



APOLLO TRAINING

GUIDANCE AND NAVIGATION
SUBSYSTEM

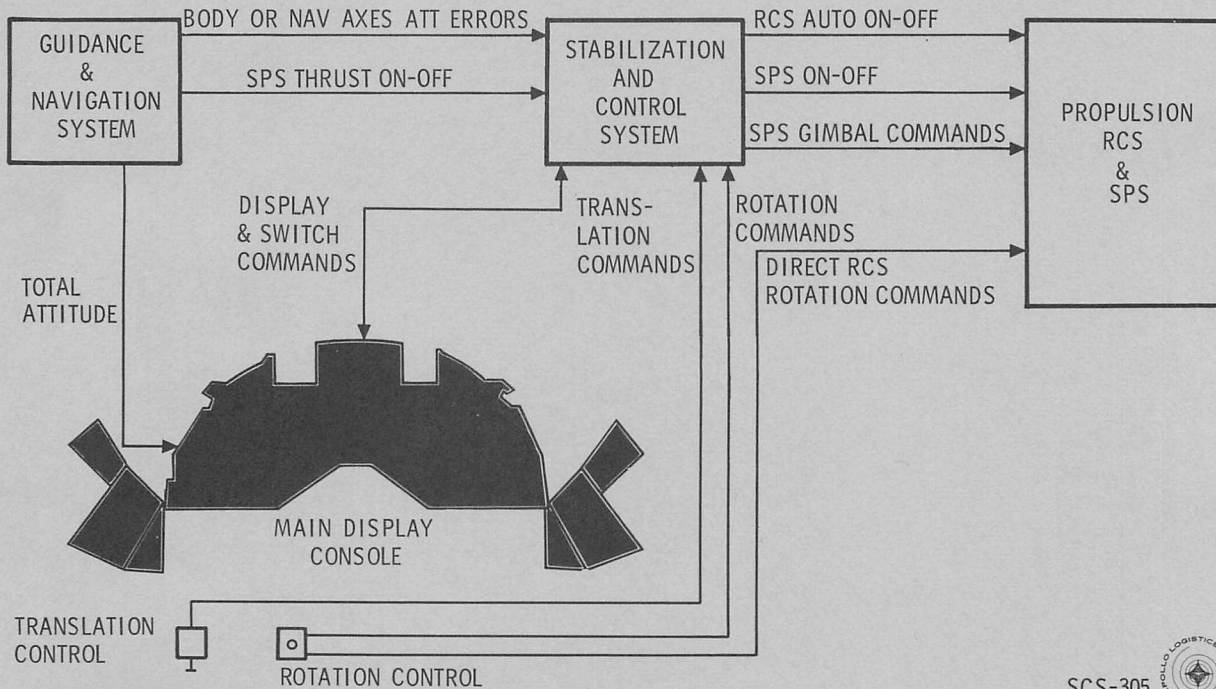
COURSE NUMBER A-920

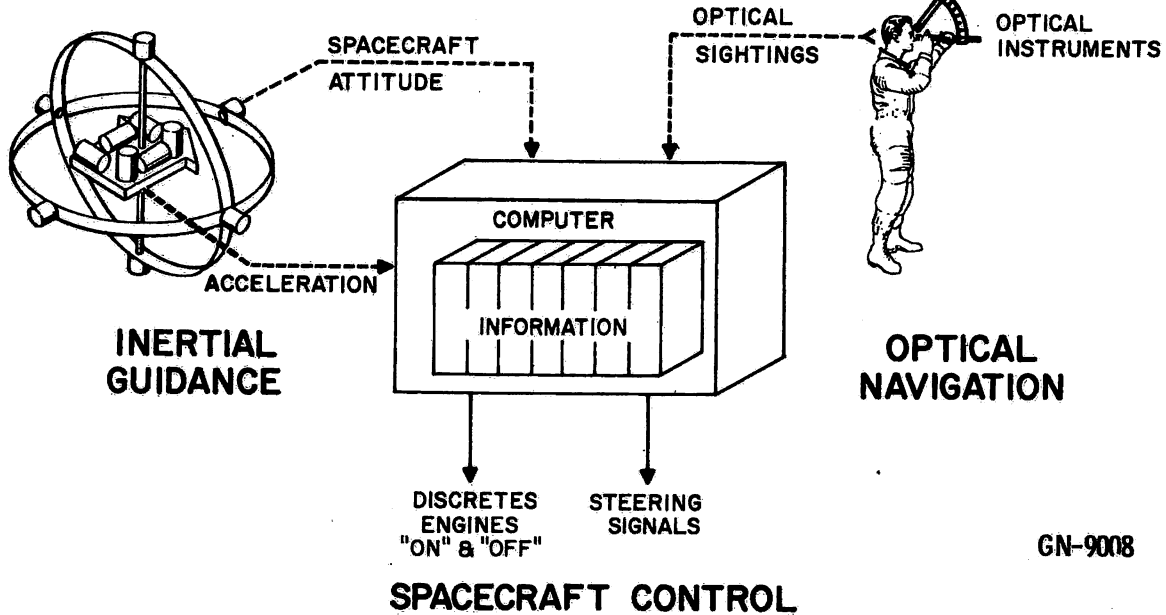
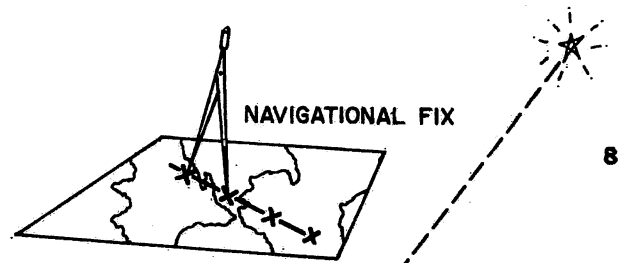
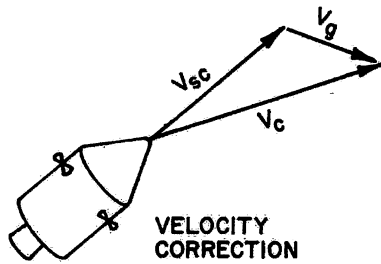
MARCH 25 , 1966

FOR TRAINING PURPOSES ONLY



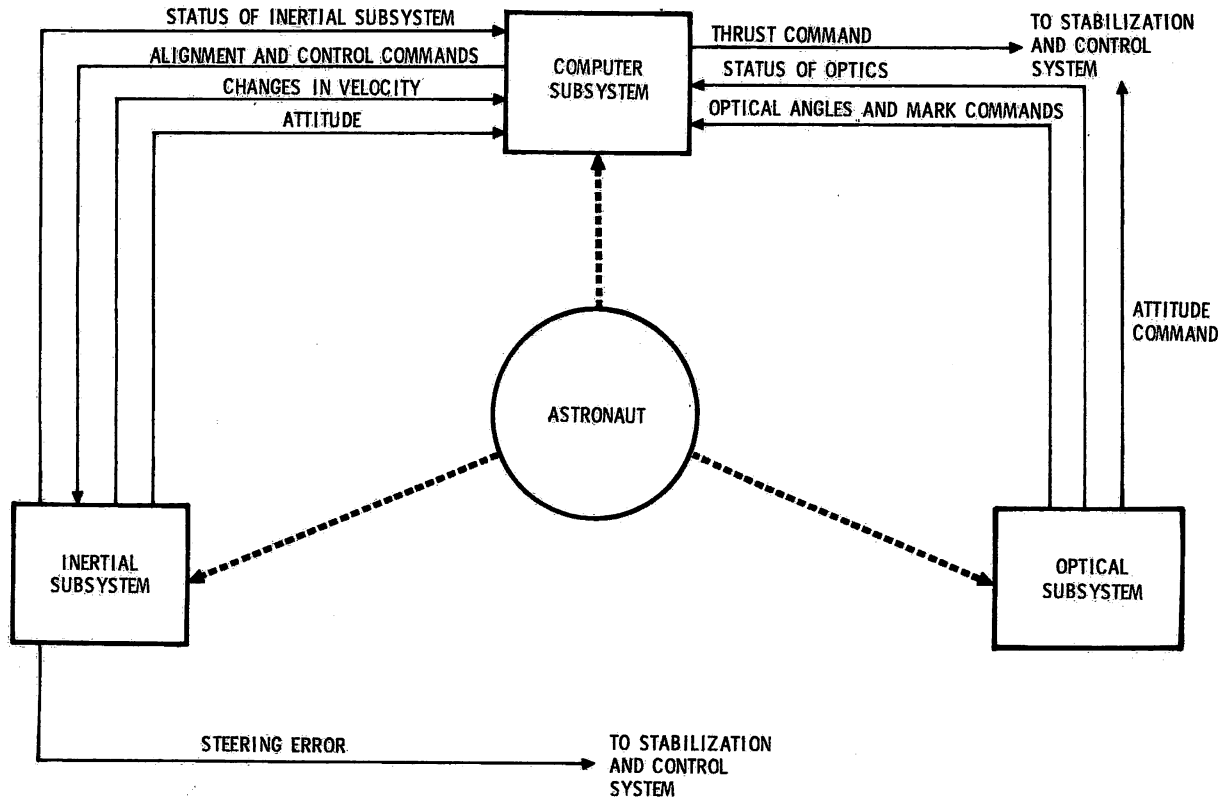
G&C FUNCTIONAL CONTROL LOOPS





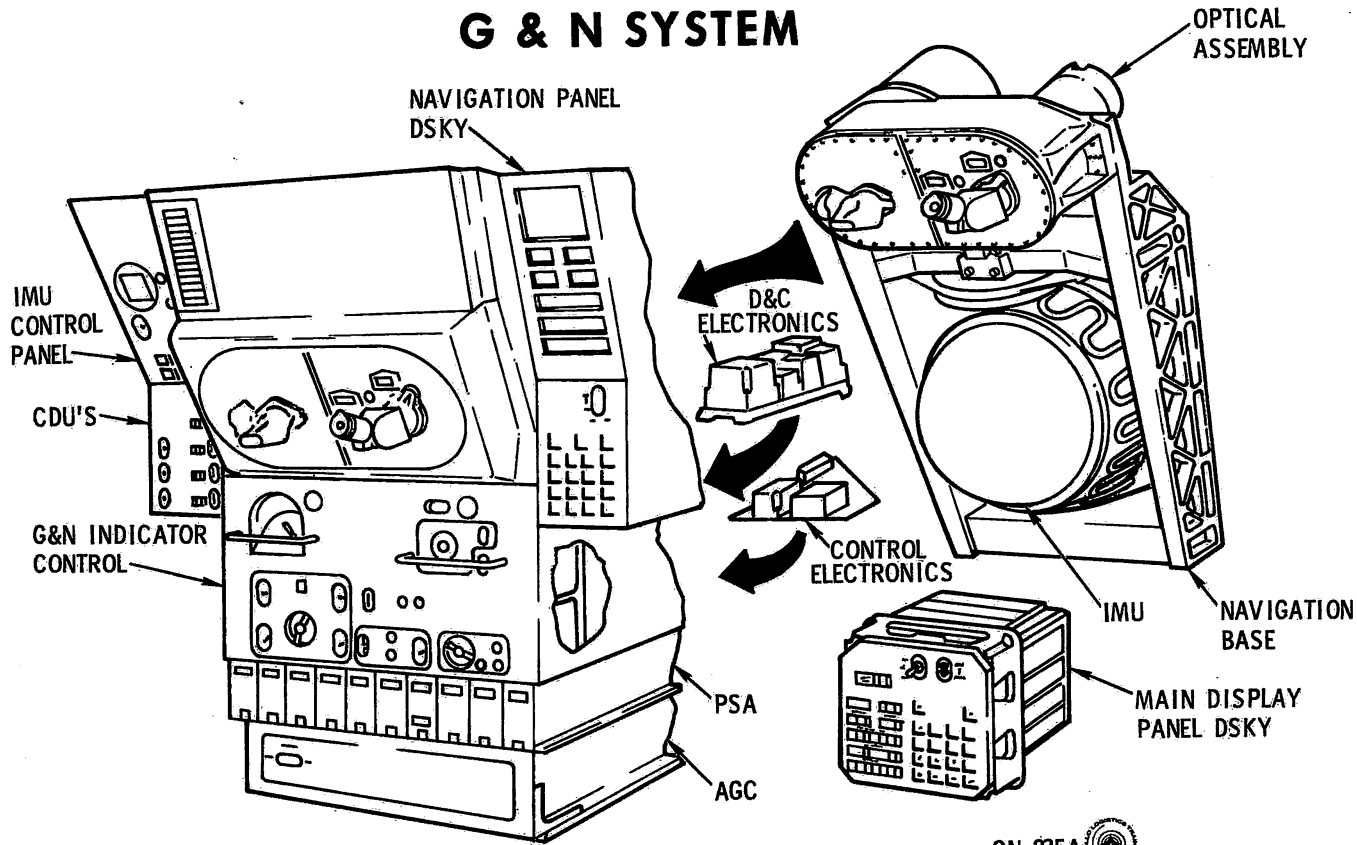
GN-9008

INTERFACE OF G AND N SUBSYSTEMS



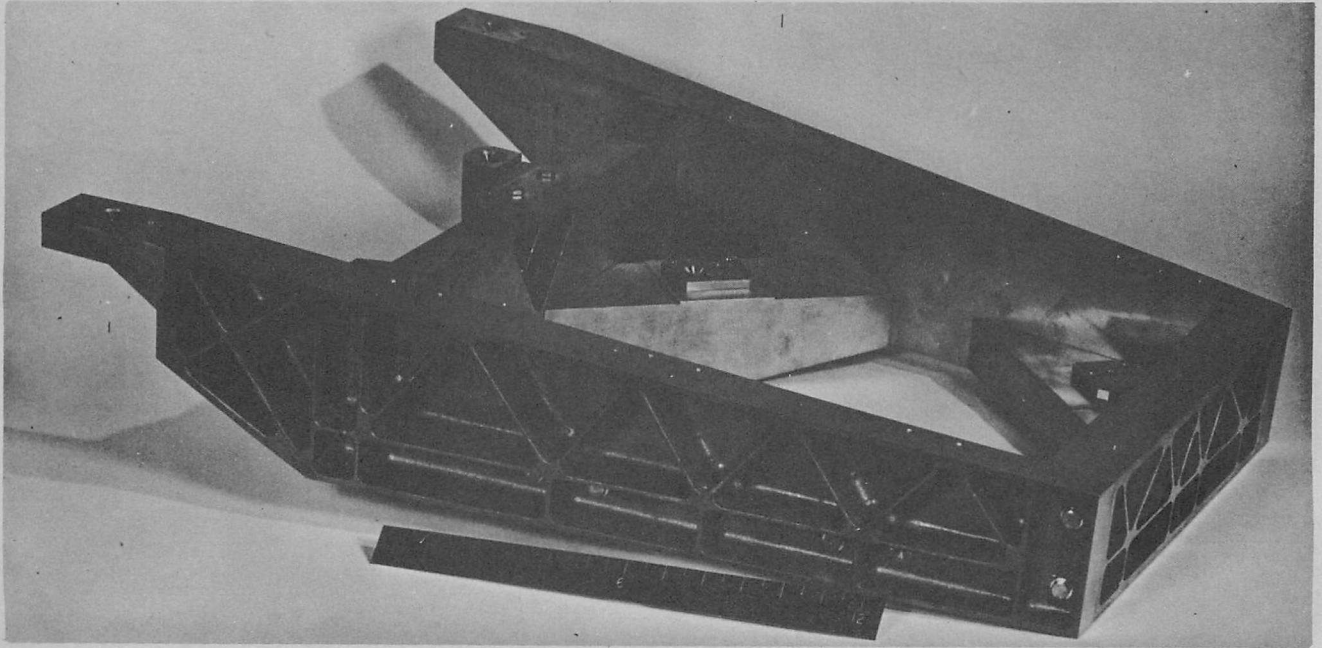
G&N HARDWARE

G & N SYSTEM



GN-235A 

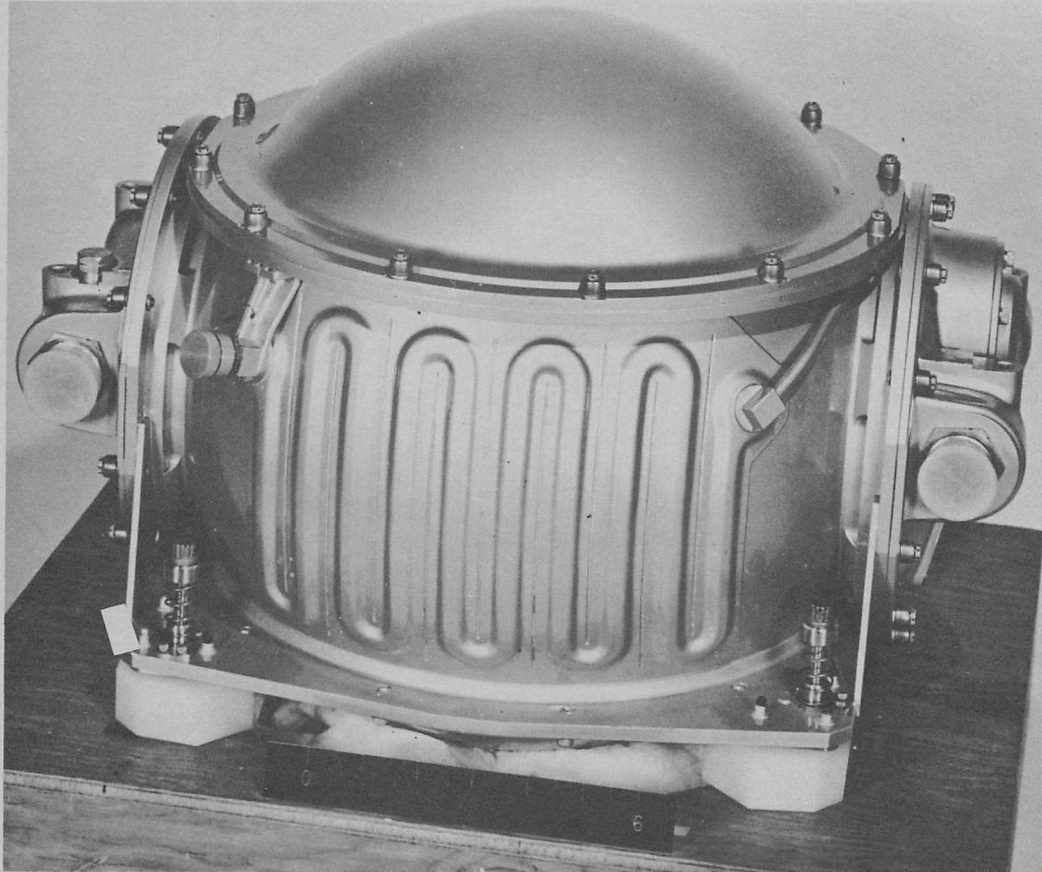
NVB



GN-190



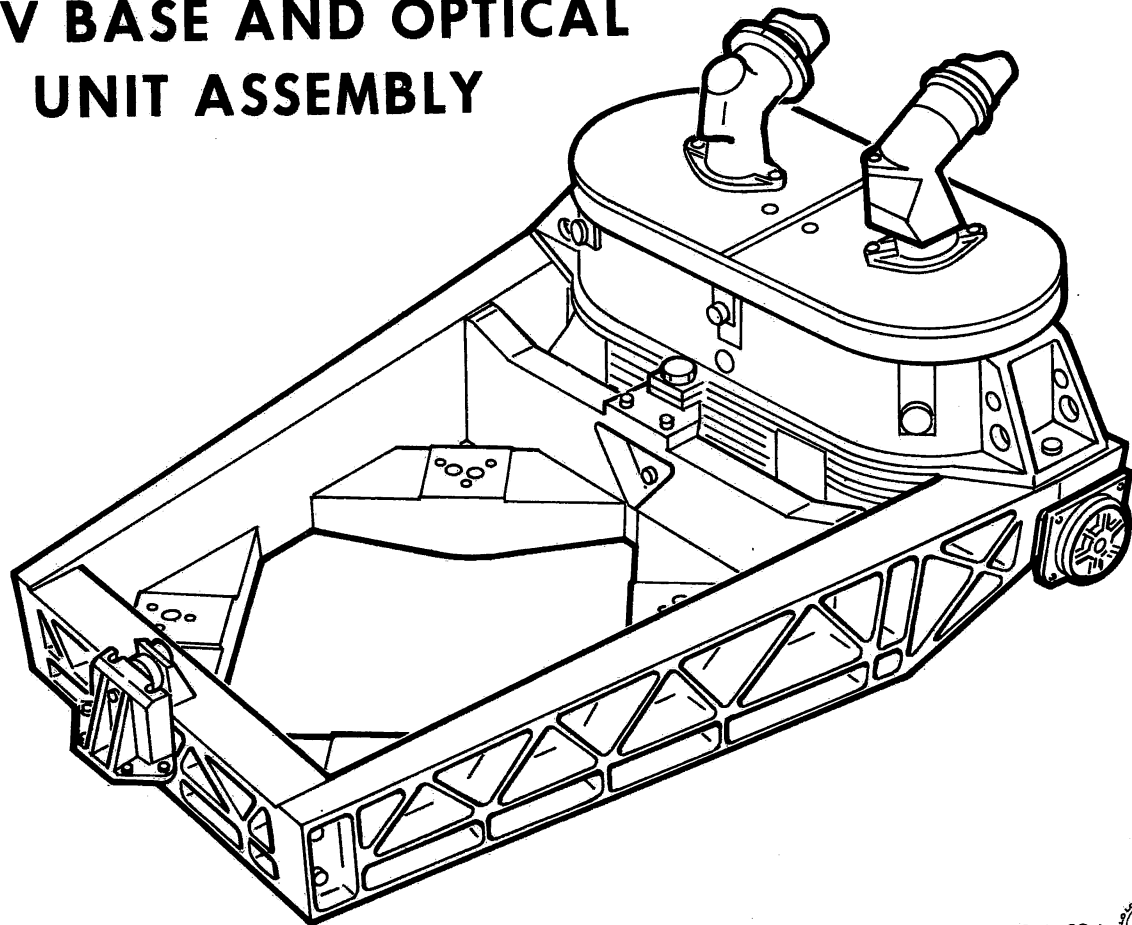
IMU



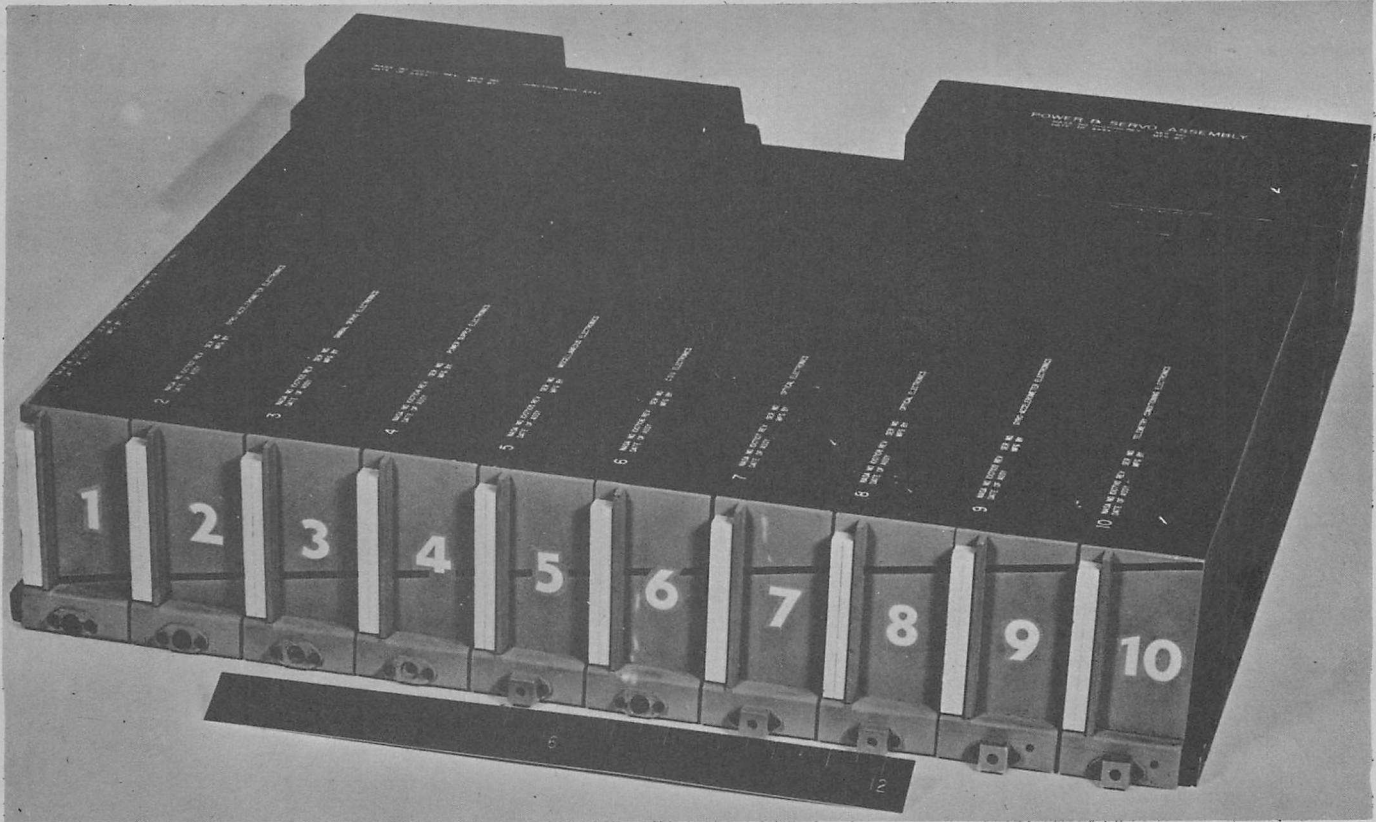
GN-189



NAV BASE AND OPTICAL UNIT ASSEMBLY

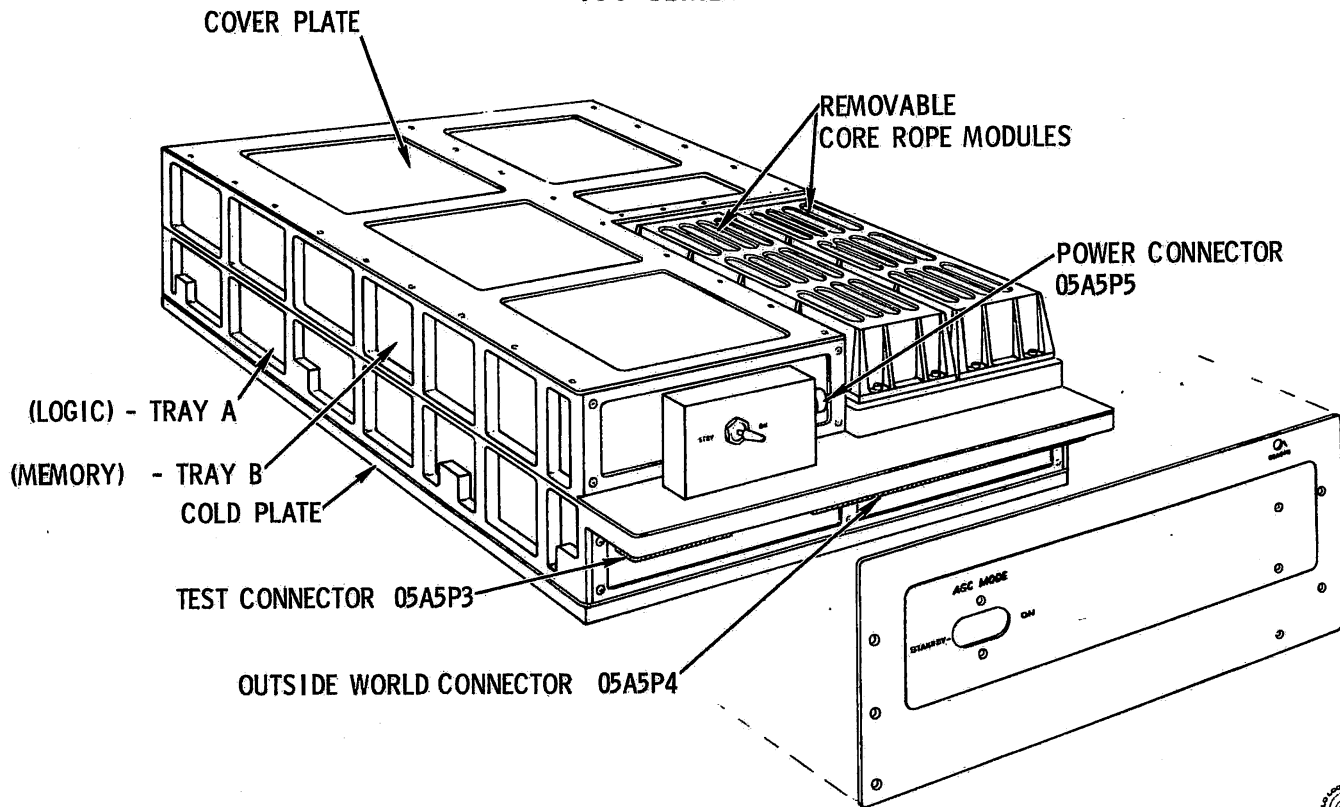


PSA

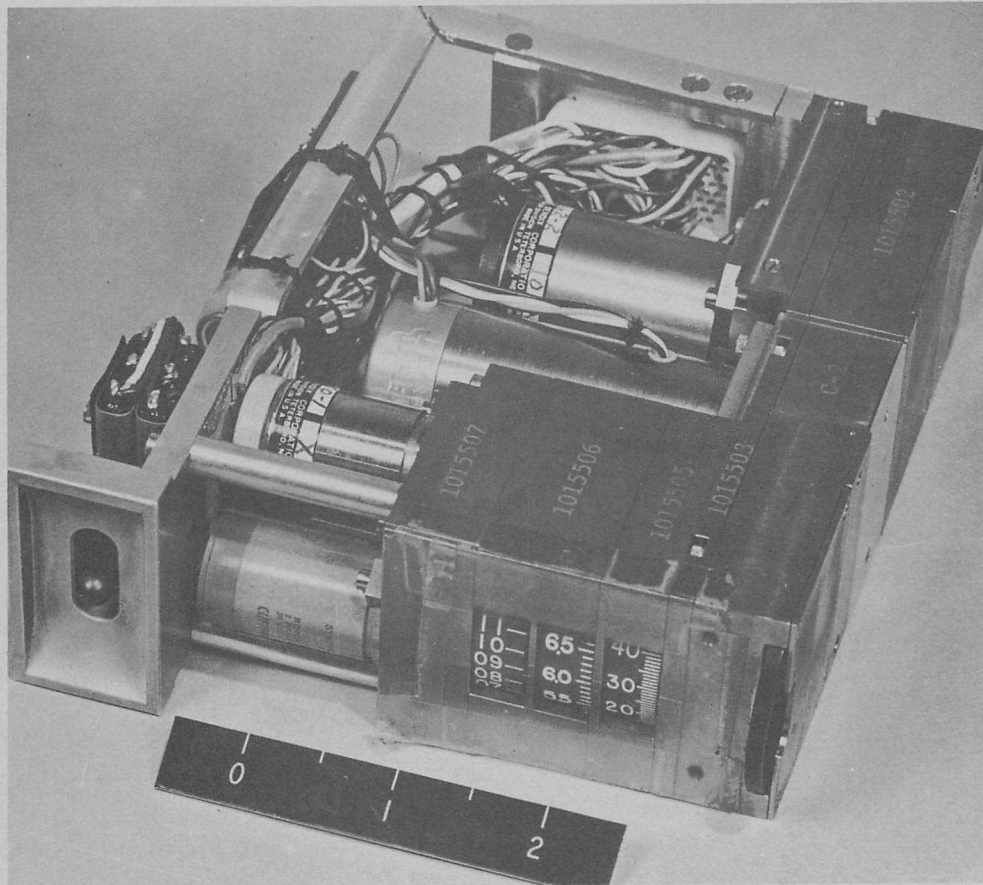


BLOCK I COMPUTER

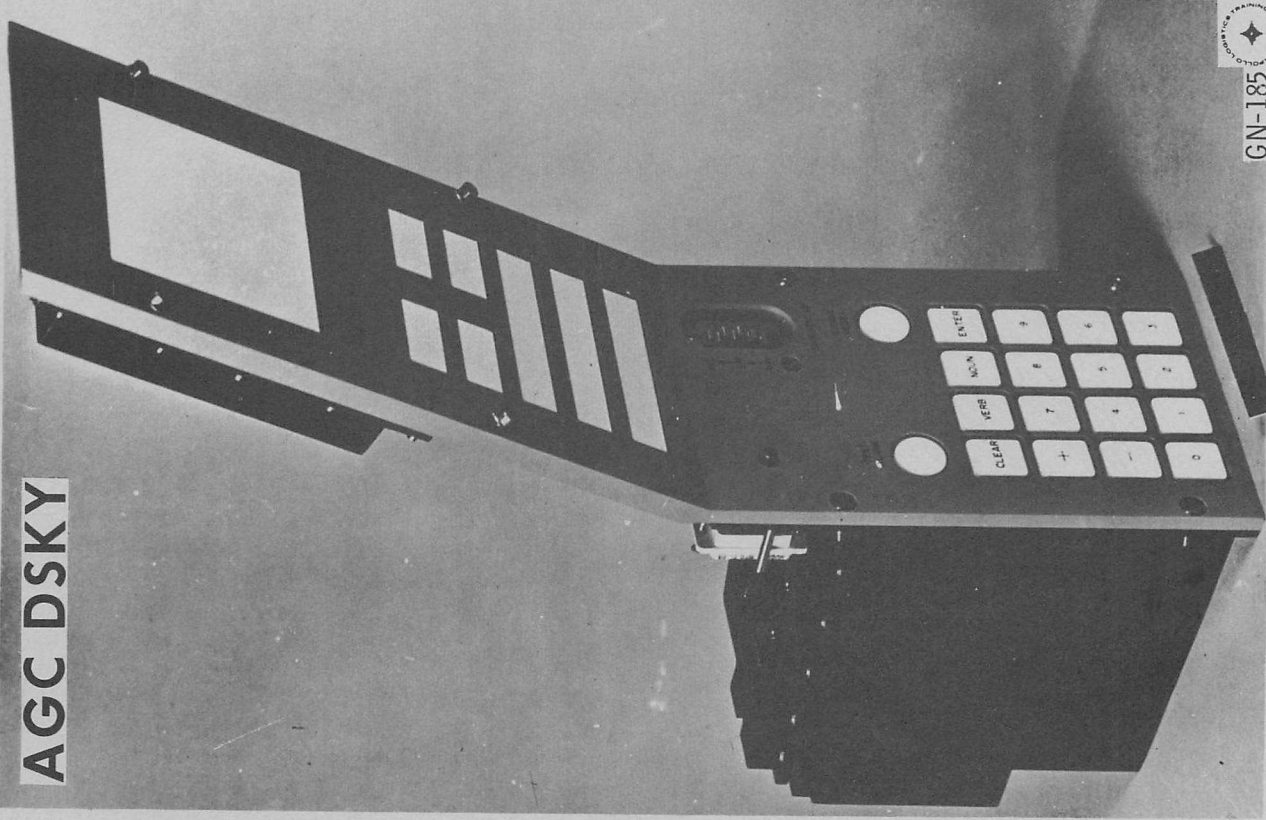
100 SERIES



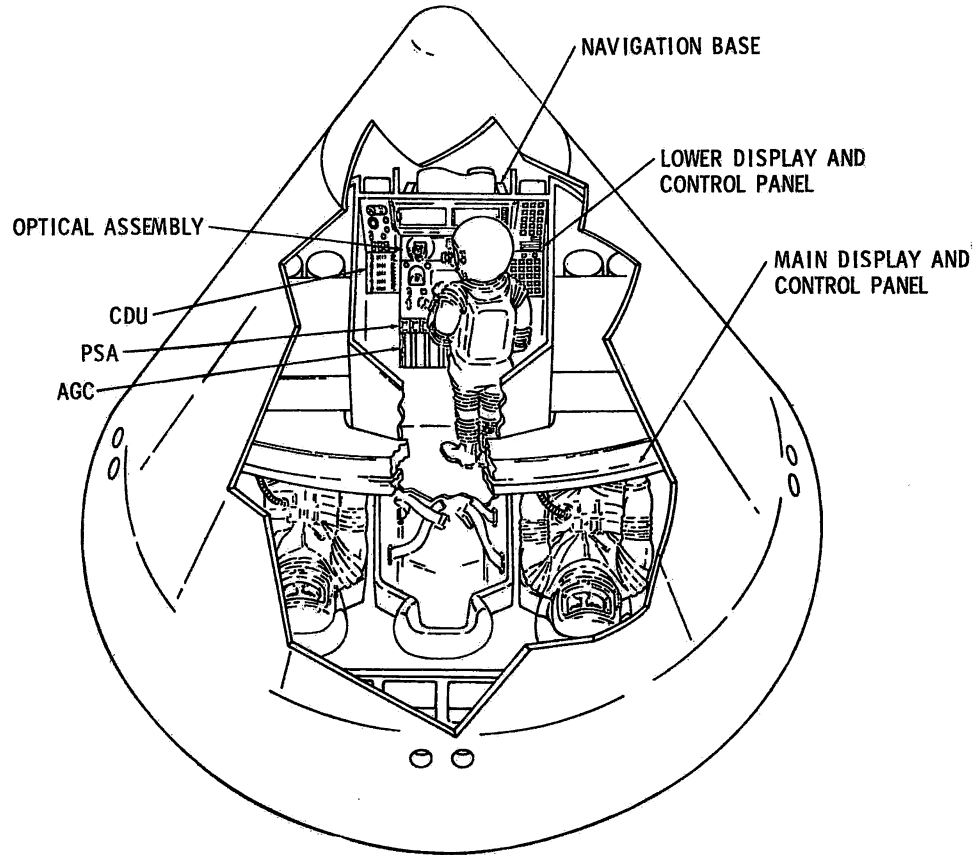
CDU

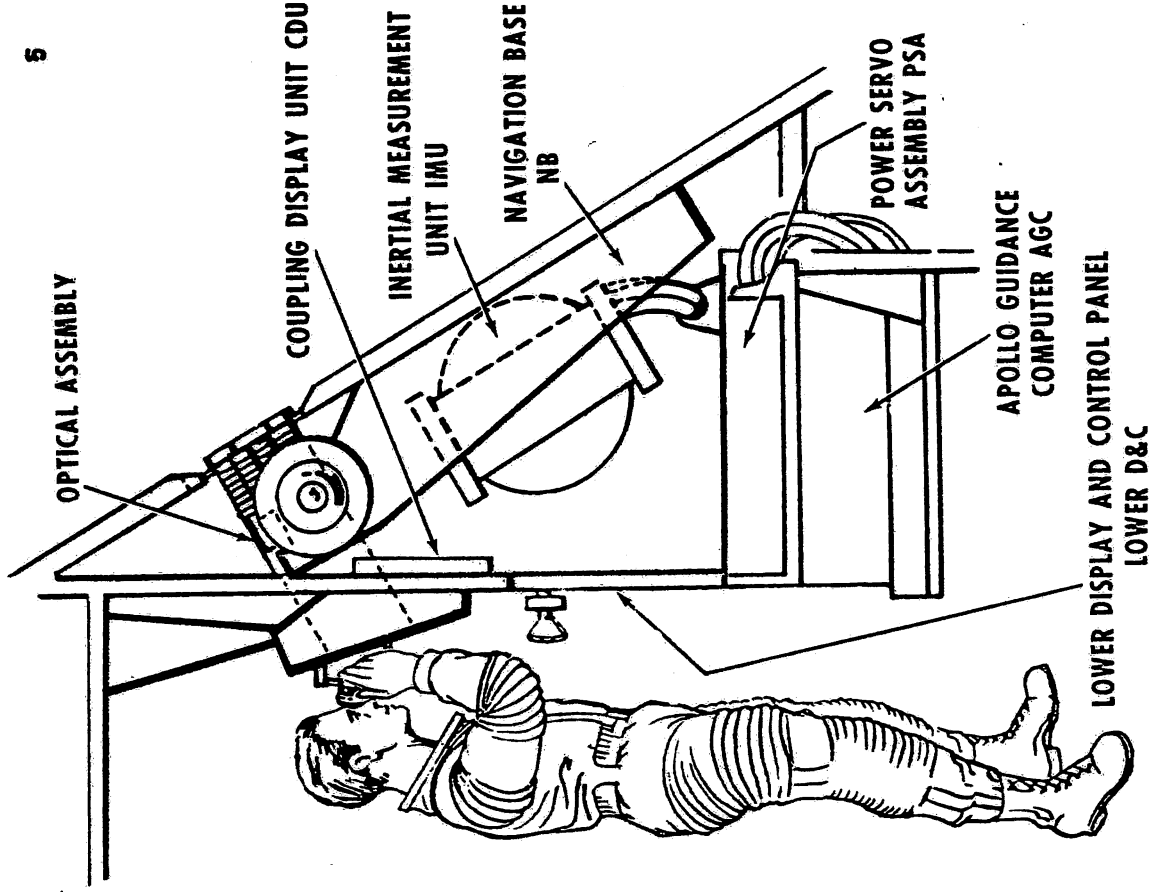


AGC DSKY



G&N SYSTEM EQUIPMENT LOCATION





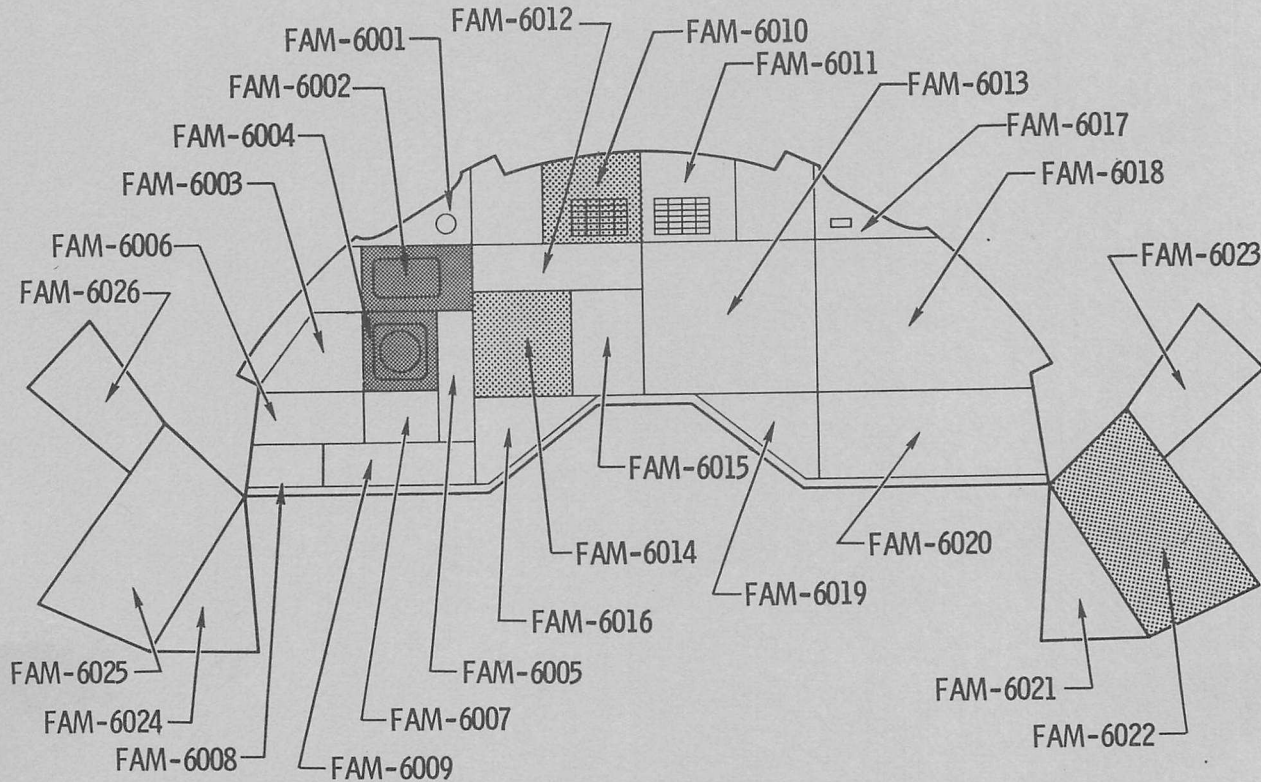
LOCATION OF GUIDANCE AND NAVIGATION EQUIPMENT IN SPACECRAFT GN-9005

G&N CONTROLS & DISPLAYS

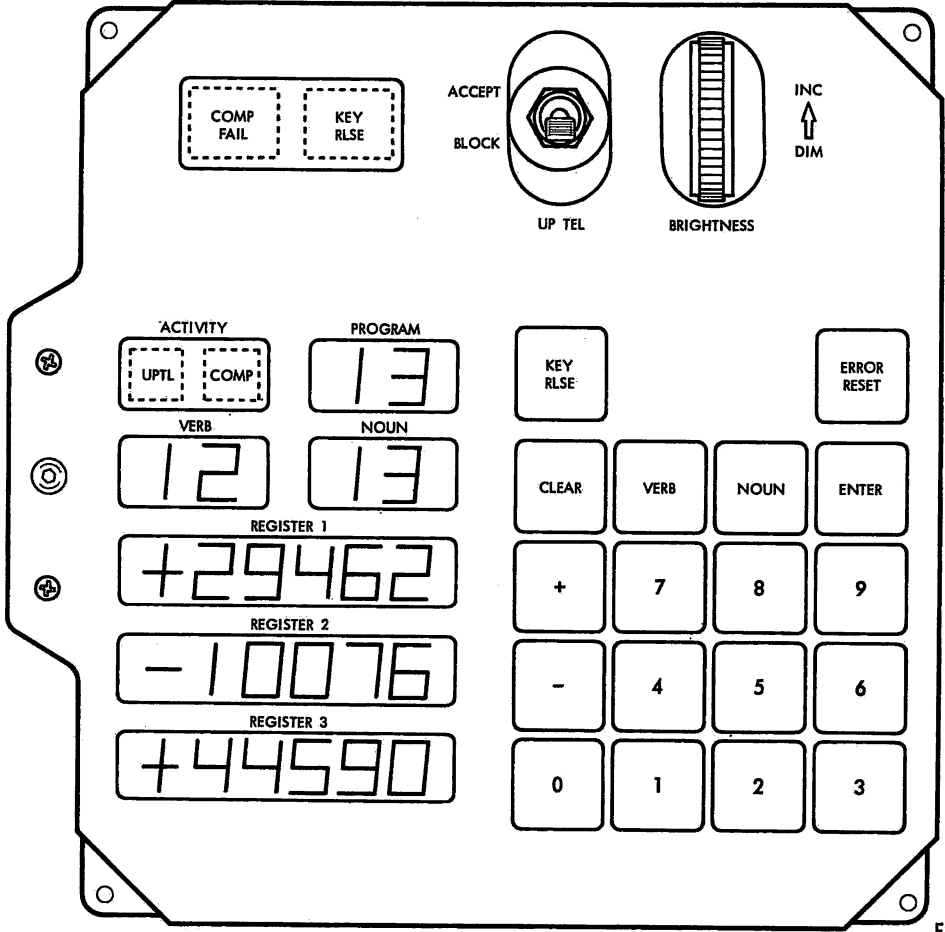
GN-305



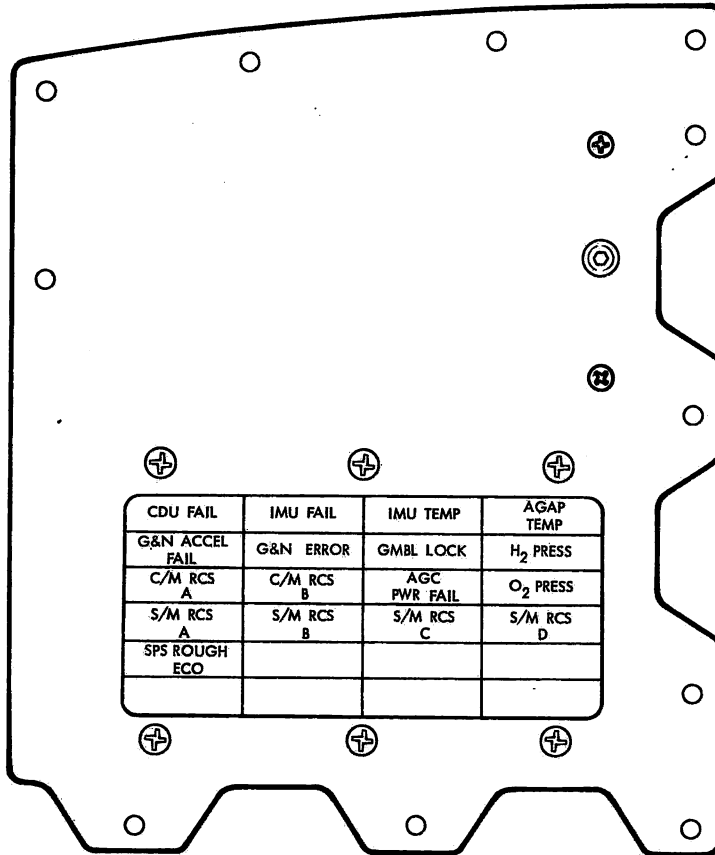
MAIN DISPLAY CONSOLE LOCATOR



14

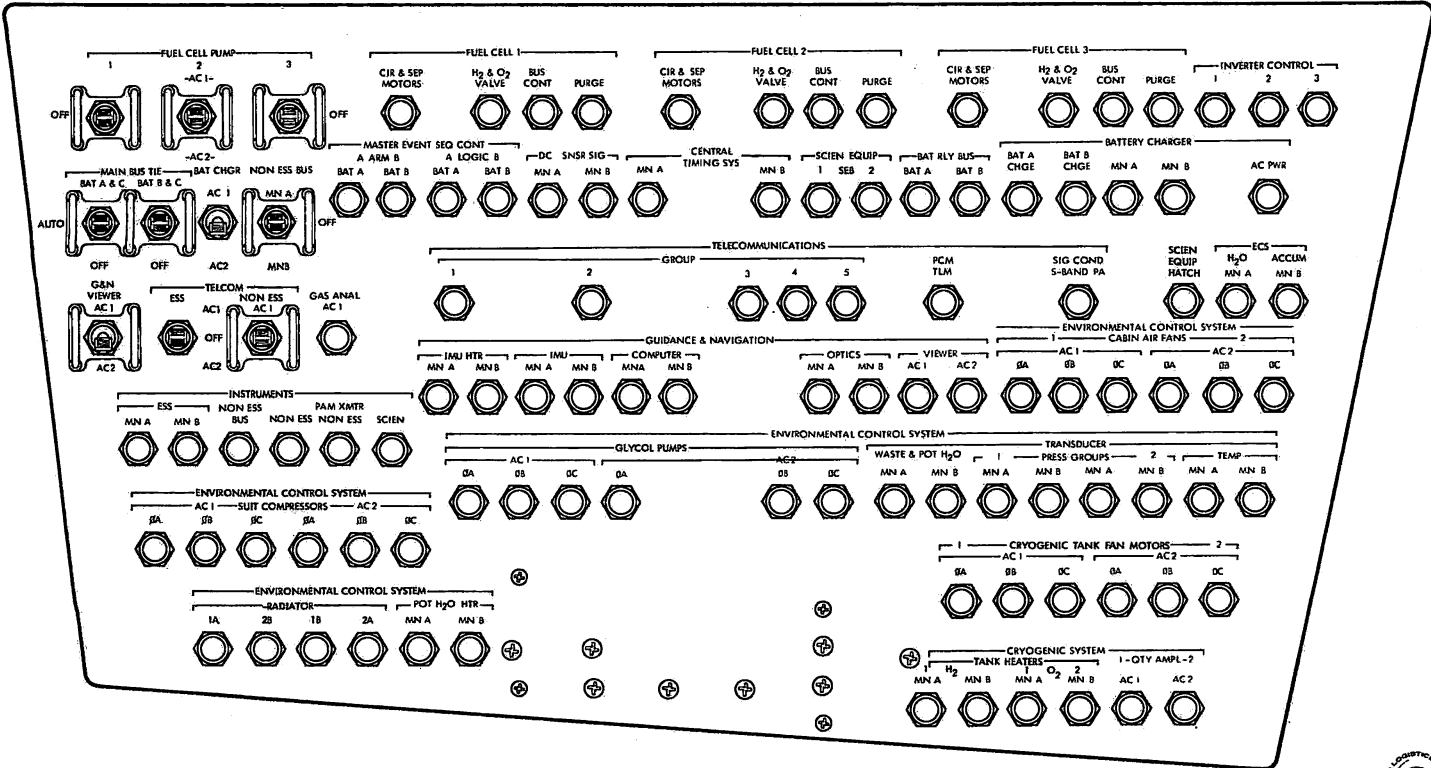


MASTER CAUTION

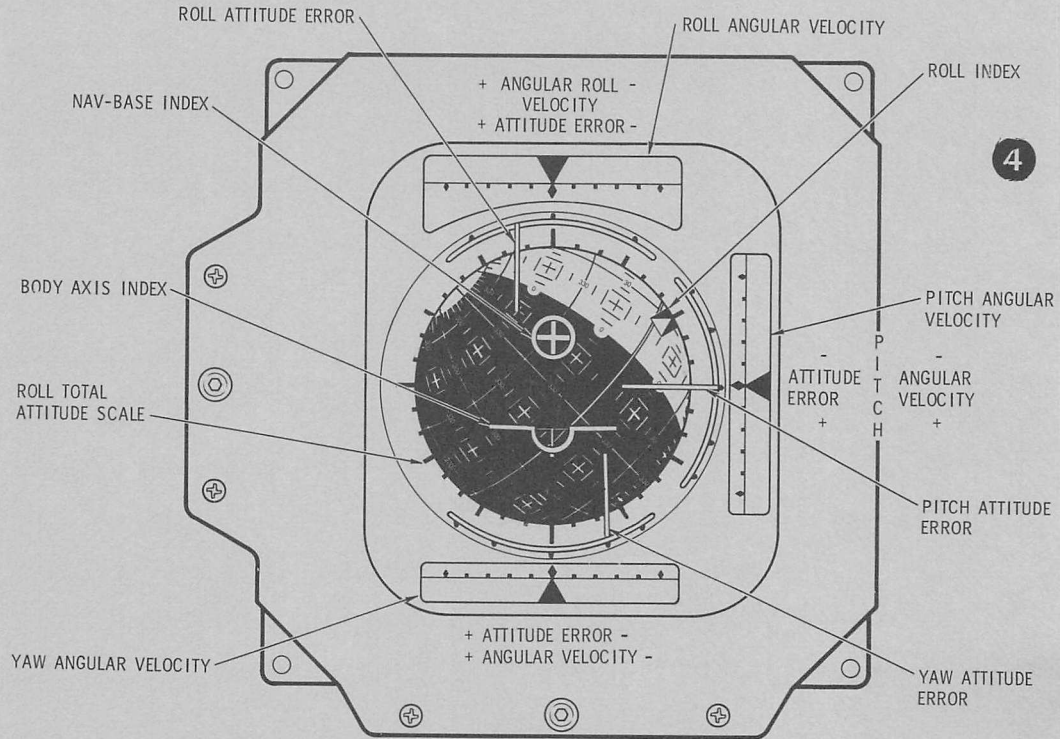


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FLIGHT DIRECTOR ATTITUDE INDICATOR



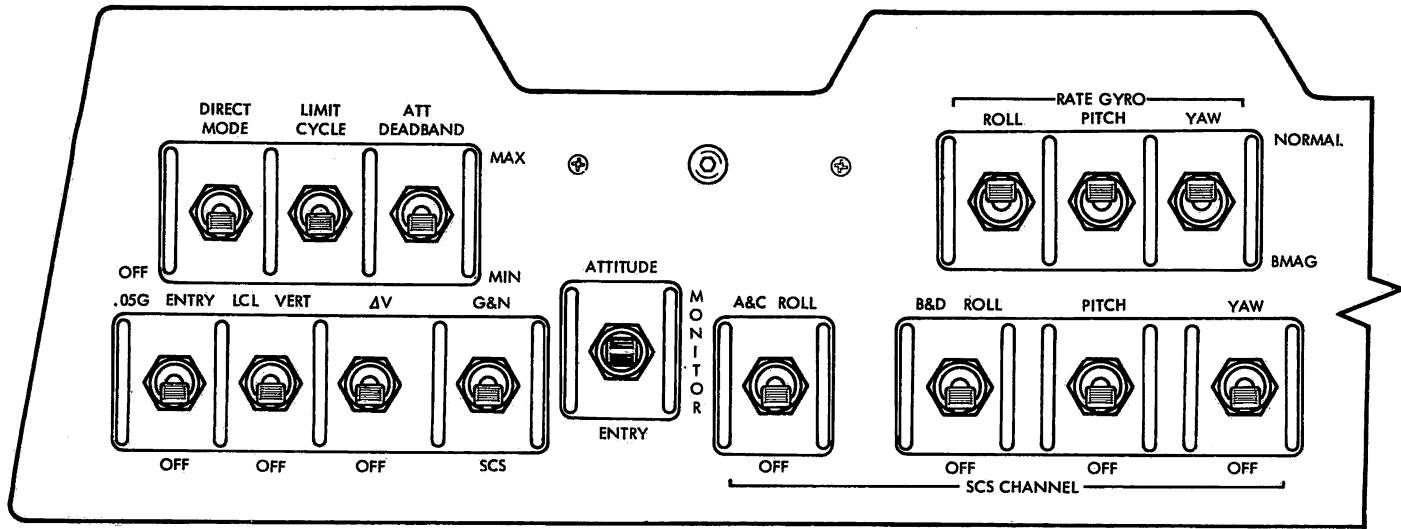
NOTES:

1. ATTITUDE ERROR = ATTITUDE DESIRED - ACTUAL ATTITUDE.
2. THE BALL IS OF THE INSIDE-OUT CONVENTION.
3. EULER ANGLE CONVENTION IS PITCH, YAW, ROLL.
4. THE BALL ATTITUDE SHOWN IS PITCH 345°, YAW 335°, AND ROLL 300°, WITH RESPECT TO THE NAVIGATION BASE INDEX.



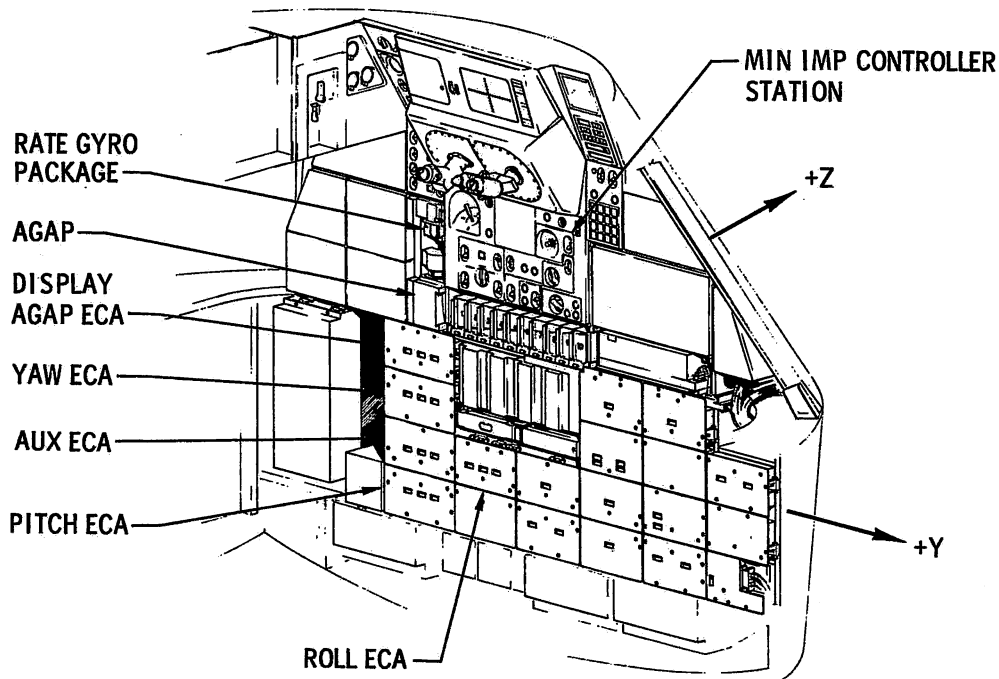
SCS CONTROL PANEL

8

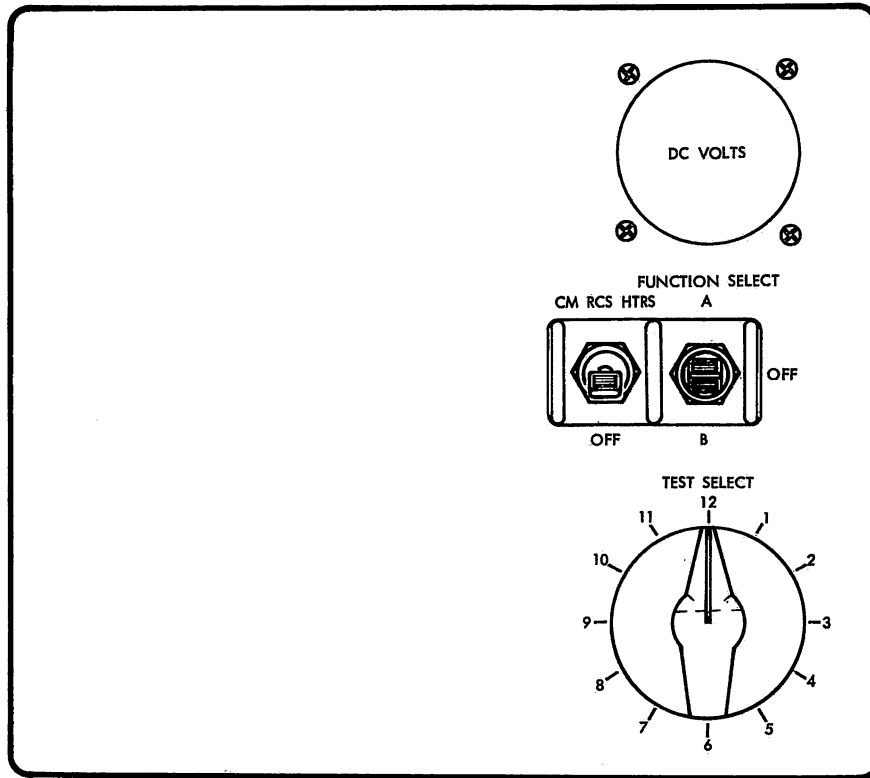


LOWER EQUIPMENT BAY

SCS FUNCTIONS



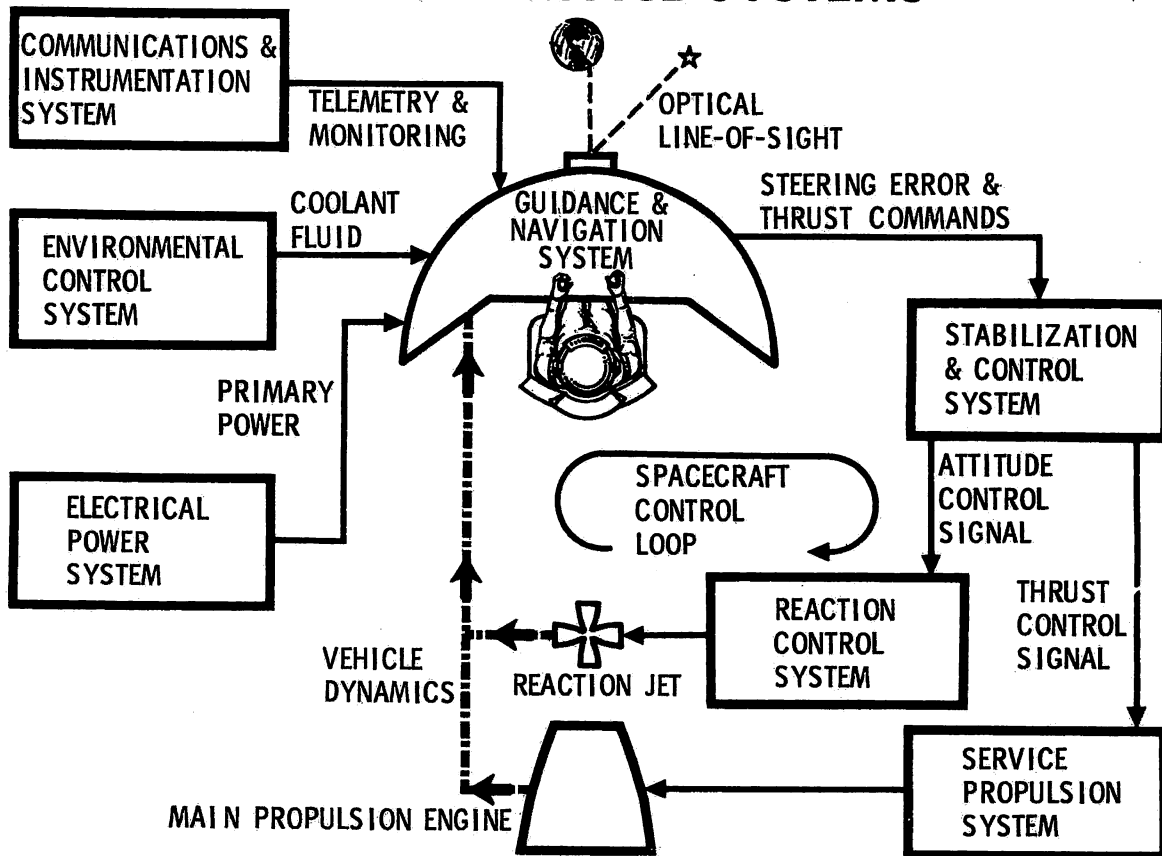
PANEL 97 LOWER EQUIPMENT BAY



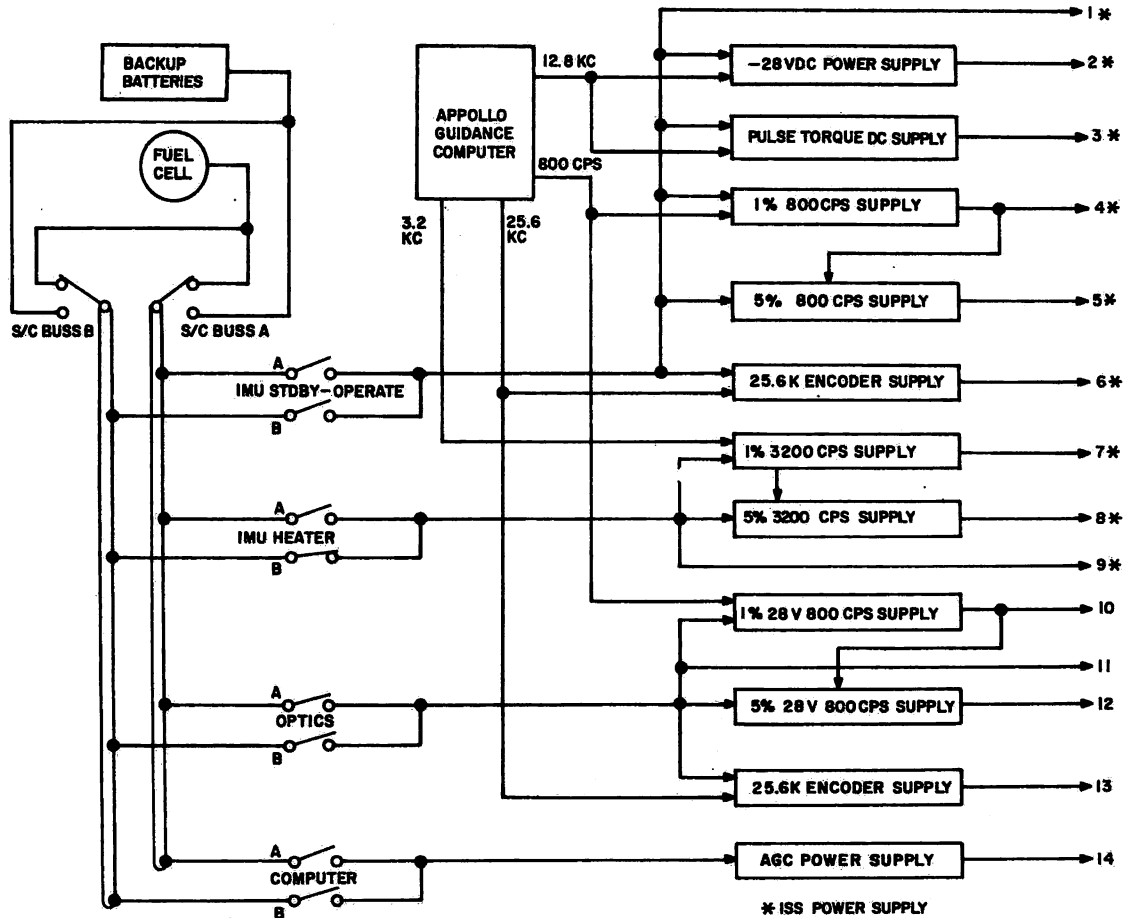
PANEL 97, AUXILIARY DISPLAY PANEL,
FORWARD RIGHTHAND EQUIPMENT BAY



G&N INTERFACE SYSTEMS



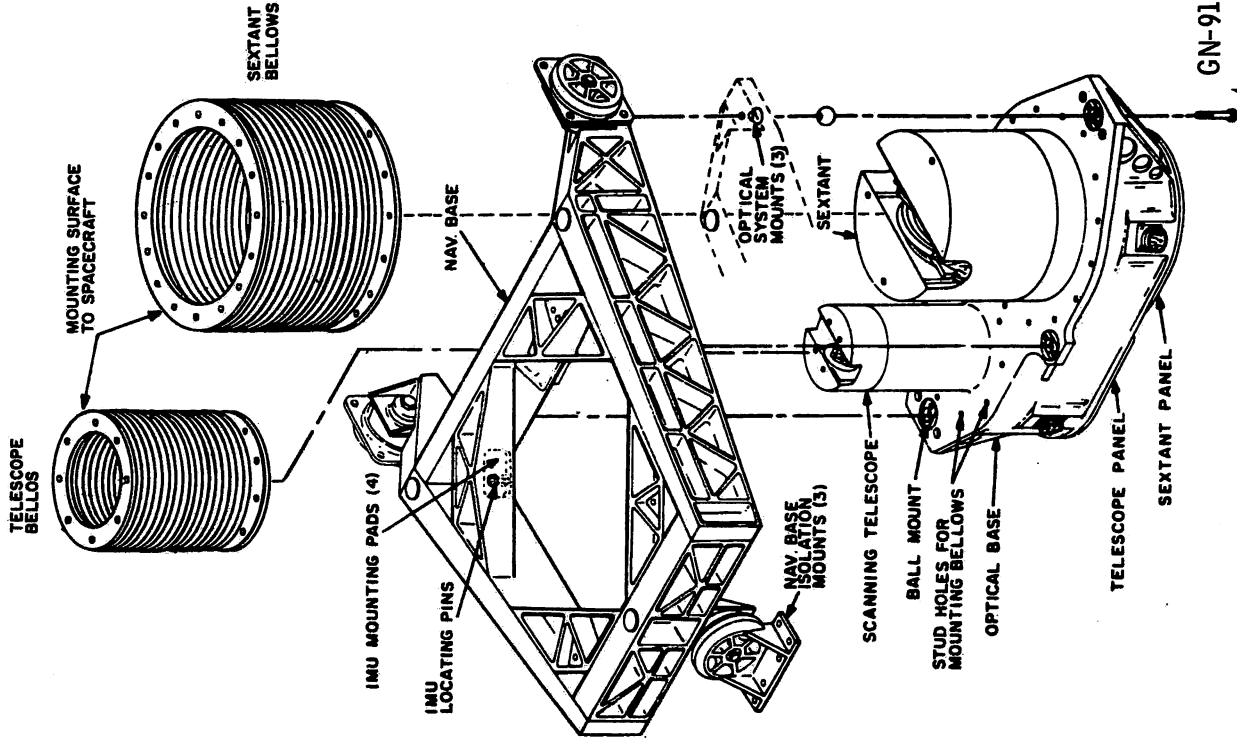
POWER SUPPLIES



OPTICS SUBSYSTEM

OPTICAL UNIT

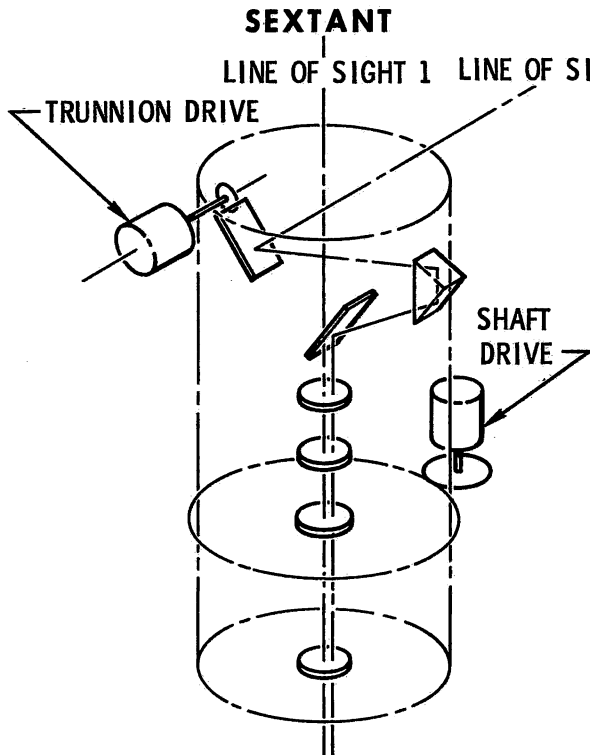
NAVIGATION BASE AND BELLOW



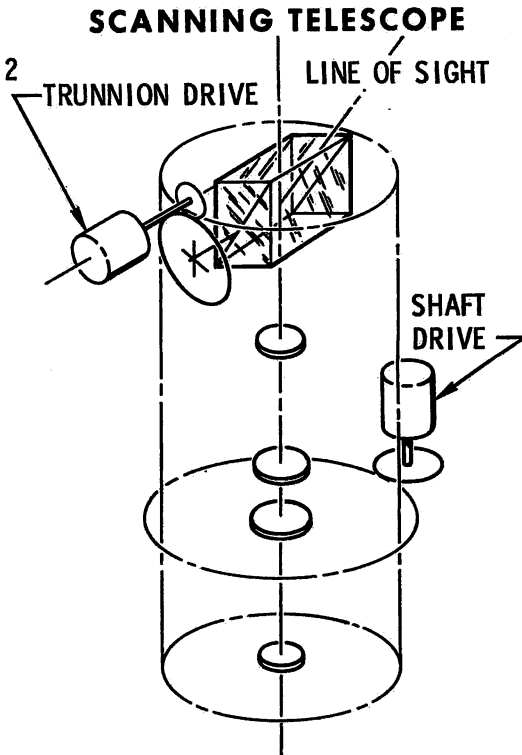
GN-9120B



OPTICAL SCHEMATIC

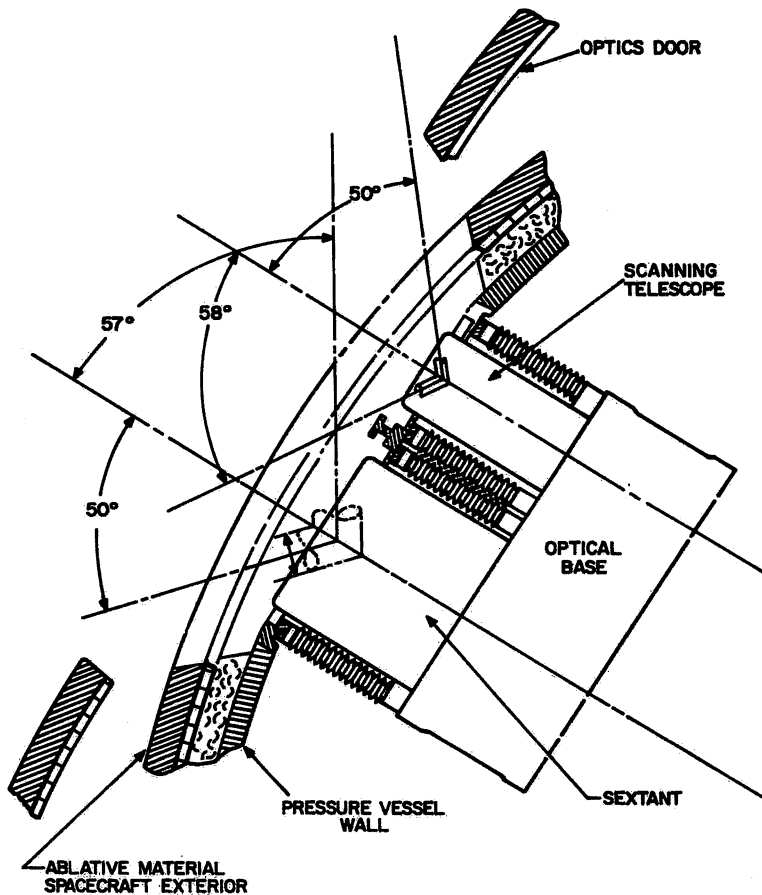


FIELD 1.8- EACH
MAGNIFICATION 28X

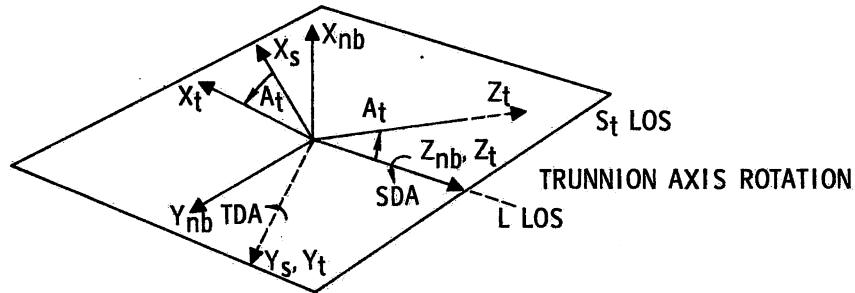
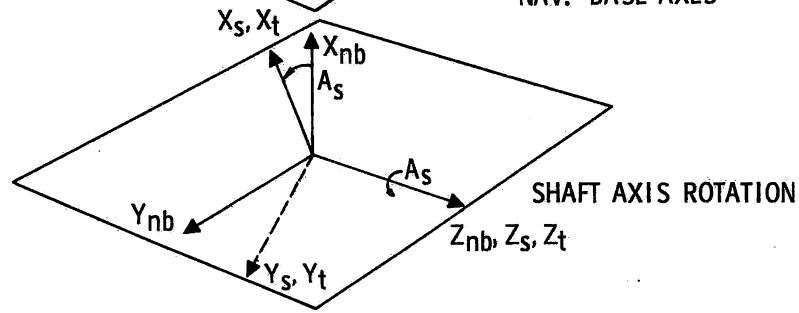
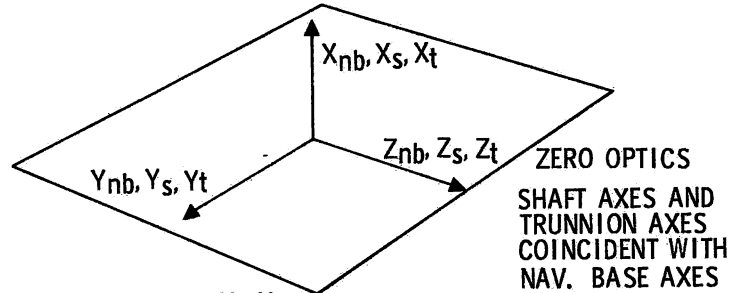


FIELD
MAGNIFICATION 60 DEG
IX

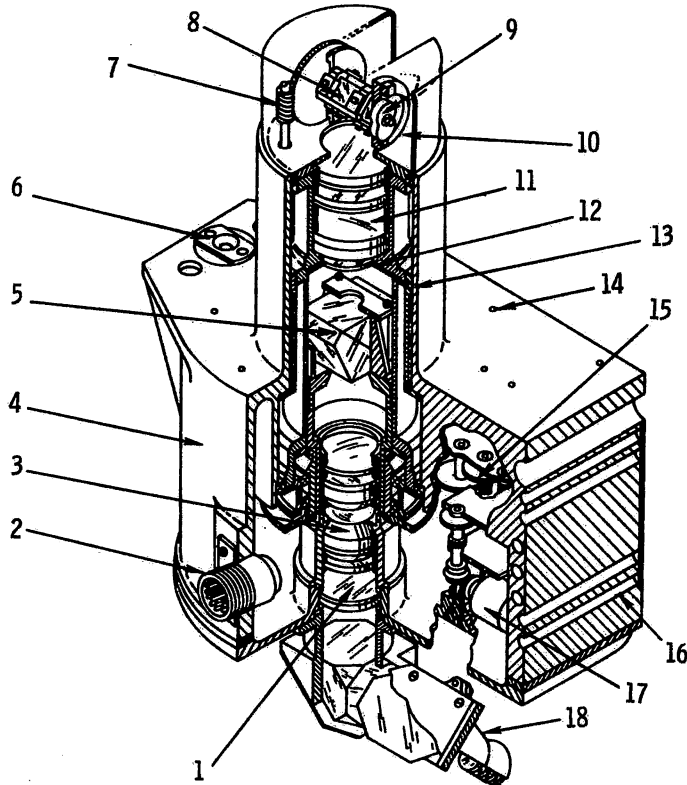
OPTICAL UNIT CUTAWAY



OPTICAL SYSTEM AXES

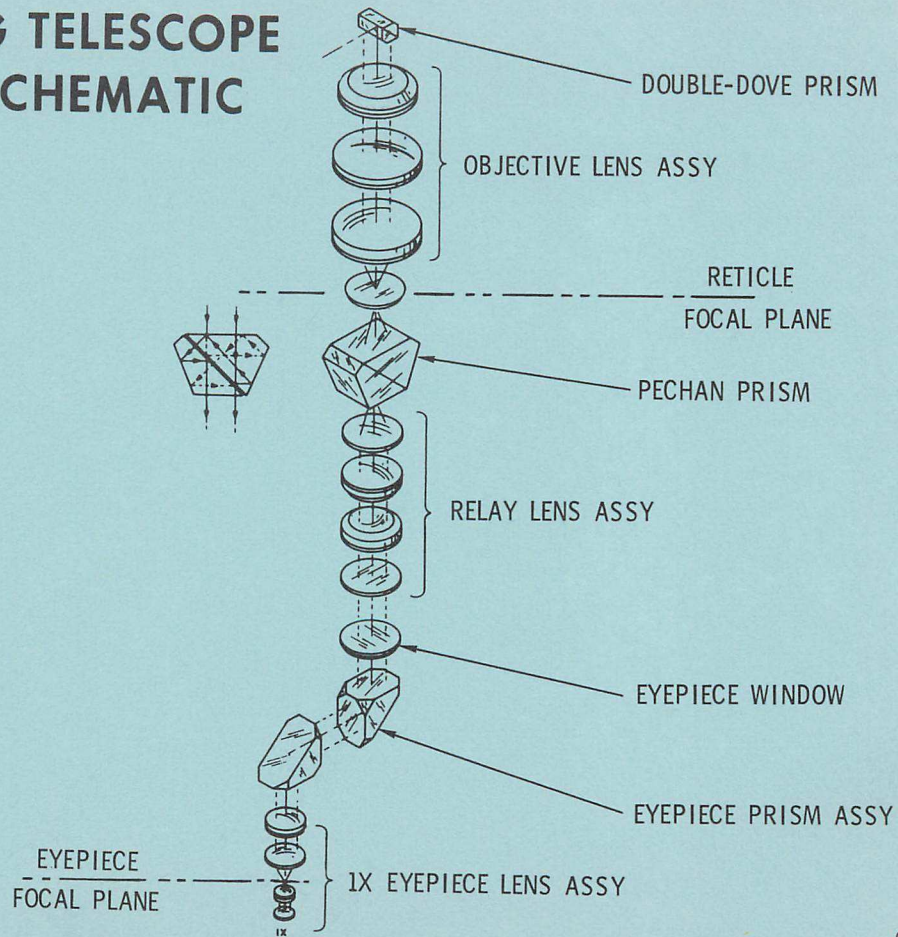


SCANNING TELESCOPE CUTAWAY

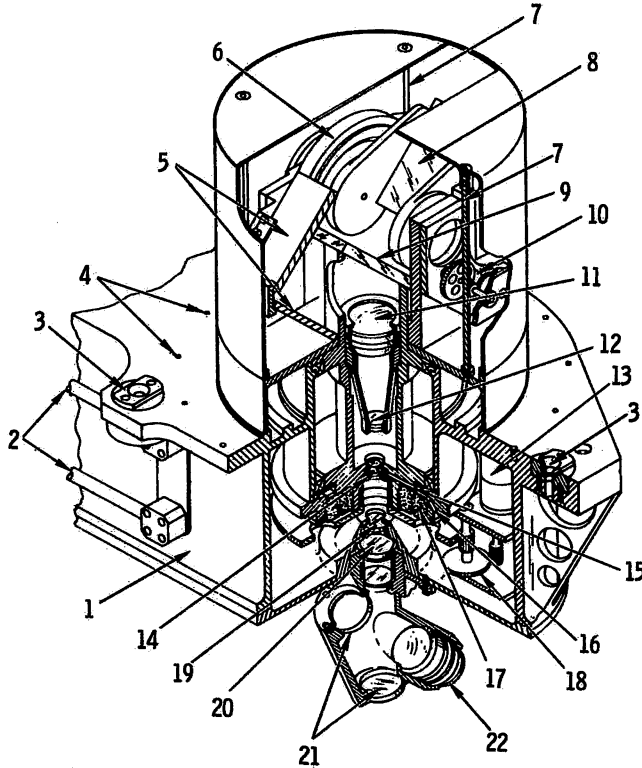


1. WINDOW
2. ELECTRICAL CONNECTOR
3. RELAY LENS ASSEMBLY
4. OPTICAL BASE
5. PECHAN PRISM
6. BALL MOUNT
7. TRUNNION DRIVE WORMSHAFT
8. PRISM & MOUNT ASSEMBLY
9. CAM
10. SPRING & CAMFOLLOWER (ANTIBACKLASH)
11. OBJECTIVE LENS ASSEMBLY
12. RETICLE
13. RETICLE ILLUMINATION
14. STUD HOLES FOR BELLOWS COVER
15. SHAFT DRIVE GEAR BOX
16. HEAT EXCHANGER CHANNELS
17. COUNTER (SHAFT AXIS)
18. EYEPIECE ASSEMBLY

SCANNING TELESCOPE OPTICAL SCHEMATIC



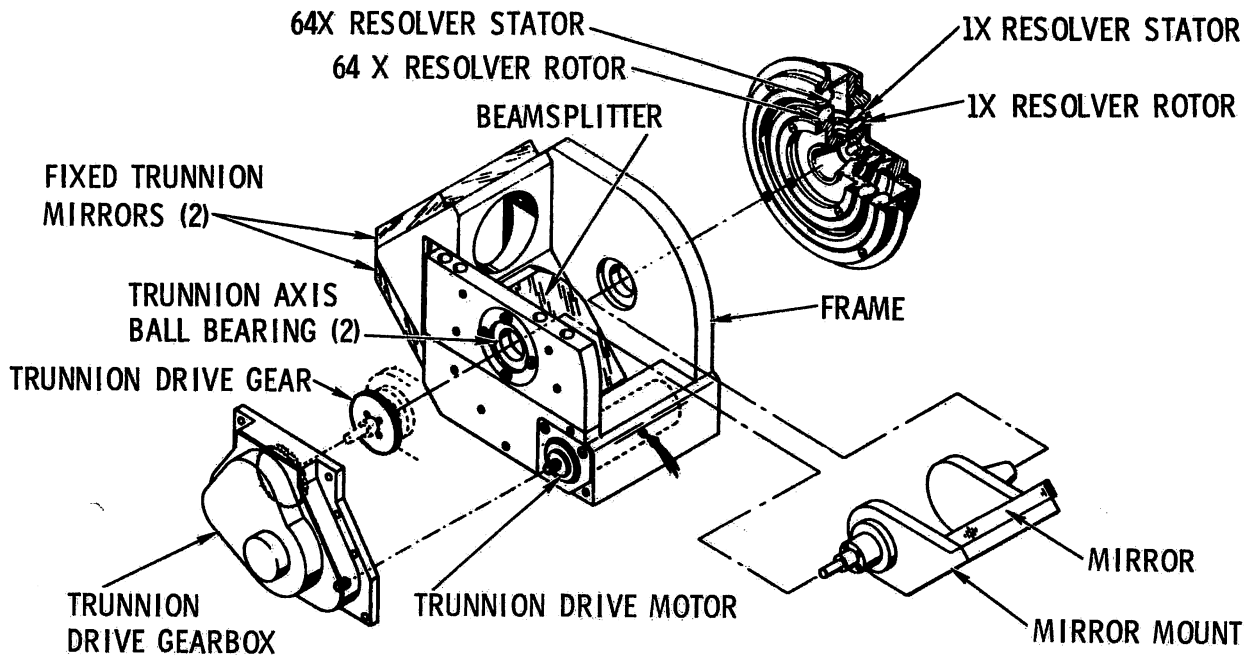
SEXTANT CUTAWAY



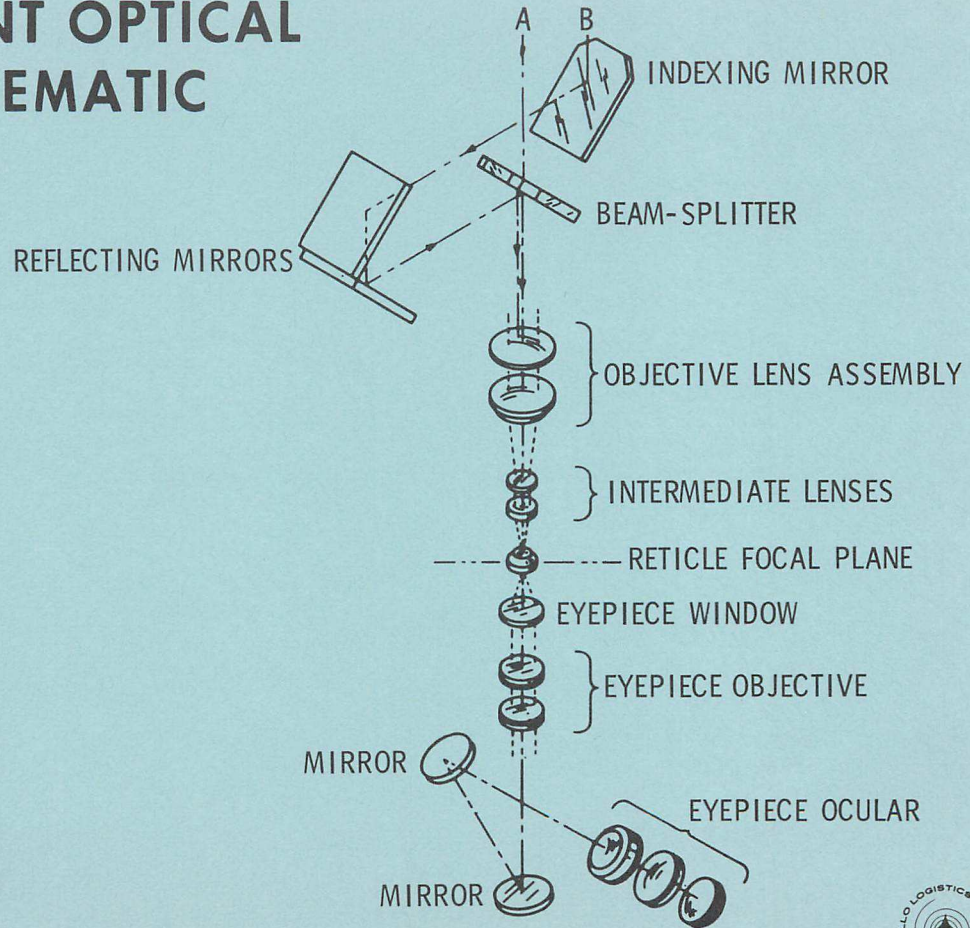
1. OPTICAL BASE
2. COOLANT CONNECTIONS
3. BALL MOUNT
4. STUD HOLES FOR MOUNTING BELLOWS COVER
5. FIXED RIGHT-ANGLE MIRRORS
6. TRUNNION AXIS RESOLVER (64X)
7. COVER-FASTENING ROD
8. INDEXING MIRROR
9. BEAM SPLITTER
10. TRUNNION DRIVE GEAR BOX
11. OBJECTIVE LENS ASSEMBLY
12. INTERMEDIATE LENS ASSEMBLY
13. SHAFT AXIS DRIVE MOTOR
14. RETICLE
15. LIGHT-TRANSMITTING ROD
16. RETICLE LAMP
17. SHAFT-AXIS RESOLVER (16X)
18. SHAFT DRIVE GEAR BOX
19. EYEPIECE SOCKET & SEAL
20. EYEPIECE OBJECTIVE LENS
21. EYEPIECE MIRRORS
22. EYEPIECE OCULAR



SEXTANT TRUNNION AXIS ASSEMBLY



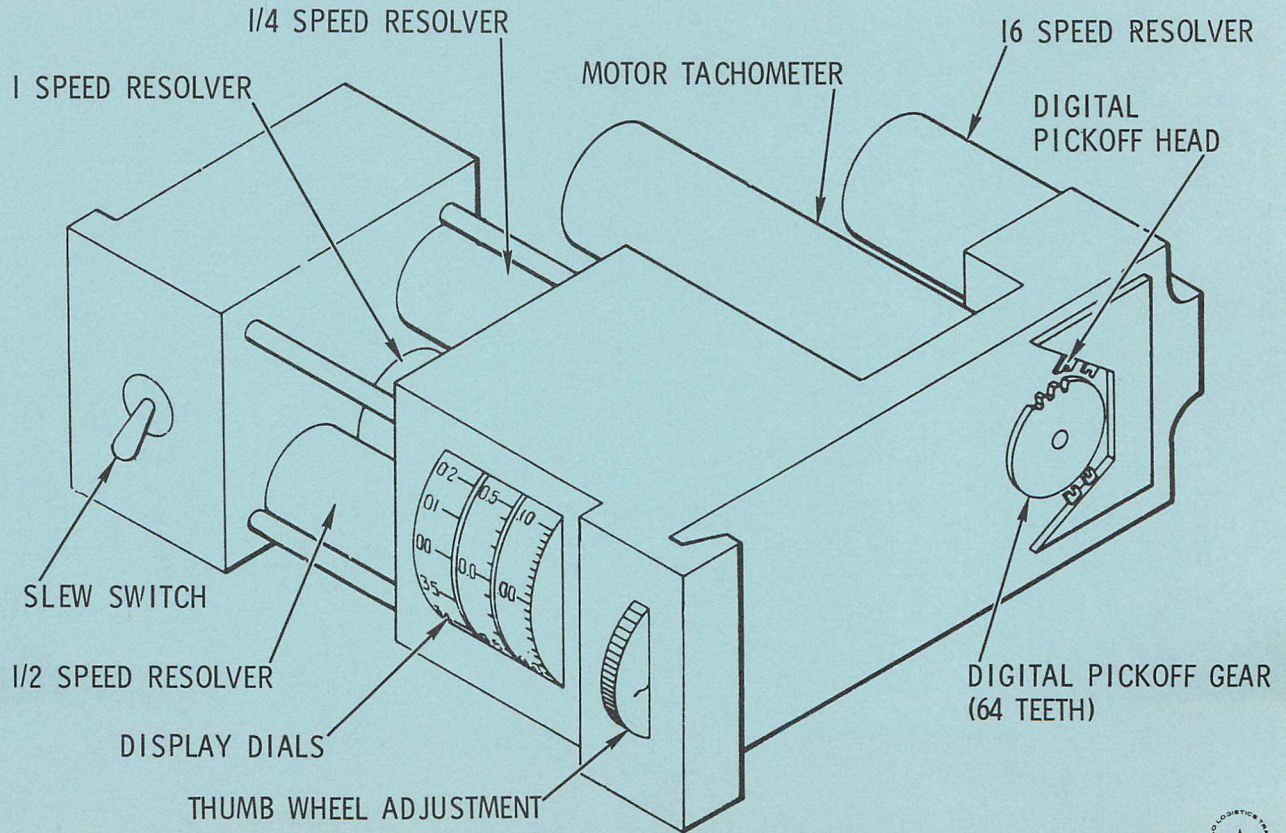
SEXTANT OPTICAL SCHEMATIC

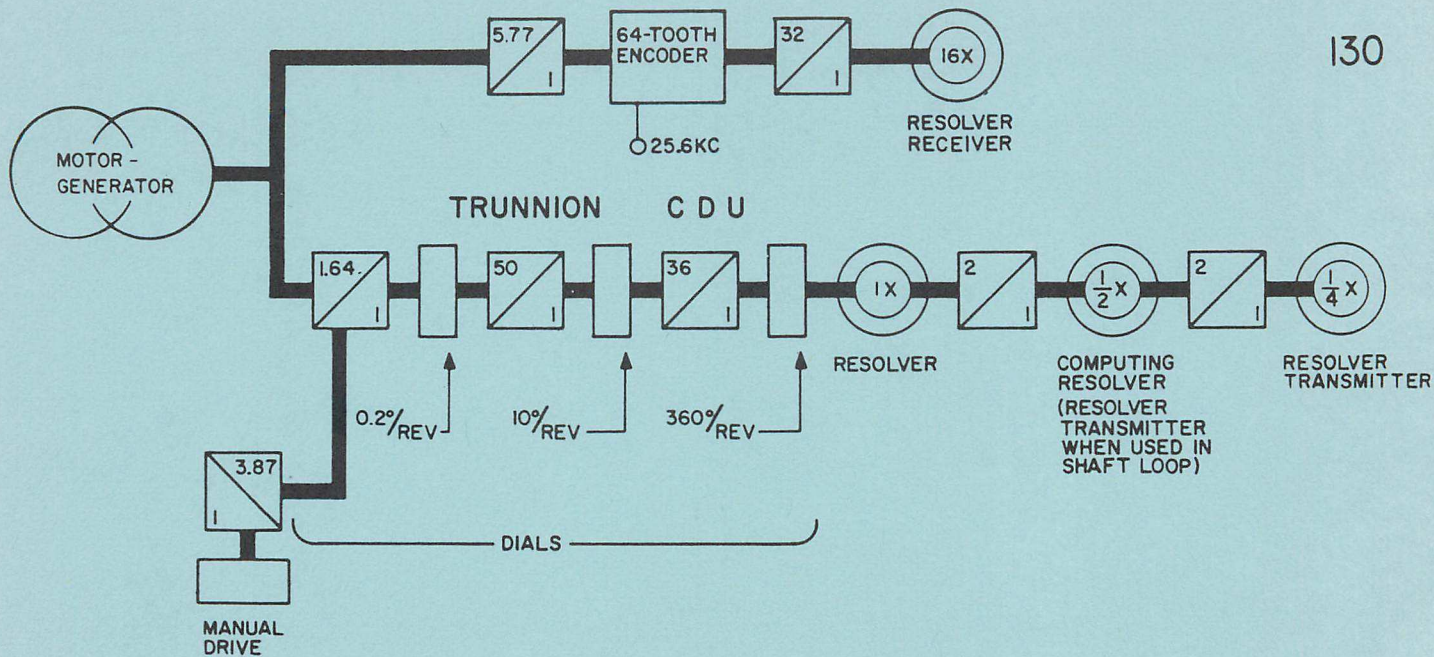


GN-9126A



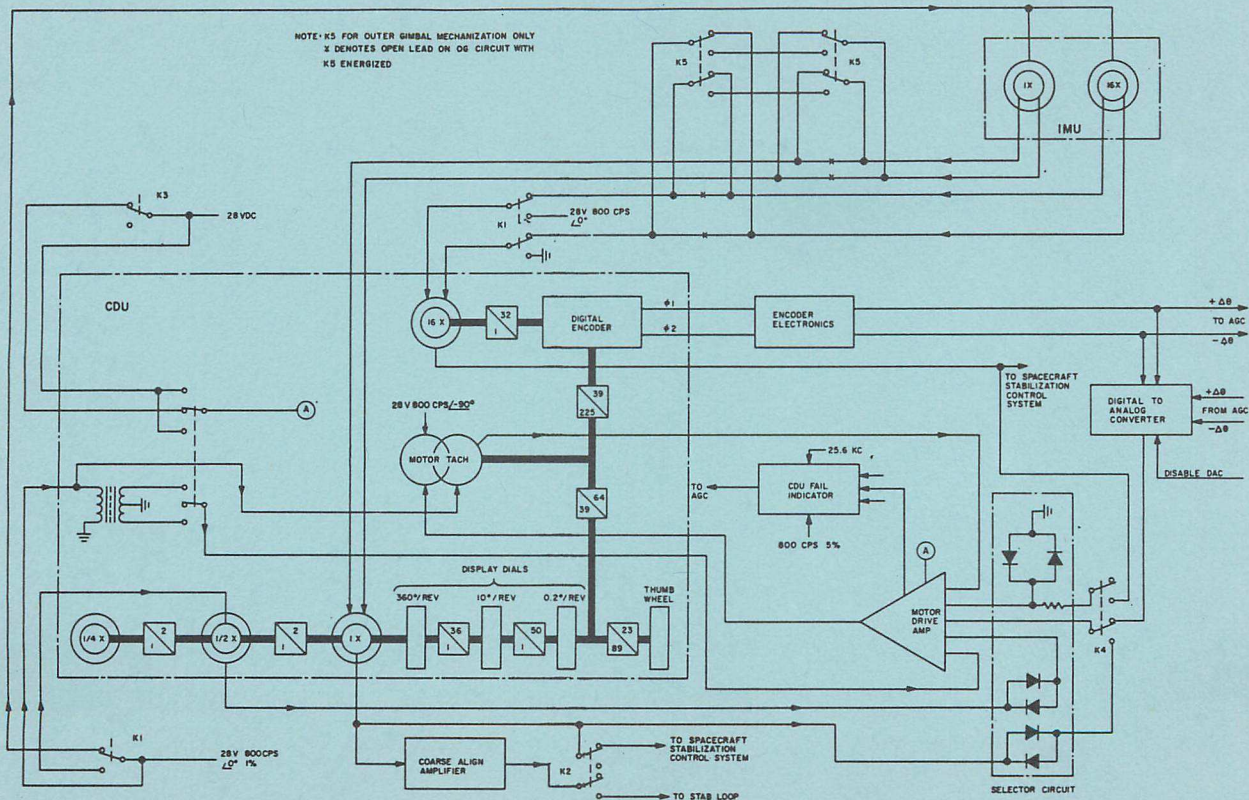
COUPLING DISPLAY UNIT



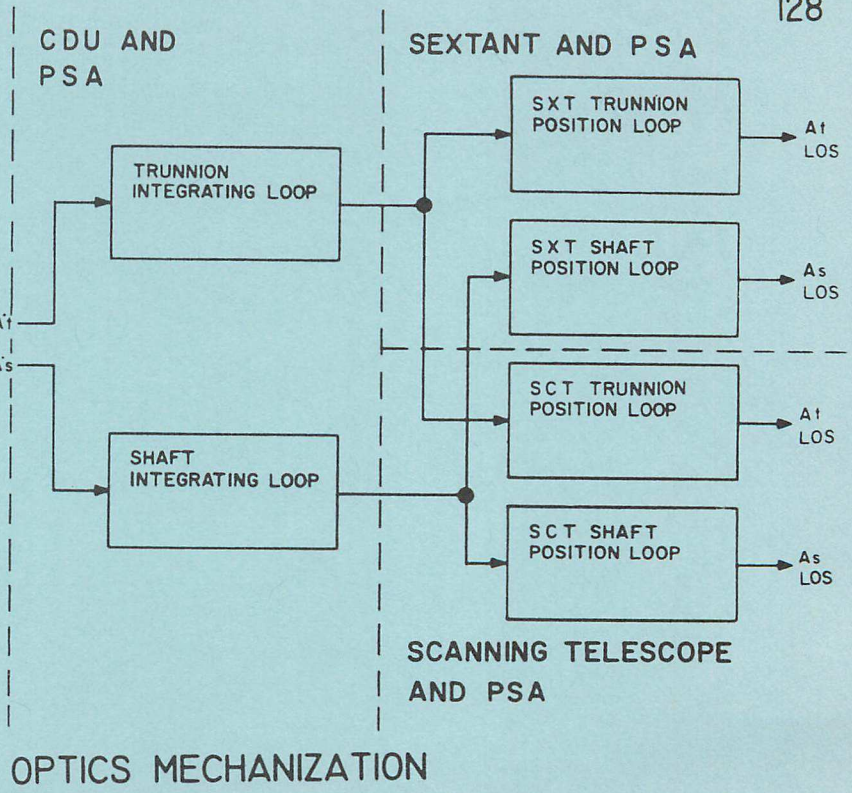
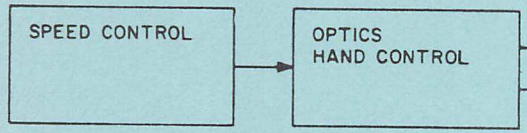


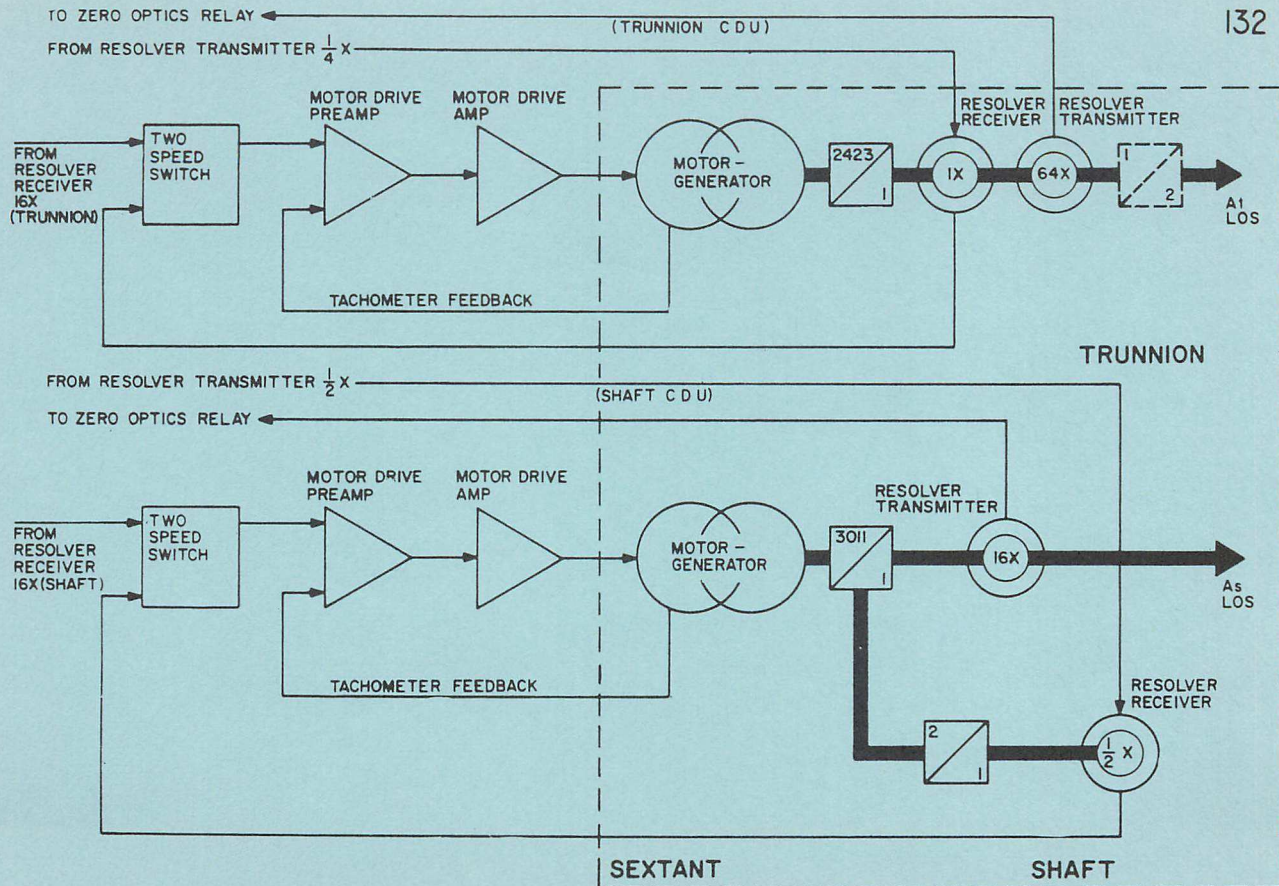
CDU BLOCK DIAGRAM

CDU FUNCTIONAL DIAGRAM

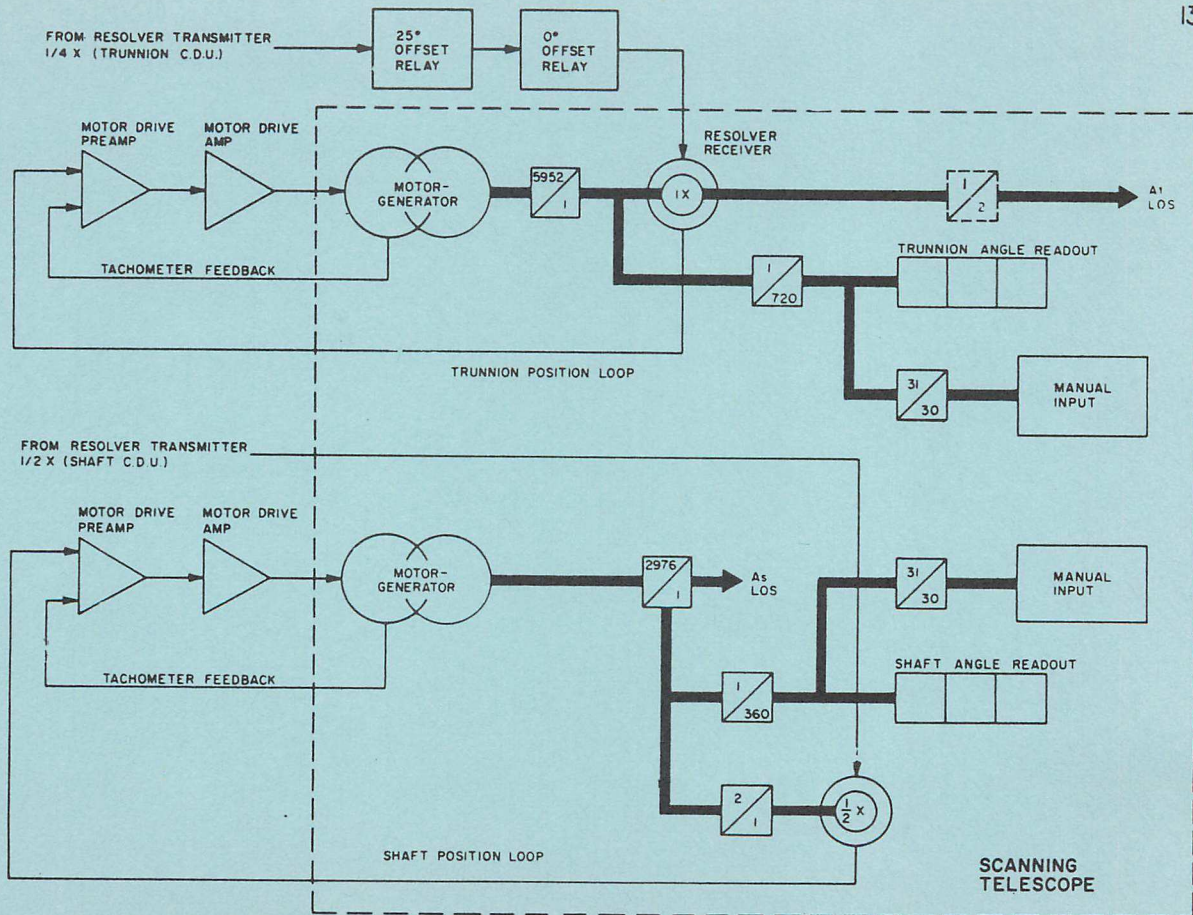


GUIDANCE AND
NAVIGATION
INDICATOR CONTROL
PANEL

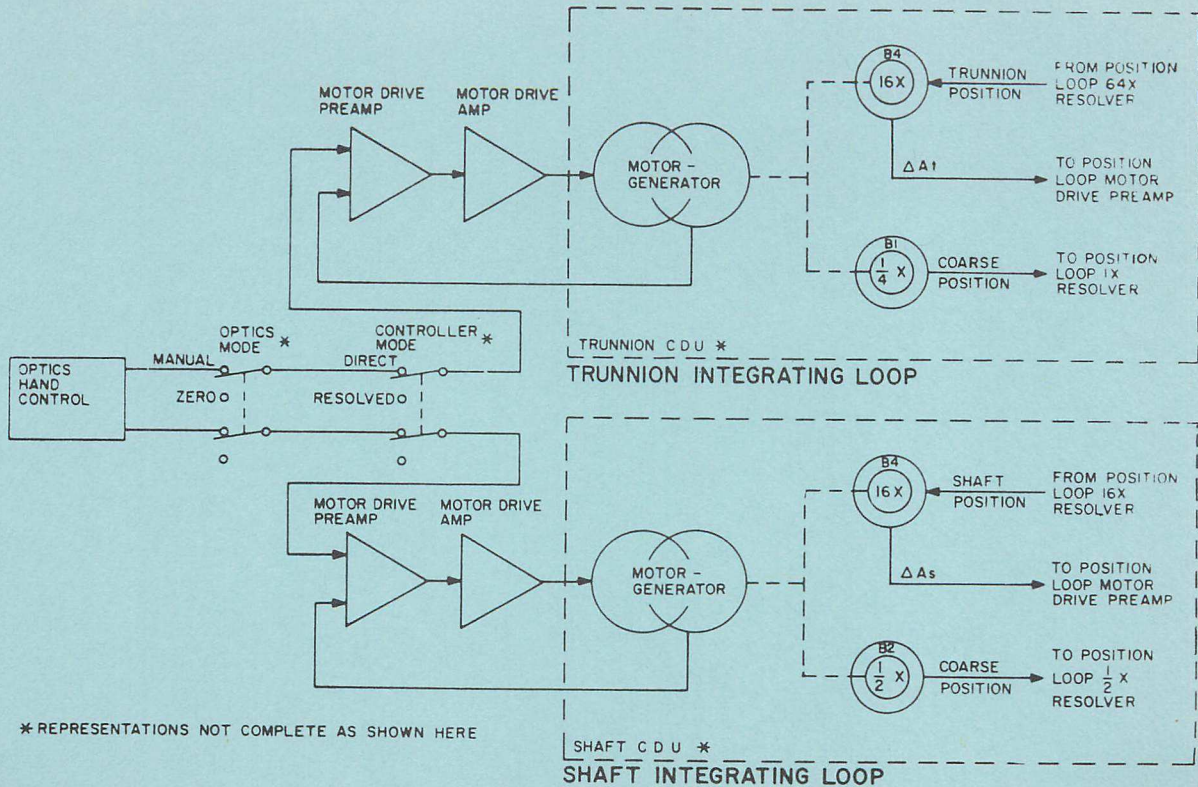




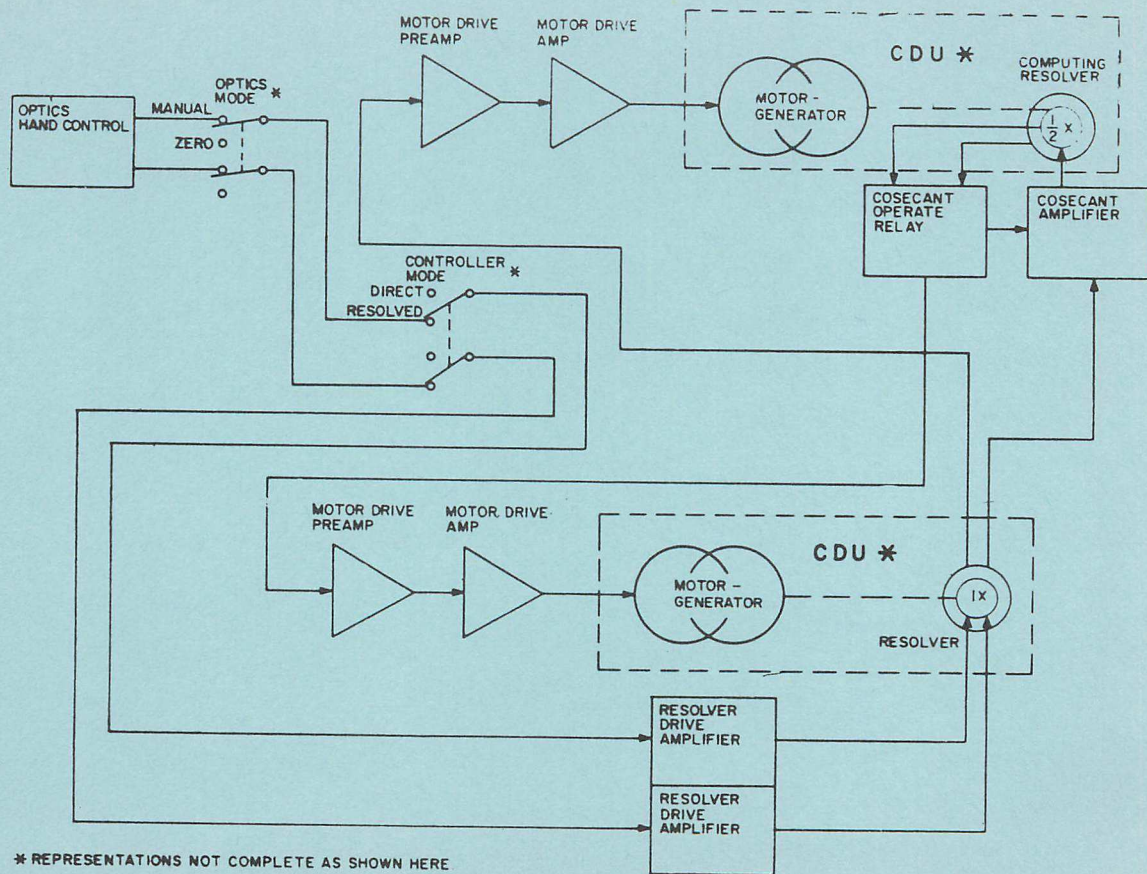
SEXTANT POSITION SERVO LOOPS



SCANNING TELESCOPE POSITION SERVO LOOPS

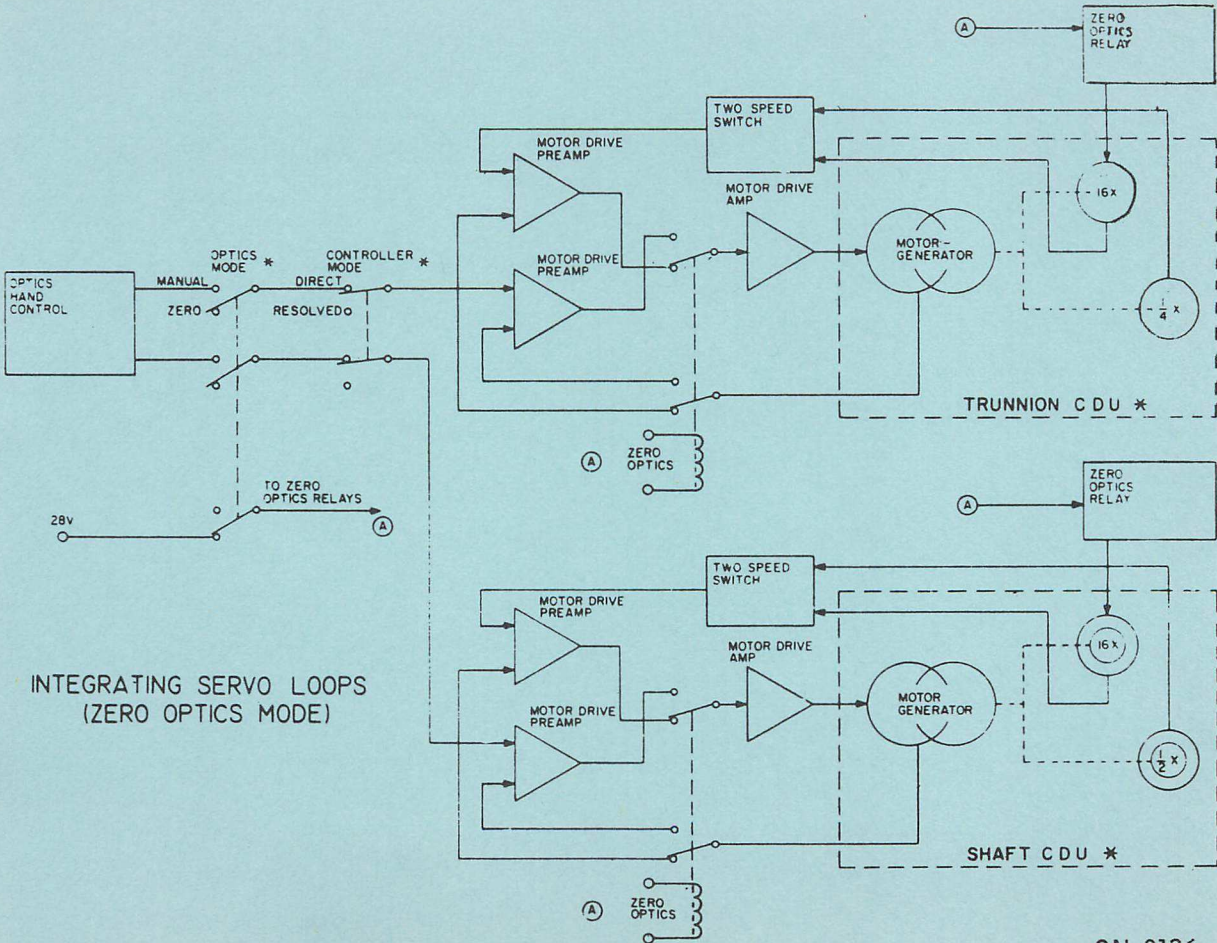


INTEGRATING SERVO LOOPS
(MANUAL-DIRECT MODE)



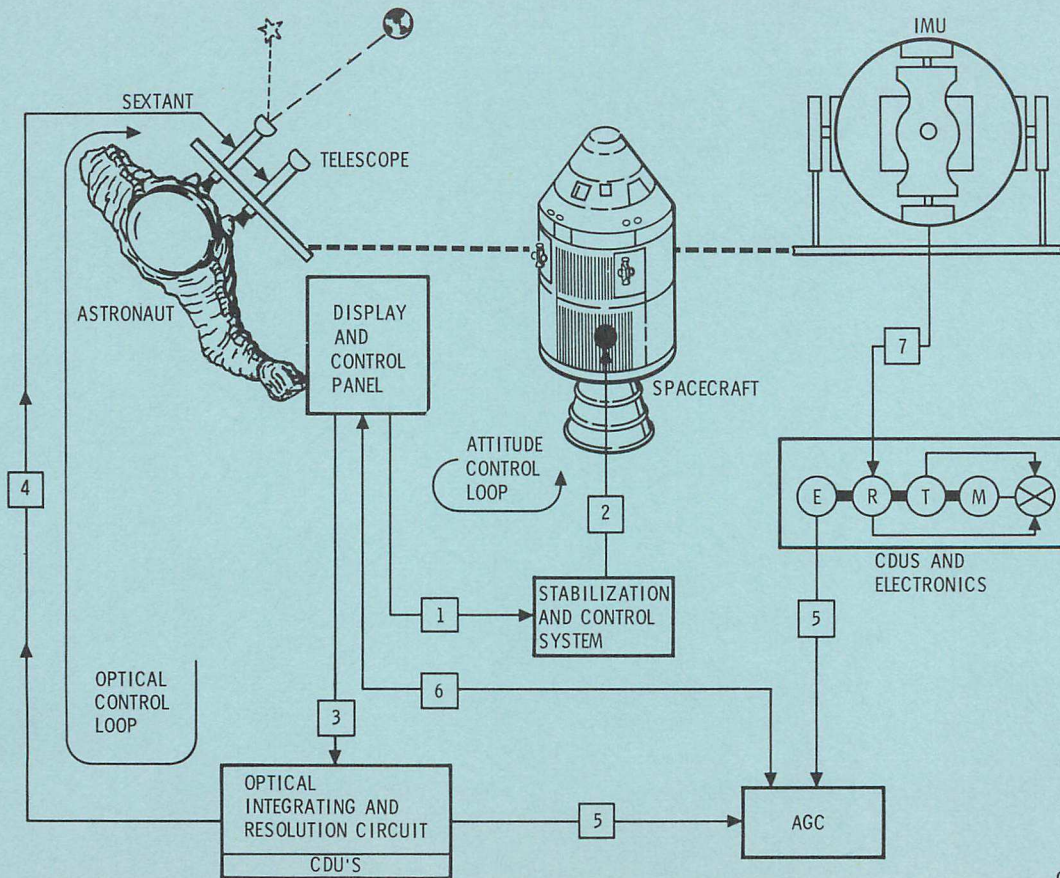
INTEGRATING SERVO LOOPS
(MANUAL-RESOLVED MODE)

GN-9135

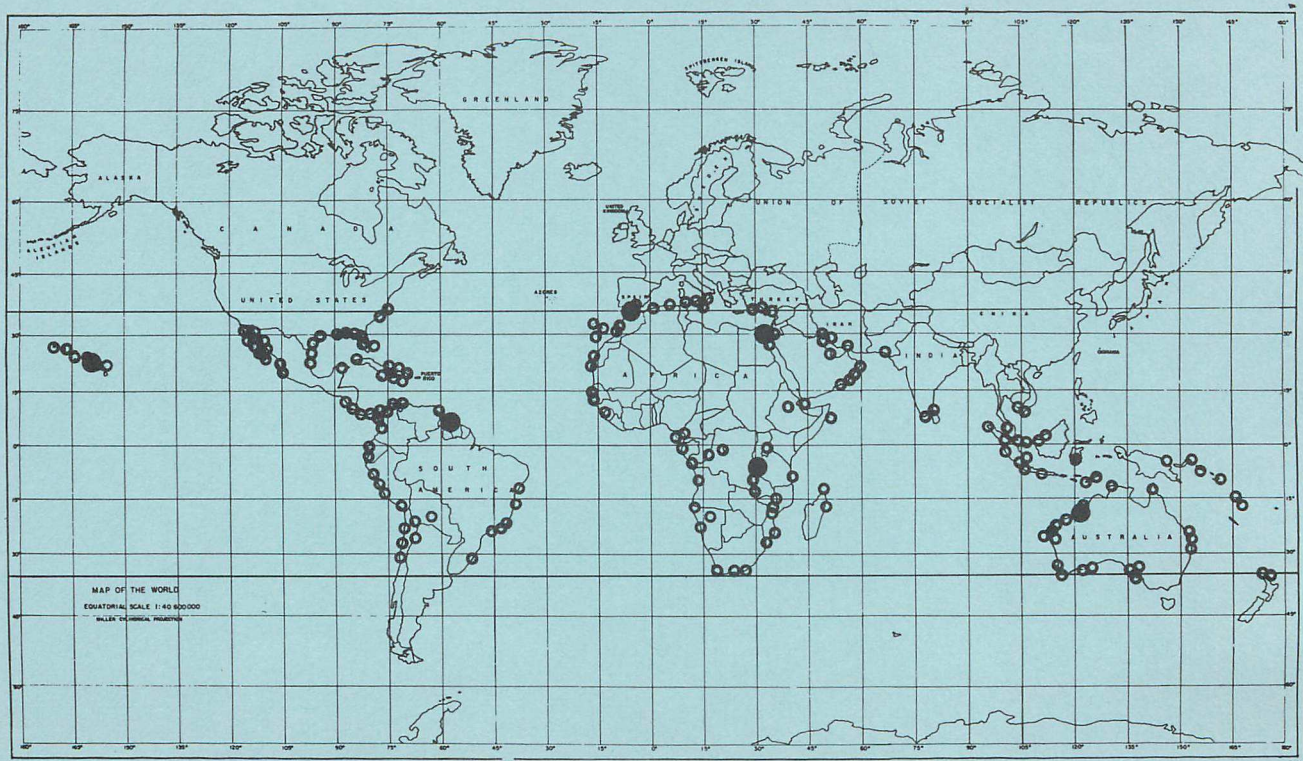


INTEGRATING SERVO LOOPS
(ZERO OPTICS MODE)

OPTICAL MEASUREMENT



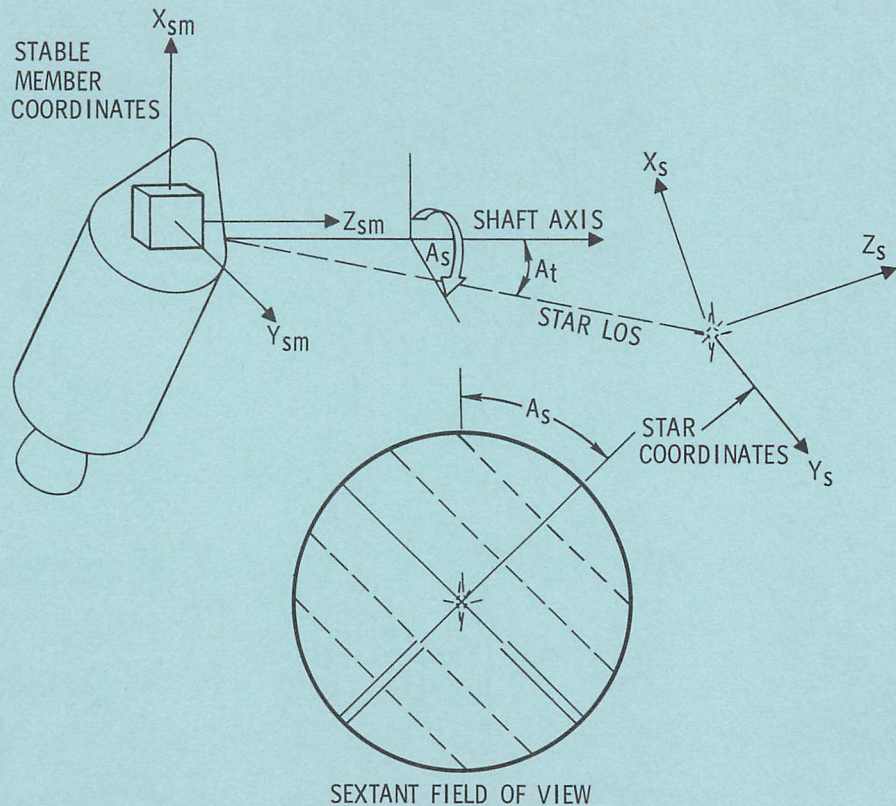
LAND MARKS



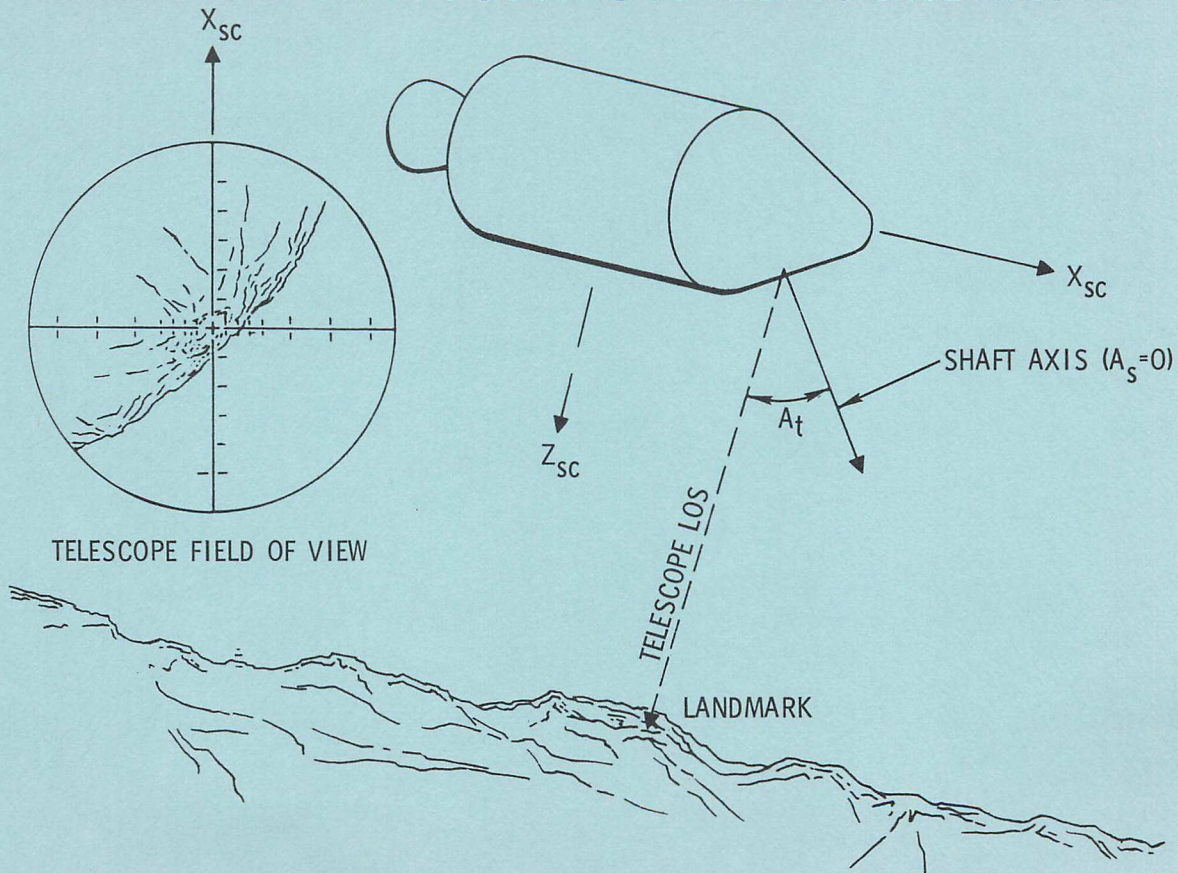
GN-198



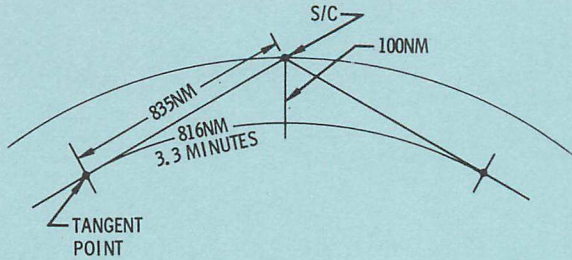
IMU ALIGNMENT MEASUREMENT



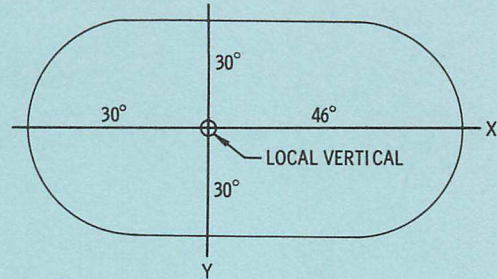
ORBITAL NAVIGATION MEASUREMENT



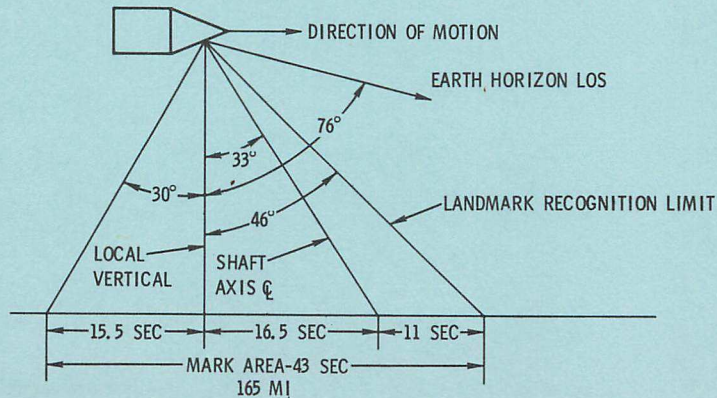
EARTH ORBIT NAVIGATION



EARTH ORBIT GEOMETRY FIGURE 1



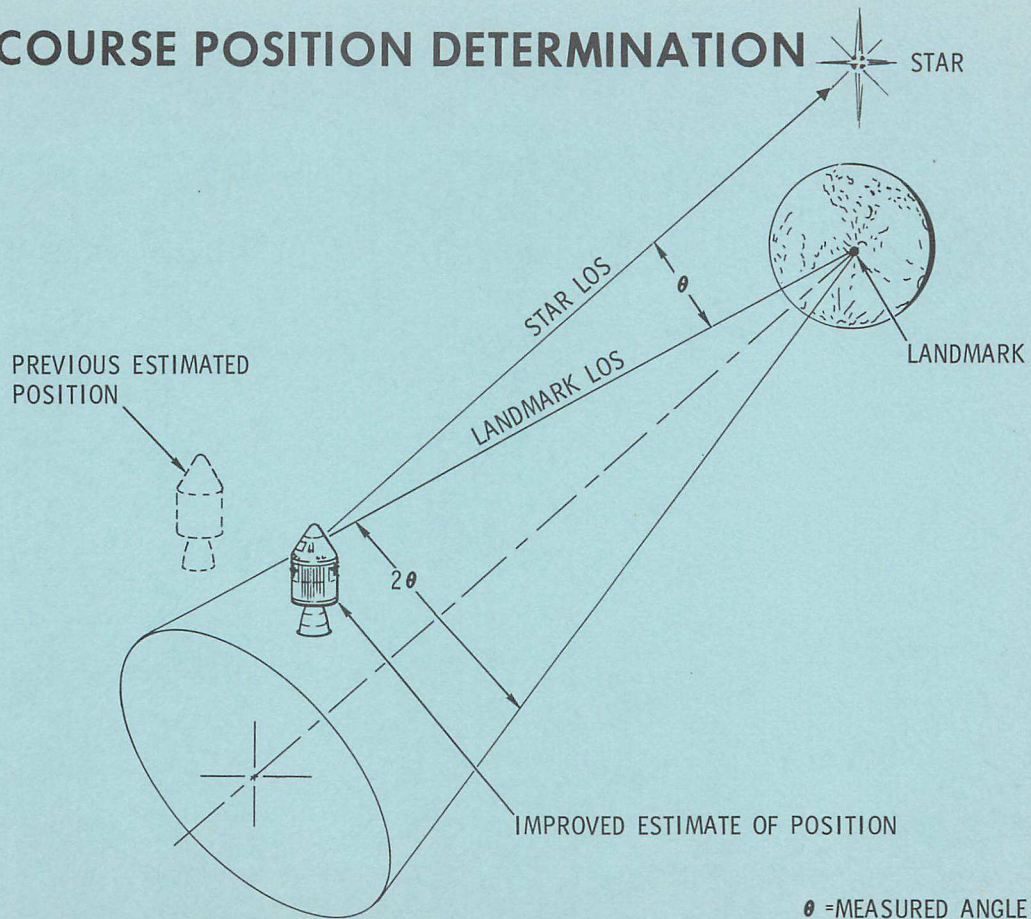
VIEW ON SURFACE FIGURE 3



COVERAGE ON SURFACE FIGURE 2



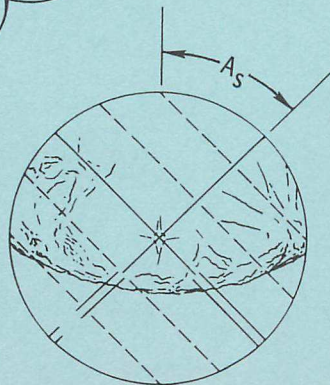
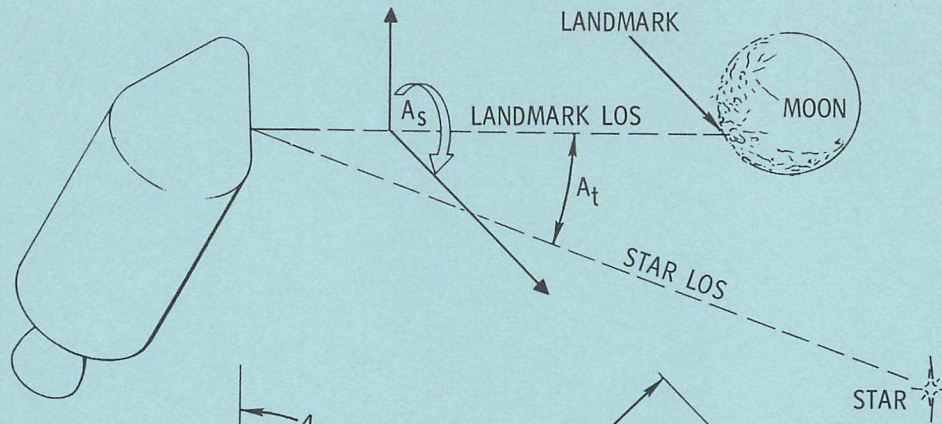
MIDCOURSE POSITION DETERMINATION



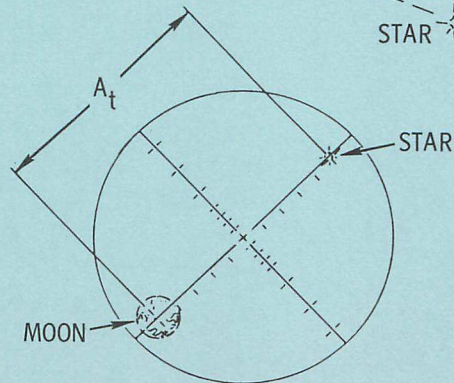
θ = MEASURED ANGLE



MIDCOURSE NAVIGATIONAL MEASUREMENT



SEXTANT FIELD OF VIEW

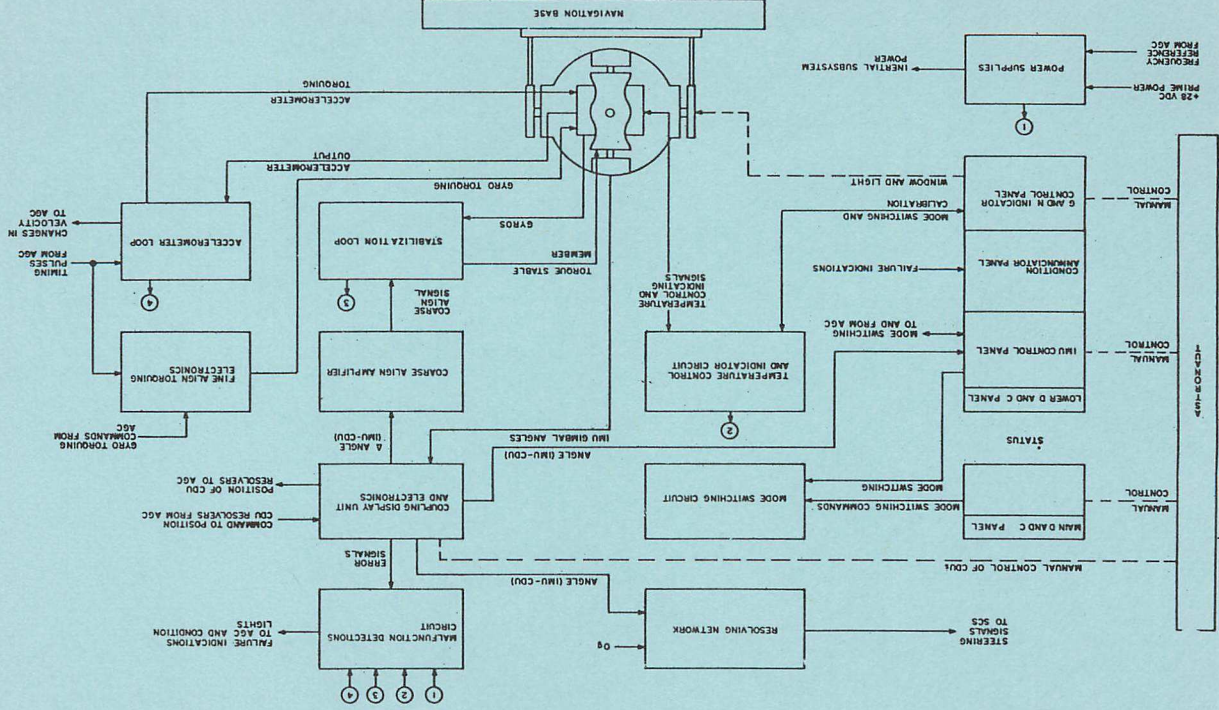


TELESCOPE FIELD OF VIEW

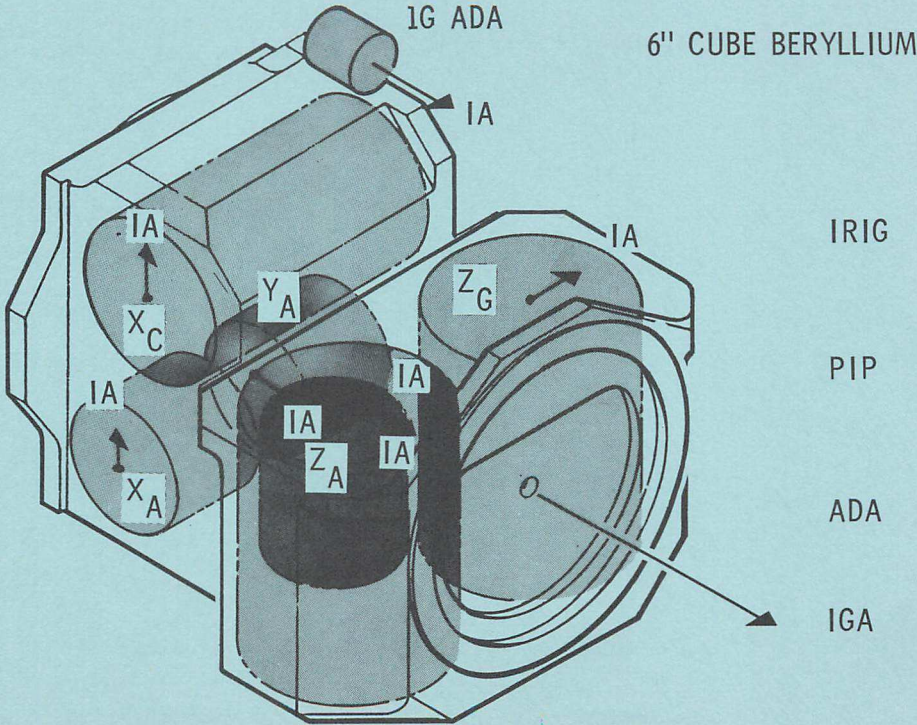


INERTIAL SUBSYSTEM

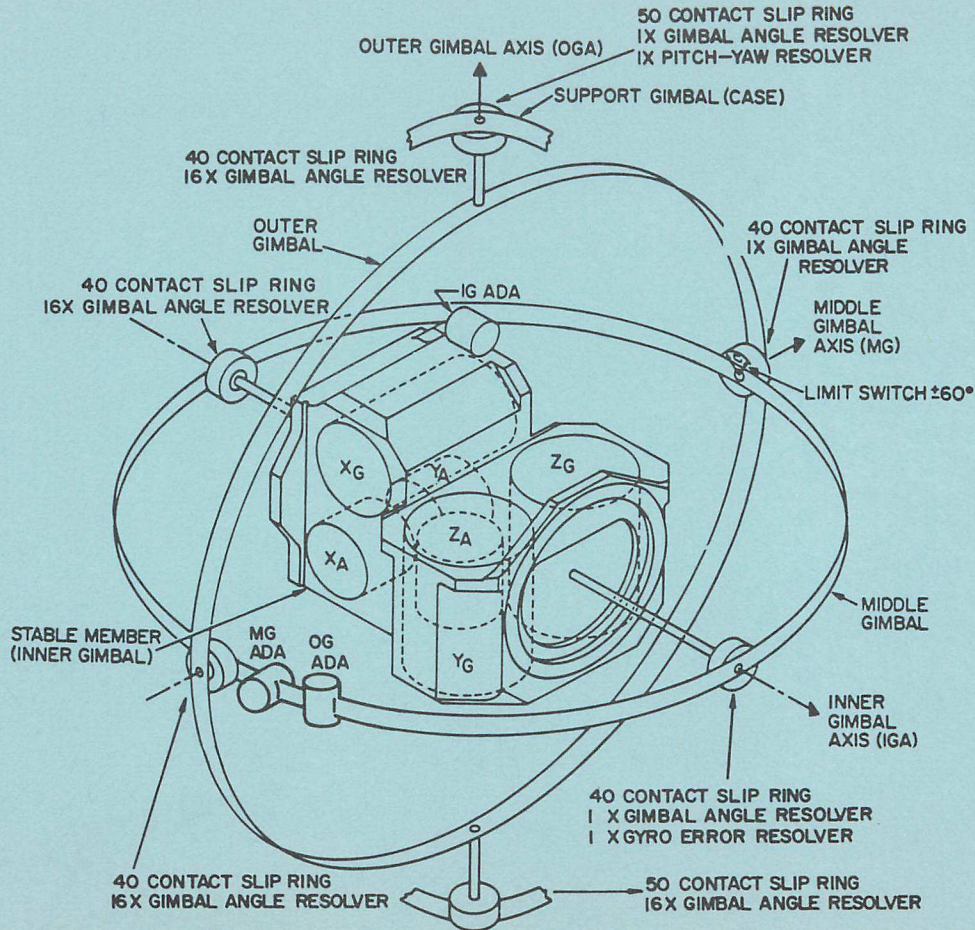
INERTIAL SUBSYSTEM INTERFACE



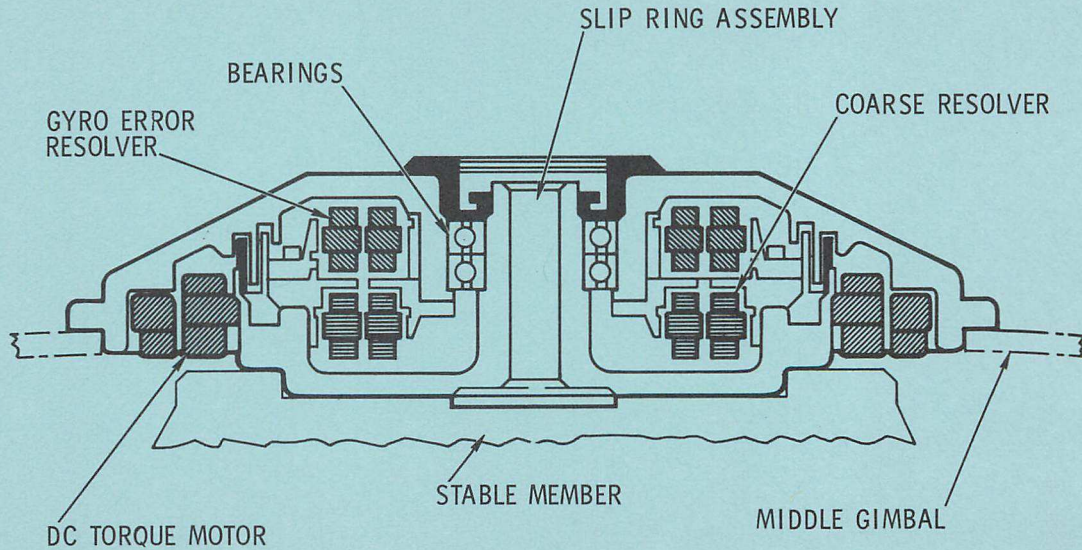
APOLLO STABLE MEMBER CONFIGURATION



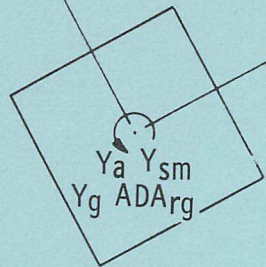
IMU GIMBAL ASSEMBLY



INTERGIMBAL ASSEMBLY

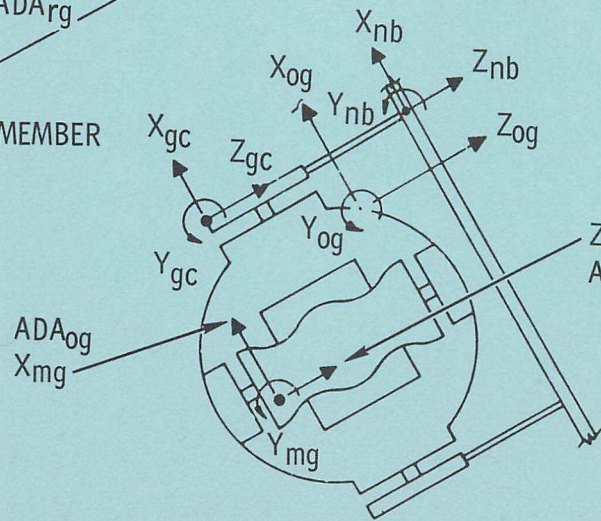


$X_a X_g X_{sm}$



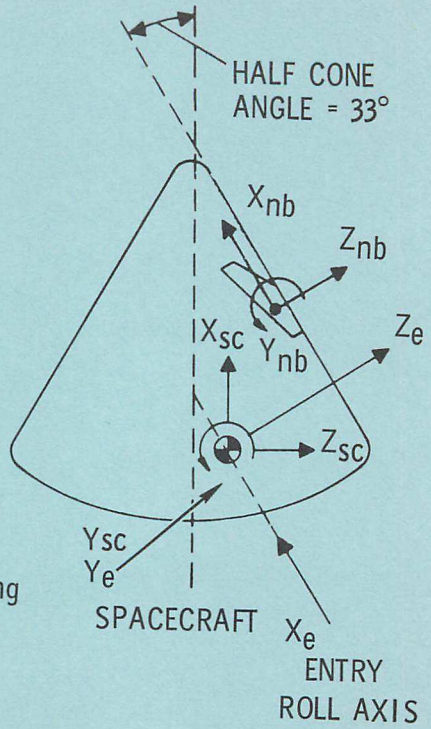
$Z_a Z_g Z_{sm}$

STABLE MEMBER



INERTIAL MEASUREMENT UNIT

HALF CONE ANGLE = 33°



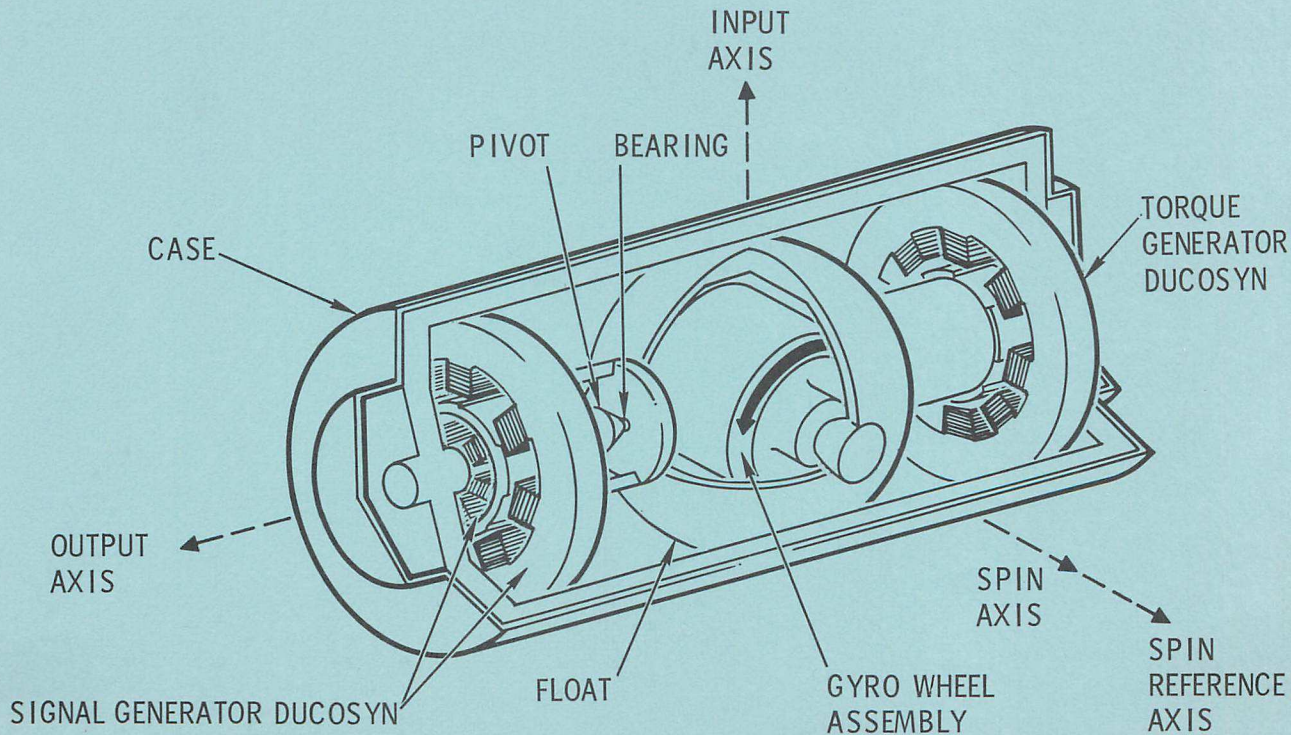
SPACECRAFT

ENTRY ROLL AXIS

GN-9064A

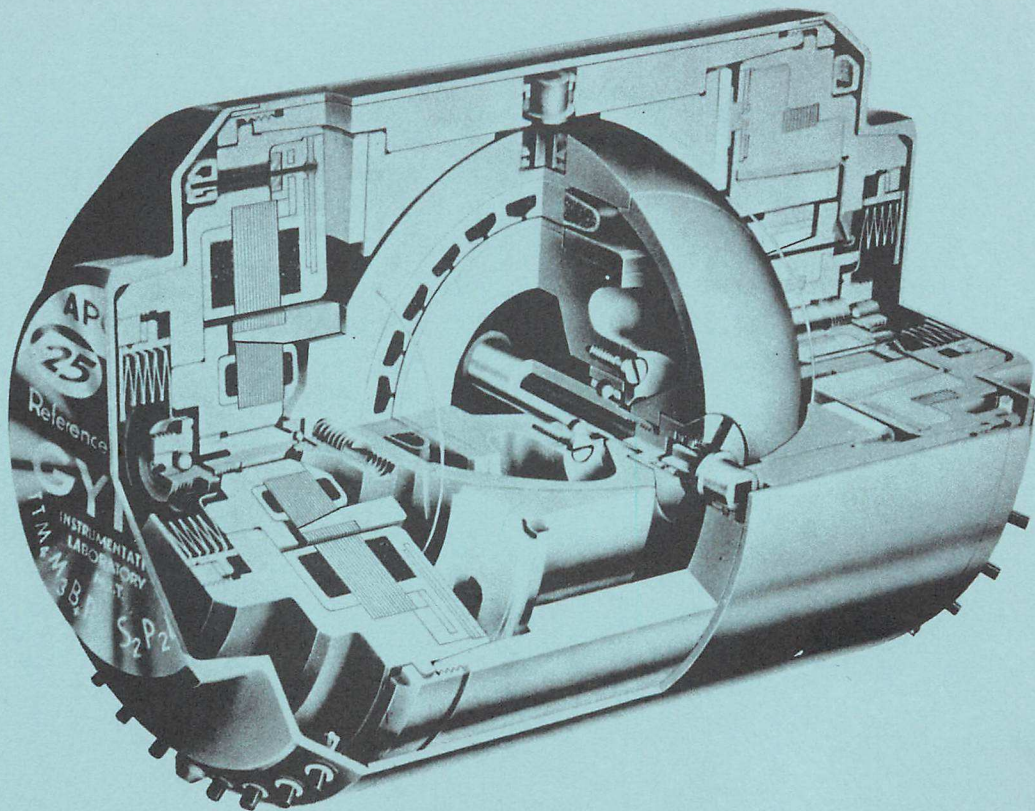


25 IRIG, SIMPLIFIED CUTAWAY VIEW



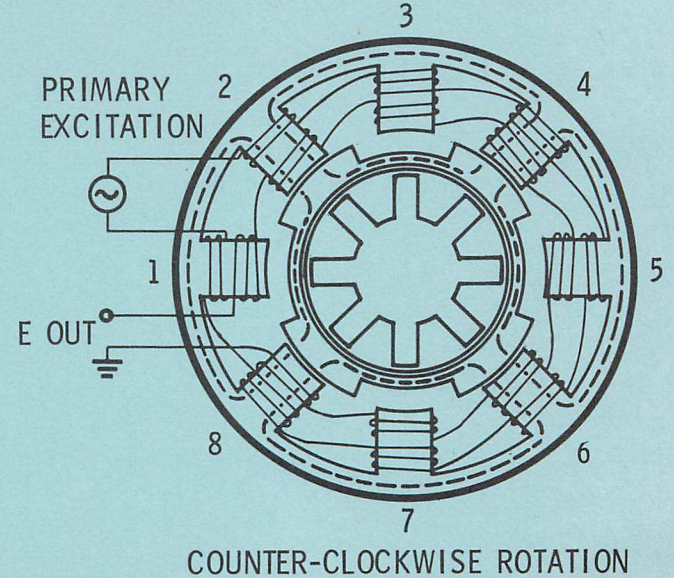
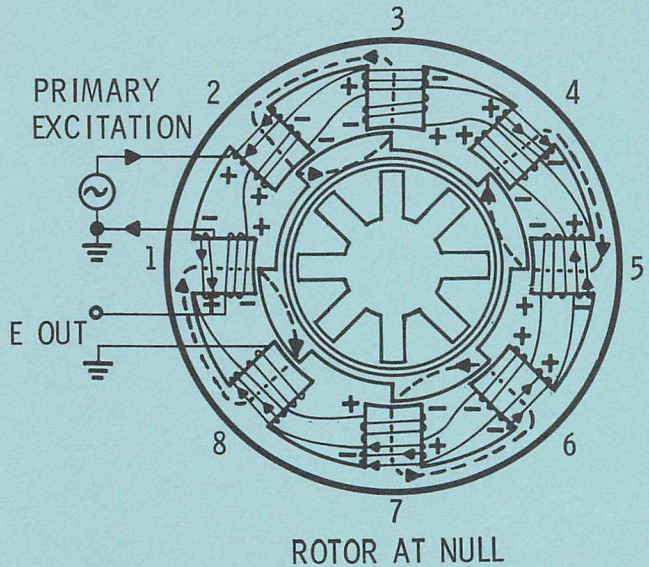
GN-240



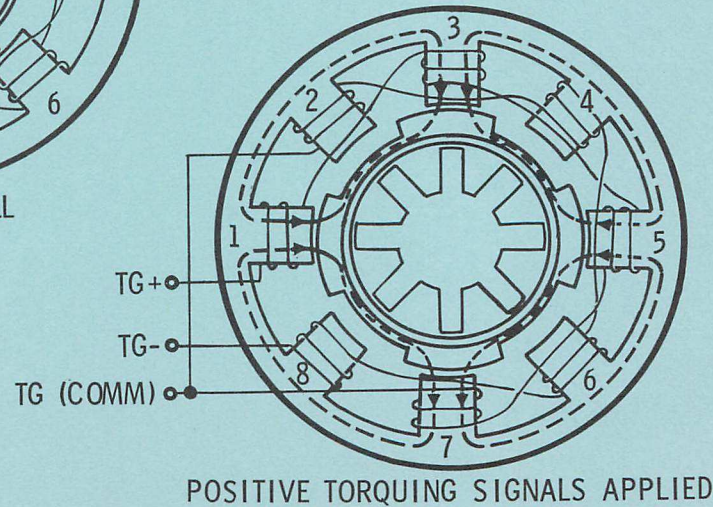
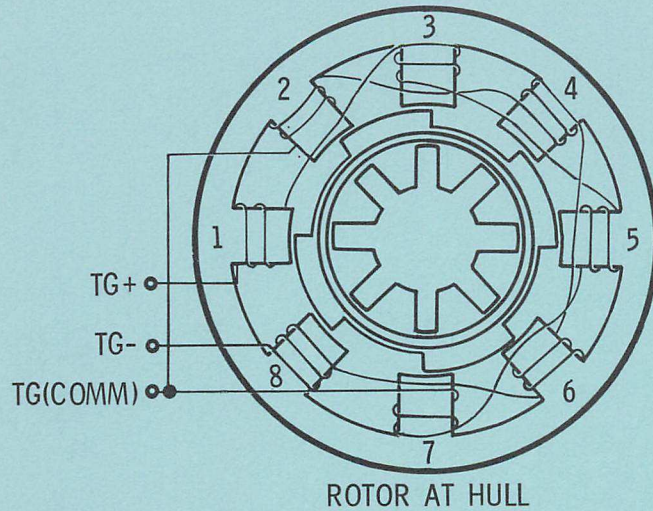


IRIG

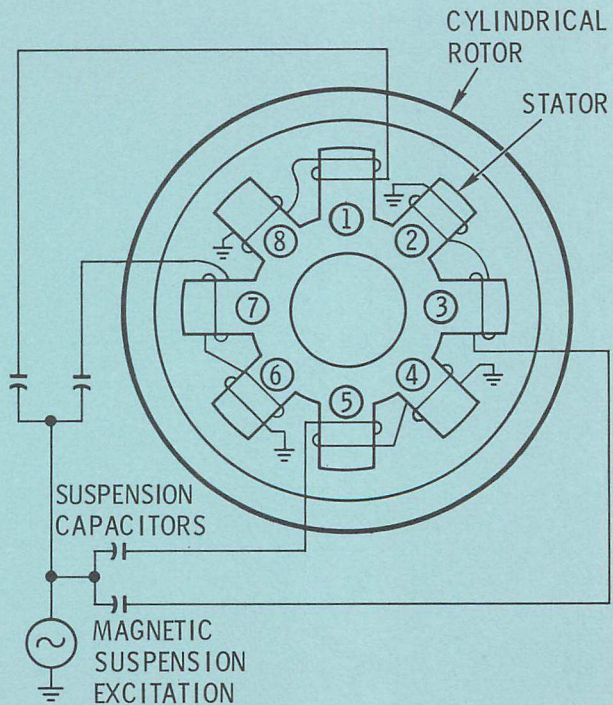
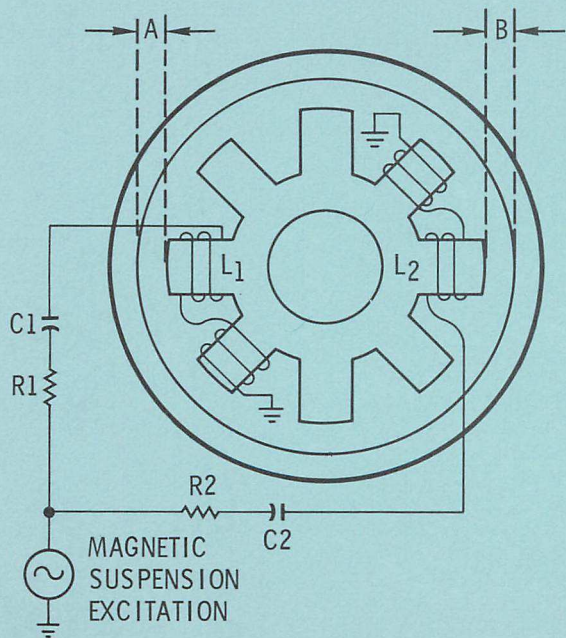
DUCOSYN SIGNAL GENERATOR OPERATION



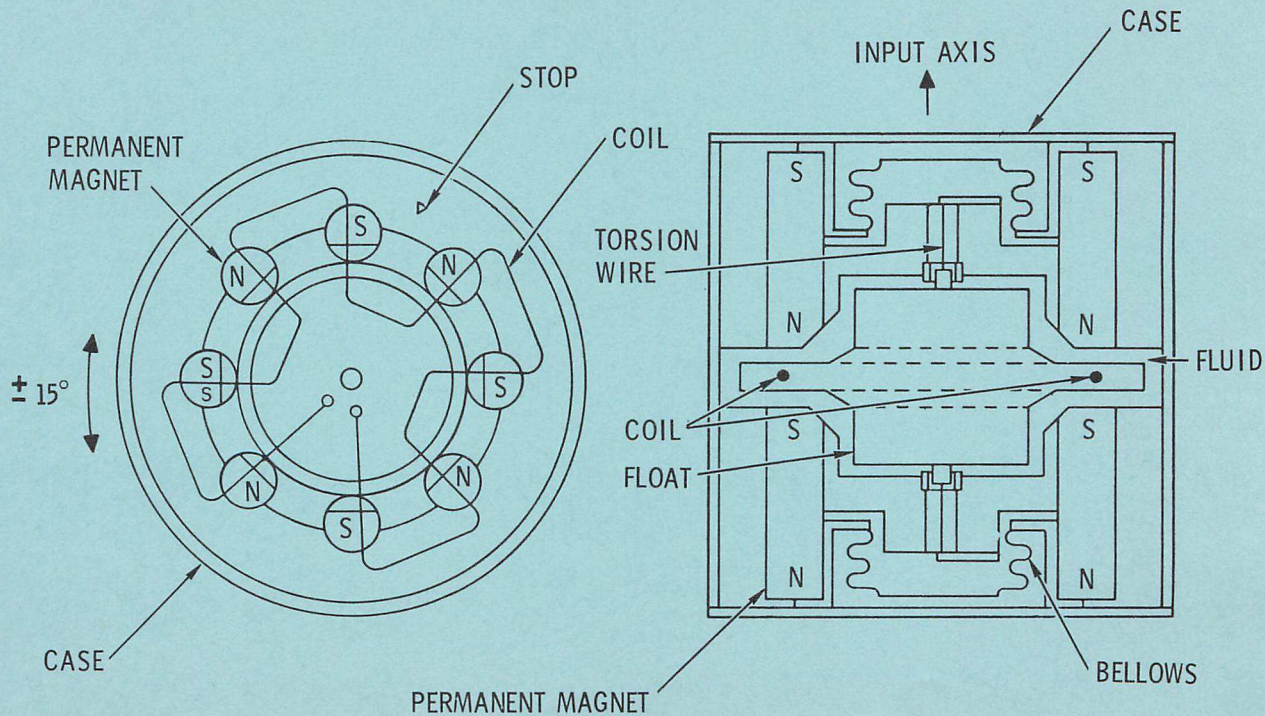
DUCOSYN TORQUE GENERATOR OPERATION



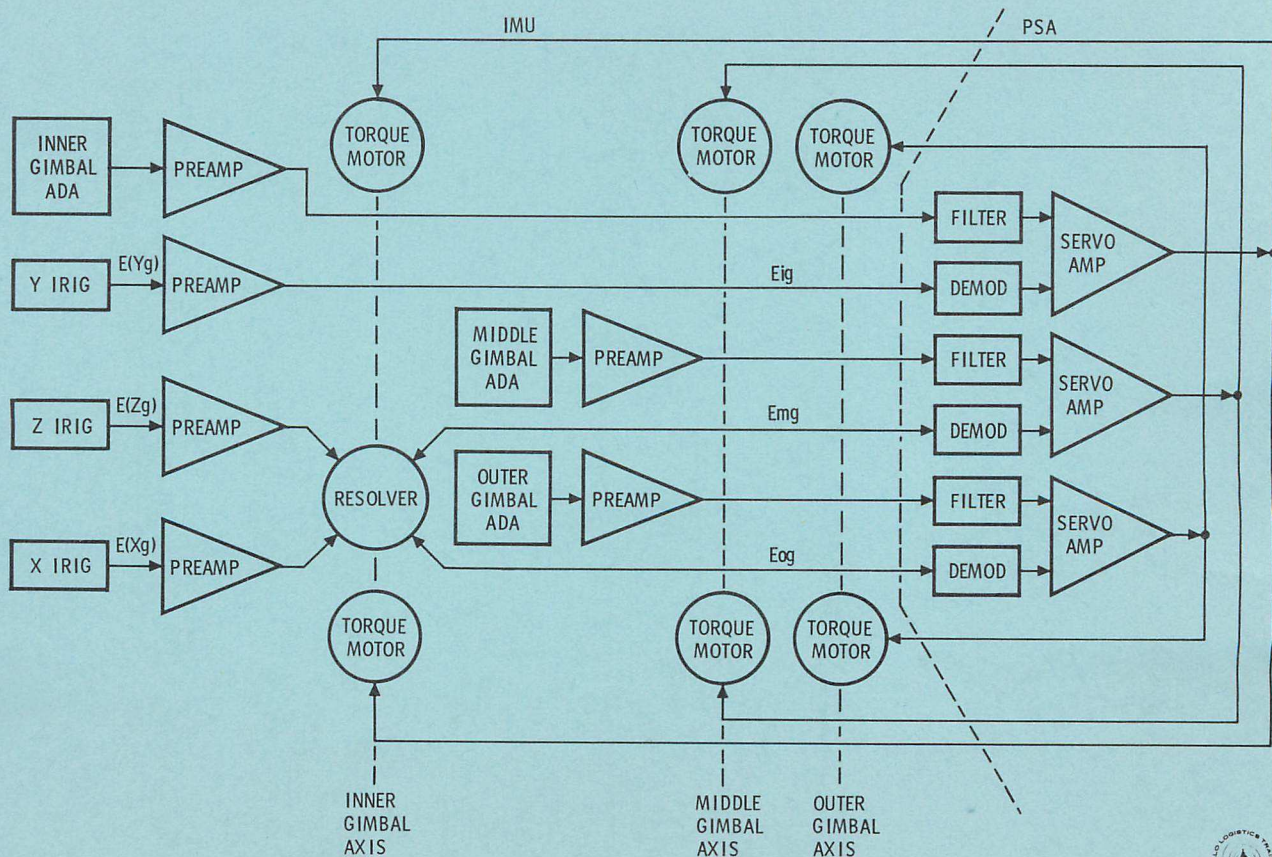
MAGNETIC SUSPENSION



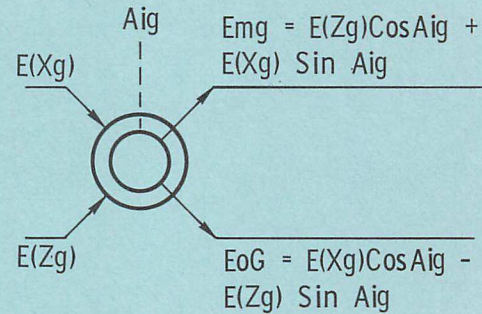
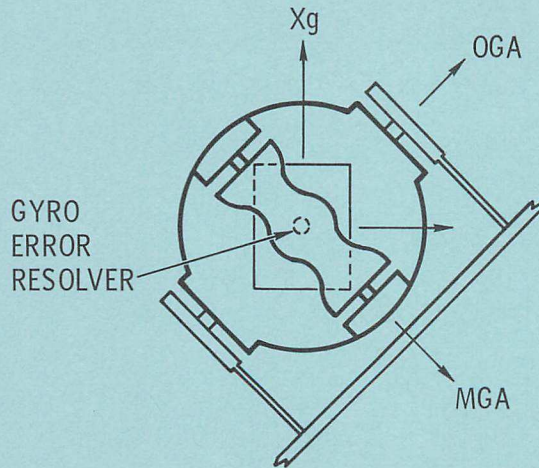
ANGULAR DIFFERENTIATING ACCELEROMETER



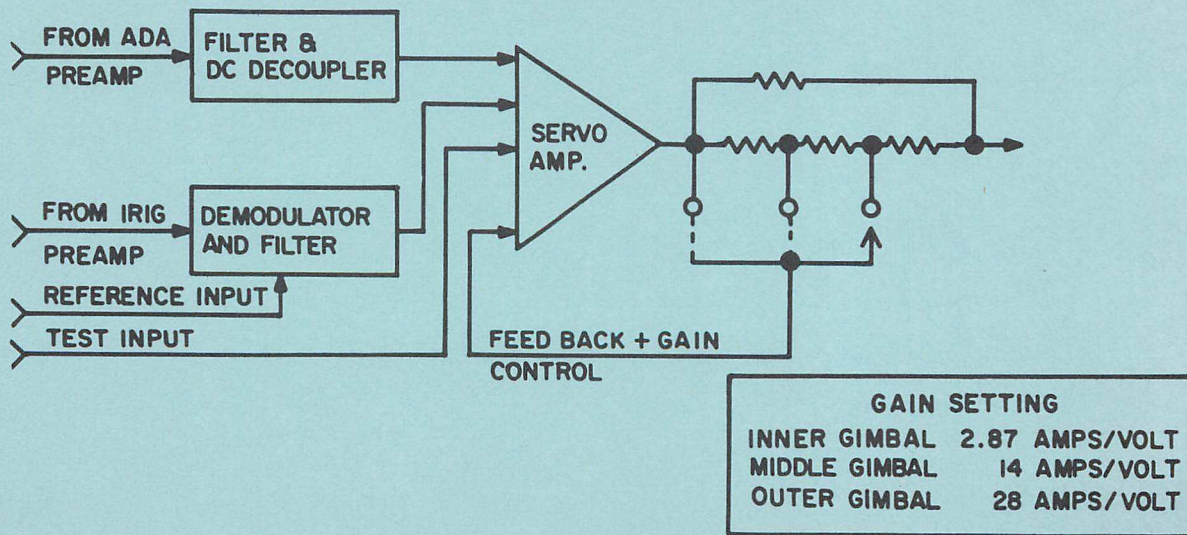
STABILIZATION LOOP



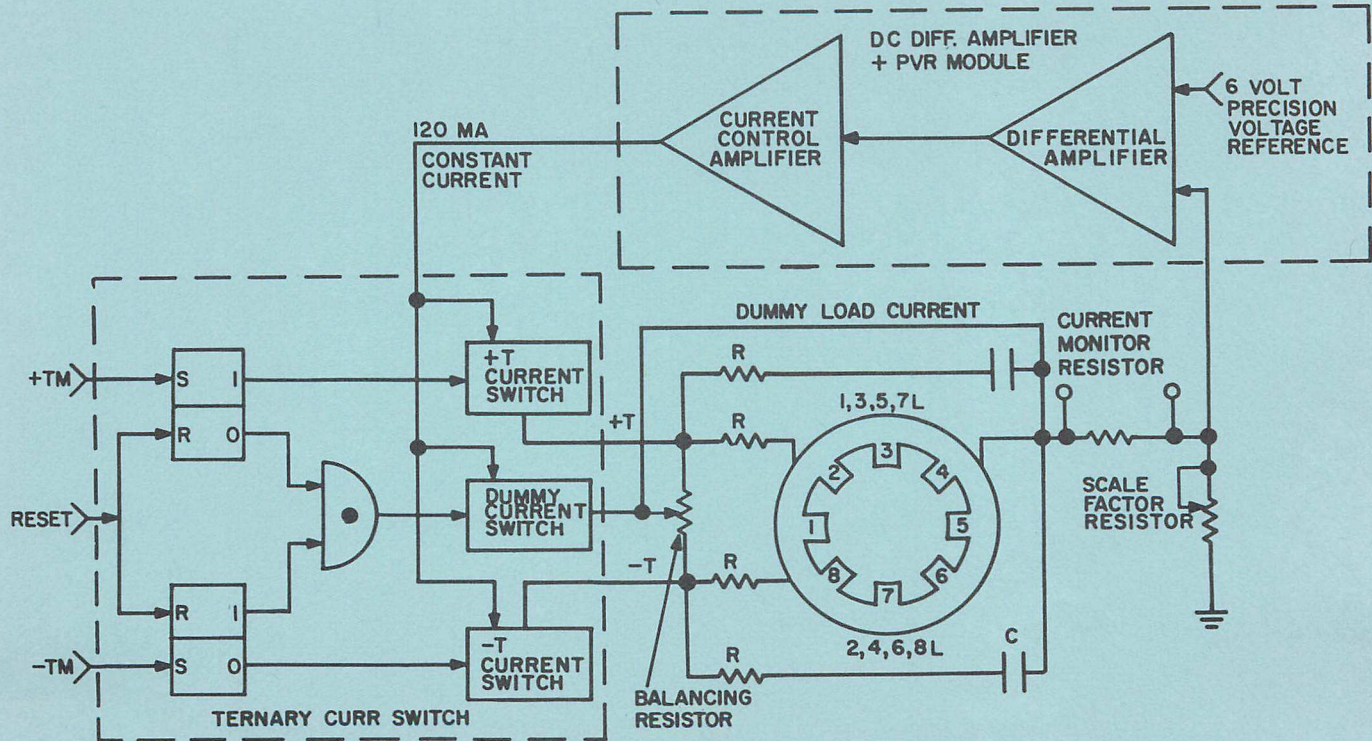
GYRO ERROR RESOLVER



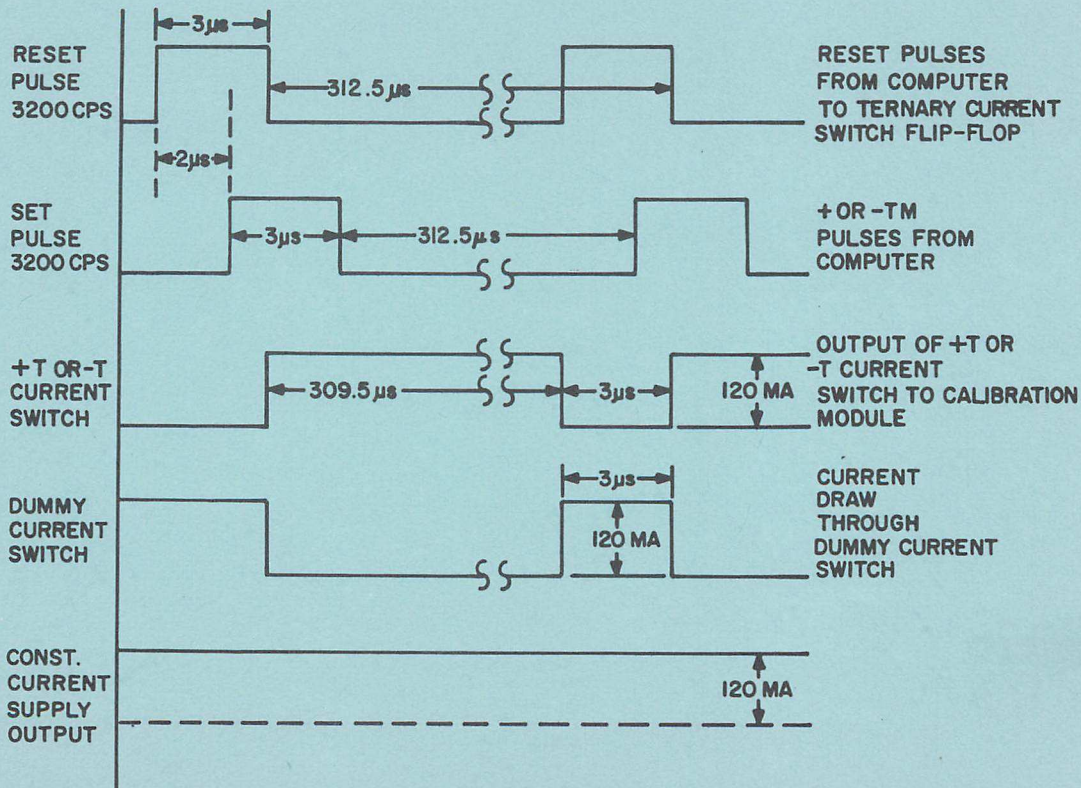
GIMBAL SERVO AMPLIFIER



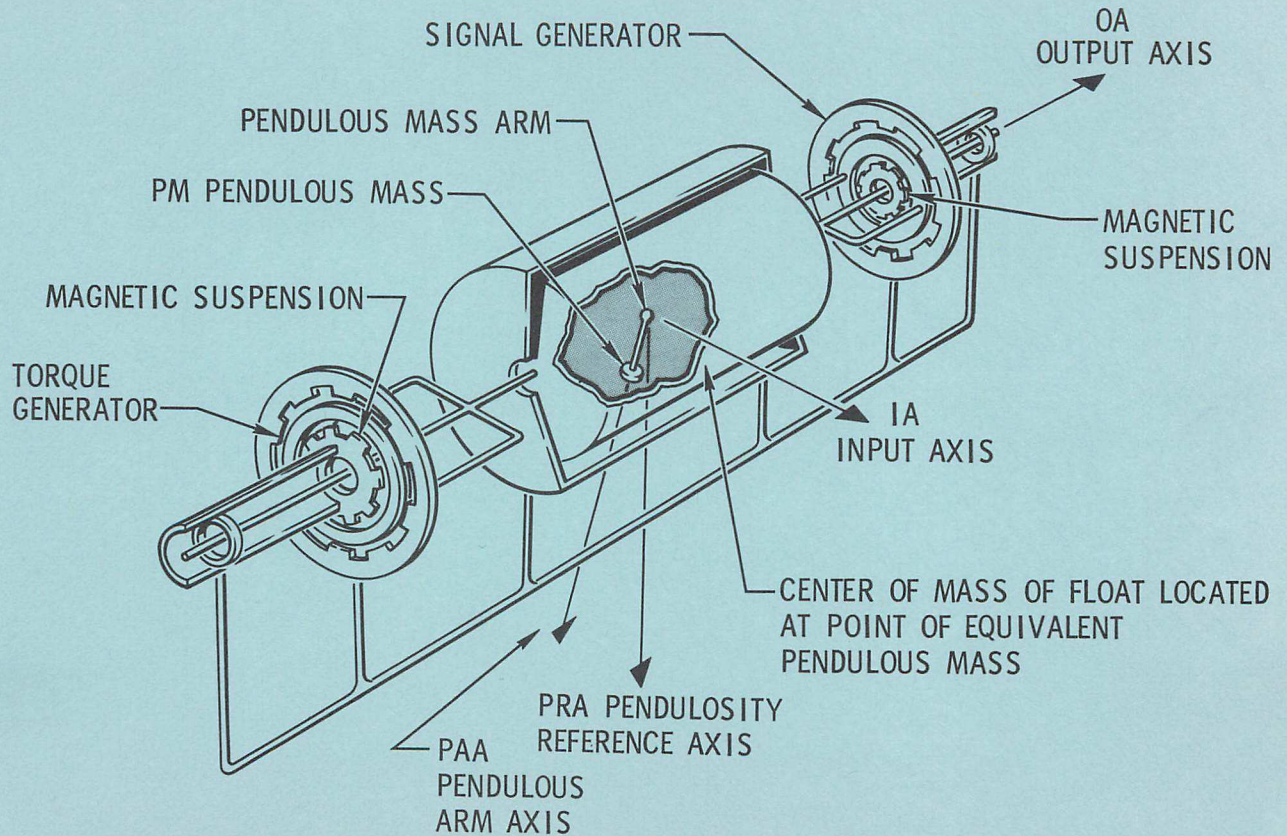
TORQUING LOOP, IRIG

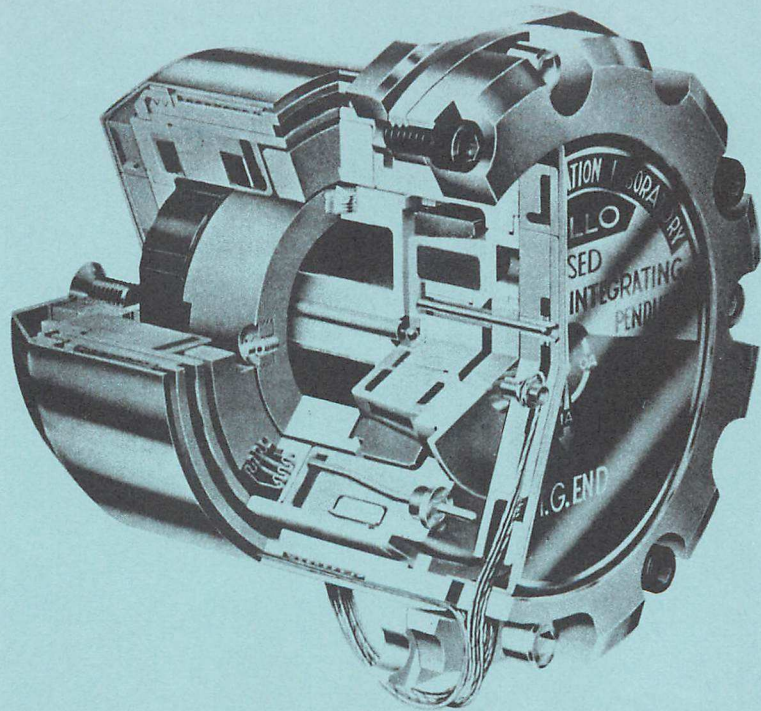


IRIG TORQUING LOOP PULSE RELATIONSHIP



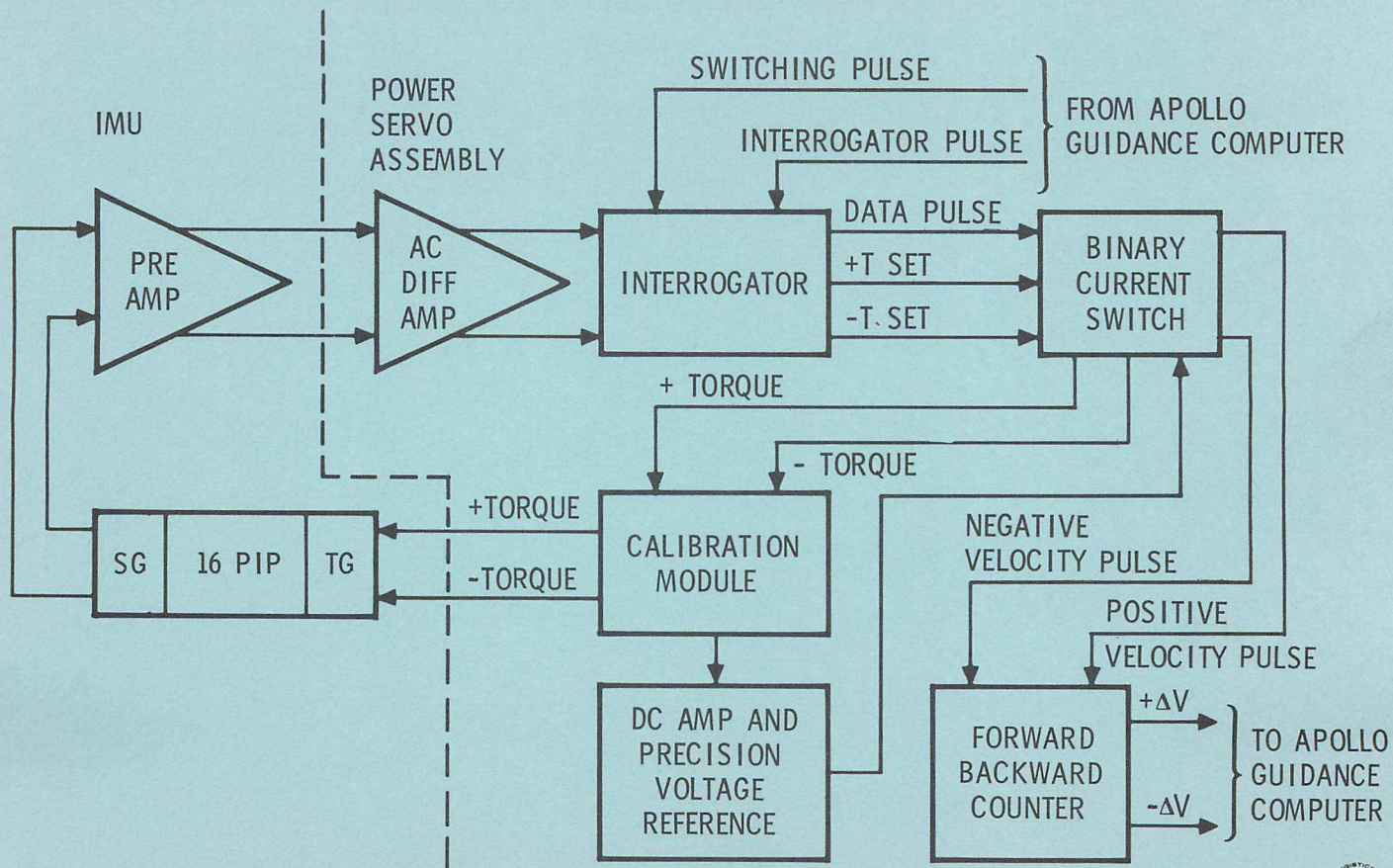
FLOATED PENDULUM UNIT





PIP

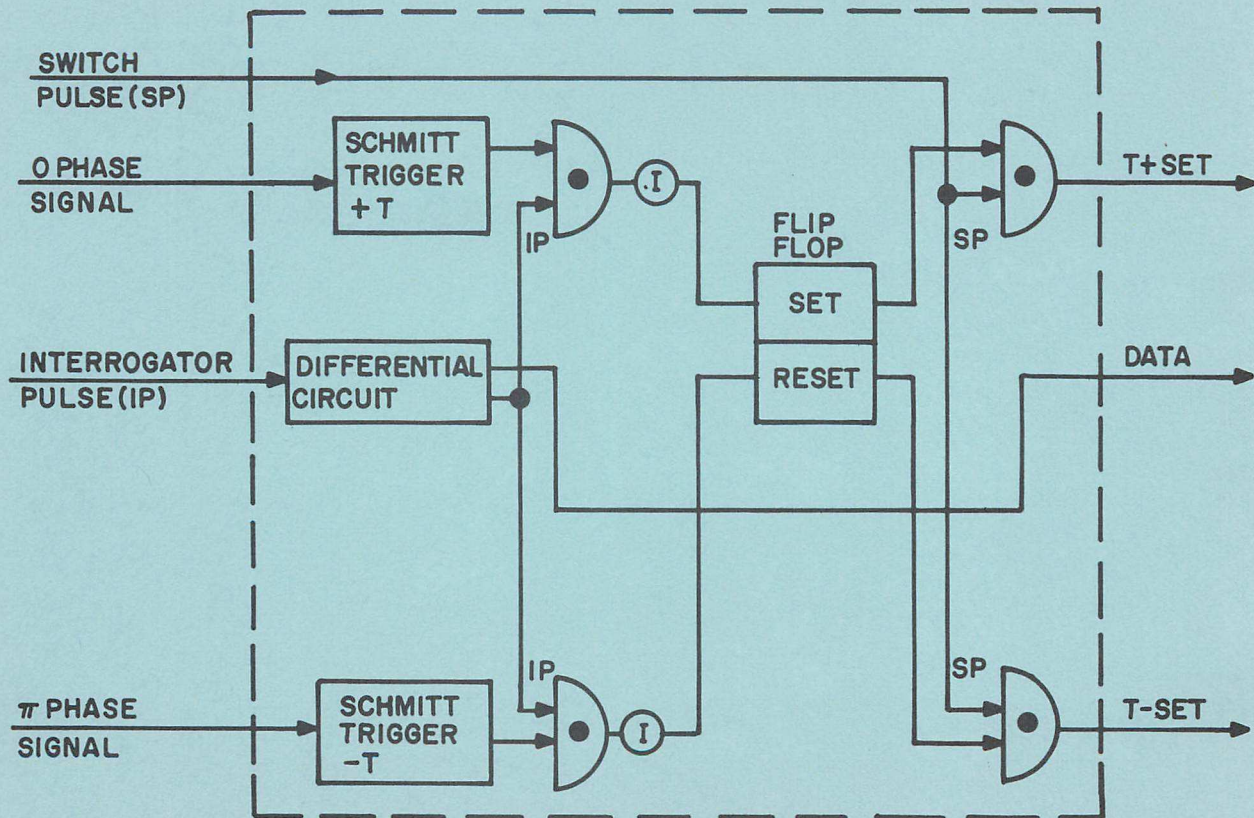
ACCELEROMETER LOOP



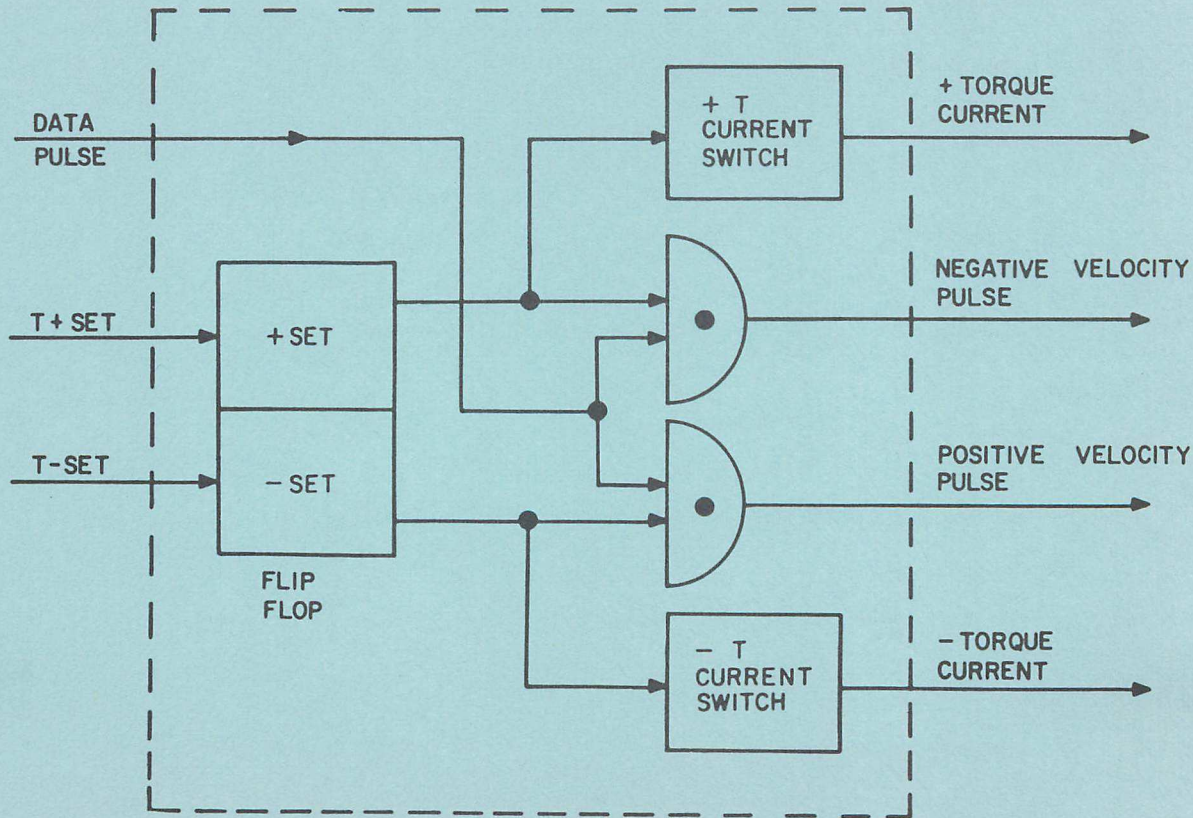
GN-9039A



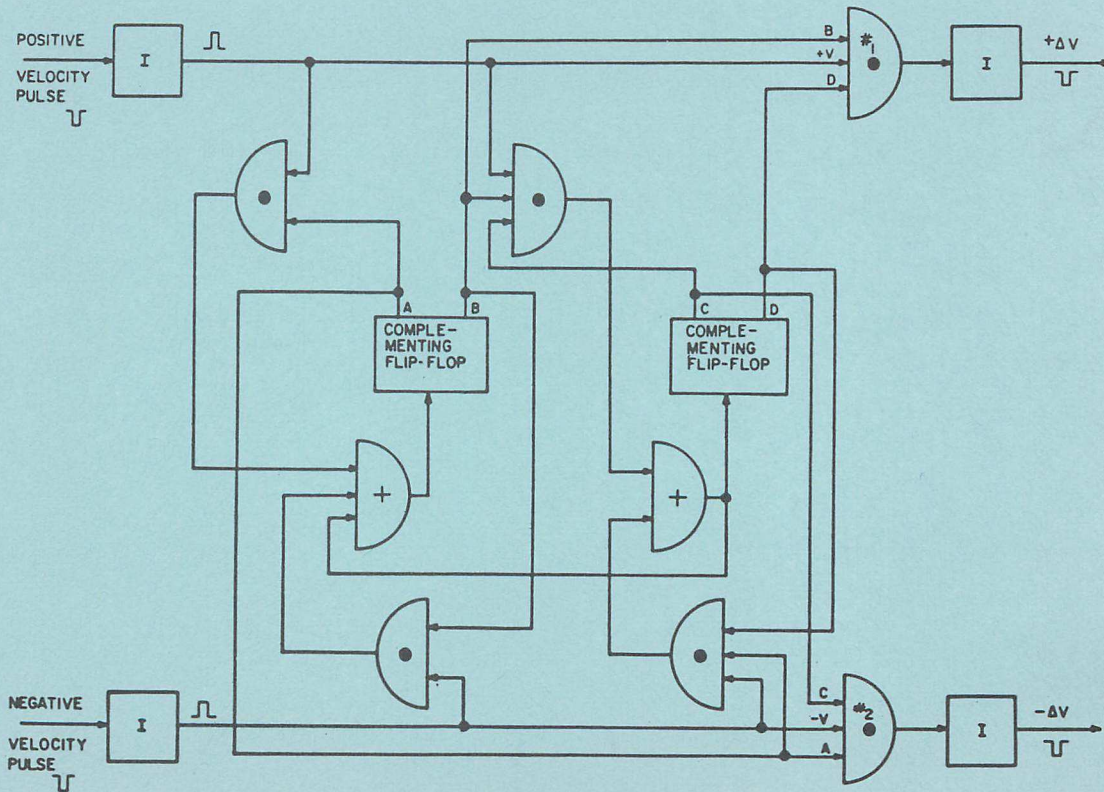
INTERROGATOR



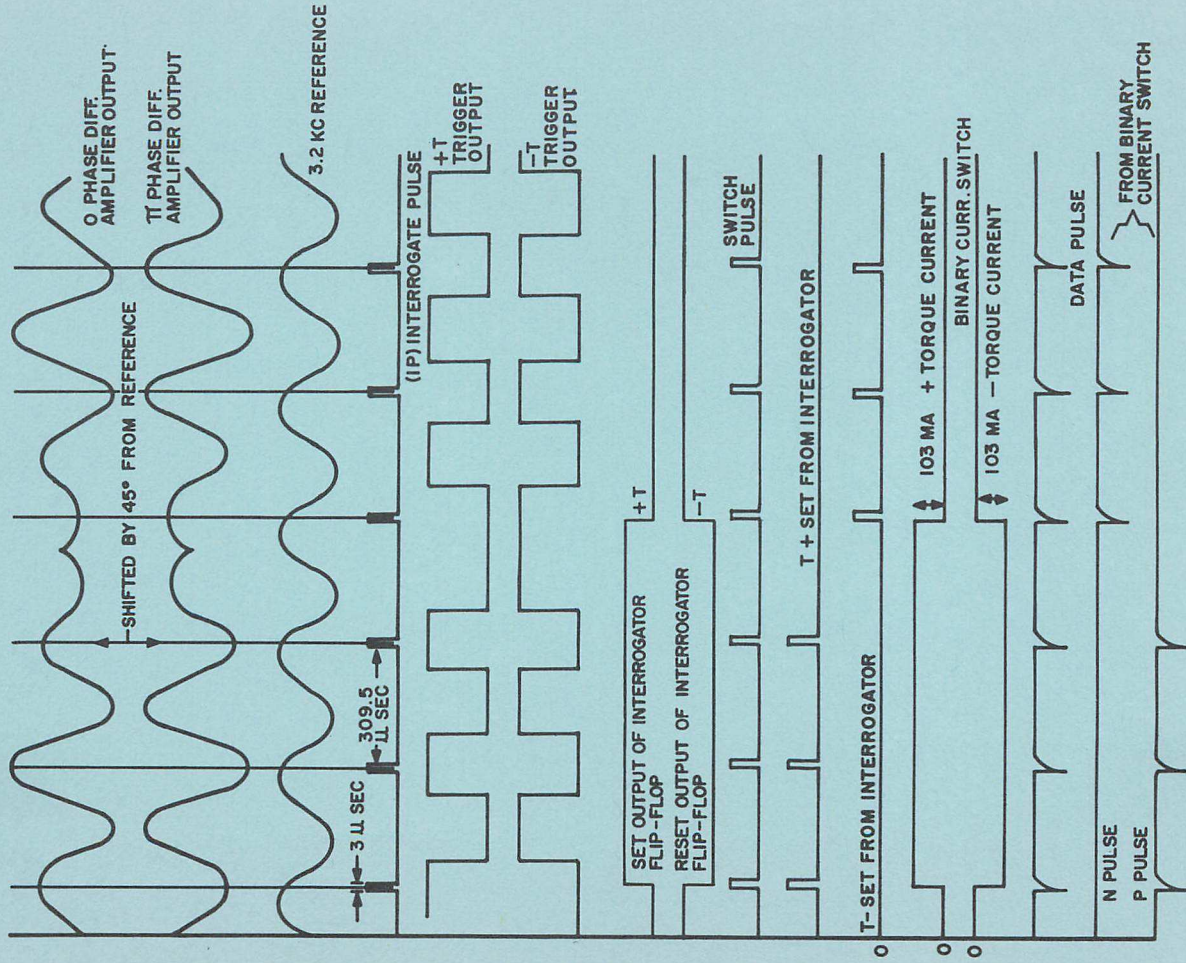
BINARY CURRENT SWITCH



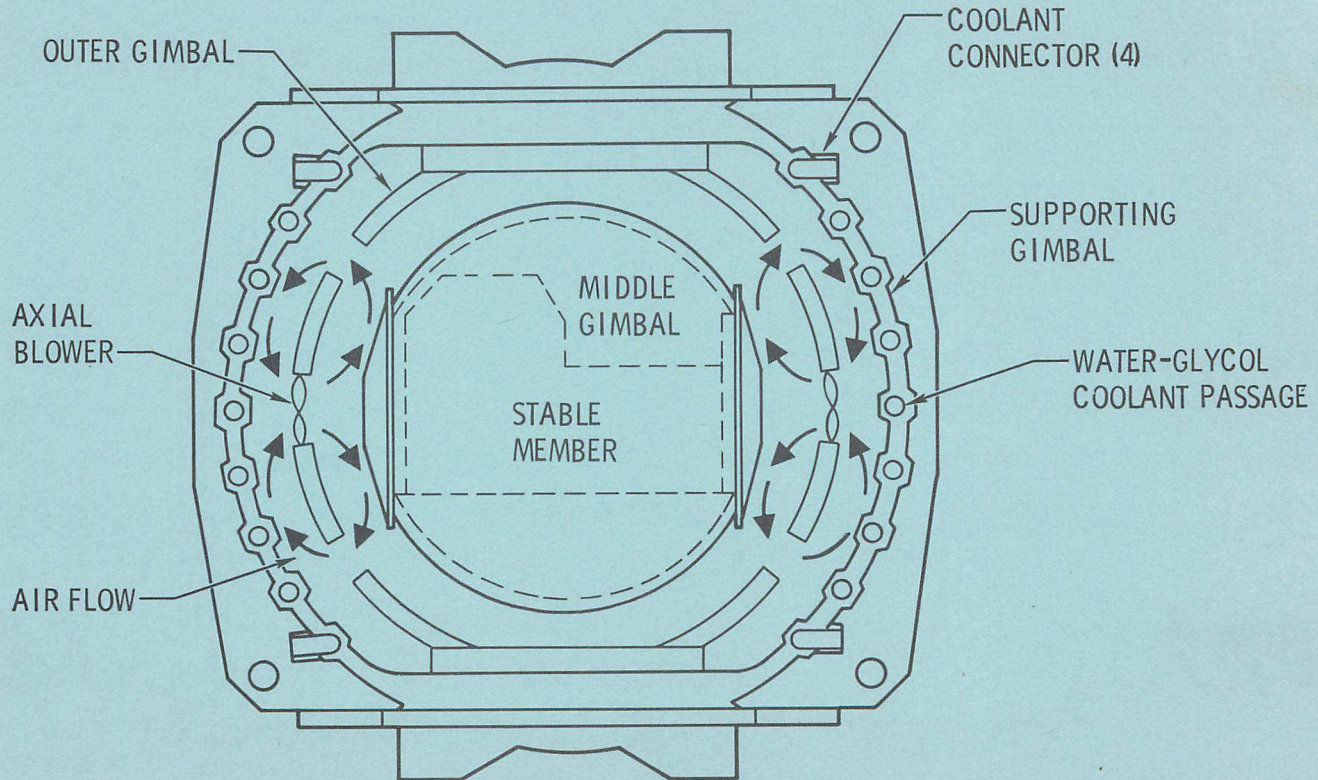
FORWARD - BACKWARD COUNTER



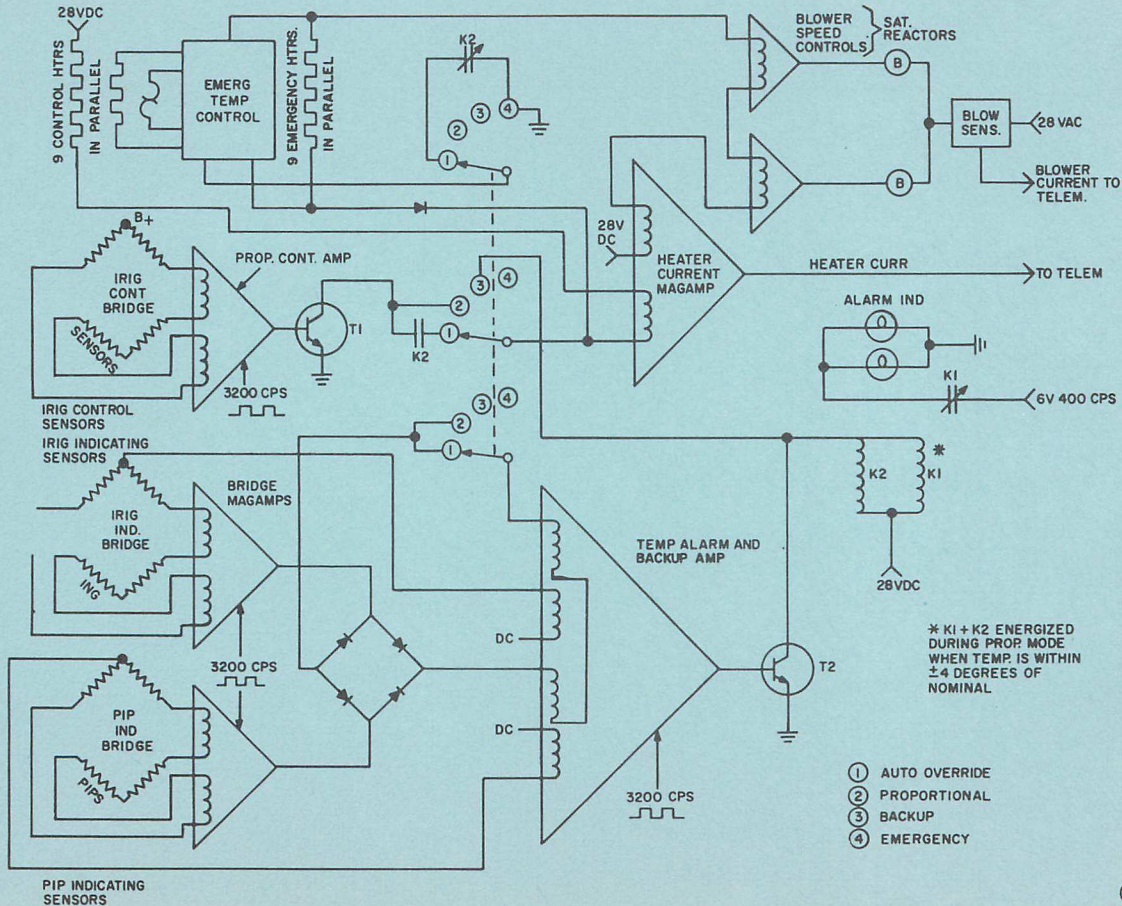
PULSE DIAGRAM PIPA LOOP



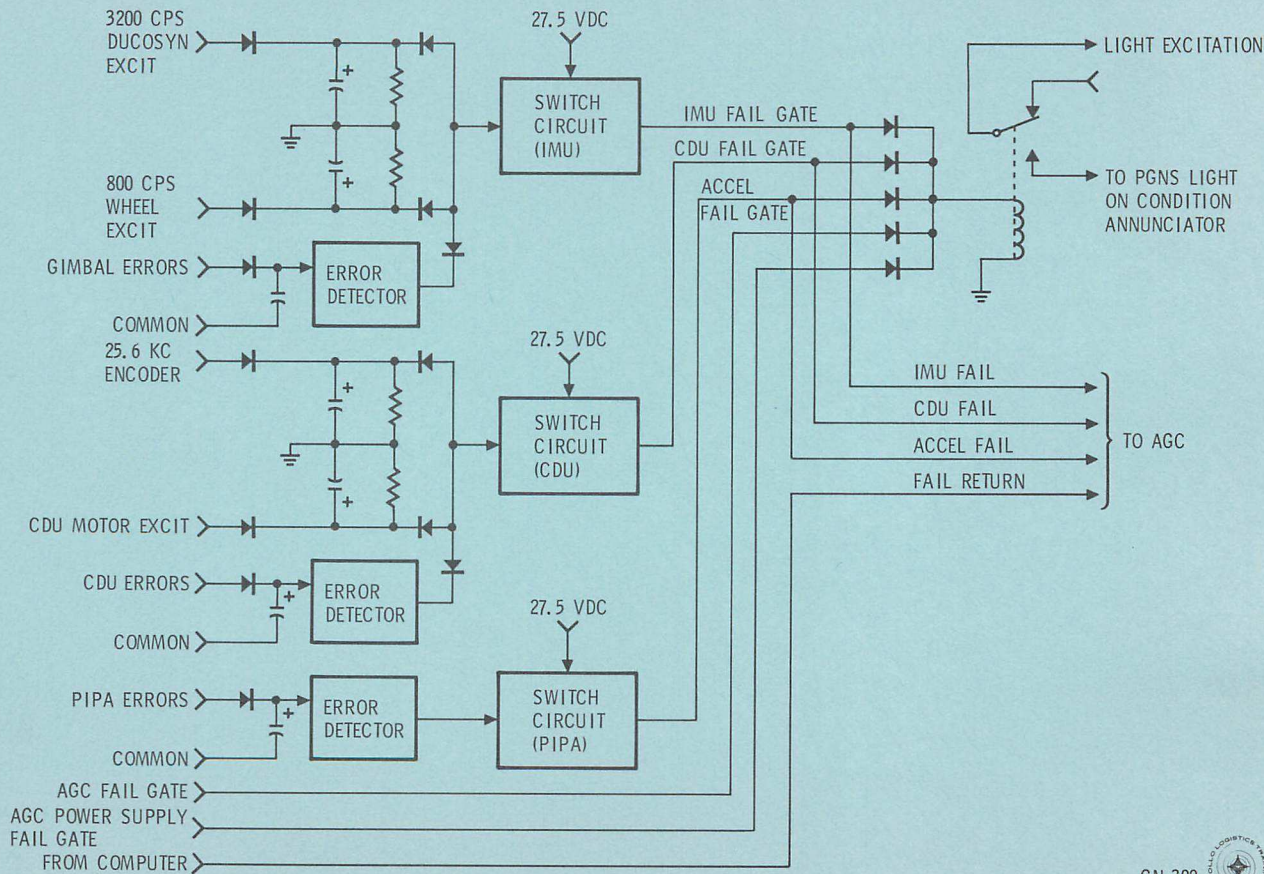
FORCED CONVECTION IN IMU



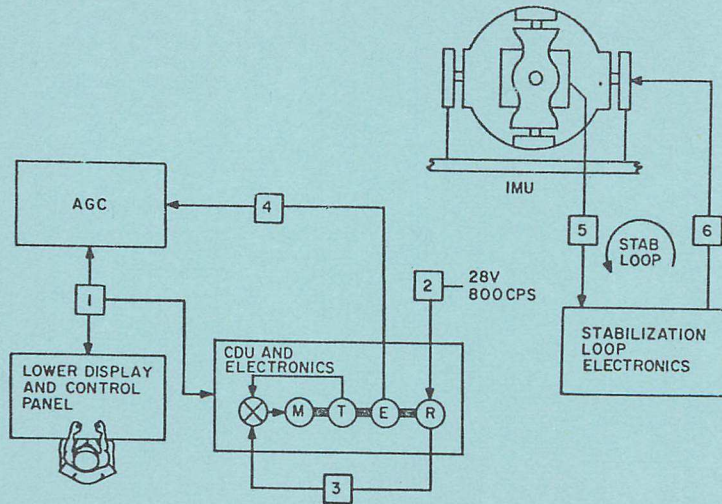
TEMPERATURE CONTROL CIRCUIT



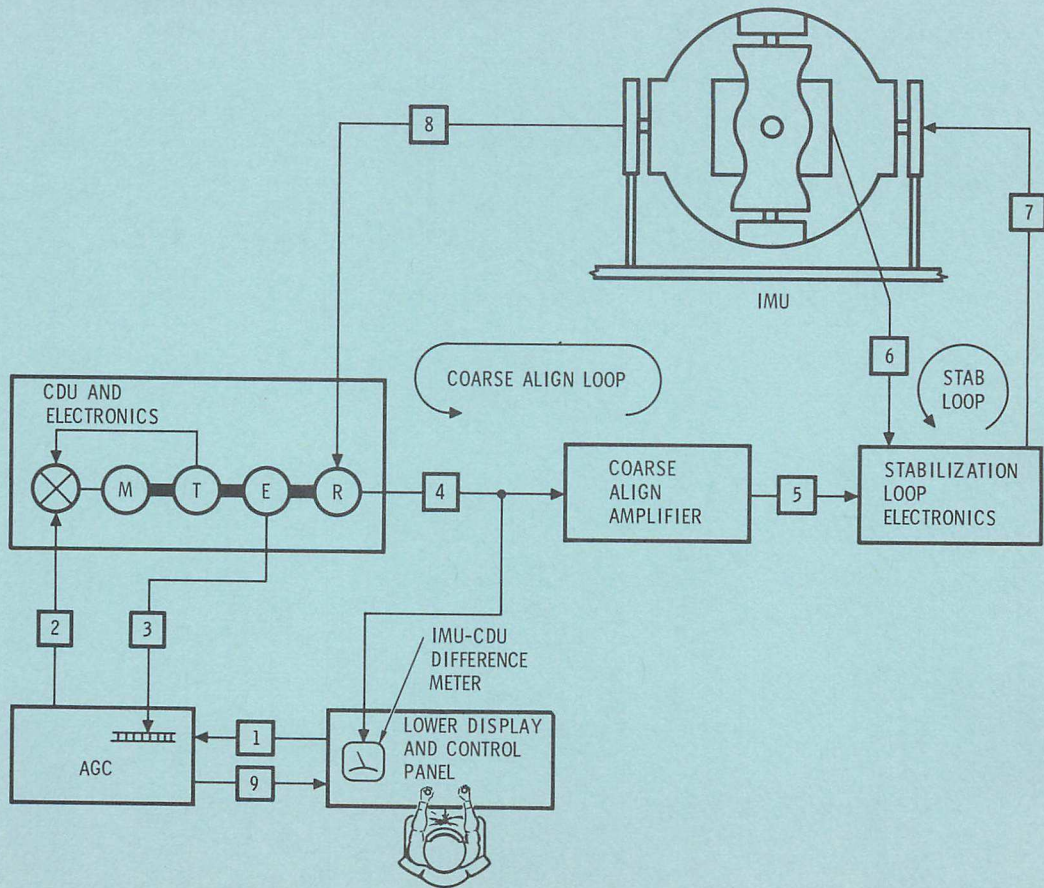
FAILURE DETECTION CIRCUITRY



ZERO ENCODER MODE

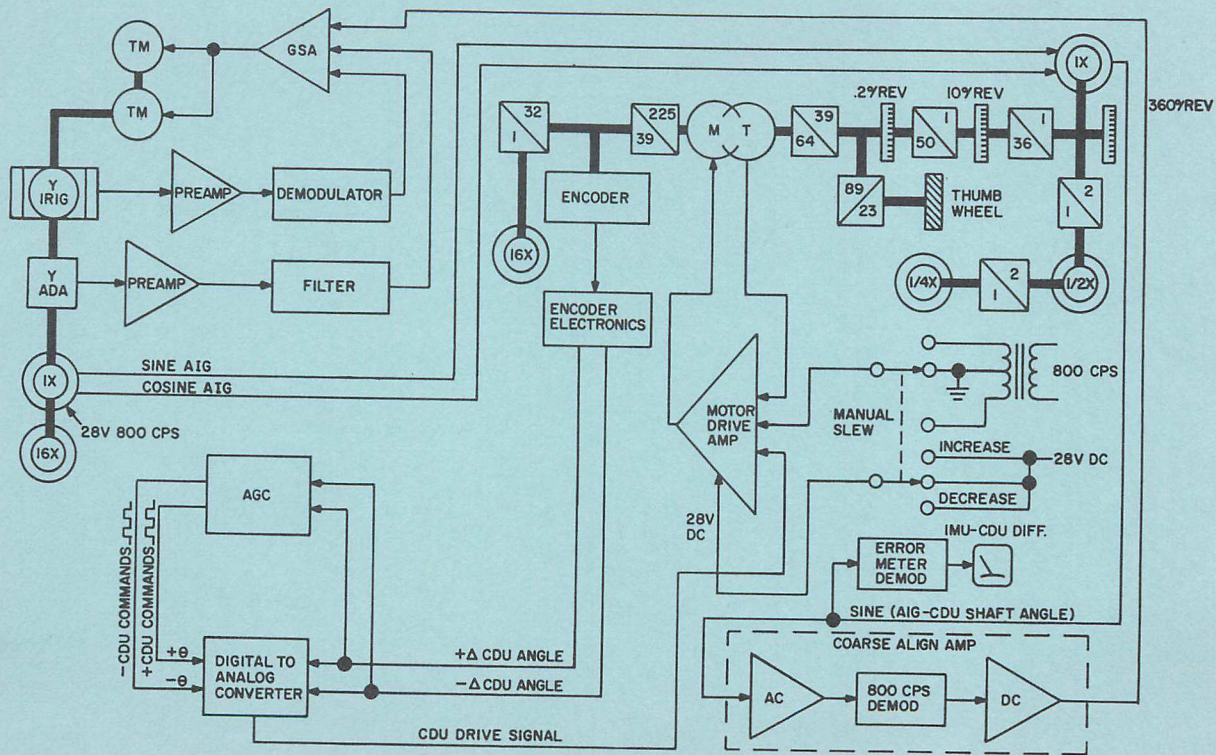


COARSE ALIGN

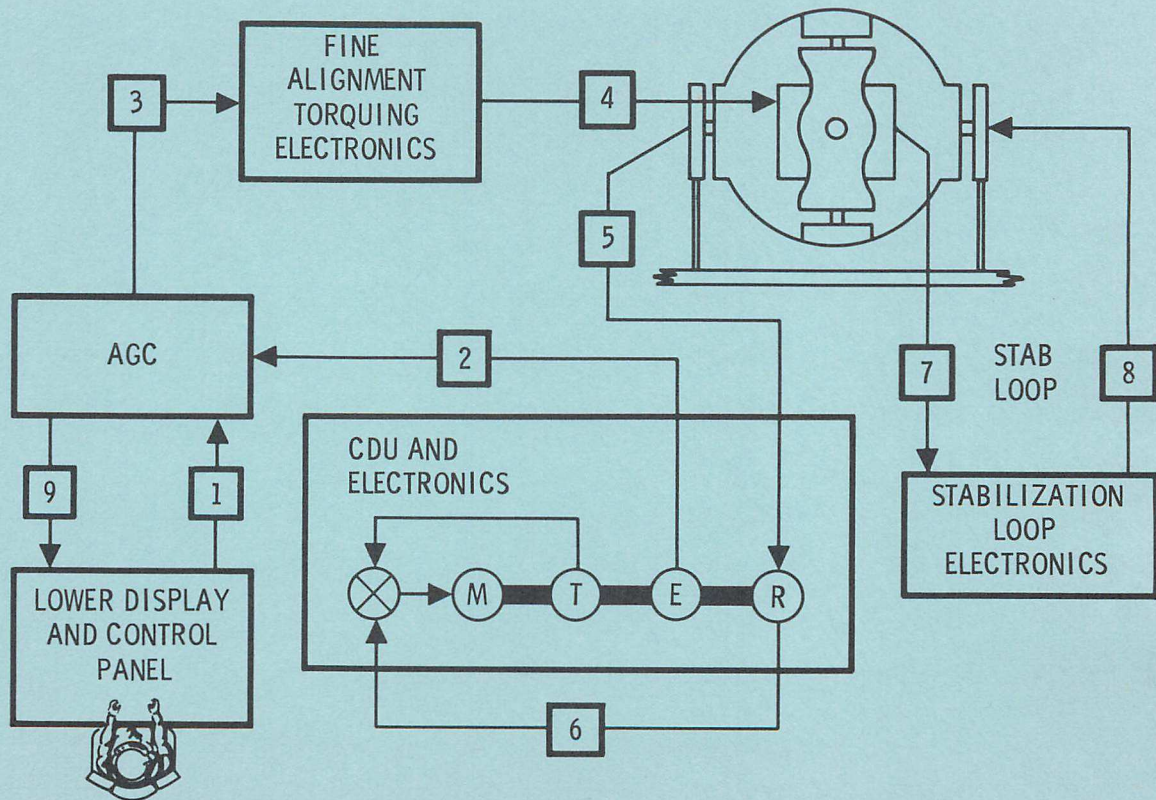


COARSE ALIGN MECHANIZATION

(INNER GIMBAL)

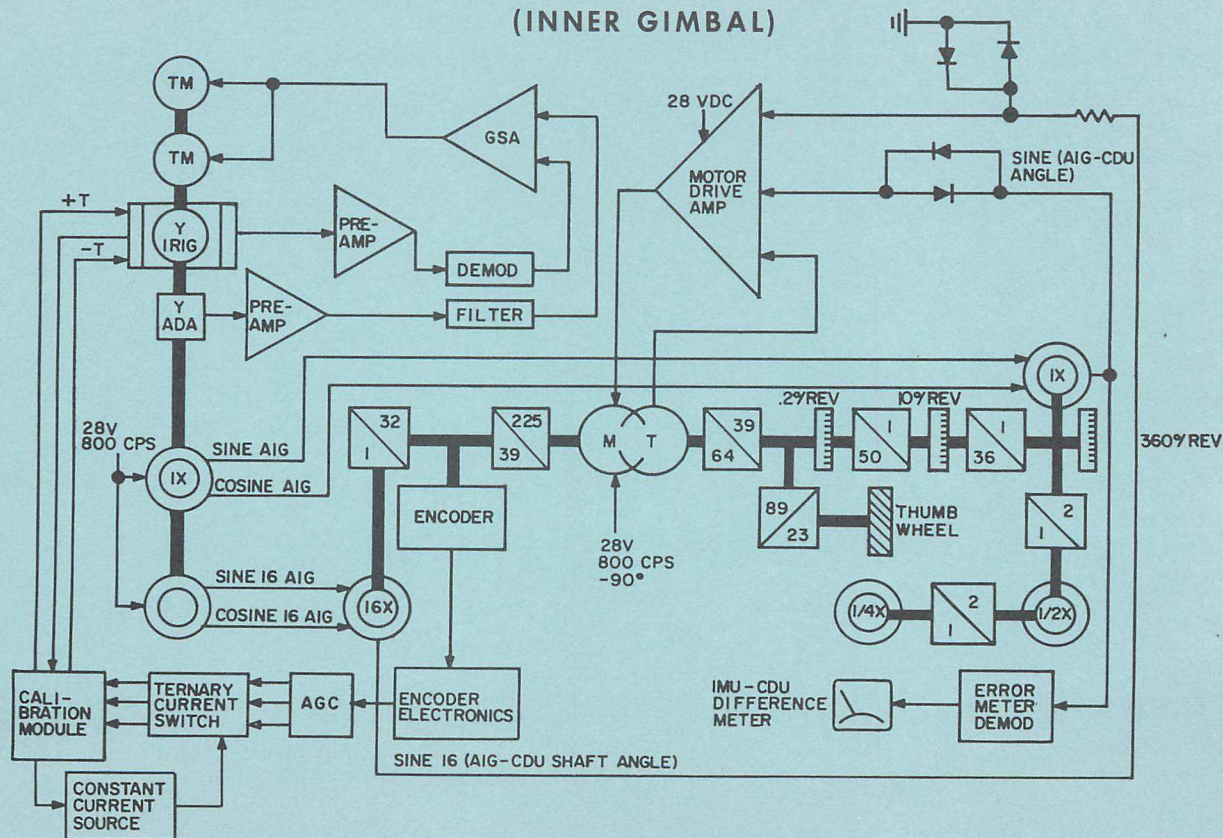


FINE ALIGN

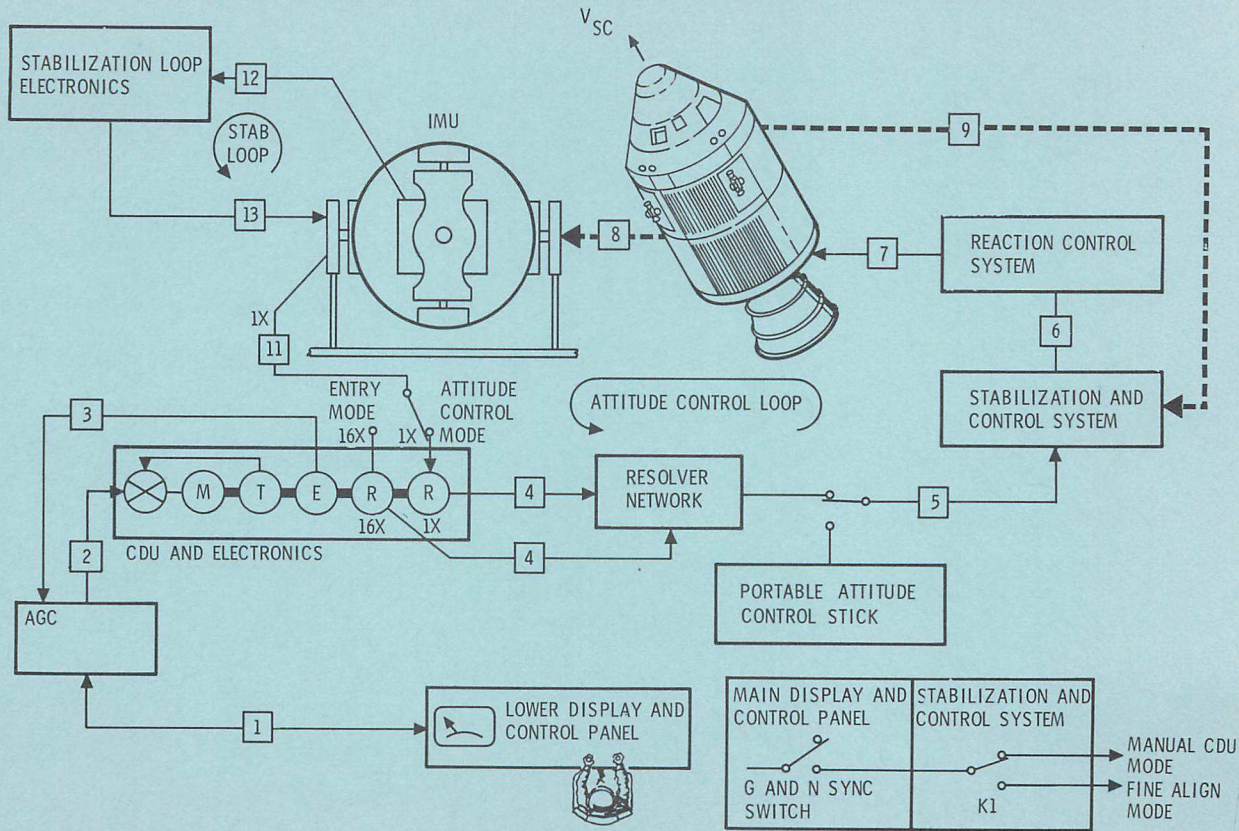


FINE ALIGN LOOP

(INNER GIMBAL)

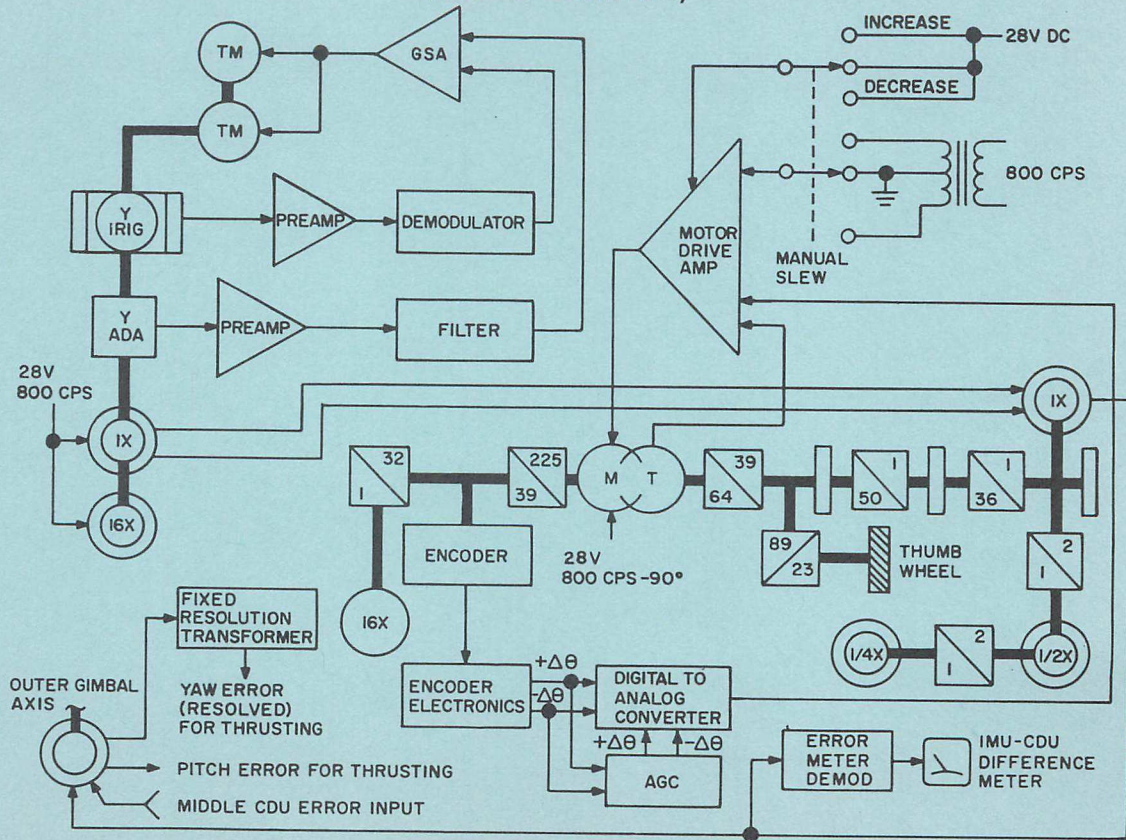


SPACECRAFT ATTITUDE CONTROL

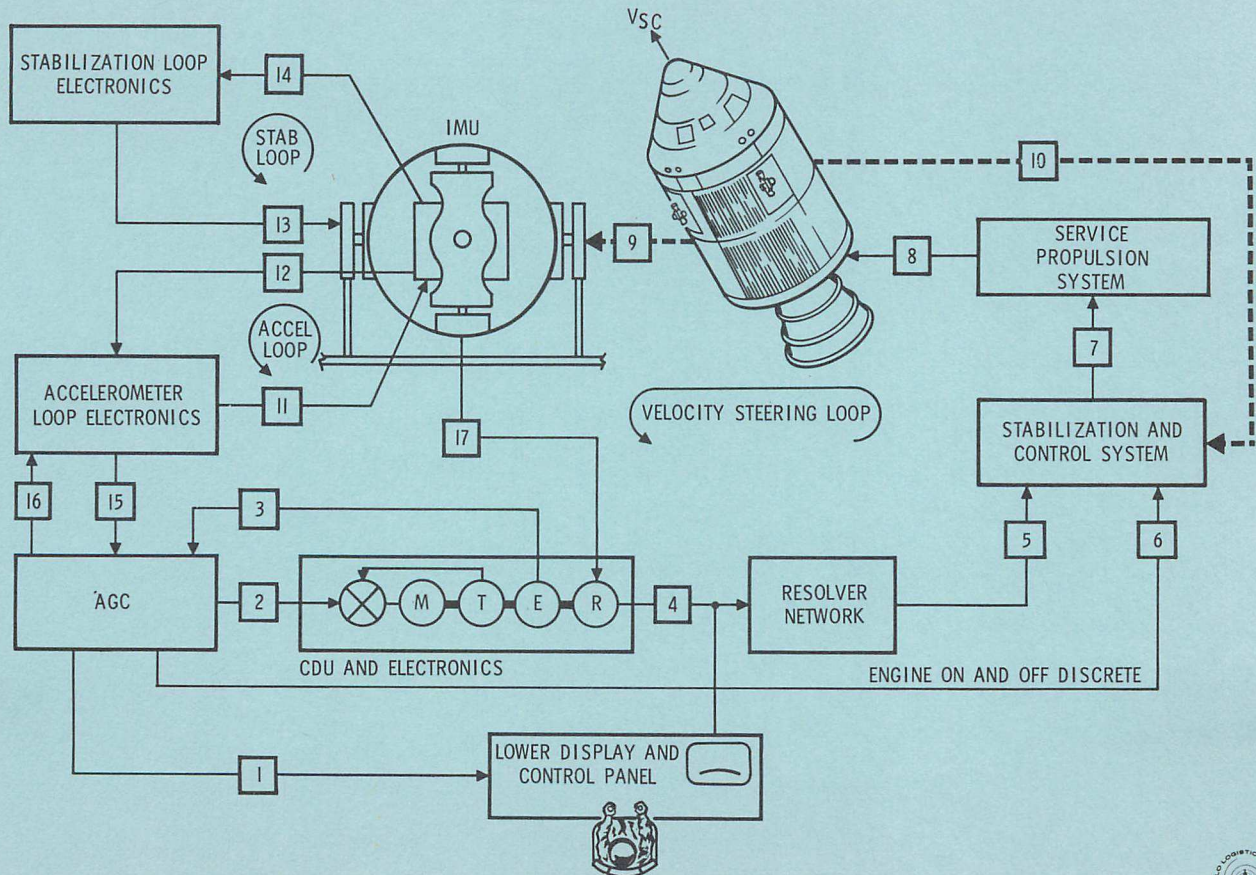


ATTITUDE CONTROL MODE MECHANIZATION

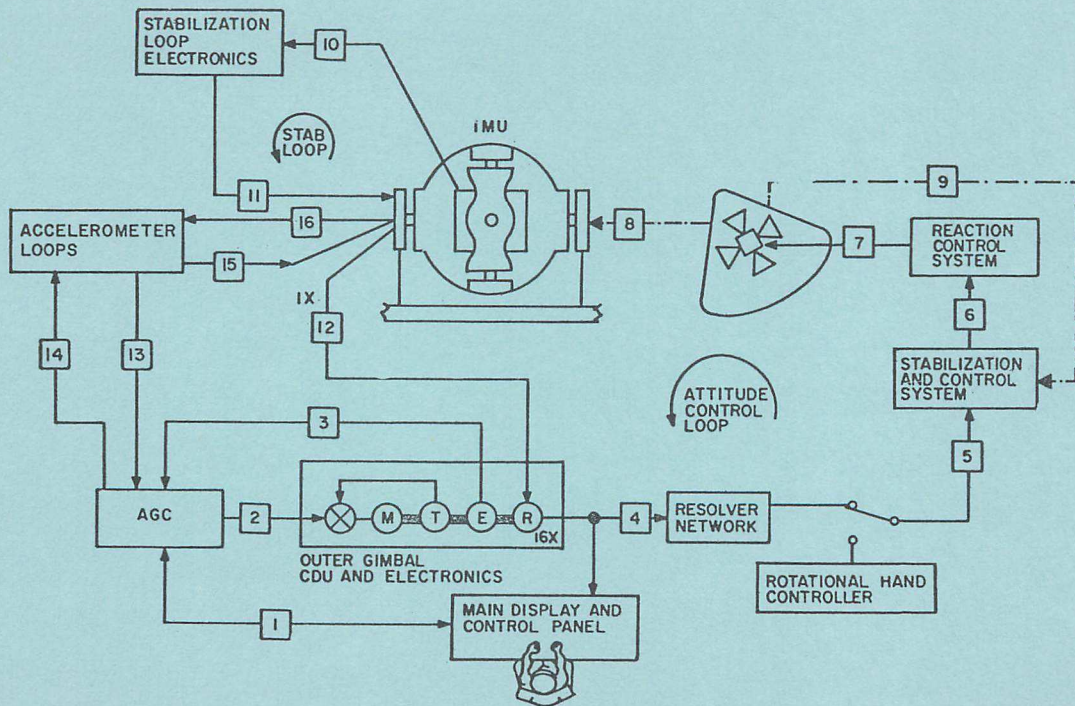
(INNER GIMBAL)



SPACECRAFT THRUST VECTOR CONTROL

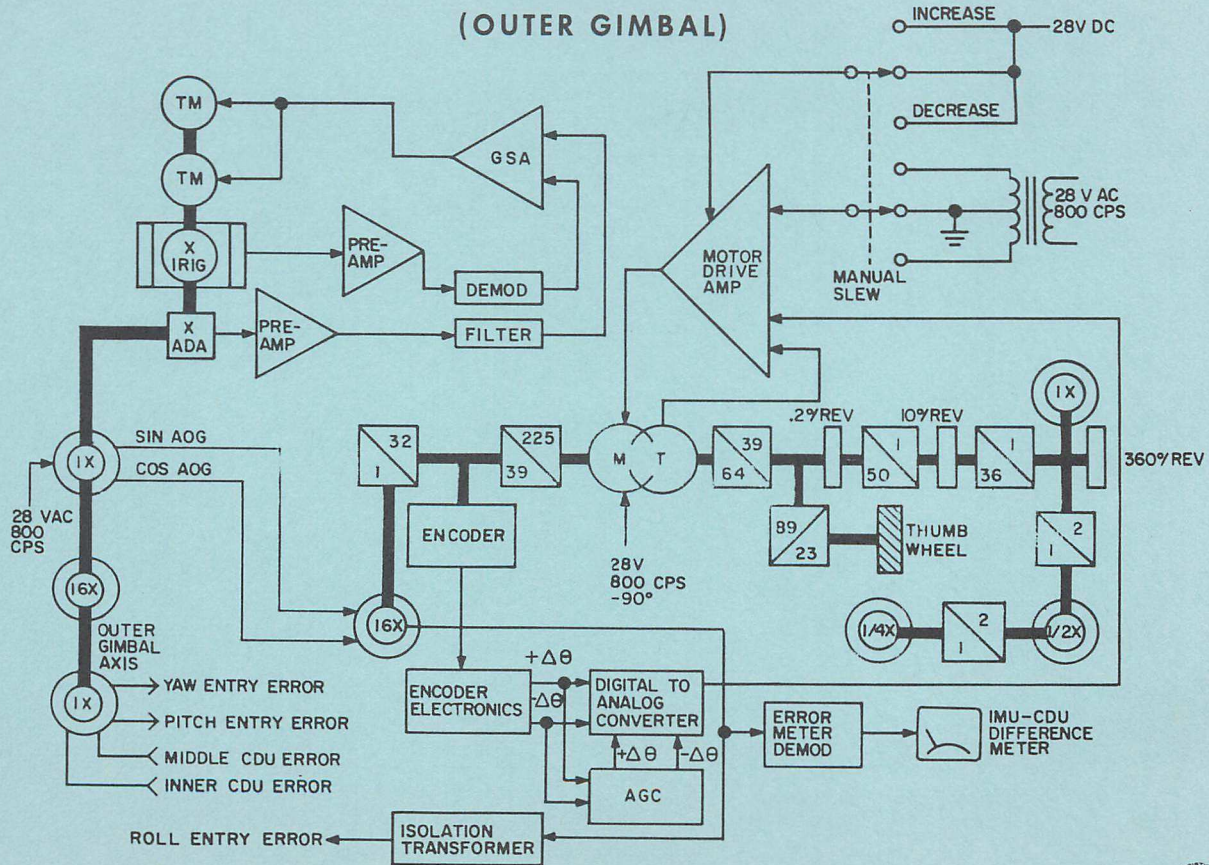


ENTRY MODE

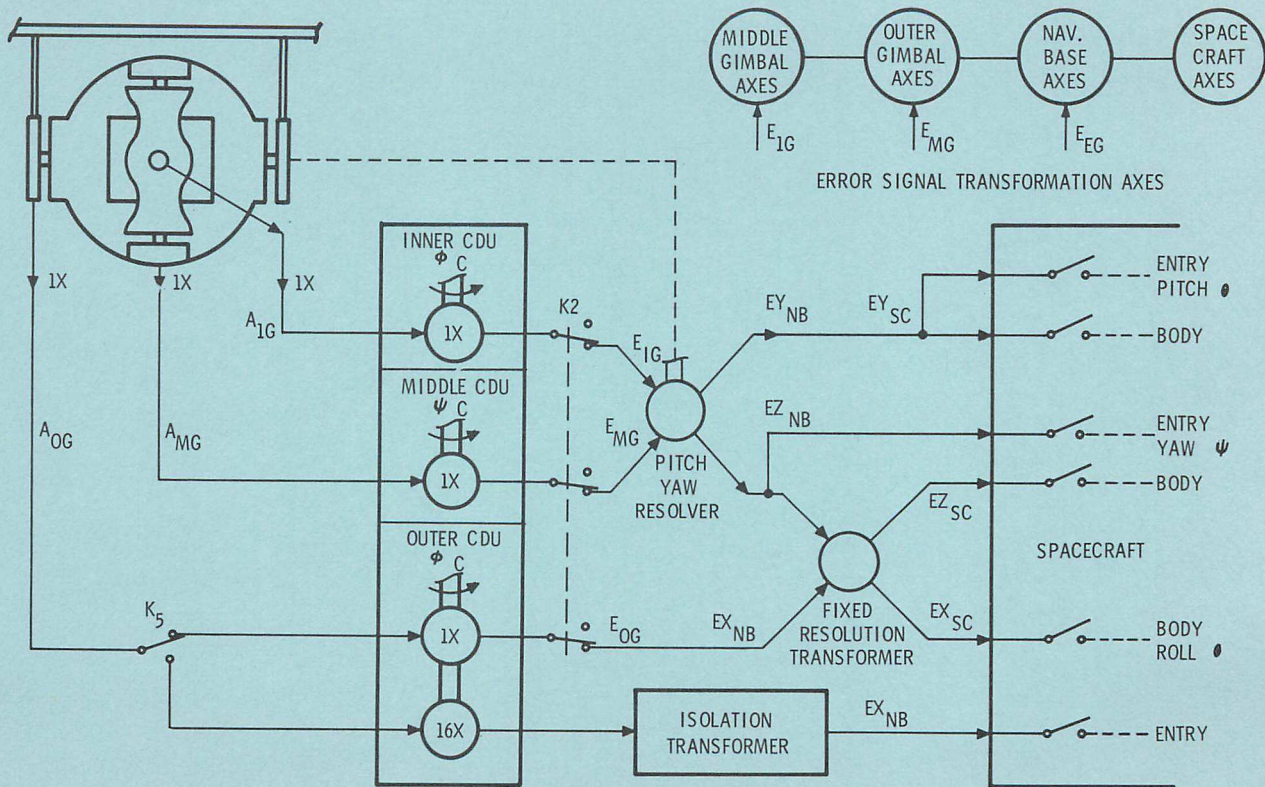


ENTRY MODE

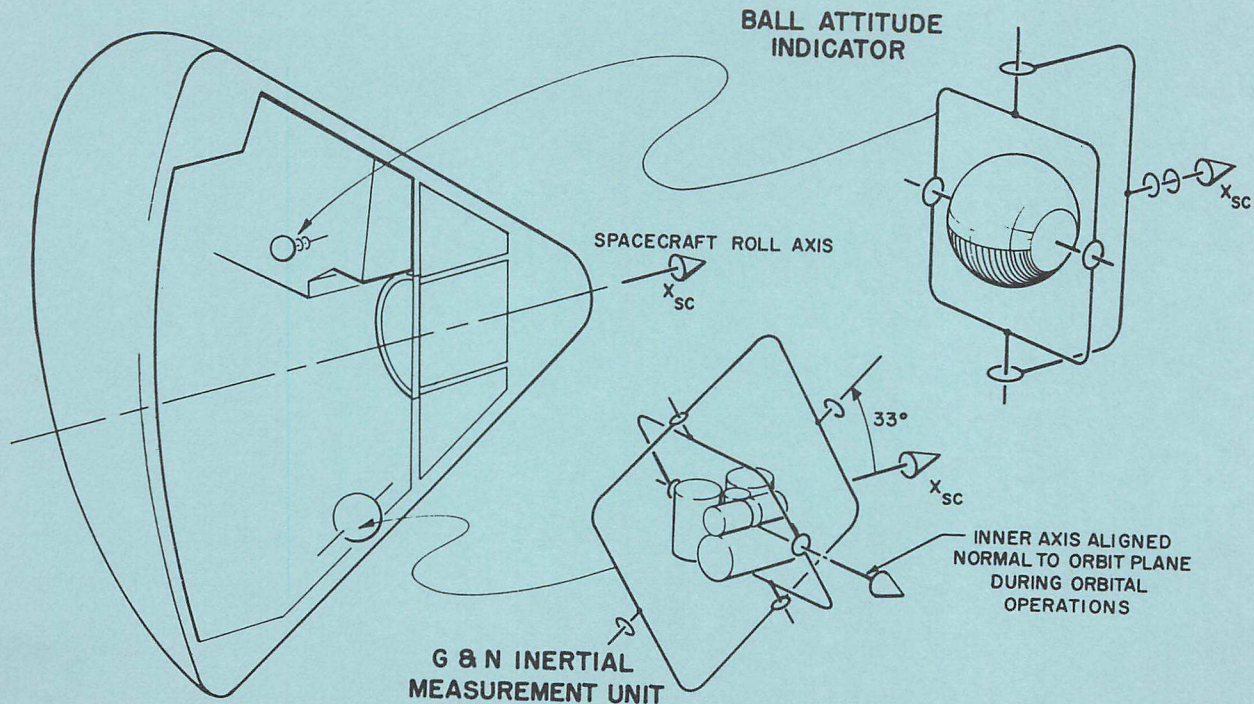
(OUTER GIMBAL)



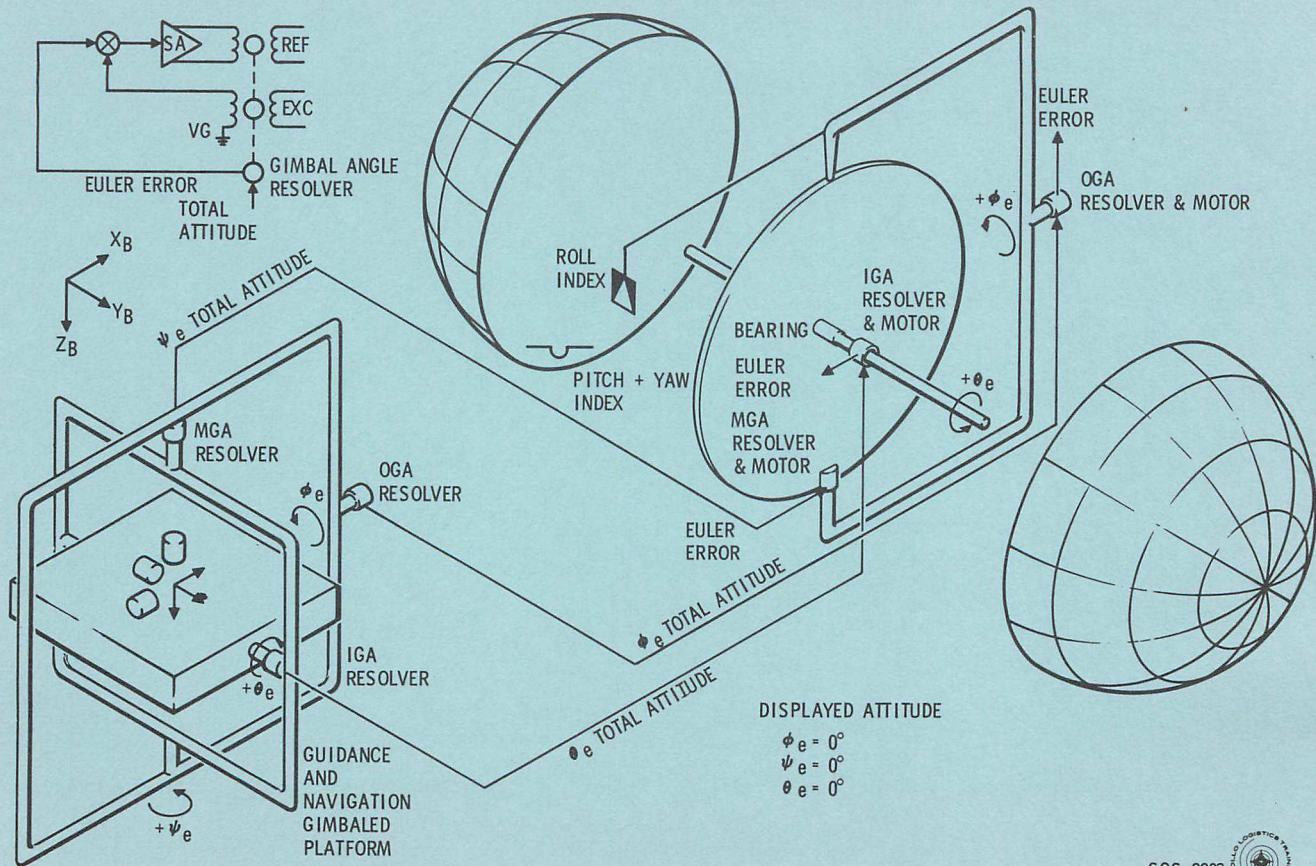
ATTITUDE ERROR TRANSFORMATION



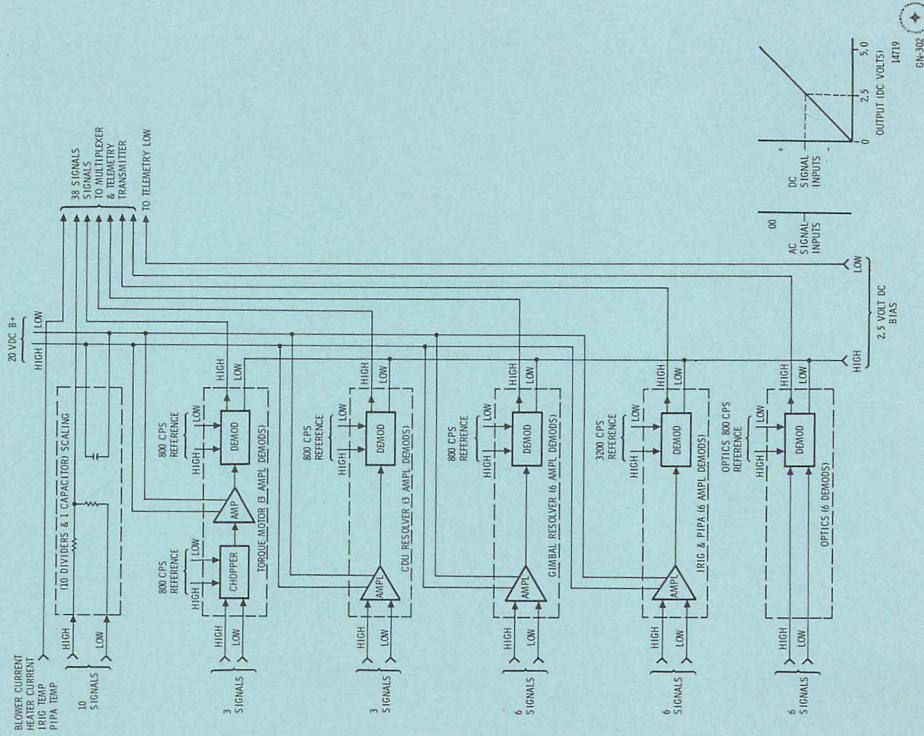
RELATIONSHIP OF BALL INDICATOR AND IMU



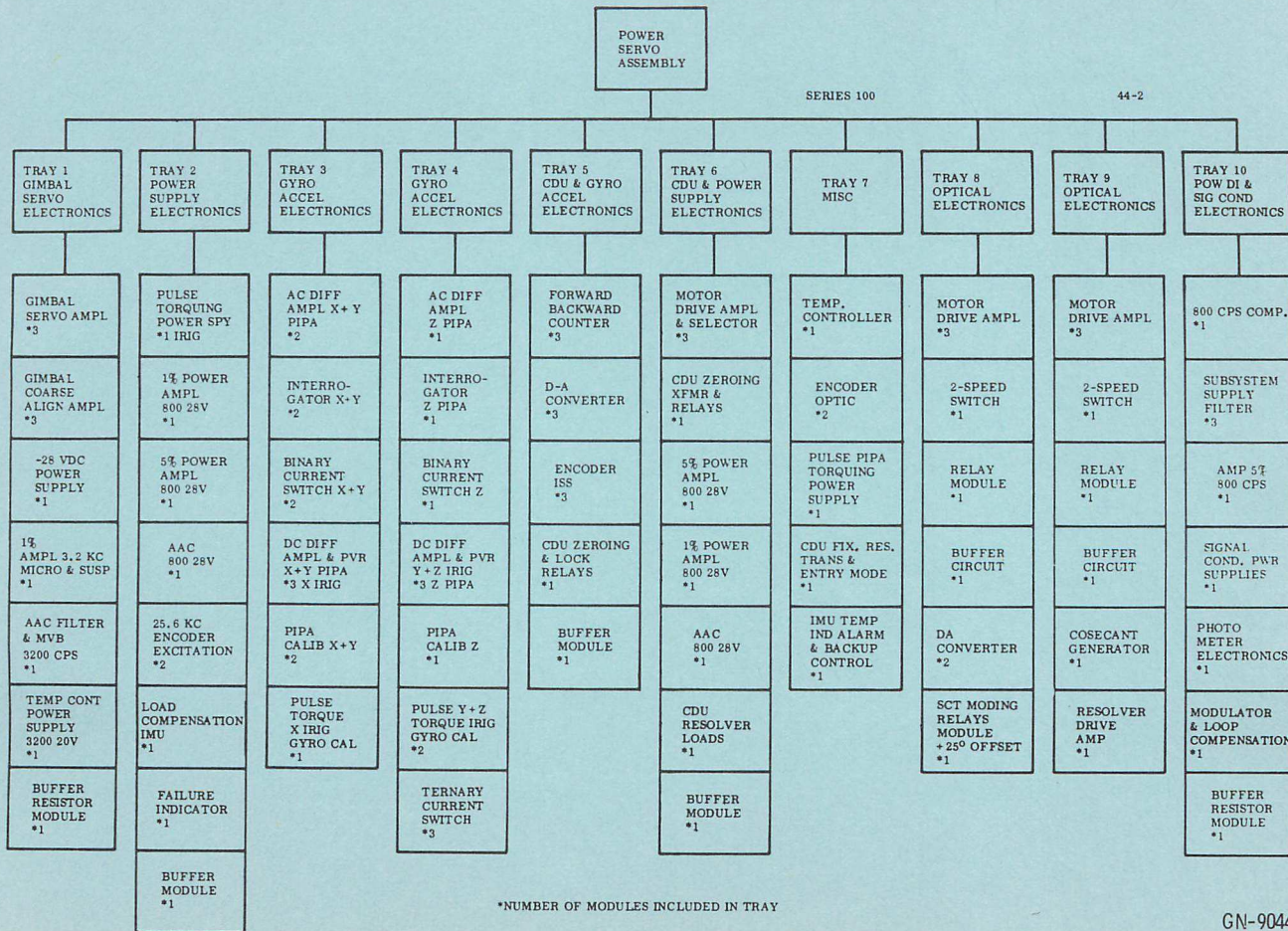
FDAI/IMU GIMBAL RELATIONSHIP



SIGNAL CONDITIONER



PSA TRAY MODULE LOCATION

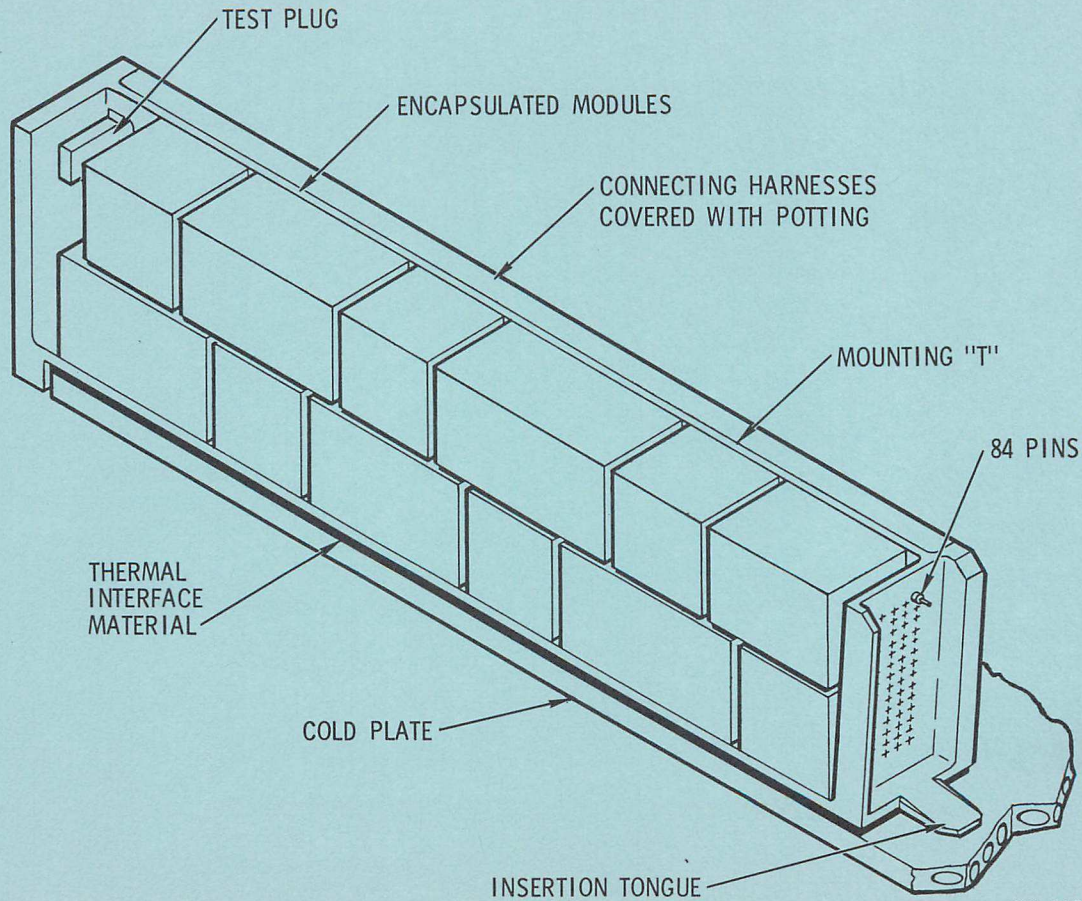


*NUMBER OF MODULES INCLUDED IN TRAY

GN-9044B



PSA TRAY

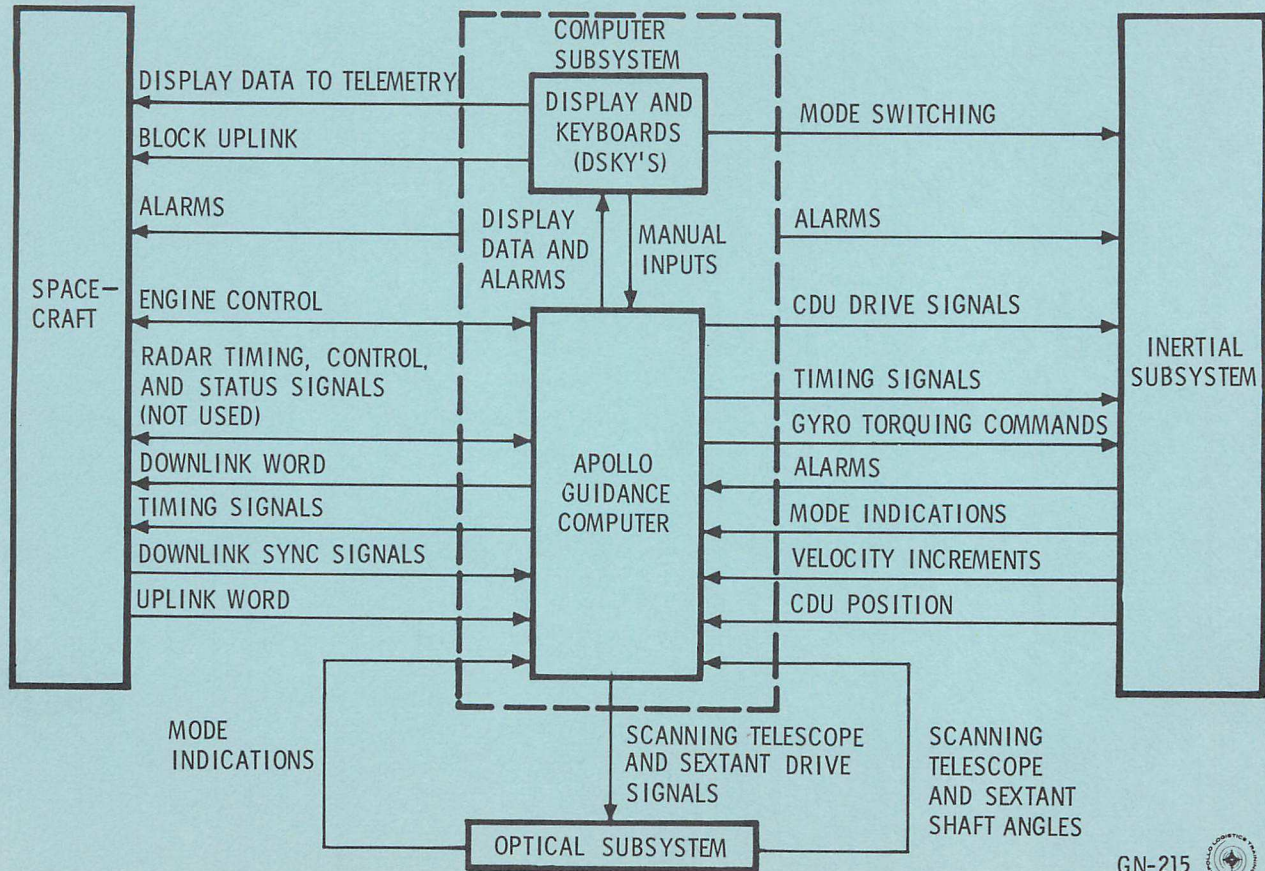


COMPUTER SUBSYSTEM

GN-222



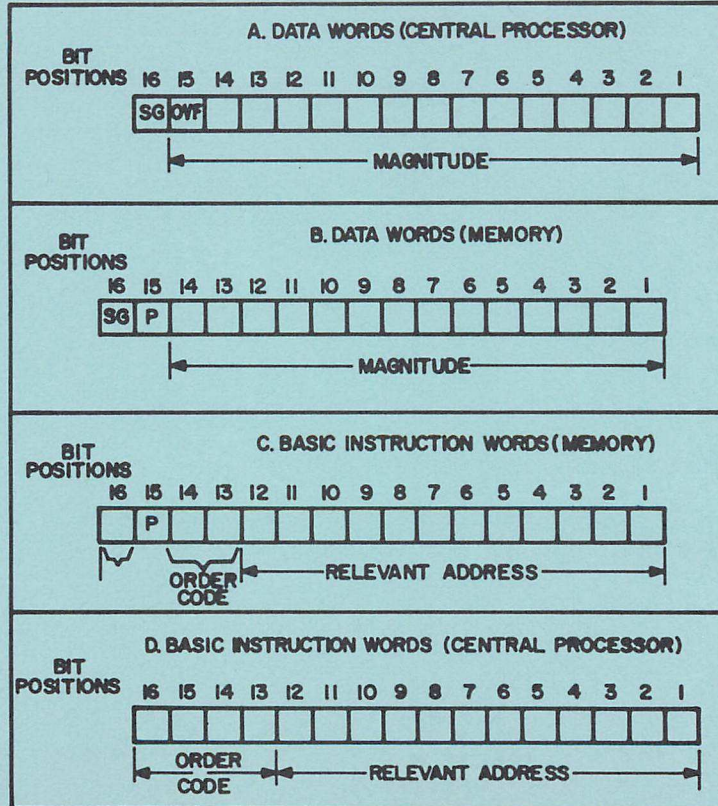
COMPUTER SUBSYSTEM, GENERAL INTERFACE



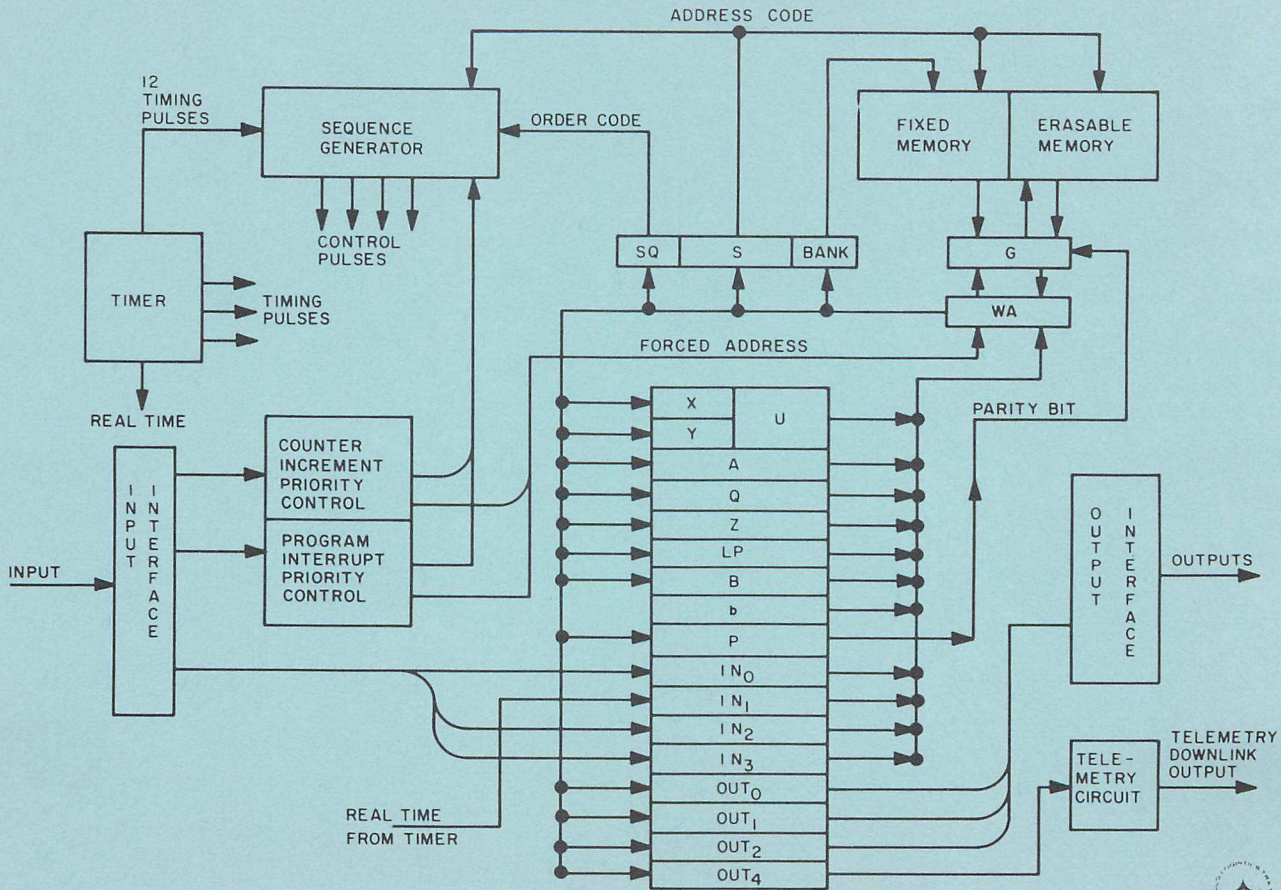
AGC CHARACTERISTICS

GENERAL PURPOSE & CONTROL COMPUTER
PARALLEL DIGITAL MACHINE
WORD LENGTH - 16 BITS
NUMBER SYSTEM - ONE'S COMPLIMENT
ODD PARITY
"NOR" MICRO LOGIC ELEMENTS
FIXED MEMORY REGISTERS - 24,576
ERASABLE MEMORY REGISTERS - 1024
CLOCK RATE - 1.024 MC
MEMORY CYCLE TIME - 11.7 μ SEC
REGULAR INSTRUCTIONS - 11
INTERPRETIVE INSTRUCTIONS - 72
INTERRUPT OPTIONS - 6
NUMBER OF COUNTERS - 20
ADD TIME - 23 μ SEC
DOUBLE PRECISION ADD - 234 μ SEC
MULTIPLY TIME - 93 μ SEC

WORD FORMATS



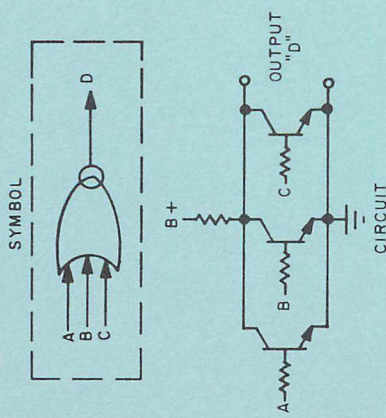
AGC BLOCK DIAGRAM



SYMBOLOLOGY

| A | B | C | D |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |

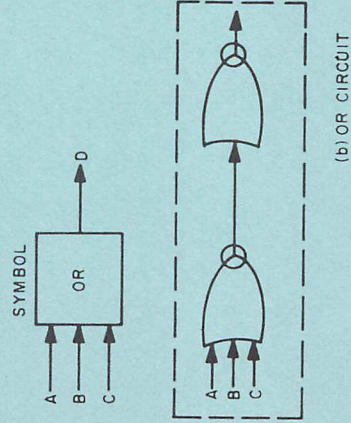
TRUTH TABLE



(a) NOR CIRCUIT

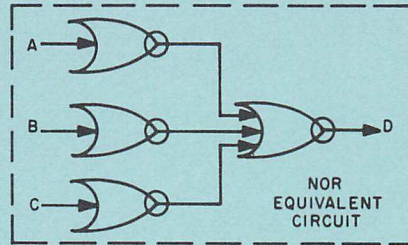
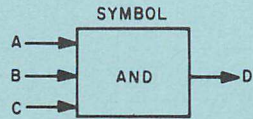
| A | B | C | D |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |

TRUTH TABLE



(b) OR CIRCUIT

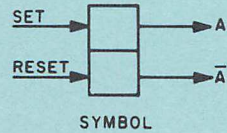
SYMBOL



| A | B | C | D |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 |

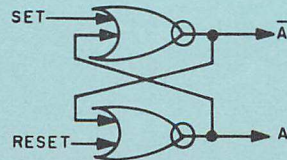
TRUTH TABLE

(c) AND CIRCUIT



| | A | \bar{A} |
|-------|---|-----------|
| SET | 1 | 0 |
| RESET | 0 | 1 |

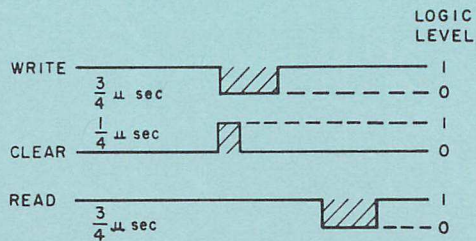
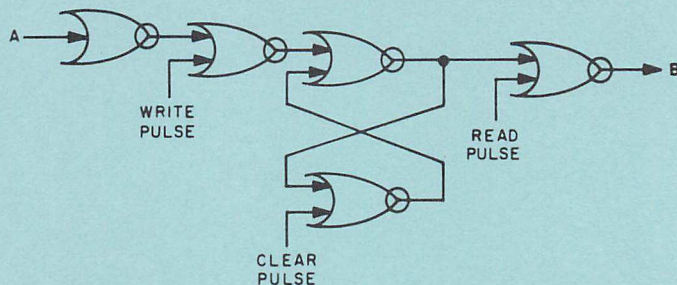
TRUTH TABLE



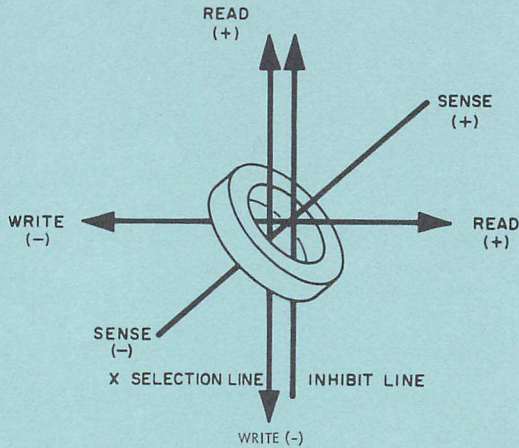
NOR EQUIVALENT

(d) FLIP FLOP

BASIC STORAGE ELEMENT

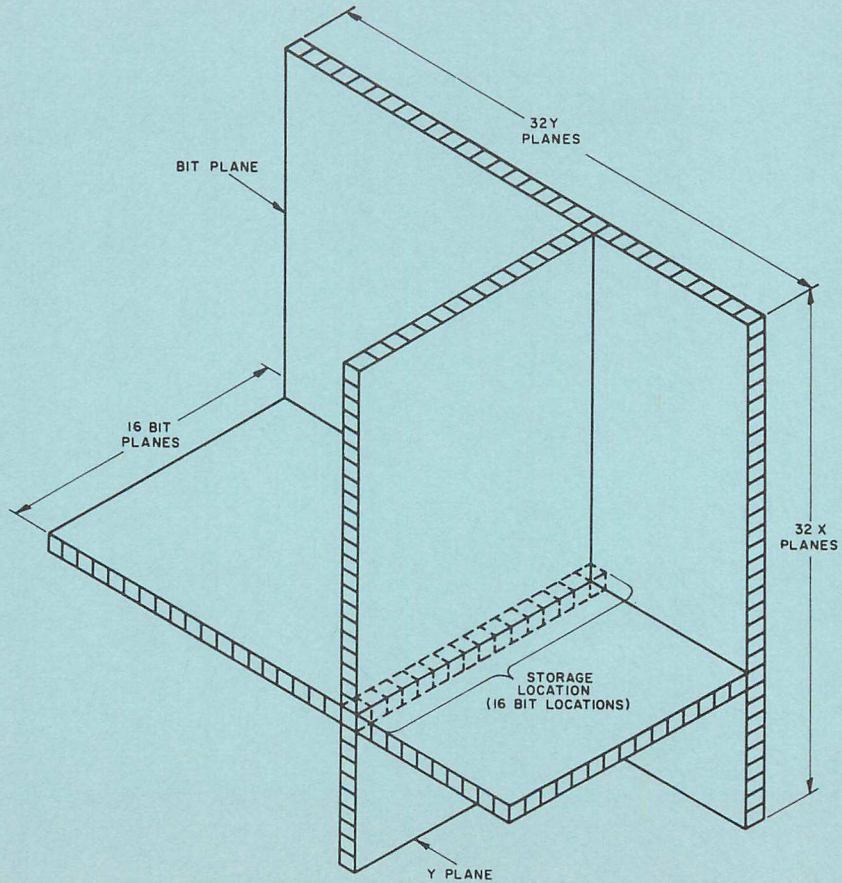


ERASABLE MEMORY CORE THREADING

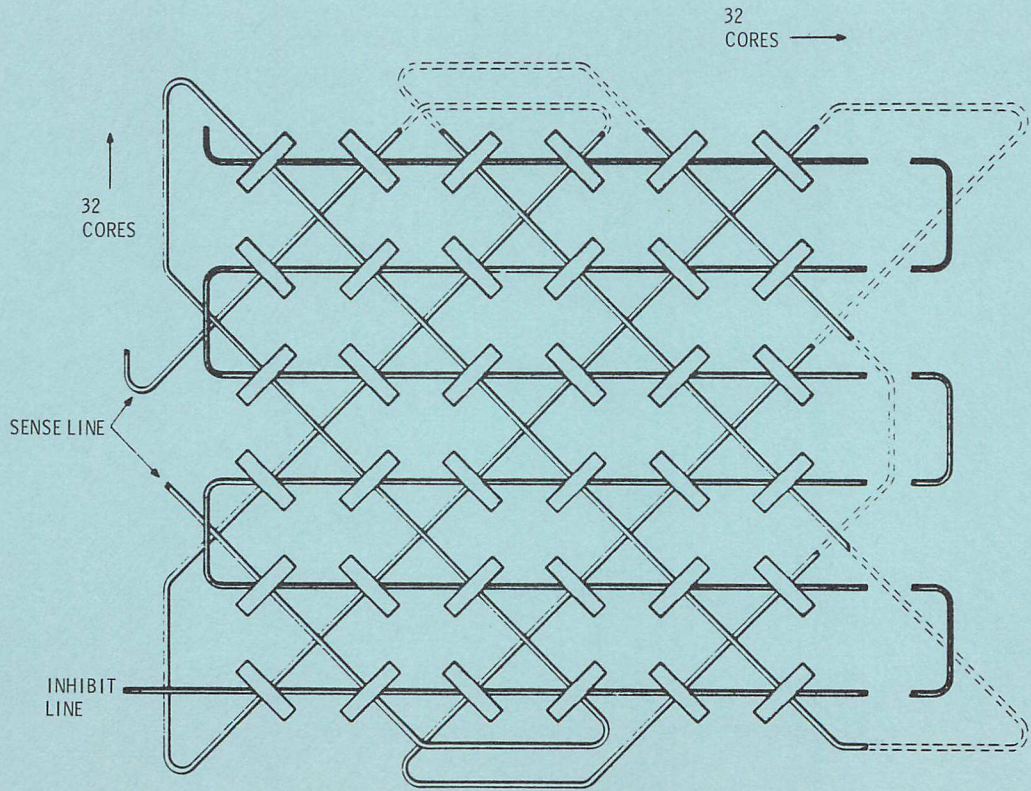


| FUNCTION | | | | |
|--------------|--------------------|--------------------|--------------------|---------------|
| | X | Y | INHIBIT | SENSE |
| WRITE ONE | $-\frac{1}{2} I_X$ | $-\frac{1}{2} I_Y$ | 0 | $-I_S$ |
| WRITE ZERO | $-\frac{1}{2} I_X$ | $-\frac{1}{2} I_Y$ | $+\frac{1}{2} I_i$ | 0 |
| READ (CLEAR) | $+\frac{1}{2} I_X$ | $+\frac{1}{2} I_Y$ | 0 | $+I_S O_{R0}$ |

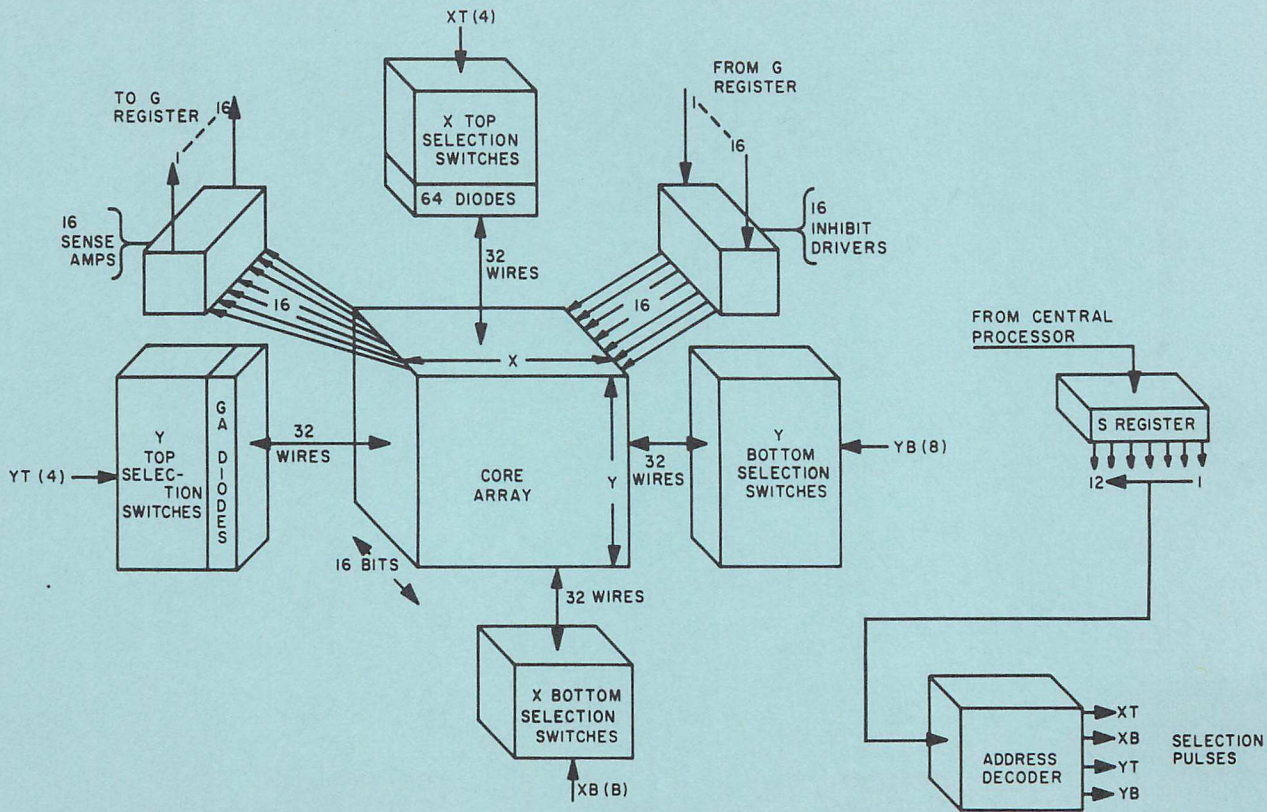
CORE ARRAY



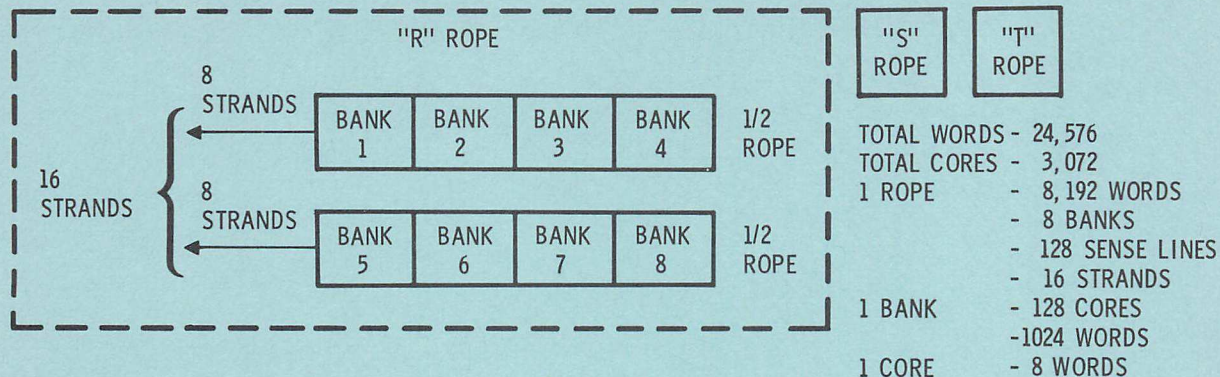
BIT PLANE



ERASABLE MEMORY BLOCK DIAGRAM



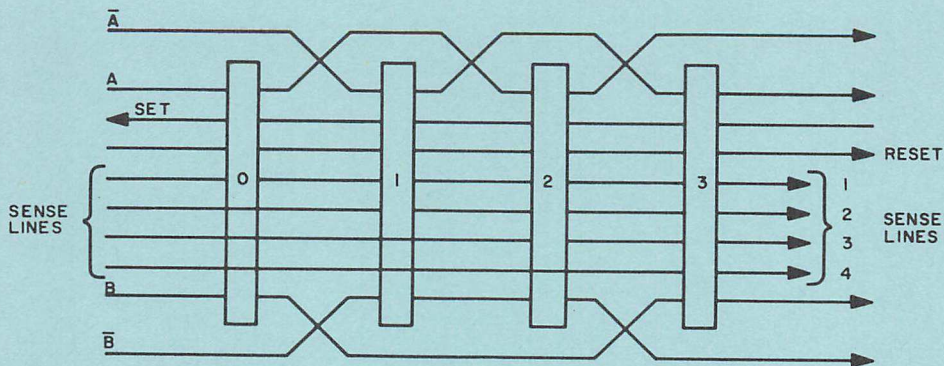
FIXED MEMORY ORGANIZATION



WORD SELECTION

1. SELECT 1 OF 3 ROPES (8,192 WDS OF 24,576 WDS)
2. SELECT 2 OF 8 BANKS (2,048 WDS OF 8,192 WDS)
3. SELECT 2 OF 256 CORES (16 WDS OF 2,048 WDS)
4. SELECT 1 OF 16 STRANDS (1 WD OF 16 WDS)

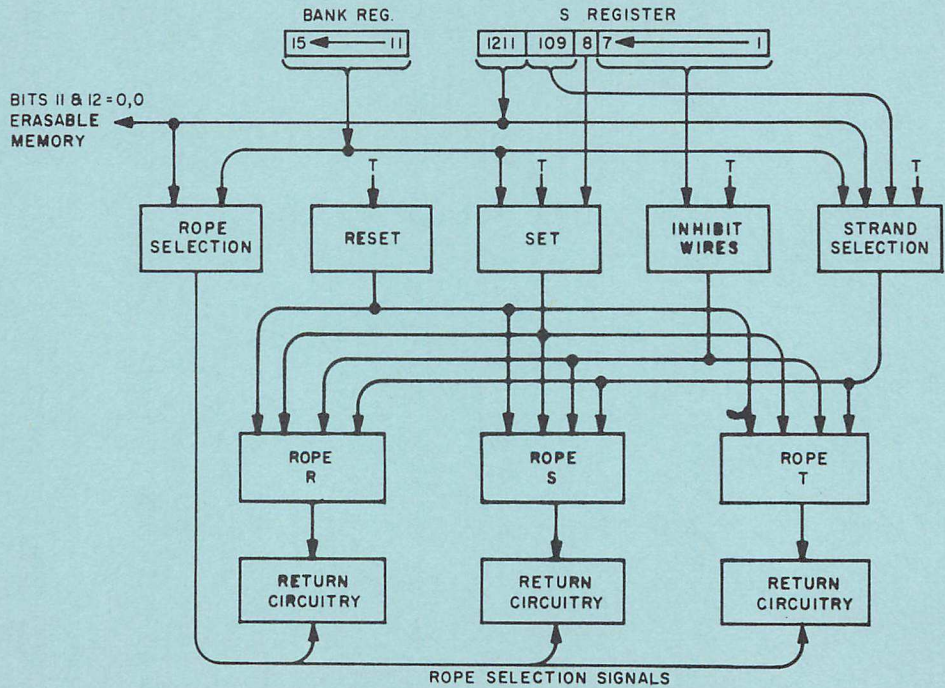
ROPE CORE



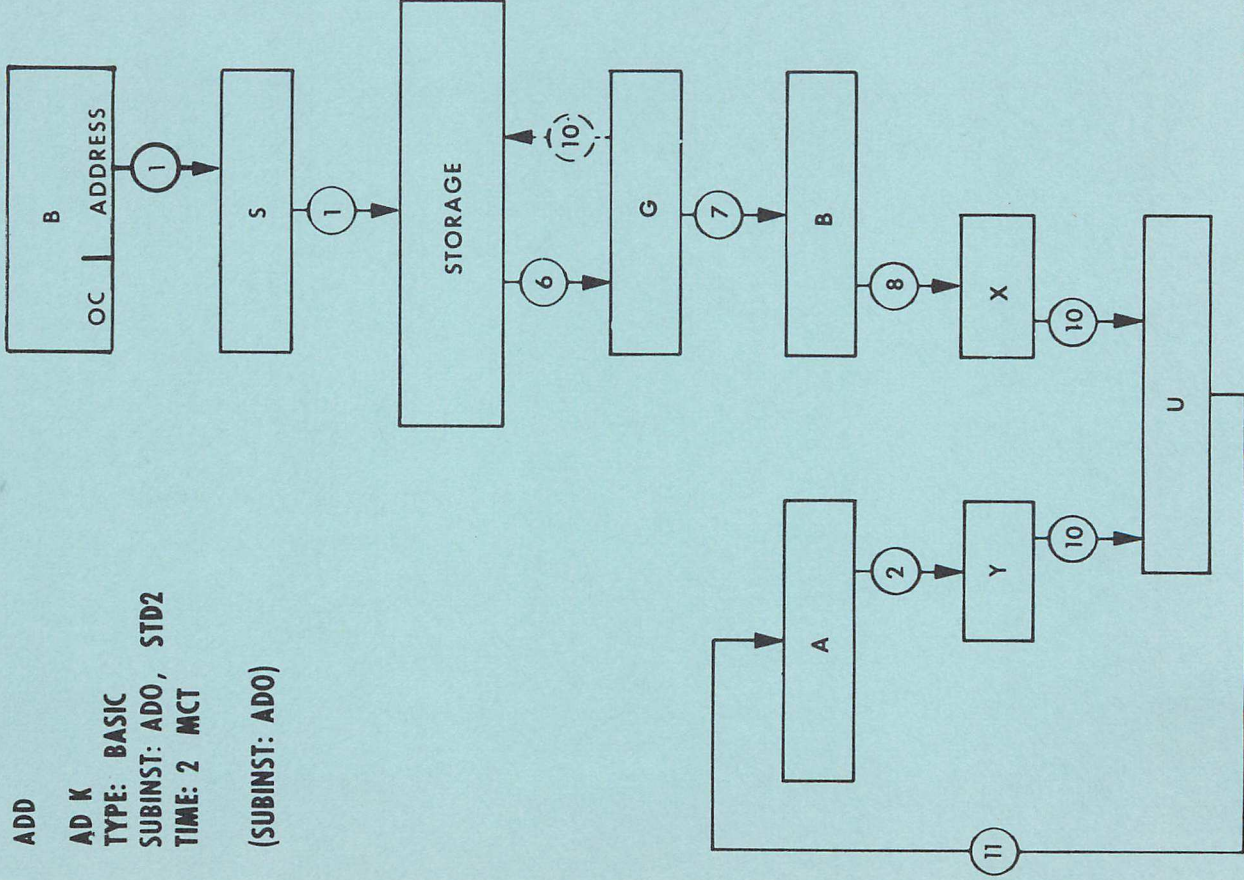
| | INHIBIT LINES | | | | SENSE LINES | | | | |
|--------|---------------|-----------|---|-----------|-------------|---|---|---|--------|
| | A | \bar{A} | B | \bar{B} | 4 | 3 | 2 | 1 | |
| CORE 0 | X | X | X | X | 0 | 0 | 0 | 1 | WORD 0 |
| CORE 1 | X | X | X | X | 0 | 0 | 1 | 1 | WORD 1 |
| CORE 2 | X | X | X | X | 0 | 1 | 1 | 1 | WORD 2 |
| CORE 3 | X | X | X | X | 1 | 1 | 1 | 1 | WORD 3 |

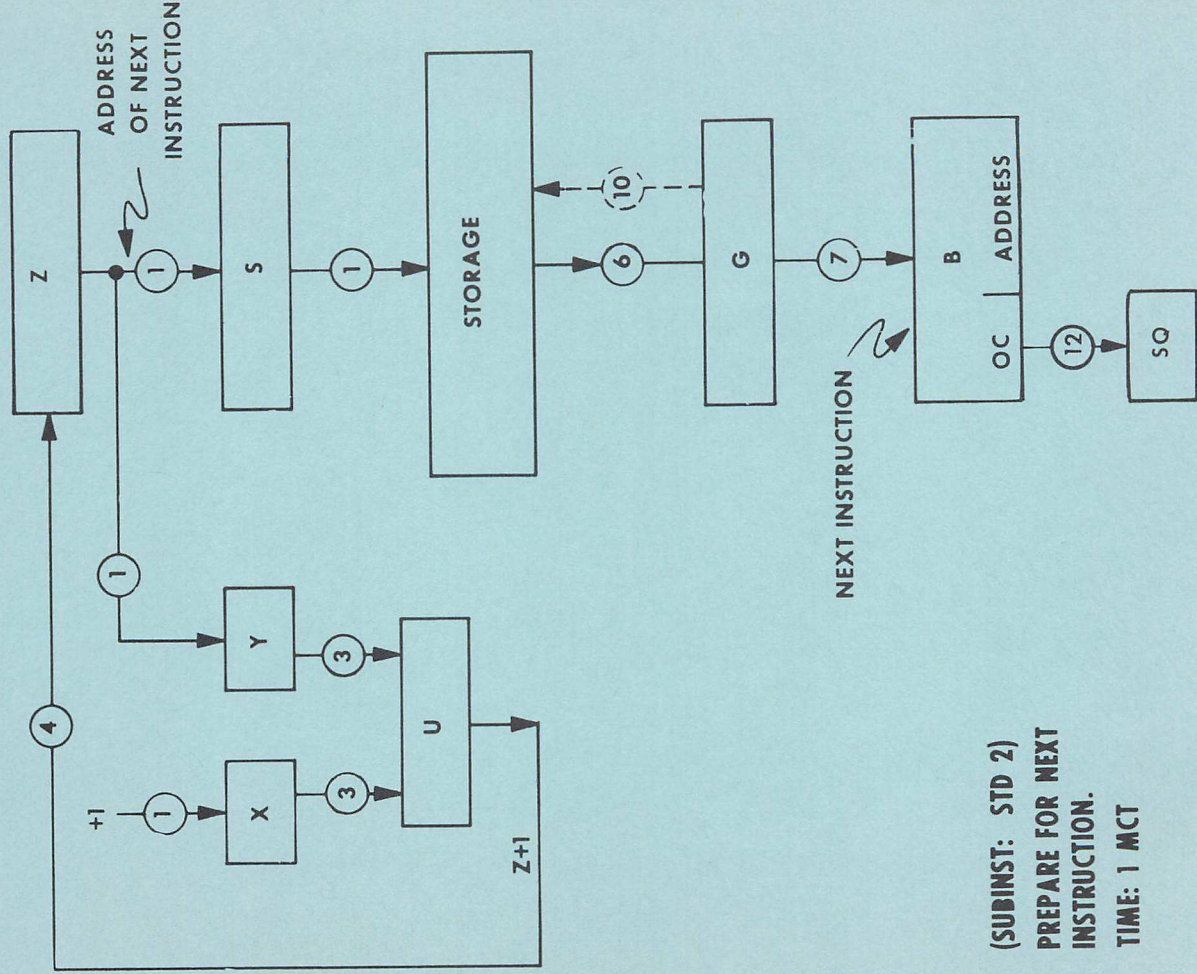
X INDICATES LINE INHIBITS CORE FROM SWITCHING

FIXED MEMORY ORGANIZATION AND SELECTION



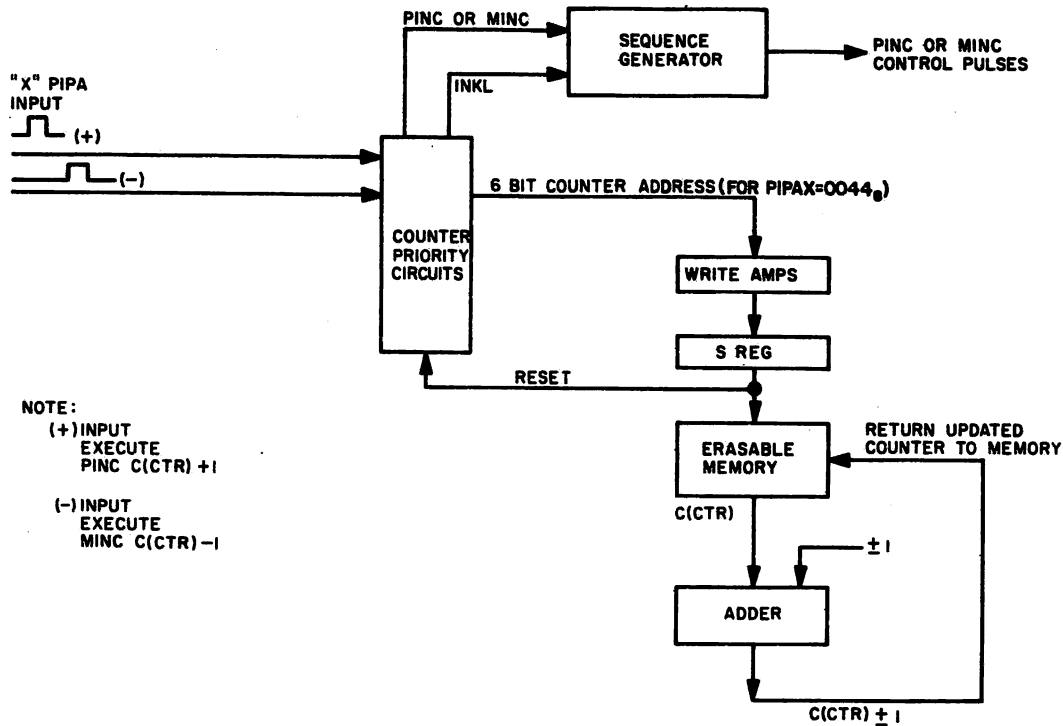
ADD
 AD K
 TYPE: BASIC
 SUBINST: ADO, STD2
 TIME: 2 MCT
 (SUBINST: ADO)



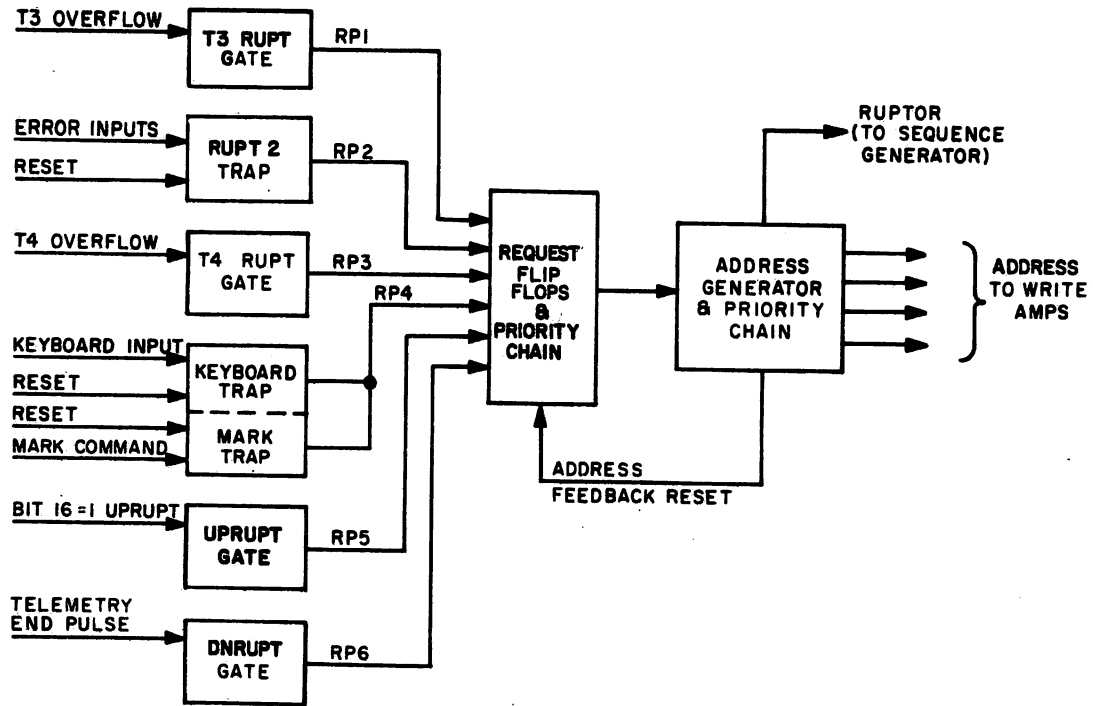


(SUBINST: STD 2)
 PREPARE FOR NEXT
 INSTRUCTION.
 TIME: 1 MCT

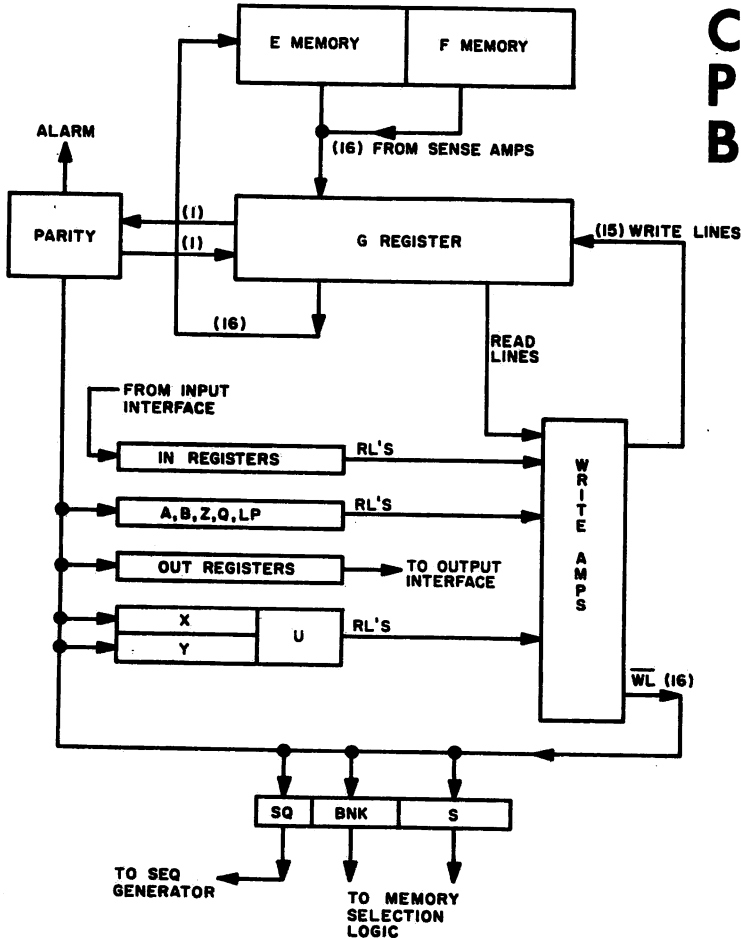
COUNTER INPUT INTERFACE FLOW DIAGRAM



PROGRAM INTERRUPT PRIORITY CONTROL



CENTRAL PROCESSING BLOCK DIAGRAM



INPUT-OUTPUT BIT ASSIGNMENTS

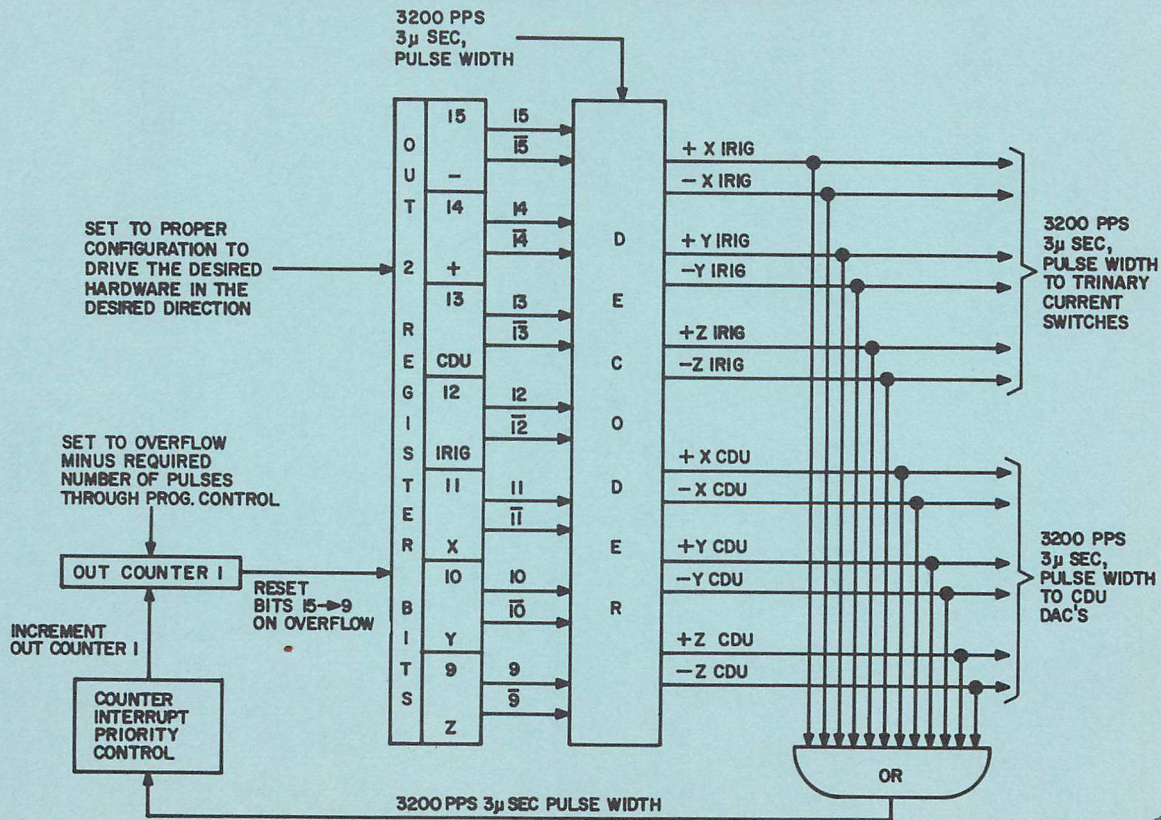
BLOCK-100

| BIT REGISTER | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|-----------------|----|---------------------|-------------------------|----------------------|--------------------|---------------------------|-----------------------|-------------------|-------------------|-------------------------|-------------------|----------------------|----------------------|---------------------|-----------------------|----------------------|
| INO | | MARK | S.P. N.C. | G/N ENTRY MODE | G/N ΔV MODE | G/N ATT. CONT. MODE | SR N.C. | SR N.C. | SR N.C. | IHIBIT UPSYNC | BLOCK UPLINK | KEY CODE 5 | KEY CODE 4 | KEY CODE 3 | KEY CODE 2 | KEY CODE 1 |
| INI | | 2 | 4 | | H | O | U | R | | C | O | U | N | T | E | R |
| IN2 | | PARITY FAIL | G/N MON. MODE | SCS ΔV MODE | IMU FAIL | PIPA FAIL | CDU FAIL | SM/CM SEP | SIVB SEP | SATN ULL. | GUID REL | LIFT OFF | F T 200PPS | I I 400PPS | N M 600PPS | E E 1600PPS |
| IN3 | | OR OF C1- C33 | COMP. CONTR. OPT. | SP NC | ZERO OPT | STAR PRES | TRKR ON | SP NC | SP NC | K5 ENTRY | TRN SW | K12 ATT. CONTR | K4 FINE ALIGN. | K3 MANUAL CDU | K2 COARSE ALIGN | K1 ZERO ENCODE |
| OUT 0 | | RELAY WORD 4 | RELAY WORD 3 | RELAY WORD 2 | RELAY WORD 1 | RELAY BIT 11 | RELAY BIT 10 | RELAY BIT 9 | RELAY BIT 8 | RELAY BIT 7 | RELAY BIT 6 | RELAY BIT 5 | RELAY BIT 4 | RELAY BIT 3 | RELAY BIT 2 | RELAY BIT 1 |
| OUT 1 | | SP NC | SP NC | ENG ON | SP NC | SP NC | BLOCK END PULSE | ID WORD | SP NC | RUPT 2 TRAP RESET | SP NC | CHECK FAIL | TEL ALARM | KEY RELEASE | COMP ACT. | PROG ALARM |
| OUT 2 | | - | + | CDU | GYRO | X | Y | Z | - | + | OPT X | OPT Y | THRUST | RADAR A | RADAR B | RADAR C |
| | | ← OUT COUNTER 1 → | | | | | ← OUT COUNTER 2 → | | | | | ← OUT COUNTER 3 → | | | | |
| OUT 3 | | | | | | S | P | A | R | E | S | | | | | |
| OUT 4 | | | | | D T | O E | W L | N E | L M | I E | N T | K R | Y | | | |

NC= NOT CONNECTED



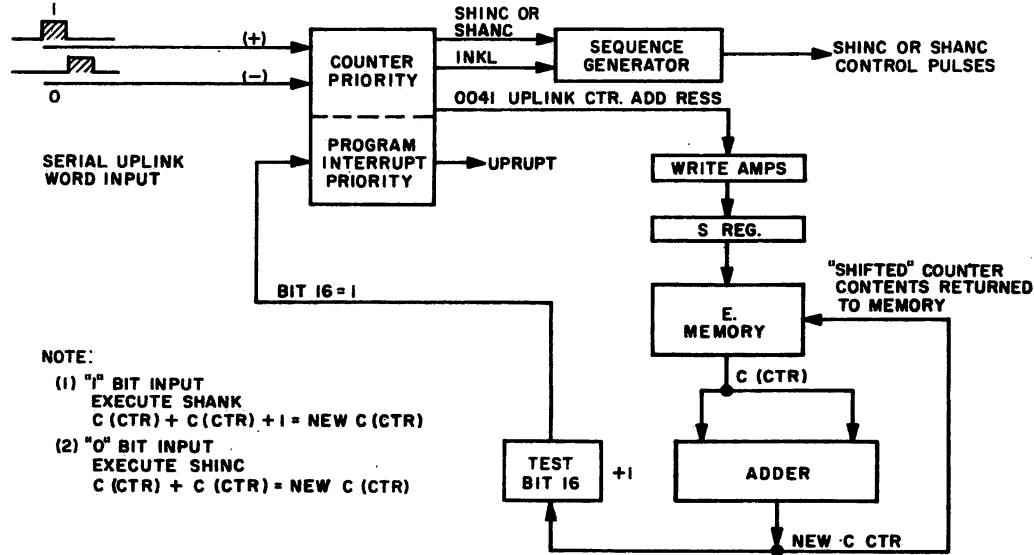
DEVELOPMENT AND CONTROL OF PROGRAM CONTROLLED DRIVE



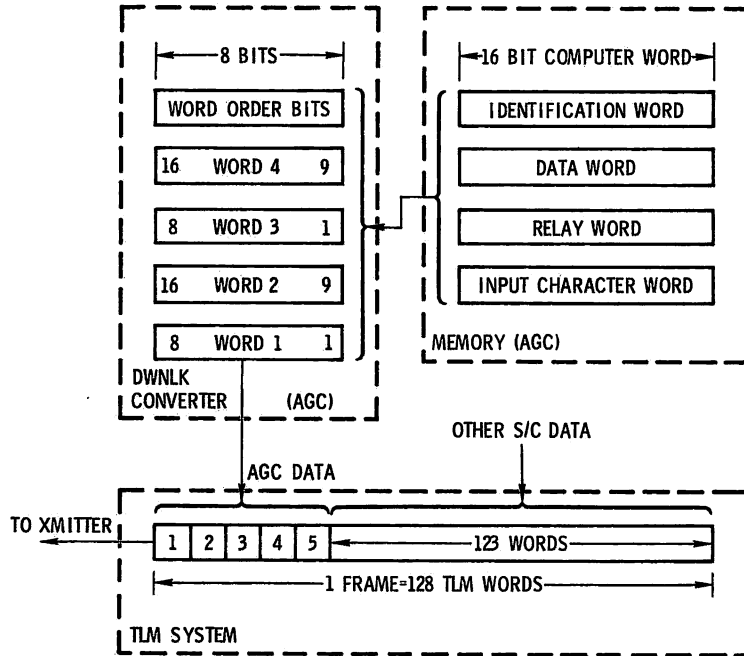
UPLINK WORD FORMAT

| BIT | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|----------|----|---------|----|----|----|----|----------------|---|---|---|---|---------|---|---|---|---|
| CONTENTS | 1 | KEYCODE | | | | | <u>KEYCODE</u> | | | | | KEYCODE | | | | |

UPLINK INTERFACE FLOW DIAGRAM



DOWNLINK



TRANSMISSION RATES-51.2Kc & 1.6Kc

TLM SYSTEM RATES-50pps & 10pps

1 FRAME=128-8 BIT TLM WORDS

5 AGC WORDS IN EACH FRAME

ID WORD

WORD ORDER BITS=0
 BITS 15-11 =00000
 BITS 10-1 =DATA INDEX

DATA WORD

WORD ORDER BITS=1
 BITS 15-1 =DATA

RELAY WORD

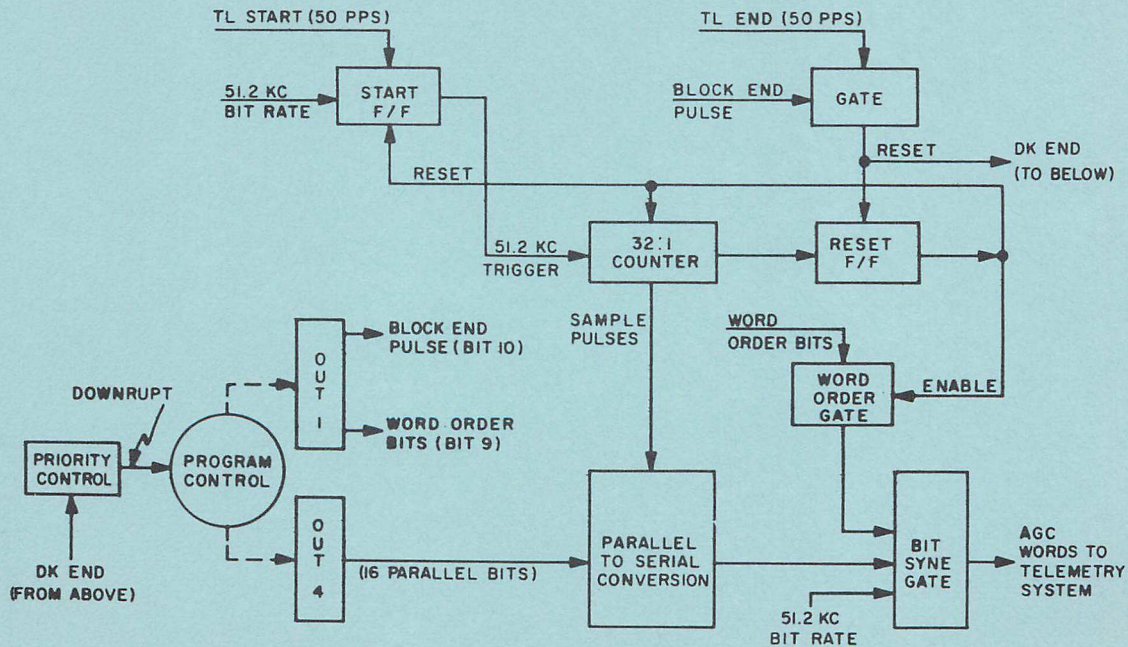
WORD ORDER BITS=0
 BITS 15-12 =RELAY WD ADDRESS
 BITS 11-1 =RELAY SETTINGS

INPUT CHARACTER WORD

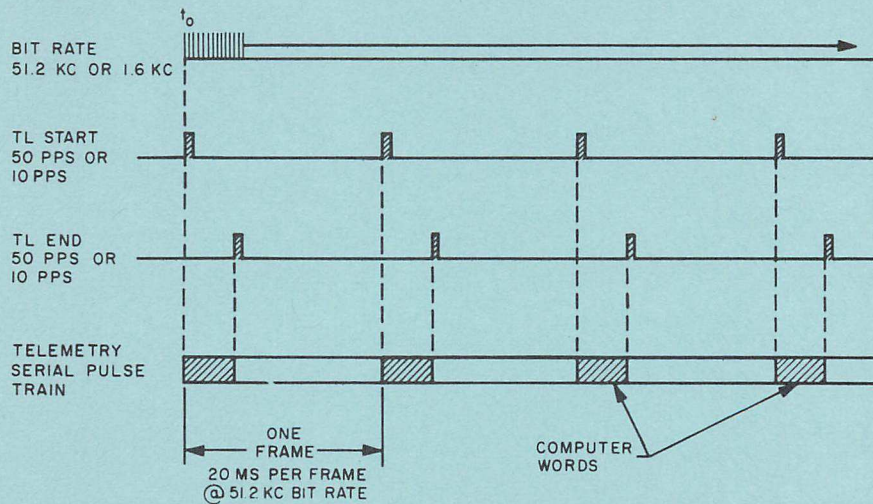
WORD ORDER BITS=0
 BITS 15-12 =0000
 BIT 11 =1
 BITS 10-8 =UNUSED
 BIT 7 =MARK
 BIT 6 =0 FOR KYBD
 1 FOR UPLK
 BITS 5-1 =KYBD OR UPLK DATA



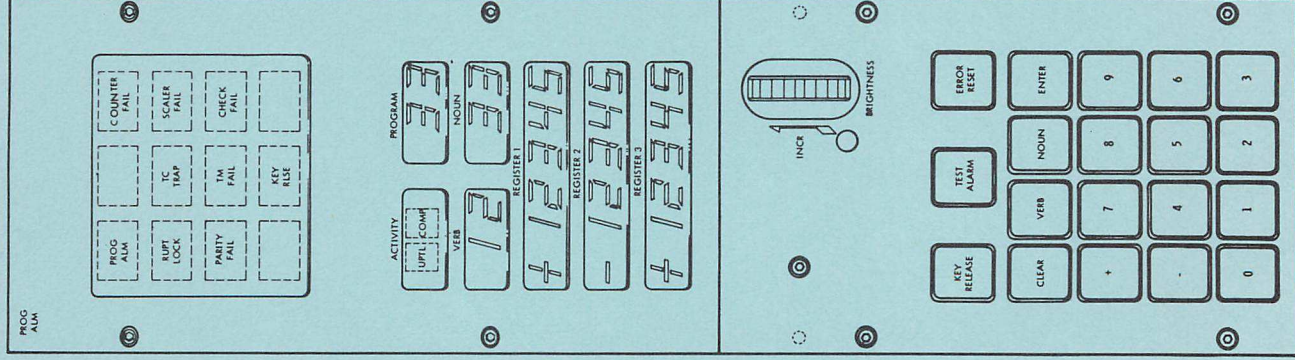
DOWNLINK CONVERTER INTERFACE FLOW DIAGRAM



TELEMETRY TIMING

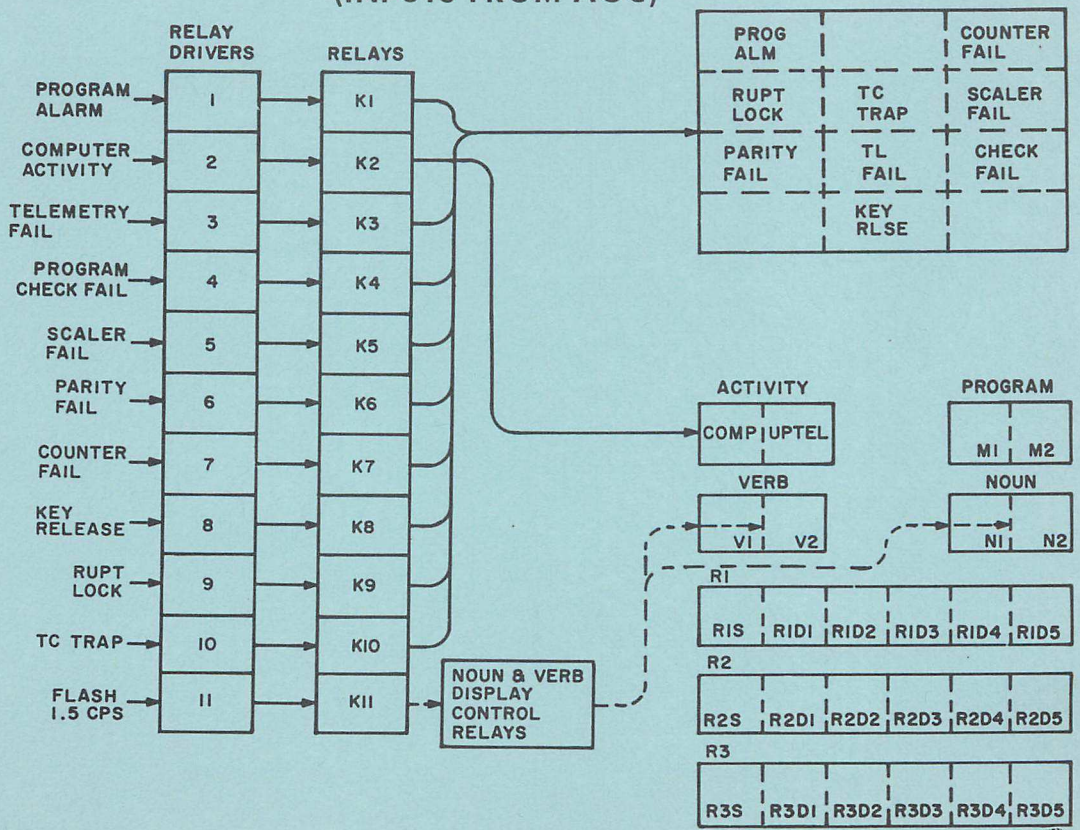


AGC DISPLAY & KEYBOARD

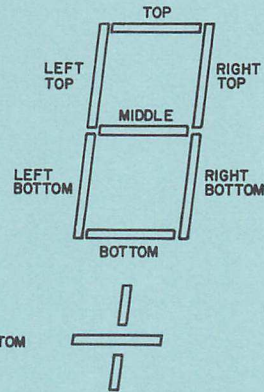
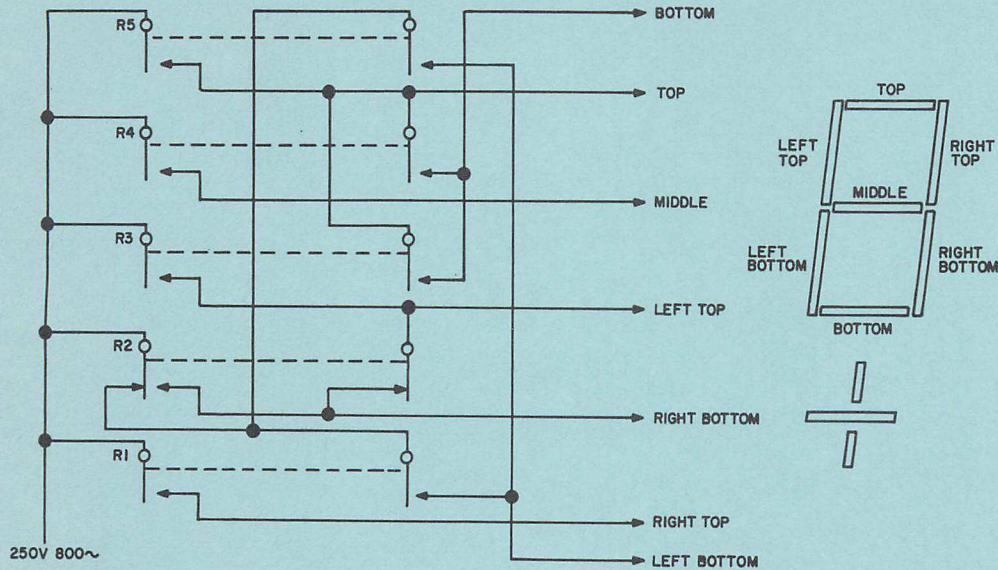


DSKY ALARM DISPLAY

(INPUTS FROM AGC)



DIGIT AND SIGN DISPLAYS



| RELAYS | | | | | DIGIT DISPLAYED |
|--------|----|----|----|----|--------------------|
| R5 | R4 | R3 | R2 | R1 | |
| | 0 | | 0 | | 0 |
| 0 | 0 | 0 | | | 1 |
| | | 0 | 0 | | 2 |
| | | 0 | | | 3 |
| 0 | | | | | 4 |
| | | | | 0 | 5 |
| | | | 0 | 0 | 6 |
| | 0 | 0 | | | 7 |
| | | | 0 | | 8 |
| | | | | | 9 |

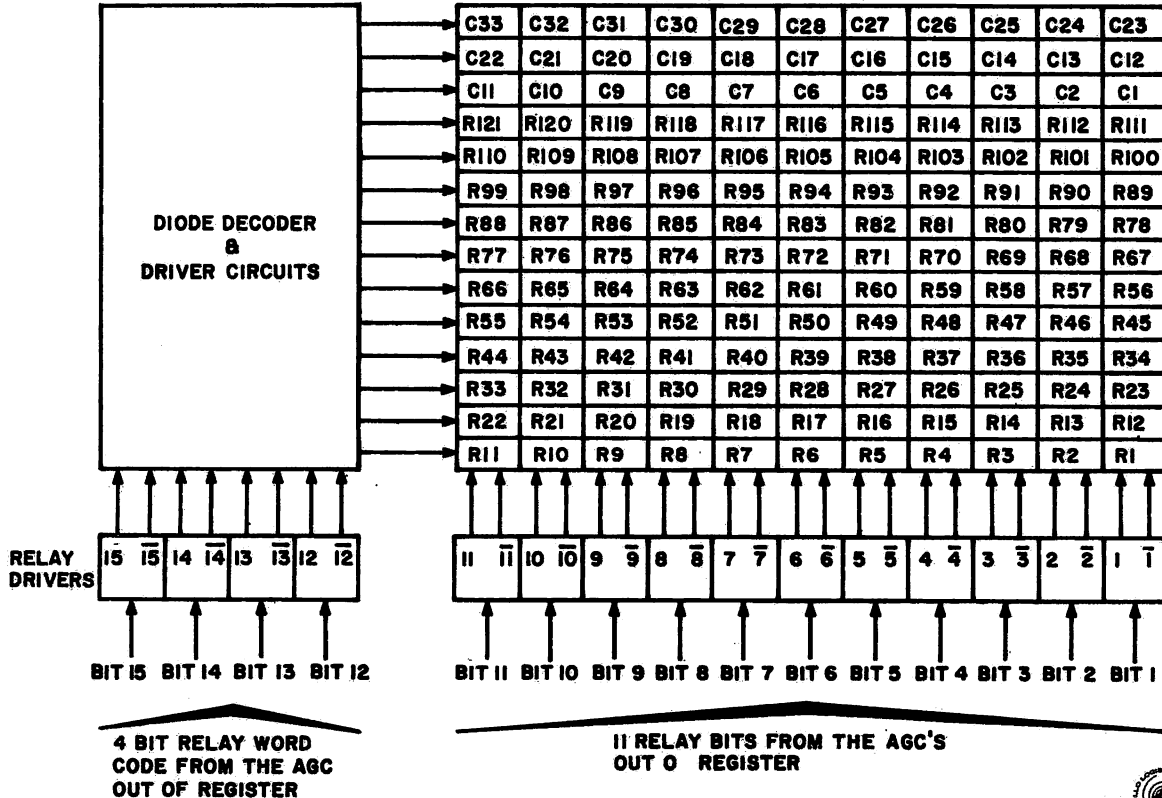
NAVIGATION & MAIN PANEL DSKY R RELAY USAGE BLOCK 1-100

| BIT CODE | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|------------------|---------------------------|----------|------|------|------|----------|----------|------|------|------|------|
| 1011 DSPTAB10 | R121 | R120 | R119 | R118 | R117 | R116 | R115 | R114 | R113 | R112 | R111 |
| | | ← MD1 → | | | | ← MD2 → | | | | | |
| 1010 DSPTAB 9 | R110 FLASH | R109 | R108 | R107 | R106 | R105 | R104 | R103 | R102 | R101 | R100 |
| | | ← VD1 → | | | | ← VD2 → | | | | | |
| 1001 DSPTAB 8 | R99 | R98 | R97 | R96 | R95 | R94 | R93 | R92 | R91 | R90 | R89 |
| | | ← NDI → | | | | ← ND2 → | | | | | |
| 1000 DSPTAB 7 | R88 UPLINK ACTIVITY | R87 | R86 | R85 | R84 | R83 | R82 | R81 | R80 | R79 | R78 |
| | | | | | | | ← RID1 → | | | | |
| 0111 DSPTAB 6 | R77 RIS+ | R76 | R75 | R74 | R73 | R72 | R71 | R70 | R69 | R68 | R67 |
| | | ← RID2 → | | | | ← RID3 → | | | | | |
| 0110 DSPTAB 5 | R66 RIS- | R65 | R64 | R63 | R62 | R61 | R60 | R59 | R58 | R57 | R56 |
| | | ← RID4 → | | | | ← RID5 → | | | | | |
| 0101 DSPTAB 4 | R55 R2S+ | R54 | R53 | R52 | R51 | R50 | R49 | R48 | R47 | R46 | R45 |
| | | ← R2D1 → | | | | ← R2D2 → | | | | | |
| 0100 DSPTAG 3 | R44 R2S- | R43 | R42 | R41 | R40 | R39 | R38 | R37 | R36 | R35 | R34 |
| | | ← R2D3 → | | | | ← R2D4 → | | | | | |
| 0011 DSPTAB 2 | R33 | R32 | R31 | R30 | R29 | R28 | R27 | R26 | R25 | R24 | R23 |
| | | ← R2D5 → | | | | ← R3D1 → | | | | | |
| 0010 DSPTAB 1 | R22 R3S+ | R21 | R20 | R19 | R18 | R17 | R16 | R15 | R14 | R13 | R12 |
| | | ← R3D2 → | | | | ← R3D3 → | | | | | |
| 0001 DSPTAB | R11 R3S- | R10 | R9 | R8 | R7 | R6 | R5 | R4 | R3 | R2 | R1 |
| | | ← R3D4 → | | | | ← R3D5 → | | | | | |



DSKY DISPLAY AND COMMAND RELAY CIRCUITRY

14 BANKS OF 11 BISTABLE RELAYS



MAIN DSKY C RELAY USAGE BLOCK 1-100

| BITS CODE | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|-------------------|---------------------------|----------------------------|-----|-------------------|--------------------|----------------------|--------------------------|---------------------|---------------------|-----------------------|-----------------------|
| 1110 DSPTAB 13 | C33 | C32 | C31 | C30 | C29 | C28 G & N FAIL | C27 | C26 | C25 | C24 | C23 |
| 1101 DSPTAB 12 | C22 STAR TRACKER ON | C21 ZERO OPTICS | C20 | C19 | C18 | C17 | C16 | C15 | C14 | C13 | C12 |
| 1100 DSPTAB 11 | C11 ENTRY | C10 ATTITUDE CONTROL | C9 | C8 IMU FAIL | C7 PIPA FAIL | C6 CDU FAIL | C5 ENCODER ZEROING | C4 FINE ALIGN | C3 CDU MANUAL | C2 COARSE ALIGN | C1 ZERO ENCODER |

NAV DSKY C RELAY USAGE BLOCK I-100

| BITS CODE | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|-------------------|-----|--------------------------|----------------------|----------------------------------|----------------------|----------------------|---------------------------------|----------------------------------|---------------------------------|------------------------------|---------------------------------------|
| 1110 DSPTAB 13 | C33 | C32 TELECOM SWITCH | C31 FDA1 ALIGN | C30 GIMBAL MOTOR ON/OFF | C29 AUTO 0.05g | C28 G & N FAIL | C27 +X TRANSLATION ON/OFF | C26 CM/SM SEPARATE COMMAND | C25 G & N ENTRY MODE SEL. | C24 G & N ΔV MODE SEL. | C23 G & N ATT. CONTR. MODE SEL. |
| 1101 DSPTAB 12 | C22 | C21 | C20 | C19 | C18 | C17 | C16 | C15 | C14 | C13 | C12 |
| 1100 DSPTAB 11 | C11 | C10 | C9 | C8 IMU FAIL | C7 PIPA FAIL | C6 CDU FAIL | C5 | C4 | C3 | C2 | C1 |



GUIDANCE & NAVIGATION ABBREVIATIONS

| | | | |
|-------|---------------------------------------|-----------|---------------------------------------|
| ACSP | A.C. SPARK PLUG | LOS | LINE OF SIGHT |
| ADA | ANGULAR DIFFERENTIATING ACCELEROMETER | LLOS | LANDMARK LINE OF SIGHT |
| AGC | APOLLO GUIDANCE COMPUTER | LSB | LEAST SIGNIFICANT BIT |
| AGE | APOLLO GUIDANCE EQUIPMENT | MGA | MIDDLE GIMBAL AXIS |
| AMR | ATLANTIC MISSILE RANGE | MIT | MASSACHUSETTS INSTITUTE OF TECHNOLOGY |
| CDU | COUPLING DISPLAY UNIT | MAG AMP | MAGNETIC AMPLIFIER |
| C.G. | CENTER OF GRAVITY | MSB | MOST SIGNIFICANT BIT |
| CSS | COMPUTER SUB SYSTEM | M&DV | MAP & DATA VIEWER |
| DNLK | DOWNLINK | NVB OR NB | NAVIGATION BASE |
| DSPY | DISPLAY | OGA | OUTER GIMBAL AXIS |
| DSKY | DISPLAY & KEYBOARD | OA | OUTPUT AXIS |
| ECS | ENVIRONMENT CONTROL SYSTEM | OSS | OPTICAL SUB SYSTEM |
| E/M | ERASABLE MEMORY | PIP OR | PULSED INTEGRATING PENDULOUS |
| EOI | EARTH ORBIT INJECTION | PIPA | ACCELEROMETER |
| EPS | ELECTRICAL POWER SYSTEM | PSA | POWER SERVO ASSEMBLY |
| FDAI | FLIGHT DIRECTOR ATTITUDE INDICATOR | PRA | PENDULOSITY REFERENCE AXIS |
| F/M | FIXED MEMORY | RCS | REACTION CONTROL SYSTEM |
| G.C. | GIMBAL CASE | RSVR | RESOLVER |
| IA | INPUT AXIS | SA | SPIN AXIS |
| IRIG | INERTIAL REFERENCE INTEGRATING GYRO | S/C | SPACECRAFT |
| IGA | INNER GIMBAL AXIS | SLOS | STAR LINE OF SIGHT |
| IMU | INERTIAL MEASUREMENT UNIT | SCT | SCANNING TELESCOPE |
| ISS | INERTIAL SUB SYSTEM | SCS | STABILIZATION & CONTROL SYSTEM |
| IU | INSTRUMENT UNIT | SDOF | SINGLE DEGREE OF FREEDOM |
| G&N | GUIDANCE & NAVIGATION | SM | STABLE MEMBER |
| KYBD | KEYBOARD | SRA | SPIN REFERENCE AXIS |
| LNDMK | LANDMARK | SPS | SERVICE PROPULSION SYSTEM |
| LOI | LUNAR ORBIT INJECTION | SXT | SPACE SEXTANT |

| | |
|---------|-----------------------|
| TEI | TRANS EARTH INJECTION |
| TACH | TACHOMETER |
| TLI | TRANS LUNAR INJECTION |
| TRKR | TRACKER |
| TVC | THRUST VECTOR CONTROL |
| T/M | TELEMETRY |
| UPLK | UPDATE LINK |
| V OR | CHANGE IN VELOCITY |
| DELTA V | |