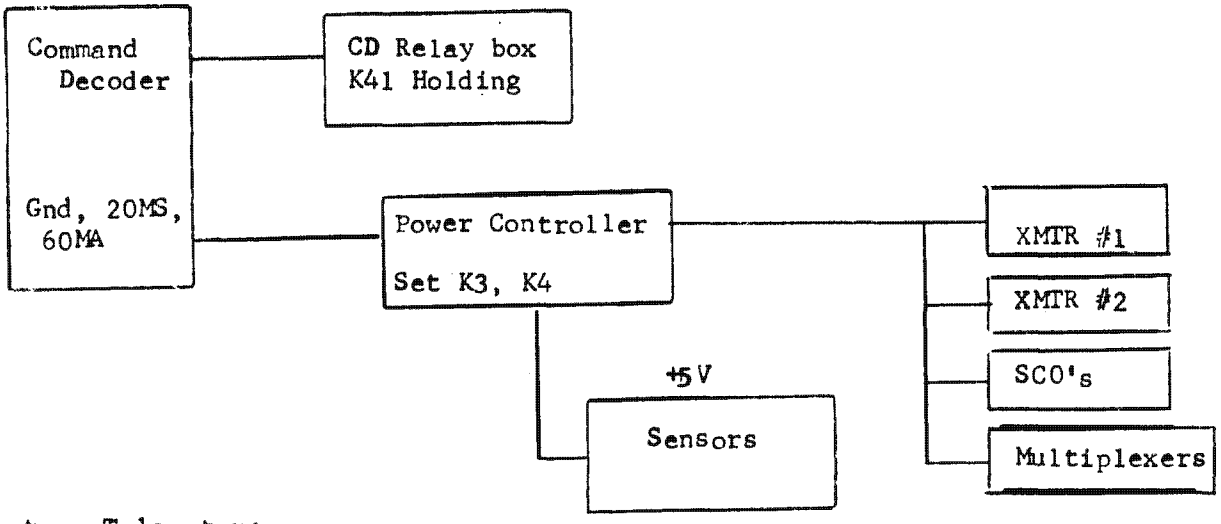
Function: Telemetry Real Time (ON/OFF)

Command: SSPC-2 Bit 29 (1 = ON; "0" = OFF)

refers to 200-238 series commands

Purpose: (ON Condition)
supplies +28 VDC to transmitters #1 and #2, SCO's and multiplexers; +5VDC to all sensors; removes power from 14.5 KC crystal oscillator

Signal Flow Sequence:



Effect on Telemetry:

Turns on all telemetry in mode selected by SSPC2, bit

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

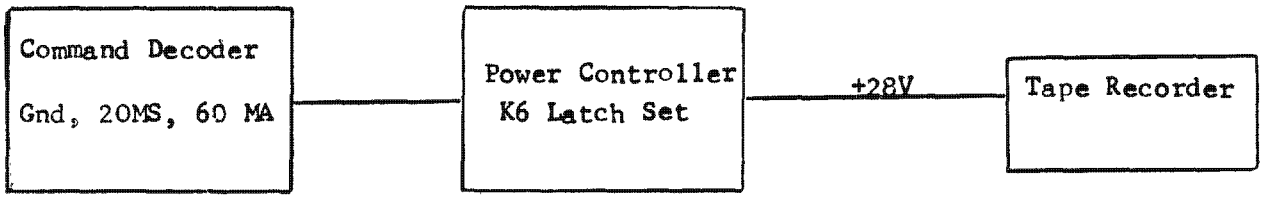
Function: Recorder Orbit PB Mode 2 (ON/OFF)

Command: SSPC 2 (TT&C) Bit 30 (1 = ON; 0 = OFF)

refers to 200 - 238 series commands

Purpose: (1 = "ON" Condition)
tape recorder in low speed & playback at high speed

Signal Flow Sequence:



Effect on Telemetry:
Both telemetry transmitters ON, Verlort Tracking Transmitter ON, 6-minute Command Decoder Timer mode ON.

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Verlort Beacon ON/OFF

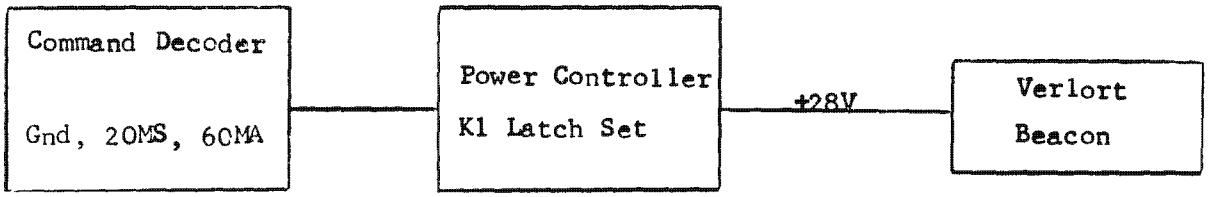
Command: SSPC-2 (TT&C) Bit 31 (1 = ON; 0 = OFF)

refers to 200 - 238 series commands

Purpose: (1 = ON Condition)

Verlort Beacon ON

Signal Flow Sequence:



Effect on Telemetry:
Both telemetry transmitters ON, Verlort Tracking Transmitter ON, Rate Beacon ON, 6-minute Command Decoder Timer Mode ON.

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: SSPC-2 Bit 32

refers to 200 - 238 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Pulse Position Demodulator ON/OFF

Command: SSPC-2 (TT&C) Bit 33 (1 = ON; 0 = OFF)

refers to 200 - 238 series commands

Purpose: (1 = "ON" Condition)
Pulse position demodulator ON (Advances Secure Counter)

Signal Flow Sequence:

Command Decoder

CD Relay Box

K42 Holding
GRD, 1A

Gnd, 20MS, 60MA

+28V Verlort

Power Controller
Set K3, K4, K1,
K21

+28V TM XMTRS

28V Real Time TM

6V PPD*

*Steps secure word memory

Effect on Telemetry:
Both telemetry transmitters ON, Verlort Tracking Transmitter ON, Rate Beacon ON, Recorder Mode 3 Playback ON, 6-minute Command Decoder Timer ON

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command SSPC-2 Bit 34

refers to 200 - 238 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Binary Coded output

Command: SSPC-2 Bits 35 & 36

refers to 200 - 238 series commands

Purpose:

Signal Flow Sequence:

35	36
0	0
1	0
0	1
1	1

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Function Priority

Command: SSPC-2 Bit 37

refers to 200 - 238 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time Label

Command: DSPC-1 Word 1 Bits 1-23

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time Parity

Command: DSPC-1 Word 1 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Word Definition Bit

Command: DSPC-1 Word 1 Bit 25 ("0" - 1st word)

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Decoder Input Address

Command: DSPC-1 Word 1 Bits 26-27-28

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Security Key (allow following commands to be executed)

Command: DSPC-1 Word 1 Bits 29-36

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

DSPC-1/ / /29-36

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Security Key

Command: DSPC-1 Word 2 Bits 1-23

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

M LFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Parity 1-23

Command: DSPC-1 Word 2 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Word Defining Bit

Command: DSPC-1 Word 2 Bit 25 ("1" = 2nd word)

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Security Key

Command: DSPC-1 Word 2 Bits 26-30

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

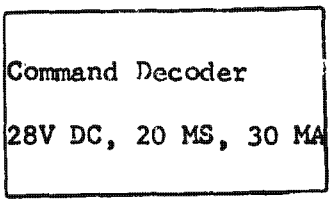
Function: Spare

Command: DSFC-1 Word 2 Bit

refers to series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

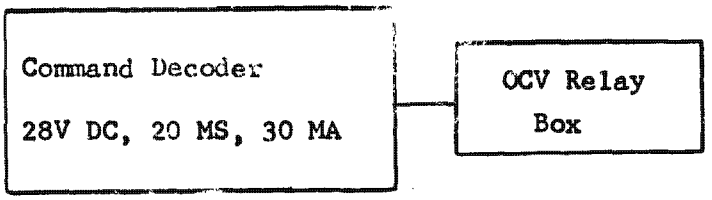
Function: Engine #1

Command: DSPC-1 Word 2 Bit 32 ("1" = on; "0" = not required)

refers to series commands

Purpose: Turns Engine #1 on

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

DSPC-1/ 2 /32

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

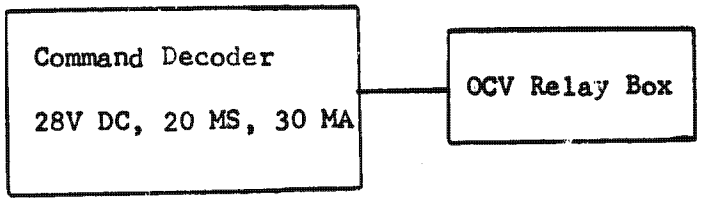
Function: Engine #2 ON

Command: DSPC-1 Word 2 Bit 33 ("1" = on; "0" = not required)

refers to series commands

Purpose: Turns Engine #2 ON

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-1 Word 2 Bit 34

refers to series commands

Purpose:

Signal Flow Sequence:

Command Decoder
Gnd, 20 MS, 30 MA

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

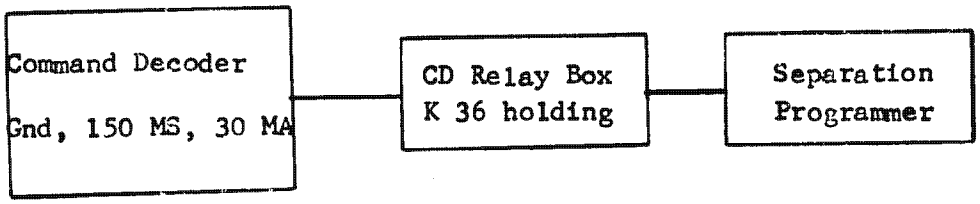
Function: Adapter SRV Separate

Command: DSPC-1 Word 2 Bit 35 ("1" = energizes relay; "0" = not required)

refers to DSPC-1 301 series commands

Purpose: Initiates separation.

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

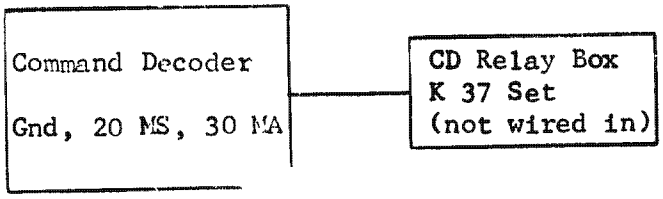
Function: Spare

Command: DSPC-1 Word 2 Bit 36

refers to series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Parity 25-37

Command: DSPC-1 Word 2 Bit 37

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time lable

Command: DSPC-2 Word 1 Bits 1-23

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time Parity

Command: DSPC-2 Word 1 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Word definition bit

Command: DSPC-2 Word 1 Bit 25 ("0" = Word 1)

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Decoder input address

Command: DSPC-2 Word 1 Bits 26-27-28

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

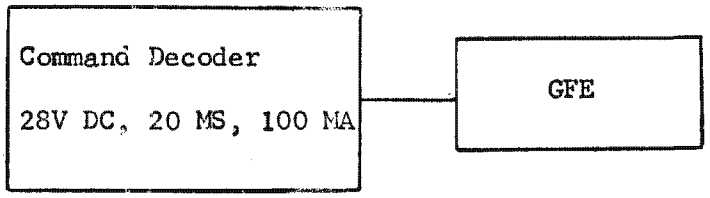
Function: GFE 1-C1A - GFE 1-C1B

Command: DSPC-2 Word 1 Bit 29 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" Condition - Refers to GFE 1-C1A
"0" Condition - Refers to GFE 1-C1B

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

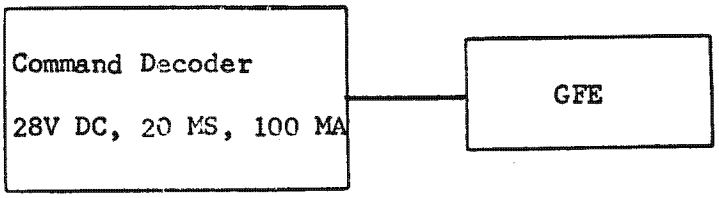
Function: GFE 1-C2A - GFE 1-C2B

Command: DSPC-2 Word 1 Bit 30 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" Condition - GFE 1-C2A
"0" Condition - GFE 1-C2B

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schemaitc Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

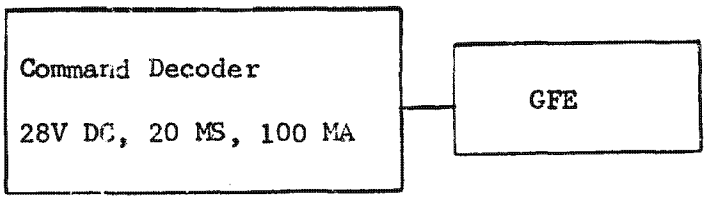
Function: GFE 1-C3A - GFE 1-C3B

Command: DSPC-2 Word 1 Bit 31 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" Condition - GFE 1-C3A
"0" Condition - GFE 1-C3B

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

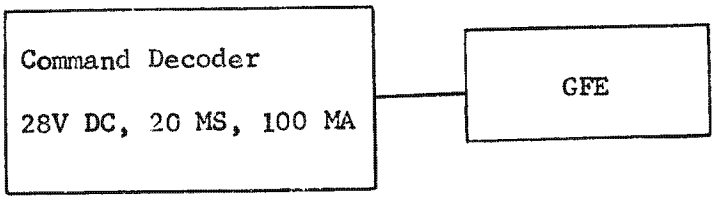
Function: GFE 1-C4A - GFE 1-C4B

Command: DSPC-2 Word 1 Bit 32 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" Condition - GFE 1-C4A
"0" Condition - GFE 1-C4B

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

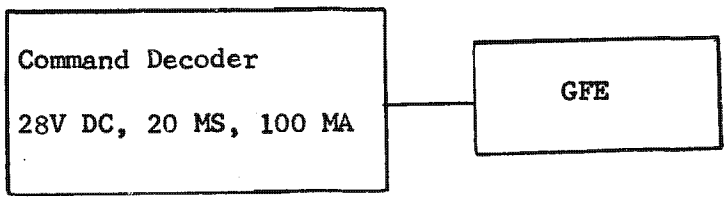
Function: GFE 1-C5A - GFE 1-C5B

Command: DSPC-2 Word 1 Bit 33 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" Condition - GFE 1-C5A
"0" Condition - GFE 1-C5B

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

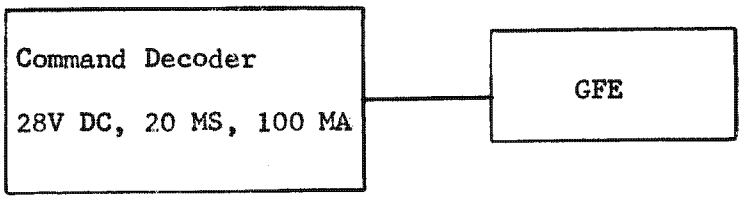
Function: GFE 1-C6A - GFE 1-C6B

Command: DSPC-2 Word 1 Bit 34 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" Condition - GFE 1-C6A
"0" Condition - GFE 1-C6B

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Duration $t_3 - t_2$

Command: DSPC-2 Word 1 Bits 35 and 36

refers to series commands

Purpose:

Signal Flow Sequence:

Time	35	36	
	0	0	3.2 sec
	1	0	5.3 sec
	0	1	7.4 sec
	1	1	9.5 sec
	0	0	11.6 sec
	1	0	13.7 sec
	0	1	15.8 sec
	1	1	17.9 sec

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Function Parity

Command: DSPC-2 Word 1 Bit 37

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Duration $t_3 - t_2$

Command: DSPC-2 Word 2 Bit 1

refers to series commands

Purpose:

Signal Flow Sequence:

Time	1	
	0	3.2 sec
	0	5.3 sec
	0	7.4 sec
	0	9.5 sec
	1	11.6 sec
	1	13.7 sec
	1	15.8 sec
	1	17.9 sec

Effect on Telemetry:

Electrical Schematic Drawing Reference:

DSPC-2/ 2 /1

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

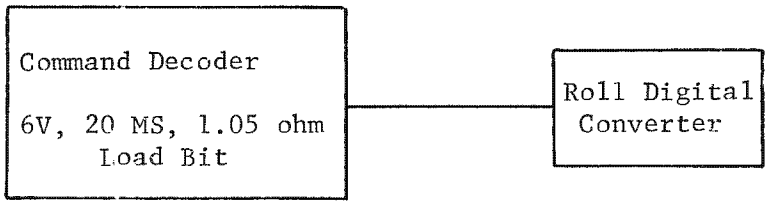
Function: Roll Angle at t_2

Command: DSPC-2 Word 2 Bits 2-8 (1 = change; 0 = no change)

refers to series commands

Purpose
1 condition - provides angle for roll maneuver between T_2 and T_3
0 condition - used when no change is desired

Signal Flow Sequence:



Effect on Telemetry

Electrical Schematic Drawing Reference:

DSPC-2/ 2 /2-8

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

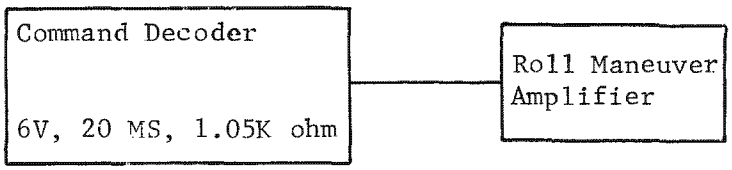
Function: Roll Rate at T_2

Command: DSPC-2 Word 2 Bits 9 and 10 (1 = change; 0 = no change)

refers to series commands

Purpose:
1 condition - sets rate of change in roll maneuver $t_3 - t_2$
0 condition -

Signal Flow Sequence



Effect on Telemetry:

Electrical Schematic Drawing Reference:

DSPC-2/ 2 /9 and 10

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Duration $T_2 - T_1$ & $T_4 - T_3$

Command: DSPC-2 Word 2 Bits 11-14

refers to series commands

Purpose:

Signal Flow Sequence:

11	12	13	14	Time
0	0	0	0	2.0
1	0	0	0	2.7
0	1	0	0	3.4
1	1	0	0	4.1
0	0	1	0	4.8
1	0	1	0	5.5
0	1	1	0	6.2
1	1	1	0	6.9
0	0	0	1	7.6
1	0	0	1	8.3
0	1	0	1	9.0
1	1	0	1	9.7
0	0	1	1	10.4
1	0	1	1	11.1
0	1	1	1	11.8
1	1	1	1	12.5

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Descreiption

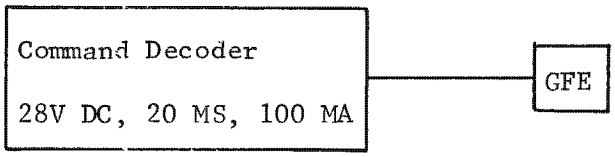
Function: GFE 1-C1A to GFE 1-C6A at T_2

Command: DSPC-2 Word 2 Bits 15-20 ("1" condition)

refers to series commands

Purpose: "1" condition - GFE 1-C1A to GFE 1-C6A at T_2

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

DSPC-2/ 2 /15-20 ("1" condition)

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

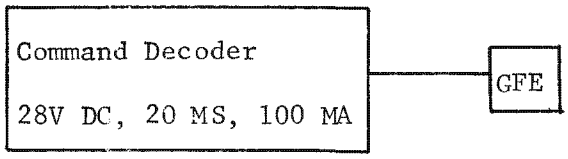
Function: GFE 1-C1B to GFE 1-C6B at T_2

Command: DSPC-2 Word 2 Bits 15-20 ("0" condition)

refers to series commands

Purpose: "0" condition - GFE 1-C1B to GFE 1-C6B at T_2

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

DSPC-2/ 2 /15-20 ("0" condition)

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

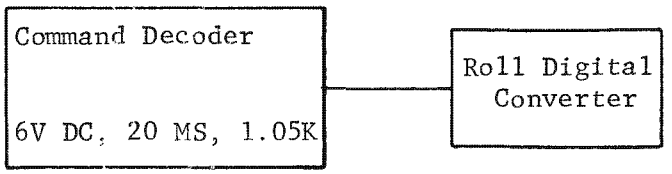
Function: Roll Angle at T_4

Command: DSPC-2 Word 2 Bits 21-23 ("1" condition - set)
("0" condition - reset)

refers to series commands

Purpose:
"1" condition - provides angle for roll maneuver between T_4 & T_1
"0" condition - used when no change is desired

Signal Flow Sequnce:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

DSPC-2/ 2 /21-23

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Parity 1-23

Command: DSPC-2 Word 2 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Worddefinition bit

Command: DSPC-2 Word 2 Bit 25 ("1" = second word)

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Binary Code

Command: DSPC-2 Word 2 Bits 26-29

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

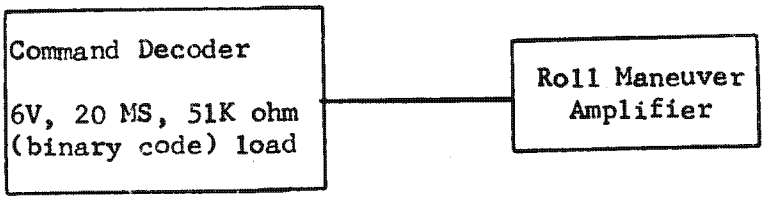
Function: Roll Rate at T_4

Command: DSPC-2 Word 2 Bits 30 and 31 ("1" condition -
"0" condition -

refers to series commands

Purpose:
"1" condition - sets rate of change in roll maneuver T_4 - T_1

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

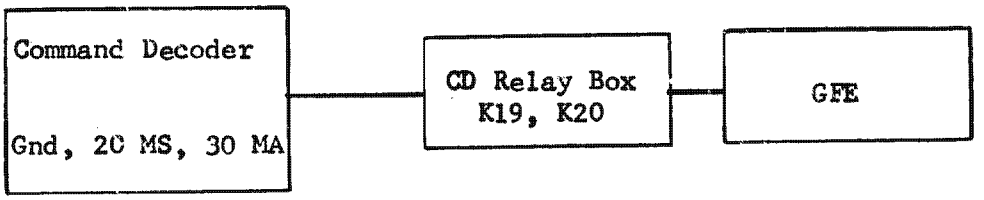
Function: GFE 1-C8 (set and reset)

Command: DSPC-2 Word 2 Bit 32 (1 = set; 0 = reset)

refers to series commands

Purpose:
"1" condition - connects GFE 1-C8A to GFE 1-C8C (set)
"0" condition - connects GFE 1-C8B to GFE 1-C8C (reset)

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

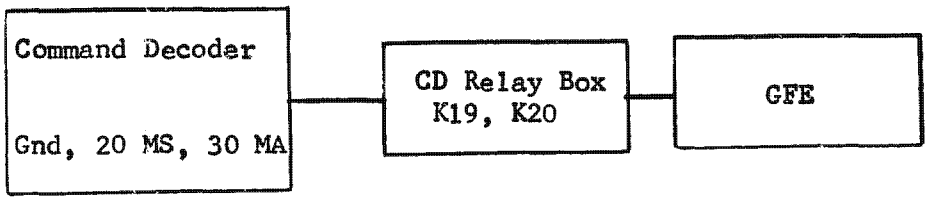
Function: GFE 1-C9 (set and reset)

Command: DSPC-2 Word 2 Bit 33 ("1" = set; "0" = reset)

refers to series commands

Purpose:
"1" condition - connects GFE 1-C9A to GFE 1-C9C (set)
"0" condition - connects GFE 1-C9B to GFE 1-C9C (reset)

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: GFE 1-C10 (set and reset)

Command: DSPC-2 Word 2 Bit 34 ("1" = set; "0" = reset)

refers to series commands

Purpose:

Signal Flow Sequence:

Command Decoder
Gnd, 20MS, 30MA

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: GFE 1-C11 (set and reset)

Command: DSPC-2 Word 2 Bit 35 ("1" = set; "0" = reset)

refers to series commands

Purpose:

Signal Flow Sequence:

Command Decoder
Gnd, 20MS, 30 MA

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: GFE 1-C12 (set and reset)

Command: DSPC-2 Word 2 Bit 36 ("1" = set; "0" = reset)

refers to series commands

Purpose:

Signal Flow Sequence:

Command Decoder
Gnd, 20MS, 30MA

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Parity 25-37

Command: DSPC-2 Word 2 Bit 37

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time label

Command: DSPC-3 Word 1 Bits 1-23

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time parity

Command: DSPC-3 Word 1 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Word definition bit

Command: DSPC-3 Word 1 Bit 25 ("0" = 1st word)

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Decoder Input Address

Command: DSPC-3 Word 1 Bits 26-27-28

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

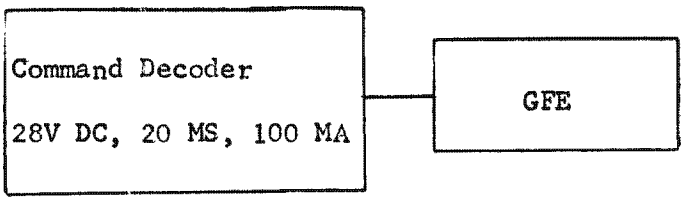
Function: GFE 1-C1B - GFE 1-C1A

Command: DSPC-3 Word 1 Bit 29 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" Condition - GFE 1-C1B
"0" Condition - GFE 1-C1A

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

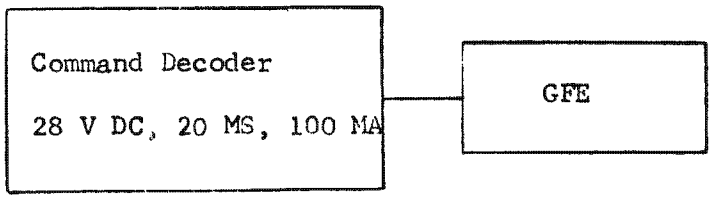
Function: GFE 1-C2B - GFE 1-C2A

Command: DSPC-3 Word 1 Bit 30 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" condition - GFE 1-C2B
"0" condition - GFE 1-C2A

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

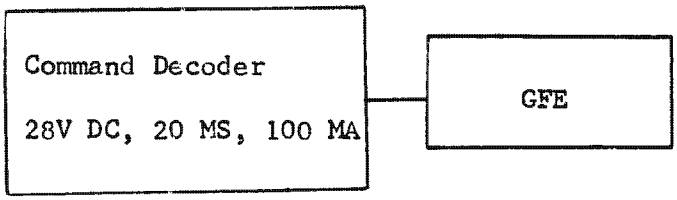
Function: GFE 1-C3B - GFE 1-C3A

Command: DSPC-3 Word 1 Bit 31 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" condition - GFE 1-C3B
"0" condition - GFE 1-C3A

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

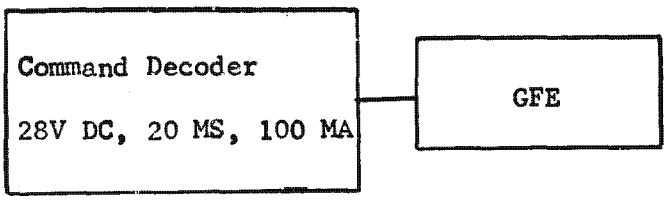
Function: GFE 1-C4B - GFE 1-C4A

Command: DSPC-3 Word 1 Bit 32 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" condition - GFE 1-C4B
"0" condition - GFE 1-C4A

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

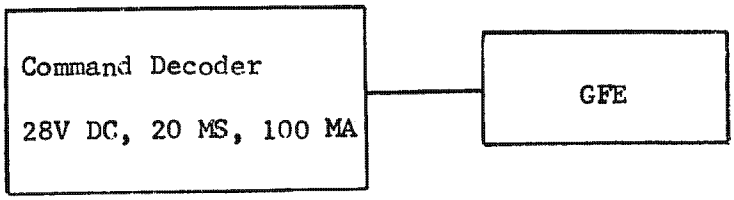
Function: GFE 1-C5B - GFE 1-C5A

Command: DSPC-3 Word 1 Bit 33 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" condition - GFE 1-C5B
"0" condition - GFE 1-C5A

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

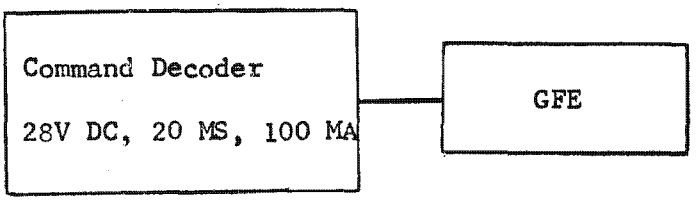
Function: GFE 1-C6B - GFE 1-C6A

Command: DSPC-3 Word 1 Bit 34 ("1" condition; "0" condition)

refers to series commands

Purpose: "1" condition - GFE 1-C6B
"0" condition - GFE 1-C6A

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Duration T_2 - T_1

Command: DSPC-3 Word 1 Bits 35 and 36

refers to series commands

Purpose:

Signal Flow Sequence:

LSD Code Bits 35	36	MSD	TIME
0	1		0.1 sec
1	0		0.2 sec
0	0		0.3 sec
0	0		102.3 sec
1	1		102.4 sec

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Functional parity

Command: DSPC-3 Word 1 Bit 37

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Duration $T_2 - T_1$

Command: DSPC-3 Word 2 Bits 1-8

refers to series commands

Purpose:

Signal Flow Sequence:

LSD	CODE	(BITS)		MSD				
1	2	3	4	5	6	7	8	TIME
1	1	1	1	1	1	1	1	0.1 sec
1	1	1	1	1	1	1	1	0.2 sec
1	1	1	1	1	1	1	1	0.3 sec
0	0	0	0	0	0	0	0	102.3 sec
1	1	1	1	1	1	1	1	102.4 sec

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: No implementation required.

Command: DSPC-3 Word 2 Bits 9-20

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Roll Angle at T_2

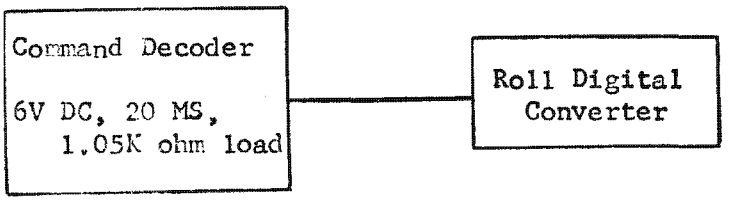
Command: DSPC-3 Word 2 Bits 21-23 ("1" condition; "0" condition)

refers to series commands

Purpose:

"1" condition - provides angle for roll maneuver between T_2 and next T.
"0" condition - used when no change is desired

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Parity 1-23

Command: DSPC-3 Word 2 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Word definition bit

Command: DSPC-3 Word 2 Bit 25 ("1" = 2nd word)

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Binary Code Load

Command: DSPC-3 Word 2 Bits 26-29

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

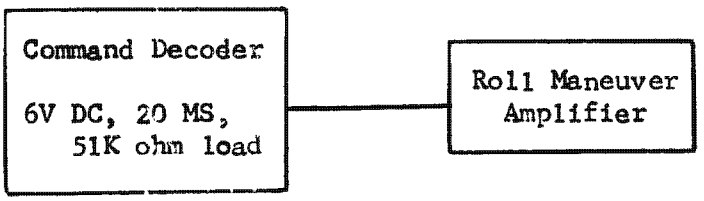
Function: Roll Rate at T_2

Command: DSPC-3 Word 2 Bits 30-31 ("1" condition; "0" condition)

refers to series commands

Purpose:
"1" condition - sets rate of change in roll maneuver between T_2 and next T_1
"0" condition - used when no change is desired

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

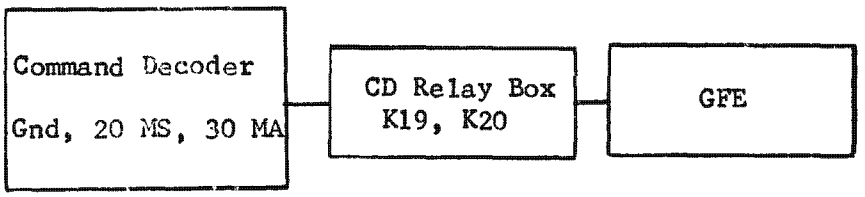
Function: GFE 1-C8 (set - reset)

Command: DSPC-3 Word 2 Bit 32 ("1" set; "0" reset)
&33

refers to series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

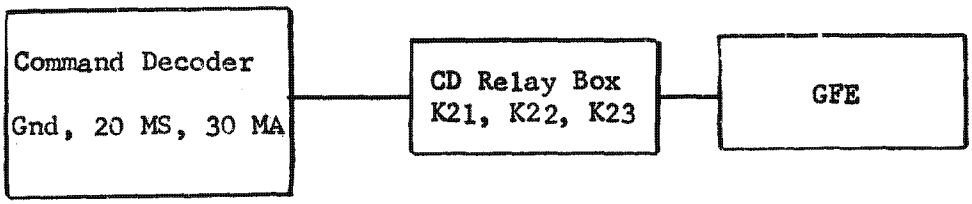
Function: GFE 1-C10 (set - reset)

Command: DSPC-3 Word 2 Bit 34 ("1" = set; "0" = reset)
35,&36

refers to series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

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MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Parity 25-37

Command: DSPC-3 Word 2 Bit 37

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time label

Command: DSPC-4 Word 1 Bits 1-23

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time parity

Command: DSPC-4 Word 1 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Word definition bit

Command: DSPC-4 Word 1 Bit 25 ("0" = 1st word)

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Decoder Input Address

Command: DSPC=4 Word 1 Bits 26-27-28

refers to series commands

Purpose:

Signal Flow Sequence:

26	-	27	-	28
1		0		0

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-4 Word 1 Bits 29-36

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Function Parity

Command: DSPC-4 Word 1 Bit 37

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Funtion: Spare

Command: DSPC-4 Word 2 Bits 1-15

refers to series commands

Turpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

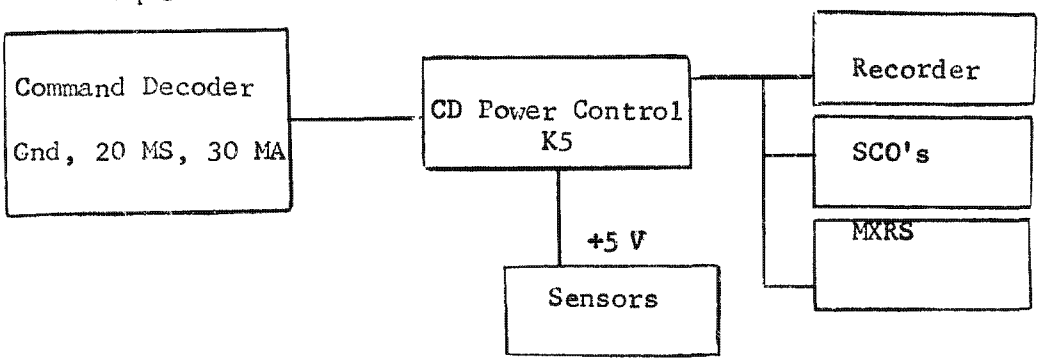
Function: Recorder Mode 1 (ON/OFF)

Command: DSPC-4 Word 2 Bit 16 ("1" = recorder on; "0" = recorder Off)

refers to DSPC-4 310 to 339 series commands

Purpose:
"1" condition: applies +28V DC to recorder in mode 1, OCV SCO's, multiplexers, 5 volt sensor supply
"0" condition: loss of above

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

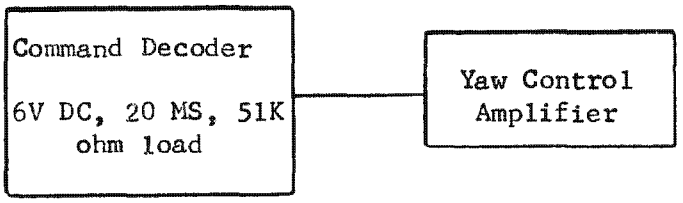
Function: Yaw level on (low - high)

Command: DSPC-4 Word 2 Bit 17 ("1" = low; "0" = high)

refers to DSPC-4 310-339 series commands

Purpose:
"1" condition - supplies low pneumatic torque
"0" condition - supplies high pneumatic torque

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

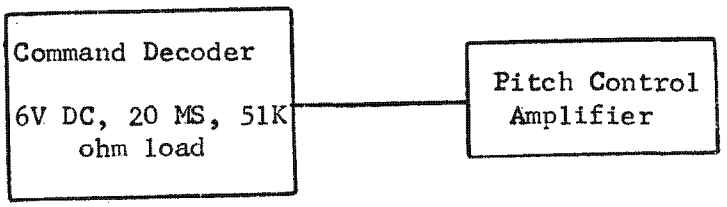
Function: Pitch Level on (Low/High)

Command: DSPC-4 Word 2 Bit 18 ("1" = low; "0" = high)

refers to DSPC-4 310-339 series commands

Purpose:
"1" condition - supplies low pneumatic torque
"0" condition - supplies high pneumatic torque

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

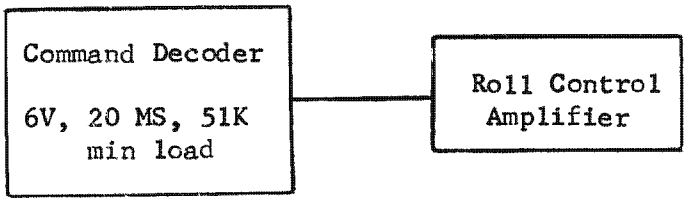
Function: Roll Level on (Low/High)

Command: DSPC-4 Word 2 Bit 19 ("1" = low; "0" = high)

refers to DSPC-4 310-339 series commands

Purpose:
"1" condition - supplies low pneumatic torque
"0" condition - supplies high pneumatic torque

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-4 Word 2 Bit 20

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

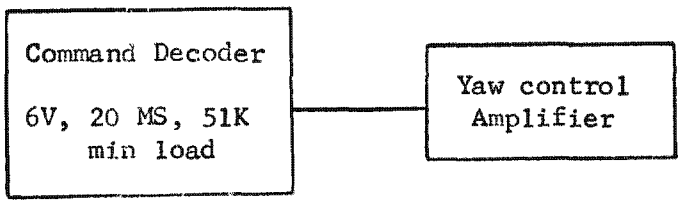
Function: Yaw deadband (Fine/Coarse)

Command: DSPC-4 Word 2 Bit 21 ("1" = fine; "0" = coarse)

refers to DSPC-4 310-339 series commands

Purpose:
"1" condition = selects fine band yaw control
"0" condition = selects coarse band yaw control

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-4 Word 2 Bit 22

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-4 Word 2 Bit 23

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Parity 1-23

Command: DSPC-4 Word 2 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Word definition bit

Command: DSPC-4 Word 2 Bit 25 ("1" = 2nd word)

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

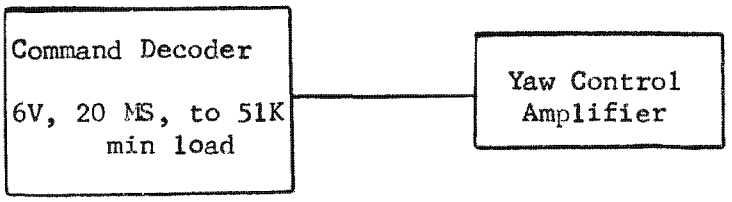
Function: Pitch Deadband (Fine/Coarse) Control

Command: DSPC-4 Word 2 Bit 26 ("1" = fine; "0" = coarse)

refers to DSPC-4 310-339series commands

Purpose:
"1" condition - selects fine band yaw control
"0" condition - selects coarse band yaw control

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

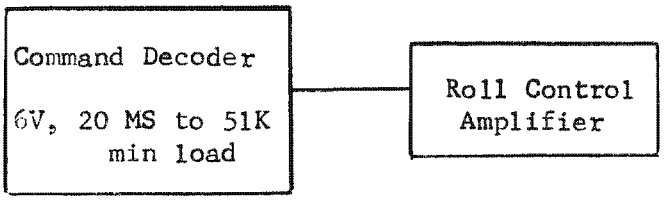
Function: Roll Deadband (Fine/Coarse) Control

Command: DSPC-4 Word 2 Bit 27 ("1" = fine; "0" = coarse)

refers to DSPC-4 310-339 series commands

Purpose:
"1" condition - selects fine band roll control
"0" condition - selects coarse band roll control

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-4 Word 2 Bit 28

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Yaw torque (On/Normal)

Command: DSPC-4 Word 2 Bit 30 ("1" = on; "0" = normal)

refers to 310-339 series commands

Purpose:

Signal Flow Sequence:

Command Decoder 28V DC, 20 MS, 100 MA

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

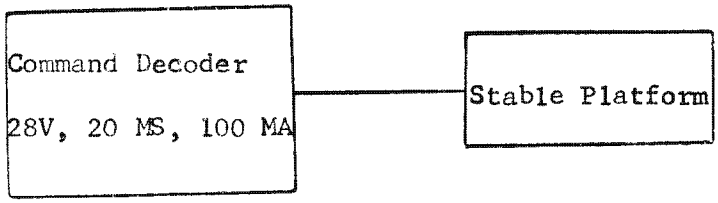
Function: Fly Forward/Normal

Command: DSPC-4 Word 2 Bit 29 ("1" = fly forward; "0" = fly normal)

refers to DSPC-4 310-339 series commands

Purpose:
"1" condition -
"0" condition -

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-4 Word 2 Bit 31

refers to 310-339 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

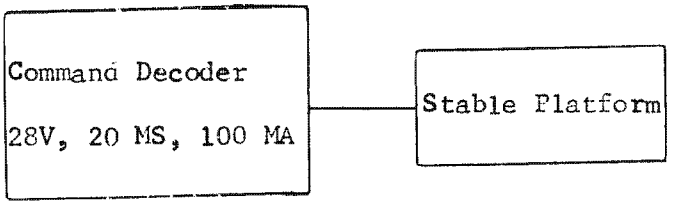
Function: Fly (Reverse/Normal)

Command: DSPC-4 Word 2 Bit 32 ("1" = reverse; "0" = normal)

refers to DSPC-4 310-339 series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-4 Word 2 Bit 33

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-4 Word 2 Bit 34

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

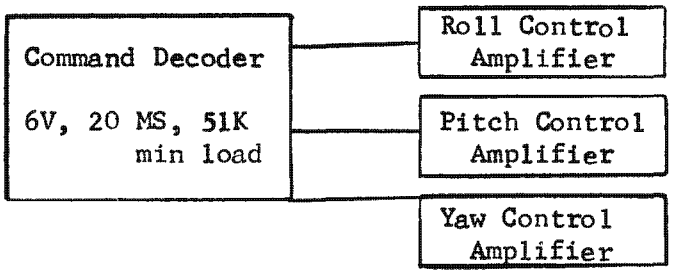
Function: Rate Roofs (Off/On)

Command: DSPC-4 Word 2 Bit 35 ("1" = off; "0" = on)

refers to DSPC-4 310-339 series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

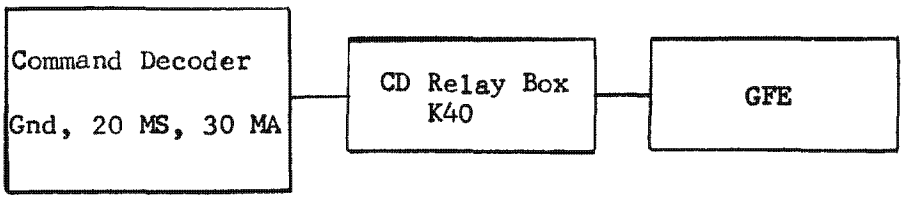
Function: GFE 1-C24 (On/Off)

Command: DSPC-4 Word 2 Bit 36 ("1" = on; "0" = off)

refers to DSPC-4 310-339 series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Parity 25-37

Command: DSPC-4 Word 2 Bit 37

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time Label

Command: DSPC - 5 Word 1 Bits 1 to 23

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Time Parity

Command: DSPC-5 Word 1 Bit 24

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Word Defining Bit

Command: DSPC-5 Word 1 Bit 25 ("0" = 1st word)

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Decoder Input Address

Command: DSPC-5 Word 1 Bits 26-27-28

refers to series commands

Purpose:

Signal Flow Sequence:

26	27	28
0	1	1

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-5 Word 1 Bit 29

refers to 340 - 376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Separate OCV/Agena

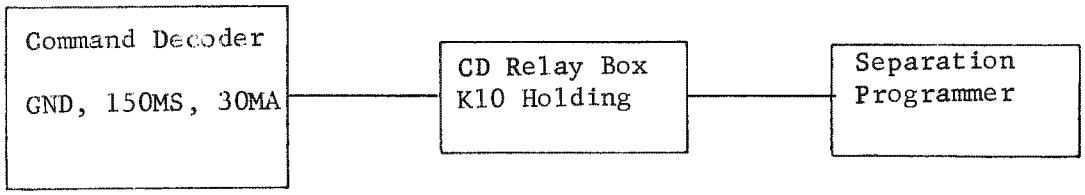
Command: DSPC-5 Word 1 Bit 30 ("1" = separate; "0" = normal)

refers to 340 - 376 series commands

Purpose:

"1" condition - fires OCV/AGENA separation squib

Signal Flow Sequence:



Effect on Telemetry:

Separation #3, Event #4 (30 KC - 17)
Separation #4, Event #3 (30 KC - 10)
Separation #7, Event #2 (40 KC - 22)
Separation #2, Event #2 (40 KC - adapter - 13)

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Roll and Pitch Gyro (Uncage/Cage)

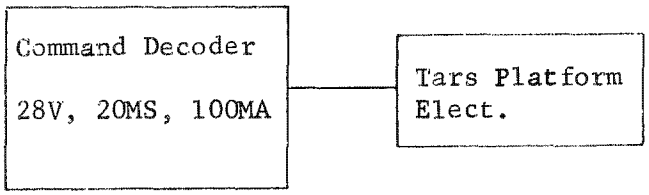
Command: DSPC-5 Word 1 Bit 31 ("1" = uncage; 0 = cage)

refers to 340-376 series commands

Purpose:

"1" condition - Uncages roll and pitch gyros.

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-5 Word 1 Bit 32

refers to 340-376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Yaw gyro (uncage/cage)

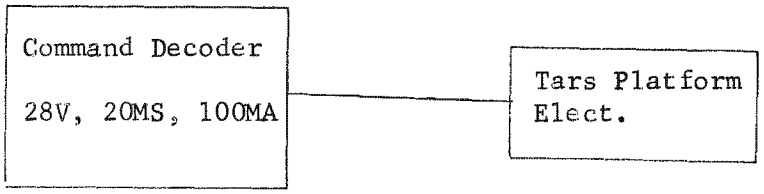
Command: DSPC-5 Word 1 Bit 33 ("1" = uncage; "0" = cage)

refers to 340-376 series commands

Purpose:

"1" condition - uncages yaw gyro

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-5 Word 1 Bit 34

refers to 340-376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Hatch Eject

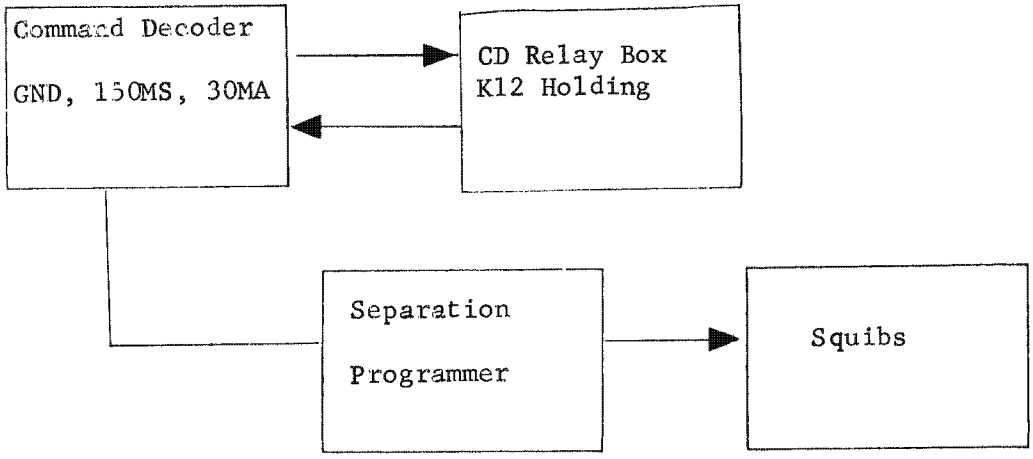
Command: DSPC-5 Word 1 Bit 35 ("1" = fire; "0" = normal)

refers to 340-376 series commands

Purpose:

To fire hatch ejection squib, normally during ascent

Signal Flow Sequence:



Effect on Telemetry:

Channel	Pin	Effect
30 kc	17	Event indicated by increase in signal level from ____% to ____%

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Pitch Position (zero/normal)

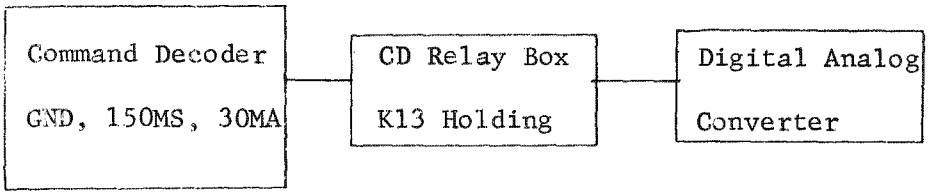
Command: DSPC-5 Word 1 Bit 36 ("1" = zero; "0" = normal)

refers to 340 - 376 series commands

Purpose:

Establishes vehicle in horizontal position.

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Function Parity

Command: DSPC-5 Word 1 Bit 37

refers to series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Pitch Down (on/normal)

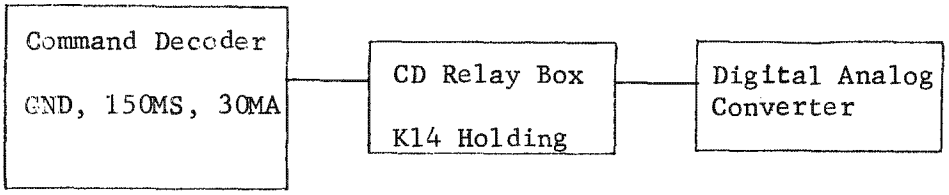
Command: DSPC-5 Word 2 Bit 1 ("1" = ON, "0" = normal)

refers to 340 - 376 series commands

Purpose:

"1" condition - place vehicle in pitch down position

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-5 Word 2 Bits 2 & 3

refers to 340 - 376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: OCV Prop. Tank Pressure (Pressure/Normal)

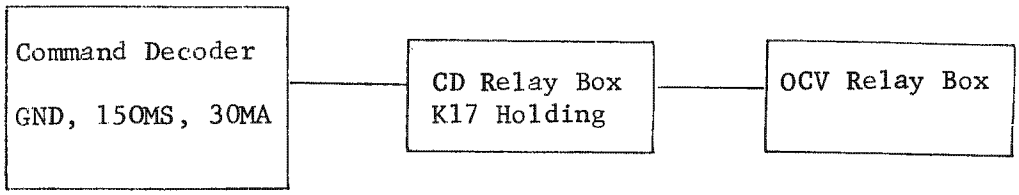
Command: DSPC-5 Word 2 Bit 4 ("1" = pressure; "0" = normal)

refers to 340 - 376 series commands

Purpose:

"1" condition - Pressurizes OCV propellant tanks

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: OCV Attitude Control Pressure (on/normal)

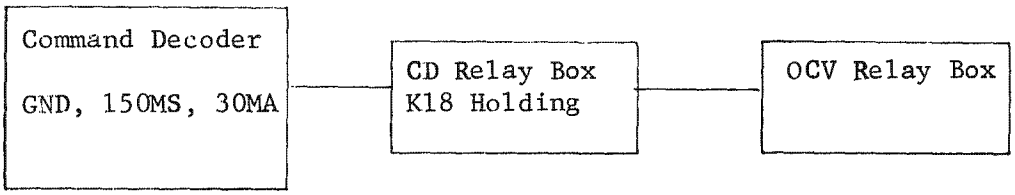
Command: DSPC-5 Word 2 Bit 5 ("1" = on ; "0" = normal)

refers to 340 - 376 series commands

Purpose:

"1" condition - pressurizes attitude control gas system

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: IR Signal (on/off)

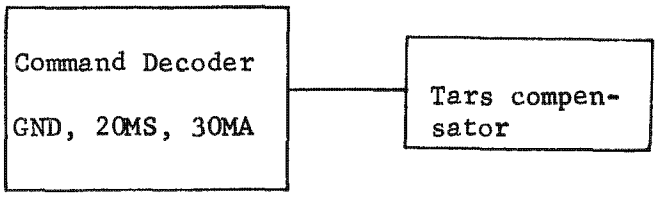
Command: DSPC-5 Word 2 Bit 8 ("1" = on; "0" = off)

refers to 340-376 series commands

Purpose:

"1" condition - selects time constant - on
"2" condition - selects time constant - off

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: OCV Spin up (on/off)

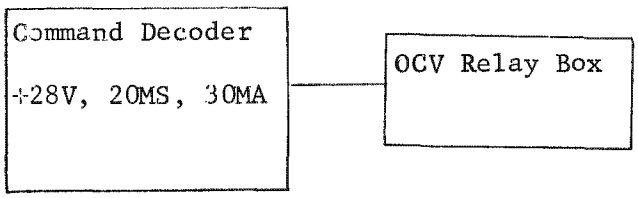
Command: DSPC-5 Word 2 Bit 6 ("1" = ON; "0" = OFF)

refers to 340 - 376 series commands

Purpose:

"1" condition - initiates OCV spin up
"0" condition - prevents OCV spin up

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-5 Word 2 Bit 7

refers to 340-376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

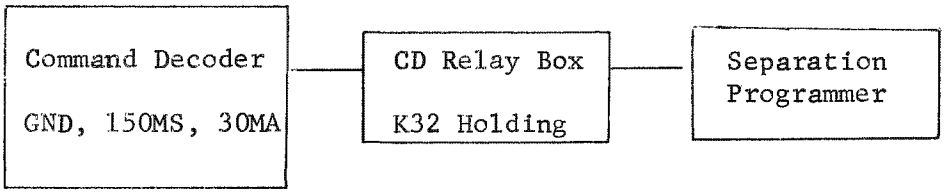
Function: Disconnect (on/normal)

Command: DSPC - 5 Word 2 Bit 9 ("1" = ON; "0" = normal)

refers to 340-376 series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-5 Word 2 Bits 10-11-12

refers to 340-376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: H-30 Prearm (on/normal)

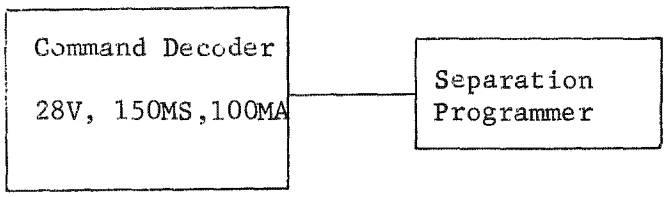
Command: DSPC-5 Word 2 Bit 13 ("1" = ON; "0" = normal)

refers to 340 - 376 series commands

Purpose:

"1" condition - fires squibs, energizing batteries

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC - 5 Word 2 Bits 14-15-16

refers to 340 - 376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

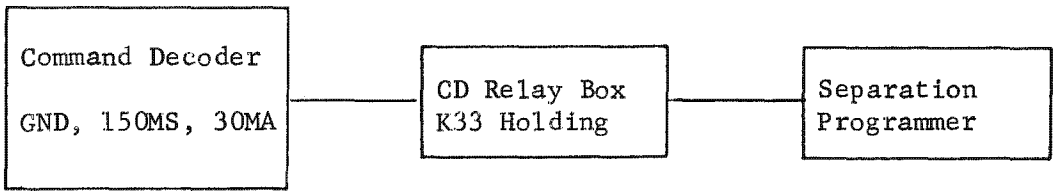
Function: H-30 Transfer (on/normal)

Command: DSPC-5 Word 2 Bit 17 ("1" = on; "0" = normal)

refers to 340-376 series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

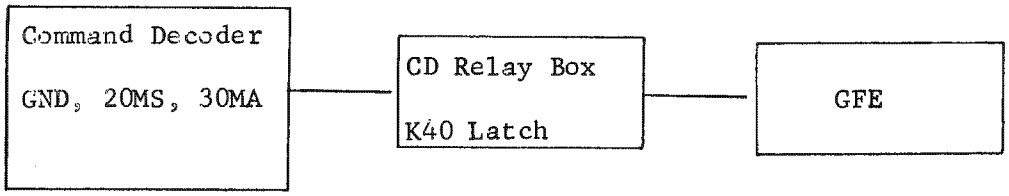
Function: GFE 1-C24 (set/reset)

Command: DSPC - 5 Word 2 Bit 18 ("1" = set; "0" = reset)

refers to 340 - 376 series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Attitude Control (on/off)

Command: DSPC-5 Word 2 Bit 19 ("1" - ON; "0" = OFF)

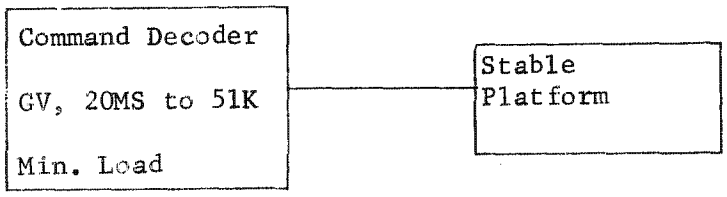
refers to 340-376 series commands

Purpose:

"1" condition - energizers attitude control subsystem

"0" condition - energizes attitude control subsystem

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-5 Word 2 Bits 20-21-22-23

refers to 340 - 376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Parity Check - Bits 1 to 23

Command: DSPC-5 Word 2 Bit 24

refers to 340 - 376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Word Defining Bit

Command: DSPC-5 Word 2 Bit 25 ("1" = 2nd word)

refers to 340 - 376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: DSPC-5 Word 2 Bits 25-32

refers to 340 - 376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

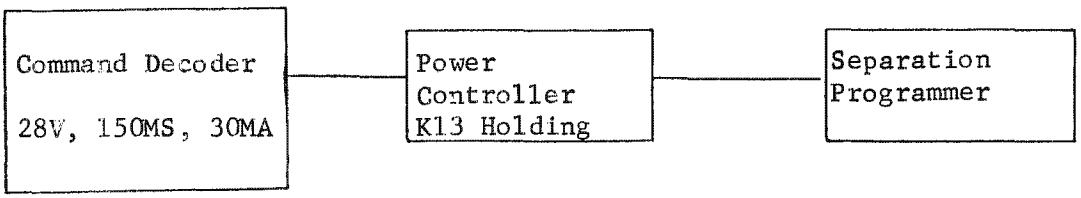
Function: H-30 Arm (on/normal)

Command: DSPC-5 Word 2 Bit 33 ("1" = ON; "0" = normal)

refers to 340 - 376 series commands

Purpose:

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Safe/Arm #3 & #4 (fire/norm)

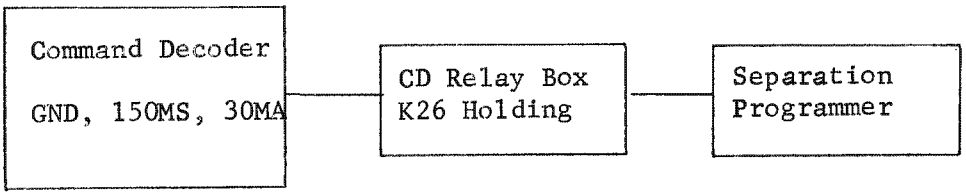
Command: DSPC-5 Word 2 Bit 34 ("1" = fire; "0" = normal)

refers to 340 - 376 series commands

Purpose:

"1" condition - activates safe/arm #3 & #4

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: TM Mode (1850/ORB)

Command: DSPC-5 Word 2 Bit 35 ("1" = 1850) "1" condition only

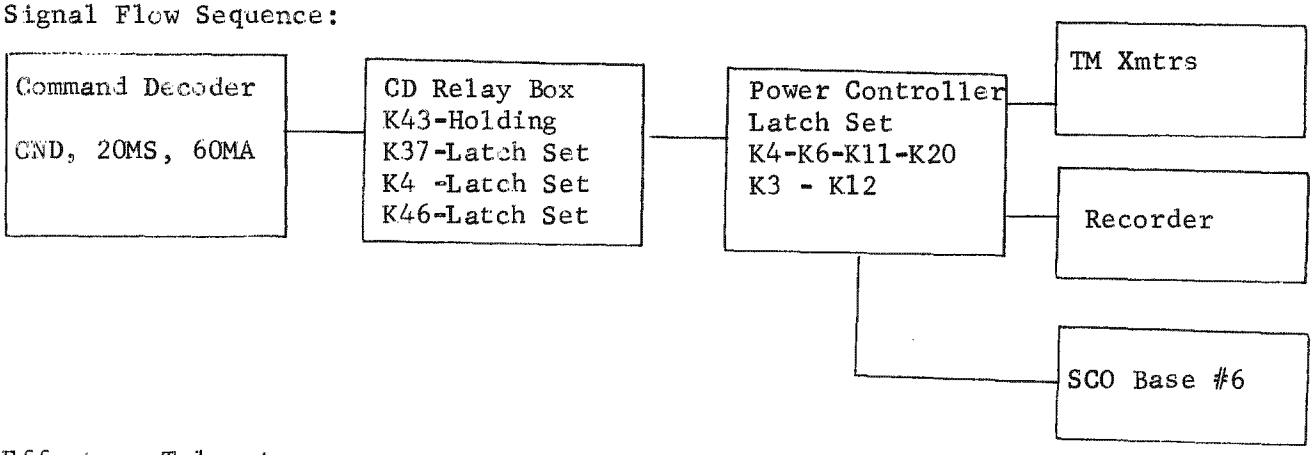
refers to 340 - 376 series commands

Purpose:

1 condition - Latches relays in power controller to energize TM Xmtrs, TM Real Time Functions, recorder in record & playback, and switches SCO's and MX's to 1850 mode.

Switches vibration outputs to base #6, 70KC, 40KC, 22KC SCO's for powered flight mode.

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

DSPC-5/2/35
(condition "1" only)

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: TM MODE (1850/ORB)

Command: DSPC-5 Word 2 Bit 35 ("0" = ORB) "0" condition only

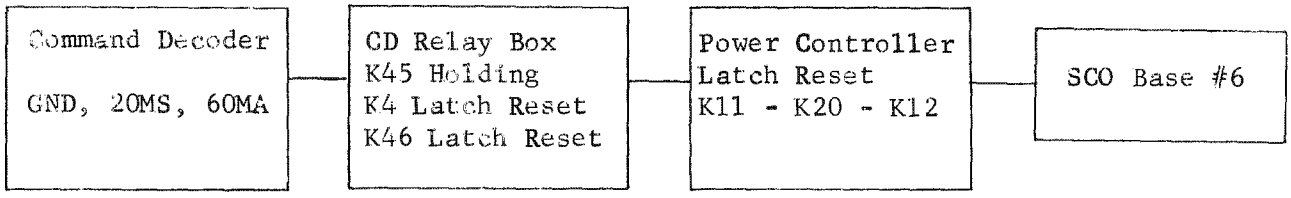
refers to 340 - 376 series commands

Purpose:

"0" condition - Resets relays in program controller to return SCO's and MXS. to orbital mode. Does not shut-off TM Wmtrs, real time functions or recorder.

Switches IR preamp-outputs and accept/reject to base #6, 70KC, 40KC, 22KC SCO's for orbital mode.

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

DSPC-5/2/35
("0" condition only)

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: OCV Engine (cutoff/norm)

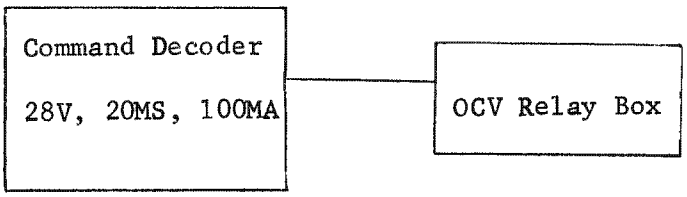
Command: DSPC - 5 Word 2 Bit 36 ("1" = cut/off; "0" = normal)

refers to 340 - 376 series commands

Purpose:

"1" condition - shuts off OCV engines

Signal Flow Sequences:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Parity 25 to 37

Command: DSPC - 5 Word 2 Bit 37

refers to 340 - 376 series commands

Purpose:

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Enable Program Line 1

Command: RTC #1

refers to series commands

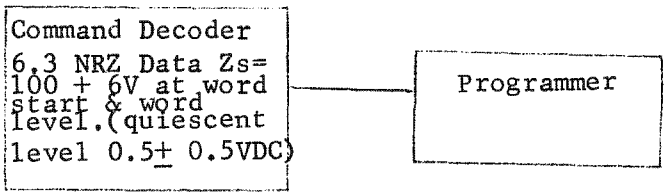
Purpose:

Shunts PPD NRZ Data to programmer line 1. Return to real time mode is by unique command or implicit with stored command to turn on PPD.

RTC Bit Arrangement:

P	2	3	4	5	6	7
0	0	0	0	0	0	0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Enable Program Line 2

Command: RTC #2

refers to series commands

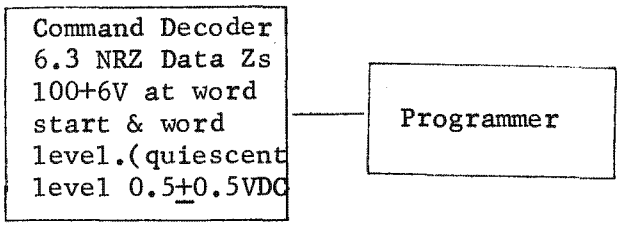
Purpose:

Shunts PPD RN2 DATA to programmer line 2. Return to real time mode is by unique command or implicit with stored command to turn on PPD.

RTC Bit Arrangement:

P	2	3	4	5	6	7
1	1	0	0	0	0	0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Enable Program Line 3

Command: RTC #3

refers to series commands

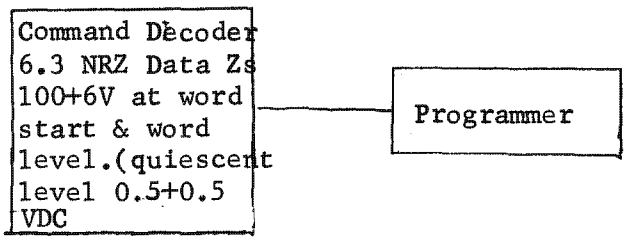
Purpose:

Shunts PPD NTZ Data to programmer Line 3. Return to real time mode is by unique command or implicit with stored command to turn on PPD.

RTC Bit Arrangement:

P	2	3	4	5	6	7
1	0	1	0	0	0	0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Enable Program Line 4

Command: RTC #4

refers to series commands

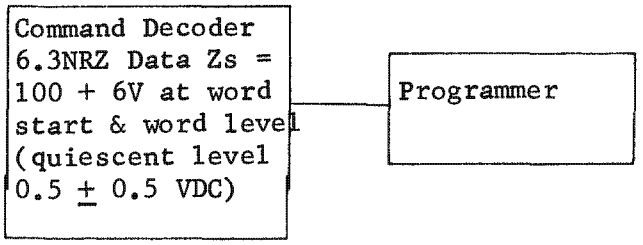
Purpose:

Shunts PPD NRZ Data to programmer line 4. Return to real time mode is made by unique command or implicit with stored command to turn on PPD.

RTC Bit Arrangement:

P	2	3	4	5	6	7
0	1	1	0	0	0	0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: GFE Environmental Power Off

Command: RTC #5

refers to series commands

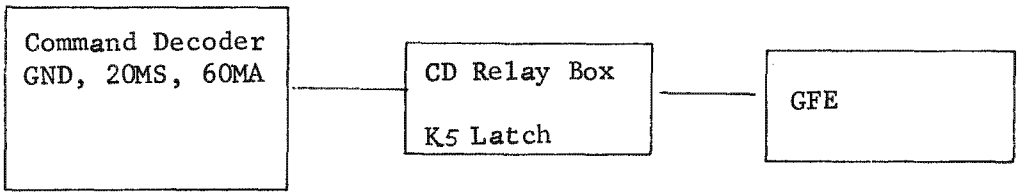
Purpose:

Remove power from GFE 1-C26A and 2-C27A

RTC Bit Arrangement:

P	2	3	4	5	6	7
1	0	0	1	0	0	0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Spare

Command: RTC #6

refers to series commands

Purpose:

RTC Bit Arrangement:

P	2	3	4	5	6	7
0	1	0	1	0	0	0

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: TM Transmitter Normal (set transfer switch)

Command: RTC #7

refers to series commands

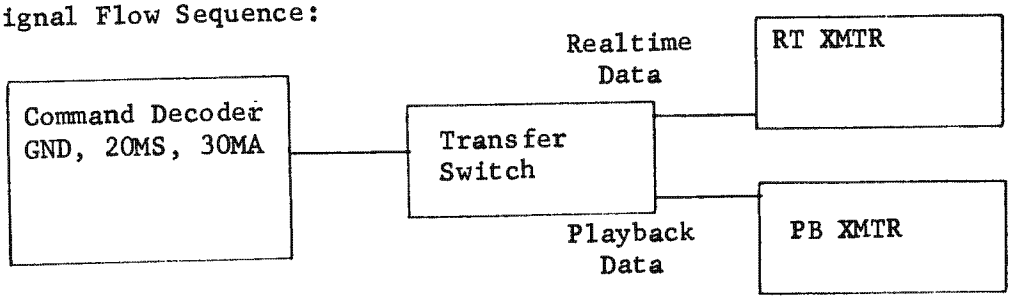
Purpose:

Sets latch relay, real time data to RT Xmtr, playback data to PB Wmtr.

RTC Bit Arrangement:

P	2	3	4	5	6	7
0	0	1	1	0	0	0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: TM transmitter reverse (reset transfer switch)

Command: RTC #8

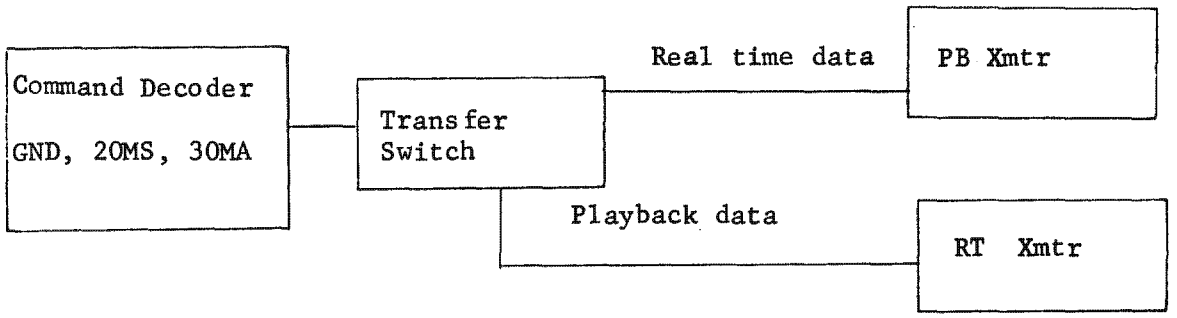
refers to series commands

Purpose:
Resets latch relay, real time data to PB Xmtr, playback data to RT Xmtr.

RTC Bit Arrangement:

P	2	3	4	5	6	7
1	1	1	1	0	0	0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

RTC #8

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Pulse Position Demodulator Off

Command: RTC #9

refers to series commands

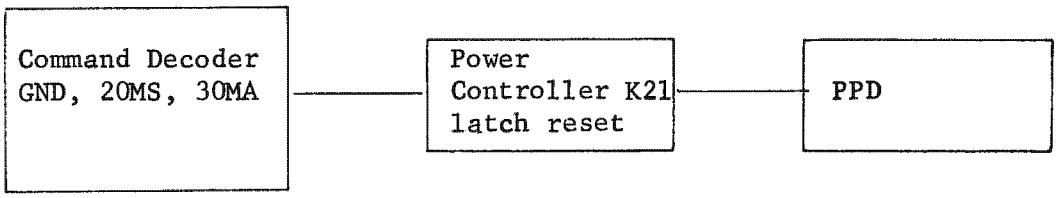
Purpose:

Removes ± 6 volts from PPD (turned on by stored command)

RTC Bit Arrangement:

P 2 3 4 5 6 7
1 0 0 0 1 0 0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: GFE Environmental Power ON

Command: RTC #10

refers to series commands

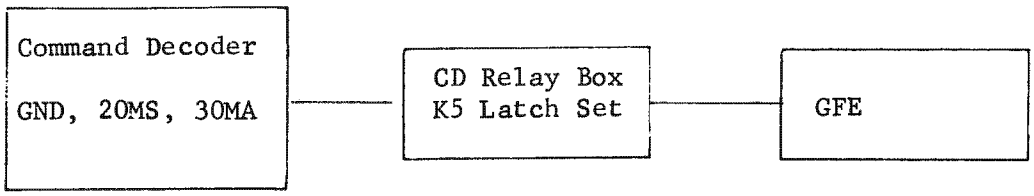
Purpose:

Applies + 28 volt DC to GFE 1-C26A and 2-C26A

RTC Bit Arrangement:

P	2	3	4	5	6	7
0	1	0	0	1	0	0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: GFE 1-C17A

Command: RTC #11

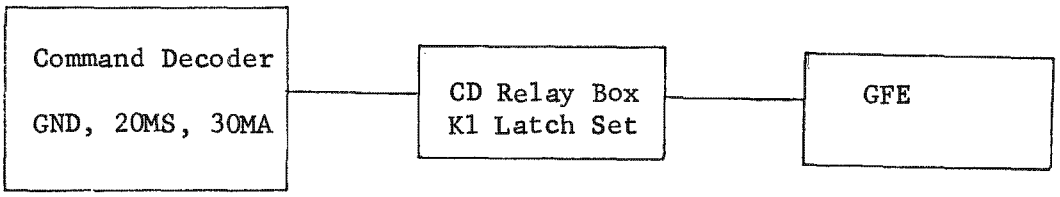
refers to series commands

Purpose:

RTC Bit Arrangement:

P 2 3 4 5 6 7
0 0 1 0 1 0 0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: GFE 1-C18A

Command: RTC #12

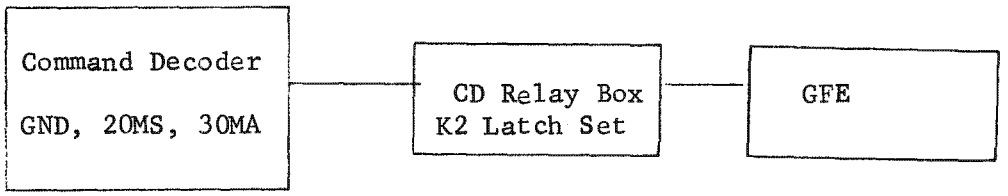
refers to series commands

Purpose:

RTC Bit Arrangement:

P	2	3	4	5	6	7
1	1	1	0	1	0	0

Signal Flow Sequence:



Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Tape Recorder ON - High Speed

Command: RTC #13

refers to series commands

Purpose:

RTC Bit Structure:

P	2	3	4	5	6	7
0	0	0	1	1	0	0

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Tape Recorder Off

Command: RTC #14

refers to series commands

Purpose:

RTC Bit Arrangement:

P	2	3	4	5	6	7
1	1	0	1	1	0	0

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Set Spare

Command: RTC #15

refers to series commands

Purpose:

RTC Bit Arrangement:

P	2	3	4	5	6	7
1	0	1	1	1	0	0

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

MALFUNCTION ANALYSIS REFERENCE BOOK

Command Function Description

Function: Reset spare

Command: RTC #16

refers to series commands

Purpose:

RTC Bit Structure:

P	2	3	4	5	6	7
0	1	1	1	1	0	0

Signal Flow Sequence:

Effect on Telemetry:

Electrical Schematic Drawing Reference:

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MALFUNCTION ANALYSIS REFERENCE BOOK

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Section 4.2

C&CS Computer Program Card Format

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

C&CS Computer Program Card Format

(to be provided later)

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 5.1

Malfunction Analysis:

Premature Loss of Battery Capacity

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARMTNET
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS: PREMATURE LOSS OF OPERATIONAL BATTERY CAPACITY

Description: This failure is characterized by the knowledge that the initial capacity of the operational batteries less the ampere-hours used is less than the ampere-hours required to complete the mission or by the knowledge that this condition is imminent.

Cause I: Loss of one or more of the five operational batteries.

Indicators: Loss of current reading(s) or sudden lower than average current reading(s) on one or more operational batteries accompanied by increased current readings on the remaining batteries.

Item	Channel	Pulse	Range	Mode
Current Opn Batt #1	30 KC	20	0-10 A	ORT
Current Opn Batt #2	30 KC	21	0-10 A	ORT
Current Opn Batt #3	30 KC	22	0-10 A	ORT
Current Opn Batt #4	30 KC	23	0-10 A	ORT
Current Opn Batt #5	30 KC	24	0-10 A	ORT

During the first four orbits it may be expected that these five readings may be significantly different and changing. After the fourth orbit, it is expected that the individual current readings will be within 10% of the average and their proportion of the average will be unchanging.

A secondary indicator is the total operational batteries current.

Item	Channel	Pulse	Range	Mode
Current Opn Batt Total	30 KC	16	0-50 A	ORT

MALFUNCTION ANALYSIS: PREMATURE LOSS OF OPERATIONAL BATTERY CAPACITY

Cause I: Loss of one or more of the five operational batteries (Continued)

The sum of the operational battery individual current readings should equal the total reading. In the event that the sum is less than the total, a faulty individual current reading may be indicated. If the total is less than the sum and one of the individual current readings is zero, a reverse current in one battery may be indicated.

The operational battery voltage is an alternate indicator for premature loss of operational battery capacity.

Item	Channel	Pulse	Range	Mode
Voltage OCV Batt	40 KC	26	23-33 V	ORT

The voltage should ecay at a predetermined rate as a function of certain operational activities. If this decay rate is excessive, it can be presumed that the available amp-hr capacity of the battery is less than intended.

Effect: This failure may cause foreshortening of the mission. When the voltage drops below 25 V, confidence in system functions drop significantly.

Recommendation: Determine the remaining capacity of the operational batteries. Terminate the mission prior to obtaining a remaining capacity of 15 ampere-hours or before operational battery voltage drops below 25.5 V.

MALFUNCTION ANALYSIS: PREMATURE LOSS OF OPERATIONAL BATTERY CAPACITY

Cause II: Unusually high current drain due to a short circuit or component malfunction.

Indicators: The ampere-hour readings will indicate a significant undesirable current drain on the operational battery.

Item	Channel	Pulse	Range	Mode
Ampere Hour Meter Total	40 KC	19	0 to 30 A-H	ORT
Ampere Hour Meter Total	40 KC	20	0 to 120 A-H	ORT
Ampere Hour Meter Total	40 KC	21	0 to 480 A-H	ORT

NOTE: The total range of the ampere-hour meter is 640 ampere-hours. After the first 640 ampere hours, the meter begins again at 0 ampere-hours.

A maximum of 26.4 ampere-hours (21 ampere-hours nominal) are consumed during one orbit. When significantly more than 21 ampere-hours have been consumed on each of four or more consecutive orbits, it is assumed that there is a high current drain on the operational batteries. A malfunction is present when no reason can be generated for this high usage.

During a station pass, real time telemetry should indicate a total current consumption of 26.25 amperes. (See Cause I for telemetry indicators). If this value suddenly increases for no known reason by 20%, it is assumed that the failure occurred between the time of normal current consumption and the time of increased current consumption. If it is desirable to know more accurately when the failure occurred, the ampere-hour reading and the increased current reading provide sufficient data to calculate an approximate time.

MALFUNCTION ANALYSIS: PREMATURE LOSS OF OPERATIONAL BATTERY CAPACITY

Cause II: Unusually high current drain due to a short circuit or component malfunction (continued)

The operational battery voltage may be an alternate indicator for excessive power drain depending upon the magnitude of the drain and the conditions of the batteries. (See Cause I for telemetry indicators and explanation)

Effect: The effect of this failure is similar to that in Cause I Failures in components that contribute to this failure or that are affected by this failure must be analyzed separately after the failed component is ascertained.

Recommendation: Determine cause of excessive power drain. If situation can be corrected, follow directions for Cause I. If situation cannot be corrected, factor the high usage rate into the remaining available mission time. Also consider the effect of the failed component or short circuit upon the mission.

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 5.2

Malfunction Analysis:

Programmer Back Up Battery Voltage Low

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS: PROGRAMMER BACK-UP BATTERY VOLTAGE LOW

Description: The programmer back-up battery supplies a constant EMF which will maintain electrical power to the programmer during transients where the operational supply drops below the programmer back-up battery voltage. When the programmer back-up battery voltage drops below the voltage required to operate the programmer, this failure has occurred. The current rating of the Programmer is 1.28 amperes, and the capacity of the Prog. B-U Batt is 5.0 amp-hr.

Cause: Programmer back-up battery voltage drops below 25 VDC due to internal short, external short or high line resistance (i.e.,cold solder joint, etc.)

Indicators:

Item	Channel	Pulse	Range	Mode
Voltage Prog. Back-up Batt.	30 KC	18	24-31 VDC	ORT

This failure is most likely to occur during powered flight or anytime that significant shock, acceleration or vibration are encountered. A voltage sensing error may not be distinguishable from a failure.

Vehicle clock time is an alternate indicator. If the vehicle clock time has changed its calibration and is incorrect, it may be assumed that the Programmer Back-Up Battery voltage was too low permitting the clock register to change its bit structure.

Item	SCO	Sensor Range	Mode
Vehicle clock time	70 KC	Events	ORT
Vehicle clock time	70 KC	Events	PF

MALFUNCATION ANALYSIS: PROGRAMMER BACK-UP BATTERY VOLTAGE LOW

Effect: The Programmer Back-Up Battery supplies current to the programmer when the operational voltage drops below the Prog. B-U. Battery voltage. This may occur frequently near the end of the mission. Current transients cause voltage drop spikes which if not attenuated may cause the delay lines in the programmer or the clock register to drop or pick up bits. Confidence in a successful separation of the nose cone from the OCV deteriorates after this failure occurs.

Recommendation: If possible, separate prior to this failure occurring. Telemetry data may indicate the decay of the battery. In the event the failure has occurred, separate the nose cone as soon as practical realizing that confidence in a successful separation deteriorates rapidly as the voltage drops below 25 and zero confidence is presumed when the voltage is below 24V. If the clock register is not reading correctly, determine, if possible, the clock time and restructure the command words using the new clock time in determining the time tag.

If the clock time changes radically, six (6) minutes or more it may be difficult to acquire the vehicle again to determine the clock time aboard. Lifeboat may be used to deboost the reentry vehicle.

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MALFUNCTION ANALYSIS REFERENCE BOOK

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Section 5.3

Malfunction Analysis:

Loss of Gaseous Nitrogen

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

SECTION 5.3

MALFUNCTION ANALYSIS: LOSS OF GASSEOUS NITROGEN

Description: This malfunction is characterized by the loss of the nitrogen gas that is used to discharge the fuel and oxidizer from their respective tanks during the orbit control vehicle engine firing. The gas is stored at high pressure (see orbit adjust subsystem description, Section 2.3, page 2.3.1) and regulated to a lower pressure for use. The quantity of gas is not great and a small leak could deplete it rapidly. Squib valves are employed immediately downstream of the nitrogen tank and burst diaphragms are employed immediately upstream of the fuel and oxidizer tanks to minimize leakage until the use of the nitrogen gas is required.

Cause: Leaks in any of the components, or tubing from the nitrogen storage tank to the fuel and oxidizer tanks inclusive will cause depletion of the nitrogen gas supply. It is also possible that a failed relief valve could deplete the nitrogen supply.

Indicators: The pressure of the nitrogen gas is measured between the nitrogen tank and the squib valves.

Item	Channel	Pulse	Range	Mode
Pressure OCV N_2 Regulator Inlet	30 KC	19	0 to 5000 psia	ORT

Before the squib valves are blown the nominal pressure should be 4500 psia. When the fuel and oxidizer tanks are empty and there has been max. spec leakage, the pressure should be 500 psia.

MALFUNCTION ANALYSIS: LOSS OF GASEOUS NITROGEN

The nitrogen gas supply pressure cannot reasonably go below the fuel and oxidizer tanks' pressures. Especially, if the nitrogen pressure drops to zero, the fuel and oxidizer tanks pressures should be monitored.

Item	Channel	Pulse	Range	Mode
Pressure OCV oxidizer	10.5 KC	21	0-350 psia	OR + RT
Pressure OCV fuel	10.5 KC	22	0-350 psia	OR + RT

If these indicators read higher than the prime indicator the nitrogen pressure transducer may be failed.

Effect: If the nitrogen supply pressure goes below 2000 psia, insufficient pressure will be available to accomplish the cross nominal range correction.

Recommendation: Monitor the nitrogen gas pressure immediately before and after each orbit adjust and well in advance of each orbit adjust in order to determine whether any loss of gas has taken place. It may be best to plan a cross range correction with the last remaining effective nitrogen pressure.

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MALFUNCTION ANALYSIS REFERENCE BOOK

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Section 5.4

Malfunction Analysis:

Orbit Adjust Not Accomplished Properly

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS: ORBIT ADJUST NOT ACCOMPLISHED PROPERLY

Description: An orbit adjust may not be accomplished properly because the impulse was not received at the proper location in the orbit or because the impulse was of wrong magnitude or in the wrong direction. Any of these will so effect the orbit that tracking will eventually indicate that the vehicle is not at its intended position.

Cause I: Low impulse due to rocket engine(s) not firing. If only one engine fires, one-half the desired impulse will be generated.

Indicators: The prime indicator for this malfunction is the tracking data. It will indicate that only approximately one-half of the impulse was received at the correct location in orbit. However, an engine may have failed or tuned off early giving an indication of more than one half of the impulse being received.

The gaseous nitrogen pressure is an alternate indicator of this malfunction.

Item	Channel	Pulse	Range	Mode
Pressure OCV N_2 Regulator Inlet	30 KC	19	0 to 5000 psia	ORT

Each engine will consume fuel and oxidizer at a constant rate while it is producing the required thrust. When both engines are operating properly, the nitrogen pressure should drop 240-260 psi per minute. If one engine is not firing due to a solenoid not operating on either the fuel or oxidizer, but no both, then the pressure loss will be approximate 3/4 of the above drop. If both the fuel and oxidizer

solenoids were to be closed on one engine while the other engine is firing, the pressure drop should be about 120-130 psi per minute. If a fuel or oxidizer solenoid were to fail closed on each of the engines the pressure drop should be between 1/2 an 3/4 of the pressure drop for normal operation.

The pressure loss will be greater than 240-260 psi if one or two of the rocket engines is not firing because the engine(s) is damaged. The greater the engine damage, the greater the pressure loss.

Effect: The loss of one or two engines during an orbit adjust will cause the SV to be in an incorrect orbit. If the loss of an engine is due to an engine exploding or the burning through of the combusion chamber wall, attitude control components on the aft bulkhead may be affected. These include the IR sensors and tars platform, solenoid valves and nozzles, attitude control gas storage tanks, pneumatic lines and wiring.

Recommendations: If it is concluded that one engine is inoperable, the next orbit adjust should be accomplished using the operable engine. It may be difficult or impossible to detect which engine is affected. In this case, plan the orbit adjust with either engine, but not with both. A correct velocity increment or decrement will indicate that the engine chosen was in fact the operable engine. If, however, no change in velocity is noted from the orbit adjust, make an orbit adjust using the other engine.

MALFUNCTION ANALYSIS: ORBIT ADJUST NOT ACCOMPLISHED PROPERLY

Cause II: Low impulse due to improper burning in rocket engines. Improper burning may be due to either off design fuel to oxidizer ratio or to low chamber pressure. Low combustion chamber pressure will be caused by an excessinely eroded nozzle throat.

Indications: Improper fuel to oxidizer ratio will be indicated by the fuel and oxidizer pressures and temperatures.

Item	Channel	Pulse	Range	Mode
Pressure Fuel	10.5kc	21	0 to 300 psia	OR+RT
Pressure Oxidizer	10.5kc	22	0 to 300 psia	OR+RT
Internal Temp. Fuel	10.5kc	20	0 to 150°	OR+RT
Internal Temp. Fuel	10.5kc	14	0 to 150°	OR+RT

If the two pressures are different by 20 psi or more and the temperatures are different by 25°F or more the fuel to oxidizer ratio will be such that the improper thrust will be obtained.

If the nozzle throat is excessively eroded so that low thrust is a problem, the nitrogen gas pressure will drop excessively, Se cause one for telemetry description. The pressure drop will be greater than that expected for normal engine operation.

Effect: The orbit adjust will be somewhat less than anticipated.

Recommendation: If temperatures are the 5.4-3 precipitating factor, another orbit adjust may be made after the temperatures have adjusted themselves. If pressure is a factor, the next orbit adjust may be timed using the previous orbit adjust as a calibration for velocity increment versus engine time.

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MALFUNCTION ANALYSIS REFERENCE BOOK

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SECTION 5.5

MALFUNCTION ANALYSIS:

ATTITUDE CONTROL RATE MALFUNCTION

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS REFERENCE BOOK

SECTION 5.5

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE RATE ERROR EXCEEDS ALLOWABLE LIMITS

Description: Two (2) items, rate and position, either individually or collectively are limited by tolerances to a specified region called a deadband. In normal orbit operation (excluding yaw around, pitch down, or roll maneuvers) the deadbands in all three (3) channels will be exceeded at a certain rate. A typical attitude cycle consists of the following:

1. Drifting in deadband (within tolerance)
2. Drifting out of deadband (exceeds tolerance, solenoids on)
3. Drifting back into deadband (opposite in direction to 1.)
4. Drifting out of deadband (opposite in direction to 2, solenoids on)

If the amount of time that the vehicle is outside deadband limits is high when compared to its time within limits, a malfunction in rate or position circuitry must have occurred.

The impulses imparted to the vehicle by the nozzles are such that high rate should not present a problem. Only a malfunction will cause high rates.

A malfunction has occurred if the rate in fine and/or coarse mode continually exceeds the deadband limits for a cumulative time of twenty (20) per cent of an observed period (e.g. five orbits). Tolerances in fine deadband are $\pm$ .05°/sec. In coarse deadband $\pm$ .05 °/sec. is the limit. In fine control mode with rate roofs on, the rate tolerances are $\pm$ .02°/sec.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE RATE ERROR EXCEEDS ALLOWABLE LIMITS

Rate and position information should be studied to verify a rate malfunction since in almost every case both determine when the ACA operates. Rate and position information are available on operational telemetry.

Item	Channel	Pulse	Range	Mode
Roll Attitude Error ACA	22 KC	7,22	$\pm$ 5°	OR,RT
Pitch Attitude Error ACA	22 KC	8,23	$\pm$ 5°	OR,RT
Yaw Attitude Error ACA	22 KC	9,24	$\pm$ 5°	OR,RT
Fine Gyro Roll Rate Output	2.3 KC	Continuous	$\pm$.05°/sec.	OR,RT
Fine Gyro Pitch Rate Output	3.9 KC	Continuous	$\pm$.05°/sec.	OR,RT
Fine Gyro Yaw Rate Output	3.0 KC	Continuous	$\pm$.05°/sec.	OR,RT

Out of tolerance rate data would indicate that the attitude control gas will be comsumed at a higher than average rate. The usage rate can be determined from operational telemetry.

Item	Channel	Pulse	Range	Mode
Pressure Attitude Control Storage Tank	40 KC	27	0-5450 psia	ORT
Temp. Cold Gas Line (Int.)	30 KC	9	-60 to 200°F	ORT

Knowledge of usage rate will be one of the main factors in determining mission life.

High rates are to be expected during and after orbit adjusts. Ten seconds after an orbit adjust the vehicle should be within the deadband.

During and immediately after a switch from coarse to fine mode operation the limit cycle will be exceeded. The vehicle should settle within the new deadband within twenty (20) seconds.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE RATE ERROR EXCEEDS ALLOWABLE LIMITS

Some causes of rate failure are similar to those for position failure. These will be discussed later in the analysis.

Most causes cannot be determined from operational telemetry. To find the cause of a rate malfunction additional telemetry (Alternate Indicators) must be studied.

Cause I: Rate Gyro System (RAGS) Malfunction

The RAGS measures the vehicle angular velocities about 3 separate axes in vehicle coordinates. Gyro output (telemetered as coarse rate data) goes to the Attitude Control Amplifier (ACA) which in turn controls the operation of the attitude control gas solenoids.

The RAGS malfunction may be such that the output signal is biased high. This results in an erroneous signal to telemetry and the ACA. Gas would then be expended in attempting to correct the vehicle.

Coarse rate information can be studied on operational telemetry listed in the description. To verify this cause an Alternate Indicator must be studied.

Item	Channel	Pulse	Range	Mode
Coarse Gyro Roll Rate Output	22 KC	6,21	$\pm 5^{o}$/sec.	OR,RT
Coarse Gyro Pitch Rate Output	10.5 KC	3,18	$\pm 1.5^{o}$/sec.	OR,RT
Coarse Gyro Yaw Rate Output	10.5 KC	4,19	$\pm 1.5^{o}$/sec.	OR,RT

A malfunction in the RAGS would be indicated by an out of tolerance reading as specified in the description.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE RATE ERROR EXCEEDS ALLOWABLE LIMITS

Cause I (Cont'd): Rate Gyro System (RAGS) Malfunction

Effect: Out of tolerance rates would indicate a high cold gas comsumption rate. Since the amount of cold gas determines the mission life a rapidly diminishing supply of gas will decrease the time in orbit.

Recommendation: A malfunction in the RAGS cannot be fixed or by-passed. The vehicle should be called down before gas necessary for maneuvering prior to deboost is exhausted.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE RATE ERROR EXCEEDS ALLOWABLE LIMITS

Cause II: Attitude Control Amplifier (ACA) Malfunction

The ACA provides circuitry to control the operation of High and Low thrust solenoid valves in both the positive and negative direction for both coarse and fine limit cycle operation. The ACA's for pitch, roll, and yaw channels are identical.

Gyro Fine Rate Output telemetry listed in the description along with the Gyro Coarse Rate Output shown in Cause I must be studied to determine an ACA failure. If the Fine Rate information is out of tolerance and Coarse Rate data is within tolerance, a failure in the ACA circuitry has occurred. If both values exceed tolerances then Cause I would be indicated.

Another ACA failure mode would be the failure to open or close a solenoid. This can be verified by looking at the direction of tne position and rate information on operational telemetry and then studying the following alternate indicators.

Item	Channel	Pulse	Range	Mode
Pitch ACA Output	22 KC	11,26	Event *	OR,RT
Yaw ACA Output	22 KC	12,27	Event *	OR,RT
Roll ACA Output	22 KC	13,28	Event *	OR,RT

* These events are:
High Positive Thrust +4 VDC
High Negative Thrust +3 VDC
Low Positive Thrust +2 VDC
Low Negative Thrust +1 VDC

A change in voltage level denotes the turning on of a solenoid. If the position and rate error are in the same direction and the corresponding solenoid is also on then a failure in the ACA has occurred. For correct operation the solenoid with a sign opposite in direction to the error must function when the deadband in that direction is exceeded.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE RATE ERROR EXCEEDS ALLOWABLE LIMITS

Cause II (cont'd.): Attitude Control Amplifier (ACA) Malfunction

Effects: The result of high rates is rapid attitude control gas usage. This will shorten the mission life.

Recommendation: The vehicle should be called down as soon as possible.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE RATE ERROR EXCEEDS ALLOWABLE LIMITS

Cause III: Attitude Control Gas Solenoid Valves Improperly Operating

The rate out-of-tolerance condition may be caused by the vehicle drifting out of deadband due to lack of solenoid action or by being forced out of the region by the valves not closing. Drift could also be the result of no attitude control gas.

These items, their effects and recommendations are discussed in 5.7.

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 5.6

Malfunction Analysis:

Premature Loss of Stabilization Gas (CF_4) Pressure

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS

Title: Premature loss of stabilization gas pressure (CF_4)

Description: The amount of gas remaining in the storage tanks is insufficient to supply the stabilization needs for the remainder of the intended mission. The loss of the stabilization gas either through leaks, inoperative solenoids, or high usage rate is considered in this analysis.

Cause I: Leaks in tanks, tubing, connectors, or components other than solenoids or nozzles.

Indicators: Compare the quantity of stabilization gas remaining with that predicted to be required to complete the mission. The quantity of stabilization gas remaining in the storage tanks is calculated from the temperature and pressure.

Item	Channel	Pulse	Range	Mode
Pressure attitude control storage tank	40 Kc	27	0 to 5450 psia	ORT
Temperature Cold Gas line (int)	30 Kc	9	-60 to 200°F	ORT

Effect: If no stabilization gas remains at time of deboost then the vehicle cannot be oriented in space for the proper deboost sequence.

Recommendation: Deboost can be accomplished in the normal manner if initiated when the tank pressure exceeds 600 psia. However, there may be no gas remaining for any other operations.

MALFUNCTION ANALYSIS

Premature loss of stabilization gas (CF_4)

Cause II: Loss or high usage rate due to a solenoid or nozzle malfunction

Indicators: Indication of this failure will be similar to indicators for Cause I plus the fact that the vehicle will make spurious movements that will be indicated by the secondary indicators of the pitch, roll, and yaw attitude control amplifier outputs, e.g., if a roll solenoid is not operative during the time when roll is called for a pitch and yaw movement will be made by the vehicle.

Item	Channel	Pulse	Range	Mode
Pitch attitude control amplifier output	22 Kc	11 & 26	events	OR & RT
Yaw attitude control amplifier output	22 Kc	12 & 27	events	OR & RT
Roll attitude control amplifier output	22 Kc	13 & 28	events	OR & RT

To compensate for this, the pitch and yaw nozzles will operate more frequently than necessary under normal circumstances.

Effect: Depletion of the stabilization gas supply prior to deboost.

Recommendation: In this case one may choose to operate on high or low level nozzles in order to avoid using the failed nozzle or solenoid.

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 5.7

Malfunction Analysis:

Altitude Control High or Low Thrust Failure

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MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
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MALFUNCTION ANALYSIS REFERENCE BOOK

SECTION 5.7

MALFUNCTION ANALYSIS: ATTITUDE CONTROL HIGH OR LOW THRUST FAILURE

Description: Partial or total loss of the attitude control impulse in the high or low level will constrain the vehicle from operating correctly in either the normal control mode and maneuver modes or orbit adjust mode, separation and spin modes or all modes. High level thrust is used only during orbit adjusts, separation and spin up.

High level thrust is initiated in pitch, roll, and yaw 2.0 sec. prior to execution of the engine on command and terminated 1.0 sec. after execution of the engine off command. During the orbit adjust mode, pitch and roll high level thrust is initiated 3.5 sec. after the pin pullers are actuated and terminated in 6.5 sec. Spin up is executed in roll high level thrust. Low thrust is used during all other modes.

Cause I: This failure may occur in pitch, roll, or yaw in the plus or minus direction on the high or low levels due to a solenoid failure, CF_4 freezing in a nozzle or solenoid, or a leak in a gas line between the solenoid and the nozzle. CF_4 will not freeze unless some thermal unbalance is generated by some other failure. In all of these cases, the thrust of the nozzle could be degraded or non-existant.

Indicators: The prime indicator of this malfunction will be the position error.

Item	Range	Channel	Pulse	Mode
Roll attitude error ACA	$\pm 5^o$	22 KC	7	OR,RT
Pitch attitude error ACA	$\pm 5^o$	22 KC	8	OR,RT
Yaw attitude error ACA	$\pm 5^0$	22 KC	9	OR,RT

MALFUNCTION ANALYSIS: ATTITUDE CONTROL HIGH OR LOW THRUST FAILURE

Due to this particular cause the position error should exceed its limits of ± .3 degrees in fine deadband or ±1.5 degrees in coarse deadband and continue to migrate further from the zero position with time. In order to verify this failure in a shorter period of time, it is necessary to note whether the rate is changing in sense and direction as the position error.

Item	Range	Channel	Pulse	Mode
Gyro Roll Rate Output fine	± .05o/sec.	2.3 KC	Continuous	OR,RT
Gyro Pitch Rate Output fine	± .05°/sec.	3.9 KC	Continuous	OR,RT
Gyro Yaw Rate Output fine	± .05°/sec.	3.0 KC	Continuous	OR,RT

If the rate is positive or negative and the position error is respectively positive or negative, then the nozzle is providing no correcting impulse to return the vehicle to its position within the deadband. If the rate changes from positive to negative or vice verse in a very long time (longer than two (2) seconds) and the position error slowly begins to correct itself then the nozzle is providing degraded thrust.

Alt. Indication & Checks: In order to clearly isolate this malfunction from an attitude sensing error, it is necessary to monitor the secondary indicators in the table below.

Item	Channel	Range	Pulse	Mode
Pitch ACA output	22 KC	4 levels 5V	11	OR,RT
Yaw ACA output	22 KC	4 levels 5V	12	OR,RT
Roll ACA output	22 KC	4 levels 5V	13	OR,RT

MALFUNCTION ANALYSIS: ATTITUDE CONTROL HIGH OR LOW THRUST FAILURE

The Attitude Control Amplifier (ACA) must be providing a signal to return the nozzles on. If the signal from the ACA indicates a positive solenoid should have been called into action, and the position error is negative, and the rate is negative, then it is presumed that the ACA is not at fault. Similarly, if the ACA output is negative, and the position and rate error is positive, then the ACA is sending a correct signal to the solenoid. To further verify the case of frozen CF_4 monitor the temperature of the gas.

Item	Range	Channel	Pulse	Mode
Temp. cold Gas Line (int)	-60 to 200°F	30 KC	9	ORT

If this temperature is below -20°F. frozen freon 14 may be suspected.

Effect: The effect of this failure is that the vehicle will have an error in one direction and one sense only. It may be that the vehicle passes out of the deadband and does not return or that the vehicle is outside the deadband in one sense much longer than it is in the other sense. This failure is much more likely to occur in the low levels which are used for most of the missions. A failure in the high levels during orbit adjust will probably cause the vehicle to be far out of the deadband at the end of the engine firing. Normally only ten (10) minutes are required to stabilize the vehicle after an orbit adjust. This malfunction in the high levels may cause the vehicle to require much more time than ten (10) minutes to stabilize.

Recommendation: When this malfunction occurs in the low level, it is recommended that the high level in the same direction be used in lieu of the low level. Monitor the gas usage rate (refer to Section 5.4)

Recommendation (Continued)
in order that the mission can be terminated prior to exhaustion of the Freon Gas. If it is determined that this failure has occurred in a high level, a subsequent orbit adjust may cause the vehicle to lose its earth reference and tumble. It is recommended that the mission be terminated without attempting another orbit adjust or cross range correction.

If frozen CF_4 is suspected, attempt to determine the prime malfunction that caused the CF_4 to freeze. Possible causes of CF_4 freezing are listed below. Confirmation of these can be made by tracking and telemetry.

1. Total or partial loss of thermal blanket during SV/Agena separation.
2. Total or partial loss of thermal blanket during OCV engine firing.
3. Leaks in the CF_4 pneumatic system.
4. Moisture in the CF_4
5. Orbit outside of design limits

MALFUNCTION ANALYSIS: ATTITUDE CONTROL HIGH OR LOW THRUST FAILURE

Cause II: A regulator may malfunction so that is provides lower pressure than intended, or it may provide no pressure at all. Frozen CF_4 may be a contributor.

Indicators: The indicators here are the same as for Cause I except that more than one control direction is involved. However, if frozen CF_4 is suspected monitor its pressure in order to determine whether leaks in the pneumatic system are causing the rapid drop in temperature.

Item	Range	Channel	Pulse	Mode
Pressure Attitude Control Storage Tank	0 to 5450 psia	40 KC	27	ORT

Continuous monitoring is required to determine whether a sudden increase in gas depletion rate has occurred.

Effect: The vehicle will have position errors and rates in the same sense simultaneously in two or three directions, depending on the operational mode. (See description) Refer to the effect of Cause I for more information.

If this failure occurred in the high levels, OCV spin up will not occur or be degraded.

Recommendation: Command the high levels in the affect directions if the failure occurred in the low levels. If the high levels are affected use only low levels and do not attempt an orbit adjust. Deboost as soon as possible.

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 5.8

Malfunction Analysis:

Attitude Control Position Malfunction

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
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MALFUNCTION ANALYSIS REFERENCE BOOK

SECTION 5.8

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE POSITION ERROR EXCEEDS ALLOWABLE LIMITS

Description: The circuitry and mechanisms associated with pitch and roll channels are identical. The yaw channel is similar to pitch or roll but there are some differences. However it is felt that the following information will apply generally to all three channels.

Two (2) items, rate and position, either individually or collectively are limited by tolerances to a specified region called a deadband. In normal orbit operation (excluding yaw around, pitch down, or roll maneuvers) the deadbands in all three (3) channels will be exceeded at a certain rate. A typical attitude cycle consists of the following:

1. Drifting in deadband (within tolerance)
2. Drifting out of deadband (exceeds tolerance, solenoids on)
3. Drifting in deadband (opposite in direction to 1.)
4. Drifting out of deadband (opposite in direction to 2, solenoids on)

If the amount of time that the vehicle is outside deadband limits is high when compared to its time within limits, a malfunction in rate or position circuitry must have occurred.

A failure in the Stabilization Subsystem has occurred if the vehicle angular position-error information in any of the pitch, roll, or yaw channels exceeds tolerances of $\pm$ 0.5 degrees in fine control deadband and $\pm$ 1.8 degrees in the coarse control deadband for a period of ten (10) per cent of an observed time (e.g., five orbits).

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE POSITION ERROR EXCEEDS ALLOWABLE LIMITS

Rate and position information should be studied to verify a position malfunction. The position may be outside the error deadband but the rate will be such that the vehicle will be correcting for the out of tolerance condition. Both rate and position information are available on operational telemetry.

Cause 1: A malfunction in an Attitude Control Amplifier (ACA).

The ACA controls the operation of High and Low thrust solenoid valves in both the positive and negative direction during coarse and fine control limit cycle operation. The control mode and thrust level are selected by stored program command (See page). A failure in the ACA would cause improper solenoid action thus affecting position error. An out of tolerance position error would be reflected in operational telemetry.

Primary Indication:

Item	Channel	Pulse	Range	Mode
Roll Attitude Error ACA	22 KC	7, 22	$\pm 5^{o}$	OR,RT
Pitch Attitude Error ACA	22 KC	8, 23	$\pm 5^{o}$	OR,RT
Yaw Attitude Error ACA	22 KC	9, 24	$\pm 5^{o}$	OR,RT

During and immediately after an orbit adjust the position error may exceed tolerances but should settle in the deadband within approximately ten seconds. An exception to this occurs if there is a yaw around prior to and following an orbit adjust. A time of approximately eighty (80) minutes is needed to complete a yaw around maneuver.

Alternate Indication:

A secondary indicator monitors the ACA output and will be found in diagnostic telemetry.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE POSITION ERROR EXCEEDS ALLOWABLE LIMITS

Cause I (cont'd.): A malfunction in an Attitude Control Amplifier (ACA).

Item	Channel	Pulse	Range	Mode
Pitch ACA Output	22 KC	11, 26	Events *	OR,RT
Roll ACA Output	22 KC	12, 27	Events *	OR,RT
Yaw ACA Output	22 KC	13, 28	Events *	OR,RT

* These events are:
High Positive Thrust + 4 VDC
High Negative Thrust + 3 VDC
Low Positive Thrust + 2 VDC
Low Negative Thrust + 1 VDC

Telemetry does not show when the solenoids are turned off. Rate information must be studied to determine this state. If an attitude rate is changing, the corresponding solenoids are open. If the rate is constant, the valves are closed. Attitude rate data can be read in fine and coarse control mode. Fine control data is present on operational telemetry.

Item	Channel	Pulse	Range	Mode
Fine Gyro Roll Rate Output	2.3 KC	Continuous	$\pm$.05°/sec.	OR,RT
Fine Gyro Pitch Rate Output	3.8 KC	Continuous	$\pm$.05°/sec.	OR,RT
Fine Gyro Yaw Rate Output	3.0 KC	Continuous	$\pm$.05°/sec.	OR,RT

Alternate indicators are located in diagnostic telemetry data.

Coarse rate information is taken from the Rate Gyro System (RAGS) output. This item must be studied to determine rate if fine rate data exceeds its telemetry range.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE POSITION ERROR EXCEEDS ALLOWABLE LIMITS

Cause I (cont'd.): A malfunction in an Attitude Control Amplifier (ACA).

Item	Channel	Pulse	Range	Mode
Coarse Gyro Roll Rate Output	22 KC	6, 21	± 5.0°/sec.	OR,RT
Coarse Gyro Pitch Rate Output	10.5 KC	3, 18	± 1.5°/sec.	OR,RT
Coarse Gyro Yaw Rate Output	10.5 KC	4, 19	± 1.5°/sec.	OR,RT

When the vehicle position is outside the deadband cold gas is expended in correcting the error. Gas usage rate will be above the expected due to frequent correction. Consumption will be reflected in the following operational telemetry items. The amount of gas available can be calculated from these values.

Item	Channel	Pulse	Range	Mode
Cold Gas Line Internal Temp.	30 KC	9	-60 to 200°F	OR,RT
Attitude Control Storage Tank Pressure	40 KC	27	0-5450 psia	OR,RT

Knowledge of the amount of gas available will determine the mission length.

Effect: If the position error is beyond tolerance for over ten (10) per cent of the mission time there is the possibility that the vehicle position at deorbit may be in error. If this is the case, recovery may be impaired.

If the position error tolerances are being exceeded, attitude control gas will be consumed in correcting the vehicle. The more often this happens the greater the amount of gas used.

Recommendation: Based on the above effect the amount of gas remaining should be determined.* At the same time, a switch to the other mode and/or thrust level should be commanded. This may trigger the ACA into correct operation,

* Using telemetered tank pressure values

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE POSITION ERROR EXCEEDS ALLOWABLE LIMITS

Cause I (cont'd.): A malfunction in an Attitude Control Amplifier (ACA). When the amount of remaining gas is calculated, a judgment on the mission life can be made. An early call-down may be necessary.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE POSITION ERROR EXCEEDS ALLOWABLE LIMITS

Cause II: Two Axis Reference System (TARS) Platform Inoperative

The TARS platform senses vehicle attitude in pitch and roll with respect to the horizon and with respect to the orbital plane in yaw. It provides the primary attitude reference for the control system.

The platform output is the error signal seen on operational telemetry under roll, pitch, or yaw attitude error ACA as shown in Cause I.

An indication of no output from a roll, pitch or yaw platform gyro would indicate an erroneous input to the ACA.

A primary indicator is ACA Attitude Error. This information is available and is listed in the Description. Alternate indicators are present in diagnostic telemetry and are shown below.

Item	Channel	Pulse	Range	Mode
Roll Torque Motor Voltage	40 KC	1, 16	24 V	ORT
Pitch Torque Motor Voltage	40 KC	2, 17	24 V	ORT
Yaw Demod. Output E/P	40 KC	3, 18	$\pm$ 5°	ORT

Effect: If the erroneous signal received by the ACA was out of tolerance, the effects would be similar to those in Cause I.

Recommendation: The recommendation is similar to that in Cause I with the exception that a command to change mode and thrust level will not effect the TARS platform performance. A yaw around, pitch down, or roll command may cause the platform to function correctly. The risk involved in this procedure is that the platform may hang up during performance of the command.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE POSITION ERROR EXCEEDS ALLOWABLE LIMITS

Cause III: IR Sensor Inoperative

The IR Sensor and its associated data processing system provides an accurate measure of the local earth vertical.

Indicators: A sensor failure would allow the TARS platform to drift since the horizon reference is lost.

A primary indicator is ACA Attitude Error information presented in the Description. Information available in diagnostic telemetry can be used as an alternate indicator.

To confirm this failure, diagnostic telemetry information must be studied.

Item	Channel	Pulse	Range	Mode
Roll IR Computer Output	30 KC	11, 26	$\pm 1^{o}$	ORT
Pitch IR Computer Output	30 KC	12, 27	$\pm 1^{o}$	ORT
L. H. Preamp	40 KC	Continuous	Events	ORT
R. H. Preamp	22 KC	Continuous	Events	ORT

This failure would have no immediate effects buy would become apparent after three (3) orbits. The TARS platform having no reference will drift out of tolerance. The control system will then attempt to correct the vehicle to the changing reference.

Effects: The Sensors being inoperative would result in a loss of reference for the platform. This will result in no attitude control commands being enacted properly. The vehicle will yaw, pitch, or roll the required number of degrees, but with the reference lost, the position desired would never be attained.

Other effects are similar to those in Cause I.

Recommendations: The vehicle should be called down as soon as possible.

MALFUNCTION ANALYSIS: PITCH, ROLL OR YAW ATTITUDE POSITION ERROR EXCEEDS ALLOWABLE LIMITS

Cause IV: Attitude Control Gas Solenoid Valves Improperly Operating

The position error out-of-tolerance condition may be caused by the vehicle drifting out of the deadband due to lack of solenoid action, or being forced out of the region by the valves not closing. Drift would also be the result of no attitude control gas.

These items, their effects and recommendations are discussed in 5.7.

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MALFUNCTION ANALYSIS REFERENCE BOOK

Contract No. AF04(695)-76

Section 5.9

Malfunction Analysis:

Telemetry Failure

GENERAL ELECTRIC COMPANY
MISSILE AND SPACE DIVISION
ADVANCED SPACE PROJECTS DEPARTMENT
P. O. Box 8661
Philadelphia 1, Penna.

MALFUNCTION ANALYSIS: TELEMETRY FAILURE

Description: Loss or degradation of telemetry data from more than one sensor reading that can contribute to localizing the TM failure. The loss of a single sensor or unrelated sensor readings will not be analyzed.

Cause 1: Multiplexer failed so that a constant signal is received or only noise is received on all sensor readings.

Indicators: All readings will be of the same characteristic, i.e. constant at zero volts or equally effected by noise. Refer to the telemetry allocation list to determine the affected multiplexer.

Effect: Information on the affected multiplexer will no longer be available.

Recommendation: There is no recovery from this situation. However, in many cases, other operational telemetry may indicate the condition of concern. In still more cases the diagnostic telemetry may be evaluated for additional information.

Use data of other multiplexers, where possible.

MALFUNCTION ANALYSIS: TELEMETRY FAILURE

Cause II: Voltage Control Oscillator Fails

Indicators: No carrier wave will be received on this channel. Refer to the telemetry block diagram to determine which voltage control oscillator is failed.

Effect: Information from the affected voltage control oscillator will no longer be available. Other voltage control oscillators in the same subcarrier oscillator will be available.

Recommendation: Command verification is available on two separate voltage control oscillators. Other telemetry is available only on one voltage control oscillator. Refer to the Recommendation for Cause I.

MALFUNCTION ANALYSIS: TELEMETRY FAILURE

Cause III: Failure of a sub-carrier oscillator.

Indicators: None or only part of the voltage control oscillators in the failed sub-carrier oscillator will be available.

Effect: Sub-carrier oscillator #3 contains a mixer amplifier which receives outputs of sub-carrier oscillators #1 and #2. If this mixer amplifier fails all information from these sub-carrier oscillators may be lost or only #2 may be lost, or #1 and #3 may be lost.

Sub-carrier oscillator #5 contains a mixer amplifier which receives outputs from sub-carrier oscillators #3 and #4. If this mixer amplifier fails, all information from sub-carrier oscillator #4 and real time information from sub-carrier oscillator #3 and consequently the real time data from sub-carrier oscillators #1 and #2 will be lost.

Sub-carrier oscillator #6 contains a mixer amplifier which receives the outputs of the airborne clock, and vibration sensors during powered flight and from command verification and the infra-red sensors in the orbital mode. Failure of this mixer amplifier will cause loss of one or both groups of information during either flight mode.

Recommendation: In case where the information is available in either orbital record or real time mode, it will be possible to obtain the information in the mode which has not failed. The two channels for command verification are completely redundant in real time and either may be used.

MALFUNCTION ANALYSIS: TELEMETRY FAILURE

Cause IV: Magnetic tape recorder failure

Indicators: Information from the tape recorder either garbled or not available. Refer to telemetry block diagram for information on tape recorder. Tape recorder may not be able to change speed. This will be noted by checking the 14.5 kc crystal oscillator channel for correct timing. Tape recorder may not shut off. Note that information received in playback is always that expected just preceding a station pass.

Effect: Information received on playback mode is either missing or degraded.

Recommendation: All subcarrier oscillators that supply information to the magnetic tape recorder can also supply information in real time. It is necessary to switch the transfer switch to do this. In some cases, as information concerning an executed orbit adjust, it may be more desirable to accept degraded information if available than to attempt to receive the information in real time by making the orbit adjust over a tracking station.

MALFUNCTION ANALYSIS: TELEMETRY FAILURE

Cause V: Transfer switch failed

Indicators: Failure to switch in or out of playback is indicated by the information received.

Inability to switch transmitters is indicated by the same information always being transmitted on the same transmitter.

Effect: Unless there is a transmitter failure the only important effect of this failure is the inability to switch in and out of the playback mode. If the switch is failed out of the playback mode, no playback information will be available.

Recommendation: Operate only in the real time telemetry mode. There is no other way of switching in the magnetic tape recorder for playback.

MALFUNCTION ANALYSIS: TELEMETRY FAILURE

Cause VI: Transmitter, power amplifier, power supply, RF filter, or VHF antenna malfunction.

Indicators: Loss or degradation of the signal received on one of the telemetry frequencies. Degradation may consist of a weak signal, noise or no modulation.

Effect: No or degrated information from the affected telemetry frequency.

Recommendation: The transfer switch is capable of transferring block of information from one telemetry transmitter to another. Refer to the telemetry block diagram. It may be desirable to obtain the most coveted information from the superior transmitter. If both transmitters have failed there is no recourse but to accept the degraded information.

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MALFUNCTION ANALYSIS REFERENCE BOOK

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Section 5.13

Malfunction Analysis:

Loss of Correct Airborne Clock Time

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MISSILE AND SPACE DIVISION
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MALFUNCTION ANALYSIS REFERENCE BOOK

SECTION 5.13

MALFUNCTION ANALYSIS: LOSS OF CORRECT AIRBORNE CLOCK TIME

Description: This failure is a condition in which the vehicle clock time does not agree with the ground time. The vehicle clock time can be either greater or less than the ground value. If the calibration of the clock changes repeatedly, consult malfunction analysis 5.2.

Cause: Improper calibration, synchronization or change in calibration can cause this failure. This cause assumes that the clock continues to count either fast, slowly or correctly but out of synchronization with the ground clock.

Indicators: Compare airborne clock time to ground clock time for synchronization.

PRIME INDICATORS

Item	Channel	Range	Mode
Vehicle clock time	70 KC	events	ORT
Vehicle clock time	70 KC	events	P

The 90 x 1/18 multiplexer is synchronized and operated by the clock. Investigation of the output of this mutliplexer may indicate a failure in the clock.

Effect: Commands will be executed at times other than intended.

Recommendation: After the new vehicle clock time is ascertained, all stored commands may be reinserted with new time tags so that they will be executed at the proper time and in proper sequence.