TECHNICAL MANUAL

ORGANIZATIONAL MAINTENANCE

F-106 AWCIS THEORY AND FUNCTIONAL DIAGRAMS

HUGHES AIRCRAFT COMPANY
CULVER CITY, CALIFORNIA

F04606-70-A-0128-SA29
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CHAPTER 1

1-1. GENERAL INFORMATION

1-2. This manual, along with manuals listed below, contains information for troubleshooting, periodic checkout, fault isolation, check and adjustment procedure of the MA-1 and AN ASQ-25 systems. These manuals comprise the F-106A and F-106B series of Technical Manual of Organizational Maintenance.

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T.O. 1F-106A-2-27-3	F-106 AWCIS Fault Isolation Procedures
T.O. 1F-106A-2-27-6	F-106 AWCIS Classified Flightline Information
T.O. 1F-106A-2-27-7	F-106 AWCIS Dynamic Flightline Checkout Procedure (AN/MPM-54)
T.O. 1F-106A-2-27-7-1	Fault Detection Tester AN/MPM-54, Fault Isolation Procedures
T.O. 1F-106A-2-27-8	F-106 AWCIS System Mockup Procedures
T.O. 1F-106A-2-27-9	F-106 AWCIS Data Analysis Manual

1-3. This manual, divided into nine chapters, provides diagrams and theory of operation for the MA-1 and AN/ASQ-25 systems. Chapter 1 contains introductory material, general information, special symbols and abbreviations. Chapter 2 contains a block diagram of the entire MA-1 system and SSGC, SCABU, B-model control transfer, and MATTS diagrams. Chapters 3 thru 9 contain theory of operation and functional diagrams for the radar, IR, armament, computer, power, FC&M, and CN&L subsystems.

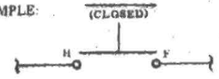
1-4. Each figure of chapters 3 thru 9 contains the theory of operation, where necessary, and a functional diagram for the portion of the subsystem covered by the figure. The MA-1 system and the AN/ASQ-25 system are referred to on the figures as A-model and B-model or (A) and (B) respectively. When B-model differences are separated in a dashed box, common units are shown as empty boxes with only wiring and transfer units detailed. B-model transfer units (564, 664, 764 and 864) are treated as regular line replaceable assemblies but do not have relay contacts listed in the relay charts. They are not listed since there is not a need to cross reference sets of contacts as in regular MA-1 units. Figure 2-4 is provided to show switching control of the transfer relays. The A-model and B-model differences in wiring are shown on the functional diagrams as illustrated in figure 1-1. Round and vertical instruments are indicated by (R) and (V), respectively. There are four rails (054) in the MA-1 or AN/ASQ-25 systems. To distinguish between the rails a (1), (2), (3), or (4) is placed beside the wiring connectors as shown in fig. 1-1.

1-5. Each circuit on a functional diagram requiring explanation refers to the theory by the use of a letter enclosed by a hexagon. All front panel controls, indicators, and test points shown on the functional diagrams call out the exact panel nomenclature. In cases when it is required to show controls, indicators, or test points that do not have descriptive front panel nomenclature, additional nomenclature is shown enclosed in parenthesis. References to functional diagrams are made in two ways. The function referenced in a box is a main type of reference while the function referenced at a breakoff line is secondary and is used for tie-in only. All MA-1 power inputs to units not shown on the functionals may be found by referring to the power distribution functions (Chapter 7).

1-6. Figure 1-1 illustrates the special symbols used in this manual. Figure 1-2 lists the special abbreviations and letter symbols used in this manual. Figure 1-3 provides a list of the units of the MA-1 and AN/ASQ-25 systems. Figure 1-3 lists the simplified unit number, nomenclature, common name, and subsystem to which the unit belongs. The simplified unit number is obtained by using the last three digits of the 464XXX number assigned to a unit in the MA-1 system. The AN/ASQ-25 units use the full 472XXX number assigned to a unit in the AN/ASQ-25 system. Vertical instrument units are identified by a ▢ next to the simplified unit number in tables. Round instrument units are identified by a ◯ next to the simplified unit number in tables.

1-7. All CVAC and ARMAMENT switches are shown on the diagrams in the book in the unactuated position; contacts of the switches are changed accordingly when the condition printed in parenthesis above the switches is met.

EXAMPLE: (CLOSED)



The contacts of this switch are closed when the door is not closed.

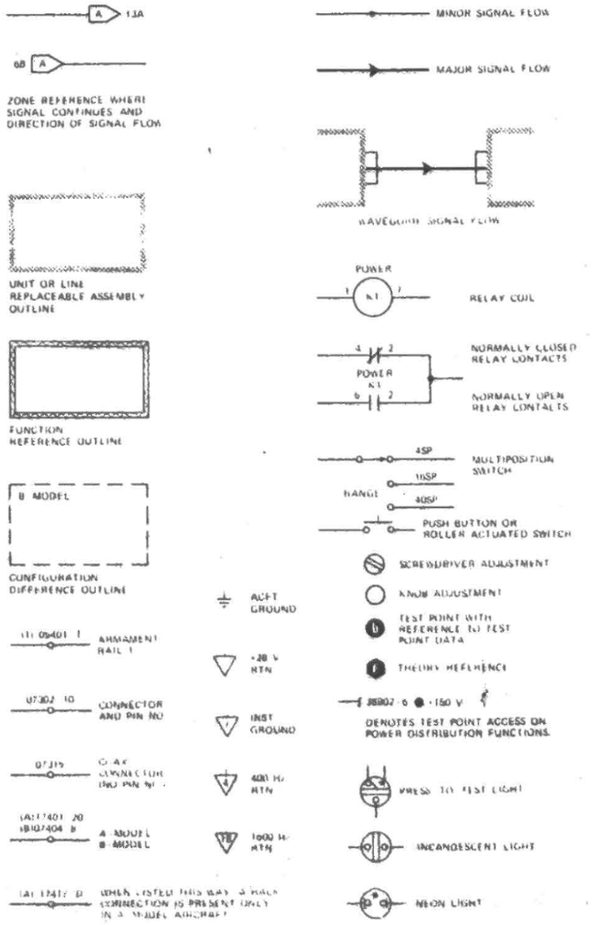


Figure 1-1. Special Symbols

AATS	ARMAMENT AUXILIARIES TEST SET
ABC	AUDIO BYPASS CONNECTOR
accel	ACCELEROMETER
acft	AIRCRAFT
ACP	ARMAMENT CONTROL PANEL
ACRB	ARMAMENT CONTROL RELAY BOX
ADF	AUTOMATIC DIRECTION FINDER
ADI	ATTITUDE DIRECTOR INDICATOR
AFCS	AUTOMATIC FLIGHT CONTROL SYSTEM
AGE	AEROSPACE GROUND EQUIPMENT
A_H	YAW ANGLE TO TURN THROUGH (SPACE COORDINATES)
$\tilde{A}_H$	SMOOTHED YAW ANGLE TO TURN THROUGH (SPACE COORDINATES)
AHI	APPROACH HORIZON INDICATOR
AIM	AIR INTERCEPT MISSILE
AIR	AIR INTERCEPT ROCKET
A_J	PITCH ANGLE TO TURN THROUGH (AIRCRAFT COORDINATES)
A_K	YAW ANGLE TO TURN THROUGH (AIRCRAFT COORDINATES)
A_L	AIRCRAFT LIFT ACCELERATION
AMCP	ARMAMENT MANUAL CONTROL PANEL
AMI	AIRSPEED MACH INDICATOR
ant.	ANTENNA
AOT	ANGLE ON TARGET
aprch	APPROACH
ARDC	AIR RESEARCH AND DEVELOPMENT COMMAND

Figure 1-2. Special Abbreviations (Sheet 1 of 4)

arm	ARMAMENT
*ATG	AIR TURBINE GENERATOR
*ATM	AIR TURBINE MOTOR
ATROT	ANGLE TRACK RANGE ON TARGET
ATOT	ANGLE TRACK ON TARGET
ATS	ARMAMENT TEST SET
A_V	PITCH ANGLE TO TURN THROUGH (SPACE COORDINATES)
$\bar{A}_V$	SMOOTHED PITCH ANGLE TO TURN THROUGH (SPACE COORDINATES)
aux	AUXILIARY
AVVI	ALTITUDE VERTICAL VELOCITY INDICATOR
AWCIS	AIRCRAFT AND WEAPONS CONTROL INTERCEPTOR SYSTEM
az	AZIMUTH
A&C	ARITHMETIC AND CONTROL
baro	BAROMETER
BCD	BINARY CODED DECIMAL
BORS	BORESIGHT
CADJ	COUNTER ANGLE DECEPTION JAMMING
CC	CLOSE CONTROL
CCM	COUNTER-COUNTERMEASURES
ccw	COUNTER CLOCKWISE
cmd	COMMAND
cmptr	COMPUTER (use capitals if referring to the computer subsystem)
CN&L	COMMUNICATION, NAVIGATION, AND LANDING
COD	CODE
comm	COMMUNICATION
comp	COMPUTER
compt	COMPARTMENT
cp	CLOCK PULSE
cpt	CLOCK PULSE TIME

*Alternate nomenclatures for Bleed Air Turbine Generator (BATG).

CVAC	CONVAIR AIRCRAFT CO.
cw	CLOCKWISE
DBS	DYNAMIC BORESIGHT
defl	DEFLECTION
DG	DIRECTIONAL GYRO
DI	DIGITAL INPUT
DIRT	DELAYED IR TRACK
DIRTOT	DELAYED IR TRACK ON TARGET
DL	DATA LINK
DR	DEAD RECKONING
DRO	DESTRUCTIVE READOUT
DROT	DELAYED RANGE ON TARGET
DSR	DIRECT SCOPE RECORDER
dwr	DRAWER
ECM	ELECTRONIC COUNTER MEASURES
el	ELEVATION
elec	ELECTRONIC
emer	EMERGENCY
ess	ESSENTIAL
exc	EXCITATION
ext	EXTERNAL
F	ARMAMENT TRAVEL DISTANCE
FC&M	FLIGHT CONTROL AND MEASUREMENT
FDT	FAULT DETECTION TESTER
FIR	FALCON IN RANGE
$f(q_cM)$	FUNCTION OF DIFFERENTIAL PRESSURE AND MACH

freq	FREQUENCY
fwd	FORWARD
GCI	GROUND CONTROL INTERCEPT
GFAE	GOVERNMENT FURNISHED AIRCRAFT EQUIPMENT
GPU	GROUND POWER UNIT
GRR	GUN READY RELAY
GS	GLIDE SLOPE
HAC	HUGHES AIRCRAFT CO.
HAT	HOMING ANGLE TRACK
HC	HAND CONTROL
h_c	COMMAND ALTITUDE
hdg	HEADING
HEP	HYDRAULIC ELEVON PACKAGE
h_i	INTERCEPTOR ALTITUDE
HIG	HERMETIC INTEGRATING GYRO
hom	HOMING
horiz	HORIZON
hor	HORIZONTAL
H_p	PRESSURE ALTITUDE
HRP	HYDRAULIC RUDDER PACKAGE
HSI	HORIZONTAL SITUATION INDICATOR
h_t	TARGET ALTITUDE
hydr	HYDRAULIC
IAS	INDICATED AIR SPEED
ID	IDENTIFICATION
IFF	IDENTIFICATION FRIEND OR FOE
ILAS	INSTRUMENT LANDING APPROACH SYSTEM

Figure 1-2. Special Abbreviations (Sheet 2 of 4)

CHAPTER 1

1-1. GENERAL INFORMATION

1-2. This manual, along with manuals listed below, contains information for troubleshooting, periodic checkout, fault isolation check and adjustment procedure of the MA-1 and AN ASQ-25 systems. These manuals comprise the F-106A and F-106B series of Technical Manual of Organizational Maintenance.

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T.O. 1F-106A-2-27-9	F-106 AWCIS Data Analysis Manual

1-3. This manual, divided into nine chapters, provides diagrams and theory of operation for the MA-1 and AN/ASQ-25 systems. Chapter 1 contains introductory material, general information, special symbols and abbreviations. Chapter 2 contains a block diagram of the entire MA-1 system and SSGC, SCABU, B-model control transfer, and MATTS diagrams. Chapters 3 thru 9 contain theory of operation and functional diagrams for the radar, IR, armament, computer, power, FC&M, and CN&L subsystems.

1-4. Each figure of chapters 3 thru 9 contains the theory of operation, where necessary, and a functional diagram for the portion of the subsystem covered by the figure. The MA-1 system and the AN/ASQ-25 system are referred to on the figures as A-model and B-model or (A) and (B) respectively. When B-model differences are separated in a dashed box, common units are shown as empty boxes with only wiring and transfer units detailed. B-model transfer units (564, 664, 764 and 864) are treated as regular line replaceable assemblies but do not have relay contacts listed in the relay charts. They are not listed since there is not a need to cross reference sets of contacts as in regular MA-1 units. Figure 2-4 is provided to show switching control of the transfer relays. The A-model and B-model differences in wiring are shown on the functional diagrams as illustrated in figure 1-1. Round and vertical instruments are indicated by (R) and (V), respectively. There are four rails (054) in the MA-1 or AN/ASQ-25 systems. To distinguish between the rails a (1), (2), (3), or (4) is placed beside the wiring connectors as shown in fig. 1-1.

1-5. Each circuit on a functional diagram requiring explanation refers to the theory by the use of a letter enclosed by a hexagon. All front panel controls, indicators, and test points shown on the functional diagrams call out the exact panel nomenclature. In cases when it is required to show controls, indicators, or test points that do not have descriptive front panel nomenclature, additional nomenclature is shown enclosed in parenthesis. References to functional diagrams are made in two ways. The function referenced in a box is a main type of reference while the function referenced at a breakoff line is secondary and is used for tie-in only. All MA-1 power inputs to units not shown on the functionals may be found by referring to the power distribution functions (Chapter 7).

1-6. Figure 1-1 illustrates the special symbols used in this manual. Figure 1-2 lists the special abbreviations and letter symbols used in this manual. Figure 1-3 provides a list of the units of the MA-1 and AN/ASQ-25 systems. Figure 1-3 lists the simplified unit number, nomenclature, common name, and subsystem to which the unit belongs. The simplified unit number is obtained by using the last three digits of the 464XXX number assigned to a unit in the MA-1 system. The AN/ASQ-25 units use the full 472XXX number assigned to a unit in the AN/ASQ-25 system. Vertical instrument units are identified by a □ next to the simplified unit number in tables. Round instrument units are identified by a ○ next to the simplified unit number in tables.

1-7. All CVAC and ARMAMENT switches are shown on the diagrams in the book in the unactuated position; contacts of the switches are changed accordingly when the condition printed in parenthesis above the switches is met.

EXAMPLE: (CLOSED) H F — The contacts of this switch are closed when the door is not closed.

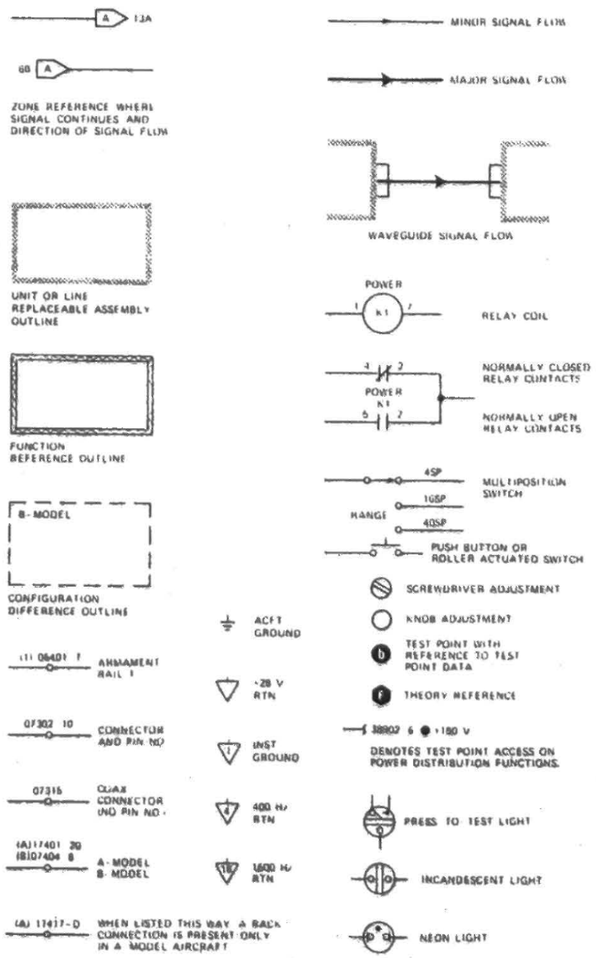


Figure 1-1. Special Symbols

AATS	ARMAMENT AUXILIARIES TEST SET
ABC	AUDIO BYPASS CONNECTOR
accel	ACCELEROMETER
acft	AIRCRAFT
ACP	ARMAMENT CONTROL PANEL
ACRB	ARMAMENT CONTROL RELAY BOX
ADF	AUTOMATIC DIRECTION FINDER
ADI	ATTITUDE DIRECTOR INDICATOR
AFCS	AUTOMATIC FLIGHT CONTROL SYSTEM
AGE	AEROSPACE GROUND EQUIPMENT
A_H	YAW ANGLE TO TURN THROUGH (SPACE COORDINATES)
$\tilde{A}_H$	SMOOTHED YAW ANGLE TO TURN THROUGH (SPACE COORDINATES)
AIM	AIR INTERCEPT MISSILE
AIR	AIR INTERCEPT ROCKET
A_J	PITCH ANGLE TO TURN THROUGH (AIRCRAFT COORDINATES)
A_K	YAW ANGLE TO TURN THROUGH (AIRCRAFT COORDINATES)
A_L	AIRCRAFT LIFT ACCELERATION
AMCP	ARMAMENT MANUAL CONTROL PANEL
AMI	AIRSPEED MACH INDICATOR
ant.	ANTENNA
AOT	ANGLE ON TARGET
aprch	APPROACH
ARDC	AIR RESEARCH AND DEVELOPMENT COMMAND

Figure 1-2. Special Abbreviations (Sheet 1 of 4)

ILS	INSTRUMENT LANDING SYSTEM
insl	INSTRUMENT
intlk	INTERLOCK
I/O	INPUT/OUTPUT
I/P	IDENTIFICATION OF POSITION
ir	INFRARED (use capitals if referring to the INFRARED SUBSYSTEM)
IRHC	IR HAND CONTROL
IROT	IR ON TARGET
IRS	IR SEARCH
IRT	IR TRACK
IRTOT	IR TRACK ON TARGET
iter	ITERATIVE
jam	JAMMING
LC	LEAD COLLISION
LH	LEFT HAND
LO	LOCAL OSCILLATOR
LOS	LINE OF SIGHT
LP	LONG PULSE
lsd	LEAST SIGNIFICANT DIGIT
LVDT	LINEARLY VARIABLE DISPLACEMENT TRANSFORMER
M	MACH
maggie	MAGNETRON
mag amp	MAGNETIC AMPLIFIER OR SATURABLE REACTOR
MAN IF	MANUAL IF GAIN CONTROL
MART	MOBILE AUTOMATIC RADIATING TESTER
MATTS	MULTIPLE AIRBORNE TARGET TRAJECTORY SYSTEM
M_C	COMMAND MACH
MCC	MODIFIED CLOSE CONTROL
mds	MINIMUM DISCERNIBLE SIGNAL
M_I	INTERCEPTOR MACH
mkr	MARKER
MLG	MAIN LANDING GEAR
MMST	MULTI-MODE STORAGE TUBE
MMT	MANUAL MODE TRIGGER
mod	MODULATOR
mr	MILLIRADIAN
msd	MOST SIGNIFICANT DIGIT
MSM	MAXIMUM SAFE MACH
MSR	MC DONNELL SIMULATOR RECORDER
M_t	MOTOR SIGNAL
MWW	MAIN WHEEL WELL
MWP	MASTER WARNING PANEL
mx	MISSILE
$\overline{\text{NAV}}$	NOT NAVIGATION
NWW	NOSE WHEEL WELL
OSC	OSCILLATOR
OV/UV	OVER VOLTAGE/UNDER VOLTAGE
PARAMP	PARAMETRIC AMPLIFIER
PFN	PULSE FORMING NETWORK
P_K	PROBABILITY OF KILL
PMG	PERMANENT MAGNET GENERATOR
P_o	BAROMETRIC PRESSURE, SEA LEVEL
p-p	PEAK-TO-PEAK
pps	PULSES PER SECOND
press.	PRESSURE
prf	PULSE REPETITION FREQUENCY
P_s	STATIC PRESSURE
$P_s f(M)$	STATIC PRESSURE TIMES FUNCTION OF MACH
P_{si}	INDICATED STATIC PRESSURE
psia	POUNDS PER SQUARE INCH ABSOLUTE
psig	POUNDS PER SQUARE INCH GAGE
P_t	TOTAL PRESSURE (RAM)
PTF	POWER TEST FAIL
PUR	PURSUIT
q_c	DIFFERENTIAL PRESSURE
R	RADAR RANGE
$\dot{R}$	RADAR RANGE RATE
RAD	RADIUS
RAM	RANDOM ACCESS MEMORY
rcvr	RECEIVER
rdr	RADAR (use capitals if referring to the radar subsystem)
RH	RIGHT HAND
R_{TT}	TACAN RANGE
rng	RANGE
ROT	RANGE ON TARGET
RT	RAPID TUNE
RTM	RAPID TUNE MAGNETRON
RTOT	RANGE TRACK ON TARGET
RT/PA	RAPID TUNE/PARAMETRIC AMPLIFIER
SCABU	SIGNAL CONDITIONER AND BUFFER UNIT
SCRG	STABLE COORDINATE REFERENCE GROUP
$\overline{\text{SEARCH}}$	NOT SEARCH
sfp	SWEEP FAILURE PROTECTION
SHEN	SNAPSHOT ENGAGE
SHON	SNAPSHOOT ON

Figure 1-2. Special Abbreviations (Sheet 3 of 4)

SIF	SELECTIVE IDENTIFICATION FEATURES
SMB	SYMBOL
SP	SHORT PULSE
SSGC	SHORT SYSTEM GROUND CHECK
sw	SWITCH
TACAN	TACTICAL AIR NAVIGATION
tach	TACHOMETER
TDDL	TIME DIVISION DATA LINK
T_F	ARMAMENT TRAVEL TIME
tgt	TARGET
T_I	TIME UNTIL ARMAMENT IMPACT
T_i	IMPACT TEMPERATURE
Tprop	PROPELLANT TEMPERATURE
TQD	THROTTLE QUADRANT DISCONNECT
TRK	TRACK
TROT	TRACK RANGE ON TARGET
TRT	TURN RATE TRANSMITTER
TSD	TACTICAL SITUATION DISPLAY
T_t	STAGNATION TEMPERATURE
TTG	TIME TO GO
uhf	ULTRA HIGH FREQUENCY (Use capitals if referring to UHF radio)
UP	UMBILICAL PLUG
V_c	INDICATED AIR SPEED
vert	VERTICAL
vfo	VARIABLE FREQUENCY OSCILLATOR
VI	VISUAL IDENTIFICATION
V_I	AIRCRAFT VELOCITY
vp-p	VOLTAGE PEAK-TO-PEAK
vswr	VOLTAGE STANDING WAVE RATIO
WSEM	WEAPON SYSTEM EVALUATOR MISSILE
xmtr	TRANSMITTER
xp	TRANSPONDER
Z_L	LOW ALTITUDE REFERENCE
Z_s	MINIMUM SAFE ALTITUDE
α	ANGLE OF ATTACK
α_l	LOCAL ANGLE OF ATTACK
α_t	TRUE ANGLE OF ATTACK
Γ	TACAN BEARING ANGLE
ρ	TACAN SLANT RANGE
ν	BEARING ANGLE
Δ	INCREMENTAL CHANGE
ΔH	DIFFERENTIAL ALTITUDE
ΔP	DIFFERENTIAL PRESSURE
δ	RADAR ANTENNA TRACK ERROR
δ_A	ROLL SURFACE COMMAND
δ_D	RADAR ANTENNA AZIMUTH TRACK ERROR
δ_E	PITCH SURFACE COMMAND
δ_E	RADAR ANTENNA ELEVATION TRACK ERROR
ϵ	RADAR ANTENNA ELEVATION ANGLE (AIRCRAFT COORDINATES)
ϵ_D	DESIRED RADAR ANTENNA ELEVATION ANGLE (AIRCRAFT COORDINATES)
ϵ_S	RADAR ANTENNA ELEVATION ANGLE (SPACE COORDINATES)
ϵ_{SD}	DESIRED RADAR ANTENNA ELEVATION ANGLE (SPACE COORDINATES)
ϵ_T	TARGET ELEVATION ANGLE
ζ	DIFFERENCE ANGLE BETWEEN INTERCEPTOR HEADING AND STABLE PLATFORM AZIMUTH GIMBAL POSITION
η	RADAR ANTENNA AZIMUTH ANGLE (AIRCRAFT COORDINATES)
$\dot{\eta}$	RADAR ANTENNA AZIMUTH ANGULAR RATE (AIRCRAFT COORDINATES)
η_D	RADAR ANTENNA AZIMUTH ANGLE DESIRED (AIRCRAFT COORDINATES)
η_S	RADAR ANTENNA AZIMUTH ANGLE (SPACE COORDINATES)
η_{SD}	RADAR ANTENNA AZIMUTH ANGLE DESIRED (SPACE COORDINATES)
λ	AIRCRAFT LATITUDE
θ	AIRCRAFT PITCH ANGLE
$\dot{\theta}$	AIRCRAFT PITCH RATE
θ_{fb}	AIRCRAFT PITCH POSITION
θ_r	AIRCRAFT PITCH REFERENCE
φ	PHASE
ϕ	AIRCRAFT ROLL ANGLE
$\dot{\phi}$	AIRCRAFT ROLL RATE
ϕ_{fb}	AIRCRAFT ROLL POSITION
ϕ_r	AIRCRAFT ROLL REFERENCE
ψ	AIRCRAFT HEADING ANGLE
ψ_e	AIRCRAFT HEADING ERROR
ω	ANGULAR ROTATION
ω_{Ai}	AIRCRAFT ROLL RATE (AIRCRAFT COORDINATES)
ω_{Aj}	AIRCRAFT PITCH RATE (AIRCRAFT COORDINATES)
ω_{Ak}	AIRCRAFT YAW RATE (AIRCRAFT COORDINATES)
ω_D	AZIMUTH ANGULAR VELOCITY OF RADAR ANTENNA TRACKING LINE
ω_E	ELEVATION ANGULAR VELOCITY OF RADAR ANTENNA TRACKING LINE
ω_e	EARTH'S RATE OF ROTATION
ω_{Rr}	RADAR ANTENNA ROLL RATE

Figure 1-2. Special Abbreviations (Sheet 4 of 4)

Simplified Unit Number	Nomenclature	Common Name	Subsystem
	NOTE If no common name is listed, the common name is the same as the simplified unit number.		
002	Indicator Electrical Equipment Rack	Scope Rack	Radar
003	Master Timer Electrical Synchronizer	. . .	Radar
472005	Intercommunications Set Control	Intercomm Control	CN&L
008	GAR Gyro Power Control Unit	. . .	Armament
009	Integrator Electronic Control Amplifier	. . .	FC&M
016	Transmission Line Waveguide Assembly	016 Waveguide	Radar
017	Radar Antenna	Antenna	Radar
019	Converter-Receiver Control (C-2588/ ARR61)	Data Link Control Box	CN&L
020	AGC and Angle Track Waveform Converter	. . .	Radar
024	Pressure Indicator	Pressure Indicator	Radar
026	RT/PA Power Supply	. . .	Radar
034	Computer Mode Annunciator	Data Link Annunciator	Computer
040	IR Signal Data Converter	. . .	Radar
041	Rate Gyro Torque Generator Amplifier	. . .	Radar
043	Missile AFC Channel Control	. . .	Armament
045	Reciprocating Power Driven Air Compressor	. . .	Radar
054	Model LE-6 Airborne Rocket Launcher	Rail	Armament
061	Normal Aircraft Accelerometer	. . .	FC&M
063	Radar Relay-Switch Assembly	. . .	Radar
065	Radar Receiver-Transmitter	RT	Radar
073	LH Fwd Compt Electrical Equipment Rack	Radar Rack	Radar
074	Aft Compt Left Electrical Equipment Rack	CN&L Rack	CN&L
472074	Elect Compt Missile Bay Electrical Equipment Rack	Coffin Rack	CN&L
080	Search and Attack Flight Command Indicator	Scope	Radar
082	Clutter Electronic Gate	. . .	Radar
083	Manual Aircraft & Radar Control	Hand Control	Radar
084	Radar Directional Coupler	. . .	Radar
087	Rocket Control Power Supply	. . .	Armament
095	Tracking Preamplifier Video Amplifier	. . .	Radar
096	Radar Self Test Meter	. . .	Radar
463097	Dehydrator	Dehydrator	Radar
102	TSD Signal Data Converter Electrical Equipment Rack	TSD Rack	CN&L
103	Range Tracking Electrical Synchronizer	. . .	Radar
106	Az Dr Electronic Control Amplifier	. . .	Radar
107	Pressure Regulating Valve	. . .	Radar
109	Roll & Pitch Electronic Control Amplifier	. . .	FC&M
117	Automatic Direction Finder Antenna	ADF Antenna	CN&L
140	Input/Output Signal Data Converter	. . .	Computer
141	Antenna Tracking Electronic Control Amplifier	. . .	Radar
149	Search-Attack Display Photographic Recorder	DSR	Radar
163	AFCS Flight Mode Control	. . .	FC&M
173	Electrical Equipment Rack	Antenna Rack	Radar
174	Aft Compartment Right Electrical Equipment Rack	Armament Rack	Armament
181	Tactical Display Horizontal Situation Indicator	TSD	CN&L

Figure 1-3. Simplified Unit Numbers and Common Names (Sheet 1 of 4)

Simplified Unit Number	Nomenclature	Common Name	Subsystem
190	Receiver-Modulator Cooling Duct Assembly	Cooling Hat	Radar
195	Ind Vid, Az Sweep & Range Voltage Amplifier Assembly	. . .	Radar
196	Radar Self Test Relay-Switch Assembly	. . .	Radar
206	Antenna Servo Electronic Control Amplifier	. . .	Radar
209	Demodulator Channel	. . .	FC&M
216	Radar Waveguide Assembly	216 Waveguide	Radar
220	Digital - Digital Converter (CV-703/ ARR-51)	. . .	CN&L
223	Attack Display Signal Data Converter	. . .	Radar
241	Antenna Control Amplifier Computer	. . .	Radar
○ 259	Bar Setting Analog Signal Control	. . .	FC&M
264	Armament Selection Relay Assembly	. . .	Armament
267	ILAS Glide Slope & Marker Beacon Radio Receiver	. . .	CN&L
273	RH Fwd Compt Electrical Equipment Rack	Computer Rack	Computer
281	Liquid Level Indicator	. . .	IR
289	Stable Element	Stable Table	FC&M
295	Intermediate Frequency/Amplifier	. . .	Radar
305	Mode Selection Radar Set Control	. . .	Radar
○ 306	Vertical Situation Amplifier Assembly	. . .	FC&M
309	Azimuth Electronic Control Amplifier	. . .	FC&M
346	Steering Signal Computer	. . .	Radar
364	Parameter Setting Relay Assembly	. . .	Armament
367	ILAS Localizer Radio Receiver	. . .	CN&L
374	Stable Platform Amplifier Electrical Equipment Rack	SCRG Rack	FC&M
389	Indicator Sweep Generator	. . .	Radar
395	Attack Display Amplifier Assembly	. . .	Radar
396	Stable Coordinate Ref Gp Programmer	. . .	FC&M
405	TACAN Channel Selector Control	TACAN Control box	CN&L
409	Latitude Counter Junction Box	. . .	FC&M
432	X_L Four Port Circulator Wave Guide Assembly	. . .	Radar
441	Passive Detection Synchro Signal Amplifier	. . .	IR
450	Support Electronics	. . .	Armament
▯ 463	Bearing Select Converter Control	Bearing Select Switch	CN&L
464	Mode Selection Relay Assembly	. . .	Armament
472473	TACAN & IR Electrical Equipment Rack	Saddle Rack	CN&L
474	Stable Platform Generator Electrical Equipment Rack	Stable Table Rack	FC&M

Figure 1-3. Simplified Unit Numbers and Common Names (Sheet 2 of 4)

Simplified Unit Number	Nomenclature	Common Name	Subsystem
484	Waveguide Directional Coupler	. . .	Radar
496	Armament Test Relay Assembly	. . .	Armament
499	Special Purpose Electrical Cable	. . .	Radar
505	Communication Frequency Selector Control	UHF Control Box	CN&L
506	Elevation Drive Electronic Control Amplifier	. . .	Radar
○ 511	Flight Director Electrical Equipment Rack	. . .	CN&L
516	Transmission Line Waveguide Assembly	516 Waveguide	Radar
518	Logic & Switching	. . .	Power
▯ 520	Cockpit Display Signal Data Converter No. 1	. . .	CN&L
523	Electronic Time Sharing Signal Data Converter	. . .	Radar
52300	Camera Assembly	. . .	Armament
529	Regulated Direct Current Computer Power Supply	. . .	Computer
52630	Jumper Connector	. . .	Armament
52800	Optical Display Unit	ODU	Armament
529	TACAN Receiver Transmitter	. . .	CN&L
541	Computer-Programmer	. . .	Radar
472564	Group I Control Transfer Relay	. . .	CN&L

Simplified Unit Number	Nomenclature	Common Name	Subsystem
472595	Auxiliary Deflection Direct Current Amplifier	. . .	Radar
596	Armament Electrical Test Panel	. . .	Armament
▯ 602	Cockpit Signal Data Converter Electrical Equipment Rack	602 Rack	CN&L
606	Audio & ADF Electronic Control Amplifier	. . .	CN&L
▯ 620	Cockpit Display Signal Data Converter No. 2	. . .	CN&L
629	TACAN Signal Data Converter	. . .	CN&L
641	AFC High Voltage Power Supply Group Amplifier	. . .	Radar
663	Infrared Relay Switch Assembly	. . .	Radar
472664	Group II Control Transfer Relay Assembly	. . .	CN&L
667	Data Link Receiver (R884/ARR-61)	. . .	CN&L
674	Dehydrator Rack	. . .	Radar
691	Battery Charger	. . .	Aircraft Power
○ 720	Flight Director Signal Data Converter	. . .	CN&L
741	Low Voltage Power Supply	. . .	Radar
			IR

Simplified Unit Number	Nomenclature	Common Name	Subsystem
755	ILS Receiver Control	ILS Control Box	CN&L
472764	Group IIIA Control Transfer Relay Assembly	. . .	CN&L
767	Infrared Receiver	IR Head	IR
774	Dehydrator & Filter Rack	. . .	Radar
780	UHF Channel & Frequency Remote Indicator	. . .	CN&L
796	AWCIS Self Test Panel	. . .	Radar
802	IR Receiver Electrical Equipment Rack	IR Head Rack	IR
811	Time Division Data Link Converter Electrical Equipment	220 Rack	CN&L
821	Interface Amplifier	. . .	FC&M
841	Hydraulic Drive Electronic Control Amplifier	. . .	Radar
846	RAM Arithmetic Computer Control	. . .	Computer
855	Azimuth Scan & Horizon Adjustment Radar Set Control	. . .	Radar
857	Memory Electronics Magnetic Drum Data Storage	Computer Drum	Computer
472864	Group IIIB Control Transfer Relay Assembly	. . .	CN&L

Figure 1 3. Simplified Unit Numbers and Common Names (Sheet 3 of 4)

Simplified Unit Number	Nomenclature	Common Name	Subsystem
866	Xmtr Tun Electronic Control Amplifier	...	Radar
873	Power Supply Electrical Equipment Rack	...	Power
○ 880	Mach Number Indicator Assembly	...	FC&M
896	Infrared Self Test Transmitter	IR Test Target	IR
905	System Power Control	...	FC&M
920	Tactical Display Horiz Situation Signal Data Converter	...	CN&L
926	Multi-DC Power Supply	...	Power
955	Auto-Navigation Selector Control	Homing Point Selector	Computer
○ 980	Com & Target Alt Indicator Assembly	...	FC&M
989	1600 Hz Power Supply	...	Power
▯ *	Displ Gyroscope Assy, AN Type AF/A24G-1	Displacement Gyro	FC&M
▯ *	Amplifier Power Supply, AN Type AF/A24G-1	Amplifier-Power Supply	FC&M
▯ *	Rate Switching Gyroscope, AN Type MC-1	Rate Switching Gyro	FC&M
▯ *	Compass Adapter, AN Type AF/A24G-1	Compass Adapter	FC&M
▯ *	Compass System Controller, AN Type AF/A25G-1	Compass Controller	FC&M
▯ *	Attitude Director Indicator, AN Type ARU-2/A	ADI	FC&M

Simplified Unit Number	Nomenclature	Common Name	Subsystem
▯ *	Mach Safe Speed Airspeed Indicator, AN Type AVU-1/A	AMI Amplifier	FC&M
▯ *	Mach Number Indicated Airspeed Indicator, AN Type AVU-1/A	AMI	FC&M
▯ *	Indicator Component of Horizontal Situation Ind Group AN Type AF/A24J-1	HSI	FC&M
▯ *	Amplifier Component Of Horizontal Situation Ind Group, AN Type AF/A24J/1	HSI Amplifier	FC&M
▯ *	Aircraft Flight Director Computer, AN Type CPU-4/A	CPU-4/A	FC&M
▯ *	Accelerometer Transmitter, AN Type TRU-3/A	Accelerometer	FC&M
▯ *	Azimuth Magnetic Detector, AN Type DT-173/AJN	Flux Valve Transmitter	FC&M
▯ *	Altitude Vertical Speed Amplifier, AN Type AAU-1/A	AVVI Amplifier	FC&M
▯ *	Altitude Vertical Speed Indicator AN Type AAU-1/A	AVVI	FC&M
▯ *	Rate Gyroscope Transmitter, AN Type TRU-2/A	Rate Gyro	FC&M
*	...	Accumulator	IR
*	...	Absorber	IR
*	...	Compressor	IR
*	...	Hourmeter	IR
*	...	IR Desiccant Container	IR

*Government-furnished equipment

Simplified Unit Number	Nomenclature	Common Name	Subsystem
*	...	N_2 Fill Fitting	IR
*	...	Capacitor-Relay	IR
*	Receiver-Transmitter Radio RT-749/ARC-109	RT-749	CN&L
*	Computer, Central Air Data CPU-111	CPU-111	FC&M
*	Test Set-Transponder Set TS-1843A/APX	IFF Test Box	CN&L
*	Receiver-Transmitter RT-859/APX-72	RT-859	CN&L
*	Control Transponder C-6280(P)/APX-72	IFF Control Box	CN&L
*	Transponder Computer KIT-1A/T SEC	...	CN&L
*	Ejection Relay	...	CN&L
*	Antenna Switching Unit SA-1474/A	...	CN&L
○ *	Approach Horizon Indicator	AHI	FC&M
○ *	Course Indicator	CI	FC&M
*	Armament Control Relay Box	ACRB	Armament
*	Armament Control Panel	ACP	Armament
*	Armament Manual Control Panel	AMCP	Armament
*	Missile Intervalometer	Intervalometer	Armament
*	Cabin Air Timer	...	Armament
*	Pitch G Limiter	...	FC&M
*	Turn Rate Transmitter	TRT	FC&M
○ *	Steering Computer ID562A-3B	ID562	CN&L
○ *	Servo Amplifier ID333B-3	ID333	CN&L

Figure 1-3. Simplified Unit Numbers and Common Names (Sheet 4 of 4)

Simplified Unit Number	Nomenclature	Common Name	Subsystem
484	Waveguide Directional Coupler	...	Radar
496	Armament Test Relay Assembly	...	Armament
499	Special Purpose Electrical Cable	...	Radar
505	Communication Frequency Selector Control	UHF Control Box	CN&L
506	Elevation Drive Electronic Control Amplifier	...	Radar
○ 511	Flight Director Electrical Equipment Rack	...	CN&L
516	Transmission Line Waveguide Assembly	516 Waveguide	Radar
518	Logic & Switching	...	Power
▯ 520	Cockpit Display Signal Data Converter No. 1	...	CN&L
523	Electronic Time Sharing Signal Data Converter	...	Radar
52800	Camera Assembly	...	Armament
526	Regulated Direct Current Computer Power Supply	...	Computer
52880	Jumper Connector	...	Armament
52800	Optical Display Unit	ODU	Armament
529	TACAN Receiver Transmitter	...	CN&L
541	Computer-Programmer	...	Radar
472564	Group I Control Transfer Relay	...	CN&L

Simplified Unit Number	Nomenclature	Common Name	Subsystem
472595	Auxiliary Deflection Direct Current Amplifier	...	Radar
596	Armament Electrical Test Panel	...	Armament
▯ 602	Cockpit Signal Data Converter Electrical Equipment Rack	602 Rack	CN&L
606	Audio & ADF Electronic Control Amplifier	...	CN&L
▯ 620	Cockpit Display Signal Data Converter No. 2	...	CN&L
629	TACAN Signal Data Converter	...	CN&L
641	AFC High Voltage Power Supply Group Amplifier	...	Radar
663	Infrared Relay Switch Assembly	...	Radar
472864	Group II Control Transfer Relay Assembly	...	CN&L
667	Data Link Receiver (R884/ARR-81)	...	CN&L
674	Dehydrator Rack	...	Radar
691	Battery Charger	...	Aircraft Power
○ 720	Flight Director Signal Data Converter	...	CN&L
741	Low Voltage Power Supply	...	Radar
			IR

Simplified Unit Number	Nomenclature	Common Name	Subsystem
755	ILS Receiver Control	ILS Control Box	CN&L
472764	Group IIIA Control Transfer Relay Assembly	...	CN&L
767	Infrared Receiver	IR Head	IR
774	Dehydrator & Filter Rack	...	Radar
780	UHF Channel & Frequency Remote Indicator	...	CN&L
796	AWCIS Self Test Panel	...	Radar
802	IR Receiver Electrical Equipment Rack	IR Head Rack	IR
811	Time Division Data Link Converter Electrical Equipment	220 Rack	CN&L
821	Interface Amplifier	...	FC&M
841	Hydraulic Drive Electronic Control Amplifier	...	Radar
846	RAM Arithmetic Computer Control	...	Computer
855	Azimuth Scan & Horizon Adjustment Radar Set Control	...	Radar
857	Memory Electronics Magnetic Drum Data Storage	Computer Drum	Computer
472864	Group IIIB Control Transfer Relay Assembly	...	CN&L

Figure 1-3. Simplified Unit Numbers and Common Names (Sheet 3 of 4)

Simplified Unit Number	Nomenclature	Common Name	Subsystem
866	Xmtr Tun Electronic Control Amplifier	...	Radar
873	Power Supply Electrical Equipment Rack	...	Power
○ 880	Mach Number Indicator Assembly	...	FC&M
896	Infrared Self Test Transmitter	IR Test Target	IR
905	System Power Control	...	FC&M
920	Tactical Display Horiz Situation Signal Data Converter	...	CN&L
926	Multi-DC Power Supply	...	Power
955	Auto-Navigation Selector Control	Homing Point Selector	Computer
○ 980	Com & Target Alt Indicator Assembly	...	FC&M
989	1600 Hz Power Supply	...	Power
□ *	Displ Gyroscope Assy, AN Type AF/A24G-1	Displacement Gyro	FC&M
□ *	Amplifier Power Supply, AN Type AF/A24G-1	Amplifier-Power Supply	FC&M
□ *	Rate Switching Gyroscope, AN Type MC-1	Rate Switching Gyro	FC&M
□ *	Compass Adapter, AN Type AF/A24G-1	Compass Adapter	FC&M
□ *	Compass System Controller, AN Type AF/A25G-1	Compass Controller	FC&M
□ *	Attitude Director Indicator, AN Type ARU-2/A	ADI	FC&M

Simplified Unit Number	Nomenclature	Common Name	Subsystem
□ *	Mach Safe Speed Airspeed Indicator, AN Type AVU-1/A	AMI Amplifier	FC&M
□ *	Mach Number Indicated Airspeed Indicator, AN Type AVU-1/A	AMI	FC&M
□ *	Indicator Component of Horizontal Situation Ind Group AN Type AF/A24J-1	HSI	FC&M
□ *	Amplifier Component Of Horizontal Situation Ind Group, AN Type AF/A24J/1	HSI Amplifier	FC&M
□ *	Aircraft Flight Director Computer, AN Type CPU-4/A	CPU-4/A	FC&M
□ *	Accelerometer Transmitter, AN Type TRU-3/A	Accelerometer	FC&M
□ *	Azimuth Magnetic Detector, AN Type DT-173/AJN	Flux Valve Transmitter	FC&M
□ *	Altitude Vertical Speed Amplifier, AN Type AAU-1/A	AVVI Amplifier	FC&M
□ *	Altitude Vertical Speed Indicator AN Type AAU-1/A	AVVI	FC&M
□ *	Rate Gyroscope Transmitter, AN Type TRU-2/A	Rate Gyro	FC&M
*	...	Accumulator	IR
*	...	Absorber	IR
*	...	Compressor	IR
*	...	Hourmeter	IR
*	...	IR Desiccant Container	IR

*Government-furnished equipment

Simplified Unit Number	Nomenclature	Common Name	Subsystem
*	...	N_2 Fill Fitting	IR
*	...	Capacitor-Relay	IR
*	Receiver-Transmitter Radio RT-749/ARC-109	RT-749	CN&L
*	Computer, Central Air Data CPU-111	CPU-111	FC&M
*	Test Set-Transponder Set TS-1843A/APX	IFF Test Box	CN&L
*	Receiver-Transmitter RT-859/APX-72	RT-859	CN&L
*	Control Transponder C-8280(P)/APX-72	IFF Control Box	CN&L
*	Transponder Computer KIT-1A/T SEC	...	CN&L
*	Ejection Relay	...	CN&L
*	Antenna Switching Unit SA-1474/A	...	CN&L
○ *	Horizontal Direction Indicator 77000000-2	HSI	FC&M
○ *	Attitude Direction Indicator 77200000-2	ADI	FC&M
*	Armament Control Relay Box	ACRB	Armament
*	Armament Control Panel	ACP	Armament
*	Armament Manual Control Panel	AMCP	Armament
*	Missile Intervalometer	Intervalometer	Armament
*	Cabin Air Timer	...	Armament
*	Pitch G Limiter	...	FC&M
*	Turn Rate Transmitter	TRT	FC&M
○ *	Steering Computer ID562A-3B	ID562	CN&L
○ *	Servo Amplifier ID333B-3	ID333	CN&L

Figure 1-3. Simplified Unit Numbers and Common Names (Sheet 4 of 4)

GENERAL DESCRIPTION OF THE MA-1 SYSTEM

The MA-1 System installed in the F106A/B aircraft provides weapon control and automatic flight for all phases of the normal intercept mission. It is possible to fly a mission from wheels up to flare out under completely automatic control, with pilot action required only for throttle adjustment, navigation and flight mode selection, armament selection, and radar lockon. The MA-1 system was designed to work closely with ground environment, which includes semiautomatic ground environment (SAGE) and tactical air navigation (TACAN). The system is also designed to operate independent of any ground control. Normally, the MA-1 performs the following functions:

a. Receives navigation and target information from the ground and displays this information suitably for monitoring the most complex tactical situation.

b. Automatically flies the interceptor to a point (offset point) where the pilot can advantageously detect and identify a target, and after the pilot has selected and locked on to the target, automatically flies the interceptor to a point where the armament is fired.

c. Automatically flies the interceptor back to base, on the optimum standard climb-cruise-descent profile, through penetration and instrument landing approach to the point of flare out.

d. Automatically responds to IFF interrogations.

e. Provides pilot assistance if desired.

f. Provides alternative attack and search measure under a countermeasure environment.

A COMMUNICATIONS, NAVIGATION AND LANDING (CN&L) SUBSYSTEM 9-1

The CN&L subsystem is composed on an integrated complement of radio receivers and transmitters required to fulfill the voice and data link communications functions of the system and to supply the system with inputs from the various navigational aids with which the system operates. This subsystem has five basic components, the command transmitter-receiver, the data link receiver, tactical air navigation (TACAN), instrument landing system (ILS), and identification, friend or foe (IFF) equipment. The command transmitter-receiver provides an air-to-ground and air-to-air voice communications link. The data link receiver receives high speed digital command and target information for display to the pilot and use by the computer, and a single voice channel from the ground control station. The TACAN equipment interrogates TACAN stations and provides the computer and pilot with the interceptor's position relative to these stations for use in interceptor navigation. The ILS receiver provides landing approach information to the pilot and the computer. The IFF transponder responds to interrogations from ground based radar stations, thereby enabling these stations to identify the interceptor. The IFF also responds to friendly aircraft.

Associated with communications and data link receivers is automatic direction finder (ADF) equipment which permits bearings to be taken on the stations to which these receivers are tuned.

B RADAR SUBSYSTEM, 3-1

The MA-1 radar is a tunable 250 kw (nominal) X-band radar capable of automatic searching and tracking. During automatic tracking it supplies the computer subsystem with target data, and supplies the pilot and the computer with steering signals for directing the interceptor on the correct attack course for the selected armament. The radar subsystem incorporates automatic frequency tuning (antifar) in the event of jamming, and jam-angle tracking, which permits the angle tracking of targets employing electronic jamming.

C IR SUBSYSTEM 4-1

The IR subsystem incorporates a heat sensitive device that is designed for optimum detection of infrared energy emitted by the exhaust gases of a jet engine. This subsystem supplements the radar subsystem during search and track where ground clutter and countermeasures decrease radar effectiveness, or acts as a substitute in case of radar failure. The IR subsystem is capable of automatic search, hand control, and automatic tracking of an IR source. During tracking, target data is supplied to an IR range computer which permits accurate armament launching in the absence of radar range information.

D FLIGHT CONTROL AND MEASUREMENT (FC&M) SUBSYSTEM, 8-1

The FC&M subsystem provides information of aircraft heading, altitude, and speed, as well as incorporating the automatic flight control system. The subsystem can be broken down into three basic groups: automatic flight control system (AFCS), stable coordinate reference group (SCRG), and air data computer

E COMPUTER SUBSYSTEM, 6-1

The MA-1 system's principal computing element is the IRAM general-purpose, medium-speed, series-parallel, fixed point computer which operates at a clock rate of 381 kHz. The purpose of the computer subsystem is to provide the necessary computations to direct the air defense mission of searching out, intercepting and destroying enemy aircraft, thus serving as the basic controlling element in the integrated MA-1 system. The computer also has extensive self-test capabilities that can verify the correct operation of the computer subsystem and provide the information to quickly isolate a detected malfunction. Basic computations performed by the computer provide interceptor speed, target position, steering, attitude information, missile antenna positioning signals, and signals for use by the AFCS, as required by the various subsystems during the operational phases of the air defense mission. Target information supplied to the computer by the CN&L subsystem can be in several different forms such as provided by TACAN, GCI, and data link. Until a target comes within range of the search radar, the computer processes received positional data to generate the navigational steering signals required to guide the interceptor to its attack phase. During the attack phase of the mission, the computer provides the necessary data to pursue either the lead collision, or pursuit attack course and subsequently generate the required armament and ballistic signals. The armament and ballistic signals are utilized by the armament subsystem to prepare and fire the selected weaponry available in order to accomplish the destruct phase of the mission.

F ARMAMENT SUBSYSTEM, 6-1

Before any armament can be fired, it must undergo a series of preparatory operations. The armament auxiliaries perform the prelaunch preparation of all three types of armament and control their launching. The manner in which the armament is prepared varies somewhat, depending upon the type of attack course being flown. In general, a few preliminary preparations begin when MA-1 system power is first turned on, the rest of the preparations are performed in a carefully planned sequence immediately before firing.

G AIRCRAFT ARMAMENT EQUIPMENT

That portion of the aircraft mounted armament equipment which is associated with the MA-1 system consists of the door and launcher control valves, switches which indicate the position of doors and launchers, an intervalometer, a relay switching unit and a cable air brake.

H FLIGHT CONTROLS

Electrical signals from the AFCS to the HEP and HRP valves control the flow of hydraulic fluid to the control surface actuators, thereby controlling the movement of the aircraft.

J COCKPIT

All nav displays, radar displays, and flight instruments are located in the cockpit. The control units for all subsystems are mounted in the cockpit.

K WEAPONS

The F-106A/B interceptor is designed to carry, as armament, one unguided rocket and four guided missiles. The rocket is the AIR-2A nuclear warhead weapon, the missiles are the AIM-4F radar seeker and the AIM-4G infrared seeker. The AIR-2A rocket is timed to explode at a predetermined time after launching. It is carried on a centrally located rack in the armament bay and is launched by ejection. The normal missile load consists of two AIM-4F's loaded on the forward rails and two AIM-4G's loaded on the aft rails.

L POWER SUBSYSTEM, 7-1

The aircraft power system provides 115 v, 400 Hz, three phase voltage and +28 v to the power subsystem. These voltages are transferred to the MA-1 system in their existing power forms. The 115 v, 400 Hz, three phase voltage is also utilized in the power subsystem to derive additional types of power forms. These power forms are also transferred to the MA-1 system

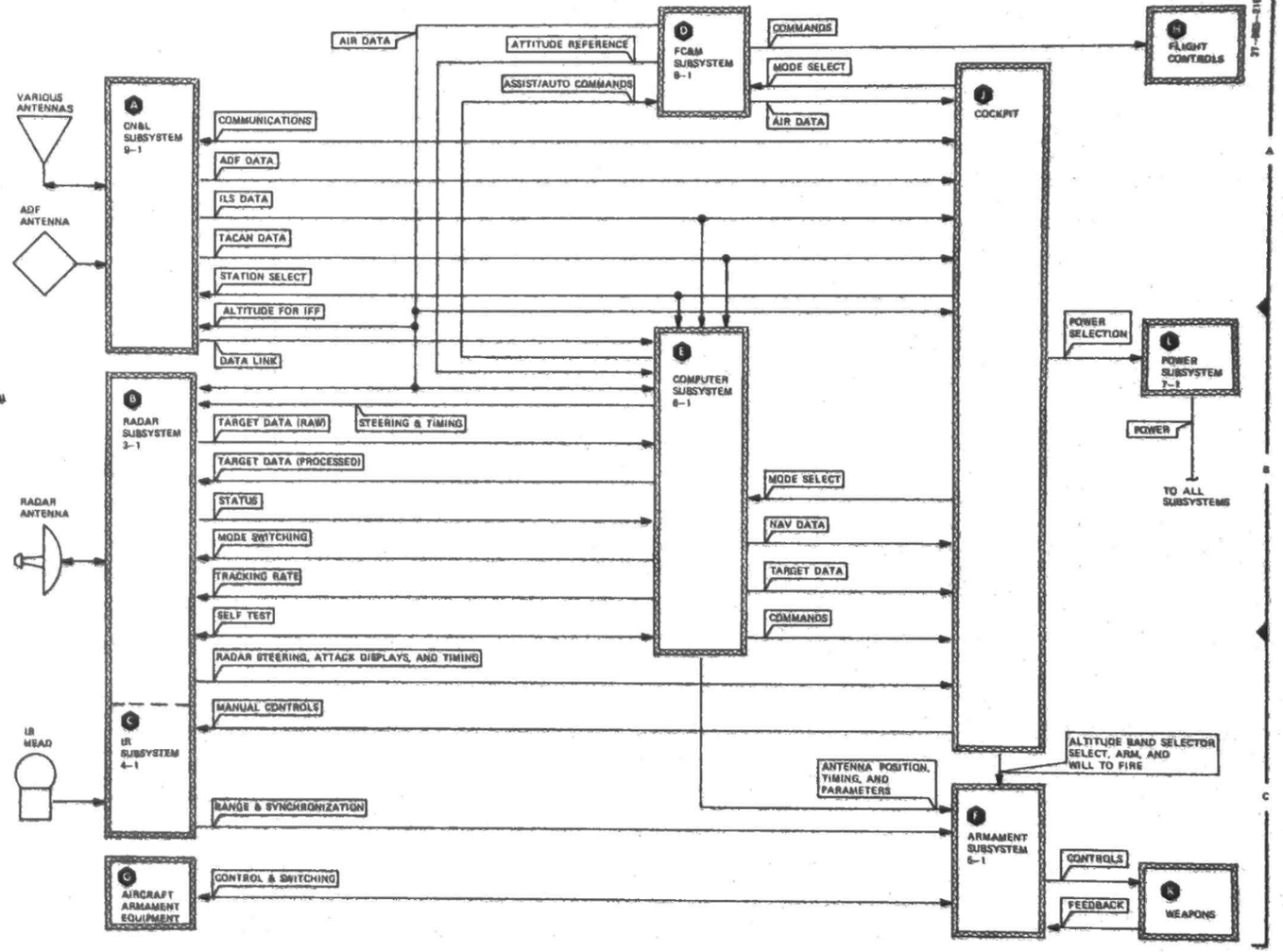


Figure 2-1. MA-1 System Block Diagram

The short system ground check (SSGC) permits one man using system self-contained test features and the Mobile Automatic Radiating Tester (MART), to perform a rapid go no-go test of the MA-1 or AN/ASQ-25 systems. Test lamps on the self-test panel (796) and cockpit instruments are monitored to determine if each test has been completed satisfactorily. Cockpit instruments are checked operationally and used as read-out devices. If a malfunction is indicated by a test failure, the fault indication will isolate the malfunction. Short system ground check functional diagrams, subsystem self-tests, computer bay tests, and flightline fault isolation procedures can be used to further isolate the fault to a specific unit. Abnormal indications are very important for the full use of fault isolation procedures. The SSGC procedures are in F-106 AWCIS Condensed Maintenance Guide 1F-106A-2-27-1 and F-106 AWCIS Check and Adjustment Procedures 1F-106A-2-27-2. Satisfactory completion of the entire SSGC provides high probability that the MA-1 or AN/ASQ-25 system can perform its tactical mission.

SSGC test sequences are started automatically with the seven test position SELECTOR TEST switch (796). Test lamps provide test information and pass-fail indications. Three lamps light with a steay on light; three lamps (COMP, FLT SENS and RADAR) may be steady or flashing. The AFCS lamp is not utilized and remains off regardless of the position of the SELECTOR TEST switch (796). When a test lamp (other than the AFCS) has no particular test significance, it is lighted directly by a voltage supplied within the 796 unit.

Pressing GND TEST INTER switch causes the MA-1 or AN/ASQ-25 digital computer to generate command signals and broadcast a test request message through the ARC-109 radio in aircraft. The MART receives the message through the 192 test stand ARC-109 radio, decodes the test request message, establishes the squadron and aircraft identity data link address, and initiates the automatic test sequence.

SSGC FUNCTIONAL DIAGRAMS. The functional diagrams represent the operation of SSGC's 1 thru 7 and should be used in conjunction with SSGC procedures as an aid in isolating faults if an abnormal indication occurs.

The circuits are essentially the same for vertical and round instrument aircraft configurations, except for output circuits to the instruments. The SSGC functional diagrams show the +28v outputs from 796 (used to start SSGC1s), and explain the sequence of relay operation and signal flow involved in each check.

MAIN SWITCHING.

Diagram shows signal paths and relay conditions with SELECTOR TEST switch (796) at OFF.

LOGIC CHART FOR SYSTEM TEST A, B, C								0 = "OFF" 1 = "ON"
	SYSTEM TEST IDENTIFICATION TO COMPUTER							
	OFF	SSGC1	SSGC2	SSGC3	SSGC4	SSGC5	SSGC6	SSGC7
ST A, D107	0	0	0	0	1	1	1	1
ST B, D115	0	0	1	1	1	0	0	1
ST C, D104	0	1	0	1	0	1	0	1

SYSTEM TEST IDENTIFICATION. Individual tests are identified to digital computer by system test (ST) A, B and C as shown in logic chart. System tests A, B and C have no function other than identification of SSGC 1 through 7 to computer (140).

Figure 2-2. SSGC (Sheet 1 of 65: Main Switching, Sheet 1 of 4)

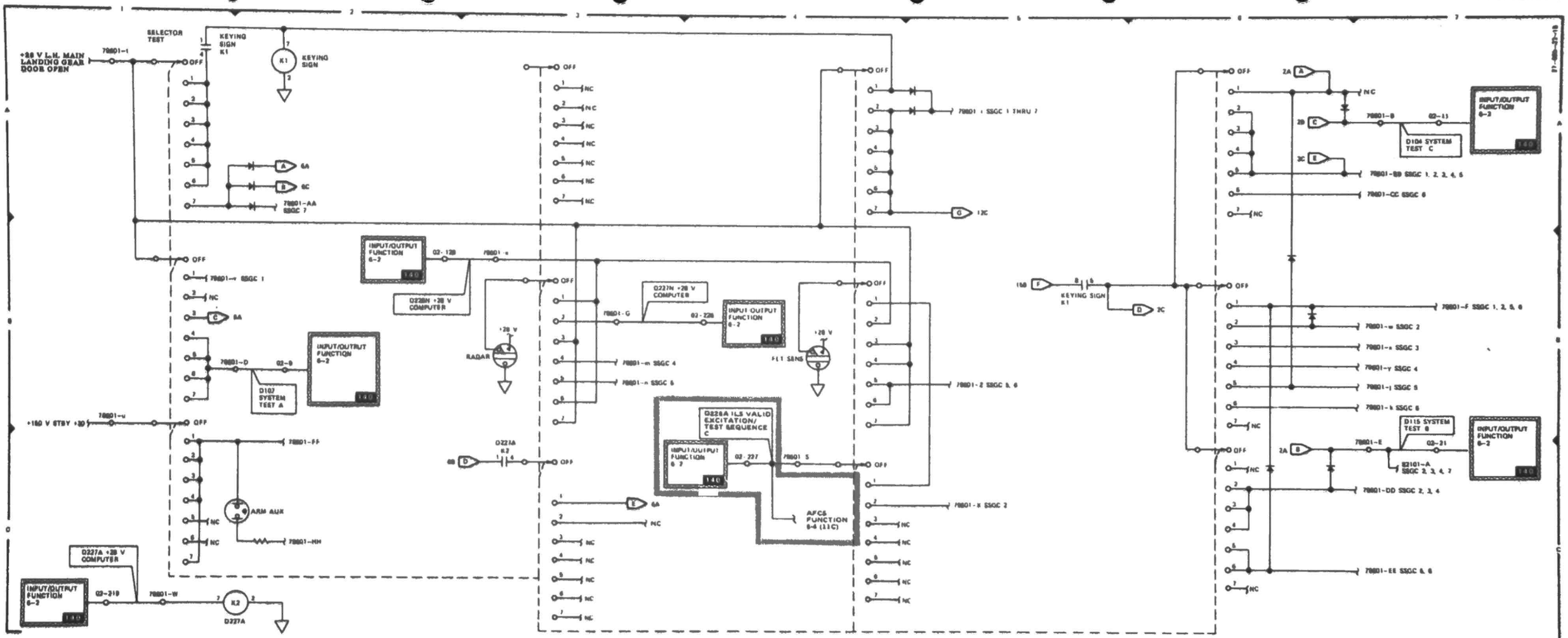
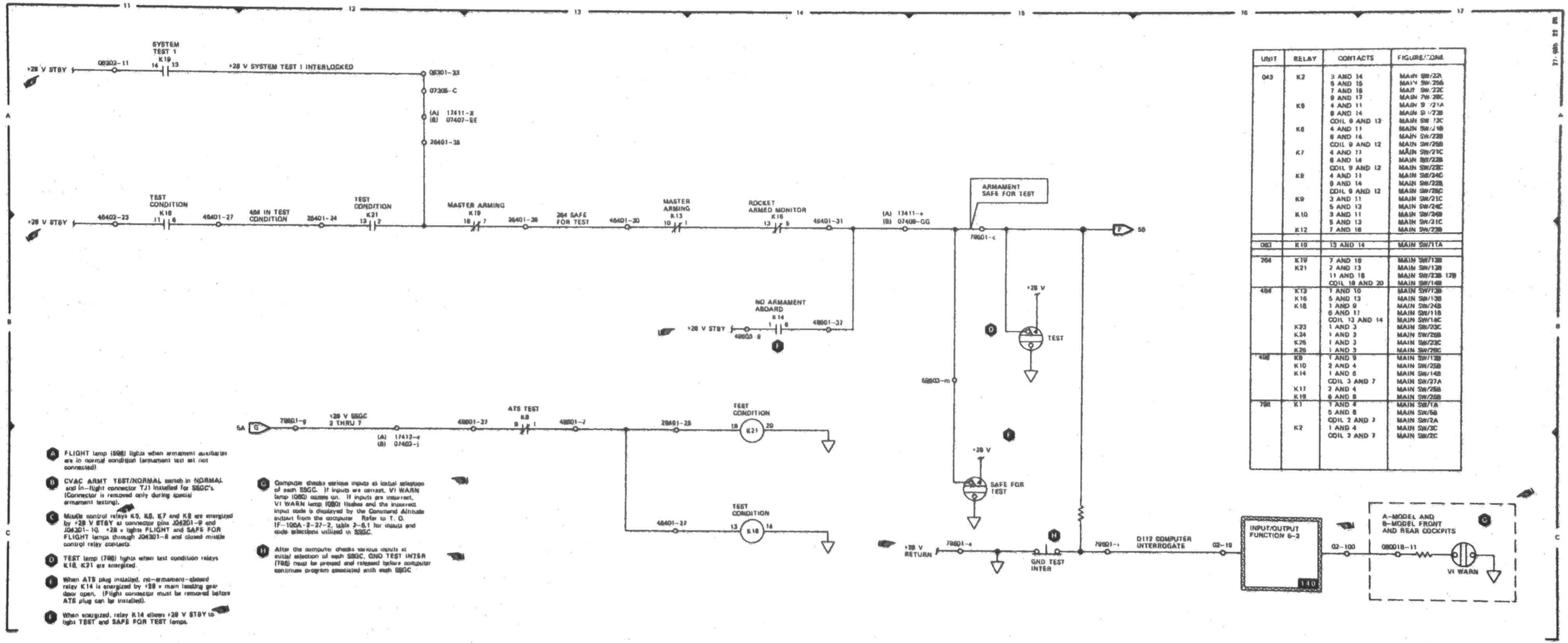


Figure 3-3. SSGC (Sheet 2 of 65: Main Switching, sheet 2 of 4)



UNIT	RELAY	CONTACTS	FIGURE/TABLE
043	K2	3 AND 14	MAIN SW/22A
		5 AND 15	MAIN SW/22B
		7 AND 16	MAIN SW/22C
		9 AND 17	MAIN SW/22D
	K6	4 AND 11	MAIN SW/21A
		6 AND 14	MAIN SW/21B
		COIL 9 AND 12	MAIN SW/21C
	K8	4 AND 11	MAIN SW/24B
		6 AND 14	MAIN SW/22B
		COIL 9 AND 12	MAIN SW/25B
	K7	4 AND 11	MAIN SW/21C
		6 AND 14	MAIN SW/22B
		COIL 9 AND 12	MAIN SW/22C
	K8	4 AND 11	MAIN SW/24C
		6 AND 14	MAIN SW/22B
		COIL 9 AND 12	MAIN SW/25C
	K9	3 AND 11	MAIN SW/21C
		5 AND 13	MAIN SW/24C
	K10	3 AND 11	MAIN SW/24B
		5 AND 13	MAIN SW/21C
	K12	7 AND 16	MAIN SW/23B
083	K19	13 AND 14	MAIN SW/11A
264	K19	7 AND 16	MAIN SW/13B
	K21	2 AND 13	MAIN SW/13B
		11 AND 18	MAIN SW/23B 12B
		COIL 18 AND 20	MAIN SW/14B
484	K13	1 AND 10	MAIN SW/13B
	K16	5 AND 13	MAIN SW/13B
	K18	1 AND 9	MAIN SW/24B
		6 AND 11	MAIN SW/11B
		COIL 13 AND 14	MAIN SW/16C
	K23	1 AND 3	MAIN SW/23C
	K24	1 AND 3	MAIN SW/26B
	K25	1 AND 3	MAIN SW/23C
	K26	1 AND 3	MAIN SW/26C
486	K8	1 AND 9	MAIN SW/13B
	K10	2 AND 4	MAIN SW/25B
	K14	1 AND 6	MAIN SW/14B
		COIL 3 AND 7	MAIN SW/27A
	K17	2 AND 4	MAIN SW/25B
	K19	6 AND 8	MAIN SW/25B
786	K1	1 AND 4	MAIN SW/1A
		5 AND 8	MAIN SW/6A
		COIL 2 AND 3	MAIN SW/2A
	K2	1 AND 4	MAIN SW/3C
		COIL 2 AND 3	MAIN SW/2C

A FLIGHT lamp (598) lights when armament auxiliaries are in normal condition (armament test set not connected).

B CVAC ARMT TEST/NORMAL switch in NORMAL and in-flight connector TJ1 installed for SSGC's. (Connector is removed only during special armament testing).

C Missile control relays K5, K6, K7 and K8 are energized by +28 V STBY at connector pins J04301-9 and J04301-10. +28 v lights FLIGHT and SAFE FOR FLIGHT lamps through J04301-8 and closed missile control relay contacts.

D TEST lamp (786) lights when test condition relays K18, K21 are energized.

E When ATS plug installed, no-armament-aboard relay K14 is energized by +28 v main landing gear door open. (Flight connector must be removed before ATS plug can be installed).

F When energized, relay K14 allows +28 V STBY to light TEST and SAFE FOR TEST lamps.

G Computer checks various inputs at initial selection of each SSGC. If inputs are correct, VI WARN lamp (080) comes on. If inputs are incorrect, VI WARN lamp (080) flashes and the incorrect input code is displayed by the Command Altitude output from the computer. Refer to T. O. 1F-106A-2-27-2, table 2-6.1 for inputs and code selections utilized in SSGC.

H After the computer checks various inputs at initial selection of each SSGC, GND TEST INTER (786) must be pressed and released before computer continues program associated with each SSGC.

Figure 2-2. SSGC (Sheet 3 of 65: Main Switching, sheet 3 of 4)

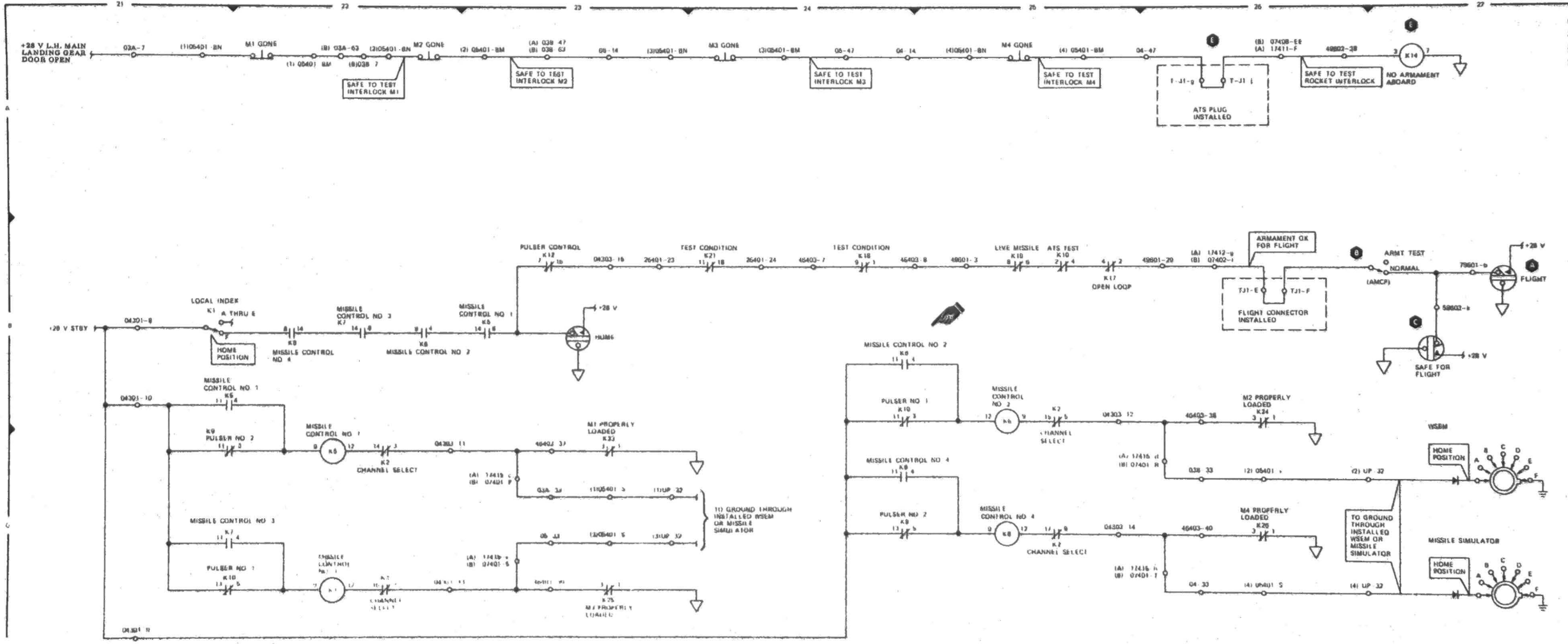


Figure 3-3. SSOC (Sheet 4 of 65: Main Switching, sheet 4 of 4)

SHORT SYSTEM GROUND CHECK 1.

SSGC 1 checks:

a. Armament auxiliaries are safe for flight and safe for testing.

b. Digital computer self-test (TF routine).

c. Digitizers slew test (LZ routine).

d. That the simulated high-speed, high-altitude air data conditions required for the successful completion of SSGC's 2 through 5 are established.

e. All 796 unit lamps except AFCS.

f. The rapid tune hydraulic control function for all tune rates, SNIFF, and jam avoid.

SSGC 1 for aircraft with Integrated (round) Instrument System is primarily the same as for the ARDC Integrated (vertical) Instrument System. There are fewer cockpit display indications in aircraft with the round instruments. The circuits are essentially the same for both aircraft, except for output circuits to the cockpits.

(A) STS and not-AFCS-engage relay 1K1 (821) energizes after computer (140) LZ routine completion, to keep AFCS engage relay 2K5 (821) deenergized. If AFCS subsystem is energized, full authority relays in the 821 unit are energized allowing AFCS steering signals to actuate the hydraulic elevon positioner (HEP) valves for positioning elevons.

(B) Keying sign relay K1 (796) energized and locked up with SELECTOR TEST switch (796) in position No. 1.

(C) Annunciator (905) energized to its TEST position.

(D) Test condition relay K1 (905) energizes to remove +28 v stable platform OK signal to annunciator when stable coordinate reference group SCRG) is in the normal mode.

(E) SSGC 1 relay K19 (003) energized with SELECTOR TEST switch (796) in position 1.

(F) If on, PTF lamp indicates a LW routine failed prior to beginning the SSGC.

(G) Computer sets D226 high (no test involved) to light RADAR lamp.

(H) Computer stops testing and COMP lamp flashes if an error is detected in any TF routines. COMP lamp lights after successful completion of the TF routine.

(J) Computer sets D227A high during beginning of LZ if checks on one of the ambient values of Mach or Altitude (H_p) pass.

(K) Computer stops testing and FLT SENS lamps flashes if an error is detected in LZ routine. FLT SENS lamp lights after successful complete of LZ routine.

(L) Tracking error zero relay K8 energizes when keying sign relay K1 (796) is energized and grounds azimuth and elevation track error signals (α_D and α_E). This prevents radar antenna movement caused by noise or drift in the radar video and error signal processing circuits.

UNIT	RELAY	CONTACTS	FIGURE ZONE
003	K9	4 AND 10	SSGC1/64B
026	K1	1 AND 6 2 AND 5 COIL 3 AND 7	SSGC1/52A SSGC1/52A SSGC1/46B
	K2	1 AND 6 COIL 3 AND 7	SSGC1/46A SSGC1/55B
	K3	2 AND 5 COIL 3 AND 7	SSGC1/55B SSGC1/55A
063	K6	7 AND 16	SSGC1/64A
	K7	1 AND 4	SSGC1/64A
	K17	1 AND 4 5 AND 8 COIL 2 AND 7	SSGC1 61A SSGC1 46B SSGC1/45C
	K18	11, 12 AND 18	SSGC1/45B
	K19	4 AND 5 9, 10 AND 11 COIL 1 AND 2	SSGC1/53C, 63C SSGC1 55C SSGC1/63B, 2B
	K22	6 AND 8 COIL 3 AND 7	SSGC1/53C SSGC1/53C, 63C
065	K351	2, 4 AND 5 1, 6 AND 8 COIL 3 AND 7	SSGC1/64B SSGC1/65B SSGC1/65B
	K451	1 AND 5 2 AND 6 COIL 3 AND 7	SSGC1/52C SSGC1/53C SSGC1/53A
	K452	COIL 3 AND 7	SSGC1. 63C
080	K3	COIL 3 AND 7	SSGC1/62B
141	K8	COIL 3 AND 7	SSGC1/3C
163	K1	1 AND 6 2 AND 5 COIL 3 AND 7	SSGC1/13B SSGC1/13C SSGC1/13B
	K2	2 AND 5 6 AND 8 COIL 3 AND 7	SSGC1/13B SSGC1/13B SSGC1/14B
195	K7	COIL 3 AND 7	SSGC1/62B
196	K14	9 AND 17	SSGC1/65A
295	K1	2, 4 AND 5 COIL 3 AND 7	SSGC1/62A SSGC1/54C
	K101	1 AND 2 COIL 3 AND 7	SSGC1/45C SSGC1/63A
305	K1	B2 AND B3	SSGC1/65A
	K3	A2 AND A3	SSGC1/66A
	K4	2 AND 3	SSGC1/66A
	K7	A1 AND A2	SSGC1/66A
496	K13	2 AND 4	SSGC1/17C
706	K1	1 AND 4 COIL 5 AND 7	SSGC1/1B SSGC1/1B
821	1K1	COIL 1 AND 2	SSGC1/4C
	1K2	COIL 1 AND 2	SSGC1/4C
	2K1	COIL 1 AND 2	SSGC1/16A
	2K1A	1 AND 2	SSGC1/12B
	2K1B	1 AND 2	SSGC1/16B
	2K2	COIL 1 AND 2	SSGC1/16A
	2K5	B2 AND B3	SSGC1/4C
	2K7	COIL 1 AND 2	SSGC1/4C
	3K1	2, 3, 7 AND 8	SSGC1/17A
841	K1	2, 4 AND 5 1, 6 AND 8 COIL 3 AND 7	SSGC1/45B SSGC1/45B SSGC1/65B
	K2	9 AND 11	SSGC1/65A
	K5	9 AND 11 COIL 6 AND 12	SSGC1/64A SSGC1/47B
	K9	COIL 3 AND 7	SSGC1/47A
	K12	COIL 3 AND 7	SSGC1/47A
	K7	COIL 3 AND 7	SSGC1/47B
	K8	COIL 6 AND 12	SSGC1/47B
	K9	6 AND 8	SSGC1/43A
	K10	9 AND 11	SSGC1/42A
	K11	1 AND 13 COIL 6 AND 12	SSGC1/64A SSGC1/47B
866	K9	1 AND 2 5 AND 6 COIL 3 AND 7	SSGC1/52A SSGC1/52A SSGC1/46A
905	K1	3 AND 7 COIL 4 AND 5	SSGC1/2A SSGC1/2A
CVAC	PRIMARY HYDRAULIC PRESSURE (A)K36(B)K37	N.O.	SSGC1/3C
	SECONDARY HYDRAULIC PRESSURE (A)K37(B)K36	N.O.	SSGC1/3C
CVAC	RUDDER INTLK (K39)	C AND D COIL A AND B	SSGC1/15B SSGC1/16B
CVAC	G LIMIT INTLK (K16)	C AND D COIL A AND B	SSGC1/15A SSGC1/15A
CVAC	RUDDER UNLOCK SOLENOID	COIL D AND E	SSGC1/17B

Figure 2-2. SSGC (Sheet 5 of 65; SSGC 1, Sheet 1 of 8)

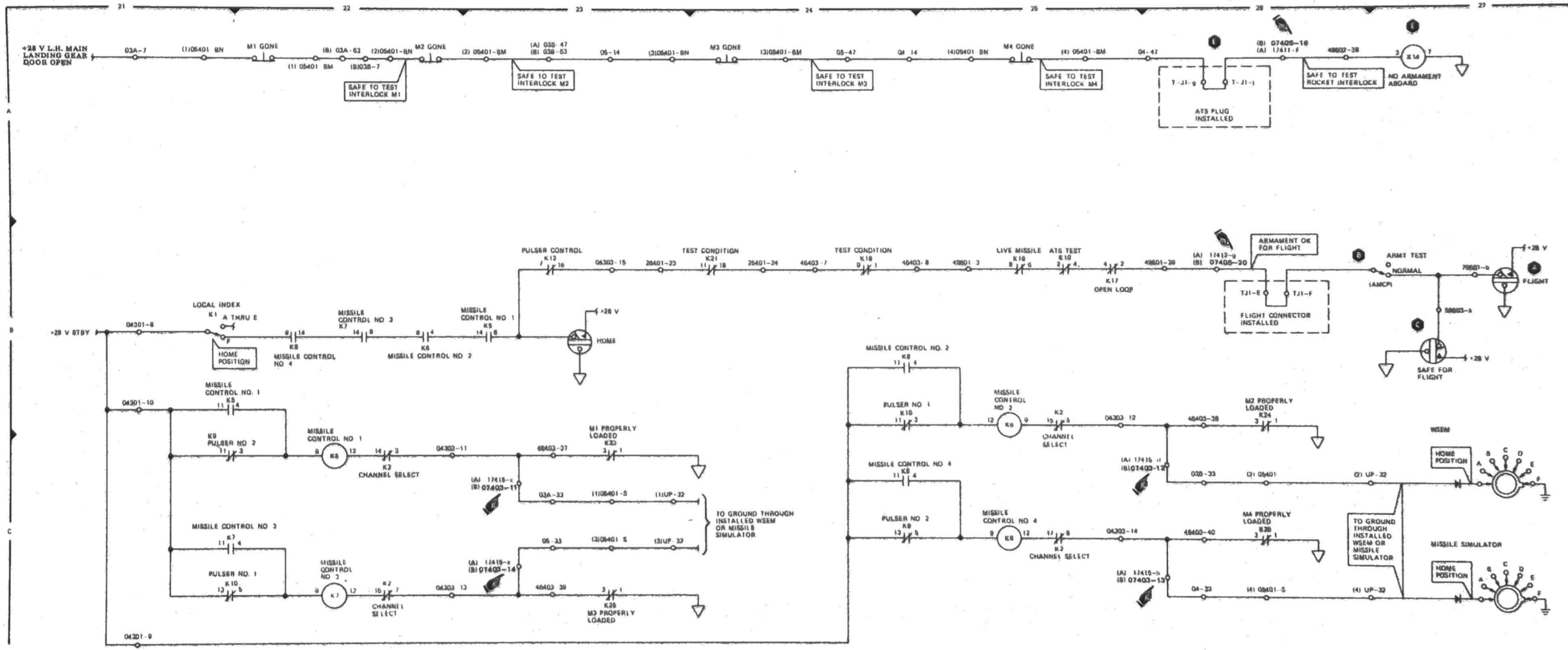


Figure 2-3. SSGC (Sheet 4 of 65; Main Switching, sheet 4 of 4)

SHORT SYSTEM GROUND CHECK 1.

SSGC 1 checks:

a. Armament auxiliaries are safe for flight and safe for testing.

b. Digital computer self-test (TF routine).

c. Digitizers slew test (LZ routine).

d. That the simulated high-speed, high-altitude air data conditions required for the successful completion of SSGC's 2 through 5 are established.

e. All 796 unit lamps except AFCS.

f. The rapid tune hydraulic control function for all tune rates, SNIFF, and jam avoid.

SSGC 1 for aircraft with Integrated (round) Instrument System is primarily the same as for the ARDC Integrated (vertical) Instrument System. There are fewer cockpit display indications in aircraft with the round instruments. The circuits are essentially the same for both aircraft, except for output circuits to the cockpits.

(A) STS and not-AFCS-engage relay 1K1 (821) energizes after computer (140) LZ routine completion, to keep AFCS engage relay 2K5 (821) deenergized. If AFCS subsystem is energized, full authority relays in the 821 unit are energized allowing AFCS steering signals to actuate the hydraulic elevon positioner (HEP) valves for positioning elevons.

(B) Keying sign relay K1 (796) energized and locked up with SELECTOR TEST switch (796) in position No. 1.

(C) Annunciator (905) energized to its TEST position.

(D) Test condition relay K1 (905) energizes to remove +28 v stable platform OK signal to annunciator when stable coordinate reference group SCRG) is in the normal mode.

(E) SSGC 1 relay K19 (063) energized with SELECTOR TEST switch (796) in position 1.

(F) If on, PTF lamp indicates a LW routine failed prior to beginning the SSGC.

(G) Computer sets D226 high (no test involved) to light RADAR lamp.

(H) Computer stops testing and COMP lamp flashes if an error is detected in any TF routines. COMP lamp lights after successful completion of the TF routine.

(J) Computer sets D227A high during beginning of LZ if checks on one of the ambient values of Mach or Altitude (H_p) pass.

(K) Computer stops testing and FLT SENS lamps flashes if an error is detected in LZ routine. FLT SENS lamp lights after successful complete of LZ routine.

(L) Tracking error zero relay K8 energizes when keying sign relay K1 (796) is energized and grounds azimuth and elevation track error signals (σ_D and σ_E). This prevents radar antenna movement caused by noise or drift in the radar video and error signal processing circuits.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
003	K9	4 AND 10	SSGC1/64B
026	K1	1 AND 6 2 AND 5 COIL 3 AND 7	SSGC1/52A SSGC1/52A SSGC1/46B
	K2	1 AND 6 COIL 3 AND 7	SSGC1/46A SSGC1/55B
	K3	2 AND 5 COIL 3 AND 7	SSGC1/55B SSGC1/55A
063	K6	7 AND 16	SSGC1/64A
	K7	1 AND 4	SSGC1/64A
	K17	1 AND 4 5 AND 8 COIL 2 AND 7	SSGC1/61A SSGC1/46B SSGC1/45C
	K18	11, 12 AND 18	SSGC1/45B
	K19	4 AND 5 9, 10 AND 11 COIL 1 AND 2	SSGC1/53C, 63C SSGC1/55C SSGC1/63B, 2B
	K22	6 AND 8 COIL 3 AND 7	SSGC1/53C SSGC1/53C, 63C
065	K351	2, 4 AND 5 1, 6 AND 8 COIL 3 AND 7	SSGC1/64B SSGC1/65B SSGC1/65B
	K451	1 AND 5 2 AND 6 COIL 3 AND 7	SSGC1/52C SSGC1/52C SSGC1/53A
	K452	COIL 3 AND 7	SSGC1/53C
080	K3	COIL 3 AND 7	SSGC1/62B
141	K8	COIL 3 AND 7	SSGC1/3C
163	K1	1 AND 6 2 AND 5 COIL 3 AND 7	SSGC1/13B SSGC1/13C SSGC1/13B
	K2	2 AND 5 6 AND 8 COIL 3 AND 7	SSGC1/13B SSGC1/13B SSGC1/14B
195	K7	COIL 3 AND 7	SSGC1/62B
196	K14	9 AND 17	SSGC1/65A
295	K1	2, 4 AND 5 COIL 3 AND 7	SSGC1/62A SSGC1/54C
	K101	1 AND 2 COIL 3 AND 7	SSGC1/45C SSGC1/63A
305	K1	B2 AND B3	SSGC1/65A
	K3	A2 AND A3	SSGC1/66A
	K4	2 AND 3	SSGC1/66A
	K7	A1 AND A2	SSGC1/66A
496	K13	2 AND 4	SSGC1/17C
796	K1	1 AND 4 COIL 5 AND 7	SSGC1/1B SSGC1/1B
821	1K1	COIL 1 AND 2	SSGC1/4C
	1K2	COIL 1 AND 2	SSGC1/4C
	2K1	COIL 1 AND 2	SSGC1/16A
	2K1A	1 AND 2	SSGC1/12B
	2K1B	1 AND 2	SSGC1/16B
	2K2	COIL 1 AND 2	SSGC1/16A
	2K5	B2 AND B3	SSGC1/4C
	2K7	COIL 1 AND 2	SSGC1/4C
	3K1	2, 3, 7 AND 8	SSGC1/17A
841	K1	2, 4 AND 5 1, 6 AND 8 COIL 3 AND 7	SSGC1/45B SSGC1/45B SSGC1/65B
	K2	9 AND 11	SSGC1/65A
	K5	9 AND 11 COIL 6 AND 12	SSGC1/64A SSGC1/47B
	K6	COIL 3 AND 7	SSGC1/47A
	K12	COIL 3 AND 7	SSGC1/47A
	K7	COIL 3 AND 7	SSGC1/47B
	K8	COIL 6 AND 12	SSGC1/47B
	K9	6 AND 8	SSGC1/43A
	K10	9 AND 11	SSGC1/42A
	K11	1 AND 12 COIL 6 AND 12	SSGC1/64A SSGC1/47B
866	K9	1 AND 2 5 AND 6 COIL 3 AND 7	SSGC1/52A SSGC1/52A SSGC1/46A
905	K1	3 AND 7 COIL 4 AND 5	SSGC1/2A SSGC1/2A
CVAC	PRIMARY HYDRAULIC PRESSURE (A)K36(B)K37	N. O.	SSGC1/3C
	SECONDARY HYDRAULIC PRESSURE (A)K37(B)K38	N. O.	SSGC1/3C
CVAC	RUDDER INTLK (K39)	C AND D COIL A AND B	SSGC1/15B SSGC1/16B
CVAC	G LIMIT INTLK (K18)	C AND D COIL A AND B	SSGC1/15A SSGC1/15A
CVAC	RUDDER UNLOCK SOLENOID	COIL D AND E	SSGC1/17B

Figure 2-8. SSGC (Sheet 5 of 65: SSGC 1, Sheet 1 of 6)

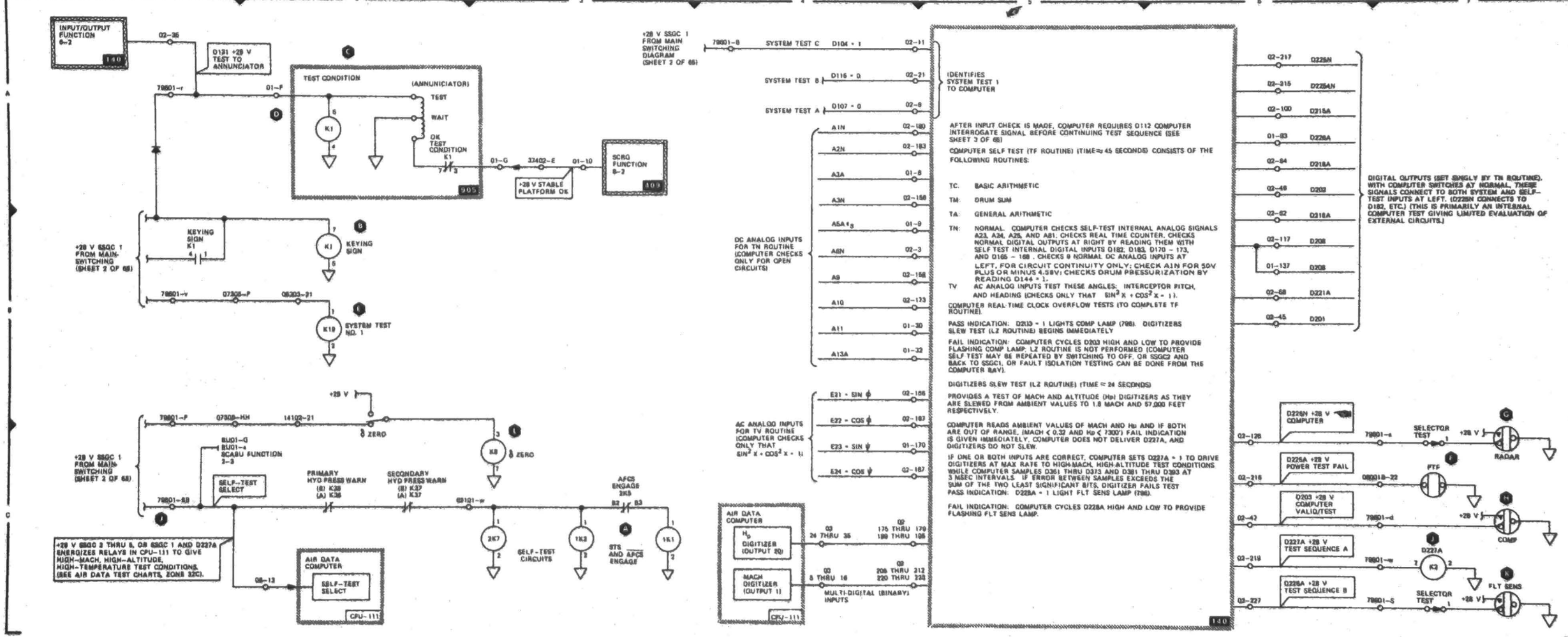


Figure 2-2. SSGC (Sheet 6 of 65; SSGC 1, sheet 2 of 8)

A Power monitor relay 3K1 (821) energizes if all internal supply voltages are correct. This provides a return for emergency direct manual relays (EDM) 2K1 and 2K2 (821), energized by +28 v non-essential voltage through EMER MANUAL switch, (083).

B Rudder interlock relay (CVAC) energizes after EDM relays when FLT MODE switch (163) in YAW, PITCH, ASSIST or AUTO.

C G- limit interlock relay energizes and holds unless pitch G- limits of aircraft exceeded.

D Flight mode hold relay K2 (163) then energizes with flight mode (FLT MODE) switch (163) in PITCH DAMP position and EDM relay 2K1 (821) energized. Flight mode hold solenoid holds FLT MODE switch (163) in selected position.

E Pressing and releasing emergency direct manual (EMER MANUAL) switch (083) deenergizes EDM relays 2K1 and 2K2 and rudder interlock relay CVAC. Flight mode hold relay K2 and flight mode hold solenoid L1 lose +28 V in both PITCH DAMP and YAW DAMP positions of FLT MODE switch (163)

F Flight mode failure warning relay K1 (163) energizes through closed contacts of deenergized flight mode hold relay K2 (163) and locks up. FLT MODE switch (163) steps back to direct manual (DIR MAN) position where flight mode hold relay locks up on +28 v nonessential through 16301-N.

G FLIGHT MODE FAILURE warning lamp on master warning panel (CVAC) energizes through relay K1 (163) contacts.

H When MAN MODE TRIGGER on 083 unit is pressed, K1 (163) deenergizes and FLIGHT MODE FAILURE warning lamp extinguishes.

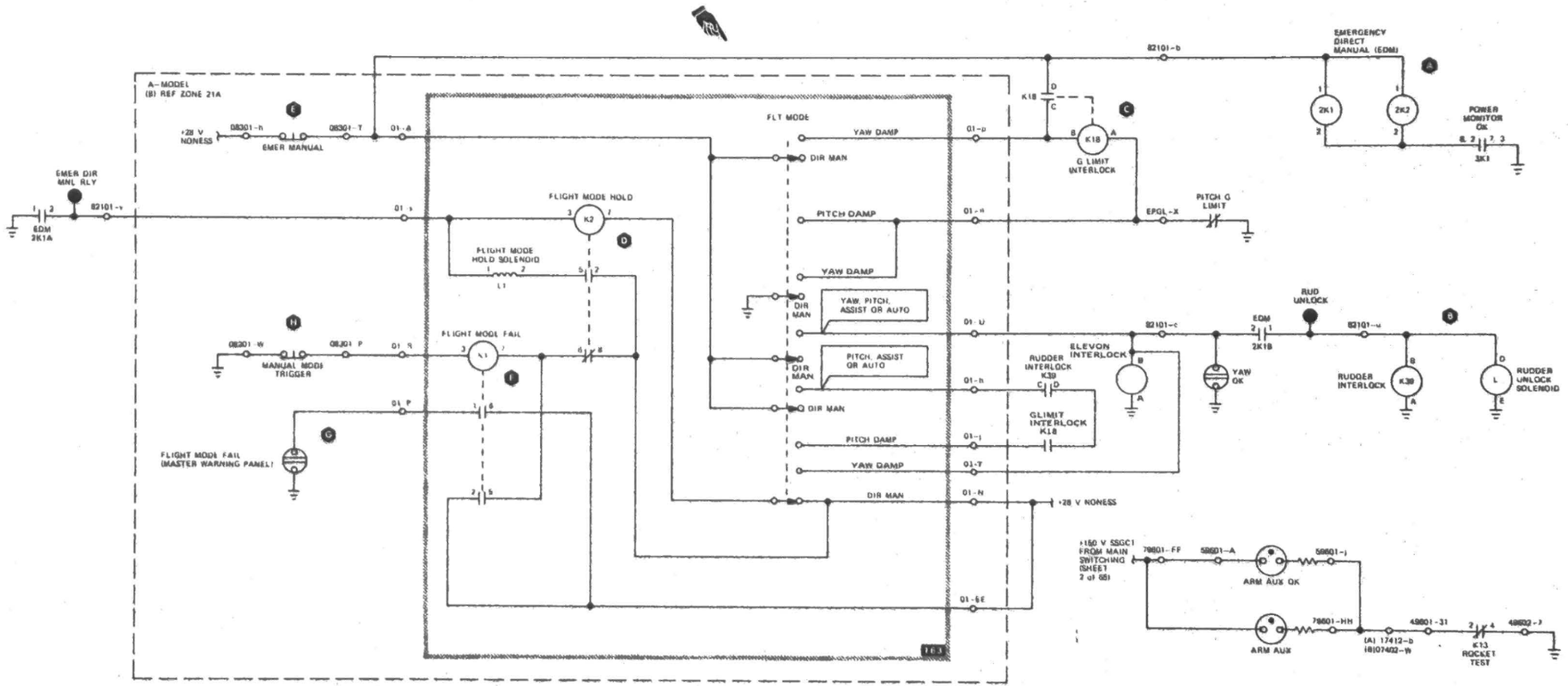


Figure 2-2. SSGC (Sheet 7 of 65: SSGC 1, sheet 3 of 8)

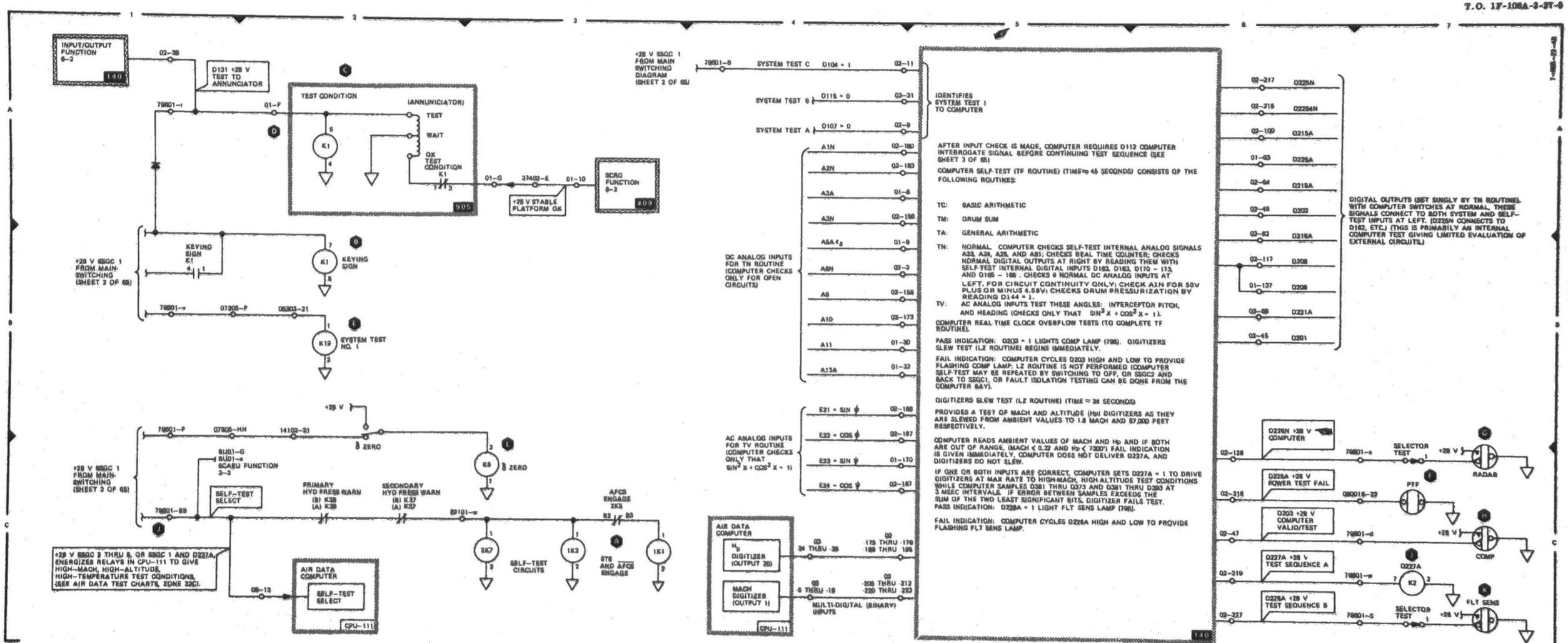


Figure 2-3. SSGC (Sheet 6 of 65: SSGC 1, sheet 2 of 8)

A Power monitor relay 2K1 (821) energizes if it internal supply voltages are correct. This provides a return for emergency direct manual relays (EDM) 2K1 and 2K2 (821), energized by +28 v non-essentrl voltage through EMER MANUAL switch, (083).

B Rudder interlock relay (CVAC) energizes after EDM relays when FLT MODE switch (163) in YAW, PITCH, ASSIST or AUTO.

C G- limit interlock relay energizes and holds unless pitch G- limits of aircraft exceeded.

D Flight mode hold relay K2 (163) then energizes with flight mode (FLT MODE) switch (163) in PITCH DAMP position and EDM relay 2K1 (821) energized. Flight mode hold solenoid holds FLT MODE switch (163) in selected position.

E Pressing and releasing emergency direct manual (EMER MANUAL) switch (083) deenergizes EDM relays 2K1 and 2K2 and rudder interlock relay CVAC. Flight mode hold relay K2 and flight mode hold solenoid L1 lose +28 V in both PITCH DAMP and YAW DAMP positions of FLT MODE switch (163)

F Flight mode failure warning relay K1 (163) energizes through closed contacts of deenergized flight mode hold relay K2 (163) and locks up. FLT MODE switch (163) steps back to direct manual (DIR MAN) position where flight mode hold relay locks up on +28 v nonessential through 163D1-N.

G FLIGHT MODE FAILURE warning lamp on master warning panel (CVAC) energizes through relay K1 (163) contacts.

H When MAN MODE TRIGGER on 083 unit is pressed, K1 (163) deenergizes and FLIGHT MODE FAILURE warning lamp extinguishes.

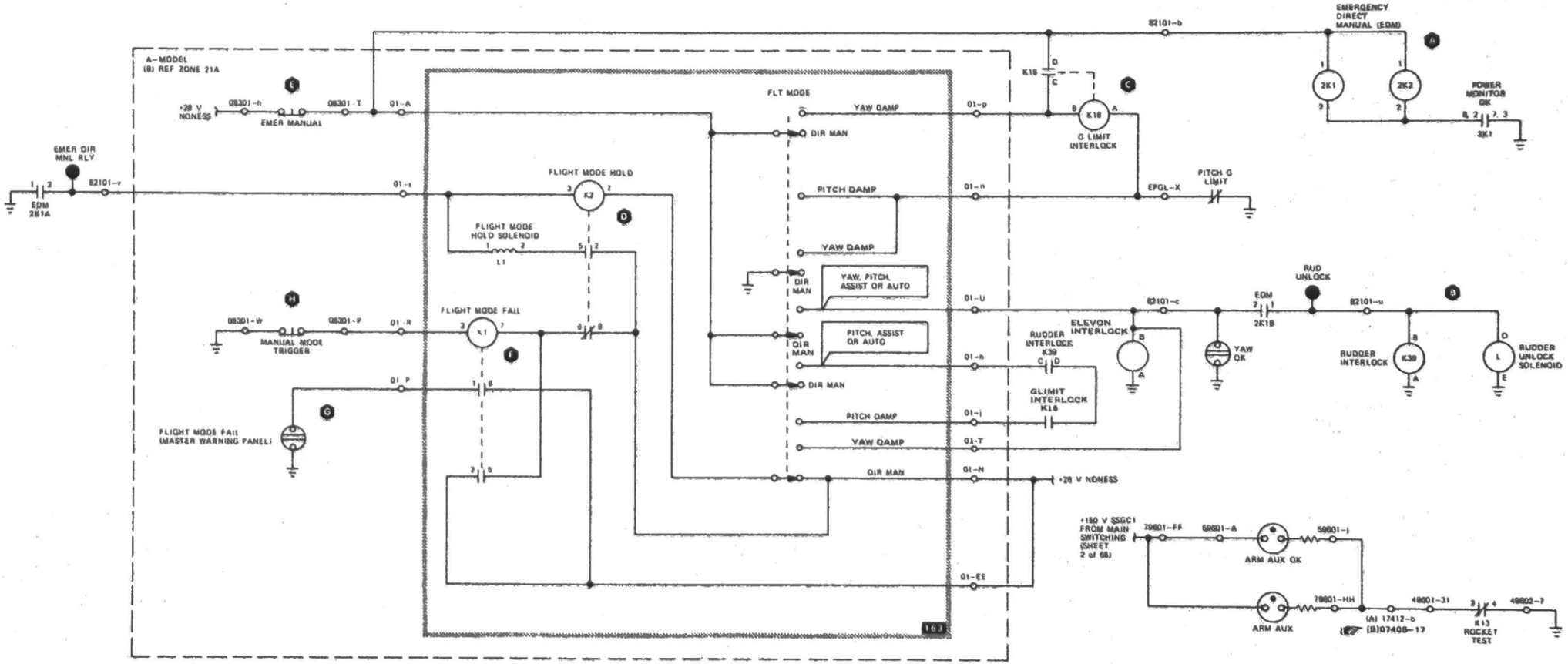


Figure 2-3. SSGC (Sheet 7 of 68: SSGC 1, sheet 3 of 8)

A MEDIUM TUNE
With TUNE switch (305) set to NORM, medium relay K6 (841) energizes, commanding a medium tune rate. Holding CADJ switch (855) to CADJ position interrupts +28V to PARAMP ON relays in the 841, 866 and 026 units. This allows the magnetron to tune the entire transmitter band at a medium rate. Indication on the scope is a movement of the B sweep from limit to limit in approximately 1 second.

B PARAMP BAND CONTROL
Switch settings are the same except CADJ switch (855) is now set to NORM. In addition to actuating medium relay K6, +28 v signal now goes through normally closed contacts of CADJ switch (855), contacts of −250 v/−400 v on relay K2 (026), and normally closed contacts of paramp test switch to actuate paramp-on relay K9 (866) and PARAMP ON light. +28 v-on signal also goes through normally closed contacts of self-test relay K10, of f max LP/SP relay K5, of f min relay K11, and of man scram/slow test relay K2 (d in 841) to actuate turn-around-select relay K1 (841). The turn-around-select contacts shift control of magnetron tuning circuits from computer programmer to paramp cavity.

C F MIN TUNE
The +28 v signal goes through f max contacts of TUNE switch (305) to 200 mi relay K18. Since range switch S1 is set to 200 LP, the signal goes through normally open contacts of K18 to energize f min relay K11. Since paramp-on relays K1 and K9 are not energized transmitter is allowed to tune through the paramp band.

D F MAX TUNE
Switching is the same except that RANGE switch S1 (305) is now set for 80 LP, the signal is shifted from the f min relay K11 (841) through normally closed contacts of 200 mi relay K18 (063) to actuate f max LP/SP relay K5 (841).

F F min relay K11 energizes when TUNE switch is set to F MIN.

G Sniff gate relay K17 energizes with TUNE SWITCH in SNIFF position.

H Paramp on relay K1 next energizes through K17 (063) contacts.

J SNIFF TUNE
With SNIFF TUNE selected PARAMP ON relays K9 (866) and K12 (841) are de-energized. PARAMP ON relay K9 disables the PARAMP cavity and the magnetron tuning circuits do not receive tuning commands. This allows the transmitter to tune at a fixed rate (a very slow controlled drift) throughout the entire frequency band. When jamming has been detected, +28V SNIFF command is routed through energized contacts of SNIFF operate relay K101 (295) to energize slow relay K7 (841) and enable the pulse generator (some 86B). This action causes the transmitter to turn-around and increase rate from a fixed to a slow rate. When jamming is no longer present K101 de-energizes and the transmitter again tunes at the fixed rate.

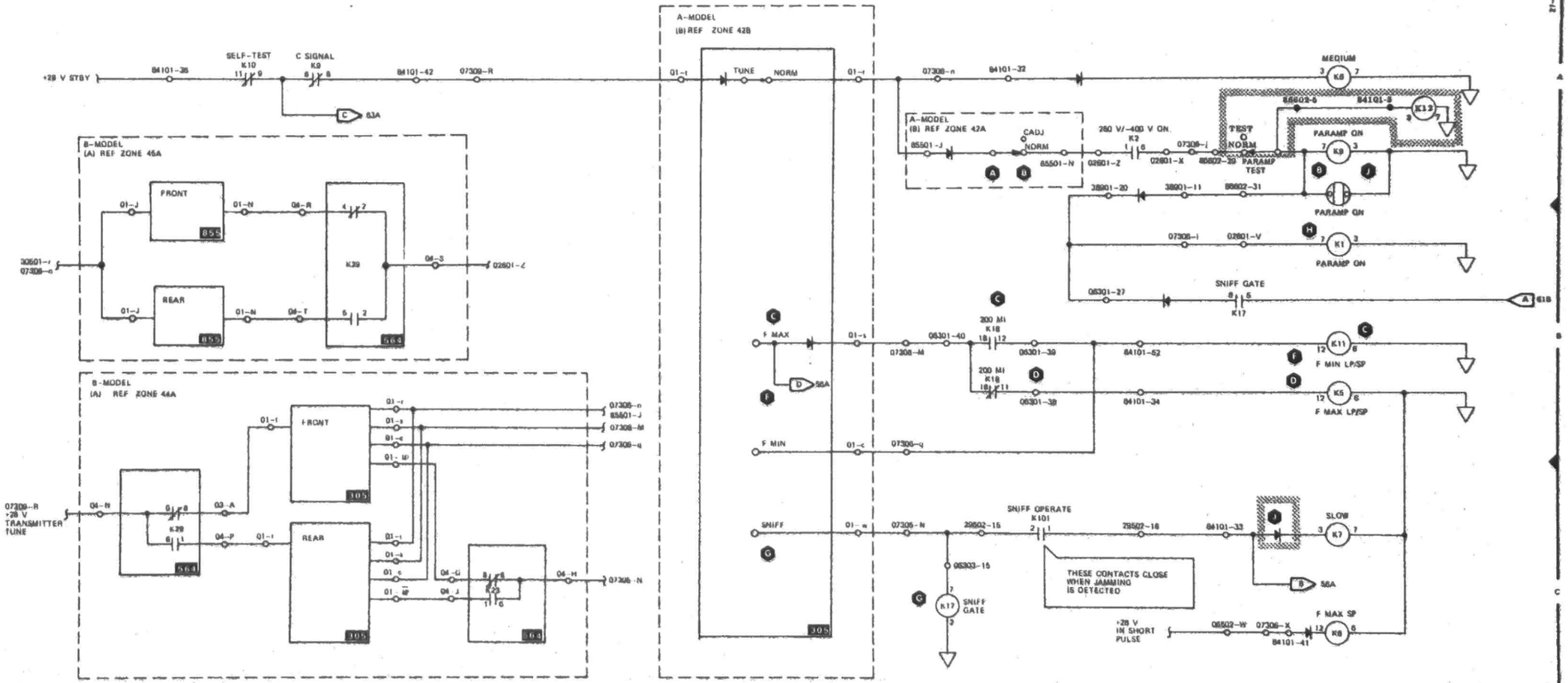


Figure 2-2. SSGC (Sheet 10 of 65: SSGC 1, sheet 6 of 8)

RAPID TUNE HYDRAULIC CONTROL CHECK
This check makes the azimuth position of the range sweep dependent on the position of the magnetron tuning arm.

A Linearly variable displacement transformer (LVDT) is connected mechanically to magnetron tuning arm. It supplies a signal to the phase detector indicating the tuning arm position.

B Phase detector supplies a d-c signal proportional to tuning arm position to the azimuth sweep circuits.

C Rapid tune hydraulic control is checked for various tune rates.

D Generate tune-up and tune-down commands to the magnetron tuning circuits through relay K1 and flip-flop. Range sweep display confined to either right or left portion of display.

E SNIFF operation is tested by causing system to tune at a fixed (very slow controlled drift) rate. PARAMP ON relay K9 is energized in NORM TUNE mode. With K9 de-energized, no plate voltage is supplied to the pulse amplifiers. Magnetron tuning circuits do not receive turn-around commands from the PARAMP Cavity and the transmitter is allowed to tune outside the paramp band at the rate determined by the SNIFF circuits. SNIFF becomes operational when jamming is detected and the tuning reverses direction and rate increases to SLOW-TUNE.

F Since relay K1 is energized the paramp is on and paramp noise is applied to the Klystron, then to the receiver (065).

G SSGC 1 or SSGC 4 relay K22 energizes when SSGC 1 relay K19 is energized through SELECTOR TEST switch in SSGC 1 position.

H Paramp on relay K1 is held deenergized by energized relay K22. This selects normal position of the attenuator pad (065). When the magnetron tunes into paramp band, the higher paramp noise level appears as a jamming signal because the noise is less attenuated in the normal position than it would be in the paramp position of attenuator pad.

J Enabled when jamming detected.

K The Flip-Flop Circuit accepts tune up/down (641), PARAMP Cavity Commands (886), High/Low limit turn-around signals, or SNIFF tune commands. The magnetron tuning circuit accepts the tune command and determines the proper tune rate. It then amplifies this signal to drive the hydraulic valve and magnetron.

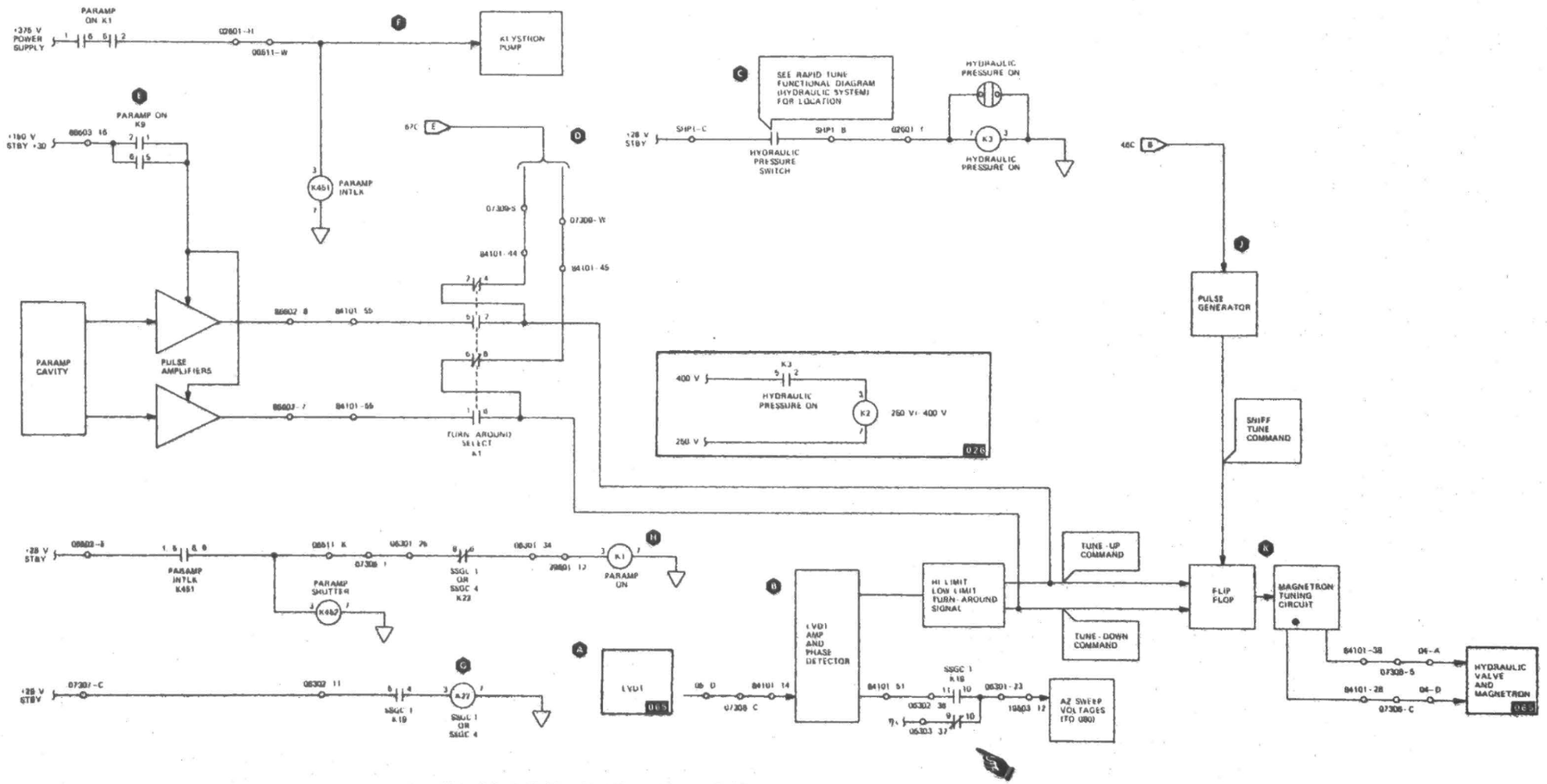


Figure 2-3. SSGC (Sheet 11 of 65: SSGC 1, sheet 7 of 8)

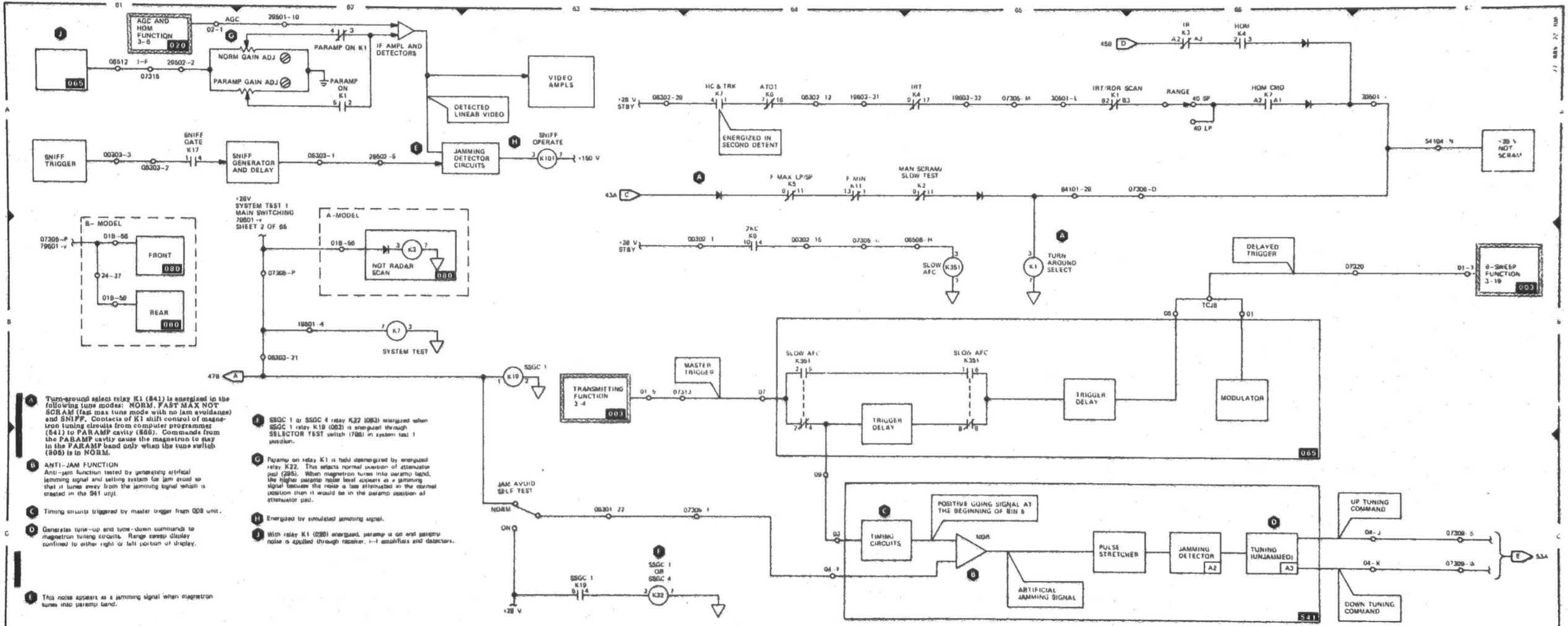


Figure 2-2. SSGC (Sheet 12 of 65: SSGC 1, sheet 8 of 8)

SHORT SYSTEM GROUND CHECK 2

This test checks the radar antenna servo precession, space stabilization elevation angle, steering servo and SCRG parameters and precession.
The antenna servo precession test (LE -1) is performed to provide an open loop check of the radar antenna tracking servo. The antenna (017) is driven and checks made of transit time and drift. The computer (140) first enables the normal attack display (086). The antenna is then centered by computer (140) and hand control (083). The computer (140) then performs the space stabilized elevation angle test (LS). It is supplied sine and cosine of the antenna azimuth, elevation, roll and pitch angles and calculates sine ϕ_s. The measured space stabilized radar elevation angle ϕ_s (A6A) is then compared with the calculated angle. The test passes if the absolute error value is less than an 3 degrees.
The computer returns to the LE -1 routine to check antenna azimuth and elevation steering time and drift. Test results are displayed at the end of SSGC 2 using the COMP light (796). A flashing light indicates at least one of the LS or LE -1 routines failed. A steady on light indicates both tests passed.
The digital steering and AFCS checks (LQ routine) begins after LS and LE -1 routines are complete. The LC routine (SCRG tests) are performed after the LQ routine is completed. The SCRG test checks the X and Y gyro loops, latitude counters, earth rate correction terms, and precession rate of the stable platform.
The radar portion of SSGC 2 checks the following:

a. Flight command indicator displays.
b. Operation of the steering dot quick indication channel.
c. Operation of the transmitter.

A. K4 removes +28 V from crystal protection shutter relay K483 (005).

B. Identifies SSGC 2 to computer.

C. energizes self test select relays and AFCS engage relay (821) through primary and secondary hydraulic pressure relays (CVAC).

D. Energizes relays in air data computer CPU 111 to give high mach, high-altitude, and high temperature conditions.

E. Energized to set roll search signal D108 0.

F. Energized through normally closed steering test switch (196) to energize antenna servo error test relay K6 and rear test relay K3 through ant servo test switch.

G. Energized to deenergize steering signal blank relay K4 (623) which removes steering signal blanking to 060 unit.

H. Energized to remove NTG gyro outputs and apply antenna positioning search signals to phase detector (041).

J. **Relay K4 energized when action switch (083) is pressed to second detent and released. This action de-energizes antenna servo error test relay K6 and the ϕ error signals are reconnected to the steering deflection channels.**

K. **When energized, K5 connects steering deflection channels to the resolver search error test signals thus causing the steering bar to move opposite the B sweep in search.**

L. Energized to connect steering deflection channels to simulate δ signals in 141 unit. Relay K6 controlled by computer (140) signal D228A.

M. Steering deflection signals δ_E and δ_D continue through signal conditioner (821) to be processed into steering deflection signals A66A, A67, A5852, and A6752 in computer (140).

+28 V IN SSGC 2 SEE MAIN SWITCHING DIAGRAM SHEET 7 OF 65

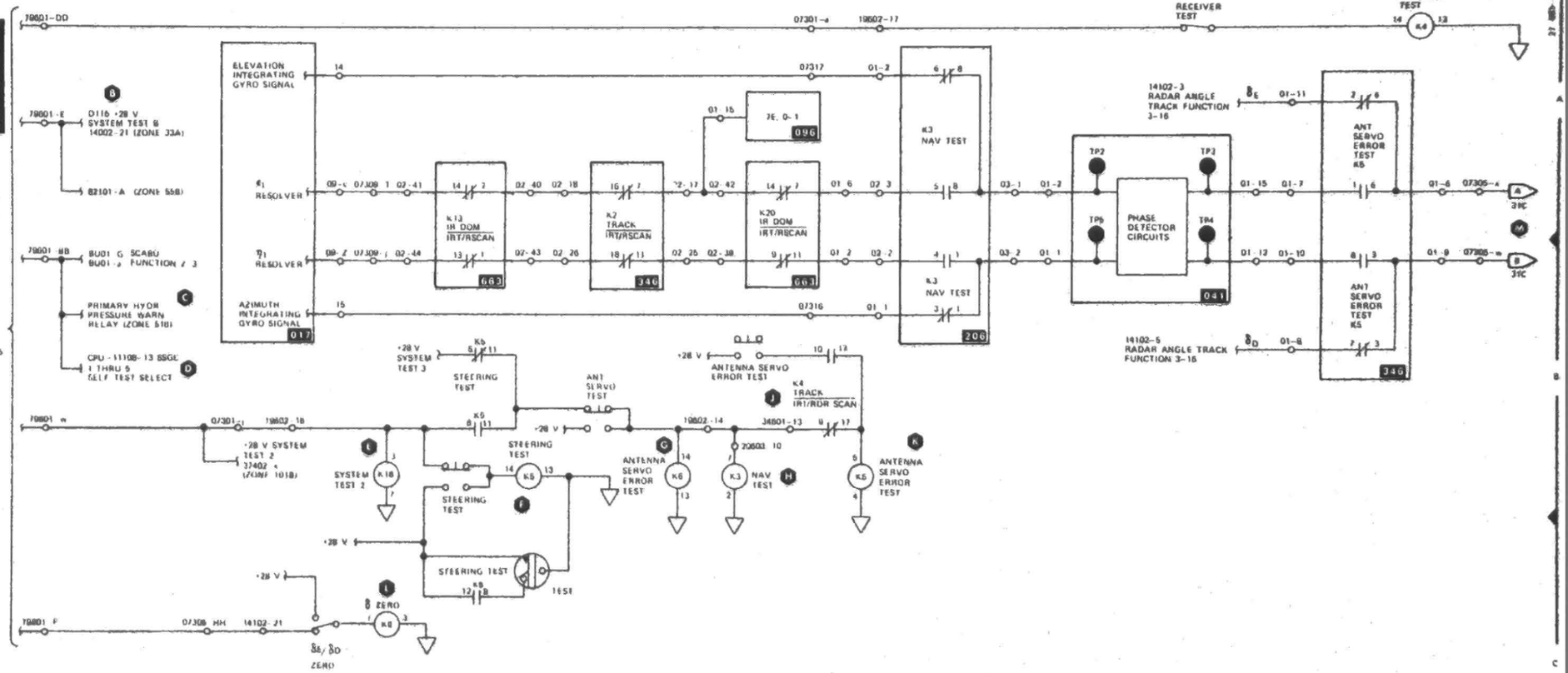


Figure 2-3. SSGC (Sheet 13 of 65: SSGC 2, sheet 1 of 13)

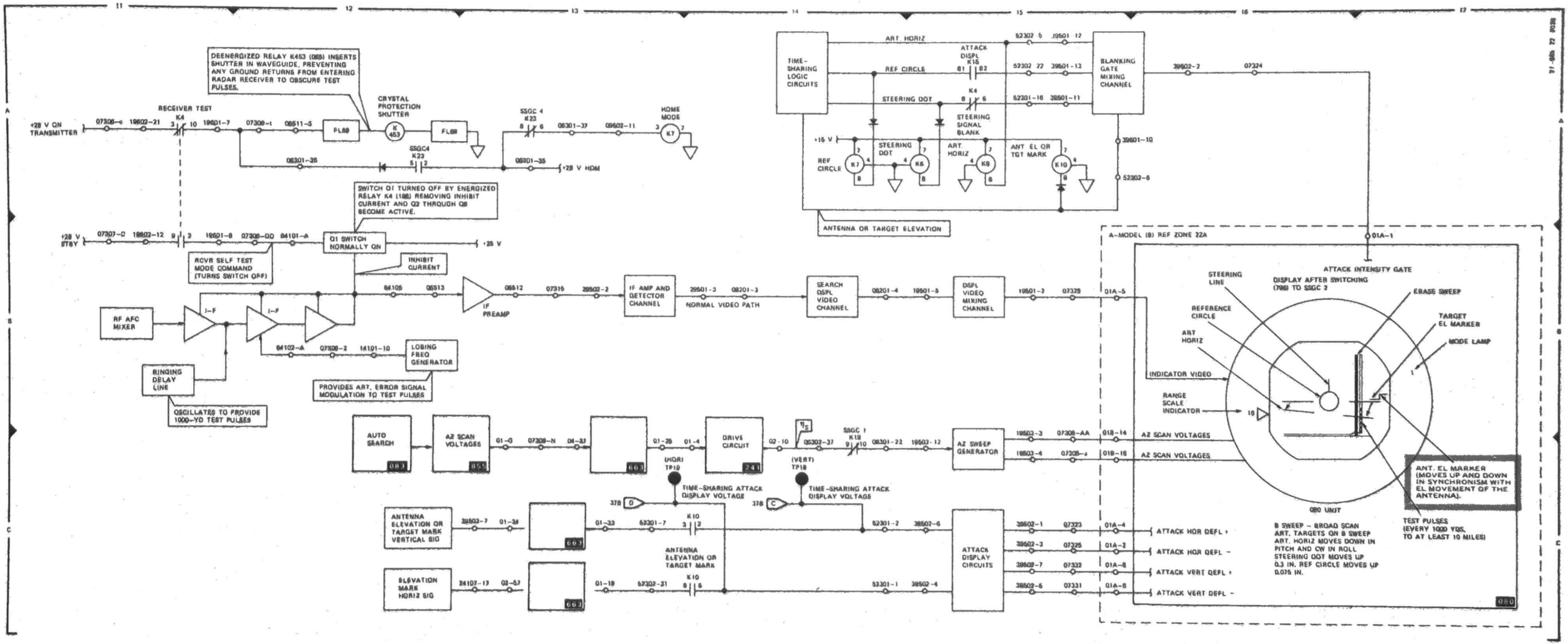


Figure 2-2. SSGC (Sheet 14 of 65: SSGC 2, sheet 2 of 13)

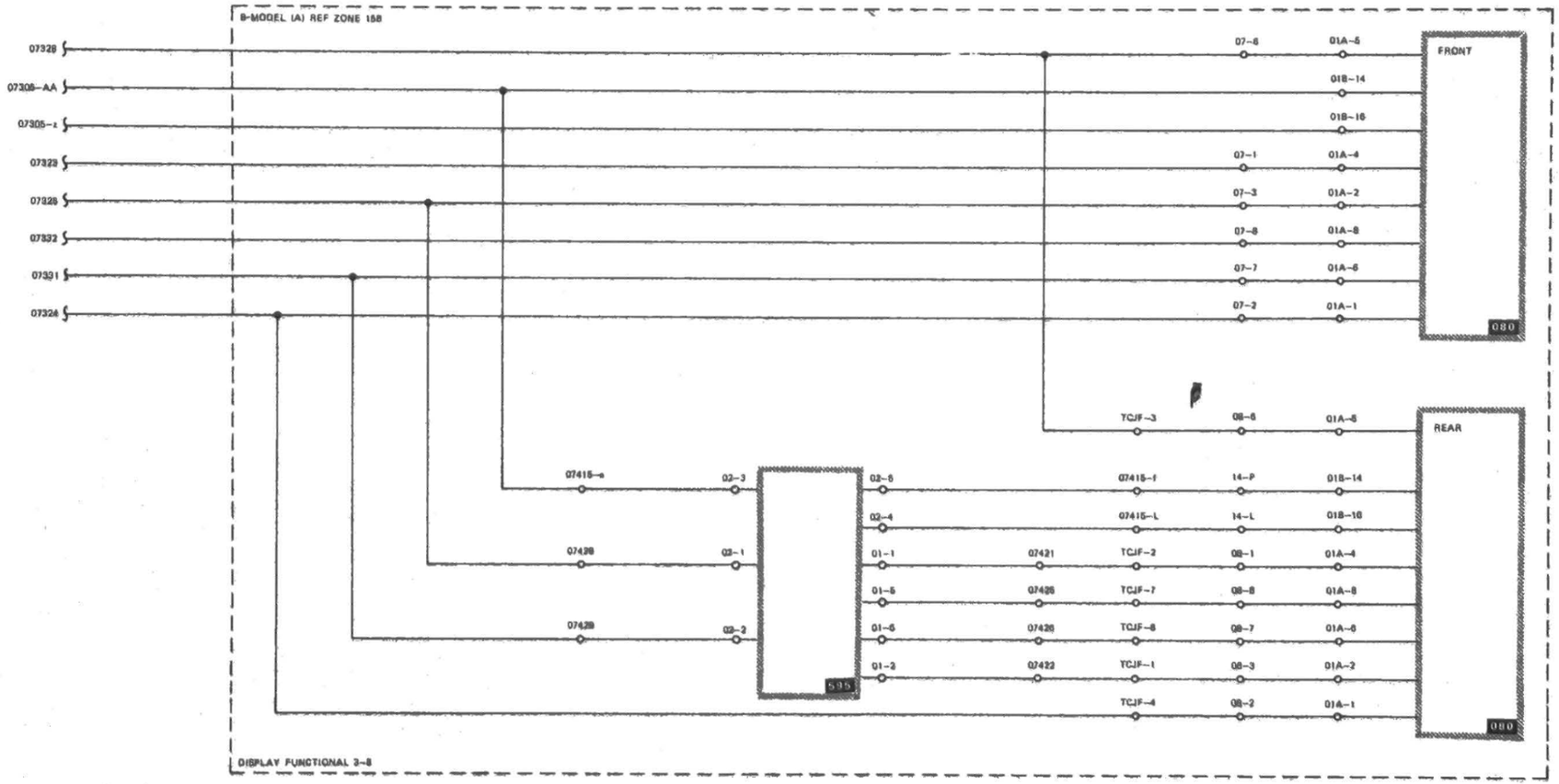


Figure 2-2. SSGC (Sheet 15 of 65: SSGC 2, sheet 3 of 13)

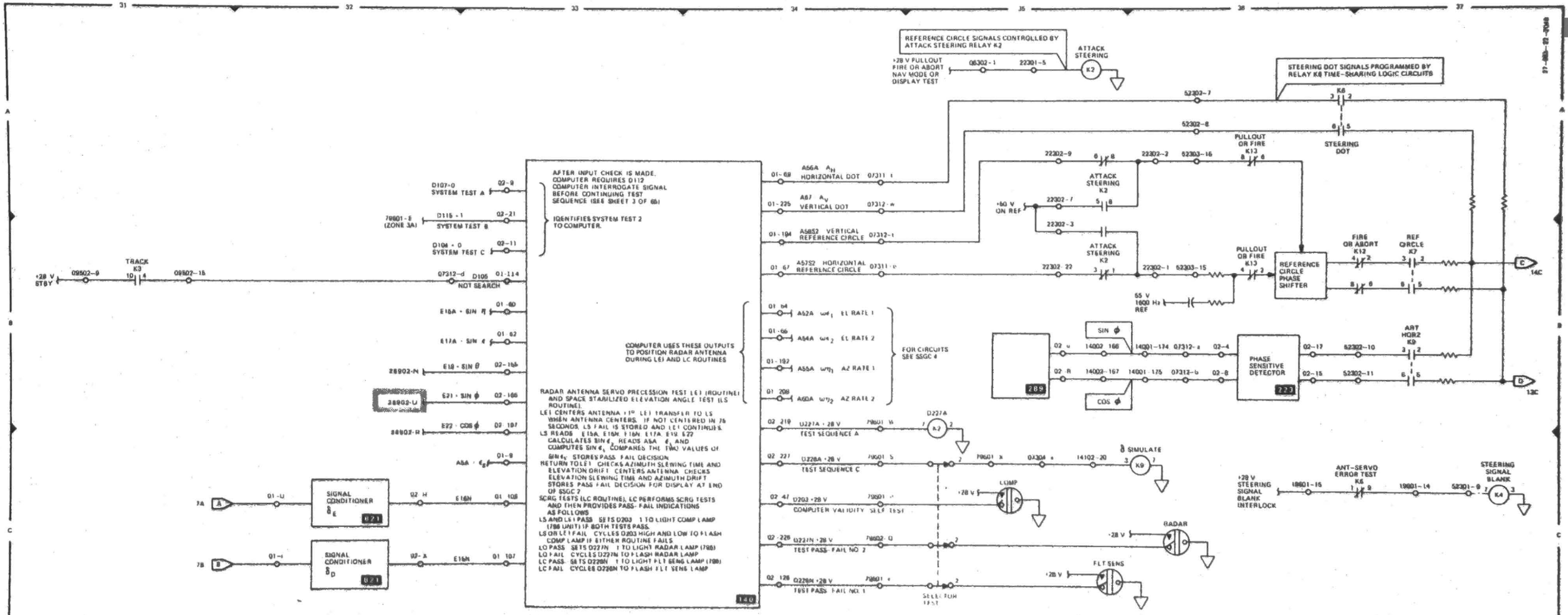


Figure 2-2. SSGC (Sheet 16 of 65; SSGC 2, sheet 4 of 13)

AFCS Test - LQ Routine

The digital AFCS has two possible built-in test (bit) modes of operation. AFCS not engaged (AFCS) and afcs engaged (AFCS), during self-test-select (STS) when the computer interface amplifier (821) unit is tested.

Programmed outputs from the computer (140) unit develop test signal inputs for the 821 unit. The 821 outputs are returned to the computer (140) for checking. In each mode right and left eleven command inputs exercise some of the fourteen amplifiers in the 821. This test begins immediately after the LE-1 and LS routines are completed if the FLT mode switch (163) is in pitch damp.

The computer (140) sets the initial conditions by activating digital signals (D209-D210=1) which allow a valid attack display on radar scope (080) and by setting the following signals as indicated

D227N=D227A=D228A=D229A=A84N=A55N=0

A58A=A67=A58=A67= +100 V

D223A=1

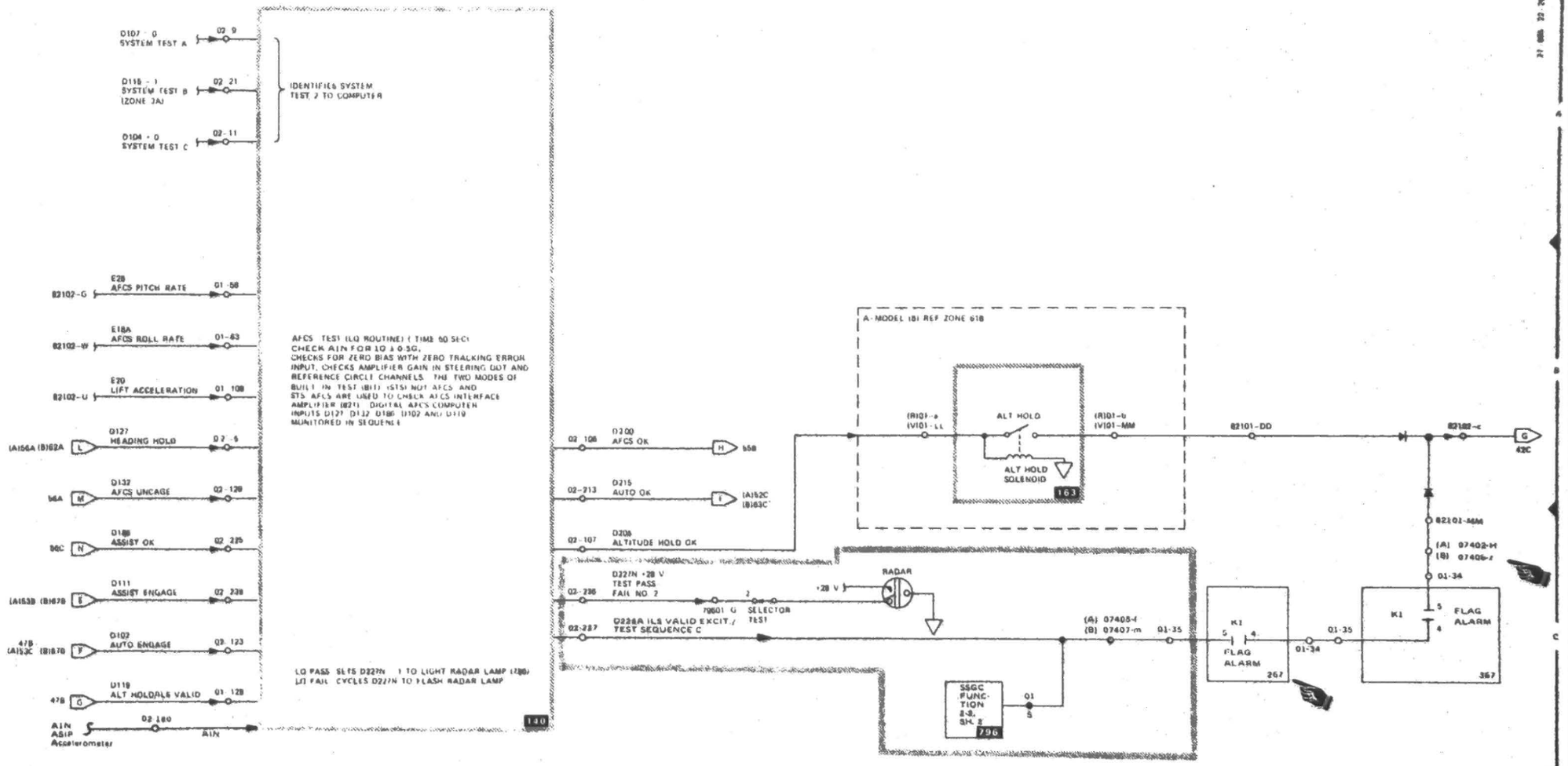


Figure 3-2. SSGC (Sheet 17 of 65, SSGC 2, sheet 5 of 13)

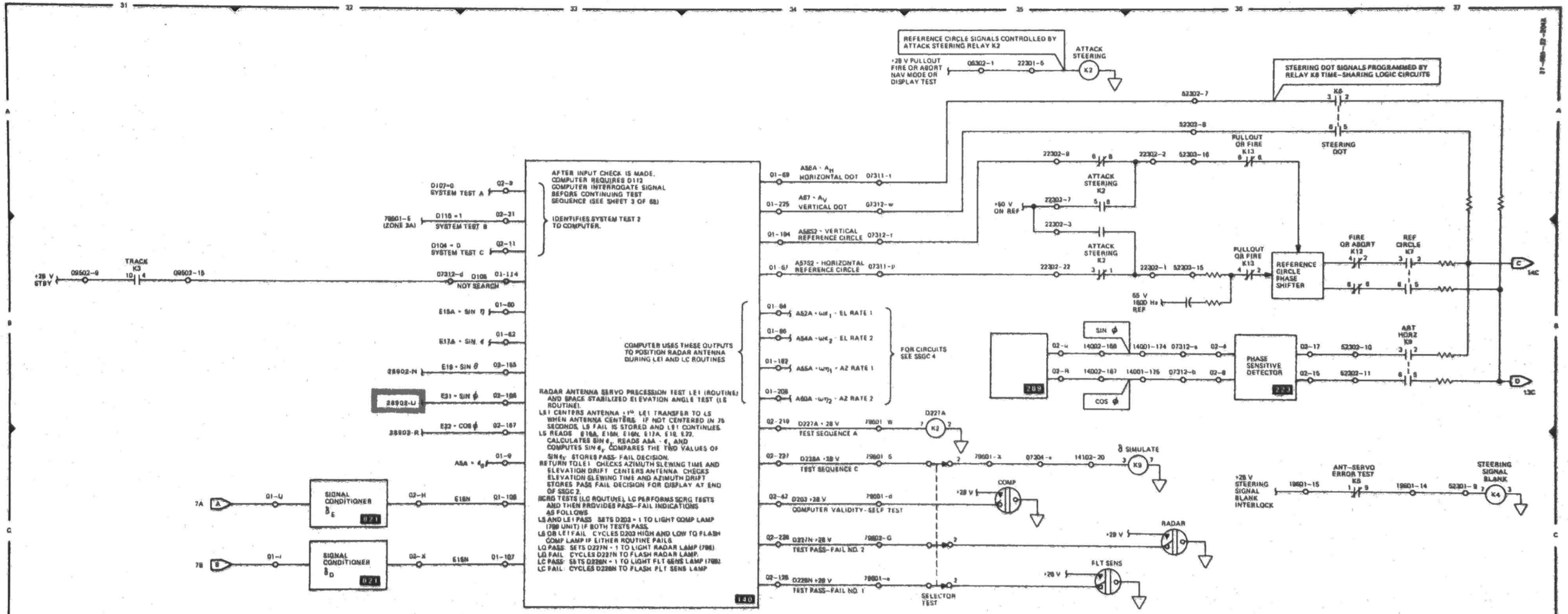


Figure 2-2. SSGC (Sheet 16 of 65: SSGC 2, sheet 4 of 13)

AFCS Test = LQ Routine

The digital AFCS has two possible built-in test (bit) modes of operation; AFCS not engaged (AFCS) and afcs enaged (AFCS), during self-test-select (STS) when the computer interface amplifier (821) unit is tested

Programmed outputs from the computer (140) unit develop test signal inputs for the 821 unit. The 821 outputs are returned to the computer (140) for checking. In each mode right and left eleven command inputs exercise some of the fourteen amplifiers in the 821. This test begins immediately after the LE-1 and LS routines are completed if the PLT mode switch (163) is in pitch damp.

The computer (140) sets the initial conditions by activating digital signals (D209=D210=1) which allow a valid attack display on radar scope (080) and by setting the following signals as indicated

D227N=D227A=D228A=D228A=A54N=A55N=0

A56A=A57=A58=A87= +100 V

D223A=1

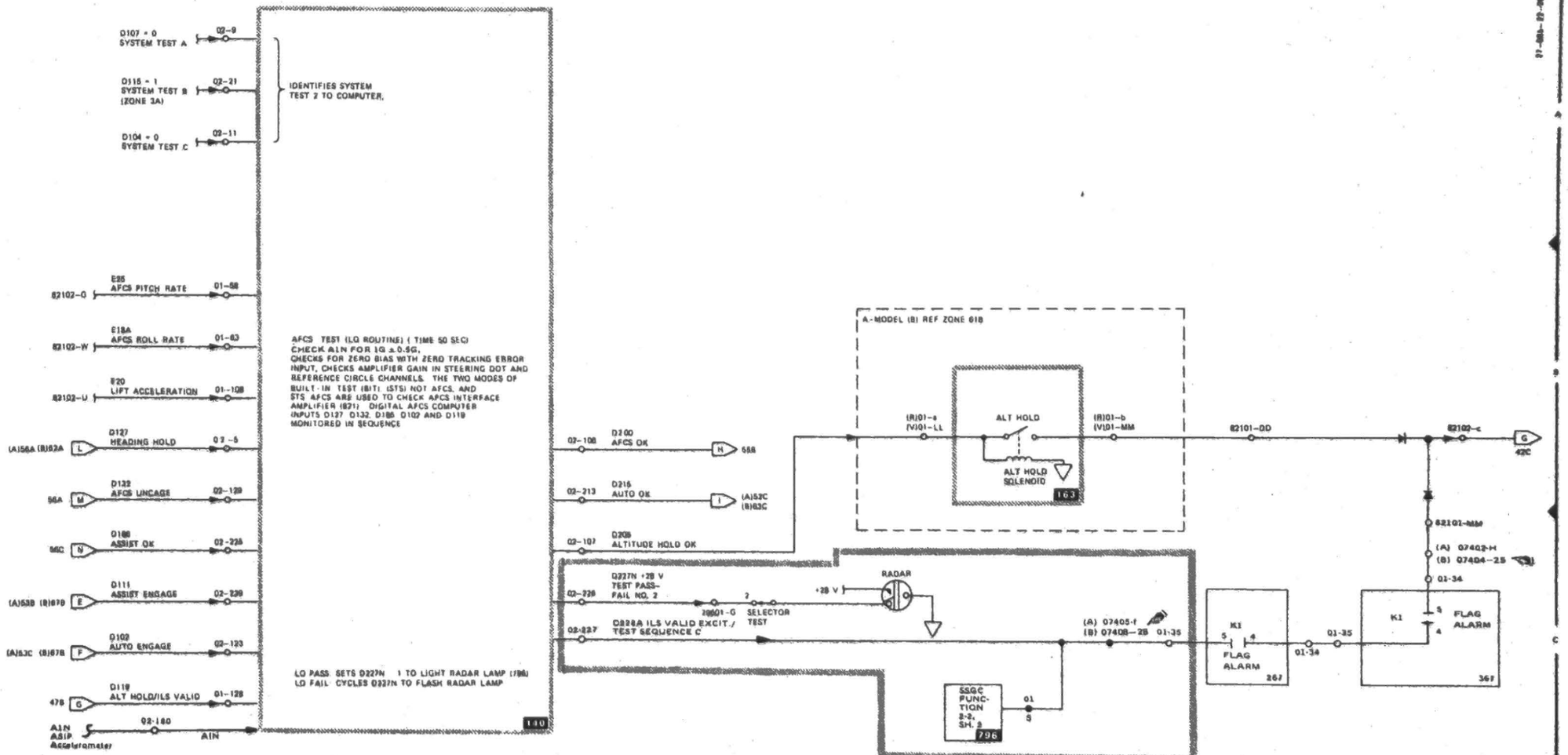


Figure 2-3. SSGC (Sheet 17 of 65, SSGC 2, sheet 5 of 13)

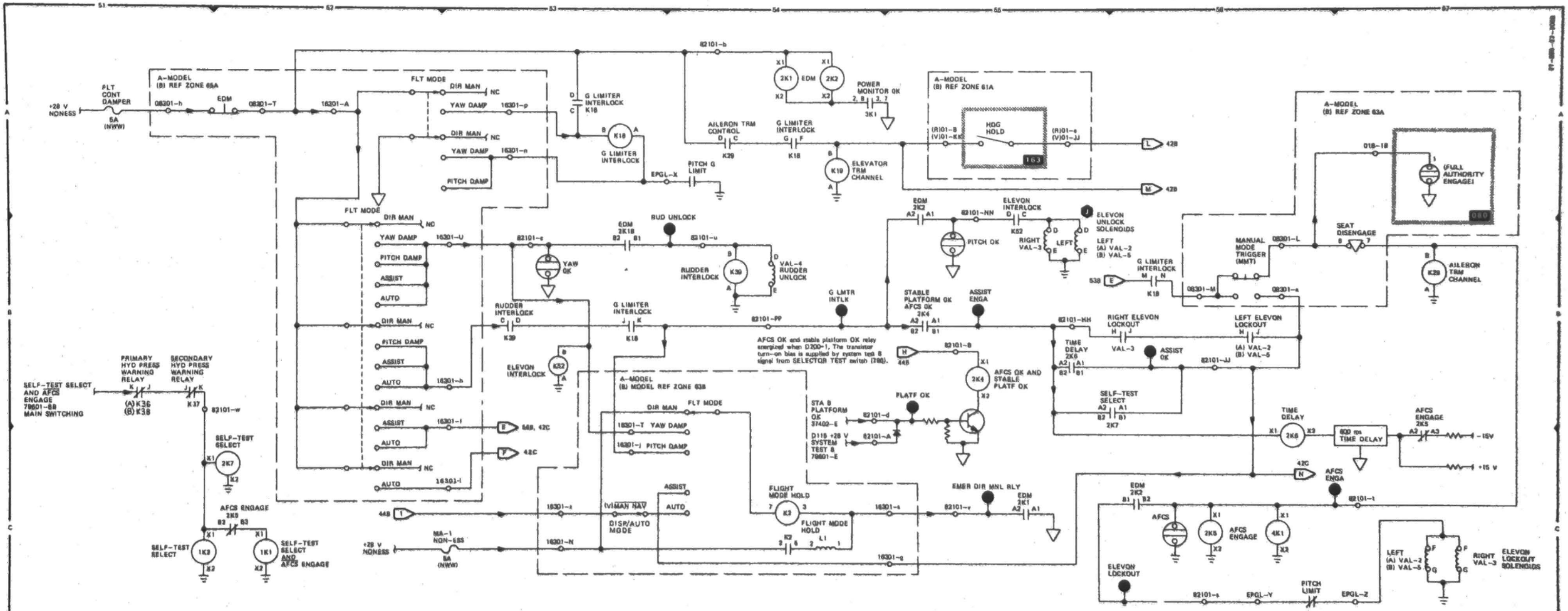


Figure 2-3. SSGC (Sheet 18 of 85: SSGC 3, sheet 6 of 13)

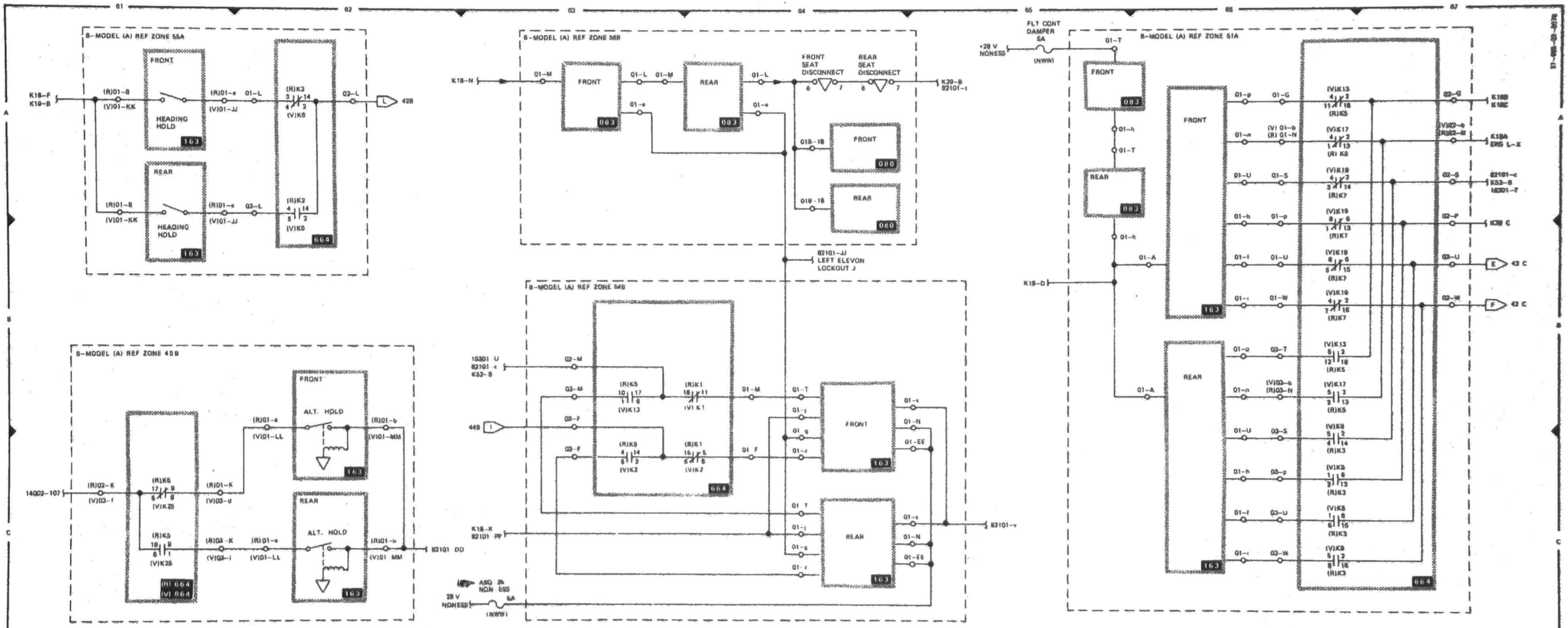


Figure 2-2. SSGC (Sheet 19 of 65: SSGC 2, sheet 7 of 13)

STABLE COORDINATE REFERENCE GROUP (SCRG) PARAMETERS AND PRECESSION TEST-LC ROUTINE

The SCRG test provides a check of the X and Y gyro loops, latitude counters, earth rate correction terms and precession rate of the stable table.

A series of seven SCRG signals are initiated with the SELECTOR TEST switch (796) in 2.

These signals are tested through relays controlled by transistor switches. The transistor switches are controlled by a logic counter. As each test is successfully completed, the input to the logic counter changes and actuates a transistor switch to initiate a new test. The start of each test is indicated on the NAVIGATION TEST SEQUENCE INDICATOR (396). As the test is run, indicator light progresses from 1 to 5. If any of the signals checked are not present, or not of correct magnitude, the computer stores this fact and proceeds to the next test. Prior to the start of any actual testing, the 396 unit generates and supplies signals to other units of the SCRG. Upon receiving these signals, the units prepare the components to deliver a desired signal for evaluation by the 396 unit in succeeding tests. This initial set up procedure is performed during SSGC1 or LC routine. If the units do not respond to the set-up signals from the 396 unit, the automatic test progression will not continue.

The four initial conditions are:

a. The latitude counter potentiometer in the 409 unit is set to a north 45-degree latitude.

b. The pitch and roll gyros are torqued to precess the gimbals.

c. The zeta resolver in the 309 unit is set to 45 degrees.

d. The azimuth gimbal in the stable table is set to zero.

(A) Automatic test of SCRG starts when D225 N = +28 v is received from the computer. The +28 v computer signal is applied to logic counter through K7. Computer reads and stores the position of the latitude counter potentiometer (409) on A2N. Computer waits 1 second and sets D224N = +28 v, then reads and stores platform roll and pitch angles, sin θ and sin φ. D224N is applied to logic counter (396) and test 1 switch is activated. This energizes K2 and numeral 1 of NAVIGATION TEST SEQUENCE INDICATOR (396). A +300 v (396) is applied to X & Y gyro torquers (289) causing artificial horizon (080) movement clockwise in roll and down in pitch. The oscillator output is switched through relay K101 (396) to the plus and minus latitude solenoids (409) which limit the solenoid stepping rate to 5 degrees/second; the latitude counter potentiometer steps to N-45 degrees. The Y integrator (009) is connected to signal conditioner amplifier (396) through relays K2, K3 and K5. After 15 seconds, the computer reads and checks Y integrator on A17 and verifies latitude potentiometer position on A2N is 45 degrees north.

(B) Computer then sets D224N = 0. This causes the logic counter to activate switch Q6 which energizes K3 and lights number 2. Energized relay K3 removes Y integrator (009) from the signal conditioner amplifier (396), removes +300 v from the X gyro torquer, and connects +28 v to the X gyro torquer, and X integrator (009) to V1 (396). In addition +28 v is removed from slew relay K202 (109) by K3. One volt a-c, 400 Hz is applied to azimuth torque motor which torques stable table and gives azimuth gyro a small stand-off precession; however, the stable table remains at zero heading, and relay K3 (396) removes +28 v from the azimuth clutch (309). Computer waits ten seconds, then reads X integrator on A17.

(C) Computer sets D224N = +28 v and logic counter (396) activates switch Q5 to energize K4 and light number 3. Relay K101 is connected to N-55 degree latitude reference by K4. Relay K4 removes the X integrator (009) from signal conditioner amplifier (396) and connects azimuth alignment signal (309) to the amplifier. Ten seconds after D224N = +28 v, the computer reads the azimuth alignment signal on A17, and reads and checks that latitude potentiometer position on A2N is 55 degrees north.

(D) Computer sets D224N = 0 and logic counter activates the test 4 switch which energizes K5 and lights numeral 4. K5 removes azimuth alignment signal from signal conditioner amplifier (396), and connects ω_e cos λ sin z to signal conditioner amplifier through K6. Ten seconds after D224N = 0, the computer reads and checks the ω_e Cos λ Sin z signal on A17.

(E) Computer then sets D224N = +28 v, the logic counter activates the test 5 switch to energize relay K8 and light numeral 5. K6 removes ω_e Cos λ Sin z from the signal conditioner amplifier (396) and connects ω_e Cos λ Cos z to the amplifier. The Y-gyro torquer signal is removed by K6 and this begins erection of the stable table around the Y axis. One second after D224N = +28 v, the computer reads and checks ω_e Cos λ Cos z signal on A17. 46 seconds after K2 energizes, the computer reads stable table roll & pitch angles for precession rate and samples Sin Θ_1 and Sin Φ_1. Computer sets D224N = 0, causing logic counter to activate test switch 9 to energize relay K9. K9 deenergizes relays K2 through K6, causing numeral 5 to go off. The latitude counter potentiometer (409) starts toward its original position. The x-gyro torquer signal is removed by K3 and erection of the stable table around the X axis begins. Computer then samples Sin Θ_2 and Sin Φ_2.

After sampling, the computer checks to ensure stable table is erecting. At 35 seconds after sampling, computer samples Sin Θ_3 and Sin Φ_3 and sets D225N = 0 which completes the SCRG test. However, test initial conditions are maintained as long as SSGC 2 or 3 is selected.

Figure 2-2. SSGC (Sheet 20 of 65: SSGC 2, Sheet 8 of 13)

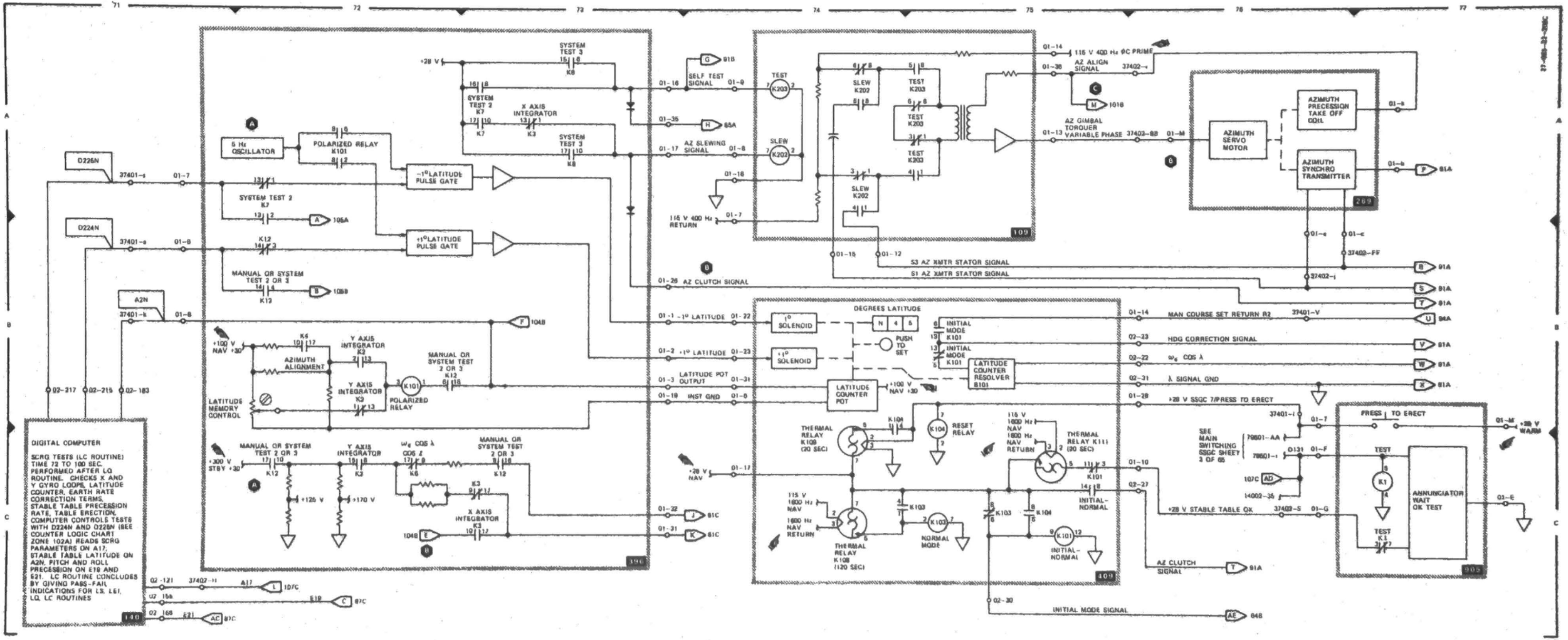


Figure 2-2. SSGC (Sheet 21 of 65; SSGC 2, sheet 9 of 13)

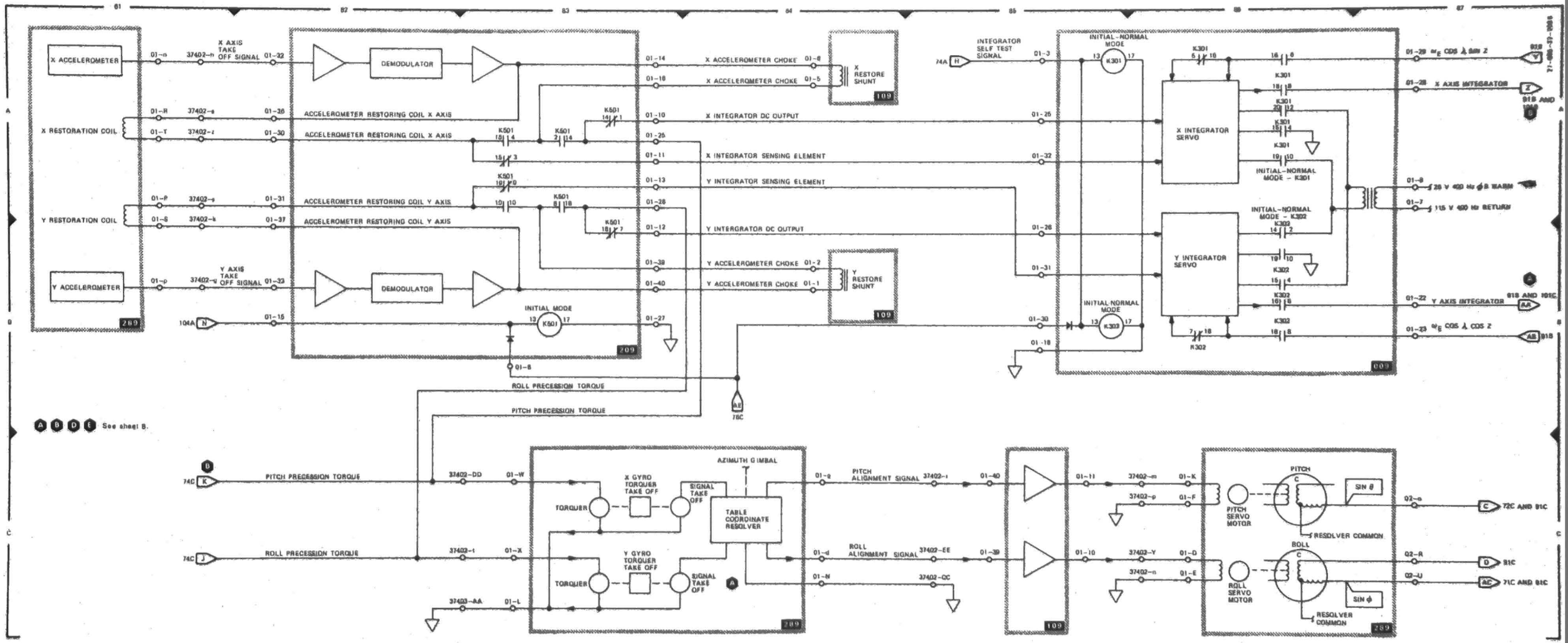


Figure 2-2. SSGC (Sheet 22 of 65: SSGC 2, sheet 10 of 13)

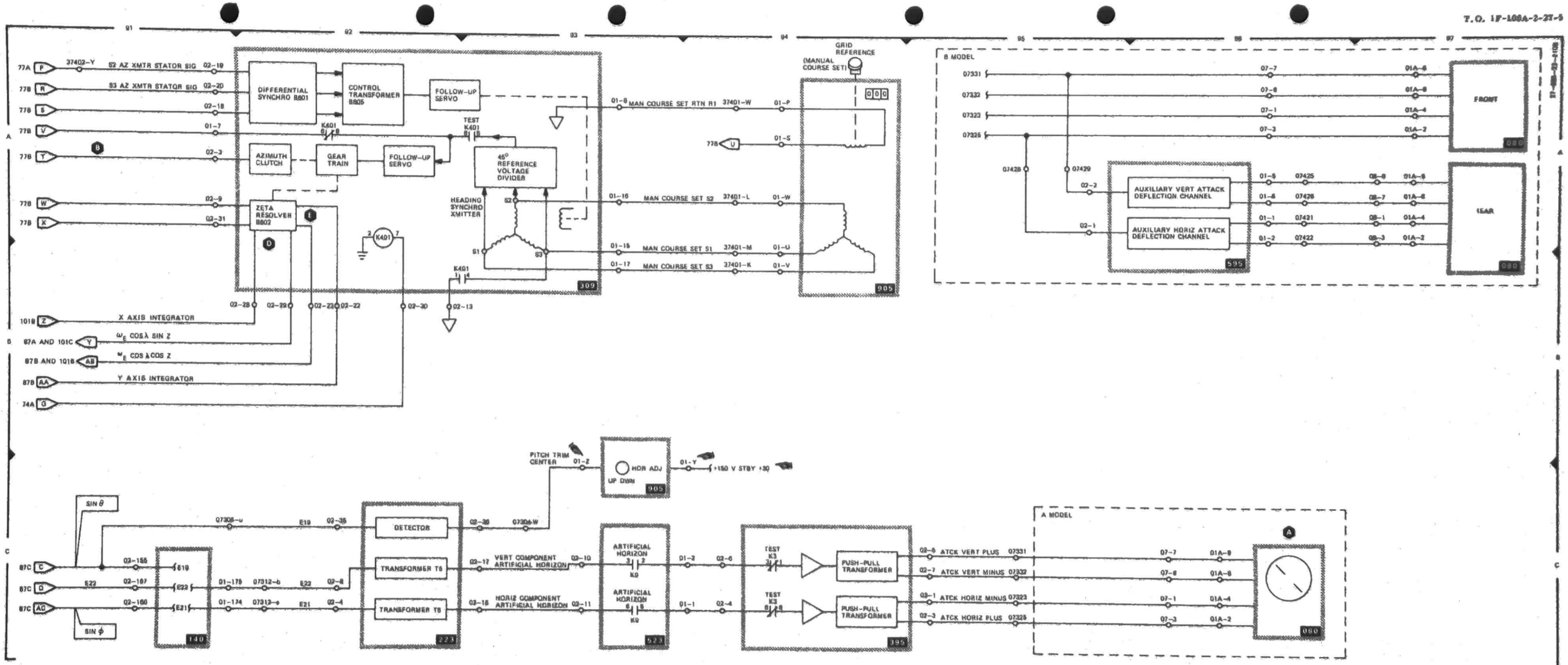


Figure 2-2. SSGC (Sheet 23 of 65: SSGC 2, sheet 11 of 13)

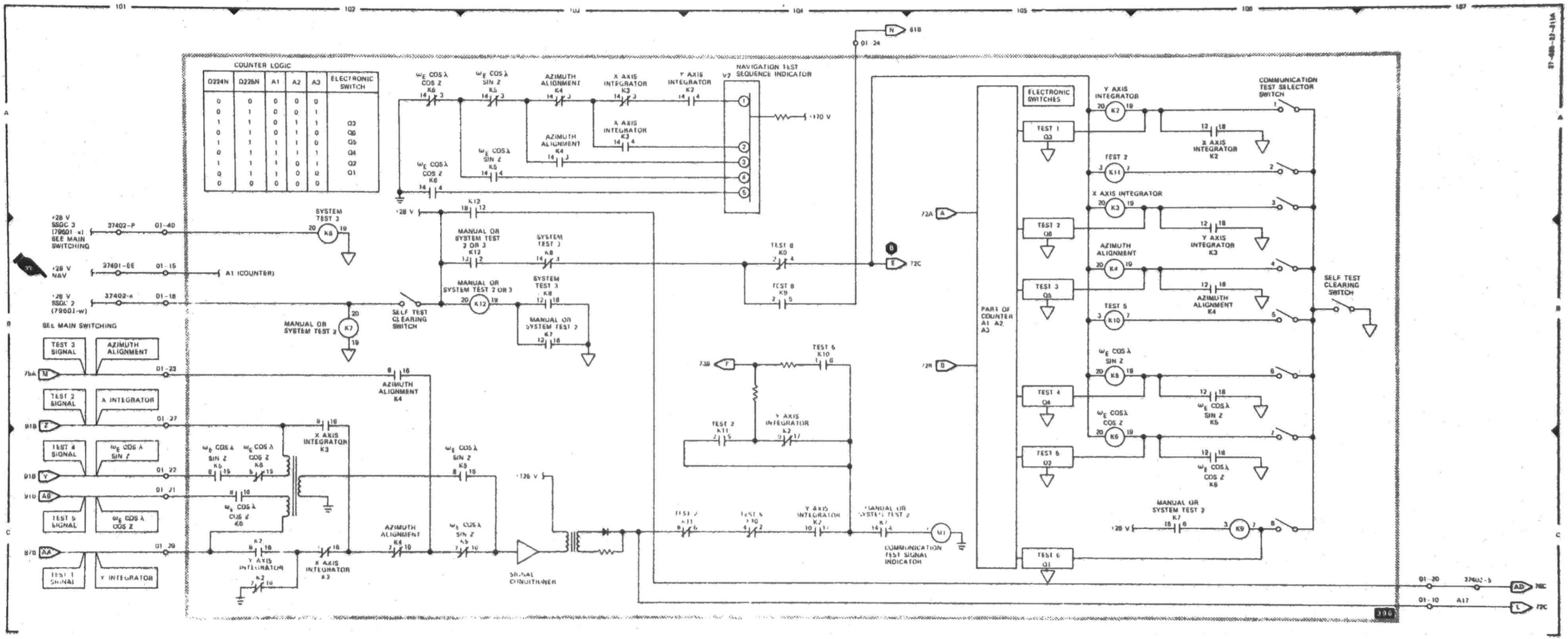


Figure 2-2. SSGC (Sheet 24 of 65; SSGC 2, sheet 12 of 13)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
009	K301	5 AND 16 6 AND 16 8 AND 18 4 AND 15 10 AND 19 12 AND 20 COIL 13 AND 17	SSGC 2/86A SSGC 2/86A SSGC 2/86A SSGC 2/86A SSGC 2/86A SSGC 2/86A SSGC 2/85A
	K302	7 AND 18 8 AND 18 2 AND 14 4 AND 15 6 AND 16 10 AND 19 COIL 13 AND 17	SSGC 2/86B SSGC 2/86B SSGC 2/86B SSGC 2/86B SSGC 2/86B SSGC 2/86B SSGC 2/85B
063	K19	9 AND 10	SSGC 2/14C
	K23	2 AND 5 6 AND 8	SSGC 2/12A SSGC 2/13A
065	K453	COIL	SSGC 2/12A
095	K3	4 AND 10	SSGC 2/81B
109	K202	1 AND 3 1 AND 4 5 AND 6 6 AND 8 COIL 2 AND 7	SSGC 2/74A SSGC 2/74A SSGC 2/74A SSGC 2/74A SSGC 2/74A
	K203	1 AND 3 1 AND 4 5 AND 6 6 AND 8 COIL 2 AND 7	SSGC 2/75A SSGC 2/75A SSGC 2/75A SSGC 2/75A SSGC 2/74A
141	K8	COIL 3 AND 7	SSGC 2/4C
	K9	COIL 3 AND 7	SSGC 2/36C
163	K2	2 AND 5 COIL 3 AND 7	SSGC 2/54C SSGC 2/54C
196	K3	3 AND 10	SSGC 2/32B
	K4	3 AND 10 2 AND 9 COIL 13 AND 14	SSGC 2/11A SSGC 2/11B SSGC 2/7A
	K5	5 AND 11 6 AND 11 8 AND 12 COIL 13 AND 14	SSGC 2/4B SSGC 2/4B SSGC 2/4C SSGC 2/4B
	K6	1 AND 9 COIL 13 AND 14	SSGC 2/37C SSGC 2/5B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	K18	2 AND 4 COIL 13 AND 14	SSGC 2/32B SSGC 2/4B
206	K3	1 AND 3 1 AND 4 5 AND 8 6 AND 8 COIL 2 AND 7	SSGC 2/6B SSGC 2/6A SSGC 2/6A SSGC 2/6A SSGC 2/5B
209	K501	3 AND 15 4 AND 15 9 AND 19 10 AND 19 1 AND 14 2 AND 14 7 AND 18 8 AND 18 COIL 13 AND 17	SSGC 2/83A SSGC 2/83A SSGC 2/83A SSGC 2/83A SSGC 2/83A SSGC 2/83A SSGC 2/83B SSGC 2/83A SSGC 2/83B
223	K2	1 AND 3 1 AND 4 5 AND 8 6 AND 8 COIL 2 AND 7	SSGC 2/35B SSGC 2/35B SSGC 2/35A SSGC 2/35A SSGC 2/35A
309	K401	1 AND 4 5 AND 8 6 AND 8 COIL 2 AND 7	SSGC 2/93B SSGC 2/93A SSGC 2/92A SSGC 2/92B
346	K4	9 AND 17	SSGC 2/5B
	K5	1 AND 6 2 AND 4 2 AND 5 6 AND 8	SSGC 2/7A SSGC 2/7B SSGC 2/7A SSGC 2/7A
	K9	COIL 3 AND 7	SSGC 2/5B
395	K3	1 AND 3 6 AND 8	SSGC 2/93C SSGC 2/93C
396	K2	1 AND 13 2 AND 13 4 AND 14 6 AND 15 7 AND 16 8 AND 16 9 AND 17 10 AND 17 12 AND 18 COIL 19 AND 20	SSGC 2/72B SSGC 2/72B SSGC 2/103A SSGC 2/72C SSGC 2/101C SSGC 2/101C SSGC 2/104C SSGC 2/104C SSGC 2/106A SSGC 2/105A
	K3	1 AND 15 3 AND 16 4 AND 14 7 AND 16 8 AND 16 9 AND 17 10 AND 17 12 AND 18 COIL 19 AND 20	SSGC 2/73A SSGC 2/103A SSGC 2/103A SSGC 2/102C SSGC 2/102B SSGC 2/73C SSGC 2/73C SSGC 2/106A SSGC 2/105A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	K4	3 AND 14 4 AND 14 7 AND 16 8 AND 16 10 AND 17 12 AND 18 COIL 19 AND 20	SSGC 2/103A SSGC 2/103A SSGC 2/102C SSGC 2/102B SSGC 2/72A SSGC 2/106B SSGC 2/105B
	K5	3 AND 14 4 AND 14 6 AND 15 7 AND 16 8 AND 16 12 AND 18 COIL 19 AND 20	SSGC 2/103A SSGC 2/103A SSGC 2/101C SSGC 2/103C SSGC 2/103C SSGC 2/106B SSGC 2/105B
	K6	3 AND 14 4 AND 14 5 AND 15 8 AND 16 9 AND 17 12 AND 18 COIL 19 AND 20	SSGC 2/102A SSGC 2/102A SSGC 2/102C SSGC 2/102C SSGC 2/72C SSGC 2/106C SSGC 2/105C
	K7	1 AND 13 2 AND 13 4 AND 14 6 AND 15 8 AND 16 10 AND 17 12 AND 18 COIL 19 AND 20	SSGC 2/72A SSGC 2/72B SSGC 2/104C SSGC 2/106C SSGC 2/73A SSGC 2/73A SSGC 2/103B SSGC 2/102B
	K8	3 AND 14 6 AND 15 10 AND 17 12 AND 18 COIL 19 AND 20	SSGC 2/103B SSGC 2/73A SSGC 2/73A SSGC 2/103B SSGC 2/102B
	K9	2 AND 4 2 AND 5 COIL 3 AND 7	SSGC 2/104B SSGC 2/104B SSGC 2/106C
	K10	1 AND 6 2 AND 4 COIL 3 AND 7	SSGC 2/104B SSGC 2/104C SSGC 2/105B
	K11	2 AND 5 6 AND 8 COIL 3 AND 7	SSGC 2/104C SSGC 2/103C SSGC 2/105A
	K12	3 AND 14 4 AND 14 6 AND 15 8 AND 16 10 AND 17 13 AND 2 18 AND 12 COIL 19 AND 20	SSGC 2/72B SSGC 2/72B SSGC 2/72B SSGC 2/73B SSGC 2/72C SSGC 2/103B SSGC 2/103A SSGC 2/103B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	K101	2 AND 8 6 AND 8 COIL 1 AND 3	SSGC 2/73A SSGC 2/73A SSGC 2/72B
409	K101	3 AND 11 5 AND 13 6 AND 13 8 AND 14 COIL 9 AND 12	SSGC 2/75C SSGC 2/75B SSGC 2/75B SSGC 2/75C SSGC 2/75C
	K103	1 AND 4 6 AND 8 COIL 2 AND 7	SSGC 2/75C SSGC 2/75C SSGC 2/75C
	K104	1 AND 4 5 AND 5 COIL 2 AND 7	SSGC 2/75B SSGC 2/75C SSGC 2/75B
523	K4	COIL 3 AND 7	SSGC 2/37B
	K6	2 AND 3 5 AND 6 COIL 4, 7 AND 8	SSGC 2/36A SSGC 2/36A SSGC 2/15A
	K7	2 AND 3 5 AND 6 COIL 4, 7 AND 8	SSGC 2/37B SSGC 2/37B SSGC 2/14A
	K9	2 AND 3 5 AND 6 COIL 4, 7 AND 8	SSGC 2/37B, 93C SSGC 2/37B, 93C SSGC 2/15A
	K10	2 AND 3 5 AND 6 COIL 4, 7 AND 8	SSGC 2/14C SSGC 2/14C SSGC 2/15A
	K12	2 AND 4 6 AND 8	SSGC 2/37B SSGC 2/37B
	K13	2 AND 4 6 AND 8	SSGC 2/36B SSGC 2/36A
	K15	B_1 AND B_2	SSGC 2/15A
796	K2	COIL 2 AND 7	SSGC 2/35B
821	1K1	COIL X 1 AND X 2	SSGC 2/51C
	1K2	COIL X 1 AND X 2	SSGC 2/51C
	2K1	A_1 AND A_2 B_1 AND B_2 COIL X 1 AND X 2	SSGC 2/55C SSGC 2/53B SSGC 2/54A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	2K2	A_1 AND A_2 B_1 AND B_2 COIL X 1 AND X 2	SSGC 2/55B SSGC 2/57C SSGC 2/54A
	2K4	A1 AND S2 B1 AND B2 COIL X1 AND X3	SSGC 2/55B SSGC 2/55B SSGC 2/55B
	2K5	A2 AND A3 B2 AND B3 COIL X1 AND X3	SSGC 2/51C SSGC 2/51C SSGC 2/57C
	2K6	A1 AND A2 B1 AND B2	SSGC 2/56B SSGC 2/56B
	2K7	A1 AND A2 B1 AND B2 COIL X 1 AND X2	SSGC 2/56B SSGC 2/56B SSGC 2/52C
	3K1	2, 3, 7 AND 8	SSGC 2/54A
	4K1	COIL X1 AND X2	SSGC 2/56C
905	K1	3 AND 7 COIL 4 AND 5	SSGC 2/77C SSGC 2/77C
CVAC	K16	C AND D F AND G J AND K M AND N COIL A AND B	SSGC 2/53A SSGC 2/54A SSGC 2/53B SSGC 2/56B SSGC 2/53A
	K19	COIL A AND B	SSGC 2/54A
	K29	C AND D COIL A AND B	SSGC 2/54A SSGC 2/37B
	K39	C AND D COIL A AND B	SSGC 2/53B SSGC 2/54B
	K52	C AND D COIL A AND B	SSGC 2/56B SSGC 2/53B

Figure 2-2. SSGC (Sheet 25 of 65; SSGC 3, Sheet 13 of 13)

Short System Ground Check 3 checks the navigation capabilities of the MA-1/ASQ-25 system. During this test the MART is interrogated for CN&L test sequence.

The specific areas that SSGC 3 checks are:

a. Armament auxiliaries are safe-for-test. (Same as during SSGC2).
b. The radar transmitter, receiver and normal display channels, antenna search loop and the navigation displays provided by the CN & L subsystem.
c. The ILS system, using signals from the MART.
d. System power forms (computer LW routine).
e. The digital computer normal navigation program.
f. The ILS, TACAN, Data Link, command transmitter and receiver, ADF, and IFF functions of the CN & L subsystem using the automatically sequenced MART test routines.
g. Cockpit instruments are utilized as readouts for the digital computer and CN & L subsystem.

A MART interrogation:

MART interrogation starts by pressing GND TEST INTER (79B) switch. This action causes MA-1 or AN/ASQ-25 digital computer to generate command signals and broadcast a test request message through the aircraft ARC-109 radio. The MART receives the message through the 182 test stand ARC-109 radio, decodes the test request message, establishes the equadron and aircraft identity data address, and initiates the automatic test sequence. Because the MART can respond to only one aircraft at a time, pulsed audio tones (busy signals) are broadcasted by the ARC-109 radio at intervals throughout the radiating period. The busy signals indicate to other aircrafts that the MART is not available.

B DL message:

A programmed data link message, broadcasted by MART radio transmitter (T-700), begins at the approximate mid-point of TACAN message transmission. This data link message is displayed on aircraft instruments.

C IFF:

The test sequence begins with transmission of ILS and IFF data by the MART. Sequentially, the ILS steering signals are transmitted as up left, center center, and down right. Any response to IFF transmission by the MA-1 or AN/ASQ-25 system is decoded in the MART. If response is correct for that aircraft, an audio IFF confirm tone is transmitted by the 182 test stand radio. IFF test mode interrogations continue for the duration of the ILS data. Reception of the audio tone in the aircraft verifies IFF operation.

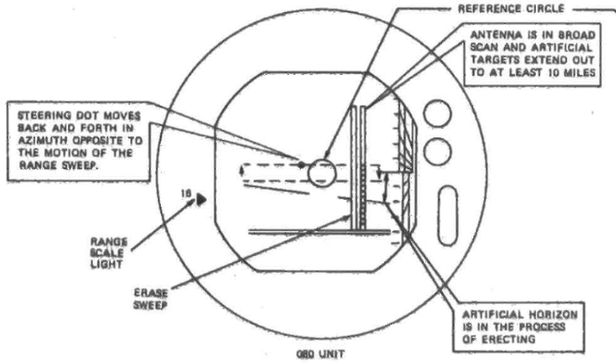
D The 182 test stand ARC-109 radio begins transmission of predetermined TACAN range and bearing at the conclusion of ILS and IFF data. The TACAN information is processed by the test aircraft to provide TACAN test range and bearing indications on cockpit instruments.

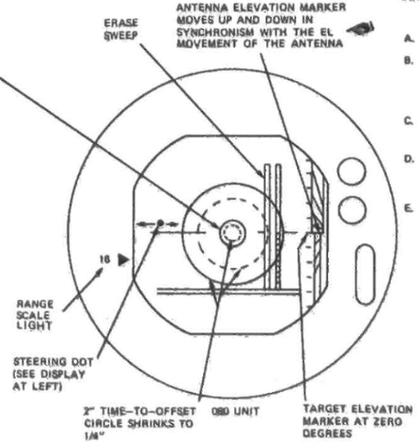
E +28 V safe-to-test signal energizes rcvr test relay K4 (19B) which supplies +28 V to energize receiver self-test relay K451 (08B) allowing self test pulses to be generated, as for SSGC 2. Voltage is removed from crystal protection shutter relay K701 (08B), keeping shutter in waveguide.

F These relays remove steering signal blanking from display circuits and connect the search error signals to steering dot channel as during SSGC 2.

G When GND TEST INTER switch (79B) is pressed, a ground is supplied energize PTT-tone relays K3 and K5 (60B), and K1 ant. transmit and transmit relays K4 and K5 in RT-749 unit. Ptt tone relays K3, K5 permit cond xmtr tone to be heard in head sets. Transmit relays K4 and K5 (RT-749) enable the xmtr circuits. Ant. transmit relay K1 (RT-749) connects xmtr output to communications ant.

FLIGHT COMMAND INDICATOR DISPLAY WHEN SSGC 3 IS SELECTED AND TESTS ARE FUNCTIONING PROPERLY.





FLIGHT COMMAND INDICATOR DISPLAYS AFTER GND TEST INTER SWITCH S2 (79B UNIT) HAS BEEN PRESSED

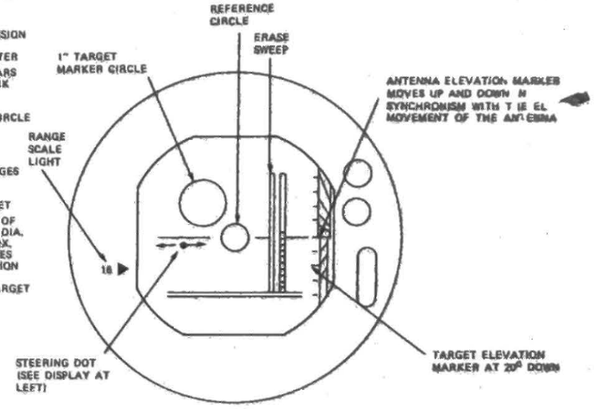
A. T_0 = START OF MART TRANSMISSION

B. T_0 +2B SEC; A TWO INCH DIAMETER TIME-TO-OFFSET CIRCLE APPEARS AFTER RECEPTION OF DATA LINK MESSAGE

C. T_0 +3B SEC; TIME-TO-OFFSET CIRCLE STARTS SHRINKING (SEE E).

D. T_0 +9B SEC; COMPUTER MODE ANNUNCIATOR (03H UNIT) CHANGES TO DR

E. T_0 +11B SEC; (1) TIME-TO-OFFSET CIRCLE HAS SHRUNK TO A DIA. OF 1/4" AND IS REPLACED BY A 1" DIA. TARGET MARKER CIRCLE APPROX. 32° LEFT OF CENTER AT 14 MILES IN RANGE. (2) TARGET ELEVATION MARKER CHANGES FROM 0° ELEVATION TO A PREDICTED TARGET ELEVATION OF 20° DOWN.



MART RESPONSE CHART

PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
TIME (SEC)	4	8	12	16	20	24	28	32	36	40	44	48	52	
ILS		UP	LEFT	CENTER										
				CENTER		DOWN	RIGHT							
IFF														
IFF CONFIRM														
TACAN														
DATA LINK														
BUSY SIGNAL	1080 Hz				1200 Hz			1080 Hz						

Figure 2-2. SSGC (Sheet 26 of 65; SSGC 3, sheet 1 of 16, A-Model)

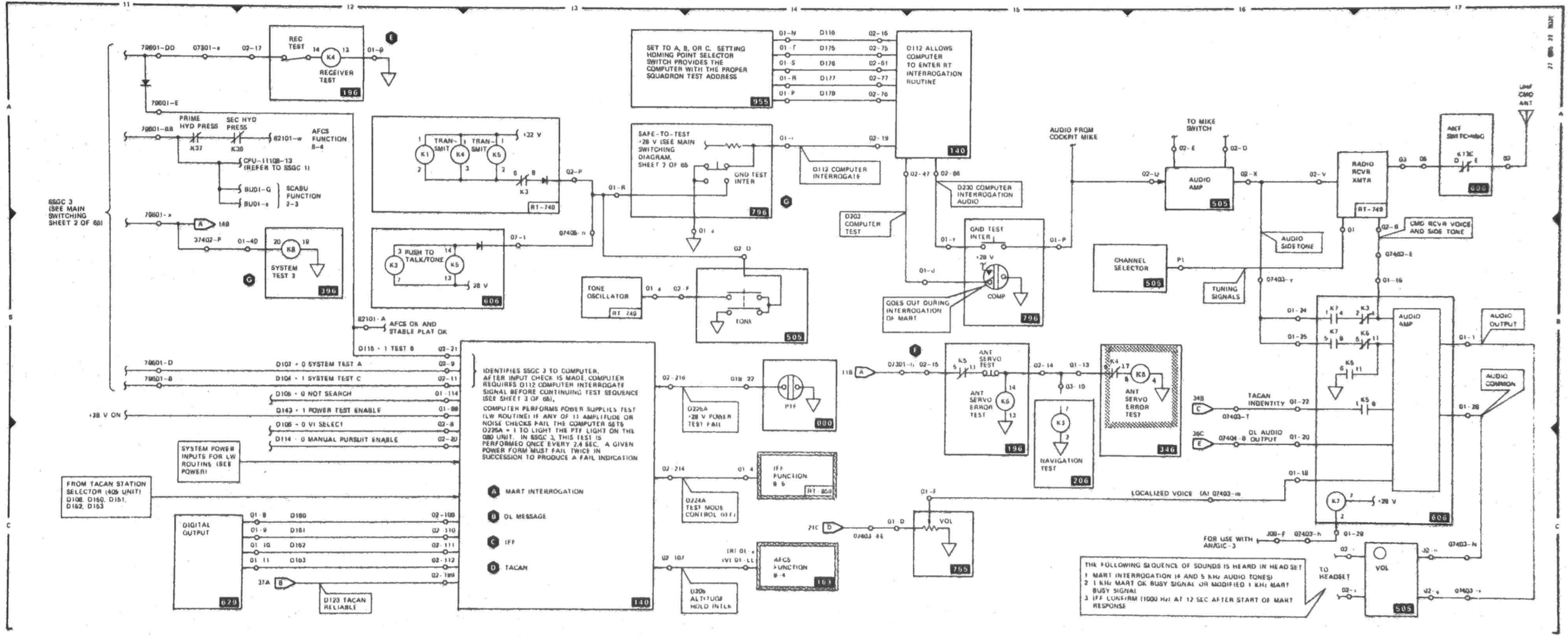


Figure 2-2. SSGC (Sheet 27 of 65: SSGC 3, sheet 2 of 16, A-Model)

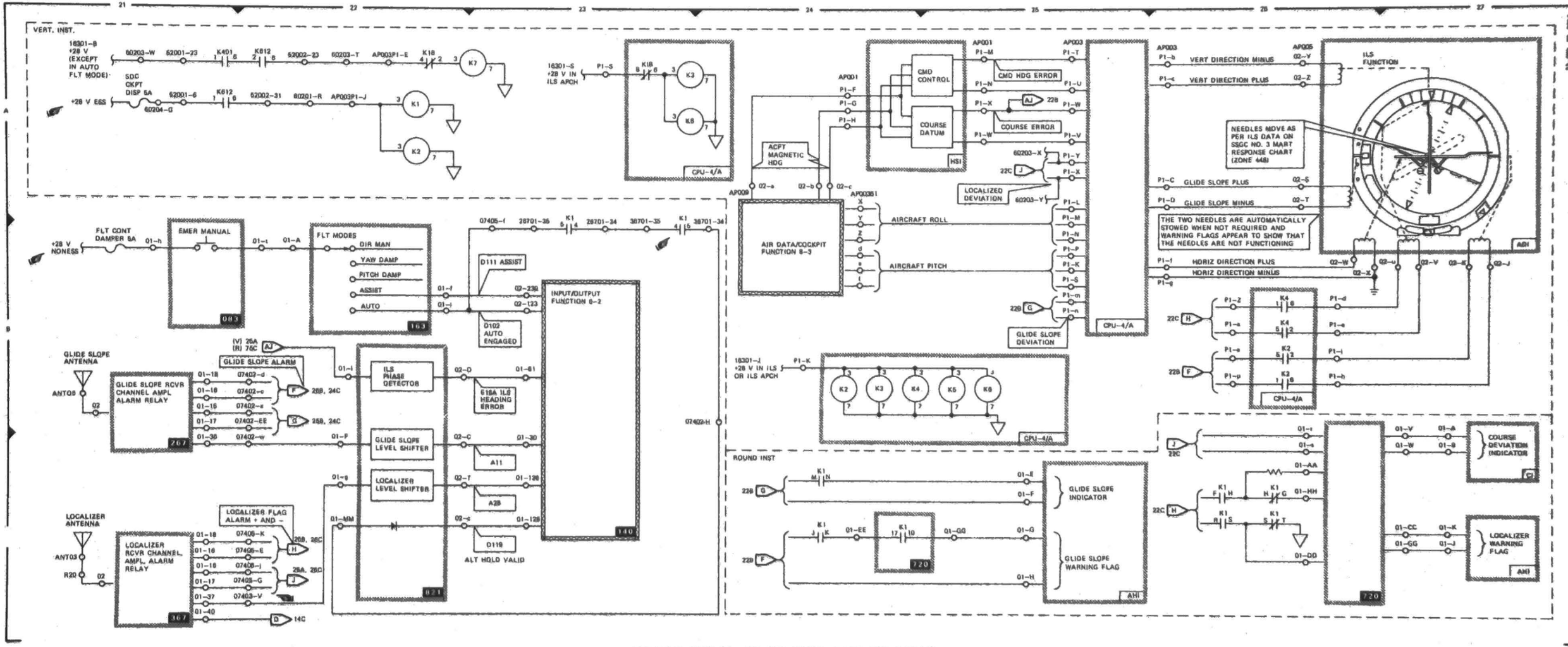


Figure 2-2. SSGC (Sheet 28 of 65: SSGC 3, sheet 3 of 16, A-Model)

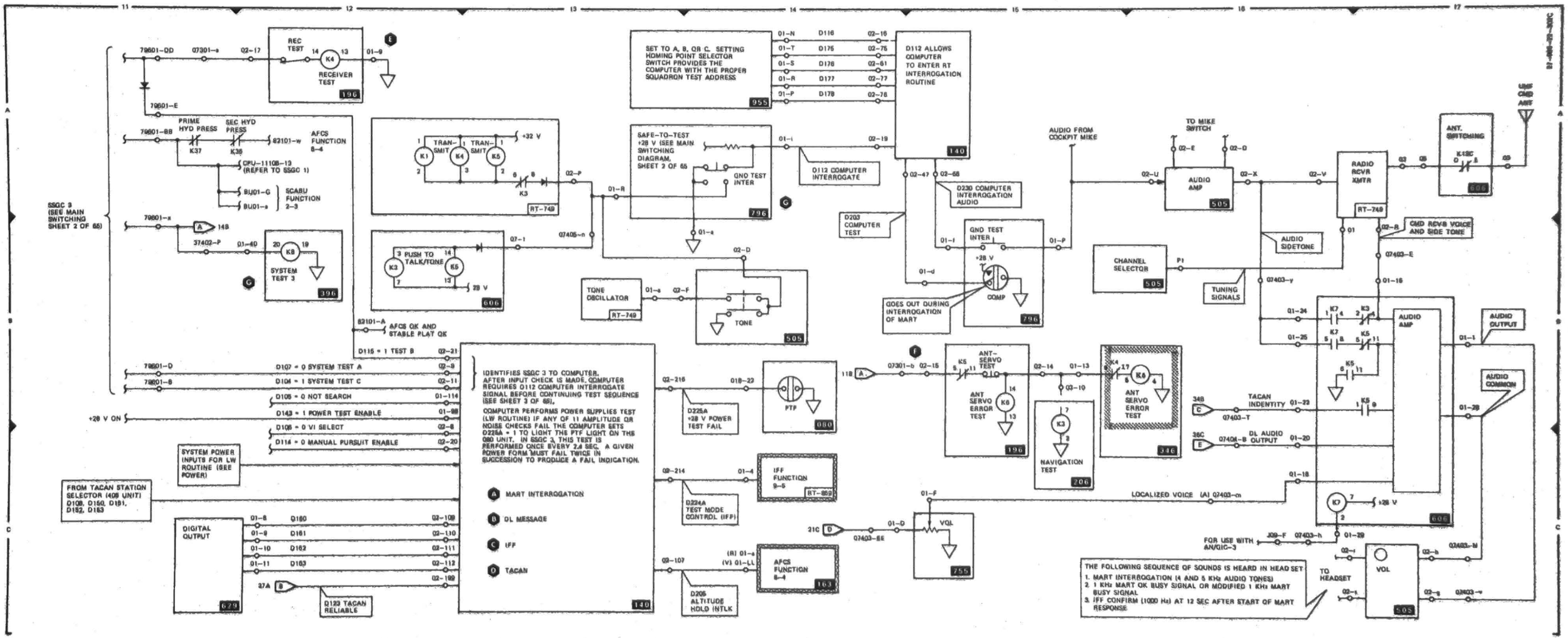


Figure 2-2. SSGC (Sheet 27 of 65: SSGC 3, sheet 2 of 16, A-Model)

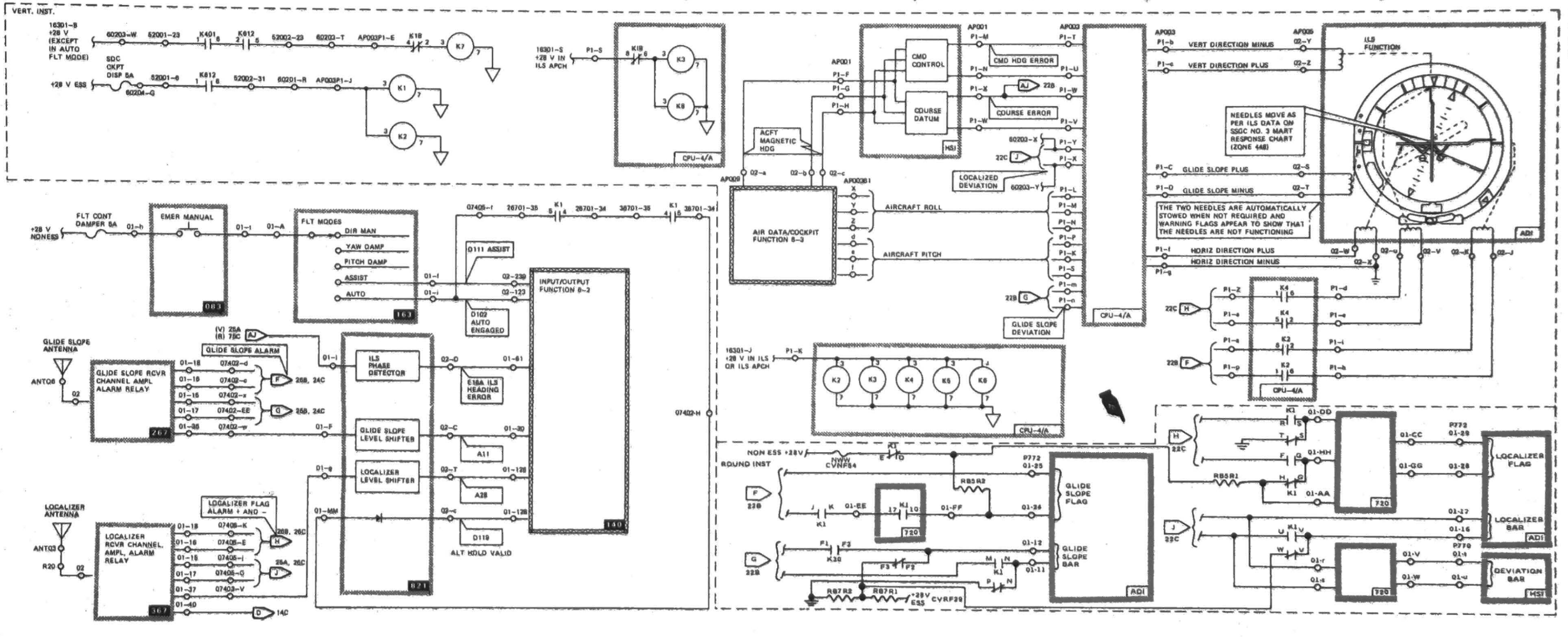


Figure 2-2. SSGC (Sheet 28 of 65: SSGC 3, sheet 3 of 16, A-Model)

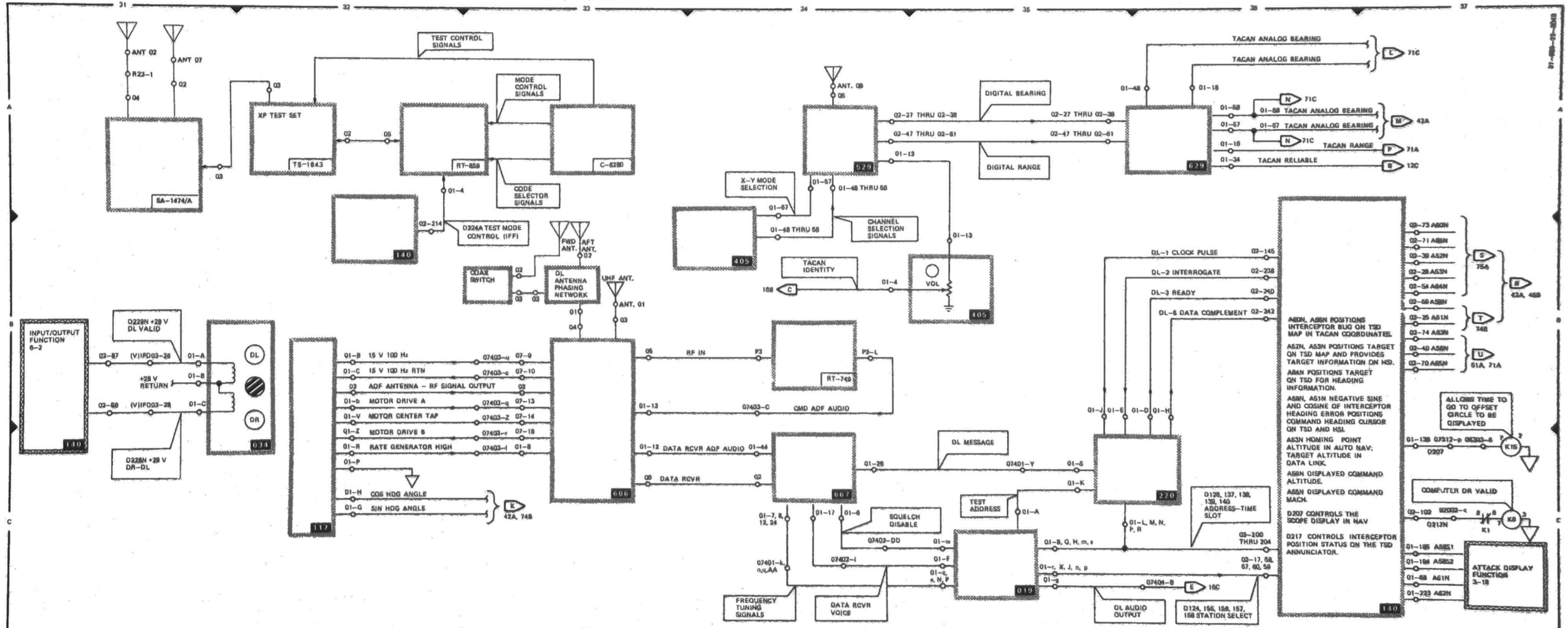


Figure 2-2. SSGC (Sheet 29 of 65: SSGC 3, sheet 4 of 16, A-Model)

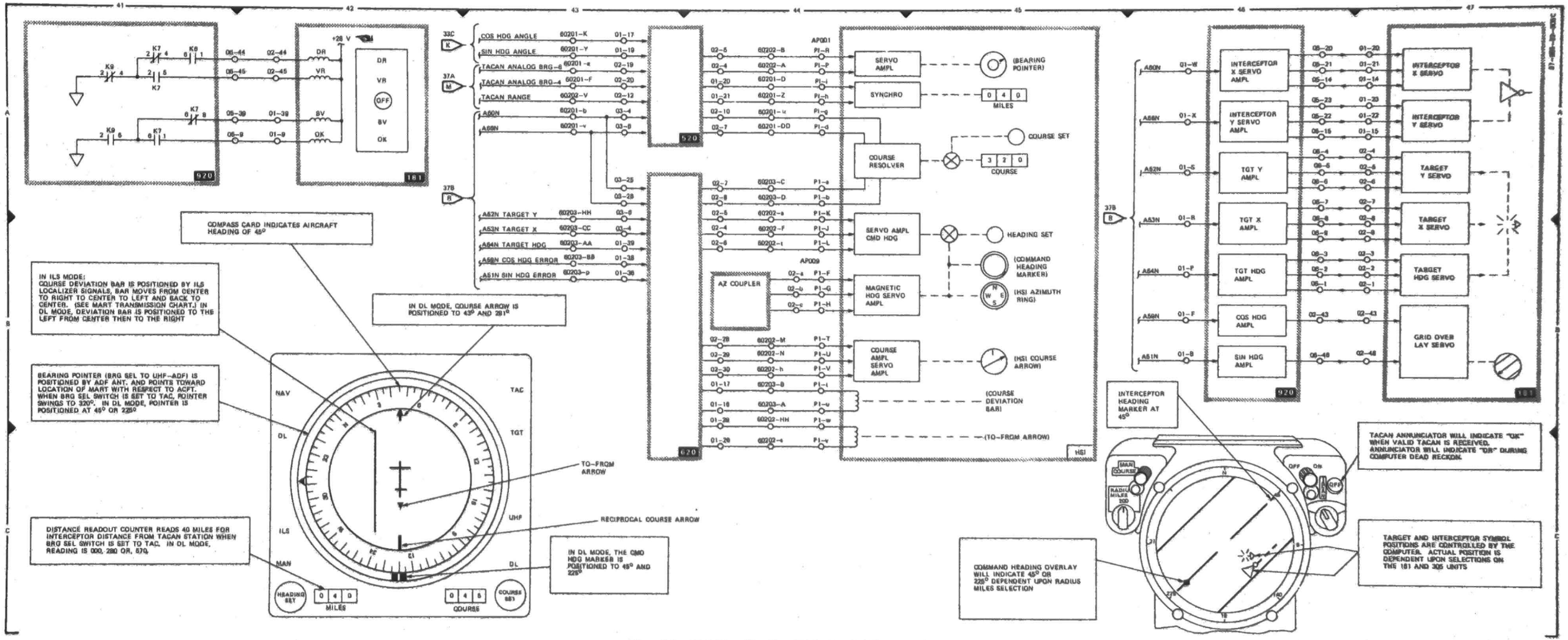


Figure 2-2. SSGC (Sheet 30 of 65: SSGC 3, sheet 5 of 16, A-Model)

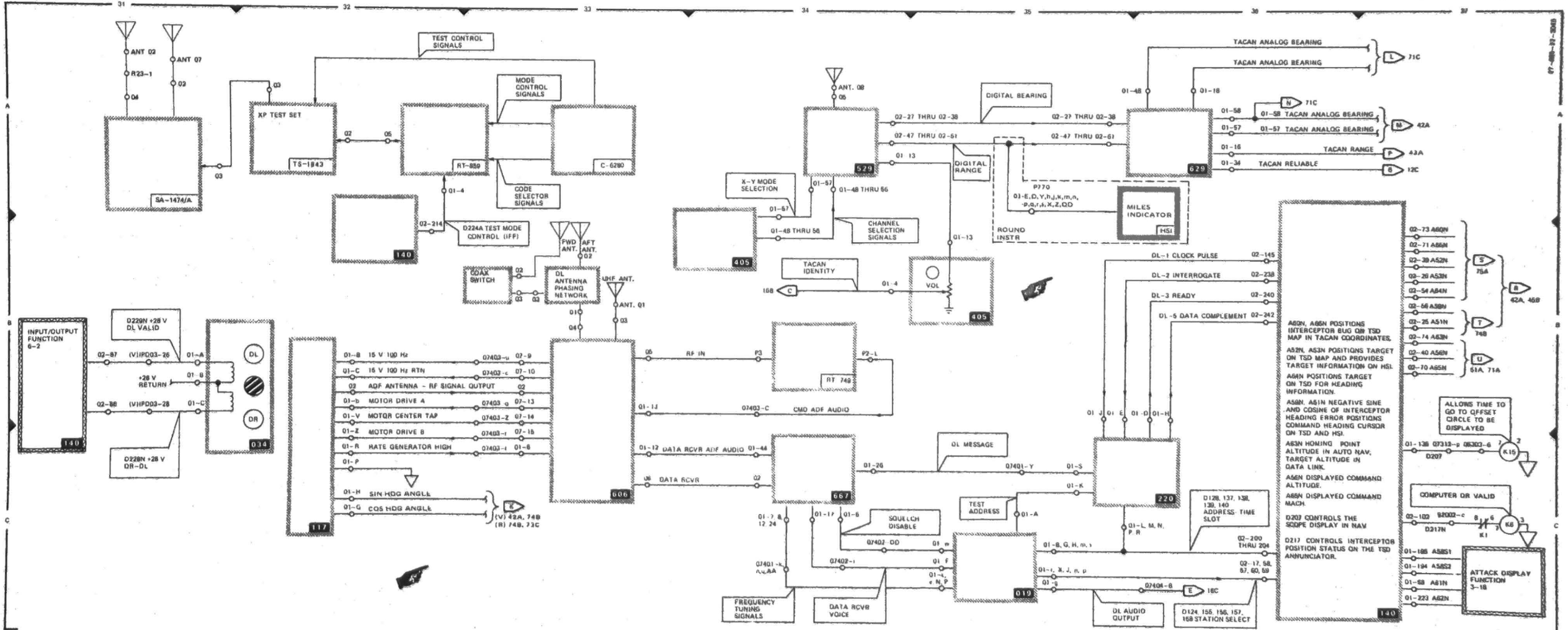


Figure 2-2. SSGC (Sheet 29 of 65: SSGC 3, sheet 4 of 16, A-Model)

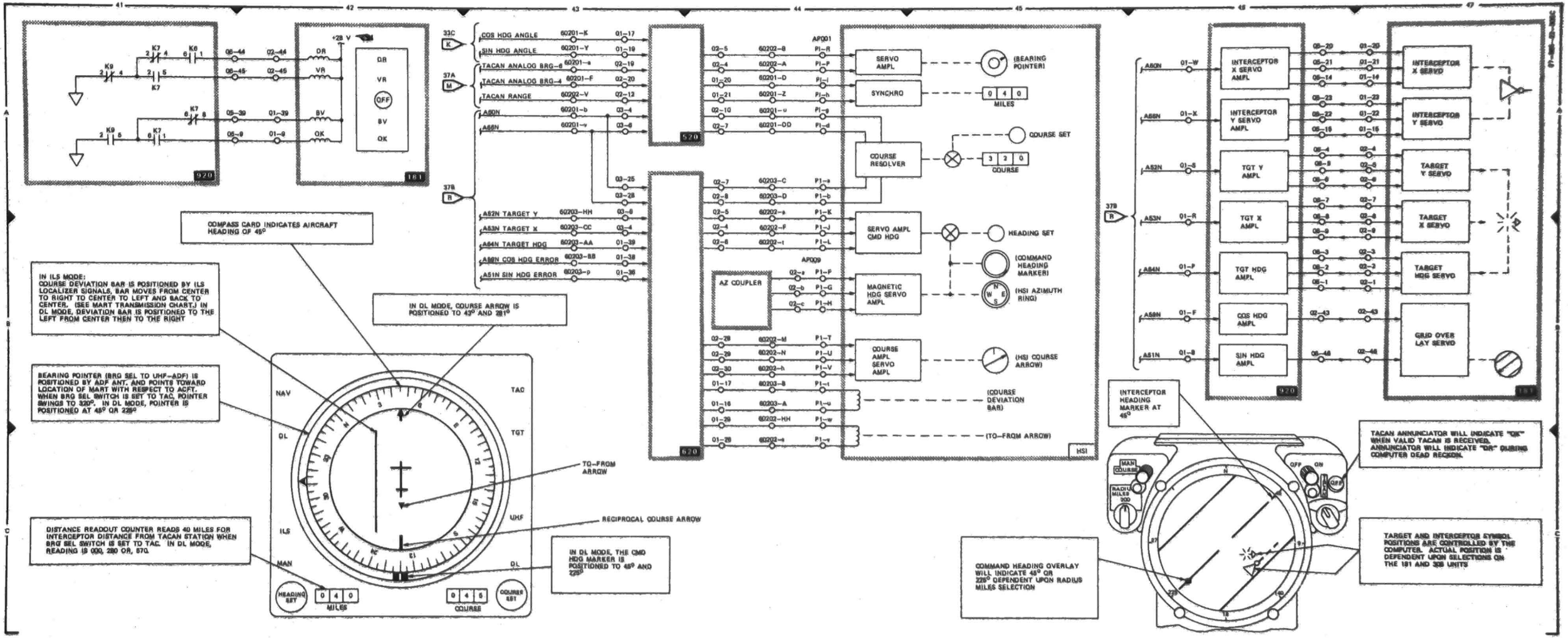


Figure 2-2. SSGC (Sheet 30 of 65: SSGC 3, sheet 6 of 16, A-Model)

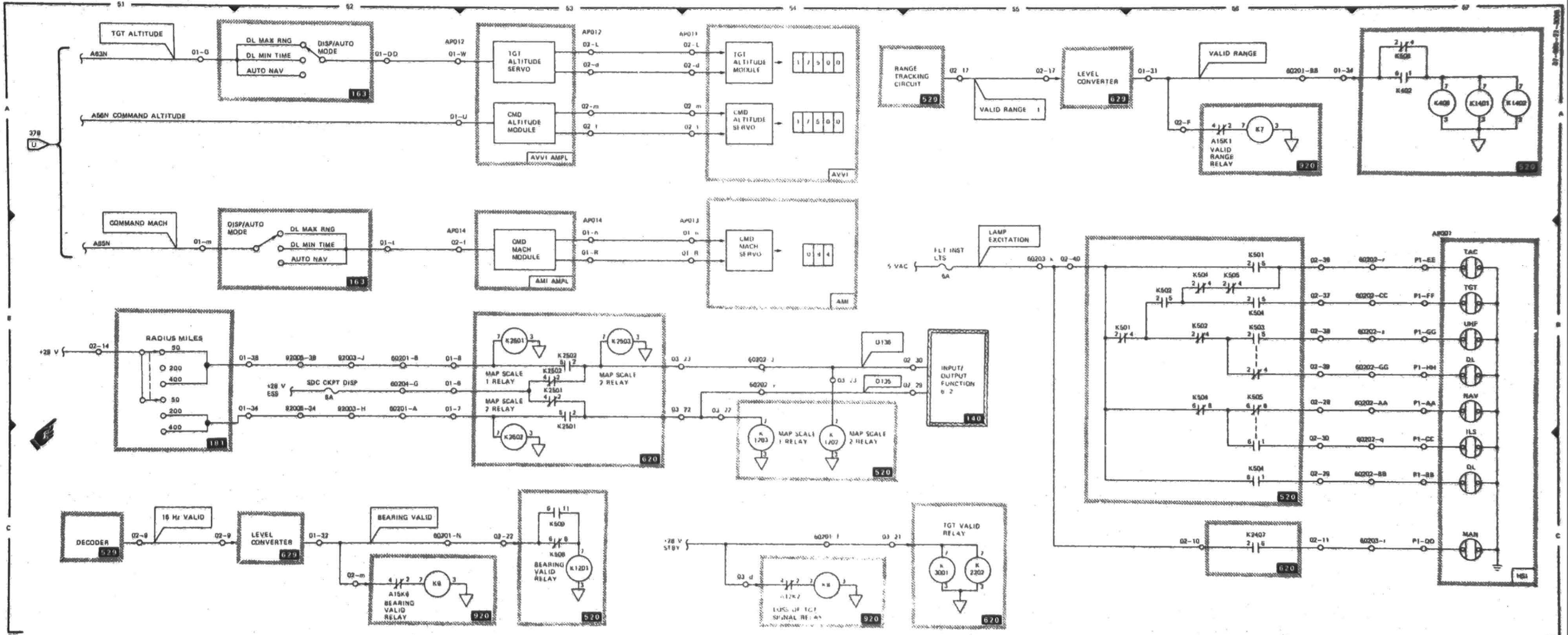


Figure 2-2 SSGC (Sheet 31 of 65 SSGC 3, sheet 6 of 16, A-Model)

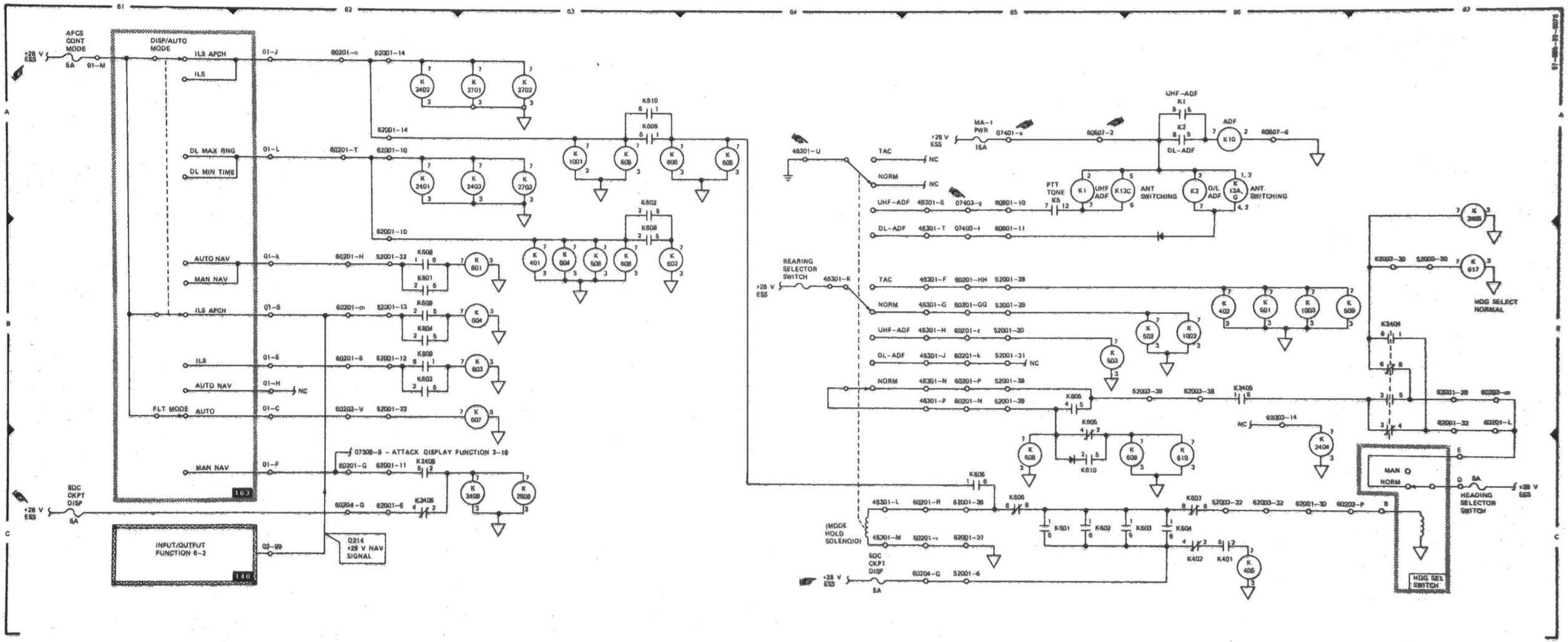


Figure 2-2. SSGC (Sheet 32 of 65: SSGC 3, Sheet 7 of 16, A-Model)

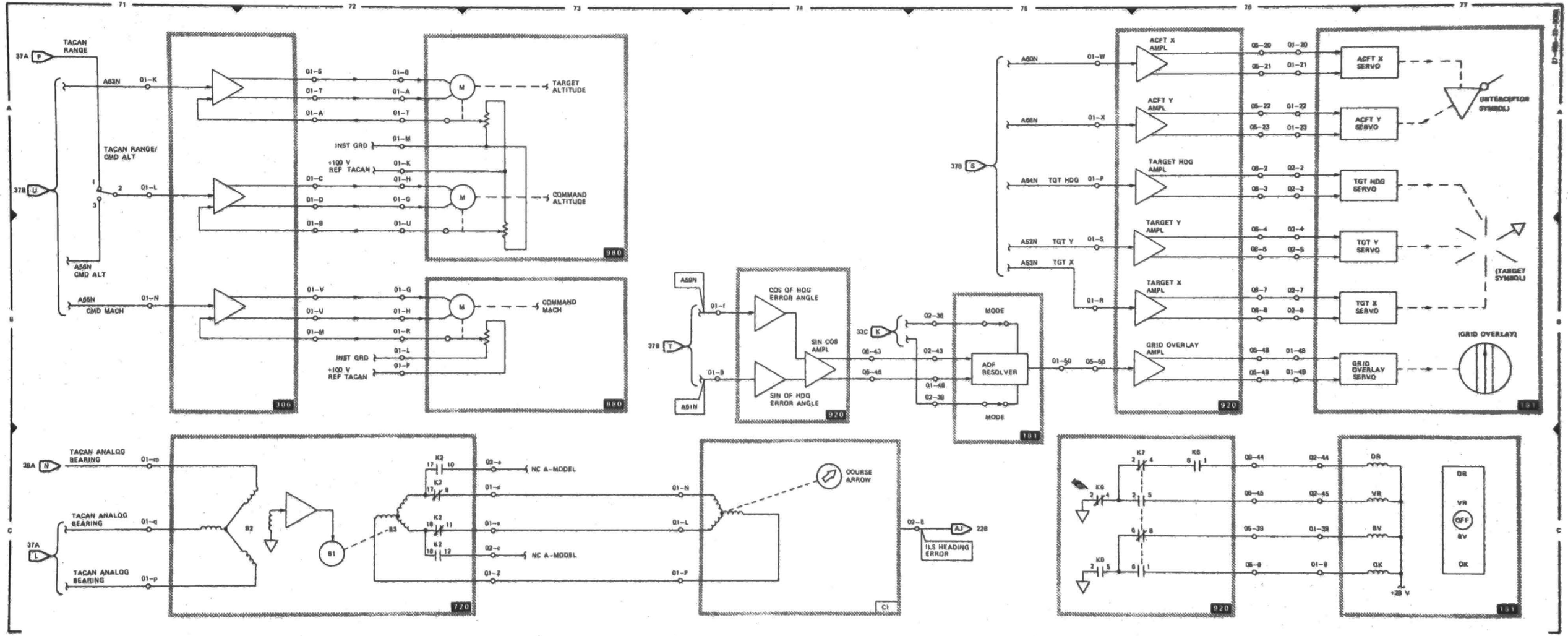


Figure 2-2. SSGC (Sheet 33 of 65: SSGC 3, sheet 8 of 16, A-Model)

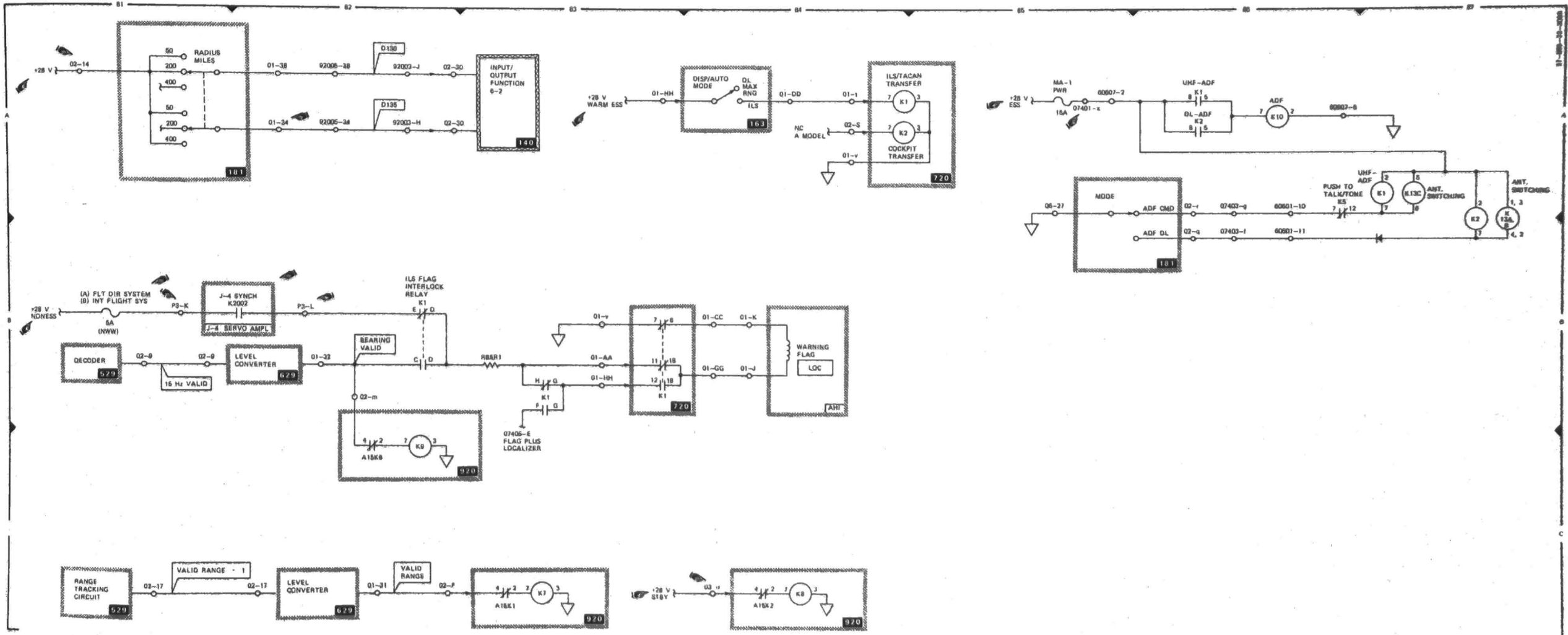


Figure 2-2. SSGC (Sheet 34 of 65: SSGC 3, sheet 2 of 16, A-Model)

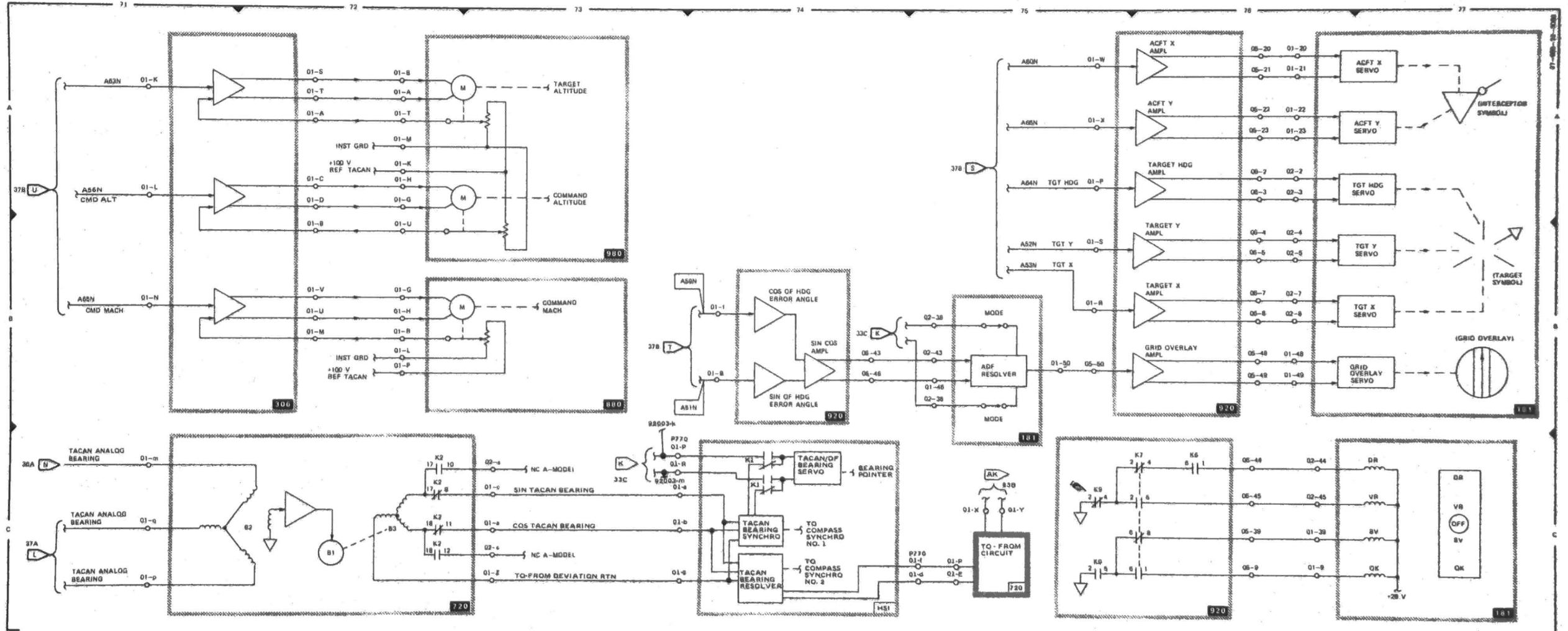


Figure 2-2. SSGC (Sheet 33 of 65: SSGC 3, sheet 8 of 16, A-Model)

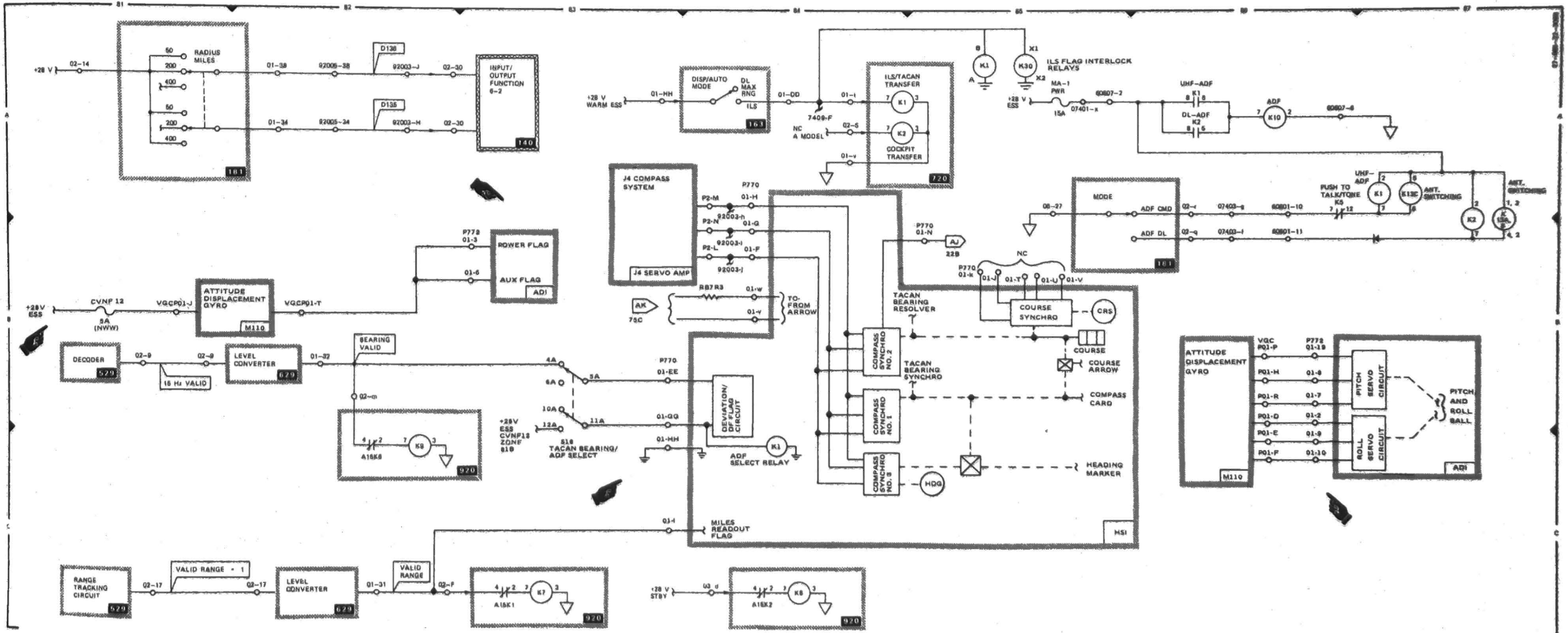


Figure 2-2. SSGC (Sheet 34 of 65: SSGC 3, sheet 9 of 16, A-Model)

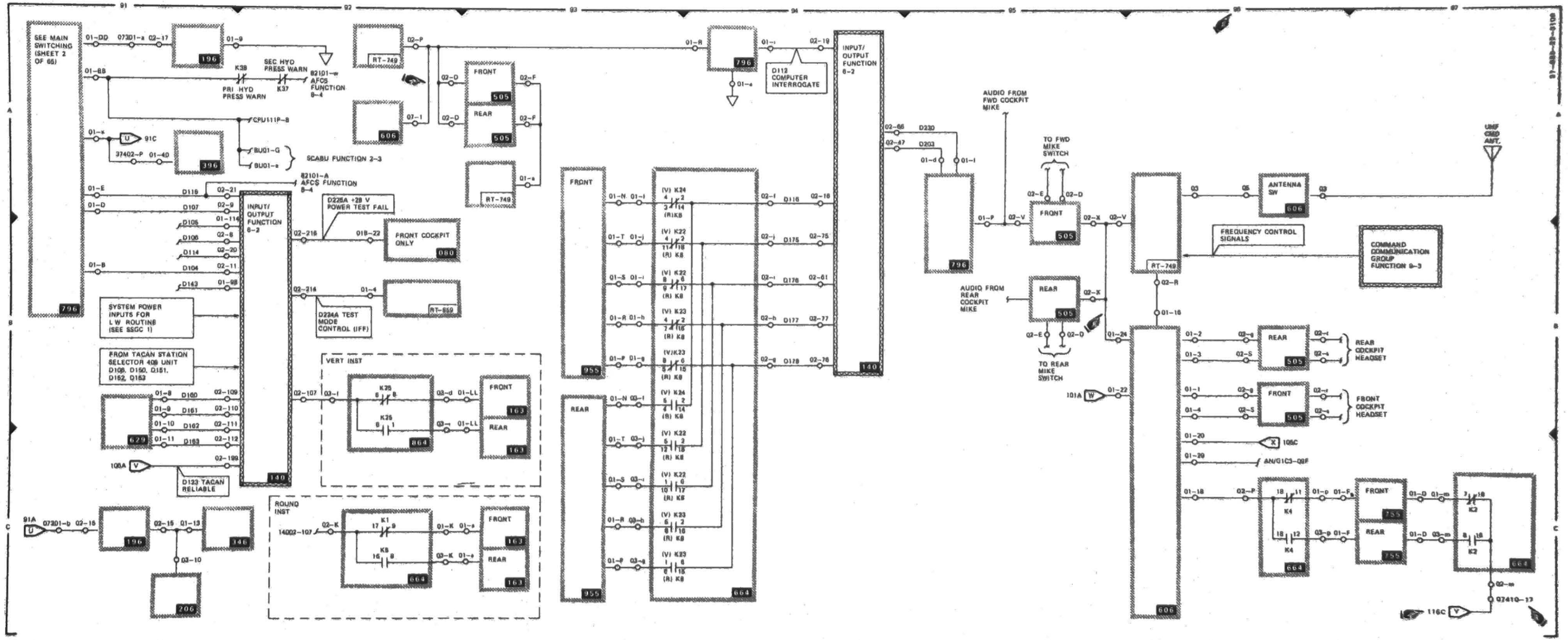


Figure 3-8. SSGC (Sheet 35 of 65: SSGC 3, sheet 10 of 16, B-Model)

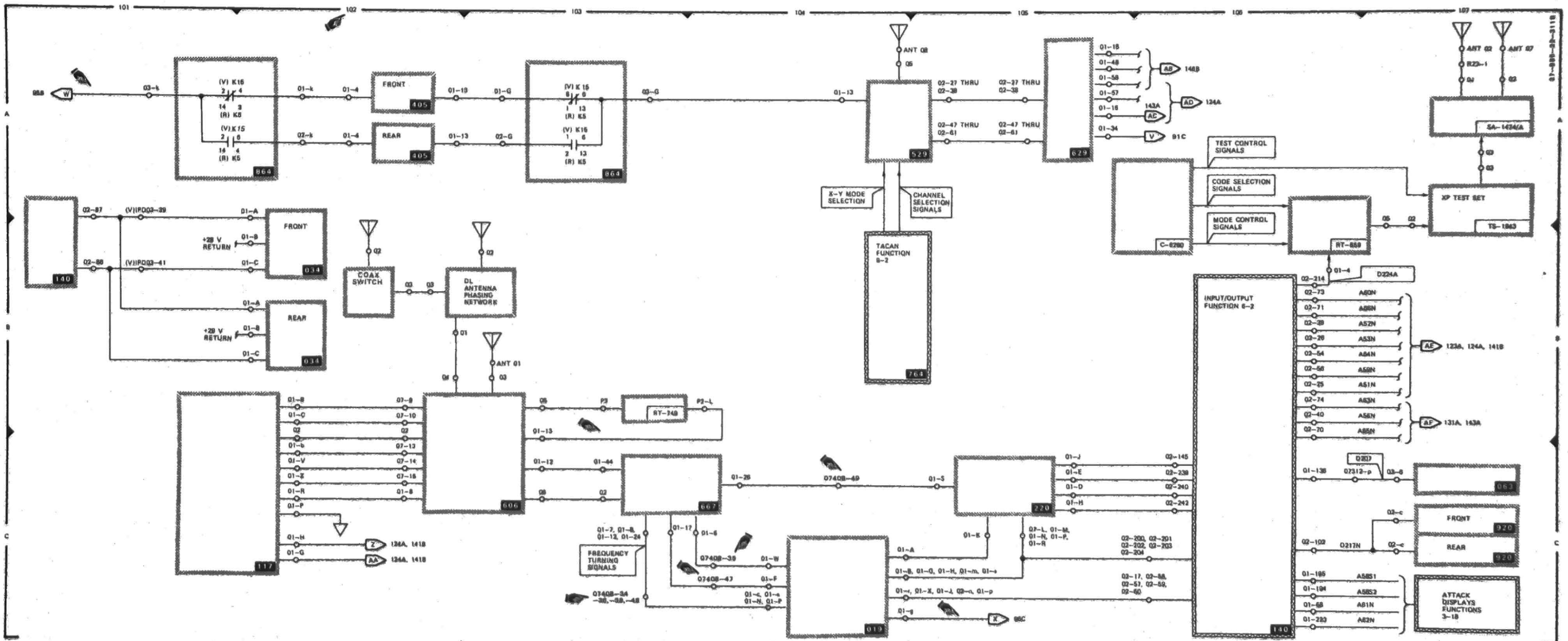


Figure 2-2. SSGC (Sheet 36 of 65: SSGC 3, sheet 11 of 16, B-Model)

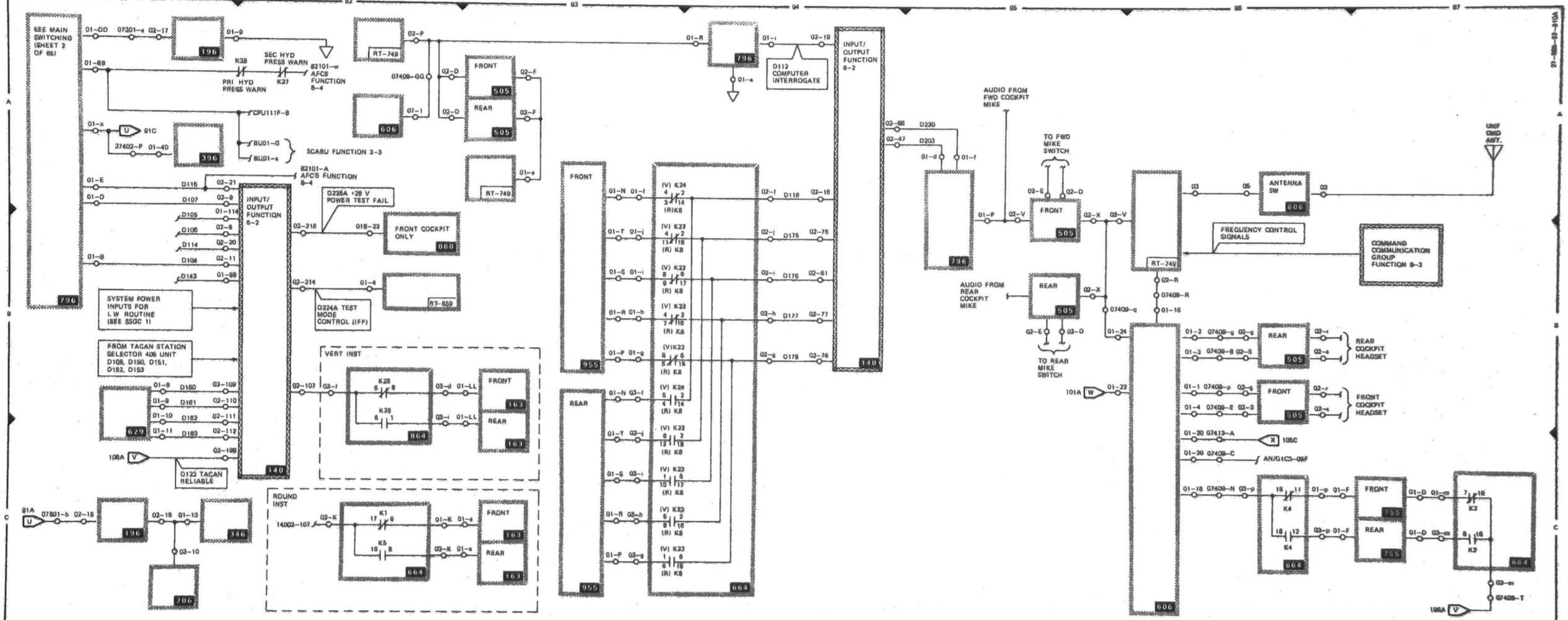


Figure 2-2. SSGC (Sheet 35 of 65: SSGC 3, sheet 10 of 16, B-Model)

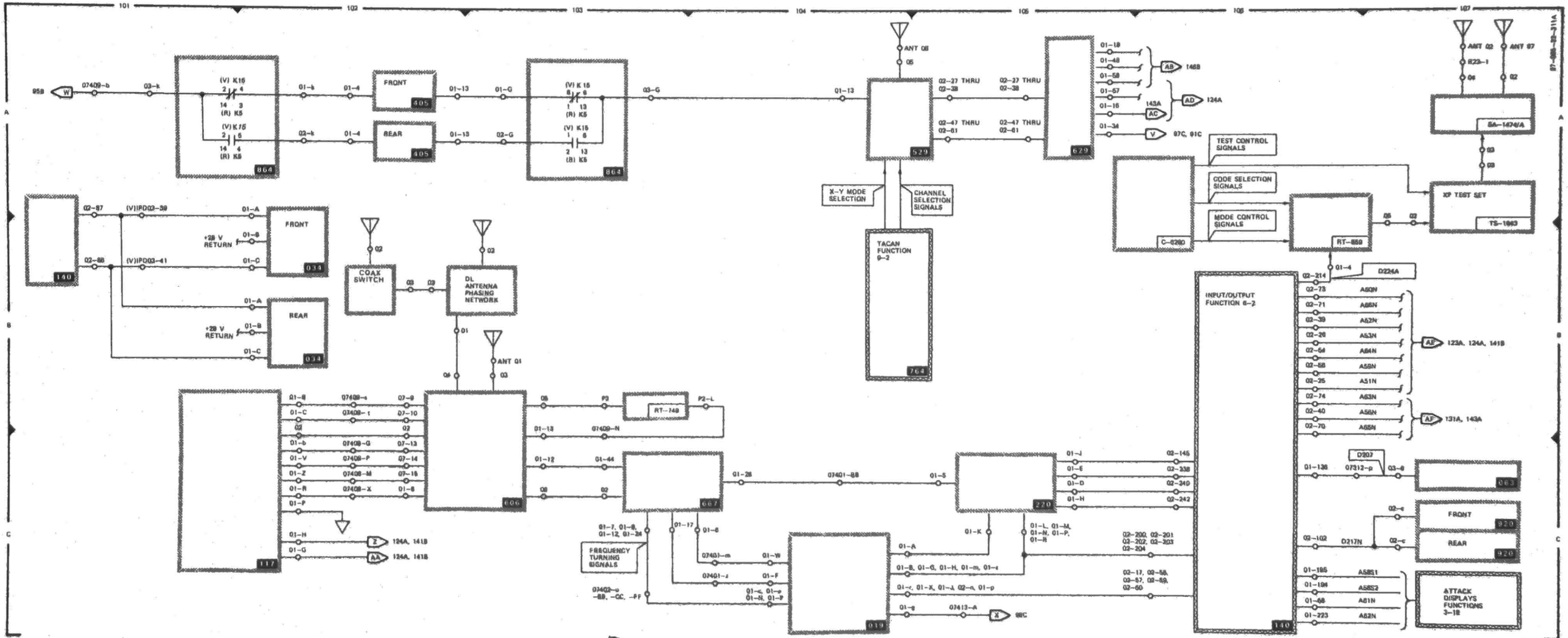


Figure 2-3. SSGC (Sheet 36 of 65: SSGC 3, sheet 11 of 16, B-Model)

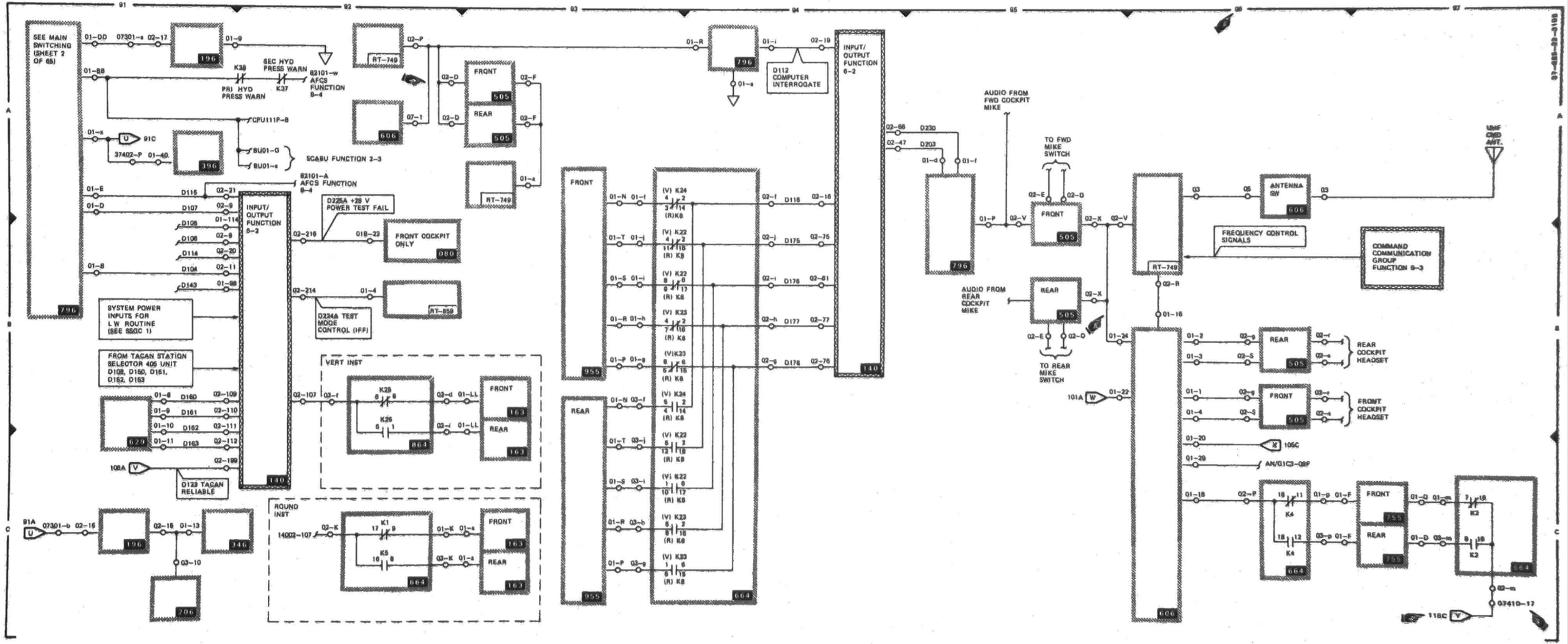


Figure 2-2. SSGC (Sheet 35 of 65: SSGC 3, sheet 10 of 16, B-Model)

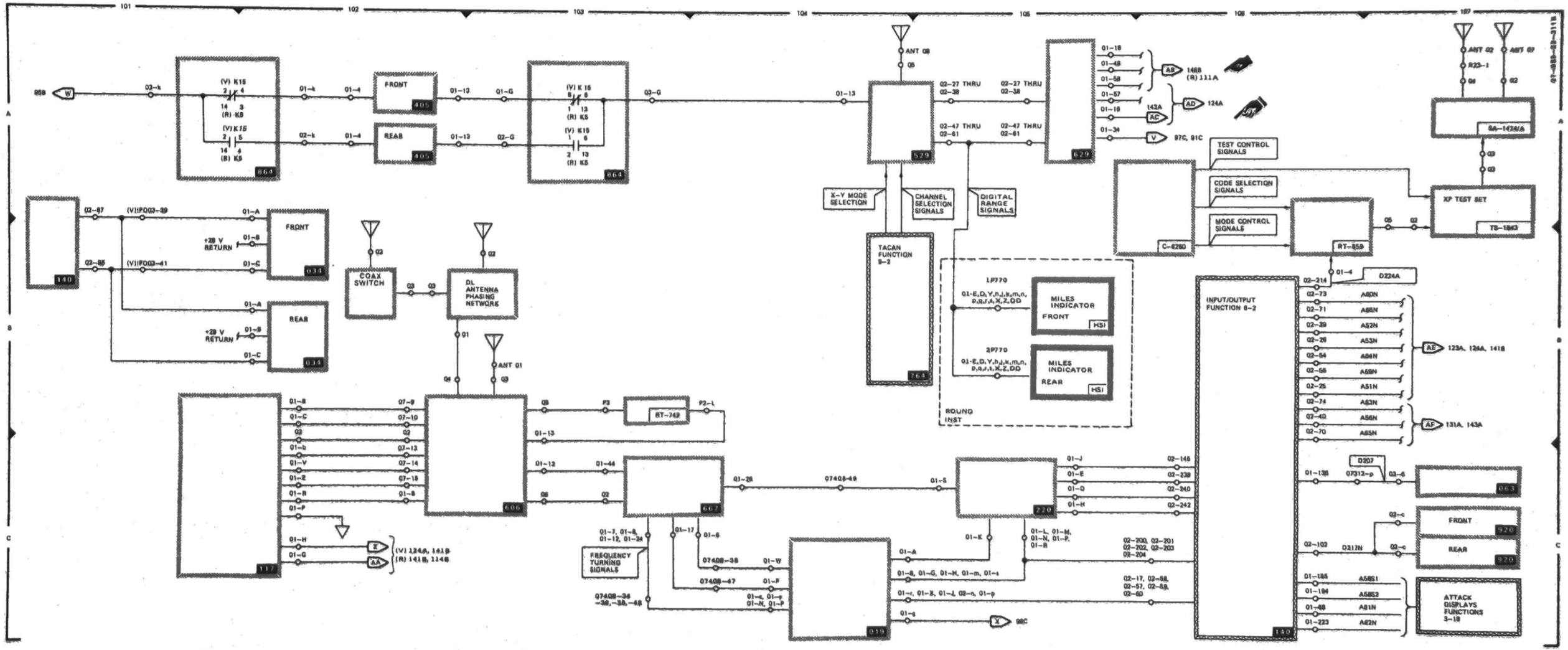


Figure 2-2. SSGC (Sheet 36 of 65: SSGC 3, sheet 11 of 16, B-Model)

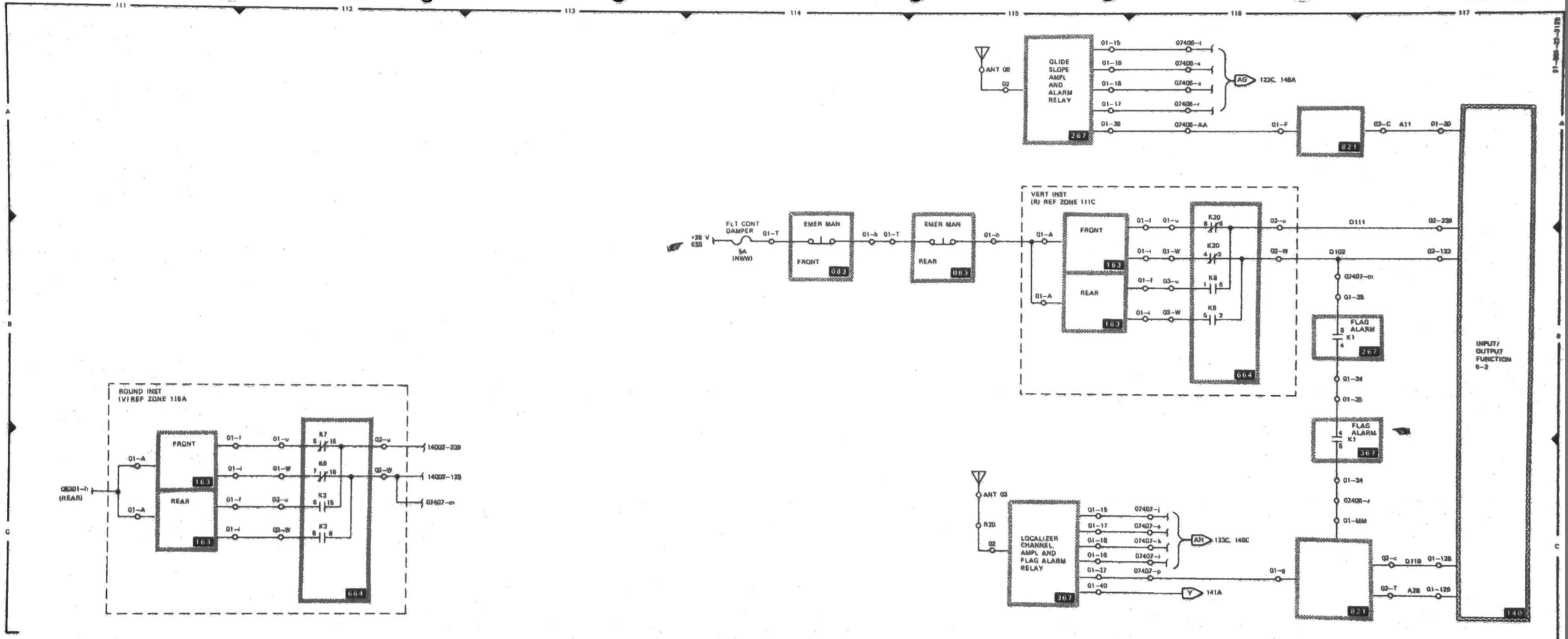


Figure 2-2. SSGC (Sheet 37 of 65: SSGC 3, sheet 12 of 16, B-Model)

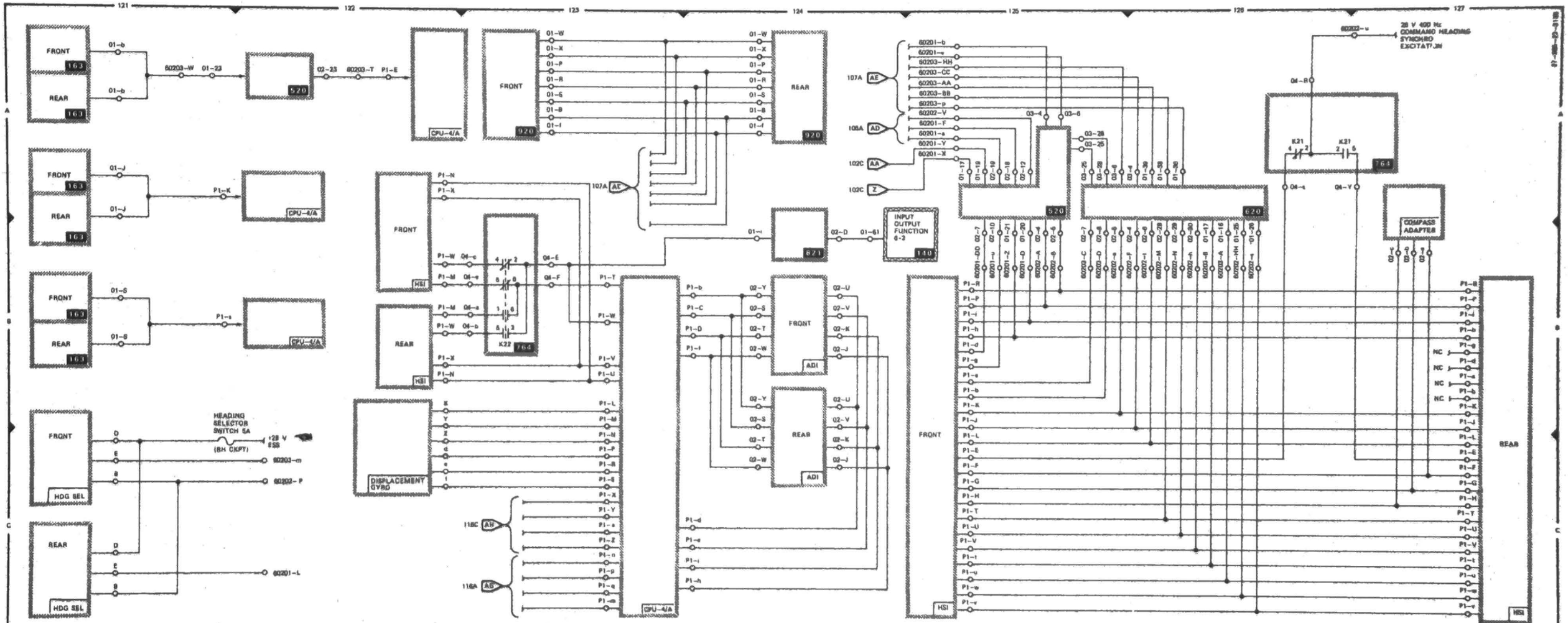


Figure 2-2. SSGC (Sheet 38 of 65: SSGC 3, sheet 13 of 16, B-Model)

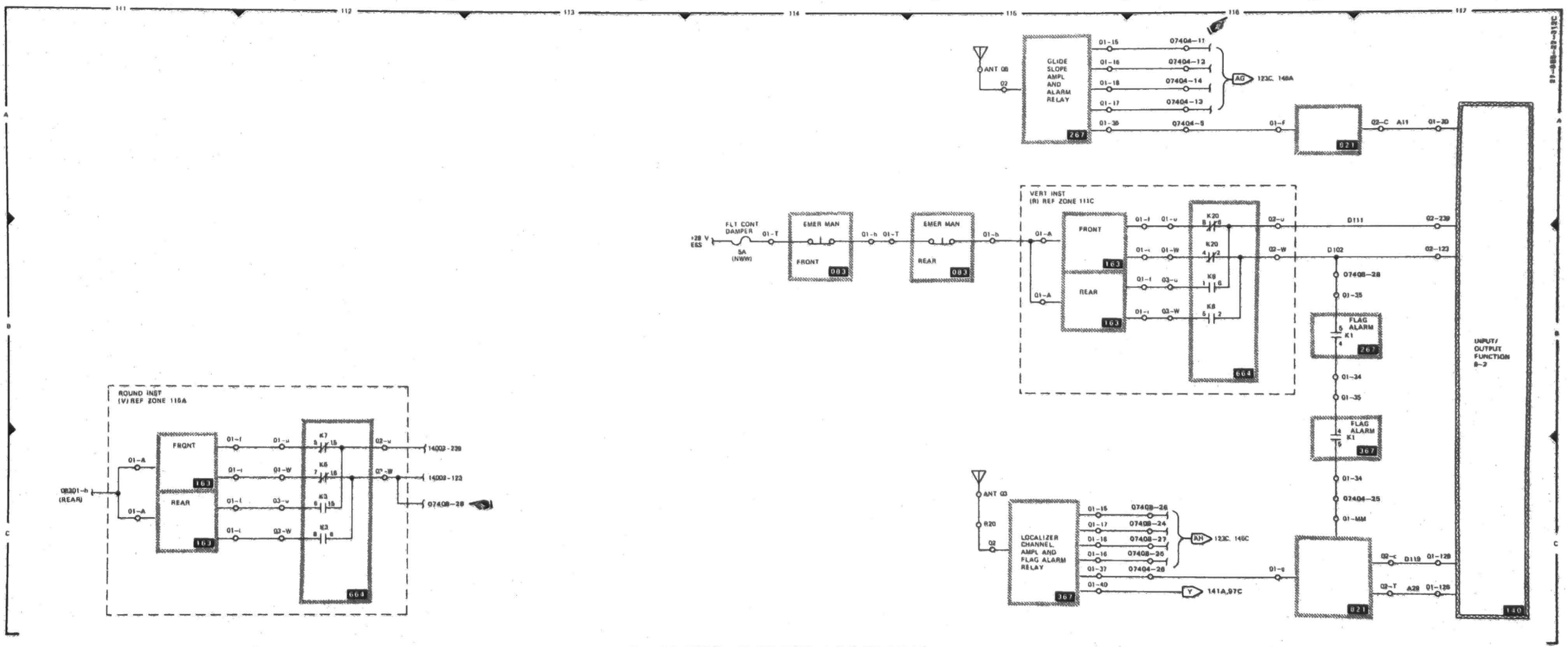


Figure 2-2. SSGC (Sheet 37 of 65: SSGC 3, sheet 12 of 16, B-Model)

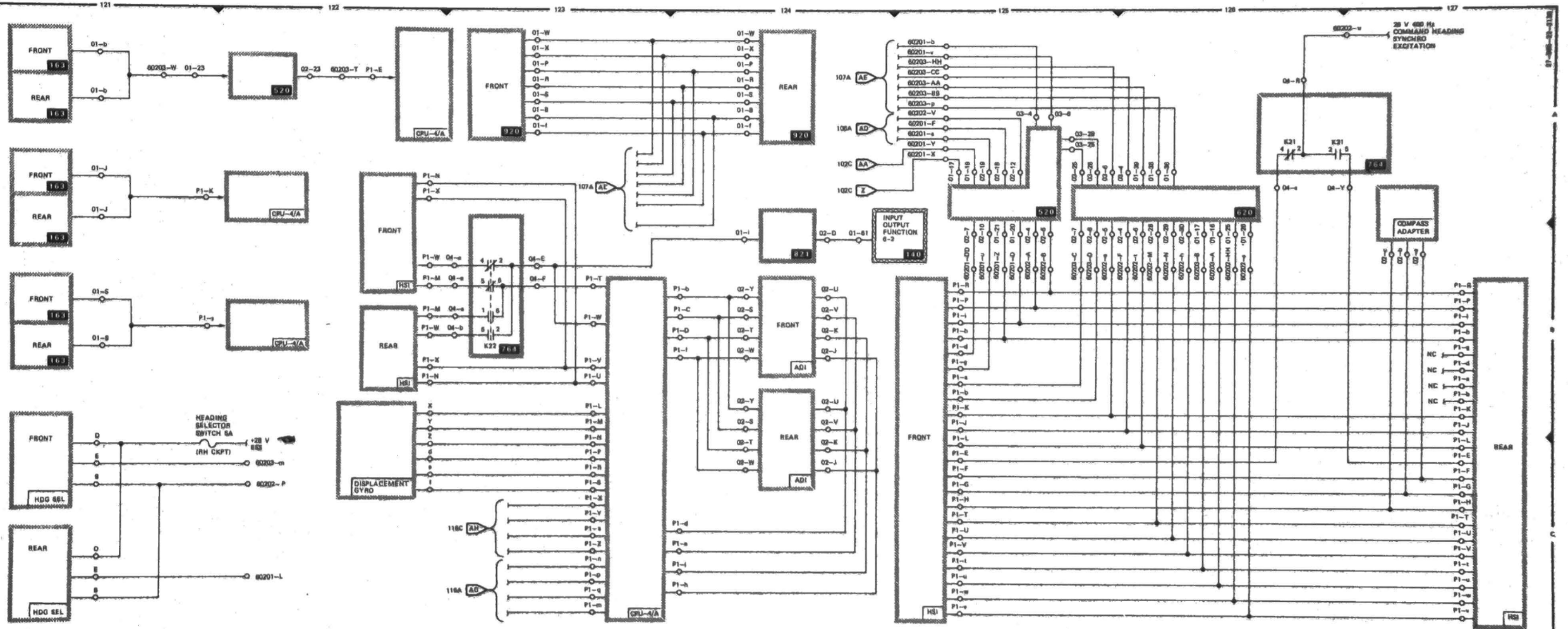


Figure 2-3. SSGC (Sheet 38 of 65: SSGC 3, sheet 13 of 16, B-Model)

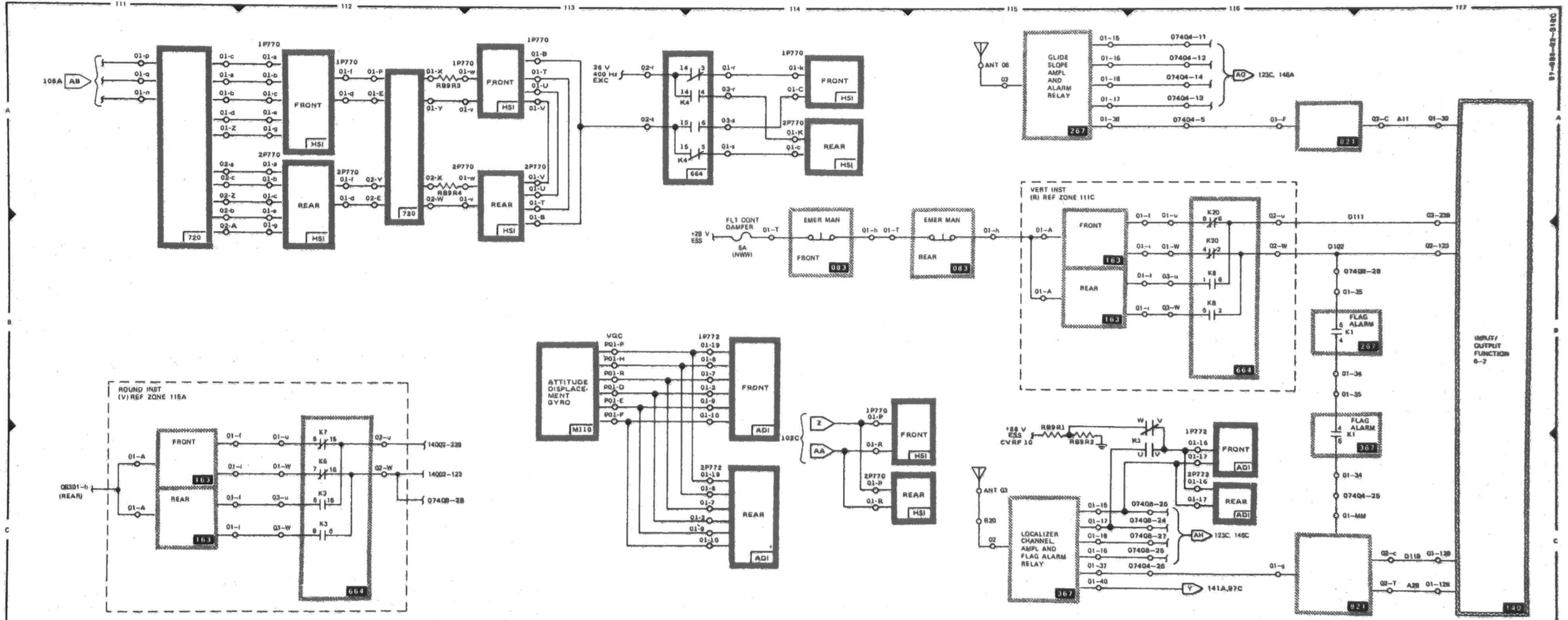


Figure 2-2. SSGC (Sheet 37 of 65: SSGC 3, sheet 12 of 16, B-Model)

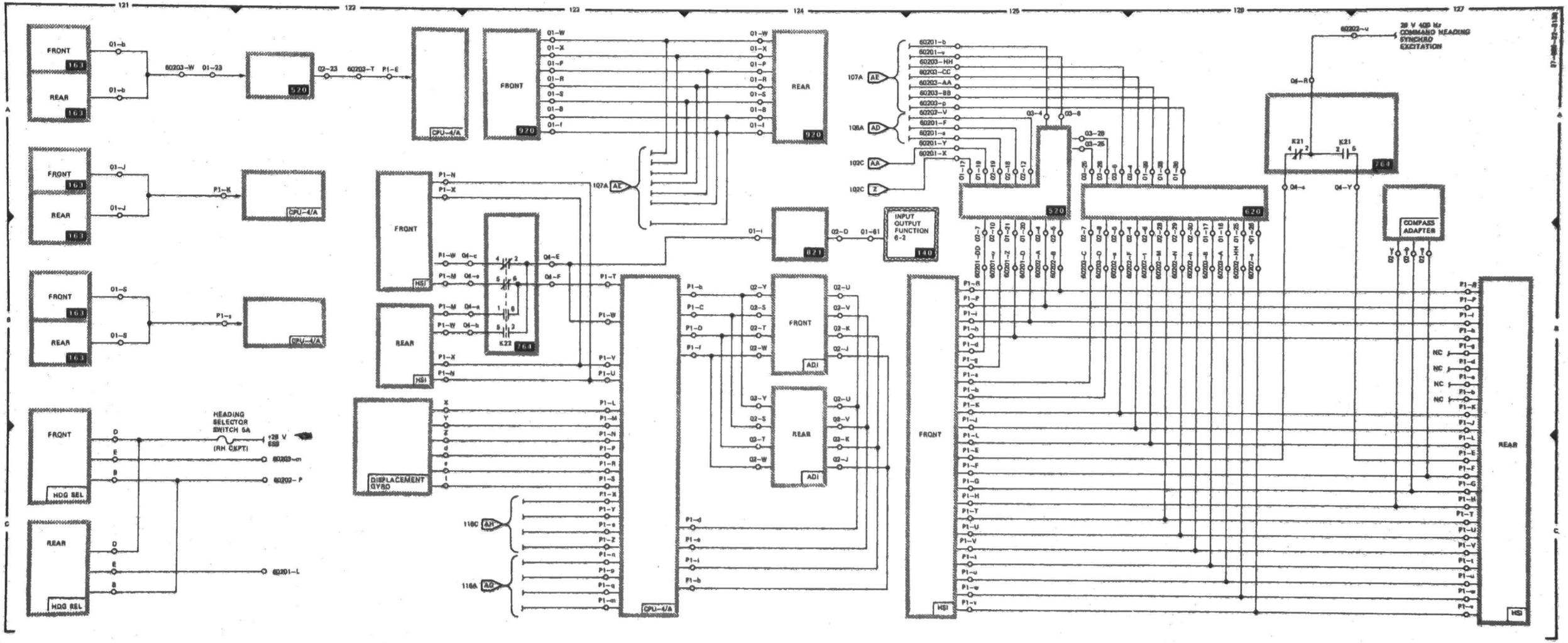


Figure 2-3. SSGC (Sheet 38 of 65: SSGC 3, sheet 13 of 16, B-Model)

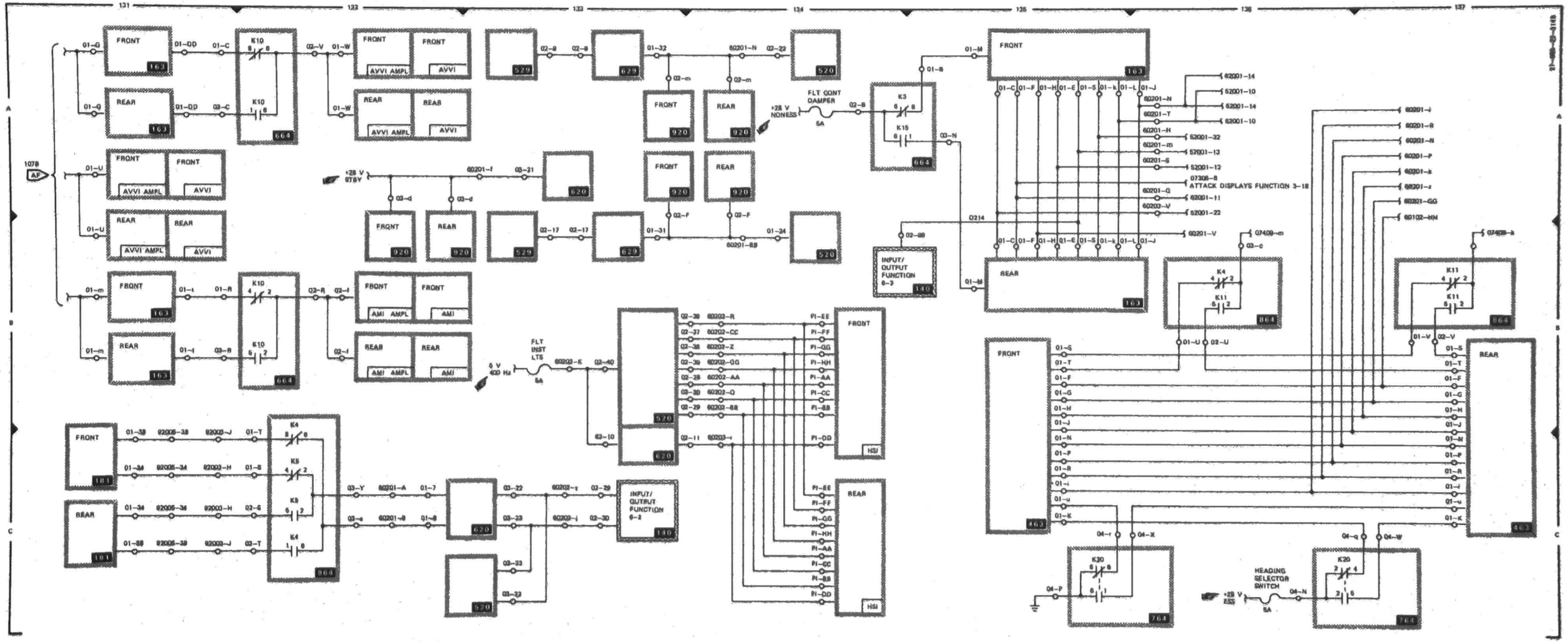


Figure 2-2. SSGC (Sheet 39 of 65: SSGC 3, sheet 14 of 16, B-Model)

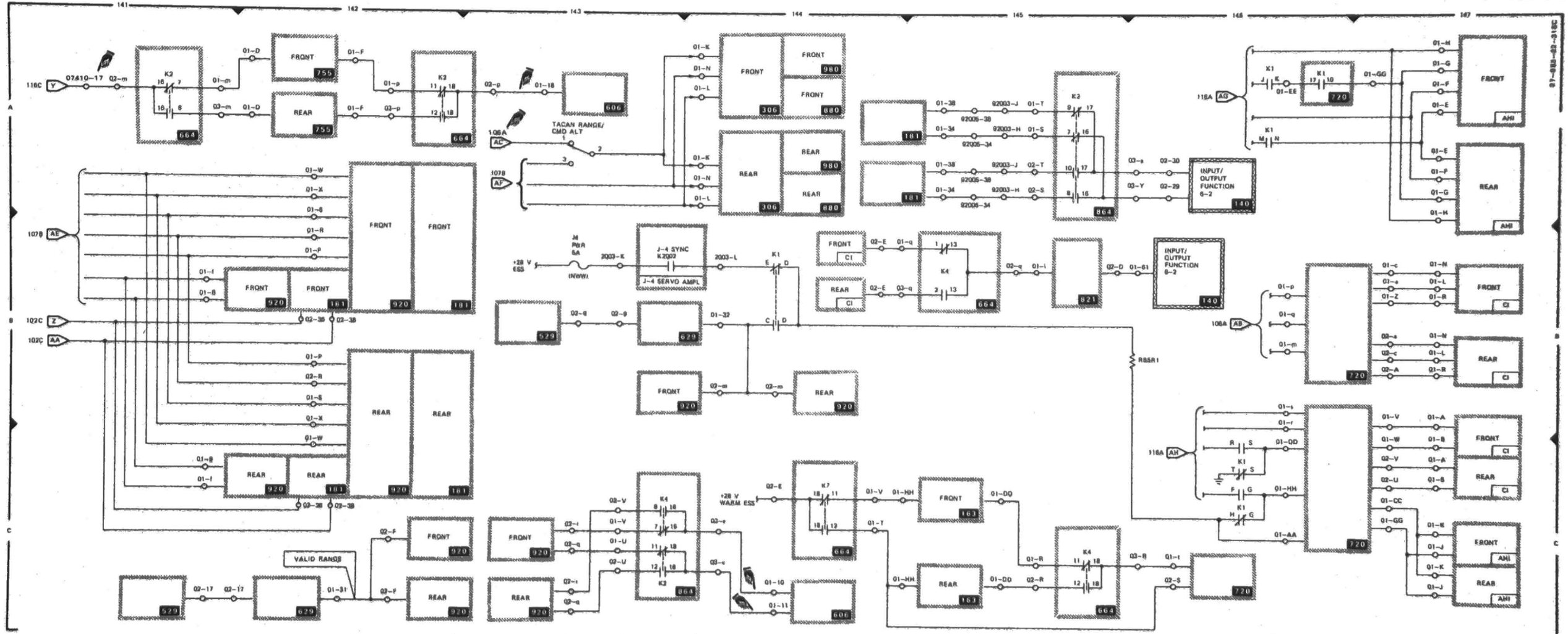


Figure 2-2, SSGC (Sheet 40 of 65: SSGC 3, sheet 15 of 16, B-Model)

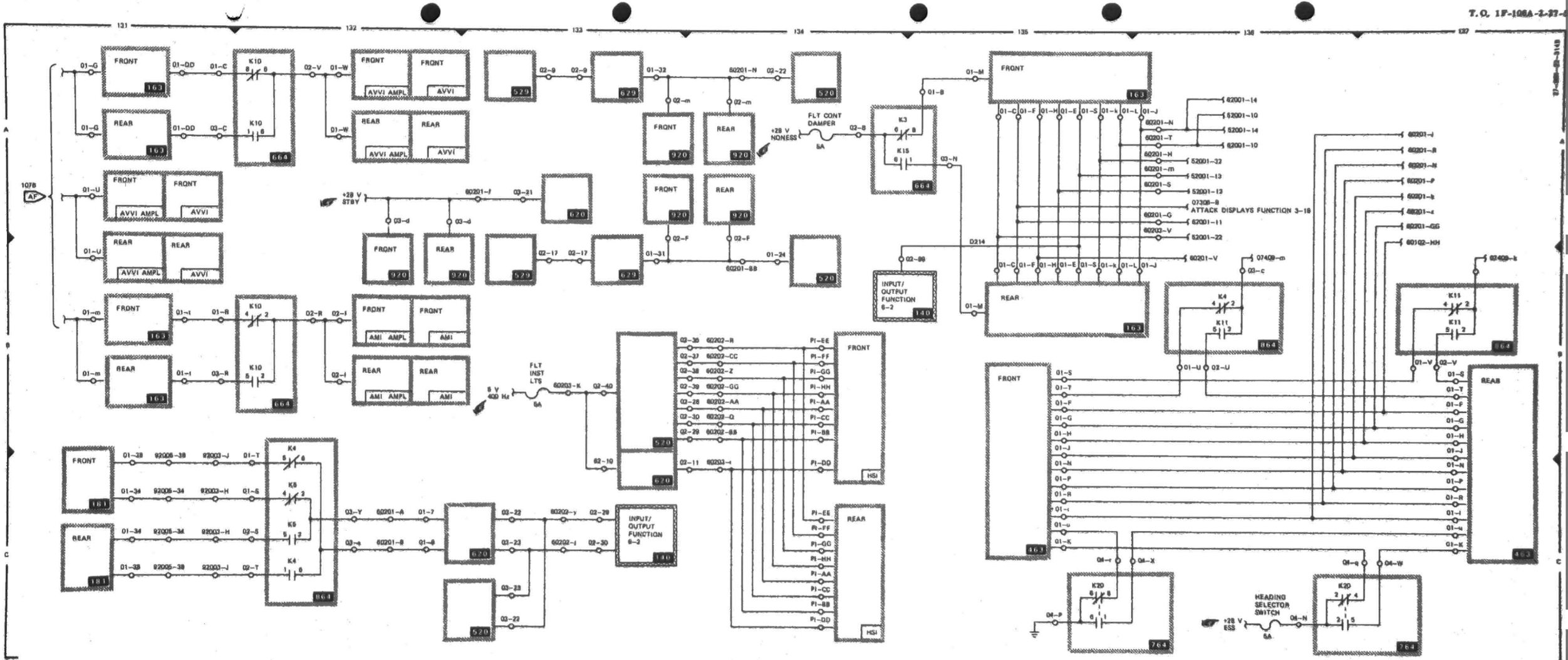


Figure 2-2. SSGC (Sheet 39 of 65: SSGC 3, sheet 14 of 16, B-Model)

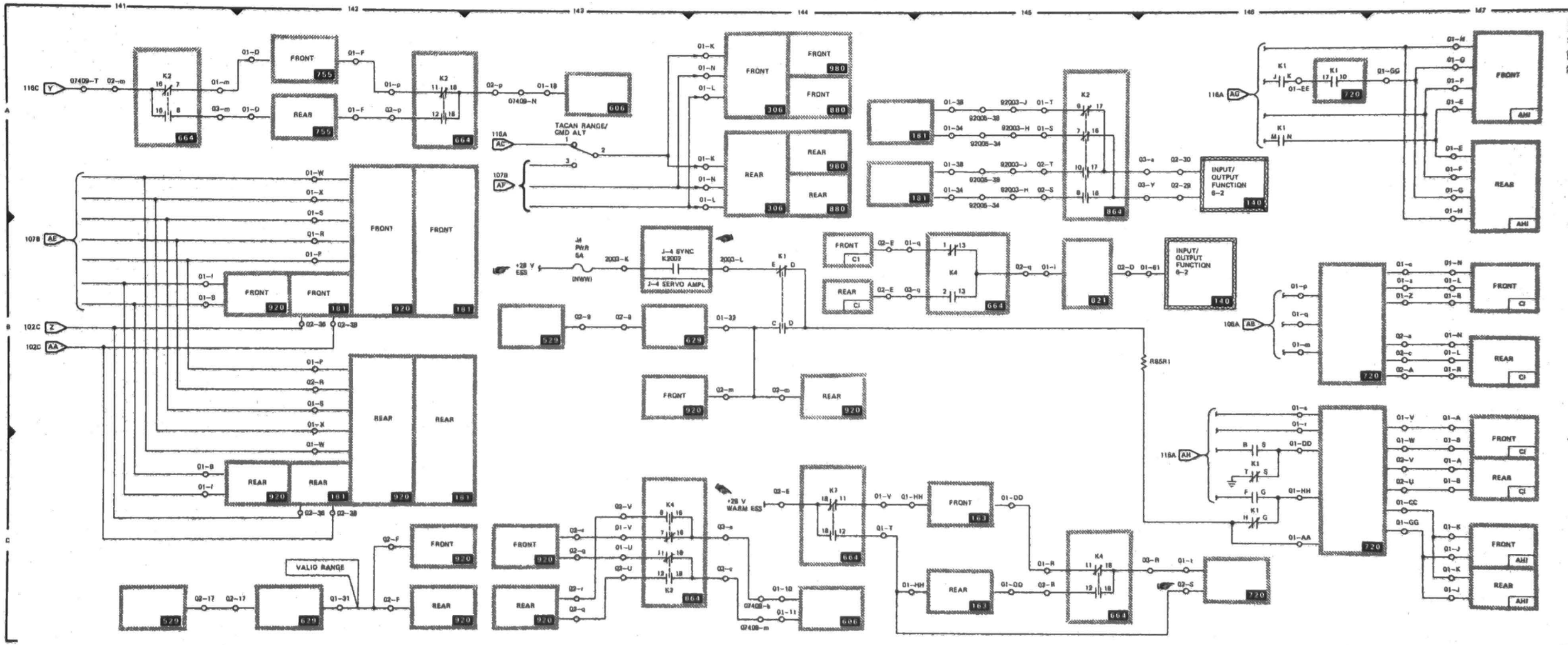


Figure 2-3. SSGC (Sheet 40 of 65: SSGC 3, sheet 15 of 16, B-Model)

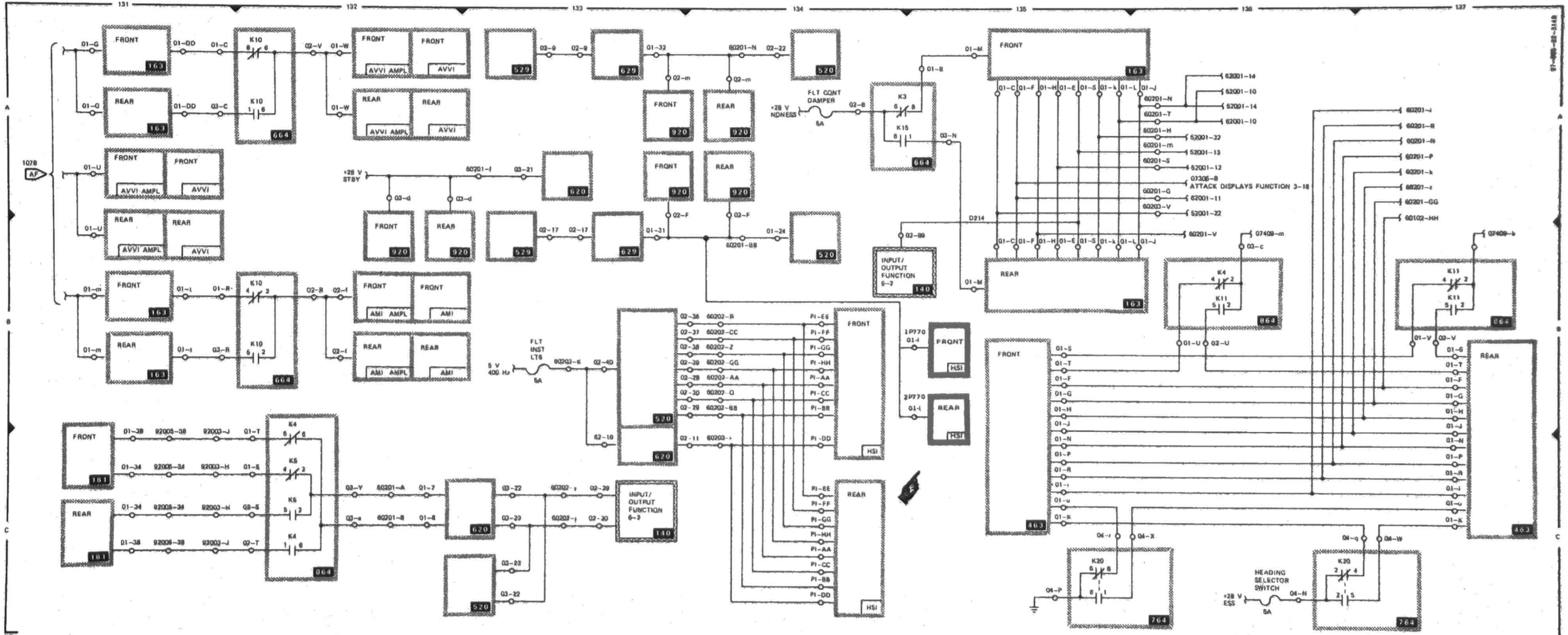


Figure 2-2. SSGC (Sheet 39 of 65: SSGC 3, sheet 14 of 16, B-Model)

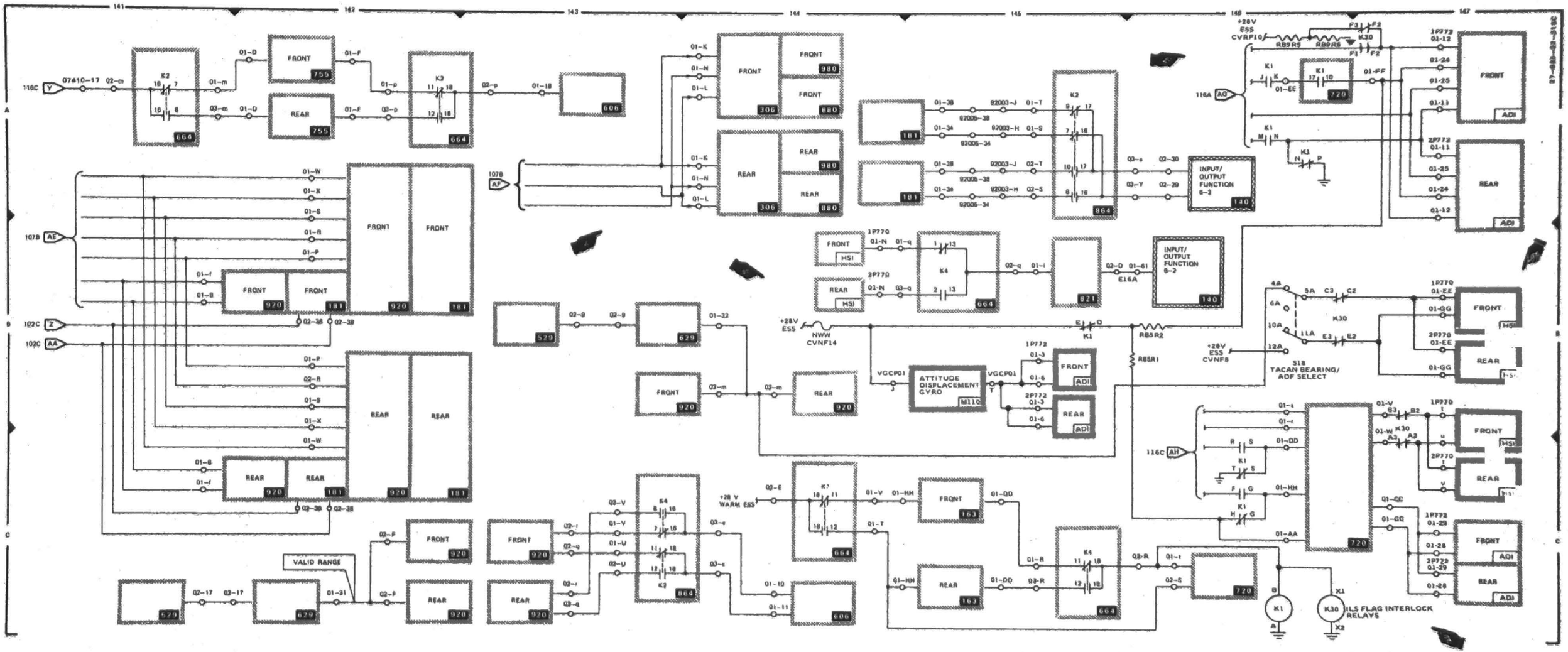


Figure 2-9. SSGC (Sheet 40 of 65: SSGC 3, sheet 15 of 16, B-Model)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
063	K15	COIL 2 AND 7	SSGC3/37C
196	K4	COIL 13 AND 14	SSGC3/12A
	K5	5 AND 11	SSGC3/15B
	K6	COIL 13 AND 14	SSGC3/15B
206	K3	COIL 2 AND 7	SSGC3/15B
267	K1	4 AND 5	SSGC3/117B, 23B
346	K4	9 AND 11	SSGC3/15B
	K5	COIL 4 AND 5	SSGC3/16B
367	K1	4 AND 5	SSGC3/117C, 23B
396	K8	COIL 19 AND 20	SSGC3/12B
520	K401	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/63B SSGC3/66C SSGC3/21A
	K402	COIL 3 AND 7 1 AND 6 2 AND 4	SSGC3/66B SSGC3/57A SSGC3/66C
	K405	COIL 3 AND 7	SSGC3/66C
	K406	COIL 3 AND 7	SSGC3/57A
	K501	COIL 3 AND 7 2, 4 AND 5	SSGC3/66B SSGC3/56B
	K502	COIL 3 AND 7 2, 4 AND 5	SSGC3/66B SSGC3/56B
	K503	COIL 3 AND 7 2, 4 AND 5	SSGC3/65B SSGC3/56B
	K504	COIL 3 AND 7 2, 4 AND 5 6 AND 8 1 AND 6	SSGC3/63B SSGC3/56B SSGC3/56B SSGC3/56C
	K505	COIL 3 AND 7 6 AND 8 1 AND 6	SSGC3/63A SSGC3/66B SSGC3/56C
	K506	COIL 3 AND 7 2 AND 4	SSGC3/63B SSGC3/57A
	K508	COIL 3 AND 7 6 AND 8	SSGC3/63B SSGC3/53C
	K509	COIL 3 AND 7 1 AND 6	SSGC3/66B SSGC3/53C
	K601	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/63B SSGC3/62B SSGC3/65C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520 (CONT)	K602	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/63B SSGC3/63B SSGC3/65C
	K603	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/62B SSGC3/62B SSGC3/65C
	K604	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/62B SSGC3/62B SSGC3/66C
	K605	COIL 3 AND 7 1 AND 6 2, 4 AND 5	SSGC3/64A SSGC3/63A SSGC3/65B
	K606	COIL 3 AND 7 1, 6 AND 8	SSGC3/63A SSGC3/65C
	K607	COIL 3 AND 7 6 AND 8	SSGC3/62B SSGC3/66C
	K608	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/65C SSGC3/63B SSGC3/62B
	K609	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/65C SSGC3/62B SSGC3/62B
	K610	COIL 3 AND 7 1 AND 6 2 AND 5	SSGC3/66C SSGC3/63A SSGC3/65C
	K612	2 AND 5 1 AND 6	SSGC3/22A SSGC3/21A
	K617	COIL 3 AND 7	SSGC3/67B
	K1001	COIL 3 AND 7	SSGC3/63A
	K1002	COIL 3 AND 7	SSGC3/66B
	K1003	COIL 3 AND 7	SSGC3/66B
	K1201	COIL 3 AND 7	SSGC3/53C
	K1202	COIL 3 AND 7	SSGC3/54B
	K1203	COIL 3 AND 7	SSGC3/54B
	K1401	COIL 3 AND 7	SSGC3/57A
	K1402	COIL 3 AND 7	SSGC3/57A
606	K1	COIL 2 AND 7 5 AND 8	SSGC3/67A, 65A SSGC3/66A, 66A
	K2	COIL 3 AND 7 5 AND 8	SSGC3/67A, 66A SSGC3/66A, 66A
	K3	COIL 3 AND 7 2 AND 4	SSGC3/12B SSGC3/17B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
606 (CONT)	K5	COIL 13 AND 14 5, 6 AND 11 1 AND 9 7 AND 12	SSGC 3/13B SSGC 3/16B SSGC 3/16B SSGC 3/65A
	K7	COIL 2 AND 7 1 AND 4 5 AND 8	SSGC 3/16C SSGC 3/16B SSGC 3/16B
	K10	COIL 2 AND 7	SSGC 3/86A, 66A
	K13A AND B	COIL 1, 2, 3 AND 4	SSGC 3/87A, 66A
	K13C	COIL 5 AND 6 D AND E	SSGC 3/87A, 65A SSGC 3/17A
620	K2302	COIL 3 AND 7	SSGC 3/55C
	K2401	COIL 3 AND 7	SSGC 3/62A
	K2402	COIL 3 AND 7	SSGC 3/62A
	K2403	COIL 3 AND 7	SSGC 3/63A
	K2404	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	SSGC 3/67B SSGC 3/67B SSGC 3/66C
	K2405	COIL 3 AND 7 2, 4 AND 5 1 AND 6	SSGC 3/67A SSGC 3/62C SSGC 3/66B
	K2406	COIL 3 AND 7	SSGC 3/62C
	K2501	COIL 3 AND 7 2, 4 AND 5	SSGC 3/53B SSGC 3/53B
	K2502	COIL 3 AND 7 2, 4 AND 5	SSGC 3/53C SSGC 3/53B
	K2503	COIL 3 AND 7	SSGC 3/53B
	K2608	COIL 3 AND 7	SSGC 3/63C
	K2701	COIL 3 AND 7	SSGC 3/63A
	K2702	COIL 3 AND 7	SSGC 3/63A
	K2703	COIL 3 AND 7	SSGC 3/63A
	K3001	COIL 3 AND 7	SSGC 3/55C
720	K1	COIL 19 AND 20 10 AND 17 7 AND 16 11, 12 AND 18	SSGC 3/84A SSGC 3/146A, 25C SSGC 3/83B SSGC 3/83B
	K2	COIL 19 AND 20 9, 10 AND 17 11, 12 AND 18	SSGC 3/84A SSGC 3/72C SSGC 3/72C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
920	K1	6 AND 8	SSGC 3/37C
	K6	COIL 3 AND 9 1 AND 6	SSGC 3/37C SSGC 3/76C, 41A
	K7	COIL 3 AND 7 2, 4 AND 5 1, 6 AND 8	SSGC 3/83C, 56C SSGC 3/75C, 41A SSGC 3/75C, 41A
	K8	COIL 3 AND 7	SSGC 3/84C, 54C
	K9	COIL 3 AND 7 2, 4 AND 5	SSGC 3/82C, 52C SSGC 3/75C, 41A
	A15K1	2 AND 4	SSGC 3/83C, 56A
	A15K2	2 AND 4	SSGC 3/84C, 54C
	A15K6	2 AND 4	SSGC 3/82C, 52C
CVAC (ILS FLAG INTERLOCK RELAY)	K1	M AND N J AND K F AND H H AND G R AND S S AND T E AND D D AND C	SSGC 3/146A, 24C SSGC 3/146A, 24C SSGC 3/83B, 26C 146C SSGC 3/83B, 26C 146C SSGC 3/146B, 26C SSGC 3/146B, 26C SSGC 3/144B, 82B SSGC 3/144B, 82B
PRIM. HYD. PRESS RELAY (A MODEL)	K37	CONTACTS	SSGC 3/11A
SEC. HYD. PRESS RELAY (A MODEL)	K36	CONTACTS	SSGC 3/12A
PRIM. HYD. PRESS RELAY (B MODEL)	K38	CONTACTS	SSGC 3/91A
SEC. HYD. PRESS RELAY (B MODEL)	K37	CONTACTS	SSGC 3/92A
FLIGHT DIRECTOR COMPUTER	K1	COIL 3 AND 7	SSGC 3/22A
	K1B	2 AND 4 6 AND 8	SSGC 3/22A SSGC 3/23A
	K2	COIL 3 AND 7 1 AND 6 2 AND 5	SSGC 3/25B/22A SSGC 3/26B SSGC 3/26B
	K3	COIL 3 AND 7	SSGC 3/25B/23A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
FLIGHT DIRECTOR COMPUTER (CONT)	K4	COIL 3 AND 7 1 AND 6 2 AND 5	SSGC 3/25B SSGC 3/26B SSGC 3/26B
	K5	COIL 3 AND 7	SSGC 3/25B
	K6	COIL 3 AND 7	SSGC 3/25B
	K7	COIL 3 AND 7	SSGC 3/23A
	K8	COIL 3 AND 7	SSGC 3/23A
RT749	K1	COIL 1 AND 2	SSGC 3/12A
	K3	6 AND 8	SSGC 3/13A
	K4	COIL 1 AND 3	SSGC 3/13A
	K5	COIL 1 AND 3	SSGC 3/13A

Figure 2-2. SSGC (Sheet 41 of 65: SSGC 3, Sheet 16 of 16)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
063	K15	COIL 2 AND 7	SSGC3/37C
196	K4	COIL 13 AND 14	SSGC3/12A
	K5	5 AND 11	SSGC3/15B
	K6	COIL 13 AND 14	SSGC3/15B
206	K3	COIL 2 AND 7	SSGC3/15B
267	K1	4 AND 5	SSGC3/117B, 23B
346	K4	9 AND 11	SSGC3/15B
	K5	COIL 4 AND 5	SSGC3/16B
367	K1	4 AND 5	SSGC3/117C, 23B
396	K8	COIL 19 AND 20	SSGC3/12B
520	K401	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/63B SSGC3/66C SSGC3/21A
	K402	COIL 3 AND 7 1 AND 6 2 AND 4	SSGC3/66B SSGC3/57A SSGC3/66C
	K405	COIL 3 AND 7	SSGC3/66C
	K406	COIL 3 AND 7	SSGC3/57A
	K501	COIL 3 AND 7 2, 4 AND 5	SSGC3/66B SSGC3/56B
	K502	COIL 3 AND 7 2, 4 AND 5	SSGC3/66B SSGC3/56B
	K503	COIL 3 AND 7 2, 4 AND 5	SSGC3/65B SSGC3/56B
	K504	COIL 3 AND 7 2, 4 AND 5 6 AND 8 1 AND 6	SSGC3/63B SSGC3/56B SSGC3/56B SSGC3/56C
	K505	COIL 3 AND 7 6 AND 8 1 AND 6	SSGC3/63A SSGC3/56B SSGC3/56C
	K506	COIL 3 AND 7 2 AND 4	SSGC3/63B SSGC3/57A
	K508	COIL 3 AND 7 6 AND 8	SSGC3/63B SSGC3/53C
	K509	COIL 3 AND 7 1 AND 6	SSGC3/66B SSGC3/53C
	K601	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/63B SSGC3/62B SSGC3/65C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520 (CONT)	K602	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/63B SSGC3/63B SSGC3/65C
	K603	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/62B SSGC3/62B SSGC3/65C
	K604	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/62B SSGC3/62B SSGC3/66C
	K605	COIL 3 AND 7 1 AND 6 2, 4 AND 5	SSGC3/64A SSGC3/63A SSGC3/65B
	K606	COIL 3 AND 7 1, 6 AND 8	SSGC3/63A SSGC3/65C
	K607	COIL 3 AND 7 6 AND 8	SSGC3/62B SSGC3/66C
	K608	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/65C SSGC3/63B SSGC3/62B
	K609	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC3/65C SSGC3/62B SSGC3/62B
	K610	COIL 3 AND 7 1 AND 6 2 AND 5	SSGC3/66C SSGC3/63A SSGC3/65C
	K612	2 AND 5 1 AND 6	SSGC3/22A SSGC3/21A
	K617	COIL 3 AND 7	SSGC3/97B
	K1001	COIL 3 AND 7	SSGC3/63A
	K1002	COIL 3 AND 7	SSGC3/66B
	K1003	COIL 3 AND 7	SSGC3/66B
	K1201	COIL 3 AND 7	SSGC3/53C
	K1202	COIL 3 AND 7	SSGC3/54B
	K1203	COIL 3 AND 7	SSGC3/54B
	K1401	COIL 3 AND 7	SSGC3/57A
	K1402	COIL 3 AND 7	SSGC3/57A
606	K1	COIL 2 AND 7 5 AND 8	SSGC3/87A, 65A SSGC3/86A, 66A
	K2	COIL 2 AND 7 5 AND 8	SSGC3/87A, 66A SSGC3/86A, 66A
	K3	COIL 3 AND 7 2 AND 4	SSGC3/12B SSGC3/17B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
606 (CONT)	K5	COIL 13 AND 14 5, 6 AND 11 1 AND 9 7 AND 12	SSGC 3/13B SSGC 3/16B SSGC 3/16B SSGC 3/65A
	K7	COIL 2 AND 7 1 AND 4 5 AND 8	SSGC 3/16C SSGC 3/16B SSGC 3/16B
	K10	COIL 2 AND 7	SSGC 3/86A, 66A
	K13A AND B	COIL 1, 2, 3 AND 4	SSGC 3/87A, 66A
	K13C	COIL 5 AND 6 D AND E	SSGC 3/87A, 65A SSGC 3/17A
620	K2302	COIL 3 AND 7	SSGC 3/55C
	K2401	COIL 3 AND 7	SSGC 3/62A
	K2402	COIL 3 AND 7	SSGC 3/62A
	K2403	COIL 3 AND 7	SSGC 3/63A
	K2404	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	SSGC 3/67B SSGC 3/67B SSGC 3/66C
	K2405	COIL 3 AND 7 2, 4 AND 5 1 AND 6	SSGC 3/67A SSGC 3/62C SSGC 3/66B
	K2406	COIL 3 AND 7	SSGC 3/62C
	K2501	COIL 3 AND 7 2, 4 AND 5	SSGC 3/53B SSGC 3/53B
	K2502	COIL 3 AND 7 2, 4 AND 5	SSGC 3/53C SSGC 3/53B
	K2503	COIL 3 AND 7	SSGC 3/53B
	K2608	COIL 3 AND 7	SSGC 3/63C
	K2701	COIL 3 AND 7	SSGC 3/63A
	K2702	COIL 3 AND 7	SSGC 3/63A
	K2703	COIL 3 AND 7	SSGC 3/63A
	K3001	COIL 3 AND 7	SSGC 3/55C
720	K1	COIL 19 AND 20 10 AND 17	SSGC 3/84A SSGC 3/146A, 25C
	K2	COIL 19 AND 20 9, 10 AND 17 11, 12 AND 18	SSGC 3/84A SSGC 3/72C SSGC 3/72C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
920	K1	6 AND 8	SSGC 3/37C
	K6	COIL 3 AND 9 1 AND 6	SSGC 3/37C SSGC 3/76C, 41A
	K7	COIL 3 AND 7 2, 4 AND 5 1, 6 AND 8	SSGC 3/83C, 56C SSGC 3/75C, 41A SSGC 3/75C, 41A
	K8	COIL 3 AND 7	SSGC 3/84C, 54C
	K9	COIL 3 AND 7 2, 4 AND 5	SSGC 3/82C, 52C SSGC 3/75C, 41A
	A15K1	2 AND 4	SSGC 3/83C, 56A
	A15K2	2 AND 4	SSGC 3/84C, 54C
	A15K6	2 AND 4	SSGC 3/82C, 52C
CVAC (ILS FLAG INTERLOCK RELAY)	K1	M AND N J AND K F AND H H AND G R AND S S AND T E AND D D AND C	SSGC 3/146A, 24C SSGC 3/146A, 24C SSGC 3/83B, 26C 146C SSGC 3/83B, 26C 146C SSGC 3/146B, 26C SSGC 3/146B, 26C SSGC 3/144B, 82B SSGC 3/144B, 82B
CVAC (ILS FLAG INTERLOCK RELAY)	K1	E AND D F, G, AND H J AND K M, N, AND P R, S, AND T U, V, AND W COIL A AND B	SSGC 3/24C, 145B SSGC 3/26C, 146C SSGC 3/24C, 146A SSGC 3/25C, 146A SSGC 3/26C, 146C SSGC 3/26C, 116C SSGC 3/85A, 146C
CVAC (ILS FLAG INTERLOCK RELAY)	K30	A2 AND A3 B2 AND B3 C2 AND C3 E2 AND E3 F1, F2, AND F3 COIL X1 AND X2	SSGC 3/ 147C SSGC 3/ 147C SSGC 3/ 146B SSGC 3/ 146B SSGC 3/25C, 147A SSGC 3/85A, 146C
PRIM. HYD. PRESS RELAY (A MODEL)	K37	CONTACTS	SSGC 3/11A
SEC. HYD. PRESS RELAY (A MODEL)	K36	CONTACTS	SSGC 3/12A
PRIM. HYD. PRESS RELAY (B MODEL)	K38	CONTACTS	SSGC 3/91A
SEC. HYD. PRESS RELAY (B MODEL)	K37	CONTACTS	SSGC 3/92A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
FLIGHT DIRECTOR COMPUTER	K1	COIL 3 AND 7	SSGC 3/22A
	K1B	2 AND 4 6 AND 8	SSGC 3/22A SSGC 3/23A
	K2	COIL 3 AND 7 1 AND 6 2 AND 5	SSGC 3/25B/22A SSGC 3/26B SSGC 3/26B
	K3	COIL 3 AND 7	SSGC 3/25B/23A
FLIGHT DIRECTOR COMPUTER (CONT)	K4	COIL 3 AND 7 1 AND 6 2 AND 5	SSGC 3/25B SSGC 3/26B SSGC 3/26B
	K5	COIL 3 AND 7	SSGC 3/25B
	K6	COIL 3 AND 7	SSGC 3/25B
	K7	COIL 3 AND 7	SSGC 3/23A
	K8	COIL 3 AND 7	SSGC 3/23A
RT749	K1	COIL 1 AND 2	SSGC 3/12A
	K3	6 AND 8	SSGC 3/13A
	K4	COIL 1 AND 3	SSGC 3/13A
	K5	COIL 1 AND 3	SSGC 3/13A

Figure 2-2. SSGC (Sheet 41 of 65: SSGC 3, Sheet 16 of 16)

SHORT SYSTEM GROUND CHECK TEST NO. 4

Short system ground check No. 4 is designed to test the radar subsystem attack and IR search and track capability. Test No. 4 checks the radar performance during the visual identification, homing, lead collision, and automatic attack modes of operation. The test also checks infrared (IR) performance during search, supersearch, spotlight, lockon and track modes.

RADAR VISUAL IDENTIFICATION MODE TEST

VI mode initiated when RADAR MODE switch (305) is set to NORM, and ACP selector switch to VIS IDENT.

A All SELECTOR TEST switch contacts are shown in position for test being run.

B +28 V safe-to-test signal initiates self-test pulses and closes crystal protection shutter (055) as in SSGC 2. Test modulation signal from the reference signal circuit (041) modulates test pulses (089).

C This modulated signal processed in 295 unit and applied to 080 unit as test pulses.

D Computer (140) inputs, range gate (07335) and sweep trigger (07334), used to calculate range and are checked in tolerance. Output D216A (140) set high (+28 V) to light VI WARN lamp if check passes.

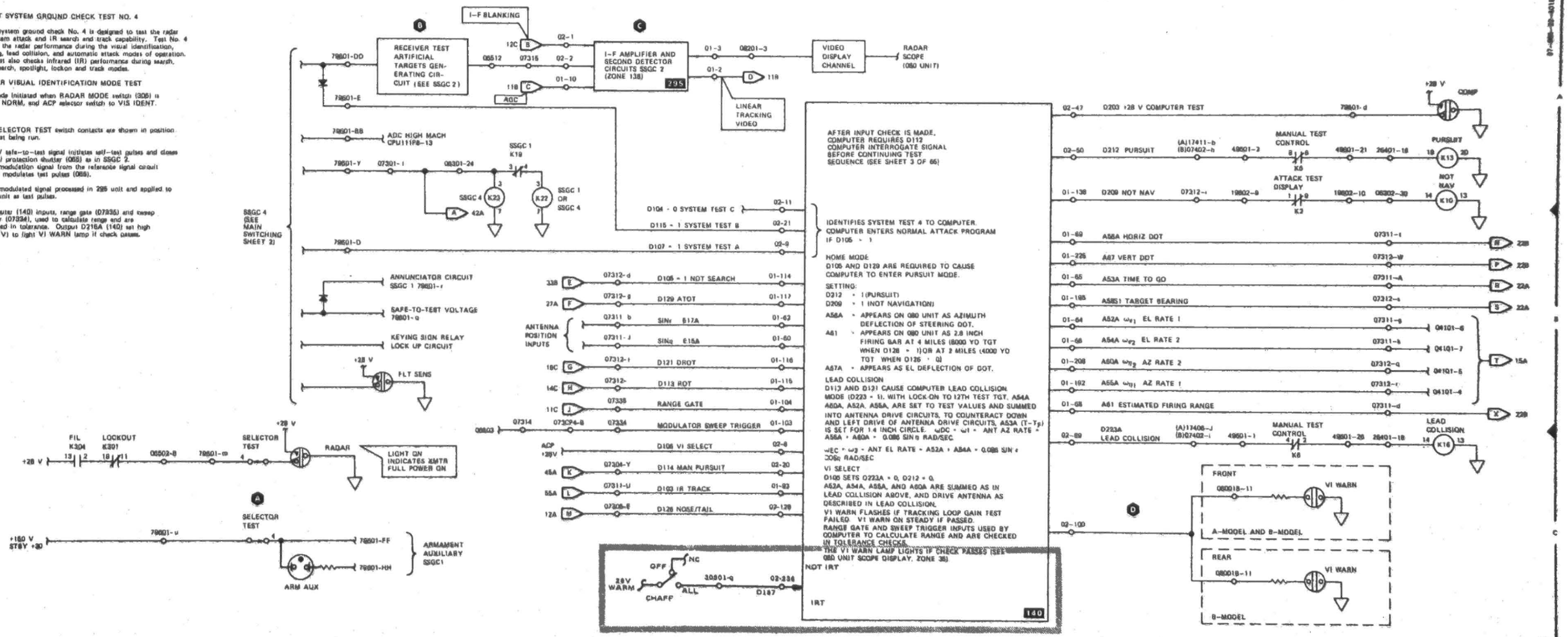


Figure 2-3. SSGC (Sheet 42 of 65: SSGC 4, sheet 1 of 9)

A Tracking video output (298) processed through 095 and 020 units into simulated error signals (δ_D and δ_E).

B When RTOT is obtained, K1 (020) is deenergized and AGC returned to normal. ATOT and synthetic target circuits are deactivated.

C When RDR switch (305) is set to HOM, pulling the crystal protection shutter, the paramp noise level (295) appears as a simulated jamming signal. This signal is processed through the 295 and 095 units to energize K2 (020) and permit checking ATOT circuits and pursuit attack display.

D Digital computer (140) receives visual identification select (VI SELECT) signal D106 from ACP. Computer (140) then produces normal visual identification mode output signals; A52A, A54A, A55A, and A60A. These signals (041) combine to produce ω_{EC} and ω_{DC}.

Radar antenna (017) is positioned by the combination of aided tracking rates ω_{EC} and ω_{DC}, and simulated error signals δ_E and δ_D. Combined tracking rates (ω) and the error (δ) signals are applied to the torquer motors of the antenna (017) HIG gyros. As the gyros are torqued, rate drive error signals are developed to position the antenna (017).

Error signal δ_E positive and δ_D negative, are developed which drive the antenna down and left. Signals ω_{EC} and ω_{DC} increase as a func- of the antenna (017) position to drive the antenna up and right. When the antenna (017) has driven down to a point where the computer (140) signals have magnitudes equal to, and polarities opposite to the radar error signals, a zero error results. When lobing frequency 3 and 12th receiver test target are used, the tracking loop gain is tested. The correct gain is indicated by a steady VI WARN light and the incorrect by a flashing VI WARN light.

E ROT or DROT signal (095) energizes a series of relays which provide the lead collision attack display.

ROT and DROT signals become the computer (140) inputs D113 and D121 which cause computer (140) to perform a lead collision program.

Computer (140) sets lead collision (D223A) output high.

Computer (140) sets output A53A to a 1.4 inch (10 seconds) time-to-go circle.

Computer (140) sets the aided tracking terms A54A, A60A, A52A and A55A to balance the simulated radar error signals, δ_E and δ_D.

Computer output D212 is set to zero, connecting the time circle vertical deflection circuits to the time circle phase splitter.

F K1 (223) connects the range output (185) to range rate circuits (223).
K4 (223) activates the range rate blanking circuits.

TEST POINT DATA

A Variable, 0 to +200 v

B Elevation error signal (adc voltage). Scaled at 25 v/radian/second.

C Azimuth error signal (adc voltage). Scaled at 25 v/radian/second.

Figure 2-2. SSGC (Sheet 43 of 65: SSGC 4, Sheet 2 of 9)

SHORT SYSTEM GROUND CHECK TEST NO. 4

Short system ground check No. 4 is designed to test the radar subsystem attack and IR search and track capability. Test No. 4 checks the radar performance during the visual identification, homing, lead collision, and automatic attack modes of operation. The test also checks infrared (IR) performance during search, supersearch, spotlight, lockon and track modes.

RADAR VISUAL IDENTIFICATION MODE TEST

VI mode initiated when RADAR MODE switch (305) is set to NORM, and ACP selector switch to VIS IDENT.

A All SELECTOR TEST switch contacts are shown in position for test being run.

B +28 V safe-to-test signal initiates self-test pulses and closes crystal protection shutter (065) as in SSGC 2. Test modulation signal from the reference signal circuit (641) modulates test pulses (065).

C This modulated signal processed in 295 unit and applied to 080 unit as test pulses.

D Computer (140) inputs, range gate (07335) and sweep trigger (07334), used to calculate range and are checked in tolerance. Output D215A (140) set high (+28 V) to light VI WARN lamp if check passes.

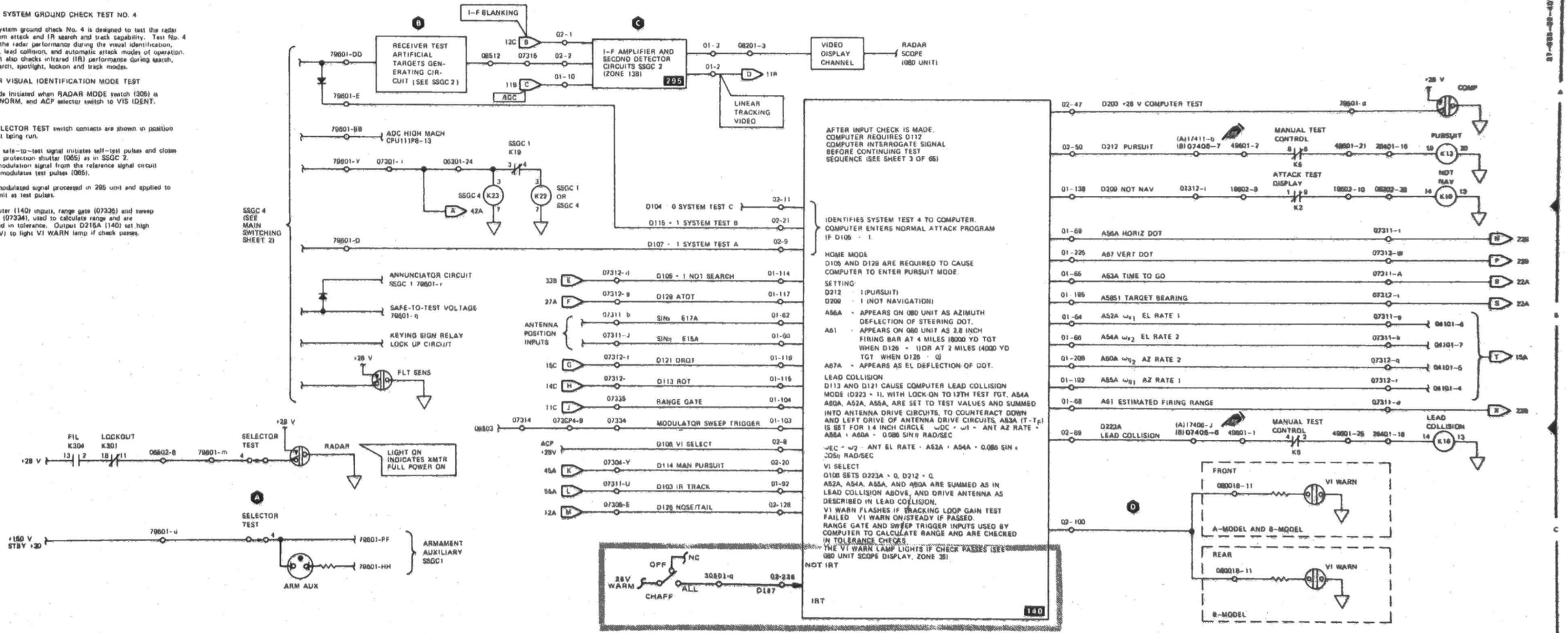


Figure 2-3. SSGC (Sheet 42 of 65: SSGC 4, sheet 1 of 9)

a. Tracking video output (295) processed through 025 and 030 units into simulated error signals (ϕ_D and ϕ_E).

b. When RTOT is obtained, K1 (020) is deenergized and AGC returned to normal. ATOT and synthetic target circuits are deactivated.

c. When RDR switch (305) is set to HOM, pulling the crystal protection shutter, the paramp noise level (295) appears as a simulated jamming signal. This signal is processed through the 295 and 025 units to energize K2 (020) and permit checking ATOT circuits and pursuit attack display.

d. Digital computer (140) receives visual identification select (VI SELECT) signal D106 from ACP. Computer (140) then produces normal visual identification mode output signals; A52A, A54A, A55A, and A60A. These signals (041) combine to produce ω_{EC} and ω_{DC}.

Radar antenna (017) is positioned by the combination of aided tracking rates ω_{EC} and ω_{DC}, and simulated error signals ϕ_E and ϕ_D. Combined tracking rates (ω) and the error (ϕ) signals are applied to the torquer motors of the antenna (017) HIG gyros. As the gyros are torqued, rate drive error signals are developed to position the antenna (017).

Error signal ϕ_E positive and ϕ_D negative, are developed which drive the antenna down and left. Signals ω_{EC} and ω_{DC} increase as a function of the antenna (017) position to drive the antenna up and right. When the antenna (017) has driven down to a point where the computer (140) signals have magnitudes equal to, and polarities opposite to the radar error signals, a zero error results. When lobing frequency 3 and 12th receiver test target are used, the tracking loop gain is tested. The correct gain is indicated by a steady VI WARN light and the incorrect by a flashing VI WARN light.

e. ROT or DROT signal (095) energizes a series of relays which provide the lead collision attack display.

ROT and DROT signals become the computer (140) inputs D113 and D121 which cause computer (140) to perform a lead collision program.

Computer (140) sets lead collision (D223A) output high.

Computer (140) sets output A52A to a 1.4 inch (1.9 seconds) time-to-go circle.

Computer (140) sets the aided tracking terms A54A, A60A, A52A and A55A to balance the simulated radar error signals, ϕ_E and ϕ_D.

Computer output D212 is set to zero, connecting the time circle vertical deflection circuits to the time circle phase splitter.

f. K1 (223) connects the range output (195) to range rate circuits (223).
K4 (223) activates the range rate blanking circuits.

TEST POINT DATA

a. Variable, 0 to +300 v

b. Elevation error signal (adc voltage). Scaled at [illegible] v/radian/second.

c. Azimuth error signal (adc voltage). Scaled at [illegible] v/radian/second.

Figure 2-2. SSGC (Sheet 43 of 65: SSGC 4, Sheet 2 of 9)

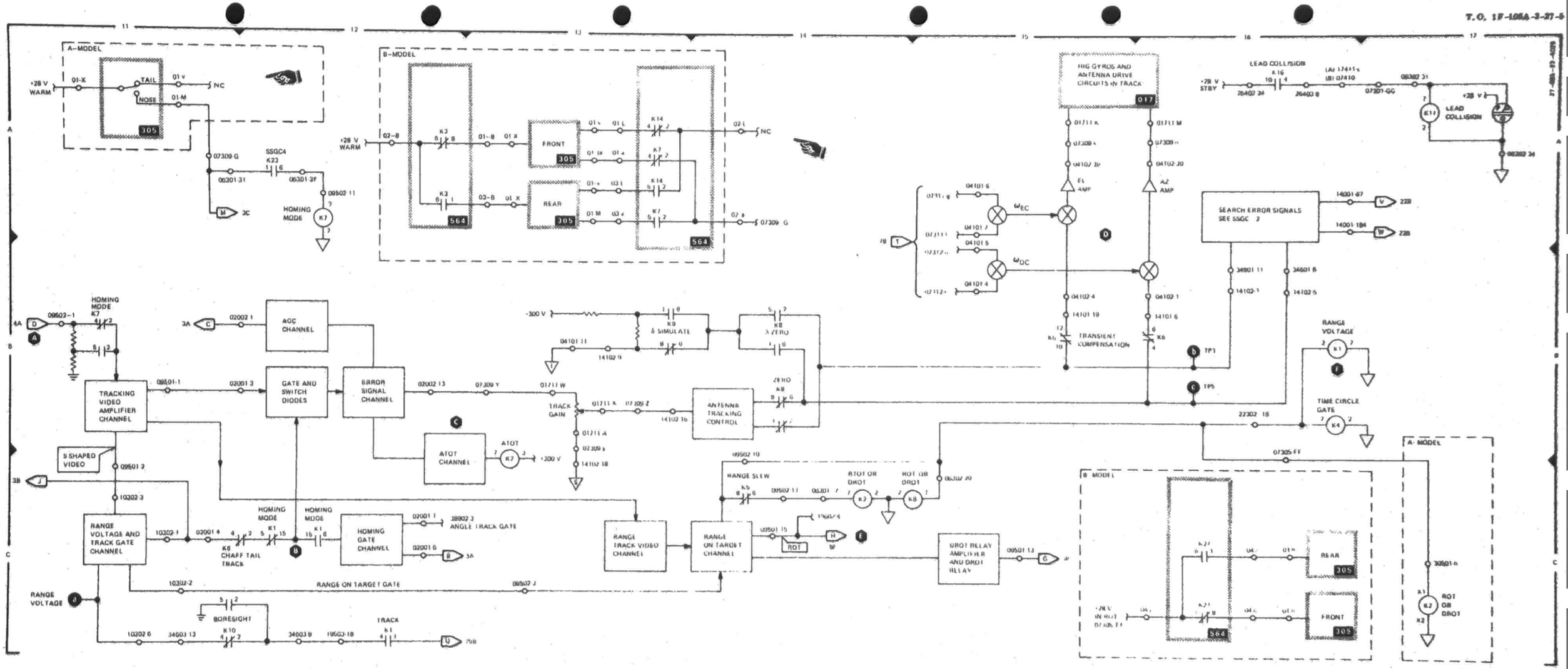


Figure 2-2. SSGC (Sheet 44 of 65: SSGC 4, sheet 3 of 9)

(A) Controls connection of attack steering signals to steering dot display channel. In pursuit or VI the steering dot is positioned by antenna (017) position error signals processed by computer (140).

(B) Vertical deflection voltage (523) removed in pursuit mode. Replaced by A61 (140).

(C) Relays K1 and K3 (523) energized in lead collision attack mode to disconnect A58S1 (140) and A61 (140) which positioned the target mark circle. Time circle also centered.

(D) Time sharing signal data converter (523) programs display information to the indicator (080).

(E) Range rate gap position is controlled by range rate derived from the range voltage input. VI select signal (ACP) energized K3 (195), K3 (083) and K20 (083).

(F) Scale factored range rate voltage applied to blanking circuit (395) in radar VI mode. No range rate simulated in SSGC 4 so range rate is zero.

(G) D212 (140) is set high (+28 VI to energize K13 (264) when system is committed to pursuit mode. Signal supplied to radar and armament subsystems to provide steering and armament preparation.

(H) ATOT circuit energized when action switch is pressed and released in radar homing mode test. Inputs (140) D129 and D105 activate a pursuit program solution resulting in output D212 (140).

(J) Energized to provide lead collision attack display.

(K) Energized to display time circle (080).

(L) Relays K1 and K3 (523) energized to disconnect A58S1 (140) and A61 (140) and center time circle.

(M) Relay K4 (523) de-energized in attack mode to display steering dot and reference circle when angle lockon is obtained. D209 - +28 V provides this activation.

(N) Output A53A (140) controls length of firing bar in pursuit. Output is 50 volts (1.4 inches) indicating not IRT, and not ATOT, 2.8 inches, indicating IRT, ROT or ATOT and manual pursuit, or 0.7 inch indicating IRT or ATOT pursuit and not manual pursuit (proportional steering).

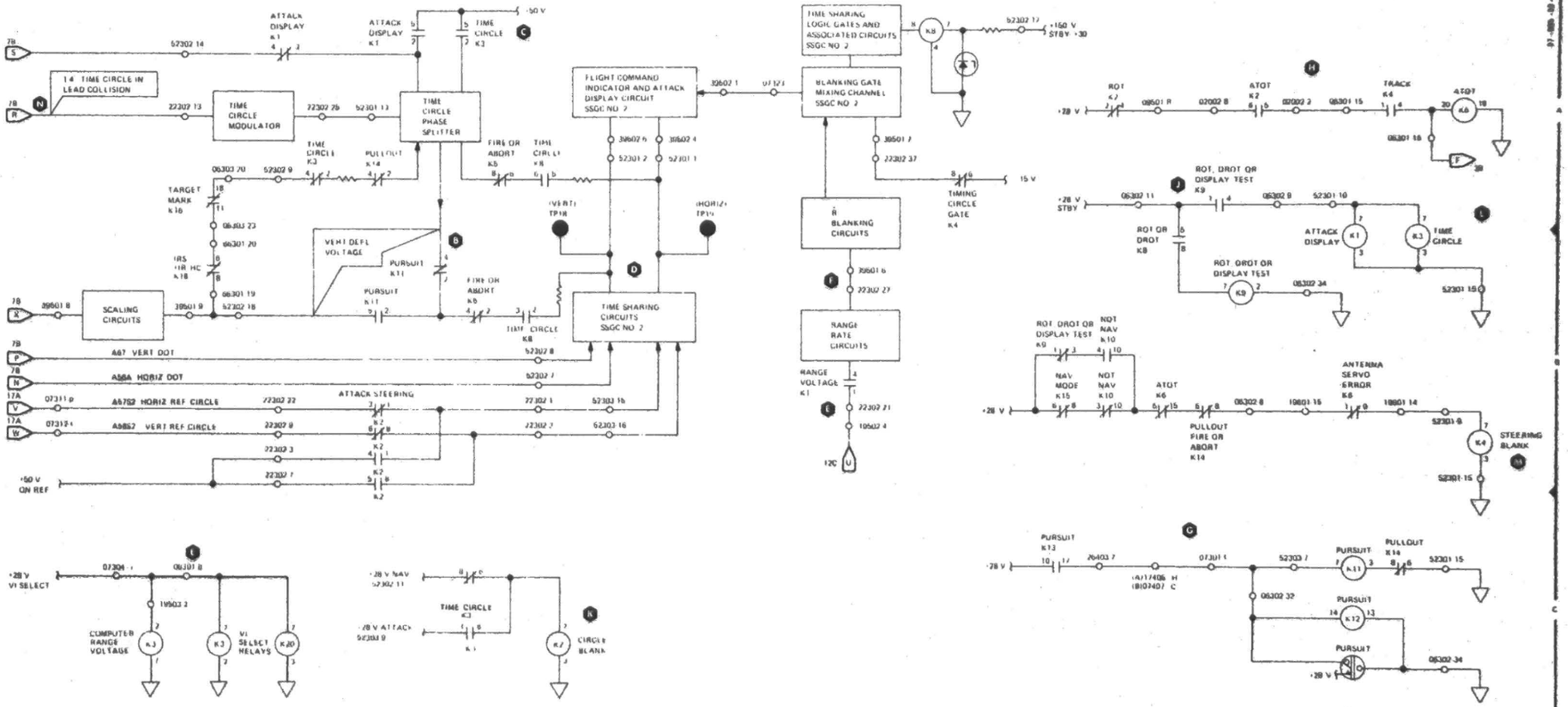
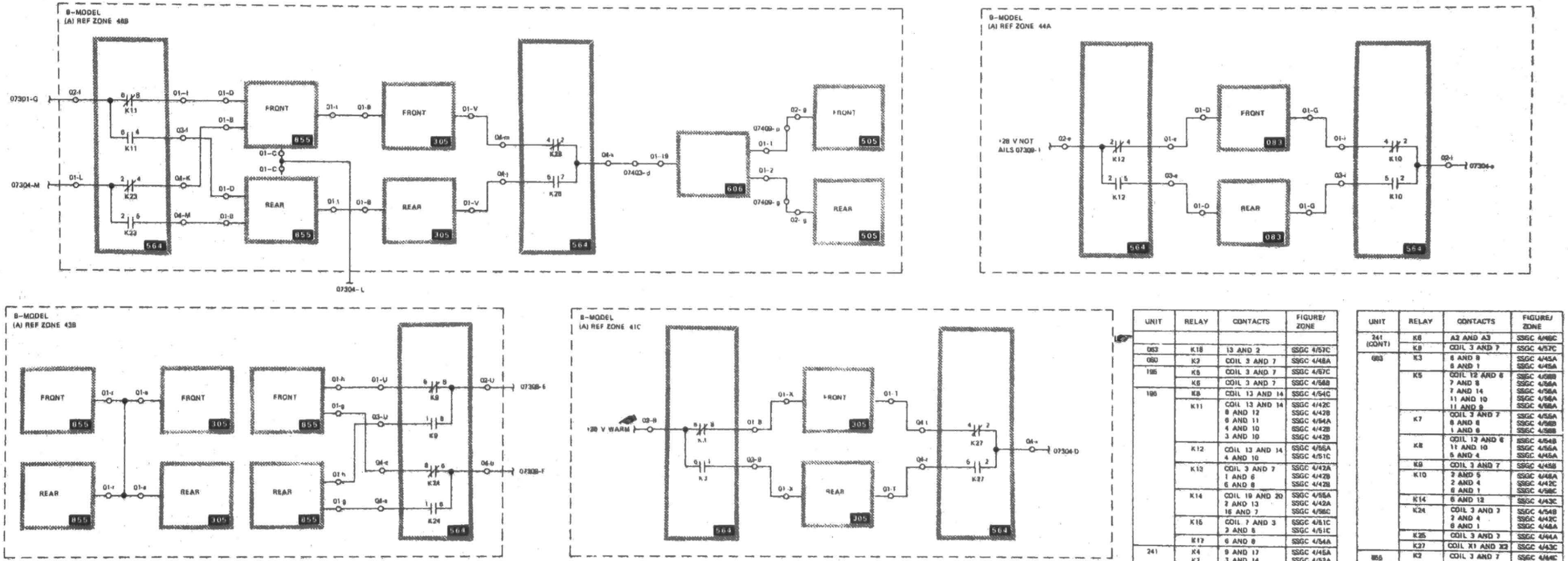


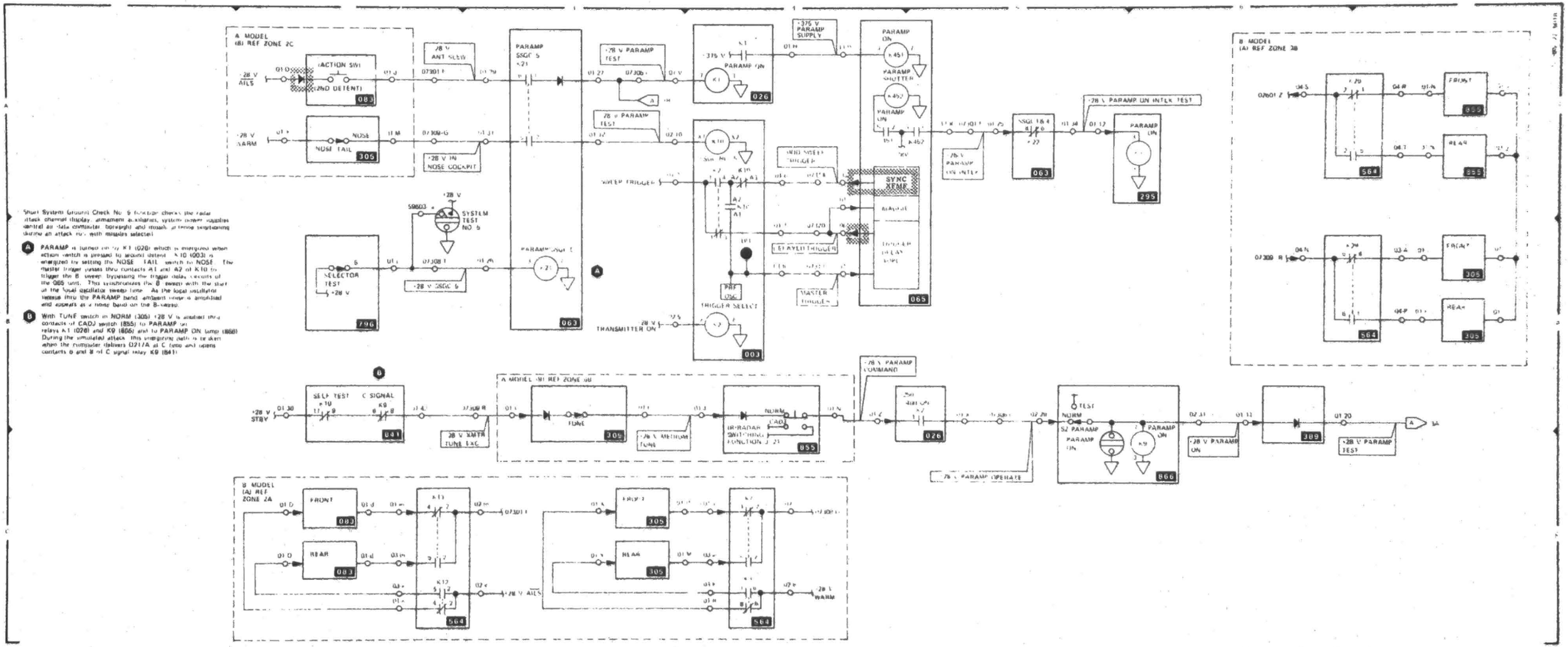
Figure 2-3. SSGC (Sheet 45 of 65: SSGC 4, sheet 4 of 9)



UNIT	RELAY	CONTACTS	FIGURE/ ZONE
063	K18	13 AND 2	SSGC 4/57C
080	K2	COIL 3 AND 7	SSGC 4/48A
195	K5	COIL 3 AND 7	SSGC 4/67C
	K6	COIL 3 AND 7	SSGC 4/58B
196	K8	COIL 13 AND 14	SSGC 4/54C
	K11	COIL 13 AND 14 8 AND 12 6 AND 11 4 AND 10 3 AND 10	SSGC 4/42C SSGC 4/42B SSGC 4/54A SSGC 4/42B SSGC 4/42B
	K12	COIL 13 AND 14 4 AND 10	SSGC 4/56A SSGC 4/51C
	K13	COIL 3 AND 7 1 AND 6 6 AND 8	SSGC 4/42A SSGC 4/42B SSGC 4/42B
	K14	COIL 19 AND 20 2 AND 13 16 AND 7	SSGC 4/55A SSGC 4/42A SSGC 4/58C
	K15	COIL 7 AND 3 2 AND 8	SSGC 4/51C SSGC 4/51C
	K17	6 AND 8	SSGC 4/54A
241	K4 K7 K8 K9	9 AND 17 3 AND 14 COIL 4 AND 6 COIL 8 AND 12	SSGC 4/45A SSGC 4/52A SSGC 4/64B SSGC 4/45A

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
241 (CONT)	K8	A3 AND A3	SSGC 4/46C
	K9	COIL 3 AND 7	SSGC 4/57C
083	K3	6 AND 9 8 AND 1	SSGC 4/45A SSGC 4/45A
	K5	COIL 12 AND 6 7 AND 9 7 AND 14 11 AND 10 11 AND 9	SSGC 4/58B SSGC 4/56A SSGC 4/56A SSGC 4/56A SSGC 4/58A
	K7	COIL 3 AND 7 8 AND 6 1 AND 6	SSGC 4/55A SSGC 4/56B SSGC 4/56B
	K8	COIL 12 AND 6 11 AND 10 5 AND 4	SSGC 4/54B SSGC 4/55A SSGC 4/45A
	K9	COIL 3 AND 7	SSGC 4/45B
	K10	2 AND 5 2 AND 4 6 AND 1	SSGC 4/48A SSGC 4/42C SSGC 4/58C
	K14	6 AND 12	SSGC 4/43C
	K24	COIL 3 AND 7 2 AND 4 8 AND 1	SSGC 4/54B SSGC 4/42C SSGC 4/48A
	K25	COIL 3 AND 7	SSGC 4/44A
	K27	COIL X1 AND X2	SSGC 4/43C
855	K2	COIL 3 AND 7 1 AND 6	SSGC 4/44C SSGC 4/44B
	K3	1 AND 6	SSGC 4/44B

Figure 2-3. SSGC (Sheet 50 of 65: SSGC 4, sheet 9 of 9)



Short System Ground Check No. 5 function checks the radar attack channel display, armament actuators, system power supplies, central air data computer, boresight and missile airframe sensitivity during an attack run with missiles selected.

A PARAMP is turned on by K1 (026) which is energized when action switch is pressed to second detent. K10 (003) is energized by setting the NOSE TAIL switch to NOSE. The master trigger passes thru contacts A1 and A2 of K10 to trigger the B sweep, bypassing the trigger delay circuits of the 065 unit. This synchronizes the B sweep with the start of the local oscillator sweep time. As the local oscillator recess thru the PARAMP band, ambient noise is amplified and appears as a noise band on the B-scope.

B With TUNE switch in NORM (305) +28 V is applied thru contacts of CADJ switch (855) to PARAMP on relays K1 (026) and K9 (866) and to PARAMP ON lamp (866). During the simulated attack this energizing path is broken when the computer delivers 0217A at C (pin) and opens contacts B and B of C signal relay K9 (841).

Figure 2-2. SSGC (Sheet 51 of 65: SSGC 5, sheet 1 of 7)

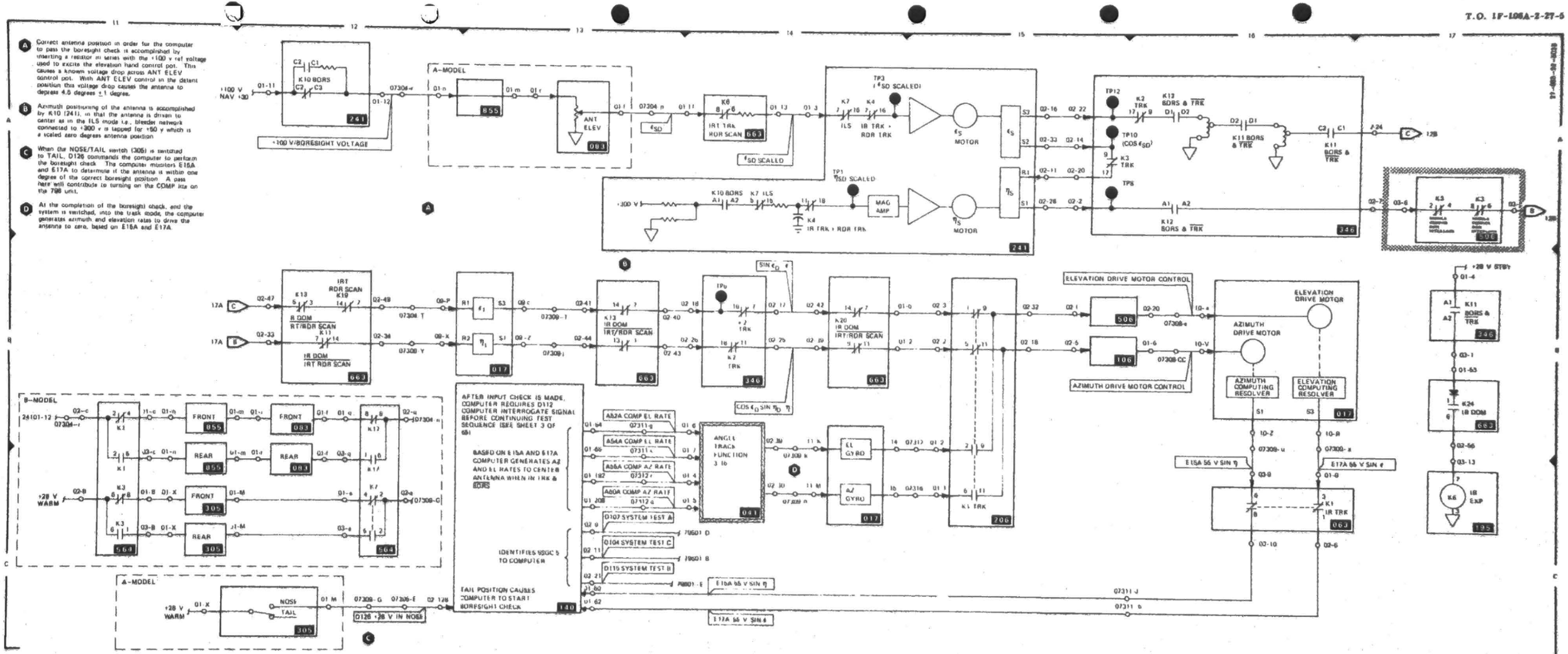


Figure 2-2. SSGC (Sheet 32 of 65: SSGC 5, sheet 2 of 7)

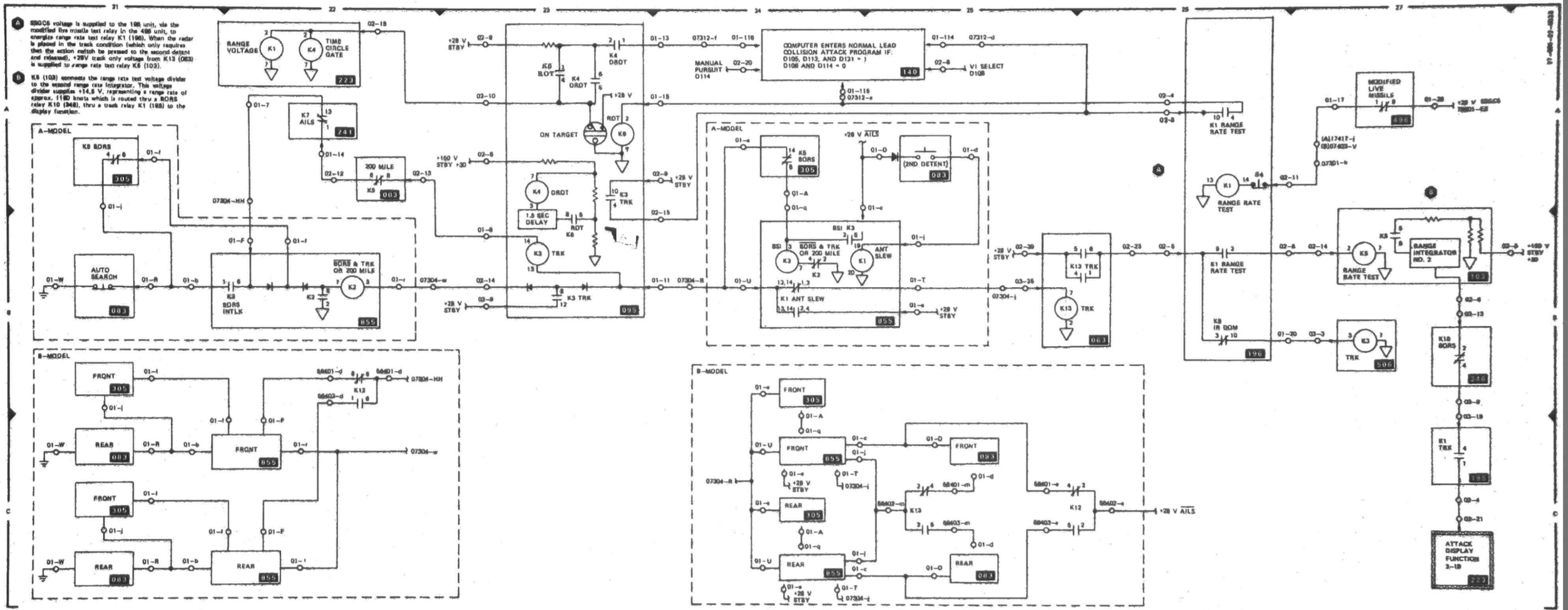


Figure 2-3. SSGC (Sheet 53 of 65: SSGC 5, sheet 3 of 7)

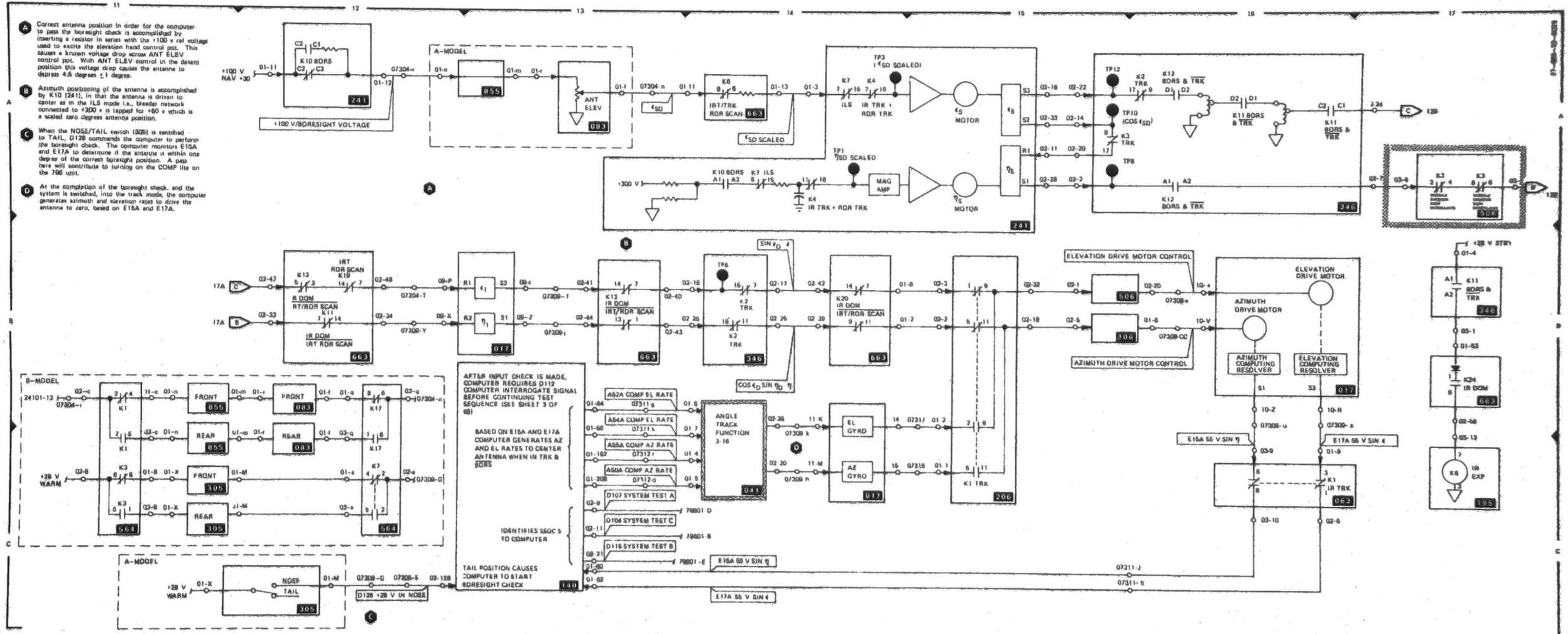


Figure 2-2. SSGC (Sheet 52 of 65: SSGC 5, sheet 2 of 7)

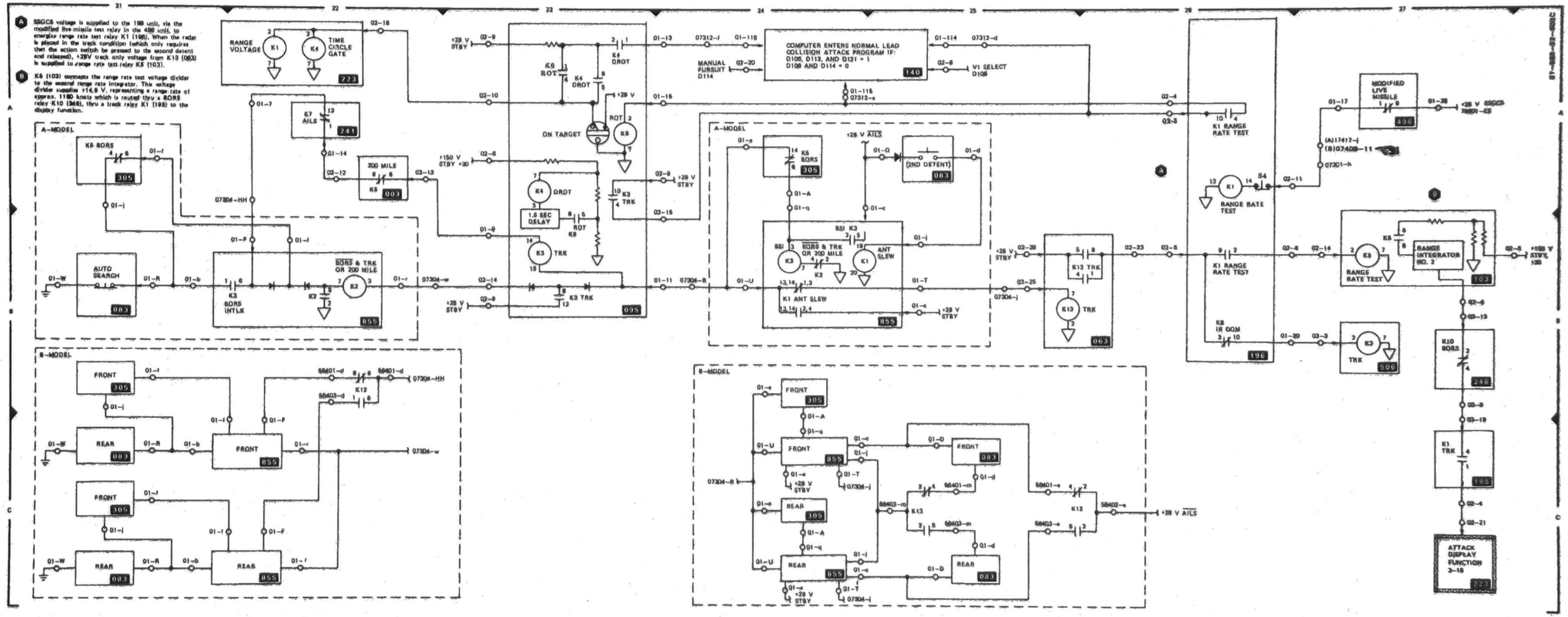


Figure 2-2. SSGC (Sheet 53 of 65: SSGC 5, sheet 3 of 7)

A The 043 unit test relay is energized if the 043 unit total index steps to the selected missile frequency at which time the channel select lamp (043) will come on.

B At C time the freq error between the radar transmitter and missile cavity in the 866 is sent to the 841 unit, ie, up and dn commands. Also, the fine tuning relay K4 energizes causing the XMTR TUNE light (596), RADAR light (796) and K3 (841) to energize. K3 tunes the magtie at a medium rate.

C Illumination of the ARM AUX light depends on range gate coincidence (K23, 496 unit) and unit test relays in the 043, 366, 484, 264 and 087 units.

D Illumination of the RADAR light depends on energizing fine tuning relay K4 (866). This occurs when the transmitter frequency and missile frequency reach coincidence.

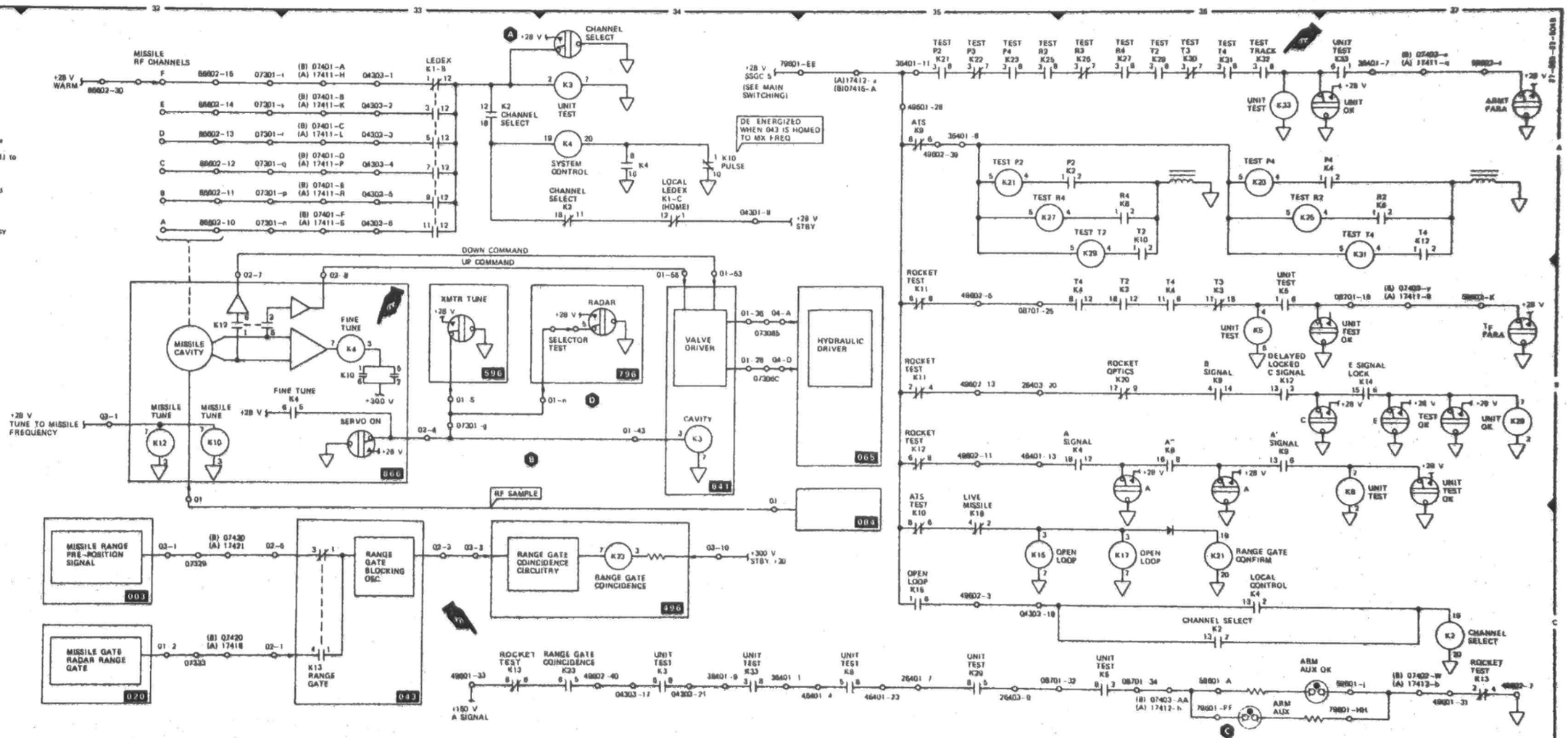


Figure 2-2. SSIC (Sheet 54 of 65: SSGC 5, sheet 4 of 7)

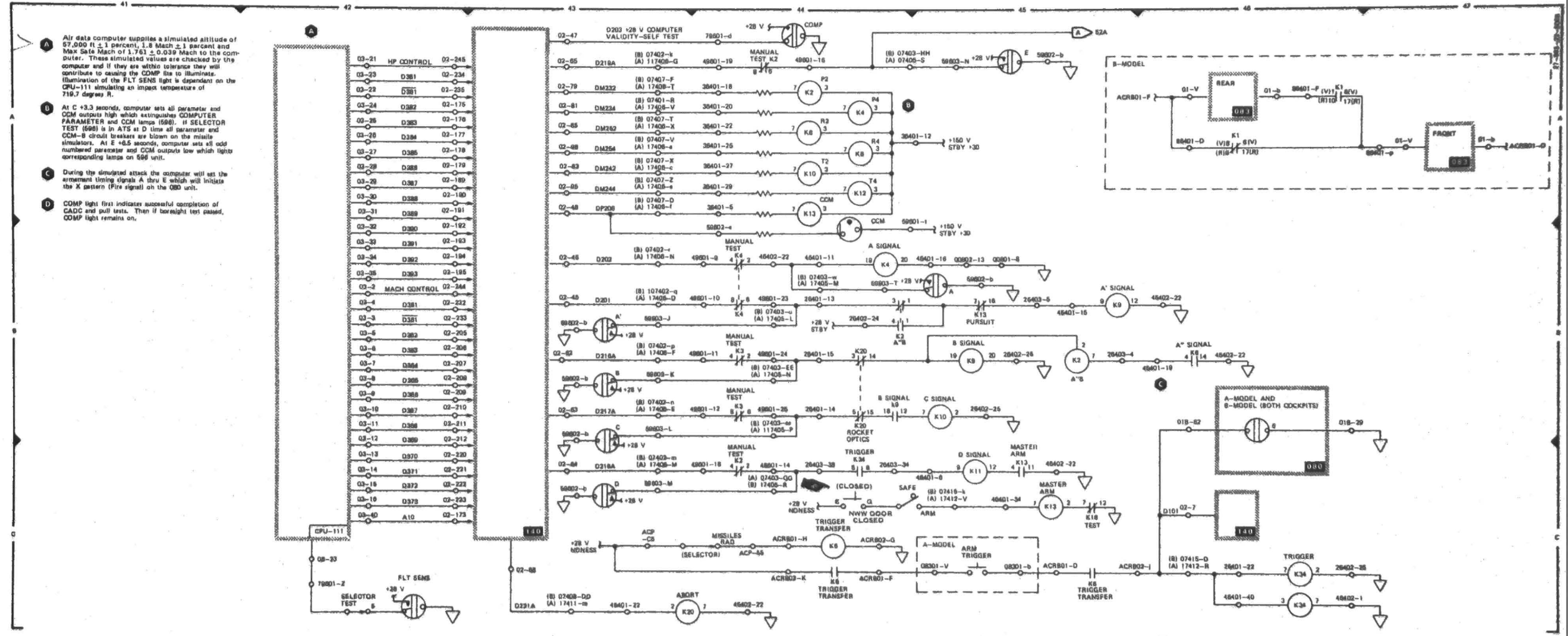


Figure 2-3. SSGC (Sheet 55 of 65; SSGC-5, sheet 5 of 7)

Ⓐ The 043 unit test relay is energized if the 043 unit local ledex steps to the selected missile frequency at which time the channel select lamp (043) will come on.

Ⓑ At C time the freq error between the radar transmitter and missile cavity in the 866 is sent to the 841 unit, ie , up and dn commands. Also, the fine tuning relay K4 energizes causing the XMTR TUNE light (596), RADAR light (796) and K3 (841) to energize. K3 turns the maggie at a medium rate.

Ⓒ Illumination of the ARM AUX light depends on range gate coincidence (K23, 496 unit) and unit test relays in the 043, 364, 484, 264 and 087 units.

Ⓓ Illumination of the RADAR light depends on energizing fine tuning relay K4 (866). This occurs when the transmitter frequency and missile frequency reach coincidence.

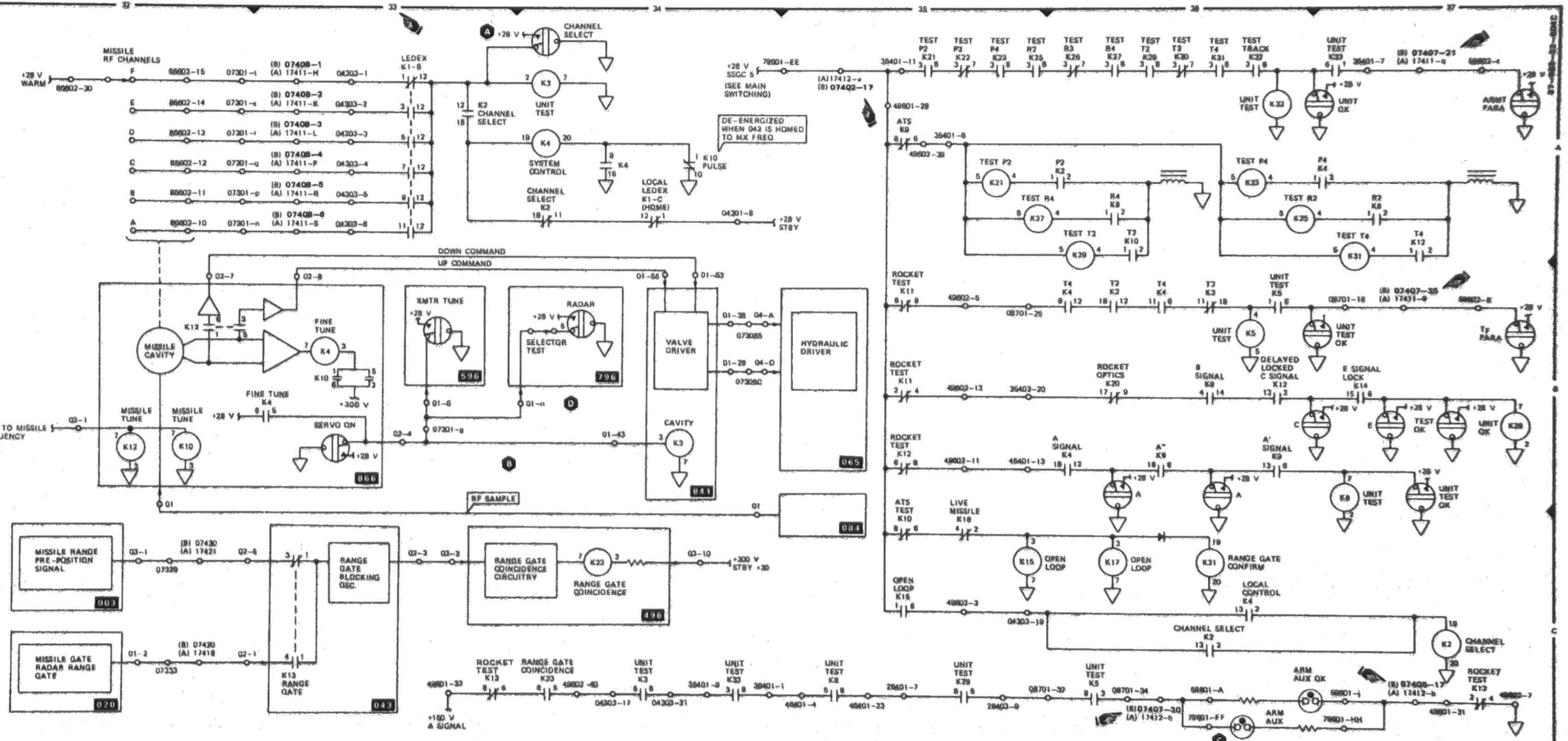


Figure 2-2. SSGC (Sheet 54 of 65: SSGC 5, sheet 4 of 7)

41 42 43 44 45 46 47

A Air data computer supplies a simulated altitude of 57,000 ft ± 1 percent, 1.8 Mach ± 1 percent and Max Safe Mach of 1.761 ± 0.039 Mach to the computer. These simulated values are checked by the computer and if they are within tolerance they will contribute to causing the COMP lite to illuminate. Illumination of the FLT SENS light is dependant on the CPU-111 simulating an impact temperature of 719.7 degrees R.

B At C +3.3 seconds, computer sets all parameter and CCM outputs high which extinguishes COMPUTER PARAMETER and CCM lamps (598). If SELECTOR TEST (598) is in ATS at D time all parameter and CCM-B circuit breakers are blown on the missile simulators. At E +0.6 seconds, computer sets all odd-numbered parameter and CCM outputs low which lights corresponding lamps on 598 unit.

C During the simulated attack the computer will set the armament timing signals A thru E which will initiate the X pattern (Fire signal) on the OBD unit.

D COMP light first indicates successful completion of CADC and pull tests. Then if boresight test passed, COMP light remains on.

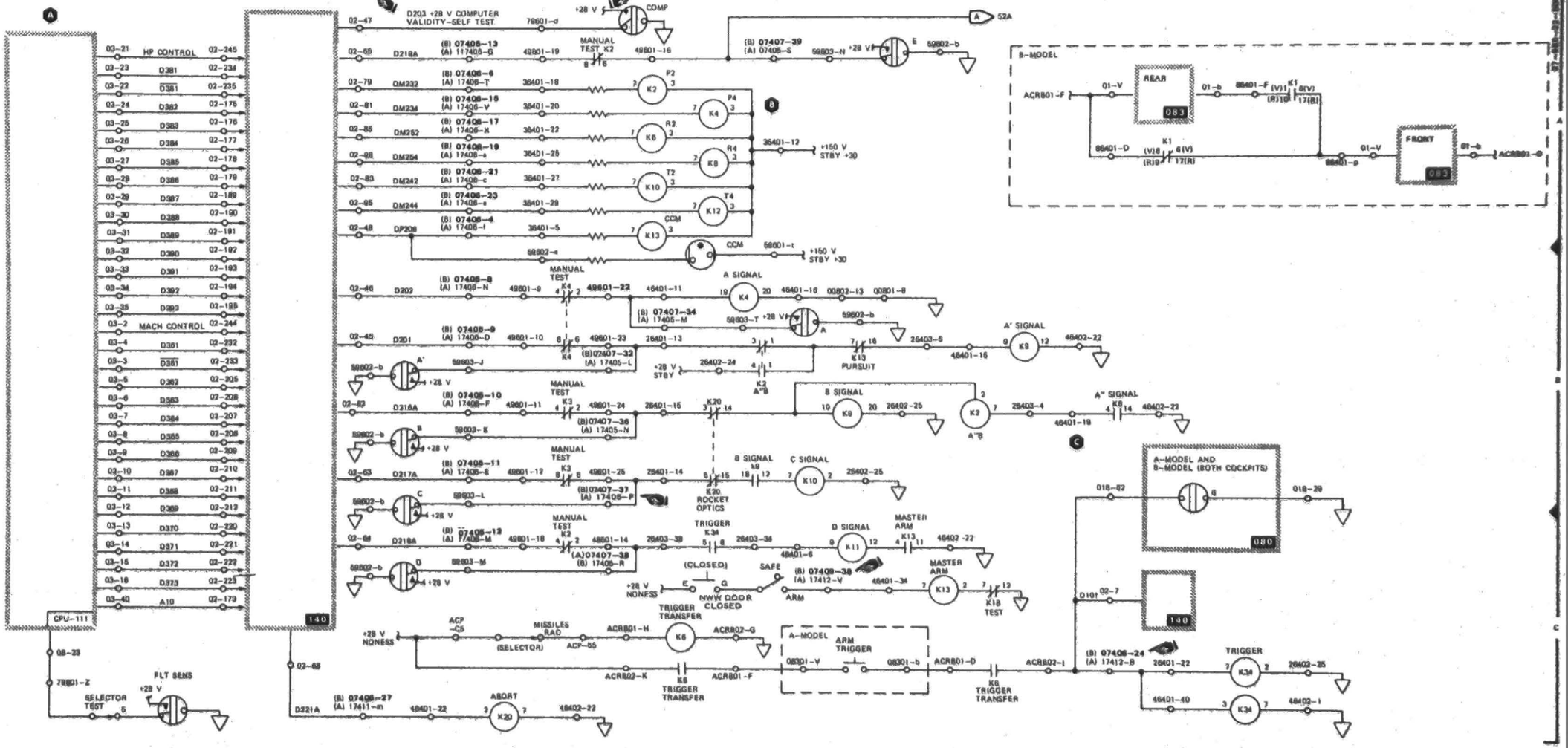


Figure 2-2. SSGC (Sheet 55 of 65: SSGC 5, sheet 5 of 7)

51 52 53 54 55 56 57

D The abort signal is generated by the computer if the preparation time between rot search to fire is < 17.5 sec

E DISPLAY LOGIC

LOCATION	FIRE	ABORT	PULLOUT
(A)17411-s (B)07408-CC	+	0	+
(A)17411-Y (B)07408-GG	0	0	+
(A)17411-K (B)07416-F	+	+	+
DISPLAY	X	A	B

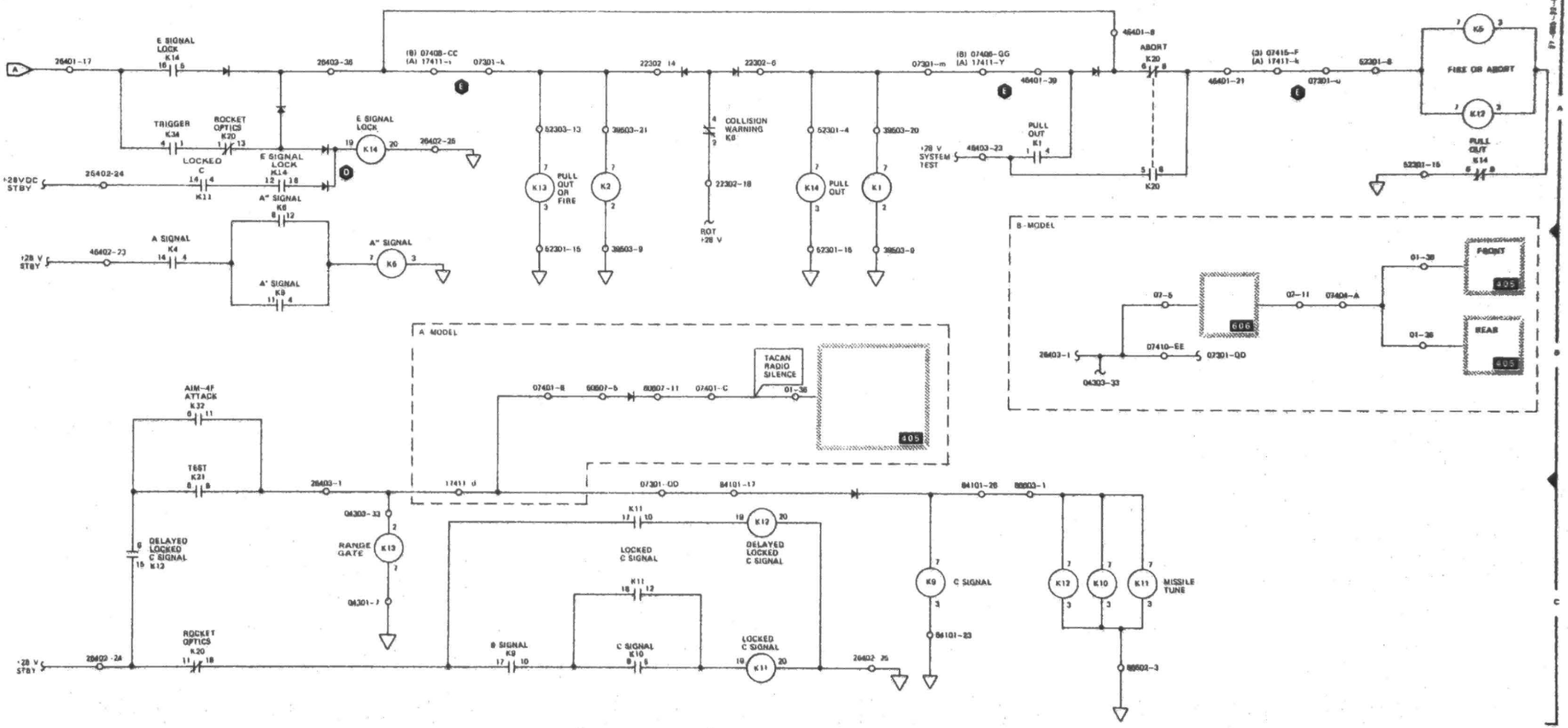


Figure 2-2. SSGC (Sheet 56 of 65; SSGC 5, sheet 6 of 7)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
003	K2	COIL 2 AND 7 1, 3 AND 4	SSGC 5/4B SSGC 5/4A
	K5	6 AND 8	SSGC 5/22A
	K10	COIL X1 AND X2 A2 AND A3 A1 AND A2	SSGC 5/4A SSGC 5/4A SSGC 5/4A
026	K1	COIL 3 AND 7 N.O.	SSGC 5/4A SSGC 5/4A
	K2	1 AND 6	SSGC 5/5B
043	K1C	1 AND 12	SSGC 5/34A
	K2	COIL 19 AND 20 2 AND 13 12 AND 18 11 AND 18	SSGC 5/37C SSGC 5/36C SSGC 5/33A SSGC 5/34A
	K3	COIL 2 AND 7 5 AND 8	SSGC 5/34A SSGC 5/34C
	K4	COIL 19 AND 20 8 AND 16 2 AND 13	SSGC 5/34A SSGC 5/34A SSGC 5/36C
	K10	1 AND 10	SSGC 5/34A
	K13	COIL 2 AND 7 1 AND 3 1 AND 4	SSGC 5/53C SSGC 5/33C SSGC 5/33C
063	K1	6 AND 8 1 AND 3	SSGC 5/16C SSGC 5/16C
	K13	COIL 2 AND 7 5 AND 8 1 AND 4	SSGC 5/25B SSGC 5/25B SSGC 5/25B
	K21	COIL 3 AND 7 1 AND 6 2 AND 5	SSGC 5/3B SSGC 5/3A SSGC 5/3A
	K22	6 AND 8	SSGC 5/5A
065	K451	COIL 3 AND 7 2 AND 5	SSGC 5/4A SSGC 5/4A
	K452	COIL 3 AND 7 1 AND 6	SSGC 5/4A SSGC 5/5A
087	K2	12 AND 18	SSGC 5/36B
	K3	11 AND 18	SSGC 5/36B
	K4	6 AND 12 11 AND 6	SSGC 5/36B SSGC 5/36B
	K5	COIL 4 AND 5 1 AND 6 3 AND 8	SSGC 5/36B SSGC 5/36B SSGC 5/36C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
095	K3	COIL 13 AND 14 8 AND 12 4 AND 10	SSGC 5/23B SSGC 5/23B SSGC 5/23A
	K4	COIL 3 AND 7 5 AND 6 1 AND 2	SSGC 5/23A SSGC 5/23A SSGC 5/23A
	K6	COIL 2 AND 7 5 AND 8	SSGC 5/23A SSGC 5/23B
103	K5	COIL 2 AND 7 5 AND 8	SSGC 5/27B SSGC 5/27B
195	K1	1 AND 4	SSGC 5/27C
	K6	COIL 3 AND 7	SSGC 5/17C
196	K1	COIL 13 AND 14 2 AND 9 4 AND 10	SSGC 5/26A SSGC 5/26B SSGC 5/26A
	K3	3 AND 10	SSGC 5/26A
	K8	3 AND 10	SSGC 5/26B
208	K1	1 AND 9 2 AND 9 5 AND 11 6 AND 11	SSGC 5/15B SSGC 5/15B SSGC 5/15B SSGC 5/15C
223	K1	COIL 2 AND 7	SSGC 5/22A
	K4	COIL 2 AND 7	SSGC 5/22A
	K6	2 AND 4	SSGC 5/54A
241	K4	11 AND 18	SSGC 5/14A
	K4D	7 AND 16	SSGC 5/14A
	K7	1 AND 13 5 AND 15	SSGC 5/22A SSGC 5/14A
	K7D	7 AND 16	SSGC 5/14A
	K10	A1 AND A2 C1 AND C2 C2 AND C3	SSGC 5/14A SSGC 5/14A SSGC 5/12A
264	K2	1 AND 3 1 AND 4 COIL 2 AND 7	SSGC 5/44B SSGC 5/44B SSGC 5/45B
	K9	COIL 19 AND 20 10 AND 17 12 AND 18 4 AND 14	SSGC 5/45B SSGC 5/53C SSGC 5/44B SSGC 5/36B
	K10	COIL 2 AND 7 5 AND 8	SSGC 5/45B SSGC 5/54C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	K11	COIL 19 AND 20 12 AND 18 10 AND 17	SSGC 5/54C SSGC 5/54C SSGC 5/54C
	K12	COIL 19 AND 20 6 AND 15 2 AND 13	SSGC 5/54C SSGC 5/52C SSGC 5/36B
	K13	7 AND 16	SSGC 5/45B
	K14	8 AND 16 6 AND 15 COIL 19 AND 20	SSGC 5/52A SSGC 5/37B 53A
	K20	1 AND 13 11 AND 18 9 AND 17 3 AND 14 5 AND 15	SSGC 5/52A SSGC 5/52C SSGC 5/36B SSGC 5/44B SSGC 5/44B
	K21	6 AND 8	SSGC 5/52C
	K29	COIL 2 AND 7 5 AND 8	SSGC 5/37B SSGC 5/35C
	K32	6 AND 11	SSGC 5/52B
	K34	COIL 2 AND 7 5 AND 8 1 AND 4	SSGC 5/46C SSGC 5/44C SSGC 5/52A
295	K1	COIL 3 AND 7	SSGC 5/6A
305	K3	2 AND 3	SSGC 5/3B
	K5	4 AND 6 8 AND 14	SSGC 5/21A SSGC 5/24A
346	K2	7 AND 16 9 AND 17 11 AND 18	SSGC 5/14B SSGC 5/16A SSGC 5/14B
	K3	9 AND 17	SSGC 5/15A
	K11	A1 AND A2 C1 AND C2 D1 AND D2	SSGC 5/17B SSGC 5/16A SSGC 5/16A
	K12	A1 AND A2 D1 AND D2	SSGC 5/16A SSGC 5/16A
	K10	2 AND 4	SSGC 5/27B
364	K2	COIL 3 AND 7 1 AND 2	SSGC 5/44A SSGC 5/36A
	K4	COIL 3 AND 7 1 AND 2	SSGC 5/44A SSGC 5/37A
	K6	COIL 3 AND 7 1 AND 2	SSGC 5/44A SSGC 5/37A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	K8	COIL 3 AND 7 1 AND 2	SSGC 5/44A SSGC 5/36A
	K10	COIL 3 AND 7 1 AND 2	SSGC 5/44A SSGC 5/36A
	K12	COIL 3 AND 7 1 AND 2	SSGC 5/44B SSGC 5/37A
	K13	COIL 3 AND 7	SSGC 5/44A
	K21	COIL 4 AND 5 3 AND 8	SSGC 5/35A SSGC 5/35A
	K23	3 AND 7	SSGC 5/35A
	K23	COIL 4 AND 5 3 AND 8	SSGC 5/36A SSGC 5/35A
	K25	COIL 4 AND 5	SSGC 5/36A
	K26	3 AND 7	SSGC 5/36A
	K27	COIL 4 AND 5 3 AND 8	SSGC 5/35A SSGC 5/36A
	K29	COIL 4 AND 5 3 AND 8	SSGC 5/36A SSGC 5/36A
	K30	3 AND 7	SSGC 5/36A
	K31	COIL 4 AND 5 3 AND 8	SSGC 5/37A SSGC 5/36A
	K32	3 AND 7	SSGC 5/36A
	K33	COIL 5 AND 4 3 AND 8 1 AND 6	SSGC 5/36A SSGC 5/34C SSGC 5/37A
395	K1	COIL 2 AND 7	SSGC 5/55A
	K2	COIL 2 AND 7	SSGC 5/54A
464	K1	1 AND 4	SSGC 5/35A
	K4	COIL 19 AND 20 4 AND 14 12 AND 18	SSGC 5/44B SSGC 5/52B SSGC 5/36B
	K6	COIL 3 AND 7 4 AND 14 6 AND 12 8 AND 16	SSGC 5/53B SSGC 5/46B SSGC 5/53A SSGC 5/36B
	K8	COIL 2 AND 7 5 AND 8	SSGC 5/37B SSGC 5/35C
	K9	COIL 9 AND 12 6 AND 13 4 AND 11	SSGC 5/45B SSGC 5/36B SSGC 5/53B
	K11	COIL 9 AND 13	SSGC 5/45C
	K13	COIL 3 AND 7 4 AND 11	SSGC 5/45C SSGC 5/45C
	K18	7 AND 13	SSGC 5/45C
	K20	COIL 2 AND 7 5 AND 8 6 AND 8	SSGC 5/44C SSGC 5/56A SSGC 5/56A
496	K1	1 AND 9	SSGC 5/27A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	K2	2 AND 4 6 AND 8	SSGC 5/44C SSGC 5/44A
	K3	2 AND 4 6 AND 8	SSGC 5/44B SSGC 5/44B
	K4	2 AND 4 6 AND 8	SSGC 5/44B SSGC 5/44B
	K9	6 AND 8	SSGC 5/35A
	K10	6 AND 8	SSGC 5/35C
	K11	2 AND 4 6 AND 8	SSGC 5/35B SSGC 5/35B
	K13	2 AND 4 6 AND 8	SSGC 5/37C SSGC 5/33C
	K15	COIL 3 AND 7 1 AND 6	SSGC 5/35C SSGC 5/35C
	K17	COIL 3 AND 7	SSGC 5/36C
	K18	2 AND 4	SSGC 5/35C
	K21	COIL 19 AND 20	SSGC 5/36C
	K23	COIL 3 AND 7 5 AND 6	SSGC 5/34C SSGC 5/34C
506	K3	2 AND 4 6 AND 8	SSGC 5/17A SSGC 5/17A
	K4	COIL 3 AND 7	SSGC 5/27B
523	K5	COIL 3 AND 7	SSGC 5/57A
	K12	COIL 3 AND 7	SSGC 5/57A
	K13	COIL 3 AND 7	SSGC 5/54A
	K14	COIL 3 AND 7 6 AND 8	SSGC 5/55A SSGC 5/57A
663	K6	6 AND 8	SSGC 5/14A
	K11	7 AND 14	SSGC 5/12B
	K13	3 AND 5 1 AND 13 7 AND 14	SSGC 5/12B SSGC 5/13B SSGC 5/13B
	K19	7 AND 14	SSGC 5/12B
	K20	7 AND 14 9 AND 11	SSGC 5/14B SSGC 5/14B
	K24	1 AND 6	SSGC 5/17B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
841	K3	COIL 2 AND 7	SSGC 5/34B
	K9	COIL 3 AND 7 5 AND 8	SSGC 5/55C SSGC 5/2B
	K10	9 AND 11	SSGC 5/2B
855	K1	COIL 19 AND 20 3 AND 14 2 AND 13	SSGC 5/24B SSGC 5/24B SSGC 5/24B
	K2	COIL 3 AND 7 3 AND 4 2 AND 5	SSGC 5/22B SSGC 5/24B SSGC 5/22B
	K3	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC 5/24B SSGC 5/24B SSGC 5/21B
866	K4	COIL 3 AND 7 5 AND 6	SSGC 5/33B SSGC 5/33B
	K9	COIL 3 AND 7	SSGC 5/6C
	K10	COIL 3 AND 7	SSGC 5/56C
	K11	COIL 3 AND 7	SSGC 5/56C
	K12	COIL 3 AND 8 6 AND 8 3 AND 4	SSGC 5/32B, 56C SSGC 5/32B SSGC 5/32B
ACRB CVAC	K6	COIL N.O. N.O.	SSGC 5/44C SSGC 5/44C SSGC 5/45C

Figure 2-2. SSGC (Sheet 57 of 65: SSGC 5, Sheet 7 of 7)

51 52 53 54 55 56 57

(D) The abort signal is generated by the computer if the preparation time between rail launch to fire is < 17.5 sec.

(E) DISPLAY LOGIC

LOCATION	FIRE	ABORT	PULLOUT
(A)17411-s (B)07408-13	+	0	+
(A)17411-Y (B)07408-62	0	0	+
(A)17411-K (B)07408-16	+	+	+
DISPLAY	X	A	B

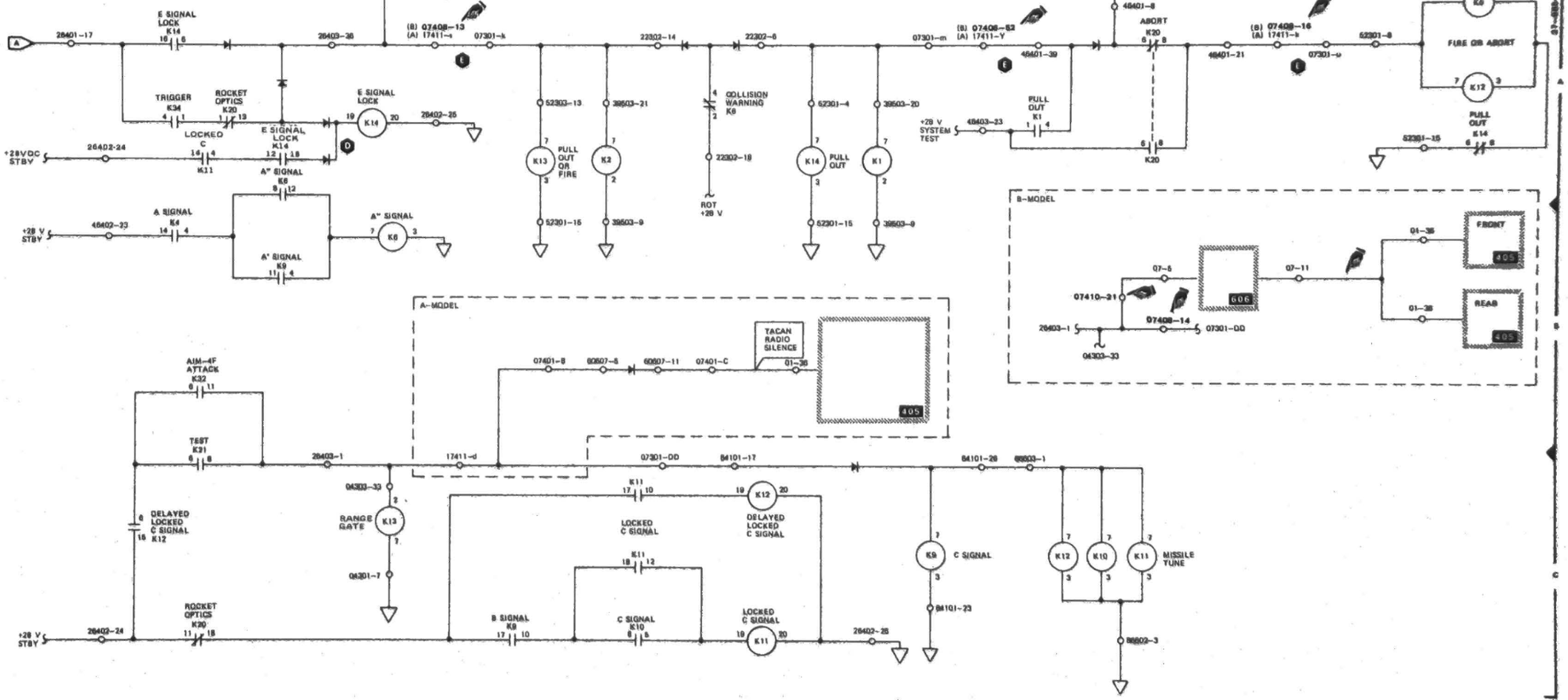


Figure 2-2. SSGC (Sheet 56 of 65: SSGC 5, sheet 6 of 7)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
003	K2	COIL 2 AND 7 1, 3 AND 4	SSGC 5/4B SSGC 5/4A
	K5	6 AND 8	SSGC 5/22A
	K10	COIL X1 AND X2 A2 AND A3 A1 AND A2	SSGC 5/4A SSGC 5/4A SSGC 5/4A
026	K1	COIL 3 AND 7 N.O.	SSGC 5/4A SSGC 5/4A
	K2	1 AND 6	SSGC 5/5B
043	K1C	1 AND 12	SSGC 5/34A
	K2	COIL 19 AND 20 2 AND 18 12 AND 18 11 AND 18	SSGC 5/37C SSGC 5/36C SSGC 5/33A SSGC 5/34A
	K3	COIL 2 AND 7 5 AND 8	SSGC 5/34A SSGC 5/34C
	K4	COIL 19 AND 20 8 AND 16 2 AND 13	SSGC 5/34A SSGC 5/34A SSGC 5/36C
	K10	1 AND 10	SSGC 5/34A
	K13	COIL 2 AND 7 1 AND 3 1 AND 4	SSGC 5/53C SSGC 5/33C SSGC 5/33C
063	K1	6 AND 8 1 AND 3	SSGC 5/16C SSGC 5/16C
	K13	COIL 2 AND 7 5 AND 6 1 AND 4	SSGC 5/25B SSGC 5/25B SSGC 5/25B
	K21	COIL 3 AND 7 1 AND 6 2 AND 5	SSGC 5/3B SSGC 5/3A SSGC 5/3A
	K22	6 AND 8	SSGC 5/5A
065	K451	COIL 3 AND 7 2 AND 5	SSGC 5/4A SSGC 5/4A
	K452	COIL 3 AND 7 1 AND 6	SSGC 5/4A SSGC 5/5A
067	K2	12 AND 18	SSGC 5/36B
	K3	11 AND 18	SSGC 5/36B
	K4	6 AND 12 11 AND 6	SSGC 5/36B SSGC 5/36B
	K5	COIL 4 AND 5 1 AND 6 3 AND 8	SSGC 5/36B SSGC 5/36B SSGC 5/36C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
095	K3	COIL 13 AND 14 8 AND 12 4 AND 10	SSGC 5/23B SSGC 5/23B SSGC 5/23A
	K4	COIL 3 AND 7 5 AND 6 1 AND 2	SSGC 5/23A SSGC 5/23A SSGC 5/23A
	K6	COIL 2 AND 7 5 AND 8	SSGC 5/23A SSGC 5/23B
103	K5	COIL 2 AND 7 5 AND 8	SSGC 5/27B SSGC 5/27B
195	K1	1 AND 4	SSGC 5/27C
	K6	COIL 3 AND 7	SSGC 5/17C
196	K1	COIL 13 AND 14 2 AND 9 4 AND 10	SSGC 5/26A SSGC 5/26B SSGC 5/26A
	K3	3 AND 10	SSGC 5/26A
	K6	3 AND 10	SSGC 5/26B
206	K1	1 AND 9 2 AND 9 5 AND 11 6 AND 11	SSGC 5/15B SSGC 5/15B SSGC 5/15B SSGC 5/15C
225	K1	COIL 2 AND 7	SSGC 5/22A
	K4	COIL 2 AND 7	SSGC 5/22A
	K6	2 AND 4	SSGC 5/54A
241	K4	11 AND 18	SSGC 5/14A
	K4D	7 AND 16	SSGC 5/14A
	K7	1 AND 13 5 AND 15	SSGC 5/22A SSGC 5/14A
	K7D	7 AND 16	SSGC 5/14A
	K10	A1 AND A2 C1 AND C2 C2 AND C3	SSGC 5/14A SSGC 5/14A SSGC 5/12A
264	K3	1 AND 3 1 AND 4 COIL 2 AND 7	SSGC 5/44B SSGC 5/44B SSGC 5/45B
	K9	COIL 19 AND 20 10 AND 17 12 AND 18 4 AND 14	SSGC 5/45B SSGC 5/53C SSGC 5/44B SSGC 5/36B
	K10	COIL 2 AND 7 5 AND 8	SSGC 5/45B SSGC 5/54C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	K11	COIL 19 AND 20 12 AND 18 10 AND 17	SSGC 5/54C SSGC 5/54C SSGC 5/54C
	K12	COIL 19 AND 20 6 AND 15 2 AND 13	SSGC 5/54C SSGC 5/52C SSGC 5/36B
	K13	7 AND 16	SSGC 5/45B
	K14	8 AND 18 6 AND 15 COIL 19 AND 20	SSGC 5/52A SSGC 5/37B 53A
	K20	1 AND 13 11 AND 18 9 AND 17 3 AND 14 5 AND 15	SSGC 5/52A SSGC 5/52C SSGC 5/36B SSGC 5/44B SSGC 5/44B
	K21	6 AND 8	SSGC 5/52C
	K29	COIL 2 AND 7 5 AND 8	SSGC 5/37B SSGC 5/35C
	K32	6 AND 11	SSGC 5/52B
	K34	COIL 2 AND 7 5 AND 8 1 AND 4	SSGC 5/46C SSGC 5/44C SSGC 5/52A
295	K1	COIL 3 AND 7	SSGC 5/6A
305	K3	2 AND 3	SSGC 5/3B
	K5	4 AND 6 8 AND 14	SSGC 5/21A SSGC 5/24A
346	K2	7 AND 16 9 AND 17 11 AND 18	SSGC 5/14B SSGC 5/16A SSGC 5/14B
	K3	9 AND 17	SSGC 5/15A
	K11	A1 AND A2 C1 AND C2 D1 AND D2	SSGC 5/17B SSGC 5/16A SSGC 5/16A
	K12	A1 AND A2 D1 AND D2	SSGC 5/16A SSGC 5/16A
	K10	2 AND 4	SSGC 5/27B
364	K3	COIL 3 AND 7 1 AND 2	SSGC 5/44A SSGC 5/35A
	K4	COIL 3 AND 7 1 AND 2	SSGC 5/44A SSGC 5/37A
	K6	COIL 3 AND 7 1 AND 2	SSGC 5/44A SSGC 5/37A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	K8	COIL 3 AND 7 1 AND 2	SSGC 5/44A SSGC 5/36A
	K10	COIL 3 AND 7 1 AND 2	SSGC 5/44A SSGC 5/36A
	K12	COIL 3 AND 7 1 AND 2	SSGC 5/44B SSGC 5/37A
	K13	COIL 3 AND 7	SSGC 5/44A
	K21	COIL 4 AND 5 3 AND 8	SSGC 5/35A SSGC 5/35A
	K22	3 AND 7	SSGC 5/35A
	K23	COIL 4 AND 5 3 AND 8	SSGC 5/36A SSGC 5/35A
	K25	COIL 4 AND 5	SSGC 5/36A
	K26	3 AND 7	SSGC 5/36A
	K27	COIL 4 AND 5 3 AND 8	SSGC 5/35A SSGC 5/36A
	K29	COIL 4 AND 5 3 AND 8	SSGC 5/36A SSGC 5/36A
	K30	3 AND 7	SSGC 5/36A
	K31	COIL 4 AND 5 3 AND 8	SSGC 5/37A SSGC 5/36A
	K32	3 AND 7	SSGC 5/36A
	K33	COIL 6 AND 4 3 AND 8 1 AND 6	SSGC 5/36A SSGC 5/34C SSGC 5/37A
395	K1	COIL 2 AND 7	SSGC 5/55A
	K3	COIL 2 AND 7	SSGC 5/54A
464	K1	1 AND 4	SSGC 5/55A
	K4	COIL 19 AND 20 4 AND 14 12 AND 18	SSGC 5/44B SSGC 5/52B SSGC 5/36B
	K6	COIL 3 AND 7 4 AND 14 8 AND 12 6 AND 16	SSGC 5/53B SSGC 5/46B SSGC 5/53A SSGC 5/36B
	K8	COIL 2 AND 7 5 AND 6	SSGC 5/37B SSGC 5/35C
	K9	COIL 9 AND 12 6 AND 13 4 AND 11	SSGC 5/45B SSGC 5/36B SSGC 5/53B
	K11	COIL 9 AND 12	SSGC 5/45C
	K13	COIL 2 AND 7 4 AND 11	SSGC 5/45C SSGC 5/45C
	K18	7 AND 13	SSGC 5/45C
	K20	COIL 2 AND 7 5 AND 6 6 AND 8	SSGC 5/44C SSGC 5/56A SSGC 5/56A
496	K1	1 AND 9	SSGC 5/27A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	K3	2 AND 4 6 AND 8	SSGC 5/44C SSGC 5/44A
	K3	2 AND 4 6 AND 8	SSGC 5/44B SSGC 5/44B
	K4	2 AND 4 6 AND 8	SSGC 5/44B SSGC 5/44B
	K9	6 AND 8	SSGC 5/35A
	K10	6 AND 8	SSGC 5/35C
	K11	2 AND 4 6 AND 8	SSGC 5/35B SSGC 5/35B
	K13	2 AND 4 6 AND 8	SSGC 5/37C SSGC 5/33C
	K15	COIL 3 AND 7 1 AND 6	SSGC 5/35C SSGC 5/35C
	K17	COIL 3 AND 7	SSGC 5/36C
	K18	2 AND 4	SSGC 5/35C
	K21	COIL 19 AND 20	SSGC 5/36C
	K23	COIL 3 AND 7 5 AND 6	SSGC 5/34C SSGC 5/34C
506	K3	2 AND 4 6 AND 8	SSGC 5/17A SSGC 5/17A
	K4	COIL 3 AND 7	SSGC 5/27B
523	K5	COIL 3 AND 7	SSGC 5/57A
	K12	COIL 3 AND 7	SSGC 5/57A
	K13	COIL 3 AND 7	SSGC 5/54A
	K14	COIL 3 AND 7 6 AND 8	SSGC 5/55A SSGC 5/57A
663	K6	6 AND 8	SSGC 5/14A
	K11	7 AND 14	SSGC 5/12B
	K13	3 AND 5 1 AND 13 7 AND 14	SSGC 5/12B SSGC 5/13B SSGC 5/13B
	K19	7 AND 14	SSGC 5/12B
	K20	7 AND 14 9 AND 11	SSGC 5/14B SSGC 5/14B
	K34	1 AND 6	SSGC 5/17B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
841	K3	COIL 3 AND 7	SSGC 5/34B
	K9	COIL 3 AND 7 6 AND 8	SSGC 5/54C SSGC 5/2B
	K10	9 AND 11	SSGC 5/2B
855	K1	COIL 19 AND 20 3 AND 14 2 AND 13	SSGC 5/24B SSGC 5/24B SSGC 5/24B
	K2	COIL 3 AND 7 2 AND 4 2 AND 5	SSGC 5/22B SSGC 5/24B SSGC 5/22B
	K3	COIL 3 AND 7 2 AND 5 1 AND 6	SSGC 5/24B SSGC 5/24B SSGC 5/21B
866	K4	COIL 3 AND 7 6 AND 8	SSGC 5/32B SSGC 5/32B
	K9	COIL 3 AND 7	SSGC 5/6C
	K10	COIL 3 AND 7	SSGC 5/56C
	K11	COIL 3 AND 7	SSGC 5/56C
	K12	COIL 3 AND 8 6 AND 8 3 AND 4	SSGC 5/32B, 56C SSGC 5/32B SSGC 5/32B
ACRB CVAC	K6	COIL N.O. N.O.	SSGC 5/44C SSGC 5/44C SSGC 5/45C

Figure 2-3. SSGC (Sheet 57 of 65: SSGC 5, Sheet 7 of 7)

Short System Ground Check 6 checks the systems performance under simulated attack conditions with SPECIAL WEAPON selected.

A Digital inputs D104, D107 and D115 indicate to the computer that SSGC 6 has been selected. D104 and D115 are logic zeros and D107 is a logic 1.

B When SSGC 6 is selected, the self-test circuits in the air data computer are activated. The self test circuits apply signals to the Hp digitizer, Mach digitizer, and the temperature section. The simulated impact temperature is 490.5°R ±1%. The simulated Hp (altitude pressure) is 33,170 feet ±1%. The simulated Mach number is 0.785 Mach ±0.01. These three inputs are applied to the digital computer and if in tolerance, the digital computer sets the digital output O203 to a logic 1 (+28 V) which lights the COMP light (798). Also if the temperature is valid, a set of contacts is closed and the FLT SENS (798) lights.

C Closed during valid temperature self-test.

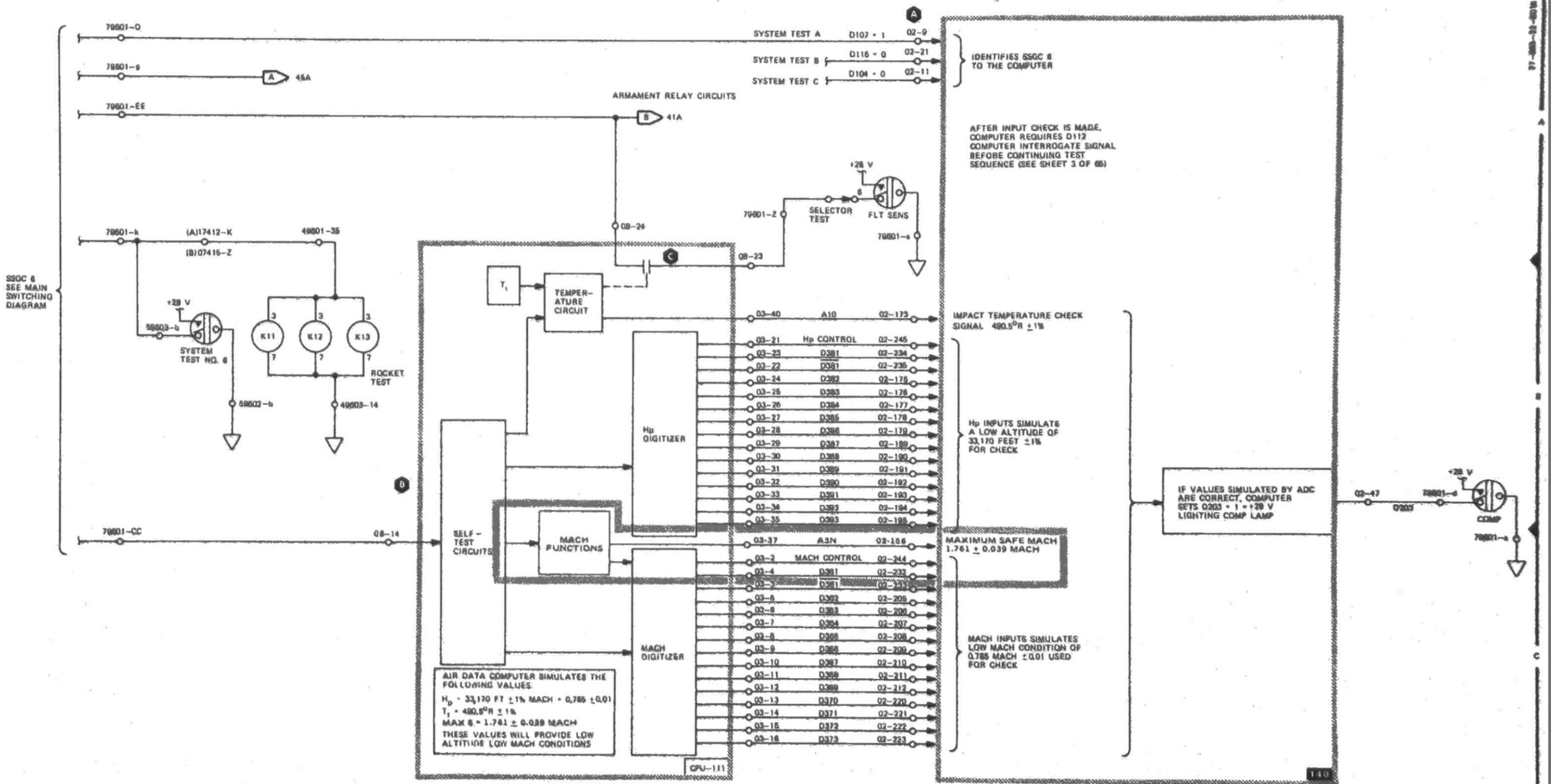


Figure 2-2. SSGC (Sheet 58 of 65: SSGC 6, sheet 1 of 7)

A When the action switch is pressed to the second detent, antenna slew relay K1 (855) energizes. The track action relay K3 (095) then energizes through contacts of energized relay K1 and deenergized 200 mile relay (241), A/LS relay K7 (083) and AUTO SEARCH switch. K3 then locks up through contacts 12 and 8 of K3. When action switch is released to first detent after lockon, the antenna slew relay K1 deenergizes and track relay K13 (083) energizes. Range rate test relay K1 (190 unit, sheet 3) energizes when SSGC 6 is selected. When range rate test relay K1 energizes, rate test relay K5 (103) and ROT relay K6 (095) energize. 1.5 seconds after ROT relay K6 energizes, DROT relay K4 (095) energizes. Also on target indicator (095) lights and timing circle gate relay K14 (223) energizes. The following signals are applied to the digital computer:

Not search	D105 = 1
ROT	D113 = 1
VI select	D108 = 0
Manual pursuit	D114 = 0
DROT	D121 = 1

The armament selector switch is set to SPL WPN and the D130 signal equals 1. These signals cause the digital computer to go into a normal lead collision co-altitude attack program for the AIM-2A rocket.

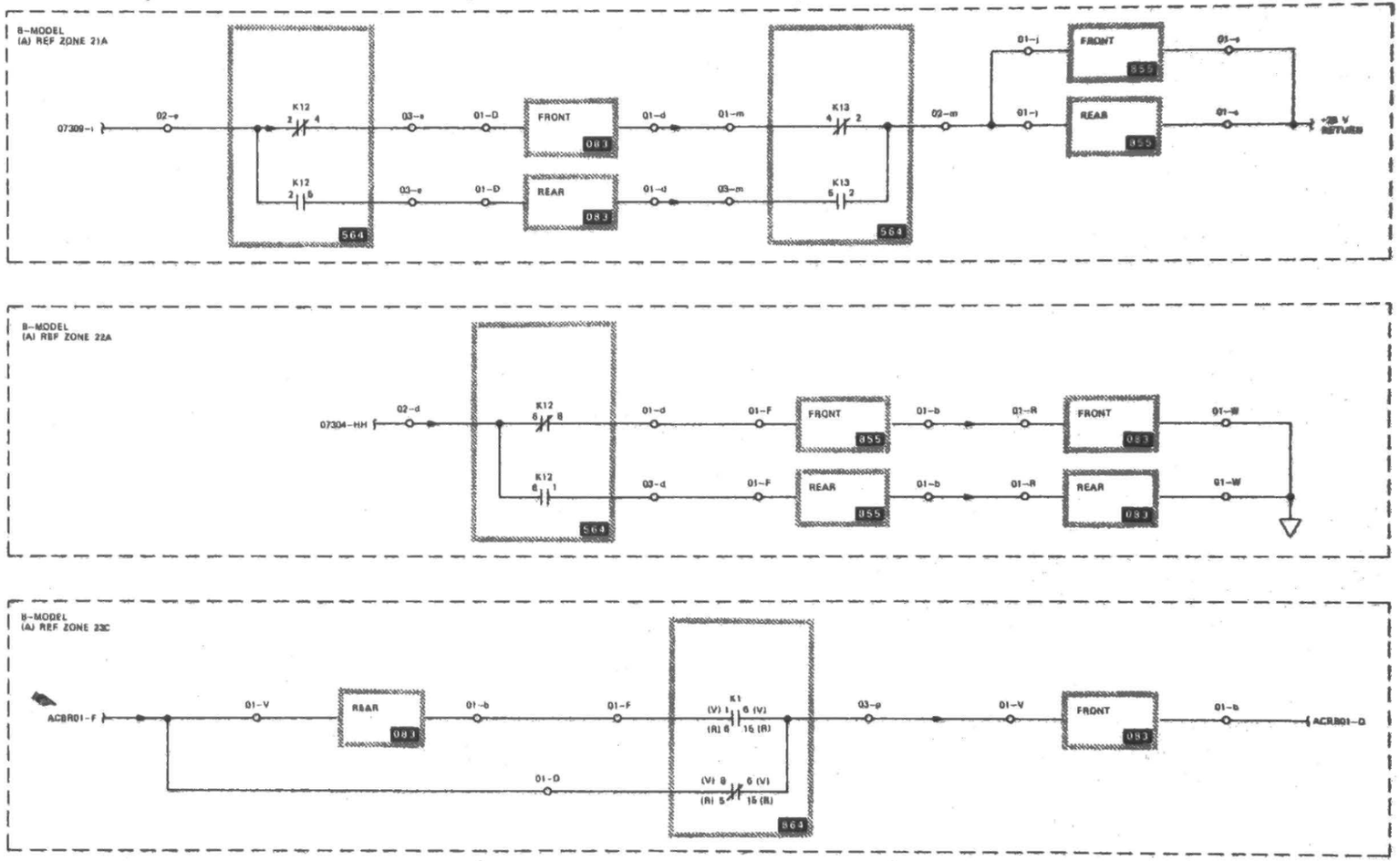


Figure 2-2. SSGC (Sheet 59 of 65: SSGC 6, sheet 2 of 7)

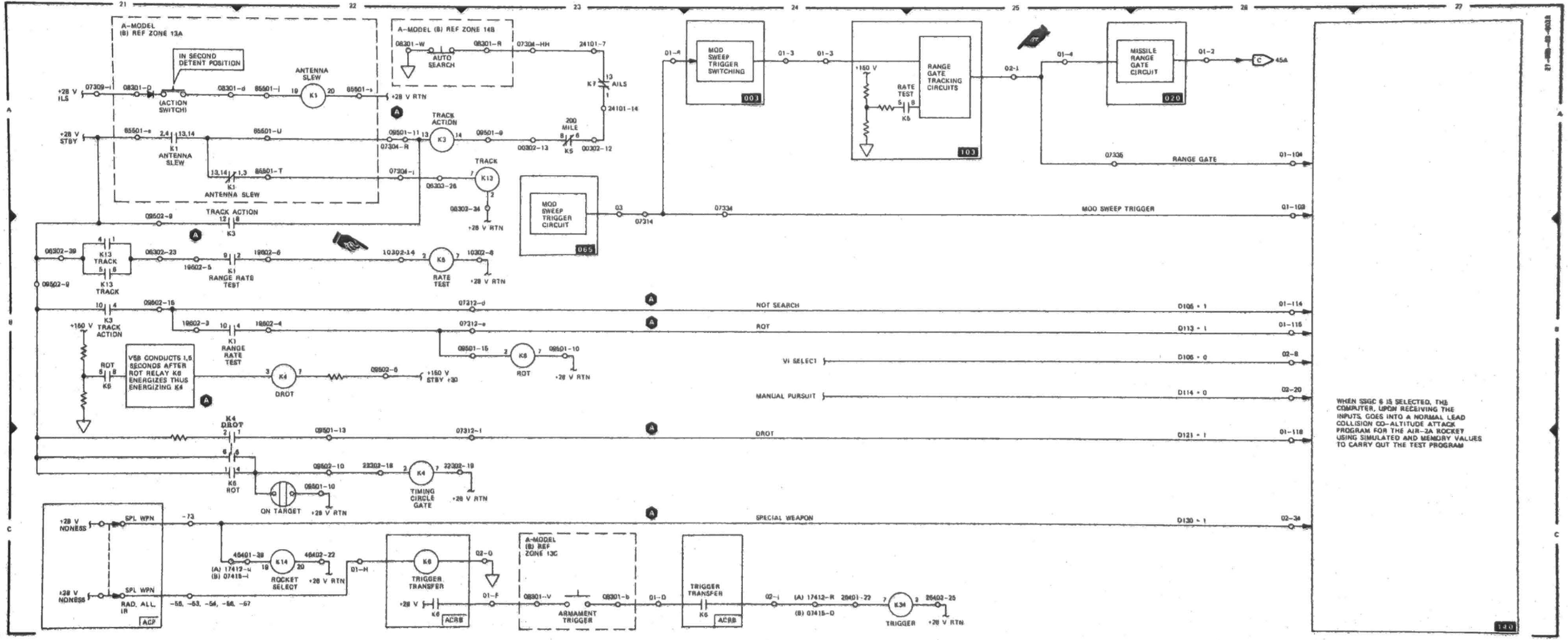


Figure 2-2. SSGC (Sheet 60 of 65: SSGC 6, sheet 3 of 7)

31 32 33 34 35 36 37

A When SSGC 6 is selected, the following signals drive the antenna to the dead ahead position:

El rate 1	A52A
El rate 2	A54A
Az rate 1	A56A
Az rate 2	A60A

See SSGC 5 for a more detailed explanation

B The time–to–go signal (A53A) and lead collision signal (D223A) are generated as described in the digital computer explanation box. These signals are used to control the time–to–go circle on the OBD unit display. For a more detailed explanation see SSGC 4.

COMPUTER SENDS THESE SIGNALS OUT IMMEDIATELY AFTER SELECTING SSGC NO. 6. SIGNALS ARE USED TO DRIVE ANTENNA TO A DEAD AHEAD POSITION $\omega_1 = \omega_{DC} = 0.25 \sin\eta$ $\omega_2 = \omega_{EC} = -0.25 \cos\eta \sin\epsilon$

WHEN ACTION SWITCH IS RELEASED AND A LOCKON SITUATION IS SIMULATED AT 16 MILES, THE TIME CIRCLE WILL APPEAR FIRST AS A 2.8 INCH CIRCLE. AT 20 SECONDS TO FIRE, THE CIRCLE SHRINKS AND THEN IS REPLACED WITH A PULLOUT SYMBOL

WHEN $T-T_F$ EQUALS 10 SECS, COMPUTER DELIVERS THE B SIGNAL WHICH ENERGIZES K9 (284 UNIT).

WHEN $T-T_F$ EQUALS 3 SECS, COMPUTER DELIVERS THE C SIGNAL WHICH ENERGIZES K10 (284 UNIT).

EVEN τ (TAU) PARAMETERS ARE SET BY NORMAL CALCULATIONS (USING MEMORY TEST VALUES OF AIR DATA) THUS HOLDING EVEN PARAMETER RELAYS DEENERGIZED AND CAUSING ODD PARAMETER RELAYS TO ENERGIZE.

EVEN R PARAMETERS ARE SET BY TEST ROUTINE THUS HOLDING EVEN R PARAMETER RELAYS DEENERGIZED AND CAUSING ODD R PARAMETER RELAYS TO ENERGIZE.

EVEN ρ (RHO) PARAMETERS ARE SET BY TEST ROUTINE THUS HOLDING EVEN ρ PARAMETER RELAYS DEENERGIZED AND CAUSING ODD ρ PARAMETER RELAYS TO ENERGIZE

CCM SIGNAL DP208 = 0 THUS CCM RELAY K13 (284 UNIT) IS ENERGIZED.

COMPUTER DELIVERS THE E SIGNAL WHICH ENERGIZES K14 (284 UNIT). TIME–TO–GO CIRCLE HAS SHRUNK TO ZERO AND THE FIGURE 8 PULLOUT SYMBOL APPEARS ON THE OBD UNIT

140

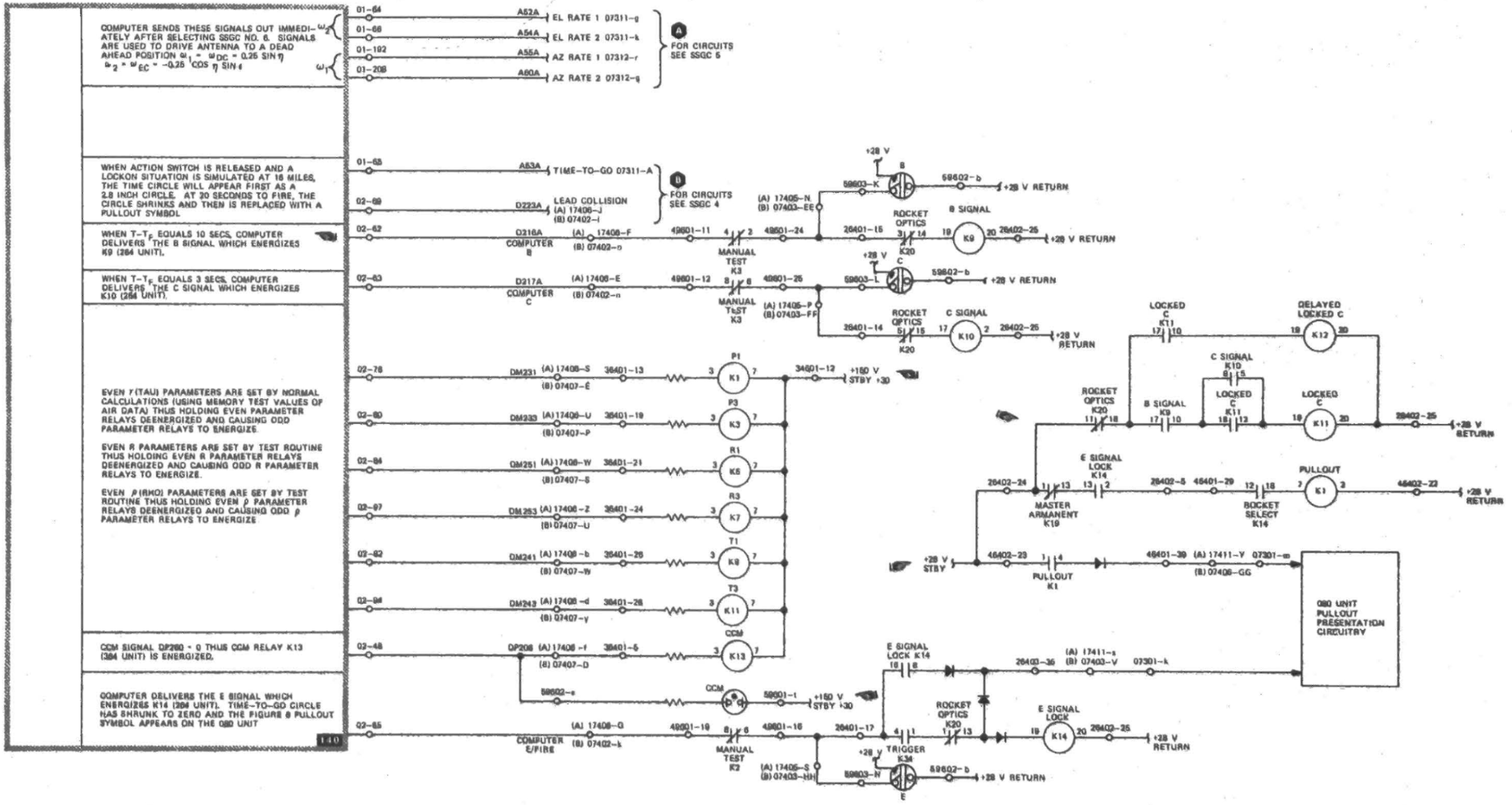


Figure 2-2. SSGC (Sheet 61 of 65: SSGC 6, sheet 4 of 7)

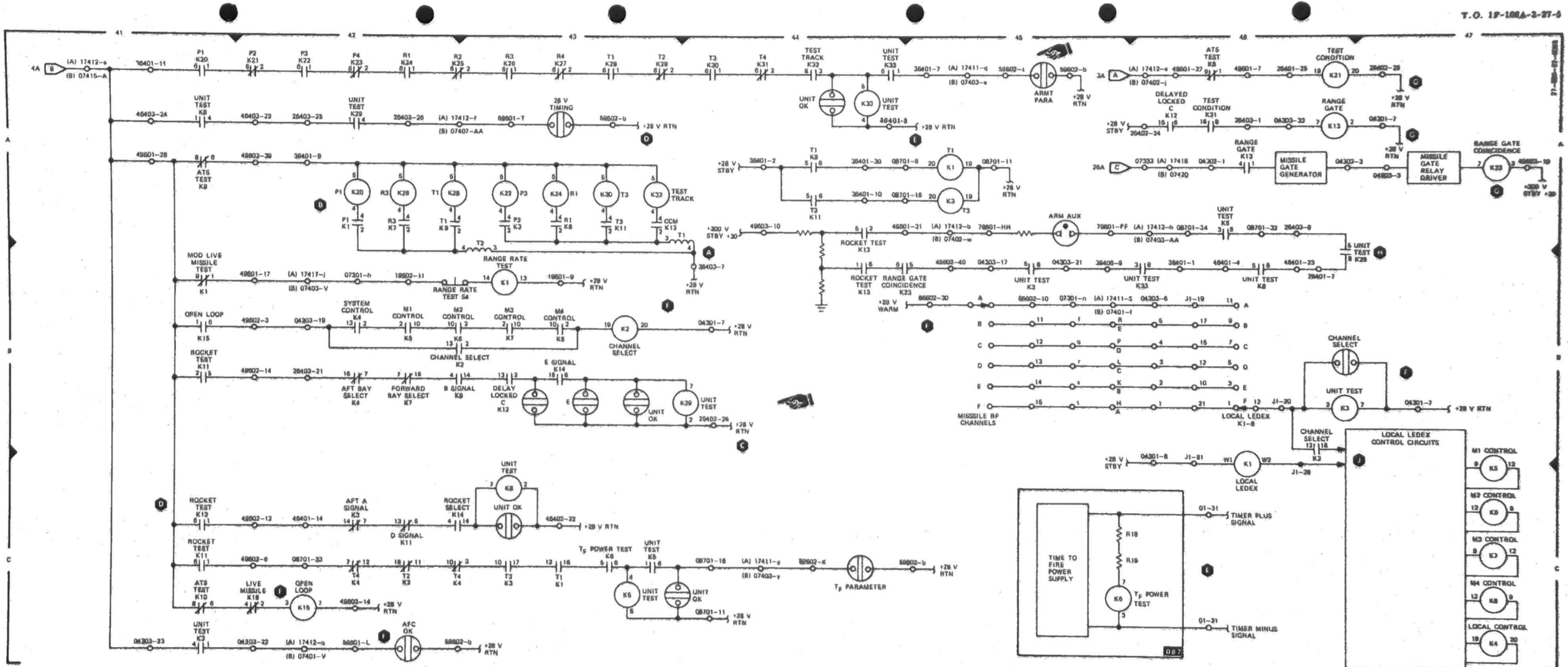


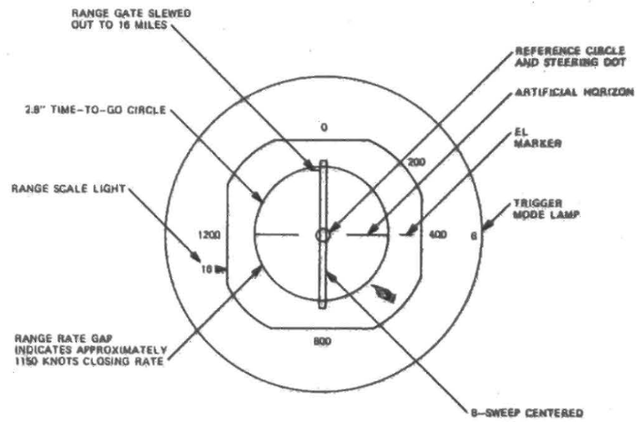
Figure 2-2. SSGC (Sheet 63 of 65: SSGC 6, sheet 6 of 7)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
003	K5	6 AND 8	SSGC 6/23A
043	K1	COIL W1 AND W2	SSGC 6/46C
	K2	2 AND 13 12 AND 18 COIL 19 AND 20	SSGC 6/42B SSGC 6/46B SSGC 6/43B
	K3	1 AND 4 5 AND 8 COIL 2 AND 7	SSGC 6/41C SSGC 6/45B SSGC 6/46B
	K4	2 AND 13 COIL 19 AND 20	SSGC 6/42B SSGC 6/47C
	K5	2 AND 10 COIL 9 AND 12	SSGC 6/42B SSGC 6/47C
	K6	2 AND 10 COIL 9 AND 12	SSGC 6/42B SSGC 6/47C
	K7	2 AND 10 COIL 9 AND 12	SSGC 6/43B SSGC 6/47C
	K8	2 AND 10 COIL 9 AND 12	SSGC 6/43B SSGC 6/47C
	K10	1 AND 4 COIL 2 AND 7	SSGC 6/46A SSGC 6/46A
063	K13	1 AND 4 5 AND 8 COIL 2 AND 7	SSGC 6/21B SSGC 6/21B SSGC 6/23A
067	K1	12 AND 18 COIL 19 AND 20	SSGC 6/43C SSGC 6/45A
	K2	11 AND 18	SSGC 6/42C
	K3	10 AND 17 COIL 19 AND 20	SSGC 6/43C SSGC 6/45A
	K4	3 AND 10 7 AND 12	SSGC 6/42C SSGC 6/42C
	K5	1 AND 6 3 AND 8 COIL 4 AND 5	SSGC 6/43C SSGC 6/46A SSGC 6/43C
	K6	5 AND 8 COIL 3 AND 7	SSGC 6/43C SSGC 6/46C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
095	K3	4 AND 10 9 AND 13 COIL 13 AND 14	SSGC 6/21B SSGC 6/21B SSGC 6/23A
	K4	1 AND 2 COIL 3 AND 7	SSGC 6/21C SSGC 6/22B
	K6	1 AND 4 5 AND 8 COIL 2 AND 7	SSGC 6/21C SSGC 6/21B SSGC 6/23B
103	K5	COIL 2 AND 7	SSGC 6/22B
195	K1	2 AND 9 4 AND 10 COIL 13 AND 14	SSGC 6/21B SSGC 6/21B SSGC 6/43B
223	K4	COIL 2 AND 7	SSGC 6/22C
241	K7	1 AND 13	SSGC 6/23A
264	K4	7 AND 16	SSGC 6/42B
	K7	7 AND 16	SSGC 6/42B
	K9	4 AND 14 10 AND 17 COIL 19 AND 20	SSGC 6/42B SSGC 6/36B SSGC 6/35A
	K10	5 AND 8 COIL 2 AND 17	SSGC 6/36B SSGC 6/35B
	K11	10 AND 17 12 AND 18 COIL 19 AND 20	SSGC 6/36B SSGC 6/36B SSGC 6/37B
	K12	2 AND 13 6 AND 15 COIL 19 AND 20	SSGC 6/43B SSGC 6/46A SSGC 6/37B
	K14	2 AND 13 6 AND 15 9 AND 16 COIL 19 AND 20	SSGC 6/36B SSGC 6/43B SSGC 6/35C SSGC 6/36C
	K19	1 AND 13	SSGC 6/36B
	K20	1 AND 13 3 AND 14 6 AND 16 11 AND 18	SSGC 6/35C SSGC 6/35A SSGC 6/35B SSGC 6/36B
	K21	6 AND 16 COIL 19 AND 20	SSGC 6/46A SSGC 6/46A
	K29	1 AND 4 5 AND 8 COIL 2 AND 7	SSGC 6/42A SSGC 6/46B SSGC 6/43B
	K34	1 AND 4 COIL 2 AND 7	SSGC 6/35C SSGC 6/25C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
364	K1	2 AND 4 COIL 3 AND 7	SSGC 6/42A SSGC 6/36B
	K3	2 AND 4 COIL 3 AND 7	SSGC 6/43A SSGC 6/36B
	K5	2 AND 4 COIL 3 AND 7	SSGC 6/43A SSGC 6/36B
	K7	2 AND 4 COIL 3 AND 7	SSGC 6/42A SSGC 6/36B
	K9	2 AND 4 5 AND 6 COIL 3 AND 7	SSGC 6/42A SSGC 6/44A SSGC 6/35C
	K11	2 AND 4 5 AND 6 COIL 3 AND 7	SSGC 6/43A SSGC 6/44A SSGC 6/35C
	K13	2 AND 4 COIL 3 AND 7	SSGC 6/43A SSGC 6/35C
	K20	1 AND 6 COIL 4 AND 5	SSGC 6/41A SSGC 6/42A
	K21	2 AND 6	SSGC 6/42A
	K22	1 AND 6 COIL 4 AND 5	SSGC 6/42A SSGC 6/43A
	K23	2 AND 6	SSGC 6/42A
	K24	1 AND 6 COIL 4 AND 5	SSGC 6/42A SSGC 6/43A
	K25	2 AND 6	SSGC 6/42A
	K26	1 AND 6 COIL 4 AND 5	SSGC 6/43A SSGC 6/42A
	K27	2 AND 6	SSGC 6/43A
	K28	1 AND 6 COIL 4 AND 5	SSGC 6/43A SSGC 6/42A
	K29	2 AND 6	SSGC 6/43A
	K30	1 AND 6 COIL 4 AND 5	SSGC 6/44A SSGC 6/43A
	K31	2 AND 6	SSGC 6/44A
	K32	3 AND 8 COIL 4 AND 5	SSGC 6/44A SSGC 6/43A
	K33	1 AND 6 3 AND 8 COIL 4 AND 5	SSGC 6/44A SSGC 6/46B SSGC 6/44A
464	K1	1 AND 4 COIL 4 AND 5	SSGC 6/36C SSGC 6/37B
	K3	7 AND 14	SSGC 6/42C
	K8	1 AND 4 5 AND 8 COIL 2 AND 7	SSGC 6/41A SSGC 6/46B SSGC 6/43C
	K11	6 AND 13	SSGC 6/42C
	K14	4 AND 14 12 AND 18 COIL 19 AND 20	SSGC 6/42C SSGC 6/36B SSGC 6/22C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
496	K1	1 AND 9	SSGC 6/41B
	K2	6 AND 8	SSGC 6/35C
	K3	2 AND 4 8 AND 8	SSGC 6/35B SSGC 6/39B
	K8	1 AND 9	SSGC 6/46A
	K9	6 AND 8	SSGC 6/41A
	K10	6 AND 8	SSGC 6/41C
	K11	1 AND 6 2 AND 5 COIL 3 AND 7	SSGC 6/41C SSGC 6/41A SSGC 6/39
	K12	1 AND 6 COIL 3 AND 7	SSGC 6/41C SSGC 6/38
	K13	1 AND 6 2 AND 5 COIL 3 AND 7	SSGC 6/44B SSGC 6/44A SSGC 6/38
	K15	1 AND 6	SSGC 6/41B
	K23	5 AND 6 COIL 3 AND 7	SSGC 6/44B SSGC 6/47A
885	K1	2, 4, 13 AND 14 1, 3, 13 AND 14 COIL 19 AND 20	SSGC 6/21A SSGC 6/21A SSGC 6/22A
ACRB	K6	NO NO COIL	SSGC 6/22C SSGC 6/24C SSGC 6/22C



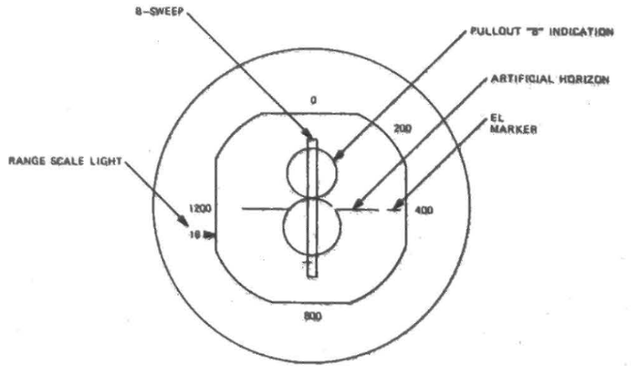


Figure 2-2. SSGC (Sheet 64 of 65: SSGC 6, sheet 7 of 7)

System test No. 7 permits detailed testing of the CN&L subsystem using the MART. This is not a portion of system test, but an extension of test procedures used to isolate trouble in the CN&L subsystem, should a failure occur during system test No. 3.

ARMAMENT TEST CONDITIONS. +28 volts is supplied to the armament subsystem to hold test condition relays K21 (284) and K18 (484) energized. These relays supply safe- to-test voltage to the 796 unit interlocked through the master armed relays. With these relays energized, the FLIGHT lamp on the 796 unit remains out. This is the same as during tests 2 thru 6. All other test voltages are removed from the armament subsystem. Removing the open loop test voltage, removes the +28 volts simulated nose wheel up voltage to the 043 unit. Open loop relay K2 (284) is deenergized, opening the circuit to the channel select relay K2 in the 043 unit. With relay K2 deenergized (and if the ledex has not homed), relay K2 interrupts the path to system control relay K4. Channel select relay K2 (043) and system control relay K4 are deenergized. When system control relay K4 is deenergized the local ledex is stepped back to the home position, thus resetting the 043 unit for flight and re-establishing the illumination path for the FLIGHT lamp (798) when the SELECTOR TEST is returned to test No. 1 or OFF and test condition relays K18 (484) and K21 (284) are deenergized. When the local ledex reaches the home position, relay K4 is energized, and the voltage to pulsing relay K12 is open, so that the stepping action stops.

KEYING SIGN RELAY K1. During test No. 7, the holding voltage to relay K1 is removed. The safe-to-test voltage supplied through keying sign relay K1(798) during system test No.1 thru No.6 is removed.

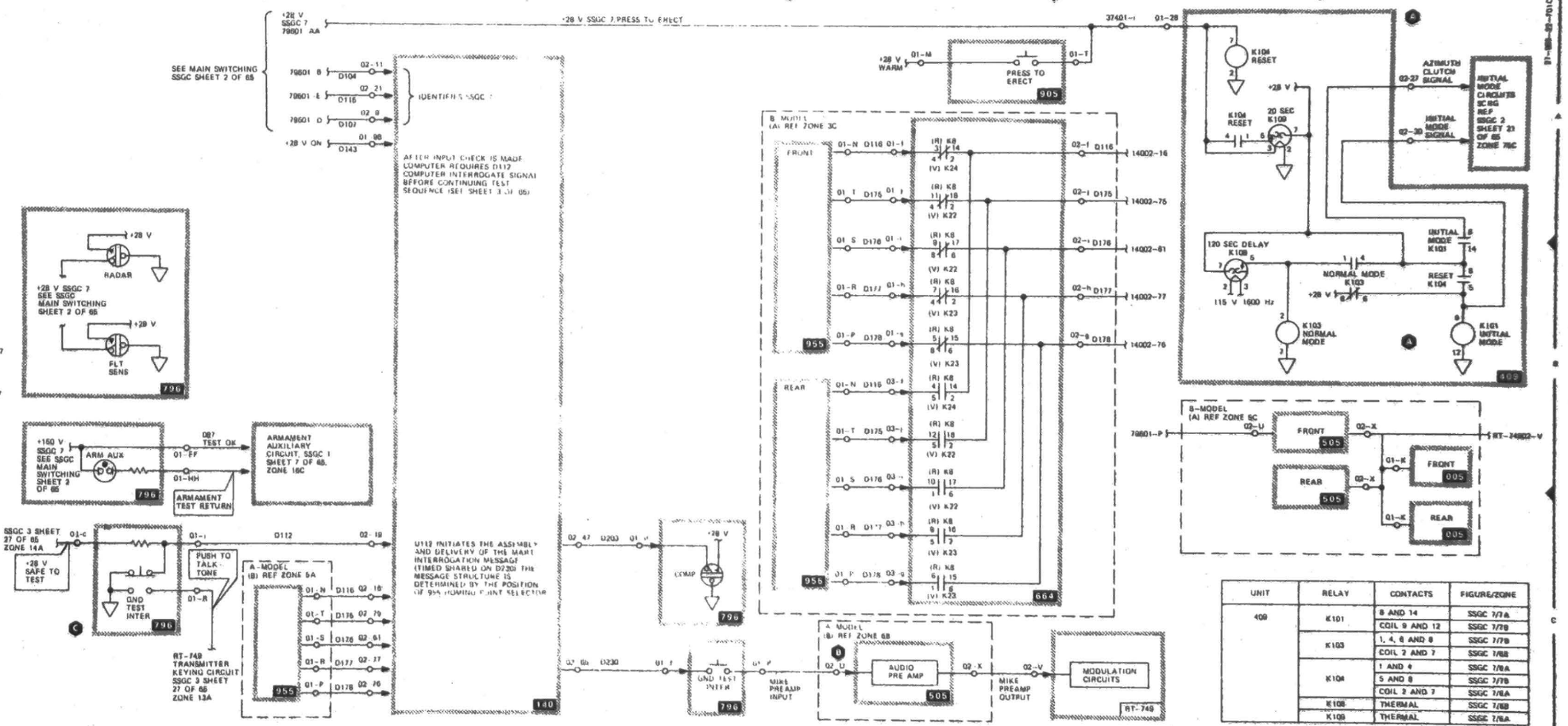
SCRG TEST CONDITIONS. The SCRG is placed in the initial mode during SSGC No. 7 by +28VDC from the 796 to the 409 unit, which energizes K104. K104 contacts supply +28VDC to energize initial mode relay K101. Unlike the Press-to-Erect function which only momentarily energizes K104, the 796 unit keeps K104 energize as long as SSGC No. 7 is selected. Re-erection in SSGC No. 7 is provided to assure return of the SCRG to a normal erected condition at the conclusion of system testing.

DIGITAL COMPUTER OPERATION. For the normal SSGC test No. 7 the computer sets D203 high so that the COMP lamp lights. For the special diagnostic testing of the MART, the computer functions almost exactly as it does in systems test No. 3. Yes-no inputs "A", "B" and "C" (D107 = 1, D116 = 1 and D104 = 1), along with not visual identification, not manual pursuit, and search place the computer in the navigation routine. In system test 7 the computer RT test interrogation routine is slightly modified so that the tracking point selector switch (955) selects the particular CN&L subtest to be performed. The computer generates the MART interrogations in the same manner as during system test No. 3. Only if a failure occurs during system test No. 3, are the extended testing features of system test No. 7 used. The digital computer provides the interrogation sequence for the MART by branching into the RT interrogation routine when the 798 unit GND TEST INTER switch is pressed.

(A) Initial mode is entered during SSGC 7, to eject the 289 unit in case it did not correctly reerect after the LC Routine in SSGC 2.

(B) Provides amplification of the MART interrogation message and modulates the UHF transmission with that message.

(C) When 798 GND TEST INTER is pressed during SSGC 7, the RT-749 transmits on the selected frequency. The computer senses D112 input and delivers the MART interrogation message.



UNIT	RELAY	CONTACTS	FIGURE/ZONE
409	K101	8 AND 14	SSGC 7/7A
		COIL 9 AND 12	SSGC 7/7B
	K103	1, 4, 6 AND 8	SSGC 7/7B
		COIL 2 AND 7	SSGC 7/6B
	K104	1 AND 4	SSGC 7/6A
		5 AND 8	SSGC 7/7B
		COIL 2 AND 7	SSGC 7/6A
	K108	THERMAL	SSGC 7/6B
	K109	THERMAL	SSGC 7/6A

Figure 2-2. SSGC (Sheet 65 of 65: SSGC 7)

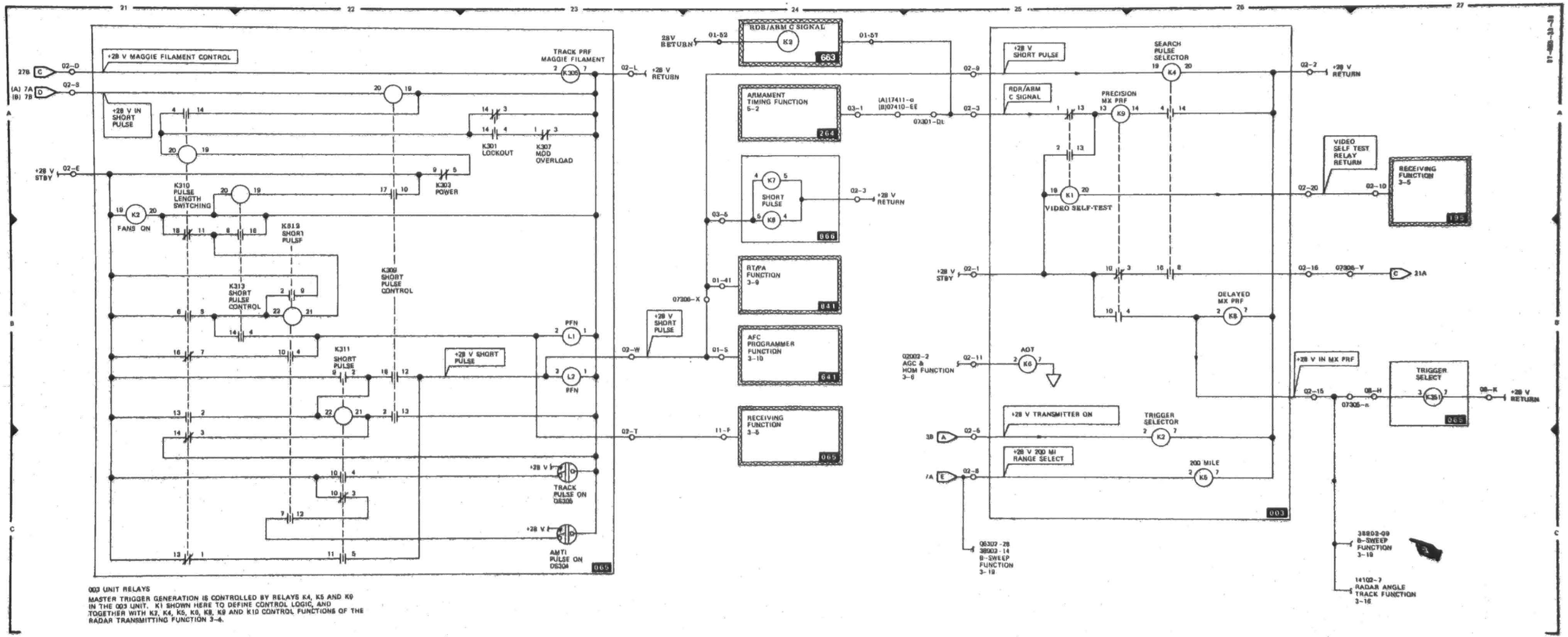


Figure 3-3. Transmitter-Receiver Switching (Sheet 3 of 4)

RELAY LOGIC DIAGRAM – 065 UNIT

RELAY CONTROLLED	INTERNAL/EXTERNAL CONTROL LOGIC: INTERNAL TO 065 K301	K302	K303	K304	K305	K306	K307	K308	K309	K310	K311	K312	K313	EXTERNAL +28 V SOURCE	REMARKS
K301 SL		E								E					
K302 SL							E								
K303							D D D D	D D D D	D D E E		D D E E	D E D E	D E D E	*196 UNIT	*In addition, only energizes when K8 relay in 196 unit is deenergized
K304							D	D							
K305															See Note 1
K306															
K307 SL	D					D D				D					Self-latching if K310 or K301 deenergized
K308															Mod dummy load S1 closed
K309														**305 UNIT	**Via RANGE sw'
K310 SL	D E		D D				D								
K311 SL									E	E					Self-latching if K309 energized
K312 SL										E			E		Self-latching if K310 deenergized and K313 energized
K313									E						
K1 (MOD ON)				E											S201 must be closed. See Note 1
K2 (FANS ON)															From power distribution
L1 (PFN)										E D		E E	E E		Deenergized for LP prf; energized for SP prf.
L2 (PFN)									E E	E	E				
	Lockout	Power Reduction	Power	Magslip Filament Control Track PRF	Magslip Filament	Arcing Overload	Modulator Overload	Thermal Timing	Short Pulse Control	Pulse Length Switching	Short Pulse	Short Pulse	Short Pulse Control		

Legend:
D = Relay must be deenergized
E = Relay must be energized
SL = Self-latching

Notes: 1. In addition to logic listed, K1 and K305 must have PRECISION MX PRF relay K9 deenergized and search pulse selector relay K4 (003) energized.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
003	K1	COIL 19 AND 20 1, 2 AND 13	3-3/25A 3-3/25A
	K2	COIL 2 AND 7	3-3/26C
	K4	COIL 19 AND 20 4 AND 14 8 AND 16	3-3/26A 3-3/26A 3-3/26B
	K5	COIL 2 AND 7	3-3/26C
	K6	COIL 2 AND 7 1 AND 3	3-3/25B 3-4/4C
	K8	COIL 2 AND 7	3-3/26B
	K9	COIL 13 AND 14 3, 4 AND 10	3-3/25A 3-3/25B
017	K3	COIL 3 AND 7 1 AND 2 5 AND 6	3-3/4C 3-6/4B 3-6/4B
065	K1	COIL 13 AND 14 1 AND 9 2 AND 10 3 AND 11 4 AND 12	3-3/15B 3-3/15C 3-3/15C 3-3/15C 3-3/15C
	K2	COIL 19 AND 20 2 AND 13 4 AND 14	3-3/21A 3-3/2A 3-3/2A
	K301	COIL 19 AND 20 2 AND 13 3, 4 AND 14 7, 8 AND 16 11 AND 18	3-3/15B 3-3/15B 3-3/23A 3-3/15B 3-3/15B
	K302	COIL 13 AND 14 1 AND 9 2, 6 AND 10 3 AND 11 8 AND 12	3-3/14A 3-3/15A 3-3/14B 3-3/15B 3-3/14B
	K303	COIL 13 AND 14 2, 6 AND 10 4, 8 AND 12 5 AND 9	3-3/14A 3-3/14C 3-3/14C 3-3/22A
	K304	COIL 19 AND 20 2 AND 13 4 AND 14 5, 6 AND 15	3-3/14A 3-3/14B 3-3/14C 3-3/14C
	K305	COIL 2 AND 7 1 AND 3 5, 6 AND 8	3-3/23A 3-3/14C 3-3/14C
	K306	COIL 3 AND 7 6 AND 8	3-4/13B 3-3/16B
	K307	A COIL 7 AND 8 B COIL 9 AND 10 1 AND 3 2 AND 3 4 AND 5 5 AND 6	3-3/15B 3-3/15A 3-3/23A 3-3/15A 3-3/15A 3-3/15B
	K308	COIL 2 AND 3 1, 4, 6, 7 AND 5	3-3/15A 3-3/15A
	K309	COIL 19 AND 20 2 AND 13 5, 6 AND 15 10 AND 17 12 AND 18	3-3/22A 3-3/22B 3-3/13A 3-3/22A 3-3/22B
	K310	COIL 19 AND 20 1 AND 13 2 AND 13 3 AND 14 4 AND 14 7, 8 AND 16 9, 10 AND 17 11 AND 18	3-3/21A 3-3/21C 3-3/21B 3-3/21C 3-3/21A 3-3/21B 3-3/13B 3-3/21B
	K311	COIL 21 AND 22 2 AND 9 3, 4 AND 10 5 AND 11 7, 8 AND 12	3-3/22B 3-3/22B 3-3/22C 3-3/22C 3-3/13A
	K312	COIL 21 AND 22 2 AND 9 4 AND 10 5, 6 AND 11 7 AND 12	3-3/22B 3-3/22B 3-3/22B 3-3/13A 3-3/22C
	K313	COIL 19 AND 20 1, 2 AND 13 4 AND 14 8 AND 16	3-3/22A 3-3/12A 3-3/22B 3-3/22B
065	K351	COIL 3 AND 7	3-3/27B
	K4	COIL 12 AND 14 2 AND 9 3 AND 10 8 AND 12	3-3/3C 3-3/3C 3-3/3C 3-3/3C
	K8	COIL 13 AND 14 16 AND 1	3-21/12A 3-3/2B
	K10	COIL 3 AND 7 2 AND 5	3-20/5C 3-3/3B
	K15	COIL 3 AND 7 6 AND 1	3-21/15C 3-3/3B
305	K1	COIL X1 AND X2 B2 AND B3	3-21/6A 3-3/5A
	K2	COIL X1 AND X2 B1 AND B2	3-17/16B 3-3/6A
	K4	COIL 1 AND 7 4, 5 AND 6	3-6/3B 3-3/6A
663	K2	COIL 3 AND 7	3-3/27C
866	K7	COIL 4 AND 5	3-3/24A
	K8	COIL 4 AND 5	3-3/24B

Figure 3-3. Transmitter-Receiver Switching (Sheet 4 of 4)

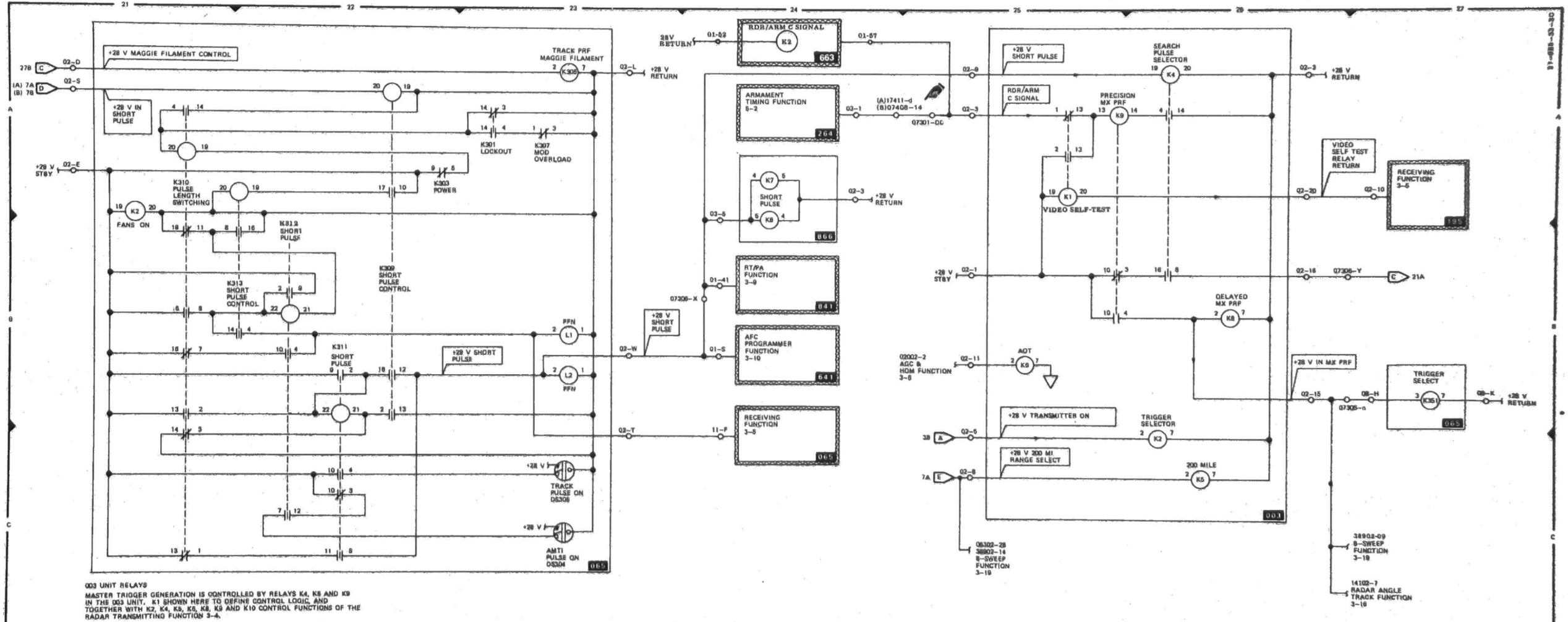


Figure 3-3. Transmitter-Receiver Switching (Sheet 3 of 4)

RELAY LOGIC DIAGRAM – 065 UNIT

RELAY CONTROLLED	INTERNAL/EXTERNAL CONTROL LOGIC: INTERNAL TO 065 K301	K302	K303	K304	K305	K306	K307	K308	K309	K310	K311	K312	K313	EXTERNAL +28 V SOURCE	REMARKS
K301 SL		E								E					
K302 SL							E								
K303							D D D D	D D D D	D D E E		D D E E	D E D E	D E D E	*196 UNIT	*In addition, only energizes when K8 relay in 196 unit is deenergized
K304							D	D							
K305															See Note 1
K306															
K307 SL	D					D D				D					Self-latching if K310 or K301 deenergized
K308															Mod dummy load S1 closed
K309														**305 UNIT	**Via RANGE sw
K310 SL	D E		D D				D								
K311 SL									E	E					Self-latching if K309 energized
K312 SL										E			E		Self-latching if K310 deenergized and K313 energized
K313									E						
K1 (MOD ON)				E											S201 must be closed. See Note 1
K2 (FANS ON)															From power distribution
L1 (PFN)										E D		E E	E E		Deenergized for LP prf; energized for SP prf.
L2 (PFN)									E E	E	E				
	Lockout	Power Reduction	Power	Maggie Filament Control Track PRF	Maggie Filament	Arcing Overload	Modulator Overload	Thermal Timing	Short Pulse Control	Pulse Length Switching	Short Pulse	Short Pulse	Short Pulse Control		

Legend:
D = Relay must be deenergized
E = Relay must be energized
SL = Self-latching

Notes: 1. In addition to logic listed, K1 and K305 must have PRECISION MX PRF relay K9 deenergized and search pulse selector relay K4 (003) energized.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
003	K1	COIL 19 AND 20 1, 2 AND 13	3-3/25A 3-3/25A
	K2	COIL 2 AND 7	3-3/26C
	K4	COIL 19 AND 20 4 AND 14 8 AND 16	3-3/26A 3-3/26A 3-3/26B
	K5	COIL 2 AND 7	3-3/26C
	K6	COIL 2 AND 7 1 AND 3	3-3/25B 3-4/4C
	K8	COIL 2 AND 7	3-3/26B
	K9	COIL 13 AND 14 3, 4 AND 10	3-3/25A 3-3/25B
017	K3	COIL 3 AND 7 1 AND 2 5 AND 6	3-3/4C 3-6/4B 3-6/4B
065	K1	COIL 13 AND 14 1 AND 9 2 AND 10 3 AND 11 4 AND 12	3-3/15B 3-3/15C 3-3/15C 3-3/15C 3-3/15C
	K2	COIL 19 AND 20 2 AND 13 4 AND 14	3-3/21A 3-3/2A 3-3/2A
	K301	COIL 19 AND 20 2 AND 13 3, 4 AND 14 7, 8 AND 16 11 AND 18	3-3/15B 3-3/15B 3-3/23A 3-3/15B 3-3/15B
	K302	COIL 13 AND 14 1 AND 9 2, 6 AND 10 3 AND 11 8 AND 12	3-3/14A 3-3/15A 3-3/14B 3-3/15B 3-3/14B
	K303	COIL 13 AND 14 2, 6 AND 10 4, 8 AND 12 5 AND 9	3-3/14A 3-3/14C 3-3/14C 3-3/22A
	K304	COIL 19 AND 20 2 AND 13 4 AND 14 5, 6 AND 15	3-3/14A 3-3/14B 3-3/14C 3-3/14C
	K305	COIL 2 AND 7 1 AND 3 5, 6 AND 8	3-3/23A 3-3/14C 3-3/14C
	K306	COIL 3 AND 7 6 AND 8	3-4/13B 3-3/16B
	K307	A COIL 7 AND 8 B COIL 9 AND 10 1 AND 3 2 AND 3 4 AND 5 5 AND 6	3-3/15B 3-3/15A 3-3/23A 3-3/15A 3-3/15A 3-3/15B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
	K308	COIL 2 AND 3 1, 4, 6, 7 AND 5	3-3/15A 3-3/15A
	K309	COIL 19 AND 20 2 AND 13 5, 6 AND 15 10 AND 17 12 AND 18	3-3/22A 3-3/22B 3-3/13A 3-3/22A 3-3/22B
	K310	COIL 19 AND 20 1 AND 13 2 AND 13 3 AND 14 4 AND 14 7, 8 AND 16 9, 10 AND 17 11 AND 18	3-3/21A 3-3/21C 3-3/21B 3-3/21C 3-3/21A 3-3/21B 3-3/13B 3-3/21B
	K311	COIL 21 AND 22 2 AND 9 3, 4 AND 10 5 AND 11 7, 8 AND 12	3-3/22B 3-3/22B 3-3/22C 3-3/22C 3-3/13A
	K312	COIL 21 AND 22 2 AND 9 4 AND 10 5, 6 AND 11 7 AND 12	3-3/22B 3-3/22B 3-3/22B 3-3/13A 3-3/22C
	K313	COIL 19 AND 20 1, 2 AND 13 4 AND 14 8 AND 16	3-3/22A 3-3/13A 3-3/22B 3-3/22B
065	K351	COIL 3 AND 7	3-3/27B
	K4	COIL 12 AND 14 2 AND 9 3 AND 10 8 AND 12	3-3/3C 3-3/3C 3-3/3C 3-3/3C
	K8	COIL 13 AND 14 16 AND 1	3-21/12A 3-3/3B
	K10	COIL 3 AND 7 2 AND 5	3-20/6C 3-3/3B
	K15	COIL 3 AND 7 6 AND 1	3-21/15C 3-3/3B
305	K1	COIL X1 AND X2 B2 AND B3	3-21/6A 3-3/5A
	K2	COIL X1 AND X2 B1 AND B2	3-17/16B 3-3/6A
	K4	COIL 1 AND 7 4, 5 AND 6	3-6/3B 3-3/6A
663	K2	COIL 3 AND 7	3-3/27C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
866	K7	COIL 4 AND 5	3-3/24A
	K8	COIL 4 AND 5	3-3/24B

Figure 3-3. Transmitter-Receiver Switching (Sheet 4 of 4)

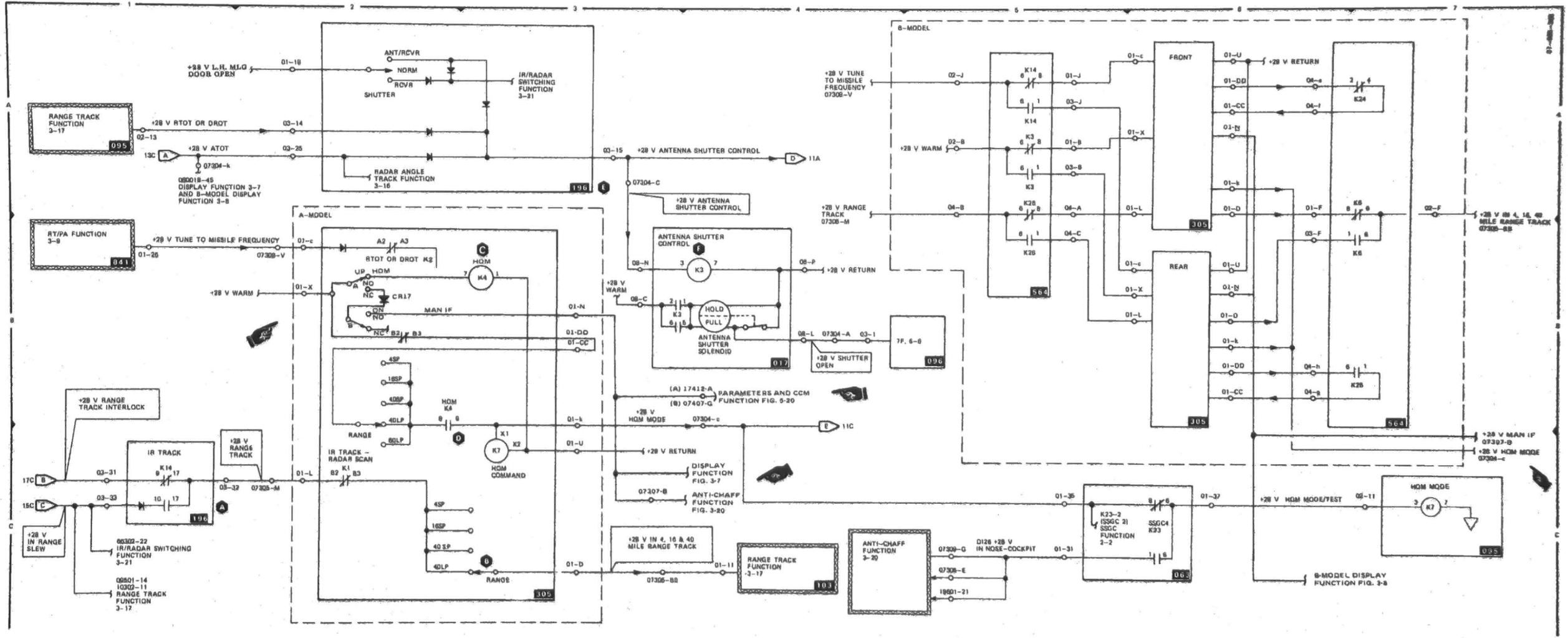


Figure 3-6. AGC and HOM (Sheet 2 of 4)

The agc and angle track waveform converter (020) detects modulation of target returns and furnishes an angle error signal to tracking circuits. Since the amplitude of the return signal is effected by range, an automatic gain control (agc) voltage is developed to control receiver gain. The agc voltage prevents saturation of the i-f stages so that there would be no loss of the target amplitude modulation signal.

A. Delays the agc video 0.44 or 1.0 microseconds. The 0.1 microsecond delay permits development of the agc voltage from approximately the first half of the relatively chaff-free region of the agc video.

B. SELF TEST switch allows inserting an a-c signal derived from the lobing frequency. This permits adjustment of the video gain by comparing the input signal at AGC VIDEO test point and the output signal at ERROR SIGNAL test point.

C. The agc video and agc gate signals are applied to a video gating circuit. This circuit will gate through either the leading or trailing edge of the video depending on which of the two input signals is delayed. The gated signal is then applied through a pulse shaper, amplifier, cathode follower and a disconnect diode to charge the boxcar capacitor. The boxcar capacitor will maintain this charge until the next agc gate is generated at which time a discharge tube will conduct, discharging the capacitor. The boxcar capacitor will then charge to the new level determined by the amplitude of the gated agc video. The charge is applied to the radar angle track function (3-16) through a cathode follower and the track gain potentiometer (017). The error signal can be measured at the ERROR SIGNAL test point.

D. A d-c driver and amplifier network which energizes ATOT relay K2 to enable angle track operation after homing switch is engaged and system is in track mode.

E. A chopper and amplifier network which processes the average d-c level of the error signal to generate the agc voltage during radar tracking. The agc voltage is used to control the radar receiver i-f gain. The delayed boxcar signal is tapped by the agc delay potentiometer wiper to control edge angle track operation. When MAN IF is selected, contacts 8 and 6 of K9 open, removing delayed boxcar voltage from 095 unit and disabling agc channel. Contacts 5 and 2 of K9 close and enable 080 unit IF GAIN control to adjust IF GAIN.

F. The hom mode energizes three monostable multivibrators synchronized to the angle track gate from the indicator sweep generator (389) whose width is determined by range selection. The first two pulses generated and depicted at the IF BLANKING GATE test point are used to bias off the i-f strip. The first short pulse occurs 12 microsecond after the start of angle track and is used as a synthetic target. The second short pulse, 225 microsecond in duration, is used to gate off the i-f strip. A 100 microsecond pulse, synchronized with the trailing edge of the 225 microsecond pulse, is used to gate the jamming source into the agc and track circuits.

G. Generates the missile gate when triggered by the range gate. The missile gate is used to synchronize the missile and radar circuits and also to discharge the boxcar capacitor.

H. Delays the range gate 0.1 microsecond to permit development of the agc voltage from approximately the last half of the relatively chaff-free region of the agc video.

J. Energized when the interceptor is in a tail attack and ALL or GATE on the CHAFF switch (305) is selected. Routes the range gate through the delay network.

K. Energized during homing mode to track a jamming signal.

L. ATOT lamp lights at a predetermined level when ATOT is present.

M. Energized when the system is in normal or homing mode operation. Permits generation of the agc signal by opening the bias line. Disables the override of the agc delay during initial homing mode operation. When system is in search, IR track, or range slew operation, relay permits manual i-f gain control of the receiver.

N. Energized during homing mode if the system is in hand control and track. Permits the gate generator to develop the coincidence gate.

P. Energized when the interceptor is in a nose attack and ALL or GATE on the CHAFF switch (305) is selected.

R. Energizes ATOT circuits throughout system and locks-up hom mode until ATOT is lost or ROT is obtained.

S. Track gain pot located on the antenna used during depot alignment to maintain interchangeability of antennas by correcting for variances in antenna gain.

T. Energized when the action switch (083) is released from second detent to first detent. Applies ATOT signal to MA-1 computer and to armament sub-system test.

U. Energized when second detent is selected by action switch. Applies +28 v through contacts of ATOT relay K6 (if ATOT is not present) to initiate track and to stop programmer commands to RT/PA function.

V. Energized when ATOT is present and track relay K4 energized. Applies +28 v through contacts 8 and 16 of ATOT relay K6 to initiate range track when action switch is pressed to first detent.

W. Energized when MAN IF on RDR switch [305] is selected.

Figure 3-6. AGC and Hom (Sheet 3 of 4)

TEST POINT DATA

a. 20 V p-p (APPROXIMATE)
FREQUENCY SAME AS LOBING FREQUENCY WITH G/G SELF TEST PRESSED IN TO JCK

b. 70 V MIN
0.27 μsec

c. 1.0 μsec JITTERED SYNTHETIC TARGET PULSE
DURATION DEPENDS ON RANGE SCALE SETTING
14 V
APPROX 17 V
16 V
12 μsec (FROM SYNC TRIGGER)
225 μsec

d. PULSE ENVELOPE WITH 020 SELF TEST PRESSED IN TRACK

e. A NEGATIVE DC VOLTAGE, VARIES WITH THE STRENGTH OF THE ERROR SIGNAL DURING TRACK, OR WITH THE I-F GAIN CONTROL (080 UNIT) SETTING WHEN IN SEARCH, IR TRACK, OR RANGE SLEW OPERATION

f. 25%

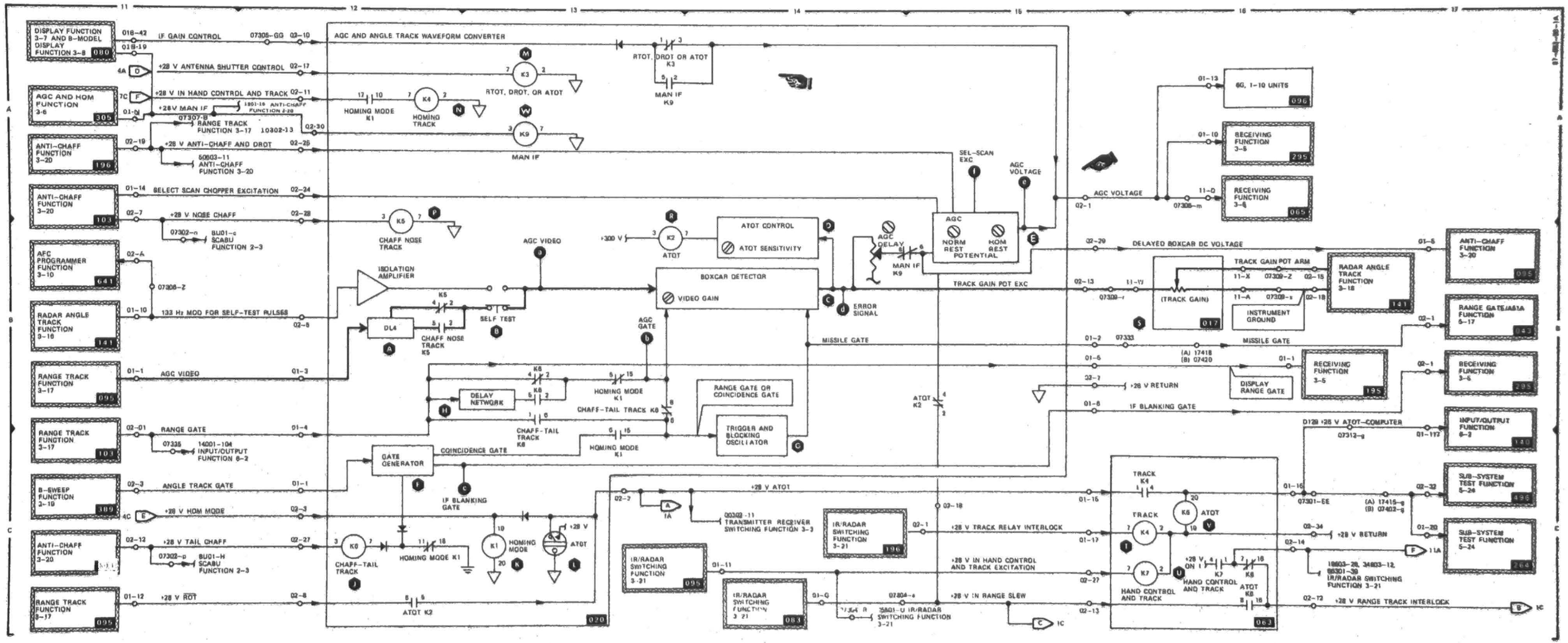


Figure 3-6. AGC and HOM (Sheet 4 of 4)

The flight command indicator (080) converts the electrical display signals to a visual display of navigational and tactical information for the pilot. The conversion is accomplished by means of a 5-inch four gun multi-mode storage tube (MMST). The information is displayed in stored and non-stored form on the face of the MMST. Function 3-7 covers only the erase (low energy) and search (high energy) guns and deflection plates in both radar and IR modes of operation. It also covers the photographic recorder (149) and the relay logic required for its operation. For the attack (intermediate energy) and flood guns refer to attack displays function 3-16.

The MMST provides two modes of erasure of stored information on the viewing screen, selective erase and raster erase. Selective erase is a vertical erase sweep of high intensity preceding the search B-sweep in azimuth across the MMST viewing screen. Used in this manner, selective erase occurs just before a new target is painted by the B-sweep. The resultant stored video presentation shows target azimuth and range. The ERASE INTENSITY control on the front of the 080 unit controls the intensity level of the erase sweep. In raster erase, the entire viewing screen is continuously being erased by the erase gun. This causes the target to fade after a short period of time. The length of time the target is displayed is determined by the setting of the ERASE INTENSITY. The type of erase selected depends upon the mode of operation. Selective erase is provided in radar automatic search and IR dominant/radar scan, all other modes use raster erase.

A Provides a sawtooth output to drive the differential amplifiers for vertical deflection in both selective erase and raster erase modes. Potentiometer R21 adjusts the amplitude of the sawtooth signal prior to application to differential amplifiers. This effects the length of the erase sweep on the viewing screen.

B The 50 Hz raster generator operates similar to that of the 20 KHz raster generator (A), but only operates in the raster erase mode.

C In selective erase, the erase sweep utilizes the B-sweep azimuth position signals from the 195 unit. The positive and negative azimuth sweep signals are fed to the azimuth tracking amplifier circuit, where the erase sweep is offset 3 16" in azimuth so that it precedes the B-sweep across the viewing screen.

D The search and erase sweep failure protection circuit senses the loss of the 20 KHz vertical raster or the selective erase signals, applied to the erase gun vertical deflection plates.

Loss of deflection voltages enables switching circuits to bias the search and erase guns to an off condition by controlling the operation of the two summing networks utilized in the search and erase functions. This is to prevent the high energy electron beam from damaging the storage surface and viewing screen of the MMST.

E The azimuth and elevation deflection signals for the search deflection plates are applied directly from the 195 and 389 units respectively, however a 3 MHz jizzle oscillator is provided on the negative azimuth sweep for target enhancement, during conditions of ECM activity. The oscillator functions only when AOT relay A2K1 is energized and a radar video display is present. Filters are provided to prevent reflection of the 3 MHz signal back into the low voltage power supply, and the 195 unit.

F Two time delay circuits are used in the flight command indicator to protect the multi-mode storage tube. The 30 second time delay circuit provides a +45 V disable signal to the search, erase and attack low voltage power supplies for 30 seconds. This allows the filaments in the four guns to warm up before the high voltage is turned on. The 3 minute time delay circuit provides +45 V after an elapsed period of 3 minutes, to the 50 kHz failure detection circuit for processing into a disable signal. The disable signal then shuts off the attack gun, reducing the possibility of image retention during ground operation.

G Automatically removes the +30 v from the 2.5 KHz multivibrators after sensing a loss of input signal to one of the multivibrators utilized in the intensity bias control circuits. The failure detection circuit supplies +35 v disable signals to low voltage power supply (1) and (2). Disabling these power supplies shuts down the high voltage for the search, erase, and attack guns.

H When the range sweep ends, a video blanking gate is generated in the 389 unit. This is applied to the video pedestal trigger circuit. The video pedestal is lowered in amplitude to prevent any retrace or noise when the high energy electron beam returns to the bottom of the viewing screen. The blanking gate is removed just prior to the start of the next sweep.

J Coupling transformer combines the indicator video signal with the video pedestal. Video control R27 controls the amplitude and d-c level of the combined, and enhanced, search video and pedestal signal. The search video and pedestal signal is applied to the control grid (rg1) of the search gun, and to the differential amplifier of the search summing network through search pedestal squaring potentiometer R20.

K The analog bias compensation circuit automatically provides for changing intensity levels of the search display for different range selections and scan rates. Adjustments R1 thru R4, on the ODU, 080 unit, or filter and control assembly, provides the proper bias for the compensation circuit in the radar mode selected.

TEST POINT DATA

- +28 v pulse, 30 ms long which occurs at end of each radar antenna or IR seeker head azimuth scan
- +28 v

Figure 3-7. Display (Sheet 1 of 6)

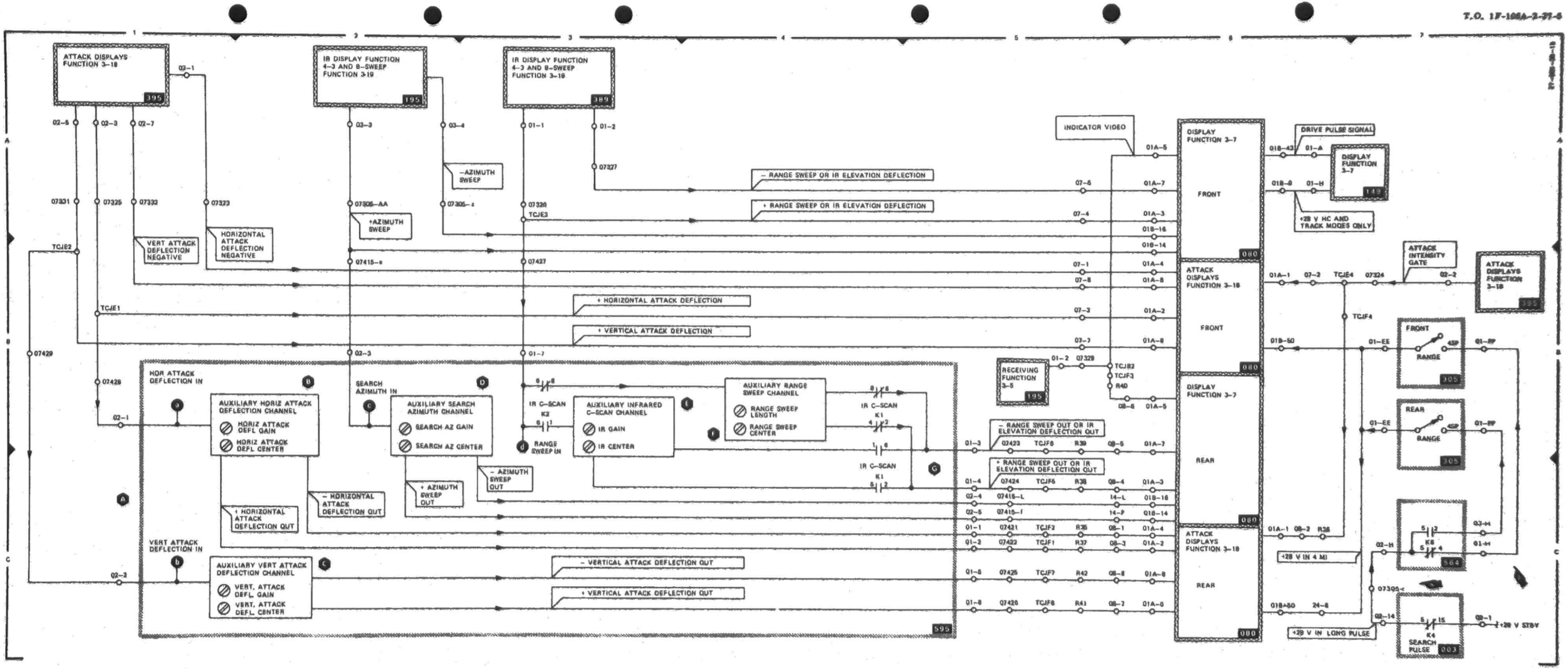


Figure 3-8. B-Model Display (Sheet 2 of 3)

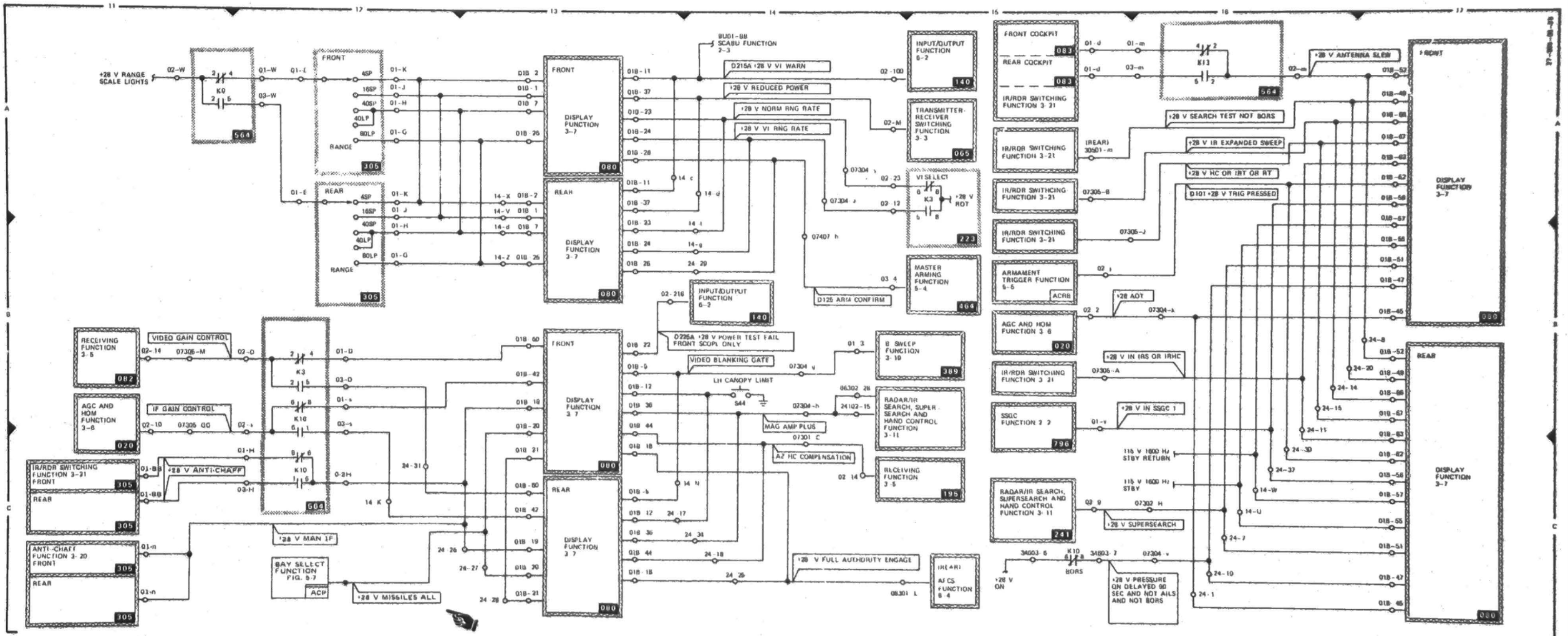


Figure 3-8. B-Model Display (Sheet 3 of 3)

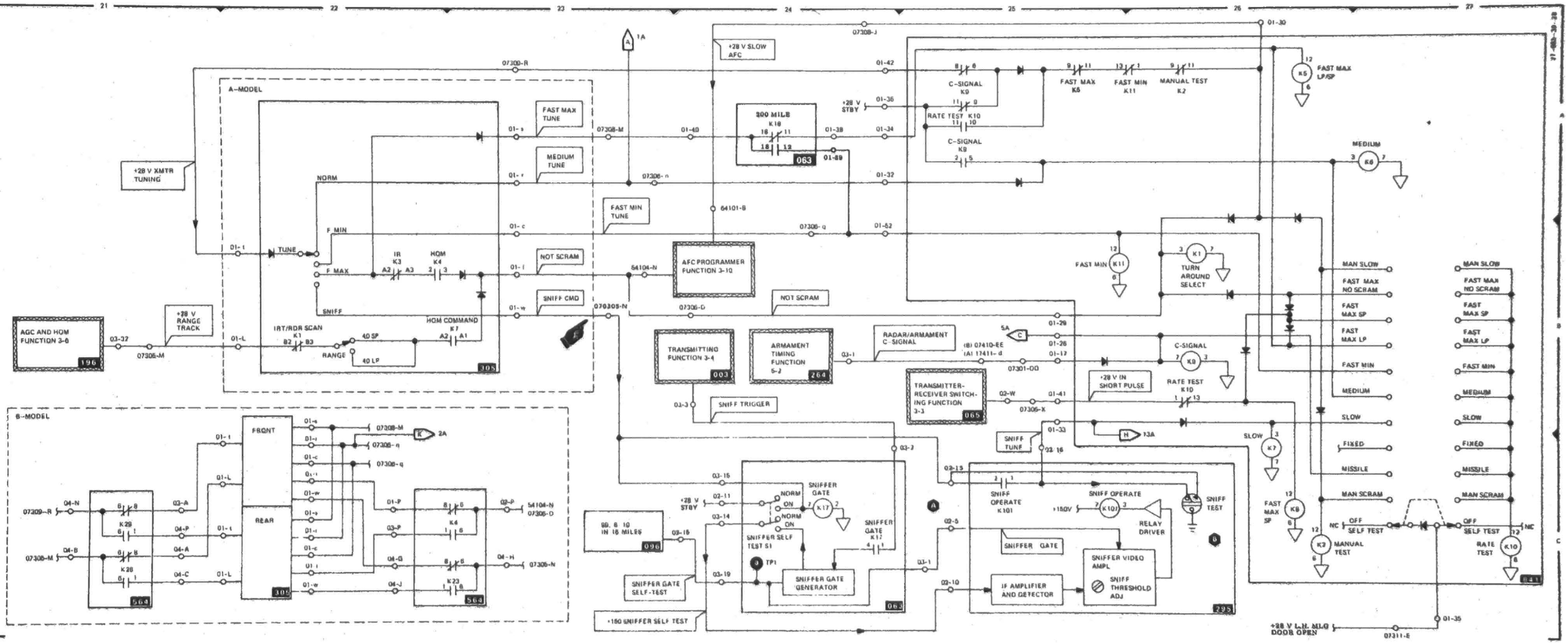


Figure 3-9. RT/PA (Sheet 6 of 6)

The afc programmer function detects jamming and provides tuning commands to the hydraulic amplifier (641) to tune the receiver-transmitter (065).

The afc high voltage power supply and group amplifier (641) provides local oscillator frequency to the receiver (065). It also provides receiver self test pulses to simulate targets for self test purpose. During listening time (receiver listening for return signals) the local oscillator frequency must be kept 30 MHz below the previous transmitted frequency. If the system is in jam avoid mode, the local oscillator output is swept over the entire frequency band. This sweep allows the system to sample the jamming signal to determine the best transmitter frequency. During the transmitted pulse, the 641 unit tunes the local oscillator to 30 MHz below the transmitted frequency. If tuning can be accomplished (lock-on achieved), then the tuning action can be described in three time periods: before transmission output, during transmission output, and after transmission output. If lockon cannot be achieved, the local oscillator sweeps slowly over the frequency band. This sweep tries to bring the local oscillator frequency close enough to the desired frequency so that lock-on can be achieved.

A. Detects jamming in the received video. Indicates if any frequency regions (bins) are clear of jamming. If no bins are clear of jamming, the jamming threshold is increased so that the bins with the minimum level of jamming will be indicated. R1 THRESHOLD 1 and R5 THRESHOLD 2 are used to set the two levels of the jamming thresholds. Do not adjust at aircraft.

B. The scram trigger which precedes each transmitter pulse triggers the clock. This clock provides the basic timing for all the computer programmer flip-flops.

C. Transmitter frequency reference signal is utilized to coarse tune the local oscillator during the time remaining between the end of the scram ramp and the time when the transmitter fires. Ramp generator generates the scram voltage ramp which is used to tune the local oscillator through its entire frequency band in a period of 322 microseconds when triggered with the scram trigger pulse. R3 STEP determines the lowest starting voltage of the positive going scram ramp while R2 SLOPE determines the slope of the scram ramp.

D. Stores jamming information in relation to the present transmitter frequency.

E. Makes the decision to change or continue tuning direction.

F. Provides regulated current to the voltage tuned magnetron (VTM) filaments, and regulated voltage to the grid and cathode of the VTM.

G. Mixes the radar frequency with the local oscillator signal to produce an intermediate frequency of approximately 30 MHz, the output of which produces the i-f error to fine tune the VTM. When the system is in short pulse, the +28 v short pulse signal allows the VTM to be fine tuned for 0.43 microseconds during transmission.

H. Produces an 11 microsecond gate to allow the exact 30 MHz i-f signal to be fed into the discriminator and fine tuning circuits 15 microseconds before the transmitter fires.

J. Afc error signals from the 541 are time shared to VTM to tune the local oscillator before, during, and after transmission. S1 set to MAN AFC simulates stable frequency to allow system adjustments.

K. Produces a train of modulated pulses used to develop test targets to the receiver during self test mode.

L. Local oscillator tuned to 30 MHz below transmitted frequency. After transmission, local oscillator is held to frequency determined during transmission.

M. Compares the difference frequency from afc mixer with accurate 30 MHz and produces the error signal which fine tunes the local oscillator.

N. Mixes the radar pulses with the local oscillator injection signal to produce the 30 MHz i-f self test signal.

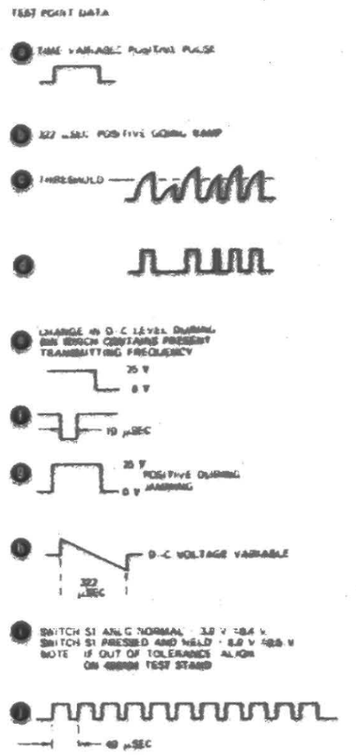


Figure 3-10. AFC Programmer (Sheet 1 of 3)

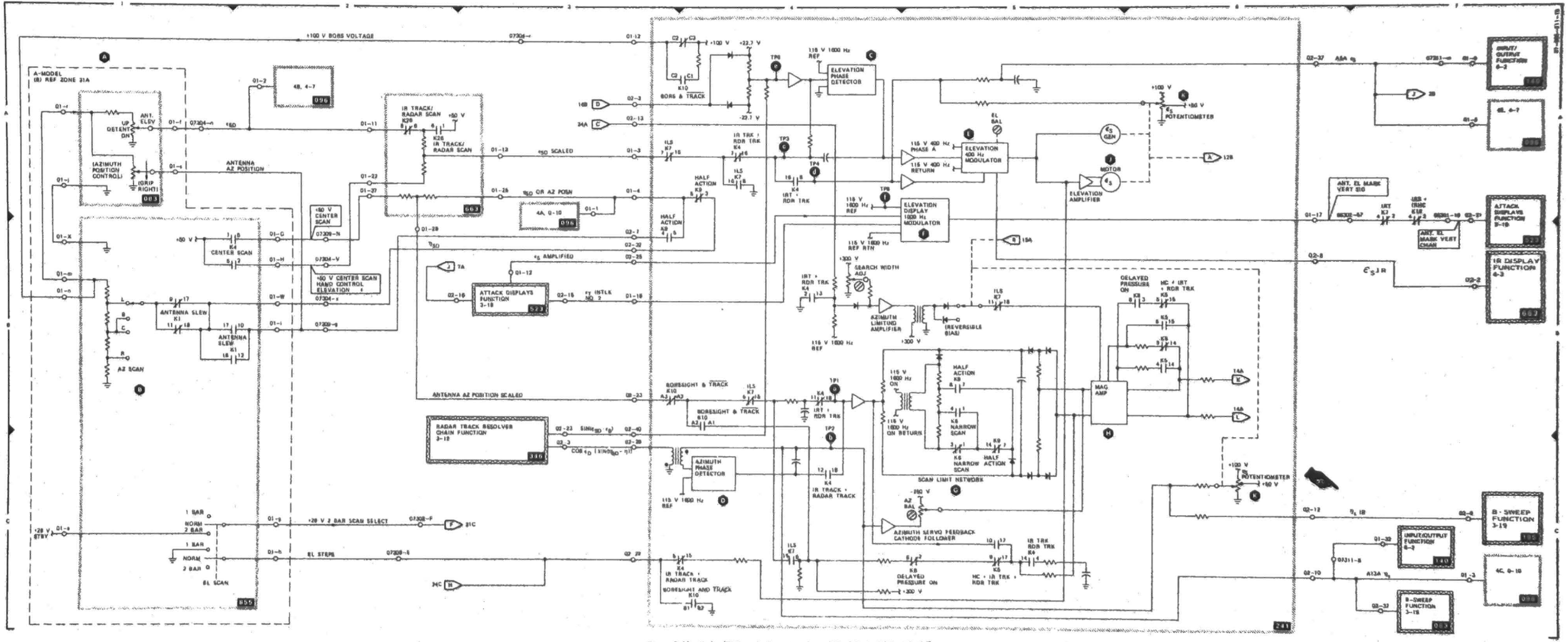


Figure 3-11. Radar/IR Search, Supersearch, and Haul Control (Sheet 2 of 6)

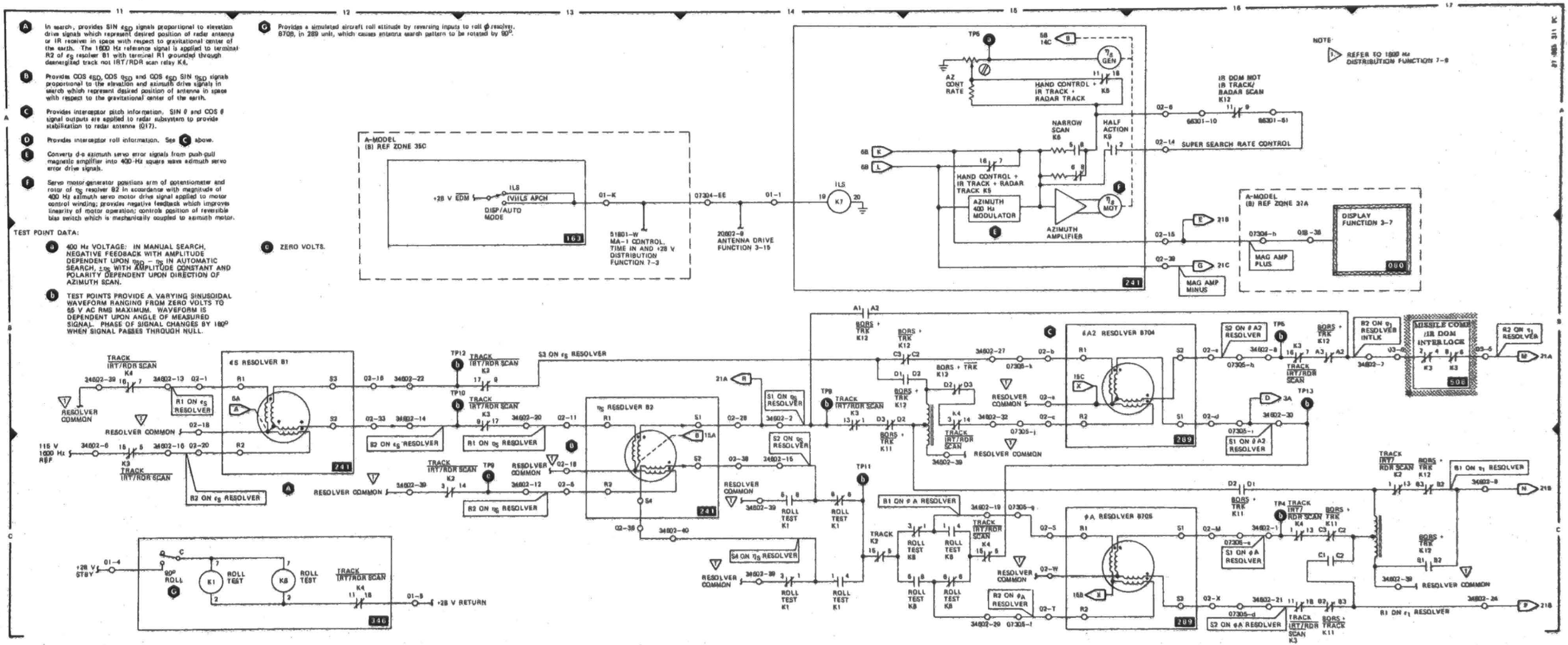


Figure 3-11. Radar/IR Search, Supersearch, and Hand Control (Sheet 3 of 6)

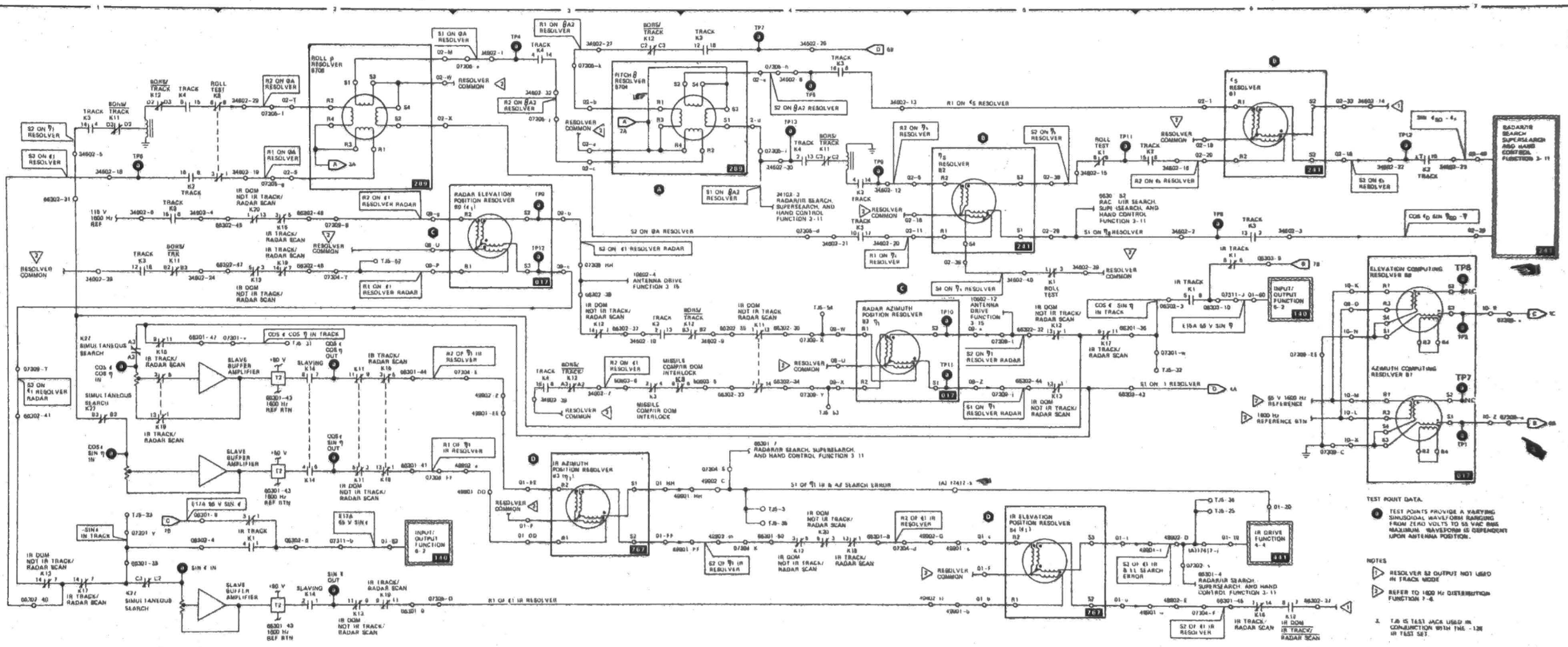


Figure 3-12. Radar Track Resolver Chain (Sheet 2 of 2)

In IR track/radar scan mode of operation, the resolver chain provides radar antenna drive circuits with azimuth position command signals generated by the IR/radar search and hand control function and slaves the radar antenna to the IR receiver in elevation. To prevent excessive loading on the IR elevation resolver, two slave buffer amplifiers are used. The radar antenna searches in azimuth as it is driven by azimuth resolver signals generated in the 241 unit. The radar search can be broad, narrow, supersearch, or hand control but the system cannot be put into radar track without changing modes.

(A) Resolvers B3 and B4 are identical in construction and operation and are geared to the IR receiver. The resolvers provide outputs indicative of instantaneous azimuth and elevation position of the sensor; 1600 Hz input signals are applied to rotor input windings through relays in the 663 unit. Output signals from stator windings are applied to the stabilization loop amplifier input through relays in the 663 unit and vary IR and radar functions, depending upon selected mode of operation.

(B) Resolvers B2 and B6 act as summing network to compare signals representing actual antenna position with space stabilized command signals from roll and pitch resolvers representing desired antenna position in search mode of operation. In automatic track mode of operation, B2 and B6 provide signals representing antenna position in aircraft coordinates and apply them to computer to aid in solving fire control problems. Outputs of B2 and B6 in search mode represent the slight difference between actual and desired antenna position and are used as error signals to drive the antenna and make desired and actual antenna positions coincident. The output error signals are applied to azimuth and elevation error signals in 206 unit.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
063	K1	1 AND 4 5 AND 8 COIL 2 AND 7	3-13 4C 3-13 7C 3-21 17A
346	K2	11 AND 18 7 AND 16 COIL 19 AND 20	3-13 5A 3-13 5B 3-21 3C
663	K13	1 AND 13 7 AND 14 COIL 6 AND 12	3-13 5A 3-13 5B 3-21 13A
	K15	1 AND 2 4 AND 5 COIL 6 AND 12	3-13 1C 3-13 2B 3-21 5A
	K16	7 AND 8 1 AND 2 4 AND 5 10 AND 11 COIL 6 AND 12	3-13 3C 3-13 3C 3-13 4B 3-13 6C 3-21 5A
	K17	7 AND 8 10 AND 11 COIL 6 AND 12	3-13 3C 3-13 6C 3-21 6A
	K19	10 AND 11 4 AND 5 1 AND 2 7 AND 8 COIL 6 AND 12	3-13 1C 3-13 2A 3-13 2A 3-13 2B 3-21 6A
	K20	9 AND 11 7 AND 14 COIL 6 AND 12	3-13 6A 3-13 6A 3-21 14A
	K27	C2 AND C3 COIL X1 AND X2	3-13 2B 3-21 3B

Figure 3-13 IR Track/Radar Scan Resolver Chain (Sheet 1 of 2)

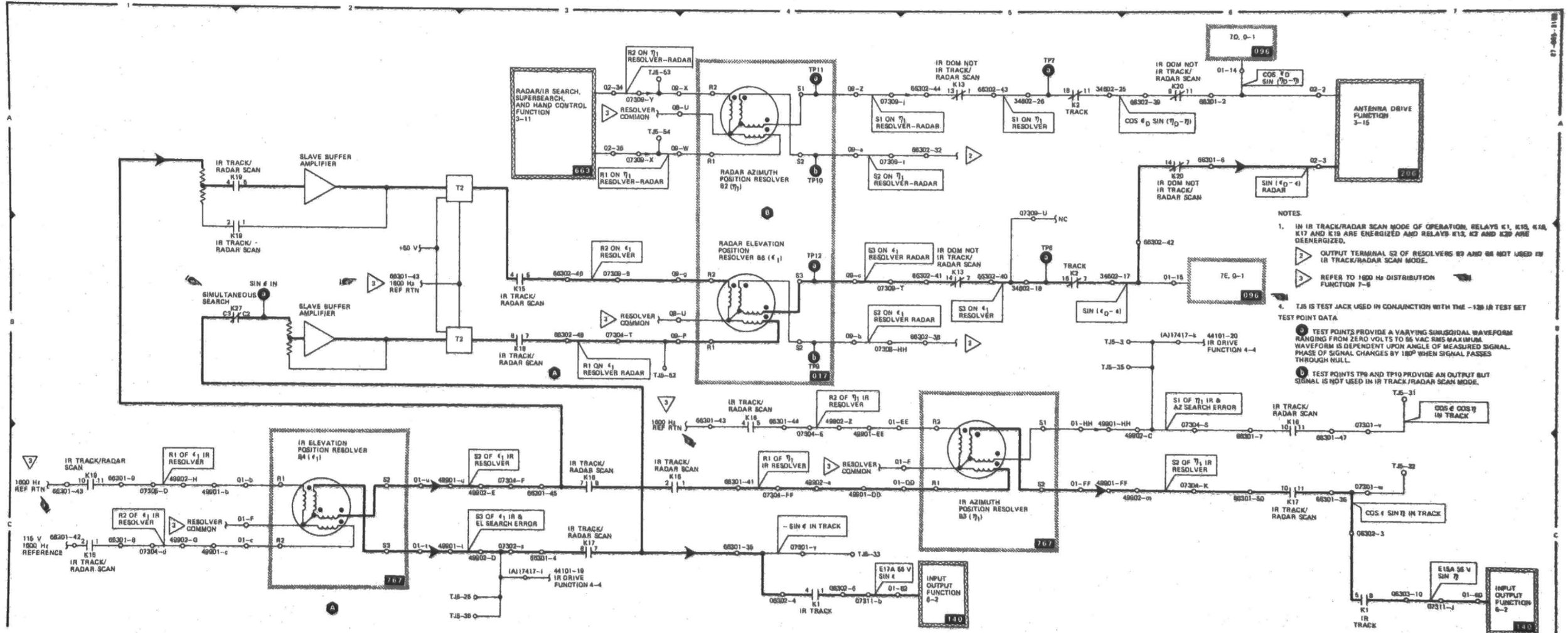


Figure 3-13. IR Track/Radar Scan Resolver Chain (Sheet 2 of 2)

In the IR track/radar slaved mode of operation, the resolver chain supplies IR receiver position information to the 241 unit and slaves the radar antenna to the movements of the IR receiver. The IR azimuth and elevation position resolvers are geared to the IR receiver and provide IR receiver position information signals. Outputs from the azimuth and elevation resolvers are applied to the radar azimuth and elevation position resolvers through three slave buffer amplifiers to prevent excessive loading of the IR resolvers. The IR receiver position signals are also applied to the Radar Track Resolver chain (figure 3-12).

(A) Resolvers B3 and B4 provide inputs to resolver chain during IR track/radar slaved mode of operation. IR receiver position information signals originate in IR elevation and azimuth position resolvers (B3 and B4) which are geared to the IR receiver. Outputs from B3 and B4 are applied through slave buffer amplifiers to radar elevation and azimuth position resolvers B2 and B6. IR receiver position signals are also applied to Radar Track Resolver Chain diagram 3-12 where they are routed to the η_s and ϵ_s resolvers in 241 unit through roll and pitch resolvers in the stable table.

(B) Outputs from B2 and B6 represent the slight difference between actual and desired antenna position and are used as error signals to make desired and actual antenna positions the same. Output error signals are applied to azimuth and elevation error signal circuits in 206 unit.

(C) Signal inputs to Radar Track Resolver Chain (346 unit) are used for display to the cockpit only.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
063	K1	1 AND 4 5 AND 8 COIL 2 AND 7	3-14/6B 3-14/7A 3-21/17A
346	K2	2 AND 13 COIL 19 AND 20	3-14/4A 3-21/3C
	K3	12 AND 18 6 AND 15 COIL 19 AND 20	3-14/1A 3-14/1A 3-21/3C
	K4	8 AND 16 COIL 19 AND 20	3-14/3A 3-21/3C
	K11	B2 AND B3 COIL X1 AND X2	3-14/1A 3-21/24A
	K12	A2 AND A3 COIL X1 AND X2	3-14/3A 3-21/24A
506	K3	6 AND 8 2 AND 4 COIL 3 AND 7	3-14/4A 3-14/4A 3-21/5C
603	K11	7 AND 8 1 AND 2 10 AND 11 4 AND 5 COIL 6 AND 12	3-14/4A 3-14/4A 3-14/2C 3-14/2C 3-21/13A
	K12	4 AND 5 1 AND 2 7 AND 8 COIL 6 AND 12	3-14/4C 3-14/6A 3-14/4A 3-21/13A
	K13	10 AND 11 1 AND 2 7 AND 8 4 AND 5 COIL 6 AND 12	3-14/3B 3-14/6A 3-14/3A 3-14/1A 3-21/13A
	K14	7 AND 8 4 AND 5 1 AND 2 COIL 6 AND 12	3-14/2C 3-14/2C 3-14/3B 3-21/3B
	K15	3 AND 5 1 AND 13 COIL 6 AND 12	3-14/4C 3-14/1A 3-21/5A
	K16	9 AND 11 3 AND 5 1 AND 13 7 AND 14 COIL 6 AND 12	3-14/7A 3-14/4A 3-14/4A 3-14/3A 3-21/5A
	K17	9 AND 11 7 AND 14 COIL 6 AND 12	3-14/6A 3-14/1B 3-21/6A
	K19	7 AND 14 9 AND 11 3 AND 5 1 AND 13 COIL 6 AND 12	3-14/3B 3-14/1A 3-14/1C 3-14/1C 3-21/6A
	K20	7 AND 8 4 AND 5 10 AND 11 1 AND 2 COIL 6 AND 12	3-14/6C 3-14/4C 3-14/5C 3-14/1A 3-21/14A
	K27	C2 AND C3 D1 AND D2 COIL X1 AND X2	3-14/2B 3-14/2B 3-21/3B

Figure 3-14. IR Track/Radar Slaved Resolver Chain (Sheet 1 of 2)

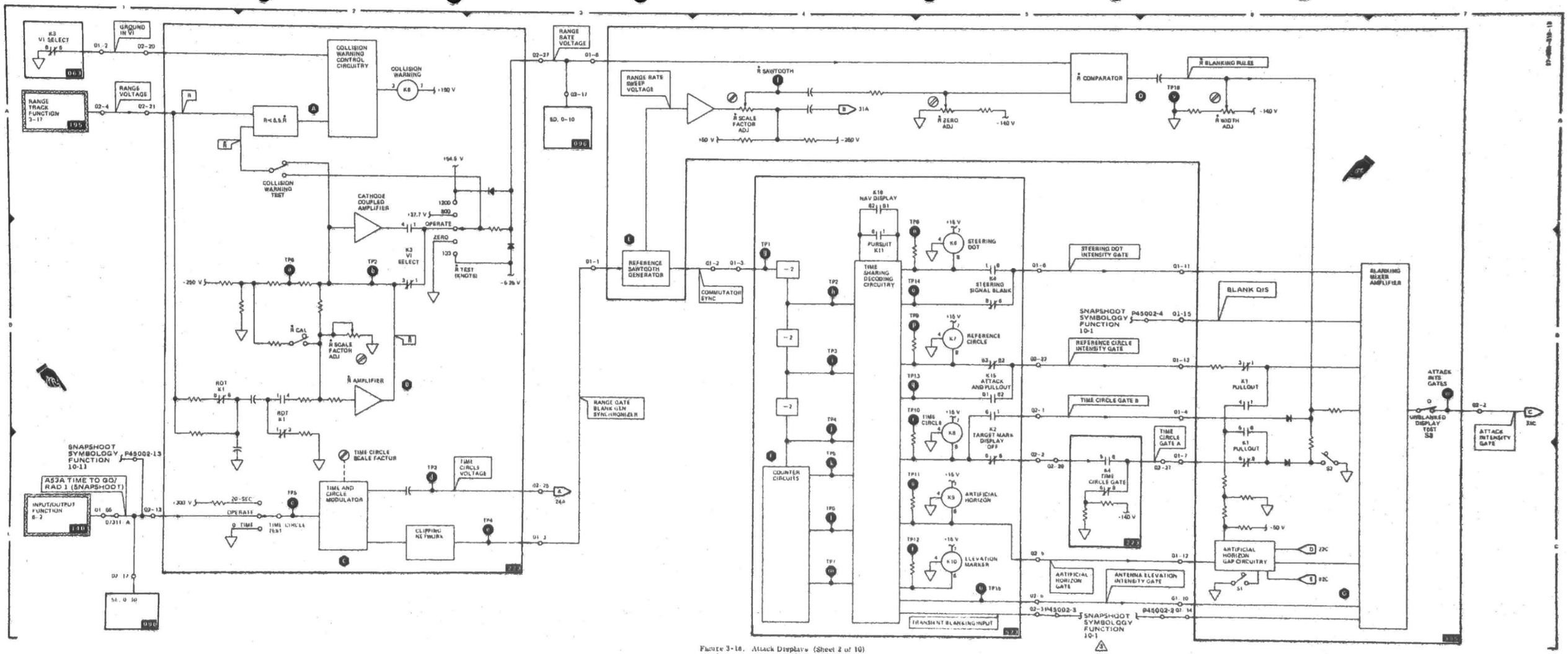


Figure 3-16. Attack Displays (Sheet 2 of 10)

(A) Provides information to position antenna elevation marker, target elevation marker, validity of data link, the IR range marker. The outer portion of the elevation marker indicates antenna elevation angle. The inner portion indicates electrical vertical center of the scope or from offset to lockon, it indicates target elevation. During IR dominant mode the antenna elevation marker indicates data link validity by positioning the bar to the right if invalid and to the left if valid. In IR track the bar does not represent IR range but is positioned at the top of the indicator and to the left. When FIR is obtained, the bar doubles in length. The above information is time shared through deviation marker relay K10 (contacts on sheet 6).

IR search and IR hand control relay K18 is energized when the system is in IR dominant and not in IR track or radar track. When the system is not in IR track and relay K18 is deenergized, information to position the Z marker is supplied from the 241 unit. During IR track a fixed voltage (-100 volts) is supplied to the 603 unit. When hand control relay K3 is deenergized, data link information, or +50 volts indicating data link is invalid, is applied to the 523 unit. When hand control relay K3 is energized, -100 volts is applied through the same circuitry used to process the +50 volts signal or the data link range information.

The purpose of relay K8 (sheet 6) is to help control system logic by allowing only IR dominant mode of operation while energized and only radar dominant mode of operation while deenergized. When hand control relay K3 is energized, relay K8 allows manual pursuit signals to be applied to the digital computer and to the armament subsystems. The data link range marker or the IR range marker on the flight command indicator is also used as part of the Z marker during radar dominant modes of operation. When IR dominant relay K8 is deenergized (system not in IR dominant mode of operation), the line of the flight command indicator is held to the side of the indicator. When the system is in IR dominant, relay K8 energizes allowing data link invalid relay K21 to determine whether to hold the line on the left side of the flight command indicator, indicating data link is valid, or to hold the line on the right side of the flight command indicator indicating that data link is invalid.

The purpose of relay K6 (sheet 6) is to supply FIR information to the flight command indicator (080) and to the FIR lamp on the IR test set (486126). Relay K6 is normally energized and is deenergized when the IR signal strength becomes great enough for the IR missiles to track the infrared source. In the energized condition, before FIR occurs, the IR range bar has a width of approximately 0.4 inches. K6 deenergizes causing the IR range marker to double in length.

The purpose of relay K21 is to apply signals to the flight command indicator (080) giving data link range information or indicating lack of valid data link range information. In the energized condition relay K21 (portions of K21 on sheet 6) passes signals to the flight command indicator indicating that data link range information is invalid. When relay K21 is deenergized signals are sent to the flight command indicator giving data link range information. Range information is applied through relay K21 to vertically position the range marker on the flight command indicator.

Attack display relay K1 supplies the horizontal component of the target elevation signal from the 063 unit to the 241 unit during the search phase of operation of the system. When data link information is available, the target elevation vertical component through relay K1 displaces the target elevation marker, which is part of the Z marker on the indicator, indicating a predicted target elevation in reference to the antenna.

K16 provides target elevation or antenna elevation depending on mode selected.

(B) The artificial horizon gives the pilot an indication of aircraft roll and pitch angles. The deflection voltages originate in the stable platform (289). The signals are processed into suitable deflection signals in the 223 unit. HORIZON ADJUST in the 905 provides adjustments for horizonal altitude. HORIZ TEST in the 223 causes the artificial horizon indication to tilt CCW, simulating right roll.

(C) Provides steering information to the display indicator. Smoothed attack steering signals are routed to the 395 through K6, steering dot relay.

Attack display relay K15, when deenergized adds a small 1600 Hz jizzle voltage to display a vertical 1/4 inch line rather than a dot. This prevents the possibility of burning the screen (080 unit) as might happen with an intense dot remaining in one place for a prolonged period during the navigation mode.

TEST POINT DATA

(a) D-c voltage varies with elevation position of antenna.

(b) A-c signal riding at a d-c level. A-c amplitude depends on aircraft pitch angle and d-c level depends on setting of HOR ADJ (905).

Figure 3-18. Attack Displays (Sheet 3 of 10)

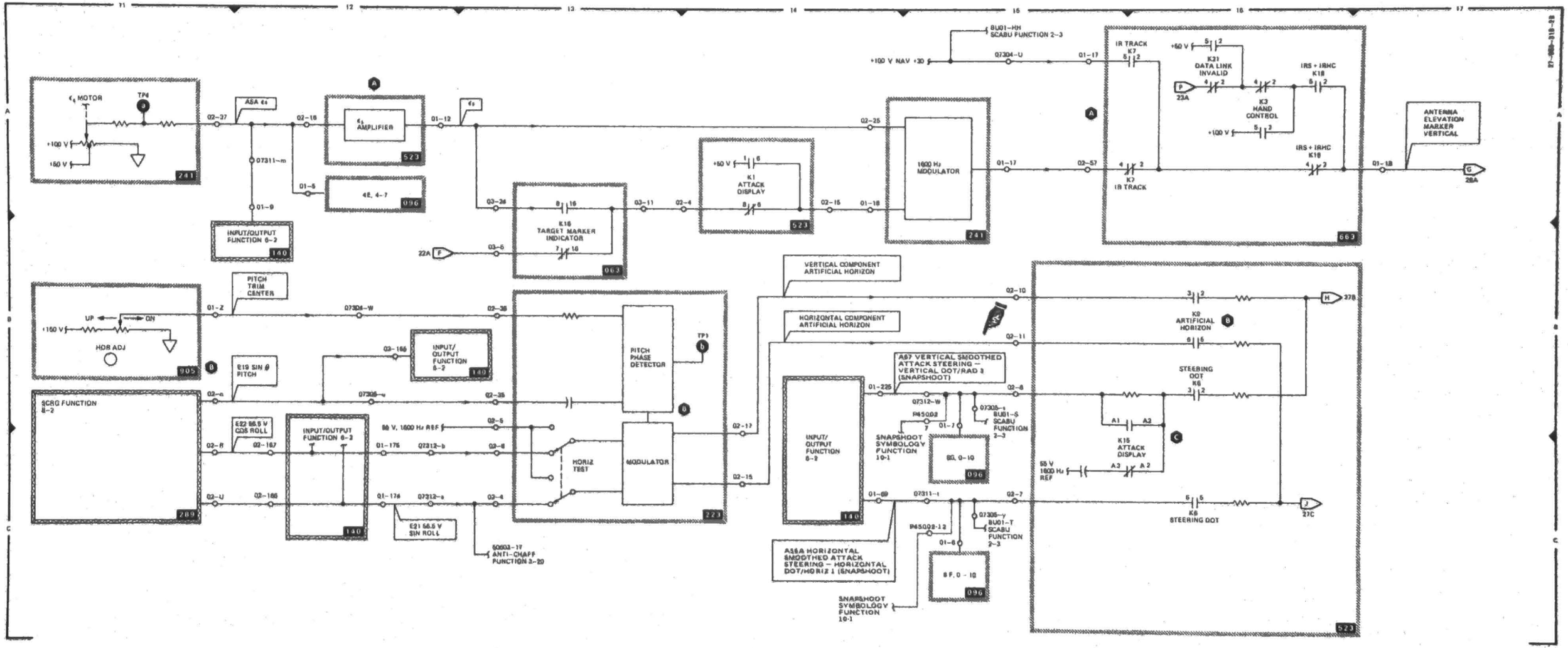


Figure 3-18. Attack Displays (Sheet 4 of 10)

(A) The time circle phase network splits the phase of the time circle voltage from the time circle circuit in the 223 unit during the attack mode of operation. During the search mode of operation, this circuitry provides the phase splitting of the target marker circle signal when data-link information is received. In the visual identification mode of operation, the circle diameter represents target range. The total phase shift is 90 degrees. Application of these signals to the deflection plates of the indicator provides a circle. Target bearing, circle vertical position and time circle voltage are applied to the time circle phase network to position the circle on the flight command indicator. The shape of the circle to be displayed may be varied to give a round circle by varying the phase relationship slightly between the vertical and horizontal deflection voltages. This is accomplished by adjustment of TIME CIRCLE PHASE.

A horizontal positioning voltage is switched through K1 to position the target-mark circle on the flight command indicator. During the attack mode of operation of the system, relay K1 is energized and provides +50 volts to center the display.

Attack display relay K3 supplies the vertical component of the target marker circle positioning system. This signal adjusts the d-c level of the vertical component of the time circle. During the attack mode of operation of the system, relay K3 is energized and supplies a centering voltage for the time circle.

Pursuit relay K11 energizes in the pursuit mode of operation of the interceptor to provide the flight command indicator with the firing bar. When relay K11 is energized, the vertical positioning signal for the firing bar from the computer is applied to the vertical deflection circuit in the 395 unit. This signal vertically positions the firing bar in range for optimum firing time according to the armament selected. During the pursuit mode, when lockon is accomplished, and manual pursuit is selected, a 2.8 inch firing bar is developed for attack. When manual pursuit is not selected, a 0.7 inch firing bar is developed when ATOT pursuit or IRT is present. Before lockon, a 1.4 inch firing bar is provided on the flight command indicator if IR lockon has been accomplished.

Fire or abort relay K5, when energized, applies the fire or abort warning signals from the 395 unit to the vertical and horizontal commutation circuits to be displayed on the flight command indicator. When relay K5 is deenergized vertical and horizontal components of the time circle or lower half of the pullout "8" is applied to the vertical and horizontal deflection circuits in the 395 unit.

Time circle relay K8 commutates the time circle and warning signals to the 395 unit for 10 milliseconds to produce the time circle or half of the warning display on the flight command indicator. The other half of the warning display is supplied through reference circle relay K7.

When the pullout, fire or abort display is to appear on the flight command indicator, the voltages which generate half of the pullout "8," fire "X" or abort "A" is supplied to the deflection circuit through relay K8.

Pullout relay K14 removes the time circle from the flight command indicator and applies voltages to aid in forming the pullout "8." When energized, relay K14 prevents relay K5, relay K12 and relay K11 from energizing. With relays K5 and K12 deenergized the pullout sealed voltage applied to the time circle phase network and reference circle phase network is used to form the pullout "8."

The warning signal generation circuit generates the signals required to produce fire "X" and abort "A" displays on the indicator. The signals are generated all the time but the displays are presented only when relay logic permits. The top half of the "X" and "A" are processed by the time circle circuitry. These signals are time-shared by time circle relay K8, but do not go through the time circle phase circuit.

The pullout circuitry produces a circle which is applied to both the reference circle and the circle relays (K7 and K8) to produce the pullout display (figure 8).

The target marker scaling circuit scales the computer analog output A61 so that the target marker circle or the pursuit firing bar is positioned properly on the flight command indicator as the vertical range scale is changed by RANGE selector switch (305 unit). In the navigation mode after offset, the target marker circle is displayed if the 16 or 40 mile range is selected. It is positioned vertically by the scaled computer analog output A61 which represents target range. In a pursuit attack the pursuit firing bar is displayed provided the 4, 16, or 40 mile range is selected. It also is positioned vertically by the scaled computer analog output A61, but A61 now represents the estimated optimum firing range to the target.

(B) Develops the horizontal and vertical deflection voltages to produce the time circle on the flight command indicator during the attack phase of operation. The circuit develops the target marker circle during the search phase of operation of the interceptor, when the data-link information is received. During the visual identification mode of operation, the range circle is developed in the circuit. The vertical and horizontal components which produce the steering reference circle on the flight command indicator are also produced in this circuit. Relays in the circle generating the warning signal control circuit present to the commutation circuit the components that produce part of the armament fire "X", pullout "8" or abort "A" on the flight command indicator.

(C) The phase relationship between the reference circle deflection voltages may be varied to control the shape of the circle on the flight command indicator by varying REF CIRCLE PHASE ADJUSTMENT. During the attack phase, horizontal and vertical smoothed attack steering signals are applied to the reference circle phasing network. The addition of horizontal and vertical smoothed steering signals allows the reference circle to change its position on the flight command indicator (080 unit) correspondingly as the steering dot changes during the attack run. During the navigation phase, the reference circle is centered on the flight command indicator.

Fire or abort relay K12 removes the reference circle from the flight command indicator and applies the warning signals from the 395 unit to the commutation circuit to be displayed on the flight command indicator. When relay K12 is deenergized the horizontal and vertical components of the reference circle or upper half of the pull "8" are applied to the flight command indicator. When K12 is energized, the fire or abort signal is applied to reference circle relay K7.

Pullout or fire relay K13, when energized, removes the reference circle from the flight command indicator and applies the proper voltages to form the selected warning display.

During pullout a voltage is applied from the pullout network, to the reference circle phase network. This signal is applied to the deflection circuits in the 395 unit to form the upper half of the pullout "8."

Reference circle relay K7 commutates the reference circle and warning signals to the 395 unit for 5 milliseconds to produce the reference circle or half of the warning display on the flight command indicator. The other half of the warning display is supplied through time circle relay K8.

When the pullout, fire or abort display is to appear on the flight command indicator, the voltages which generate half of the pullout "8," fire "X" or abort "A" is supplied to the deflection channels through relay K7. K2, attack steering relay, provides a reference voltage to center the reference circle during navigation mode.

NOTES:

⚠ WHEN A 450 UNIT IS INSTALLED, THE VERTICAL AND HORIZONTAL DEFECTION SIGNALS ARE ROUTED TO "SNAPSHOOT ON" RELAY K1 CONTACTS. WHEN A 450 UNIT IS NOT INSTALLED, CONNECTOR PINS P45002-3 AND P45001-1 ARE SHORTED, AND CONNECTOR PINS P45001-4 AND P45001-2 ARE SHORTED BY JUMPER CONNECTOR PN 52630.

TEST POINT DATA:

(a) D c voltage, amplitude depends on signal and scale factoring

(b) +50 v.

(c) Vertical deflection signal depends on signals being commutated.

(d) Horizontal deflection signal depends on signals being commutated.

Figure 3-18. Attack Displays (Sheet 5 of 10)

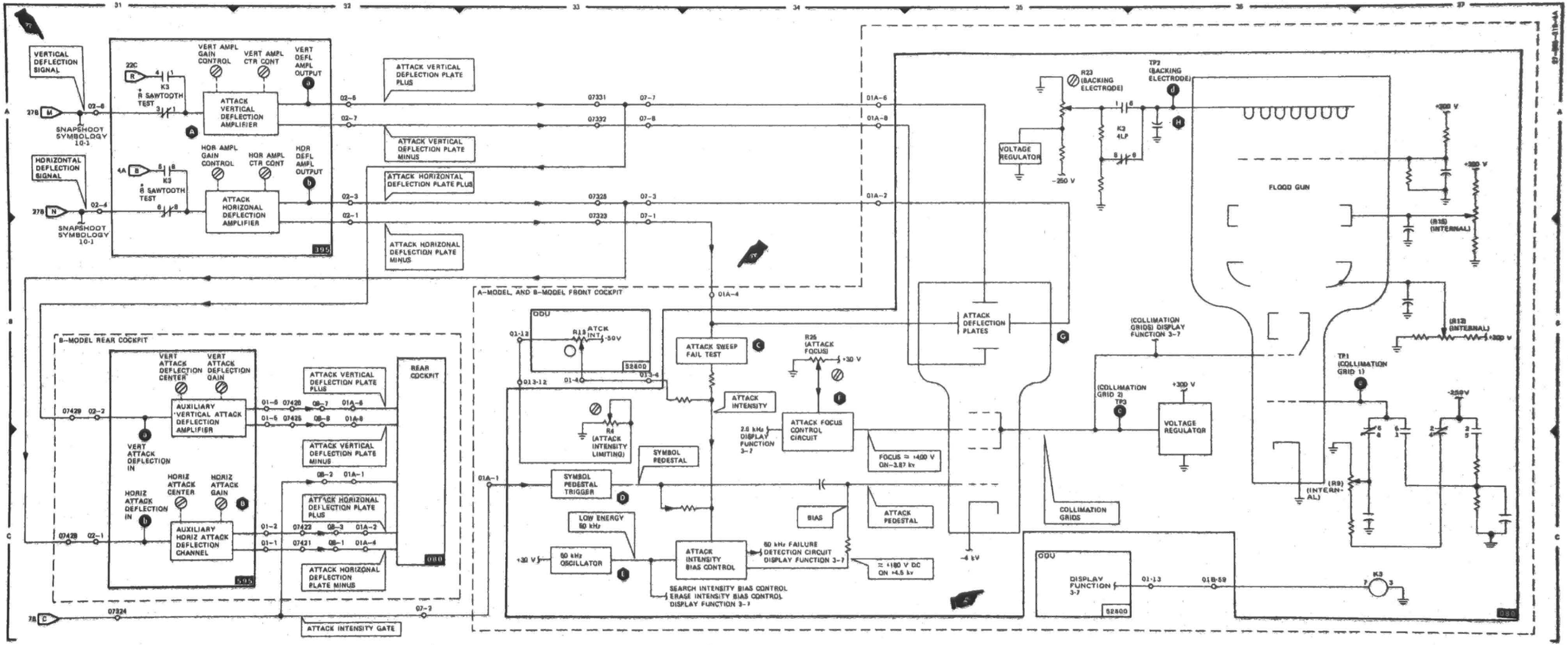


Figure 3-18. Attack Displays (Sheet 8 of 10)

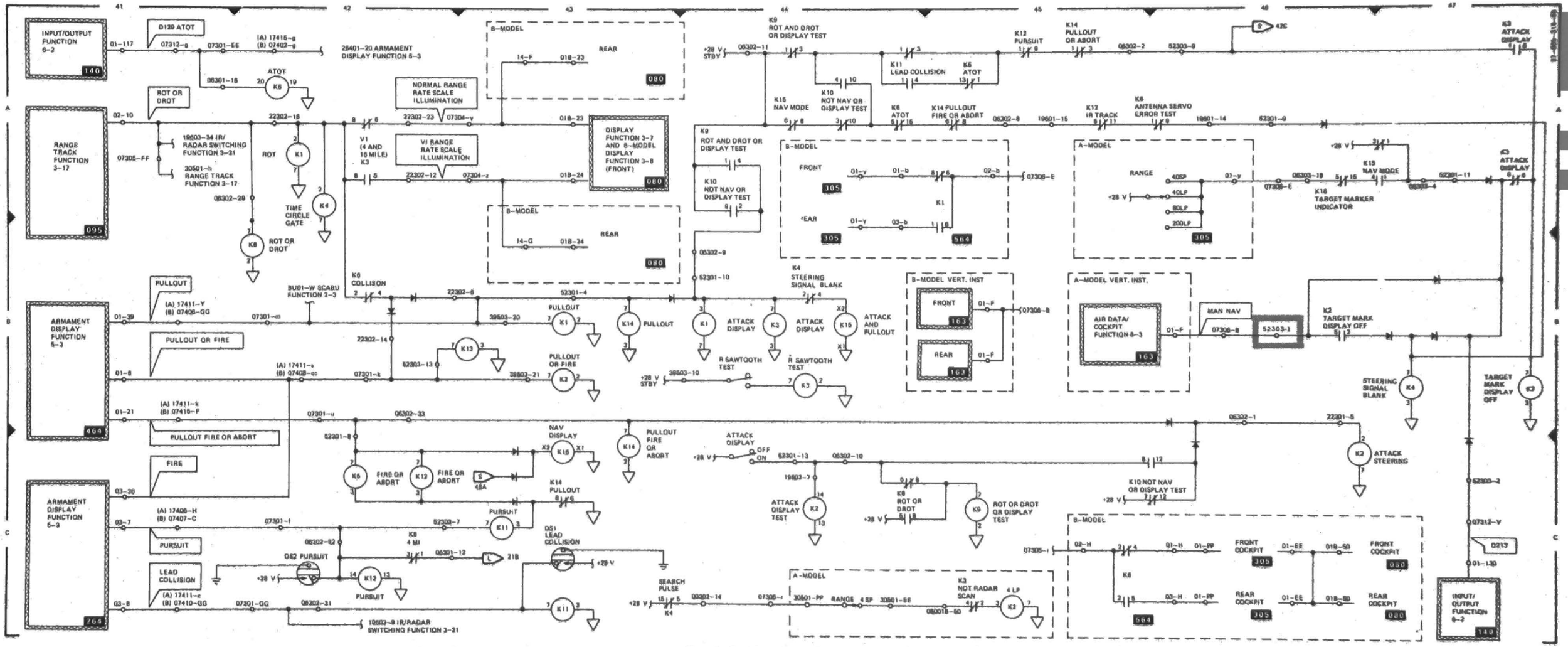


Figure 3-18. Attack Displays (Sheet 9 of 10)

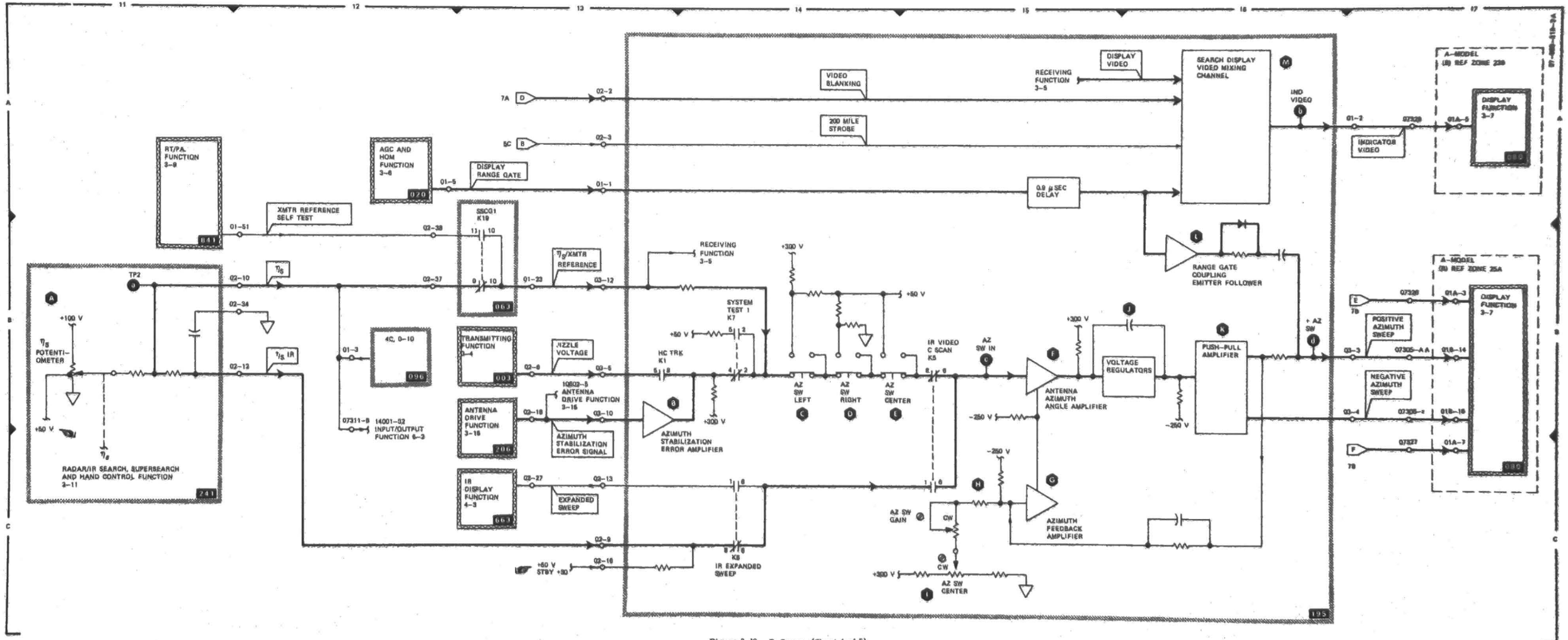


Figure 3-19. B-Sweep (Sheet 4 of 5)

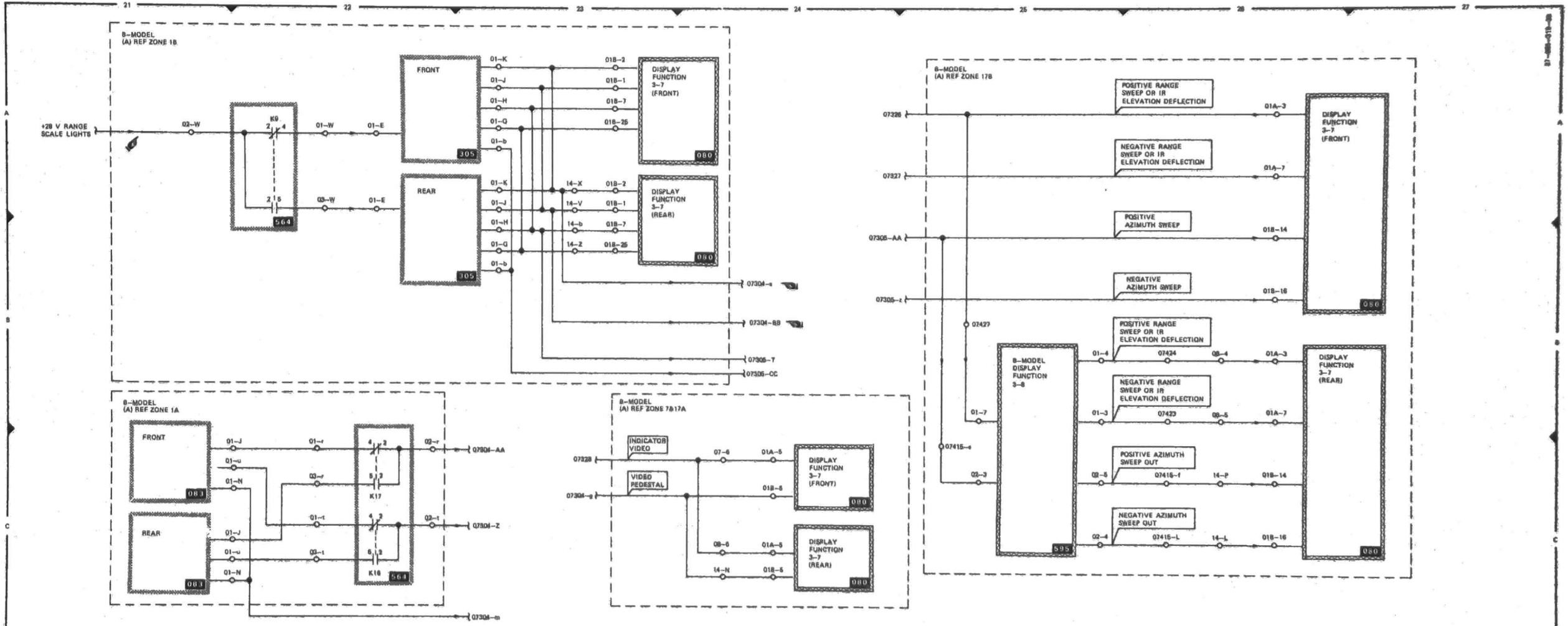


Figure 3-10. B-Sweep (Sheet 5 of 5)

The anti-chaff function is the radar subsystem counter-countermeasure against mechanical jamming. The anti-chaff circuits are the repositioned gate, selective scan, and edge angle track. The repositioned gate circuit provides +28 v nose/tail switching to the 103 and 020. The selective scan circuits extract a reference signal from the modulator returns. This signal is roll stabilized and used to provide attenuation of the chaff returns. The edge angle track circuits provide antenna displacement away from the chaff returns.

A The CHAFF switch controls the selection of the anti-chaff circuits. In the OFF position, none of the anti-chaff circuits are selected. In the GATE position, only the repositioned gate circuit is selected. In the ALL position, all three anti-chaff circuits are selected.

The NOSE-TAIL switch initiates nose chaff mode tracking.

The RDR switch controls the selection of NOM, NORM, or MAN IF. When MAN IF is selected the system goes to NOSE track after lockon, and the AGC circuit is disabled. The IF GAIN controls the receiver gain after lockon.

B Indicators on scope (080). 4 (anti-chaff) indicators light when CHAFF switch is set to ALL or GATE. 3 (tail) indicators light when NOSE-TAIL switch is set to TAIL.

C Energized when CHAFF switch is set to ALL or GATE. If K9 is energized when the computer B signal (D216A) occurs, then K9 locks up through contacts 6 and 1. This prevents the loss of anti-chaff capabilities even if the CHAFF switch is set to OFF. When K9 energizes, contacts 2 and 4 of K9 open and the cockpit chaff relay K34 (364) deenergizes.

D Energized when CHAFF switch is set to ALL. When energized, applies the left/right signal-interlock to energize the left/right relay K2 and initiate operation of the edge angle track transient compensation circuit. Also couples +28 v DROT signal from radar track function 3-17 to selective scan relay K4, and to AGC and homing function 3-6.

E Energized when D210 +28 v attack valid signal is applied from the computer (140). If the NOSE-TAIL switch (305) is set to NOSE and K10 is deenergized, then +28 v energizes the nose-tail relays in the 103 and 095 units. When K10 energizes, the D208 +28 v in nose-computer signal (140) determines whether the nose-tail relays in the 103 and 105 units are energized or not. With MAN IF selected, the nose relay in the (103) and (095) are energized independent of the nose-tail switch or D208 from the computer. In addition, 28V is applied to the (364) unit to provide additional control of CCM parameters.

F Used during maintenance to simulate the left/right signal-interlock. In NORM position, the D226A left/right signal is applied to the 506 unit. When LEFT is selected, +28 v is applied to the 506 unit, and when RIGHT is selected, 0 v is applied to the 506 unit.

G Orthogonal stator windings of the ferrite modulator located on the antenna forward assembly. Modulate received radar returns at the selected lobing frequency.

H A two-stage d-c amplifier and filter network. Processes the delayed boxcar d-c voltage, generated during lockon, to produce a bias voltage proportional to the magnitude of the target return.

Figure 3-20. Anti-chaff (Sheet 1 of 4)

TEST I[illegible] DATA

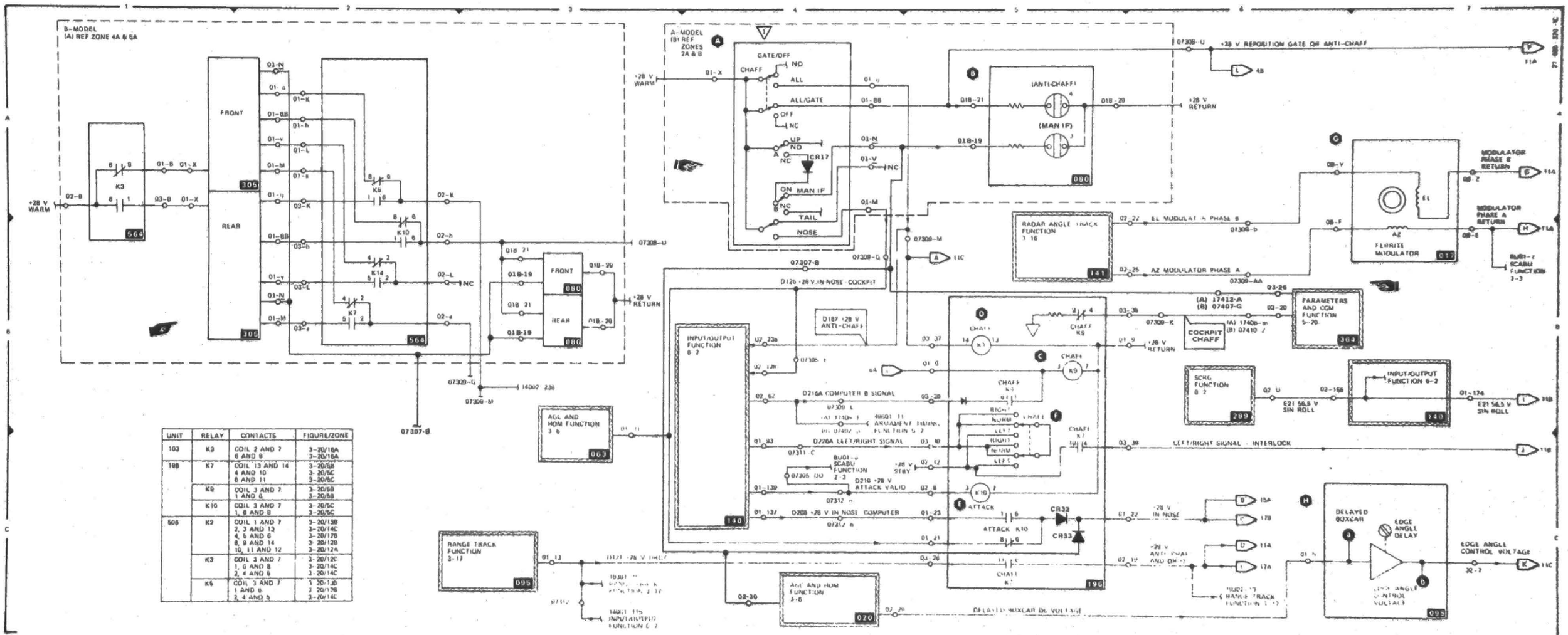
J Agc signal modulated pressure dc. The output of the AGC DELAY potentiometer (020) is applied to the 095 unit.

K A positive control voltage ranging from 0 volts without lockon and +7 volts with lockon (varied with agc signal)

NOTE

1

SW.	UP POS 1	MIDDLE POS 2	DOWN POS 3
	DC	DC	DC
	ALL	ALL	ALL
	ALL/GATE	ALL/GATE	ALL/GATE
	OFF	OFF	OFF
	ALL	GATE	OFF



UNIT	RELAY	CONTACTS	FIGURE/ZONE
103	K3	COIL 2 AND 7 6 AND 9	3-20/18A 3-20/18A
188	K7	COIL 13 AND 14 4 AND 10 8 AND 11	3-20/5B 3-20/5C 3-20/5C
	K9	COIL 3 AND 7 1 AND 6	3-20/6B 3-20/6B
	K10	COIL 3 AND 7 1, 6 AND 8	3-20/5C 3-20/5C
506	K2	COIL 1 AND 7 2, 3 AND 13 4, 5 AND 6 8, 9 AND 14 10, 11 AND 12	3-20/13B 3-20/14C 3-20/12B 3-20/12B 3-20/12A
	K3	COIL 3 AND 7 1, 6 AND 8 2, 4 AND 6	3-20/12C 3-20/14C 3-20/14C
	K6	COIL 3 AND 7 1 AND 8 2, 4 AND 5	3-20/13B 3-20/12B 3-20/14C

Figure 3-20. Anti-chaff (Sheet 2 of 4)

A. Uses the azimuth and elevation lobing frequencies to generate sine and cosine waveforms. The sine and cosine waveforms are summed together to provide inputs to the selective scan generator and to the edge angle track generator. The AZ and EL ADJ potentiometers determine the amplitude of the lobing frequencies applied to the circuit.

B. A network which compares the SCRG roll signal (E21 56.5 v sin roll) to a 115 v 1600 Hz reference signal to generate a ± dc aircraft roll compensation signal which is applied to the selective scan generator and to the edge angle track generator.

C. Two zero crossing detectors, a bi-stable flip-flop, and an amplifier use the summed sine and cosine waveforms to generate an asymmetrical square wave. The asymmetrical square wave drives choppers in the 103 and 020 units.

D. Two zero crossing detectors, a bi-stable flip-flop, and an amplifier use the summed sine and cosine waveforms to generate a synthetic error signal. Enables subsequent networks to position the radar antenna from the normal tracking line of sight away from the chaff concentration in a direction determined by the digital computer analysis of the attack geometry. Amplitude of the output waveform is determined by the edge control voltage which is dependent on the strength of the target returns.

E. A pushbutton switch which permits triggering the edge angle track transient compensation one-shot multivibrator from the front of the unit.

F. One-shot multivibrator and switch network which responds to computer or pilot initiated switching transients to generate a corresponding 0.7 second blanking pulse. Switching transients in the tracking error signals, caused by the rapid motion of the radar antenna during edge angle track switching, are squelched by disconnecting the tracking error signal from the steering and AFCS circuits.

G. Energized by the left/right signal from the computer. Switches the phase of the sine and cosine signals which are summed before being applied to the selective scan generator and edge angle track generator. This corresponds to the selection of the left/right lobing cycle quadrant selected by the digital computer.

H. Enabled when CHAFF switch is set to ALL and tracking is initiated. Applies 0.5 v 1600 Hz to the radar antenna (017) azimuth position resolver B2. When left/right relay K2 is deenergized (right signal), output is in phase with input reference. When K2 is energized (left signal), output is 180 degrees out of phase with input reference. In search, supersearch or hand control relay K3 is deenergized, and the output of the 346 unit is applied to the 663 unit.

I. Energized when CHAFF switch is set to ALL. When energized, applies the edge angle track generator output to the i-f amplifier strip (295).

J. Energized during track. When deenergized, applies the R2 on eta 1 resolver-interlock signal from the 346 unit to the 663 unit. When energized and edge angle track is selected, applies the 0.5 v, 1600 Hz output from transformer (either in phase or out of phase with reference) to the 663 unit.

K. The last stage of a five stage i-f amplifier-detector network. The i-f signal is modulated by the edge angle track signal. This causes the tracking loop (095, 020, and 141) to position the antenna slightly off the target away from chaff.

L. Normally closed spring loaded switch. Disables the reposition gate circuits in the 103 and 020 units for test purposes.

M. Energized when NOSE-TAIL switch (305) is set to NOSE when attack is not specified by computer. Also energized when NOSE and attack are specified by computer (140) or MAN IF selected (305).

N. Two-pole two-position spring loaded switch. Disables selective scan for test purposes.

O. Chopper coil alternately energized and deenergized by the +28 v selective scan signal. Allows range gate to be developed from the cleanest (least chaff contaminated) portion of the target returns in the 103 unit. Contacts of G1 are shown on the range track function (fig. 3-17). This signal also drives a chopper in the 020 unit which allows agc voltage to be developed from the cleanest portion of the target returns.

P. Provides 115 v 1600 Hz reference signal for the roll phase detector.

Q. Biases difference amplifiers in the selective scan generator and edge angle track generator to compensate for aircraft roll. Compensation is limited to approximately ±60 degrees.

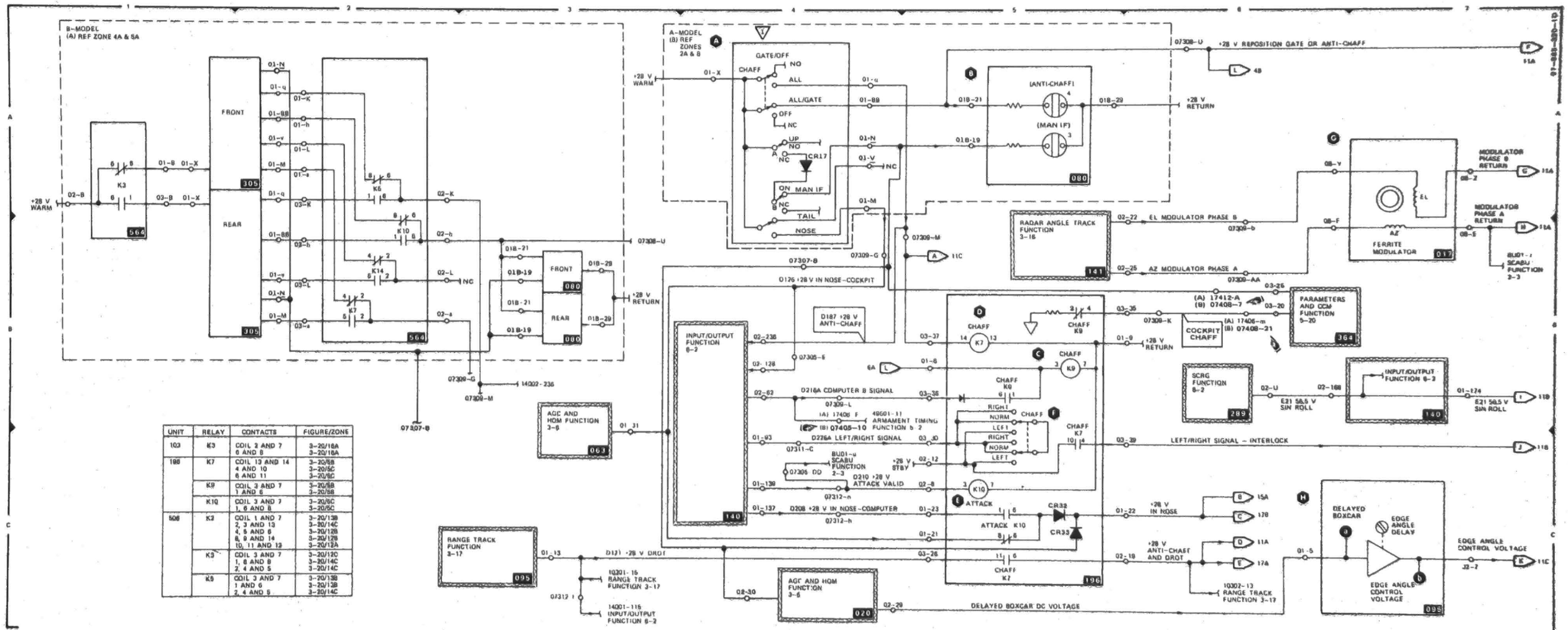
R. Biases the output amplifier to control the amplitude of the edge angle track signal.

S. Enables the last stage of the output amplifier.

T. Energizes relay when chaff switch is set to ALL and DROT occurs. Relay applies +75V to last stage amplifier.

U. Correct output adjustment is determined by computer during a special portion of LR routine. Computer provides adjustment indications by use of lead collision and pursuit lights on 063 unit and/or value of time to go output monitored by position 5E or 096 unit.

Figure 3-29. Anti-chaff (Sheet 3 of 4)



UNIT	RELAY	CONTACTS	FIGURE/ZONE
103	K3	COIL 2 AND 7	3-20/16A
		6 AND 8	3-20/16A
198	K7	COIL 13 AND 14	3-20/6B
		4 AND 10	3-20/6C
		6 AND 11	3-20/6C
	K9	COIL 3 AND 7	3-20/6B
		1 AND 8	3-20/6B
	K10	COIL 3 AND 7	3-20/6C
		1, 8 AND 9	3-20/6C
506	K2	COIL 1 AND 7	3-20/13B
		2, 3 AND 13	3-20/14C
		4, 5 AND 6	3-20/12B
		8, 9 AND 14	3-20/12B
		10, 11 AND 12	3-20/13A
	K3	COIL 3 AND 7	3-20/12C
		1, 8 AND 9	3-20/14C
		2, 4 AND 5	3-20/14C
	K9	COIL 3 AND 7	3-20/13B
		1 AND 6	3-20/13B
		2, 4 AND 5	3-20/14C

Figure 3-20. Anti-chaff (Sheet 2 of 4)

A. Uses the azimuth and elevation lobing frequencies to generate sine and cosine waveforms. The sine and cosine waveforms are summed together to provide inputs to the selective scan generator and to the edge angle track generator. The AZ and EL ADJ potentiometers determine the amplitude of the lobing frequencies applied to the circuit.

B. A network which compares the SCRG roll signal (E21 56.5 v sin roll) to a 115 v 1600 Hz reference signal to generate a a dc aircraft roll compensation signal which is applied to the selective scan generator and to the edge angle track generator.

C. Two zero crossing detectors, a bi-stable flip-flop, and an amplifier use the summed sine and cosine waveforms to generate an asymmetrical square wave. The asymmetrical square wave drives choppers in the 103 and 020 units.

D. Two zero crossing detectors, a bi-stable flip-flop, and an amplifier use the summed sine and cosine waveforms to generate a synthetic error signal. Enables subsequent networks to position the radar antenna from the normal tracking line of sight away from the chaff concentration in a direction determined by the digital computer analysis of the attack geometry. Amplitude of the output waveform is determined by the edge control voltage which is dependent on the strength of the target returns.

E. A pushbutton switch which permits triggering the edge angle track transient compensation one-shot multivibrator from the front of the unit.

F. One-shot multivibrator and switch network which responds to computer or pilot initiated switching transients to generate a corresponding 0.7 second blanking pulse. Switching transients in the tracking error signals, caused by the rapid motion of the radar antenna during edge angle track switching, are squelched by disconnecting the tracking error signal from the steering and AFCS circuits.

G. Energized by the left/right signal from the computer. Switches the phase of the sine and cosine signals which are summed before being applied to the selective scan generator and edge angle track generator. This corresponds to the selection of the left/right lobing cycle quadrant selected by the digital computer.

H. Enabled when CHAFF switch is set to ALL and tracking is initiated. Applies 0.5 v 1600 Hz to the radar antenna (017) azimuth position resolver B2. When left/right relay K2 is deenergized (right signal), output is in phase with input reference. When K2 is energized (left signal), output is 180 degrees out of phase with input reference. In search, supersearch or hand control relay K3 is deenergized, and the output of the 346 unit is applied to the 663 unit.

I. Energized when CHAFF switch is set to ALL. When energized, applies the edge angle track generator output to the i-f amplifier strip (295).

J. Energized during track. When deenergized, applies the R2 on eta 1 resolver-interlock signal from the 346 unit to the 663 unit. When energized and edge angle track is selected, applies the 0.5 v, 1600 Hz output from transformer (either in phase or out of phase with reference) to the 663 unit.

K. The last stage of a five stage i-f amplifier-detector network. The i-f signal is modulated by the edge angle track signal. This causes the tracking loop (095, 020, and 141) to position the antenna slightly off the target away from chaff.

L. Normally closed spring loaded switch. Disables the reposition gate circuits in the 103 and 020 units for test purposes.

M. Energized when NOSE-TAIL switch (305) is set to NOSE when attack is not specified by computer. Also energized when NOSE and attack are specified by computer (140) or MAN IF selected (305).

N. Two-pole two-position spring loaded switch. Disables selective scan for test purposes.

O. Chopper coil alternately energized and deenergized by the +28 v selective scan signal. Allows range gate to be developed from the cleanest (least chaff contaminated) portion of the target returns in the 103 unit. Contacts of G1 are shown on the range track function (fig. 3-17). This signal also drives a chopper in the 020 unit which allows agc voltage to be developed from the cleanest portion of the target returns.

P. Provides 115 v 1600 Hz reference signal for the roll phase detector.

Q. Biases difference amplifiers in the selective scan generator and edge angle track generator to compensate for aircraft roll. Compensation is limited to approximately ±60 degrees.

R. Biases the output amplifier to control the amplitude of the edge angle track signal.

S. Enables the last stage of the output amplifier.

T. Energizes relay when chaff switch is set to ALL and DROT occurs. Relay applies +75V to last stage amplifier.

U. Correct output adjustment is determined by computer during a special portion of LR routine. Computer provides adjustment indications by use of lead collision and pursuit lights on 063 unit and/or value of time to go output monitored by position 5E or 096 unit.

Figure 3-20. Anti-chaff (Sheet 3 of 4)

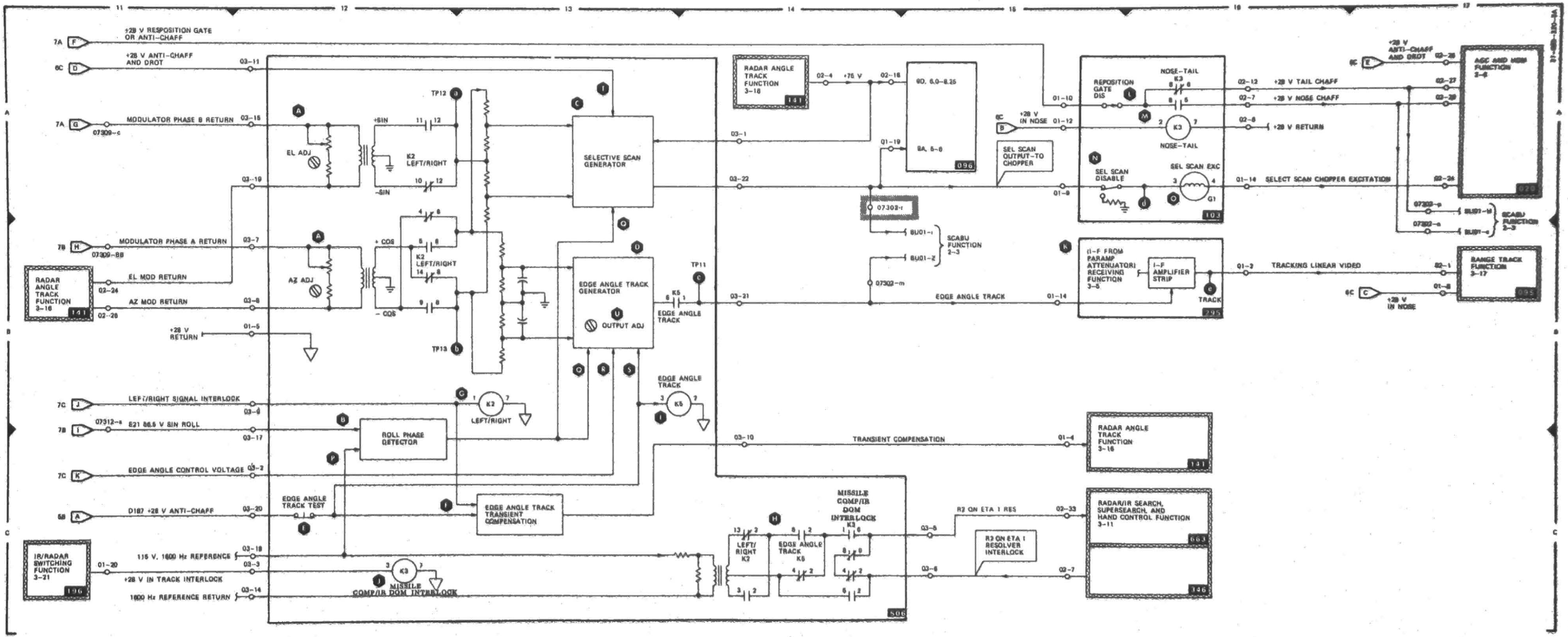


Figure 3-20. Anti-chaff (Sheet 4 of 4)

IR/RADAR SWITCHING INVOLVES THE FUNCTIONS DEALING WITH THE SELECTION OF IR OR RADAR DOMINANT MODES AND SUBMODES. THE IR AND RADAR MODES AND CROSS-MODES SWITCHING ARE ATTAINED BY A SERIES OF OPERATIONS PERFORMED WITH SWITCHES AND CONTROLS ON THE PILOTS HAND CONTROL (083), RADAR SET CONTROL (309), AND AZIMUTH SCAN AND HORIZON ADJUSTMENT RADAR SET CONTROL (855).

CONTACTS OF THE RELAYS SHOWN APPEAR ON VARIOUS RADAR AND IR FUNCTIONS. THE FUNCTIONS WHERE THEY APPEAR REFERENCE THE COILS TO THIS FUNCTION INSTEAD OF SHOWING THE INTRICATE ENERGIZING LOGIC INVOLVED WITH SOME RELAYS.

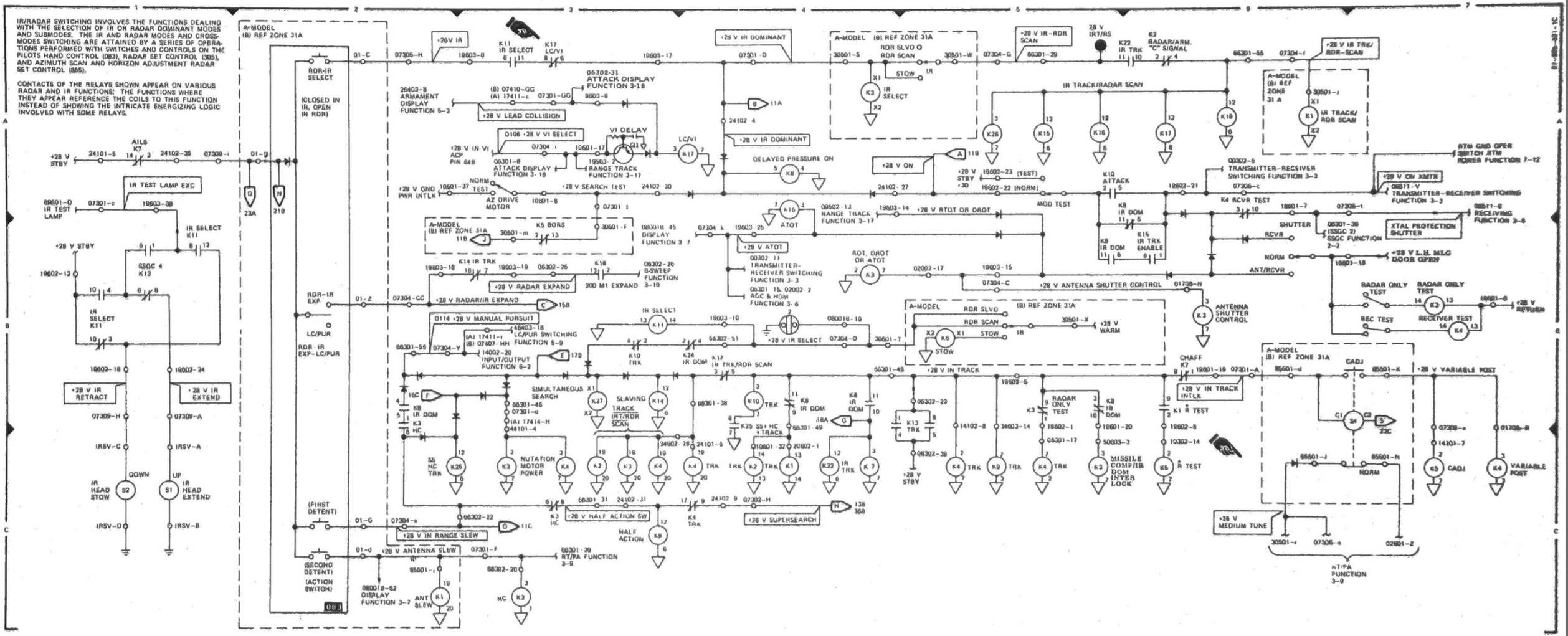


Figure 3-21. IR/Radar Switching (Sheet 1 of 5)

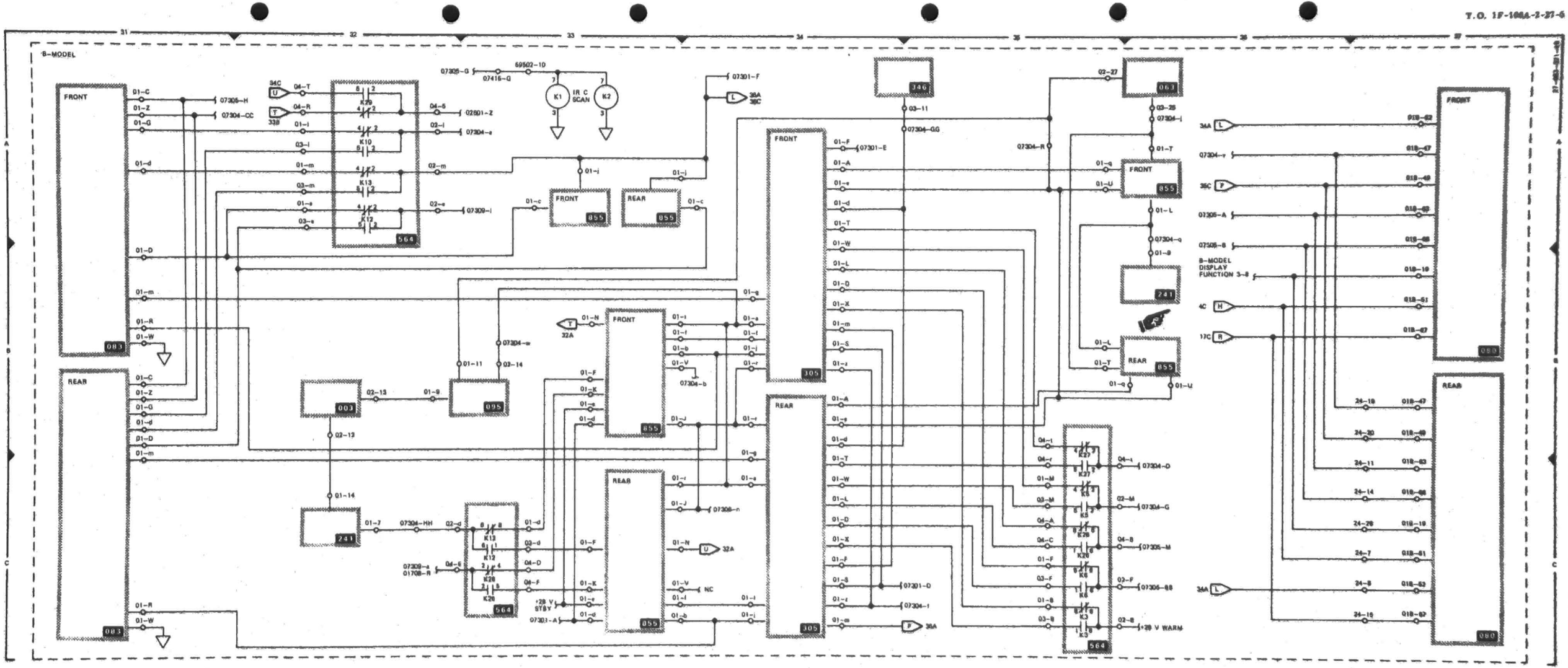


Figure 3-21. IR Radar Switching (Sheet 4 of 5)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
003	K5	COIL 2 AND 7 6 AND 8	3-3/26C 3-21/26C
017	K3	COIL 3 AND 7	4-21/6B
	K4	COIL 3 AND 7	3-21/7C
020	K1	COIL 19 AND 20 10 AND 17	3-21/13C 3-21/15C
	K2	COIL 3 AND 7 2 AND 4	3-6/13B 3-21/1K
	K3	COIL 2 AND 7	3-21/4B
	K4	COIL 2 AND 7	3-21/15C
	K8	COIL 3 AND 7	3-21/11C
040	K4	COIL 3 AND 7	3-21/16B
041	K2	COIL 10 AND 20	3-21/15B
063	K1	COIL 2 AND 7	3-21/17A
	K4	COIL 1 AND 2	3-21/5C
	K8	COIL 19 AND 20 7 AND 16 8 AND 16	3-6/16C 3-21/14C 3-21/14C
	K7	COIL 2 AND 7 1 AND 4 5 AND 8	3-21/27B 3-21/14C 3-21/14C
	K13	COIL 2 AND 7 1 AND 4 5 AND 8	3-21/27B 3-21/4C 3-21/5C
	K18	COIL 19 AND 20 2 AND 13	3-19/2B 3-21/4B
080	K1	COIL 3 AND 7	3-21/12B
	K2	COIL 3 AND 7	3-21/12B
	K3	COIL 3 AND 7 6 AND 8	3-7/12B 3-21/12B
	K4	COIL 3 AND 7	3-21/12B
095	K3	COIL 4 AND 13 8 AND 12	3-21/26C 3-21/26C
	K4	COIL 3 AND 7 6 AND 8	3-17/14A 3-21/11A
	K5	COIL 2 AND 7	3-21/11C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
103	K1	COIL 2 AND 7	3-21/11B
	K4	COIL 2 AND 7	3-21/12C
	K5	COIL 2 AND 7	3-21/6C
106	K2	COIL 13 AND 14	3-21/4C
	K4	COIL 3 AND 7	3-21/14B
141	K1	COIL 2 AND 7	3-21/16C
	K4	COIL 2 AND 7	3-21/5C
	K5	COIL 2 AND 7	3-21/7C
195	K1	COIL 2 AND 7	3-21/17B
	K5	COIL 3 AND 7	3-21/14A
	K6	COIL 3 AND 7	3-21/14B
196	K1	COIL 13 AND 14 2 AND 9	SSGC 5/26A 3-21/6B
	K3	COIL 13 AND 14 1 AND 9	3-21/7B 3-21/5B
	K4	COIL 13 AND 14 3 AND 10	3-3/7B 3-21/6A
	K7	COIL 13 AND 14 1 AND 9	3-20/6B 3-21/6B
	K8	COIL 13 AND 14 3 AND 10 5 AND 11 6 AND 11	3-21/12A 3-21/5B 3-21/6B 3-21/5B
	K10	COIL 3 AND 7 2 AND 5	3-20/5C 3-21/5A
	K11	COIL 13 AND 14 2 AND 9 6 AND 11	3-21/3B 3-21/12A 3-21/3A
	K12	COIL 13 AND 14 4 AND 10	3-21/17A 3-21/15C
	K14	COIL 19 AND 20 7 AND 16 9, 10 AND 17	3-21/17A 3-21/3B 3-21/13C
	K15	COIL 3 AND 7 1 AND 6 2 AND 5	3-21/15C 3-21/6B 3-21/15C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
196 (Cont)	K16	COIL 3 AND 7 2 AND 4	3-21/4A 3-21/12A
	K17	COIL 3 AND 7 2 AND 4 6 AND 8	3-21/4A 3-21/12A 3-21/3A
206	K1	COIL 13 AND 14	3-21/4C
241	K4	COIL 19 AND 20 9 AND 17	3-21/4C 3-21/4C
	K5	COIL 19 AND 20	3-21/17B
	K6	COIL 2 AND 7	3-21/27A
	K7	COIL 19 AND 20 1 AND 13 3 AND 14 4 AND 14 9 AND 17	7-3/26B 3-21/25C 3-21/1B 3-21/17C 3-21/17C
	K8	COIL 4 AND 5	3-21/4A
	K9	COIL 6 AND 12 9 AND 11	3-21/2C 3-21/27A
	K10	COIL X1 AND X2	3-21/17B
305	K1	COIL X1 AND X2 B2 AND B3	3-21/6A 3-21/12B
	K3	COIL X1 AND X2	3-21/4A
	K5	COIL 1 AND 7 4 AND 6 6 AND 9 3 AND 13 8 AND 14	3-21/22B 3-21/22B 3-21/22B 3-21/3B 3-21/24B
	K6	COIL X1 AND X2	3-21/5B
346	K2	COIL 19 AND 20	3-21/3C
	K3	COIL 19 AND 20	3-21/3C
	K4	COIL 19 AND 20	3-21/3C
	K9	COIL 3 AND 7 6 AND 8	3-21/5C 3-21/24A
	K10	COIL 3 AND 7 6 AND 8	3-21/24A 3-21/11B
	K11	COIL X1 AND X2 A1 AND A2	3-21/24A 3-21/15B
	K12	COIL X1 AND X2	3-21/24A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
389	K8	COIL 3 AND 7	3-21/15A
441	K1	COIL 3 AND 7	3-21/ 16B
	K2	COIL 3 AND 7	3-21/17B
	K3	COIL 2 AND 7	3-21/3C
	K4	COIL 2 AND 7	3-21/3C
506	K3	COIL 3 AND 7	3-21/5C
595	K1	COIL 3 AND 7	3-21/33A
	K2	COIL 3 AND 7	3-21/33A
663	K2	COIL 3 AND 7 2 AND 4	3-3/27C 3-21/6A
	K3	COIL 3 AND 7 1 AND 6 6 AND 8	3-21/3C 3-21/2C 3-21/3C
	K5	COIL 6 AND 12 7 AND 8 7 AND 14 9 AND 11 10 AND 11	3-21/16A 3-21/15A 3-21/15A 3-21/16A 3-21/16A
	K7	COIL 3 AND 7 1 AND 6 6 AND 8	3-21/4C 3-21/14A 3-21/14A
	K8	COIL 6 AND 12 4 AND 5 9 AND 11 10 AND 11	3-21/12A 3-21/2B 3-21/4B 3-21/4B
	K10	COIL 3 AND 7 1 AND 6 2 AND 4	3-21/4B 3-21/15A 3-21/3B
	K11	COIL 6 AND 12	3-21/13A
	K12	COIL 6 AND 12	3-21/13A
	K13	COIL 6 AND 12	3-21/13A
	K14	COIL 6 AND 12	3-21/3B
	K15	COIL 6 AND 12 9 AND 11	3-21/6A 3-21/13A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
663 (cont)	K16	COIL 6 AND 12	3-21/5A
	K17	COIL 6 AND 12 1 AND 13 3 AND 5	3-21/6A 3-21/16C 3-21/4B
	K18	COIL 3 AND 7	3-21/14A
	K19	COIL 6 AND 12	3-21/6A
	K20	COIL 6 AND 12	3-21/14A
	K22	COIL 6 AND 12 1 AND 2 1 AND 13 10 AND 11	3-21/4C 3-21/12A 3-21/14A 3-21/6A
	K24	COIL 3 AND 7 1 AND 6 2 AND 4	3-21/12A 3-21/15A 3-21/4B
	K25	COIL 6 AND 12	3-21/2C
	K26	COIL 3 AND 7	3-21/5A
	K27	COIL X1 AND X2	3-21/3B
855	K1	COIL 10 AND 20 2 AND 13 3 AND 14 6 AND 15	3-21/2C 3-21/26B 3-21/26B 3-21/14C
	K2	COIL 3 AND 7 2 AND 4 2 AND 5	3-21/24C 3-21/25A 3-21/24C
	K3	COIL 3 AND 7 1 AND 6 2 AND 5	3-21/24A 3-21/23C 3-21/24A
	K4	COIL 3 AND 7	3-21/26B

Figure 3-21. IR/Radar Switching (Sheet 5 of 5)

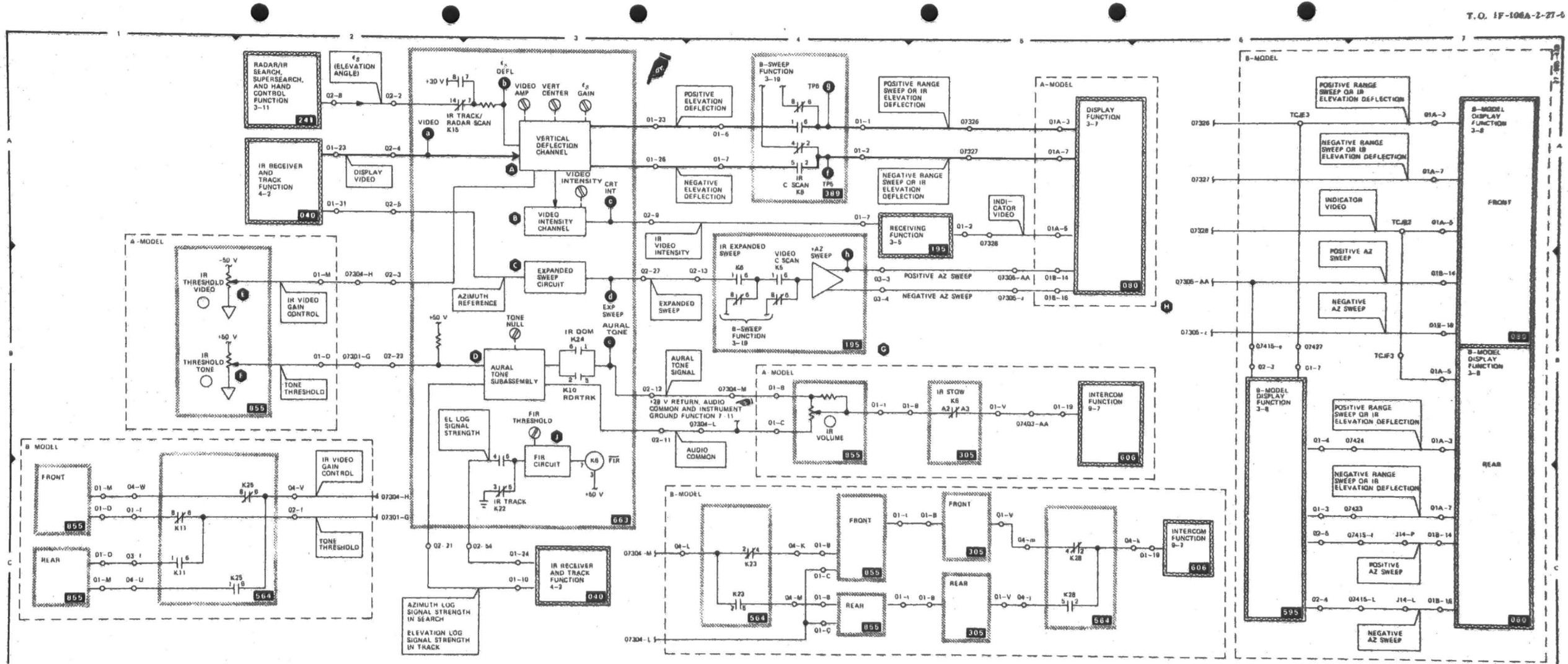


Figure 4-3. IR Display (Sheet 2 of 3)

The IR drive function compares IR receiver velocity (direction and speed) with a signal indicating desired position and develops drive signals to move the IR receiver to the desired position. In IR track, the desired position is indicated by error signal from the IR track function. The track stabilization loop supplies azimuth and elevation signals indicating present IR receiver direction of movement. In IR search, the stabilization loop receives IR receiver desired position and present position and supplies drive to move the IR receiver toward the desired position. In both IR search and track, a tachometer loop supplies azimuth and elevation signals that control IR receiver speed so that the IR receiver may be repositioned quickly and accurately. IR track error inputs are developed in the 040 unit and are routed into the 441 unit. IR search error inputs are developed in the 241 unit.

A Provides an output proportional to the turning rate of the IR receiver on the azimuth axis and accomplishes space stabilization of the IR receiver in azimuth as it tracks a target.

B Provides an output proportional to the movements of the IR receiver in elevation. When the IR receiver moves up, a signal is developed that is out of phase with the phase A reference signal.

C Develops 26 v, 400 Hz two-phase power for gyro spin motors.

D Chops azimuth track error signal to a 1600 Hz square wave error signal which is passed by energized IR TRACK relay K1 to drive the IR receiver (767). When the IR TRACK relay is deenergized, the azimuth search drive signal replaces the track input.

E Converts elevation rate gyro signals into d-c voltage having a polarity determined by phase of the input. When the input elevation rate signal is in phase with the phase A EL GYRO SIG GEN reference signal, a negative d-c voltage is developed at the output. EL GYRO PD adjustment nulls the elevation rate gyro phase detector output under zero input signal conditions.

F Same as E above except in azimuth.

G Compares elevation tachometer generator output with the phase B 400 Hz supply reference voltage and demodulates it into d-c voltage having a polarity dependent upon the relative phase between the two signals. When a signal in phase with the reference is applied to the input, a positive d-c output is developed at the output.

H Chops output of summing resistors in elevation tachometer loop circuitry into a 400 Hz error signal. Chopper is driven by the 400 Hz supply through a lag network which adds 35 degrees of lag to the inherent 55 degree lag of the chopper causing the chopped output to lag the 400 Hz phase B supply by 90 degrees. This shift is necessary to obtain the proper phase relationship to drive the two-phase servo motors.

J Same as operation of C above except in azimuth.

K The tachometers produce signals proportional to their angular velocity. Output of the tachometer is fed back to the input of the tachometer loops in opposite phase to the track error or search drive signals. In track, the tachometer signal stabilizes the speed of the servo motor since its output is proportional to motor speed. In search, tachometer feedback acts as a dynamic brake to prevent overshoot of the IR receiver and improves stability of the azimuth tachometer loop. The drive motors receive push-pull drive signals from amplifiers in the 441 unit that drive the gear trains to position the sensor.

TEST POINT DATA

A Reference phase A - when IR receiver moves up

B Negative voltage moves IR receiver up

C Self-explanatory, panel nomenclature

D Positive voltage moves IR receiver right

E Reference phase A - when IR receiver moves right

F 1600 Hz reference; - moves IR receiver up

G 1600 Hz reference; - moves IR receiver right

H Reference phase B - when IR receiver moves up

J Reference phase B 90° - moves IR receiver up

K Reference phase B 90° - moves IR receiver up

L Reference phase B 90° - moves IR receiver right

M Reference phase B 90° - moves IR receiver right

N Reference phase B - when IR receiver moves right

UNIT	RELAY	CONTACTS	FIGURE/ZONE
441	K1	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	4-4/4B 4-4/4C 3-31/18B
	K2	2 AND 5 COIL 3 AND 7	4-4/3C 3-31/19B

Figure 4-4. IR Drive (Sheet 1 of 2)

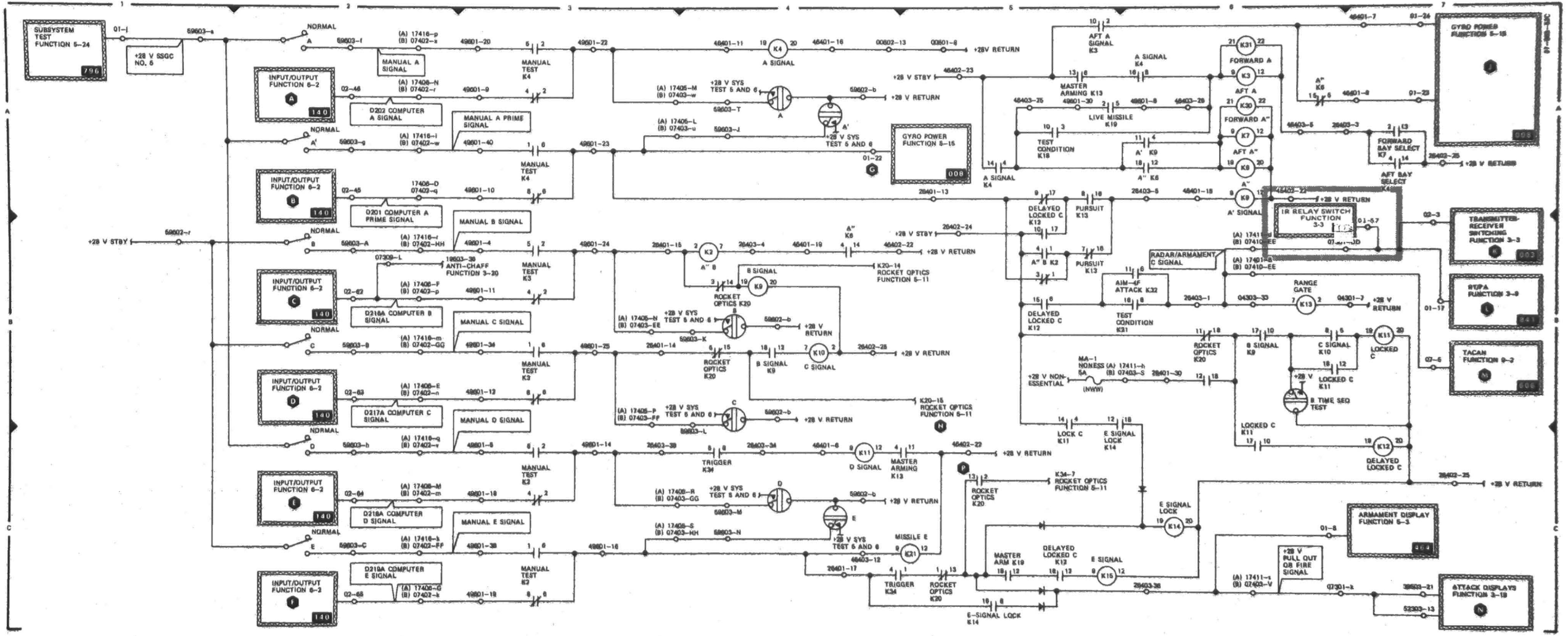


Figure 5-3. Armament Timing (Sheet 2 of 2)

The armament display function provides signals to the radar subsystem that control some of the attack displays on search and attack flight command indicator (080). The function also controls the readout on the SELECT annunciator of the armament control panel (ACP).

A. Pursuit relay K13 and lead collision relay K16 when energized, route a control signal to the attack display function (figure 3-18) that controls the type of display (pursuit or lead collision) produced on the 080 unit. The lead collision signal is also routed to the IR/RDR switching function (figure 3-21) to lock out IR dominant mode in lead-collision.

B. During special weapon attack, pullout relay K1 is energized when the RH special weapon aboard switch indicates the weapon has left the rack.

C. After E time the armament timing function causes the fire signal to be routed to the attack display function (figure 3-18).

D. Pullout, fire or abort signal is routed to the attack display function (figure 3-18) from 464 unit on pin 01-21 when relay K20 is energized by the computer abort signal, D221A. Signal D221A is turned on in lead collision if signal D125 is not received by the computer before A-time plus 12 seconds (in a missile attack D125 indicates A-prime signal was received by the armament subsystem). In this situation the pilot can switch to pursuit (if within 10 seconds) and D221A will turn off. Also signal D221A is on at C-time in a missile lead collision attack for any of the following conditions: (a) 10 seconds of A-time have not elapsed, (b) 1.5 seconds of B-time have not elapsed, (c) either DROT or ATOT failed to occur. Signal D221A is on in a special weapon attack (pursuit or lead collision) if the weapon fails to arm or if at C-time, either DROT or ATOT failed to occur.

E. The pilots SELECT annunciator verify the validity of the pilots armament selection. If the selector switch is set to VIS IDENT, the blank coil should energize and cause the annunciator to display blank. For an armament selection the annunciator should display OK if the aft bay or forward bay contains the missiles selected or if a special weapon is aboard with special weapon selected. If the armament selection does not match the armament loaded, the annunciator displays NO.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
264	K3	3, 4 AND 10 COIL 13 AND 14	5-3/3C 5-7/3A
	K6	3, 4 AND 10 COIL 13 AND 14	5-3/3C 5-7/3B
	K13	10 AND 17 COIL 19 AND 20	5-3/3A 5-9/6C
	K14	2 AND 3 COIL 19 AND 20	5-3/3C 5-2/6C
	K16	3, 4 AND 10 COIL 19 AND 20	5-3/3A 5-9/6C
	K17	1 AND 3 COIL 2 AND 7	5-3/3A 5-3/3A
	K18	1 AND 3 COIL 2 AND 7	5-3/4A 5-3/4B
	K19	1, 2 AND 13 COIL 19 AND 20	5-3/3C 5-4/3A
464	K1	1 AND 4 COIL 2 AND 7	5-3/8B 5-3/6C
	K14	11, 12 AND 18 COIL 19 AND 20	5-3/6C 5-11/5C
	K20	5, 6 AND 8 COIL 2 AND 7	5-3/6C 5-3/6C

Figure 5-3. Armament Display (Sheet 1 of 2)

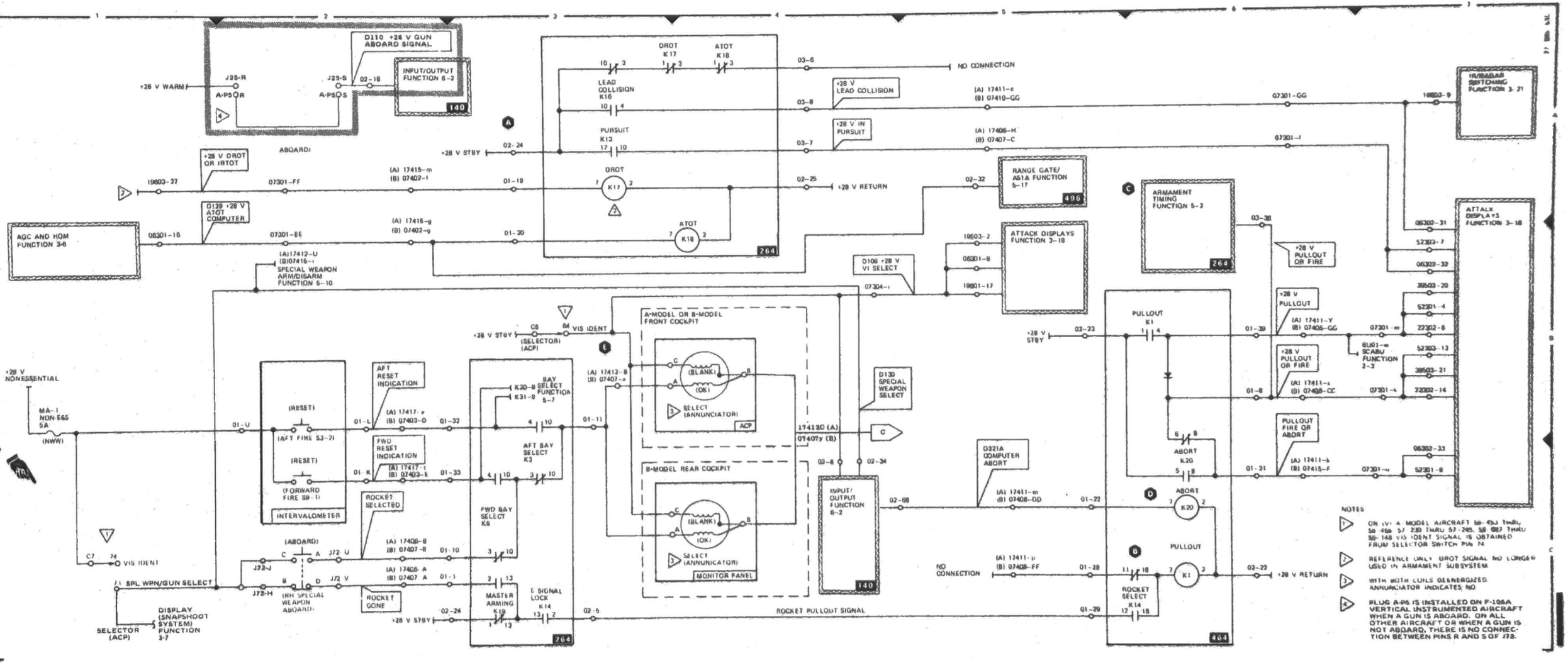
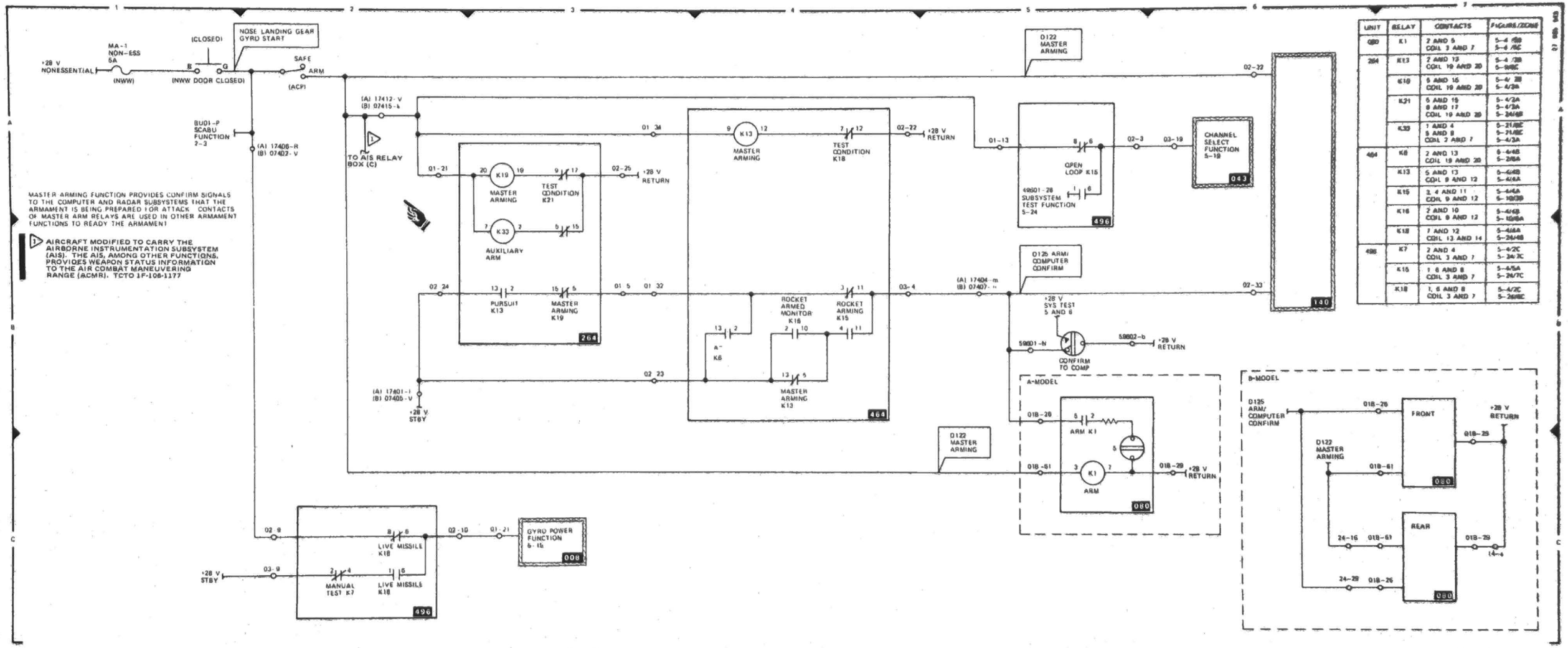


Figure 5-3. Armament Display (Sheet 2 of 2)



UNIT	RELAY	CONTACTS	FIGURE/ZONE
080	K1	2 AND 5 COIL 3 AND 7	5-4 /8B 5-4 /8C
264	K13	2 AND 13 COIL 19 AND 20	5-4 /3B 5-9/8C
	K19	5 AND 15 COIL 19 AND 20	5-4/ 3B 5-4/3A
	K21	5 AND 15 8 AND 17 COIL 19 AND 20	5-4/3A 5-4/3A 5-24/4B
	K33	1 AND 4 5 AND 8 COIL 2 AND 7	5-21/8C 5-21/8C 5-4/3A
464	K8	2 AND 13 COIL 19 AND 20	5-4/4B 5-2/8A
	K13	5 AND 13 COIL 9 AND 12	5-4/4B 5-4/6A
	K15	3, 4 AND 11 COIL 9 AND 12	5-4/4A 5-10/3B
	K16	2 AND 10 COIL 9 AND 12	5-4/4B 5-10/6A
	K18	7 AND 12 COIL 13 AND 14	5-4/4A 5-24/4B
496	K7	2 AND 4 COIL 3 AND 7	5-4/2C 5-24/3C
	K15	1 6 AND 8 COIL 3 AND 7	5-4/5A 5-24/7C
	K18	1, 6 AND 8 COIL 3 AND 7	5-4/2C 5-26/8C

Figure 5-4. Master Arming

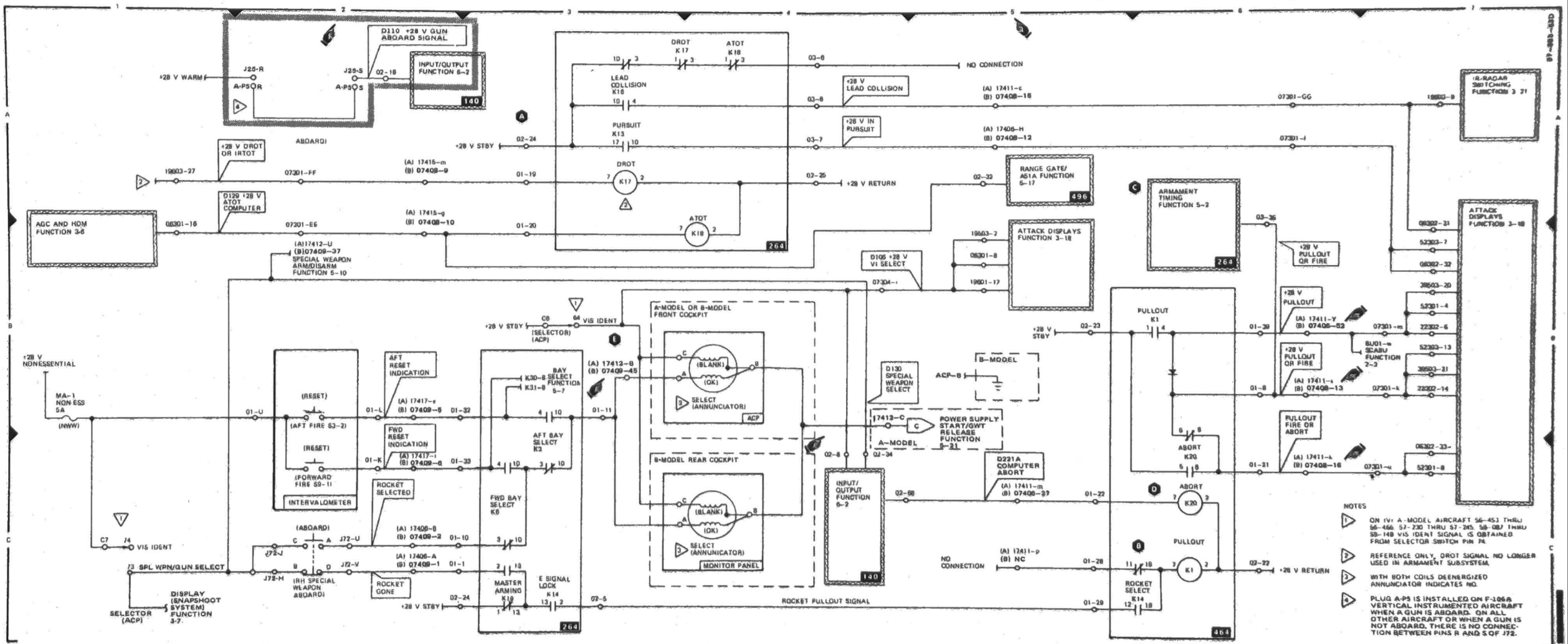
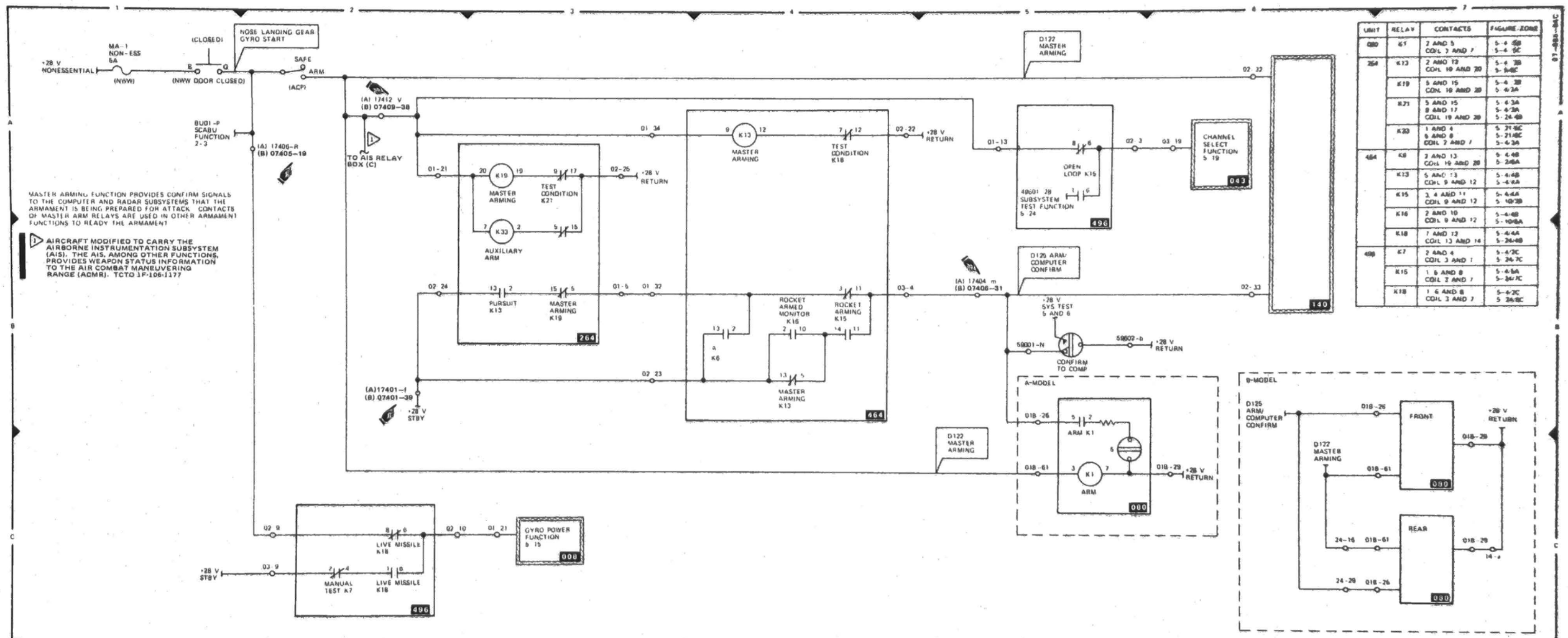


Figure 5-3. Armament Display (Sheet 2 of 2)

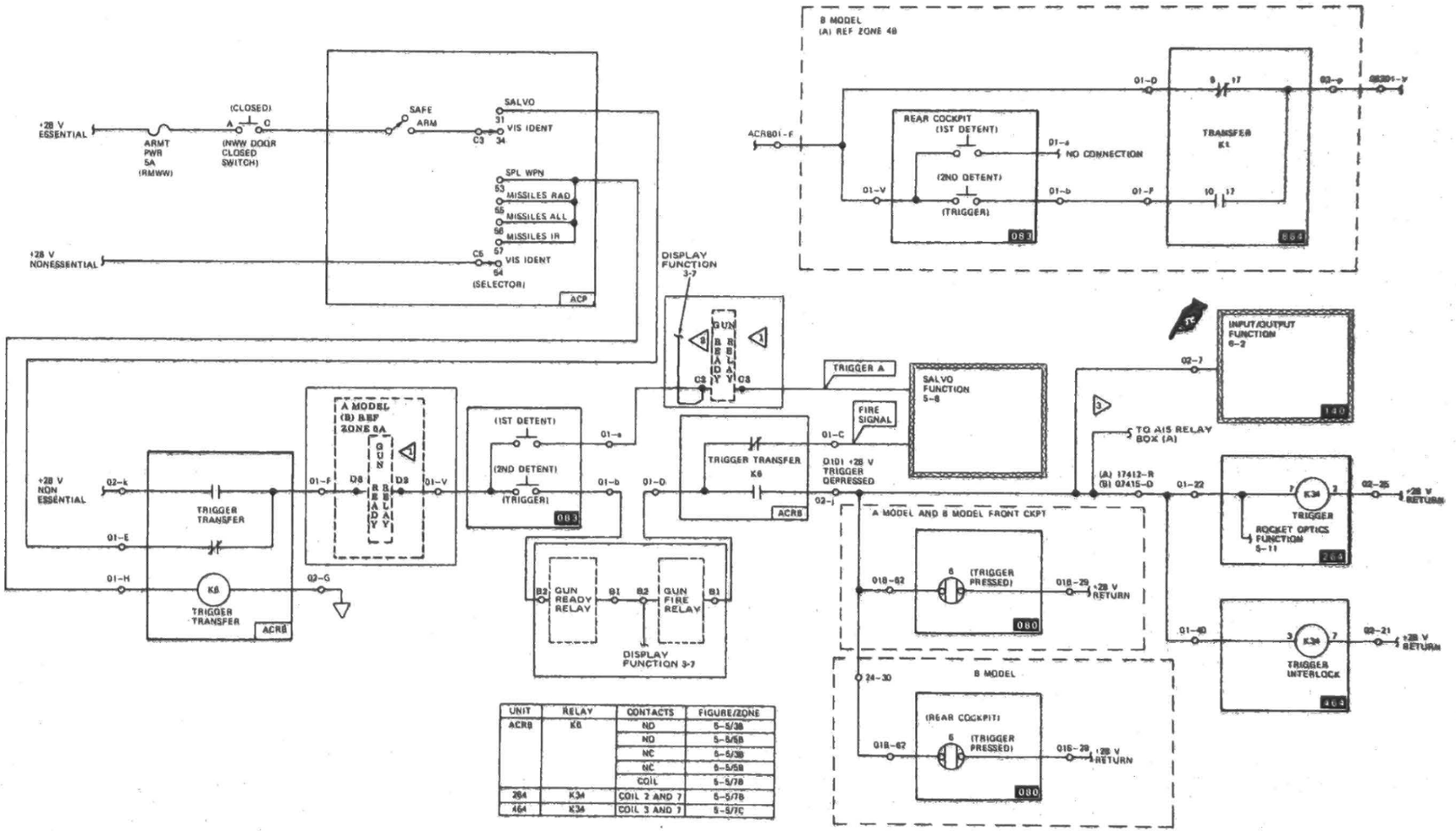


UNIT	RELAY	CONTACTS	FIGURE-ZONE
030	K7	2 AND 5 COIL 3 AND 7	5-4 5B 5-4 5C
264	K13	2 AND 13 COIL 19 AND 20	5-4 3B 5-5B
	K19	5 AND 15 COIL 19 AND 20	5-4 3B 5-6 3A
	K21	5 AND 15 8 AND 17 COIL 19 AND 20	5-6 3A 5-6 3A 5-24 4B
	K33	1 AND 4 6 AND 8 COIL 2 AND 7	5-21 5C 5-21 5C 5-6 3A
464	K6	2 AND 13 COIL 19 AND 20	5-4 4B 5-2 4A
	K13	5 AND 13 COIL 9 AND 12	5-4 4B 5-4 2A
	K15	3, 4 AND 11 COIL 9 AND 12	5-4 4A 5-10 2B
	K16	2 AND 10 COIL 9 AND 12	5-4 4B 5-10 2A
	K18	7 AND 12 COIL 13 AND 14	5-4 4A 5-24 4B
496	K7	2 AND 4 COIL 3 AND 7	5-4 3C 5-24 7C
	K15	1 & AND 8 COIL 3 AND 7	5-4 5A 5-24 7C
	K18	1 & AND 8 COIL 3 AND 7	5-4 7C 5-24 8C

Figure 5-4. Master Arming

Placing the selector switch (ACP) in any armament position energizes trigger transfer relay K6. When the trigger switch (083) is fully depressed, the trigger depressed signal, D101, is routed to the computer and to the 264 and 464 units. The trigger depressed signal also lights the "6" lamp on the 080 unit. Trigger relay K34 (264) must be kept energized during the period that the computer delivers the D and E signals. Trigger interlock relay K34 (464) when energized prevents mode switching (lead collision to pursuit and vice versa). When the selector switch (ACP) is positioned to SALVO and the trigger fully depressed, signals are provided to operate the armament doors and launchers, fire the missile, and eject the special weapon. In rocket optics mode (figure 5-11), the trigger signal is used to generate the C and E signals.

1. Applicable to F-106A Vertical Instrumented Aircraft after TCTO 1F-106A-658 is incorporated.
2. Wire incorporated by TCTO 1F-106A-658 for future use when gunsight camera is incorporated.
3. AIRCRAFT MODIFIED TO CARRY THE AIRBORNE INSTRUMENTATION SUBSYSTEM (AIS). THE AIS, AMONG OTHER FUNCTIONS, PROVIDES WEAPON STATUS TO THE AIR COMBAT MANEUVERING RANGE (ACMR). TCTO 1F-106-1177



UNIT	RELAY	CONTACTS	FIGURE/ZONE
ACR8	K6	NO	5-5/3B
		NO	5-5/5B
		NC	5-5/3B
		NC	5-5/5B
		COIL	5-5/7B
264	K34	COIL 2 AND 7	5-5/7B
464	K34	COIL 3 AND 7	5-5/7C

Figure 5-5. Armament Trigger

The normal full complement of missile armament consists of IR missiles on the aft launchers and radar missiles on the forward launchers. Description of circuit operation for this loading and an armament selection of "MISSILES – ALL" is provided here. Following this, circuit operation for other missile selections, door operation for special weapon and salvo selection, and manual door closure are described.

A Arming and bay selection: Closure of the ARM-SAFE switch and nose wheel well door closed switch energizes master arming relay K19 (264 unit, figure 5-4) and ignitor safety relay K14. The bay select circuits (figure 5-7) cause K4 and K7 (264) to energize and supply +28 volts to intervalometer relays, K4 and K5. Relay K5 energizes and locks out relay K4, which forces the aft bay missiles to be launched first followed by the forward bay missiles. Energizing the ignitor safety relay K14 closes the ground return to ignition interlock relay K2 (054) so that each missile can receive the fire signal at E-time.

B C-time: At C-time the extension signal is transferred from relays K10 and K12 (264) through the armament control relay box (ACRB) to pin 01-D of the intervalometer. The selector is set to MISSILES ALL, relay K9 (ACRB) is deenergized until the doors start to open, relay K7 (ACRB) is energized for any missile selection and during missile salvo. Energized door indicator relay K5 (ACRB, prevents the DOOR OPEN indicator on the pilots master warning panel from lighting when the doors are intentionally opened. Energized door hold relay K4 partially completes a circuit, used after the bay doors open to keep the doors open independent of the extension signal.

C Door start: Door opening is started when the extension signal reaches the intervalometer at pin 01-D. Intervalometer cam switches S3 and S9 are in the reset position and close the circuits as shown. Aft launcher extend relay K7 is energized, followed by aft door interlock relay K6. Contacts of relay K7 completes the circuit that allows the door selection valve (sheet 3) to open the bay doors. Relay K6 partially opens the circuit path to intervalometer relay K3 and closes a circuit (figure 5-22) that causes the missiles fire signal (when delivered) to be diverted to the aft launcher missiles.

D Door control: As the doors start to open, the RH door close or LH door close switch. Causes door open relay K2 (ACRB) and auxiliary door open relay (airframe) to energize. The auxiliary door open relay must be energized before activation of the thermal battery of the special weapon can take place (figure 5-12). Door open relay K2 performs the following functions: a) in conjunction with relay K4, provides a circuit to maintain the extension signal independent of the C-signal, b) energizes the pull-in coil of door recycle relay K3, which locks itself in as long as the C-signal is present (to allow the pilot to manually close the doors and keep them closed in the presence of the C-signal), c) to light the master warning panel DOOR OPEN light when the C-signal is not present.

E Power supply start and bay select prevention: As the doors start to open, a RH door close switch provides +28 volts to energize power supply relay K3 (054). Both the RH and LH door close switches provide a door open signal to the 264 unit to prevent any reselection of missile armament already selected (figure 5-7).

F Launcher extension: When the doors are fully open, RH and LH door open switches energize door position relay (airframe). This relay closes the circuit path (sheet 3) to the aft launcher selector valve and the aft launchers extend (forward launcher extension is prevented by deenergized forward selector relay K4).

G Launcher cycling: The E-signal energizes fire relay K10. If the right and left aft launchers are extended and the forward launchers retracted (figure 5-22), the intervalometer aft fire clutch is engaged. The aft cams are driven and cam switches S1 through S6 are actuated to launch the aft missiles, retract the aft launchers, and extend the forward lauchers. Switch S3 deenergizes K5, K6, and K7 causing K4, K3, and K1 to energize. This relay configuration results in aft launcher retraction and forward launcher extension. When the forward launchers reach the down position, the intervalomeier fire clutch is engaged (figure 5-22). The forward cams are driven and cam switches S7 through S12 are actuated to launch the forward missiles, retract the lauchers, and close the bay doors. The forward launchers are retracted when S9 deenergizes relay K3 and K4. The doors are closed when relay K3 deenergizes.

H Bay selection for other missile loading configurations and armament selections is a function of the bay select circuits (figure 5-7). These circuits, in turn energize either relay K4 or K7 (264), or both. Relay K4 and/or K7 then initiate door/launcher cycling in the manner just described.

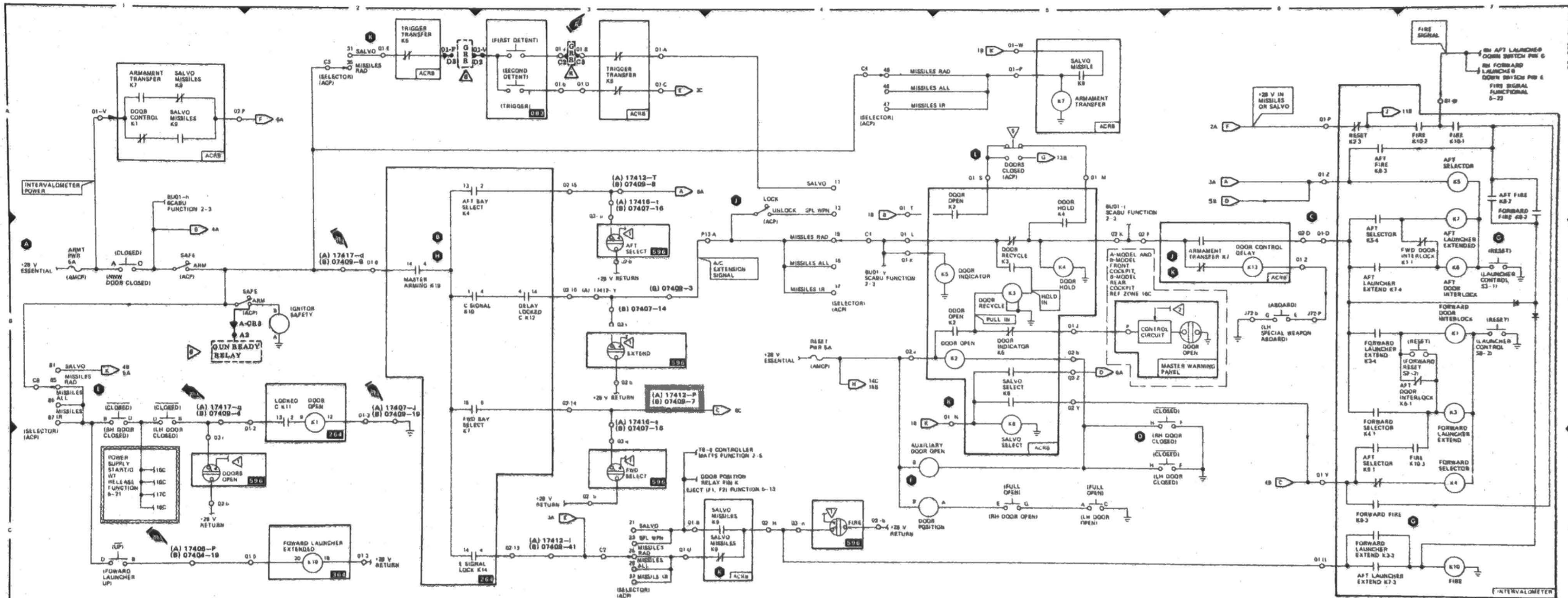
J Door operation for special weapon selection: The (LOCK-UNLOCK) switch must be set to UNLOCK. Armament transfer relay K7 (ACRB) is deenergized for this selection and if a special weapon is loaded, door control delay relay K13 (ACRB) is energized. Relay K13 energizes relay K14 and K1. Relay K1 provide the circuit path to open the doors when energized, and when deenergized provides the circuit path to close the doors. When the special weapon is ejected, relay K13 will deenergize but the door control timer delay circuit maintains K1 energized for about 0.75 seconds to ensure that the special weapon is clear of the bay doors.

K Salvo operation: Salvo is initiated by setting the selector switch to SALVO and pressing the armament trigger switch (083) to the second detent. At the first detent the door open signal is generated since trigger transfer relay K6 (ACRB) is deenergized in salvo. If a special weapon is aboard, armament transfer relay K7 and missile salvo relay K9 are both deenergized (figure 5-8) forcing salvo of the special weapon first. When the special weapon is ejected, or 25 seconds elapse after the special weapon fails to eject, relay K9 and K7 energize. Salvo select relay K8 selects both missile bays. Armament transfer relay K7 provides the extension signal. Salvo missiles relay K9 provides the fire signal.

L Manual door close. If the doors remain open for any reason, the DOORS CLOSE switch can be used to retract the launchers and close the doors. The switch opens the door hold circuit and energizes manual door close relay and manual retract control relay K2 which retract the launcher and close the doors.

UNIT	RELAY	CONTACT	FIGURE/ZONE
264	K1	COIL 9 AND 12	5-6/2B
	K4	2 AND 13 COIL 19 AND 20	5-6/2A 5-7/3B
	K7	6 AND 15 COIL 19 AND 20	5-6/2B 5-7/3B
	K10	1 AND 4 COIL 2 AND 7	5-6/2B 5-2/4B
	K11	2 AND 13 COIL 19 AND 20	5-6/2B 5-2/7B
	K12	4 AND 14 COIL 19 AND 20	5-6/3B 5-2/7C
	K14	4 AND 14 COIL 19 AND 20	5-6/2C 5-2/6C
	K19	4 AND 14 COIL 19 AND 20	5-6/2B 5-4/3A
364	K19	COIL 19 AND 20	5-6/2C
ACRB	K1	NC NC NO COIL	5-6/1A 5-6/12A 5-6/12C 5-6/12C
	K2	NO NO COIL	5-6/5B 5-6/5A 5-6/5B
	K3	NC NO COIL	5-6/5B 5-6/5B 5-6/5B
	K4	NO COIL	5-6/5A 5-6/5B
	K5	NC COIL	5-6/5B 5-6/5B
	K6	NC NC NC COIL	5-6/2A 5-6/3A 5-6/3A 5-6/3C
	K7	NC NC NC NO NO NO COIL	5-6/12A 5-6/6B 5-6/12C 5-6/12A 5-6/12C 5-6/6B 5-6/1A 5-6/6A
	K8	NO NO COIL	5-6/5B 5-6/5B 5-6/5B
	K9	NC NC NO NO NO COIL	5-6/1A 5-6/4C 5-6/4C 5-6/1A 5-6/5A 5-6/3B
	K11	NC NC NO COIL	5-6/13A 5-6/13C 5-6/13A 5-6/13A
	K12	NC NC NC NO NO COIL	5-6/13B 5-6/13C 5-6/13B 5-6/13A 5-6/13A 5-6/13B
	K13	NO NO COIL	5-6/12C 5-6/12C 5-6/6B
	K14	NC NO COIL	5-6/13C 5-6/12C 5-6/13C
INTER-VALO-METER	K1	NC (-1) COIL	5-6/7B 5-6/7B
	K2	NC (-3) COIL	5-6/6A 5-22/2A
	K3	NC (-1) NO (-1) NC (-2) NO (-3) NO (-4) COIL	5-6/11A 5-6/11C 5-6/12A 5-6/6C 5-6/6B 5-6/7B
	K4	NO (-1) (NC) (-2) NO (-3) COIL	5-6/6B 5-6/12A 5-6/12B 5-6/7C
	K5	NC (-1) NO (-1) NO (-2) NC (-3) NO (-4) COIL	5-6/6C 5-6/6C 5-6/12B 5-6/12B 5-6/7A 5-6/6A
	K6	NC (-1) COIL	5-6/7B 5-6/7B
AIR-FRAME	K7	NC (-1) NC (-2) NO (-2) NO (-3) NO (-4) COIL	5-6/11A 5-6/12B 5-6/11B 5-6/6C 5-6/6B 5-6/7A
	K8	NO (-2) NO (-3) COIL	5-6/7A 5-6/7A 5-22/4A
	K9	NO (-2) NO (-3) COIL	5-6/7A 5-6/6C 5-22/4C
	K10	NO (-1) NO (-2) NO (-3) COIL	5-6/7A 5-6/7A 5-6/7C 5-6/7C
	IGNITOR SAFETY	COIL A AND B	5-6/2B
	DOOR POSITION RELAY	C AND D F AND G COIL A AND B	5-6/15B 5-6/15C 5-6/4C
	AUXILIARY DOOR OPEN RELAY	COIL A AND B	5-6/4C
	SPECIAL WEAPON MISFIRE	K AND L COIL A1 AND A2 B1 AND B2	5-6/13A 5-23/14B
	FORWARD MISFIRE	K AND L COIL A1 AND A2 B1 AND B2	5-6/13A 5-23/14C
	AUXILIARY AFT MISFIRE RELAY	G AND H D AND E NC COIL A AND B	5-6/13B 5-6/13C 5-23/14B
AMCP	DOOR REMOTE RELAY	C, D AND E F, G AND H COIL A AND B	5-6/14C 5-6/15A 5-6/15C
	LAUNCHER REMOTE RELAY	J, K AND L F, G AND H C, D AND E M, N AND P COIL A AND B	5-6/14A 5-6/14B 5-6/15B 5-6/15C 5-6/15C

Figure 5-6. Door/Launcher Cycling Control (Sheet 1 of 3)



NOTES.

1. +28 V IN SYSTEM TEST 5 AND 8
2. +28 V FROM WARN LIGHT TEST CIRCUIT
3. PIN CONNECTORS OF THE REMOTE CONTROL RECEPTICAL ON ARMAMENT MANUAL CONTROL PANEL
4. +28 V FROM RESET PWR FUSE ON ARMAMENT MANUAL CONTROL PANEL
5. SWITCH SPRING LOADED TO POSITION SHOWN
6. APPLICABLE TO F-106A VERTICAL INSTRUMENTED AIRCRAFT AFTER TCTO 1F-106A-668 MODIFICATION

Figure 5-6. Door Launcher Cycling Control (Sheet 2 of 3)

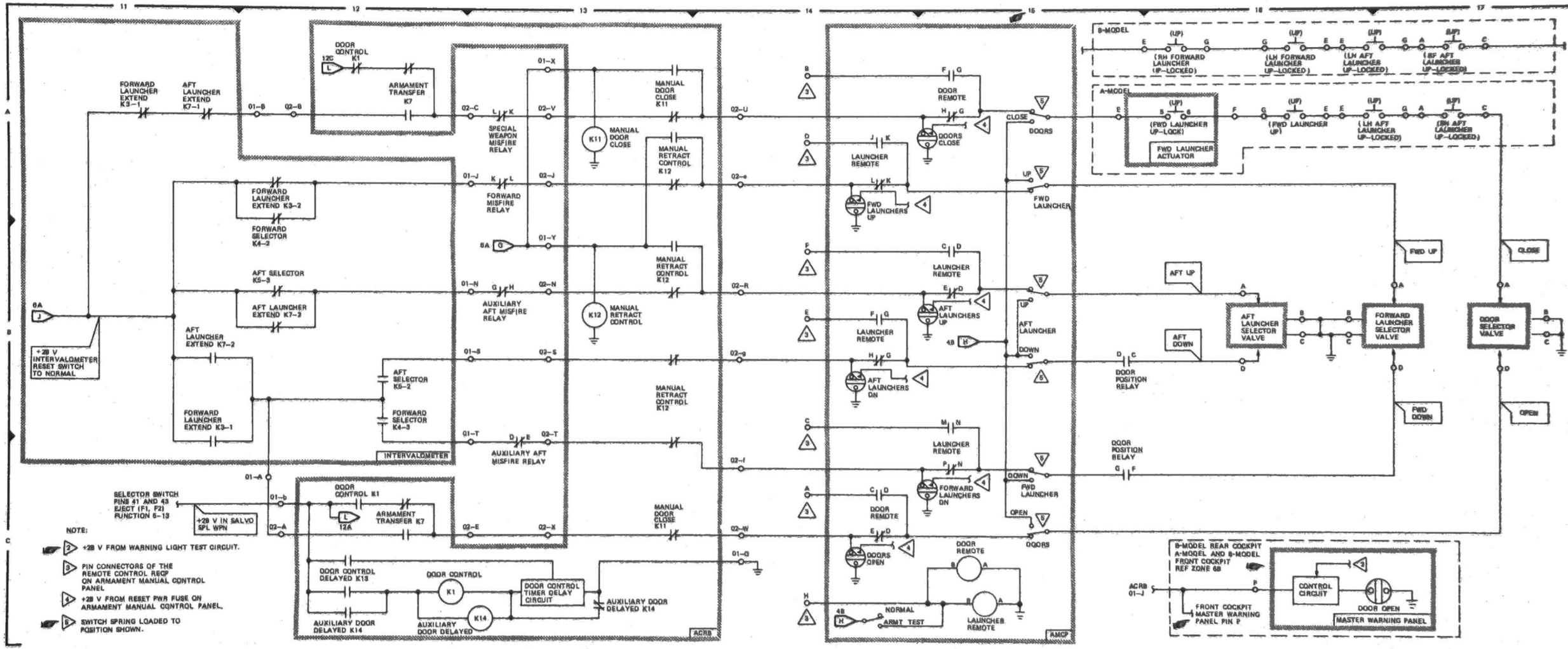


Figure 5-6. Door/Launcher Cycling Control (Sheet 3 of 3)

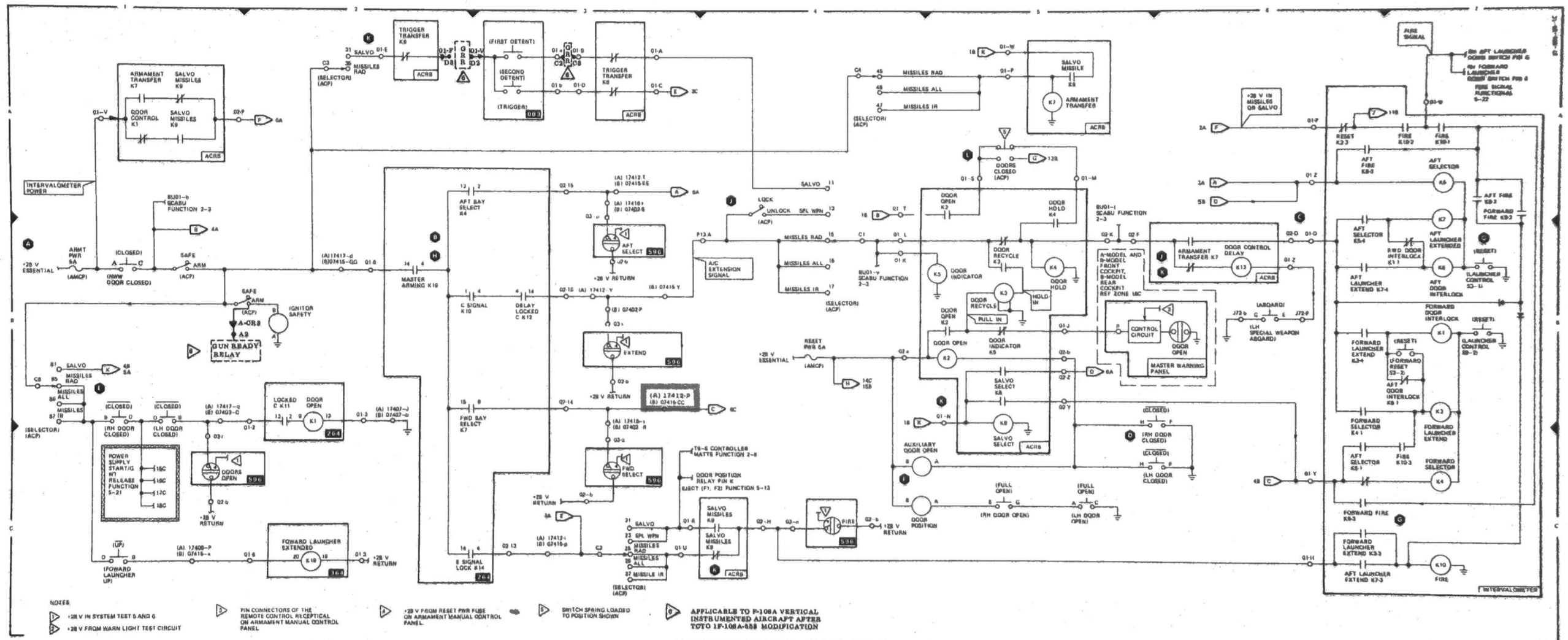


Figure 5-6. Door/Launcher Cycling Control (Sheet 3 of 3)

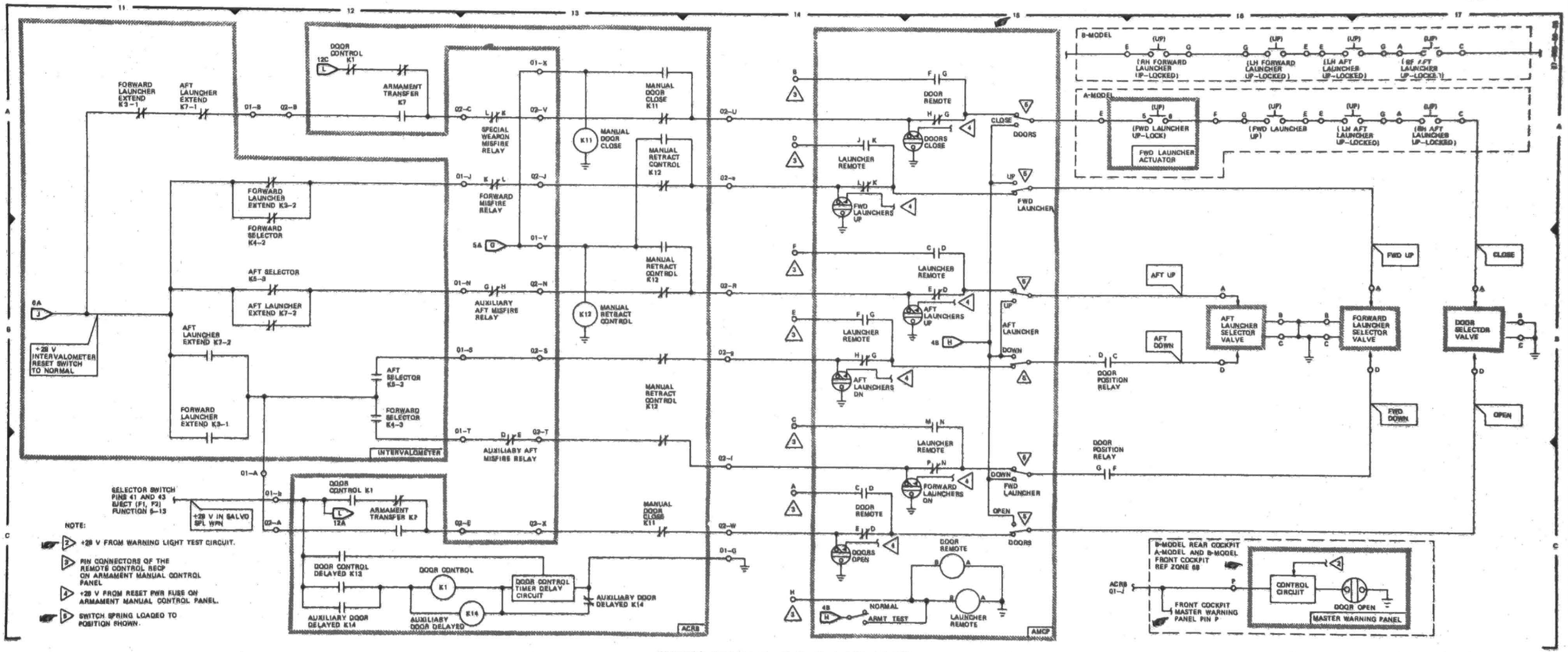


Figure 5-6. Door/Launcher Cycling Control (Sheet 3 of 3)

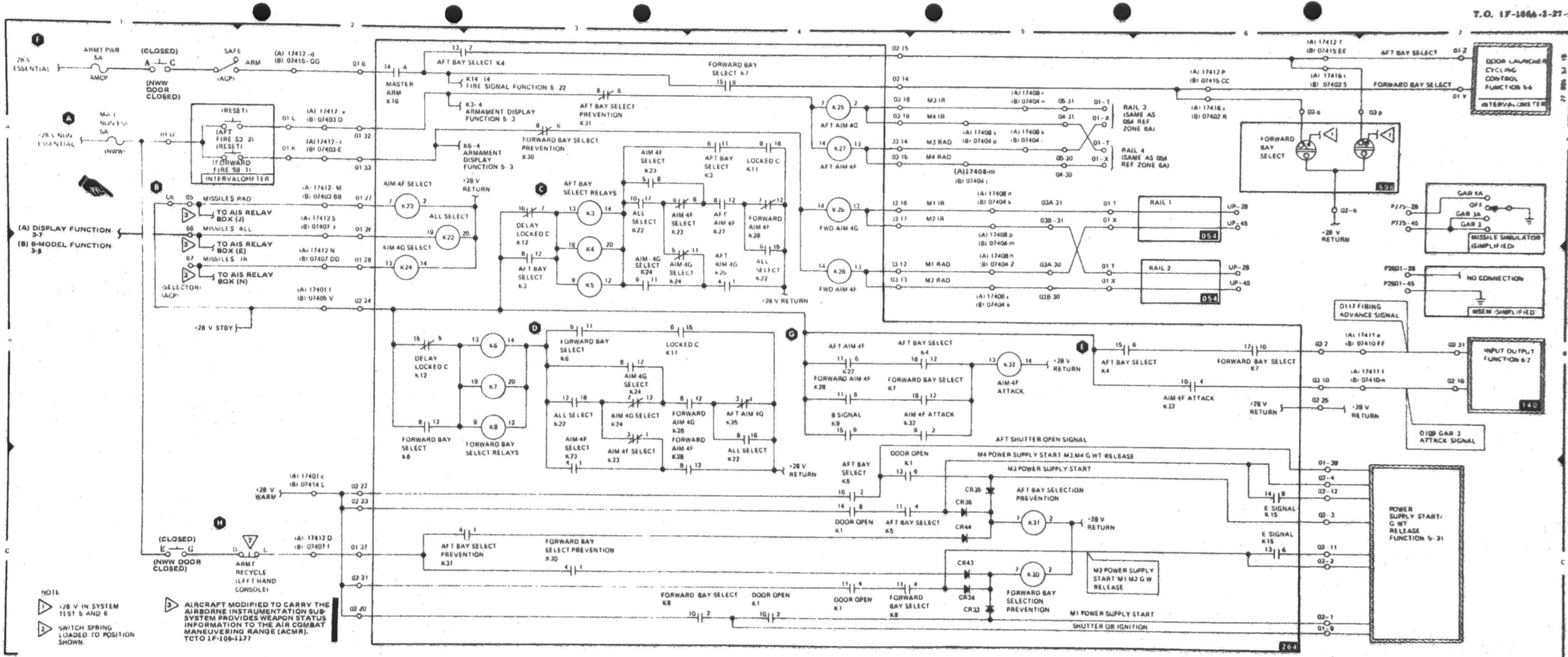
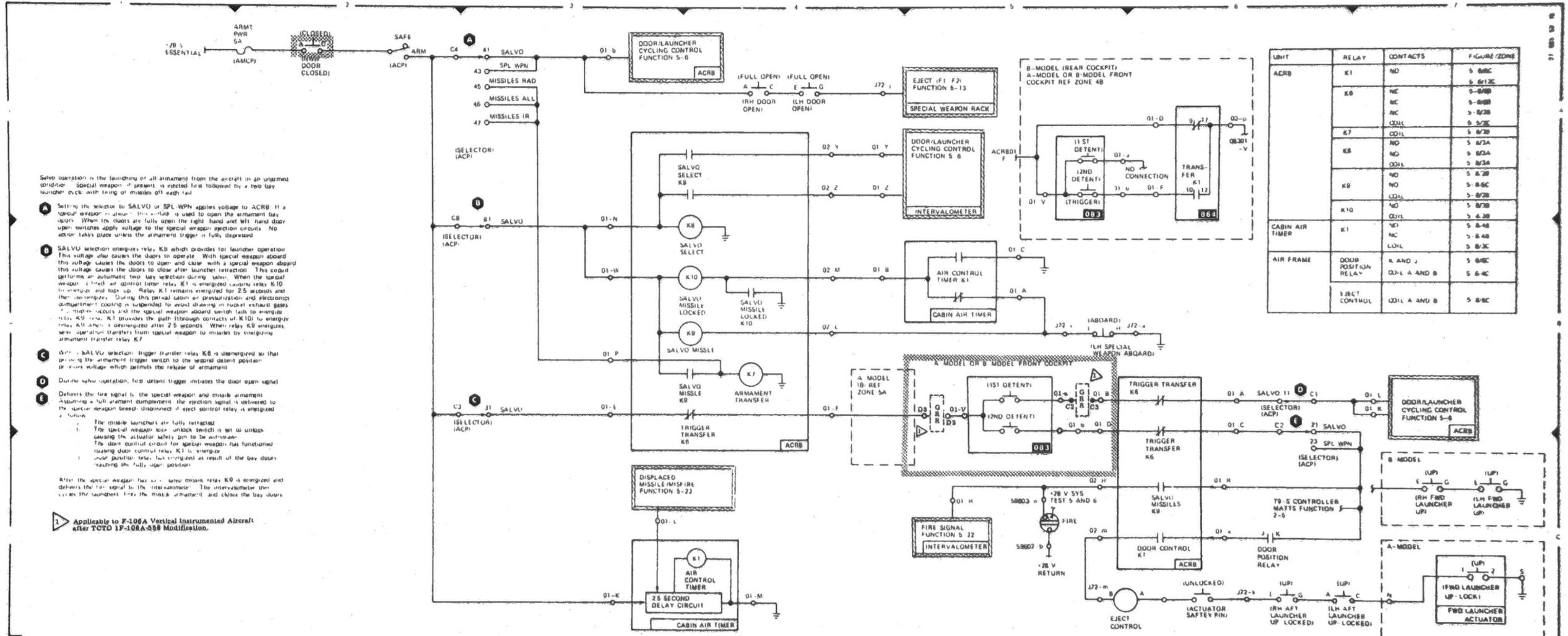


Figure 5-7. Bay Select (Sheet 2 of 2)



UNIT	RELAY	CONTACTS	FIGURE/ZONE
ACRB	K1	NO	5 B/8C 6 B/12C
	K6	NC NC NC COIL	5-B/8B 5-B/8B 5-B/8B 6 B/3C
	K7	COIL	5 B/3B
	K8	NO NO COIL	5 B/3A 6 B/3A 5 B/3A
	K9	NO NO COIL	5 B/3B 5-B/6C 5-B/3B
	K10	NO COIL	5 B/3B 5 B/3B
CABIN AIR TIMER	K1	NO NC COIL	5 B/4B 5-B/4B 5 B/3C
AIR FRAME	DOOR POSITION RELAY	K AND J COIL A AND B	5 B/8C 5 B/4C
	EJECT CONTROL	COIL A AND B	5 B/8C

Salvo operation is the launching of all armament from the aircraft in an unarmed condition. Special weapon, if present, is ejected first followed by a two bay launcher cycle with firing of missiles off each rail.

A Setting the selector to SALVO or SPL WPN applies voltage to ACRB. If a special weapon is aboard, this voltage is used to open the armament bay doors. When the doors are fully open the right hand and left hand door open switches apply voltage to the special weapon ejection circuits. No action takes place unless the armament trigger is fully depressed.

B SALVO selection energizes relay K8 which provides for launcher operation. This voltage also causes the doors to operate. With special weapon aboard this voltage causes the doors to open and close with a special weapon aboard this voltage causes the doors to close after launcher retraction. This circuit performs an automatic two bay selection during salvo. When the special weapon 2 (rail) air control timer relay K1 is energized causing relay K10 to energize and hold up. Relay K1 remains energized for 2.5 seconds and then de-energizes. During this period cabin air pressurization and electronics compartment cooling is suspended to avoid drawing in rocket exhaust gases. A master record and the special weapon aboard switch fails to energize relay K9 only. K1 provides its path (through contacts of K10) to energize relay K9 when it deenergized after 2.5 seconds. When relay K9 energizes, salvo operation transfers from special weapon to missiles by energizing armament transfer relay K7.

C With a SALVO selection trigger transfer relay K6 is deenergized so that placing the armament trigger switch to the second detent position provides voltage which permits the release of armament.

D During salvo operation, first detent trigger initiates the door open signal.

E Delivers the fire signal to the special weapon and missile armament. Assuming a full armament complement the ejection signal is delivered to the special weapon breech disconnect if eject control relay is energized as follows:

1. The missile launchers are fully retracted.
2. The special weapon lock unlock switch is set to unlock causing the actuator safety pin to be withdrawn.
3. The door control circuit for special weapon has functioned causing door control relay K1 to energize.
4. Door position relay has energized as result of the bay doors reaching the fully open position.

After the special weapon has been salvo missile relay K9 is energized and delivers the fire signal to the intervalometer. The intervalometer then closes the launchers, fires the missile armament and closes the bay doors.

1 **Applicable to F-106A Vertical Instrumented Aircraft after TCTO 1F-106A-858 Modification.**

Figure 5-8. Salvo

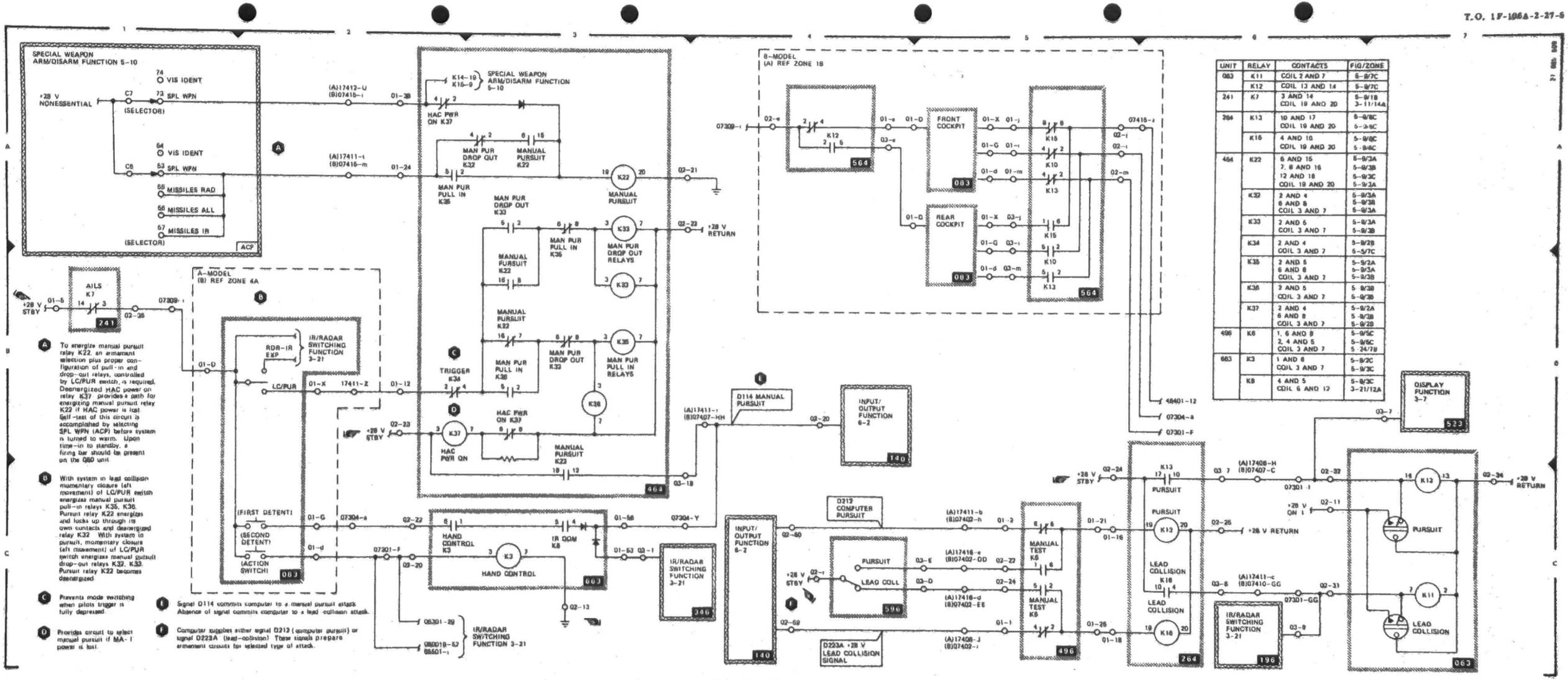


Figure 5-9. LC/PUR Switching

The arm/disarm relays in the AIR-2A, the rocket simulator and the MSR are a double latching type relay. The contacts of this type of relay remain in the position commanded by the last application of voltage to either the arm or disarm coil of the relay. This type of relay is required in the AIR-2A to maintain either an armed (firing) or a disarm (salvo) condition after the AIR-2A separates from the ejection rack.

1. The contacts of the arm/disarm relay are in the disarm position when an AIR-2A, a rocket simulator or an MSR is loaded on the ejection rack. Therefore when power is applied to SW4-35, -28 v is routed to the coil of K17 (464).

2. The energized condition of K17 (464) indicates a disarmed condition exists and the rocket disarm signal is not routed to SW1-14.

3. When SPL WPN (ACP) is selected, the NWW door is closed and the ARM/SAFE (ACP) is set to ARM, the rocket arm signal is routed to SW1-35.

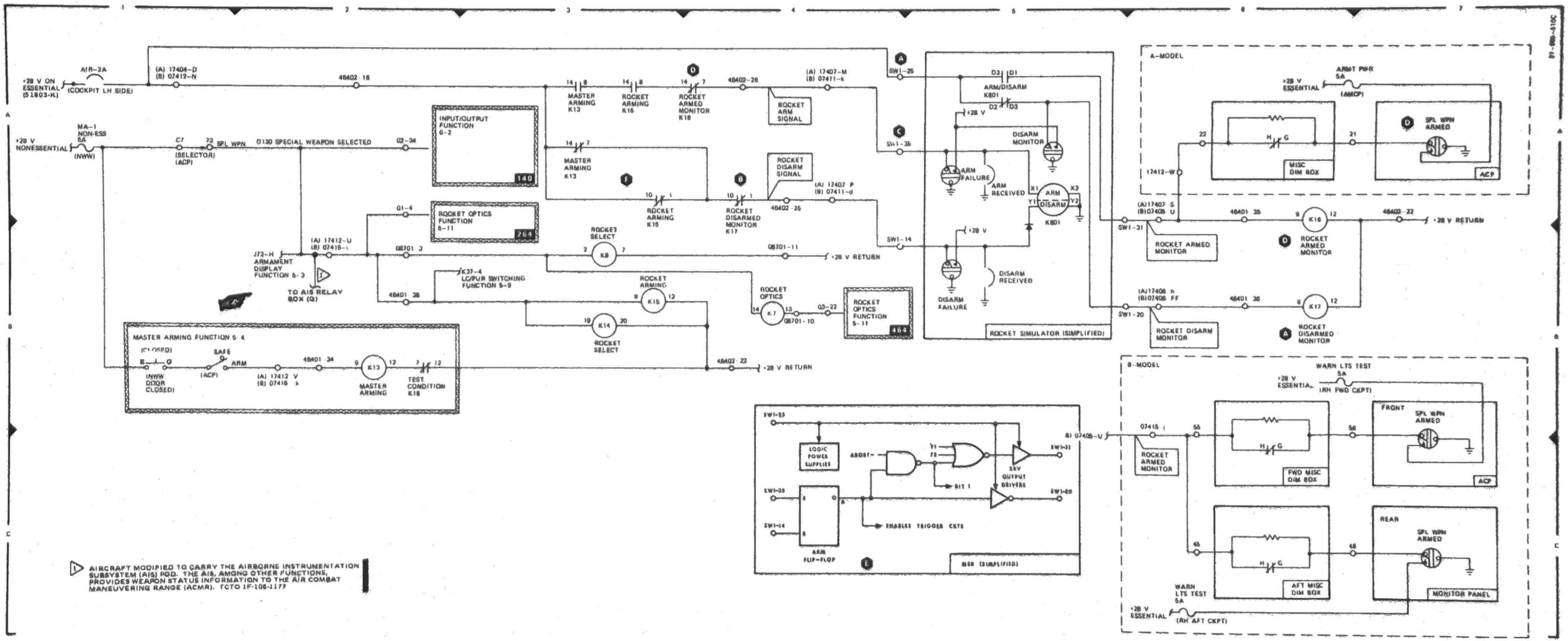
4. The contacts of the arm/disarm relay switch from the disarmed position to the armed position and +28 v is routed to the coil of K16 (464) and the SPL WPN ARMED light (ACP). The energized condition of K16 (464) removes the rocket arm signal 3.

5. The MSR simulates the separation of the AIR-2A from the ejection rack by removing the rocket armed monitor signal, at fire time, when FIRE signals, F1 and/or F2 (MSR) are set.

6. The rocket disarm signal is applied to SW1-14 when either the ARM/SAFE (ACP) is set to SAFE or the SELECTOR (ACP) is set to a position other than SPL WPN and K17 is deenergized.

UNIT	RELAY	CONTACT	FIGURE/ZONE
089	K1	2 AND 5	5-10/2C
087	K7	COIL 13 AND 14	5-10/4B
	K8	COIL 2 AND 7	5-10/2B
464	K13	6 AND 13 7, 8 AND 14 COIL 9 AND 12	5-10/1C 5-10/3A 5-10/2B
	K14	COIL 19 AND 20	5-10/2B
	K15	1 AND 10 4 AND 11 8 AND 14 COIL 9 AND 12	5-10/4A 5-10/2C 5-10/3A 5-10/2B
	K16	2 AND 10 7 AND 14 COIL 9 AND 12	5-10/1C 5-10/4A 5-10/6A
	K17	1 AND 10 COIL 9 AND 12	5-10/4A 5-10/6B
	K19	7 AND 13 COIL 2 AND 7	5-10/2B 5-3/4B
AIR FRAME	AFT MISC DIM RELAY	H AND G	5-10/6C
	FWD MISC DIM RELAY	H AND G	5-10/6C
	MISC DIM RELAY	H AND G	5-10/6A
ROCKET SIMULATOR	K601	D1, D2 AND D3 COIL X1, Y1 AND XY2	5-10/3A 5-10/4A

Figure 5-10. Special Weapon Arm/Disarm (Sheet 1 of 2)



▷ AIRCRAFT MODIFIED TO CARRY THE AIRBORNE INSTRUMENTATION SUBSYSTEM (AIS) POD. THE AIS, AMONG OTHER FUNCTIONS, PROVIDES WEAPON STATUS INFORMATION TO THE AIR COMBAT MANEUVERING RANGE (ACMR). TCTO 1F-106-1177

Figure 5-10. Special Weapon Arm Disarm (Sheet 2 of 2)

In rocket optics mode, the B, C, and E timing signals are delivered in rapid sequences after the armament trigger is fully pressed. The following describes the sequence of events. In order to fire armament the ARM SAFE switch must be in the ARM position which energizes master arming relay K19 (provided the system is not in a test condition). The unlock signal must also be delivered to the special weapon rack.

A With the selector set to SPL WPN rocket select relays K8 (087) and K14 (464) and rocket arm relay K15 (464) are energized.

B Manual pursuit relay K22 is energized when pursuit is selected on the flight stick. In the event of an MA-1 power loss with SPL WPN selected, relay K22 is energized.

C Setting the ALTITUDE BAND SELECTOR to any altitude position causes rocket optics relays K7 (087) and K20 (264) to energize.

D Energized rocket optics relay K20 disconnects the timing signals supplied from the 498 unit. B signal relay K9 is energized when relay K20 energizes. C signal relay K10 energizes through contacts of relay K9 if the armament trigger is fully pressed. While the trigger is pressed, with relay K20 energized, the fire signal is routed through the armament display function to the 080 unit. E signal lock relay K14 is also energized. Delayed locked C relay K12 energizes after relay K10 causing E signal relay to energize.

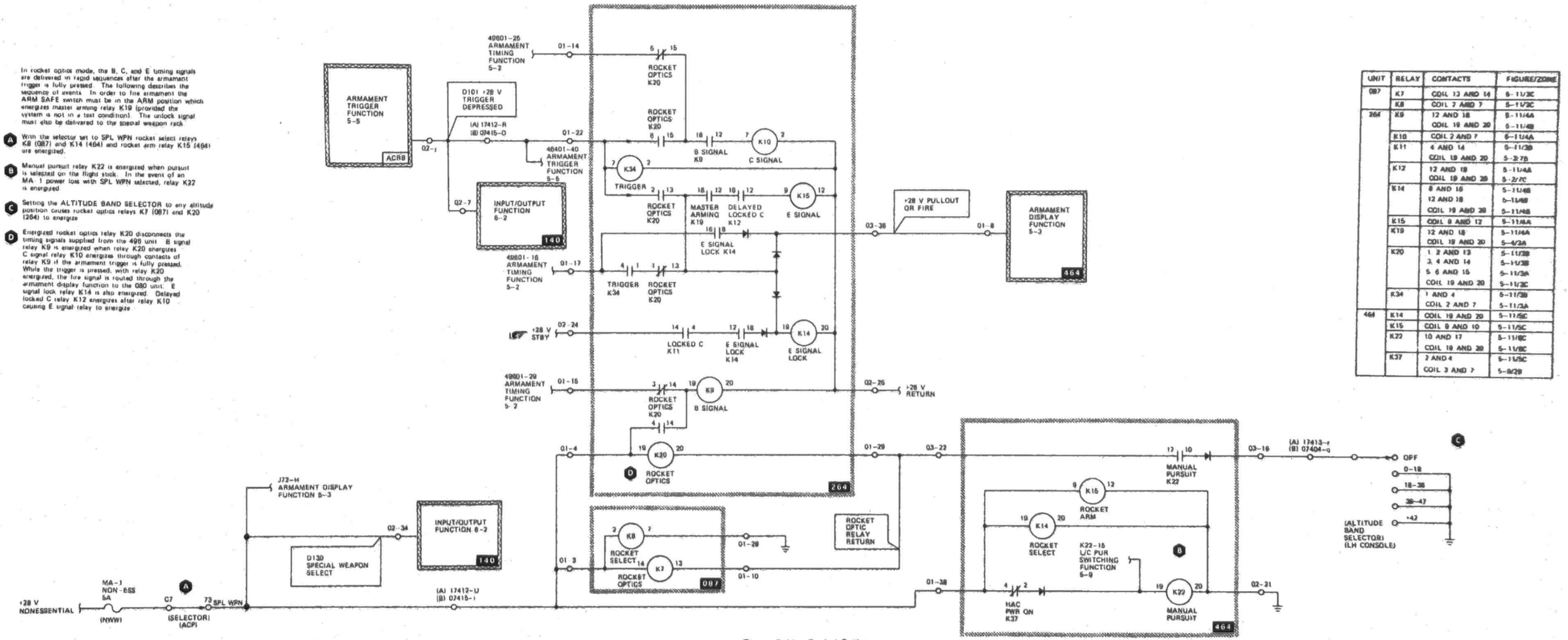


Figure 5-11. Rocket Optics

UNIT	RELAY	CONTACTS	FIGURE/ZONE
087	K7	COIL 12 AND 14	5-11/2C
	K8	COIL 2 AND 7	5-11/2C
264	K9	12 AND 18 COIL 19 AND 20	5-11/4A 5-11/4B
	K10	COIL 2 AND 7	5-11/4A
	K11	4 AND 14 COIL 19 AND 20	5-11/3B 5-2/7B
	K12	12 AND 18 COIL 19 AND 20	5-11/4A 5-2/7C
	K14	8 AND 16 12 AND 18 COIL 19 AND 20	5-11/4B 5-11/4B 5-11/4B
	K15	COIL 8 AND 12	5-11/4A
	K19	12 AND 18 COIL 19 AND 20	5-11/4A 5-4/3A
	K20	1 2 AND 13 3, 4 AND 14 5 6 AND 15 COIL 19 AND 20	5-11/2B 5-11/2B 5-11/3A 5-11/3C
	K34	1 AND 4 COIL 2 AND 7	5-11/3B 5-11/3A
464	K14	COIL 19 AND 20	5-11/5C
	K15	COIL 8 AND 10	5-11/5C
	K22	10 AND 17 COIL 19 AND 20	5-11/6C 5-11/6C
	K37	2 AND 4 COIL 3 AND 7	5-11/5C 5-9/2B

At C-time the thermal battery M_t function provides power to the special weapon to ignite the thermal battery squibs. The heat resulting when the squibs ignite liquifies the electrolyte thus activating the rocket motor battery. The battery is in the circuit of the rocket motor igniter squibs. When the special weapon falls into the airstream at ejection, a lanyard actuates a switch which completes the circuit from the thermal battery to the rocket motor ignition squibs.

(A) Door control relay K1 is energized (figure 5-6) when the extension signal (C-time) is delivered.

(B) Auxiliary door control relay is energized when the armament bay doors start to open (figure 5-6), causing the thermal battery control relay to energize. At this time power is available at special weapon rack aft umbilical plug, pins J and K.

(C) When the bay doors reach nearly full open, the right door open and left door open switches interrupt the circuit.

(D) Sufficient squib blowing power is measured in the rocket simulator if the thermal battery circuit breaker trips.

(E) With the MSR mounted in the special weapon rack, the MOTOR flip-flop is set when squib blowing power is applied (+28V on J5-J and GND on J5-K) and is recorded as bit 15. The MOTOR flip-flop is reset by RETURN when the MSR is disarmed.

(F) Computer logic assumes a propellant temperature value of 60°F. The E-26 propellant temperature input is utilized as a correction term in the relative travel to detonation equation. The MSR provides a simulated propellant temperature value of 60°F.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
ACRB	K1	NO	5-12/3A
		COIL	5-6/12C
AIRFRAME	AUXILIARY DOOR OPEN RELAY	C AND D	5-12/4B
		COIL	5-6/4C
SPECIAL WEAPON RACK	THERMAL BATTERY CONTROL RELAY	C, D AND E	5-12/5A
		F, G AND H	5-12/5B
		COIL A, B	5-12/5B

NOTE

1 WHEN A 450 UNIT IS NOT INSTALLED, CONNECTOR PINS P45002-31 AND P45002-32 ARE SHORTED BY JUMPER CONNECTOR, PART NO. 52630.

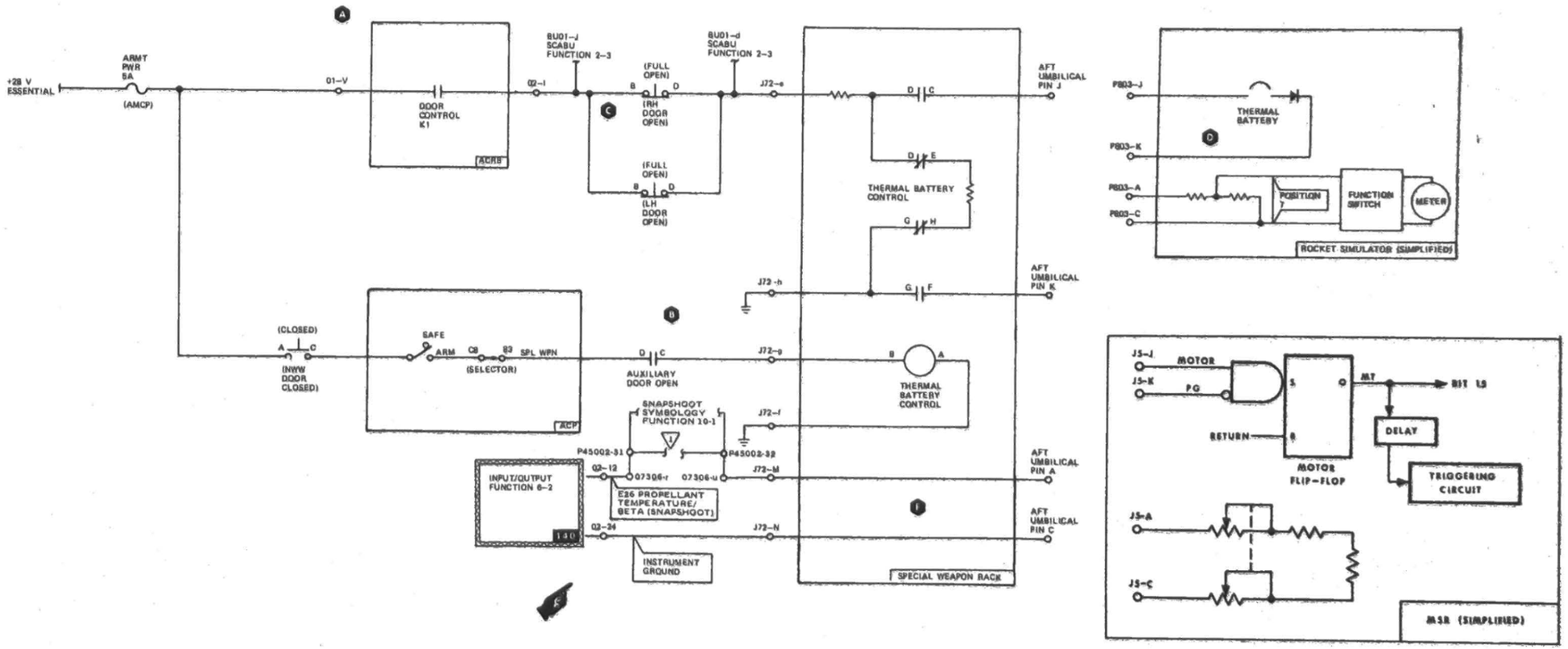


Figure 5-12. Thermal Battery (M_t)

The special weapon is ejected after the E signal is delivered, if the bay doors are fully open and the missile launchers are fully retracted.

A Door control relay K1 is energized at C-time and initiates armament bay door opening for a special weapon or salvo selection (figure 5-6).

B When the armament bay doors are fully open, the door open switches close the circuit path shown. Door position relay is also energized (figure 5-6).

C When the E signal is delivered K14 (264) is energized and the ejection control relay is energized if the actuator safety pin is withdrawn and the launchers are fully retracted.

D Contacts of ejection control relay deliver the ejection signals F1 and F2 to either the rocket simulator or the MSR and also energize the pull-in coil of the special weapon misfire relay Adequate eject signals cause the EJECT 1 and EJECT 2 circuit breakers in the rocket simulator to trip. The eject signals applied to the MSR cause F1 and F2 to be recorded as bits 13 and 14. The eject signals also activate the weapon gone and the triggering circuits of the MSR (figure 5-26). If a special weapon misfire occurs, the hold-in coil of the special weapon misfire relay will energize (figure 5-23) and sustain the misfire condition, otherwise the relay is energized only until the weapon is gone.

E The actuator safety pin is part of the mechanism associated with the shackles which support the special weapon. The position of the pin is controlled by the LOCK-UNLOCK switch (ACP). Setting the LOCK-UNLOCK switch to LOCK inserts the activator safety pin into the shackles to prevent the special weapon from being ejected. Setting the LOCK-UNLOCK switch to unlock retracts the safety pin from the shackles, to allow the special weapon to separate from the rack. To receive an UNLOCK indicator on the Special Weapon Annunciator (ACP) the lock-unlock switch must be in the unlock position and the actuator safety pin retracted.

UNIT	RELAY	CONTACTS	FIGJRE/ZONE
264	K14	4 AND 14 COIL 19 AND 20	5-13/2C 5-2/6C
	K19	4 AND 14 COIL 19 AND 20	5-13/1C 5-4/3A
ACRB	K1	NO COIL	5-13/3C 5-6/12C
AIR-FRAME	DOOR POSI-TION RELAY	J AND K COIL A1 AND B1	5-13/3C 5-6/5B
	SPE-CIAL WEAP-ON MIS-FIRE	COIL A1 AND B1	5-13/5B
SPE-CIAL WEA-PON	EJEC-TION CON-TROL	C AND D F, G AND H J, K AND L COIL A AND B	5-13/4B 5-13/4B 5-13/4B 5-13/4C

Figure 5-13. Eject (F1, F2) (Sheet 1 of 2)

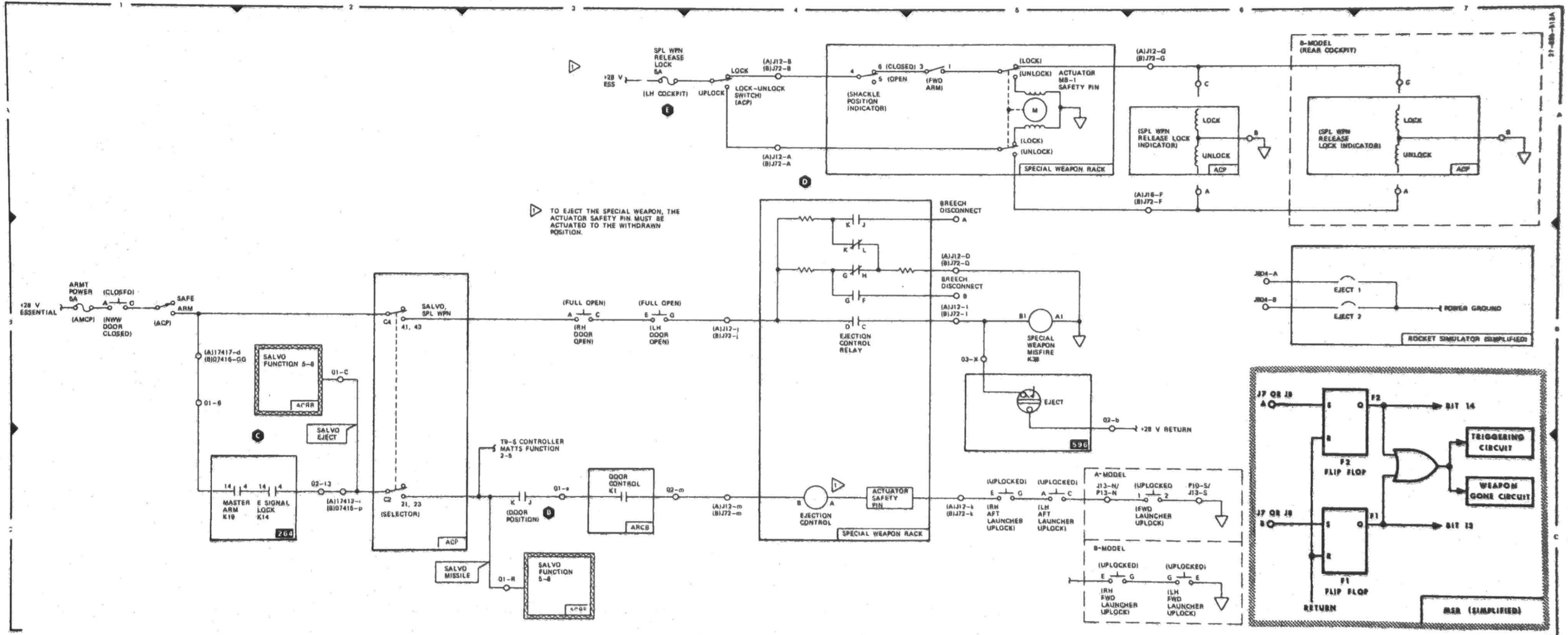


Figure 5-13. Eject (F1, F2) (Sheet 3 of 2)

The setting of the rocket time-of-flight circuits determines the time it takes for the rocket to detonate after firing. The armament subsystem mechanizes the time of flight as a precise voltage ratio and sets it into the rocket. This time is the minimum required to guarantee safe interceptor escape from the radiation and over-pressure effects of the warhead detonation. Safe time of flight is a function of target altitude and interceptor Mach number. The time of flight is normally determined by the MA-1 computer, but can be manually selected by the pilot when using the optical pursuit mode. Since target altitude and interceptor Mach number varies widely from one attack to another, the value of the minimum safe time of flight must be determined and set into the rocket immediately prior to firing.

(A) Either of two a-c voltage sources are used. Normally MA-1 115 v 1600 Hz is used, but in the event of an MA-1 power failure, a rocket optics attack can be executed using aircraft 115 v 400 Hz power. Thus filament voltage is always supplied and high voltage is supplied to the special weapon when special weapon has been selected.

(B) During a normal AIR-2A attack the digital computer determines the time of flight by solving an equation which is a function of target altitude and interceptor Mach number. The digital computer outputs control the four T parameter relays in the 364 unit. The relays, when energized, route a +28 v signal to the 087 unit. This signal is used to energize the T parameter relays located in that unit.

(C) The contacts of the T parameter relays located in the 087 unit are used to shift the ground reference on a precision voltage divider network in that unit. This voltage divider is excited by a special 400 V regulated power supply in the 087 unit. The magnitude of the two output voltages of the voltage divider, measured with respect to ground, represent a particular time of flight. The binary coded output of the computer can set the four T parameter relays into sixteen different combinations thereby yielding sixteen different time of flight settings.

(D) During a rocket optics attack, only four time-of-flight settings are available. Logic for the selection of the rocket optics mode representing the time of flight is provided by the ALTITUDE BAND SELECTOR which is operated manually by the pilot. When the selector is rotated to correspond to target altitude, a ground connection is made to the desired position on the precision voltage divider in the 087 unit. Rocket optics relay K7 energizes if any position other than OFF is selected on the ALTITUDE BAND SELECTOR switch.

(E) The two voltage outputs of the precision voltage divider in the 087 unit are applied through the forward umbilical connector to r-c networks in the firing circuits of the AIR-2A rocket. Charging of the timing and firing capacitors within this network, controls the time of flight of the rocket. Under test conditions sixteen different times of flight voltages can be selected by use of the TIME OF FLIGHT switch on the rocket voltage checker. The voltages selected are monitored by a meter on the rocket voltage checker.

(F) Checks all voltages necessary to prepare and launch the special weapon. Also measures the time of flight voltage ratio determined by the system and converts it to digital form which is recorded. This recorded time-of-flight is then compared to the theoretical time-of-flight which is obtained from a graph of plotted values.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
087	K1	1, 2 AND 13 3, 4 AND 14 5, 6 AND 15 7, 8 AND 16 9, 10 AND 17 COIL 19 AND 20	5-14/3A 5-14/3A 5-14/3A 5-14/3B 5-14/4C 5-14/2C
	K2	1, 2 AND 13 3, 4 AND 14 5, 6 AND 15 7, 8 AND 16 9, 10 AND 17 COIL 19 AND 20	5-14/4A 5-14/4C 5-14/3B 5-14/4C 5-14/3C 5-14/2C
	K3	1 AND 13 2 AND 13 3, 4 AND 14 5 AND 15 6 AND 15 7 AND 16 8 AND 16 COIL 19 AND 20	5-14/4A 5-14/4B 5-14/3B 5-14/3B 5-14/3C 5-14/4B 5-14/4C 5-14/2C
	K4	1 AND 9 2 AND 9 COIL 13 AND 14	5-14/4B 5-14/4C 5-14/2C
	K6	1 AND 2 COIL 3 AND 7	5-14/2C 5-14/3C
	K7	3 AND 10 4 AND 10 5, 6 AND 11 7, 8 AND 12 COIL 13 AND 14	5-14/4A 5-14/4B 5-14/2B 5-14/2B 5-11/3C
	K8	5 AND 8 COIL 2 AND 7	5-14/2B 5-11/3C
364	K9	5 AND 6 COIL 3 AND 7	5-14/1C 5-20/3B
	K10	5 AND 6 COIL 3 AND 7	5-14/1C 5-20/3B
	K11	5 AND 6 COIL 3 AND 7	5-14/1C 5-20/3B
	K12	5 AND 6 COIL 3 AND 7	5-14/1C 5-20/3B

Figure 5-14. T_p and T_F Power Supply (Sheet 1 of 2)

TEST POINT DATA:

(a) +390 ± 30 v from TIMER POS to TIMER NEG.

(b) +300 ± 50 v from CAP POS to CAP NEG.

(c) Floating voltage; varies with time-of-flight setting.

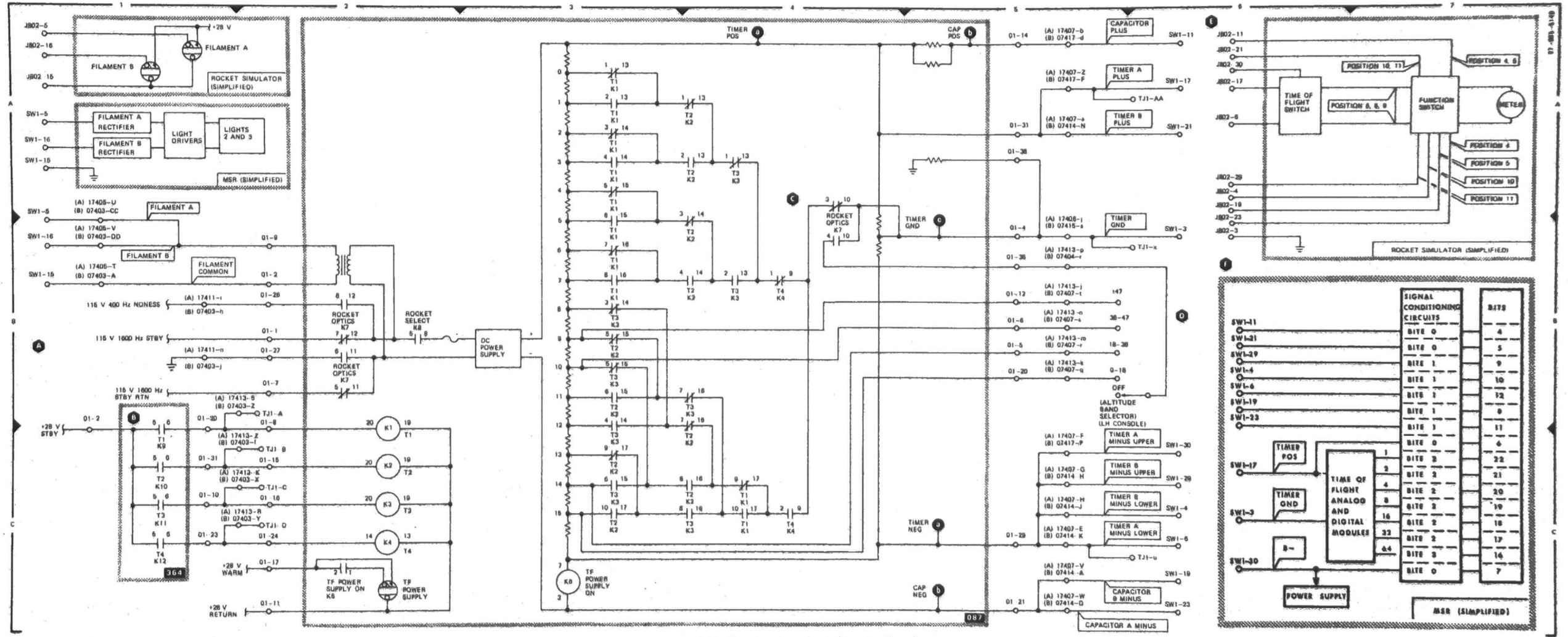
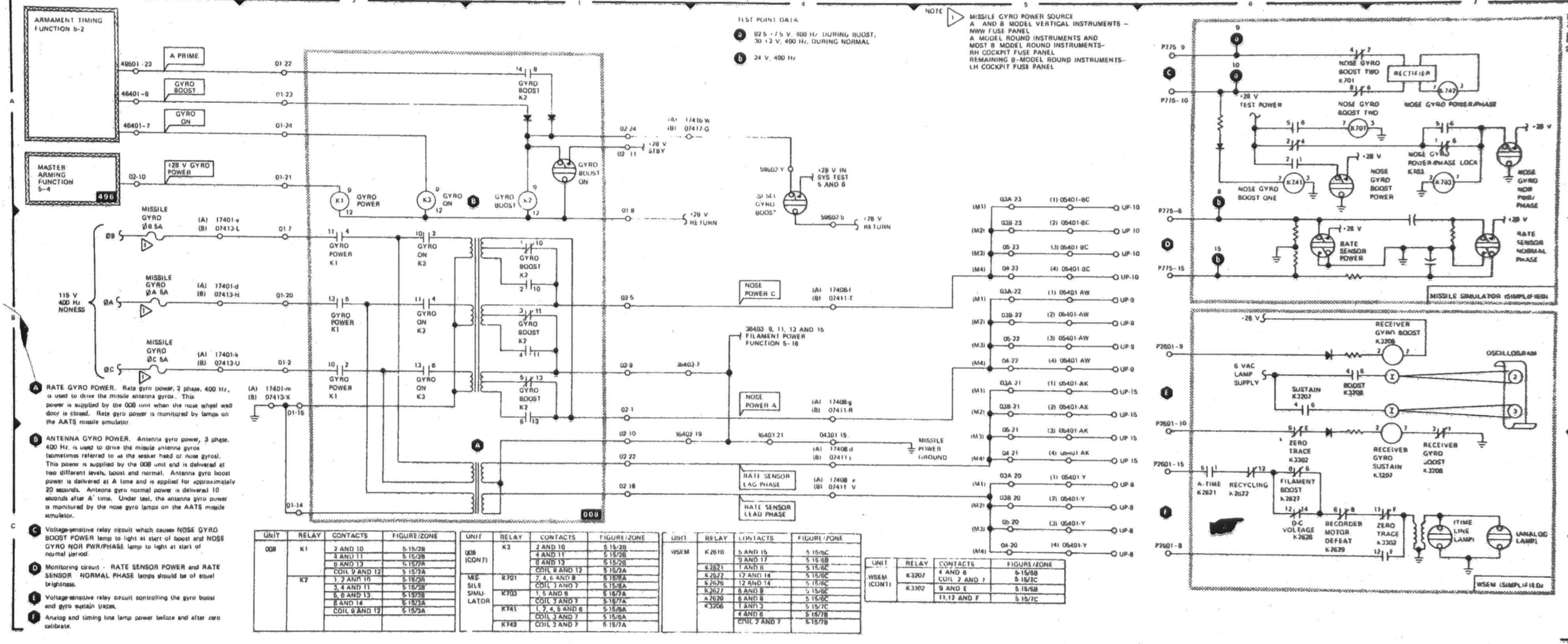


Figure 5-14. T_P and T_F Power Supply (Sheet 2 of 2)



A RATE GYRO POWER. Rate gyro power, 2 phase, 400 Hz, is used to drive the missile antenna gyros. This power is supplied by the 008 unit when the nose wheel well door is closed. Rate gyro power is monitored by lamps on the AATS missile simulator.

B ANTENNA GYRO POWER. Antenna gyro power, 3 phase, 400 Hz, is used to drive the missile antenna gyros (sometimes referred to as the seeker head or nose gyros). This power is supplied by the 008 unit and is delivered at two different levels, boost and normal. Antenna gyro boost power is delivered at A time and is applied for approximately 20 seconds. Antenna gyro normal power is delivered 10 seconds after A time. Under test, the antenna gyro power is monitored by the nose gyro lamps on the AATS missile simulator.

C Voltage-sensitive relay circuit which causes NOSE GYRO BOOST POWER lamp to light at start of boost and NOSE GYRO NOR PWR/PHASE lamp to light at start of normal period.

D Monitoring circuit – RATE SENSOR POWER and RATE SENSOR NORMAL PHASE lamps should be of equal brightness.

E Voltage-sensitive relay circuit controlling the gyro boost and gyro sustain tones.

F Analog and timing line lamp power before and after zero calibrate.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
008	K1	2 AND 10	5-15/2B
		4 AND 11	5-15/2B
		8 AND 13	5-15/2A
		COIL 9 AND 12	5-15/2A
	K2	1, 2 AND 10	5-15/3A
		3, 4 AND 11	5-15/3B
		5, 6 AND 13	5-15/3B
		8 AND 14	5-15/3A
		COIL 9 AND 12	5-15/3A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
008 (CONT)	K3	2 AND 10	5-15/2B
		4 AND 11	5-15/2B
		8 AND 13	5-15/2B
		COIL 9 AND 12	5-15/2A
MISSILE SIMULATOR	K701	2, 4, 6 AND 8	5-15/8A
		COIL 1 AND 7	5-15/8A
	K703	1, 5 AND 6	5-16/7A
		COIL 3 AND 7	5-16/7A
	K741	1, 2, 4, 5 AND 6	5-15/8A
		COIL 3 AND 7	5-15/8A
	K743	COIL 3 AND 7	5-15/7A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
WSEM	K2610	5 AND 15	5-15/6C
		9 AND 17	5-15/6B
	K2621	1 AND 6	5-15/6C
	K2622	12 AND 14	5-15/6C
	K2626	12 AND 14	5-15/6C
	K2627	8 AND 8	5-15/6C
	K2629	6 AND 8	5-15/6C
	K3206	1 AND 3	5-15/7C
		4 AND 6	5-15/7B
		COIL 2 AND 7	5-15/7B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
WSEM (CONT)	K3207	4 AND 6	5-15/8B
		COIL 2 AND 7	5-15/7C
	K3302	9 AND E	5-15/6B
		11,12 AND F	5-15/7C

Figure 5-15. Gyro Power

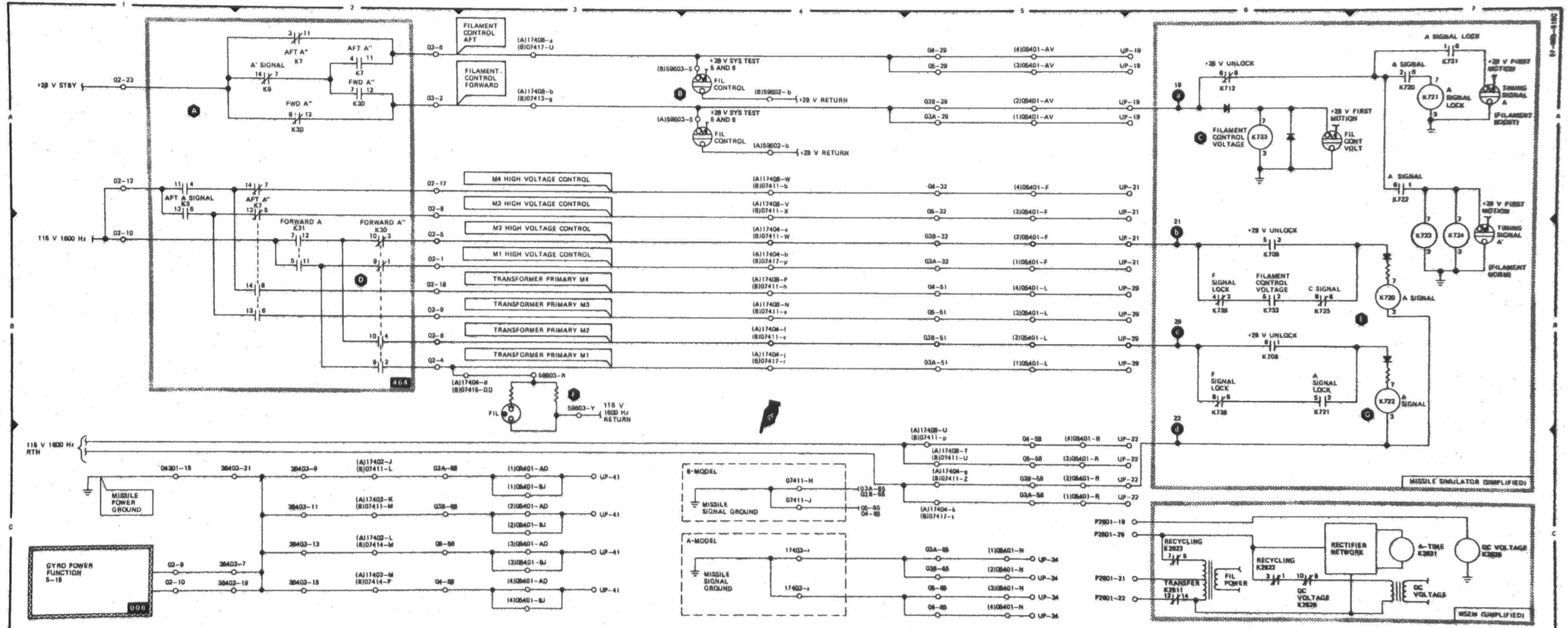


Figure 5-16. Filament Power (Sheet 2 of 2)

The range gate/A51A function establishes radar range gate adequacy and accomplishes and checks the synchronization of each missile, missile simulator, or WSEM range gate with the radar range gate prior to flight time. Synchronization assures the gating of radar echoes from any selected target. It ensures more positive lock-on to a target by improving target return signal "signal-to-noise" ratio and effecting target range discrimination should several targets lie on the same radar line-of-sight. Additionally this function provides relay control of the computer A51A signal output for WSEM recording.

Course preliminary synchronization of the missile range gate to the radar range gate is achieved before the radar is switched to the missile prf (C time) by pre-positioning of the missile range gate to zero range. Precise alignment of the missile gate into time coincidence with target video results (C time) when the radar prf is switched to the precision missile prf preassigned for the mission. Missile and WSEM range gate synchronization with updated radar range gate position information proceeds continuously during a missile flight to assure proper missile tracking.

B During A' to C time, pre-positions missile and WSEM range gates at zero range to provide coarse preliminary synchronization of missile to radar range gate. This reduces radar transmitter "required on time" for subsequent precision alignment of missile and radar gates, decreasing possibility of system becoming vulnerable to CCM actions. The pre-position gate from the 003 unit is checked for correct amplitude and rise-time by the radar range gate pulse analyzer in the ATS. Correct waveform causes the TIMING SIGNAL (PRE POS) indicator to light until C-time through energized range gate voltage relay K743 and deenergized C-signal relay K726.

C C-time, replaces pre-position function and precisely aligns missile range gate into time coincidence with selected target return before fire time. Range gating of target return enhances video signal to improve its signal-to-noise level and thereby optimize target lock-on retention.

D Develops missile gate generator outputs from radar input gate to:

a. A' to fire time, slave live missile and WSEM range gates first to zero range, then into synchronization with radar range gate – (range gate relay deenergized on til C time, then energized; range gate unslave relay deenergized).

b. Verify radar range gate amplitude and rise time for forthcoming coincidence check reliability – (range gate and range gate unslave relays energized).

c. Check synchronization (time coincidence) of missile, missile simulator and WSEM range gates with radar range gate – (range gate and range gate unslave relays energized).

E Simulates a live missile loaded on launcher rail to provide:

a. D to fire time, missile range gate via UP-31 to confirm proper functioning of radar pre-position and range gate inputs.

b. After D time, range gate lock light indication if analyzed radar range gate input pulse has proper amplitude and rise time.

F With SSGC 5 or 6 selected, lights indicators RG1 thru RG4 as applicable to confirm:

a. Time coincidence (synchronization) of missile, missile simulator or WSEM range gate to radar range gate – (subsystem in live missile mode).

b. That missile gate generator (developed) radar) range gate characteristics are suitable for slaving of missile and WSEM range gates – (range gate confirm relay energized to block missile inputs to coincidence gates).

G During WSEM captive flight, provides computer processed A51A signal to WSEM for recording – (live missile ATS relay deenergized).

H Produces three separate timed functions:

a. Prior to fire time, accepts radar pre-position and range gates to synchronize WSEM range gate.

b. Following C time, records "lock-on" confirmation signal on channel 17.

c. During captive flight, records computer output WSEM A51A signal on channel 35.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
003	K13	1, 3 AND 6 COIL 2 AND 7	5-17/2B 5-2/6B
	K14	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	5-17/2B 5-17/2B 5-17/2B
005	K1	3, 4 AND 10 COIL 19 AND 16	5-17/1C 5-26/7B
	K21	1 AND 13 5, 6 AND 15 7, 8 AND 16 9, 10 AND 17 11, 12 AND 18 COIL 18 AND 17	5-17/6C 5-15/6B 5-17/6C 5-17/6B 5-17/6A 5-26/7C
	K22	1, 2 AND 13 3, 4 AND 14 7, 8 AND 16 11, 12 AND 18 COIL 19 AND 20	5-17/6B 5-17/5C 5-17/5B 5-17/5A 5-26/7C
	K23	1 AND 2 COIL 3 AND 7	5-17/7A 5-17/6A
	K24	1 AND 3 COIL 5 AND 7	5-17/7B 5-17/6B
	K25	1 AND 3 COIL 5 AND 7	5-17/7B 5-17/6B
	K26	1 AND 3 COIL 5 AND 7	5-17/7B 5-17/6B
MISSILE SIMULATOR	K724	2 AND 5	5-17/4B
	K25	2 AND 5	5-17/4B
	K726	1, 6 AND 8	5-17/4A
	K743	1 AND 2 5 AND 6 COIL 3 AND 7	5-17/4A 5-17/4A 5-17/4B
	K740	6 AND 8	5-17/4B
	K747	3 AND 4 COIL 3 AND 7	5-17/4B 5-17/4A
	K748	3 AND 5 COIL 3 AND 7	5-17/4A 5-17/4A
	K749	2 AND 5 COIL 3 AND 7	5-17/4A 5-17/4A
WSEM	K3630	2 AND 4	5-17/6C
	K3501	11, 13 AND F	5-17/6C

Figure 5-17. Range Gate/A51A (Sheet 1 of 2)

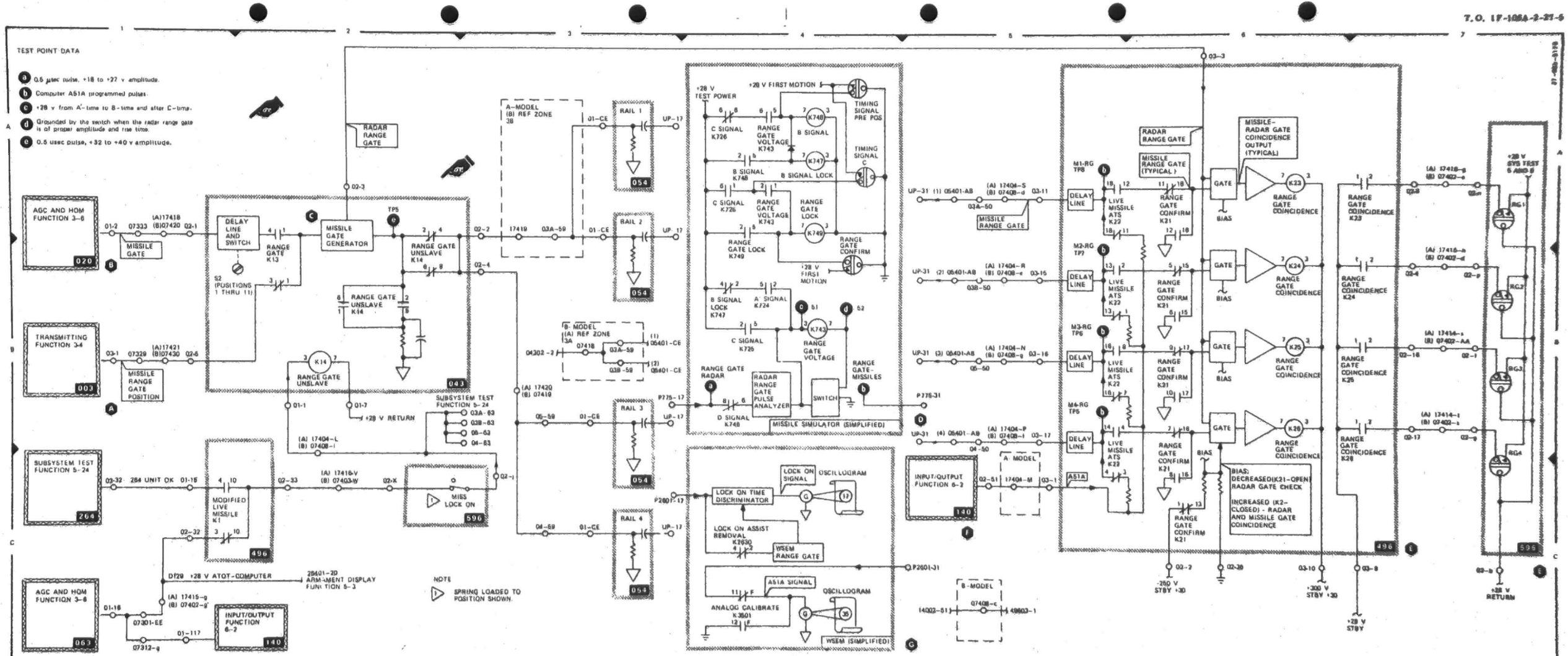


Figure 5-17. Range Gate A51A (Sheet 2 of 2)

The MA-1 computer compares the pointing direction of the radar antenna in radar track, or the IR head in IR track with the pointing direction of each missile seeker head and provides drive signals to the individual missiles to ensure that the missiles point at the target within the mechanical limits of the missile look angle. The missile simulator or WSEM are used as test instruments to check system operation.

(A) Prior to C-time a relatively large voltage (representing large missile pointing error) is tapped from the voltage divider across the computer pot excitation voltage. This voltage at umbilical plug pins 37 and 38 is checked by the computer to verify the integrity of the feed back circuits.

(B) Following C-time the computer pot excitation voltage is applied to a voltage divider containing taps selected by the MISSILE POSITION switch. M1 must be selected on MISSILE POSITION switch regardless of the actual rail position. This permits the computer to verify the post C-time feedback circuits.

(C) Pitch and yaw precession signals are applied through deenergized slave defeat relay K2609, amplified and used to drive the pitch and yaw torquer coils. The pitch and yaw precession signals are also applied through deenergized analog calibrate relay K3501 to the pitch galvanometer (channel 11) and the yaw galvanometer (channel 25) to cause deflection if the oscillogram trace for these channels. At E-time, slave defeat relay is energized for two seconds by the slave removal voltage (not shown). The WSEM self angle tracks the target during the two second interval. During the zero calibration period, analog calibrate relay is energized. As a result the galvanometer current control network provides the no-signal trace.

(D) The pitch and yaw position outputs at umbilical plug pins 37 and 38 result from the positions of the potentiometer arms which tap portions of the computer pot excitation voltage. Potentiometer arm position is determined by the position of the seeker head.

(E) When a missile simulator is used, place a jumper wire from TP11 to TP18 and another jumper wire from TP24 to TP30. This allows the computer to deliver test signals on one signal path at a time to verify circuit continuity from the 140 unit to the missile simulator.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
MISSILE SIMULATOR	K728	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	5-18/2B 5-18/2B 5-21/15C
	K763	2, 4 AND 5 COIL 3 AND 7	5-18/1B 5-21/15C
WSEM	K2609	5 AND 15 7 AND 16 9 AND 17 11 AND 18	5-18/5B 5-18/5B 5-18/5A 5-18/5A
	K3501	1, 2 AND A 3, 4 AND B	5-18/5A 5-18/5B

TEST POINT DATA:

(a) +48 to +50 v when computer A-time signal present.

(b) Approximately ±27.5 v prior to C-time and +24.5V after C-time.

(c) Approximately +55 v

(d) Instrument ground.

(e) Approximately ±22.5 v prior to C-time and +27.5 v after C-time.

Figure 5-18. Pitch and Yaw Slaving (Sheet 1 of 2)

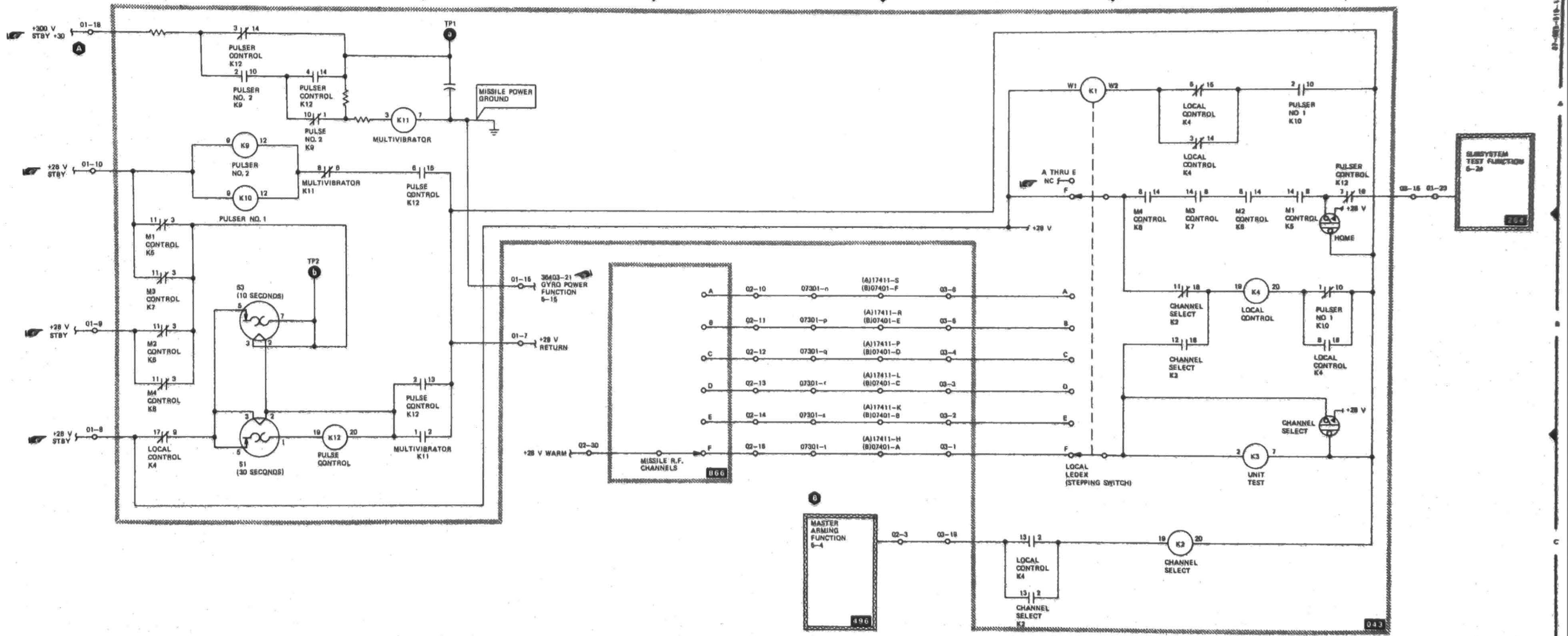


Figure 5-19. Channel Select (Sheet 2 of 3)

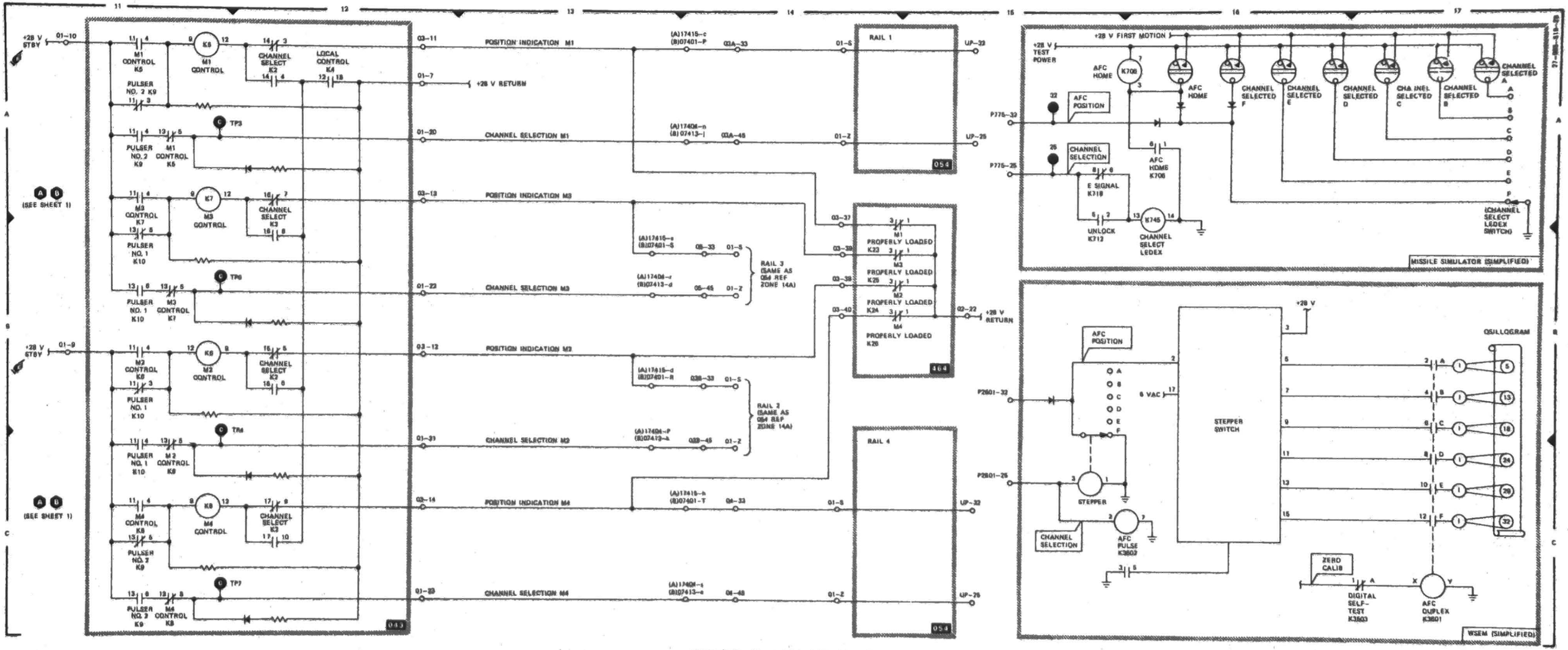


Figure 5-19. Channel Select (Sheet 3 of 3)

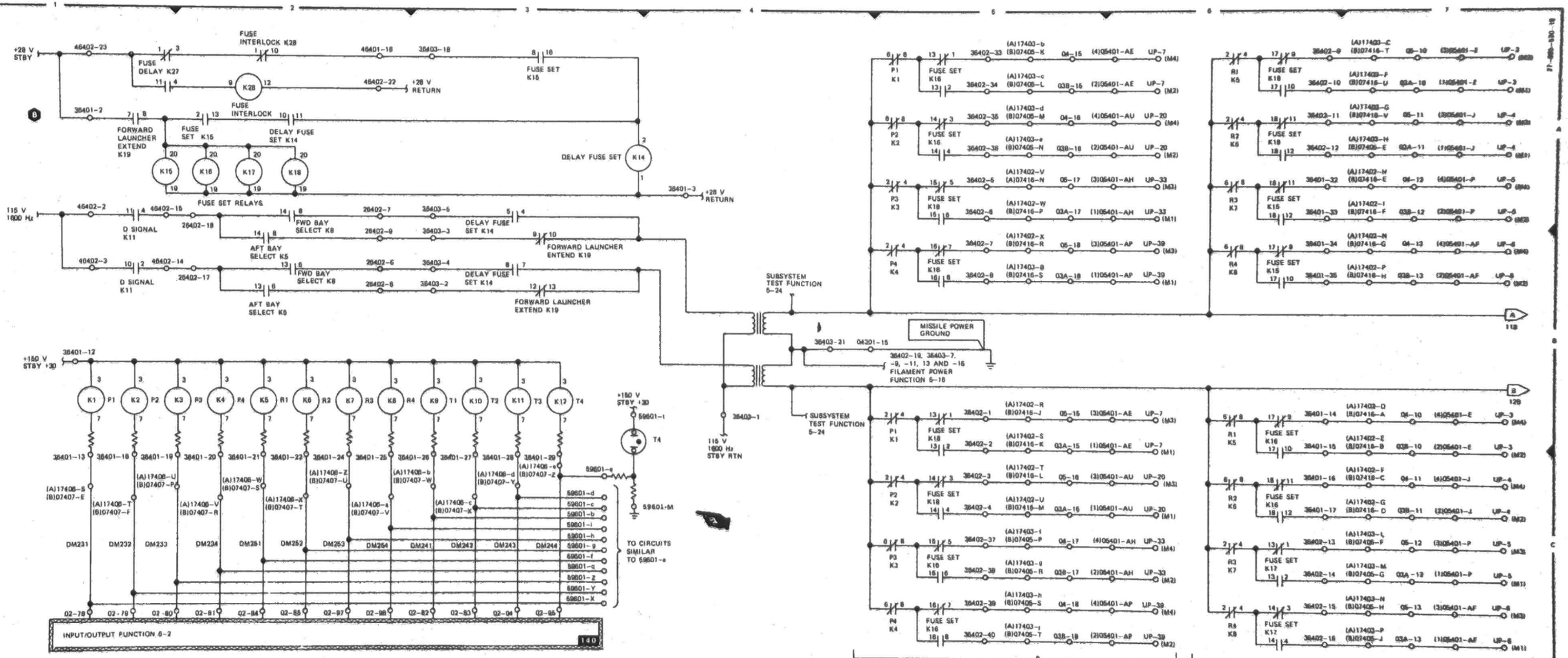
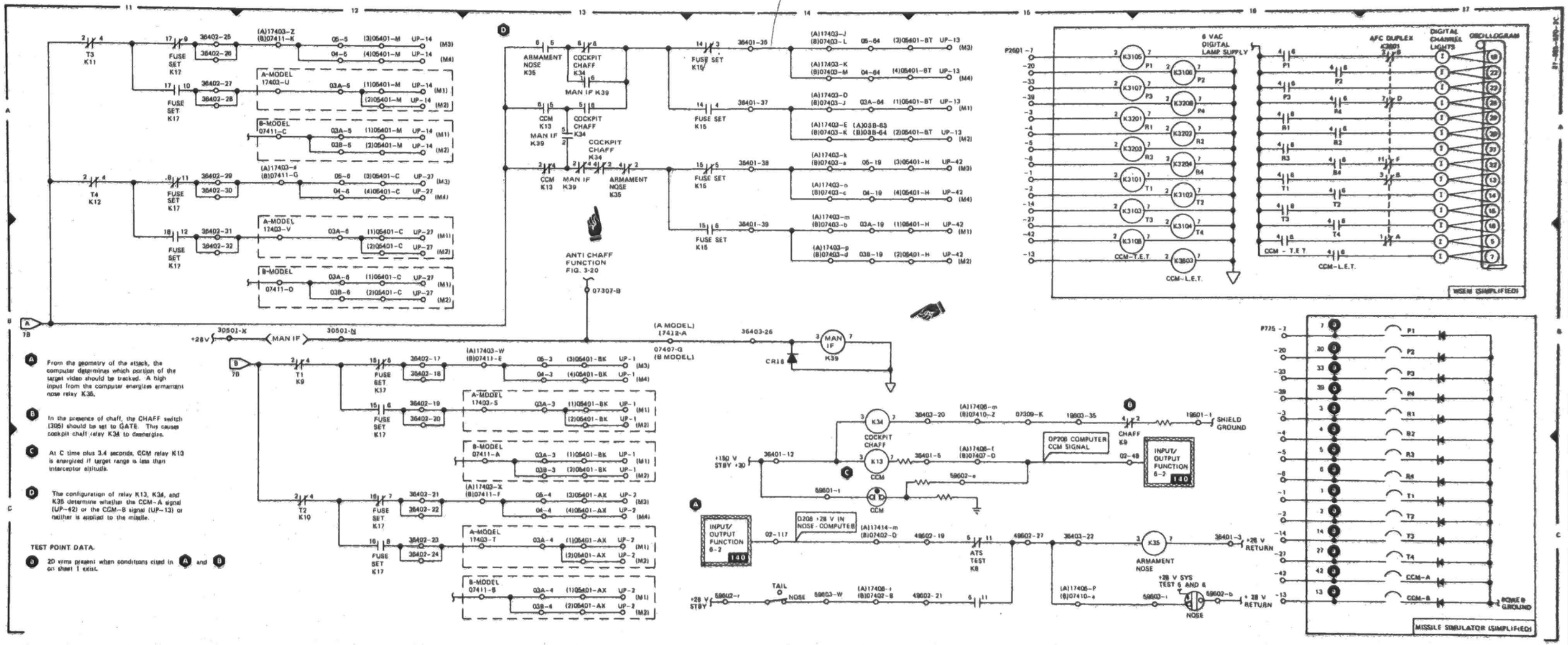


Figure 5-20. Parameters and CCM (Sheet 2 of 3)



A From the geometry of the attack, the computer determines which portion of the target video should be tracked. A high input from the computer energizes armament nose relay K35.

B In the presence of chaff, the CHAFF switch (305) should be set to GATE. This causes cockpit chaff relay K34 to deenergize.

C At C time plus 3.4 seconds, CCM relay K13 is energized if target range is less than interceptor altitude.

D The configuration of relay K13, K34, and K35 determine whether the CCM-A signal (UP-42) or the CCM-B signal (UP-13) or neither is applied to the missile.

TEST POINT DATA.

J 20 vrms present when conditions cited in **A** and **B** on sheet 1 exist.

Figure 5-20. Parameters and CCM (Sheet 3 of 3)

The circuits of this function perform the following:

1. Activation of the missile internal power supply
2. Enabling of the G-weight release
3. Opening of the missile waveguide shutter.

The power supply start circuit blows a squib which activates the missile internal power supply and the missile then transfers to internal power as soon as sufficient rotational speed is attained. The G-weight release circuit blows a squib that unlatches the G-weight which allows it to start the missile internal arming sequence after the missile attains sufficient acceleration. On some radar missiles a shutter blocks the missile waveguide until the shutter release circuit delivers voltage to release the shutter.

A With the nose wheel well door closed, the ARM-SAFE switch set to ARM, and the selector switch set to a missile position, power supply start relay K3 will be energized when the right-hand armament bay door starts to open and will be deenergized when the E signal is delivered. The proper bay select relays are energized when the selector switch is set to some missile position. Auxiliary arming relay K33 is energized when the ARM-SAFE switch is set to ARM.

B Door open relay K1 is energized when the left-hand armament bay door starts to open following the C signal. Power supply start voltage is applied through connector 805 and umbilical plug pin 26. The AIM-4F and AIM-4G missiles connect to 805.

C At E time the G-weight release signal is delivered to umbilical plug pin, UP-43 by E-signal relay K15. For a two-bay launch, the G-weight release signal to the forward bay is delayed until K14 (384) is energized. Fuse delay relay K27 (464) causes the G-weight release signal to be a voltage pulse because relay K28 is energized directly by relay K27.

D At E time, missile E relay K21 (464) routes the waveguide shutter signal to the umbilical plug, pin 40 (UP-40).

UNIT	RELAY	CONTACTS	FIGURE/ZONE
054	K3	A1 AND A2	5-21/16A AND 16C
		B1 AND B2	5-21/14A AND 14C
		COIL X1 AND X2	5-21/4C
284	K1	2 AND 10	5-21/11A
		4 AND 11	5-21/11B
		6 AND 13	5-21/11C
		8 AND 14	5-21/11C
		COIL 9 AND 12	5-6/2B
	K3	2 AND 9	5-21/6C
		COIL 13 AND 14	5-7/3A
	K5	2 AND 10	5-21/11C
		4 AND 11	5-21/11C
		COIL 9 AND 12	5-7/3B
	K6	2 AND 9	5-21/6C
		COIL 13 AND 14	5-7/3B
	K8	2 AND 10	5-21/11A
		4 AND 11	5-21/11B
		COIL 9 AND 12	5-7/3B
	K15	1 AND 10	5-21/6C
		6 AND 13	5-21/11B
		8 AND 14	5-21/11B
		COIL 9 AND 12	5-2/6C
	K33	1 AND 4	5-21/6C
		5 AND 8	5-21/6C
		COIL 2 AND 7	5-4/3A
384	K14	13 AND 14	5-21/12B
		COIL 1 AND 2	5-20/3A
	K19	3 AND 4	5-21/12B
		COIL 10 AND 20	5-6/2C
464	K21	4 AND 11	5-21/12C
		6 AND 13	5-21/12A
		COIL 9 AND 12	5-2/6C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
464	K27	COIL 2 AND 7	5-21/13B
	K28	5 AND 13	5-21/13B
		7 AND 14	5-21/13B
		COIL 2 AND 9	5-20/2A
MISSILE SIMULATOR	K708	2 AND 5	5-21/15C
	K717	2 AND 5	5-21/14C
		COIL 3 AND 7	5-21/14B
	K719	2 AND 4	5-21/16C
		COIL 3 AND 7	5-21/14C
	K725	COIL 3 AND 7	5-21/15C
	K726	COIL 3 AND 7	5-21/15C
	K727	COIL 3 AND 7	5-21/16C
	K728	COIL 3 AND 7	5-21/15C
	K730	2 AND 4	5-21/15C
	K733	6 AND 8	5-21/15C
	K737	2 AND 4	5-21/14C
		6 AND 8	5-21/14B
	K763	COIL 3 AND 7	5-21/15C
WSEM	K2621	2 AND 5	5-21/14A
	K2622	8 AND 10	5-21/14A
		COIL 4 AND 11	5-25/3B
	K2625	2 AND 5	5-21/15A
		COIL 3 AND 7	5-21/16B
	K3208	4 AND 6	5-21/14A
		COIL 2 AND 7	5-21/14A

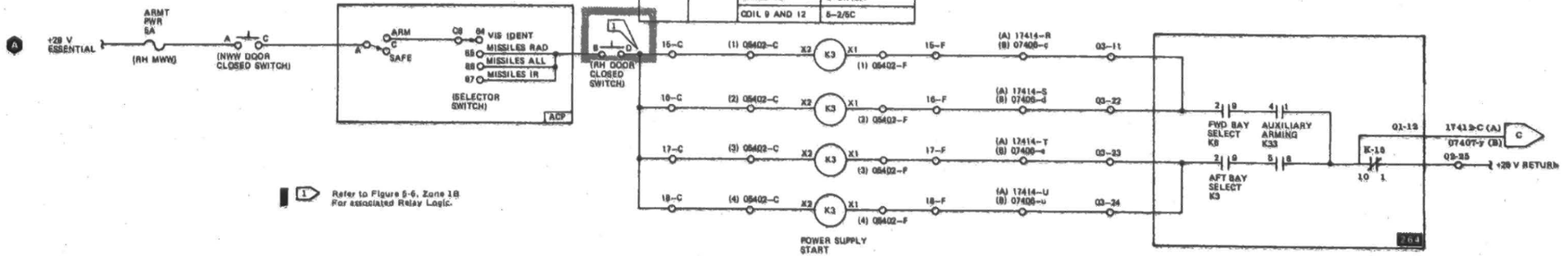


Figure 5-21. Power Supply Start/G WT Release (Sheet 1 of 2)

The circuits of this function perform the following:

1. Activation of the missile internal power supply
2. Enabling of the G-weight release
3. Opening of the missile waveguide shutter.

The power supply start circuit blows a squib which activates the missile internal power supply and the missile then transfers to internal power as soon as sufficient rotational speed is attained. The G-weight release circuit blows a squib that unlatches the G-weight which allows it to start the missile internal arming sequence after the missile attains sufficient acceleration. On some radar missiles a shutter blocks the missile waveguide until the shutter release circuit delivers voltage to release the shutter.

A With the nose wheel well door closed, the ARM-SAFE switch set to ARM, and the selector switch set to a missile position, power supply start relay K3 will be energized when the right-hand armament bay door starts to open and will be deenergized when the E signal is delivered. The proper bay select relays are energized when the selector switch is set to some missile position. Auxiliary arming relay K33 is energized when the ARM-SAFE switch is set to ARM.

B Door open relay K1 is energized when the left-hand armament bay door starts to open following the C signal. Power supply start voltage is applied through connector 805 and umbilical plug pin 26. The AIM-4F and AIM-4G missiles connect to 805.

C At E time the G-weight release signal is delivered to umbilical plug pin, UP-43 by E-signal relay K15. For a two-bay launch, the G-weight release signal to the forward bay is delayed until K14 (384) is energized. Fuse delay relay K27 (484) causes the G-weight release signal to be a voltage pulse because relay K28 is energized directly by relay K27.

D At E time, missile E relay K21 (484) routes the waveguide shutter signal to the umbilical plug, pin 40 (UP-40).

UNIT	RELAY	CONTACTS	FIGURE/ZONE
054	K3	A1 AND A2	5-21/16A AND 16C
		B1 AND B2	5-21/14A AND 14C
		COIL X1 AND X2	5-21/4C
284	K1	2 AND 10	5-21/11A
		4 AND 11	5-21/11B
		6 AND 13	5-21/11C
		8 AND 14	5-21/11C
		COIL 9 AND 12	5-6/2B
	K3	2 AND 9	5-21/6C
		COIL 13 AND 14	5-7/3A
	K5	2 AND 10	5-21/11C
		4 AND 11	5-21/11C
		COIL 9 AND 12	5-7/3B
	K6	2 AND 9	5-21/6C
		COIL 13 AND 14	5-7/3B
	K8	2 AND 10	5-21/11A
		4 AND 11	5-21/11B
		COIL 9 AND 12	5-7/3B
	K15	1 AND 10	5-21/6C
		6 AND 13	5-21/11B
		8 AND 14	5-21/11B
		COIL 9 AND 12	5-2/6C
	K33	1 AND 4	5-21/6C
		5 AND 8	5-21/6C
		COIL 2 AND 7	5-4/3A
384	K14	13 AND 14	5-21/12B
		COIL 1 AND 2	5-20/3A
	K19	3 AND 4	5-21/12B
		COIL 18 AND 20	5-6/2C
484	K21	4 AND 11	5-21/12C
		6 AND 13	5-21/12A
		COIL 9 AND 12	5-2/6C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
464	K27	COIL 2 AND 7	5-21/13B
	K28	5 AND 13	5-21/13B
		7 AND 14	5-21/13B
		COIL 2 AND 9	5-20/2A
MISSILE SIMULATOR	K708	2 AND 6	5-21/15C
	K717	2 AND 6	5-21/14C
		COIL 3 AND 7	5-21/14B
	K718	2 AND 4	5-21/15C
		COIL 3 AND 7	5-21/14C
	K726	COIL 3 AND 7	5-21/15C
	K726	COIL 3 AND 7	5-21/15C
	K727	COIL 3 AND 7	5-21/15C
	K728	COIL 3 AND 7	5-21/15C
	K730	2 AND 4	5-21/15C
	K733	6 AND 8	5-21/15C
	K737	2 AND 4	5-21/14C
		6 AND 8	5-21/14B
	K763	COIL 3 AND 7	5-21/15C
WSEM	K2621	2 AND 5	5-21/14A
	K2622	8 AND 10	5-21/14A
		COIL 4 AND 11	5-25/3B
	K2625	2 AND 5	5-21/15A
		COIL 3 AND 7	5-21/15B
	K3208	4 AND 6	5-21/14A
		COIL 2 AND 7	5-21/14A

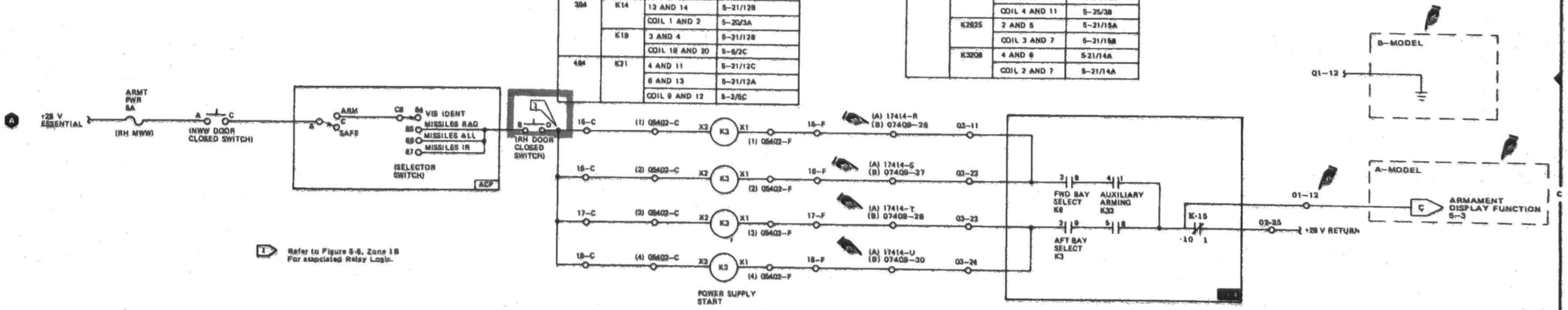


Figure 5-21. Power Supply Start/G WT Release (Sheet 1 of 2)

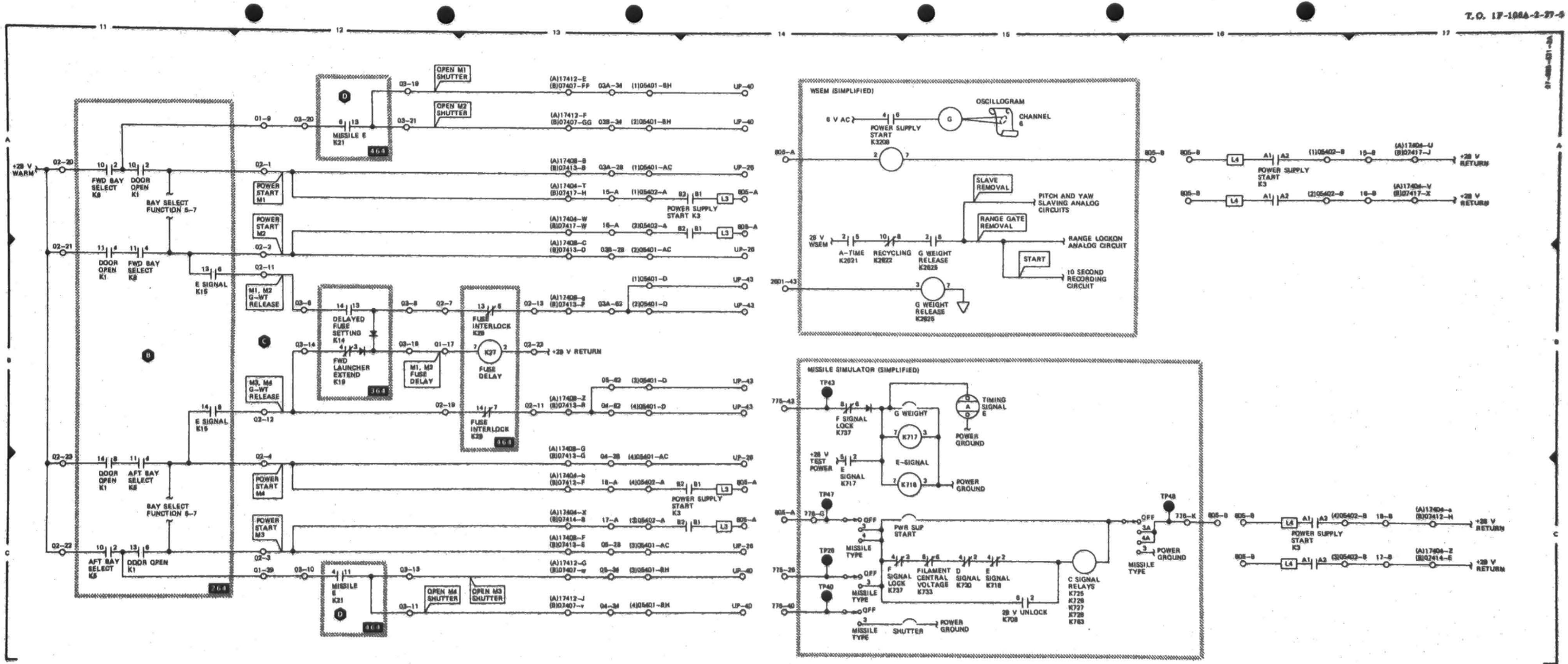


Figure 5-21. Power Supply Start G WT Release (Sheet 2 of 2)

The intervalometer contains a motor driven cam assembly which actuates switches that control the application of the MA-1 fire signal (E-signal) to the missile armament.

A When the INTERVALOMETER RESET switch is pressed the intervalometer motor runs because relay K2 is energized. If the cam assembly for the aft launchers is not at the reset position, the aft reset clutch will be engaged through switch S2. When the aft cams reach the reset position, switch S2 disconnects the aft clutch and provides power to the forward reset switch S8. If the forward cam assembly is not at the rest position, switch S5 engages the forward reset clutch. When the forward cams reach the rest position, switch S8 disconnects the forward clutch and provides power to light the RESET indicator. Release of the button allows the light to turn off and the motor to stop. The intervalometer can also be reset from the cockpit by selecting VIS IDENT and holding the ARMAMENT RECYCLE switch closed. The cam dam assembly is now positioned to properly control the application of the fire signal to the armament.

B Prior to the E-signal, the NWW door closed switch will be actuated, the ARM-SAFE switch set to ARM, and the missile selection completed. The bay select circuits (figure 5-7) will have caused either aft launcher extend K7 or forward launcher extend K3 to energize. When the E-signal is delivered, fire relay K10 will energize.

C The relay logic in ACRB causes the intervalometer motor to run during any missile selection, or during salvo after the AIR-2A has either been ejected or 2.5 seconds have elapsed since the AIR-2A failed to eject. The same voltage source causes fire relay K10 to lock up through its contacts providing either aft fire relay K8 or forward fire relay K9 is energized.

D If the armament loading and the pilots armament selection are such that the bay select circuits provide for an aft bay missile launch, aft fire clutch will be engaged if the aft and forward launchers are in the correct position. Aft fire relay K8 and forward fire relay K9 are interlocked by forward select relay K4 and interlock relay K6 so that only one can be energized at any given time.

E As the aft fire clutch drives the aft cam assembly, the firing position is reached and fire switches S4, S5, and S6 close. Switches S4 and S6 deliver the fire signal to the aft missiles and S5 energizes the pull-in coil of the aft misfire relay. The relay will remain energized only if the missile fails to launch. The aft fire clutch is disengaged by switch S1 after the fire signals have been delivered.

F The fire signal can be delivered to the aft missile only if ignition interlock relay K2 is energized. This requires the missile fire signal and an aft launcher down condition so that the relay is energized only at the fire signal time. A ground is applied, through intervalometer switch action, to the ignitor input circuit at all other times.

G The forward fire circuit is similar to the aft fire circuit. When the forward bay is to be fired after the aft bay (as is normal for an ALL armament selection) aft cam switch S3 (figure 5-6) is the signal mechanism which brings about forward launcher extension and the activation of the forward fire clutch. For a single-bay firing, the fire signal occurs about 0.3 second after the E signal. If both bays are fired, the aft bay is fired about 0.3 second after the E signal and the forward bay is fired about 1.2 seconds after the E signal.

H The fire signal pulse is delivered to the WSEM through the stinger as the igniter A signal to energize ignitor relay K3301. Ignitor B signal is the ground return. When relay K3301 is pulsed, ignitor hold relay K3303 energizes and locks in through its own contacts. Other contacts of K3303 supply voltage to operate the galvometer for the oscillogram channel. At zero calibrate time, zero trace relay K3302 energizes which deenergizes K3303. The digital self test is then traced on the WSEM tape.

I If the fire signal applied to the missile simulator is adequate, circuit breaker CB 715 will trip and cause F signal relay K 735 to energize. Relay K 735 causes the FIRE indicator to light.

J Delays the fire signal to the rail on the target side of the aircraft so that the missile on the opposite rail from the target will fire first. The time delay for the second missile to fire is approximately 45 milliseconds. With the incorporation of ripple fire, the fire switches in the intervalometer have been adjusted to provide a fire signal of 75 to 90 millisecond duration. This is to insure firing of the delayed rail.

Figure 5-22. Fire Signal (Sheet 1 of 2)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
054	K2(M3&4)	B1 AND B2	5-22/5A
	(M1&2)	B1 AND B2	5-22/5C
	(M3&4)	A1 AND A2	5-22/5A
	(M1&2)	A1 AND A2	5-22/5C
	(M1)	COIL X1 AND X2	5-22/2C
	(M2)	COIL X1 AND X2	5-22/2C
	(M3)	COIL X1 AND X2	5-22/3A
	(M4)	COIL X1 AND X2	5-22/3A
264	K14	4 AND 14	5-22/2B
		COIL 19 AND 20	5-2/6C
	K19	4 AND 14	5-22/2B
		COIL 19 AND 20	5-4/3A
ACRB	K1	NC	5-22/1B
		COIL	5-6/12C
	K7	NO	5-22/1A
		COIL	5-8/3B
	K9	NC	5-22/1A
		NC	5-22/3B
		NO	5-22/1B
		NO	5-22/3B
		COIL	5-8/3B
INTER-VAL-OM-ETER	K2	NC (-2)	5-22/2B
		NC (-3)	5-22/2B
		NO (-2)	5-22/2A
		COIL	5-22/2A
	K3	NO (-3)	5-22/3B
		COIL	5-6/7B
	K4	NC (-4)	5-22/4A
		NO (-4)	5-22/4C
		COIL	5-6/7C
	K6	NO (-2)	5-22/4A
		COIL	5-6/7B
	K7	NO (-3)	5-22/3B
		COIL	5-6/7A
	K8	NC (-1)	5-22/3C
		NO (-3)	5-22/2B
		NO (-4)	5-22/4A
		NO (-2)	5-22/3B
		COIL	5-22/4A
	K9	NC (-1)	5-22/3A
		NO (-4)	5-22/4C
		NO (-2)	5-22/3B
		NO (-3)	5-22/2B
		COIL	5-22/4C
	K10	NO (-1)	5-22/2B
		NO (-2)	5-22/2B
		COIL	5-22/4B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
AIR-FRAME	IGNITOR SAFETY	C AND D	5-22/3A
		F AND G	5-22/3C
		COIL A AND B	5-22/1C
MIS-SILE SIMU-LATOR	K707	2 AND 5	5-22/6B
		COIL 3 AND 7	5-22/7B
	K718	2 AND 5	5-22/6A
		COIL 3 AND 7	5-22/6A
	K722	2 AND 5	5-22/6B
		COIL 3 AND 7	5-16/7B
	K734	2 AND 5	5-22/6A
		6 AND 8	5-22/6B
		COIL 3 AND 7	5-22/6A
	K735	5 AND 6	5-22/6A
		COIL 3 AND 7	5-22/7B
	K736	COIL 3 AND 7	5-22/7A
	K737	COIL 3 AND 7	5-22/7A
	K738	COIL 3 AND 7	5-22/7A
	K739	1 AND 6	6-22/7A
		COIL 3 AND 7	5-22/7A
	K750	6 AND 8	5-22/6A
		COIL 3 AND 7	5-22/7B
WSEM	K3301	3 AND 5	5-22/7C
		COIL 2 AND 7	5-22/7B
	K3302	3 AND B	5-22/6C
		5 AND C	5-22/6C
		COIL 2 AND 7	5-25/6C
	K3303	3 AND 5	5-22/6C
		6 AND 8	5-22/7C
		COIL 2 AND 7	5-22/7C

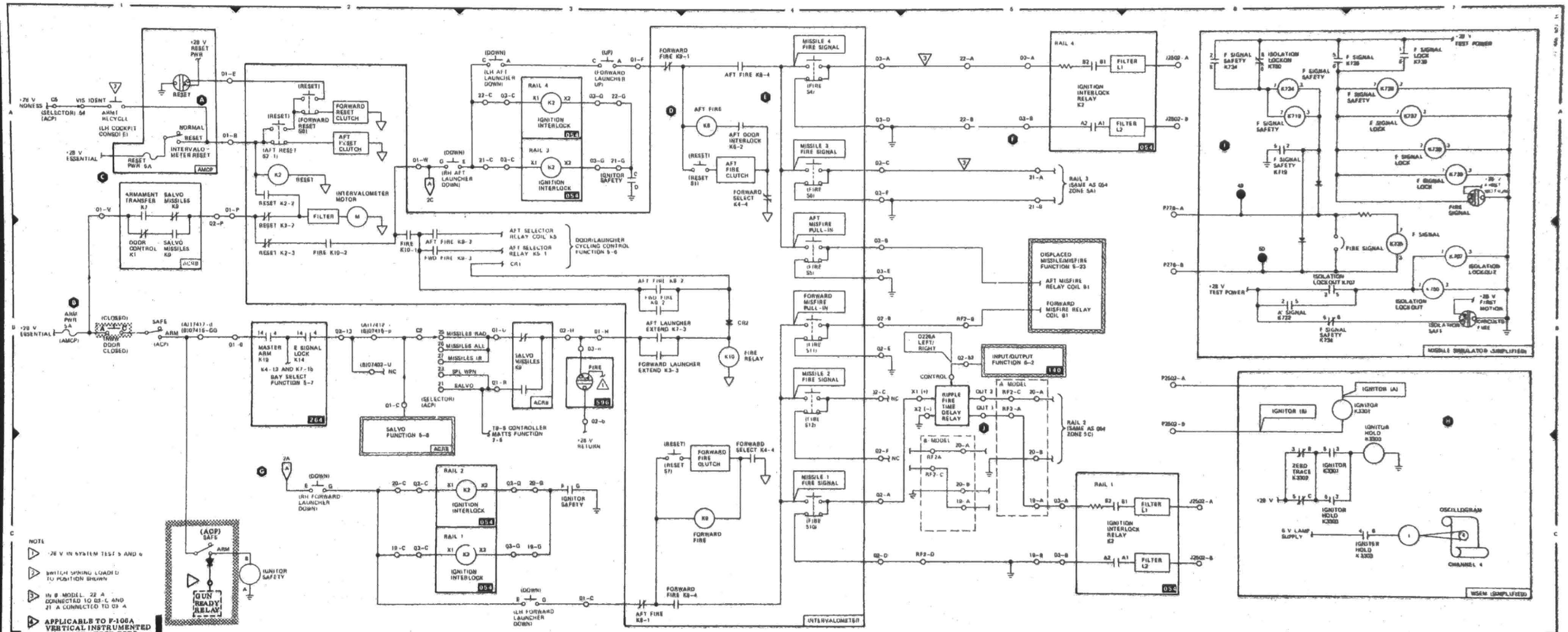


Figure 5-22. Fire Signal (Sheet 2 of 2)

The displaced missile circuit lights the MISSILE DISPLACED indicator on the pilot's master warning panel when any missile is not properly loaded on the launcher rail. In a like manner, the misfire circuit causes the MISFIRE indicator to light if any missile or the special weapon fails to leave the launcher or special weapon rack, respectively, after the fire signal is delivered.

A The complete displaced missile circuit for the left-hand forward launcher is shown. Where exact duplication exists for the remaining launchers, the circuits are not repeated. For any launcher, if the holdback release handle is not fully forward or the holdback pin properly extended, the missile properly loaded relay will remain deenergized. If a missile is loaded on that rail the MISSILE DISPLACED indicator will light.

B The complete misfire circuit for the right-hand aft launcher and the right-hand forward launcher are shown to illustrate the interface with the missile simulator and the WSEM. Where exact duplication exists for the other launchers, the circuits are not repeated.

C During a missile launch the intervalometer fire signal energizes the pull-in coil of the misfire relay as each bay (aft and/or forward) is fired. The pull-in coil remains energized only during the period of the fire signal.

D With the INTERVALOMETER RESET switch in the normal position and the bay doors open, the MISFIRE indicator lights while the misfire relay is energized.

E If the missile fails to leave the rail, or in the case of a WSEM or missile simulator, if the gone signal is not applied to relay K4 (054), the hold-in coil of the misfire relay will have a ground return path. This condition causes the MISFIRE indicator to remain on after the fire signal is removed.

F During the ATS test in ESQC 8 a misfire can be simulated by setting either the TEST MISFIRE-FWD or TEST MISFIRE-AFT switch to on (up) position.

G The special weapon misfire circuit functions in a manner similar to the missile misfire circuit. The special weapon eject signal energizes the pull-in coil of the misfire relay. The hold-in coil is deenergized when the special weapon leaves the rack.

H A momentary misfire signal causes the cabin air timer to discontinue cabin pressurization and electronics equipment area cooling for about 2.5 seconds to prevent exhaust gases from entering those areas.

UNIT	RELAY	CONTACTS	FIGURE/ZONE
054	K4 (M1)	2 AND 4 COIL 3 AND 7	5-23/16A 5-23/16A
	K4 (M4)	2 AND 4 COIL 3 AND 7	5-23/16C 5-23/16C
464	K23	6 AND 8 COIL 2 AND 7	5-23/ 5A 5-23/ 5A
	K24	6 AND 8 COIL 2 AND 7	5-23/ 5B 5-23/ 5B
	K25	6 AND 8 COIL 2 AND 7	5-23/ 5C 5-23/ 5B
	K26	6 AND 8 COIL 2 AND 7	5-23/ 5C 5-23/ 5C
498	K9	2 AND 5 COIL 3 AND 7	5-23/14A 5-24/7C
ACRB	K2	NO COIL	5-23/11A 5-6/5B
AIR-FRAME	SPECIAL WEAPON MISFIRE	C AND D F AND G COIL A1, A2, B1, AND B2	5-23/12C 5-23/12C 5-23/12C
	AFT MISFIRE	C AND D F AND G J AND K COIL A1, A2, B1 AND B2	5-23/12B 5-23/12B 5-23/13A 5-23/13A
	AUXILIARY AFT MISFIRE	COIL A AND B	5-23/13B
	FOWARD MISFIRE	C AND D F AND G COIL A1, A2, B1 AND B2	5-23/12A 5-23/12A 5-23/12A
WSEM	K2621	2 AND 5 COIL	5-23/17C 5-25/4A
	K2622	8 AND 10 COIL	5-23/17C 5-25/3B
	K2625	2 AND 5 COIL	5-23/17C 5-25/3B
	K2632	2 AND 4 COIL	5-23/17C 5-25/5C
	K2634	2 AND 5 COIL	5-23/17C 5-25/5C

NOTES:

1. +28 V FROM WARNING LIGHT TEST CIRCUIT.

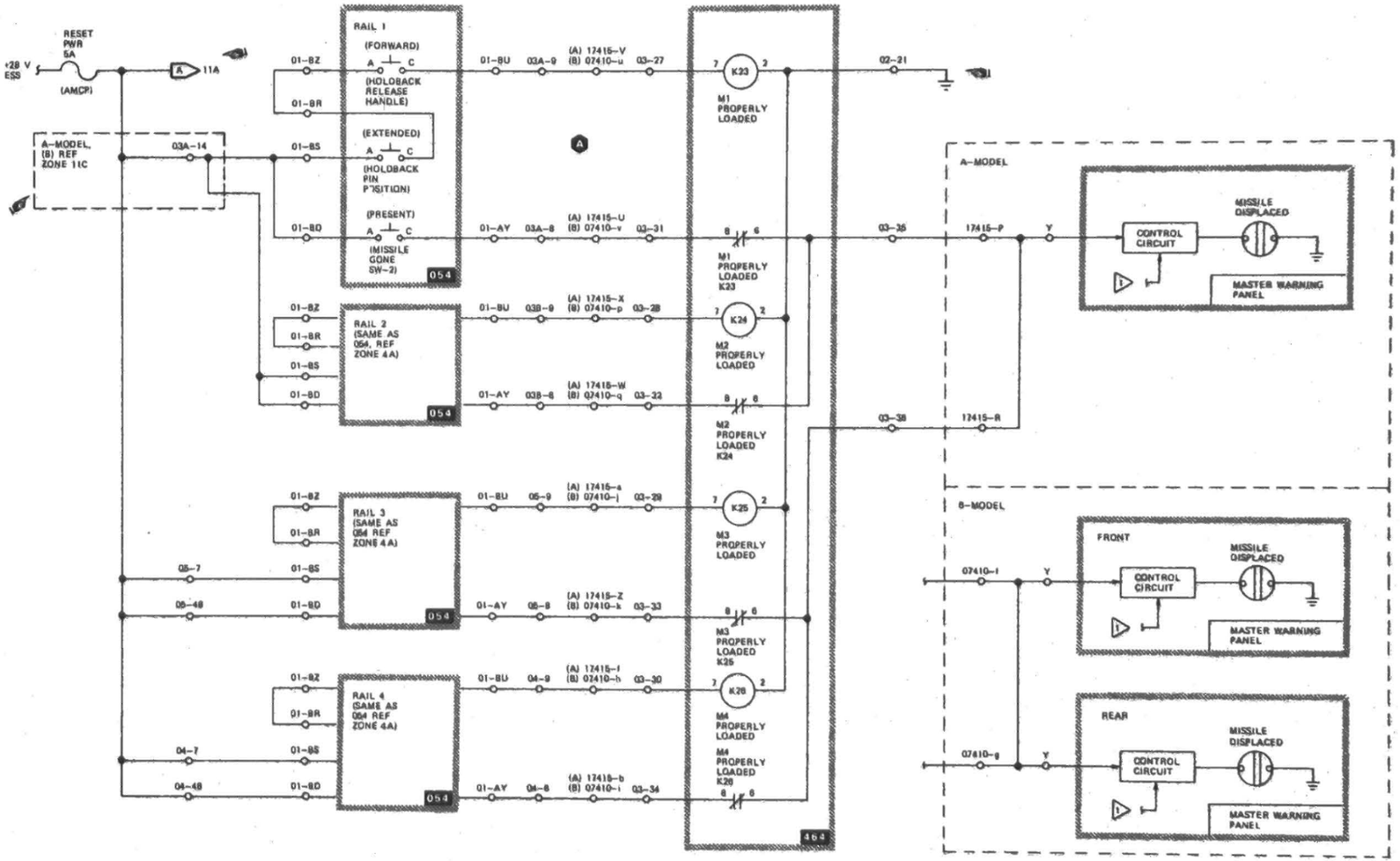


Figure 5-23. Displaced Missile/Misfire (Sheet 1 of 2)

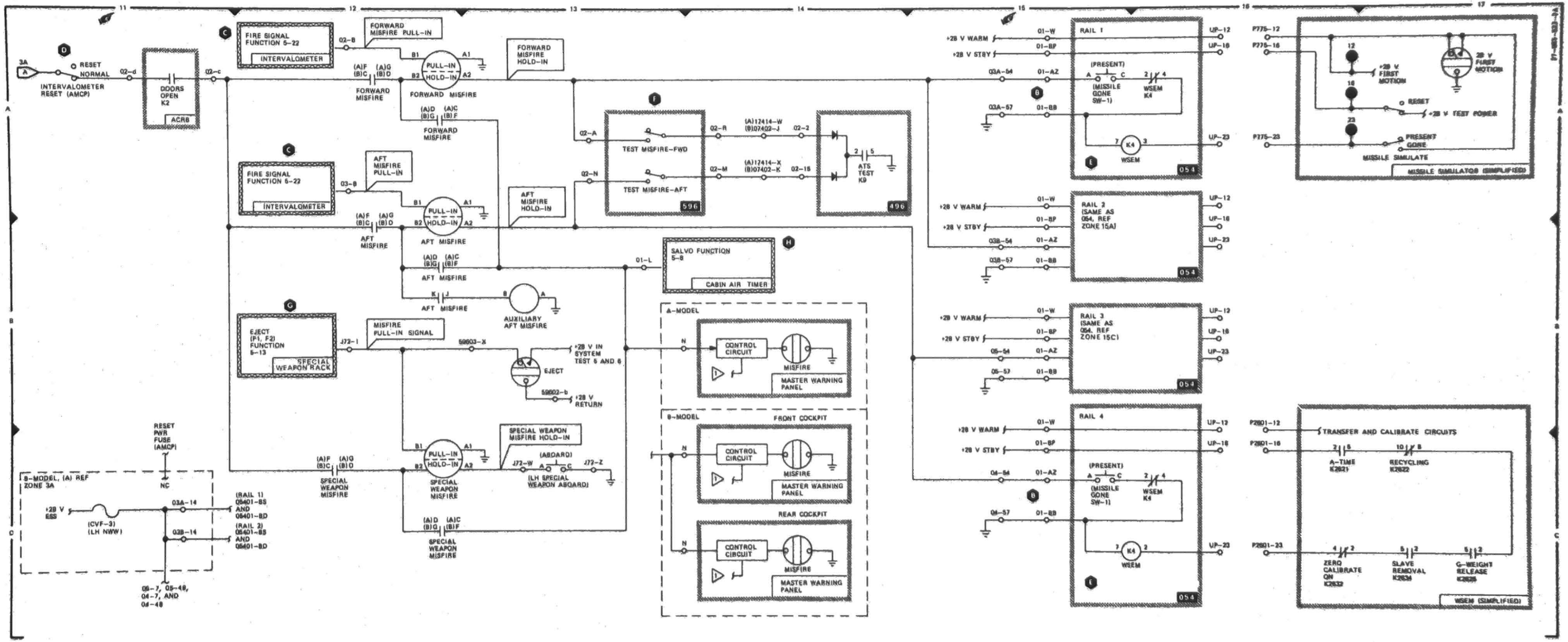
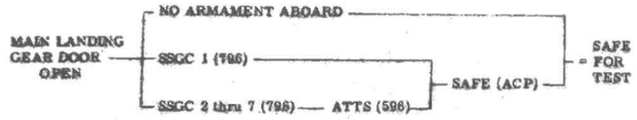


Figure 5-23. Displaced Missile/Misfire (Sheet 2 of 2)

Short System Ground Checks (SSGC) 1 through 7 are tests used to verify the ability of the MA-1 system to function correctly during a tactical situation. SSGC 1 is a preparatory procedure performed to place all subsystems in an initial test status and ensure that the system is safe for testing. The armament auxiliaries are tested during SSGC 5 and 6. During SSGC 5 the armament is configured for an all missile attack and the system is configured to simulate a high speed, high altitude tactical mission. During SSGC 6 the armament is configured for a rocket attack and the system is configured to simulate a low speed, low altitude tactical mission. Switches and indicators on the Self Test Panel (796) and Armament Electrical Test Panel (596) are used to control test progress and provide test results.

A When the SELECTOR TEST switch (796) is set from OFF to 1, 28 volts from the main landing gear door open switch (door open position) energizes test condition relay K1 (796). In addition to the relay action shown, test condition relay K1 (905) is energized causing the 905 annunciator to indicate TEST. Also, other MA-1 subsystems are placed in a test status.

B The conditions necessary to light the SAFE FOR TEST (596) and TEST (796) indicators, and provide the armament test voltage are summarized in the flow chart below:



C When the SELECTOR TEST switch (796) is set to 5 (missile test) or 6 (rocket test), the armament test signal is applied to test logic of the various armament units (sheets 2 and 3) to determine if the units are receiving the correct inputs from other subsystems and are, in turn, functioning properly. Proper unit operation is indicated by the various unit test indicators lighting.

D The SAFE FOR FLIGHT (596) and FLIGHT (796) indicators are lighted if the 043 unit local ledex and all missile ledexes are homed, the SELECTOR TEST switch (796) is set to deenergize the test condition relays, the armament test switch (AMCP) is set to NORMAL, and the flight connector is installed.

Figure 5-24. Subsystem Test (Sheet 1 of 6)

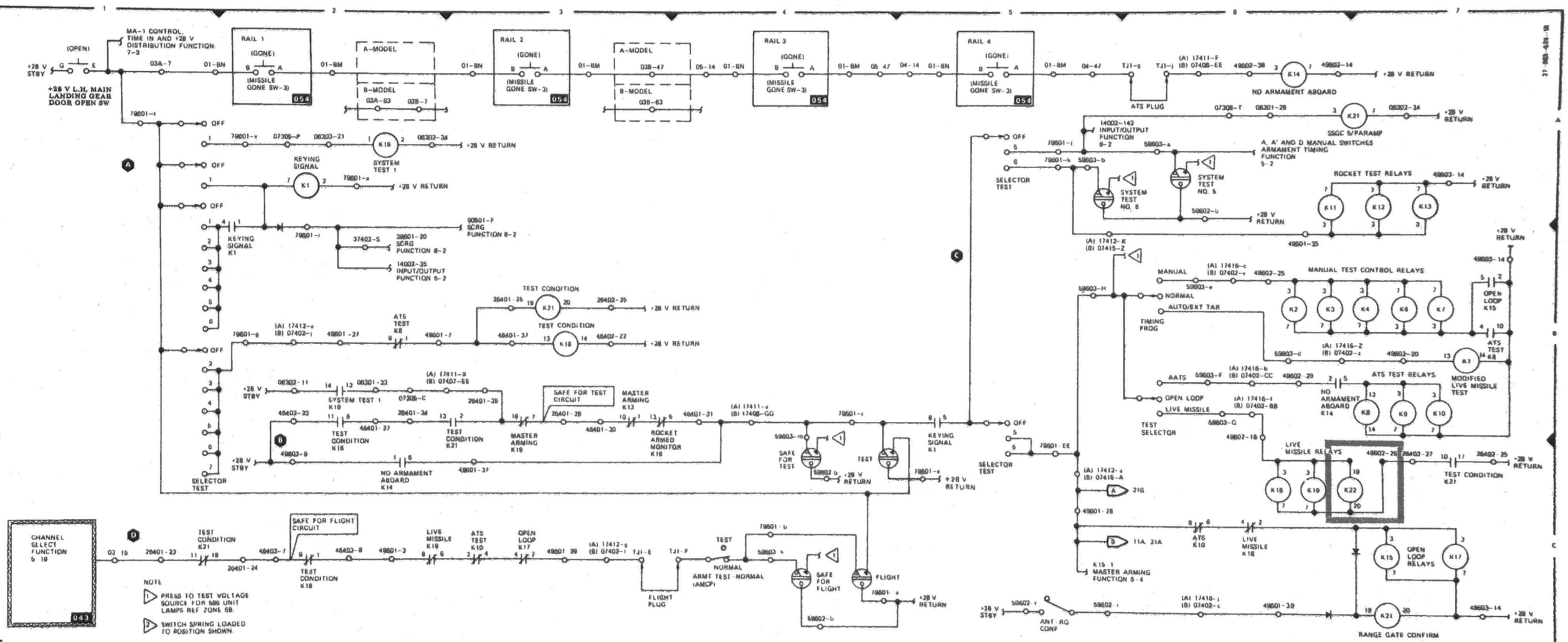
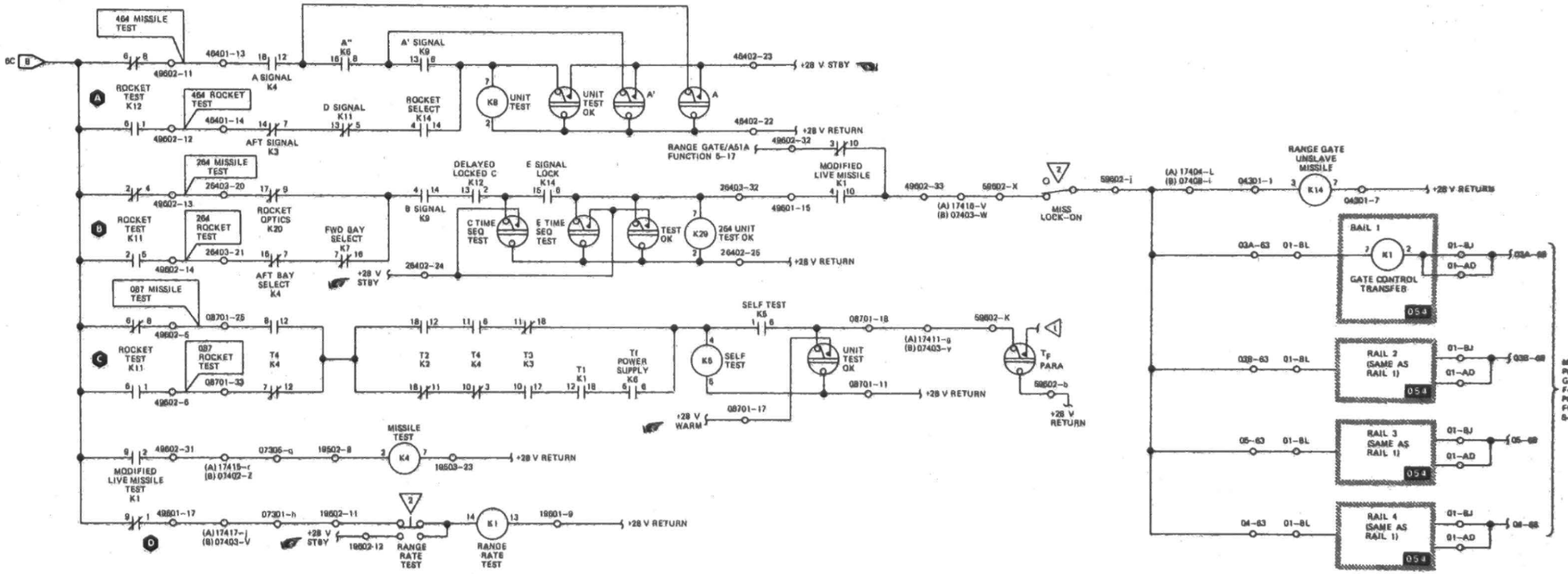


Figure 5-24. Subsystem Test (Sheet 2 of 5)



A The 464 unit test monitors receipt of and response to the A and A' timing signals for a missile attack test (5). For a rocket attack test (6), the selection of rocket attack and the lack of an A signal and D signal are monitored.

B The 264 unit test monitors receipt of and response to the B, C, and E timing signals for a missile attack test (5). The D signal relay is not energized during test to ensure that missile parameter fuses will not be blown. Test condition relay K18 (master arming diagram) keeps master arm relay K13 (464) deenergized for this purpose. For the rocket attack test, the 264 unit test ensures missile bay selections are not made.

C The T-parameter relays in the 087 unit are energized by corresponding relays in the 364 unit. If the proper combination of T relays (087) are energized during test the UNIT TEST OK (087) and T_f PARA (59B) indicators will light.

D The 087 and 364 unit tests check the armament parameter relays to verify that the computer and armament parameter setting circuits are functioning properly. Fuse blowing power is not applied since D-timing signal relay K11 (464) is deenergized under test conditions. For this test RANGE RATE TEST relay K1 (19B) is energized so that a simulated fixed value of target closing rate is provided to the computer to determine the R-parameters. The computer also uses simulated test values of static pressure, Mach, and temperature to compute the remaining armament parameters. Under these simulated conditions, if the computer and armament parameter circuits are functioning properly a definite and complementary pattern of 364 unit and 087 unit parameter relays (sheet 4) will be energized for a missile attack test and a rocket attack test. For the missile test (5) all 364 and 087 unit relays for even-numbered parameters (P2, P4, R2, R4, T2, and T4 of the 364 unit and T2, T4 of the 087 unit) are energized. Relays for odd-numbered parameters and CCM relay K13 (364) are deenergized. For the rocket test (6), the exact opposite is true. As shown, contacts of the parameter relays (364) in turn energize P, R, and T test relays. If the proper combination of test relays are energized for a missile test or rocket test the series chain formed by the relay contacts will energize 364 unit test K33 and light the UNIT OK (364) and ARMT PARA (59B) indicators.

System test 5 computer sets all parameters at 0 time from computer stored values. At C plus 10.4 seconds the computer changes the parameter settings to those calculated from simulated Air Data.

NOTE.

1. PRESS TO TEST VOLTAGE SOURCE FOR 59B UNIT LAMPS REF ZONE 6B.
2. SWITCH SPRING LOADED TO POSITION SHOWN.

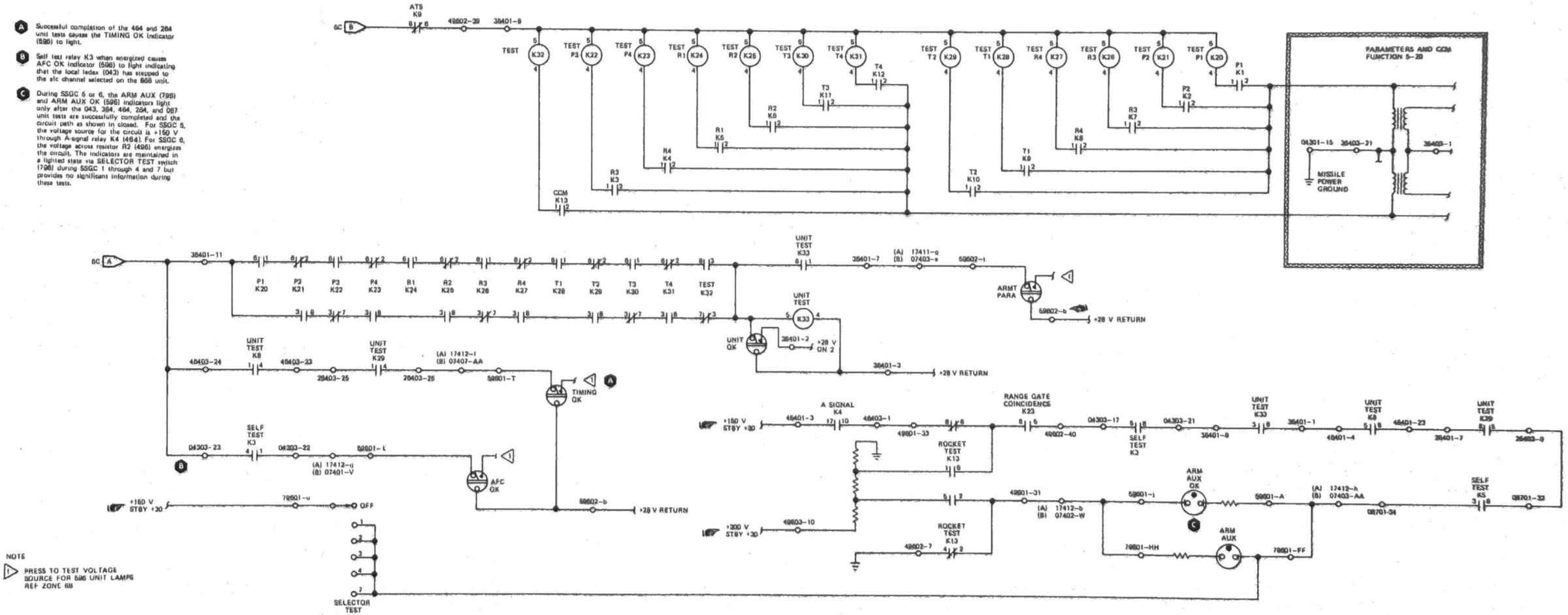
Figure 5-24. Subsystem Test (Sheet 3 of 6)

21 22 23 24 25 26 27

A Successful completion of the 464 and 264 unit tests causes the TIMING OK indicator (598) to light.

B Self test relay K3 when energized causes AFC OK indicator (598) to light indicating that the local index (043) has stepped to the afc channel selected on the 868 unit.

C During SSGC 5 or 6, the ARM AUX (798) and ARM AUX OK (598) indicators light only after the 043, 364, 464, 264, and 097 unit tests are successfully completed and the circuit path as shown in closed. For SSGC 5, the voltage source for the circuit is +150 V through A-signal relay K4 (464). For SSGC 6, the voltage across resistor R2 (498) energizes the circuit. The indicators are maintained in a lighted state via SELECTOR TEST switch (798) during SSGC 1 through 4 and 7 but provides no significant information during these tests.



NOTE

1 PRESS TO TEST VOLTAGE SOURCE FOR 598 UNIT LAMPS REF ZONE 6B

Figure 5-34. Subsystem Test (Sheet 4 of 5)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
043	K3	1 AND 4 5 AND 8 COIL 2 AND 7	5-24/22C 5-24/25C 5-19/6B
	K14	COIL 3 AND 7	5-24/16A
054	K1 (M1, 3 AND 4)	COIL 2 AND 7	5-24/16B
063	K19	13 AND 14 COIL 1 AND 2	5-24/2B 5-24/3A
087	K1	12 AND 16 COIL 19 AND 20	5-24/14B 5-14/2C
	K2	11, 12 AND 16 COIL 19 AND 20	5-24/13B 5-14/2C
	K3	10 AND 17 11 AND 18 COIL 19 AND 20	5-24/13B 5-24/13B 5-14/2C
	K4	3 AND 10 6 AND 11 7, 8 AND 12 COIL 13 AND 14	5-24/13B 5-24/13B 5-24/12B 5-14/2C
	K5	1 AND 6 3 AND 8 COIL 4 AND 5	5-24/14B 5-24/27C 5-24/14B
	K6	5 AND 6 COIL 3 AND 7	5-24/14B 5-14/3C
195	K4	COIL 2 AND 7	5-24/13B
196	K1	COIL 13 AND 14	5-24/13C
264	K4	7 AND 16 COIL 19 AND 20	5-24/13B 5-7/3B
	K7	7 AND 16 COIL 19 AND 20	5-24/13B 5-7/3B
	K9	4 AND 14 COIL 19 AND 20	5-24/13A 5-2/4B
	K12	2 AND 13 COIL 19 AND 20	5-24/13A 5-2/7C
	K14	6 AND 15 COIL 19 AND 20	5-24/13A 5-2/6C
	K19	7 AND 16 COIL 19 AND 20	5-24/3B 5-4/3A
	K20	9 AND 17 COIL 19 AND 20	5-24/13A 5-11/13C
	K21	2 AND 13 10 AND 17 11 AND 18 COIL 19 AND 20	5-24/3B 5-24/7C 5-24/1C 5-24/4B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
264 (cont)	K29	1 AND 4 5 AND 8 COIL 19 AND 20	5-24/22B 5-24/27C 5-24/14A
364	K1	1 AND 2 COIL 3 AND 7	5-24/26A 5-20/1B
	K2	1 AND 2 COIL 3 AND 7	5-24/26A 5-20/1B
	K3	1 AND 2 COIL 3 AND 7	5-24/23A 5-20/1B
	K4	1 AND 2 COIL 3 AND 7	5-24/23A 5-20/2B
	K5	1 AND 2 COIL 3 AND 7	5-24/24A 5-20/2B
	K6	1 AND 2 COIL 3 AND 7	5-24/24A 5-20/2B
	K7	1 AND 2 COIL 3 AND 7	5-24/25A 5-20/2B
	K8	1 AND 2 COIL 3 AND 7	5-24/25A 5-20/2B
	K9	1 AND 2 COIL 3 AND 7	5-24/25A 5-20/3B
	K10	1 AND 2 COIL 3 AND 7	5-24/25A 5-20/3B
	K11	1 AND 2 COIL 3 AND 7	5-24/24A 5-20/3B
	K12	1 AND 2 COIL 3 AND 7	5-24/24A 5-20/3B
	K13	1 AND 2 COIL 3 AND 7	5-24/23B 5-24/14C
	K20	1 AND 6 COIL 4 AND 5	5-24/22B 5-24/26A
	K21	2 AND 6 3 AND 8 COIL 4 AND 5	5-24/22B 5-24/22B 5-24/26A
	K22	1 AND 6 3 AND 7 COIL 4 AND 5	5-24/22B 5-24/22B 5-24/23A
	K23	2 AND 6 3 AND 8 COIL 4 AND 5	5-24/22B 5-24/22B 5-24/23A
	K24	1 AND 6 COIL 4 AND 5	5-24/22B 5-24/24A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
364 (cont)	K25	2 AND 6 3 AND 8 COIL 4 AND 5	5-24/22B 5-24/22B 5-24/24A
	K26	1 AND 6 3 AND 7 COIL 4 AND 5	5-24/23B 5-24/23B 5-24/25A
	K27	2 AND 6 3 AND 8 COIL 4 AND 5	5-24/23B 5-24/23B 5-24/25A
	K28	1 AND 6 COIL 4 AND 5	5-24/23B 5-24/25A
	K29	2 AND 6 3 AND 8 COIL 4 AND 5	5-24/23B 5-24/23B 5-24/25A
	K30	1 AND 6 3 AND 7 COIL 4 AND 5	5-24/23B 5-24/23B 5-24/24A
	K31	2 AND 6 3 AND 8 COIL 4 AND 5	5-24/23B 5-24/23B 5-24/24A
	K32	3, 7 AND 8 COIL 4 AND 5	5-24/24B 5-24/23A
	K33	1 AND 6 3 AND 8 COIL 4 AND 5	5-24/24B 5-24/26C 5-24/24B
464	K3	7 AND 14 COIL 9 AND 12	5-24/13A 5-2/6A
	K4	10 AND 17 12 AND 18 COIL 19 AND 20	5-24/24C 5-24/12A 5-2/4A
	K6	8 AND 16 COIL 19 AND 20	5-24/12A 5-2/6A
	K8	1 AND 4 5 AND 8 COIL 2 AND 7	5-24/22B 5-24/26C 5-24/13A
	K9	6 AND 13 COIL 9 AND 12	5-24/13A 5-2/6A
	K11	5 AND 13 COIL 9 AND 12	5-24/13A 5-2/4C
	K13	1 AND 10 COIL 9 AND 12	5-24/4B 5-4/4A
	K14	4 AND 14 COIL 19 AND 20	5-24/13A 5-10/3B
	K16	5 AND 13 COIL 9 AND 12	5-24/4B 5-10/6A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
464 (cont)	K18	1 AND 9 6 AND 11 COIL 13 AND 14	5-24/2C 5-24/2B 5-24/4B
496	K1	1, 2 AND 9 3, 4 AND 10 COIL 13 AND 14	5-24/12A 5-24/14A 5-24/7B
	K2	COIL 3 AND 7	5-24/6B
	K3	COIL 3 AND 7	5-24/6B
	K4	COIL 3 AND 7	5-24/7B
	K6	COIL 3 AND 7	5-24/7B
	K7	COIL 3 AND 7	5-24/7B
	K8	1 AND 9 4 AND 10 COIL 13 AND 14	5-24/3B 5-24/7B 5-24/7C
	K9	6 AND 8 COIL 3 AND 7	5-24/22A 5-24/7C
	K10	2 AND 4 6 AND 8 COIL 3 AND 7	5-24/3C 5-24/6C 5-24/7C
	K11	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	5-24/13B 5-24/12A 5-24/6B
	K12	1, 6 AND 8 COIL 3 AND 7	5-24/12A 5-24/7B
	K13	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	5-24/25C 5-24/25C 5-24/7B
	K14	1 AND 6 2 AND 5 COIL 3 AND 7	5-24/3B 5-24/6B 5-24/7A
	K15	2 AND 5 COIL 3 AND 7	5-24/7B 5-24/7C
	K17	2 AND 4 COIL 3 AND 7	5-24/3C 5-24/7C
	K18	2 AND 4 COIL 3 AND 7	5-24/6C 5-24/6C
	K19	6 AND 8 COIL 3 AND 7	5-24/2C 5-24/7C
	K21	COIL 19 AND 20	5-24/7C
	K22	COIL 19 AND 20	5-24/7C
	K23	5 AND 6 COIL 3 AND 7	5-24/25C 5-17/6A

UNIT	RELAY	CONTACTS	FIGURE/ZONE
796	K1	1 AND 4 5 AND 8 COIL 2 AND 7	5-24/2A 5-24/5B 5-24/2A

Figure 5-24. Subsystem Test (Sheet 5 of 5)

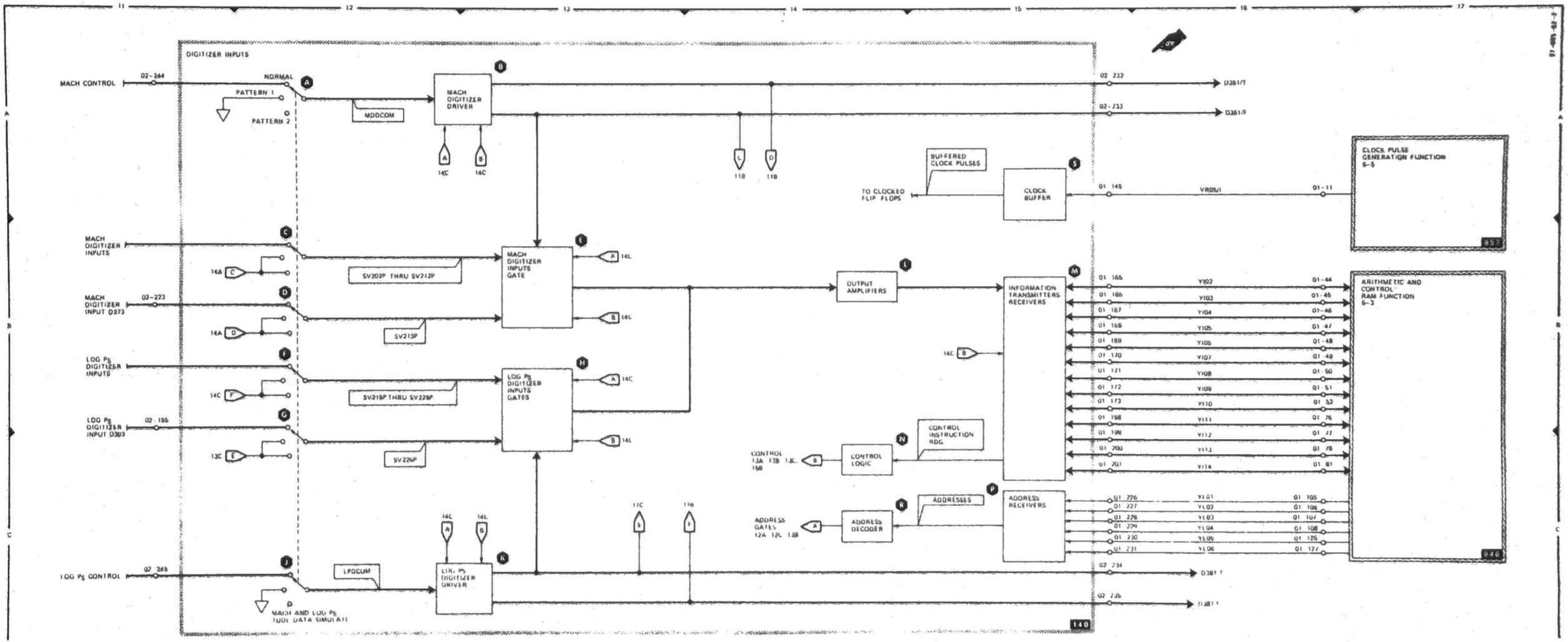


Figure 6-2. Input Output (Sheet 4 of 9)

The digital outputs function of the 140 unit provides an electrical interface between the digital computer and the other subsystems of the MA-1 system for digital-type signals that are output from the computer.

- **A** Receives and buffers digital output signals and control instructions from 846 unit that are received on information bus.
- **B** Provides logic required for distributing digital output signals to digital flip-flops and converters.
- **C** Stores and converts digital output signals to form required by MA-1 subsystems.
- **D** Provides voltage and current forms to digital output signals required by MA-1 subsystems.
- **E** Receives and buffers address signals from 846 unit.
- **F** Decodes addresses of digital output signals.
- **G** Receives and buffers transient protection pulse.
- **H** Causes control and digital flip-flops to be reset when a power transient protection pulse is received from 846 unit.
- **J** Buffers and distributes clock pulse signal to digital outputs logic.
- **K** Generates and distributes control signals derived from Write Digital Output control instruction.

DIGITAL OUTPUTS SIGNALS	SIGNAL NOMENCLATURE	140 CONNECTOR/PIN
D200	AFCS OK	02-106
D201	COMPUTER A PRIME SIGNAL	02-45
D202	COMPUTER A SIGNAL	02-46
D203	COMPUTER VALIDITY	02-47
D206	ALTITUDE HOLD INTERLOCK	02-107
D207	+28 V NAVIGATION MODE	01-136
D208	+28 V IN NOSE - COMPUTER	02-117; 01-137
D209	+28 V NOT NAVIGATION	01-138
D210	+28 V ATTACK VALID	01-139
D212	COMPUTER PURSUIT	02-50
D213	TIME TO GO CIRCLE BLANK	01-130
D214	+28 V ILS APPROACH	02-99
D215A	VISUAL IDENTIFICATION WARNING	02-100
D215N	AUTO OK	02-213
D216A	COMPUTER B SIGNAL	02-62
D216N	HSI RANGE VALID	02-101
D217A	COMPUTER C SIGNAL	02-63
D217N	TACAN ANNUNCIATOR OR	02-102
D218A	COMPUTER D SIGNAL	02-64
D218N	+28 V TARGET MARKER IND NAV	01-140
D219A	COMPUTER E SIGNAL	02-65
D220A	NOT CONNECTED	01-147
D220N	NOT CONNECTED	01-148
D221A	COMPUTER ABORT	02-68
D221N	NOT CONNECTED	01-149
D222A	NOT CONNECTED	01-150
D223A	+28 V LEAD COLLISION SIGNAL	02-69
D224A	IFF TEST MODE CONTROL	02-214
D224N	LATITUDE CORRECTION PLUS ONE DEGREE	02-215
D225A	+28 V POWER TEST FAIL	02-216
D225N	LATITUDE CORRECTION MINUS ONE DEGREE	02-217
D226A	LEFT/RIGHT SIGNAL	02-52,01-93
D226N	PASS/FAIL NO. 1	02-126
D227A	TEST SEQUENCE A	02-219
D227N	PASS/FAIL NO. 2	02-226
D228A	ILS VALID EXCITATION/ TEST SEQUENCE C	02-227
D228N	+28 V DR/DL	02-89
D229A	ALTITUDE WARN SIGNAL	02-228
D229N	+28 V DL VALID	02-87
D230	COMPUTER INTERROGATION AUDIO	02-66
D260	SHIFT ENVELOPE BEARING	02-229
D261	SHIFT ENVELOPE RANGE	02-230
D262	GATED SHIFT CLOCK	02-231
DM231	P1 PARAMETER	02-78
DM232	P2 PARAMETER	02-79
DM233	P3 PARAMETER	02-80
DM234	P4 PARAMETER	02-81
DM241	T1 PARAMETER	02-82
DM242	T2 PARAMETER	02-83
DM243	T3 PARAMETER	02-84
DM244	T4 PARAMETER	02-85
DM251	R1 PARAMETER	02-86
DM252	R2 PARAMETER	02-85
DM253	R3 PARAMETER	02-87
DM254	R4 PARAMETER	02-88
DP206	COMPUTER CCM SIGNAL	02-48
DP222N	NOT CONNECTED	01-162
DP223N	NOT CONNECTED	01-163
DL1	DATA LINK CLOCK PULSE	02-145
DL2	DATA LINK INTERROGATE	02-238

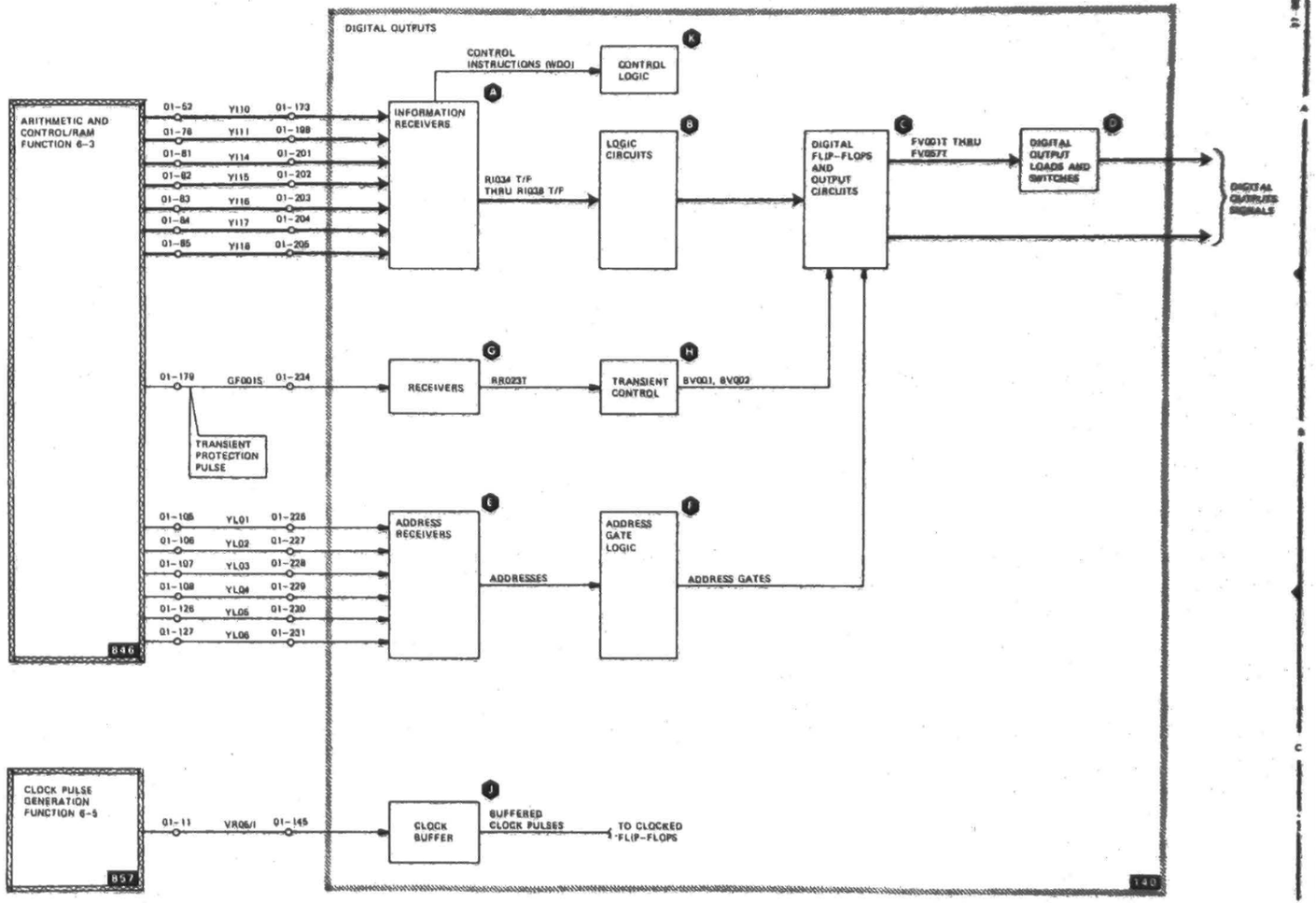


Figure 6-2. Input/Output (Sheet 5 of 9).

The analog inputs function of the 140 unit provides an electrical interface between the computing and memory functions of the computer and other subsystems of the MA-1 system for analog-type signals that are input to the computer. Each analog input signal is multiplexed through a single analog-to-digital converter to make the signal form compatible with computer logic. The converter generates a ten-bit binary signal for each analog input signal, and the ten bits are transmitted in parallel to the arithmetic and control/RAM(A&C/RAM) function for processing.

- **A** Normally sequences HIGH LEVEL DC ANALOG INPUT signals to null error amplifier as addressed by A&C/RAM function (FEEDBACK TEST - NORMAL/TEST switch on 140 unit front panel set to NORMAL). During test, sequences ANALOG OUTPUTS FEEDBACK signals through to null error amplifier as addressed by A&C/RAM function (FEEDBACK TEST - NORMAL/TEST switch set to TEST).
- **B** High level bootstrap unloader supplies charging current to line capacitance of HIGH LEVEL COMMON POINT. Groundout switch grounds HIGH LEVEL COMMON POINT during low level electronic switch operation, analog-to-digital conversion, and during sample and hold updating.
- **C** Converts AC POWER FORMS to low level dc voltages (-5 volt to +5 volt range) that are compatible with the operating range of low level electronic switches. Also scales down DC POWER FORMS to -5 volt to +5 volt range.
- **D** Detects noise content of DC POWER FORMS and outputs dc voltage in range of 0 to +5 volts. Computer determines whether or not noise levels are within tolerance.
- **E** Converts AC ANALOG INPUT SIGNALS to dc voltages. Amplitude of dc voltage is proportional to AC ANALOG INPUT SIGNALS amplitude and sign is dependent on phase relation with respect to AC COMP reference signal.
- **F** Provides reference signal (AC COMP) to phase detector from system 1600 Hz reference.
- **G** Sequences input DC VOLTAGES to null error amplifier as addressed by A&C/RAM function.
- **H** Low level bootstrap unloader supplies drive current to summing point of null error amplifier and charging current to line capacitance of LOW LEVEL COMMON POINT. Groundout switch grounds LOW LEVEL COMMON POINT during high level electronic switch operation, analog-to-digital conversion, and sample-and-hold updating periods.
- **J** An element of analog-to-digital converter. At beginning of analog-to-digital conversion cycle, routes high-level or low-level signal to sample and hold amplifier. During conversion, compares ANALOG FEEDBACK signal with SAMPLE AND HOLD FEEDBACK signal to generate ERROR SIGNAL.
- **K** An element of analog-to-digital converter. Sample and hold amplifier stores each analog voltage as it is converted to digital value. A200 amplifier compares ERROR SIGNAL from null error amplifier with output of sample and hold amplifier to generate COUNT UP/DOWN signals.
- **L** An element of analog-to-digital converter. Generates ten-bit binary digital equivalent of analog voltage stored in sample and hold amplifier.
- **M** Transmits ten-bit binary digital equivalent of each analog input voltage as it is sequenced through analog-to-digital converter. Also receives Read Analog Input control instructions from A&C/RAM function.
- **N** An element in feedback servo loop of analog-to-digital converter. Connects output of binary voltage weighted (BVW) register to BVW network and provides voltage levels required by BVW network.
- **P** An element in feedback servo loop of analog-to-digital converter. Converts digital signal of BVW register to analog signal for servo comparison with analog input voltage stored in sample and hold amplifier.
- **R** Receives analog input addresses from A&C/ RAM function via address bus to drive address gate logic.
- **S** Address gate logic decodes addresses that sequence analog input signals (or ANALOG OUTPUTS FEEDBACK signals) to analog-to-digital converter. Control logic controls sequence of analog inputs operations from control instructions.
- **T** Buffers and distributes clock pulses to analog inputs function.
- **U** Utilized for self-test. When set to NORMAL position, signals listed in five tables are processed. When set to TEST position, ANALOG OUTPUTS FEEDBACK SIGNALS are processed.

HIGH LEVEL DC ANALOG INPUT SIGNALS	SIGNAL NOMENCLATURE	140 UNIT CONNECTOR/PIN
A1N	LIFT ACCELERATION (ASIP)	02-180
A2A	(NOT CONNECTED)	01-7
A2N	STABLE PLATFORM LATITUDE	02-183
A3A	MISSILE FEEDBACK POT EXCITATION	01-8
A3N	MAXIMUM SAFE MACH ANALOG IN	02-156
A4	M2 ANTENNA POSITION P	02-14
A5A	ϵ_S	01-9
A6N	INDICATED SEA LEVEL PRESSURE	02-3
A7	M2 ANTENNA POSITION Y	02-49
A8	M3 ANTENNA POSITION P	02-186
A9	TRUE A OF A	02-158
A10	IMPACT TEMPERATURE ANALOG	02-173
A11	GLIDE SLOPE OUT	01-30
A12	(AGE ONLY)	02-13
A13A	η_S	01-32
A14	M3 ANTENNA POSITION Y	02-127
A15	M4 ANTENNA POSITION Y	02-93
A16	PILOT WARN ALTITUDE	02-119
A17	STABLE COORDINATE REFERENCE	02-121
A18	(NOT CONNECTED)	01-44
A19	(NOT CONNECTED)	01-49
A20	(AGE ONLY)	02-125
A21	LEFT ELEVON FEEDBACK	01-195
A22	RIGHT ELEVON FEEDBACK	01-47
A23	SELF TEST (HIGH STANDARD)	(INTERNAL TO COMPUTER)
A24	SELF TEST (LOW STANDARD)	(INTERNAL TO COMPUTER)
A25	SELF TEST (ANALOG OUTPUT)	(INTERNAL TO COMPUTER)
A26	M4 ANTENNA POSITION P	02-131
A28	LOCALIZER	01-126
A29	M1 ANTENNA POSITION P	02-141
A30	M1 ANTENNA POSITION Y	02-143

AC ANALOG INPUT SIGNALS	SIGNAL NOMENCLATURE	140 UNIT CONNECTOR/PIN
E15A	+55 V SIN η	01-60
E17A	+55 V SIN ϵ	01-62
E19	SIN ϕ PITCH	02-155
E21	+56.5 V SIN ROLL	01-174, 02-166
E22	+56.5 V COS ROLL	01-175, 02-167
E23	+56.5 V SIN HEADING	02-170
E24	+56.5 V COS HEADING	02-187

LOW LEVEL DC ANALOG INPUT SIGNALS	SIGNAL NOMENCLATURE	140 UNIT CONNECTOR/PIN
E15N	ϕ_D	01-107
E16A	ILS HEADING ERROR/YAW RATE (SNAPSHOOT)	01-81
E16N	ϕ_E	01-106
E18A	AFCS ROLL RATE	01-83
E20	LIFT ACCELERATION	01-108
E25	AFCS PITCH RATE	01-58
E26	PROPELLANT TEMPERATURE/ BETA (SNAPSHOOT)	02-12

Figure 6-2. Input/Output (Sheet 6 of 9)

DC POWER FORMS	140 CONNECTOR/PIN
+300 V	01-42
+150 V	01-41
+140 V	01-54
-250 V	01-53

AC POWER FORMS	140 CONNECTOR/PIN
115 V 1600 Hz STBY	01-143
115 V 1600 Hz STBY RTN	01-144
115 V 400 Hz ØA	01-123
115 V 400 Hz ØB	01-124
115 V 400 Hz ØC	01-134
115 V 400 Hz RTN	01-135

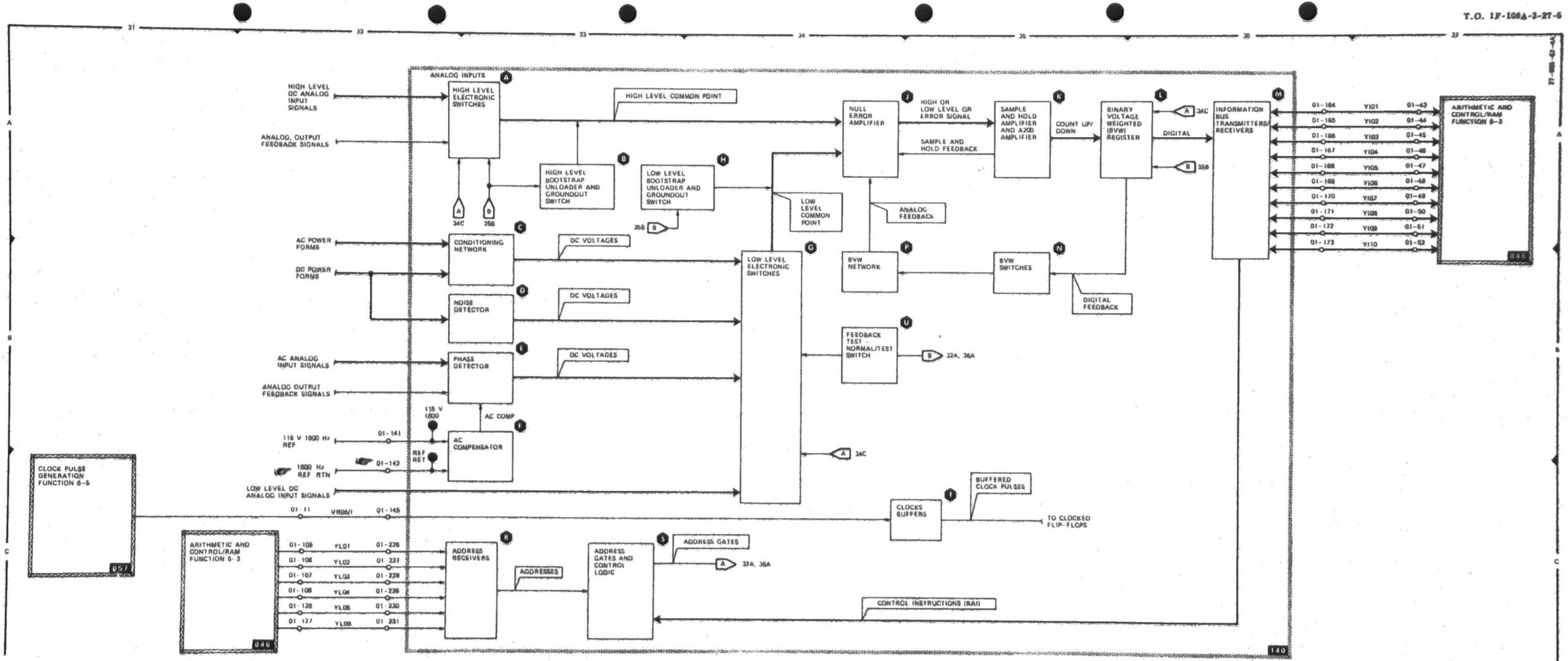


Figure 6-2. Input/Output (Sheet 7 of 9)

The analog outputs function of the 140 unit provides an electrical interface between the computing and memory functions of the computer and other subsystems of the MA-1 system for analog signals that are output to the MA-1 system. This function requests analog outputs from the arithmetic and control/RAM (A&C/RAM) and addresses these signals in the random access memory (RAM) of the A&C/RAM function. Analog outputs are received in digital form from the A&C/RAM function and converted to analog form.

(A) Receives and buffers analog outputs in digital form from A&C/RAM function.

(B) Controls transfer of analog outputs from information receivers to binary voltage weighted (BVW) register.

(C) Stores ten bits of each analog output signal in digital form during digital-to-analog conversion process.

(D) Connects BVW register flip-flop outputs to BVW network and provides voltage levels required by BVW network.

(E) Converts digital signals to analog.

(F) Initially routes analog signal to sample and hold amplifier and then compares SAMPLE AND HOLD FEEDBACK signal with ANALOG FEEDBACK signal to generate ERROR SIGNAL.

(G) Samples and holds each converted analog output signal, sends SAMPLE AND HOLD FEEDBACK signal to null error amplifier, and drives analog output circuits.

(H) Provides ANALOG OUTPUTS to MA-1 system and ANALOG OUTPUTS FEEDBACK SIGNALS to analog inputs function for self test. The POT EXCITATION signal excites the missile antenna position potentiometers and is derived from A3A when appropriate analog output circuit is enabled by D202.

(J) Closes servo-feedback loop between analog output circuits and null error amplifier as addressed by address counter.

(K) Buffers and distributes clock pulses from drum memory function.

(L) Generates addresses that select analog outputs from the A&C/RAM function, high level electronic switches, and analog output circuits.

(M) Decodes and distributes address counter addresses.

(N) Transmits analog outputs addresses to A&C/RAM function in parallel, six-bit digital form.

(P) Receives and buffers ANALOG OUTPUTS RESPONSE from A&C/RAM function as a result of sending an ANALOG OUTPUTS REQUEST to A&C/RAM function.

(R) Controls ANALOG OUTPUTS REQUEST line to A&C/RAM function. When an analog outputs request is made, A&C/RAM function responds with ANALOG OUTPUTS RESPONSE. This removes request for an analog output, until end of analog outputs execution, at which time, another analog outputs request is made.

(S) Transmits analog outputs requests to A&C/RAM, function.

(T) Enables analog outputs requests to be made when in ENABLE position. Grounds and disables ANALOG OUTPUTS REQUEST line when in I/O DISABLE position.

ANALOG OUTPUTS AND ANALOG OUTPUTS FEEDBACK SIGNALS	SIGNAL NOMENCLATURE	140 UNIT CONNECTOR/PIN
A51A	PROGRAM SEQUENCE	02-51
A51N	SIN OF HEADING ERROR ANGLE	02-26
A52A	COMPUTED ELEVATION RATE 1	01-64
A52N	TARGET Y	02-39
A53A	TIME TO GO/RAD 1 (SNAPSHOOT)	01-65
A53N	TARGET X	02-26
A54A	COMPUTED ELEVATION RATE 2	01-66
A54N	LEFT ELEVON COMMAND	01-129
A55A	COMPUTED AZIMUTH RATE 1	01-192
A55N	RIGHT ELEVON COMMAND	01-125
A56A	HORIZONTAL SMOOTHED ATTACK STEERING - HORIZONTAL DOT/ HORIZ 1 (SNAPSHOOT)	01-69
A56N	COMMAND ALTITUDE ANALOG	02-40
A57S1	(NOT CONNECTED)	01-193
A57S2	HORIZONTAL REFERENCE CIRCLE/ VERT 1 (SNAPSHOOT)	01-67
A58S1	TARGET BEARING	01-195
A58S2	VERTICAL REFERENCE CIRCLE/RAD 2 (SNAPSHOOT)	01-194
A59A	SPARE	02-147
A59N	COS OF HEADING ERROR ANGLE	02-56
A60A	COMPUTED AZIMUTH RATE 2	01-208
A60N	AIRPLANE X	02-73
A61	VERTICAL TARGET MARKER/HORIZ 2 (SNAPSHOOT)	01-68
A62	ELEVATION TARGET MARKER/VERT 2 (SNAPSHOOT)	01-223
A63N	TARGET ALTITUDE ANALOG	02-74
A64N	TARGET HEADING	02-54
A65N	COMMAND MACH ANALOG	02-70
A66N	AIRPLANE Y	02-71
A67	VERTICAL SMOOTH ATTACK STEERING - VERTICAL DOT/RAD 3 (SNAPSHOOT)	01-225
A68	HORIZ 3 (SNAPSHOOT)	01-91
A69	VERT 3 (SNAPSHOOT)	01-79
A70	P PRECESS - A M1	02-15
A70A*	P PRECESS - B M1	02-23
A71	Y PRECESS - A M1	02-22
A71A*	Y PRECESS - B M1	02-36
A72	P PRECESS - A M3	02-150
A72A*	P PRECESS - B M3	02-162
A73	Y PRECESS - A M3	
A73A*	Y PRECESS - B M3	
A74	P PRECESS - A M2	02-132
A74A*	P PRECESS - B M2	02-89
A75	Y PRECESS - A M4	02-113
A75A*	Y PRECESS - B M4	02-115
A76	P PRECESS - A M4	02-247
A76A*	P PRECESS - B M4	02-118
A77	Y PRECESS - A M2	02-116
A77A*	Y PRECESS - B M2	02-90
. . .*	POT EXCITATION	02-248
. . .*	POT EXCITATION RTN	02-246

*Not a feedback signal.

Figure 6-2. Input/Output (Sheet 8 of 9)

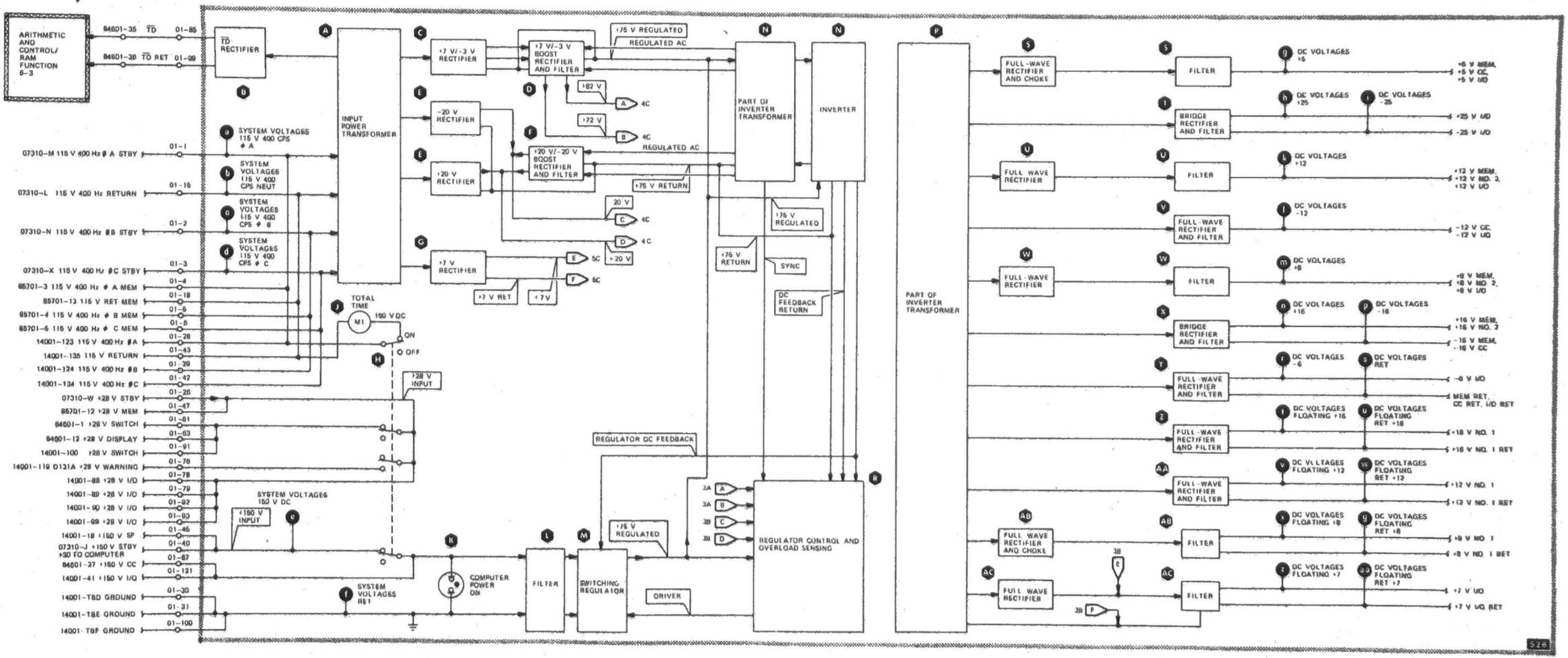


Figure 6-6. Power Supply (Sheet 2 of 2)

SIGNAL	140 UNIT CONNECTOR AND PIN	FUNCTIONAL DIAGRAM CROSS-REFERENCE	
		FIGURE TITLE	FIGURE NO.
A1N Lift Acceleration (ASIP)	02-180	Computer Tie-in (Sheet 6 of 6)	6-7
A2A Spare	01-7	---	---
A2N Stable Platform Latitude	02-183	SCRG (Sheet 6 of 8)	8-2
A3A Missile Feedback Pot Excitation	01-8	+50V and -50V Distribution	7-7
A3N Maximum Safe Mach Analog In	02-156	Air Data/Cockpit (Sheet 3 of 29)	8-3
A4 M2 Antenna Position P	02-14	Pitch and Yaw Slaving	5-18
A5A Space Stabilized Radar Elev Angle	01-9	Radar/IR Search, Supersearch, and Hand Control (Sheet 2 of 6)	3-11
A6N Indicated Sea Level Pressure	02-3	Air Data/Cockpit (Sheet 6 of 29)	8-3
A7 M2 Antenna Position Y	02-49	Pitch and Yaw Slaving	5-18
A8 M3 Antenna Position P	02-186	Pitch and Yaw Slaving	5-18
A9 True Angle of Attack	02-158	Air Data/Cockpit (Sheet 3 of 29)	8-3
A10 Impact Temperature Analog In	02-173	Air Data/Cockpit (Sheet 3 of 29)	8-3
A11 Glide Slope Out	01-30	ILS (Sheet 5 of 7)	9-4
A12 AGE Only (No Connection)	02-13	---	---
A13A η_S	01-32	Radar/IR Search, Supersearch, and Hand Control (Sheet 2 of 6)	3-11
A14 M3 Antenna Position Y	02-127	Pitch and Yaw Slaving	5-18
A15 M4 Antenna Position Y	02-93	Pitch and Yaw Slaving	5-18
A16 Pilot Warn Altitude	02-119	Computer Tie-in (Sheet 6 of 6)	6-7
A17 Stable Coordinate Reference	02-121	SSGC (Sheet 21 of 65)	2-2
A18 Spare	01-44	---	---
A19 Spare	01-49	---	---
A20 AGE Only (No Connection)	02-125	---	---
A21 Left Elevon Feedback	01-95	AFCS (Sheet 7 of 9)	8-4
A22 Right Elevon Feedback	01-47	AFCS (Sheet 7 of 9)	8-4
A23 Self Test (High Standard) (Internal to Computer)	---	---	---
A24 Self Test (Low Standard) (Internal to Computer)	---	---	---
A25 Self Test (Analog Output) (Internal to Computer)	---	---	---
A26 M4 Antenna Position P	02-131	Pitch and Yaw Slaving	5-18
A28 Localizer	01-126	ILS (Sheet 3 of 7)	9-4
A29 M1 Antenna Position P	02-141	Pitch and Yaw Slaving	5-18
A30 M1 Antenna Position Y	02-143	Pitch and Yaw Slaving	5-18
A51A (Program Sequence)	02-51	---	---
		Range Gate/A51A (Sheet 2 of 2)	5-17
A51N Sin of Heading Error Angle	02-25	Air Data/Cockpit (Sheet 11 of 29)	8-3
		TSD (Sheet 1 of 11)	8-5
A52A Computed Elevation Rate 1	01-64	Radar Angle Track (Sheet 4 of 4)	3-16
A52N Target Y	02-39	Air Data/Cockpit (Sheet 11 of 29)	8-3
		TSD (Sheet 6 of 11)	8-5
A53A Time to Go/RAD 1 (Snapshoot)	01-65	Attack Displays (Sheet 2 of 10) and Snapshoot System Symbol	3-18 & 10-1
A53N Target X	02-26	Air Data/Cockpit (Sheet 11 of 29)	8-3
		TSD (Sheet 6 of 11)	8-5
A54A Computed Elevation Rate 2	01-66	Radar Angle Track (Sheet 4 of 4)	3-16
A54N Left Elevon Command	01-129	AFCS (Sheet 7 of 9)	8-4
A55A Computed Azimuth Rate 1	01-192	Radar Angle Track (Sheet 4 of 4)	3-16
A55N Right Elevon Command	01-125	AFCS (Sheet 7 of 9)	8-4
A56A Horizontal Smoothed Attack Steering - Horizontal Dot/ HORIZ 1 (Snapshoot)	01-69	Attack Displays (Sheet 4 of 10)	3-18
A56N Command Altitude Analog	02-40	Air Data/Cockpit (Sheet 6 of 29)	8-3
A57S1 Spare	01-193	---	---
A57S2 Horizontal Reference Circle/ VERT 1 (Snapshoot)	01-67	Attack Displays (Sheet 6 of 10) and Snapshoot System Symbology	3-18 & 10-1
A58S1 Target Bearing	01-195	Attack Displays (Sheet 6 of 10)	3-18
A58S2 Vertical Reference Circle/RAD 2 (Snapshoot)	01-194	Attack Displays (Sheet 6 of 10) and Snapshoot System Symbology	3-18 & 10-1
A59A Estimated Range Rate	02-147	Output Not Utilized	---
A59N Cos of Heading Error Angle	02-36	Air Data/Cockpit (Sheet 11 of 29)	8-3
		TSD (Sheet 1 of 11)	8-5
A60A Computed Azimuth Rate 2	01-208	Radar Angle Track (Sheet 4 of 4)	3-16
A60N Airplane X	02-73	Air Data Cockpit (Sheet 10 of 29)	8-3
		TSD (Sheet 1 of 11)	8-5
A61 Vertical Target Marker/HORIZ 2 (Snapshoot)	01-68	Attack Displays (Sheet 6 of 10) and Snapshoot System Symbology	3-18 & 10-1
A62 Elevation Target Marker Navigation/VERT 2 (Snapshoot)	01-223	Attack Displays (Sheet 6 of 10) and Snapshoot System Symbology	3-18 & 10-1
A63N Target Altitude Analog Signal	02-74	Air Data/Cockpit (Sheet 6 of 29)	8-3
A64N Target Heading	02-54	Air Data/Cockpit (Sheet 11 of 29)	8-3
		TSD (Sheet 6 of 11)	8-5
A65N Command Mach Analog Signal	02-70	Air Data/Cockpit (Sheet 4 of 29)	8-3
A66N Airplane Y	02-71	Air Data/Cockpit (Sheet 10 of 29)	8-3
		TSD (Sheet 1 of 11)	8-5
A67 Vertical Smooth Attack Steering-Vertical Dot/RAD 3 (Snapshoot)	01-225	Attack Displays (Sheet 4 of 10) and Snapshoot System Symbology	3-18 & 10-1
A68 HORIZ 3 (Snapshoot)	01-91	Snapshoot System Symbology	10-1
A69 VERT 3 (Snapshoot)	01-79	Snapshoot System Symbology	10-1
A70 P Precess a M1	02-15	Pitch and Yaw Slaving	5-18
A70A P Precess b M1	02-23	Pitch and Yaw Slaving	5-18
A71 Y Precess a M1	02-22	Pitch and Yaw Slaving	5-18
A71A Y Precess b M1	02-36	Pitch and Yaw Slaving	5-18
A72 P Precess a M3	02-150	Pitch and Yaw Slaving	5-18
A72A P Precess b M3	02-162	Pitch and Yaw Slaving	5-18
A73 Y Precess a M3	02-159	Pitch and Yaw Slaving	5-18
A73A Y Precess b M3	02-53	Pitch and Yaw Slaving	5-18
A74 P Precess a M2	02-132	Pitch and Yaw Slaving	5-18
A74A P Precess b M2	02-89	Pitch and Yaw Slaving	5-18
A75 Y Precess a M4	02-113	Pitch and Yaw Slaving	5-18
A75A Y Precess b M4	02-115	Pitch and Yaw Slaving	5-18
A76 P Precess a M4	02-247	Pitch and Yaw Slaving	5-18
A76A P Precess b M4	02-118	Pitch and Yaw Slaving	5-18
A77 Y Precess a M2	02-116	Pitch and Yaw Slaving	5-18
A77A Y Precess b M2	02-90	Pitch and Yaw Slaving	5-18
A81 Self-Test (Internal to Computer)	---	---	---

Figure 6-7. Computer Tie-In (Sheet 1 of 6)

SIGNAL	140 UNIT CONNECTOR AND PIN	FUNCTIONAL DIAGRAM CROSS-REFERENCE	
		FIGURE TITLE	FIGURE NO.
D101 +28 V Trigger Depression	02-7	Armament Trigger	5-5
D102 Auto Engage	02-123	AFCS (Sheet 3 of 9)	8-4
D103 +28 V In IR Track	01-92	IR/Radar Switching (Sheet 2 of 5)	3-21
D104 +28 V System Test C	02-11	SSGC (Sheet 2 of 65)	2-2
D105 +28 V Not Search Computer	01-114	Range Track (Sheet 4 of 4)	3-17
D106 +28 V Visual Identification Select Signal	02-8	Armament Display (Sheet 2 of 2)	5-3
D107 System Test A	02-9	SSGC (Sheet 2 of 65)	2-2
D108 TACAN Station 5A Select	02-6	TACAN (Sheet 5 of 8)	9-2
D109 Radar Missiles Select	02-10	Bay Select (Sheet 2 of 2)	5-7
D110 GUN ABOARD	02-18	Armament Display (Sheet 2 of 2)	5-3
D111 Assist Engage	02-239	AFCS (Sheet 3 of 9)	8-4
D112 Computer Interrogate Test Radiating Facility Signal	02-19	SSGC (Sheet 27 of 65)	2-2
D113 +28 V ROT Computer	01-115	Range Track (Sheet 4 of 4)	3-17
D114 +28 V Manual Pursuit Signal	02-20	IR/Radar Switching (Sheet 1 of 5)	3-21
D115 +28 V System Test B	02-21	SSGC (Sheet 2 of 65)	2-2
D116 Digital Input Navigation	02-16	Computer Tie-In (Sheet 6 of 6)	6-7
D117 Firing Advance Signal	02-31	Bay Select (Sheet 2 of 2)	5-7
D118 COD 1 (Snapshoot)	01-127	Snapshoot System Symbology	10-1
D119 Altitude Hold/ILS	01-128	AFCS (Sheet 5 of 9)	8-4
D120 COD 2 (Snapshoot)	01-105	Snapshoot System Symbology	10-1
D121 +28 V DROT	01-116	Range Track (Sheet 4 of 4)	3-17
D122 Master Arming	02-32	Master Arming	5-4
D123 TACAN Reliability Signal	02-199	TACAN (Sheet 5 of 8)	9-2
D124 16S Station Select	02-17	Data Link (Sheet 2 of 6)	9-6
D125 Arm/Computer Confirm Voltage	02-33	Master Arming	5-4
D126 +28 V In Nose-Cockpit	02-128	Anti-Chaff (Sheet 2 of 4)	3-20
D127 Heading Hold	02-5	AFCS (Sheet 3 of 9)	8-4
D128 Address-Time Slot 22	02-200	Data Link (Sheet 2 of 6)	9-6
D129 +28 V ATOT Computer	01-117	AGC and HOM (Sheet 4 of 4)	3-6
D130 SPL WPN OR GUN SELECT	02-34	Armament Display (Sheet 2 of 2)	5-3
D131 +28 V Test to Annunciator	02-35	SSGC (Sheet 6 of 65)	2-2
D132 AFCS Uncage	02-129	AFCS (Sheet 3 of 9)	8-4
D133 Navigation Mode Select 1	02-27	Computer Tie-in (Sheet 6 of 6)	6-7
D134 Navigation Mode Select 2	02-28	Computer Tie-in (Sheet 6 of 6)	6-7
D135 +28 V Map Scale 1	02-29	Air Data/Cockpit (Sheet 15 of 29)	8-3
		TSD (Sheet 1 of 11)	8-5
D136 +28 V Map Scale 2	02-30	Air Data/Cockpit (Sheet 15 of 29)	8-3
		TSD (Sheet 1 of 11)	8-5
D137 Address-Time Slot 23	02-201	Data Link (Sheet 2 of 6)	9-6
D138 Address-Time Slot 24	02-202	Data Link (Sheet 2 of 6)	9-6
D139 Address-Time Slot 25	02-203	Data Link (Sheet 2 of 6)	9-6
D140 Address-Time Slot 26	02-204	Data Link (Sheet 2 of 6)	9-6
D141 AGE/COD 3 (SNAPSHOOT)	01-96	Snapshoot System Symbology	10-1
D142 AGE Only (No Connection)	01-97	---	---
D143 (No Connection)	01-98	---	---
D144 Drum Pressurization	01-86	Drum Memory (Sheet 2 of 2)	6-4
D145 Trim Up	02-133	AFCS (Sheet 5 of 9)	8-4
D146 Trim Down	02-153	AFCS (Sheet 5 of 9)	8-4
D147 Trim Right	02-151	AFCS (Sheet 5 of 9)	8-4
D148 Trim Left	02-165	AFCS (Sheet 5 of 9)	8-4
D150 TACAN Station 1A Select	02-42	TACAN (Sheet 5 of 8)	9-2
D151 TACAN Station 2A Select	02-41	TACAN (Sheet 5 of 8)	9-2
D152 TACAN Station 3A Select	02-44	TACAN (Sheet 5 of 8)	9-2
D153 TACAN Station 4A Select	02-43	TACAN (Sheet 5 of 8)	9-2
D155 1S Station Select	02-58	Data Link (Sheet 2 of 6)	9-6
D156 2S Station Select	02-57	Data Link (Sheet 2 of 6)	9-6
D157 4S Station Select	02-60	Data Link (Sheet 2 of 6)	9-6
D158 8S Station Select	02-59	Data Link (Sheet 2 of 6)	9-6
D160 Range/Bearing Digital	02-109	TACAN (Sheet 5 of 8)	9-2

Figure 6-7, Computer Tie-In (Sheet 2 of 6)

SIGNAL	140 UNIT CONNECTOR AND PIN	FUNCTIONAL DIAGRAM CROSS-REFERENCE	
		FIGURE TITLE	FIGURE NO.
D161 Range/Bearing Digital	02-110	TACAN (Sheet 5 of 8)	9-2
D162 Range/Bearing Digital	02-111	TACAN (Sheet 5 of 8)	9-2
D163 Range/Bearing Digital	02-112	TACAN (Sheet 5 of 8)	9-2
D165 thru D168 and D170 thru D173 Digital Display (Internal to Computer)	---	---	---
D175 Destination Select	02-75	Computer Tie-in (Sheet 6 of 6)	6-7
D176 Digital Input Navigation	02-61	Computer Tie-in (Sheet 6 of 6)	6-7
D177 Digital Input Navigation	02-77	Computer Tie-in (Sheet 6 of 6)	6-7
D178 Digital Input Navigation	02-76	Computer Tie-in (Sheet 6 of 6)	6-7
D180 Self-Test (Internal to Computer)	01-87	---	---
D181 thru D183 Digital Display (Internal to Computer)	---	---	---
D185 +28 V Tank Aboard Signal	02-224	Computer Tie-in (Sheet 6 of 6)	6-7
D186 Assist OK	02-225	AFCS (Sheet 3 of 9)	8-4
D187 +28 V Anti-Chaff	02-236	Anti-Chaff (Sheet 2 of 4)	3-20
D188 Gunsight Selected (Snapshoot)	02-237	Display (Snapshoot System) (Sheet 4B of 6)	3-7
D200 AFCS OK	02-106	AFCS (Sheet 3 of 9)	8-4
D201 Computer A Prime Signal	02-45	Armament Timing (Sheet 2 of 2)	5-2
D202 Computer A Signal	02-46	Armament Timing (Sheet 2 of 2)	5-2
D203 Computer Validity-Self Test	02-47	SSGC (Sheet 16 of 65)	2-2
D205 Altitude Hold Interlock	02-107	AFCS (Sheet 5 of 9)	8-4
D207 +28 V Navigation Mode	01-136	Attack Displays (Sheet 10 of 10)	3-18
D208 +28 V In Nose-Computer	01-137	Anti-Chaff (Sheet 2 of 4)	3-20
	02-117	Parameters and CCM (Sheet 3 of 3)	5-20
D209 +28 V Not Navigation	01-138	Attack Displays (Sheet 10 of 10)	3-18
D210 +28 V Attack Valid	01-139	Anti-Chaff (Sheet 2 of 4)	3-20
D212 Computer Pursuit Signal	02-50	LC/PUR Switching	5-9
D213 Time to Go Circle Blank	01-130	Attack Displays (Sheet 9 of 10)	3-18
D214 +28 V ILS Approach	02-99	Air Data/Cockpit (Sheet 16 of 29)	8-3
D215A +28 V Visual Identification Warning	02-100	Display (Sheet 4 of 6)	3-7
D215N Auto OK	02-213	AFCS (Sheet 3 of 9)	8-4
D216A Computer B Signal	02-62	Anti-Chaff (Sheet 2 of 4)	3-20
		Armament Timing (Sheet 2 of 2)	5-2
D216N HSI Range Validity Signal	02-101	Air Data/Cockpit (Sheet 16 of 29)	8-3
D217A Computer C Signal	02-63	Armament Timing (Sheet 2 of 2)	5-2
D217N TACAN Annunciator DR Signal	02-102	TSD (Sheet 1 of 11)	8-6
D218A Computer D Signal	02-64	Armament Timing (Sheet 2 of 2)	5-2
D218N +28 V Target Marker Indicator Navigation	01-140	Attack Displays (Sheet 10 of 10)	3-18
D219A Computer E Signal	02-65	Armament Timing (Sheet 2 of 2)	5-2
D220A (No Connection)	01-147	---	---
D220N (No Connection)	01-148	---	---
D221A Computer Abort Signal	02-68	Armament Display (Sheet 2 of 2)	5-3
D221N (No Connection)	01-149	---	---
D222A (No Connection)	01-150	---	---
D223A +28V Lead Collision Signal	02-69	LC/PUR Switching	5-9
D224A Test Mode Control (IFF)	02-214	SSGC (Sheet 29 of 65)	2-2
		IFF (Sheet 2 of 3)	9-5
D224N Latitude Correction Plus One Degree	02-215	SSGC (Sheet 21 of 65)	2-2
		SCRG (Sheet 2 of 8)	8-2
D225A +28 V Power Test Fail	02-216	Display (Sheet 4 of 6)	3-7
D225N Latitude Correction Minus One Degree	02-217	SSGC (Sheet 21 of 65)	2-2
		SCRG (Sheet 2 of 8)	8-2
D226A Left/Right Signal	01-93	Anti-Chaff (Sheet 2 of 4)	3-20
	02-52	Fire Signal (Sheet 2 of 2)	5-22
D226N +28 V Computer	02-126	SSGC (Sheet 2 of 65)	2-2
D227A +28 V Computer	02-219	SSGC (Sheet 2 of 65)	2-2

Figure 6-7. Computer Tie-In (Sheet 3 of 6)

SIGNAL	140 UNIT CONNECTOR AND PIN	FUNCTIONAL DIAGRAM CROSS-REFERENCE	
		FIGURE TITLE	FIGURE NO.
D227N +28 V Computer	02-226	SSGC (Sheet 2 of 65)	2-2
D228A +28 V Computer	02-227	SSGC (Sheet 2 of 65 and 17 of 65) ILS (Sheet 5 of 7)	2-2
D228N +28 V DR/DL	02-86	Data Link (Sheet 6 of 6)	9-6
D229A Altitude Warn Signal	02-228	Intercomm (Sheet 1 of 4)	9-7
D229N +28 V DL Valid	02-87	Data Link (Sheet 6 of 6)	9-6
D230 Computer Interrogation Audio	02-66	SSGC (Sheet 27 of 65)	2-2
D260 Shift Envelope Bearing	02-229	TACAN (Sheet 5 of 8)	9-2
D261 Shift Envelope Range	02-230	TACAN (Sheet 5 of 8)	9-2
D262 Gated Shift Clock	02-231	TACAN (Sheet 5 of 8)	9-2
$\overline{D361}$	02-233	Air Data/Cockpit (Sheet 3 of 29)	8-3
D361	02-232	Air Data/Cockpit (Sheet 3 of 29)	8-3
D362 Mach Multi Digit	02-205	Air Data/Cockpit (Sheet 3 of 29)	8-3
D363 Mach Multi Digit	02-206	Air Data/Cockpit (Sheet 3 of 29)	8-3
D364 Mach Multi Digit	02-207	Air Data/Cockpit (Sheet 3 of 29)	8-3
D365 Mach Multi Digit	02-208	Air Data/Cockpit (Sheet 3 of 29)	8-3
D366 Mach Multi Digit	02-209	Air Data/Cockpit (Sheet 3 of 29)	8-3
D367 Mach Multi Digit	02-210	Air Data/Cockpit (Sheet 3 of 29)	8-3
D368 Mach Multi Digit	02-211	Air Data/Cockpit (Sheet 3 of 29)	8-3
D369 Mach Multi Digit	02-212	Air Data/Cockpit (Sheet 3 of 29)	8-3
D370 Mach Multi Digit	02-220	Air Data/Cockpit (Sheet 3 of 29)	8-3
D371 Mach Multi Digit	02-221	Air Data/Cockpit (Sheet 3 of 29)	8-3
D372 Mach Multi Digit	02-222	Air Data/Cockpit (Sheet 3 of 29)	8-3
D373 Mach Multi Digit	02-223	Air Data/Cockpit (Sheet 3 of 29)	8-3
D381	02-234	Air Data/Cockpit (Sheet 2 of 29)	8-3
$\overline{D381}$	02-235	Air Data/Cockpit (Sheet 2 of 29)	8-3
D382 Hp Multi Digit	02-175	Air Data/Cockpit (Sheet 2 of 29)	8-3
D383 Hp Multi Digit	02-176	Air Data/Cockpit (Sheet 2 of 29)	8-3
D384 Hp Multi Digit	02-177	Air Data/Cockpit (Sheet 2 of 29)	8-3
D385 Hp Multi Digit	02-178	Air Data/Cockpit (Sheet 2 of 29)	8-3
D386 Hp Multi Digit	02-179	Air Data/Cockpit (Sheet 2 of 29)	8-3
D387 Hp Multi Digit	02-189	Air Data/Cockpit (Sheet 2 of 29)	8-3
D388 Hp Multi Digit	02-190	Air Data/Cockpit (Sheet 2 of 29)	8-3
D389 Hp Multi Digit	02-191	Air Data/Cockpit (Sheet 2 of 29)	8-3
D390 Hp Multi Digit	02-192	Air Data/Cockpit (Sheet 2 of 29)	8-3
D391 Hp Multi Digit	02-193	Air Data/Cockpit (Sheet 2 of 29)	8-3
D392 Hp Multi Digit	02-194	Air Data/Cockpit (Sheet 2 of 29)	8-3
D393 Hp Multi Digit	02-195	Air Data/Cockpit (Sheet 2 of 29)	8-3
DL1 Clock Pulse	02-145	Data Link (Sheet 6 of 6)	9-6
DL2 Interrogate	02-238	Data Link (Sheet 6 of 6)	9-6
DL3 Ready	02-240	Data Link (Sheet 6 of 6)	9-6
DL5 Data Complement	02-242	Data Link (Sheet 6 of 6)	9-6
DM231 P1 Parameter	02-78	Parameters and CCM (Sheet 3 of 3)	5-20
DM232 P2 Parameter	02-79	Parameters and CCM (Sheet 3 of 3)	5-20
DM233 P3 Parameter	02-80	Parameters and CCM (Sheet 3 of 3)	5-20
DM234 P4 Parameter	02-81	Parameters and CCM (Sheet 3 of 3)	5-20
DM241 T1 Parameter	02-82	Parameters and CCM (Sheet 3 of 3)	5-20
DM242 T2 Parameter	02-83	Parameters and CCM (Sheet 3 of 3)	5-20
DM243 T3 Parameter	02-94	Parameters and CCM (Sheet 3 of 3)	5-20
DM244 T4 Parameter	02-95	Parameters and CCM (Sheet 3 of 3)	5-20
DM251 R1 Parameter	02-84	Parameters and CCM (Sheet 3 of 3)	5-20
DM252 R2 Parameter	02-85	Parameters and CCM (Sheet 3 of 3)	5-20
DM253 R3 Parameter	02-97	Parameters and CCM (Sheet 3 of 3)	5-20
DM254 R4 Parameter	02-98	Parameters and CCM (Sheet 3 of 3)	5-20
DP204 Antenna Rate Increase (Internal to Computer)	---	---	---
DP206 Computer CCM Signal	02-48	Parameters and CCM (Sheet 3 of 3)	5-20
DP211 Antenna Rate Increase (Internal to Computer)	---	---	---
DP222N (No Connection)	01-162	---	---
DP223N (No Connection)	01-163	---	---
E15A 55 V sin η	01-60	Radar Track Resolver Chain (Sheet 2 of 2)	3-12
		IR Track/Radar Scan Resolver Chain (Sheet 2 of 2)	3-13
		IR Track/Radar Slaved Resolver Chain (Sheet 2 of 2)	3-14
E15N $\dot{\eta}_D$/Az Angle Rate	01-107	Radar Angle Track (Sheet 2 of 4)	3-16
E16A ILS Heading Error/Yaw Rate (Snapshoot)	01-61	AFCS (Sheet 7 of 9) and Snapshoot System Symbology	8-4 & 10-1
E16N $\dot{\eta}_E$ El Angle Rate	01-106	Radar Angle Track (Sheet 2 of 4)	3-16

Figure 6-7. Computer Tie-In (Sheet 4 of 6)

SIGNAL	140 UNIT CONNECTOR AND PIN	FUNCTIONAL-DIAGRAM CROSS-REFERENCE	
		FIGURE TITLE	FIGURE NO.
E17A 55 V sin ϵ	01-62	Radar Track Resolver Chain (Sheet 2 of 2)	3-12
		IR Track/Radar Scan Resolver Chain (Sheet 2 of 2)	3-13
		IR Track/Radar Slaved Resolver Chain (Sheet 2 of 2)	3-14
E18A AFCS Roll Rate	01-63	AFCS (Sheet 7 of 9)	8-4
E19 sin Pitch Angle θ Signal	02-155	Attack Displays (Sheet 4 of 10)	3-18
		SCRG (Sheet 4 of 8)	8-2
E20 Lift Acceleration	01-108	AFCS (Sheet 7 of 9)	8-4
E21 56.5 V sin Roll	02-166	Attack Displays (Sheet 4 of 10)	3-18
E22 56.5 V cos Roll	02-167	Attack Displays (Sheet 4 of 10)	3-18
E23 56.5 V sin Heading Angle	02-170	SSRG (Sheet 4 of 8)	8-2
E24 56.5 V cos Heading Angle	02-187	SCRG (Sheet 4 of 8)	8-2
E25 AFCS Pitch Rate	01-58	AFCS (Sheet 7 of 9)	8-4
E26 Propellant Temperature/BETA (Snapshoot)	02-12	Thermal Battery (M) and Snapshoot System Symbology	5-12 & 10-1
Hp Control	02-245	Air Data/Cockpit (Sheet 2 of 29)	8-3
Mach Control	02-244	Air Data/Cockpit (Sheet 3 of 29)	8-3
Modulator Sweep Trigger	01-103	Transmitting (Sheet 2 of 4)	3-4
Pot Excitation	02-248	Pitch and Yaw Slaving	5-18
Range Gate	01-104	Range Track (Sheet 2 of 4)	3-17
+28 V SSGC No. 5	02-142	Subsystem Test (Sheet 2 of 5)	5-24

(A) HOMING POINT SELECTOR switch provides inputs to computer to select desired homing point data stored on 857 unit.

SWITCH POSITION	D116	D175	D176	D177	D178
A	0	0	1	0	1
B	0	1	0	1	0
C	0	0	1	0	0
D	1	1	0	0	0
E	1	0	0	0	1
F	0	0	0	1	1
G	1	0	1	1	0
H	1	1	1	0	1
J	0	1	0	1	1
K	0	0	1	1	0
L	1	1	1	0	0
M	0	1	0	0	1
N	0	0	0	1	0
O	1	0	1	0	0
P	1	1	0	0	1
Q	1	0	0	1	1
R	0	0	1	1	1
S	1	1	1	1	0
T	0	1	1	0	1
U	1	1	0	1	0

(B) AUTO MODE selector switch provides inputs to computer to indicate desired navigation mode.

SWITCH POSITION	D133	D134
AUTO NAV	0	0
MAX RANGE	0	1
MIN TIME	1	0
ILS	1	1
(V) ILS APCH	1	1
(V) MAN NAV	0	0

Figure 8-7. Computer Tie-in (Sheet 5 of 8)

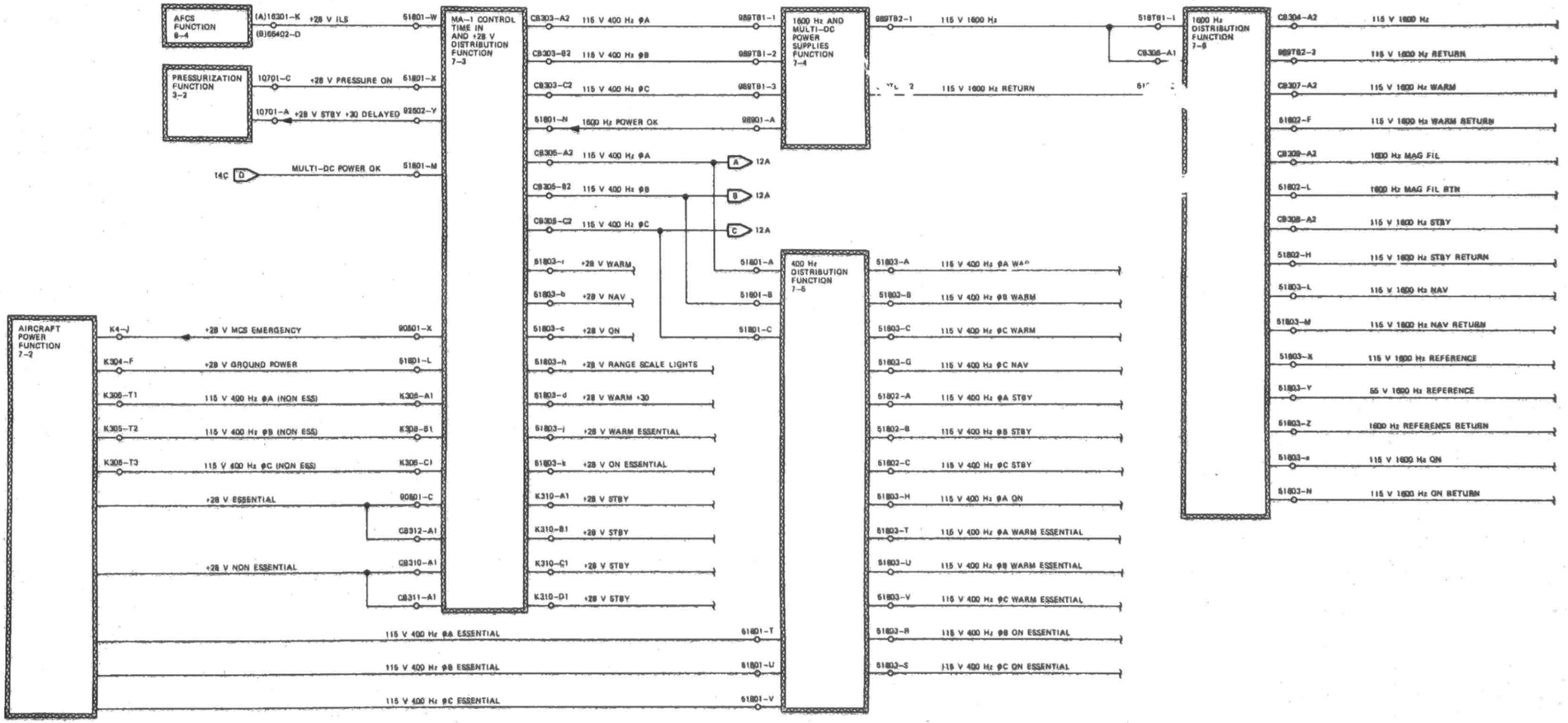


Figure 7-1. MA-1 Power Subsystem Block Diagram (Sheet 2 of 3)

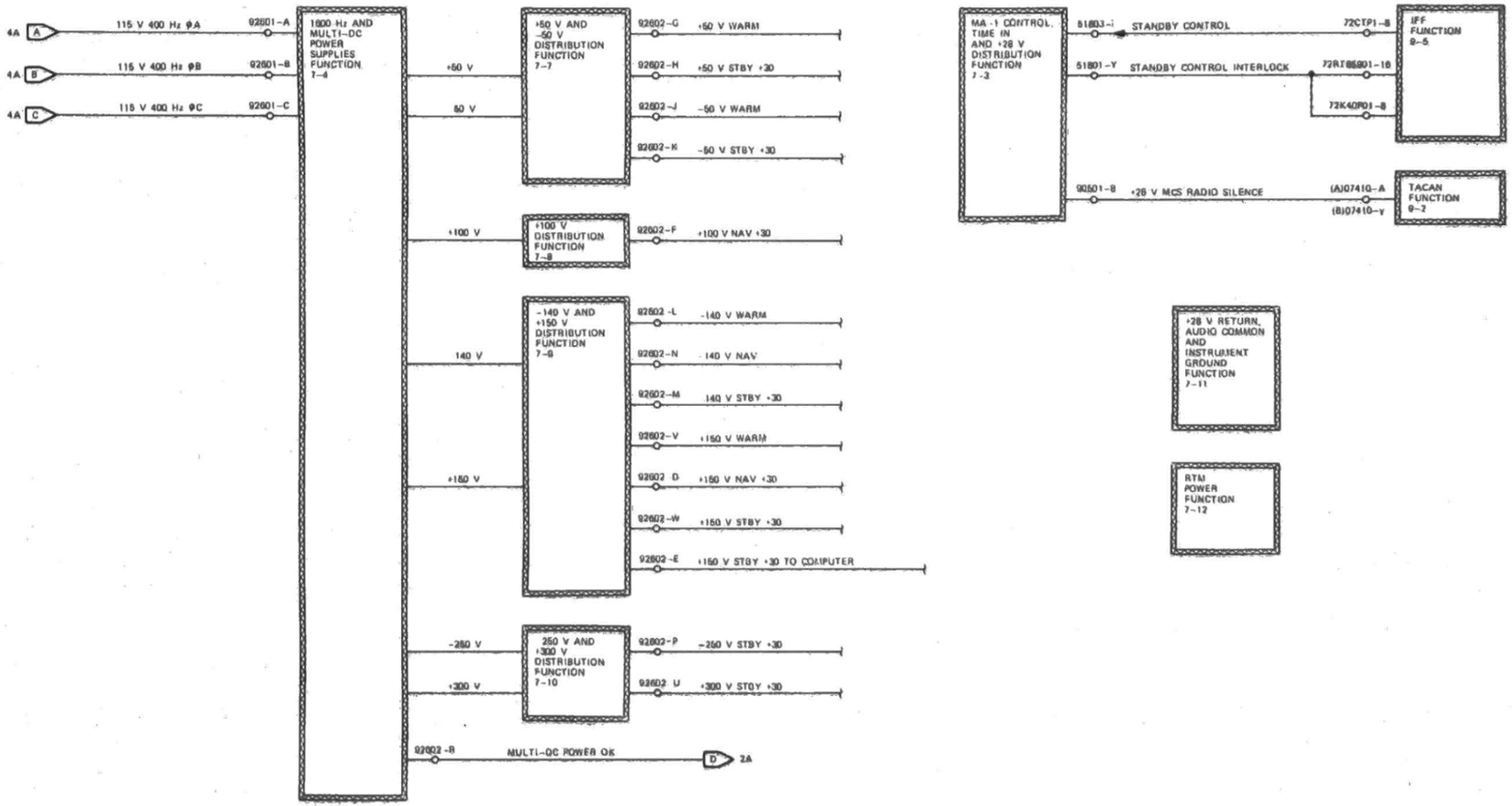


Figure 7-1. MA-1 Power Subsystem Block Diagram (Sheet 3 of 3)

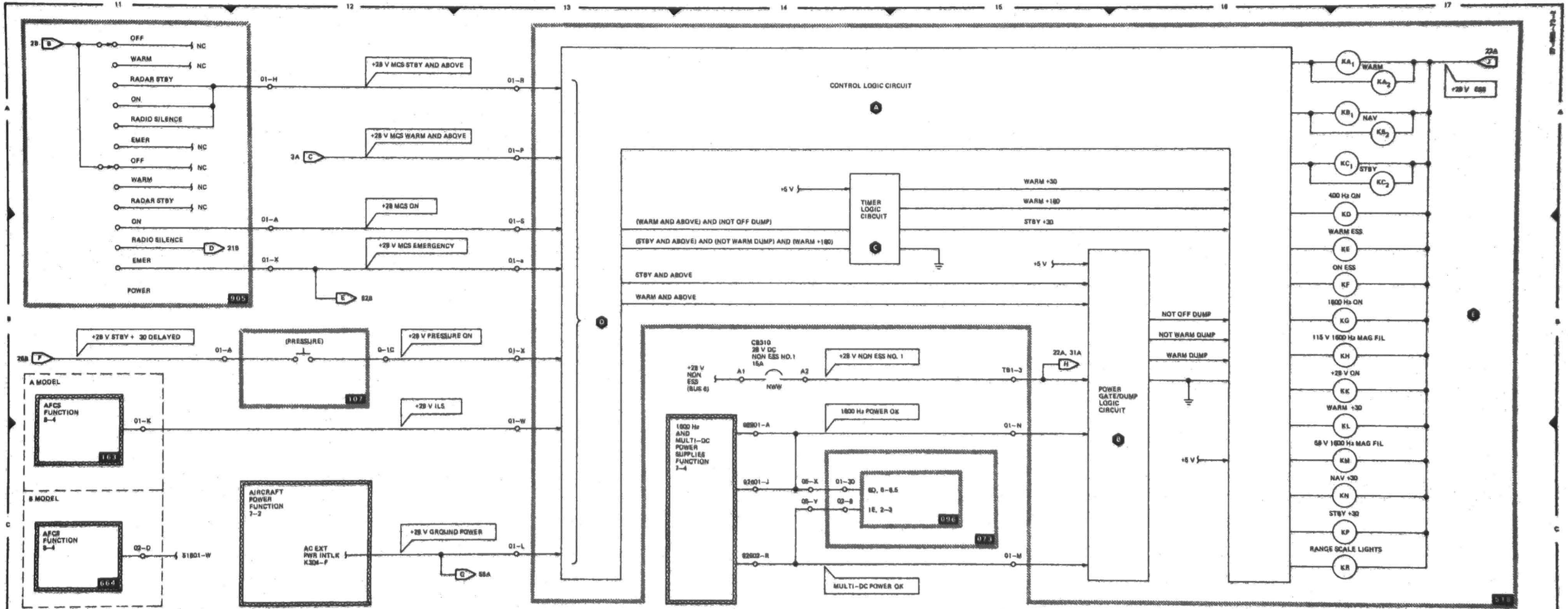


Figure 7-3. MA-1 Control, Time In and +28 v Distribution (Sheet 3 of 7)

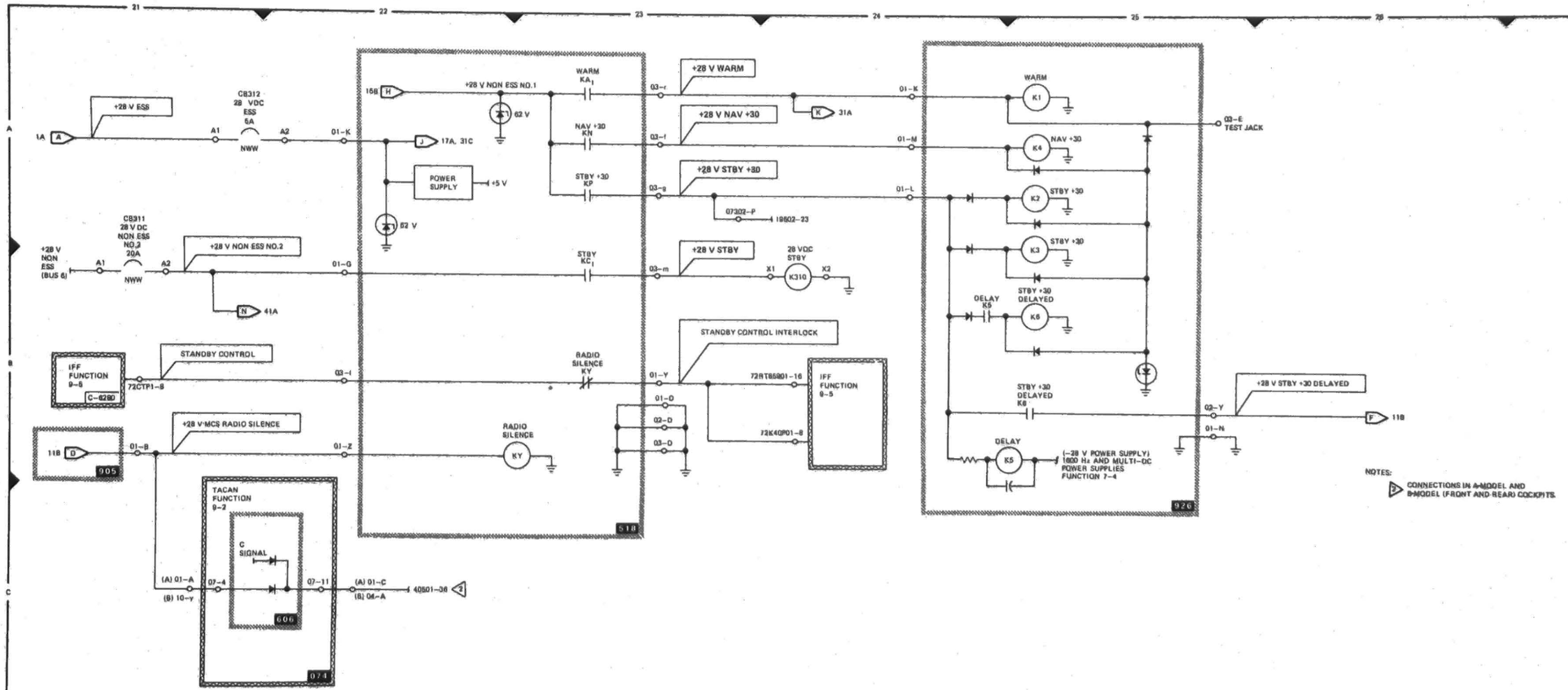


Figure 7-3. MA-1 Control, Time In and +28 v Distribution (Sheet

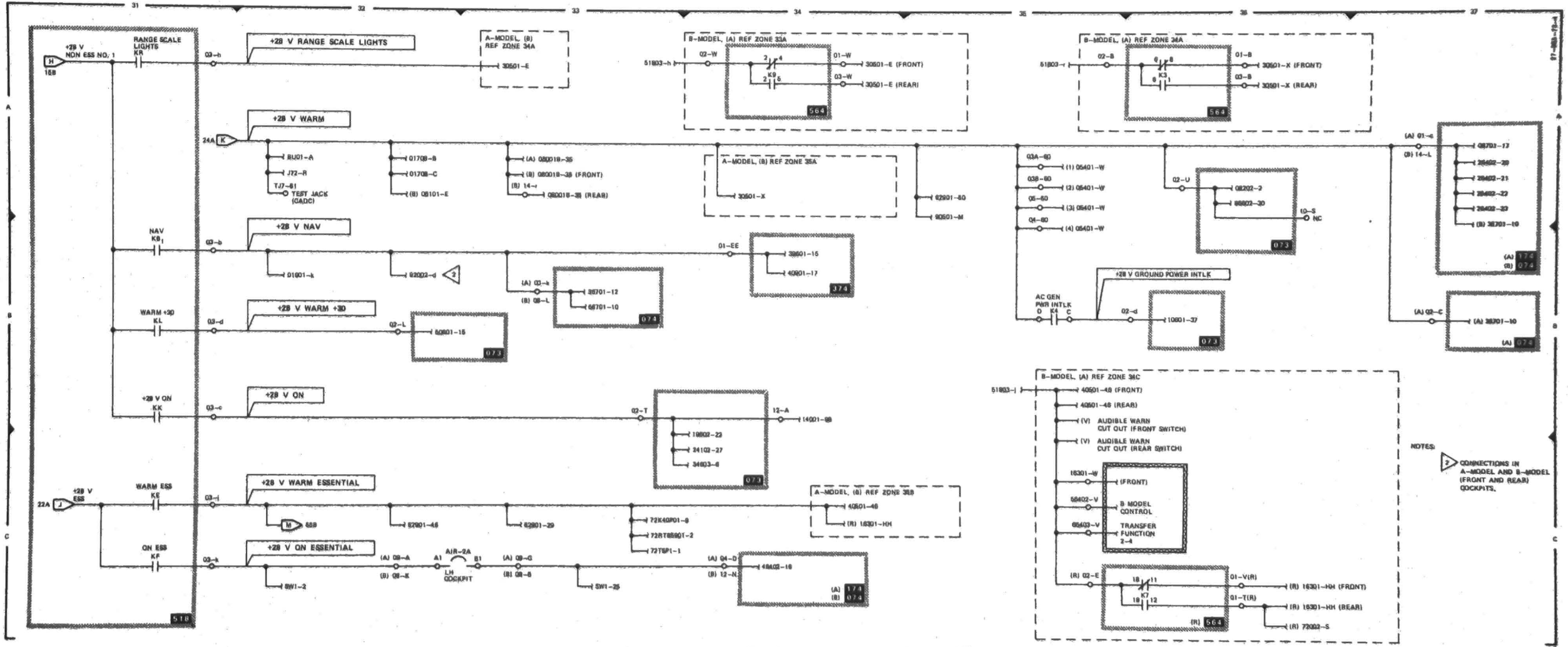


Figure 7-3. MA-1 Control, Time In and +28 v Distribution (Sheet 5 of 7)

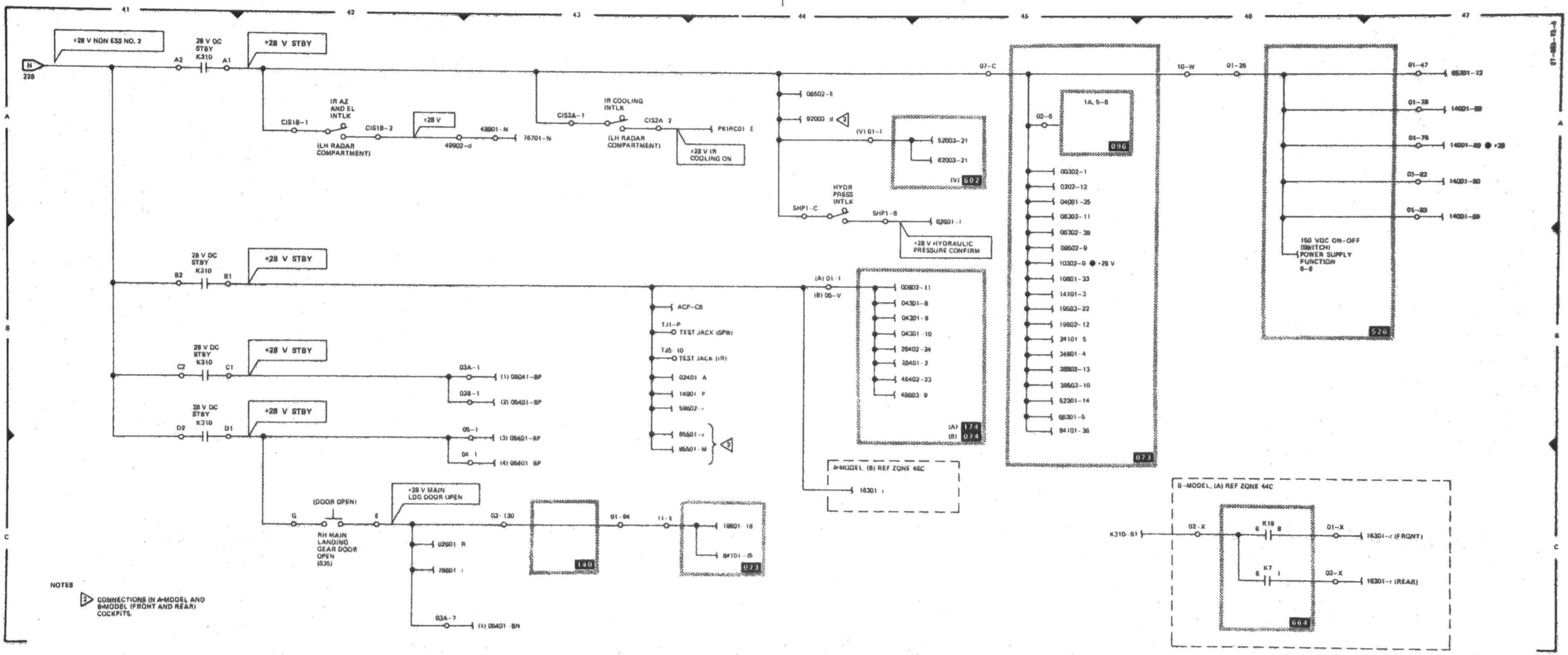


Figure 7-3. MA-1 Control, Time In and +28 v Distribution (Sheet 6 of 7)

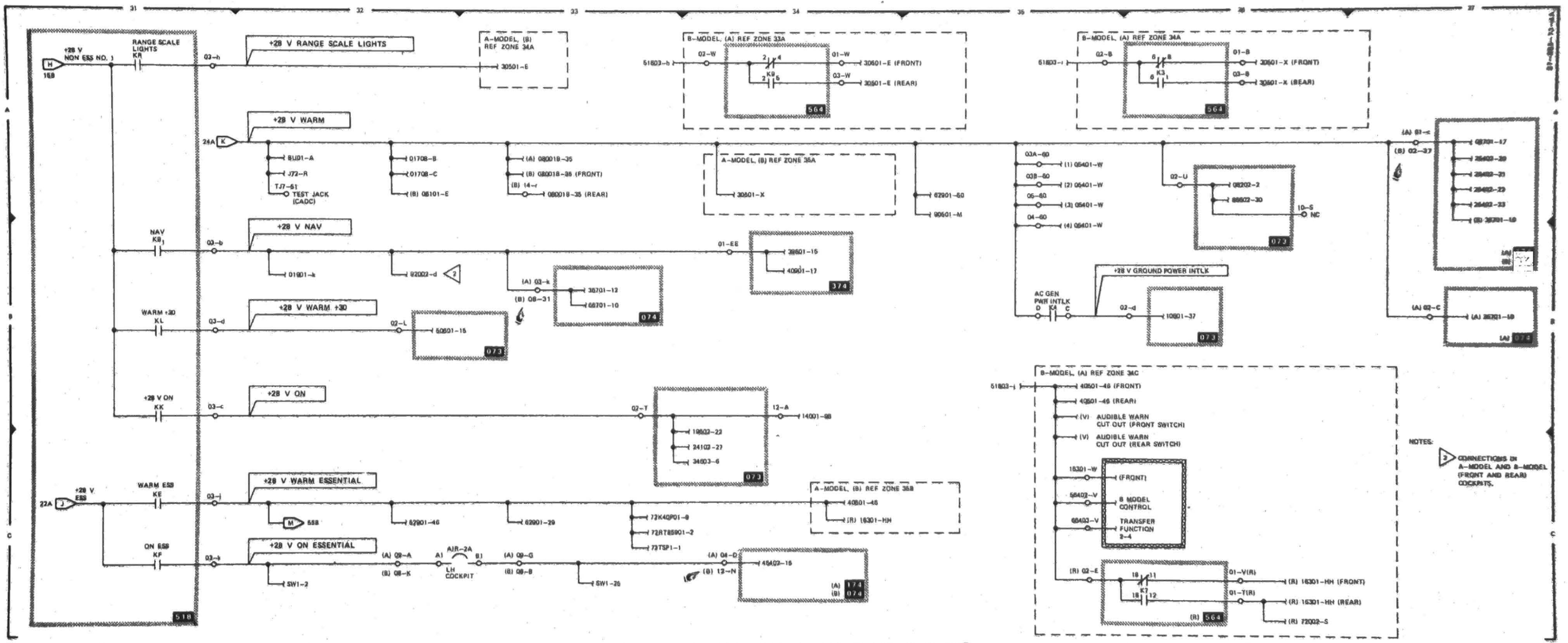


Figure 7-3. MA-1 Control, Time In and +28 v Distribution (Sheet 5 of 7)

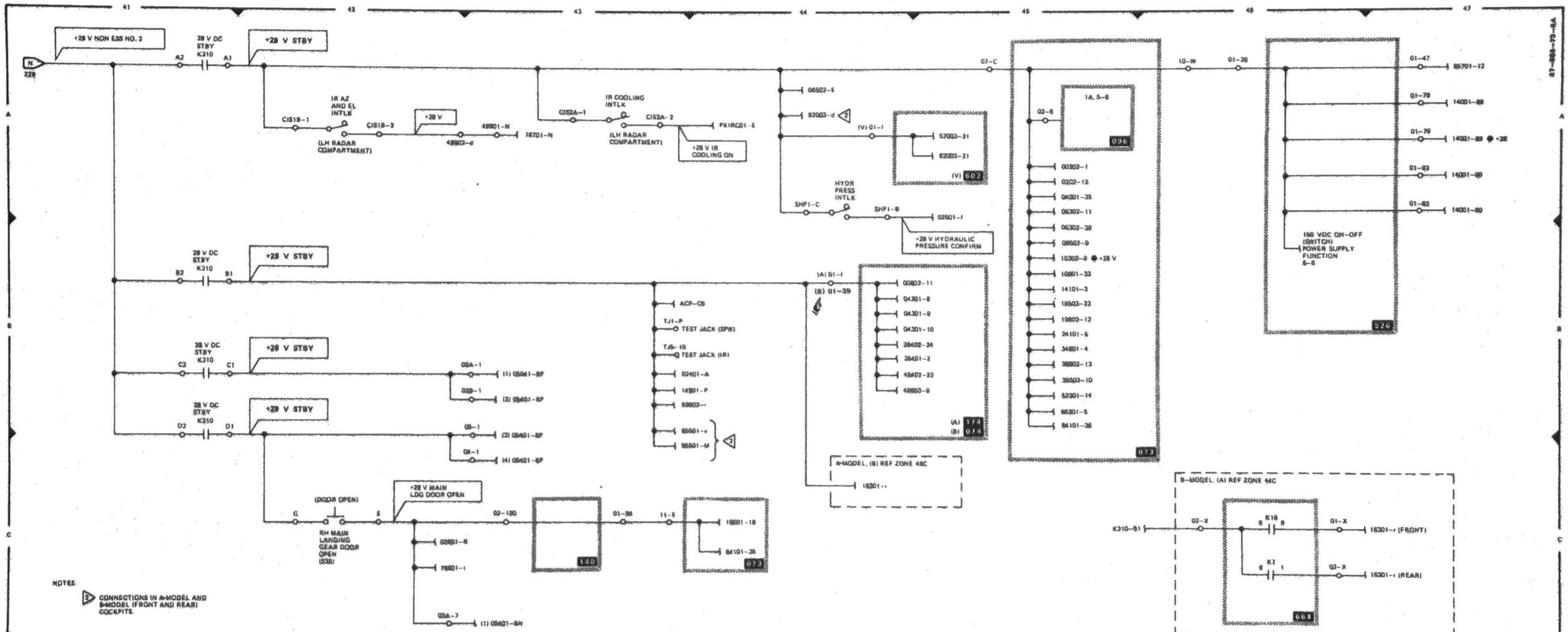


Figure 7-3. MA-1 Control, Time In and +28 v Distribution (Sheet 6 of 7)

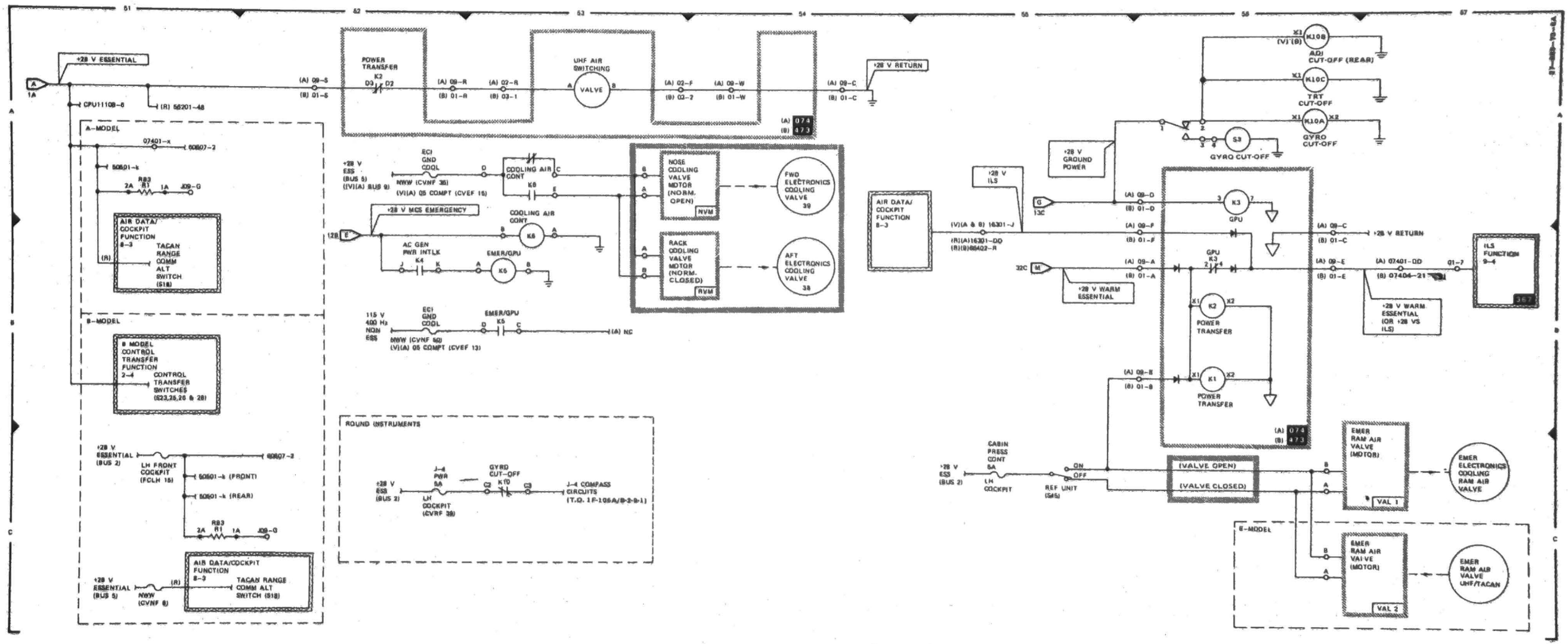


Figure 7-3. MA-1 Control, Time In and +28 v Distribution (Sheet 7 of 7)

989 unit rectifies 115 v 400 Hz input voltage to a dc voltage which is then inverted to provide a 115 v 1600 Hz output voltage.

A. Six SCRs are arranged in a full wave bridge rectifier circuit. Rectifier output, approximately +200 v, determines amplitude value of 115 v 1600 Hz output voltage. Regulation of rectifier output is obtained by individual control of each SCR.

B. Four SCRs are utilized to generate a quasi-square wave which is filtered to provide 115 v 1600 Hz output voltage. Frequency and current factors of quasi-square wave are obtained by individual control of each SCR. Feedback from individual SCR circuits ensure only one SCR is gated on during a given interval. Internal inverter current sensing is provided to protection circuits.

C. Regulation of output voltage is maintained at ±1.0%. Output voltage is sensed by transformer across TB2-1 and TB2-2 and output current is sensed by transformer in return path at TB2-2. Results are combined with reference to provide regulation control signals to modulator in rectifier control circuits.

D. Modulator utilizes input voltage phase references in conjunction with regulation control signals to provide gating signals to SCRs in rectifier.

E. 19.2 KHz oscillator frequency is locked to 400 Hz input frequency. Clock pulse signals are provided to ring counter in inverter control circuits.

F. Ring counter outputs are combined with feedback signals from inverter to ensure proper gating of inverter SCRs.

G. Over current condition sensed in either 400 Hz input or 1600 Hz output removes +28V switched output from protection circuits. Removal of +28V switched in rectifier and inverter control circuits terminates gating of SCRs in rectifier and inverter circuits during over current conditions. Over current condition also causes inhibit signal to terminate operation of ring counter in inverter control circuits.

H. Provides digital type signal that is present when 1600 Hz output voltage is between 103 to 126 v.

J. Provides digital type signal that is present when an over current condition(48.7 ±6.21 amps)does not exist in 989 unit or 1600 Hz load. Utilized only for test purposes.

Figure 7-4. 1600 Hz and Multi-dc Power Supplies (Sheet 1 of 4)

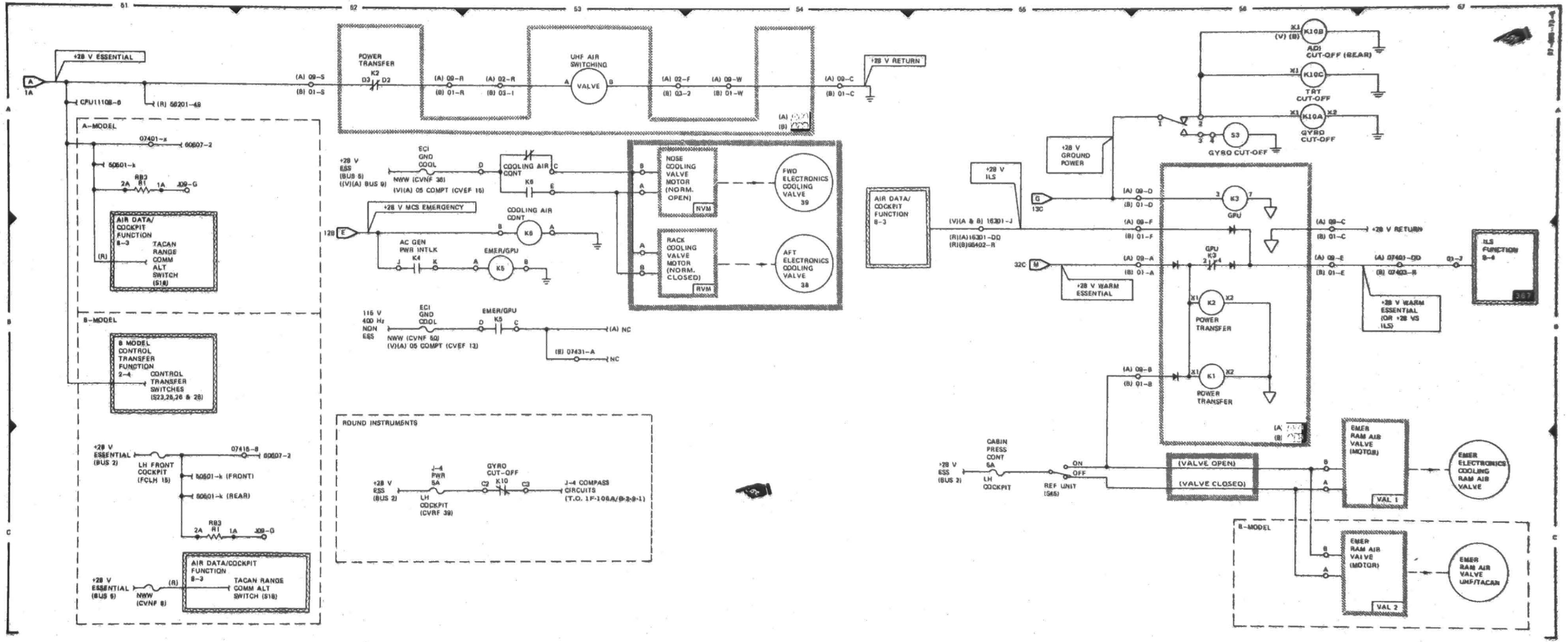


Figure 7-3. MA-1 Control, Time In and +28 v Distribution (Sheet 7 of 7)

989 unit rectifies 115 v 400 Hz input voltage to a dc voltage which is then inverted to provide a 115 v 1600 Hz output voltage.

A Six SCRs are arranged in a full wave bridge rectifier circuit. Rectifier output, approximately +200 v, determines amplitude value of 115 v 1600 Hz output voltage. Regulation of rectifier output is obtained by individual control of each SCR.

B Four SCRs are utilized to generate a quasi-square wave which is filtered to provide 115 v 1600 Hz output voltage. Frequency and current factors of quasi-square wave are obtained by individual control of each SCR. Feedback from individual SCR circuits ensure only one SCR is gated on during a given interval. Internal inverter current sensing is provided to protection circuits.

C Regulation of output voltage is maintained at ±1.0%. Output voltage is sensed by transformer across TB2-1 and TB2-2 and output current is sensed by transformer in return path at TB2-2. Results are combined with reference to provide regulation control signals to modulator in rectifier control circuits.

D Modulator utilizes input voltage phase references in conjunction with regulation control signals to provide gating signals to SCRs in rectifier.

E 19.2 KHz oscillator frequency is locked to 400 Hz input frequency. Clock pulse signals are provided to ring counter in inverter control circuits.

F Ring counter outputs are combined with feedback signals from inverter to ensure proper gating of inverter SCRs.

G Over current condition sensed in either 400 Hz input or 1600 Hz output removes +29V switched output from protection circuits. Removal of +29V switched in rectifier and inverter control circuits terminates gating of SCRs in rectifier and inverter circuits during over current conditions. Over current condition also causes inhibit signal to terminate operation of ring counter in inverter control circuits.

H Provides digital type signal that is present when 1600 Hz output voltage is between 108 to 126 v.

I Provides digital type signal that is present when an over current condition(48.7 ±5.21 amps)does not exist in 989 unit or 1600 Hz load. Utilized only for test purposes.

Figure 7-4. 1600 Hz and Multi-dc Power Supplies (Sheet 1 of 4)

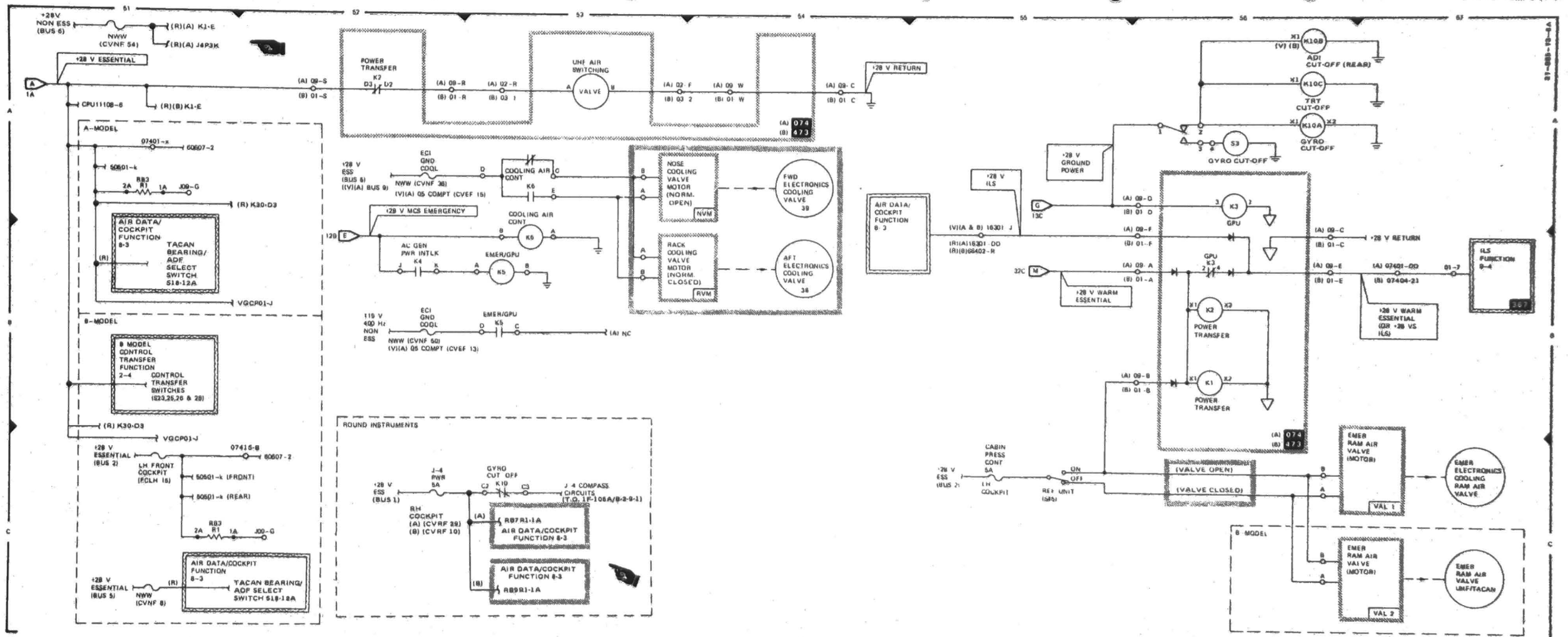


Figure 7-3. MA-1 Control, Time (a and +28 v Distribution (Sheet 7 of 7)

989 unit rectifies 115 v 400 Hz input voltage to a dc voltage which is then inverted to provide a 115 v 1600 Hz output voltage.

A. Six SCRs are arranged in a full wave bridge rectifier circuit. Rectifier output, approximately +300 v, determines amplitude value of 115 v 1600 Hz output voltage. Regulation of rectifier output is obtained by individual control of each SCR.

B. Four SCRs are utilized to generate a quasi-square wave which is filtered to provide 115 v 1600 Hz output voltage. Frequency and current factors of quasi-square wave are obtained by individual control of each SCR. Feedback from individual SCR circuits ensure only one SCR is gated on during a given interval. Internal inverter current sensing is provided to protection circuits.

C. Regulation of output voltage is maintained at ±1.0%. Output voltage is sensed by transformer across TB2-1 and TB2-2 and output current is sensed by transformer in return path at TB2-2. Results are combined with reference to provide regulation control signals to modulator in rectifier control circuits.

D. Modulator utilizes input voltage phase references in conjunction with regulation control signals to provide gating signals to SCRs in rectifier.

E. 19.2 KHz oscillator frequency is locked to 400 Hz input frequency. Clock pulse signals are provided to ring counter in inverter control circuits.

F. Ring counter outputs are combined with feedback signals from inverter to ensure proper gating of inverter SCRs.

G. Over current condition sensed in either 400 Hz input or 1600 Hz output removes +29V switched output from protection circuits. Removal of +29V switched in rectifier and inverter control circuits terminates gating of SCRs in rectifier and inverter circuits during over current conditions. Over current condition also causes inhibit signal to terminate operation of ring counter in inverter control circuits.

H. Provides digital type signal that is present when 1600 Hz output voltage is between 103 to 126 v.

I. Provides digital type signal that is present when an over current condition(48.7 ±5.21 amps)does not exist in 989 unit or 1600 Hz load. Utilized only for test purposes.

Figure 7-4. 1600 Hz and Multi-dc Power Supplies (Sheet 1 of 4)

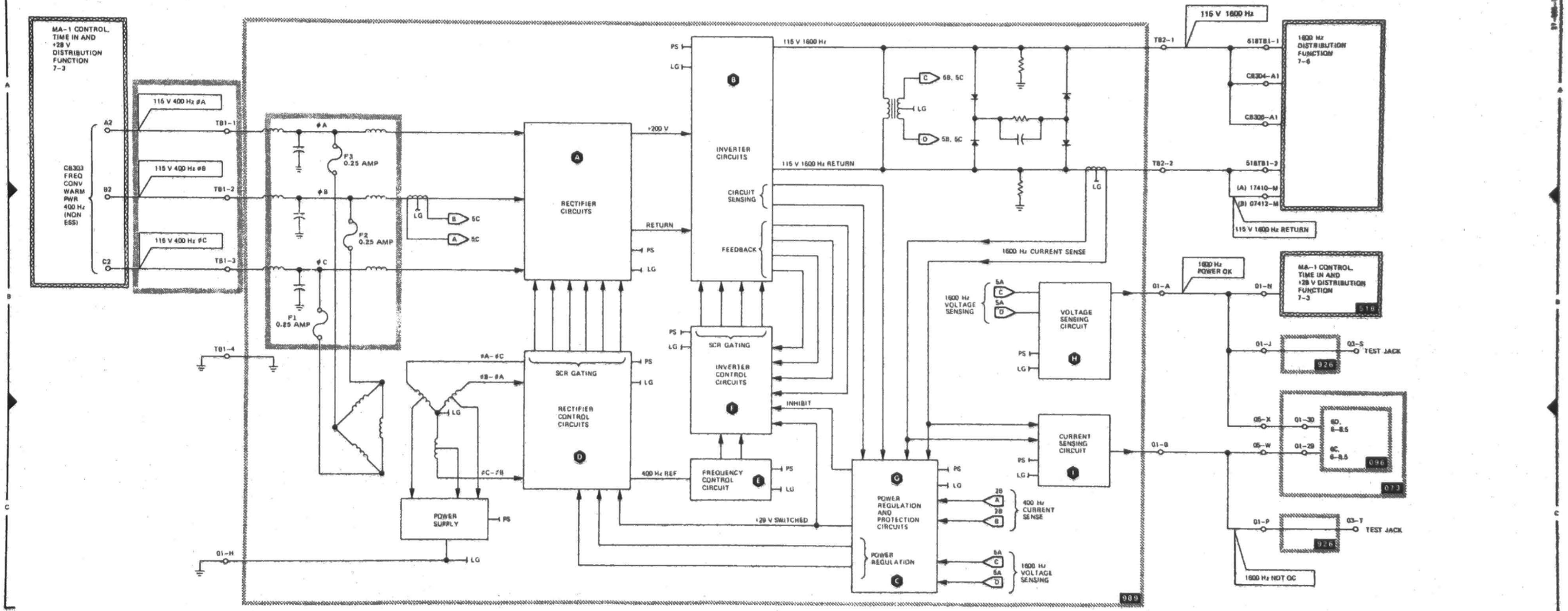


Figure 7-4. 1600 Hz and Multi-dc Power Supplies (Sheet 2 of 4)

926 unit utilizes transformer-rectifier circuits in conjunction with series regulators to provide seven output power forms. Voltage sensing, current limit, voltage regulation and ripple values for output power forms are as follows:

OUTPUT POWER FORM	VOLTAGE SENSING UV	VOLTAGE SENSING OV	CURRENT LIMIT (amperes)	VOLTAGE REGULATION	RIPPLE NOISE (at 25 KHz)	RIPPLE SPIKES (at 1 MHz)
+50V	+46.5	+53.5	1.7 to 2.55	+49.75 to +50.25	±200 mv	N/A
-50V	-46.5	-53.5	1.7 to 2.55	-49.75 to -50.25	±200 mv	N/A
+150V	+140	+162	4.0 to 6.0	+148.5 to -151.5	±200 mv	±1.0V
-140V	-130	-150	1.35 to 2.03	-138.6 to -141.4	±200 mv	±250 mv
+100V	+93	+107	0.42 to 0.63	+99.5 to +100.5	±70 mv	±125 mv
-250V	-232	-268	0.56 to 0.84	-247.5 to -252.5	±200 mv	±500 mv
+300V	+279	+321	2.4 to 3.6	+297 to +303	±300 mv	±500 mv

(A) SCRs and magnetic amplifier circuits are connected in each input line to power transformer. Gating of SCRs, by their respective magnetic amplifiers, regulate input voltage to power transformer which provides course voltage control for each of seven output power forms.

(B) Separate rectifier output provides a sensing voltage back to preregulator control circuit. As a result course voltage control for six output power forms is referenced to +300 v output.

(C) Sensing voltage is compared to reference voltage and resulting signal is applied to control windings of magnetic amplifiers in preregulator circuits.

(D) Rectifier and series regulator circuits are similar in operation and each circuit includes a current limiter. When a short circuit occurs, current limiter causes a significant reduction in output voltage which is sensed by protection circuit and terminates transfer of output voltages.

(E) Provides a digital type signal that is present when all seven output power forms are within ov-uv limits cited above.

(F) Provides a digital type signal that is present when all seven output power forms are within current limits cited above. Utilized only for test purposes.

Figure 7-4. 1600 Hz and Multi-dc Power Supplies (Sheet 3 of 4)

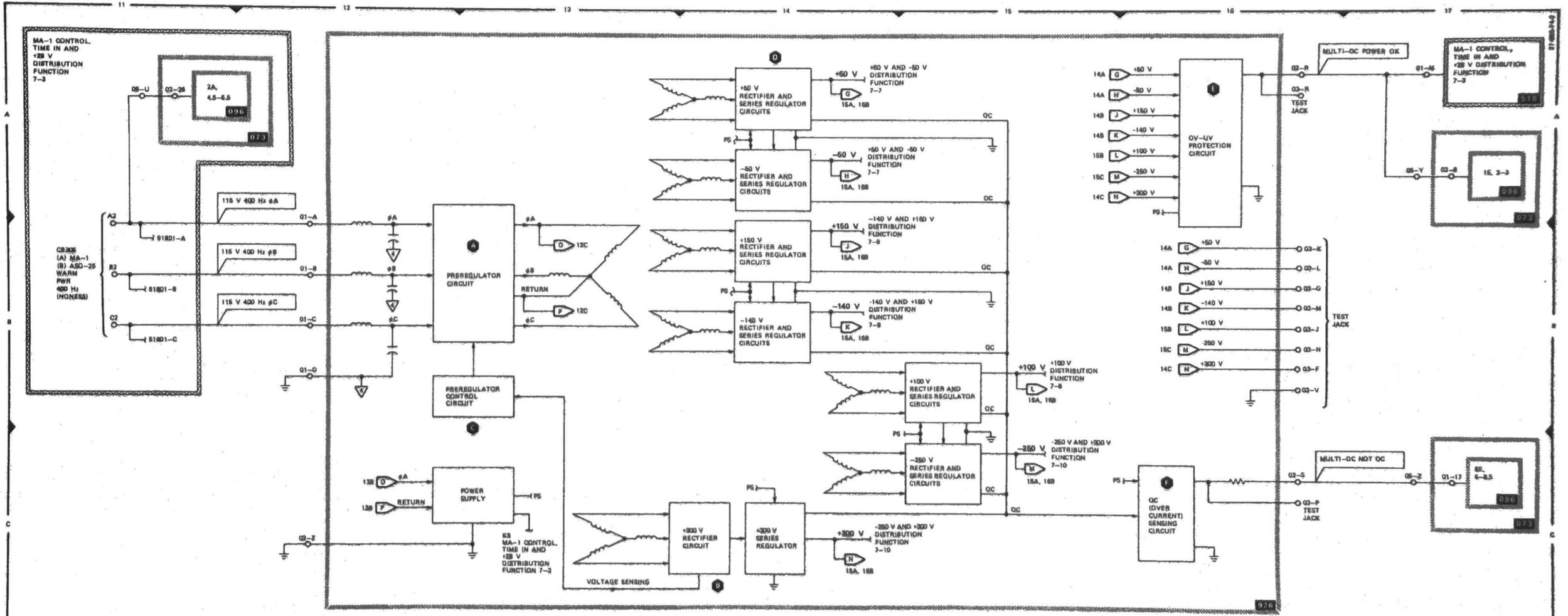


Figure 7-4. 1600 Hz and Multi-dc Power Supplies (Sheet 4 of 4)

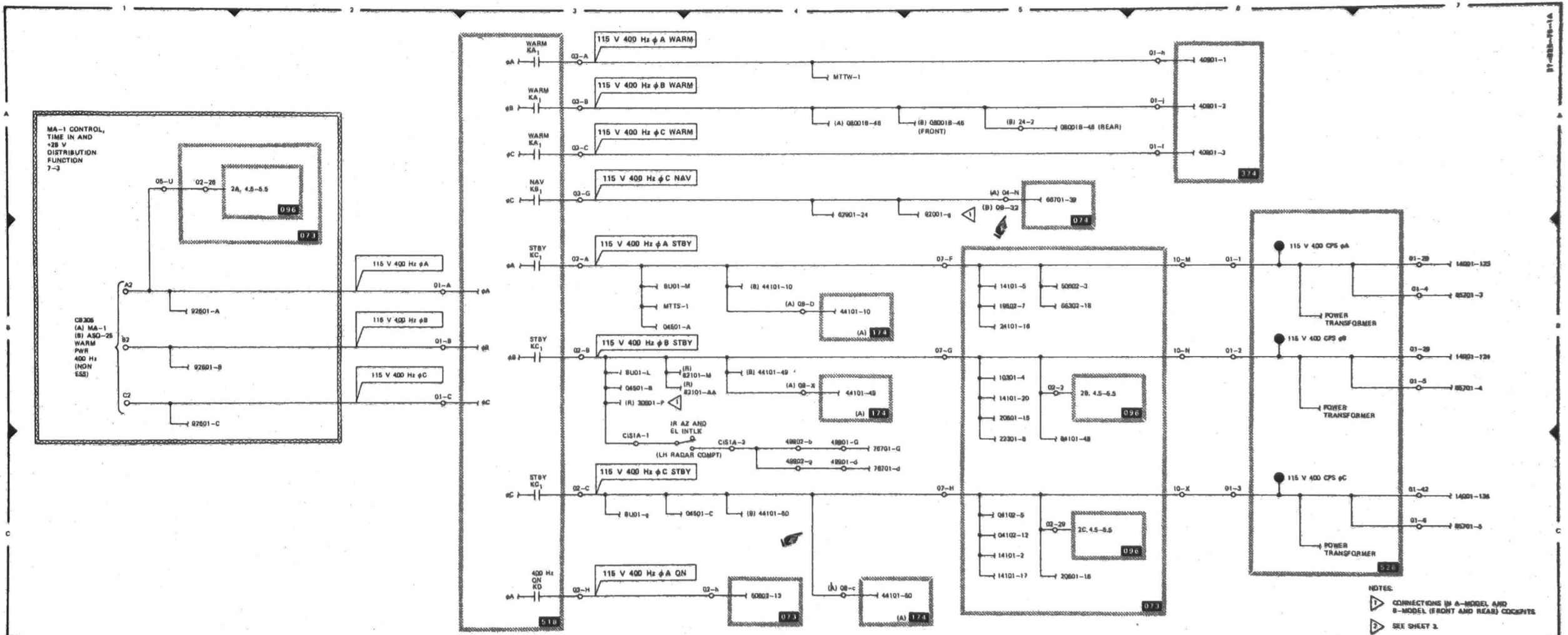


Figure 7-6. 400 Hz Distribution (Sheet 1 of 3)

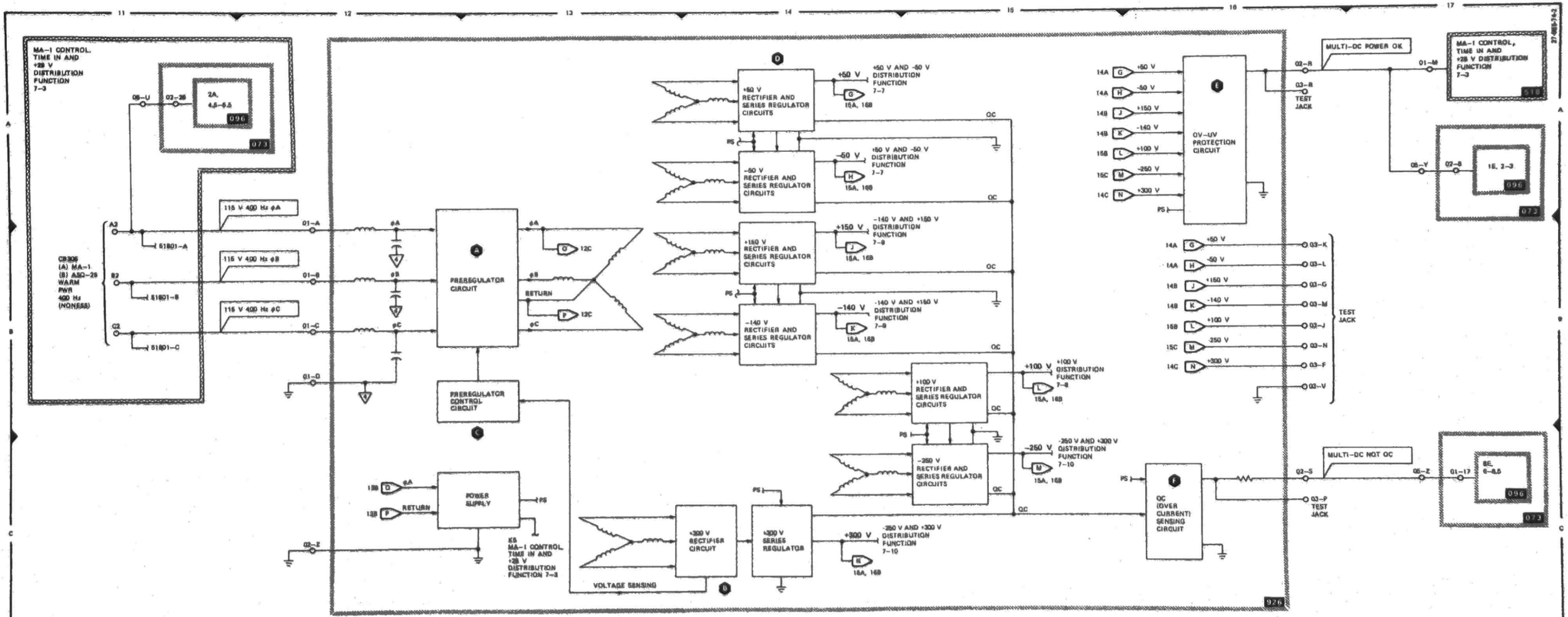


Figure 7-4. 1600 Hz and Multi-dc Power Supplies (Sheet 4 of 4)

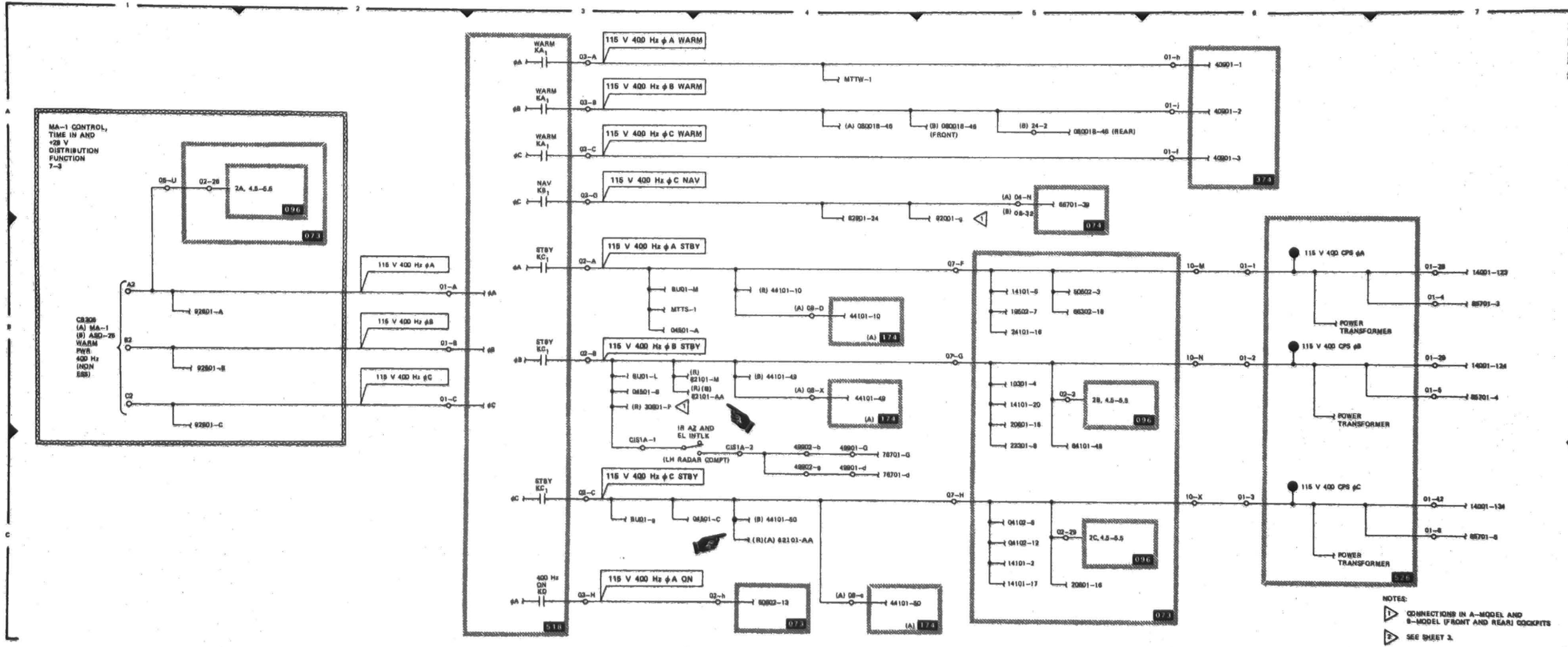


Figure 7-5. 400 Hz Distribution (Sheet 1 of 3)

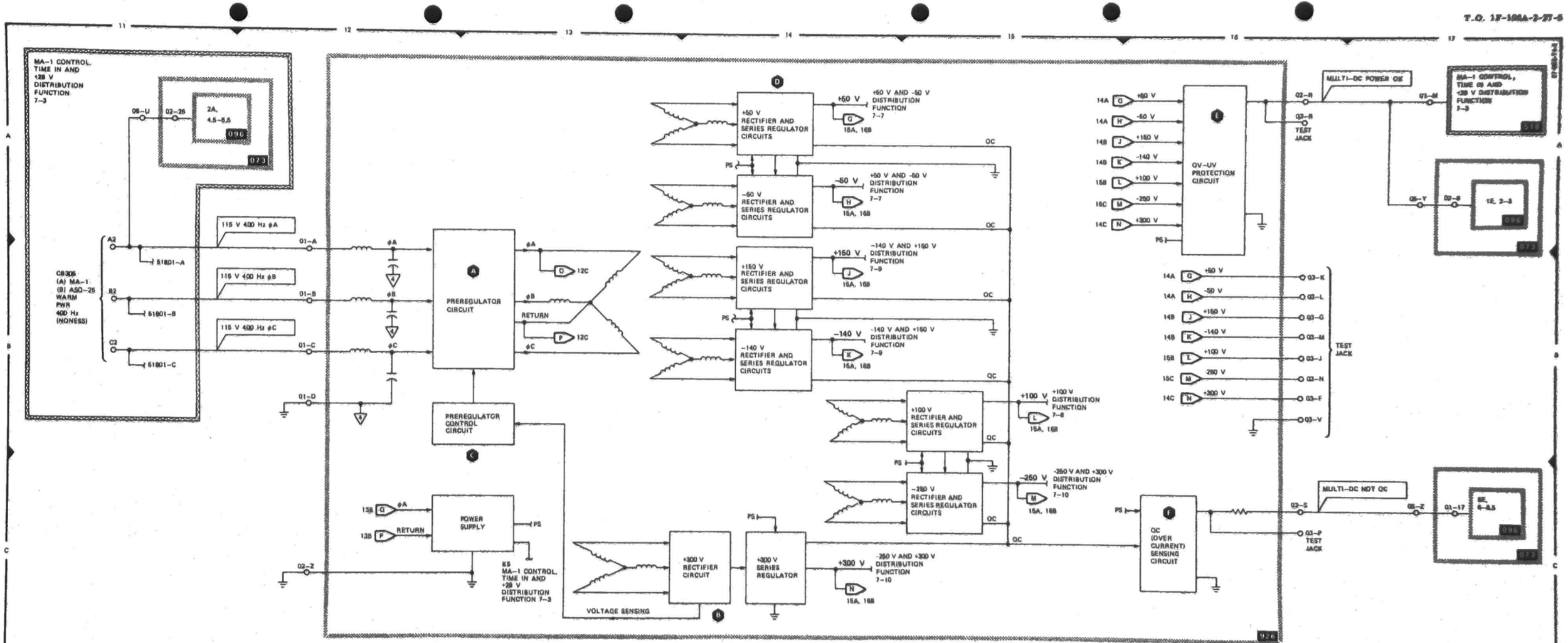


Figure 7-4. 1600 Hz and Multi-dc Power Supplies (Sheet 4 of 4)

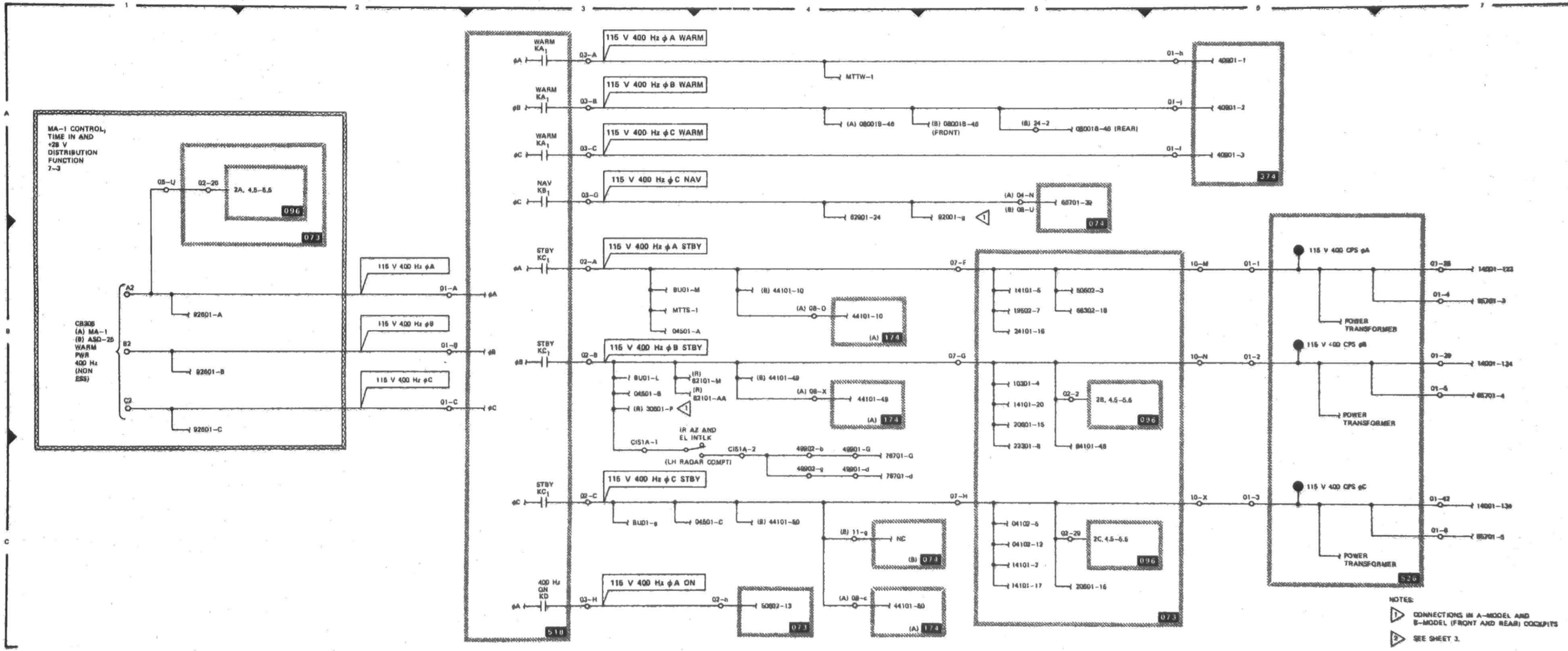
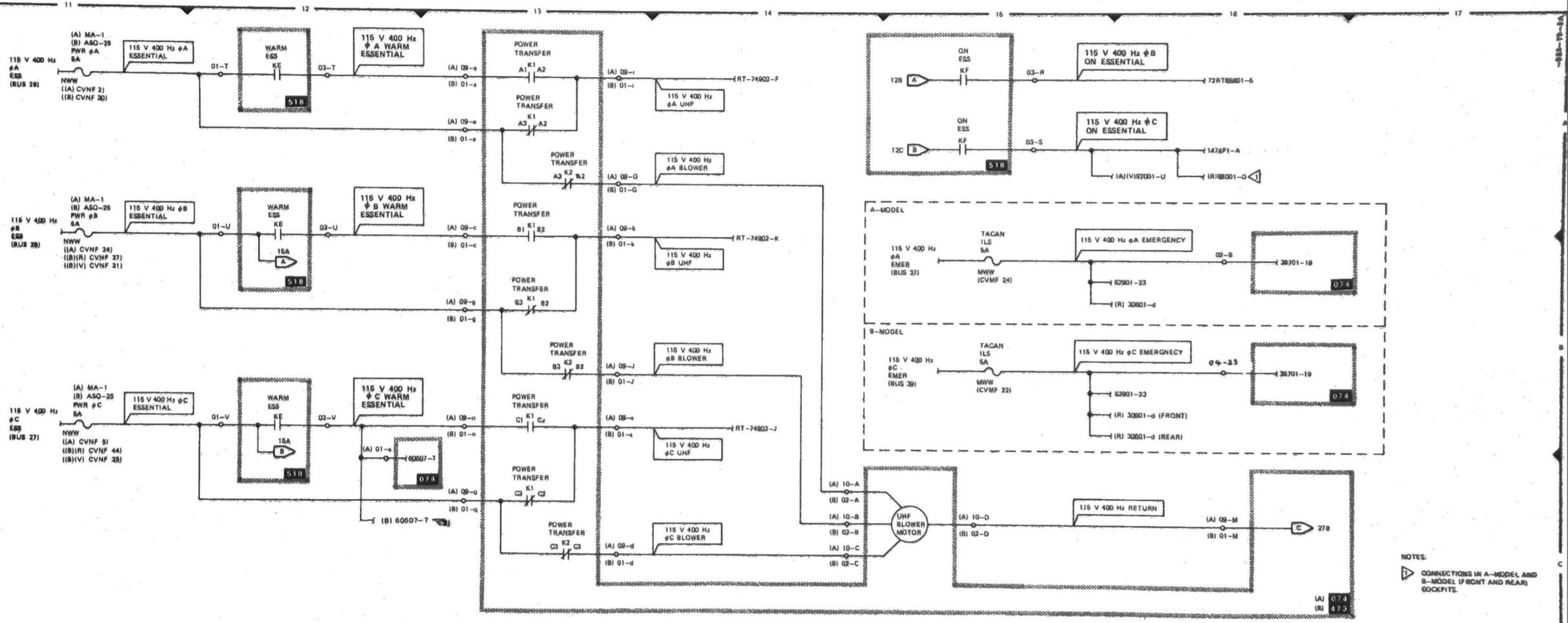


Figure 7-5. 400 Hz Distribution (Sheet 1 of 3)



NOTES:

1. CONNECTIONS IN A-MODEL AND B-MODEL (FRONT AND REAR) COCKPITS.

Figure 7-5. 400 Hz Distribution (Sheet 2 of 3)

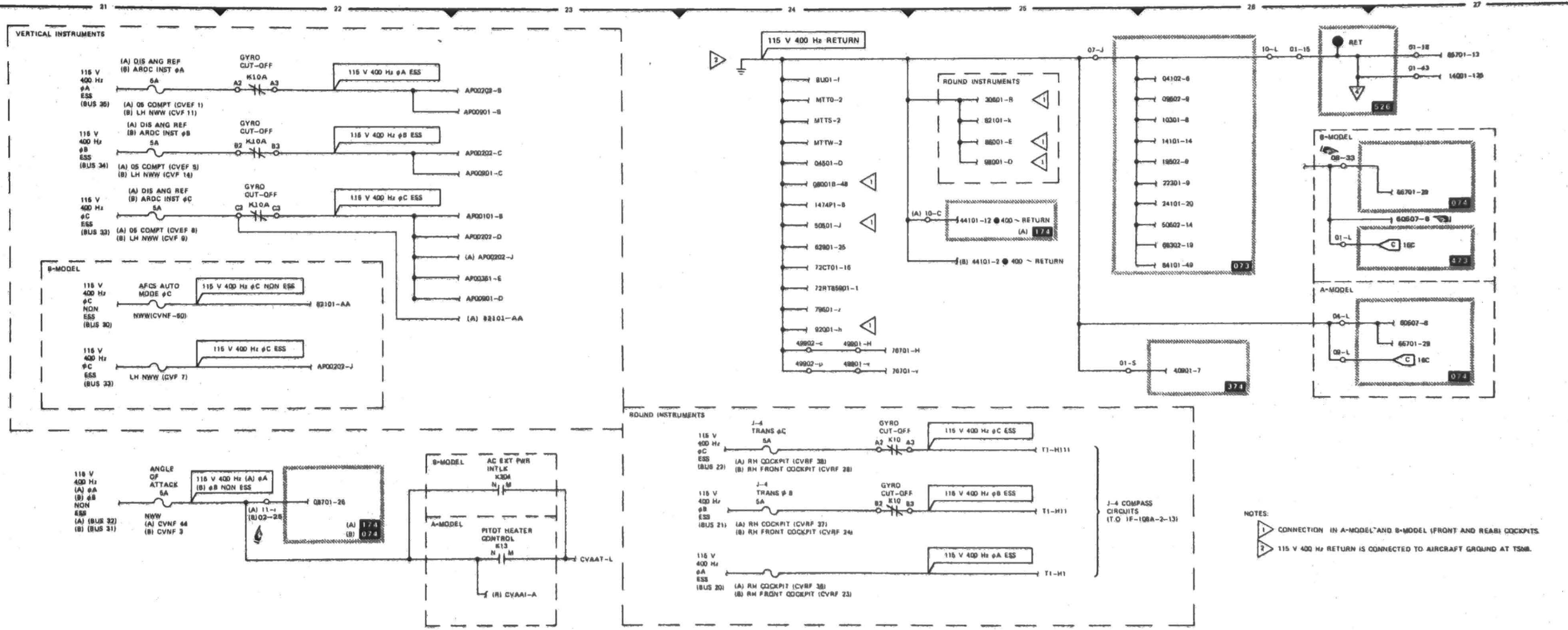
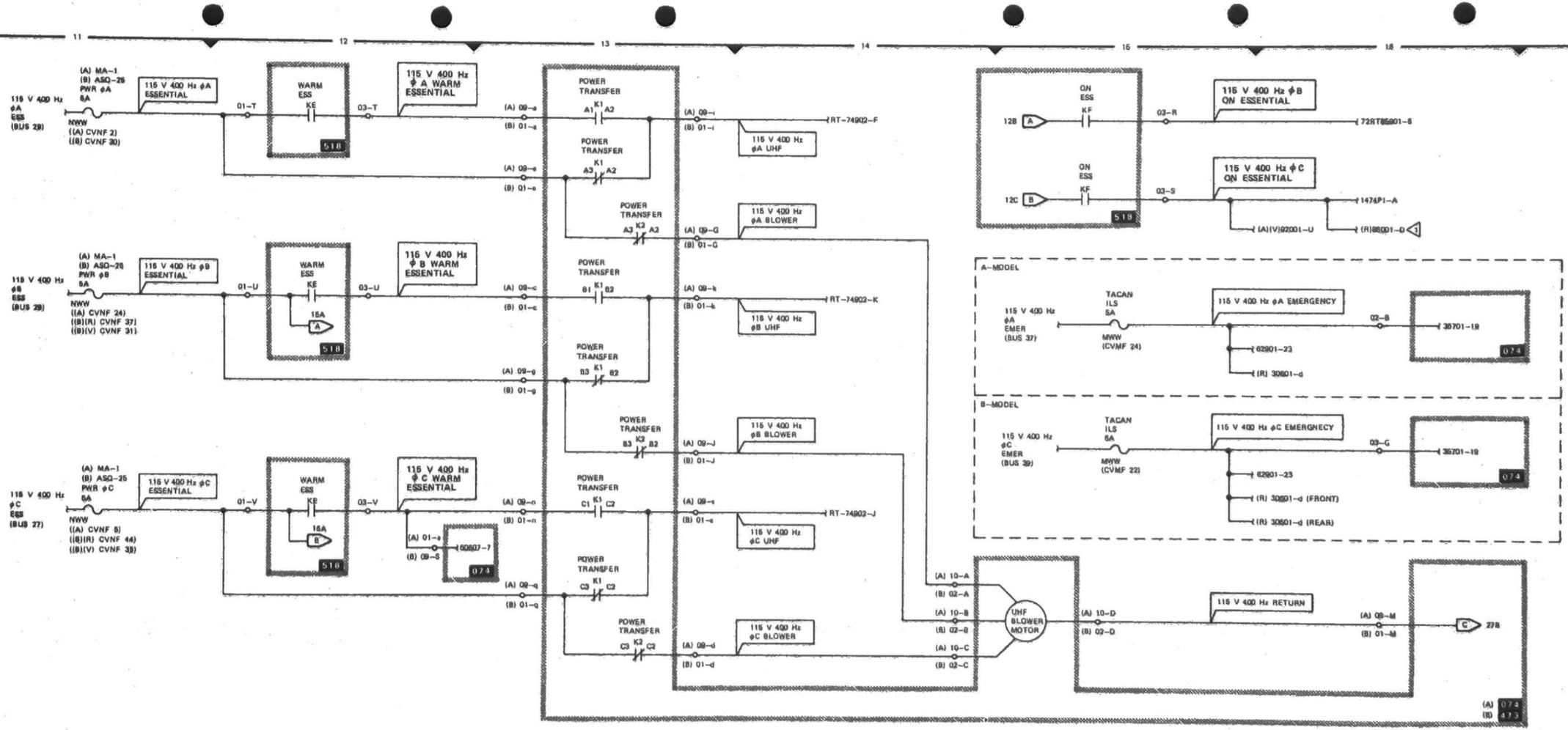


Figure 7-5. 400 Hz Distribution (Sheet 3 of 3)



NOTES:

1. CONNECTIONS IN A-MODEL AND B-MODEL (FRONT AND REAR) COCKPITS.

Figure 7-5. 400 Hz Distribution (Sheet 2 of 3)

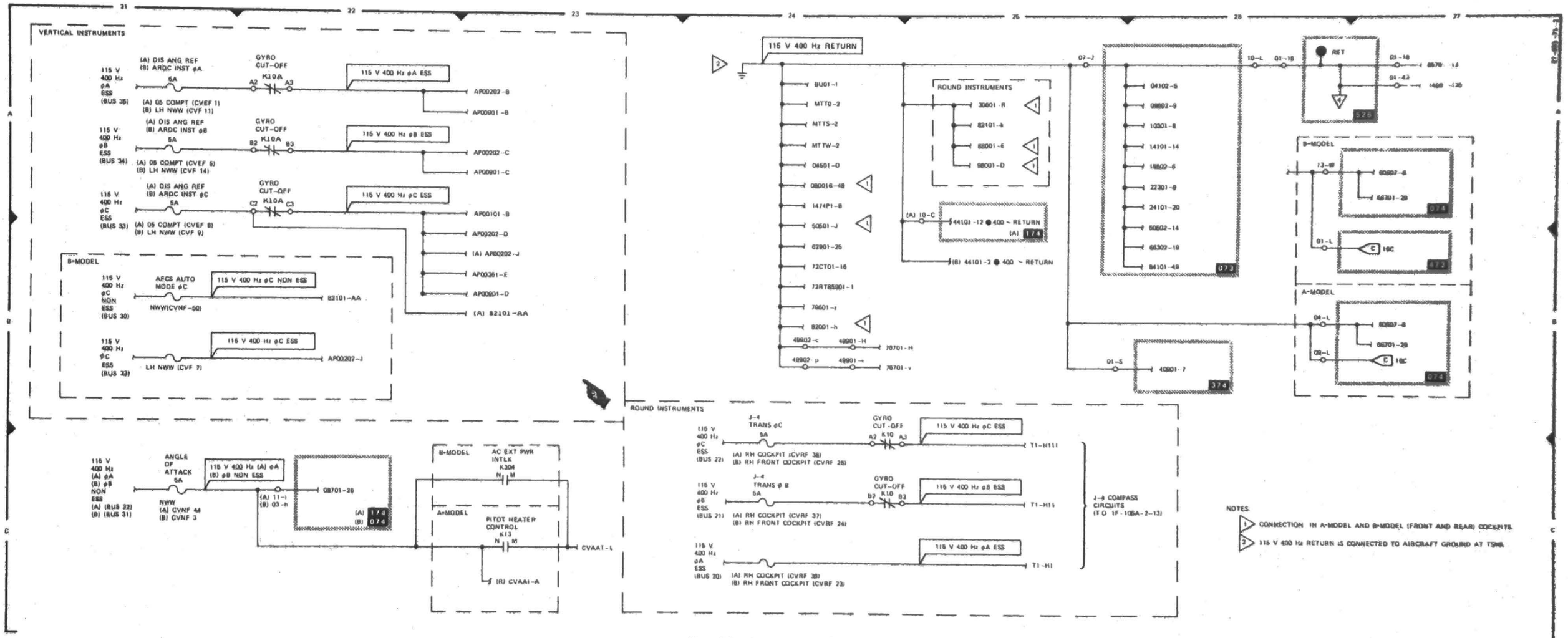


Figure 7-5. 400 Hz Distribution (Sheet 3 of 3)

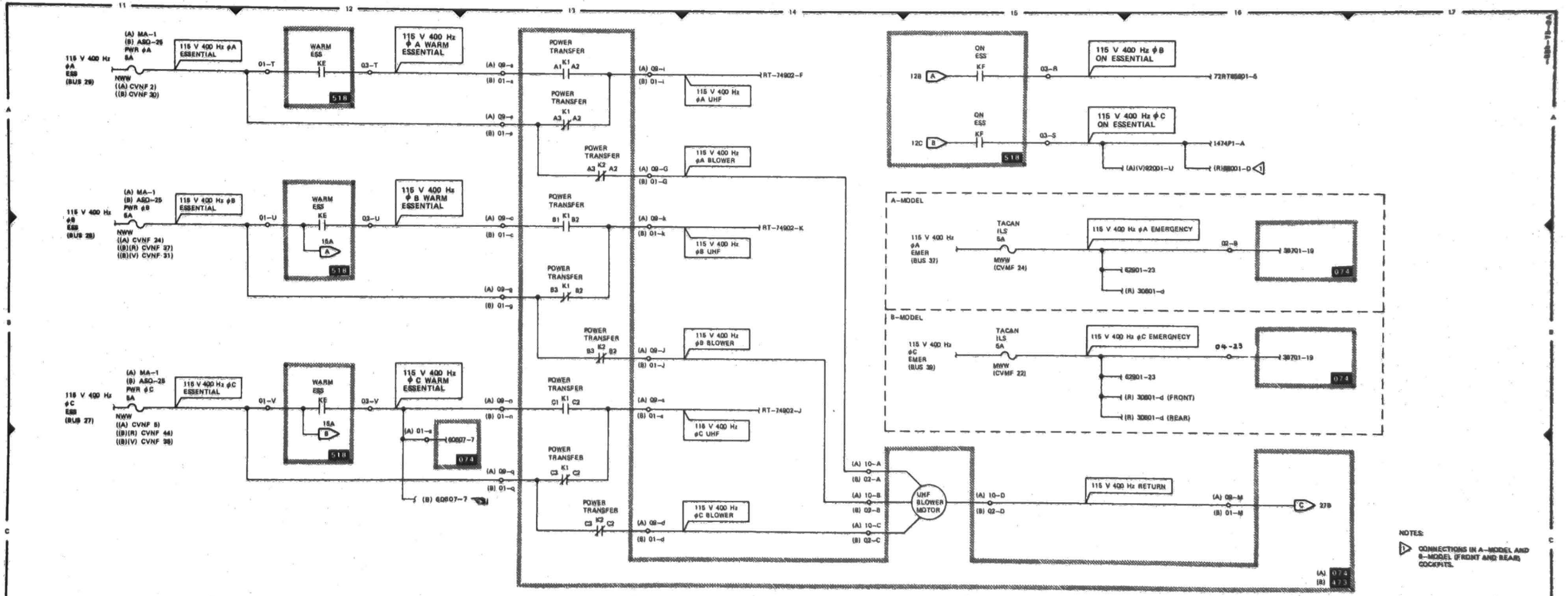


Figure 7-5. 400 Hz Distribution (Sheet 2 of 3)

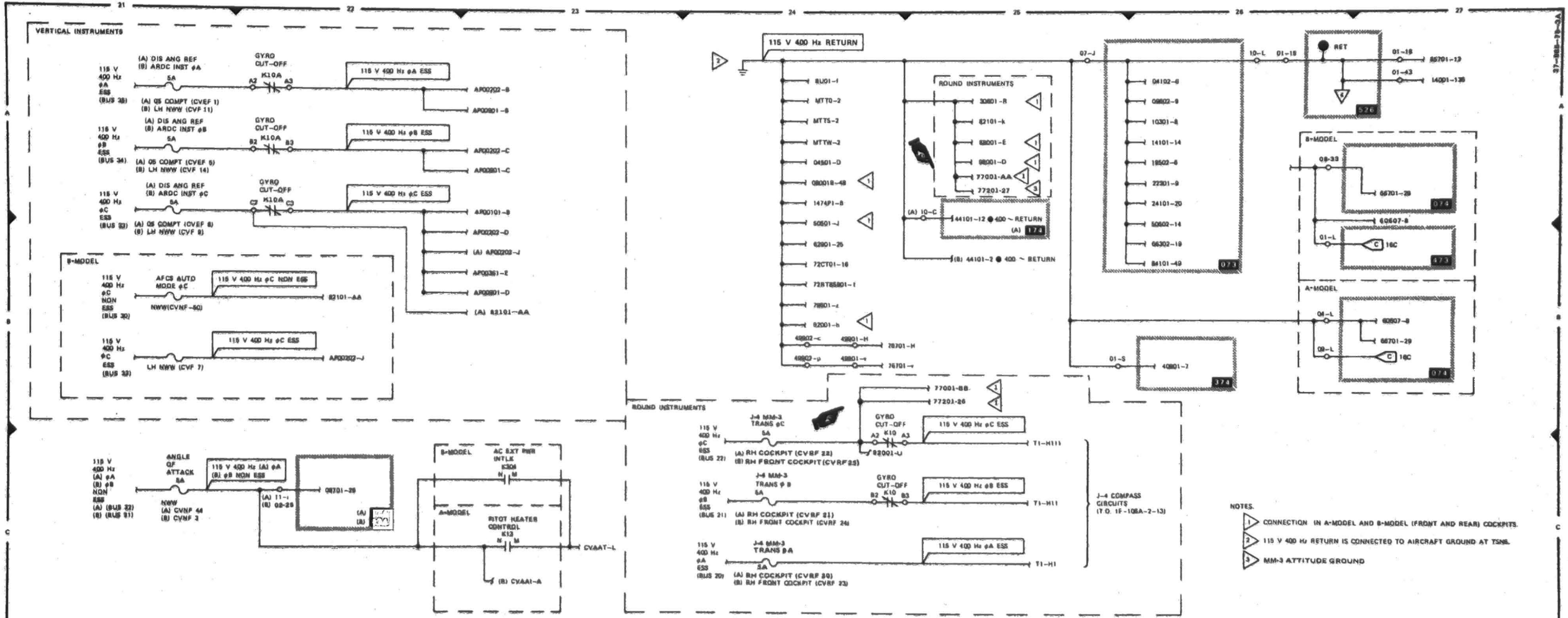


Figure 7-5. 400 Hz Distribution (Sheet 3 of 3)

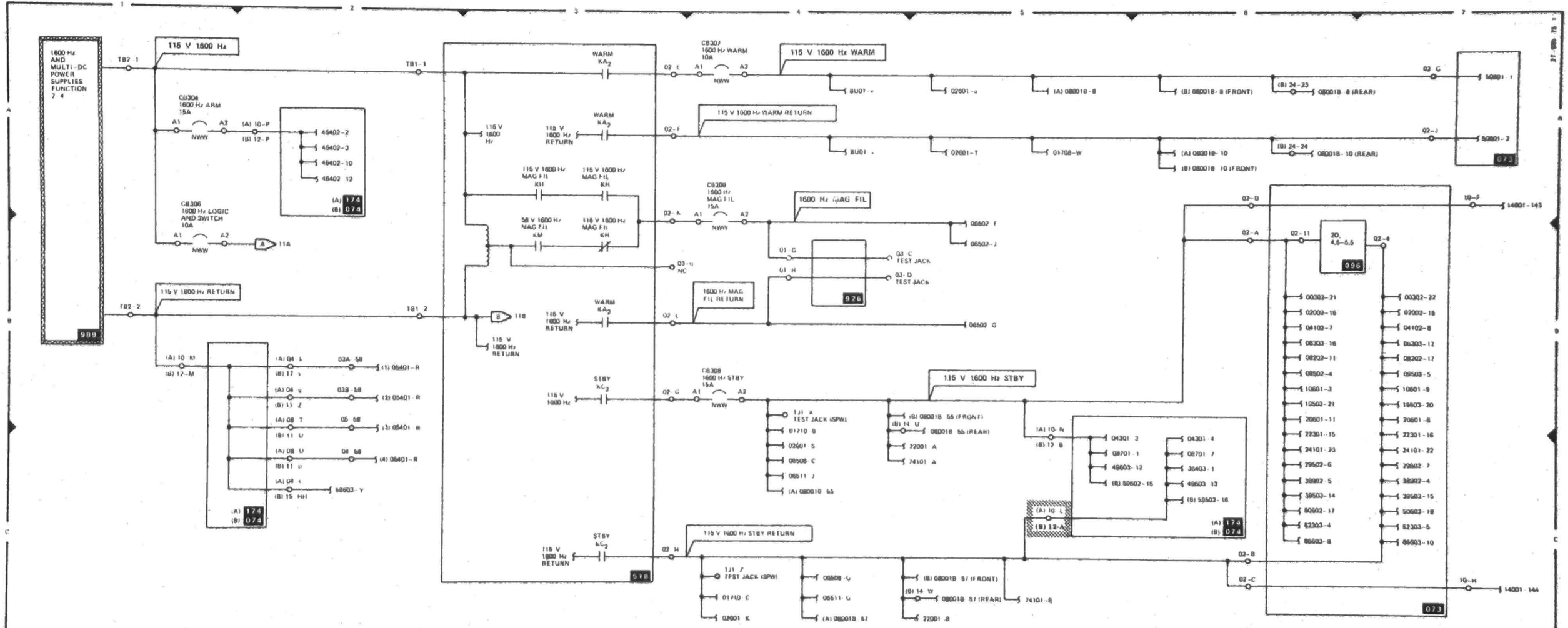


Figure 7-6. 1600 Hz Distribution (Sheet 1 of 2)

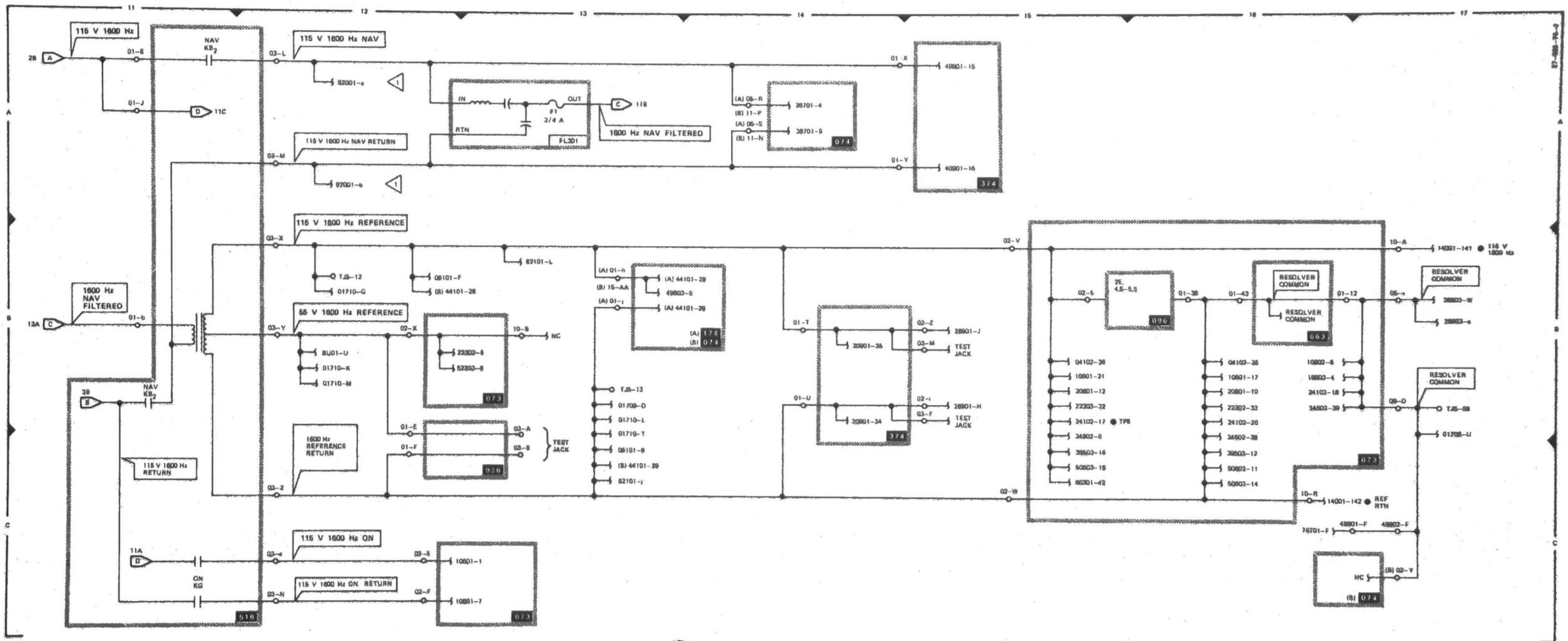


Figure 7-6. 1600 Hz Distribution (Sheet 2 of 2)

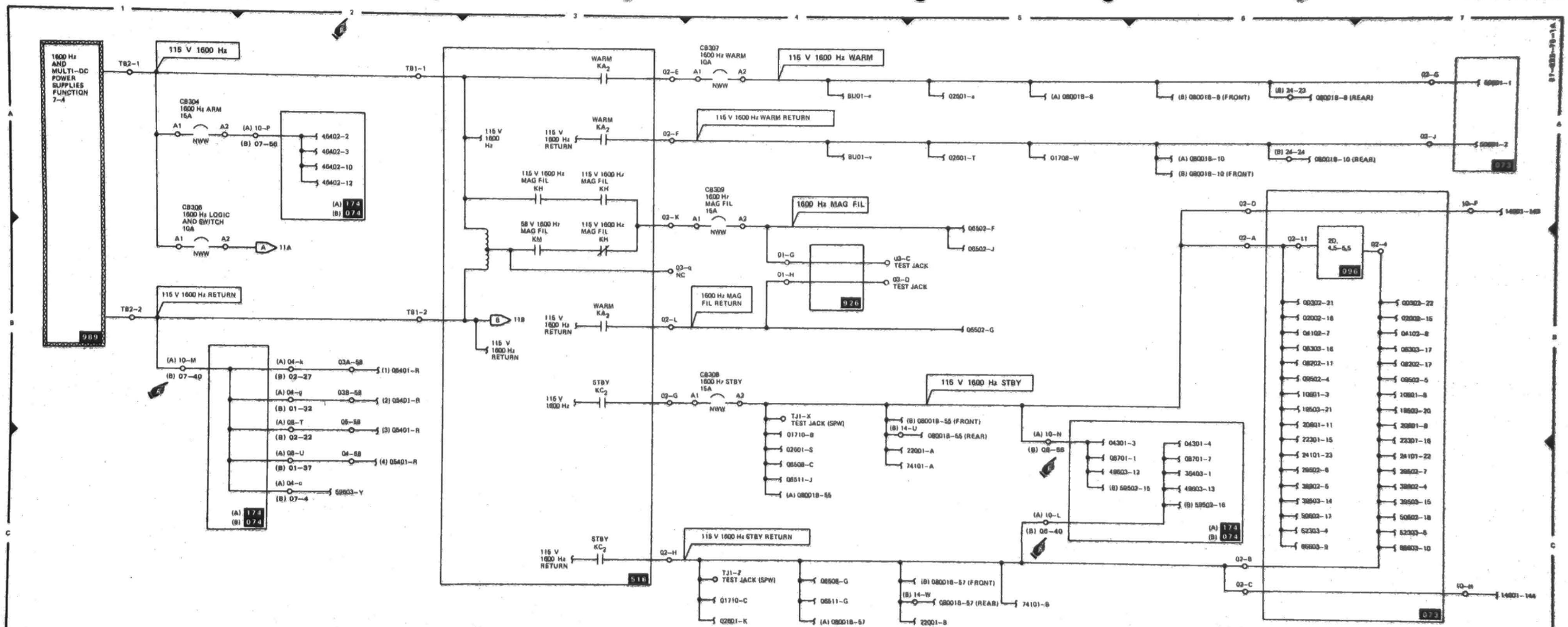


Figure 7-6. 1600 Hz Distribution (Sheet 1 of 2)

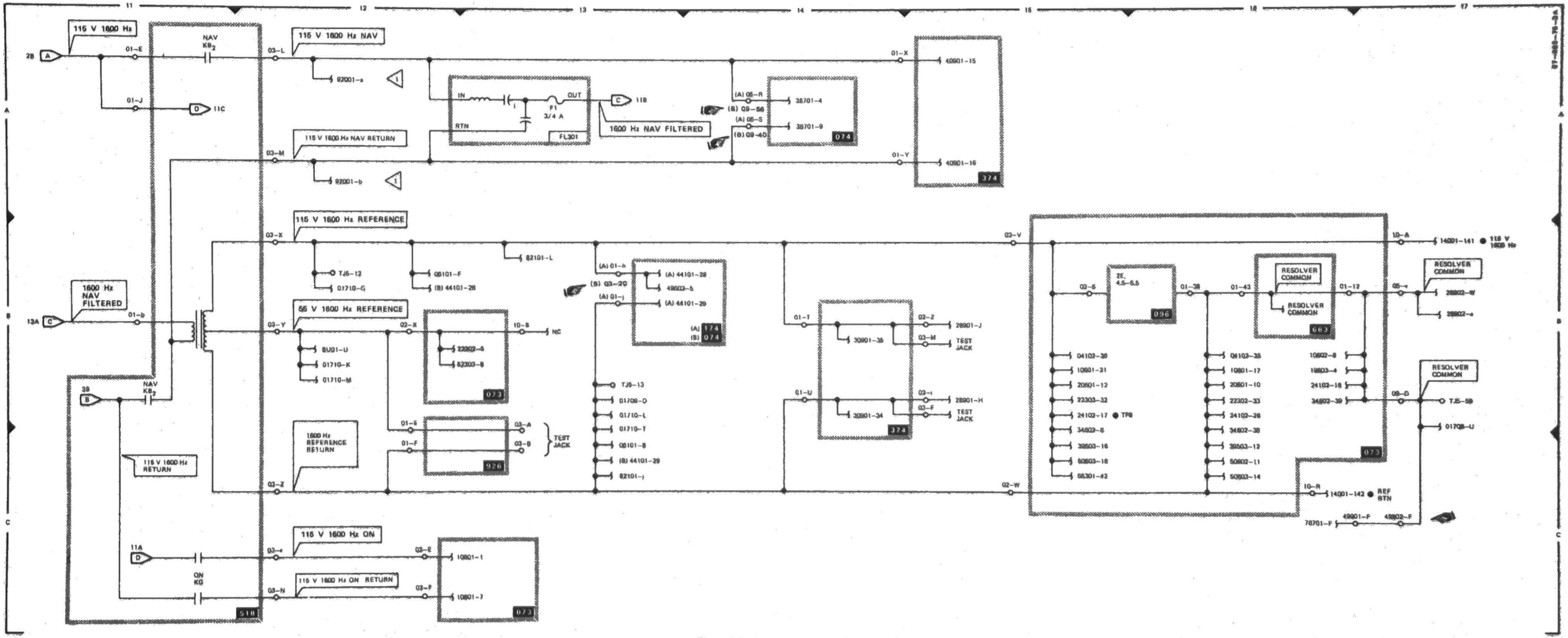


Figure 7-6. 1600 Hz Distribution (Sheet 2 of 2)

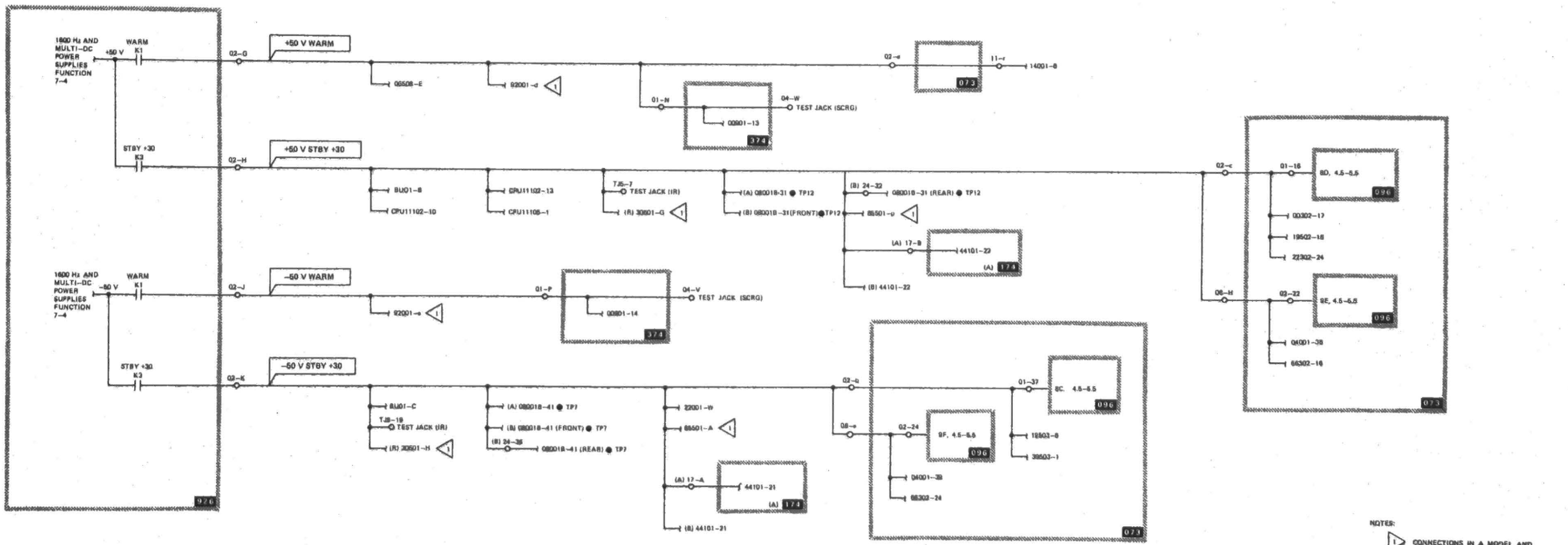


Figure 7-7. +50 v and -50 v Distribution

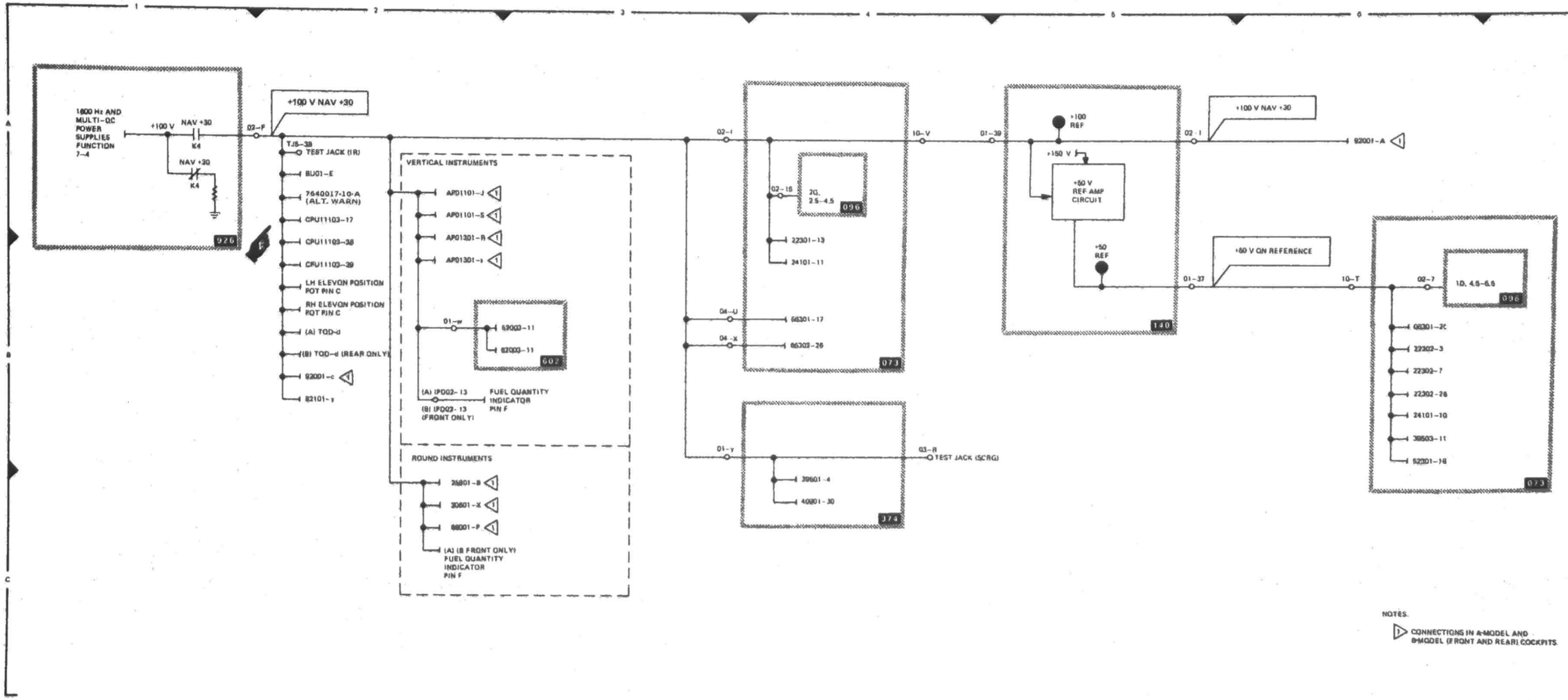


Figure 7-8 +100 v Distribution

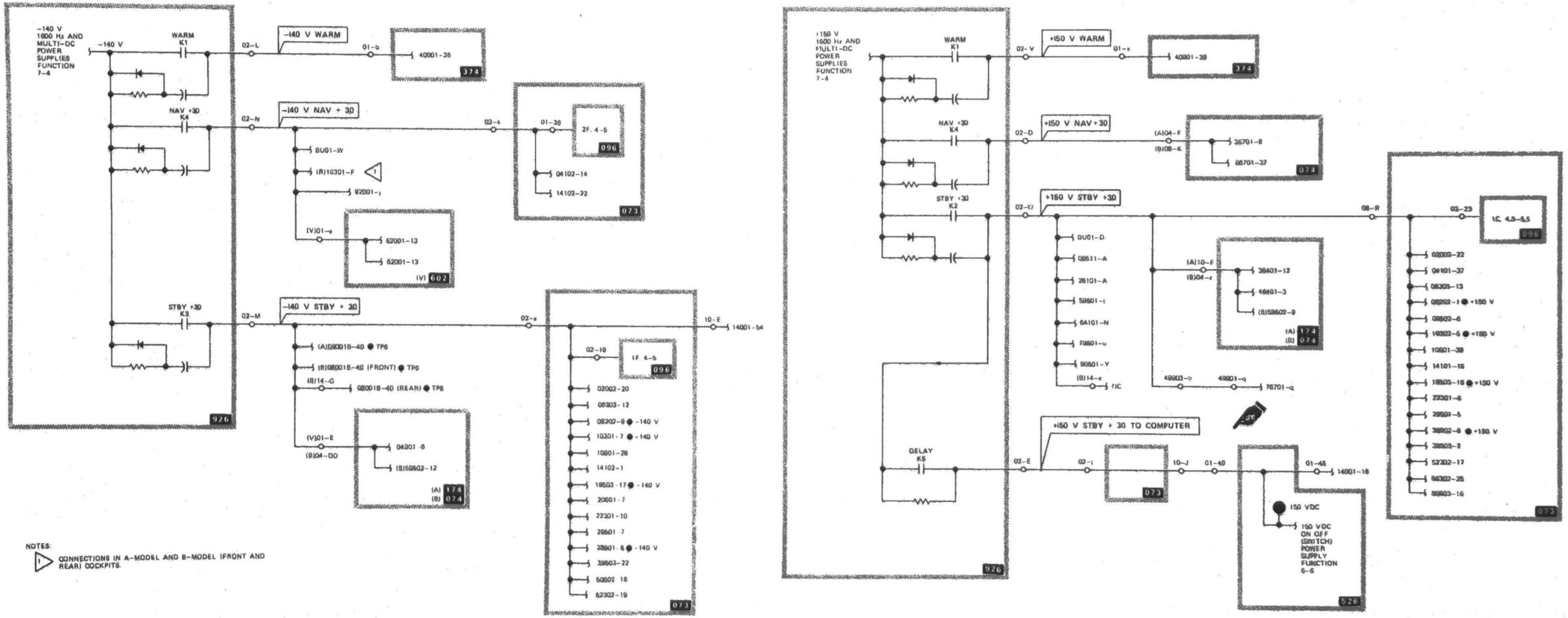


Figure 7-9. -140 v and +150 v Distribution

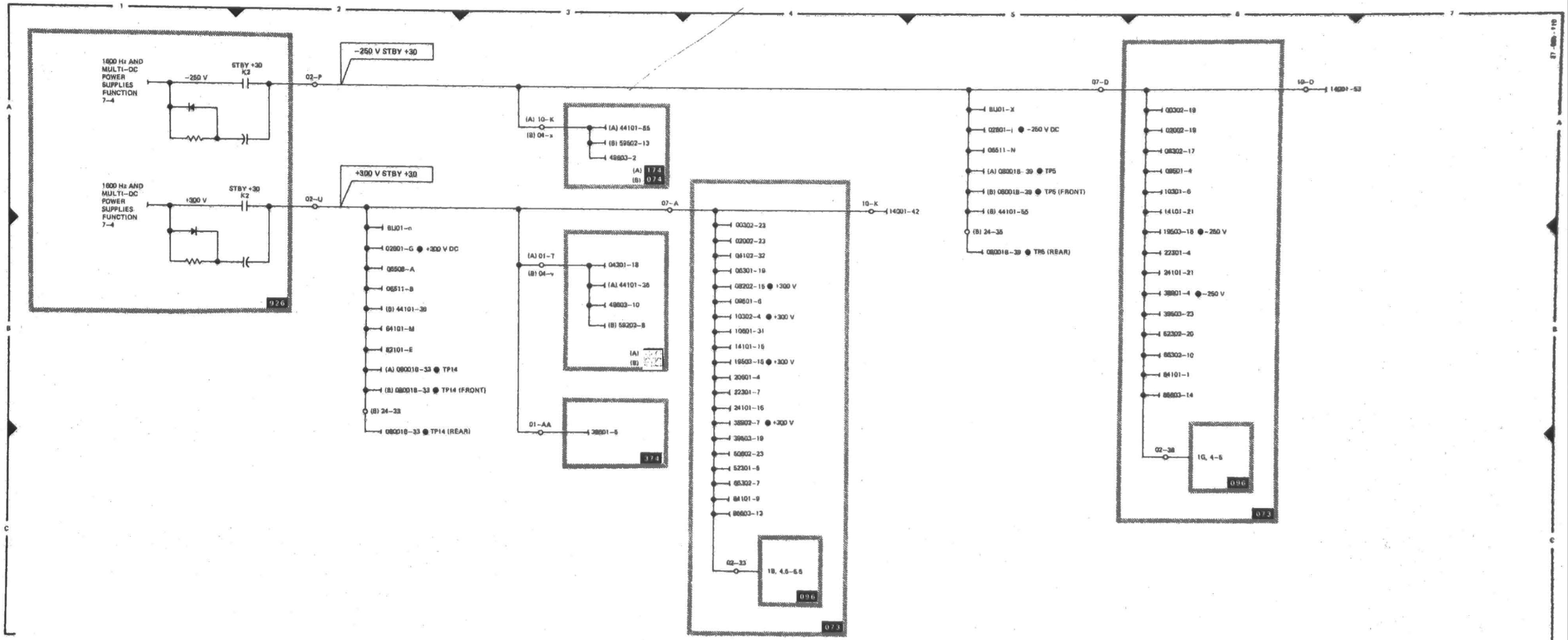


Figure 7-10. -250 v and +300 v Distribution

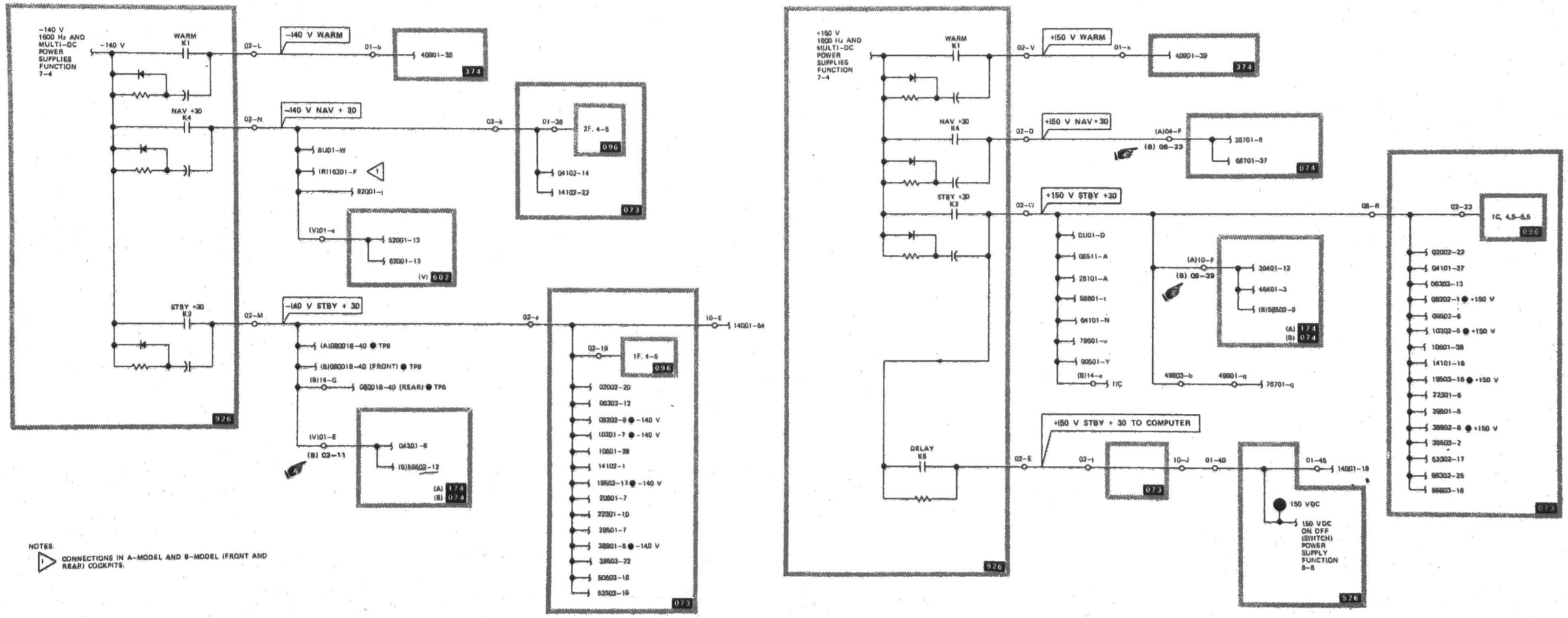


Figure 7-9. -140 v and +150 v Distribution

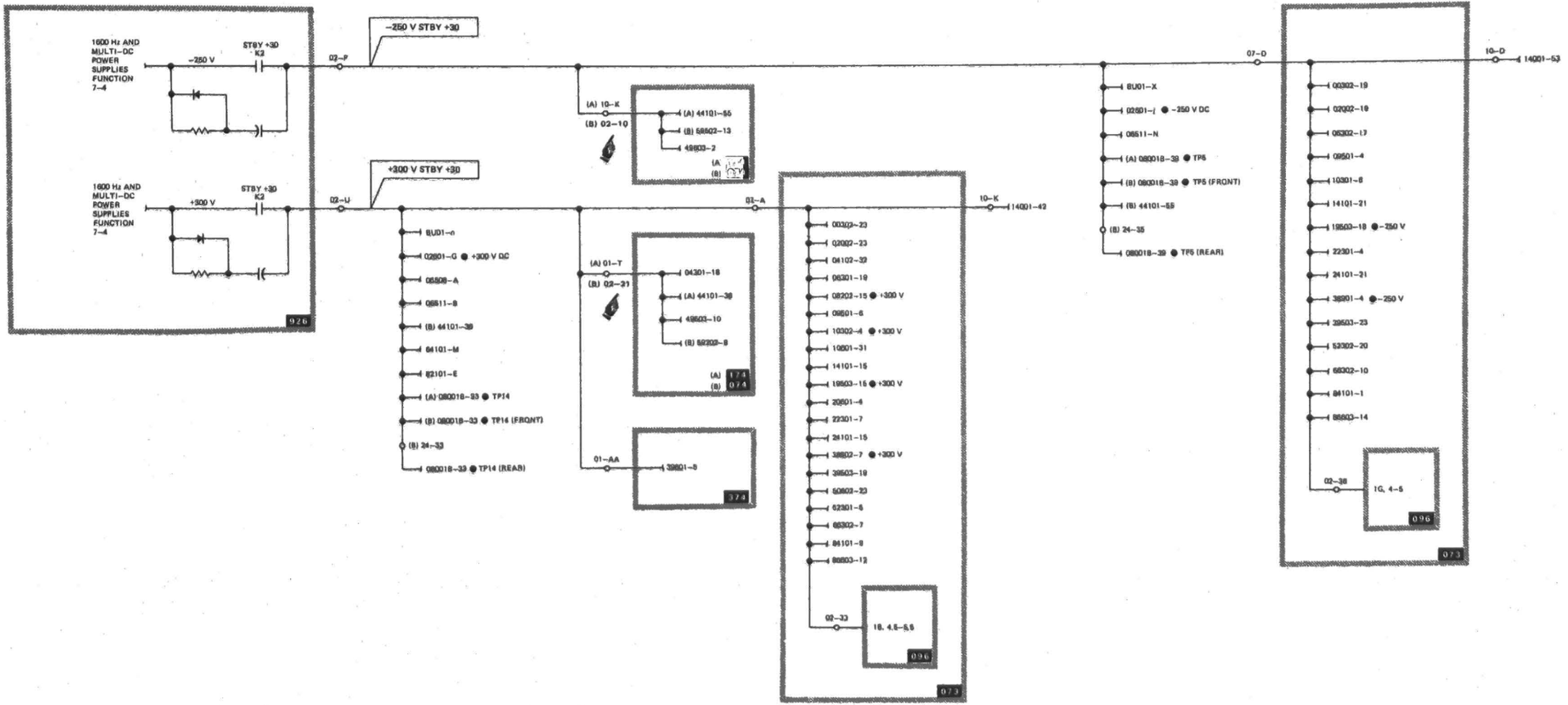


Figure 7-10. -250 v and +300 v Distribution

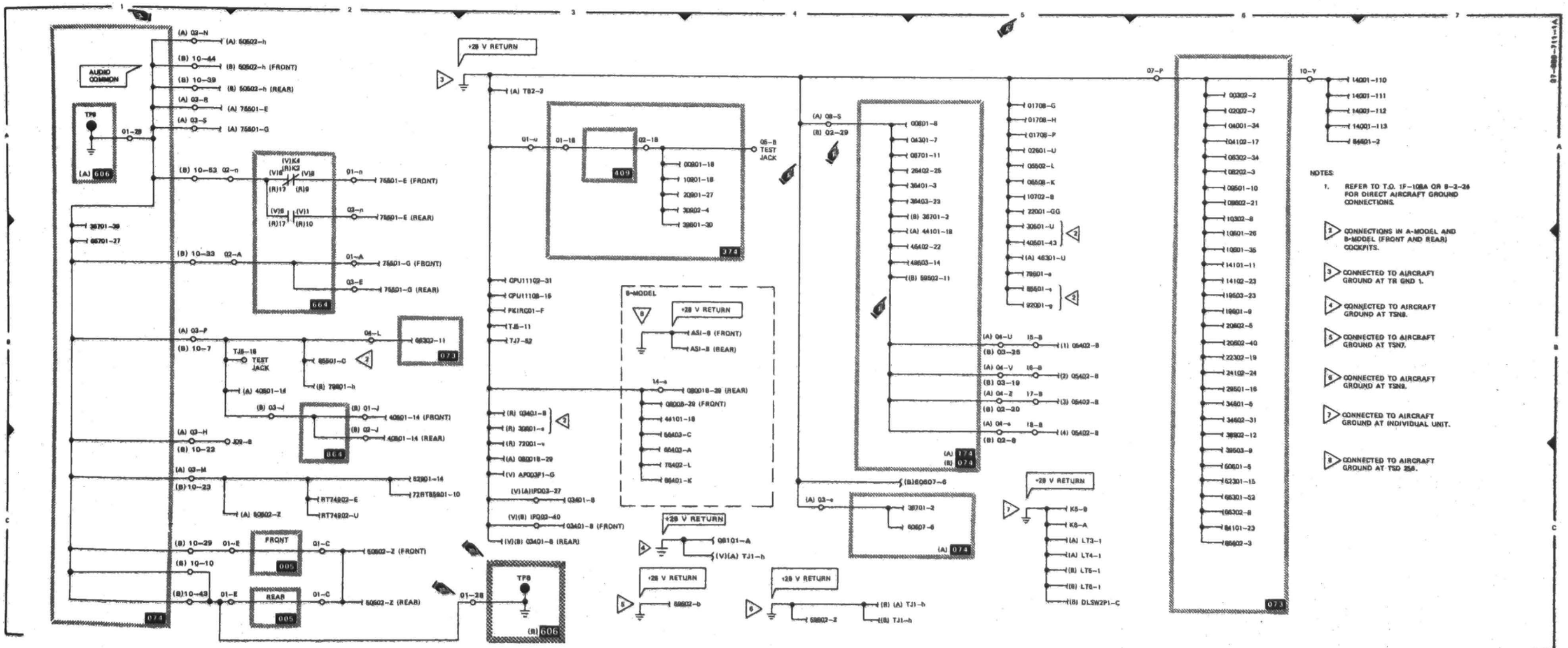


Figure 7-11. +28 v Return, Audio Common and Instrument Ground (Sheet 1 of 2)

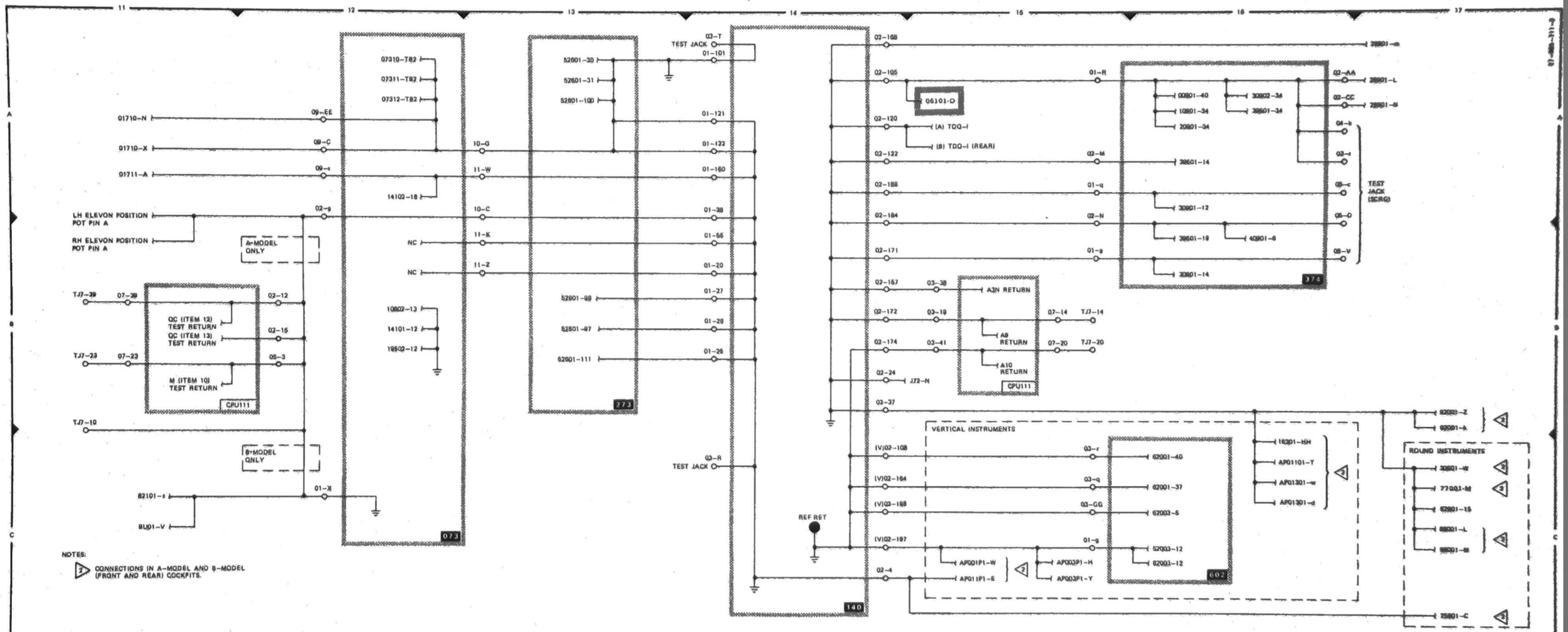


Figure 7-11. +28 v Return, Audio Common and Instrument Ground (Sheet 2 of 2)

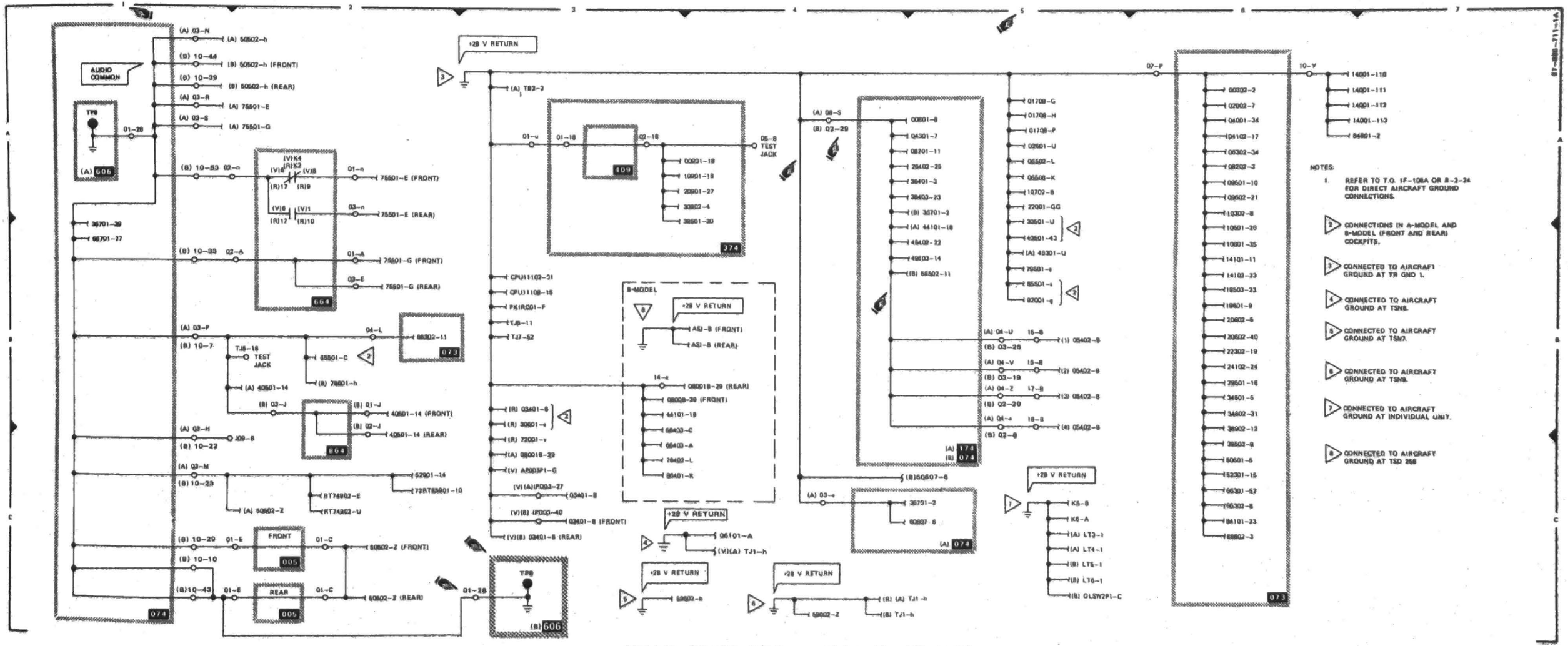


Figure 7-11. +28 v Return, Audio Common and Instrument Ground (Sheet 1 of 2)

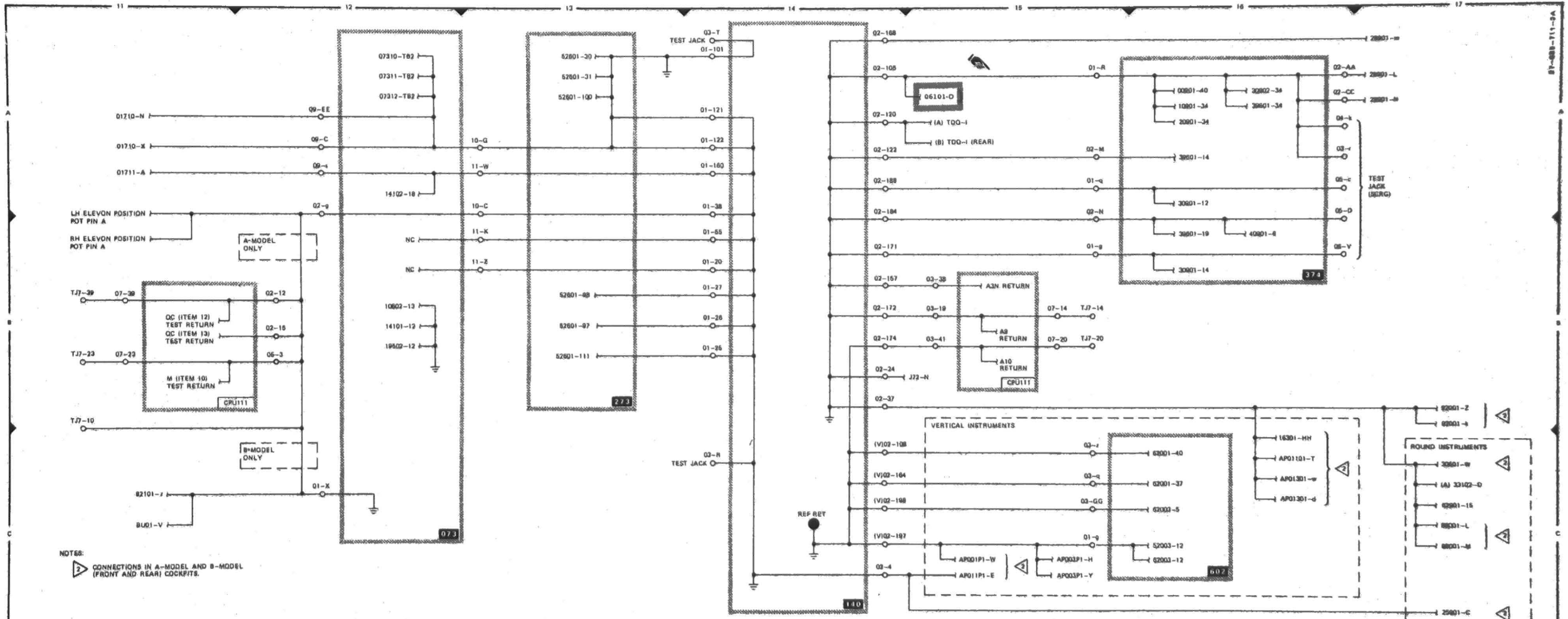


Figure 7-11. +28 v Return, Audio Common and Instrument Ground (Sheet 2 of 2)

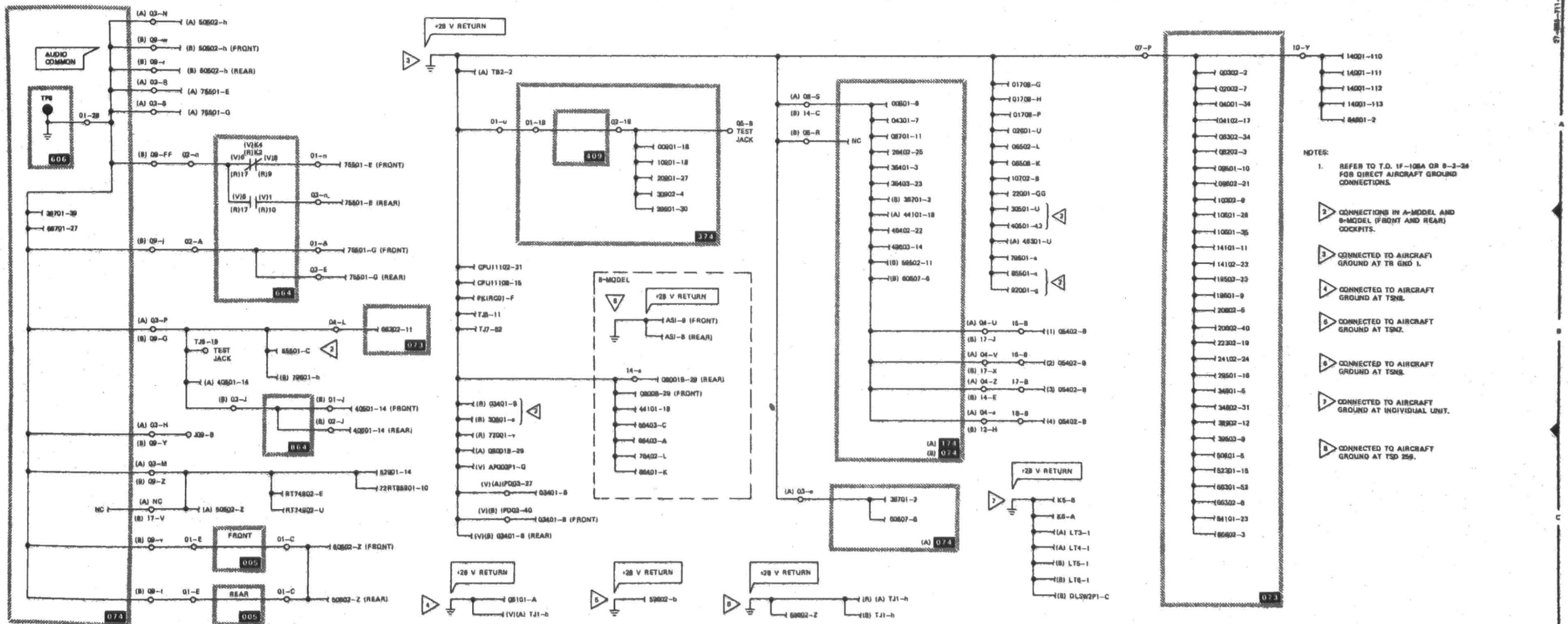
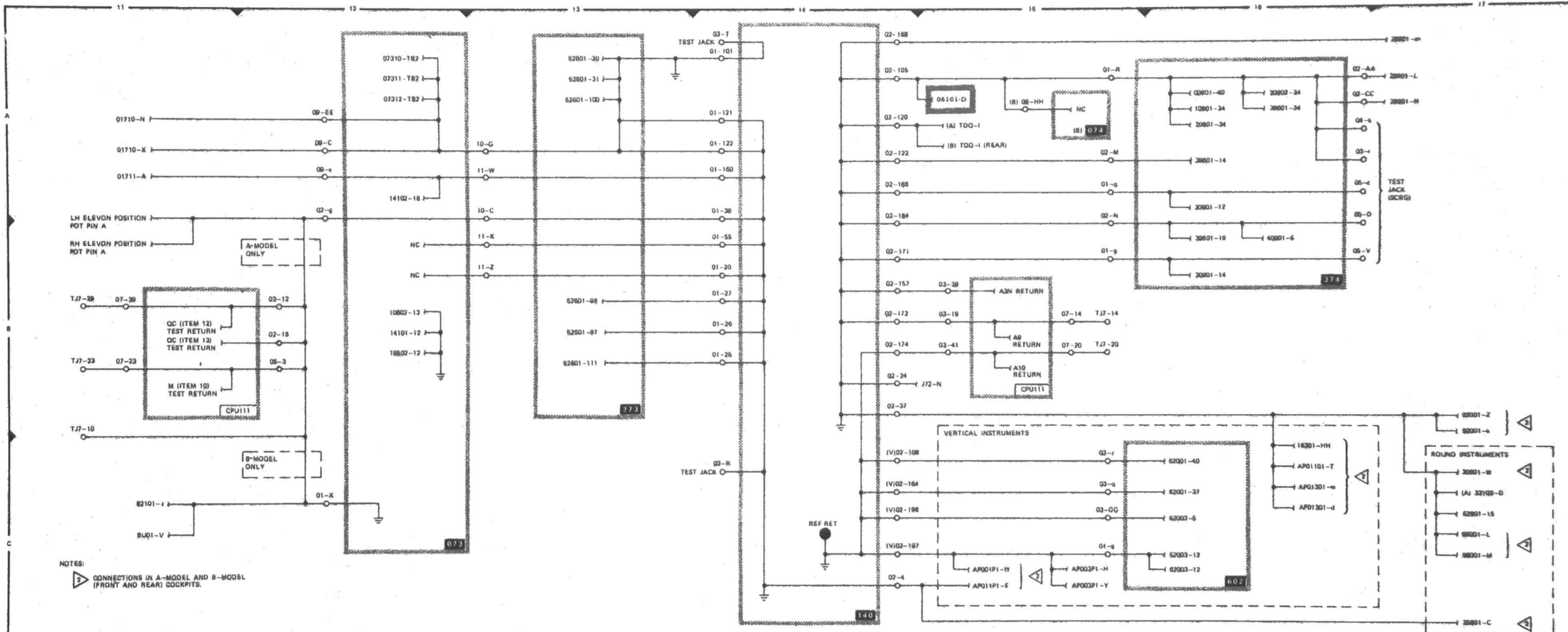


Figure 7-11. +28 v Return, Audio Common and Instrument Ground (Sheet 1 of 2)



NOTES:

2 CONNECTIONS IN A-MODEL AND B-MODEL (FRONT AND REAR) COCKPITS.

Figure 7-11. +28 v Return, Audio Common and Instrument Ground (Sheet 2 of 2)

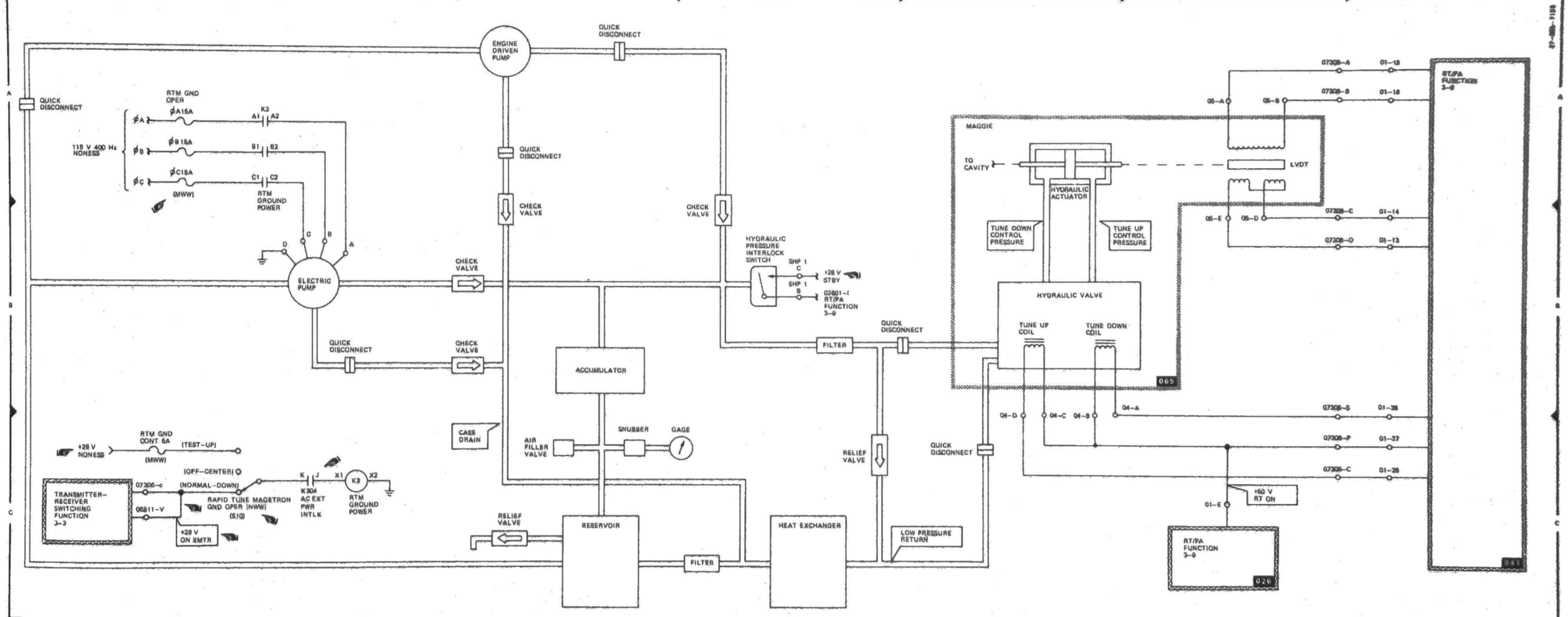


Figure 7-12. RTM Power

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
Aircraft	K2	COIL X1 AND X2 A1 AND A2 B1 AND B2 C1 AND C2	7-12/2C 7-12/2A 7-12/2A 7-12/2A
	K4	COIL A AND B C AND D G AND H J AND K	7-2/13B 7-3/35B 7-2/13B 7-3/52B
	K5	COIL A AND B C AND D	7-3/53B 7-3/53B
	K6	COIL A AND B C, D AND E	7-3/53B 7-3/53A
	K10	COIL X1, X2 AND Y1 (V) A2 AND A3 (V) B2 AND B3 (V) C2 AND C3 (R) A2 AND A3 (R) B2 AND B3 (R) C2 AND C3	 7-3/56A 7-5/22A 7-5/22A 7-5/22A 7-5/24C 7-5/24C 7-3/53C
	(A)K13	* (A) M AND N	* 7-5/23C
	K101	COIL X1 AND X2 A1 AND A2 11 AND 12 13 AND 14	7-2/23A 7-2/23A 7-2/23A 7-2/23B
	K105	COIL A AND B C AND D F AND G (B) J AND K M AND N	7-2/11A 7-2/13A 7-2/12A 0-7/25C 7-2/17A
	K106	COIL A AND B C, D AND E F, G AND H J, K AND L	7-2/16A 7-2/16A 7-2/16A 7-2/16A
	K107	COIL X1 AND X2 A1, A2 AND A3 B1, B2 AND B3 C1, C2 AND C3	7-2/16C 7-2/16B 7-2/16B 7-2/16B
	K108	COIL A AND B C AND D J AND K	7-2/15B 7-2/17C 7-2/15B

*Refer to T.O. 1F-106A-2-13, Pitot Heater Circuit, for K13 coil information.

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
Aircraft (Cont)	K301	COIL X1 AND X2 A2 AND A3 B2 AND B3 C2 AND C3	7-2/24A 7-2/22B 7-2/22B 7-2/22B
	K302	COIL X1 AND X2 A1 AND A2	7-2/25B 7-2/25B
	K303	COIL X1 AND X2 A1, A2 AND A3 B1 AND B2 C1, C2 AND C3	7-2/24B 7-2/25B 7-2/23C 7-2/23C
	K304	COIL A AND B D AND E F AND G J AND K (B) M AND N	7-2/4A 7-2/5C 7-2/4A 7-12/2C 7-5/23C
	K305	COIL A AND B COIL C AND D J AND K L AND M L1, L11 AND T1 L2, L12 AND T2 L3, L13 AND T3	7-2/6A 7-2/6C 7-2/6A 7-2/6C 7-2/6A/ B 7-2/6A/ B 7-2/6A/ B
	K306	COIL X1 AND X2 A1 AND A2 B1 AND B2 C1 AND C2	7-3/4A 7-3/2B 7-3/2B 7-3/2B
	K307	COIL A AND B K AND L	7-2/5C 7-2/5C
	K308	COIL A AND B C, D AND E	7-2/24B 7-2/25B
	K309	COIL X1 AND X2 A1 AND A2	7-2/23B 7-2/23B
	K310	COIL X1 AND X2 A1 AND A2 B1 AND B2 C1 AND C2 D1 AND D2	7-3/24B 7-3/41A 7-3/41B 7-3/41B 7-3/41B

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
VR301	K1	COIL NO	7-2/3A 7-2/4A
(A)074 (B)473	K1	COIL X1 AND X2 A1, A2 AND A3 B1, B2 AND B3 C1, C2 AND C3	7-3/56B 7-5/13A 7-5/13B 7-5/13B/C
	K2	COIL X1 AND X2 A2 AND A3 B2 AND B3 C2 AND C3 D2 AND D3	7-3/56B 7-5/13A 7-5/13B 7-5/13C 7-3/52A
	K3	COIL 3 AND 7 2 AND 4	7-3/56A 7-3/56B
518	KA_1	COIL NO NO NO NO	7-3/17A 7-3/23A 7-5/3A 7-5/3A 7-5/3A
	KA_2	COIL NO NO NO	7-3/17A 7-6/3A 7-6/3A 7-6/3B
	KB_1	COIL NO NO	7-3/17A 7-3/31B 7-5/3A
	KB_2	COIL NO NO	7-3/17A 7-6/11A 7-6/11B
	KC_1	COIL NO NO NO NO	7-3/17A 7-3/23B 7-5/3B 7-5/3B 7-5/3C
	KC_2	COIL NO NO	7-3/17A 7-6/3B 7-6/3C
	KD	COIL NO	7-3/17A 7-5/3C

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
518 (Cont)	KE	COIL NO NO NO NO	7-3/17B 7-3/31C 7-5/12A 7-5/12B 7-5/12B
	KF	COIL NO NO NO	7-3/17B 7-3/31C 7-5/15A 7-5/15A
	KG	COIL NO NO	7-3/17B 7-6/11C 7-6/11C
	KH	COIL NO NO NC	7-3/17B 7-6/3A 7-6/3A 7-6/3B
	KK	COIL NO	7-3/17B 7-3/31B
	KL	COIL NO	7-3/17B 7-3/31B
	KM	COIL NO	7-3/17C 7-6/3B
	KN	COIL NO	7-3/17C 7-3/23A
	KP	COIL NO	7-3/17C 7-3/23A
	KR	COIL NO	7-3/17C 7-3/31A
	KY	COIL NC	7-3/23B 7-3/23B
926	K1	COIL NO NO NO NO	7-3/25A 7-7/1A 7-7/1B 7-9/1A 7-9/5A
	K2	COIL NO NO NO	7-3/25A 7-7/1B 7-10/2A 7-10/2A

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
926 (Cont)	K3	COIL NO NO NO	7-3/25B 7-7/1B 7-7/1C 7-9/1B
	K4	COIL NO NC NO NO	7-3/25A 7-8/1A 7-8/1A 7-9/1A 7-9/5A
	K5	COIL NO NO	7-3/25B 7-3/24B 7-9/5C
	K6	COIL NO	7-3/25B 7-3/25B

CIRCUIT BREAKER	FIGURE/ZONE
CB301	7-2/21B
CB302	7-2/21A
CB303	7-3/3C
CB304	7-6/1A
CB305	7-3/3B/C
CB306	7-6/1B
CB307	7-6/4A
CB308	7-6/4B
CB309	7-6/4B
CB310	7-3/14B
CB311	7-3/21B
CB312	7-3/21A

Figure 7-13. Power Subsystem Relay and Circuit Breaker Location

CHAPTER 8

FC&M SUBSYSTEM

FC&M Subsystem

The FC&M subsystem provides the MA-1 system with air data parameters for computer use and tactical situation displays for pilot information. The subsystem also utilizes the air data and computer mission calculations to achieve automatic flight control. Individual functions of the subsystem perform in combination with each other to establish flight reference and control information to the aircraft and other subsystems. These functions also respond to outputs from other subsystems during the mission. Performance of the FC&M subsystem includes major interface with the CN&L, computer, and radar subsystems, SSGC, and SCABU functions. TACAN, ILS, IFF, data link, and command communication group functions of the CN&L subsystem feed or respond to the four functions of the FC&M subsystem. The input/output function of the computer subsystem receives FC&M controlled inputs and delivers programmed commands to direct the FC&M functions to display tactical and related data, provide interceptor flight control, and establish precision timing references. Radar subsystem attack displays are supplied with aircraft heading and attitude information by the FC&M subsystem. Contributions of the four functions of the FC&M subsystem to the MA-1 AWCIS are, in summary:

A SCRG

Furnishes aircraft pitch rate to the radar/IR search, supersearch, and hand control function as an aircraft attitude reference.

Provides roll rate to anti-chaff function to permit roll correction.

Accepts +28 V selected inputs for performing annunciator and system 1 and 2 tests.

Routes aircraft roll and pitch rate to attack display function to provide position references for the antenna. Pitch and roll resolver excitation returns from attack display function to establish phase reference.

Provides +28 V signal to AFCS to confirm SCRG stable platform is OK.

Supplies stable platform latitude, heading and coordinate data to input/output computer function.

B AFCS

Receives +28 V signal from SCRG verifying stable platform is leveled for use.

Receives system test B and self-test signals from SSGC function.

Alerts ILS function that AFCS is in AUTO mode.

Receives roll rate and impact pressure inputs from air data/cockpit function.

Receives elevon servo commands and AFCS performance evaluation signals from input/output function; sends elevon feedback, pitch and roll rates, trim signals, and AFCS mode-defining signals to computer.

C Air Data/Cockpit

Develops raw air data inputs into computed flight data outputs (H_p, Q_c, V_c, M, MSM, a_t) to cockpit instruments, AFCS, and input/output function.

Receives and displays ILS function parameters.

Acquires self-test and system test inputs from SSGC function.

Displays heading inputs from command communication group function.

Receives command mach signals from data link function.

Receives and displays TACAN function bearing and range information.

Generates mode inputs for IFF function.

Feeds computer flight data and map scale +28 V signals to input/output function; routes computer-processed command and target altitude, heading, range, and mach flight information to the cockpit displays.

D TSD

Accepts valid bearing and range TACAN inputs for tactical situation display.

Receives target and aircraft position coordinates for tactical presentation.

Figure 6-1. FC&M Subsystem Block Diagram (Sheet 1 of 3)

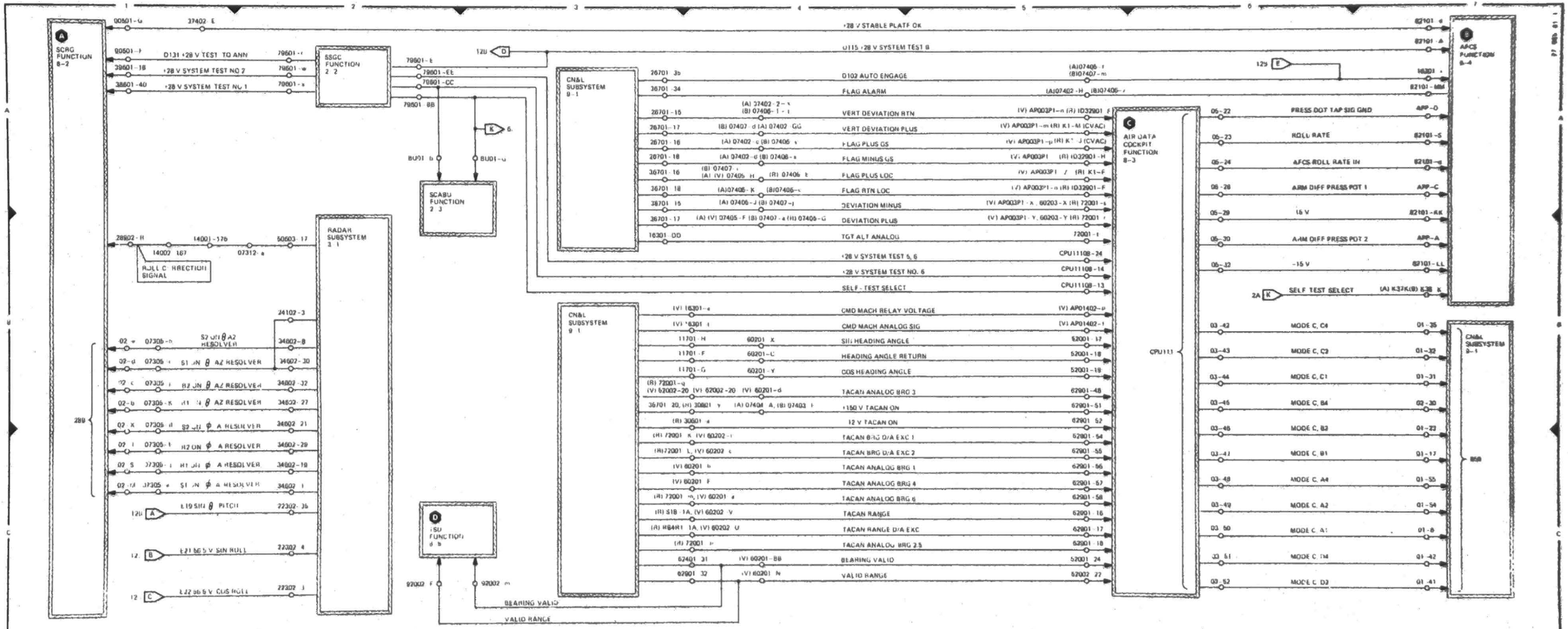


Figure 8-1. FC & M Sub-system Block Diagram (Sheet 2 of 3)

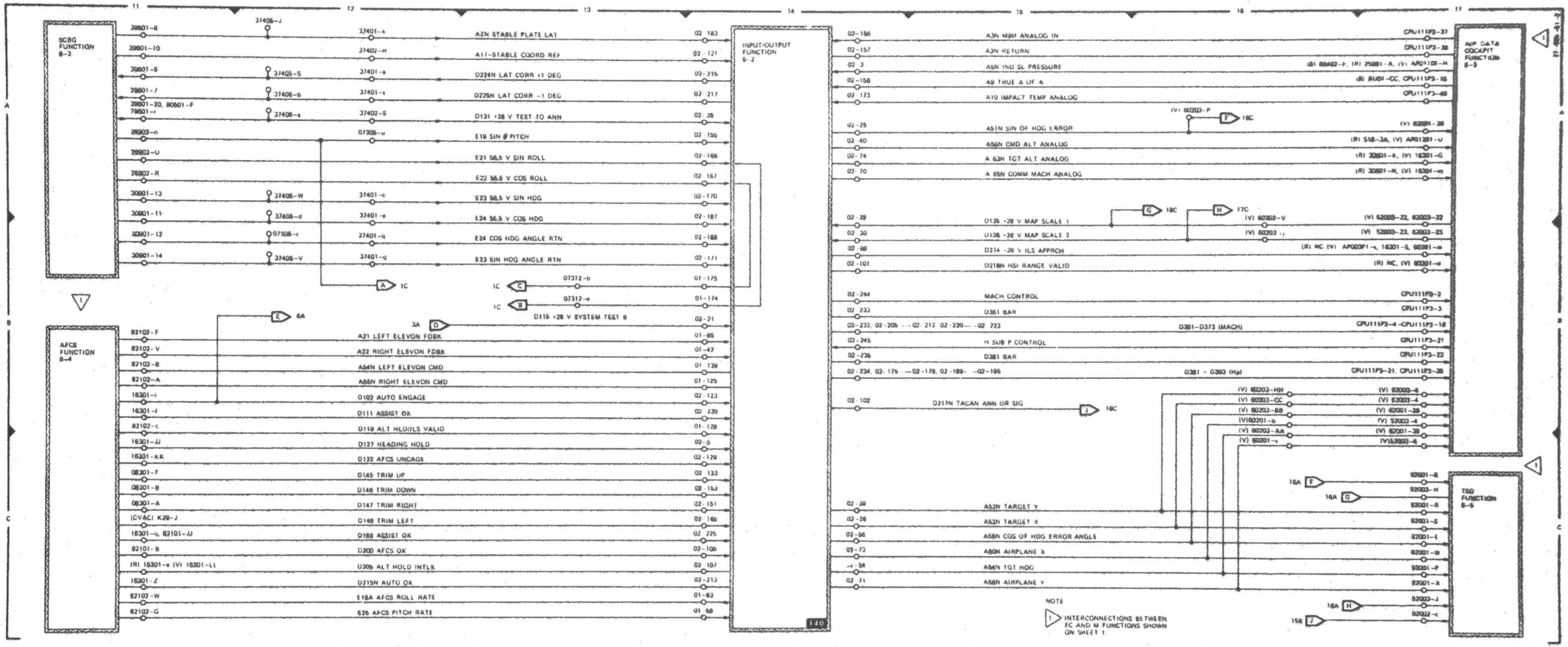


Figure 8-1. FC & M Sub-system Block Diagram (Sheet 3 of 3)

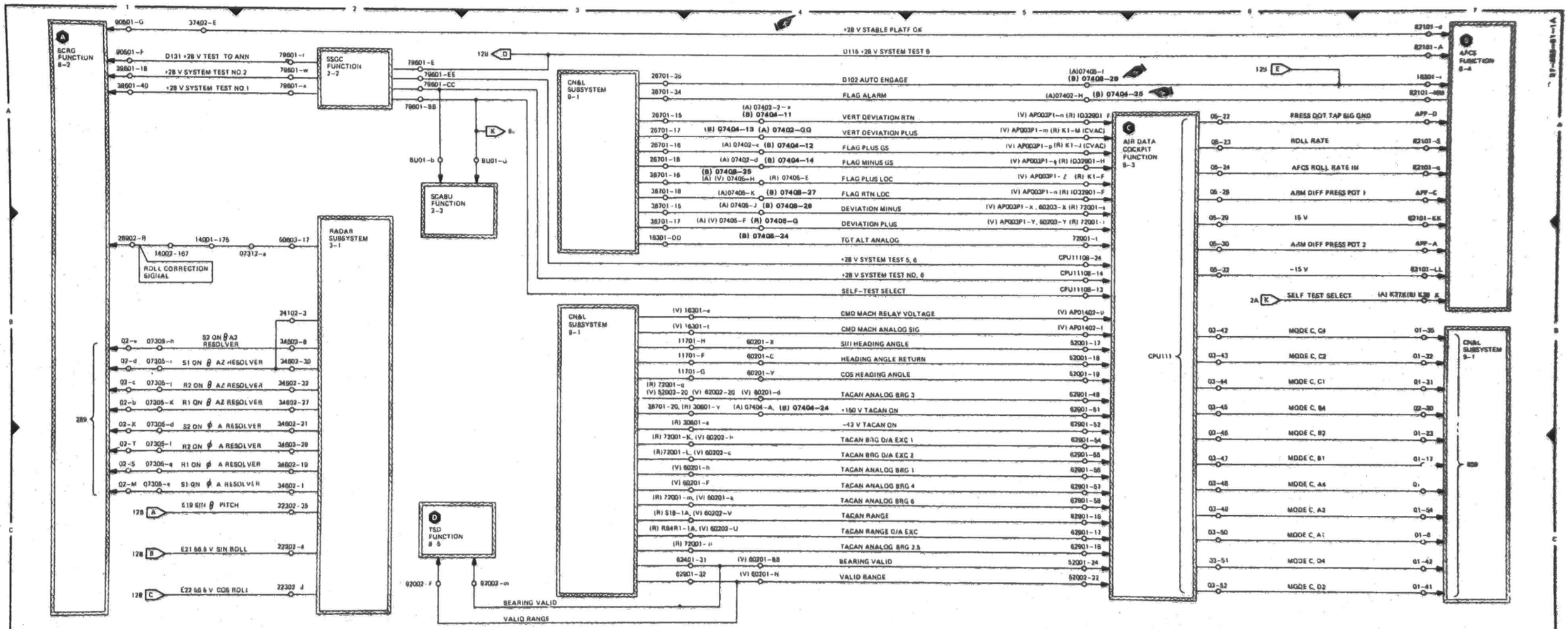


Figure 8-1. FC & M Sub-system Block Diagram (Sheet 2 of 3)

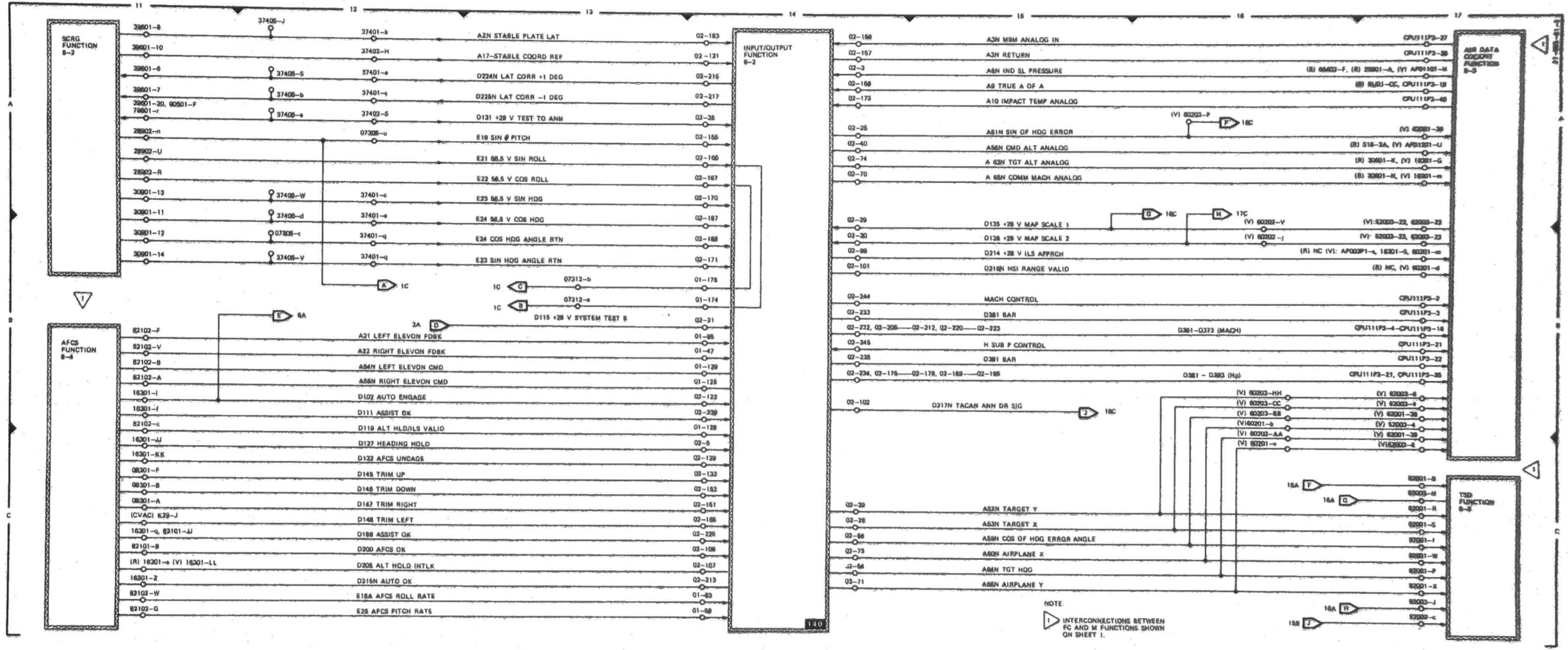


Figure 8-1. FC & M Sub-system Block Diagram (Sheet 3 of 3)

STABLE COORDINATE REFERENCE GROUP (SCRG) INITIAL AND NORMAL FUNCTIONS

Provides accurate three-axis directional reference independent of aircraft maneuvering for navigation and flight control of the interceptor. The SCRG consists of a gyro-controlled fully gimballed stable platform supporting a two-axis vertical reference accelerometer. The gyros are the positional reference for platform orientation and the accelerometers measure interceptor horizontal accelerations. The measured accelerations are integrated to derive equivalent aircraft horizontal velocities and thereby correct for: platform displacements, aircraft movement over the earth's surface (translation), earth rotation (15 deg/hr at equator), and change in the platform vertical with geographical position (apparent precession).

SCRG operates in one of two modes, automatically selected by relay time-in circuits:

a. Initial mode – physically orients aircraft to initial heading presented by GRID REFERENCE control (905 unit), and from latitude counter resolver output (409 unit).

b. Normal mode – follows initial mode, routinely making corrections to keep local vertical and stable platform heading accurate. The stable platform supplies pitch and roll heading signals to the radar display, anti-chaff, and to the computer input/output functions.

A Initial mode, restoring shunt (109 unit) is from vertical as platform departs from a level condition or aircraft acceleration is felt. X and Y acceleration components of vertical tilt angle develop proportional phase shift in output 1600 Hz signals relative to reference signal, with phase shift corresponding to direction of tilt.

B Ring demodulators full-wave phase-detect amplified 1600 Hz acceleration signals from X and Y accelerometers into d-c signals with polarities based on input signal. These d-c outputs are used as gyro torquer voltages to correct stable platform position, and as inputs to the accelerometer X and Y restoring coils to restore the accelerometers to vertical.

C Generates magnetic field in restoring coils to interact with accelerometer restoring magnets (289 unit) to reposition accelerometer pendulum toward vertical of stable platform. During initial mode, restoring shunt (109 unit) is paralleled across restoring coils to desensitize them to provide a larger accelerometer tilt drive signal to the stable platform position-controlling gyros. This shortens the time required to initially position the stable platform.

D Relay K501 energizes for 120 second initial mode duration to:

a. Independently desensitize accelerometer X and Y restorer coils.

b. Bypass drive signals around E bridges.

K501 switches to normal mode (deenergizes) to accommodate the more precise platform stabilization and slower platform positioning requirements of normal stabilized flight.

E As "no-shunt" restoring effect on Y accelerometer is sufficient to keep its reference axis essentially vertical, Y or X output acceleration signals represent horizontal change only. Signals feed through deenergized initial-normal relay K501 (209 unit) to integrator unit (009). The integrator E bridge, an electromechanical fractional rotation magnetic device, sums acceleration d-c signal increments into a 400-Hz phase B output signal. Output signal voltage phase and amplitude is dependent on direction and amount of armature displacement from E bridge neutral (no output) position. The Y and X signals from the 009 unit provide constant correction to keep the stable platform level.

F 400 Hz signals from the E bridges drive corresponding servo loops to mechanical position their gang and square law potentiometers. The combined d-c outputs of the lower gang and square law potentiometers is a summation of the horizontal acceleration effects sensed by the Y and X accelerometers added to or subtracted from the earth's rate. Earth rate is developed from heading and latitude correction signals and is set into the lower gang potentiometers in the initial mode.

G Computer (140 unit) outputs command latitude stepping through manual or system test relays and stepping signal conditioning (396 unit).

H DEGREES LATITUDE counter, +1 degree and -1 degree stepping solenoids drive latitude count resolver rotor and latitude potentiometer to flight latitude of aircraft. Latitude potentiometer returns stable platform A2N latitude setting feedback signal to computer (140 unit) to close latitude counter servo loop. Computer, when inputed with valid TACAN compares stored latitude against A2N latitude against A2N latitude signal and repositions DEGREES LATITUDE counter accordingly.

I In initial mode, latitude count resolver couples earth-rate correction ($\omega_e \cos x$) directly to zeta resolver rotor to correct its outputs for earth-rate changes. In NORMAL mode, it couples $\omega_e \sin x$ to heading correction servo motor throughout mission to correct for earth-rate changes.

J Heading corrector generator output (proportional to north/south earth-rate correction) drives through heading corrector servo and clutch to constantly reposition zeta resolver rotor and differential synchro to selected heading.

K Zeta resolver rotor position: represents azimuth gimbal displacement angle ± aircraft heading (computer grid north).

L Indicates completion of SCRG 120 second time in interval or return to normal mode after 905 PRESS TO ERECT switch was utilized to revert to a 20 second initial mode condition. On aircraft power, initiation of SCRG 120 second time in interval occurs when 905 POWER switch is set to WARM or above. On ground power, initiation of SCRG 120 second time in interval occurs 120 seconds after 905 POWER switch has been set to RADAR STBY, ON or RADIO SILENCE.

Figure 8-2. SCRG (Sheet 1 of 8)

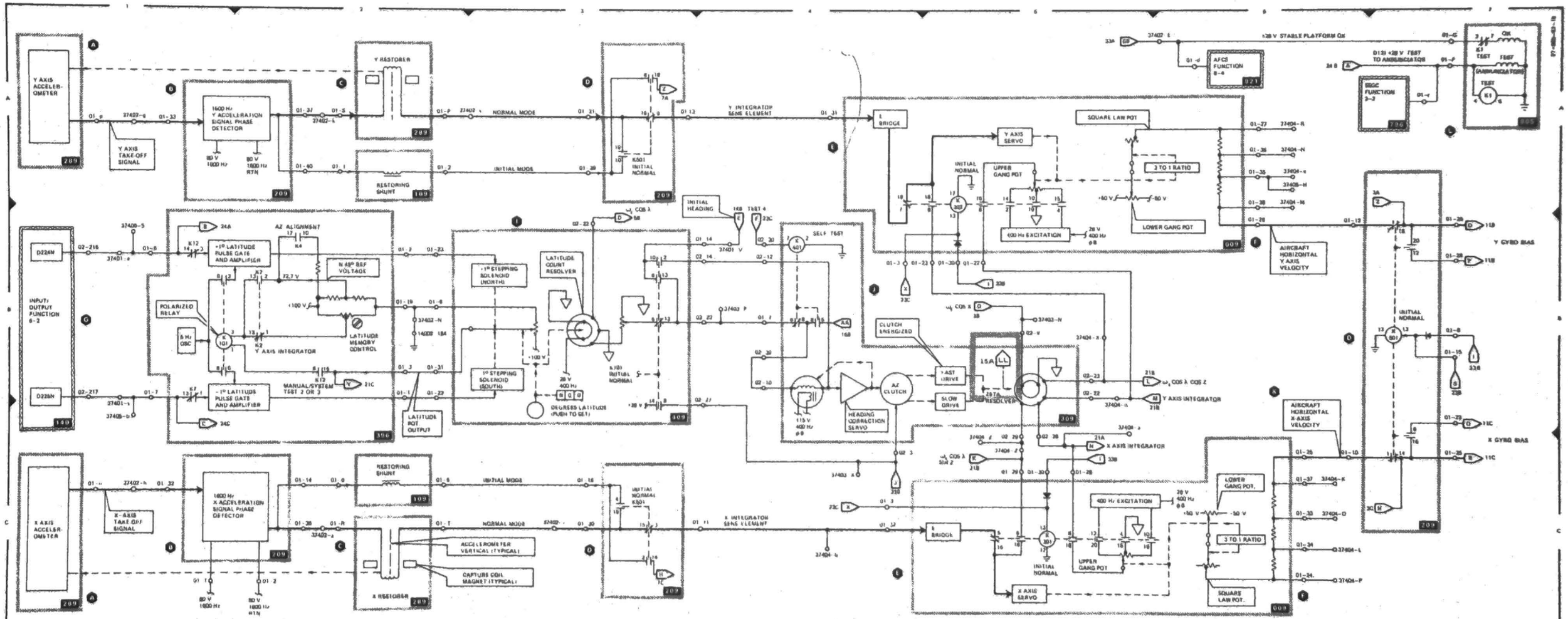


Figure 8-2. SCHG (Sheet 2 of 8)

A. Earth-rate compensated d-c Y-axis and X-axis acceleration signals from integrator (009 unit) drive gyro torquers to precess stable platform pitch and roll gyros. Gyro take-off generator outputs excite platform resolver rotor windings.

B. Since azimuth gimbal is free to assume a random heading, and take-off generators feed to azimuth-gimbal-oriented rotor of platform resolver, the Y and X gyro positional error outputs thus resolve into their respective pitch and roll error components.

C. Respectively amplify pitch and roll positional error signals to develop pitch and roll correction drive signal outputs to corresponding servo motors.

D. Pitch and roll gimbals independently reposition to keep the gyro major axes perpendicular to, and the stable platform level with, the earth's surface.

E. Gimbal attitude changes mechanically drive pitch and roll resolver rotors which transmit stable platform pitch angle (sin θ, E19) and roll angle (sin ϕ, E21 and cos ϕ, E22) to Computer Input/Output (5-2), Attack Display (3-18), and Anti-chaff (3-20) functions.

F. Since azimuth gimbal is installed at zero alignment with interceptor longitudinal axis, azimuth gyro senses attitude response during flight resulting in "aircraft-vs-azimuth-gimbal" heading variations. These are sensed by azimuth take-off generator to produce heading-angle-modulated 400-Hz output signal. (Azimuth torquer is not driven during flight.)

G. Amplifies azimuth gyro signal to develop azimuth correction drive signal to servo motor.

H. Azimuth gimbal repositions to correct stable platform position in response to aircraft azimuth movement sensed by gyro pickoff generator. Platform azimuth position change is coupled to azimuth resolver and to platform coordinate resolver (sheet 2) to resolve X and Y gyro changes into aircraft pitch and roll channels.

I. Differential synchro compares platform to aircraft heading angle on stator, with aircraft initial heading relative to computer grid north. Reference is manually set into 905 by pilot at start of mission with the differential synchro rotor at zero. Output signal then represents platform-to-aircraft heading angle A, and drives azimuth follow-up servo to position rotors of azimuth resolver and heading synchro transmitters accordingly.

J. Azimuth resolver feeds computer E24 (cos ψ) and E23 (sin ψ) heading angle functions.

K. Synchro transmitter feeds heading angle A signal to GRID REFERENCE resolver (905 unit) to compare with manually set initial course. Resolver output then drives to a null as azimuth channel functions reposition. (See sheet 3: synchro test load functions during self-test.)

Figure 8-2. SCRG (Sheet 3 of 6)

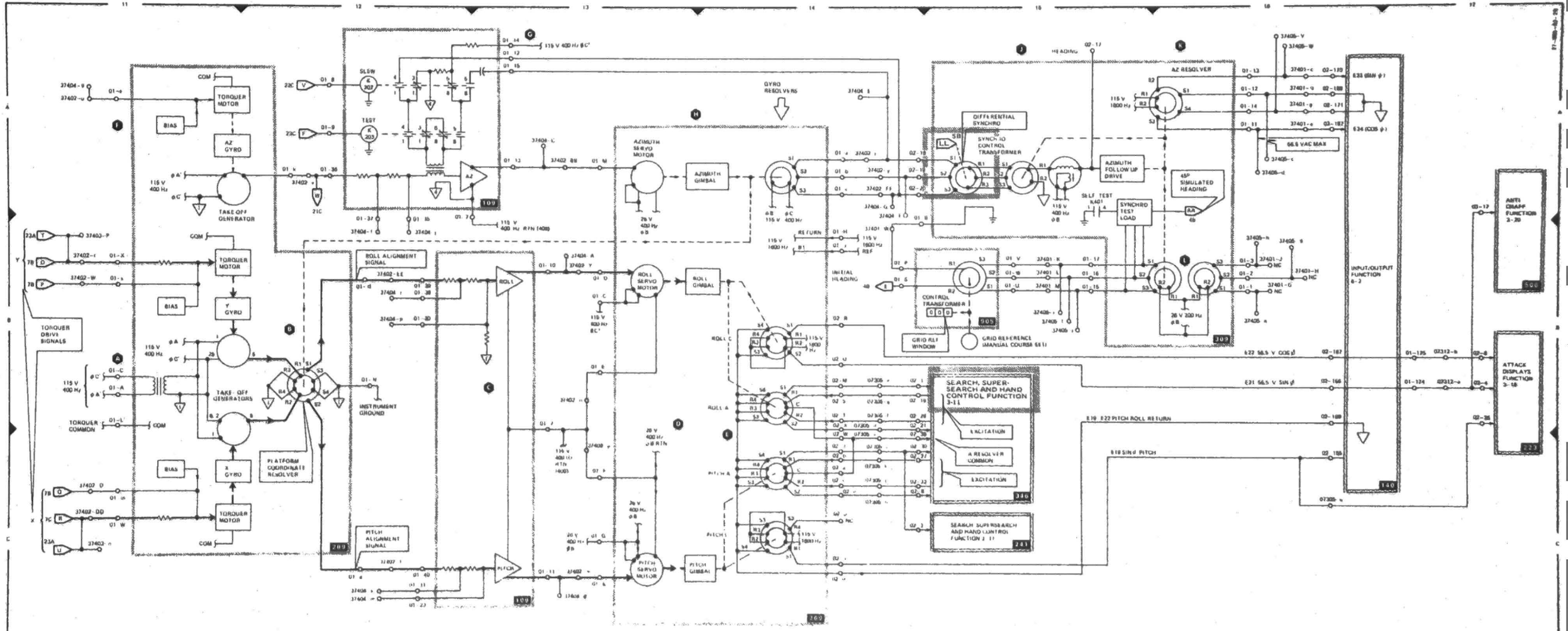


Figure 1-2. SCDG (Sheet 4 of 11)

SCRG SELF-TEST FUNCTION

SCRG self-tests are a function of short system ground check (SSGC) No. 2 and 3. When self-test panel (796 unit) SELECTOR TEST switch is set to position 2, a sequence of seven SCRG self-test signals is initiated. Each signal is tested through a series of relays controlled by logic switch switches, which in turn are controlled by test sequencer counter circuits. As each test is successfully completed, the counter circuits initiate the next test in sequence. The start of each test is indicated on the NAVIGATION TEST SEQUENCE INDICATOR, (396 unit) which automatically progresses from 1 to 5. If any of the SCRG signals tested are not present or of correct magnitude, the computer (140 unit) stores this information before continuing the remaining sequence of tests.

The following conditions are set into the SCRG system before any testing is started:

a. Latitude potentiometer (409 unit) to N45°, and maintained through SSGC's 2 and 3.

b. P and R gimbals precessed to "roll left - pitch up" simulated aircraft attitude.

c. Zeta resolver (309 unit) to 45°.

d. Azimuth gimbal (289 unit) to 0°.

(A) Energizes from 796 unit +28 v SSGC 2 input to:

a. Couple computer D225N signal (at +28v) to prepare sequencer counter circuits for test cycle.

b. Ready relay K9 for test activation.

c. Energize relay K12 to start system test 2 or permit manual testing.

d. Energize azimuth clutch to produce fast drive of zeta resolver in azimuth alignment closed loop; this reduces test time by speeding up the heading corrector servo nulling process.

e. Energize azimuth slew relay K202 and test relay K203 to provide automatic drive of the azimuth gimbal to zero degrees for start of test.

f. Insert earth-rate correction signal onto Y axis integrator upper gang potentiometer arm (via K301-8 and 18) to stimulate servo to respond with proper output.

Computer sets D224N to 0 v if correct Y integrator response occurred, advancing sequencer to next test.

(B) When energized by K7, +28 v is sent to computer and automatic test sequencer counter and +300 v to NAVIGATION TEST SEQUENCE INDICATOR to power system for tests. Also feeds D224N (0 v) signal to test sequence counter circuits to start automatic test sequence. Develops unequal d-c drive voltages from +300 v warm to drive pitch and roll torquers to an "up and left" simulation. Artificial horizon (080 unit) responds to moving down and tilting cw.

(C) Combination of D225N +28 v and D224N 0 v signals sets test sequencer counter logic to initial state and results in computer storage of latitude counter setting (signal A2N). Computer waits one second and sets D224N to +28 v to store platform roll and pitch angles, and sequence Y axis integrator relay K2 to start first SCRG test. K2 then supplies to a positive d-c drive signal to the torquers to stimulate yaw and pitch test outputs.

(D) Energized by SSGC 3 +28 v from 796 unit (SSGC Function 2-2) to provide SCRG four initial conditions for start of MA-1 system navigation capability check. K8 function is same as that of K7 (B), without automatic test sequencing.

(E) During other self-tests, K9 is deenergized to provide +28 v input to all sequencer relays. When energized for test 8, stops test sequencing and supplies +28 v self-test signal to demodulator during manual test or self-test 2 or 3.

(F) During SCRG automatic self-test sequence, routes selected SCRG developed output signals (Y and X integrators, tests 1 and 2; azimuth gyro take-off signal, test 3; and zeta resolver sine and cosine outputs, tests 4 and 5) to computer. Verifies developed signals correspond to test latitudes and headings introduced into SCRG by test circuitry.

(G) COMMUNICATION TEST SIGNAL INDICATOR monitors the A17 signal to the computer for all tests. Test inputs 1-5 are selected by test selection relays (4) shown. Relays K10 and K11 permit "no-test" monitoring of stable platform latitude A2N signal.

Provides the following additional tests:

a. Stable platform latitude check. When held on, with COMMUNICATION TEST SELECTOR SWITCH set to 2 or 5, A2N stable platform latitude signal can be monitored on COMMUNICATION TEST SIGNAL INDICATOR.

b. Manual SCRG test.
When held on, with computer cycling in a navigation mode, energizes relay K7 to initiate the test selected by COMMUNICATION TEST SELECTOR SWITCH.

Figure 8-2. SCRG (Sheet 5 of 8)

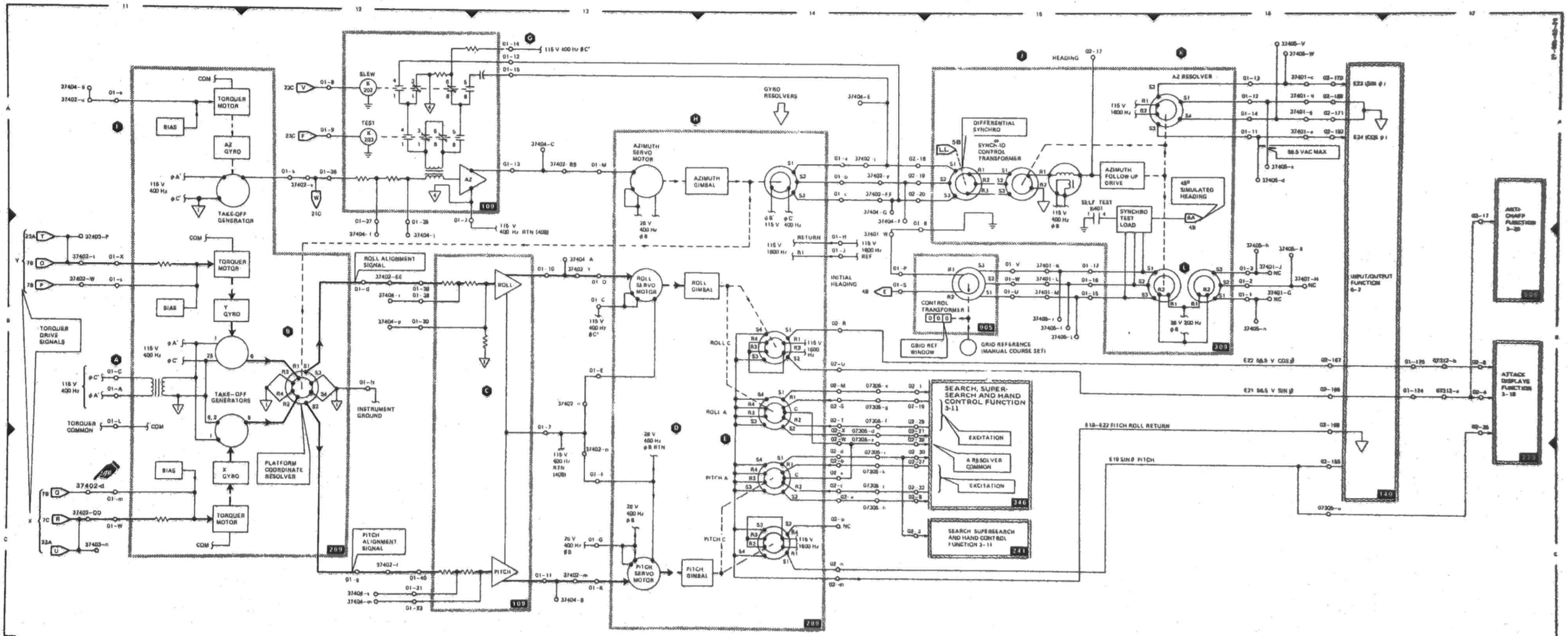


Figure 8-2. SCRG (Sheet 4 of 8)

SCRG SELF-TEST FUNCTION

SCRG self-tests are a function of short system ground check (SSGC) No. 2 and 3. When self-test panel (796 unit) SELECTOR TEST switch is set to position 2, a sequence of seven SCRG self-test signals is initiated. Each siangl is tested through a series of relays controlled by logic switch switches, which in turn are controlled by test sequencer counter circuits. As each test is successfully completed, the counter circuits initiate the next test in sequence. The start of each test is indicated on the NAVIGATION TEST SEQUENCE INDICATOR, (396 unit) which automatically progresses from 1 to 5. If any of the SCRG signals tested are not present or of correct magnitude, the computer (140 unit) stores this information before continuing the remaining sequence of tests.

The following conditions are set into the SCRG system before any testing is started:

a. Latitude potentiometer (409 unit) to N45°, and maintained through SSGC's 2 and 3.

b. P and R gimbals precessed to "roll left - pitch up" simulated aircraft attitude.

c. Zeta resolver (309 unit) to 45°.

d. Azimuth gimbal (289 unit) to 0°.

(A) Energizes from 796 unit +28 v SSGC 2 input to:

a. Couple computer D225N signal (at +26v) to prepare sequencer counter circuits for test cycle.

b. Ready relay K9 for test activation.

c. Energize relay K12 to start system test 2 or permit manual testing.

d. Energize azimuth clutch to produce fast drive of zeta resolver in azimuth alignment closed loop; this reduces test time by speeding up the heading corrector servo nulling process.

e. Energize azimuth slew relay K202 and test relay K203 to provide automatic drive of the azimuth gimbal to zero degrees for start of test.

f. Insert earth-rate correction signal onto Y axis integrator upper gang potentiometer arm (via K301-8 and 16) to stimulate servo to respond with proper output.

Computer sets D224N to 0 v if correct Y integrator response occurred, advancing sequencer to next test.

(B) When energized by K7, +28 v is sent to computer and automatic test sequencer counter and +300 v to NAVIGATION TEST SEQUENCE INDICATOR to power system for tests. Also feeds D224N (0 v) signal to test sequence counter circuits to start automatic test sequence. Develops unequal d-c drive voltages from +300 v warm to drive pitch and roll torquers to an "up and left" simulation. Artificial horizon (080 unit) responds to moving down and tilting cw.

(C) Combination of D225N +28 v and D224N 0 v signals sets test sequencer counter logic to initial state and results in computer storage of latitude counter setting (signal A2N). Computer waits one second and sets D224N to +28 v to store platform roll and pitch angles, and sequence Y axis integrator relay K2 to start first SCRG test. K2 then supplies to a positive d-c drive signal to the torquers to stimulate yaw and pitch test outputs.

(D) Energized by SSGC 3 +28 v from 796 unit (SSGC Function 2-2) to provide SCRG four initial conditions for start of MA-1 system navigation capability check. K8 function is same as that of K7 (B), without automatic test sequencing.

(E) During other self-tests, K9 is deenergized to provide +28 v input to all sequencer relays. When energized for test 8, stops test sequencing and supplies +28 v self-test signal to demodulator during manual test or self-test 2 or 3.

(F) During SCRG automatic self-test sequence, routes selected SCRG developed output signals (Y and X integrators, tests 1 and 2; azimuth gyro take-off signal, test 3; and zeta resolver sine and cosine outputs, tests 4 and 5) to computer. Verifies developed signals correspond to test latitudes and headings introduced into SCRG by test circuitry.

(G) COMMUNICATION TEST SIGNAL INDICATOR monitors the A17 signal to the computer for all tests. Test inputs 1-5 are selected by test selection relays (4) shown. Relays K10 and K11 permit "no-test" monitoring of stable platform latitude A2N signal.

Provides the following additional tests:

a. Stable platform latitude check. When held on, with COMMUNICATION TEST SELECTOR SWITCH set to 2 or 5, A2N stable platform latitude signal can be monitored on COMMUNICATION TEST SIGNAL INDICATOR.

b. Manual SCRG test.
When held on, with computer cycling in a navigation mode, energizes relay K7 to initiate the test selected by COMMUNICATION TEST SELECTOR SWITCH.

Figure 8-2. SCRG (Sheet 5 of 8)

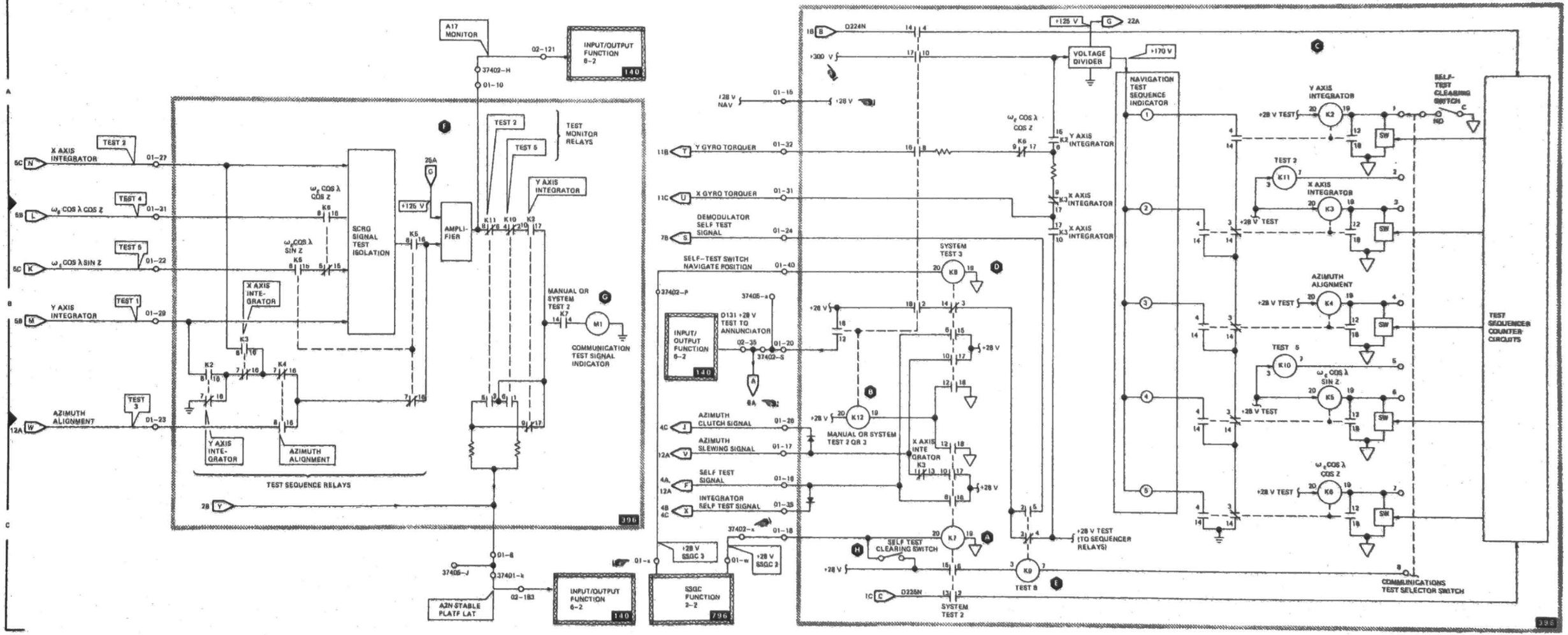


Figure 8-2. SCRG (Sheet 6 of 8)

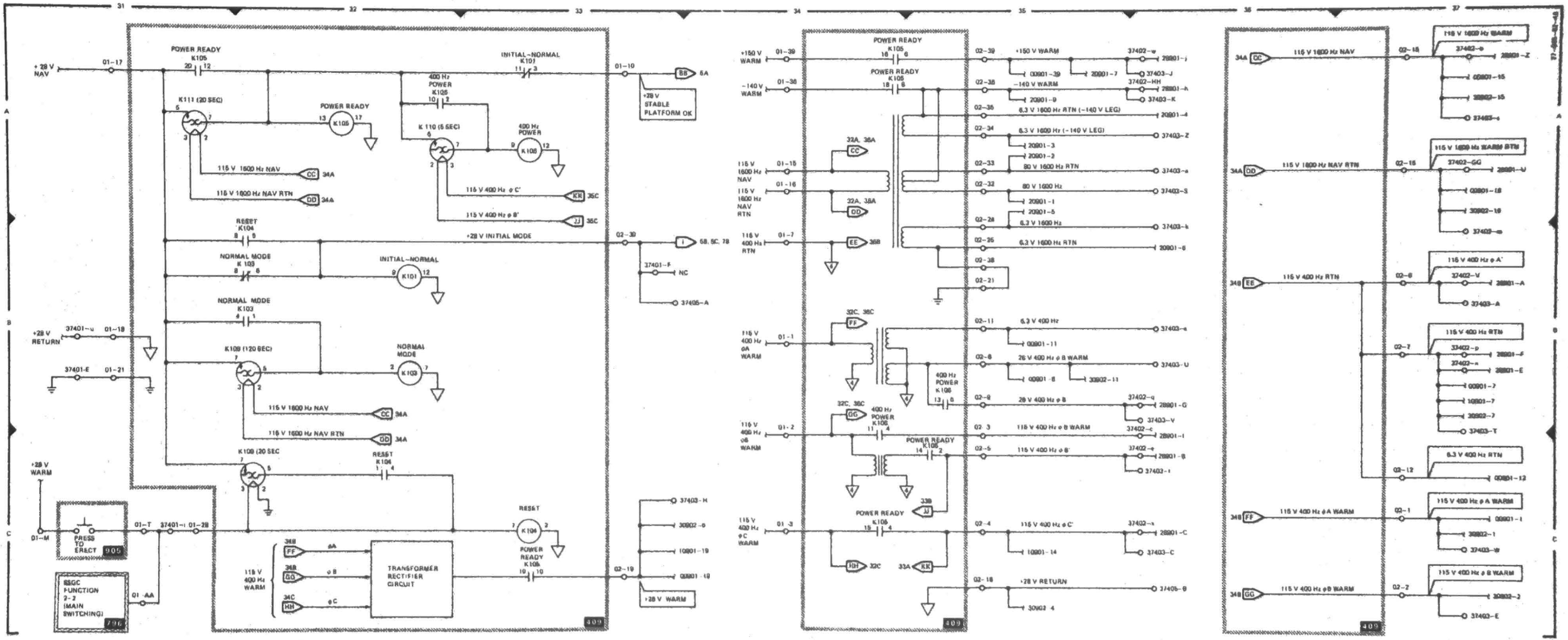


Figure 8-2. SCRG (Sheet 7 of 8)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
009	K301	2 AND 14 4 AND 15 5, 6 AND 16 8 AND 18 10 AND 19 COIL 13 AND 17	8-2/5C 8-2/6C 8-2/5C 8-2/5C 8-2/5C 8-2/
	K302	2 AND 14 4 AND 15 6 AND 16 7, 8 AND 18 10 AND 19 COIL 13 AND 17	8-2/5A 8-2/5A 8-2/5A 8-2/5A 8-2/5A 8-2/5A
109	K202	3, 4 AND 1 5, 6 AND 8 COIL 2 AND 7	8-2/12A 8-2/12A 8-2/12A
	K203	3, 4 AND 1 5, 6 AND 8 COIL 2 AND 7	8-2/12A 8-2/12A 8-2/12A
209	K501	1 AND 2 2 AND 14 3, 4 AND 15 6 AND 16 7 AND 18 8 AND 18 9, 10 AND 19 12 AND 20 COIL 13 AND 17	8-2/7C 8-2/3C 8-2/3C 8-2/7C 8-2/7B 8-2/3A 8-2/3A 8-2/7B 8-2/7B
309	K401	1 AND 4 5, 6 AND 8 COIL 2 AND 7	8-2/4B 8-2/4B 8-2/4B
398	K2	1, 2 AND 13 4 AND 14 6 AND 15 7, 8 AND 16 9, 10 AND 17 12 AND 18 COIL 19 AND 20	8-2/2B 8-2/26A 8-2/25A 8-2/21B 8-2/23B, 23C 8-2/26A 8-2/26A
	K3	1 AND 13 3, 4 AND 14 7, 8 AND 16 9, 10 AND 17 12 AND 18 COIL 19 AND 20	8-2/24C 8-2/26B 8-2/31B 8-2/25B 8-2/26B 8-2/26A
	K4	3, 4 AND 14 7, 8 AND 16 10 AND 17 12 AND 18 COIL 19 AND 20	8-2/26B 8-2/22B 8-2/2B 8-2/26B 8-2/26B
	K5	6 AND 15 7, 8 AND 16 12 AND 18 COIL 17 AND 20	8-2/22B 8-2/22B 8-21/26B 8-2/26B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
398 (cont)	K6	3, 4 AND 14 5 AND 15 8 AND 16 9 AND 17 12 AND 18 COIL 19 AND 20	8-2/26C 8-2/22B 8-2/22B 8-2/25A 8-2/26C 8-2/26C
	K7	1 AND 13 2 AND 13 4 AND 14 6 AND 15 8 AND 16 10 AND 17 12 AND 18 COIL 19 AND 20	8-2/1B 8-2/25C 8-2/23B 8-2/25C 8-2/25C 8-2/25C 8-2/25C 8-2/25C
	K8	3 AND 14 6 AND 15 10 AND 17 12 AND 18 COIL 19 AND 20	8-2/25B 8-2/25B 8-2/25B 8-2/25B 8-2/25B
	K9	4, 5 AND 2 COIL 3 AND 7	8-2/25C 8-2/25C
	K10	1 AND 6 2 AND 4 COIL 3 AND 7	8-2/23C 8-2/23B 8-2/26B
	K11	2 AND 5 6 AND 8 COIL 3 AND 7	8-2/22B 8-2/22B 8-2/26A
	K12	3 AND 14 2, 12 AND 18 4 AND 14 6 AND 15 8 AND 16 10 AND 17 COIL 19 AND 20	8-2/1B 8-2/24B 8-2/24A 8-2/2B 8-2/24A 8-2/24A 8-2/24B
	K101	2, 6 AND 8 COIL 1 AND 3	8-2/2A 8-2/2B
409	K101	2 AND 10 3 AND 11 5, 6 AND 13 8 AND 14 COIL 9 AND 12	8-2/3B 8-2/33A 8-2/3B 8-2/3B 8-2/33B
	K103	1 AND 4 6 AND 8 COIL 2 AND 7	8-2/32B 8-2/32B 8-2/32B
	K104	1 AND 4 5 AND 8 COIL 2 AND 7	8-2/32C 8-2/32B 8-2/33C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
409 (cont)	K105	2 AND 14 4 AND 15 6 AND 16 8 AND 18 10 AND 19 12 AND 20 COIL 13 AND 17	8-2/35C 8-2/34C 8-2/34A 8-2/34A 8-2/33C 8-2/31A 8-2/32A
	K106	2 AND 10 4 AND 11 6 AND 13 COIL 9 AND 12	8-2/32A 8-2/34C 8-2/35B 8-2/33A
905	K1	7 AND 3 COIL 4 AND 5	8-2/7A 8-2/7A

Figure 8-2. SCRG (Sheet 8 of 8)

The air data/cockpit function includes the controls and displays used by the pilot in operating the F106/MA-1 aircraft and weapons control interceptor system. The basic function includes the central air data computer, angle of attack transmitter, temperature probe, indicators and control switches. The central air data computer contains altitude, Mach, and airspeed processing. The Mach subfunction also contains maximum-safe-Mach circuitry, and the airspeed subfunction temperature sensing circuitry. Test connector TJ7 provides for Line Analyzer connections to permit computer test on the aircraft.

On vertical (integrated instrument) aircraft, the instruments are the Altitude and Vertical Velocity Indicator, Airspeed Mach Indicator, Horizontal Situation Indicator, and Altitude Director Indicator. Round instrument aircraft contain the AAU-19 Altimeter, Mach Indicator (880 unit), and Target and Command Altitude Indicator (980 unit).

Functional control (vertical instruments) is effected by the DISP/AUTO MODE, HDG SEL, BRG SEL, and RADIUS MILES switches. Round instrument aircraft contain only the DISP/AUTO MODE switch and switching from the TSD.

The air data/cockpit function consists of 26 sheets, grouped sequentially to cover vertical and round instrument aircraft, with primary coverage as follows:

Sheet No.	Coverage
1	Summary of function
2-19	Vertical instrument diagrams
20-27	Round instrument diagrams
28-29	Relay chart for all diagrams

Basic content of individual diagram is:

Sheet No.	Content
1	a. General theory of function. b. Text for sheet 2.
2	Central Air Data Computer (CPU-111) digitizer and synchro outputs
3 4	CPU-111 digitizer, synchro, potentiometer, and switch outputs.
5	Mach number (M)
6	Altimeter
7	Safe speed and lift acceleration (G)
8	Target altitude and vertical speed
9	Indicated airspeed (IAS)
10	Cockpit Display SDC No. 1 (520 unit) signal flow
11	Cockpit Display SDC No. 2 (620 unit) signal flow
12	Flight Director Computer (CPU-4)
13	Horizontal Situation Indicator (HSI) and CPU-4
14	Attitude Director Indicator (ADI)
15	620 unit switching
16	Bearing select switching
17 18	520 unit and CPU-4 switching
19	HSI

Round Instrument:

Sheet No.	Content
20	CPU-111 and potentiometer outputs
21	CPU-111 digitizer outputs
22	CPU-111 potentiometer, synchro, switch and digital outputs
23	Mach No. Indicator Assembly (880 unit) - M output, Baro Setting Analog Signal Control (259 unit) - barometric outputs
24	Vertical Situation Amplifier Assembly (306 unit)
25	Flight Director Signal Data Converter (720 unit), Course Indicator ID331
26	Approach Horizon Indicator (AHI) ID329
27	"B" Model version of sheet 25
28 29	Relay chart

(A) The angle of attack transducer vane positions itself in the aircraft windstream supplying as indicated angle-of-attack signal to the Mach module. The signal is processed into true angle-of-attack.

(B) The temperature probe senses slipstream variations, and couples them to the temperature servoamplifier where they are combined with a signal from the Mach module to produce a true-temperature indication.

(C) The self-test lights of the air data computer indicate H_p, V_c or M failures as follows:

H_p – Self-test low and high simulated pressure altitude signals, corresponding to 33,170 feet and 57,000 feet respectively, are simulated for ground test of servo operation. During self-test, altitude servo functional problems resulting in erroneous output readings will cause the H_p failure indicator to light.

V_c – For self test, the pressure transducer resolver outputs are simulated for low and high airspeeds of 278 and 412 knots. If the computed airspeed parameters disagree with the proper readings, the V_c failure indicator lights.

Initiation of self test of the altitude and airspeed modules results in the introduction of test low and high inputs to the Mach module, producing the following readings:

Test	M Reading
Self-test low	0.785
Self-test high	1.80

If the computed mach parameters disagrees with the proper reading for low or high self test, the Mach (M) failure indicator lights.

Self-test outputs are the same when using short system ground checks or when performing self-tests with the Line Analyzer.

Figure 8-3. Air Data/Cockpit (Sheet 1 of 29)

OUTPUT NO.	OUTPUT	FUNCTION	DESTINATION
20	H_p	PRESSURE ALTITUDE	DIGITAL COMPUTER
22	P_s	STATIC PRESSURE	ELEVON (OVER-CONTROL AVOIDANCE)
23	P_s	STATIC PRESSURE	
25	P_s	STATIC PRESSURE	CVAC (LANDING GEAR WARNING)
26	P_s	STATIC PRESSURE	CVAC (CG FUEL TRANSFER)
39	H_p	PRESSURE ALTITUDE	VERTICAL SPEED INDICATOR
40	H_p	ALTITUDE RATE	VERTICAL SPEED AMPLIFIER
43	H_p	PRESSURE ALTITUDE	IFF TRANSPONDER

UNIT	RELAY	CONTACTS	FIGURE/ZONE
009	K301	2 AND 14 4 AND 15 5, 6 AND 16 8 AND 18 10 AND 19 COIL 13 AND 17	8-2/5C 8-2/6C 8-2/5C 8-2/5C 8-2/5C 8-2/
	K302	2 AND 14 4 AND 15 6 AND 16 7, 8 AND 18 10 AND 19 COIL 13 AND 17	8-2/5A 8-2/5A 8-2/5A 8-2/5A 8-2/5A 8-2/5A
109	K202	3, 4 AND 1 5, 6 AND 8 COIL 2 AND 7	8-2/12A 8-2/12A 8-2/12A
	K203	3, 4 AND 1 5, 6 AND 8 COIL 2 AND 7	8-2/12A 8-2/12A 8-2/12A
209	K501	1 AND 2 2 AND 14 3, 4 AND 15 6 AND 16 7 AND 18 8 AND 18 9, 10 AND 19 12 AND 20 COIL 13 AND 17	8-2/7C 8-2/3C 8-2/3C 8-2/7C 8-2/7B 8-2/3A 8-2/3A 8-2/7B 8-2/7B
309	K401	1 AND 4 5, 6 AND 8 COIL 2 AND 7	8-2/4B 8-2/4B 8-2/4B
396	K2	1, 2 AND 13 4 AND 14 6 AND 15 7, 8 AND 16 9, 10 AND 17 12 AND 18 COIL 19 AND 20	8-2/2B 8-2/26A 8-2/25A 8-2/21B 8-2/23B, 23C 8-2/26A 8-2/26A
	K3	1 AND 13 3, 4 AND 14 7, 8 AND 16 9, 10 AND 17 12 AND 18 COIL 19 AND 20	8-2/24C 8-2/26B 8-2/21B 8-2/25B 8-2/26B 8-2/26A
	K4	3, 4 AND 14 7, 8 AND 16 10 AND 17 12 AND 18 COIL 19 AND 20	8-2/26B 8-2/22B 8-2/2B 8-2/26B 8-2/26B
	K5	6 AND 15 7, 8 AND 16 12 AND 18 COIL 17 AND 20	8-2/22B 8-2/22B 8-21/26B 8-2/26B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
396 (cont)	K6	3, 4 AND 14 5 AND 15 8 AND 16 9 AND 17 12 AND 18 COIL 19 AND 20	8-2/26C 8-2/22B 8-2/22B 8-2/25A 8-2/26C 8-2/26C
	K7	1 AND 13 2 AND 13 4 AND 14 6 AND 15 8 AND 16 10 AND 17 12 AND 18 COIL 19 AND 20	8-2/1B 8-2/25C 8-2/23B 8-2/25C 8-2/25C 8-2/25C 8-2/25C 8-2/25C
	K8	3 AND 14 6 AND 15 10 AND 17 12 AND 18 COIL 19 AND 20	8-2/25B 8-2/25B 8-2/25B 8-2/25B 8-2/25B
	K9	4, 5 AND 2 COIL 3 AND 7	8-2/25C 8-2/25C
	K10	1 AND 6 2 AND 4 COIL 3 AND 7	8-2/23C 8-2/23B 8-2/26B
	K11	2 AND 5 6 AND 8 COIL 3 AND 7	8-2/22B 8-2/22B 8-2/26A
	K12	3 AND 14 2, 12 AND 18 4 AND 14 6 AND 15 8 AND 16 10 AND 17 COIL 19 AND 20	8-2/1B 8-2/24B 8-2/24A 8-2/2B 8-2/24A 8-2/24A 8-2/24B
	K101	2, 6 AND 8 COIL 1 AND 3	8-2/2A 8-2/2B
409	K101	2 AND 10 3 AND 11 5, 6 AND 13 8 AND 14 COIL 9 AND 12	8-2/3B 8-2/33A 8-2/3B 8-2/3B 8-2/32B
	K103	1 AND 4 6 AND 8 COIL 2 AND 7	8-2/32B 8-2/32B 8-2/32B
	K104	1 AND 4 5 AND 8 COIL 2 AND 7	8-2/32C 8-2/32B 8-2/33C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
409 (cont)	K105	2 AND 14 4 AND 15 6 AND 16 8 AND 18 10 AND 19 12 AND 20 COIL 13 AND 17	8-2/35C 8-2/34C 8-2/34A 8-2/34A 8-2/33C 8-2/31A 8-2/32A
	K106	2 AND 10 4 AND 11 6 AND 13 COIL 9 AND 12	8-2/32A 8-2/34C 8-2/35B 8-2/33A
905	K1	7 AND 3 COIL 4 AND 6	8-2/7A 8-2/7A

Figure 8-3. SCRG (Sheet 8 of 8)

The air data/cockpit function includes the controls and displays used by the pilot in operating the F106/MA-1 aircraft and weapons control interceptor system. The basic function includes the central air data computer, angle of attack transmitter, temperature probe, indicators and control switches. The central air data computer contains altitude, Mach, and airspeed processing. The Mach subfunction also contains maximum-safe-Mach circuitry, and the airspeed subfunction temperature sensing circuitry. Test connector TJ7 provides for Line Analyzer connections to permit computer test on the aircraft.

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Functional control (vertical instruments) is effected by the DISP/AUTO MODE, HDG SEL, BRG SEL, and RADIUS MILES switches. Round instrument aircraft contain only the DISP/AUTO MODE switch and switching from the TSD.

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Basic content of individual diagram is:

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8	Target altitude and vertical speed
9	Indicated airspeed (IAS)
10	Cockpit Display SDC No. 1 (520 unit) signal flow
11	Cockpit Display SDC No. 2 (620 unit) signal flow
12	Flight Director Computer (CPU-4)
13	Horizontal Situation Indicator (HSI) and CPU-4
14	Attitude Director Indicator (ADI)
15	620 unit switching
16	Bearing select switching
17 18	520 unit and CPU-4 switching
19	HSI

Round Instrument:

Sheet No.	Content
20	CPU-111 and potentiometer outputs
21	CPU-111 digitizer outputs
22	CPU-111 potentiometer, synchro, switch and digital outputs
23	Mach No. Indicator Assembly (880 unit) - M output. Baro Setting Analog Signal Control (259 unit) - barometric outputs
24	Vertical Situation Amplifier Assembly (306 unit)
25 28A	Flight Director Signal Data Converter (720 unit). Horizontal Situation Indicator (770 unit)
26 27	Attitude Direction Indicator 772 unit)
28 28B	"B" Model, version of sheets 25, 26, 27 and 28A
29	Relay chart

(A) The angle of attack transducer vane positions itself in the aircraft windstream supplying as indicated angle-of-attack signal to the Mach module. The signal is processed into true angle-of-attack.

(B) The temperature probe senses slipstream variations, and couples them to the temperature servoamplifier where they are combined with a signal from the Mach module to produce a true-temperature indication.

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Initiation of self test of the altitude and airspeed modules results in the introduction of test low and high inputs to the Mach module, producing the following readings:

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Figure 8-3. Air Data Cockpit (Sheet 1 of 29)

OUTPUT NO.	OUTPUT	FUNCTION	DESTINATION
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25	P_s	STATIC PRESSURE	CVAC (LANDING GEAR WARNING)
26	P_s	STATIC PRESSURE	CVAC (CG FUEL TRANSFER)
39	H_p	PRESSURE ALTITUDE	VERTICAL SPEED INDICATOR
40	H_p	ALTITUDE RATE	VERTICAL SPEED AMPLIFIER
43	H_p	PRESSURE ALTITUDE	IFF TRANSPONDER

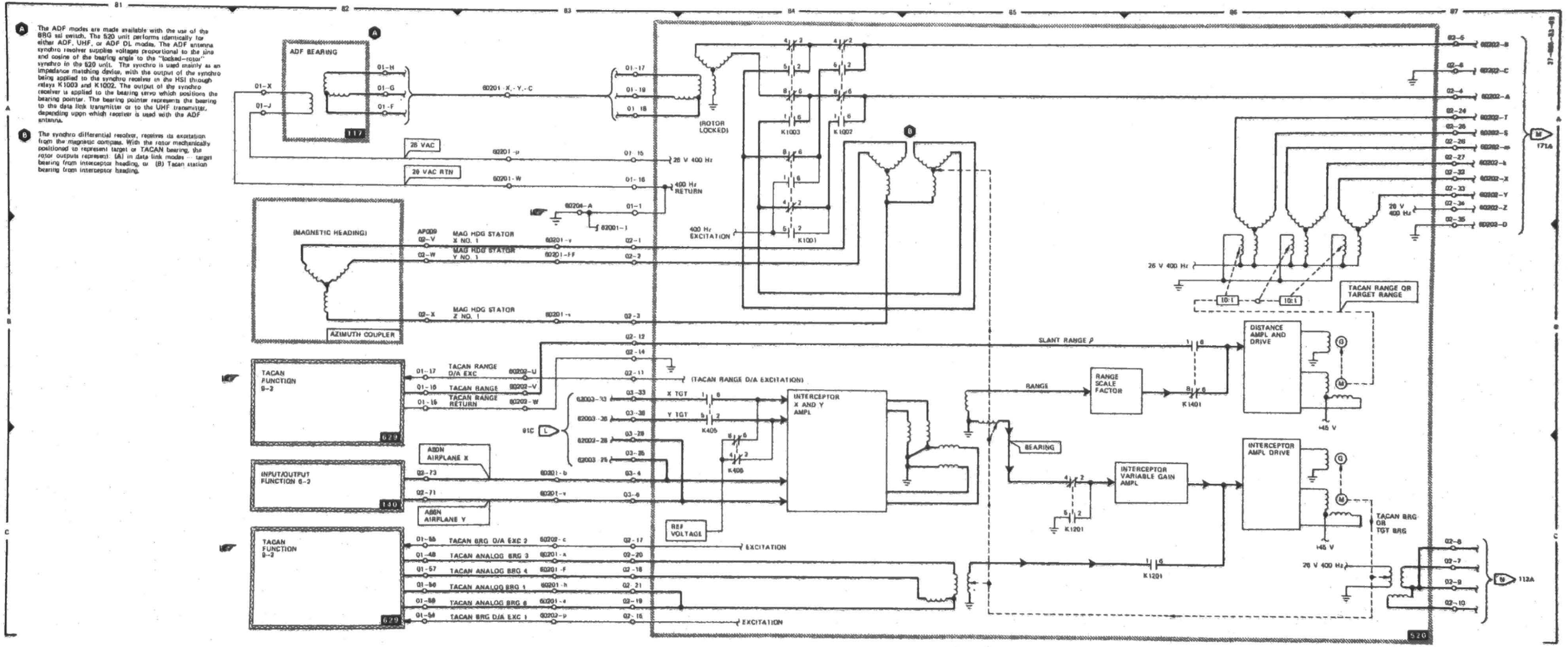


Figure 8-3. Air Data/Cockpit (Sheet 10 of 20)

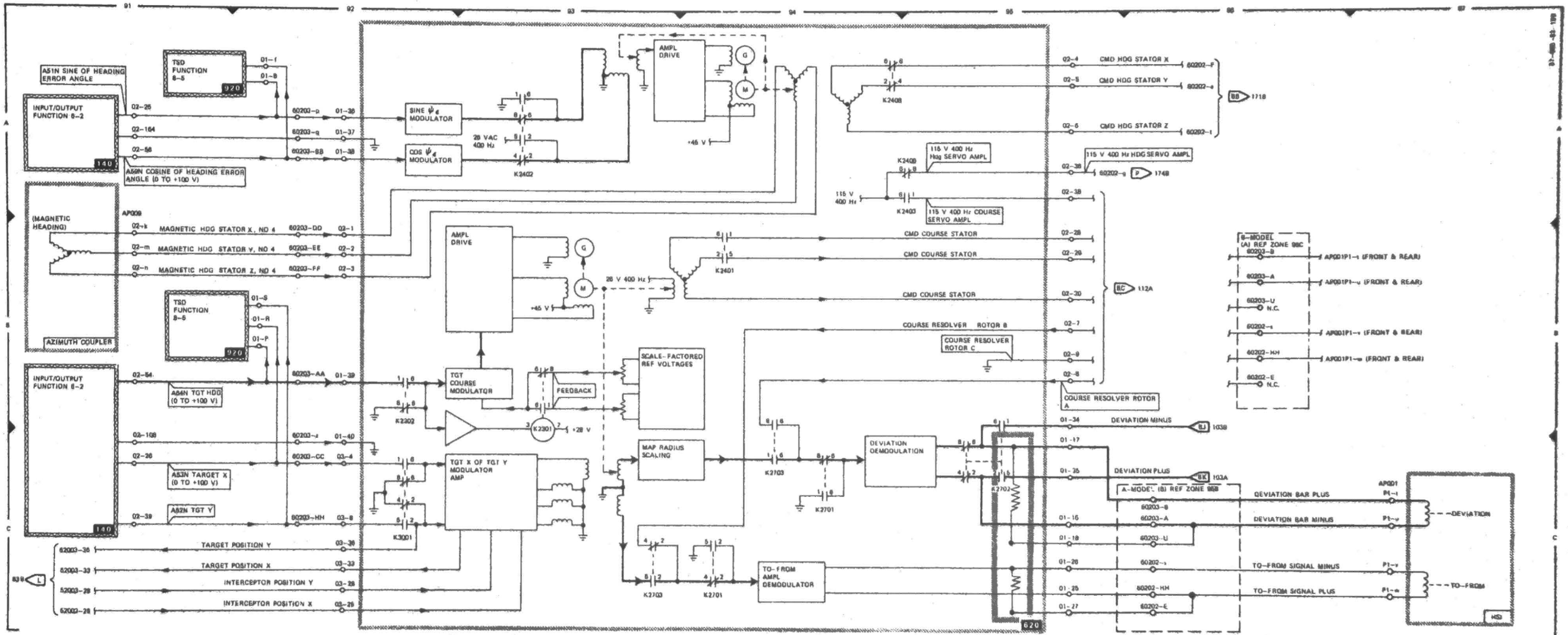


Figure 8-3. Air Data/Cockpit (Sheet 11 of 29)

A The flight director computer consists of roll and pitch channels. Roll channel signals activate the vertical indicating bars and localizer warning flags of the two indicators used in conjunction with the computer. Pitch channel signals activate the horizontal indicating bars, glide slope bars, and glide slope flags of the indicators.

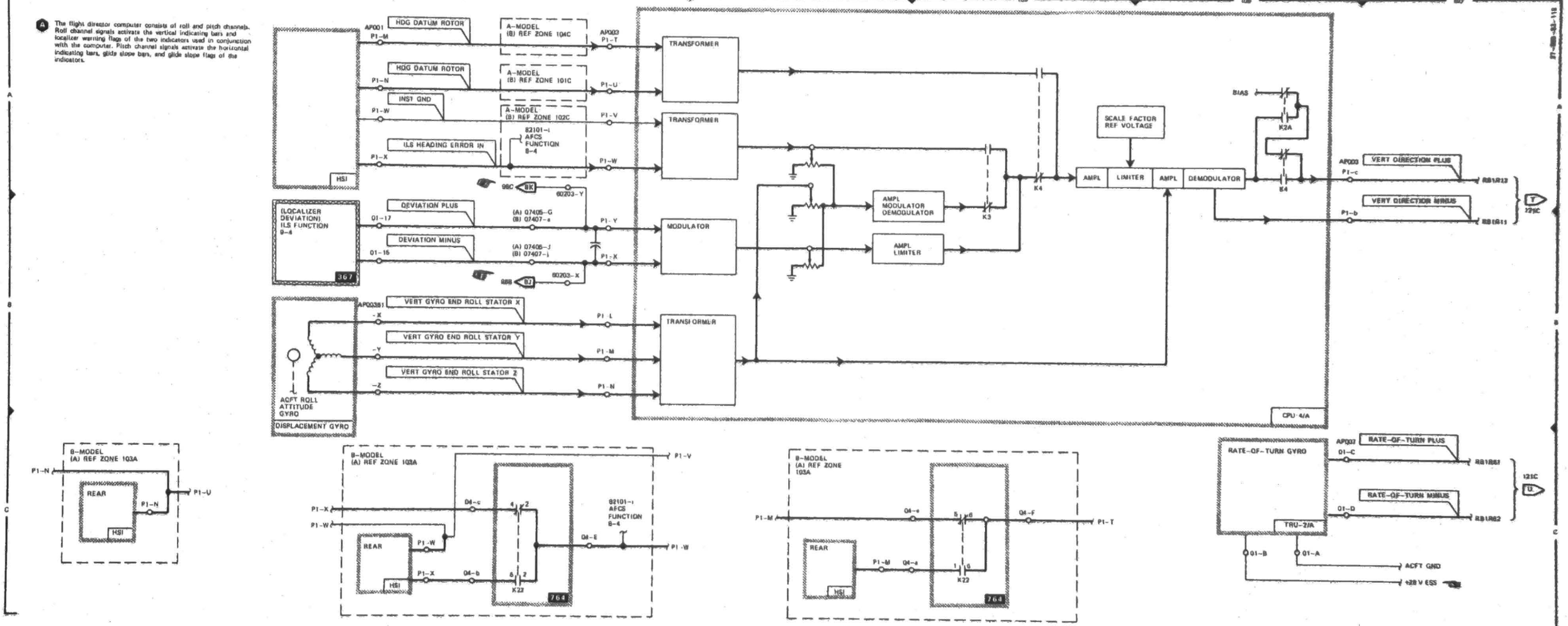


Figure 8-3. Air Data/Cockpit (Sheet 12 of 20)

A The flight director computer contains the roll and pitch channels. Roll channel signals activate the vertical indicating bars and localizer warning flags of the two indicators are used in conjunction with the computer. Pitch channel signals activate the horizontal indicating bars, glide slope bars and glide slope warning flags of the indicators.

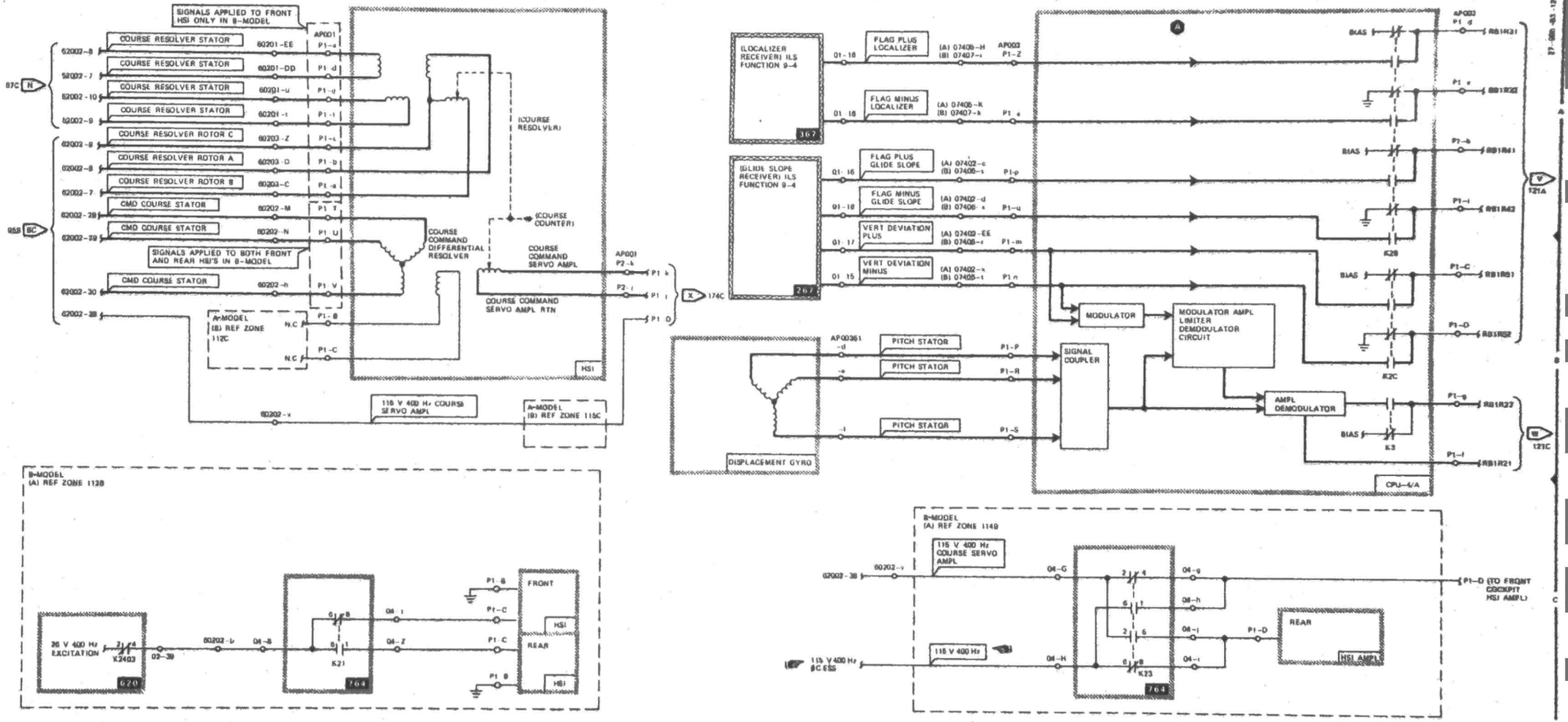


Figure 8-3. Air Data/Cockpit (Sheet 13 of 29)

A The flight director computer consists of roll and pitch channels. Roll channel signals activate the vertical indicating bars and localizer warning flags of the two indicators used in conjunction with the computer. Pitch channel signals activate the horizontal indicating bars, glide slope bars, and glide slope flags of the indicators.

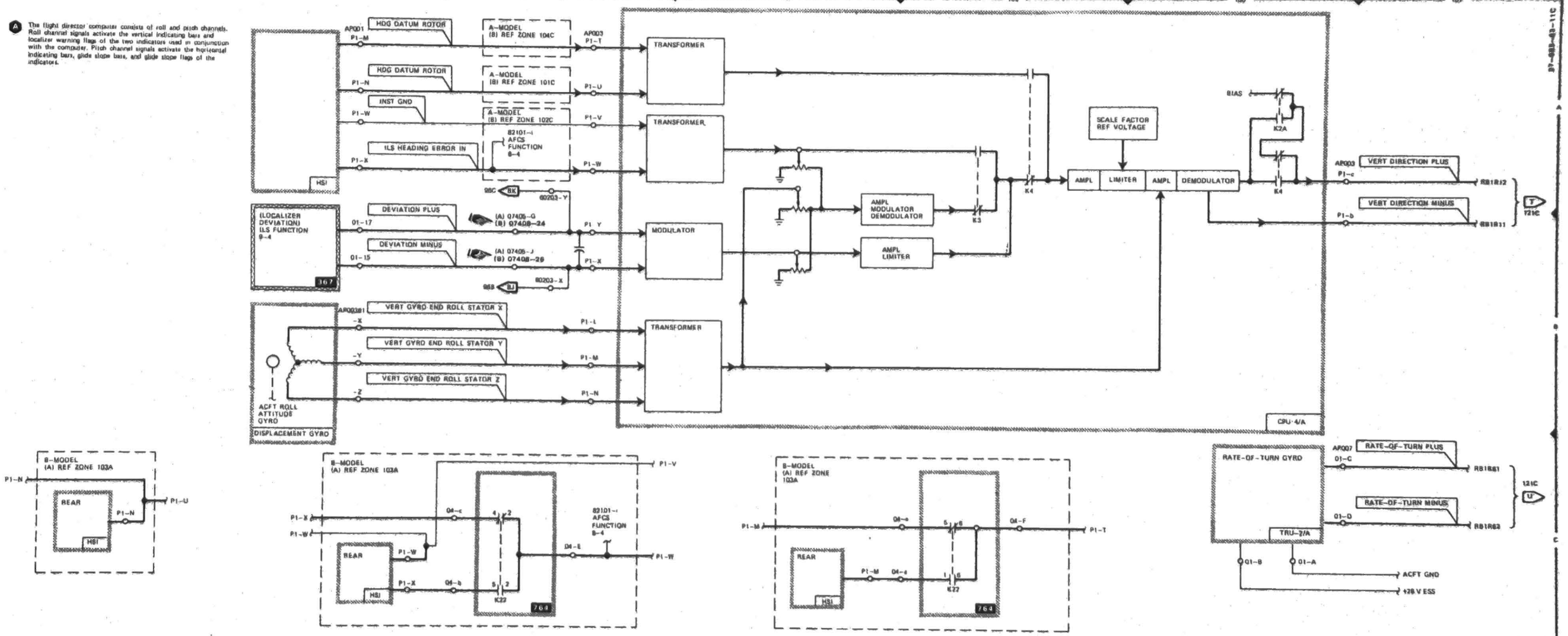


Figure 8-3. Air Data/Cockpit (Sheet 12 of 29)

A The flight director computer contains the roll and pitch channels. Roll channel signals activate the vertical indicating bars and localizer warning flags of the two indicators are used in conjunction with the computer. Pitch channel signals activate the horizontal indicating bars, glide slope bars and glide slope warning flags of the indicators.

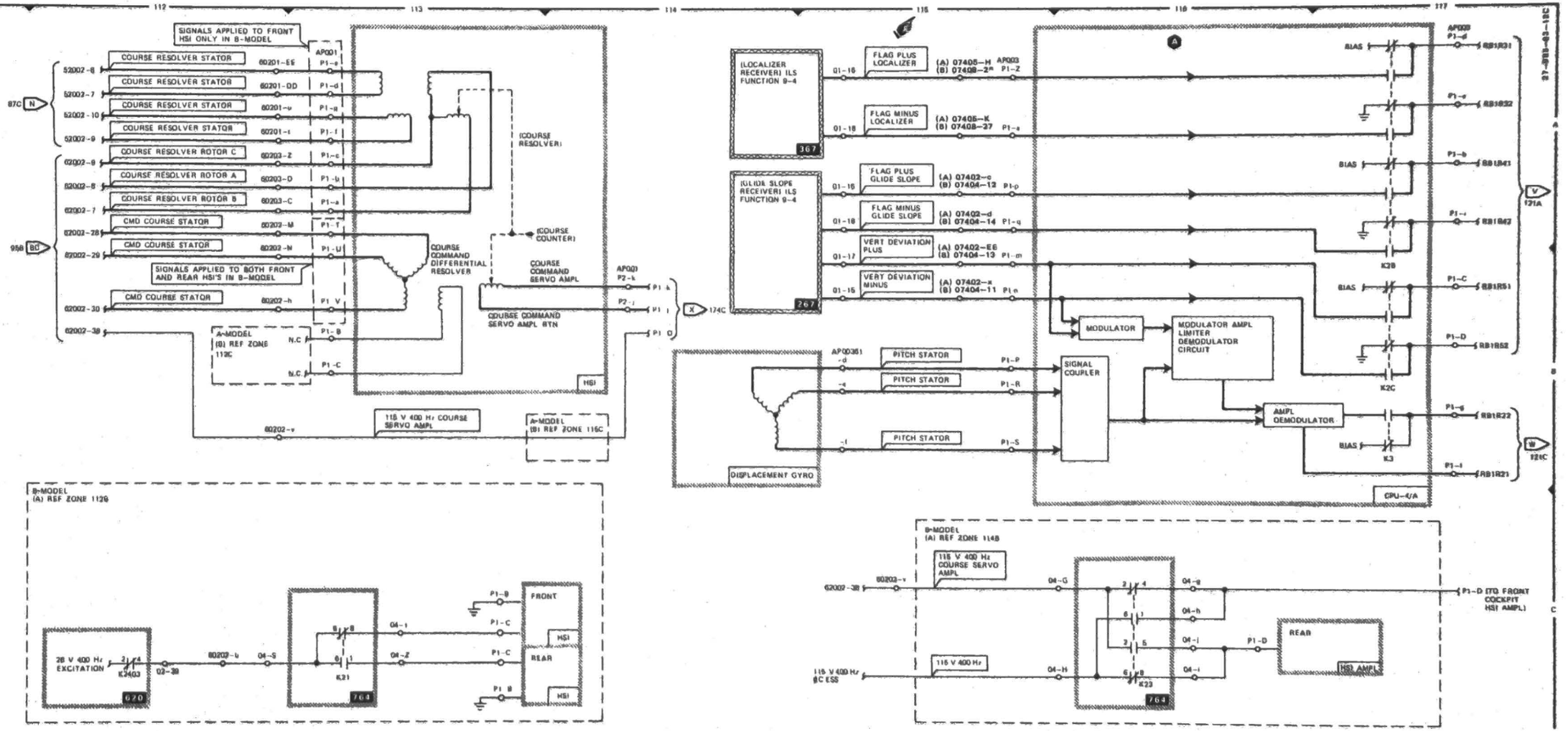
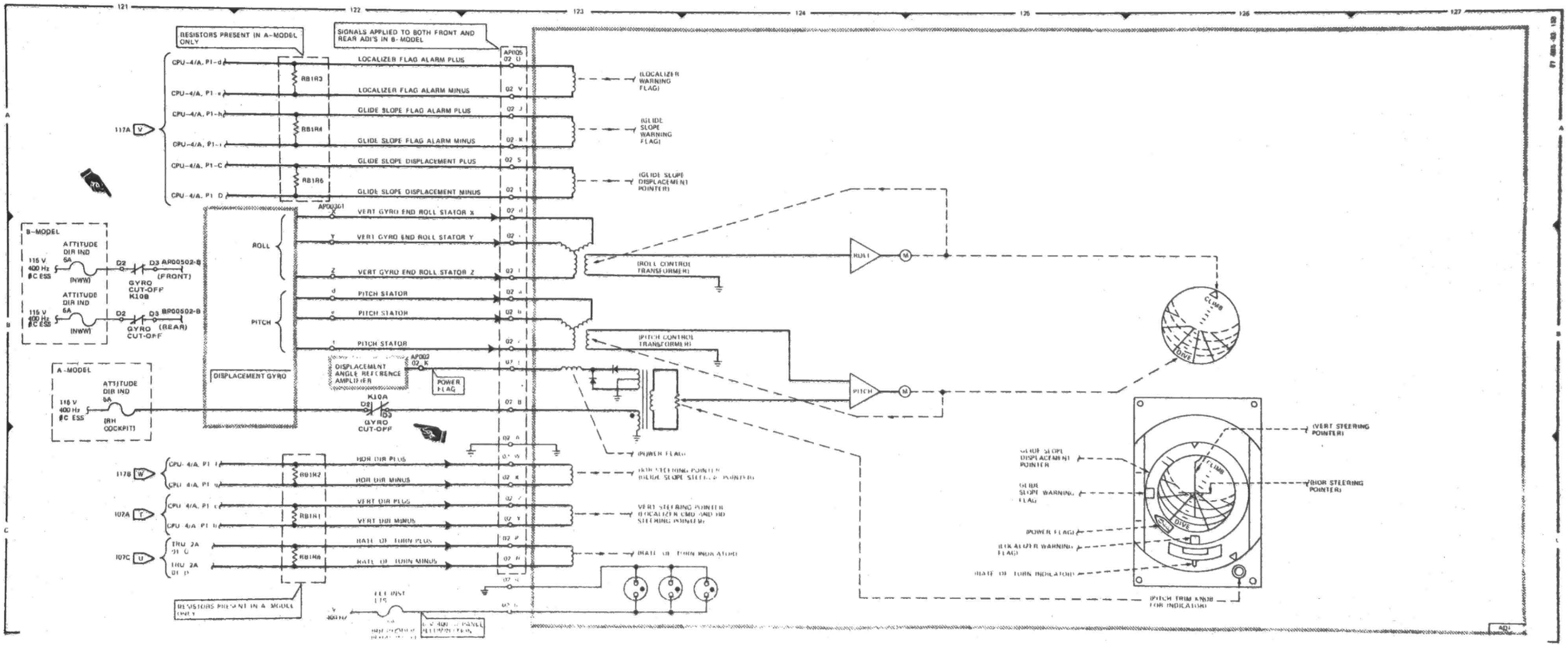


Figure 6-3. Air Data Cockpit (Sheet 13 of 29)


RESISTORS PRESENT IN A-MODEL ONLY
SIGNALS APPLIED TO BOTH FRONT AND REAR ADI'S IN B-MODEL
AP005
LOCALIZER FLAG ALARM PLUS
LOCALIZER FLAG ALARM MINUS
GLIDE SLOPE FLAG ALARM PLUS
GLIDE SLOPE FLAG ALARM MINUS
GLIDE SLOPE DISPLACEMENT PLUS
GLIDE SLOPE DISPLACEMENT MINUS
RB1R3
RB1R4
RB1R6
(LOCALIZER WARNING FLAG)
(GLIDE SLOPE WARNING FLAG)
(GLIDE SLOPE DISPLACEMENT POINTER)
117A V
B-MODEL
ATTITUDE DIR IND
115 V 400 Hz ØC ESS
6A
(NWW)
D2
D3 AP00502-B
(FRONT)
GYRO CUT-OFF K10B
(REAR)
GYRO CUT-OFF
A-MODEL
(RH COCKPIT)
AP001361
VERT GYRO END ROLL STATOR X
VERT GYRO END ROLL STATOR Y
VERT GYRO END ROLL STATOR Z
ROLL
PITCH STATOR
PITCH
DISPLACEMENT GYRO
DISPLACEMENT ANGLE REFERENCE AMPLIFIER
AP002
POWER FLAG
K10A
GYRO CUT-OFF
(ROLL CONTROL TRANSFORMER)
(PITCH CONTROL TRANSFORMER)
ROLL
PITCH
M
(POWER FLAG)
117B W
107A T
107C U
HOR DIR PLUS
HOR DIR MINUS
VERT DIR PLUS
VERT DIR MINUS
RATE OF TURN PLUS
RATE OF TURN MINUS
RB1R2
RB1R1
RB1R8
(HOR STEERING POINTER (GLIDE SLOPE STEERING POINTER)
(VERT STEERING POINTER (LOCALIZER AND HD STEERING POINTER)
(RATE OF TURN INDICATOR)
RESISTORS PRESENT IN A-MODEL ONLY
CLIMB
DIVE
(VERT STEERING POINTER)
(HOR STEERING POINTER)
GLIDE SLOPE DISPLACEMENT POINTER
GLIDE SLOPE WARNING FLAG
(POWER FLAG)
(LOCALIZER WARNING FLAG)
(RATE OF TURN INDICATOR)
(PITCH TRIM KNOB FOR INDICATOR)
ADI

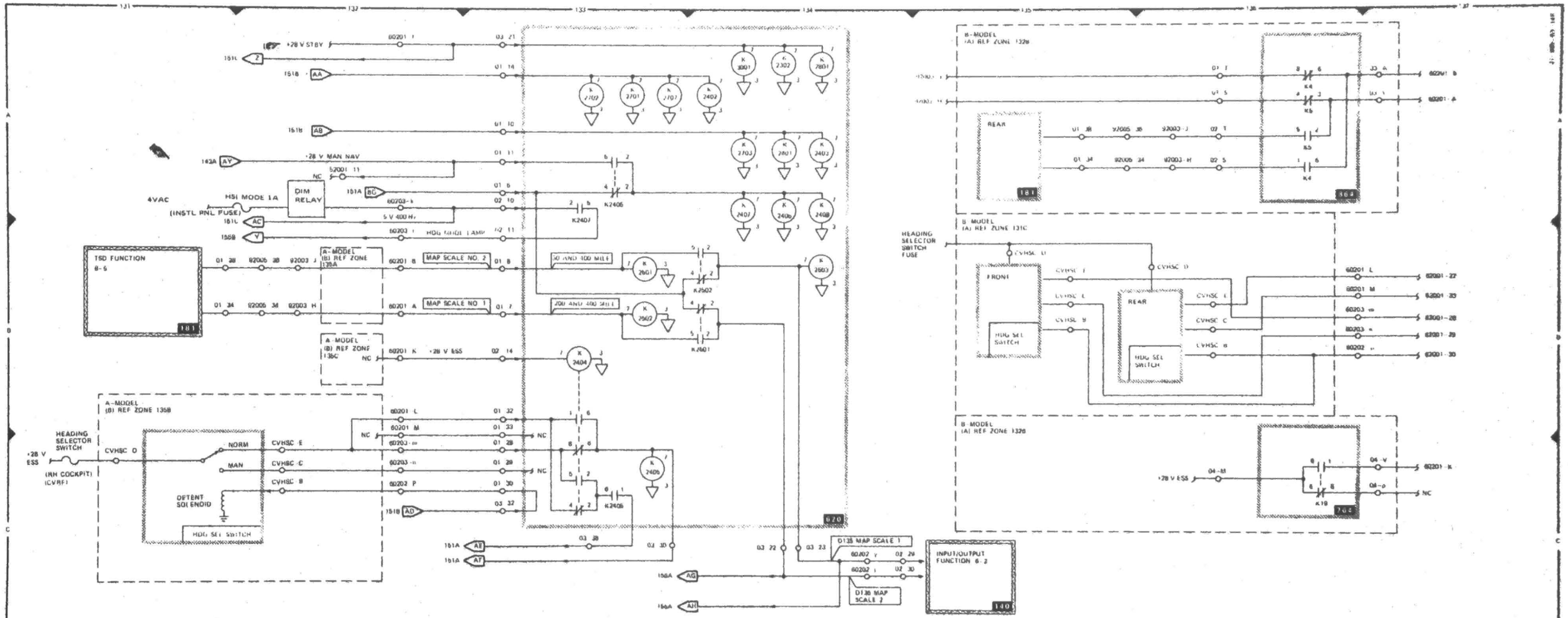


Figure 6-3. Air Data Cockpit (Sheet 15 of 29)

161 162 163 164 165 166 167

A The horizontal situation indicator displays information from TACAN, data link, the compass system and digital computer. The indicator displays include the following:

COURSE ARROW - A long arrow with movable center section. The arrow head is positioned automatically in the data link modified close control mode only where it indicates target heading. During all other times, it is positioned manually by the pilot. In ILS modes, it is set to the runway heading. In MAN or AUTO NAV modes, it may be set to the desired TACAN radial for navigation purposes. During data link modified close control, the center section is displaced away from the center position to indicate the perpendicular distance of the interceptor from the target track. During TACAN navigation modes, the center section is displaced in the direction of the desired radial course. In ILS modes, the center section is displaced (to indicate "raw" localizer error. The course counter supplies a more accurate readout of the course arrow magnetic heading.

BEARING POINTER - A heavy arrow fastened on the outer movable ring of the HSI. The BRG SEL switch and DISP/AUTO MODE switch determine the source of the drive signal for this display, with the BRG SEL switch in NORM and:

a. In DL modified close control, the pointer indicates target direction.

b. In AUTO and MAN NAV modes, or in DL close control, it serves to point toward the TACAN station.

c. In ILS modes, it serves to indicate aircraft heading.

When the BRG SEL switch is set to TACAN, the pointer always points towards the selected TACAN station. When the BRG SEL switch is in ADF-DL or ADF-UHF, the bearing pointer is serveod to the ADF antenna heading.

COMMAND HEADING POINTER - A pointer on the ring just inside the bearing pointer. Its position is controlled by the HDG SEL switch and the DISP/AUTO MODE switch. When the HDG SEL switch is in NORMAL and:

a. The DISP/AUTO MODE switch is in AUTO NAV, the marker points toward the homing point.

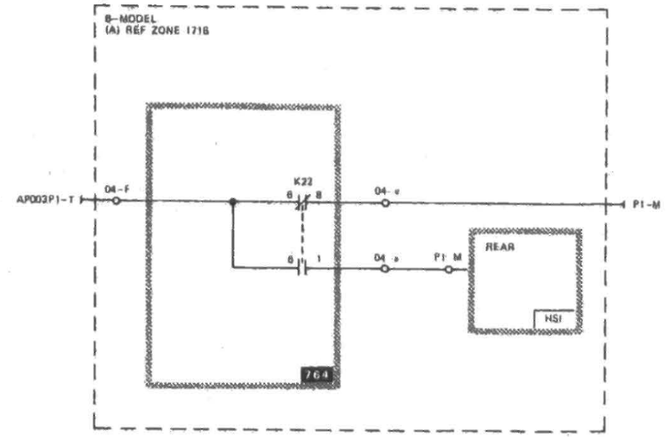
b. In DL modes, it displays data link command heading until lock-on is achieved.

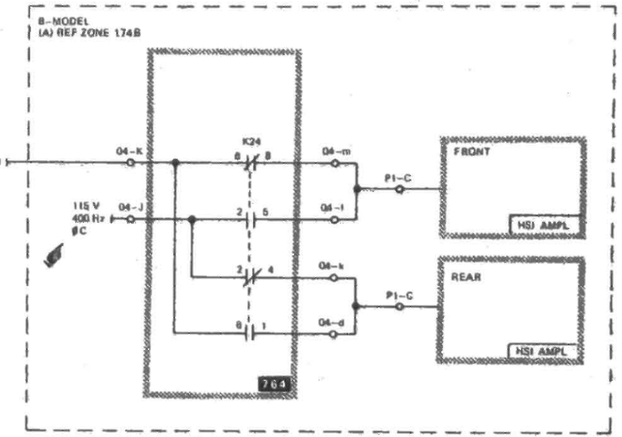
c. In ILS modes, it serves to indicate aircraft heading.

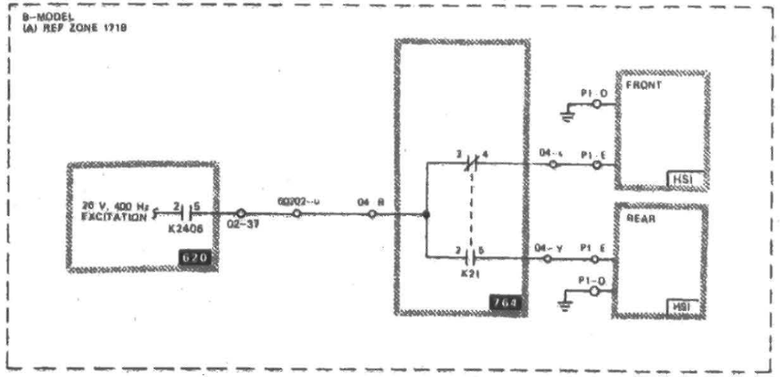
When the HDG SEL switch is set to MANUAL, the marker is positioned manually by the HDG SET knob on the lower left face of the indicator.

COMPASS ROSE - The inner of three rings that are free to rotate, is positioned by the aircraft magnetic compass. The aircraft magnetic heading is read under the rubber line at the top of the instrument face. The course arrow and heading marker are positioned relative to magnetic north. Each of their servo-positioners is coupled to the magnetic compass drive through differential gear. The bearing pointer is positioned with relative aircraft error signals and thus need not be connected to the compass servo system.

MILES COUNTER - A window display giving range to TACAN station or target on lower left of indicator face. Window is masked at all other times. Signals for the various indicators of the HSI are supplied by the digital computer or the TACAN receiver. These signals are processed and selected within the 920 and 620 units.







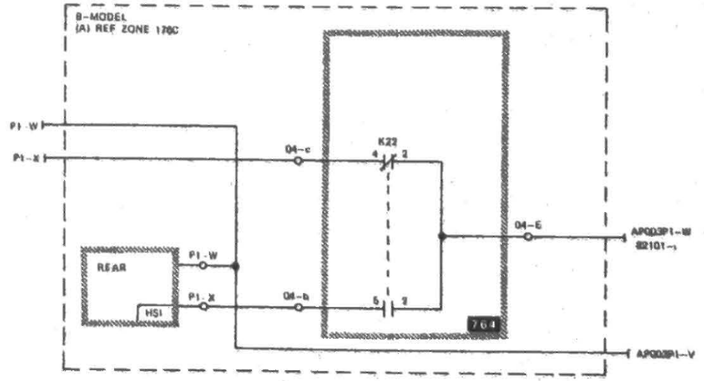


Figure 8-3. Air Data Cockpit (Sheet 18 of 20)

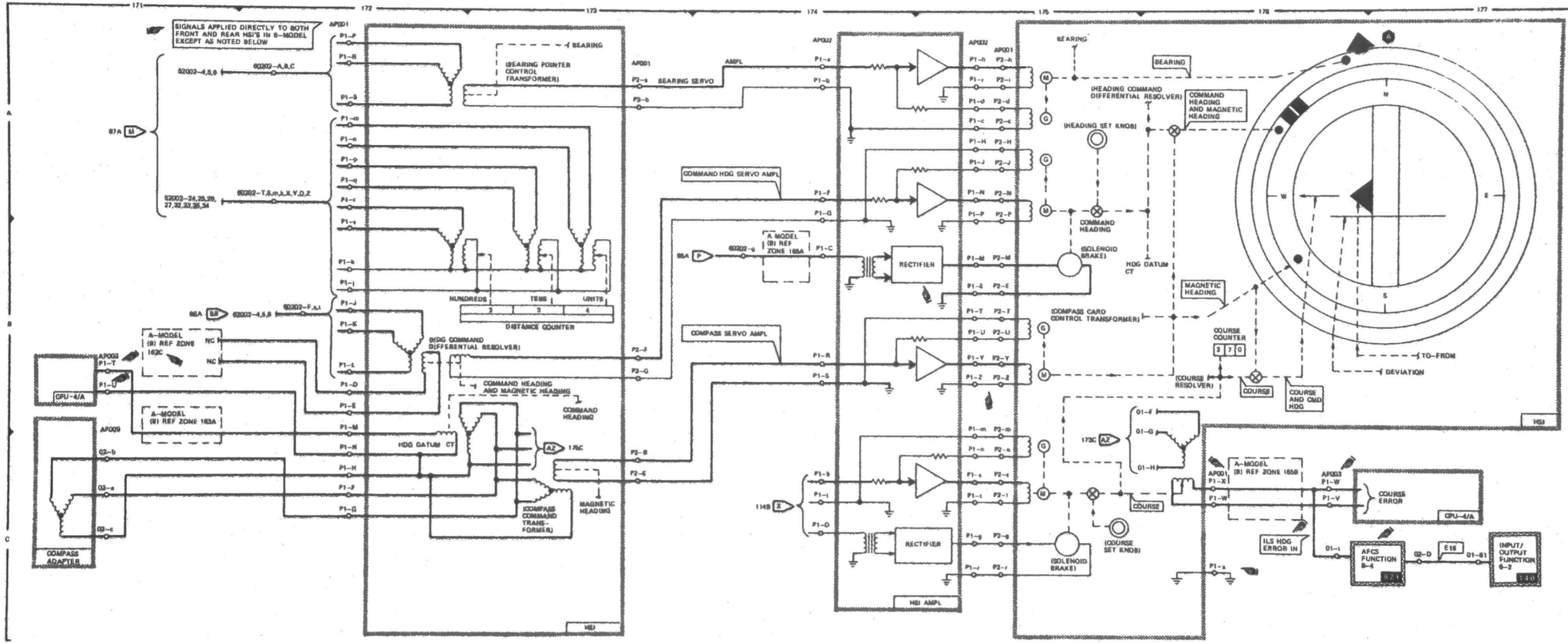


Figure 8-3. Air Data/Cockpit (Sheet 19 of 39)

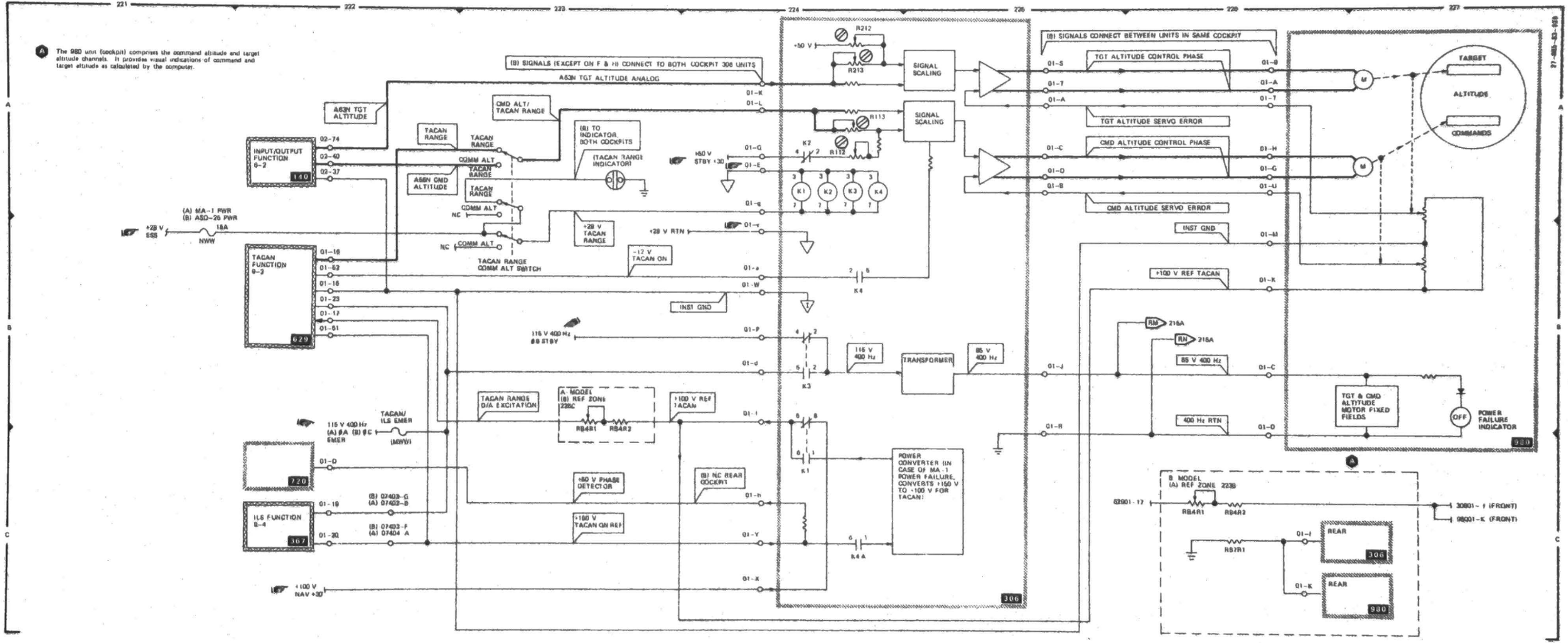


Figure 8-3. Air Data Cockpit (Sheet 24 of 29)

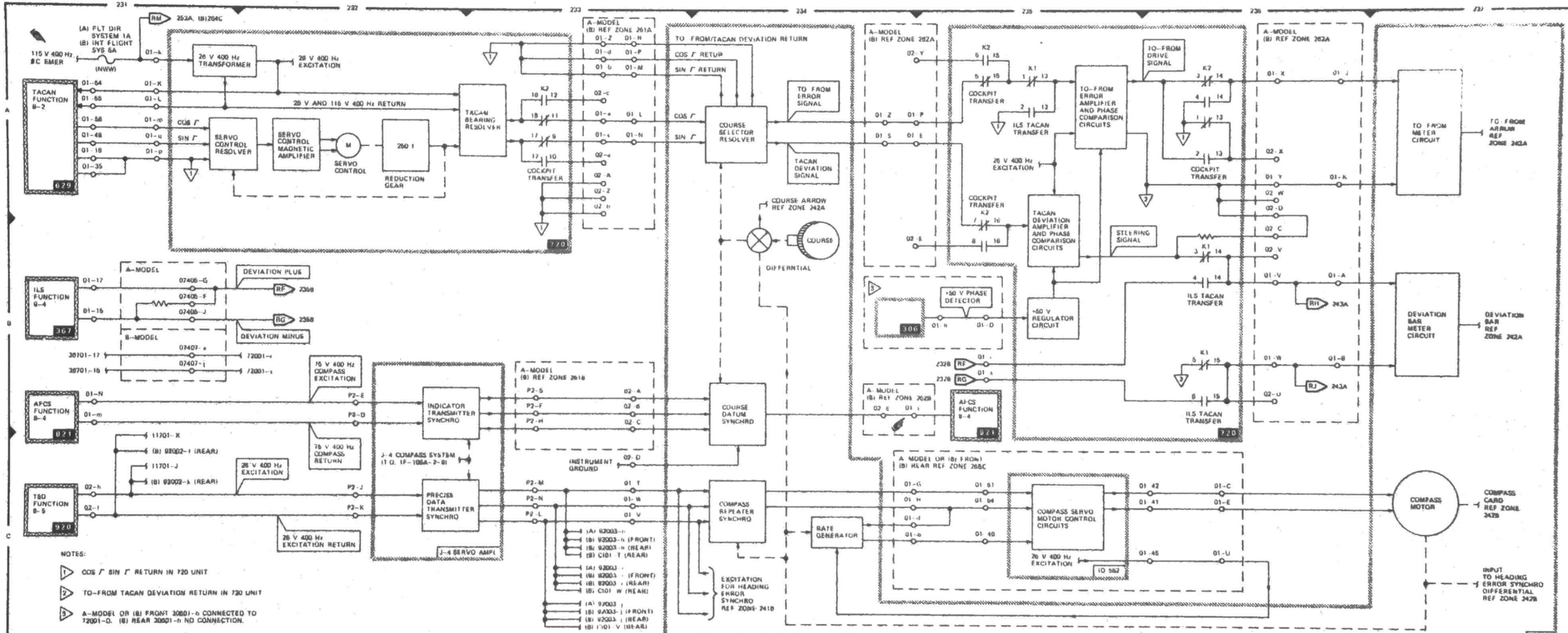


Figure 8-3. Air Data, Cockpit (Sheet 25 of 39)

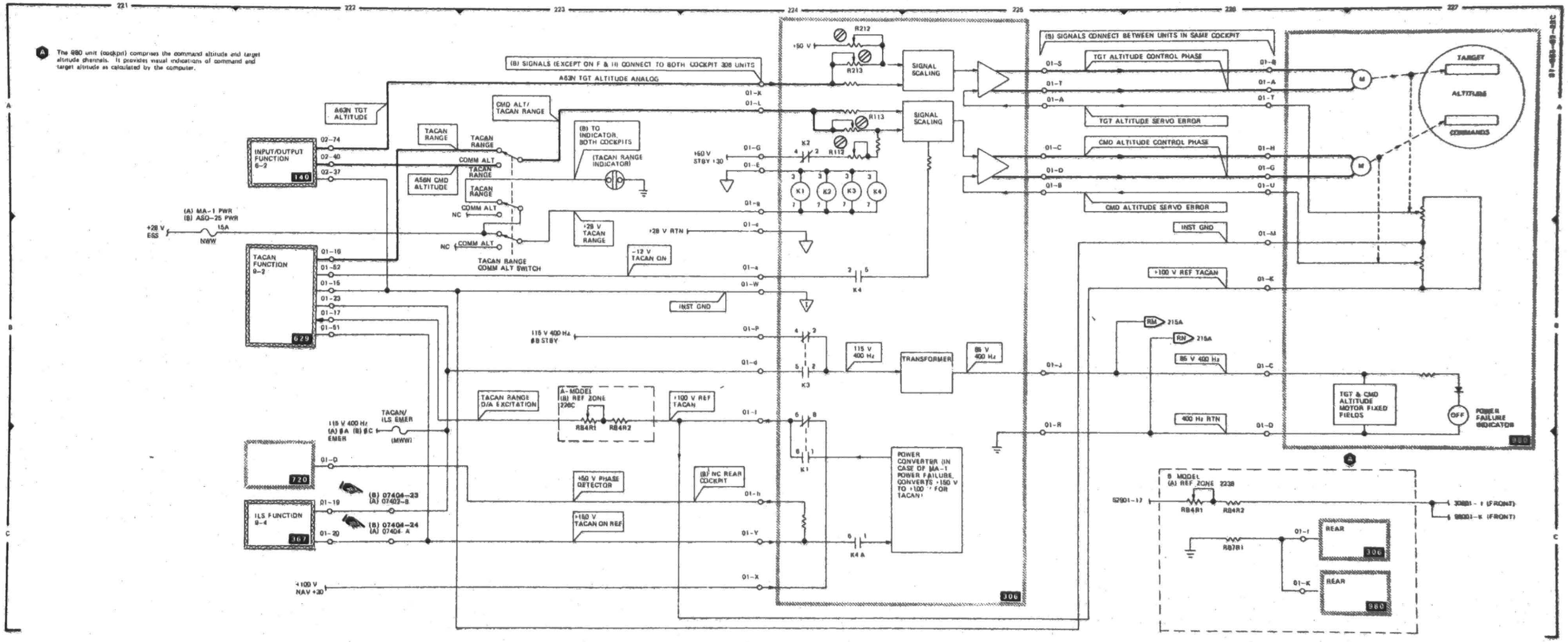


Figure 8-3. Air Data Cockpit (Sheet 24 of 29)

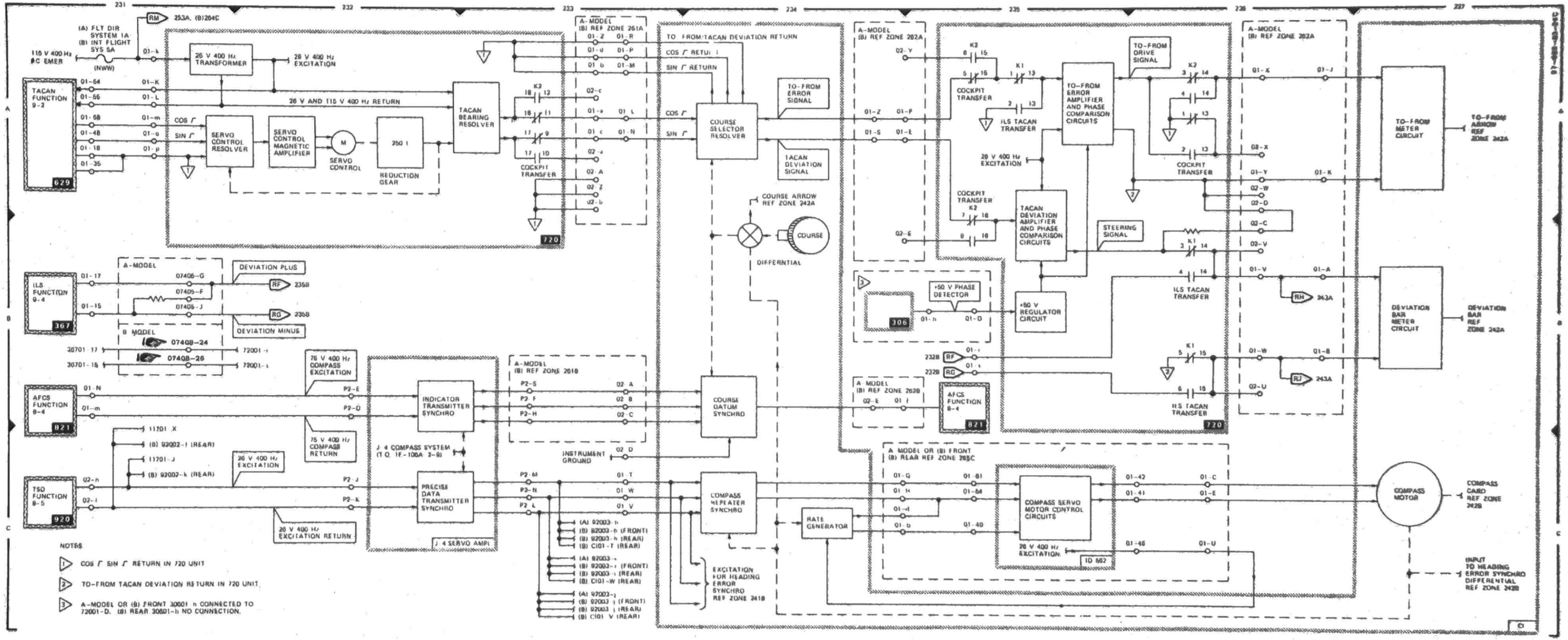


Figure 8-3. Air Data Cockpit (Sheet 25 of 29)

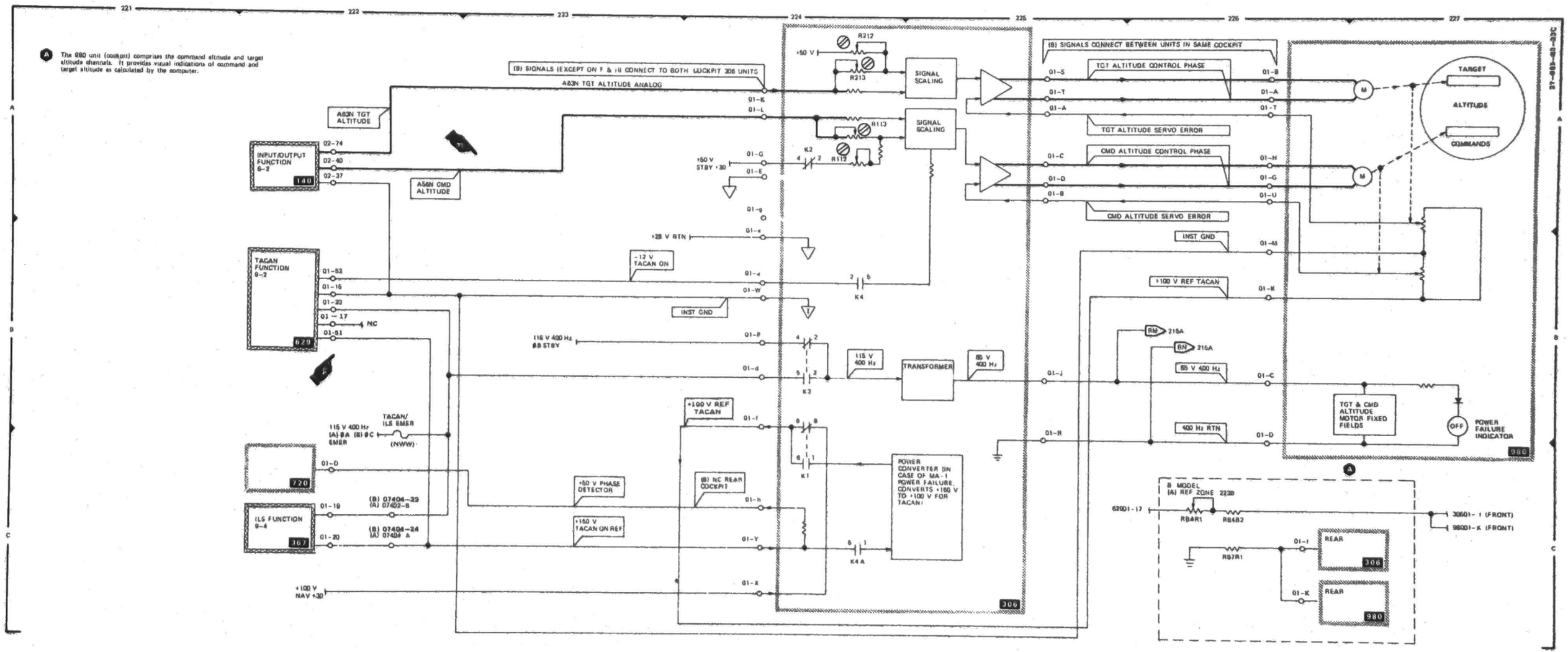


Figure 8-3. Air Data Cockpit (Sheet 24 of 29)

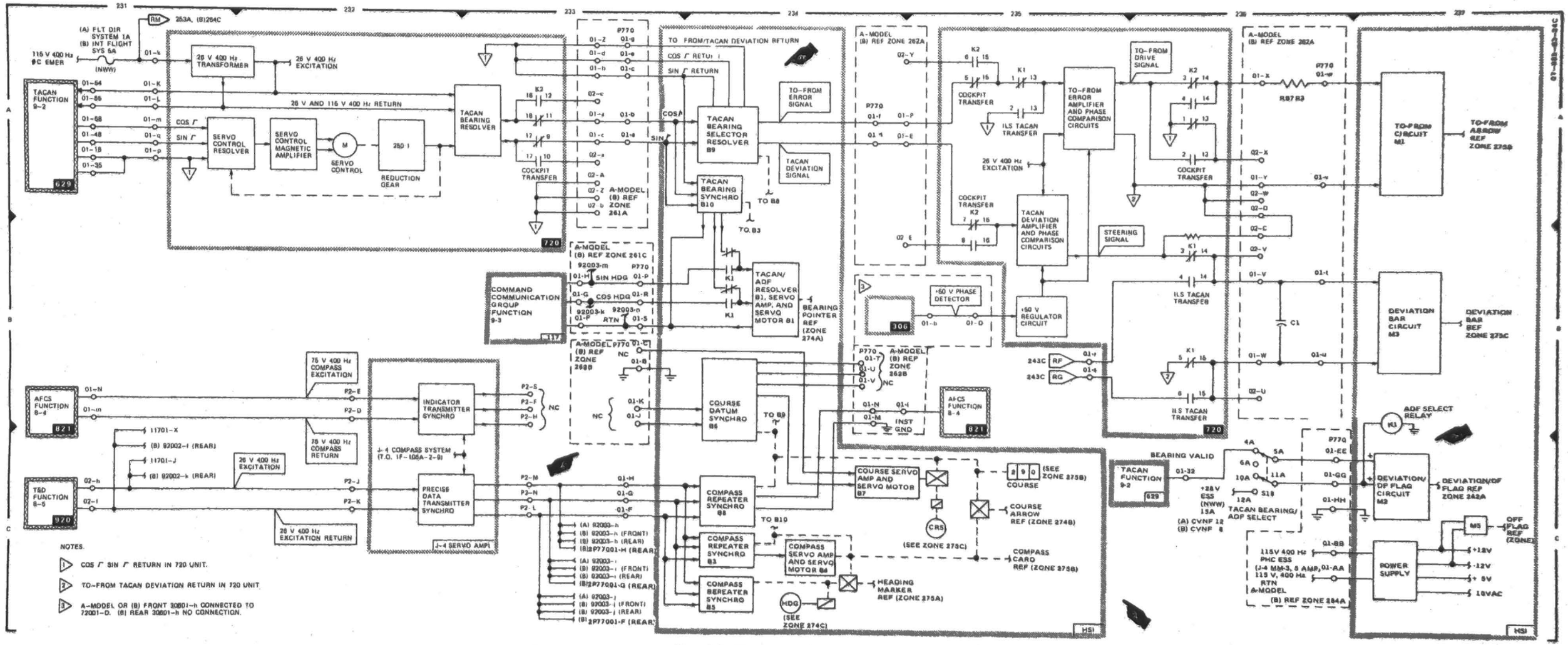
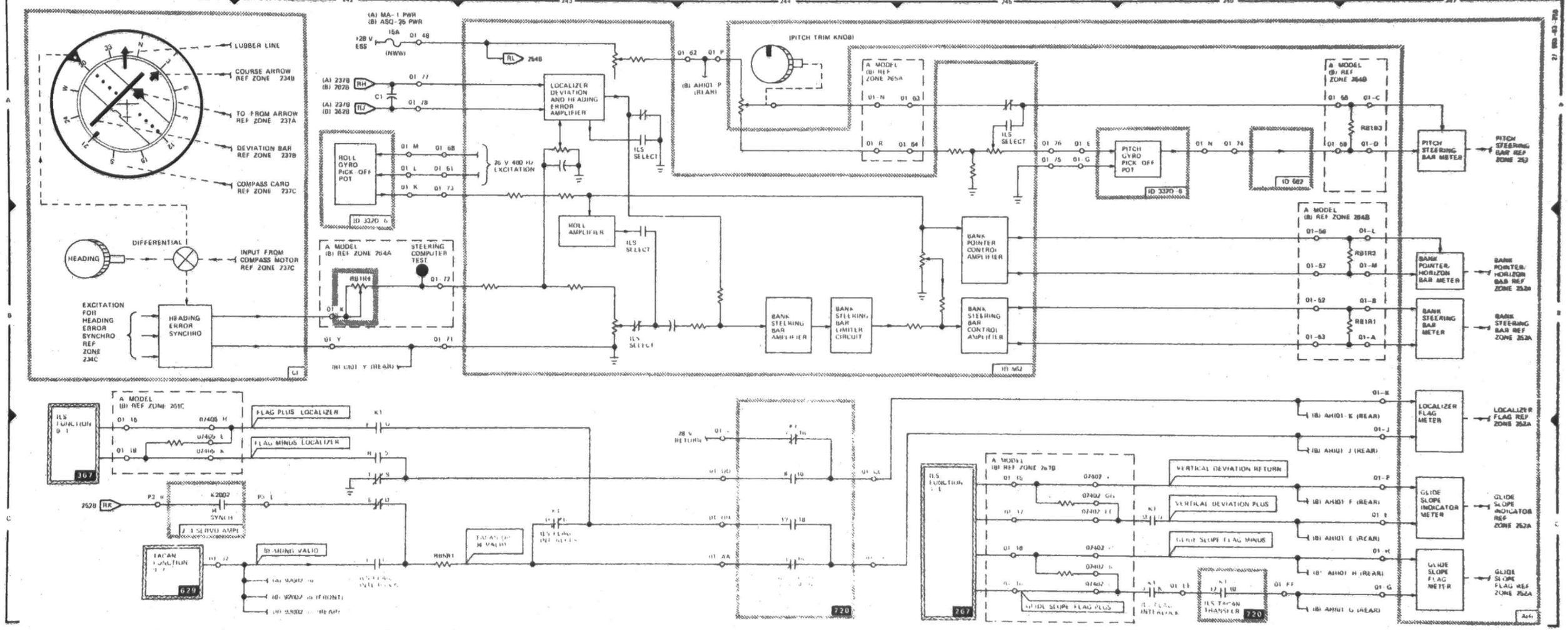


Figure 8-3, Air Data Cockpit (Sheet 35 of 29)


LUBBER LINE
COURSE ARROW REF ZONE 234B
TO FROM ARROW REF ZONE 237A
DEVIATION BAR REF ZONE 237B
COMPASS CARD REF ZONE 237C
HEADING
DIFFERENTIAL
INPUT FROM COMPASS MOTOR REF ZONE 737C
EXCITATION FOR HEADING ERROR SYNCHRO REF ZONE 234C
HEADING ERROR SYNCHRO
(A) MA-1 PWR
(B) ASQ-26 PWR
+28 V ESS
(NWW)
15A
(A) 237B (B) 707B
(A) 237D (B) 362B
LOCALIZER DEVIATION AND HEADING ERROR AMPLIFIER
ILS SELECT
ROLL GYRO PICK OFF POT
ID 3370 G
26 V 400 HZ EXCITATION
ROLL AMPLIFIER
A MODEL (B) REF ZONE 264A
STEERING COMPUTER TEST
(PITCH TRIM KNOB)
A MODEL (B) REF ZONE 265A
PITCH GYRO PICK OFF POT
ID 3370 G
ID 682
A MODEL (B) REF ZONE 264B
PITCH STEERING BAR METER
PITCH STEERING BAR REF ZONE 252
BANK POINTER CONTROL AMPLIFIER
BANK STEERING BAR AMPLIFIER
BANK STEERING BAR LIMITER CIRCUIT
BANK STEERING BAR CONTROL AMPLIFIER
ID 662
BANK POINTER/ HORIZON BAR METER
BANK POINTER/ HORIZON BAR REF ZONE 252B
BANK STEERING BAR METER
BANK STEERING BAR REF ZONE 252A
ILS FUNCTION
367
A MODEL (B) REF ZONE 261C
FLAG PLUS LOCALIZER
FLAG MINUS LOCALIZER
2528
K2002
J 3 SERVO AMPL
TACAN FUNCTION
629
STEERING VALID
TACAN H VALID
ILS FLAG INTERLOCK
720
28 V RETURN
ILS FUNCTION
267
A MODEL (B) REF ZONE 267B
VERTICAL DEVIATION RETURN
VERTICAL DEVIATION PLUS
GLIDE SLOPE FLAG MINUS
GLIDE SLOPE FLAG PLUS
ILS FLAG INTERLOCK
ILS TACAN TRANSFER
720
(B) AH101 K (REAR)
(B) AH101 J (REAR)
(B) AH101 F (REAR)
(B) AH101 E (REAR)
(B) AH101 H (REAR)
(B) AH101 G (REAR)
LOCALIZER FLAG METER
LOCALIZER FLAG REF ZONE 252A
GLIDE SLOPE INDICATOR METER
GLIDE SLOPE INDICATOR REF ZONE 252A
GLIDE SLOPE FLAG METER
GLIDE SLOPE FLAG REF ZONE 252A

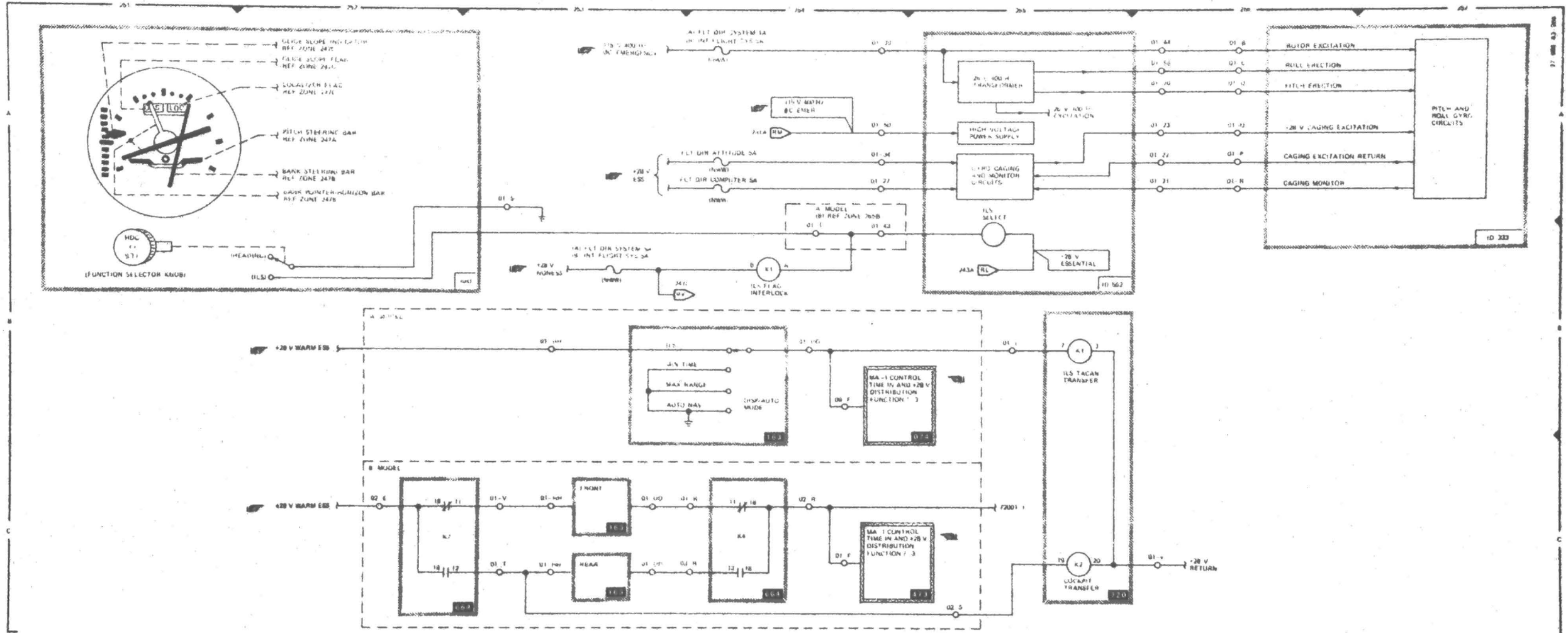


Figure 8-3. Air Data/Cockpit (Sheet 27 of 29)

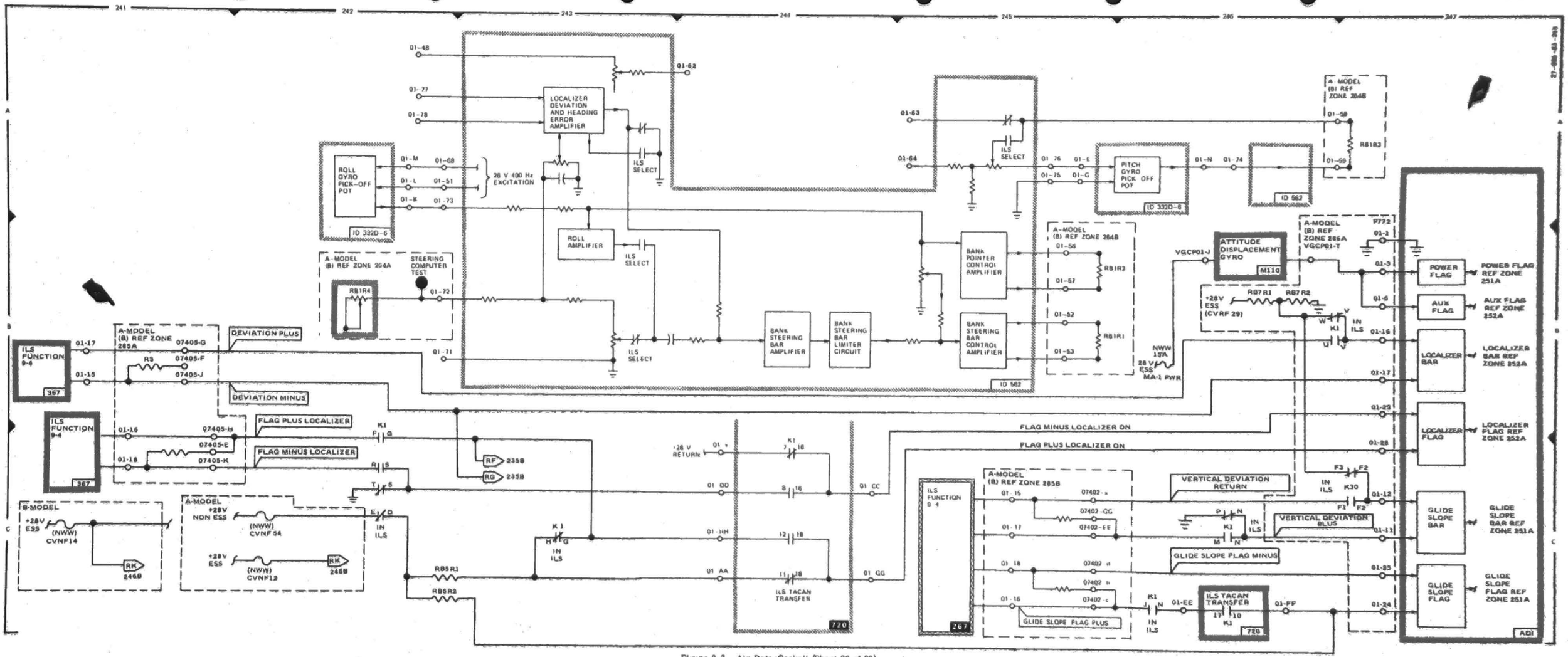


Figure 8-3. Air Data Cockpit (Sheet 26 of 29)

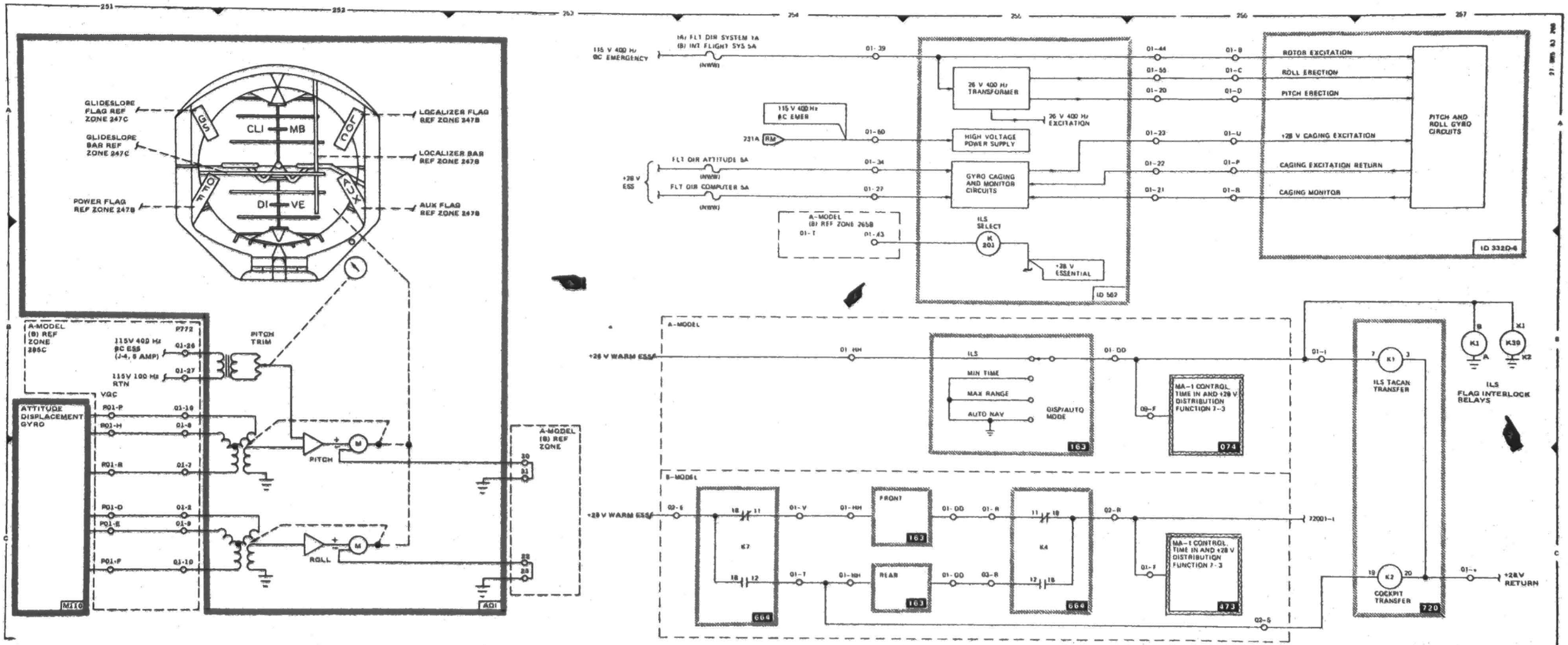


Figure 8-3. Air Data/Cockpit (Sheet 27 of 29)

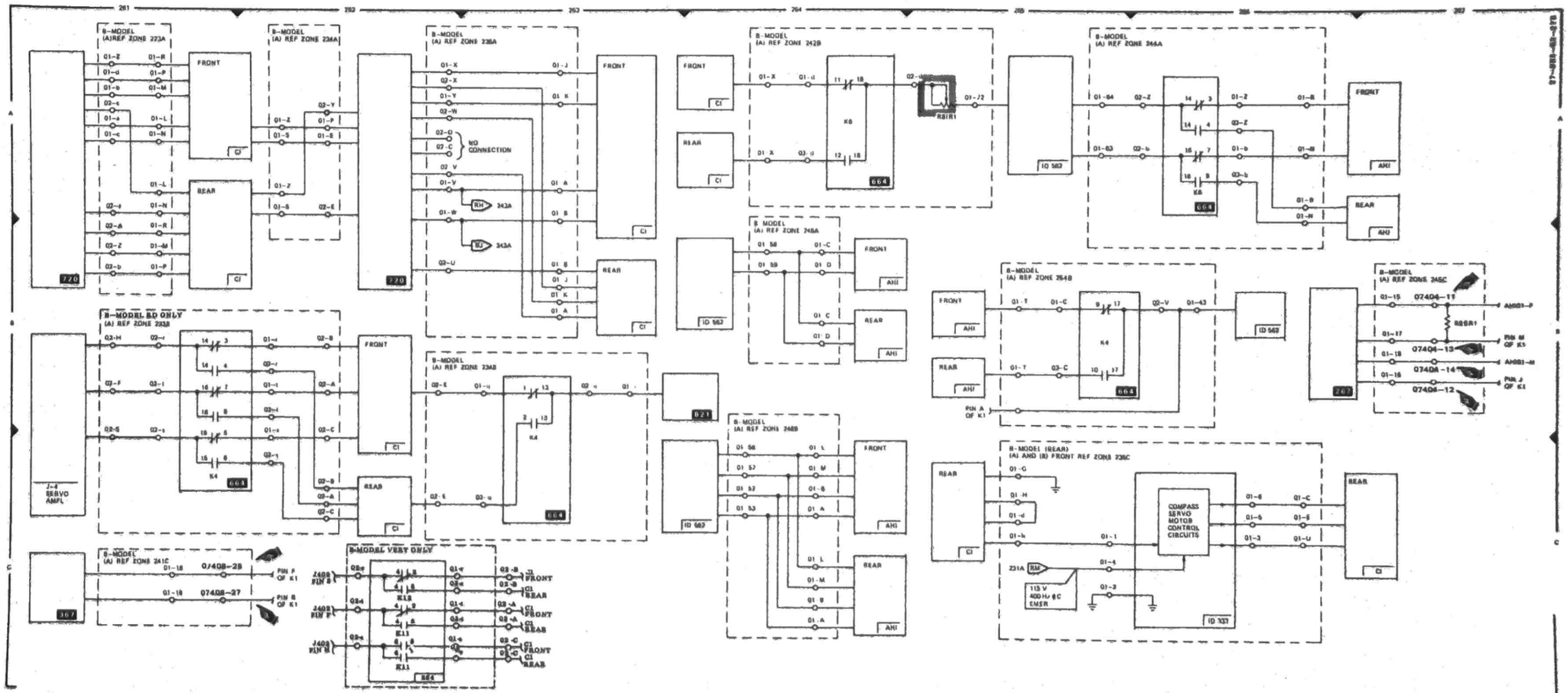


Figure 8-3. Air Data/Cockpit (Sheet 28 of 29).

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520	K401	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/154A 8-3/153A 8-3/154B
	K402	1 AND 6 2 AND 4 COIL 3 AND 7	8-3/153C 8-3/153A 8-3/153B
	K403	COIL 3 AND 7	8-3/152C
	K404	2 AND 4 COIL 3 AND 7	8-3/153C 8-3/153A
	K405	1 AND 6 2 AND 4 6 AND 8 COIL 3 AND 7 2 AND 5	8-3/84B 8-3/84B 8-3/84C 8-3/153A 8-3/84C
	K406	1, 6 AND 8 COIL 3 AND 7	8-3/153C 8-3/154C
	K407	COIL 3 AND 7	8-3/153A
	K408	COIL 3 AND 7	8-3/153A
	K501	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/153C 8-3/154C 8-3/153B
	K502	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/153C 8-3/154C 8-3/153B
	K503	2, 4 AND 5 COIL 3 AND 7	8-3/155C 8-3/152B
	K504	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/154C 8-3/155C 8-3/155B
	K505	1, 6 AND 8 2 AND 4 COIL 3 AND 7	8-3/155C 8-3/155C 8-3/154B
	K506	1, 6 AND 8 2 AND 4	8-3/153C 8-3/155B
	K507	1, 6 AND 8 COIL 3 AND 7	8-3/153C 8-3/154C
	K508	6 AND 8 COIL 3 AND 7	8-3/153C 8-3/155B
	K509	1 AND 6 COIL 3 AND 7	8-3/153C 8-3/153B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520	K601	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153A 8-3/155B 8-3/155B
	K602	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153A 8-3/155B 8-3/154B
	K603	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153B 8-3/155A 8-3/155A
	K604	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153B 8-3/155A 8-3/155A
	K605	1 AND 6 2, 4 AND 5 COIL 3 AND 7	8-3/154B 8-3/153A 8-3/154B
	K606	1, 6 AND 8 COIL 3 AND 7	8-3/152B 8-3/154B
	K607	2 AND 4 6 AND 8 COIL 3 AND 7	8-3/152A 8-3/152B 8-3/152C
	K608	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/155B 8-3/155B/155A 8-3/153A
	K609	2 AND 5 COIL 3 AND 7	8-3/155B 8-3/153A
	K610	1 AND 6 COIL 3 AND 7	8-3/154B 8-3/153A
	K612	1, 6 AND 8 2 AND 5 COIL 3 AND 7	8-3/153A 8-3/154A 8-3/152A
	K1001	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/84A 8-3/84B 8-3/154B
	K1002	1, 6 AND 8 2 AND 4 2 AND 5 COIL 3 AND 7	8-3/84A 8-3/84A 8-3/84B 8-3/153B
	K1003	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/84A 8-3/84A 8-3/153B
	K1201	1 AND 6 2, 4 AND 5	8-3/86C 8-3/85C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520	K1202	COIL 3 AND 7	8-3/155A
	K1203	COIL 3 AND 7	8-3/155A
	K1401	1, 6 AND 8 COIL 3 AND 7	8-3/86B 8-3/154C
	K1402	COIL 3 AND 7	8-3/154C
620	K2301	1 AND 6 6 AND 8 COIL 3 AND 7	8-3/93B 8-3/93B 5-3/93C, 134A
	K2302	1 AND 6 6 AND 8 COIL 3 AND 7	8-3/92B 8-3/92B 8-3/134A
	K2401	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/94B 8-3/94B 8-3/134A
	K2402	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/93A 8-3/93A 8-3/93A 8-3/134A
	K2403	1 AND 6 COIL 3 AND 7	8-3/95A 8-3/134A
	K2404	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/133C 8-3/133C 8-3/133B 8-3/133B
	K2405	1 AND 6 2, 4 AND 5 COIL 3 AND 7	8-3/133C 8-3/133A 8-3/133C
	K2406	6 AND 8 COIL 3 AND 7	8-3/95A 8-3/134A
	K2407	2 AND 5 COIL 3 AND 7	8-3/133A 8-3/134A
	K2408	2 AND 4 6 AND 8 COIL 3 AND 7	8-3/94A 8-3/94A 8-3/134A
	K2501	2, 4 AND 5 COIL 3 AND 7	8-3/134B 8-3/133B
	K2502	2, 4 AND 5 COIL 3 AND 7	8-3/134B 8-3/133B
	K2503	COIL 3 AND 7	8-3/134B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
620	K2701	1 AND 6 2, 4 AND 5 6 AND 8	8-3/94C 8-3/94C 8-3/94C
	K2702	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/95B 8-3/95C 8-3/95C 8-3/133A
	K2703	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/94C 8-3/93C 8-3/94C 8-3/134A
	K2707	COIL 3 AND 7	8-3/133A
	K3001	1 AND 6 2 AND 4 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/92C 8-3/92C 8-3/92C 8-3/92C 8-3/134A
720	K1	1, 2 AND 13 3, 4 AND 14 5, 6 AND 15 7, 8 AND 16 10 AND 17 11, 12 AND 18 COIL 3 AND 7	8-3/235A 8-3/236B 8-3/236B 8-3/244C 8-3/246C 8-3/244C 8-3/255B
	K2	1, 2 AND 13 3, 4 AND 14 5, 6 AND 15 7, 8 AND 16 9, 10 AND 17 11, 12 AND 18 COIL 19 AND 20	8-3/236A 8-3/236A 8-3/235A 8-3/235B 8-3/233A 8-3/233A 8-3/255C
CVAC	K1	J AND K M AND N C, D AND E F AND G G AND H R, S AND T COIL A AND B	8-3/245C 8-3/245C 8-3/242C 8-3/242C 8-3/243C 8-3/242C 8-3/254B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
CPU-4 (CVAC)	K1	N.C. COIL	8-3/157A 8-3/157A
	K2A	N.O. N.C. N.O. COIL	8-3/157A 8-3/106A 8-3/106A 8-3/157A
	K2B	N.O. N.C. N.O. N.C. N.O. N.C. N.O. N.C. COIL	8-3/117A 8-3/117A 8-3/117A 8-3/117A 8-3/117A 8-3/117A 8-3/117B 8-3/117A 8-3/157A
	K2C	N.O. N.C. N.O. N.C. COIL	8-3/117B 8-3/117B 8-3/117B 8-3/117B 8-3/157A
	K3	N.O. N.C. COIL	8-3/117B 8-3/117B 8-3/157A
	K4	N.O. N.C. COIL	8-3/106A 8-3/106A 8-3/157A
CPU-111 (CVAC)	KC	N.O. N.O. COIL	8-3/6B, 196C 8-3/2C, 185B 8-3/5C, 185C
AIR SPEED, MACH AMPLI-FIER (CVAC)	K1	N.O. COIL	8-3/23C 8-3/23C
	K2	N.O. N.C. COIL	8-3/23C 8-3/23C 8-3/23C
ALTI-TUDE, VERTI-CAL SPEED AMPLI-FIER	K40	N.O. COIL	8-3/43B 8-3/43B
	K41	N.O. N.C. COIL	8-3/43B 8-3/43B 8-3/43B
ID562	ILS SELECT	N.O. N.C. N.O. N.C. N.O. N.C. COIL	8-3/244A 8-3/244A 8-3/243B 8-3/243B 8-3/245A 8-3/245A 8-3/255B
J-4 SERVO	K2002	N.O.	8-3/241C

Figure 8-3. Air Data/Cockpit (Sheet 29 of 29)

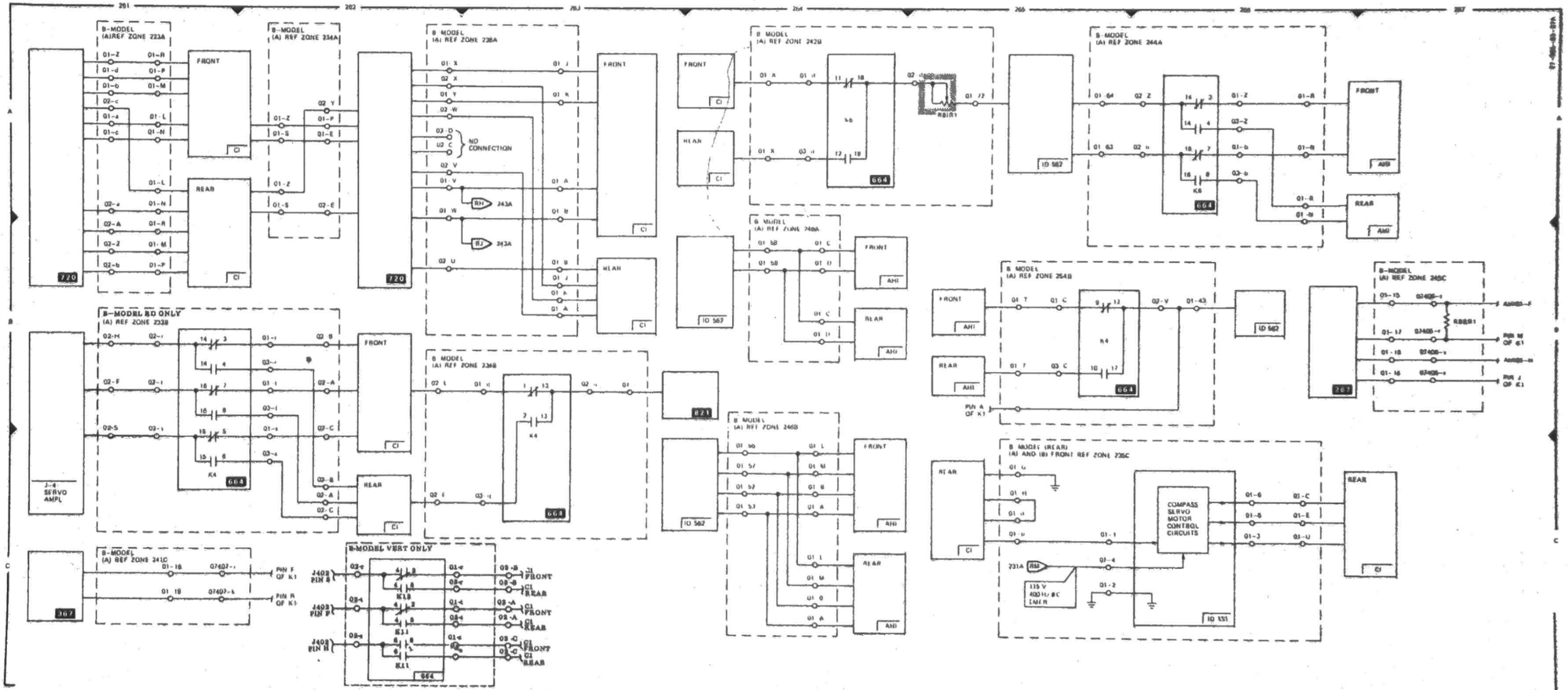


Figure 8-3. Air Data/Cockpit (Sheet 28 of 29).

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520	K401	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/154A 8-3/153A 8-3/154B
	K402	1 AND 6 2 AND 4 COIL 3 AND 7	8-3/153C 8-3/153A 8-3/153B
	K403	COIL 3 AND 7	8-3/152C
	K404	2 AND 4 COIL 3 AND 7	8-3/153C 8-3/153A
	K405	1 AND 6 2 AND 4 6 AND 8 COIL 3 AND 7 2 AND 5	8-3/84B 8-3/84B 8-3/84C 8-3/153A 8-3/84C
	K406	1, 6 AND 8 COIL 3 AND 7	8-3/153C 8-3/154C
	K407	COIL 3 AND 7	8-3/153A
	K408	COIL 3 AND 7	8-3/153A
	K501	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/153C 8-3/154C 8-3/153B
	K502	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/153C 8-3/154C 8-3/153B
	K503	2, 4 AND 5 COIL 3 AND 7	8-3/155C 8-3/152B
	K504	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/154C 8-3/155C 8-3/155B
	K505	1, 6 AND 8 2 AND 4 COIL 3 AND 7	8-3/155C 8-3/155C 8-3/154B
	K506	1, 6 AND 8 2 AND 4	8-3/153C 8-3/155B
	K507	1, 6 AND 8 COIL 3 AND 7	8-3/153C 8-3/154C
	K508	6 AND 8 COIL 3 AND 7	8-3/153C 8-3/155B
	K509	1 AND 6 COIL 3 AND 7	8-3/152C 8-3/153B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520	K601	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153A 8-3/155B 8-3/155B
	K602	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153A 8-3/155B 8-3/154B
	K603	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153B 8-3/155A 8-3/155A
	K604	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153B 8-3/155A 8-3/155A
	K605	1 AND 6 2, 4 AND 5 COIL 3 AND 7	8-3/154B 8-3/153A 8-3/154B
	K606	1, 6 AND 8 COIL 3 AND 7	8-3/152B 8-3/154B
	K607	2 AND 4 6 AND 8 COIL 3 AND 7	8-3/152A 8-3/152B 8-3/152C
	K608	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/156B 8-3/155B/155A 8-3/153A
	K609	2 AND 5 COIL 3 AND 7	8-3/155B 8-3/153A
	K610	1 AND 6 COIL 3 AND 7	8-3/154B 8-3/153A
	K612	1, 6 AND 8 2 AND 5 COIL 3 AND 7	8-3/153A 8-3/154A 8-3/152A
	K1001	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/84A 8-3/84B 8-3/154B
	K1002	1, 6 AND 8 2 AND 4 2 AND 5 COIL 3 AND 7	8-3/84A 8-3/84A 8-3/84B 8-3/153B
	K1003	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/84A 8-3/84A 8-3/153B
	K1201	1 AND 6 2, 4 AND 5	8-3/86C 8-3/86C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520	K1202	COIL 3 AND 7	8-3/155A
	K1203	COIL 3 AND 7	8-3/155A
	K1401	1, 6 AND 8 COIL 3 AND 7	8-3/86B 8-3/154C
	K1402	COIL 3 AND 7	8-3/154C
620	K2301	1 AND 6 6 AND 8 COIL 3 AND 7	8-3/93B 8-3/93B 5-3/93C, 134A
	K2302	1 AND 6 6 AND 8 COIL 3 AND 7	8-3/92B 8-3/92B 8-3/134A
	K2401	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/94B 8-3/94B 8-3/134A
	K2402	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/93A 8-3/93A 8-3/93A 8-3/134A
	K2403	1 AND 6 COIL 3 AND 7	8-3/95A 8-3/134A
	K2404	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/133C 8-3/133C 8-3/133B 8-3/133B
	K2405	1 AND 6 2, 4 AND 5 COIL 3 AND 7	8-3/133C 8-3/133A 8-3/133C
	K2406	6 AND 8 COIL 3 AND 7	8-3/95A 8-3/134A
	K2407	2 AND 5 COIL 3 AND 7	8-3/133A 8-3/134A
	K2408	2 AND 4 6 AND 8 COIL 3 AND 7	8-3/94A 8-3/94A 8-3/134A
	K2501	2, 4 AND 5 COIL 3 AND 7	8-3/134B 8-3/133B
	K2502	2, 4 AND 5 COIL 3 AND 7	8-3/134B 8-3/133B
	K2503	COIL 3 AND 7	8-3/134B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
620	K2701	1 AND 6 2, 4 AND 5 6 AND 8	8-3/94C 8-3/94C 8-3/94C
	K2702	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/95B 8-3/95C 8-3/95C 8-3/133A
	K2703	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/94C 8-3/93C 8-3/94C 8-3/134A
	K2707	COIL 3 AND 7	8-3/133A
	K3001	1 AND 6 2 AND 4 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/92C 8-3/92C 8-3/92C 8-3/92C 8-3/134A
720	K1	1, 2 AND 13 3, 4 AND 14 5, 6 AND 15 7, 8 AND 16 10 AND 17 11, 12 AND 18 COIL 3 AND 7	8-3/235A 8-3/236B 8-3/236B 8-3/244C 8-3/246C 8-3/244C 8-3/255B
	K2	1, 2 AND 13 3, 4 AND 14 5, 6 AND 15 7, 8 AND 16 9, 10 AND 17 11, 12 AND 18 COIL 19 AND 20	8-3/236A 8-3/236A 8-3/235A 8-3/235B 8-3/233A 8-3/233A 8-3/255C
CVAC	K1	J AND K M AND N C, D AND E F AND G G AND H R, S AND T COIL A AND B	8-3/245C 8-3/245C 8-3/242C 8-3/242C 8-3/243C 8-3/242C 8-3/254B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
CPU-4 (CVAC)	K1	N.C. COIL	8-3/157A 8-3/157A
	K2A	N.O. N.C. N.O. COIL	8-3/157A 8-3/106A 8-3/106A 8-3/157A
	K2B	N.O. N.C. N.O. N.C. N.O. N.C. N.O. N.C. COIL	8-3/117A 8-3/117A 8-3/117A 8-3/117A 8-3/117A 8-3/117A 8-3/117B 8-3/117A 8-3/157A
	K2C	N.O. N.C. N.O. N.C. COIL	8-3/117B 8-3/117B 8-3/117B 8-3/117B 8-3/157A
	K3	N.O. N.C. COIL	8-3/117B 8-3/117B 8-3/157A
	K4	N.O. N.C. COIL	8-3/106A 8-3/106A 8-3/157A
CPU-111 (CVAC)	KC	N.O. N.O. COIL	8-3/6B, 196C 8-3/2C, 185B 8-3/5C, 185C
AIR SPEED, MACH AMPLI-FIER (CVAC)	K1	N.O. COIL	8-3/23C 8-3/23C
	K2	N.O. N.C. COIL	8-3/23C 8-3/23C 8-3/23C
ALTI-TUDE, VERTI-CAL SPEED AMPLI-FIER	K40	N.O. COIL	8-3/43B 8-3/43B
	K41	N.O. N.C. COIL	8-3/43B 8-3/43B 8-3/43B
ID562	TLS SELECT	N.O. N.C. N.O. N.C. N.O. N.C. COIL	8-3/244A 8-3/244A 8-3/243B 8-3/243B 8-3/245A 8-3/245A 8-3/255B
J-4 SERVO	K2002	N.O.	8-3/241C

Figure 8-3. Air Data/Cockpit (Sheet 29 of 29)

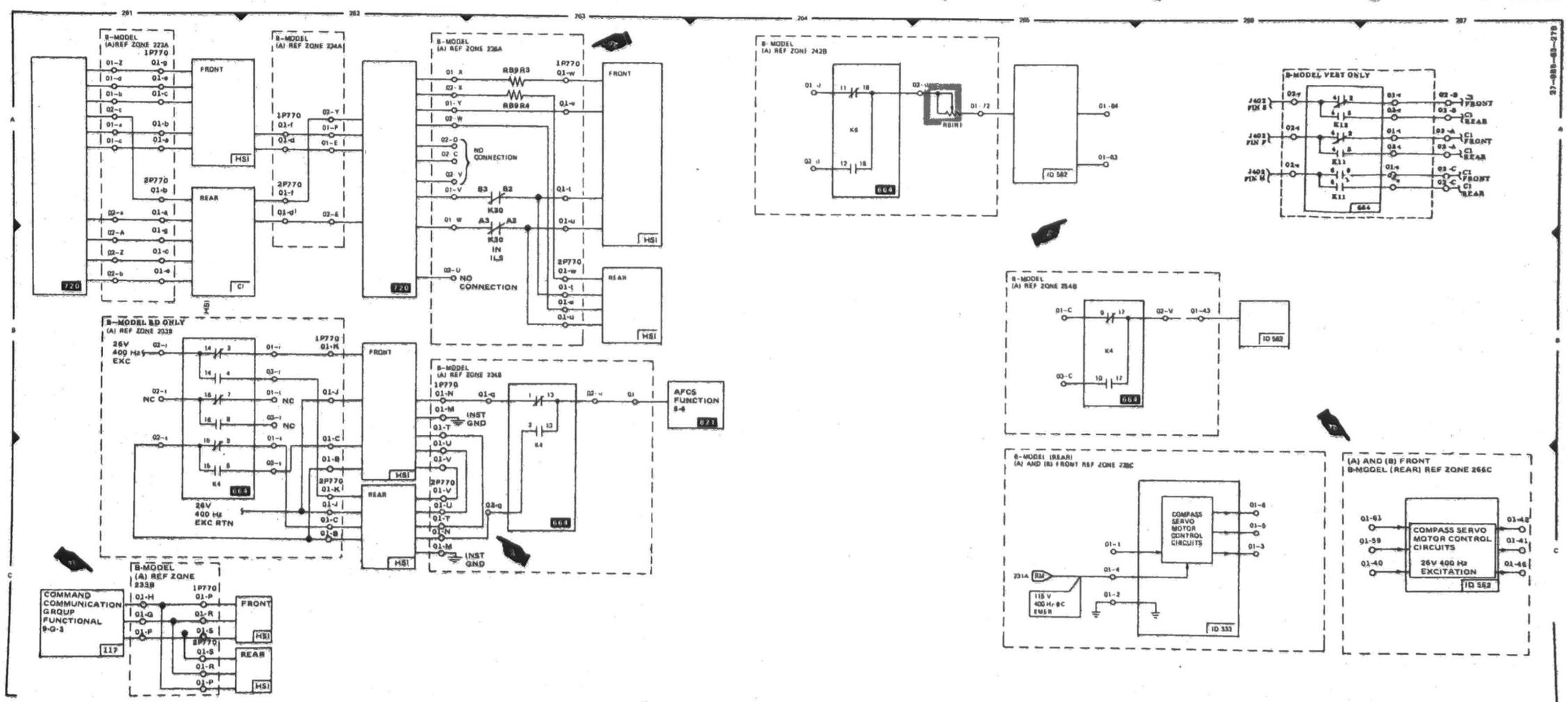


Figure 8-3. Air Data/Cockpit (Sheet 28 of 29).

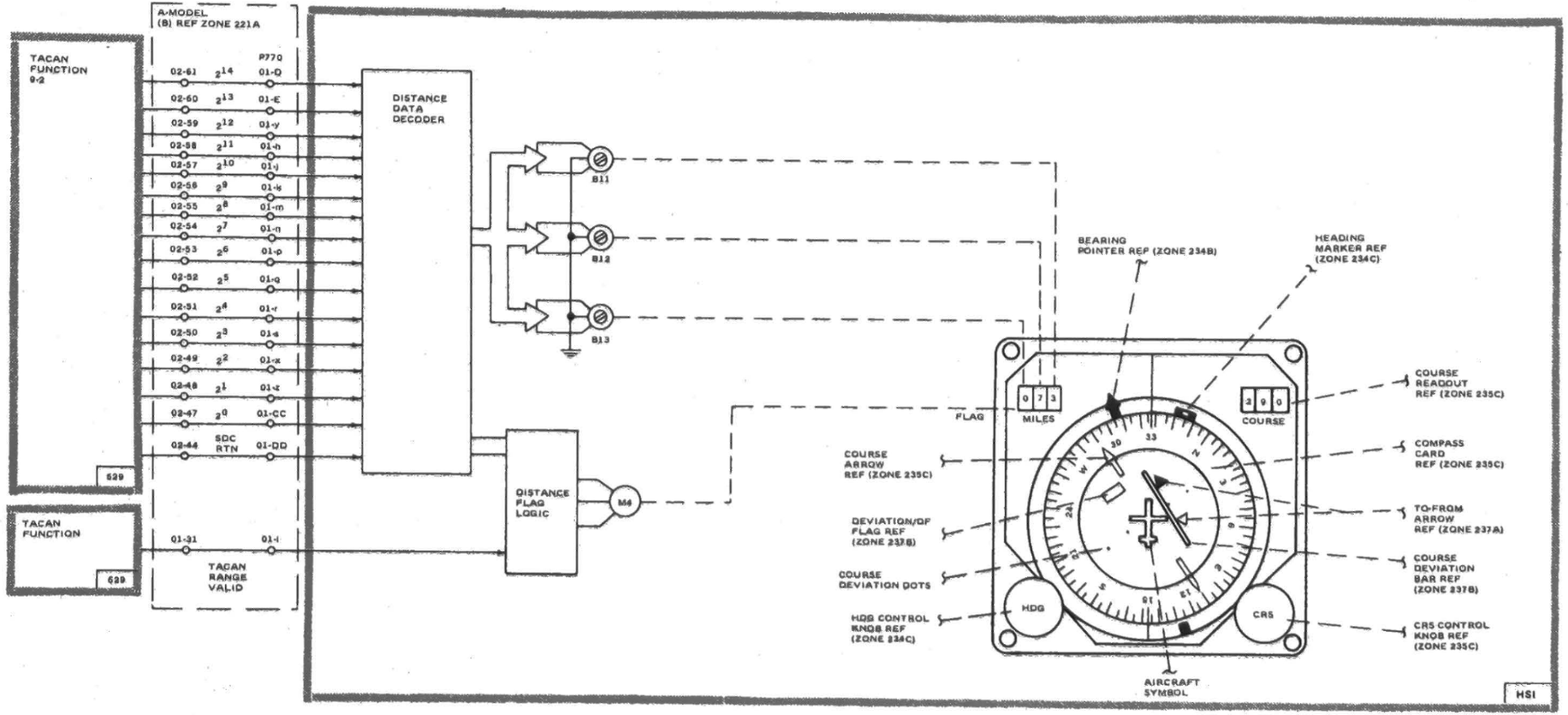


Figure 8-3. Air Data/Cockpit (Sheet 28A of 29)

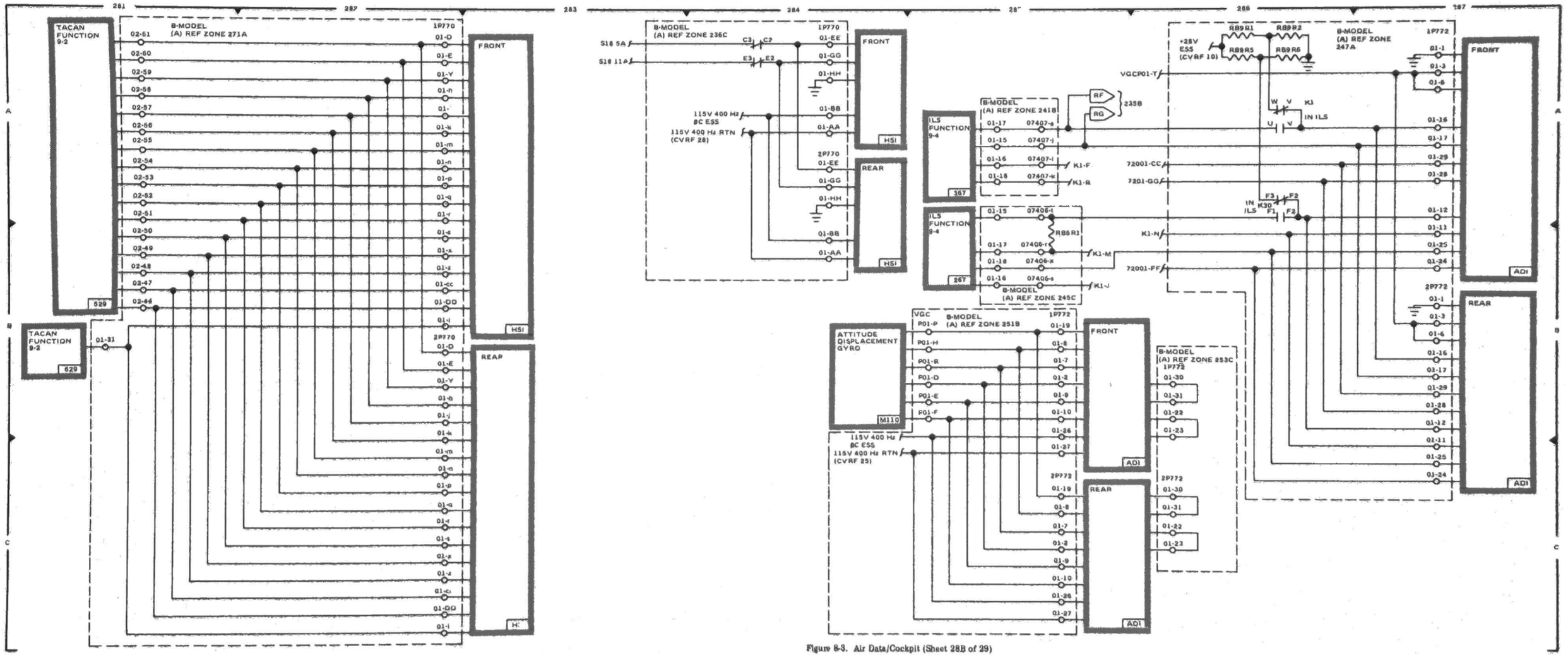


Figure 8-3. Air Data/Cockpit (Sheet 28B of 29)

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520	K401	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/154A 8-3/153A 8-3/154B
	K402	1 AND 6 2 AND 4 COIL 3 AND 7	8-3/153C 8-3/153A 8-3/153B
	K403	COIL 3 AND 7	8-3/152C
	K404	2 AND 4 COIL 3 AND 7	8-3/153C 8-3/153A
	K405	1 AND 6 2 AND 4 6 AND 8 COIL 3 AND 7 2 AND 5	8-3/84B 8-3/84B 8-3/84C 8-3/153A 8-3/84C
	K406	1, 6 AND 8 COIL 3 AND 7	8-3/153C 8-3/154C
	K407	COIL 3 AND 7	8-3/153A
	K408	COIL 3 AND 7	8-3/153A
	K501	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/153C 8-3/154C 8-3/153B
	K502	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/153C 8-3/154C 8-3/153B
	K503	2, 4 AND 5 COIL 3 AND 7	8-3/155C 8-3/152B
	K504	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/154C 8-3/155C 8-3/155B
	K505	1, 6 AND 8 2 AND 4 COIL 3 AND 7	8-3/155C 8-3/156C 8-3/154B
	K506	1, 6 AND 8 2 AND 4	8-3/153C 8-3/155B
	K507	1, 6 AND 8 COIL 3 AND 7	8-3/153C 8-3/154C
	K508	6 AND 8 COIL 3 AND 7	8-3/153C 8-3/155B
	K509	1 AND 6 COIL 3 AND 7	8-3/153C 8-3/153B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520	K601	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153A 8-3/155B 8-3/155B
	K602	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153A 8-3/155B 8-3/154B
	K603	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153B 8-3/155A 8-3/155A
	K604	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/153B 8-3/155A 8-3/155A
	K605	1 AND 6 2, 4 AND 5 COIL 3 AND 7	8-3/154B 8-3/153A 8-3/154B
	K606	1, 6 AND 8 COIL 3 AND 7	8-3/152B 8-3/154B
	K607	2 AND 4 6 AND 8 COIL 3 AND 7	8-3/152A 8-3/152B 8-3/152C
	K608	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/155B 8-3/155B/155A 8-3/153A
	K609	2 AND 5 COIL 3 AND 7	8-3/155B 8-3/153A
	K610	1 AND 6 COIL 3 AND 7	8-3/154B 8-3/153A
	K612	1, 6 AND 8 2 AND 5 COIL 3 AND 7	8-3/153A 8-3/154A 8-3/152A
	K1001	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/84A 8-3/84B 8-3/154B
	K1002	1, 6 AND 8 2 AND 4 2 AND 5 COIL 3 AND 7	8-3/84A 8-3/84A 8-3/84B 8-3/153B
	K1003	1, 6 AND 8 2, 4 AND 5 COIL 3 AND 7	8-3/84A 8-3/84A 8-3/153B
	K1201	1 AND 6 2, 4 AND 5	8-3/86C 8-3/85C

UNIT	RELAY	CONTACTS	FIGURE/ZONE
520	K1202	COIL 3 AND 7	8-3/155A
	K1203	COIL 3 AND 7	8-3/155A
	K1401	1, 6 AND 8 COIL 3 AND 7	8-3/86B 8-3/154C
	K1402	COIL 3 AND 7	8-3/154C
620	K2301	1 AND 6 6 AND 8 COIL 3 AND 7	8-3/93B 8-3/93B 5-3/93C, 134A
	K2302	1 AND 6 6 AND 8 COIL 3 AND 7	8-3/92B 8-3/92B 8-3/134A
	K2401	1 AND 6 2 AND 5 COIL 3 AND 7	8-3/94B 8-3/94B 8-3/134A
	K2402	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/93A 8-3/93A 8-3/93A 8-3/134A
	K2403	1 AND 6 COIL 3 AND 7	8-3/95A 8-3/134A
	K2404	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/133C 8-3/133C 8-3/133B 8-3/133B
	K2405	1 AND 6 2, 4 AND 5 COIL 3 AND 7	8-3/133C 8-3/133A 8-3/133C
	K2406	6 AND 8 COIL 3 AND 7	8-3/95A 8-3/134A
	K2407	2 AND 5 COIL 3 AND 7	8-3/133A 8-3/134A
	K2408	2 AND 4 6 AND 8 COIL 3 AND 7	8-3/94A 8-3/94A 8-3/134A
	K2501	2, 4 AND 5 COIL 3 AND 7	8-3/134B 8-3/133B
	K2502	2, 4 AND 5 COIL 3 AND 7	8-3/134B 8-3/133B
	K2503	COIL 3 AND 7	8-3/134B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
620	K2701	1 AND 6 2, 4 AND 5 6 AND 8	8-3/94C 8-3/94C 8-3/94C
	K2702	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/95B 8-3/95C 8-3/95C 8-3/133A
	K2703	1 AND 6 2, 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/94C 8-3/93C 8-3/94C 8-3/134A
	K2707	COIL 3 AND 7	8-3/133A
	K3001	1 AND 6 2 AND 4 4 AND 5 6 AND 8 COIL 3 AND 7	8-3/92C 8-3/92C 8-3/92C 8-3/92C 8-3/134A
720	K1	1, 2 AND 13 3, 4 AND 14 5, 6 AND 15 7, 8 AND 16 10 AND 17 11, 12 AND 18 COIL 3 AND 7	8-3/235A 8-3/236B 8-3/236B 8-3/244C 8-3/246C 8-3/244C 8-3/255B
	K2	1, 2 AND 13 3, 4 AND 14 5, 6 AND 15 7, 8 AND 16 9, 10 AND 17 11, 12 AND 18 COIL 19 AND 20	8-3/236A 8-3/236A 8-3/235A 8-3/235B 8-3/233A 8-3/233A 8-3/255C
CVAC	K1	E AND D F AND G H AND G J AND K P, M, AND N R, S, AND T U, V, AND W COIL A AND B	8-3/242C 8-3/242C 8-3/243C 8-3/246C 8-3/246C 8-3/242C 8-3/247B, 286A 8-3/257B
	K30	A2 AND A3 B2 AND B3 C2 AND C3 E2 AND E3 F1, F2, AND F3 COIL X1 AND X2	8-3/265A 8-3/263A 8-3/284A 8-3/284A 8-3/247C, 286A 8-3/257B

UNIT	RELAY	CONTACTS	FIGURE/ZONE
CPU-4 (CVAC)	K1	N.C. COIL	8-3/157A 8-3/157A
	K2A	N.O. N.C. N.O. COIL	8-3/157A 8-3/106A 8-3/106A 8-3/157A
	K2B	N.O. N.C. N.O. N.C. N.O. N.C. N.O. N.C. COIL	8-3/117A 8-3/117A 8-3/117A 8-3/117A 8-3/117A 8-3/117A 8-3/117B 8-3/117A 8-3/157A
	K2C	N.O. N.C. N.O. N.C. COIL	8-3/117B 8-3/117B 8-3/117B 8-3/117B 8-3/157A
	K3	N.O. N.C. COIL	8-3/117B 8-3/117B 8-3/157A
	K4	N.O. N.C. COIL	8-3/106A 8-3/106A 8-3/157A
CPU-111 (CVAC)	KC	N.O. N.O. COIL	8-3/6B, 106C 8-3/3C, 185B 8-3/5C, 185C
AIR SPEED, MACH AMPLI-FIER (CVAC)	K1	N.O. COIL	8-3/23C 8-3/23C
	K2	N.O. N.C. COIL	8-3/23C 8-3/23C 8-3/23C
ALTI-TUDE, VERTI-CAL SPEED AMPLI-FIER	K40	N.O. COIL	8-3/43B 8-3/43B
	K41	N.O. N.C. COIL	8-3/43B 8-3/43B 8-3/43B
ID562	ILS SELECT	N.O. N.C. N.O. N.C. N.O. N.C. COIL	8-3/244A 8-3/244A 8-3/243B 8-3/243B 8-3/245A 8-3/245A 8-3/255B

Figure 8-3. Air Data/Cockpit (Sheet 29 of 29)

MA-1 AUOTMATIC FLIGHT CONTROL SYSTEM (AFCS)

In a typical intercept mission, the pilot's function is complex; it involves numerous tactical decisions and mechanical actions in a relatively brief period of time. To free the pilot of some of the routine mission operations, to allow him more time for attention to tactical matters, and otherwise ease his task, automatic flight control features are included in the MA-1 system. A direct manual mode and damper modes are available to the pilot in addition to the AFCS mode. The pilot has the choice of selecting any of the following modes of operation:

a. Direct Manual Mode

b. Damper Mode (Stability Augmentation)

1. Yaw Damping with turn coordination

2. Pitch and Yaw Damping with turn coordination

c. Pilot Assist Mode (AFCS)

1. Pitch hold with heading hold or roll hold

2. Altitude hold with heading hold or roll hold

d. Automatic Modes (AFCS)

1. Navigation

2. Landing (Instrument Landing Approach)

3. Attack

Control of the aircraft flight path is accomplished by means of three movable control surfaces: the left elevon, right elevon and rudder. In flight, positioning these control surfaces cause the aircraft to rotate about its center of gravity in a manner defined in terms of pitch, roll and yaw motion about the lateral, longitudinal and vertical reference axes respectively. Left rudder causes yaw motion to the left, and right rudder causes yaw motion to the right. Pitch motion is accomplished by moving left and right elevons the same amount in a parallel direction: both elevons up produce pitch up and both elevons down produce pitch down. Moving the left and right elevons differently produces roll motion of the aircraft. Left aileron control (left elevon up and right elevon down) produces roll to the left and right aileron control (right elevon up and left elevon down) produces roll to the right. When the AFCS is engaged and functioning in any of its modes, pilot-initiated control motion is locked out by solenoid-operated valves in the hydraulic system. When the lockout valves are energized, the mechanical follow-up linkage is replaced by an electrical feedback system. The flight stick moves in response to control surface deflections, but the pilot can assume control only by disengaging the AFCS.

Several methods of disengaging the AFCS are available to the pilot. If the pilot wishes to fly manually for a brief period, he simply presses the manual mode trigger (MMT) on the flight stick. This trigger, a momentary-contact AFCS interlock switch is effective whenever the pilot assist or one of the completely automatic flight modes has been selected. When the trigger is pressed, the pilot is provided with manual steering augmented with turn coordination and pitch and yaw damping. When it is released, the AFCS resumes operation in the selected mode. If the pilot wishes to fly manually for extended periods of time, he sets the flight mode selector switch to the damper mode which provides the desired degree of stability augmentation. To disengage the AFCS in an emergency, the pilot presses the EMER MANUAL push-button switch on the flight stick. This is a panic button which, when pressed momentarily, causes the flight mode selector switch to be turned automatically to the DIR MAN position, disengaging both the AFCS and the aircraft's damping system. Releasing the emergency manual switch does not restore the system to its previous mode of operation; therefore, the flight mode switch must be reset manually to the desired position when the emergency has passed. The AFCS is designed so that conditions which render it inoperative in any selected mode will cause it to revert to the next most automatic mode in which it can operate. The mode shift is controlled through mechanical rotation of the flight mode switch shaft to the appropriate new position. Such automatic repositioning of the flight mode switch is accomplished by illumination of the FLIGHT MODE FAILURE warning lamp on the master warning panel. Among the conditions which will cause reversion to a less sophisticated mode are loss of radar lockon of the target, loss of data link, loss of ILS signals (or failure to intercept the glide slope beam) as well as malfunctions in the AFCS itself. In typical cases, interruption of data link transmissions would cause the FLT MODE switch (163) to shift automatically from the AUTO position to the ASSIST position, and a failure in the pilot assist circuitry of the AFCS would cause the switch to turn automatically from ASSIST to PITCH DAMP. Each automatic movement of the FLT MODE switch illuminates the FLIGHT MODE FAILURE warning lamp to inform the pilot of the unusual condition. Actuation of the manual mode trigger on the flight stick (placing the aircraft in the manual mode) turns off the warning light.

DAMPER MODES

The aircraft may be operated with or without stability augmentation (damper mode). When operated without augmentation, the pilot has full control of the aircraft, actuating the main hydraulic control valves directly by moving the flight stick or the rudder pedals and by using elevon and rudder electrical trim switches. This is the direct manual mode. When stability augmentation is introduced, the pilot operates the control stick to maneuver the aircraft in pitch and roll. In this manner, the turn coordination circuits control the rudder to maintain coordinated flight. During the AFCS modes, the computer supplies pitch and roll inputs to the control circuits but does not supply rudder input signals; the rudder is controlled by the turn coordination circuits.

PILOT ASSIST MODES

The PILOT ASSIST selection is provided to give the pilot relief in situations where command information for completely automatic control is not available or desired by the pilot. In the pilot assist mode, the AFCS circuits maintain the aircraft attitude that existed at the time PILOT ASSIST was engaged. If the pilot selects the pilot assist mode but does not actuate the ALT HOLD switch (163) or the HDNG HOLD switch (163), the aircraft will maintain a pitch hold-roll hold attitude. If the ALT HOLD switch is set to ALT HOLD, the aircraft will maintain a constant altitude. To attain the heading hold mode, the HDNG HOLD switch must be set to HDNG HOLD and the roll angle of the aircraft must be less than ±5 degrees. If the HDNG HOLD switch is set to HDNG HOLD but the roll angle is greater than ±5 degrees, the roll hold mode will be engaged. Depending on the present aircraft roll angle and the switches operated, four modes of pilot assist can be attained. These modes are: pitch hold-roll hold, pitch hold-heading hold, altitude hold-roll hold and altitude hold-heading hold. Altitude hold will be inoperative between Mach 0.96 and Mach 1.05. When accelerating or decelerating through this Mach region, the system will automatically revert to pitch hold and after the region is passed the system will automatically reengage altitude hold. The reference altitude will then be established at the reengagement altitude. Altitude hold is disengaged in the transonic region to prevent erroneous control caused by the variation of air data in this region. If the manual mode trigger (MMT) is pressed the system will revert to the damper mode. Release of the MMT causes the system to return to altitude hold mode with the reference altitude being the altitude at reengagement. Operation of the trim button (083) in pitch will cause the ALT HOLD switch to drop to OFF. The bank trim switch enables the pilot to trim from bank hold to heading hold and vice versa while engaged in pilot assist mode.

AUTO MODES

To attain the navigation mode, the FLT MODE switch (163) must be set to AUTO and the DISP/AUTO MODE switch (163) set to AUTO NAV, DL MAX RNG, or DL MIN TIME. The digital computer determines the proper value of pitch and bank command signals required to direct the aircraft to the selected homing points are pre-programmed destinations or set of geographical coordinates. The digital computer stores 20 homing point coordinates which may be selected by positioning the HOMING POINT SELECTOR switch on the 955 unit. These homing points have many purposes, some of which are: favorable positions for receiving the runway localizer beam, rendezvous areas for practice flights, or reassembly and useful navigation aids during limited visibility conditions. If the ALT HOLD switch is set to ALT HOLD, the aircraft will be directed to the selected homing point maintaining the engage altitude. In the DL MAX RNG position, the DISP/AUTO MODE switch activates the digital computer to use data link signals and steering schedule based upon maximum range performance. In the DL MIN TIME position data link signals are used by the computer to compute an efficient schedule based upon a minimum time performance (higher speed and greater fuel consumption) and to supply command signals to the 821 unit based upon these computations. Altitude hold may also be selected in DL MIN TIME or DL MAX RNG.

For automatic landing of the aircraft by instrument control, the ILS (R) or ILS and ILS APCH (V) positions of the DISP/AUTO MODE switch (163) are used. In the ILS position the DISP/AUTO MODE switch causes the guidance in formation to be obtained from the localizer and glide slope receivers and processed for application to the attitude director indicator (V) (ADI) or to the course indicator (R) (CI). The ILS APCH (V) position is used after the outer beacon marker has been passed. This position is not required if the AUTO flight mode is selected; however, selection of ILS APCH will permit pilot monitoring of flight director computer glide slope steering computations. In round instrument aircraft, this is accomplished by selecting ILS on the approach horizon indicator (AHI).

In the automatic instrument landing approach mode, the AFCS uses inputs from the ILS localizer and glide slope receivers, air data computer and the HSI. In response to these inputs, the AFCS automatically controls the aircraft during a landing approach down to an altitude of approximately 75 feet above the runway. At this time the pilot takes control for flare-out and touch down functions. To make an automatic instrument landing approach, the ILS mode of AFCS should be engaged when the aircraft is in level flight under the following conditions:

Altitude:	1500 feet ±100 feet above the runway
Heading:	Inbound within ±90 degrees from runway heading
Airspeed:	Between 200 and 235 knots
Position:	Anywhere within a 4 mile radius of a point that is located on the centerline of the runway and 15 miles from its approach edge.

In general, the attack mode differs from the landing mode in two important respects. First, the course is specified in terms of the instantaneous value of the angle-to-turn-through to put the aircraft on course rather than the displacement from the desired course. The reason for this is that the attack course may not only have an infinite number of oriented paths in space, but also a different direction for each angular position of the aircraft relative to the target. The second general difference is that the response of the AFCS in the attack mode is extremely rapid. This is necessary since the time available to get on course may be limited and the course itself may change at any time as a result of target maneuvers. In the lead-collision mode, the AFCS is designed to turn the aircraft on to the specified course at a rate proportional to the angle-off course. This is accomplished by deriving normal and lateral acceleration command signals which are proportional to the azimuth and elevation components of the angle-off course and comparing them with the measured vertical and lateral accelerations to produce the pitch and bank error signals. The vertical and lateral accelerations actually are measured by measuring lift acceleration and bank angles. The primary inputs to the computer in the lead-collision mode are two angular rate difference signals from the radar subsystem. These signals, E15N and E16N are proportional to the azimuth and elevation components, respectively, of the differences between the computed and measured rates of rotation of the line of sight to the target. These difference signals are proportional to the horizontal and vertical distances that the armament of the aircraft will miss the target if the aircraft continues on its present course. The pursuit mode is practically identical to the lead-collision mode. The course is specified in terms of the angle to turn through, and the computer is programmed to turn the interceptor at a rate proportional to this angle. The only differences between the two modes are the inputs which the computer uses from the radar subsystem. These differences stem from the difference in the equations for the angle to-turn-through and the need to compensate for curvature of the pursuit course. The angle to-turn-through to obtain a pursuit course is simply the angle between the velocity vector of the aircraft and the line of sight to the target. The elevation angle to-turn-through is equal to the elevation angle of the target plus the angle of attack of the aircraft. The lateral angle to-turn-through is equal to the azimuth angle of the target times the cosine of the elevation angle. When the MA-1 system is in its visual identification mode, offset corrections are added to these angles during the final portion of the pursuit pass to prevent a collision and put the aircraft in the optimum position for identifying the target.

Figure 8-4. AFCS (Sheet 1 of 9)

A. Normally closed contacts of the EMER MANUAL switch used in conjunction with the power monitor relay provide a safety interlock for the AFCS. Pressing the EMER MANUAL switch initiates a series of actions which cause the FLT MODE switch to step down to the DIR MAN position and cause the MWP FLIGHT MODE FAILURE lamp to light.

B. The power monitor circuit is used to disengage the AFCS in the event of a failure or interruption of the 821 unit power forces.

C. The AFCS ok and stable platform ok coincidence circuit is used to disable the pilot assist mode of operation when the SCEG is placed in initial mode or test.

D. The E.P.G.L. G-limit relay forms part of the aircraft structural safety interlock. If a high negative or positive pitch G force is sensed, the relay is de-energized to prevent over stressing the airframe. Refer to T. O. 1F-106A-2-7 for further details on the pitch G limiter.

E. When the rudder unlock solenoid is energized, the HRP valve allows the electrical inputs to extend and retract the actuator. These movements are coupled to the rudder through mechanical linkage.

F. The fit mode fail warning circuit provides a visual cockpit indication on the MWP whenever a malfunction, pilot action, or abnormal condition has caused the FLT MODE switch to step down to a lower mode.

G. The HDNG HOLD switch applies D127 to the computer for use in the pilot-assist mode of operation.

H. The MMT provides the capability to temporarily disengage the pilot assist or auto mode of operation without changing the selection of the FLT MODE switch.

I. The digital computer monitors the digital inputs to determine the system conditions and mode selection. D111 is pilot assist engage. D102 is auto engage. D127 is heading hold select. D132 is AFCS uncage. D186 is assist ok. Digital output D215N is auto ok. D215N signal holds the FLT MODE switch in the AUTO position when all the programmed prerequisites are met.

J. The VALVE GAIN ADJ switch is used during alignment of the 821 unit. When pressed, -15 v is applied to the three sets of valve drivers (sheet 7) as a fixed input. The three gain adjustments can then be made.

K. The YAW ENGA and PITCH ENGA switches are used to engage the yaw and pitch damp modes of operation during maintenance.

TEST POINT CHART ▲

- [illegible]
- [illegible]
- [illegible]
- Ground for pulling contact at 825 unit when 5.0DE mode is energized.
- [illegible]

Figure 8-4. AFCS (Sheet 1 of 9)

MA-1 AUOTMATIC FLIGHT CONTROL SYSTEM (AFCS)

In a typical intercept mission, the pilot's function is complex; it involves numerous tactical decisions and mechanical actions in a relatively brief period of time. To free the pilot of some of the routine mission operations, to allow him more time for attention to tactical matters, and otherwise ease his task, automatic flight control features are included in the MA-1 system. A direct manual mode and damper modes are available to the pilot in addition to the AFCS mode. The pilot has the choice of selecting any of the following modes of operation:

a. Direct Manual Mode

b. Damper Mode (Stability Augmentation)

1. Yaw Damping with turn coordination

2. Pitch and Yaw Damping with turn coordination

c. Pilot Assist Mode (AFCS)

1. Pitch hold with heading hold or roll hold

2. Altitude hold with heading hold or roll hold

d. Automatic Modes (AFCS)

1. Navigation

2. Landing (Instrument Landing Approach)

3. Attack

Control of the aircraft flight path is accomplished by means of three movable control surfaces: the left elevon, right elevon and rudder. In flight, positioning these control surfaces cause the aircraft to rotate about its center of gravity in a manner defined in terms of pitch, roll and yaw motion about the lateral, longitudinal and vertical reference axes respectively. Left rudder causes yaw motion to the left, and right rudder causes yaw motion to the right. Pitch motion is accomplished by moving left and right elevons the same amount in a parallel direction: both elevons up produce pitch up and both elevons down produce pitch down. Moving the left and right elevons differently produces roll motion of the aircraft. Left aileron control (left elevon up and right elevon down) produces roll to the left and right aileron control (right elevon up and left elevon down) produces roll to the right. When the AFCS is engaged and functioning in any of its modes, pilot-initiated control motion is locked out by solenoid-operated valves in the hydraulic system. When the lockout valves are energized, the mechanical follow-up linkage is replaced by an electrical feedback system. The flight stick moves in response to control surface deflections, but the pilot can assume control only by disengaging the AFCS.

Several methods of disengaging the AFCS are available to the pilot. If the pilot wishes to fly manually for a brief period, he simply presses the manual mode trigger (MMT) on the flight stick. This trigger, a momentary-contact AFCS interlock switch is effective whenever the pilot assist or one of the completely automatic flight modes has been selected. When the trigger is pressed, the pilot is provided with manual steering augmented with turn coordination and pitch and yaw damping. When it is released, the AFCS resumes operation in the selected mode. If the pilot wishes to fly manually for extended periods of time, he sets the flight mode selector switch to the damper mode which provides the desired degree of stability augmentation. To disengage the AFCS in an emergency, the pilot presses the EMER MANUAL pushbutton switch on the flight stick. This is a panic button which, when pressed momentarily, causes the flight mode selector switch to be turned automatically to the DIR MAN position, disengaging both the AFCS and the aircraft's damping system. Releasing the emergency manual switch does not restore the system to its previous mode of operation; therefore, the flight mode switch must be reset manually to the desired position when the emergency has passed. The AFCS is designed so that conditions which render it inoperative in any selected mode will cause it to revert to the next most automatic mode in which it can operate. The mode shift is controlled through mechanical rotation of the flight mode switch shaft to the appropriate new position. Such automatic repositioning of the flight mode switch is accomplished by illumination of the FLIGHT MODE FAILURE warning lamp on the master warning panel. Among the conditions which will cause reversion to a less sophisticated mode are loss of radar lockon of the target, loss of data link, loss of ILS signals (or failure to intercept the glide slope beam) as well as malfunctions in the AFCS itself. In typical cases, interruption of data link transmissions would cause the FLT MODE switch (163) to shift automatically from the AUTO position to the ASSIST position, and a failure in the pilot assist circuitry of the AFCS would cause the switch to turn automatically from ASSIST to PITCH DAMP. Each automatic movement of the FLT MODE switch illuminates the FLIGHT MODE FAILURE warning lamp to inform the pilot of the unusual condition. Actuation of the manual mode trigger on the flight stick (placing the aircraft in the manual mode) turns off the warning light.

DAMPER MODES

The aircraft may be operated with or without stability augmentation (damper mode). When operated without augmentation, the pilot has full control of the aircraft, actuating the main hydraulic control valves directly by moving the flight stick or the rudder pedals and by using elevon and rudder electrical trim switches. This is the direct manual mode. When stability augmentation is introduced, the pilot operates the control stick to maneuver the aircraft in pitch and roll. In this manner, the turn coordination circuits control the rudder to maintain coordinated flight. During the AFCS modes, the computer supplies pitch and roll inputs to the control circuits but does not supply rudder input signals; the rudder is controlled by the turn coordination circuits.

PILOT ASSIST MODES

The PILOT ASSIST selection is provided to give the pilot relief in situations where command information for completely automatic control is not available or desired by the pilot. In the pilot assist mode, the AFCS circuits maintain the aircraft attitude that existed at the time PILOT ASSIST was engaged. If the pilot selects the pilot assist mode but does not actuate the ALT HOLD switch (163) or the HDNG HOLD switch (163), the aircraft will maintain a pitch hold-roll hold attitude. If the ALT HOLD switch is set to ALT HOLD, the aircraft will maintain a constant altitude. To attain the heading hold mode, the HDNG HOLD switch must be set to HDNG HOLD and the roll angle of the aircraft must be less than ±5 degrees. If the HDNG HOLD switch is set to HDNG HOLD but the roll angle is greater than ±5 degrees, the roll hold mode will be engaged. Depending on the present aircraft roll angle and the switches operated, four modes of pilot assist can be attained. These modes are: pitch hold-roll hold, pitch hold-heading hold, altitude hold-roll hold and altitude hold-heading hold. Altitude hold will be inoperative between Mach 0.96 and Mach 1.05. When accelerating or decelerating through this Mach region, the system will automatically revert to pitch hold and after the region is passed the system will automatically reengage altitude hold. The reference altitude will then be established at the reengagement altitude. Altitude hold is disengaged in the transonic region to prevent erroneous control caused by the variation of air data in this region. If the manual mode trigger (MMT) is pressed the system will revert to the damper mode. Release of the MMT causes the system to return to altitude hold mode with the reference altitude being the altitude at reengagement. Operation of the trim button (083) in pitch will cause the ALT HOLD switch to drop to OFF. The bank trim switch enables the pilot to trim from bank hold to heading hold and vice versa while engaged in pilot assist mode.

AUTO MODES

To attain the navigation mode, the FLT MODE switch (163) must be set to AUTO and the DISP/AUTO MODE switch (163) set to AUTO NAV, DL MAX RNG, or DL MIN TIME. The digital computer determines the proper value of pitch and bank command signals required to direct the aircraft to the selected homing points are pre-programmed destinations or set of geographical coordinates. The digital computer stores 20 homing point coordinates which may be selected by positioning the HOMING POINT SELECTOR switch on the 955 unit. These homing points have many purposes, some of which are: favorable positions for receiving the runway localizer beam, rendezvous areas for practice flights, or reassembly and useful navigation aids during limited visibility conditions. If the ALT HOLD switch is set to ALT HOLD, the aircraft will be directed to the selected homing point maintaining the engage altitude. In the DL MAX RNG position, the DISP/AUTO MODE switch activates the digital computer to use data link signals and steering schedule based upon maximum range performance. In the DL MIN TIME position data link signals are used by the computer to compute an efficient schedule based upon a minimum time performance (higher speed and greater fuel consumption) and to supply command signals to the 821 unit based upon these computations. Altitude hold may also be selected in DL MIN TIME or DL MAX RNG.

For automatic landing of the aircraft by instrument control, the ILS (R) or ILS and ILS APCH (V) positions of the DISP/AUTO MODE switch (163) are used. In the ILS position the DISP/AUTO MODE switch causes the guidance in formation to be obtained from the localizer and glide slope receivers and processed for application to the attitude director indicator (V) ADI. The ILS APCH (V) position is used after the outer beacon marker has been passed. This position is not required if the AUTO flight mode is selected; however, selection of ILS APCH will permit pilot monitoring of flight director computer glide slope steering computations.

In the automatic instrument landing approach mode, the AFCS uses inputs from the ILS localizer and glide slope receivers, air data computer and the HSI. In response to these inputs, the AFCS automatically controls the aircraft during a landing approach down to an altitude of approximately 75 feet above the runway. At this time the pilot takes control for flareout and touch down functions. To make an automatic instrument landing approach, the ILS mode of AFCS should be engaged when the aircraft is in level flight under the following conditions:

Altitude:	1500 feet ±100 feet above the runway
Heading:	Inbound within ±90 degrees from runway heading
Airspeed:	Between 200 and 225 knots
Position:	Anywhere within a 4 mile radius of a point that is located on the centerline of the runway and 15 miles from its approach edge.

In general, the attack mode differs from the landing mode in two important respects. First, the course is specified in terms of the instantaneous value of the angle-to-turn-through to put the aircraft on course rather than the displacement from the desired course. The reason for this is that the attack course may not only have an infinite number of oriented paths in space, but also a different direction for each angular position of the aircraft relative to the target. The second general difference is that the response of the AFCS in the attack mode is extremely rapid. This is necessary since the time available to get on course may be limited and the course itself may change at any time as a result of target maneuvers. In the lead-collision mode, the AFCS is designed to turn the aircraft on to the specified course at a rate proportional to the angle-off course. This is accomplished by deriving normal and lateral acceleration command signals which are proportional to the azimuth and elevation components of the angle-off course and comparing them with the measured vertical and lateral accelerations to produce the pitch and bank error signals. The vertical and lateral accelerations actually are measured by measuring lift acceleration and bank angles. The primary inputs to the computer in the lead-collision mode are two angular rate difference signals from the radar subsystem. These signals, E15N and E16N are proportional to the azimuth and elevation components, respectively, of the differences between the computed and measured rates of rotation of the line of sight to the target. These difference signals are proportional to the horizontal and vertical distances that the armament of the aircraft will miss the target if the aircraft continues on its present course. The pursuit mode is practically identical to the lead-collision mode. The course is specified in terms of the angle to turn through, and the computer is programmed to turn the interceptor at a rate proportional to this angle. The only differences between the two modes are the inputs which the computer uses from the radar subsystem. These differences stem from the difference in the equations for the angle to-turn-through and the need to compensate for curvature of the pursuit course. The angle to-turn-through to obtain a pursuit course is simply the angle between the velocity vector of the aircraft and the line of sight to the target. The elevation angle to-turn-through is equal to the elevation angle of the target plus the angle of attack of the aircraft. The lateral angle to-turn-through is equal to the azimuth angle of the target times the cosine of the elevation angle. When the MA-1 system is in its visual identification mode, offset corrections are added to these angles during the final portion of the pursuit pass to prevent a collision and put the aircraft in the optimum position for identifying the target.

Figure 8-4. AFCS (Sheet 1 of 9)

Normally closed contacts of the EMER MANUAL switch used in conjunction with the power monitor relay provide a safety interlock for the AFCS. Pressing the EMER MANUAL switch initiates a series of actions which cause the FLT MODE switch to step down to the DIR MAN position and cause the MWP FLIGHT MODE FAILURE lamp to light.

The power monitor circuit is used to disengage the AFCS in the event of a failure or interruption of the 621 unit power forms.

The AFCS ok and stable platform ok coincidence circuit is used to disable the pilot assist mode of operation when the SCEG is placed in initial mode or test.

The EPGL G-limit relay forms part of the aircraft structural safety interlock. If a high negative or positive pitch G force is sensed, the relay is de-energized to prevent over stressing the airframe. Refer to T. O. 1F-106A-2-7 for further details on the pitch G limiter.

When the rudder unlock solenoid is energized, the HRP valve allows the electrical inputs to extend and retract the actuator. These movements are coupled to the rudder through mechanical linkage.

The fit mode fail warning circuit provides a visual cockpit indication on the MWP whenever a malfunction, pilot action, or abnormal condition has caused the FLT MODE switch to step down to a lower mode.

The HDNG HOLD switch applies D127 to the computer for use in the pilot-assist mode of operation.

The MMT provides the capability to temporarily disengage the pilot assist or auto mode of operation without changing the selection of the FLT MODE switch.

The digital computer monitors the digital inputs to determine the system conditions and mode selection. D111 is pilot assist engage. D102 is auto engage. D127 is heading hold select. D132 is AFCS uncage. D186 is assist ok. Digital output D215N is auto ok. D215N signal holds the FLT MODE switch in the AUTO position when all the programmed prerequisites are met.

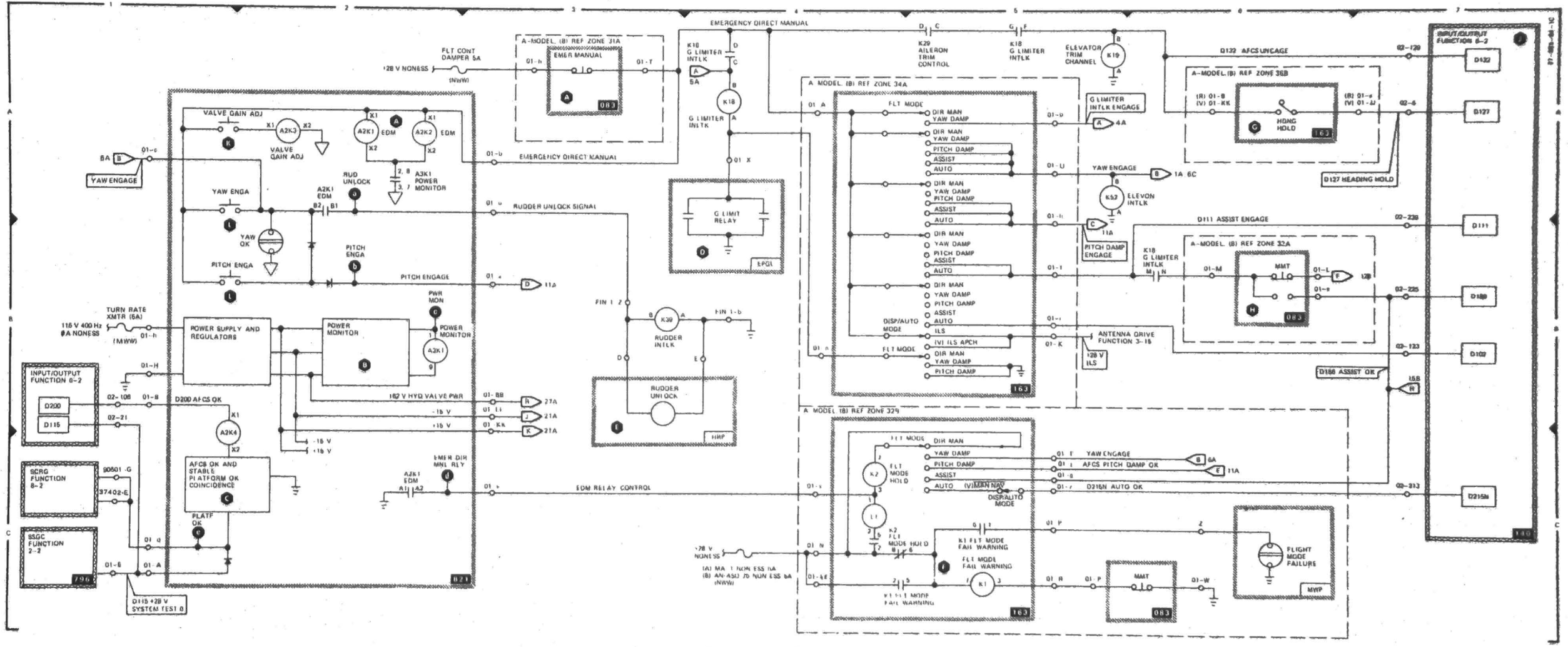
The VALVE GAIN ADJ switch is used during alignment of the 621 unit. When pressed, -15 v is applied to the three sets of valve drivers (sheet 7) as a fixed input. The three gain adjustments can then be made.

The YAW ENGA and PITCH ENGA switches are used to engage the yaw and pitch damp modes of operation during maintenance.

YAW DAMP RELAY

- +28 v to YAW DAMP, PITCH DAMP, ASSIST or AUTO, applied to rudder servo relay coil.
- +28 v to PITCH DAMP, ASSIST or AUTO, interlocked through rudder servo relay K3a.
- Approx. +28 v when RSR with power supplied and in tolerance.
- Current for energizing current to RSR coil when RSRR relay is energized.
- +28 v if stable table in normal mode or RSRC 2, 3, 4 or 5 is selected.

Figure 6-4. AFCS (Sheet 2 of 9)


EMERGENCY DIRECT MANUAL
FLT CONT DAMPER 5A
+28 V NONESS
(MWW)
A-MODEL (B) REF ZONE 31A
EMER MANUAL
083
K18 G LIMITER INTLK
5A
K18 G LIMITER INTLK
K29 AILERON TRIM CONTROL
K18 G LIMITER INTLK
ELEVATOR TRIM CHANNEL
K19
D132 AFCS UNCAGE
A-MODEL (B) REF ZONE 36B
HDNG HOLD
163
D127 HEADING HOLD
INPUT/OUTPUT FUNCTION 6-2
D132
D127
D111
D189
D102
D215N
140
VALVE GAIN ADJ
A2K3
A2K1 EDM
A2K2 EDM
2, 8 3, 7 A3K1 POWER MONITOR
RUD UNLOCK
YAW ENGA
YAW OK
PITCH ENGA
PITCH ENGAGE
RUDDER UNLOCK SIGNAL
EMERGENCY DIRECT MANUAL
G LIMIT RELAY
EPGI
8A
YAW ENGAGE
TURN RATE XMTR (6A)
115 V 400 Hz ØA NONESS
(MWW)
POWER SUPPLY AND REGULATORS
POWER MONITOR
PWR MON
POWER MONITOR
A2K1
FIN 1-Z
FIN 1-b
K39
RUDDER INTLK
RUDDER UNLOCK
HRP
INPUT/OUTPUT FUNCTION 6-2
D200
D115
D200 AFCS OK
182 V HYD VALVE PWR
-15 V
+15 V
A2K4
AFCS OK AND STABLE PLATFORM OK COINCIDENCE
PLATF OK
SCRG FUNCTION 8-2
90501-G
37402-E
SSGC FUNCTION 2-2
796
D115 +28 V SYSTEM TEST 8
EMER DIR MNL RLY
A2K1 EDM
EDM RELAY CONTROL
821
A MODEL (B) REF ZONE 34A
FLT MODE
DIR MAN YAW DAMP
PITCH DAMP
ASSIST
AUTO
DISP/AUTO MODE
ILS
(V) ILS APCH
YAW ENGAGE
1A 6C
K52 ELEVON INTLK
PITCH DAMP ENGAGE
D111 ASSIST ENGAGE
A-MODEL (B) REF ZONE 32A
K18 G LIMITER INTLK
MMT
ANTENNA DRIVE FUNCTION 3-16
+28 V ILS
D186 ASSIST OK
A MODEL (B) REF ZONE 32B
K2 FLT MODE HOLD
K1 FLT MODE FAIL WARNING
AFCS PITCH DAMP OK
D216N AUTO OK
DISP/AUTO MODE
+28 V NONESS
(A) MA-1 NON ESS 6A
(B) AN-ASQ-70 NON ESS 6A
(MWW)
FLIGHT MODE FAILURES
MWP
163
083

- The primary and secondary hydraulic pressure warning relays prevent the 621 unit self test relays from energizing when hydraulic pressure is applied to the flight controls.
- The seat disconnect interlock breaks the elevon lockout path to free the control stick in the event of pilot ejection during pilot assist or auto modes of operation.
- Mode lamp 1 provides a visual indication for the direct scope recorder and the pilot when in pilot assist or auto modes of operation.
- Digital output D285 is set high when the proper conditions are met for the altitude hold mode of operation.
- +28 v during AUTO with Glide Slope and Localizer or ALT HOLD selection becomes digital input D119 to the computer. This places the AFCS into an altitude hold mode of operation.
- The 600 ms delay circuit is used to apply +28 v to the hold path for the FLT MODE switch (163) for 600 ms when PILOT ASSIST is first selected. This allows time for the HEP valve lockouts to extend.
- The EPGL G-limit relay forms part of the aircraft structural safety interlock. If a high negative or positive pitch G force is sensed, the relay is de-energized to prevent over stressing the airframe. Refer to T. O. 1F-106A-2-7 for further details of the G limit relay operation.
- The trim switch (083) is used to supply inputs to the digital computer during the pilot assist mode of operation.
- The HEP valve lockout extended switches are closed when the mechanical input lockouts are physically extended.
- Energizing the elevon unlock solenoids allows the electrical inputs to control the amount of hydraulic pressure applied to the elevon actuators.
- Energizing the elevon lockout solenoids causes a mechanical action in the HEP valve which prevents normal mechanical inputs to the elevon control valves.
- The digital computer monitors these digital inputs during pilot assist and auto modes of operation. D119 will cause the AFCS to operate in an altitude hold mode of operation. D145, D146, D147, and D148 are used to change the aircraft attitude during pilot assist mode of operation.

TEST POINT DATA

- +28 v at AFCS ENGA monitored through [illegible] relay K34.
- +28 v at G LIMIT SET-A monitored through A FCS and stable platform limit relay A264.
- +28 v at A [illegible] Y ENGA monitored through [illegible] relay A262.
- +28 v at A [illegible] if no ALT[illegible] light, [illegible] C monitor [illegible] relay K68, [illegible] test discrepant.
- +28 v at AFCS ENGA monitored through K68 relay A262.
- +28 v to AUTO if the glide slope and localizer signals are valid.

Figure 8-4. AFCS (Sheet 4 of 9)

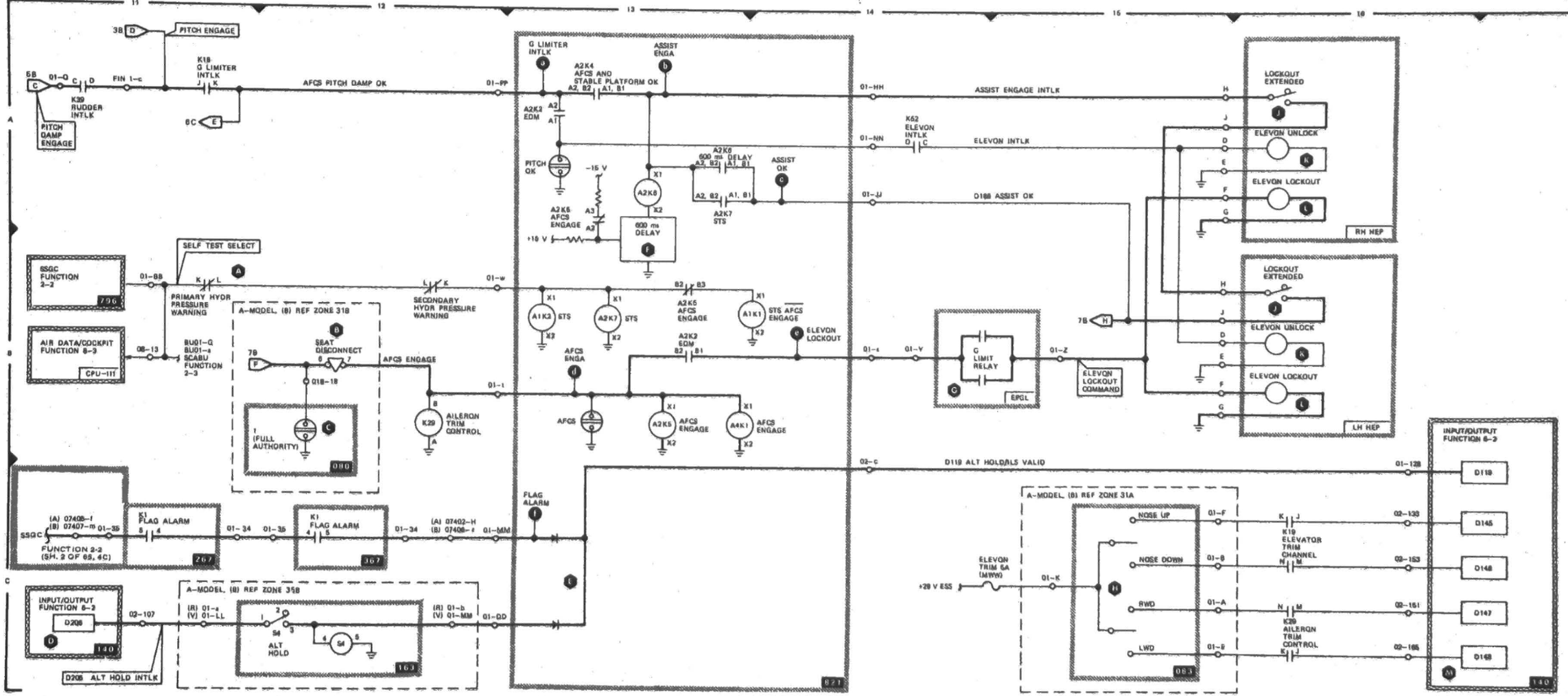


Figure 8-4. AFCS (Sheet 5 of 9)

(A) The TRT gyros provide voltage outputs proportional to the rate of aircraft movement. These voltages are scaled and used to dampen aerodynamically caused aircraft movements.

(B) The CPU-111 provides the necessary scaling of the TRT pitch and roll rate gyro outputs to compensate for differences in Q_c (airspeed) and P_s (altitude).

(C) The digital computer generates left and right elevon command signals. A54N and A55N respectively, as a result of computations which determine the difference between desired aircraft position and actual aircraft position. These computations are made from the various inputs shown throughout the diagram. The computer also uses some other inputs from the radar and SCRG for its AFCS computations. These are: E15A and E17A from the radar antenna for use during auto pursuit attack and E19, E21, E22, E23, and E24 from the SCRG for use in pilot assist and auto modes.

(D) The CPU-111 potentiometers provide a varying excitation voltage for the aileron position potentiometer. This is necessary to compensate for the aerodynamic characteristics of the aircraft at different airspeeds.

(E) The aileron position potentiometer output provides an input to the rudder control circuits to provide turn coordination.

(F) The accelerometer provides an a-c voltage output proportional to the pitch (G) forces on the aircraft. The voltage is phase detected in the 821 unit and applied to the computer for use in the AFCS computations.*

(G) The radar track error signals are applied to buffer amplifiers in the 821 unit. These signals are then applied to the computer for use in the auto attack computations.

(H) The ILS deviation signals from the ILS receivers are applied to buffer amplifiers in the 821 unit. These signals are then applied to the computer for use in the auto ILS computations.

(J) The heading error signal point or origin depends upon aircraft configuration. The a-c signal is detected in the 821 unit and used in the computers computations during the auto ILS mode of operation.

(K) The elevon position potentiometers provide a d-c voltage directly proportional to the actual position of the elevons. These voltages are applied to the computer and used in the logic for output D300 and calculation of the elevon command signals.

(L) The TRT pitch and roll rate gyro outputs are buffered in the 821 unit prior to their application to the computer. The computer utilizes these signals during pilot assist and auto mode computations to provide the proper pitch and roll axis damping.

(M) Relays A1K1 and A1K2 are used to provide a built-in self-test capability. Contacts of A1K1 allow the elevon command signals to be used as inputs to the damper mode circuits to check gain and null. Contacts of A1K2 are used to tie the outputs of the push-pull valve drivers to the E25 and E18A buffer amplifier. The computer monitors these inputs during self test. A1K1 and A1K2 are energized during damper mode testing and A1K2 and A4K1 are energized during the pilot assist and auto mode testing.

(N) Contacts of A4K1 are uses to control the source of the signals applied to the push-pull valve drivers. De-energized contacts are used during damper mode operation and energized contacts during pilot assist and auto mode operation.

(O) The rudder channel used inputs from many sources. The junction of these three resistors is a summing point. One input is the TRT roll rate gyro output, after scaling for Q_c in the CPU-111. Another input is from the aileron position amplifier. During normal operation it is a function of Q_c and control stick position. During self test it is a function of the RH elevon command signal. During the gain adjustments, it is a function of the -15 v.

(P) The HEP valves are hydraulic devices that convert mechanical or electrical input signals into hydraulic pressure outputs. These hydraulic pressure outputs are applied to the two elevon hydraulic actuators on each control surface.

(Q) The HRP valve is a hydraulic device that converts mechanical or electrical input signals into hydraulic action. The hydraulic actuator is an integral part of the HRP valve. The actuator is mechanically connected to the rudder control surface.

* Pins 01-C and 01-D represent an AC equivalent circuit and DC resistance. Checks should not be relied upon to detect a faulty unit.

(R) The digital computer monitors these analog inputs during pilot assist and auto modes of operation. E25 is derived from the TRT pitch gyro. It is used by the computer to add damper action in the pitch axis during pilot assist and auto modes of operation. E18A is derived from the TRT roll rate gyro. It is used by the computer to add damper action in the roll axis during pilot assist and auto modes of operation. E20 is derived from the output of the lift accelerometer for use in all modes of the AFCS. It is also used during steering error computations. E15N and E16N are derived from the radar azimuth and elevation track error signals. They are used as the error signal inputs during auto attack. They are also used during manual steering and missile antenna positioning computations. A11 and A26 are derived from the ILS receiver deviation signals. They are used as the error signal inputs during auto ILS. E16A is derived from the cockpit heading instrument heading error output. It is used during auto ILS to ensure that the aircraft flight path is the same as the runway heading. A21 and A22 are the outputs of the elevon feedback potentiometers. They are used during all pilot assist and auto mode computations. They are also monitored for full scale or zero as part of the logic for D200.

(S) The J4 compass system in the round instrument aircraft configuration does not provide excitation for the heading error resolver. 115 v 400 Hz 0B is stepped down, in the 821 unit, to 75 v for this purpose.

TEST POINT DATA:

(a) Pitch rate gyro output after scaling in the CPU-111.

(b) Pitch rate gyro output after scaling data is initiated in the CPU-111.

(c) Roll rate gyro output after scaling in the CPU-111.

(d) Output of TRT pitch rate gyro. 1 v per degree second of movement.

(e) Output of TRT roll rate gyro. 1 v per degree second of movement.

(f) Output of aileron position potentiometer dependent on air data computer sensed differential pressure (airspeed) and aileron position.

Airspeed	Aileron Position Potentiometer	AIL POS TP
<260 knots	right wing down	-
<260 knots	left wing down	+
>260 knots	right wing down	-
>260 knots	left wing down	+

(g) Output of TRT yaw rate gyro. .5 v degree second of output of movement.

(h) Output of glide slope receiver. ±60 v degree of deviation.

(i) Output of localizer receiver. ±12 v degree of deviation.

Figure 8-4. AFCS (Sheet 6 of 9)

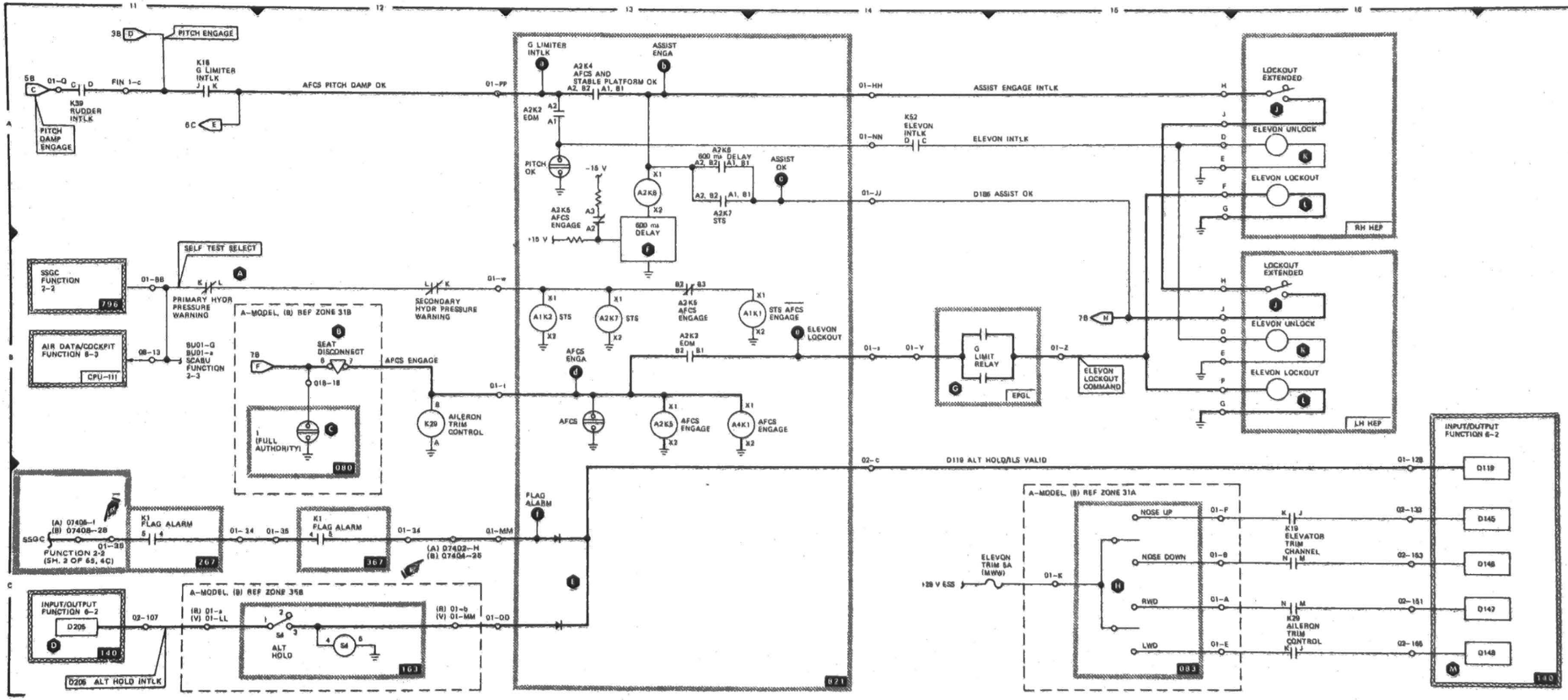


Figure 8-4. AFCS (Sheet 5 of 9)

(A) The TRT gyros provide voltage outputs proportional to the rate of aircraft movement. These voltages are scaled and used to dampen aerodynamically caused aircraft movements.

(B) The CPU-111 provides the necessary scaling of the TRT pitch and roll rate gyro outputs to compensate for differences in Q_c (airspeed) and P_s (altitude).

(C) The digital computer generates left and right elevon command signals, A54N and A55N respectively, as a result of computations which determine the difference between desired aircraft position and actual aircraft position. These computations are made from the various inputs shown throughout the diagram. The computer also uses some other inputs from the radar and SCRG for its AFCS computations. These are: E15A and E17A from the radar antenna for use during auto pursuit attack and E19, E21, E22, E23, and E24 from the SCRG for use in pilot assist and auto modes.

(D) The CPU-111 potentiometers provide a varying excitation voltage for the aileron position potentiometer. This is necessary to compensate for the aerodynamic characteristics of the aircraft at different airspeeds.

(E) The aileron position potentiometer output provides an input to the rudder control circuits to provide turn coordination.

(F) The accelerometer provides an a-c voltage output proportional to the pitch (G) forces on the aircraft. The voltage is phase detected in the 821 unit and applied to the computer for use in the AFCS computations.*

(G) The radar track error signals are applied to buffer amplifiers in the 821 unit. These signals are then applied to the computer for use in the auto attack computations.

(H) The ILS deviation signals from the ILS receivers are applied to buffer amplifiers in the 821 unit. These signals are then applied to the computer for use in the auto ILS computations.

(J) The heading error signal point or origin depends upon aircraft configuration. The a-c signal is detected in the 821 unit and used in the computers computations during the auto ILS mode of operation.

(K) The elevon position potentiometers provide a d-c voltage directly proportional to the actual position of the elevons. These voltages are applied to the computer and used in the logic for output D200 and calculation of the elevon command signals.

(L) The TRT pitch and roll rate gyro outputs are buffered in the 821 unit prior to their application to the computer. The computer utilizes these signals during pilot assist and auto mode computations to provide the proper pitch and roll axis damping.

(M) Relays A1K1 and A1K2 are used to provide a built-in self-test capability. Contacts of A1K1 allow the elevon command signals to be used as inputs to the damper mode circuits to check gain and null. Contacts of A1K2 are used to tie the outputs of the push-pull valve drivers to the E25 and E18A buffer amplifier. The computer monitors these inputs during self test. A1K1 and A1K2 are energized during damper mode testing and A1K2 and A4K1 are energized during the pilot assist and auto mode testing.

(N) Contacts of A4K1 are uses to control the source of the signals applied to the push-pull valve drivers. De-energized contacts are used during damper mode operation and energized contacts during pilot assist and auto mode operation.

(O) The rudder channel used inputs from many sources. The junction of these three resistors is a summing point. One input is the TRT roll rate gyro output, after scaling for Q_c in the CPU-111. Another input is from the aileron position amplifier. During normal operation it is a function of Q_c and control stick position. During self test it is a function of the RH elevon command signal. During the gain adjustments, it is a function of the -15 v.

(P) The HEP valves are hydraulic devices that convert mechanical or electrical input signals into hydraulic pressure outputs. These hydraulic pressure outputs are applied to the two elevon hydraulic actuators on each control surface.

(Q) The HRP valve is a hydraulic device that converts mechanical or electrical input signals into hydraulic action. The hydraulic actuator is an integral part of the HRP valve. The actuator is mechanically connected to the rudder control surface.

* Pins 01-C and 01-D represent an AC equivalent circuit and DC resistance. Checks should not be relied upon to detect a faulty unit.

(R) The digital computer monitors these analog inputs during pilot assist and auto modes of operation. E25 is derived from the TRT pitch gyro. It is used by the computer to add damper action in the pitch axis during pilot assist and auto modes of operation. E18A is derived from the TRT roll rate gyro. It is used by the computer to add damper action in the roll axis during pilot assist and auto modes of operation. E20 is derived from the output of the lift accelerometer for use in all modes of the AFCS. It is also used during steering error computations. E15N and E16N are derived from the radar azimuth and elevation track error signals. They are used as the error signal inputs during auto attack. They are also used during manual steering and missile antenna positioning computations. A11 and A28 are derived from the ILS receiver deviation signals. They are used as the error signal inputs during auto ILS. E16A is derived from the cockpit heading instrument heading error output. It is used during auto ILS to ensure that the aircraft flight path is the same as the runway heading. A21 and A22 are the outputs of the elevon feedback potentiometers. They are used during all pilot assist and auto mode computations. They are also monitored for full scale or zero as part of the logic for D200.

(S) The J4 compass system in the round instrument aircraft configuration does not provide excitation for the heading error resolver. 115 v 400 Hz ØB is stepped down, in the 821 unit, to 75 v for this purpose.

TEST POINT DATA:

(a) Pitch rate gyro output after scaling in the CPU-111.

(b) Pitch rate gyro output after being differentiated in the CPU-111.

(c) Roll rate gyro output after scaling in the CPU-111.

(d) Output of TRT pitch rate gyro: .5 v degree second of movement.

(e) Output of TRT roll rate gyro: .1 v degree second of movement.

(f) Output of aileron position potentiometer dependent on air data computer sensed differential pressure (airspeed) and aileron position.

Airspeed	Aileron Position Potentiometer	AIL POSN test point
<260 knots	right wing down	-
<260 knots	left wing down	-
>260 knots	right wing down	-
>260 knots	left wing down	-

(g) Output of TRT yaw rate gyro: .5 v degree second of output or movement.

(h) Output of glide slope receiver: ±60 v degree of deviation.

(i) Output of localizer receiver: ±12 v degree of deviation.

Figure 8-4. AFCS (Sheet 6 of 9)

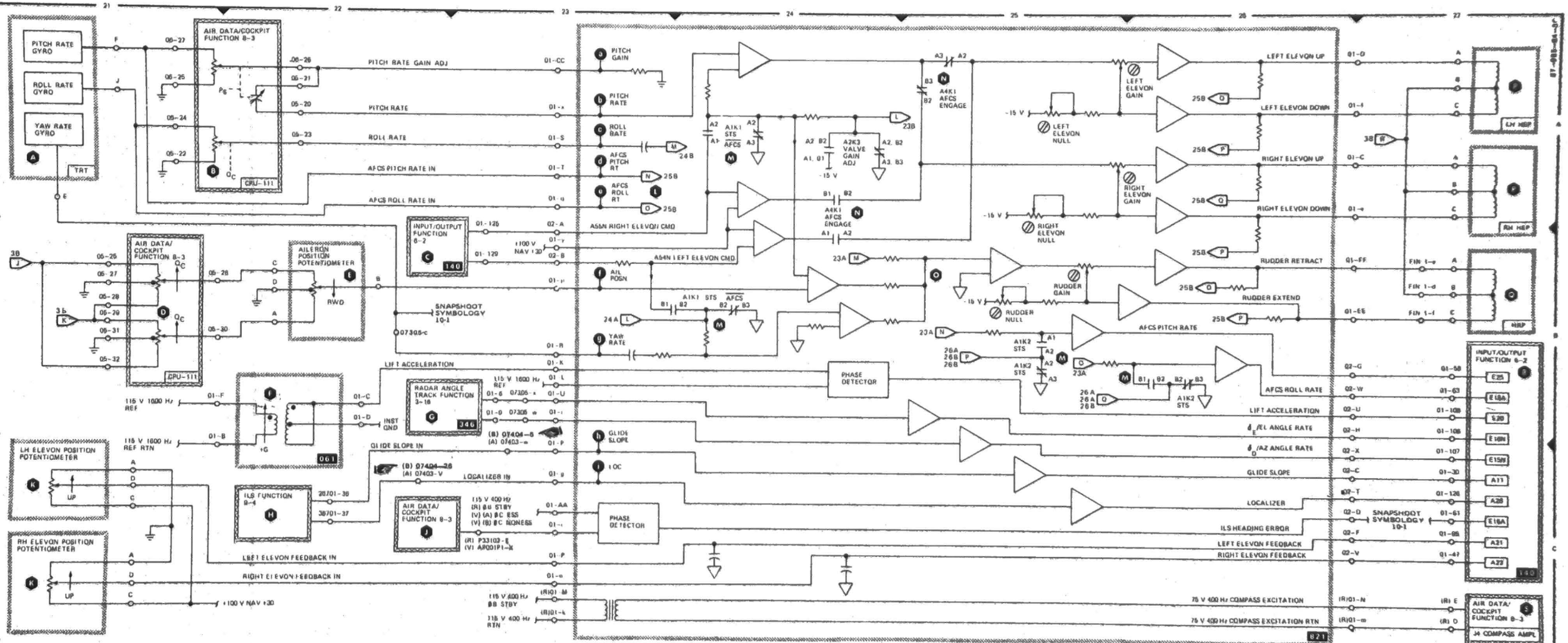


Figure 8-4. AFCS (Sheet 7 of 9)

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
163	K1	1 AND 6 2 AND 5 COIL 3 AND 7	8-4/5C 8-4/4C 8-4/5C
	K2	2 AND 5 6 AND 8 COIL 3 AND 7	8-4/4C 8-4/4C 8-4/4C
267	K1	4 AND 5 COIL 1 AND 7	8-4/11C 9-4/15B
367	K1	4 AND 5 COIL 1 AND 7	8-4/12C 9-4/26B
821	A1K1	A1, A2 AND A3 B1, B2 AND B3 COIL X1 AND X2	8-4/24A 8-4/24B 8-4/14B
	A1K2	A1, A2 AND A3 B1, B2 AND B3 COIL X1 AND X2	8-4/25B 8-4/26B 8-4/13B
	A2K1	A1 AND A2 B1 AND B2 COIL X1 AND X2	8-4/2C 8-4/2A 8-4/2A
	A2K2	A1 AND A2 B1 AND B2 COIL X1 AND X2	8-4/13A 8-4/13B 8-4/2A
	A2K3	A1, B1; A2, B2 AND A3, B3 COIL X1 AND X	8-4/24A 8-4/2A
	A2K4	A1, B1 AND A2, B2 COIL X1 AND X2	8-4/13A 8-4/1B
	A2K5	A2 AND A3 B2 AND B3 COIL X1 AND X2	8-4/13A 8-4/13B 8-4/13B
	A2K6	A1, B1 AND A2, B2 COIL X1 AND X2	8-4/13A 8-4/13A
	A2K7	A1, A2, B1, AND B2 COIL X1 AND X2	8-4/13A 8-4/13B
	A3K1	3, 7 AND 2, 8 COIL 1 AND 9	8-4/2B
	A4K1	A1 AND A2 B1 AND B2 B2 AND B3 A2 AND A3 COIL X1 AND X2	8-4/24B 8-4/24A 8-4/25A 8-4/25A 8-4/13B

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
Airframe	K18	C AND D F AND G J AND K M AND N COIL A AND B	8-4/4A 8-4/5A 8-4/11A 8-4/6B 8-4/4A
	K19	J AND K M AND N COIL A AND B	8-4/16C 8-4/16C 8-4/5A
	K22	D AND E COIL A AND B	8-4/32B 8-4/32B
	K23	D AND E COIL A AND B	8-4/32B 8-4/32B
	K24	D AND E COIL A AND B	8-4/32B 8-4/32A
	K25	D AND E COIL A AND B	8-4/32A 8-4/32B
	K29	C AND D J AND K M AND N COIL A AND B	8-4/5A 8-4/16C 8-4/16C 8-4/12B
	K39	C AND D COIL A AND B	8-4/11A 8-4/3B
	K52	C AND D COIL A AND B	8-4/14A 8-4/5A
	PRIMARY HYDR PRESSURE WARNING	K AND L	8-4/11B
	SECON-DARY HYDR PRESSURE WARNING	K AND L	8-4/12B
EPGL	G LIMIT RELAY	N.O. (2) N.O. (2)	8-4/4A 8-4/14B
LH HEP	ELEVON LOCKOUT	COIL	8-4/16A
	ELEVON UNLOCK	COIL	8-4/16A
RH HEP	ELEVON LOCKOUT	COIL	8-4/16B
	ELEVON UNLOCK	COIL	8-4/16B
HRP	RUDDER UNLOCK	COIL	8-4/3B

Figure 8-4, AFCS (Sheet 8 of 9)

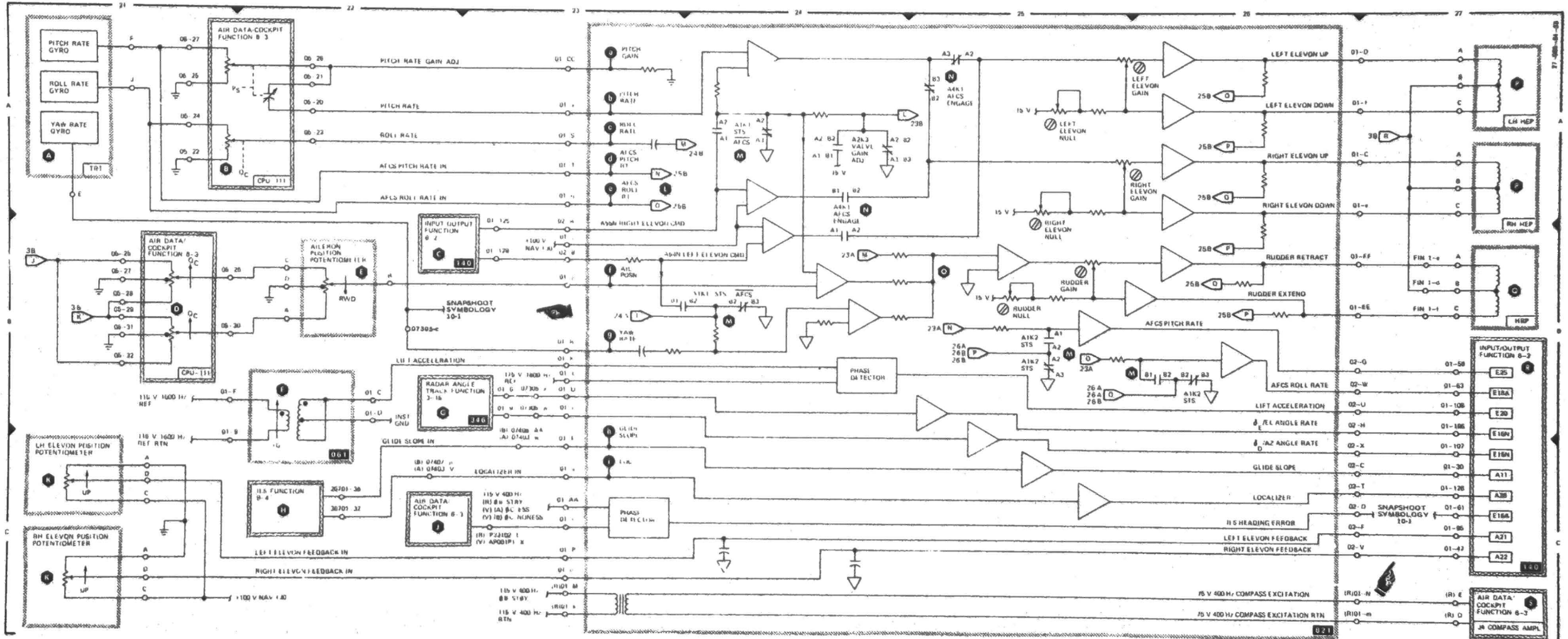


Figure 8-4. AFCS (Sheet 7 of 9)

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
103	K1	1 AND 6 2 AND 5 COIL 3 AND 7	8-4/5C 8-4/4C 8-4/5C
	K2	2 AND 5 6 AND 8 COIL 3 AND 7	8-4/4C 8-4/4C 8-4/4C
267	K1	4 AND 5 COIL 1 AND 7	8-4/11C 9-4/15B
367	K1	4 AND 5 COIL 1 AND 7	8-4/12C 9-4/26B
821	A1K1	A1, A2 AND A3 B1, B2 AND B3 COIL X1 AND X2	8-4/24A 8-4/24B 8-4/14B
	A1K2	A1, A2 AND A3 B1, B2 AND B3 COIL X1 AND X2	8-4/25B 8-4/26B 8-4/13B
	A2K1	A1 AND A2 B1 AND B2 COIL X1 AND X2	8-4/2C 8-4/2A 8-4/2A
	A2K2	A1 AND A2 B1 AND B2 COIL X1 AND X2	8-4/13A 8-4/13B 8-4/2A
	A2K3	A1, B1; A2, B2 AND A3, B3 COIL X1 AND X	8-4/24A 8-4/2A
	A2K4	A1, B1 AND A2, B2 COIL X1 AND X2	8-4/13A 8-4/1B
	A2K5	A2 AND A3 B2 AND B3 COIL X1 AND X2	8-4/13A 8-4/13B 8-4/13B
	A2K6	A1, B1 AND A2, B2 COIL X1 AND X2	8-4/13A 8-4/13A
	A2K7	A1, A2, B1, AND B2 COIL X1 AND X2	8-4/13A 8-4/13B
	A3K1	3, 7 AND 2, 8 COIL 1 AND 9	8-4/2B
	A4K1	A1 AND A2 B1 AND B2 B2 AND B3 A2 AND A3 COIL X1 AND X2	8-4/24B 8-4/24A 8-4/25A 8-4/25A 8-4/13B

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
Airframe	K18	C AND D F AND G J AND K M AND N COIL A AND B	8-4/4A 8-4/5A 8-4/11A 8-4/6B 8-4/4A
	K19	J AND K M AND N COIL A AND B	8-4/16C 8-4/16C 8-4/5A
	K22	D AND E COIL A AND B	8-4/32B 8-4/32B
	K23	D AND E COIL A AND B	8-4/32B 8-4/32B
	K24	D AND E COIL A AND B	8-4/32B 8-4/32A
	K25	D AND E COIL A AND B	8-4/32A 8-4/32B
	K29	C AND D J AND K M AND N COIL A AND B	8-4/5A 8-4/16C 8-4/16C 8-4/12B
	K39	C AND D COIL A AND B	8-4/11A 8-4/3B
	K52	C AND D COIL A AND B	8-4/14A 8-4/5A
	PRIMARY HYDR PRESSURE WARNING	K AND L	8-4/11B
	SECONDARY HYDR PRESSURE WARNING	K AND L	8-4/12B
EPGL	G LIMIT RELAY	N.O. (2) N.O. (2)	8-4/4A 8-4/14B
LH HEP	ELEVON LOCKOUT	COIL	8-4/16A
	ELEVON UNLOCK	COIL	8-4/16A
RH HEP	ELEVON LOCKOUT	COIL	8-4/16B
	ELEVON UNLOCK	COIL	8-4/16B
HRP	RUDDER UNLOCK	COIL	8-4/3B

Figure 8-4. AFCS (Sheet 8 of 9)

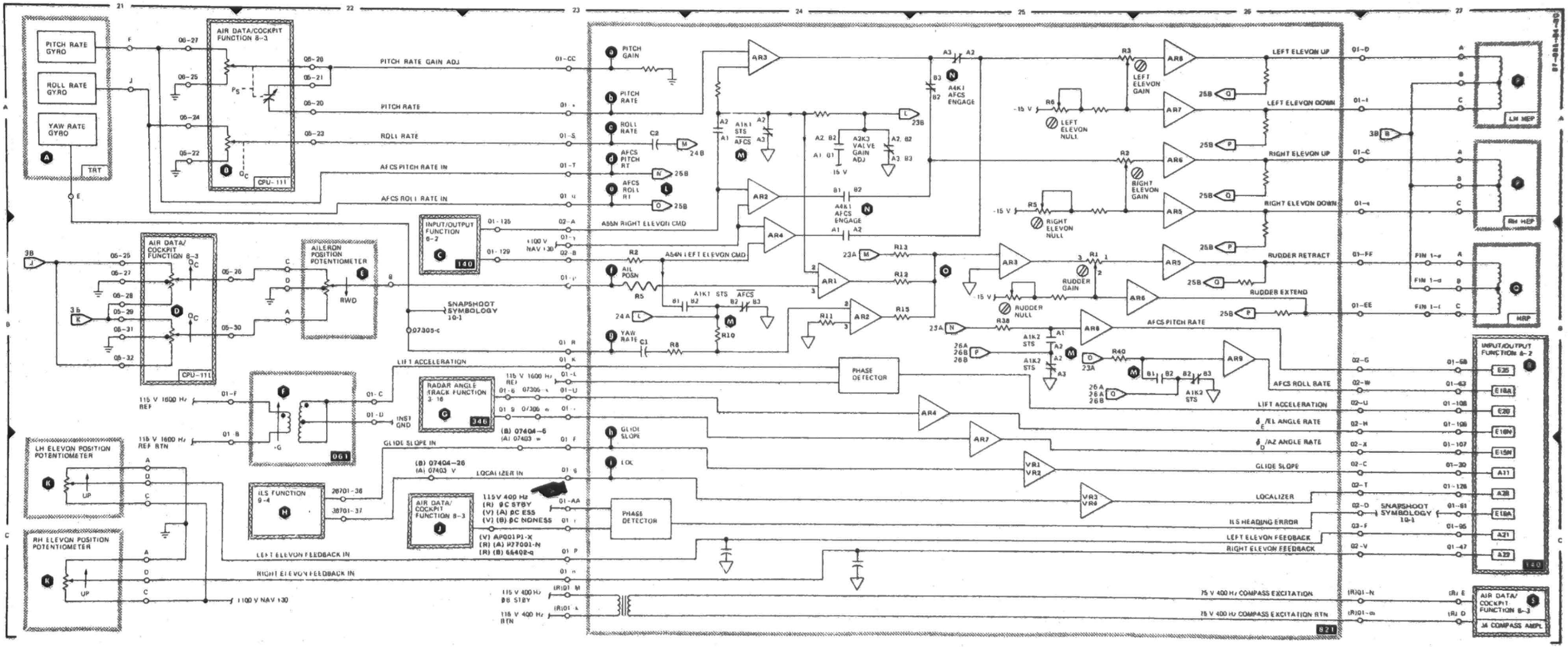


Figure 8-4. AFCS (Sheet 7 of 9)

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
163	K1	1 AND 6 2 AND 5 COIL 3 AND 7	8-4/5C 8-4/4C 8-4/5C
	K2	2 AND 5 6 AND 8 COIL 3 AND 7	8-4/4C 8-4/4C 8-4/4C
267	K1	4 AND 5 COIL 1 AND 7	8-4/11C 9-4/15B
367	K1	4 AND 5 COIL 1 AND 7	8-4/12C 9-4/26B
821	A1K1	A1, A2 AND A3 B1, B2 AND B3 COIL X1 AND X2	8-4/24A 8-4/24B 8-4/14B
	A1K2	A1, A2 AND A3 B1, B2 AND B3 COIL X1 AND X2	8-4/25B 8-4/26B 8-4/13B
	A2K1	A1 AND A2 B1 AND B2 COIL X1 AND X2	8-4/2C 8-4/2A 8-4/2A
	A2K2	A1 AND A2 B1 AND B2 COIL X1 AND X2	8-4/13A 8-4/13B 8-4/2A
	A2K3	A1, B1; A2, B2 AND A3, B3 COIL X1 AND X	8-4/24A 8-4/2A
	A2K4	A1, B1 AND A2, B2 COIL X1 AND X2	8-4/13A 8-4/1B
	A2K5	A2 AND A3 B2 AND B3 COIL X1 AND X2	8-4/13A 8-4/13B 8-4/13B
	A2K6	A1, B1 AND A2, B2 COIL X1 AND X2	8-4/13A 8-4/13A
	A2K7	A1, A2, B1, AND B2 COIL X1 AND X2	8-4/13A 8-4/13B
	A3K1	3, 7 AND 2, 8 COIL 1 AND 9	8-4/2B
	A4K1	A1 AND A2 B1 AND B2 B2 AND B3 A2 AND A3 COIL X1 AND X2	8-4/24B 8-4/24A 8-4/25A 8-4/25A 8-4/13B

UNIT	RELAY	CONTACTS	FIGURE/ ZONE
Airframe	K18	C AND D F AND G J AND K M AND N COIL A AND B	8-4/4A 8-4/5A 8-4/11A 8-4/6B 8-4/4A
	K19	J AND K M AND N COIL A AND B	8-4/16C 8-4/16C 8-4/5A
	K22	D AND E COIL A AND B	8-4/32B 8-4/32B
	K23	D AND E COIL A AND B	8-4/32B 8-4/32B
	K24	D AND E COIL A AND B	8-4/32B 8-4/32A
	K25	D AND E COIL A AND B	8-4/32A 8-4/32B
	K29	C AND D J AND K M AND N COIL A AND B	8-4/5A 8-4/16C 8-4/16C 8-4/12B
	K39	C AND D COIL A AND B	8-4/11A 8-4/3B
	K52	C AND D COIL A AND B	8-4/14A 8-4/5A
	PRIMARY HYDR PRESSURE WARNING	K AND L	8-4/11B
	SECONDARY HYDR PRESSURE WARNING	K AND L	8-4/12B
EPGL	G LIMIT RELAY	N.O. (2) N.O. (2)	8-4/4A 8-4/14B
LH HEP	ELEVON LOCKOUT	COIL	8-4/16A
	ELEVON UNLOCK	COIL	8-4/16A
RH HEP	ELEVON LOCKOUT	COIL	8-4/16B
	ELEVON UNLOCK	COIL	8-4/16B
HRP	RUDDER UNLOCK	COIL	8-4/3B

Figure 8-4. AFCS (Sheet 8 of 9)

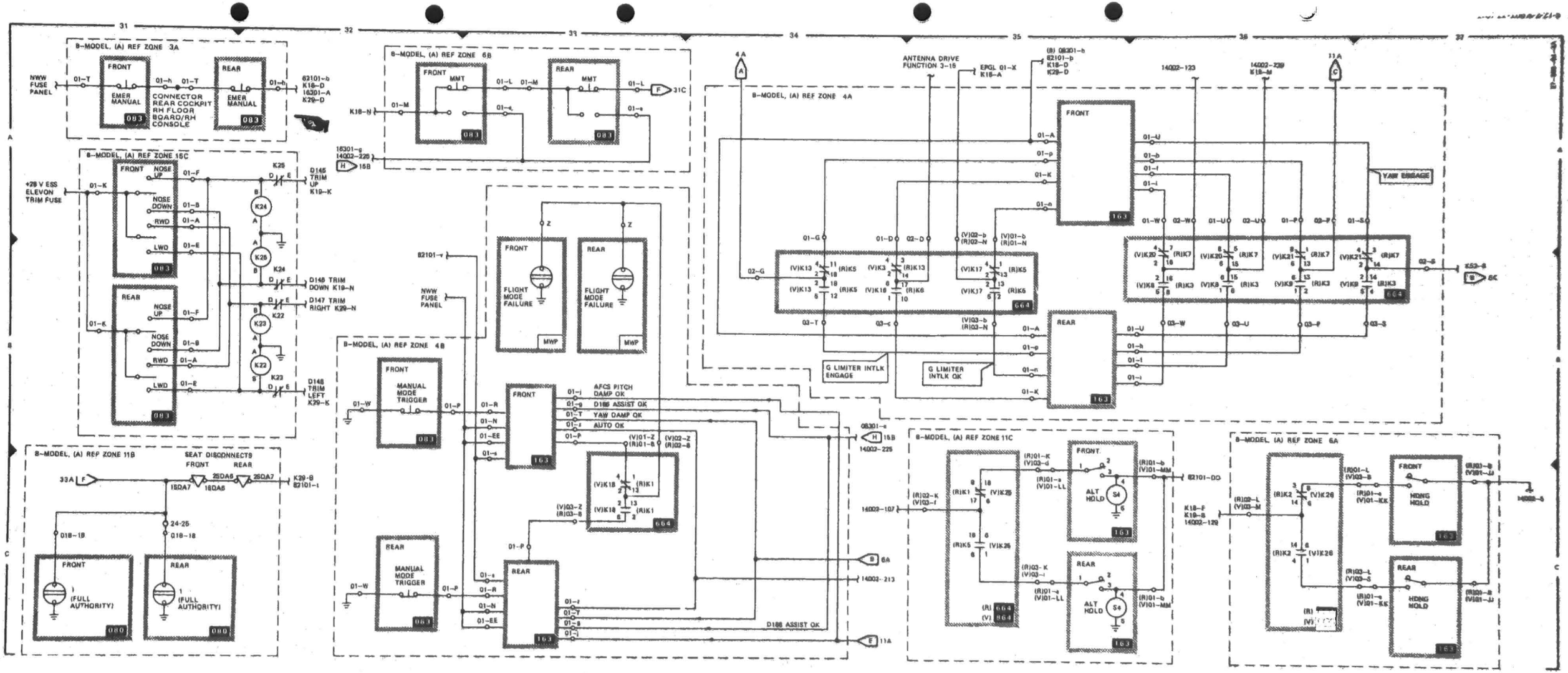
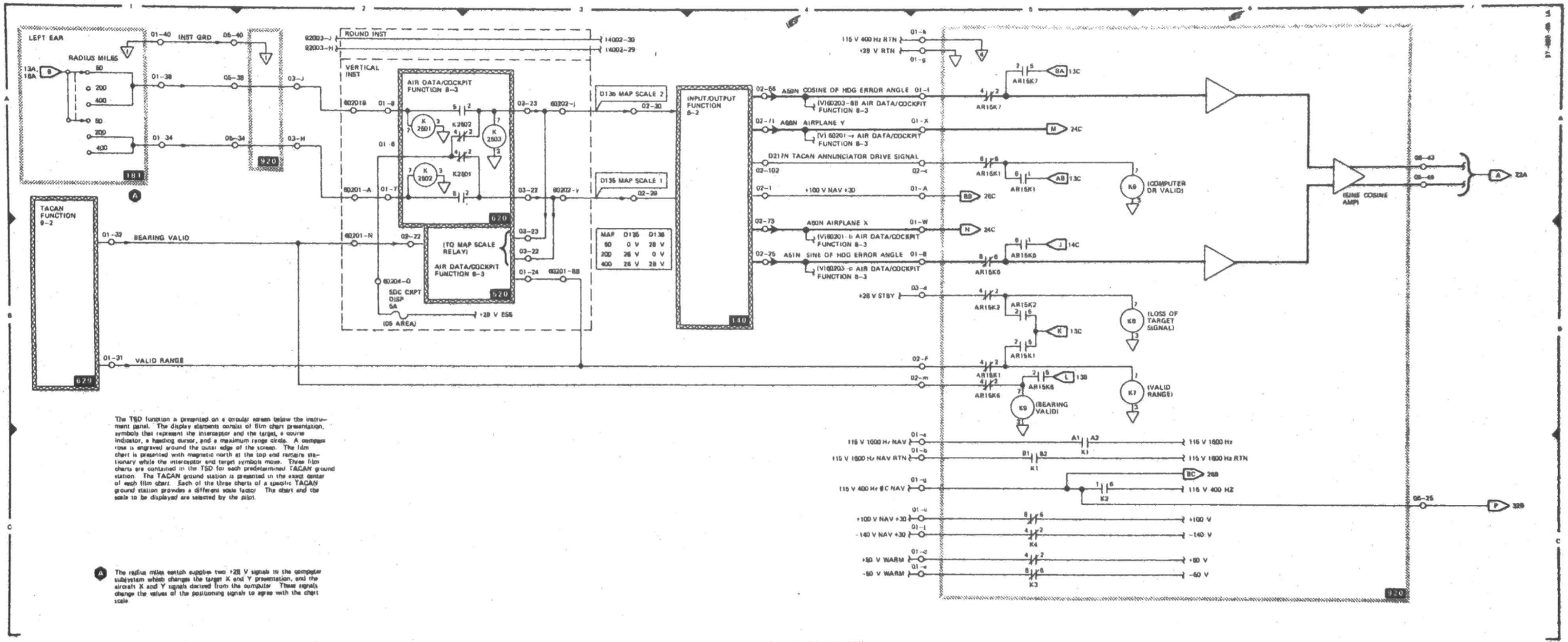


Figure 8-4. AFCS (Sheet 9 of 9)



The TSD function is presented on a circular screen below the instrument panel. The display elements consist of film chart presentation, symbols that represent the interceptor and the target, a course indicator, a heading cursor, and a maximum range circle. A compass rose is engraved around the outer edge of the screen. The film chart is presented with magnetic north at the top and remains stationary while the interceptor and target symbols move. Three film charts are contained in the TSD for each predetermined TACAN ground station. The TACAN ground station is presented in the exact center of each film chart. Each of the three charts of a specific TACAN ground station provides a different scale factor. The chart and the scale to be displayed are selected by the pilot.

(A) The radius miles switch supplies two +28 V signals to the computer subsystem which changes the target X and Y presentation, and the aircraft X and Y signals derived from the computer. These signals change the values of the positioning signals to agree with the chart scale.

Figure 8-5. TSD (Sheet 1 of 11)

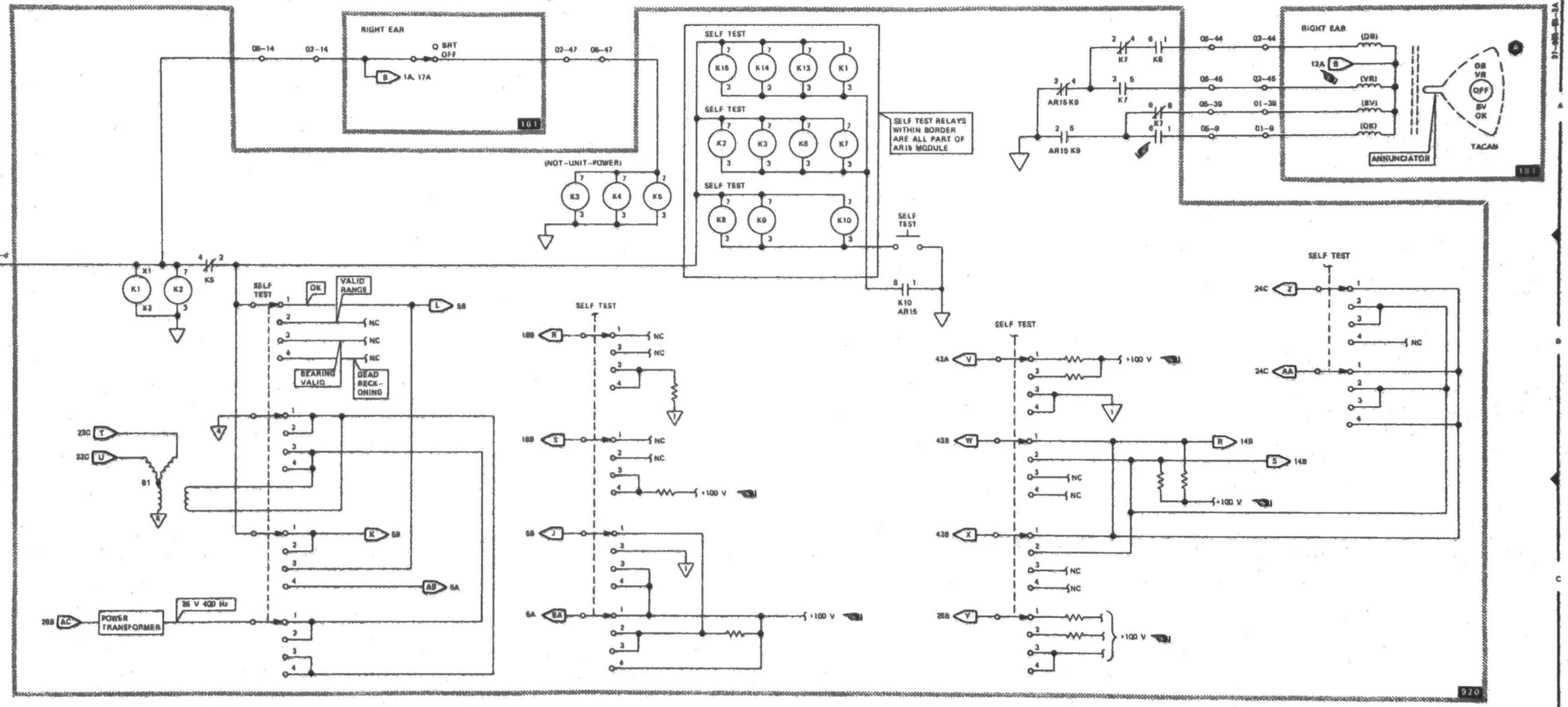


Figure 8-5. TSD (Sheet 2 of 11)

A The Aircraft X positioning channel controls the position of the aircraft symbol in the X or left-right direction on the map display. The digital computer or self test function supplies a signal to control the aircraft symbol. The signal from the computer is derived from TACAN range and bearing information when either or both the range and bearing signals are invalid, the computer switches to dead reckoning. The input signals from the digital computer or self-test function is compared with a feedback signal from the feedback pot that represents the actual aircraft X position. If a difference exists, an error signal is generated to position the aircraft symbol in the desired position. The aircraft X position consists of the aircraft X pot, scale factor pot, aircraft X servo amplifier, aircraft X Servo Motor and feedback pot.

B The aircraft Y positioning channel controls the positioning of the aircraft symbol in the vertical direction of the map display. The digital computer or self test function supplies a signal to control the aircraft symbol. The input signal from the digital computer is compared with a feedback signal, representing actual aircraft Y position. If a difference exists, an error signal is generated to position the aircraft symbol to the desired position. The operation of aircraft Y positioning channel is identical to the operation of the aircraft X positioning channel.

C The maximum range ir is position channel controls the action of the maximum range iris on the aircraft reticle. The computer subsystem provides +100 v NAV +30 signal to the maximum range iris positioning channel. The signal from the power subsystem drives the maximum range iris to the fully open position during system operation. For purposes of self-test, the iris may be decreased to smaller openings representing decreasing range. The maximum range signal from the power subsystem is compared with a feedback signal that represents the maximum range. If a difference exists, an error signal is generated to correct the maximum range iris position.

The course indicator positioning channel positions the grid overlay lines on the map display. Three input signals control the position of the grid overlay lines: the sine and cosine of the computed heading error from the digital computer, the ADF signal from the ADF antenna resolver, and the manual overlay position control which sets the grid overlay lines manually from the cockpit. The grid overlay lines represent the desired aircraft heading controlled by MAN COURSE knob, data link command, or for navigation purposes, the direction to communications or data link transmitter.

The aircraft heading cursor and aircraft heading channels provides the indication of current interceptor heading. This information is indicated by position of the aircraft heading cursor and the direction the aircraft symbol is pointing on the viewing screen. The compass heading signals are the input to the function and are applied to the aircraft heading synchro control transformer. The input compass heading signals are compared in the aircraft heading synchro control transformer with the actual heading indicated by the aircraft heading cursor. If a difference exists an error signal is generated. This error signal is amplified and used to drive the servo motor to position the heading cursor. The cursor is positioned until the heading agrees with the input compass heading. At this time the error signal is a null, or zero. The heading of the interceptor symbol is slaved to the heading of the cursor.

E The MODE switch allows the course indicator to be controlled by either ADF heading resolver or manual overlay position resolver output signals. When the switch is set to AUTO, the signals from the ADF heading resolver control the positioning of the grid overlay lines on the map display. When the MODE selector switch is set to MAN position, the signals generated by manual overlay position resolver positions the grid overlay lines.

G ADF HEADING RESOLVER B4. The servo motor B15 also positions the rotor of the ADF heading resolver to a displacement equal to the magnetic heading of the aircraft. The ADF function is performed by the HSI which also has the capability to include TACAN bearing as a form of ADF. The rotor displacement of the ADF heading resolver represents magnetic heading of the aircraft. The resolver converts the relative heading error (referenced to axis of the airframe) input from the computer to a magnetic heading error indicated by the grid overlay lines.

H GRID OVERLAY LINES. The MODE selector control provides selection of the manual or automatic mode for the grid lines. In the MAN position, the manual overlay position resolver controls the grid lines. In the AUTO position of the MODE selector control, the sin and cos of the heading error signal are used to position the grid lines. The heading error signal is generated in the computer and can be utilized in either a data link or AUTO NAV mode. In AUTO mode, the computer supplies the required sin (A51N) and cos (A59N) of heading error inputs to the grid overlay line channel.

Figure 8-5. TSD (Sheet 3 of 11)

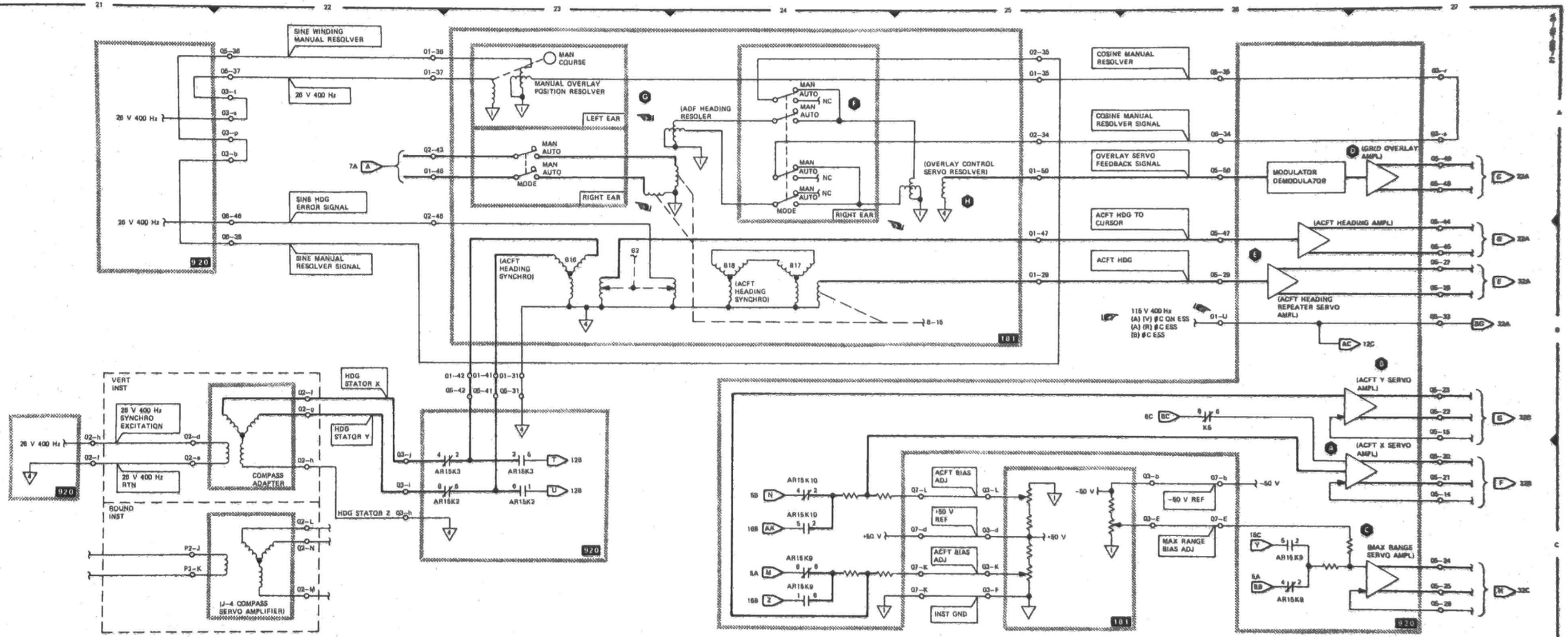


Figure 8-5. TSD (Sheet 4 of 11)

31 32 33 34 35 36

(A) The interceptor symbol is a small triangular symbol approximately 3/4 - inch long projected on the screen to represent the interceptor. A centerline through the symbol, representing the centerline of the interceptor, gives an approximation of the heading of the interceptor. The small heading cursor that appears at the edge of the display and near the compass rose represents a more precise heading.

(B) The command heading to be flown is indicated by parallel grid lines (course indicator grids) projected on the screen. The line through the diameter of the display has an arrowhead on one end to indicate the command heading in relation to the compass rose.

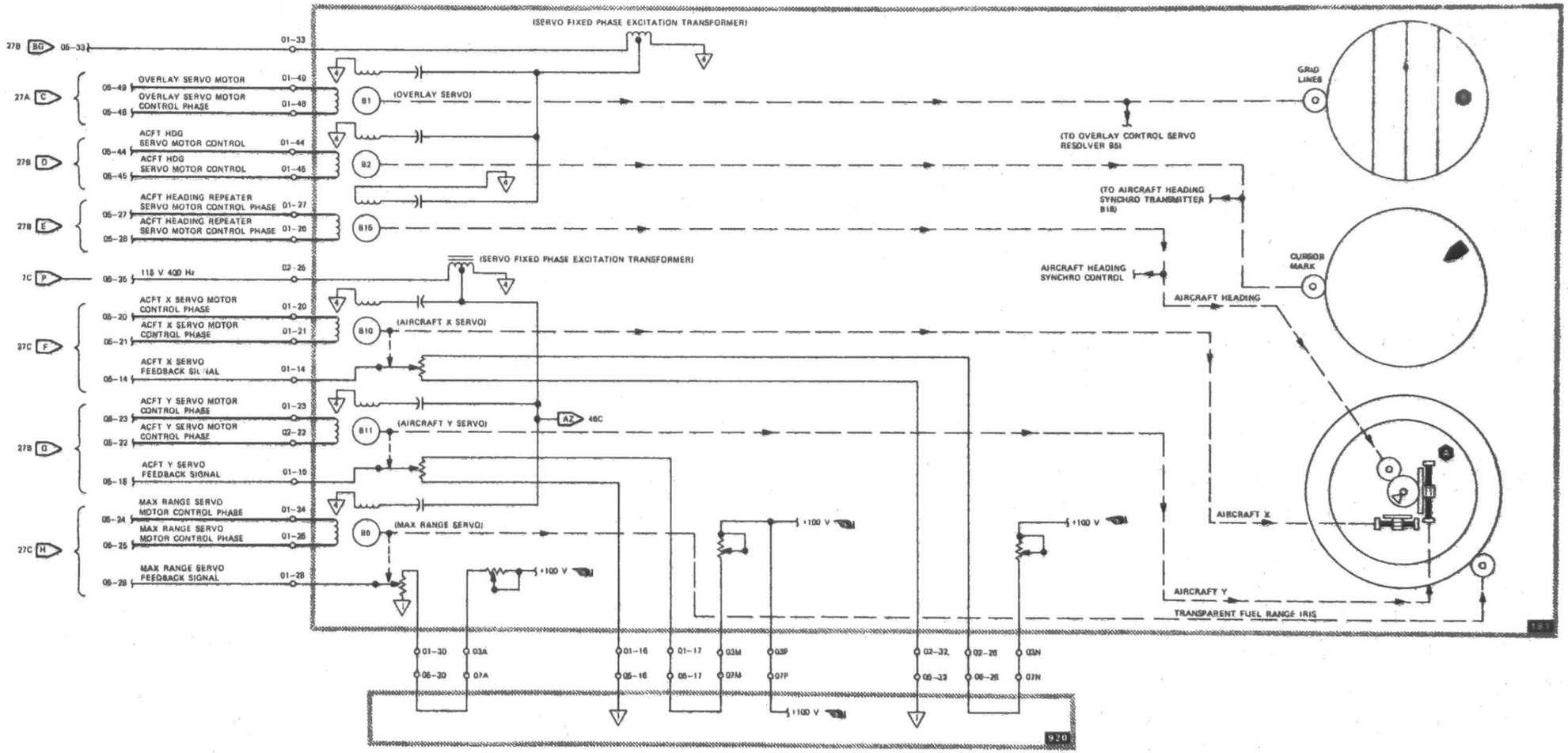


Figure 8-5. TSD (Sheet 5 of 11)

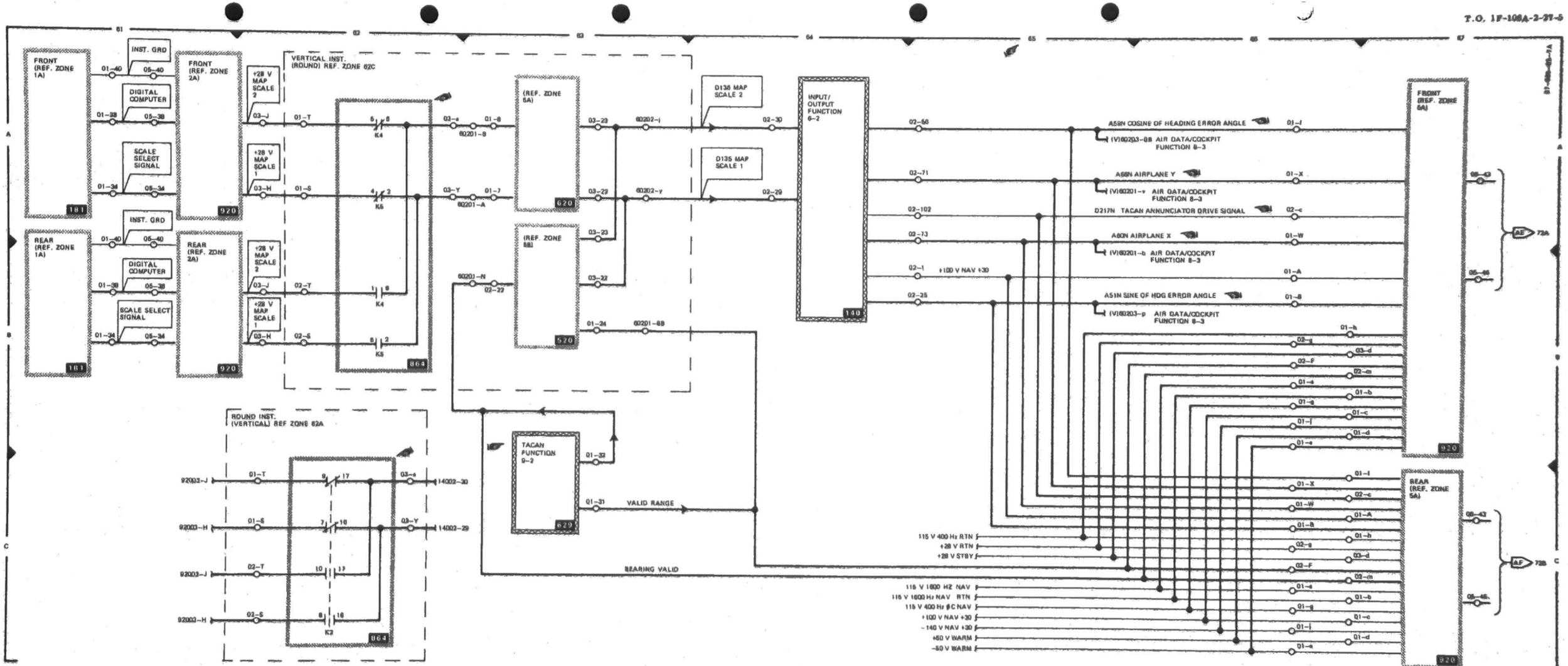


Figure 8-5. TSD (Sheet 8 of 11)

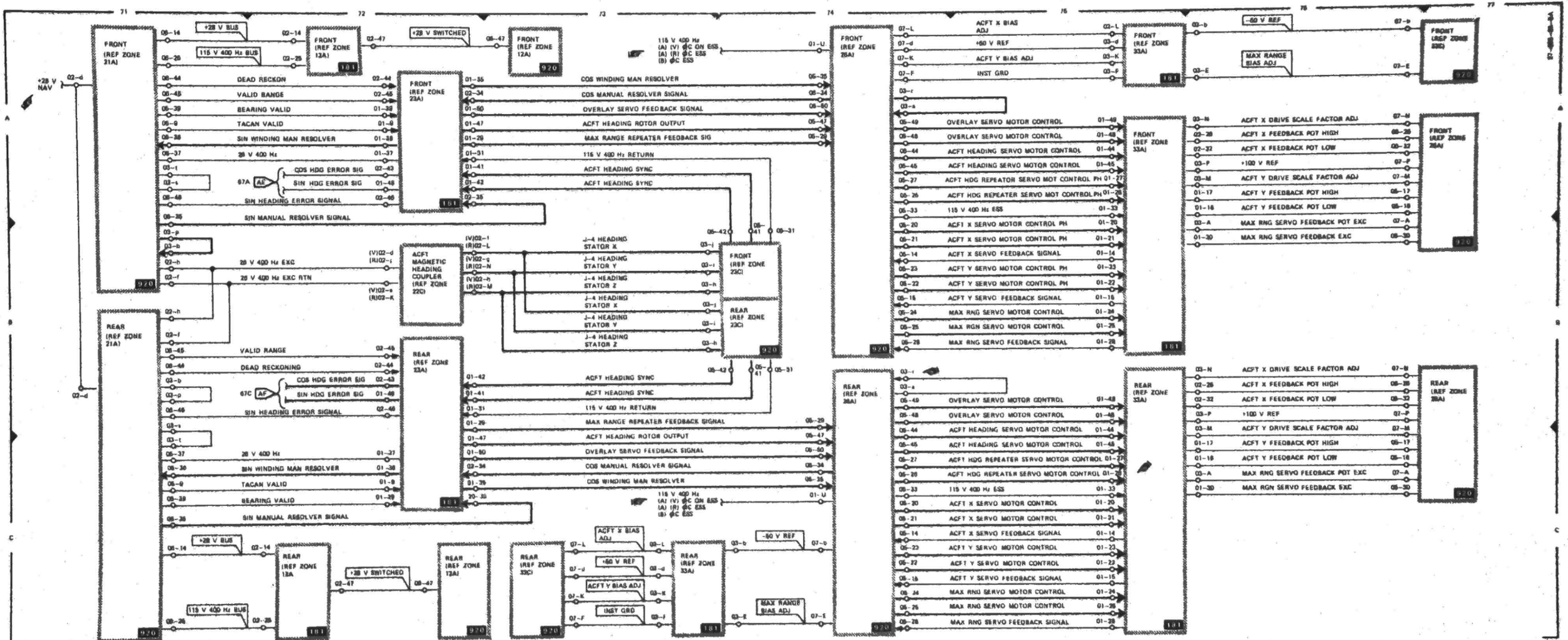


Figure 8-5. TSD (Sheet 9 of 11)

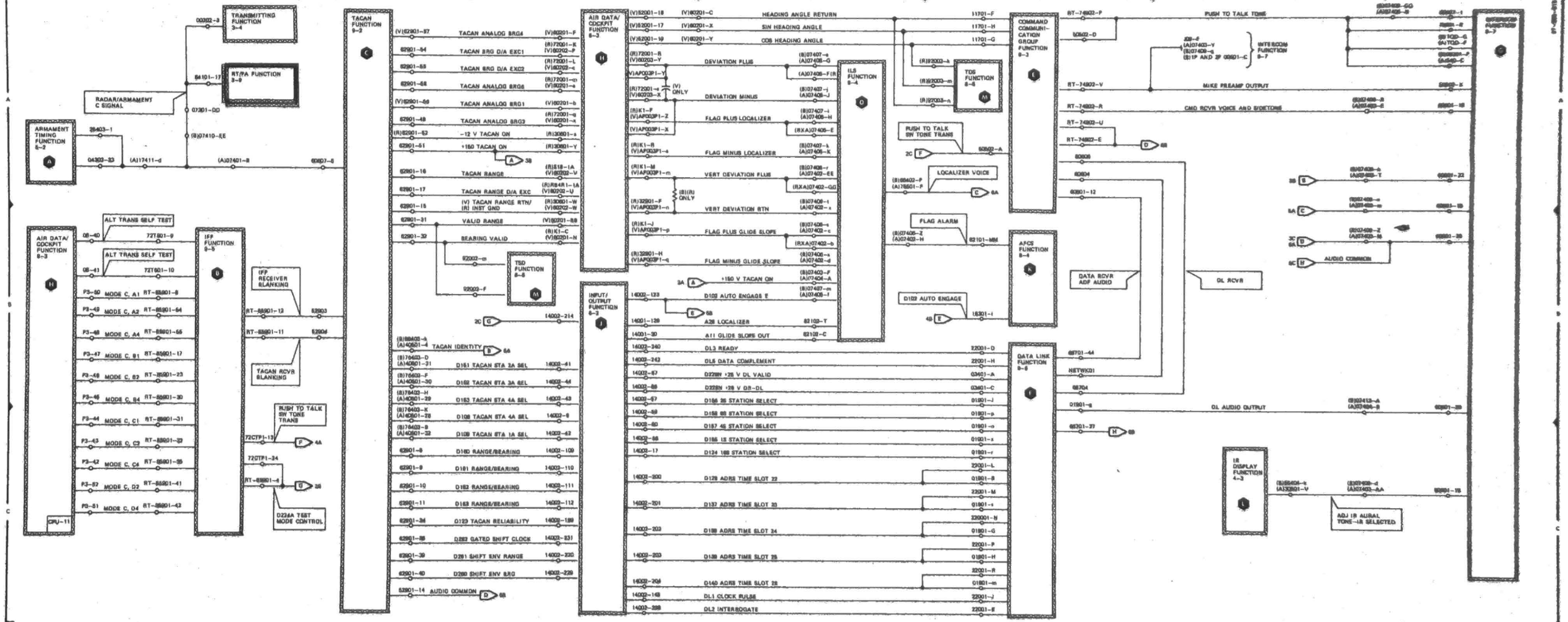


Figure 9-1. CNIL Subsystem Block Diagram (Sheet 2 of 2)

The tactical air navigation (TACAN) function of the MA-1 system assists the pilot to navigate the interceptor by providing magnetic bearing and range reference to a TACAN ground station or range only from a cooperating aircraft in air-to-air operation.

The pilot selects the desired TACAN ground station on the channel selector control (405). Twenty-four (24) positions are provided on the PRESET channel selector to enable the pilot to select 23 preset of 126 possible TACAN channels. Position M enables the Pilot to select any of the 126 TACAN channels with the MAN channel selector. The MODE switch provides the capability of receiving signals from an additional 126 channels by providing two modes (X or Y) of operation. The 23 preset positions automatically provide 23 TACAN station map-charts of 50, 200, or 400 nautical radius miles displayed on the Tactical Situation Display (181) screen.

The ground station periodically transmits a series of r-f pulse-pairs. These are the reference bearing signals which the airborne equipment (529) compares with a variable amplitude bearing signal. The electrical angular difference between the two is a measure of the bearing of the interceptor with respect to the ground station. The range is determined by radar timing principle. The airborne equipment (529) initiates an interrogative pulse-pair, which is received by the ground beacon receiver and in turn triggers the ground beacon transmitter which transmits an answering pulse-pair. The time differential between interrogation and reply determines the slant range to the TACAN station.

When the transmitter-receiver (529) receives the bearing and range signals, these signals are decoded and converted to binary information as input to the 629 unit. The signal data converter (629) converts the binary range and bearing into analog signals for display on the cockpit instruments and into digital signals to the computer (140) used in computing interceptor position for display on the Tactical Situation Display (181) screen.

(A) Transfers power from the MA-1 power subsystem to aircraft power. Relay is [illegible] always energized with +28 V warm from MA-1 power supply under normal operating condition.

(B) Contains filters and power conversion circuits necessary to operate the receiver-transmitter and other TACAN units. Relay K1 is energized when PRESET function switch (405) is set to REC, T/R or A/A.

(C) Provides +150 V and −50 V regulated power supply voltages. Also transmits a +150 V no-go signal from its self test circuits when the +150 V output differs from the nominal by ±5 V.

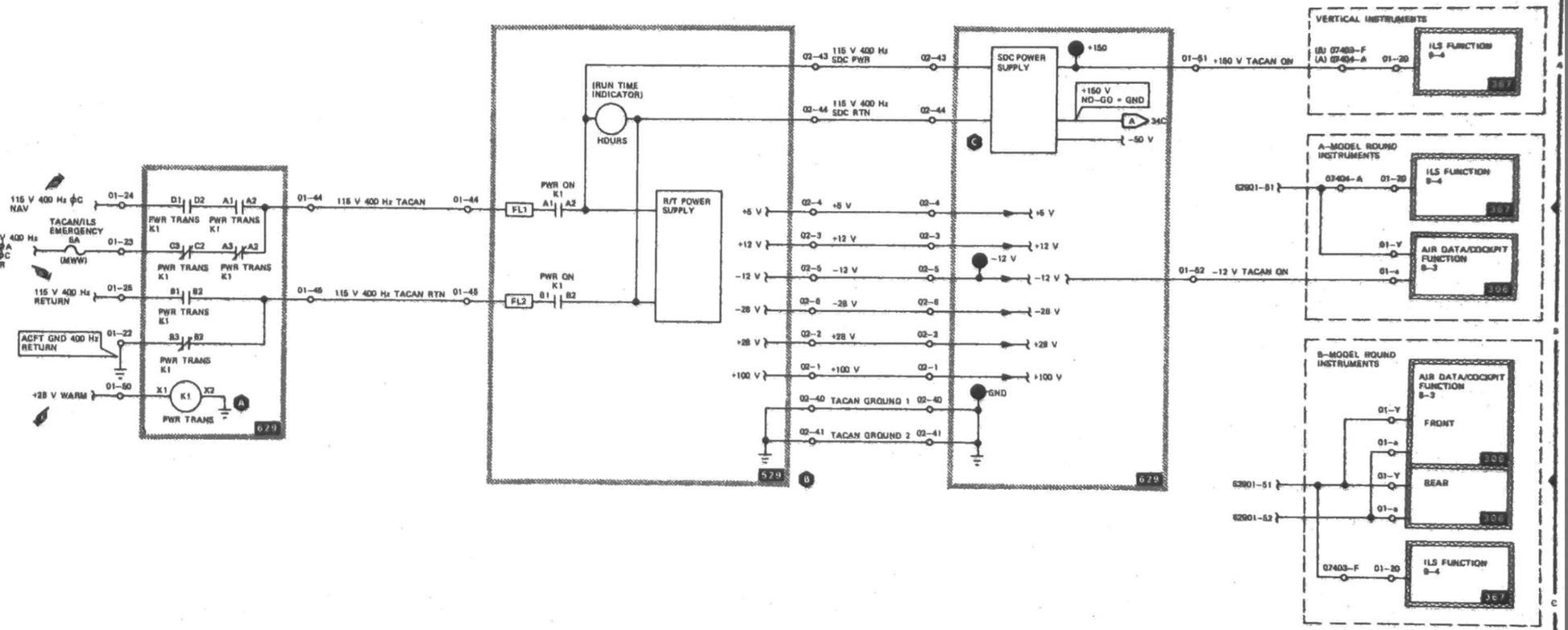


Figure 9-2. TACAN (Sheet 1 of 8)

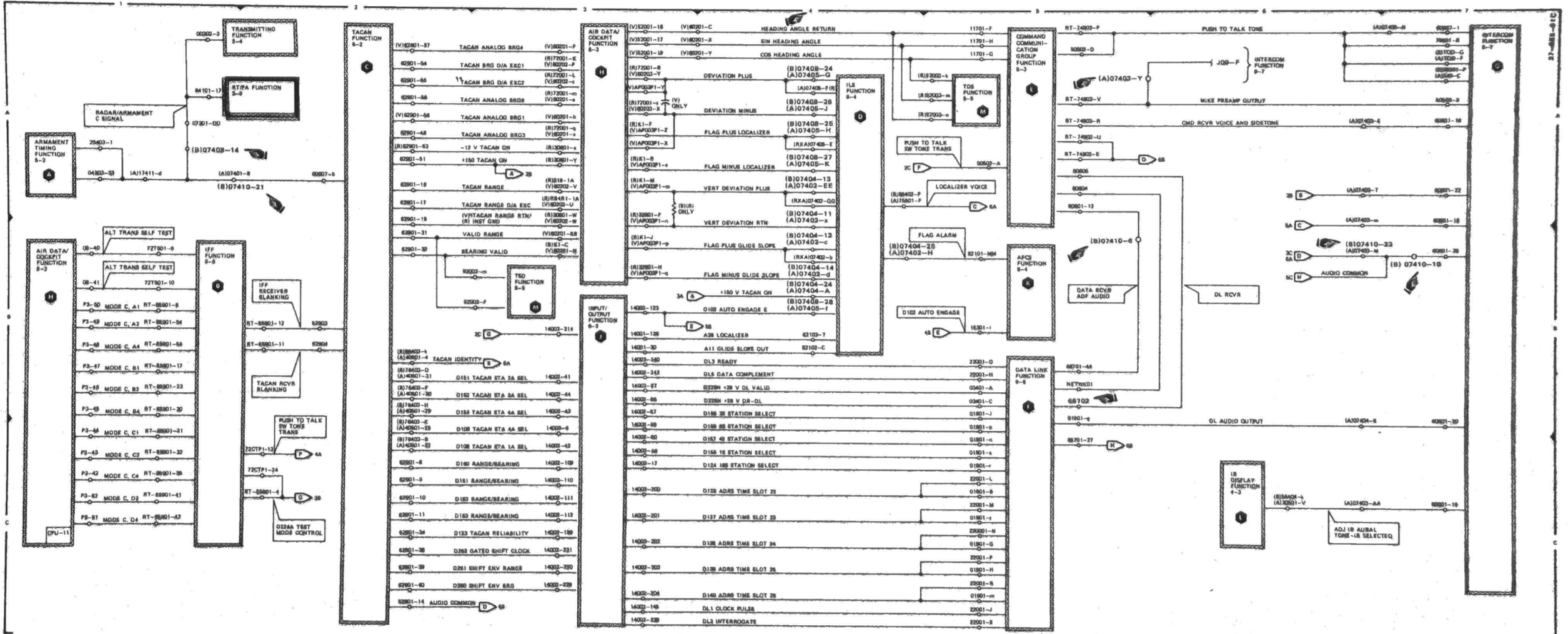


Figure 9-1. CN&L Subsystem Block Diagram (Sheet 2 of 2)

The tactical air navigation (TACAN) function of the MA-1 system assists the pilot to navigate the interceptor by providing magnetic bearing and range reference to a TACAN ground station or range only from a cooperating aircraft in air-to-air operation.

The pilot selects the desired TACAN ground station on the channel selector control (405). Twenty-four (24) positions are provided on the PRESET channel selector to enable the pilot to select 23 preset of 126 possible TACAN channels. Position M enables the Pilot to select any of the 126 TACAN channels with the MAN channel selector. The MODE switch provides the capability of receiving signals from an additional 126 channels by providing two modes (X or Y) of operation. The 23 preset positions automatically provide 23 TACAN station map-charts of 50, 200, or 400 nautical radius miles displayed on the Tactical Situation Display (181) screen.

The ground station periodically transmits a series of r-f pulse-pairs. These are the reference bearing signals which the airborne equipment (529) compares with a variable amplitude bearing signal. The electrical angular difference between the two is a measure of the bearing of the interceptor with respect to the ground station. The range is determined by radar timing principle. The airborne equipment (529) initiates an interrogative pulse-pair, which is received by the ground beacon receiver and in turn triggers the ground beacon transmitter which transmits an answering pulse-pair. The time differential between interrogation and reply determines the slant range to the TACAN station.

When the transmitter-receiver (529) receives the bearing and range signals, these signals are decoded and converted to binary information as input to the 629 unit. The signal data converter (629) converts the binary range and bearing into analog signals for display on the cockpit instruments and into digital signals to the computer (140) used in computing interceptor position for display on the Tactical Situation Display (181) screen.

(A) Transfers power from the MA-1 power subsystem to aircraft power. Relay is always energized with +28 V warm from MA-1 power supply under normal operating condition.

(B) Contains filters and power conversion circuits necessary to operate the receiver-transmitter and other TACAN units. Relay K1 is energized when PRESET function switch (405) is set to REC, T/R or A/A.

(C) Provides +150 V and -50 V regulated power supply voltages. Also transmits a +150 V no-go signal from its self test circuits when the +150 V output differs from the nominal by ±5 V.

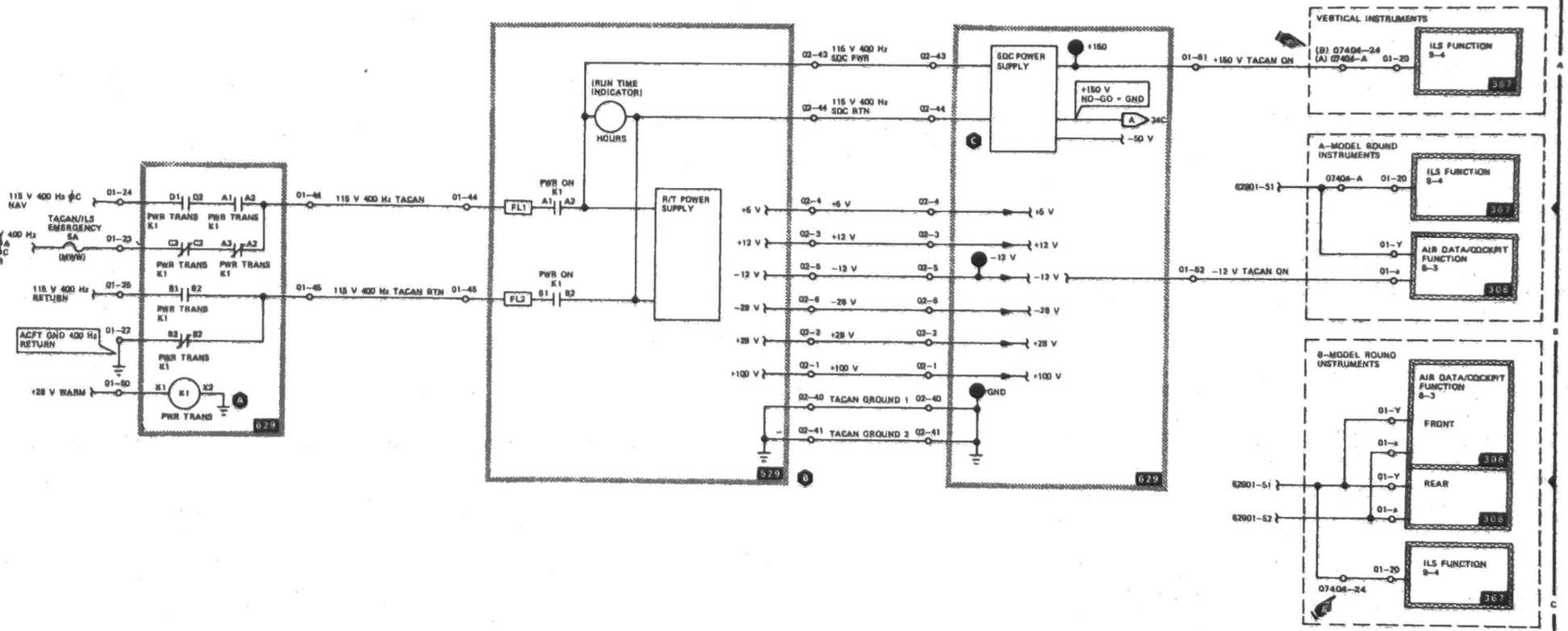


Figure 9-3. TACAN (Sheet 1 of 6)

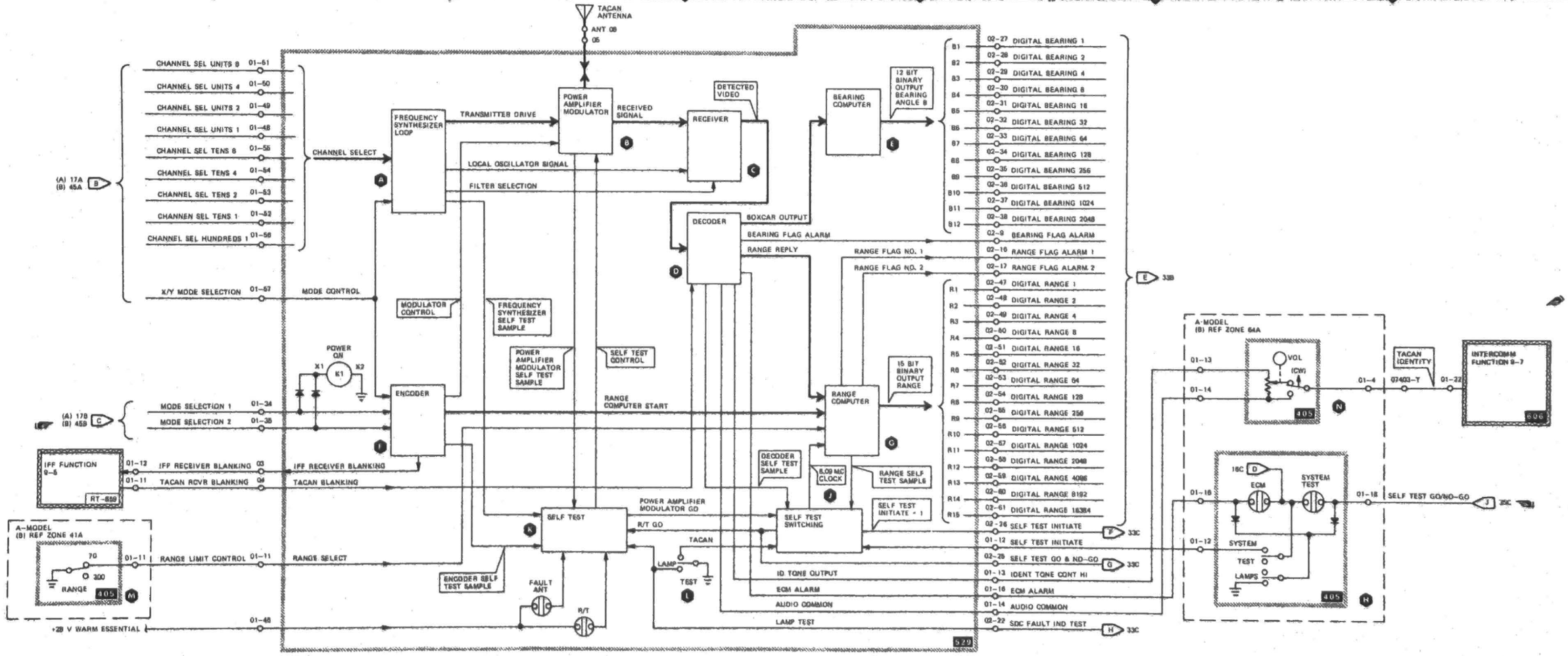


Figure 9-2. TACAN (Sheet 4 of 8)

The 629 unit is the signal data converter for the TACAN function. It converts the digital range and bearing information from the receiver - transmitter (529) into analog signals to drive cockpit display instruments.

- **A** Switches provide a five digit binary number for each of the twenty four PRESET switch positions to inform the computer (140 unit) which preset channel is selected.
- **B** Converts the digital bearing signals into sine and cosine analog signals to be applied to various bearing display circuits.
- **C** Converts digital bearing and range bit information into a form suitable for use with the MA-1 computer requirements. Transfers data when command signals (shift envelope range, shift envelope bearing) are received from the MA-1 computer.
- **D** Converts digital range signal into analog signal to be applied to various range display circuits.
- **E** Indicates testing of the range/bearing digital output function and the SDC +150 V power supply voltage and monitors the outputs. Any SDC faults generate a lamp driver signal. If all functions are operating, it places a +28 V lamp unlighting signal to the FAULT lamp in the 629 unit and the SYSTEM TEST lamp in the 529 unit.
- **F** Provides lamp driving signals to the FAULT lamp (629) and the SYSTEM TEST lamp (529 unit) under fault conditions.

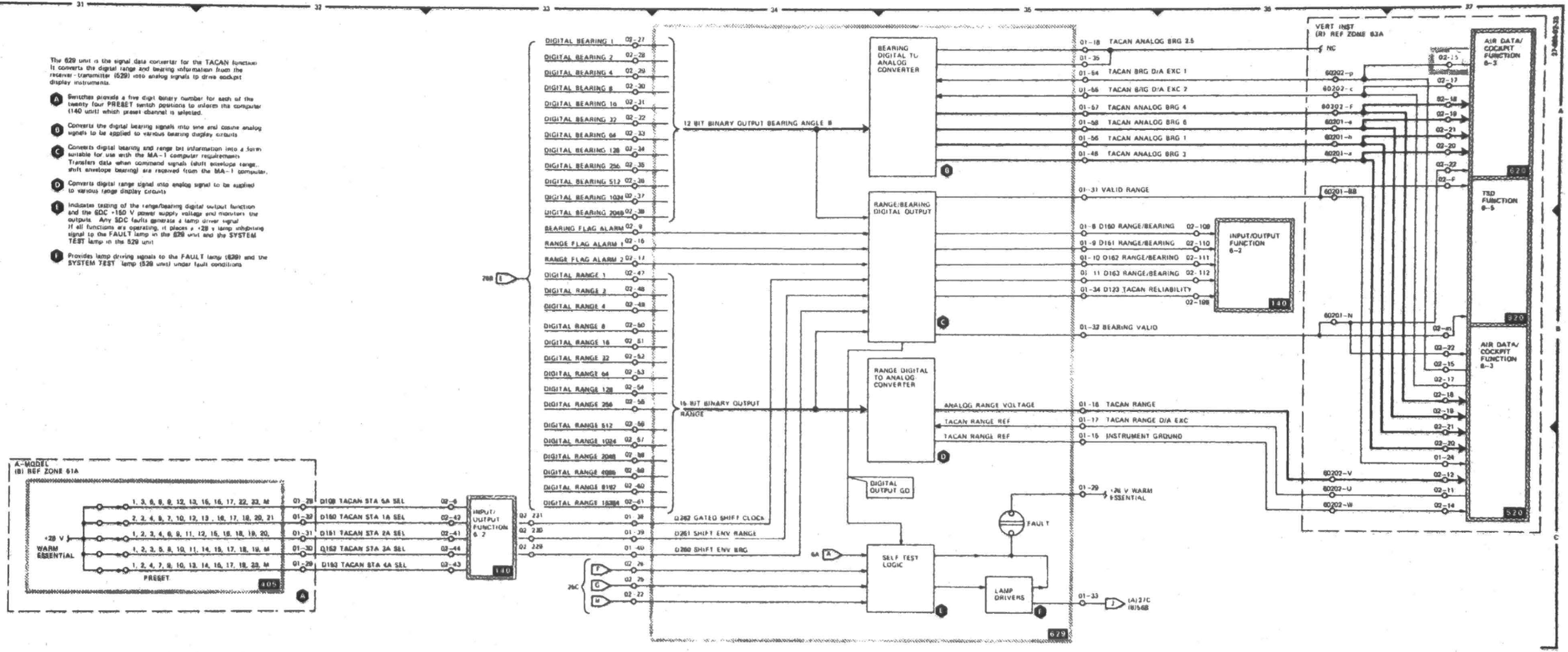


Figure 6-2. TACAN (Sheet 5 of 8)

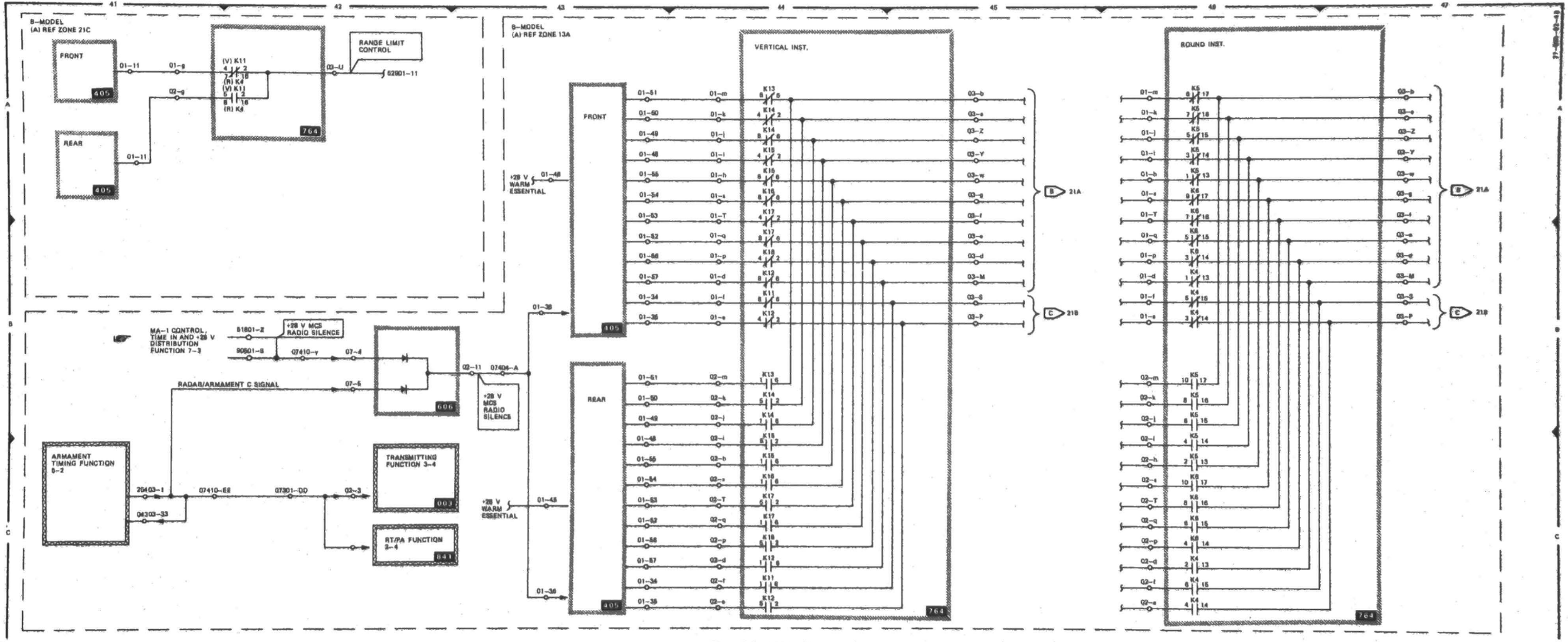


Figure 9-3. TACAN (Sheet 6 of 8)

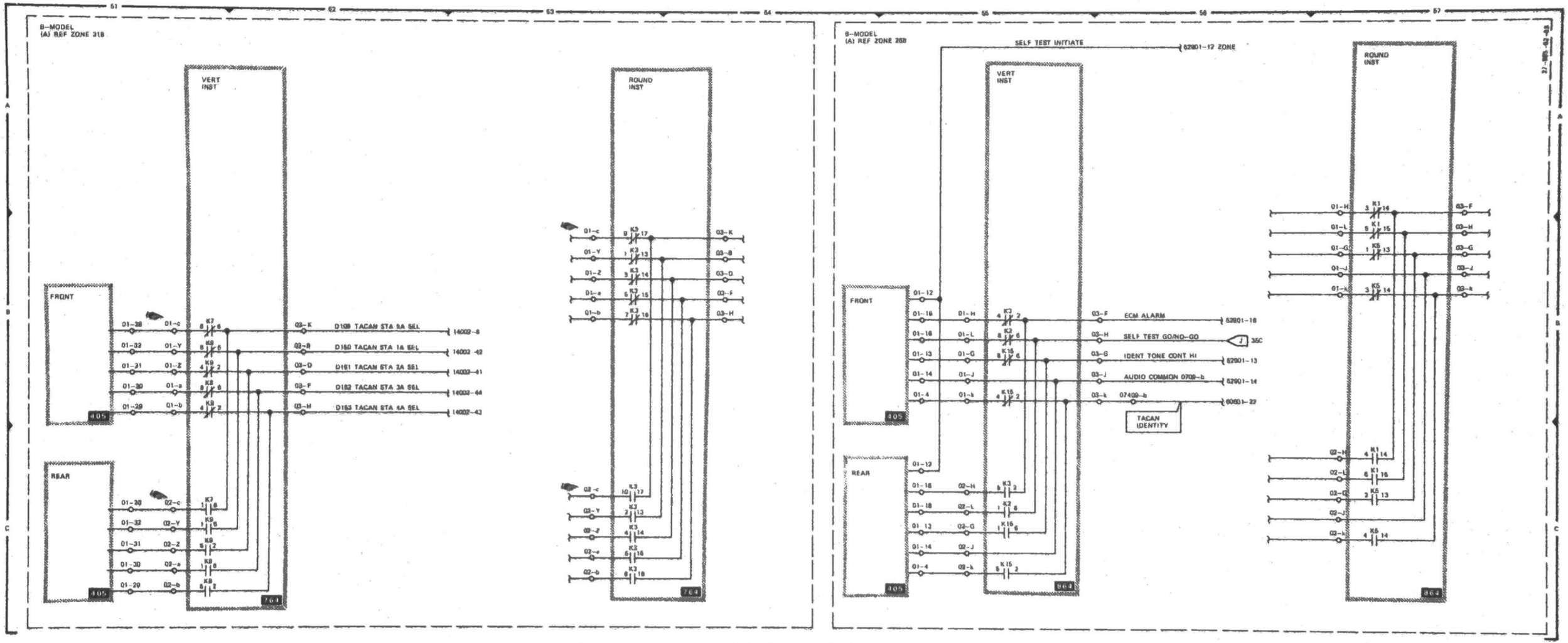


Figure 9-3. TACAN (Sheet 7 of 8)

UNIT	RELAY	CONTACT	FIGURE/ZONE
529	K1	COIL X1 AND X2	9-2/22B
		A1 AND A2	9-2/4B
		B1 AND B2	9-2/4B
829	K1	COIL X1 AND B2	9-2/3B
		A1, A3 AND A3	9-2/3B
		B1, B2 AND B3	9-2/3B
		C2 AND C3	9-2/3B
		D1 AND D2	9-2/3B

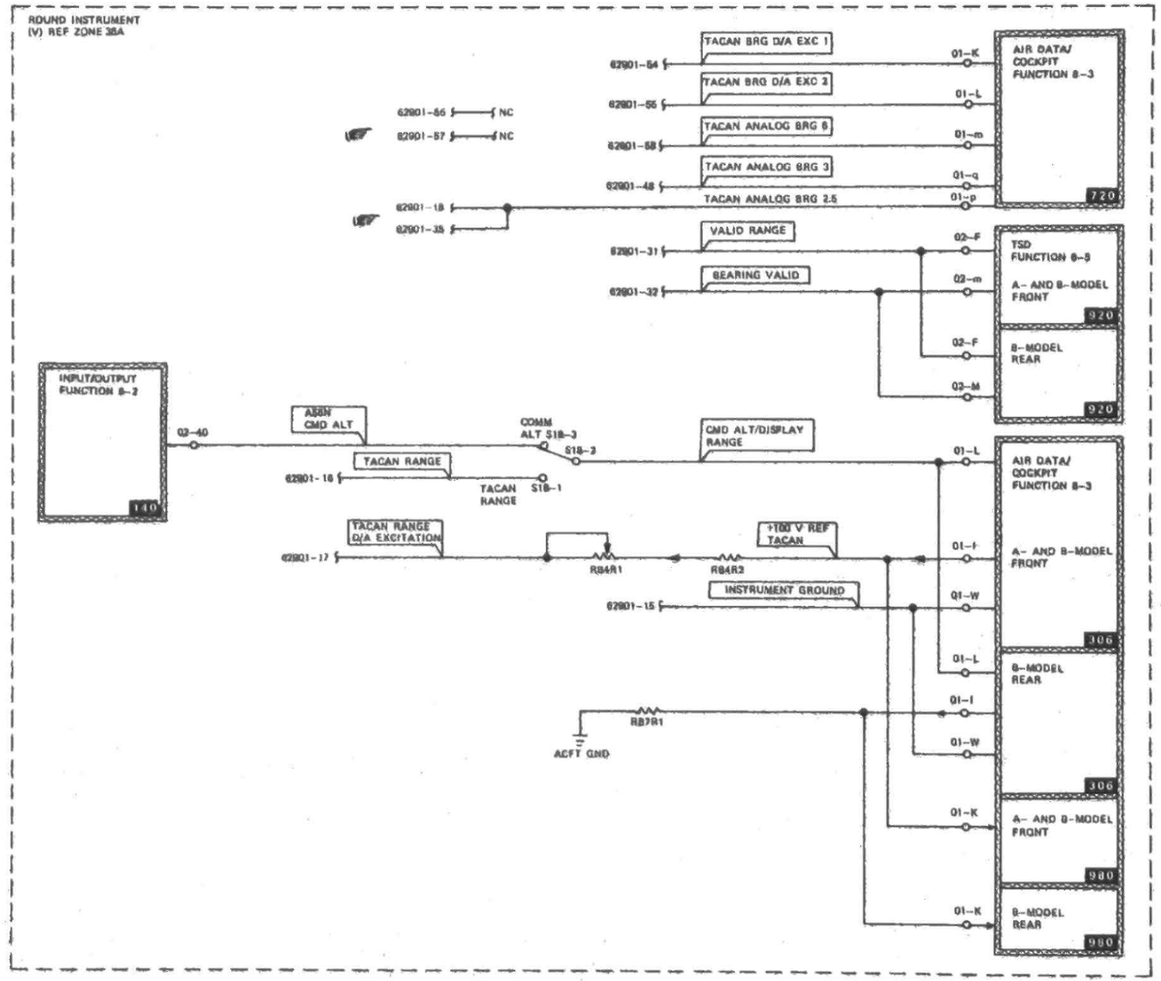


Figure 9-2. TACAN (Sheet 6 of 8)

The command communication function of the MA-1 system provides voice communication between the interceptor and a ground communication station or another aircraft.

The pilot selects the desired UHF frequency on the channel selector control (506). The channel selector permits manual selection of 3500 possible channels between the frequency range of 225.00 MHz to 399.95 MHz. Twenty (20) preset channels are also available to the pilot in the preset mode and are selected by the channel selector. A guard frequency (243.00 MHz) is provided as an emergency channel. Frequency or channel selection is displayed by a remote indicator unit (780) on the instrument panel.

The transmitter-receiver (RT-749) contains a fixed tuned guard receiver connected in parallel with the main UHF receiver. This receiver permits the pilot to monitor the 243.00 MHz emergency guard channel.

Received audio signals from the transmitter-receiver (RT-749) are sent to the audio and ADF electronic amplifier unit (606) for amplification and distribution to the pilot's headphones.

The pilot may also select the automatic direction finder (ADF) function which furnishes aircraft bearing with respect to a communication station and presents the information on the HSI (AF/A24J-1) and TSD (181).

- (A) Energizes power relay (K2) by completing the bridge rectifier circuit in the receiver-transmitter (RT-749).
- (B) Controls the application of the 3-phase essential voltage power supply to the receiver-transmitter power supply.
- (C) Rectifies 115 Volt 3-ϕ 400 Hz to d-c voltages for the various sections of the receiver-transmitter (RT-749).
- (D) Records the total number of hours the RT-749 has operated.

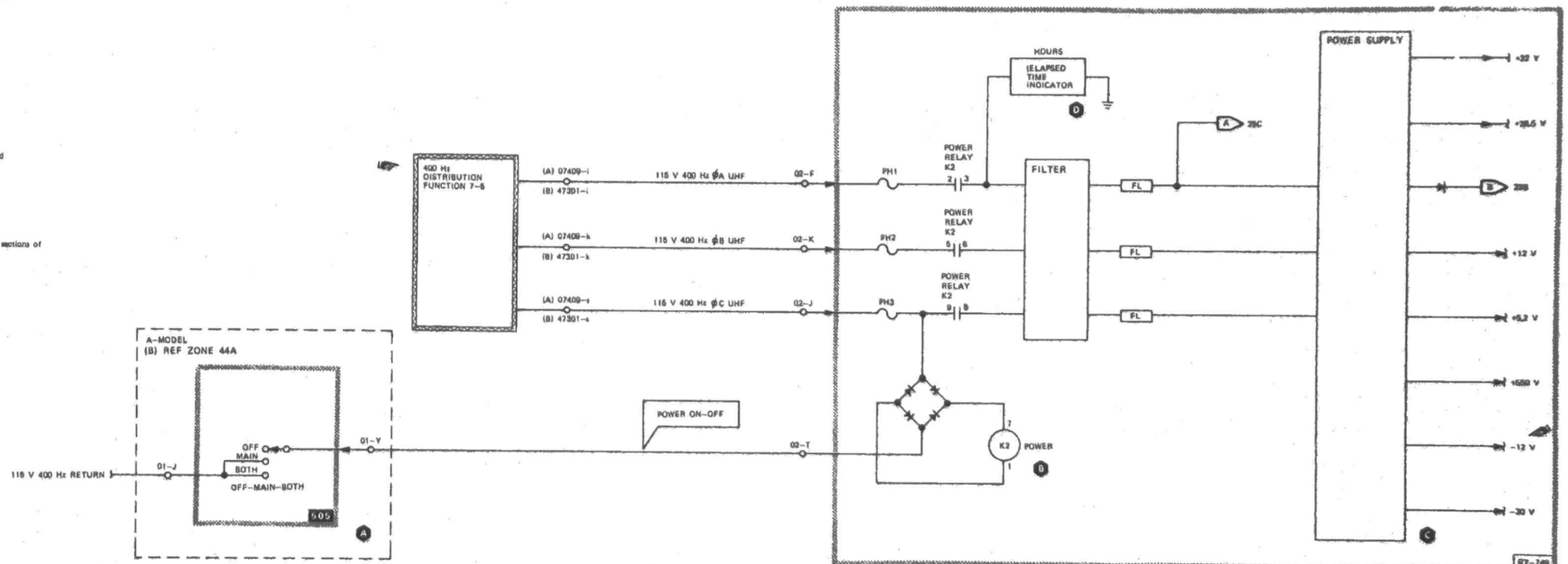


Figure 9-3. Command Communication Group (Sheet 1 of 8)

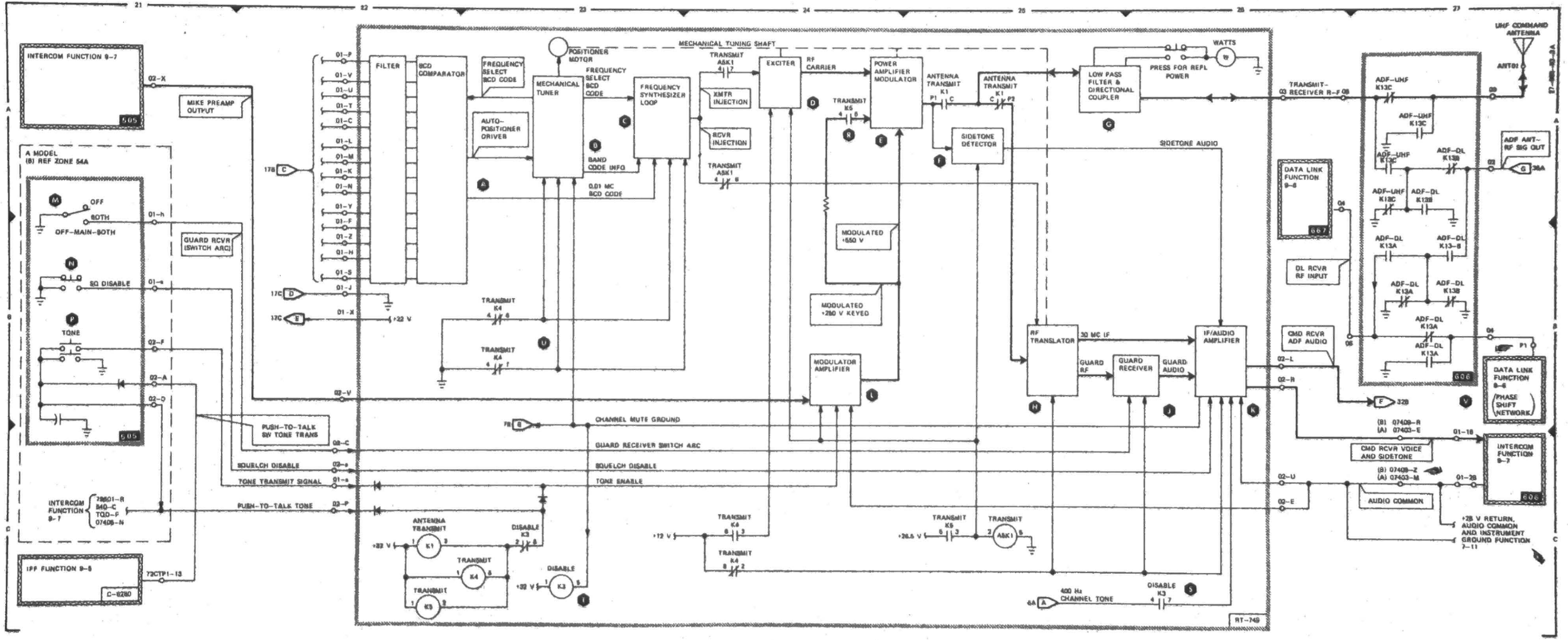


Figure 9-3. Command Communication Group (Sheet 4 of 8)

The ADF (automatic direction finder) function provides a cockpit display of the bearing from the interceptor to either a communication station (ADF-UHF mode) or a ground control intercept (GCI) station (ADF-DL mode).

The ADF rhombic antenna (117) radiates two cardioid antenna field pattern 180 degrees out of phase (back-to-back). The cardioid lobes are alternately produced at a 100 Hz rate by a chopper which controls the termination of the ADF antenna. One corner of the antenna is terminated in its characteristic impedance (50-ohm) through a chopper contact while the opposite corner is isolated to receive ADF signal and connected to a receiver through another chopper contact. The chopper alternately terminates one end, then the other, to ground through a 50-ohm resistor to radiate the two cardioid lobes pattern. Since the amplitude of the received signal depends upon the relative orientation of the antenna with respect to the transmitting station, the antenna will rotate until the signal received by the two major lobes are equal. The received signal is amplitude modulated by the antenna chopper action and is processed by a receiver (RT/749 or 667) and transmitted to the ADF servo amplifier section (606) where the signal is demodulated to produce antenna motor drive signals. These drive signals mechanically rotate the antenna, rate generator and a resolver. The resolver (117) translates the position of the directional antenna into electrical heading signals (sine and cosine) to position a synchro that rotates a bearing pointer located on the Horizontal Situation Indicator (HSI) and on the Tactical Situation Display (181).

A. Initiates ADF function in either ADF-UHF or ADF-DL (data link) position. ADF-UHF position energizes ADF-UHF relays K13C, K1 and ADF relay K10. ADF-DL position energizes ADF-DL relays K13A, K13B, and K2. Relay K13C disconnects the UHF command antenna (606) from the Receiver-Transmitter (RT-749) and connects the ADF antenna (606) in its place. Relay K13A disconnects the data link antenna (606) from the data link receiver (667) and along with relay K13B connects the ADF antenna to the data link receiver. ADF-UHF K1 and ADF-DL K2 connects the uhf command and data link receiver audio inputs to the ADF servo amplifier respectively.

B. Demodulates the 100 Hz ADF modulated signal into a 100 Hz square wave signal (by a chopper) and applies this signal to the variable phase control winding of the antenna drive motor as a two phase motor control signal. Determines the speed and direction of the rotation of the motor.

C. Generates a 100 Hz square wave excitation signal for the choppers in the ADF servo amplifier section and antenna (117) unit, the fixed phase winding of the antenna drive motor and the rate generator.

D. Supplies +250 v to the center tap of the antenna drive motor (117) through ADF-relay contacts of K10 during ADF test operation.

E. Rotates the ADF antenna, rate generator and the ADF bearing angle resolver whenever a phase difference exists between the excitation signals being applied to the two windings of the motor.

F. Generates an output voltage proportional to the rate of rotation of the drive motor. Applies the voltage as a negative feedback damping signal to prevent the directional antenna from hunting or overshooting the desired position.

G. Connects the two ends of the directional antenna alternately to a terminating impedance (50-ohm) at a 100 Hz rate to produce the two lobed antenna field pattern.

H. Resolves the directional antenna position into a sine and cosine ADF heading signals and transmits these signals to the ADF synchro (520).

J. Rhombic antenna which receives the r-f ADF signal and outputs the signal to the receiver.

K. Initiates ADF test operation by deenergizing relays K1 and K2 disconnecting the UHF and data link receiver audio inputs to the ADF servo amplifier; deenergizing switching relay K13A, K13B and K13C disconnecting the ADF antenna from the UHF communication and data link receivers; energizing ADF relay K10 applies +28 v bias voltage to the ADF antenna servo amplifier section and a +250 v to the center tap of the antenna drive motor from the +250 v power supply. Supplies a constant error voltage to the ADF servo amplifier to drive the ADF antenna at a constant rate.

Figure 9-3. Command Communication Group (Sheet 5 of 8)

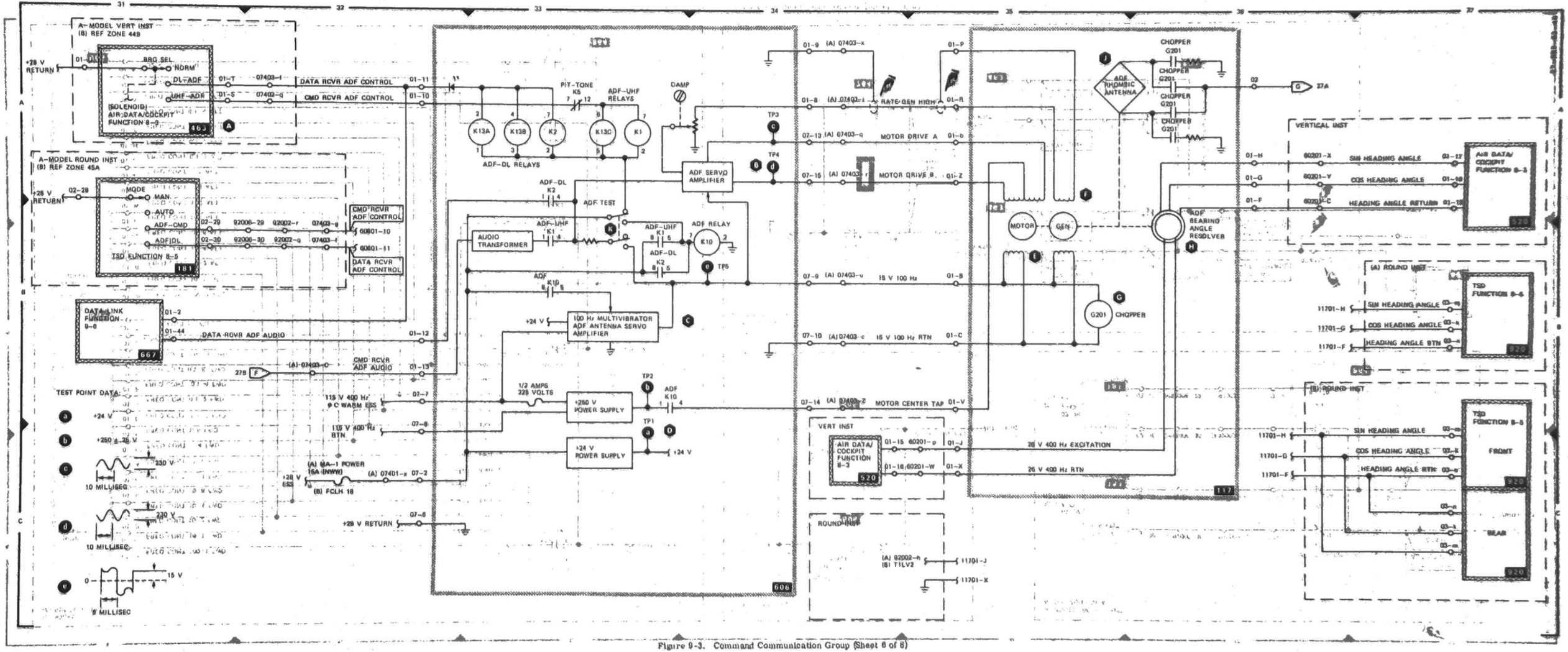


Figure 9-3. Command Communication Group (Sheet 6 of 8)

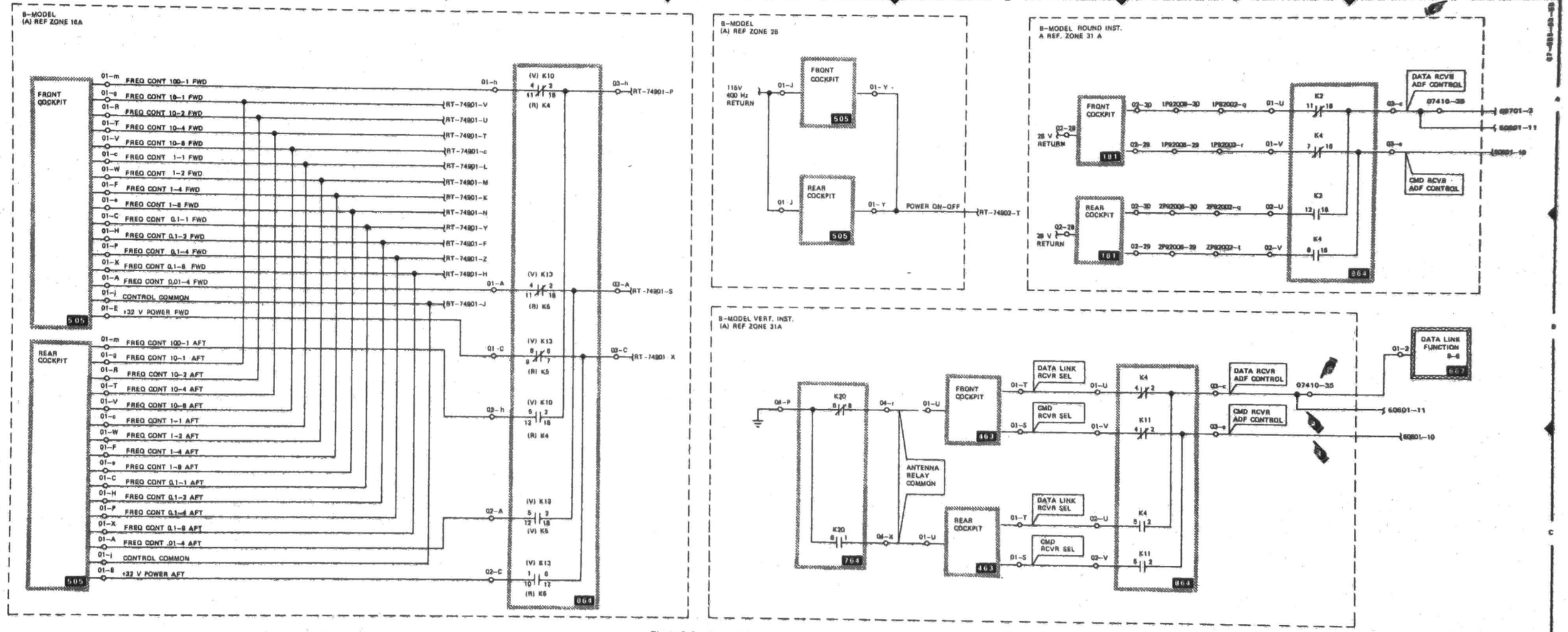


Figure 9-3. Command Communication Group (Sheet 7 of 8)

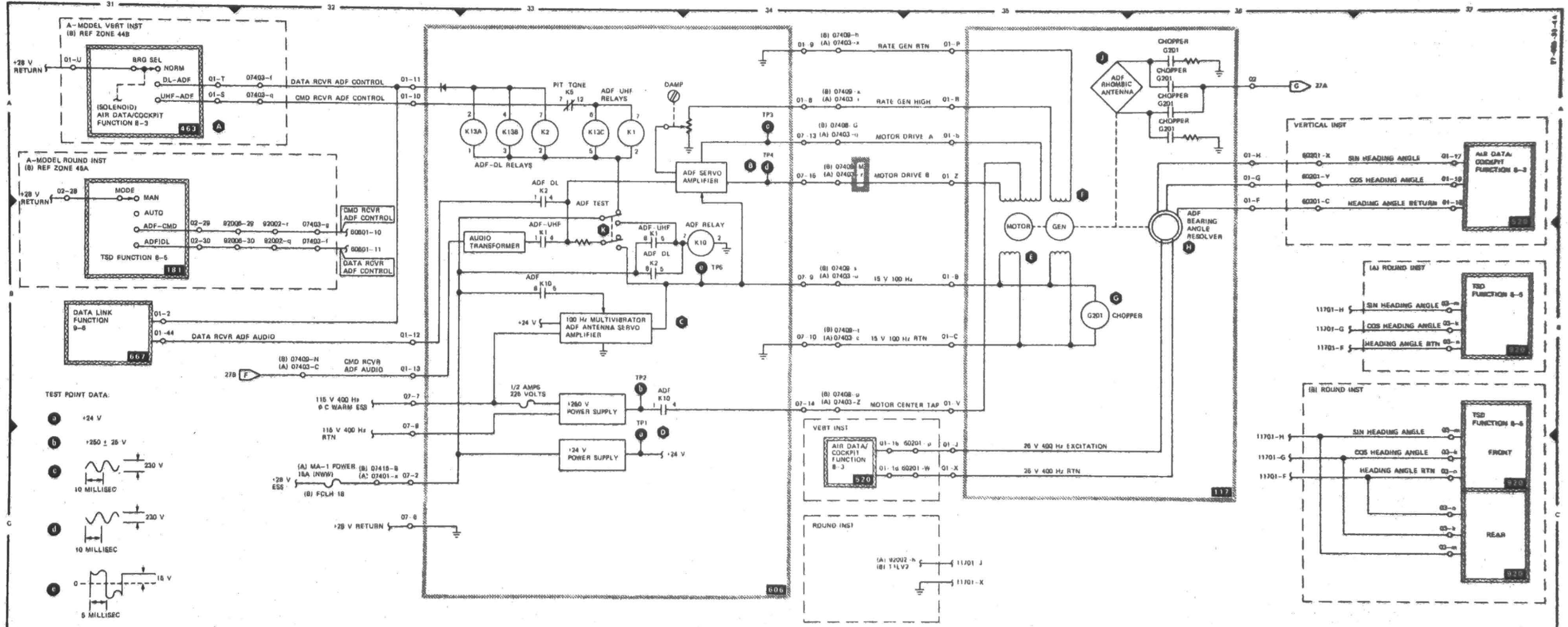


Figure 8-3. Command Communication Group (Sheet 6 of 8)

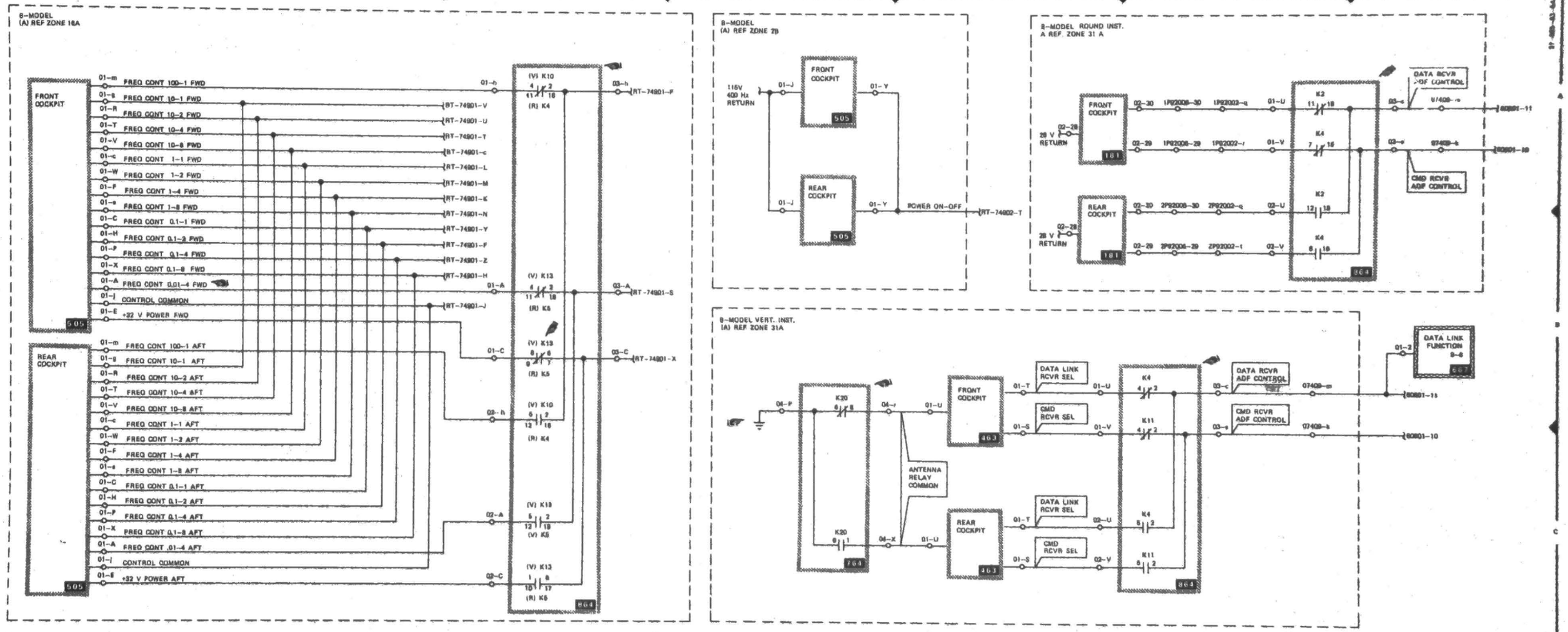
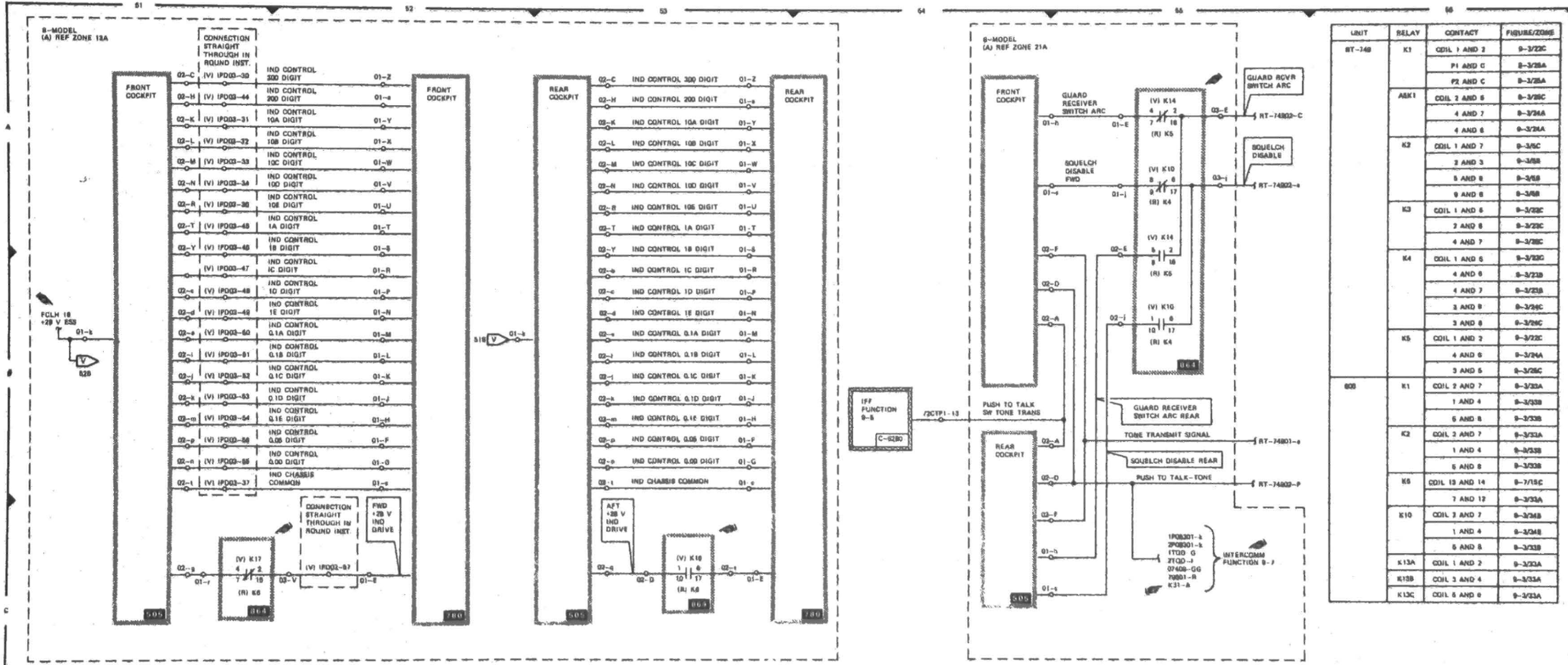


Figure 9-3. Command Communication Group (Sheet 7 of 8)



UNIT	RELAY	CONTACT	FIGURE/ZONE
RT-748	K1	COIL 1 AND 2	9-3/22C
		P1 AND C	9-3/28A
		P2 AND C	9-3/28A
	A5K1	COIL 2 AND 6	9-3/26C
		4 AND 7	9-3/24A
		4 AND 8	9-3/24A
	K2	COIL 1 AND 7	9-3/6C
		2 AND 3	9-3/6B
		5 AND 8	9-3/6B
		9 AND 8	9-3/6B
	K3	COIL 1 AND 6	9-3/22C
		2 AND 6	9-3/22C
		4 AND 7	9-3/26C
	K4	COIL 1 AND 6	9-3/22C
		4 AND 6	9-3/22B
		4 AND 7	9-3/22B
		3 AND 8	9-3/24C
		3 AND 6	9-3/24C
	K5	COIL 1 AND 2	9-3/22C
		4 AND 6	9-3/24A
		3 AND 5	9-3/26C
808	K1	COIL 2 AND 7	9-3/33A
		1 AND 4	9-3/33B
		5 AND 8	9-3/33B
	K2	COIL 2 AND 7	9-3/33A
		1 AND 4	9-3/33B
		5 AND 8	9-3/33B
	K6	COIL 13 AND 14	9-7/15C
		7 AND 12	9-3/33A
	K10	COIL 3 AND 7	9-3/34B
		1 AND 4	9-3/34B
		5 AND 8	9-3/33B
	K13A	COIL 1 AND 2	9-3/33A
	K13B	COIL 3 AND 4	9-3/33A
	K13C	COIL 5 AND 6	9-3/33A

Figure 9-3. Command Communication Group (Sheet 6 of 8)

The ILS function furnishes landing approach pattern information for landing the interceptor during periods of poor visibility. A-f directional radio beams modulated with audio tone signals are radiated by ground transmitters and are received by the ILAS localizer radio receiver (367) and ILAS glide slope and marker beacon radio receiver (267). These received signals are converted into d-c voltages to indicate whether the interceptor is above or below (glide slope) and to the right or left (localizer) of the correct approach pattern. Marker beacon transmitters are spaced at known distances from the end of the runway to provide distance information to the approach end of the runway or to be used as navigation check points during landing approach pattern. Marker beacon information is processed by the receiver in the 267 unit for application to the MARKER BEACON indicator on the pilot's instrument panel. A localizer voice function permits reception of voice communication on any of the localizer channels.

The localizer ground transmitter radiates a dual-lobed enlongated field pattern arranged in a horizontal plane with the inner edges of the lobes slightly over-lapping. The right lobe is modulated with a 150 Hz audio signal and the left lobe with a 90 Hz audio signal with reference to the inboard course. The localizer course is formed along the line of equal signal strength of the dual-lobed field pattern and is centered on the instrument runway.

The glide slope ground transmitter radiates a 90 Hz modulated top lobe and a 150 Hz modulated bottom lobe (reference to the inboard course) f-l field pattern arranged in a vertical plane with the inner edges slightly overlapping forming a glide slope angle established by the line of equal signal strength.

Two marker beacon ground transmitters each radiate a single lobe field pattern arranged perpendicular relative to the earth's surface. One transmitter has a 75 MHz carrier frequency modulated by a 400 Hz Morse-coded tone signal while the other has a 75 MHz carrier frequency modulated by a 1300 Hz Morse-coded tone signal.

(A) When in flight, energized if MA-1 POWER (905) is in WARM or higher position. On ground power, energized only if ILS or ILS ARCH is selected on the 163 unit.

(B) Energized by MA-1 +28 V.

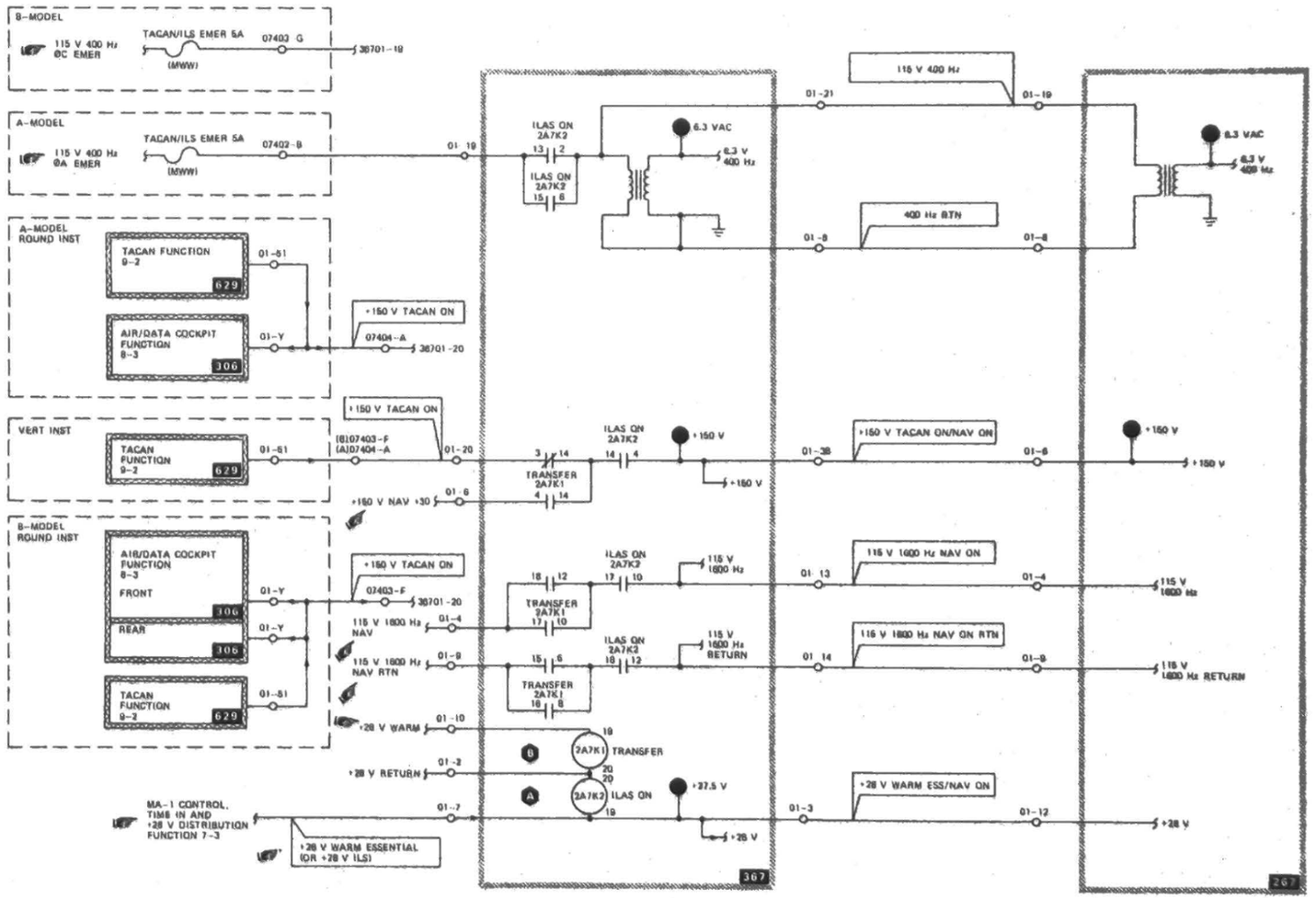


Figure 9-4. ILS (Sheet 1 of 7)

The 755 selects the desired glide-slope and localizer frequency on the channel selector (755). Twenty positions are provided on this channel selector with each position representing a preset ILS channel.

The ILAS localizer radio receiver (367) produces from the received signal a d-c voltage representing interceptor horizontal displacement from the localizer course and presents this signal as left-right localizer steering information on cockpit display instruments.

A flag alarm signal is generated to the attitude director indicator (vert. inst.) or approach horizon indicator (round inst.) whenever a valid deviation signal is being received. This signal operates the LOC flag in the ADI (ARU2 A) or AHI (ID 3288-3).

Voice signal is processed by the 367 unit and applied to the pilot's headphone through a volume control (755), audio amplifier (696) and volume control (505).

A. Selecting a channel initiate crystal selection in the 367 and 367 units by providing tuning ground signals to motor excitation removal relay K3 and presence or absence of a tuning ground signal to A-B relay K2 in the 367 and 367 units.

B. Selects a crystal for frequency control in the oscillator-doubler section by driving a twenty (20) position rotary switch. Stops when the motor excitation removal relay K3 is energized corresponding to the channel setting in the 755 unit.

C. Positions the switching motor to the channel selected on the 755 unit by providing appropriate ground signal path back to the channel selector (755).

D. Twenty (20) crystals each with a different resonant frequency used to tune the oscillation frequency of the local oscillator.

E. Switches the appropriate crystal into the oscillator circuit.

F. Generates a local oscillator injection frequency to the r-f mixer section for mixing with the received frequency to produce the intermediate frequency.

G. Conducts the received signal through a fixed-tuned bandpass filter and mixes it with the local oscillator injection signal to produce a 5.5 MHz intermediate frequency.

H. Amplifies and rectifies the 5.5 MHz I-F signal into an audio frequency signal. Produces an AGC signal for amplifier control.

J. Amplifies and transmits a portion of the audio signal to the aural amplifier section for filtering. Separates the received audio signal into 90 Hz and 150 Hz signals for comparison. Generates a localizer error (deviation) signal to the horizontal situation indicator through the 620 unit and to the aircraft flight director computer (CPU4 A) if the amplitude of 90 Hz and 150 Hz signals differ. Transmits a portion of the deviation signal to the flight director section. Applies localizer flag signal to the flag alarm amplifier section and to the CPU4 'A.

K. Amplifies the localizer deviation signal for application to the 621 unit of the automatic flight control subsystem.

L. Amplifies localizer flag signals to provide a current large enough to operate flag alarm relay K1. K1 energizes when input signals to amplifier reach a predetermined level. Contacts of K1 are in series with contacts of glideslope flag alarm relay K1. Both glideslope and localizer flag alarm relays must be energized to engage AFCS ILS mode of operation.

M. Amplifies and filters the audio signal through a 300 - 4000 Hz bandpass filter and transmits it to the 755 unit for application to the pilot's headphones.

N. Controls the volume of the localizer voice.

O. Converts the level of the localizer flight director signal into MA-1 system signal requirements.

Figure 9-4. ILS (Sheet 2 of 7)

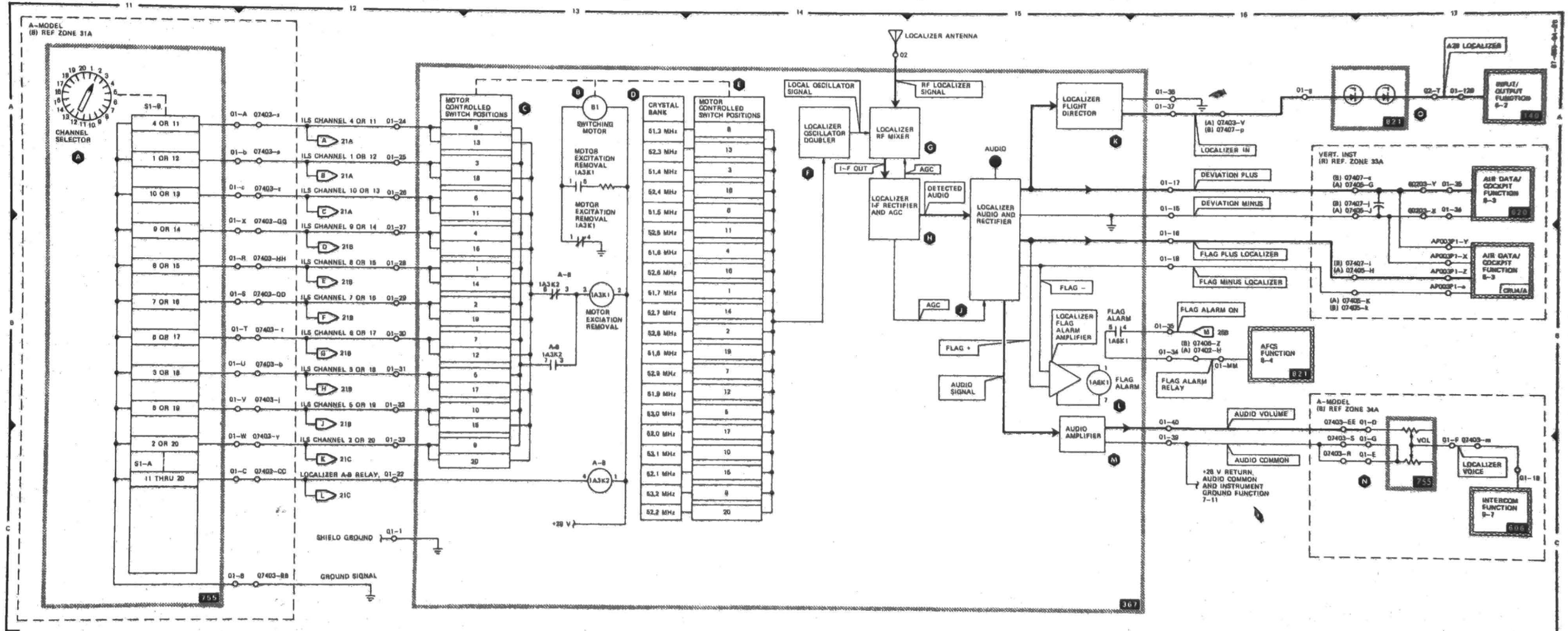


Figure 9-4. ILS (Sheet 3 of 7)

The ILAS glide slope and marker beacon radio receiver (267) detects the 90 Hz and 150 Hz tones from the received R-F glide slope signal and then filters and rectifies them separately to produce d-c voltages proportional to the magnitude of the received tones. The resultant of these d-c voltages is applied to a glide slope displacement pointer as vertical steering signal.

A glide slope flag alarm signal is generated by the 267 unit to operate a GS (glide slope) flag in the ADI or AHI units whenever a valid deviation signal is being received.

Marker beacon R-F signal is received and processed by the 267 unit and is displayed by an indicating lamp on the instrument panel.

A. Selects a crystal for frequency control in the oscillator-tripler section. Regulated by the motor excitation removal relay K1 and A-B relay K2.

B. Positions the switching motor to the channel selected on the CHANNEL SELECTOR (755) by providing ground signal path to the 755 unit.

C. Twenty (20) crystals of different resonant frequencies used for the generation of oscillator injection frequencies in the oscillator-tripler section.

D. Switches the appropriate crystal into the oscillator-tripler circuit.

E. Generates a local oscillator injection signal for mixing with the received signal to produce the intermediate frequency in the r-f mixer section.

F. Conducts the received r-f signal through a fixed-tuned bandpass filter and mixes it with the local oscillator injection signal to produce a 20.7 MHz intermediate frequency.

G. Amplifies and rectifies the 20.7 MHz i-f signal to produce an audio frequency signal. Supplies an AGC voltage for amplifier control.

H. Separates and filters the received audio signal into 90 Hz and 150 Hz signals for comparison. Generates a vertical deviation signal if the amplitude of these two signals differs. Applies a glide slope flag signal to the flag alarm amplifier section.

J. Amplifies the glide slope deviation signal for use as steering signals in the automatic flight control subsystem.

K. Amplifies glide slope flag signals to provide a current large enough to operate flag alarm relay K1. K1 energizes when input signals to amplifier reach a predetermined level. Contacts of K1 are in series with contacts of localizer flag alarm relay K1. Both glide slope and localizer flag alarm relays must be energized to engage AFCS ILS mode of operation.

L. Conducts the 75 MHz r-f received signal through a bandpass filter and mixes it with a local oscillation frequency of 69.5 MHz signal generated by a marker beacon local oscillator to produce a 5.5 MHz i-f signal. Amplifies the I-F signal and applies it to the marker beacon detector and AGC section.

M. Detects the marker beacon audio frequencies from the 5.5 MHz i-f signal. Supplies an AGC voltage for amplifier control. Transmits high or low level audio signals through high sensitivity relay contacts K1.

N. Supplies high level audio output signal to the marker beacon audio amplifier when high sensitivity relay K1 is energized.

O. Supplies low level audio output signal to the marker beacon audio amplifier when high sensitivity relay K1 is deenergized.

P. Amplifies the detected audio for application to the marker beacon indicator lamp.

Q. Transistor switch which controls the output current of the marker beacon amplifier to the marker beacon lamp.

R. Energized when the DISP/AUTO MODE switch (183) is in any position other than ILS or ILS APCH position.

S. Steps up the 14 v ac output of the 267 unit to +28v ac which the indicator lamp requires.

T. MARKER BEACON lamp lights when power is received from the receiver.

U. Converts the level of the glide slope flight director signal to MA-1 system signal requirements.

Figure 9-4. ILS (Sheet 4 of 7)

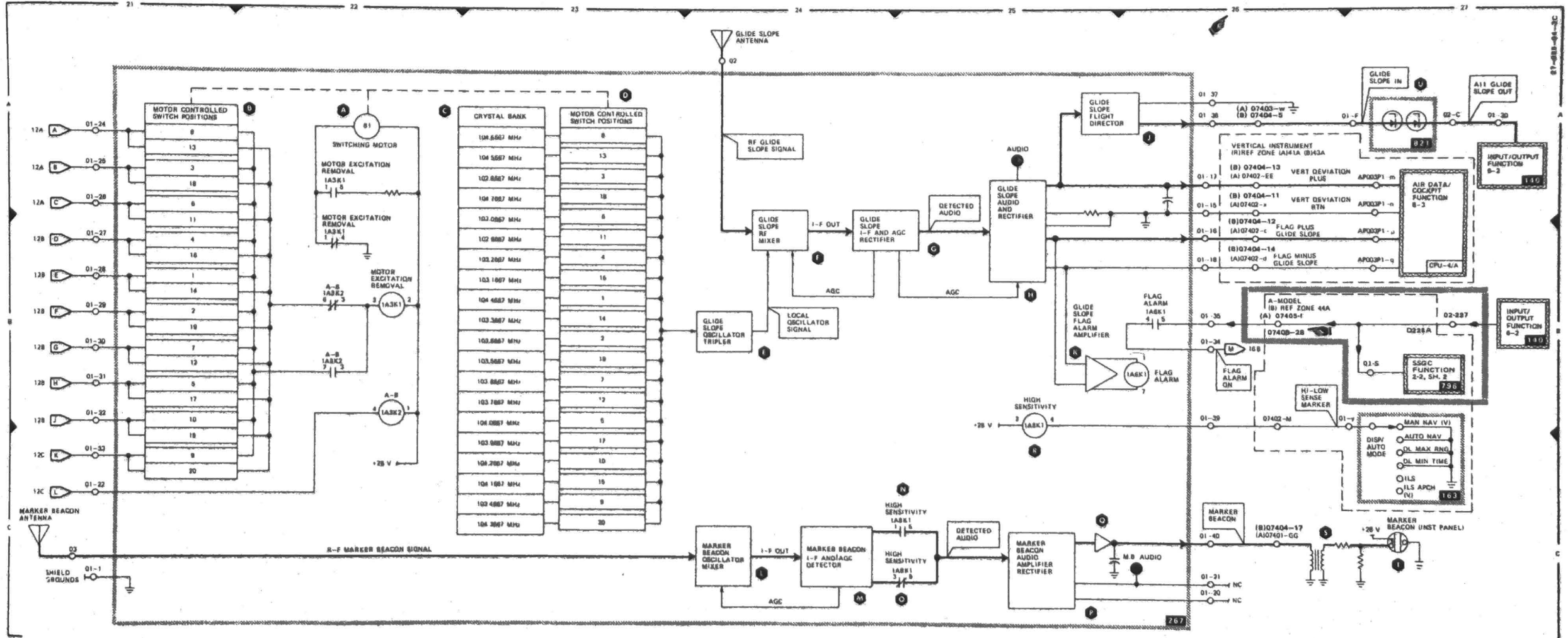


Figure 9-4. ILS (Sheet 5 of 7)

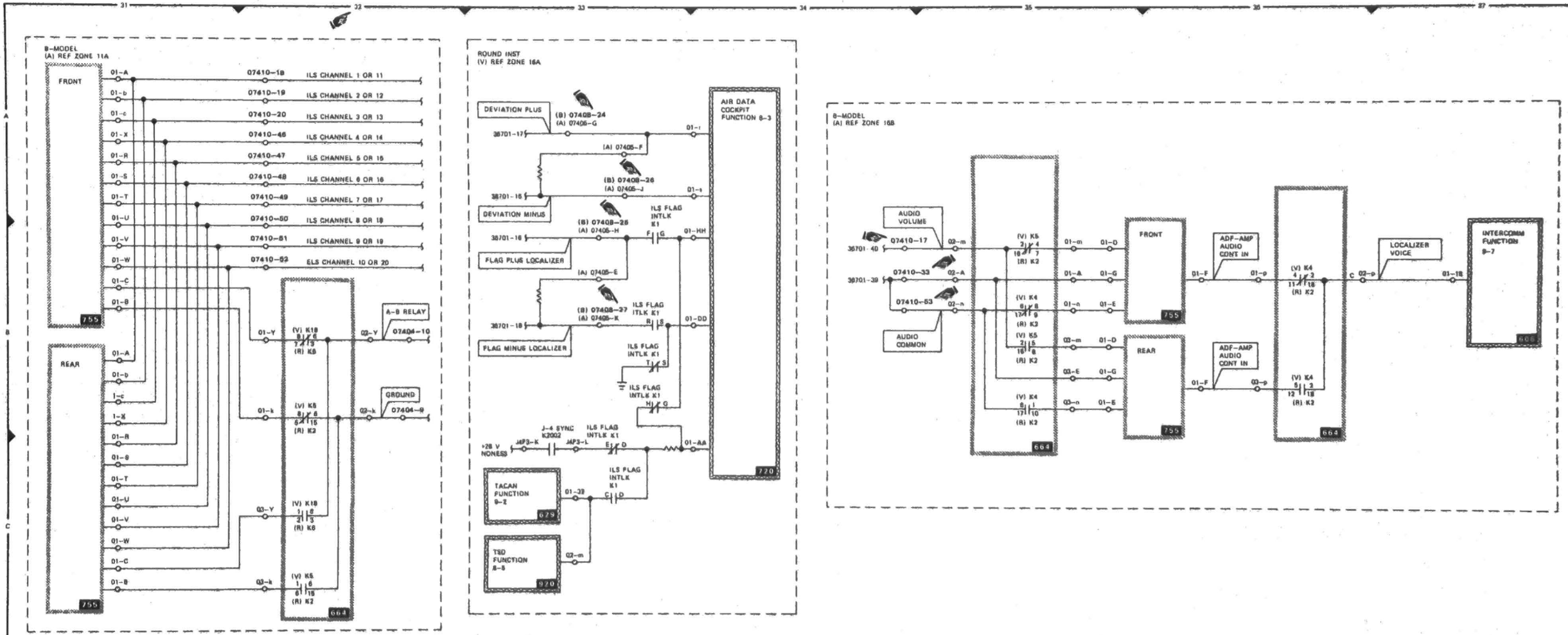


Figure 9-4. ILS (Sheet 6 of 7)

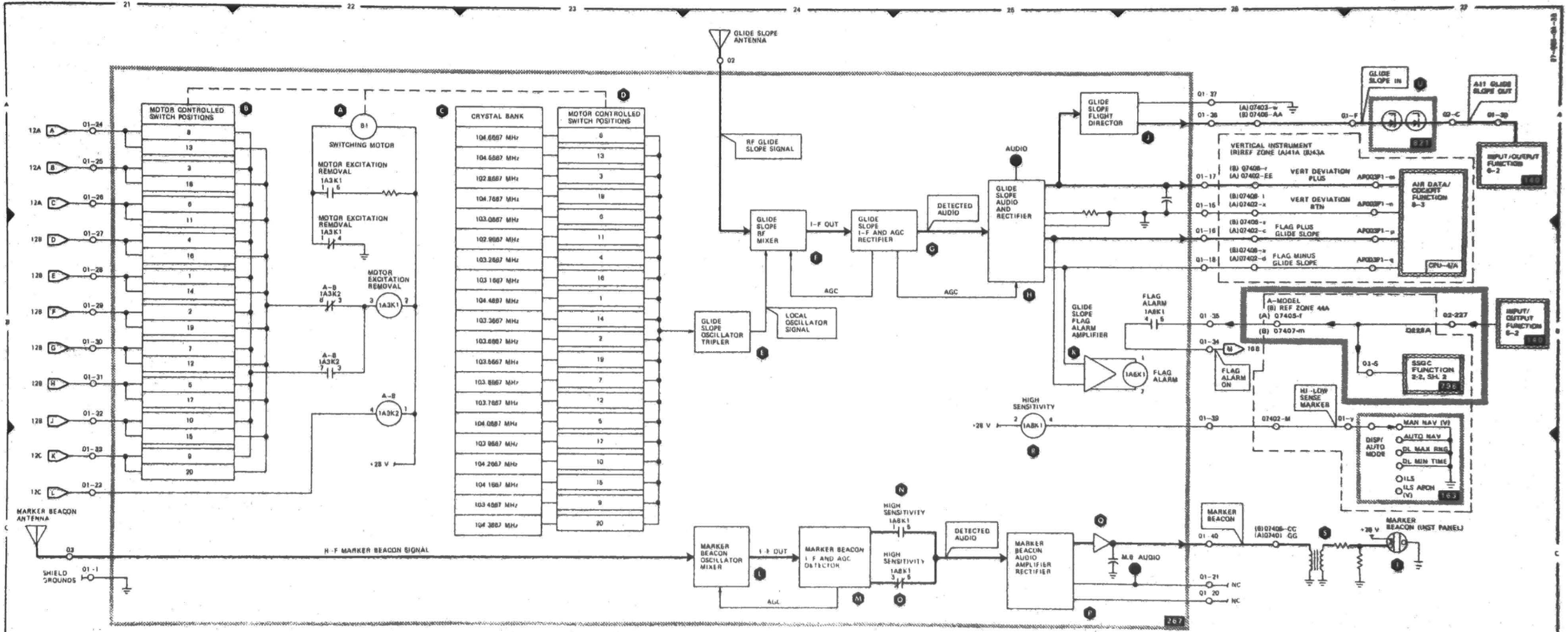


Figure 9-4. ILS (Sheet 6 of 7)

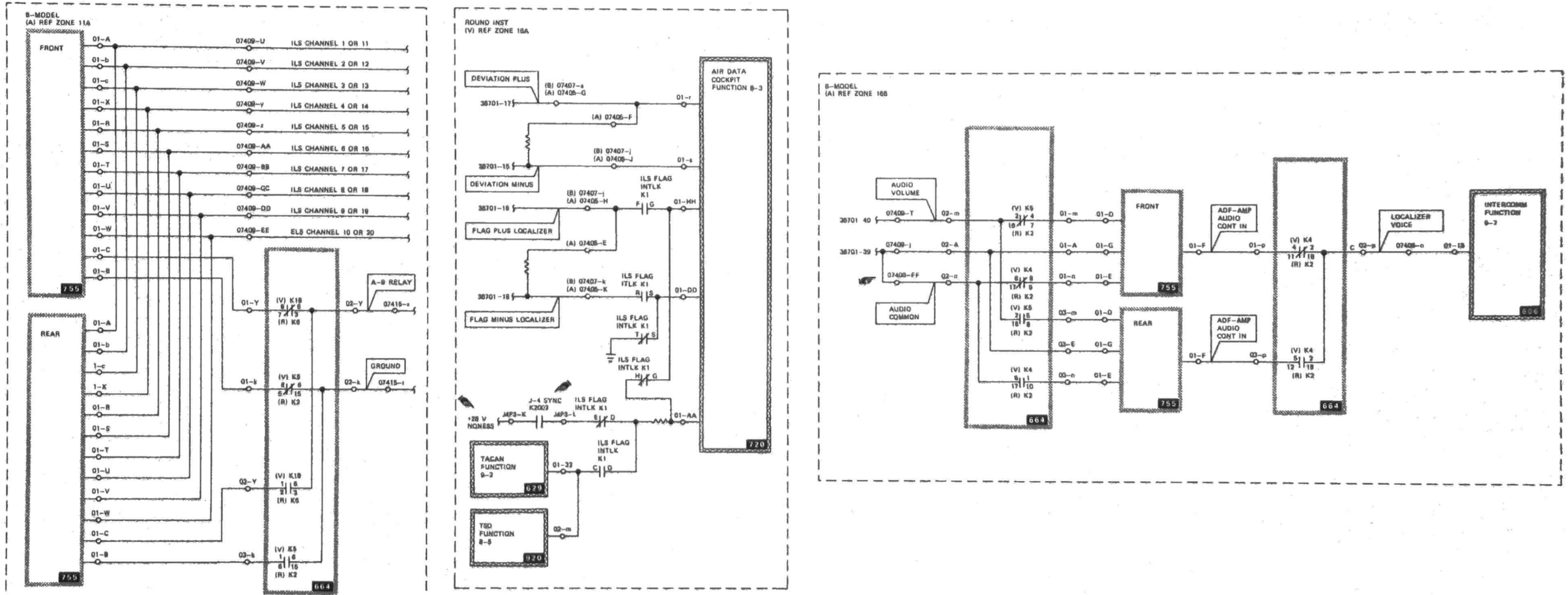
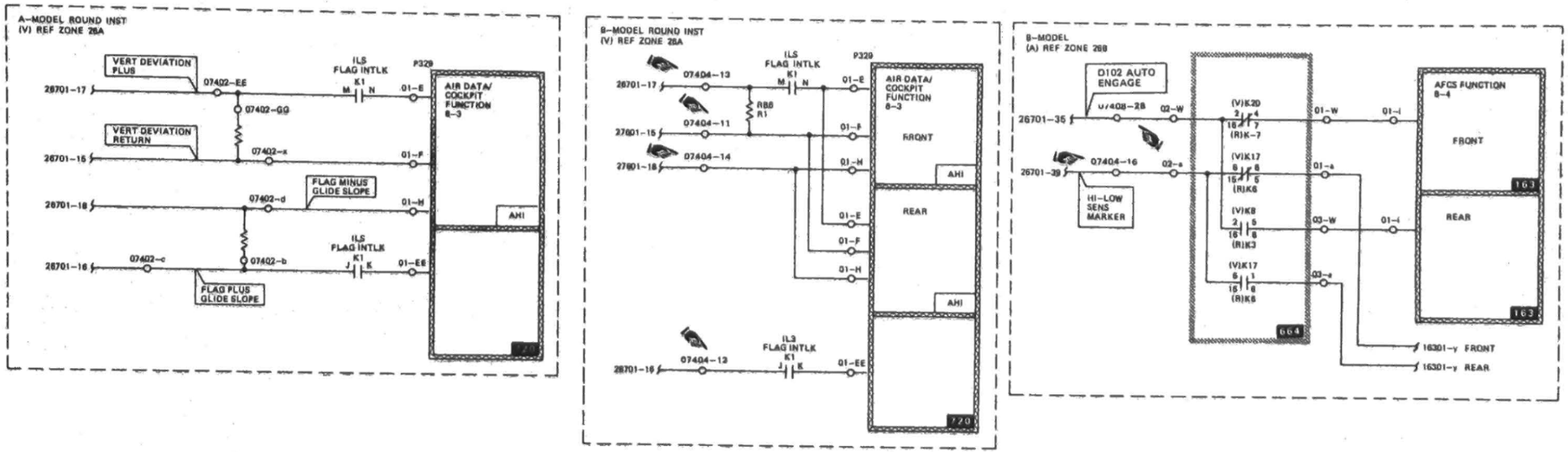


Figure 9-4. ILS (Sheet 6 of 7)



UNIT	RELAY	CONTACT	FIGURE/ZONE
267	1A8K1	1 AND 5	9-4/25C
		3 AND 6	9-4/25C
		COIL 2 AND 4	9-4/25B
	1A3K1	1 AND 8	9-4/22B
		1 AND 5	9-4/22A
		COIL 2 AND 3	9-4/22B
	1A8K1	4 AND 5	9-4/28B
		COIL 1 AND 7	9-4/26B
	1A3K2	3 AND 8	9-4/22B
		3 AND 7	9-4/22B
		COIL 1 AND 4	9-4/22B
307	2A7K1	3, AND 14	9-4/6B
		4 AND 14	9-4/6B
		6 AND 15	9-4/6C
		8 AND 16	9-4/6C
		10 AND 17	9-4/6C
		12 AND 18	9-4/6B
		COIL 19 AND 20	9-4/6C
	2A3K1	1 AND 4	9-4/13B
		1 AND 5	9-4/13A
		COIL 2 AND 3	9-4/13B
	2A8K1	4 AND 5	9-4/15B
		COIL 1 AND 7	9-4/15B
	2A7K2	2 AND 13	9-4/5A
		8 AND 15	9-4/5A
		4 AND 14	9-4/6B
		10 AND 17	9-4/6B
		12 AND 18	9-4/6C
		COIL 19 AND 20	9-4/6C
	2A3K2	3 AND 8	9-4/13B
		3 AND 7	9-4/13B
		COIL 1 AND 4	9-4/13C
CVAC	K1	C AND Q	9-4/33C
		E AND D	9-4/33C
		F AND G	9-4/33B
		H AND G	9-4/33B
		J AND K	9-4/42B
			9-4/43B
		M AND N	9-4/42A
			9-4/43A
		S AND T	9-4/33B
		S AND R	9-4/33B
		COIL A AND B	9-3/24BB

Figure 9-4. ILS (Sheet 7 of 7)

The IFF (identification friend or foe) function provides automatic ground radar identification of aircraft as friendly or hostile, identification of specific friendly aircraft, existence of an emergency on board, altitude reporting of the aircraft and a military secure mode (M-4).

When identification is required, a ground-based interrogator transmits coded interrogating pulses in synchronism with the pulses of the ground radar. Upon receipt of the interrogating pulses, a transponder aboard the aircraft transmits a coded reply. The reply is received and decoded on the ground by a responder for track or display purposes.

The pilot selects the desired interrogation and reply modes (modes 1, 2, 3/A, 4 and C) on the control transponder (C-6280) unit. TEST positions permit checking the proper operation of each mode and is indicated by the illumination of the test light (C-6280). Mode 1 is selected to identify the aircraft as friendly by properly responding to a coded mode 1 ground transmitted interrogating signal. Mode 2 is used to identify a specific aircraft in which the transponder has been preset to transmit a particular mode 2 reply. Mode 3/A is selected to identify an aircraft that has entered a radar traffic controlled area. Mode C is used to report aircraft altitude to an interrogating ground station.

Supplemental modes also include an identification of position (I/P) and an emergency response. The I/P response permits a ground radar station to identify a radar track of the aircraft via voice radio. The emergency mode informs an interrogating ground radar that the aircraft is in distress. (This supplements the guard capability of the command communications group function.)

The IFF function modes are selected by applying open and ground signals to the inputs of the receiver-transmitter (RT-859), transponder computer (KIT-1A/TSEC) and transponder test set (TS-1843A).

The receiver-transmitter (RT-859) receives and processes the interrogation signal and transmits the coded reply signal. Mode 4 challenges are processed by the transponder computer (KIT-1A/TSEC). Self-testing of the Control Transponder is provided by the Transponder Test Set (TS-1843A).

(A) MASTER switch which controls the transponder power supply, receiver sensitivity and emergency reply operation.

(B) Permits IDENT reply operation for approximately 30 seconds.

(C) RAD TEST position permits the transponder to reply to test mode interrogations from IFF test equipment. MON position permits monitoring the transponder test set (TS-1843A).

(D) Determines mode 4 code operation of the transponder computer (KIT-1A/ TSEC).

(E) Illuminates when mode 4 replies are being transmitted.

(F) When activated by the ejection relay (K40), contacts open to zero mode 4 codes A and B.

(G) When the power switch (905) is turned to RADIO SILENCE, contacts open to activate suppression circuits in the receiver-transmitter (RT-859).

(H) Ejection relay is energized when the aircraft canopy is unlocked with the nose wheel in the up position. Master switch must be in standby, low or normal position for the ejection relay to switch receiver-transmitter sensitivity from low to high; enables modes 1, 2 and 3/A; sets the emergency mode of reply and mode 3/A to code 7700 (emergency code); zero mode 4 codes codes to A and B.

(J) Processes the mode 4 challenge signal and prepares the coded mode 4 reply signal for transmission.

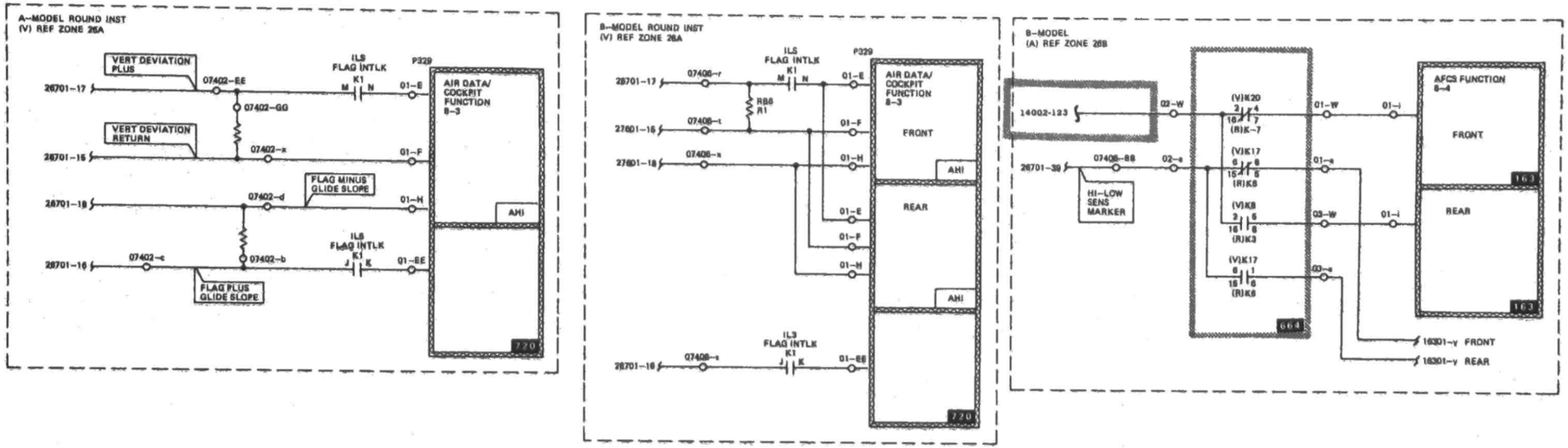
(K) When dim relay K11 is energized, contact of K11 open to dim IFF caution light.

(L) Illuminates when Transponder Computer fails to reply to a valid mode 4 interrogation.

(M) Receives, decodes and replies to interrogations of operational modes 1, 2, 3/A, C and 4. Amplifies and screens video input signal for proper width, amplitude, jamming and side lobe rejection. Contains mode 2 code select wheels used to set the desired four digit reply code. Generates a TACAN receiver blanking signal to suppress the TACAN receiver. Generates a tone to the pilot's headphones when there is a valid mode 4 interrogation. Receives IFF receiver blanking signal from the TACAN function whenever there is a TACAN transmission.

Figure 9-5. IFF (Sheet 1 of 3)

*U.S. GOVERNMENT PRINTING OFFICE: 1978-772-735



UNIT	RELAY	CONTACT	FIGURE/ZONE
387	1A8K1	1 AND 5	9-4/25C
		3 AND 5	9-4/25C
		COIL 2 AND 4	9-4/26B
	1A33K1	1 AND 4	9-4/22B
		1 AND 5	9-4/22A
		COIL 2 AND 3	9-4/22B
	1A8K1	4 AND 5	9-4/26B
		COIL 1 AND 7	9-4/26B
	1A33K3	3 AND 6	9-4/22B
		3 AND 7	9-4/22B
		COIL 1 AND 4	9-4/22B
387	2A7K1	3 AND 14	9-4/6B
		4 AND 14	9-4/6B
		6 AND 15	9-4/6C
		8 AND 16	9-4/6C
		10 AND 17	9-4/6C
		12 AND 18	9-4/6B
		COIL 19 AND 20	9-4/6C
	2A33K1	1 AND 4	9-4/13B
		1 AND 5	9-4/13A
		COIL 2 AND 3	9-4/13B
	2A8K1	4 AND 5	9-4/15B
		COIL 1 AND 7	9-4/15B
	2A7K2	2 AND 13	9-4/5A
		9 AND 15	9-4/5A
		4 AND 14	9-4/5B
		10 AND 17	9-4/5B
		12 AND 18	9-4/5C
		COIL 19 AND 20	9-4/5C
	2A33K2	3 AND 6	9-4/13B
		3 AND 7	9-4/13B
		COIL 1 AND 4	9-4/13C
CVAC	K1	C AND D	9-4/33C
		E AND D	9-4/33C
		F AND G	9-4/33B
		H AND G	9-4/33B
		J AND K	9-4/43B
			9-4/43B
		M AND N	9-4/43A
			9-4/43A
		S AND T	9-4/33B
		S AND R	9-4/33B
		COIL A AND B	9-3/24SB

Figure 9-4. ILS (Sheet 7 of 7)

The IFF (identification friend or foe) function provides automatic ground radar identification of aircraft as friendly or hostile, identification of specific friendly aircraft, existence of an emergency on board, altitude reporting of the aircraft and a military secure mode (M-4).

When identification is required, a ground-based interrogator transmits coded interrogating pulses in synchronism with the pulses of the ground radar. Upon receipt of the interrogating pulses, a transponder aboard the aircraft transmits a coded reply. The reply is received and decoded on the ground by a responder for track or display purposes.

The pilot selects the desired interrogation and reply modes (modes 1, 2, 3/A, 4 and C) on the control transponder (C-6280) unit. TEST positions permit checking the proper operation of each mode and is indicated by the illumination of the test light (C-6280). Mode 1 is selected to identify the aircraft as friendly by properly responding to a coded mode I ground transmitted interrogating signal. Mode 2 is used to identify a specific aircraft in which the transponder has been preset to transmit a particular mode 2 reply. Mode 3/A is selected to identify an aircraft that has entered a radar traffic controlled area. Mode C is used to report aircraft altitude to an interrogating ground station.

Supplemental modes also include an identification of position (I/P) and an emergency response. The I/P response permits a ground radar station to identify a radar track of the aircraft via voice radio. The emergency mode informs an interrogating ground radar that the aircraft is in distress. (This supplements the guard capability of the command communications group function.)

The IFF function modes are selected by applying open and ground signals to the inputs of the receiver-transmitter (RT-859), transponder computer (KIT-1A/TSEC) and transponder test set (TS-1843A).

The receiver-transmitter (RT-859) receives and processes the interrogation signal and transmits the coded reply signal. Mode 4 challenges are processed by the transponder computer (KIT-1A/TSEC). Self-testing of the Control Transponder is provided by the Transponder Test Set (TS-1843A).

(A) MASTER switch which controls the transponder power supply, receiver sensitivity and emergency reply operation.

(B) Permits IDENT reply operation for approximately 30 seconds.

(C) RAD TEST position permits the transponder to reply to test mode interrogations from IFF test equipment. MON position permits monitoring the transponder test set (TS-1843A).

(D) Determines mode 4 code operation of the transponder computer (KIT-1A TSEC).

(E) Illuminates when mode 4 replies are being transmitted.

(F) When activated by the ejection relay (K40), contacts open to zero mode 4 codes A and B.

(G) When the power switch (905) is turned to RADIO SILENCE, contacts open to activate suppression circuits in the receiver-transmitter (RT-859).

(H) Ejection relay is energized when the aircraft canopy is unlocked with the nose wheel in the up position. Master switch must be in standby, low or normal position for the ejection relay to switch receiver-transmitter sensitivity from low to high; enables modes 1, 2 and 3/A; sets the emergency mode of reply and mode 3/A to code 7700 (emergency code); zero mode 4 codes codes to A and B.

(J) Processes the mode 4 challenge signal and prepares the coded mode 4 reply signal for transmission.

(K) When dim relay K11 is energized, contact of K11 open to dim IFF caution light.

(L) Illumipates when Transponder Computer fails to reply to a valid mode 4 interrogation.

(M) Receives, decodes and replies to interrogations of operational modes 1, 2, 3/A, C and 4. Amplifies and screens video input signal for proper width, amplitude, jamming and side lobe rejection. Contains mode 2 code select wheels used to set the desired four digit reply code. Generates a TACAN receiver blanking signal to suppress the TACAN receiver. Generates a tone to the pilot's headphones when there is a valid mode 4 interrogation. Receives IFF receiver blanking signal from the TACAN function whenever there is a TACAN transmission.

Figure 9-5. IFF (Sheet 1 of 3)

☆U.S. GOVERNMENT PRINTING OFFICE: 1975—670-745

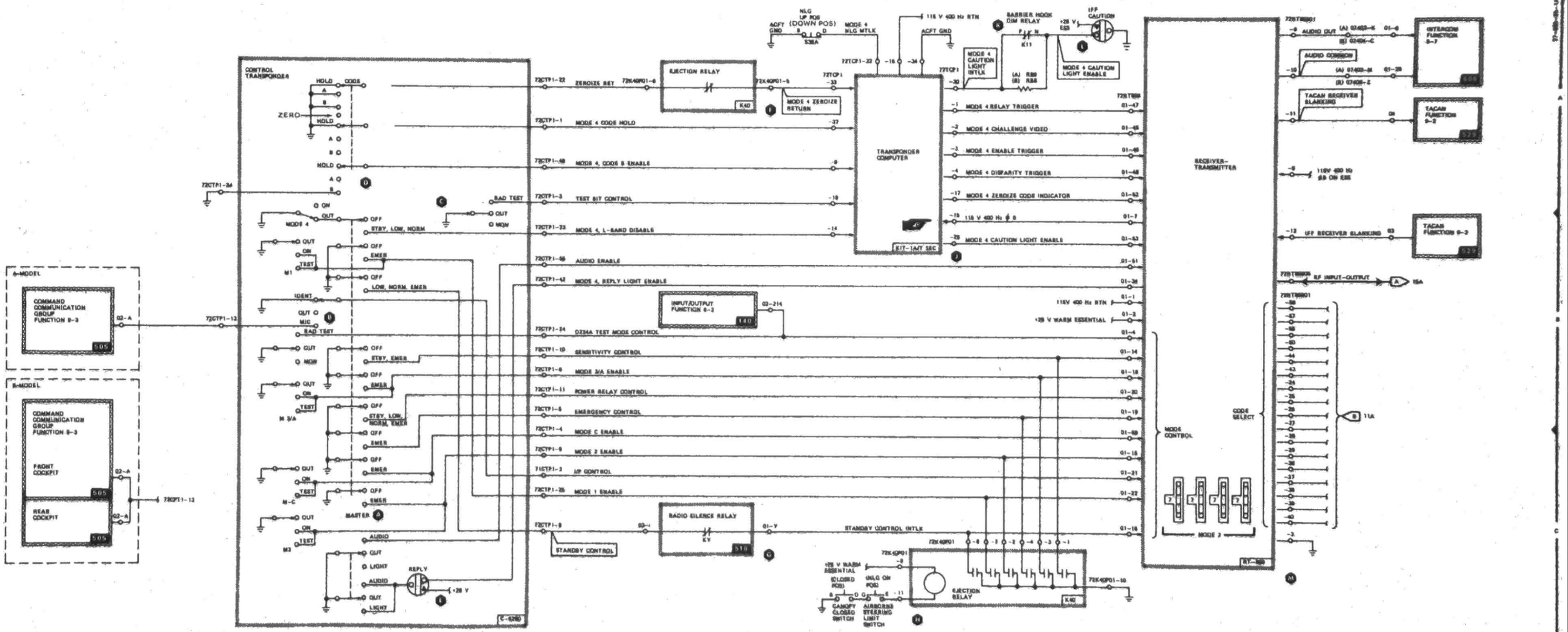
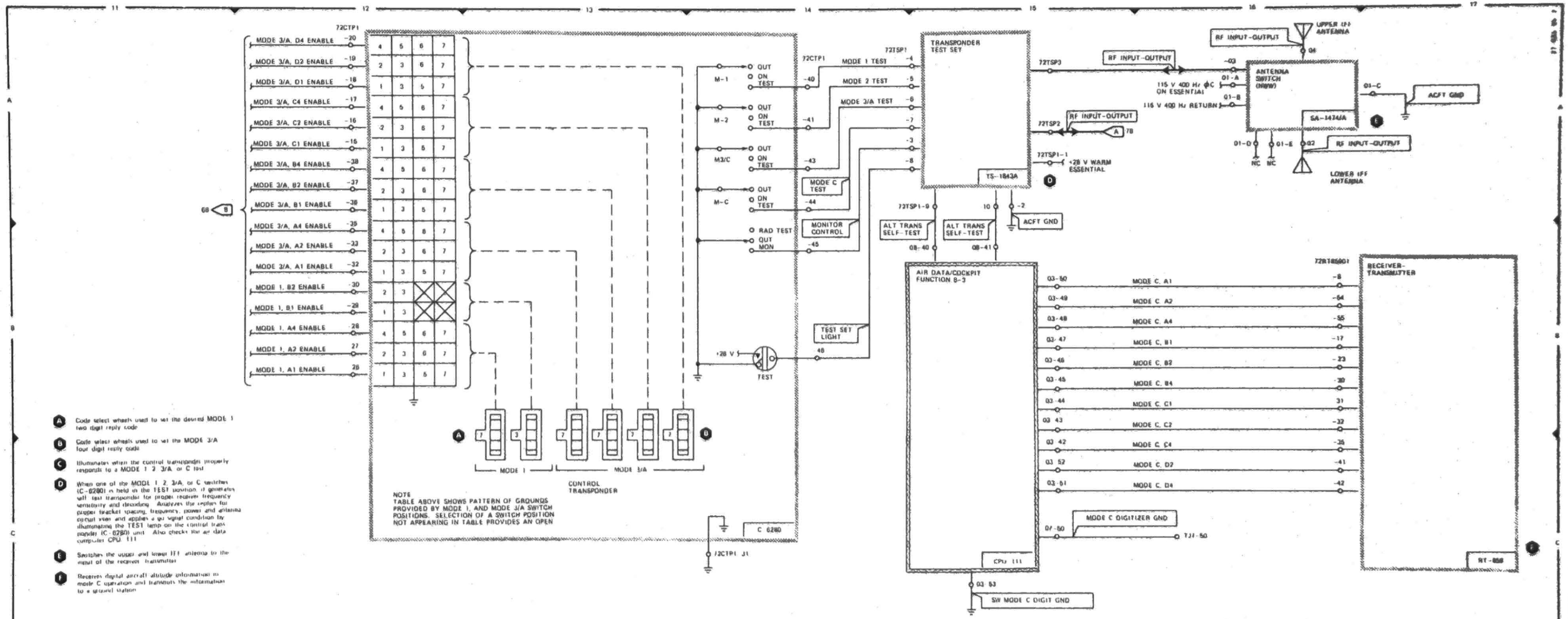


Figure 9-5 IFF (Sheet 2 of 3).



- A Code select wheels used to set the desired MODE 1 two digit reply code
- B Code select wheels used to set the MODE 3/A four digit reply code
- C Illuminates when the control transponder properly responds to a MODE 1 2 3/A or C test
- D When one of the MODE 1 2 3/A or C switches (C-6280) is held in the TEST position, it generates self test transponder for proper receive frequency sensitivity and decoding. Analyzes the replies for proper bracket spacing, frequency, power and antenna circuit vswr and applies a go/ no/go test condition by illuminating the TEST lamp on the control transponder (C-6280) unit. Also checks the air data computer CPU 111
- E Switches the upper and lower IFF antenna to the input of the receiver transmitter
- F Receives digital aircraft altitude information in mode C operation and transmits the information to a ground station

Figure 9-5. IFF (Sheet 3 of 3)

★U.S. GOVERNMENT PRINTING OFFICE: 1976- 676-749

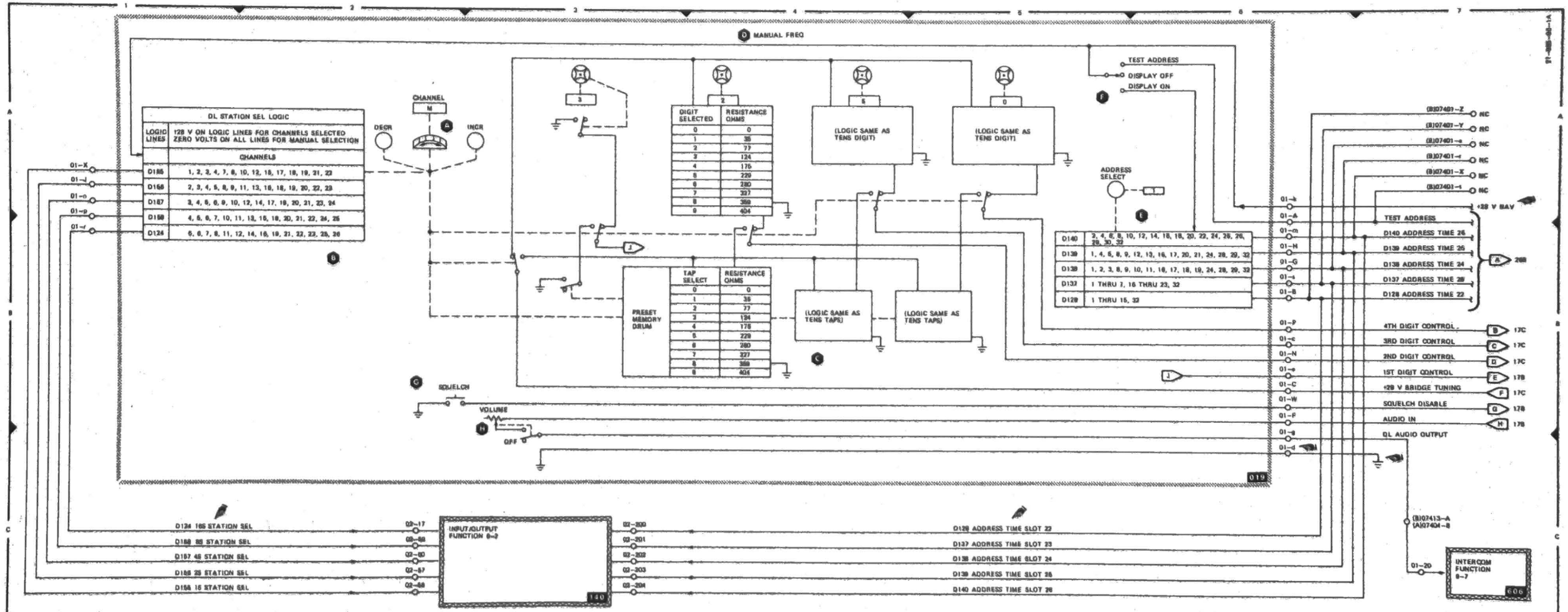


Figure 9-6. Data Link (Sheet 2 of 6)

The data link receiver (667) is a multichannel receiver that processes time division data link (TTDL) signals transmitted by a GCI station. The receiver detects and amplifies the A-M (voice ADF) and F-M (data content) signals. Receiver band switching and tuning is accomplished by an electrical-mechanical positioner (autopositioner) system based on control signals supplied by the converter control unit (019). Two injection frequencies are developed and used in forming the two i-f frequencies within the receiver.

A. Voltage sensitive relays receive frequency selected reference voltages from the converter control (019) unit to drive the positioner motor until voltages equal to the incoming reference voltages are received from the positioner motor tapped resistors. This represents a voltage null and opens the positioner motor power supply.

B. Positioner motor tapped resistors which form the second half of the resistance bridge used to energize voltage sensitive relays in the relay assembly section.

C. Positioner motor drives the tapped resistors and the tuning shafts of the oscillators, injection amplifiers, mixers, and r-f receiver.

D. Crystal controlled oscillator (A) develops the first injection frequency (between 190 and 360 MHz). The value of the first injection frequency is controlled by the selection of the first and second digits of the selected frequency.

E. Crystal controlled oscillators (B&C) develop the second local oscillator injection frequency (33.05 to 42.95 MHz) whose value is controlled by the third and fourth digits of the selected frequency.

F. Doubles and amplifies the first local oscillator injection frequency and applies it to the r-f tuner and mixer.

G. Amplifies and buffers the second local oscillator injection frequency and applies it to the variable i-f amplifier and mixer.

H. Amplifies the incoming r-f signals appearing at the data link antennas and mixes it with the first local oscillator injection signal to produce an i-f signal between 30.0 and 39.9 MHz. Applies the i-f signal to the variable amplifier mixer.

J. Mixes the 30.0 to 39.9 MHz i-f signal from the R-F tuner amplifier mixer with the 33.05 to 42.95 MHz injection signal to produce a difference frequency of 3.05 MHz.

K. Rejects spurious signals outside the 3.05 MHz band and determines the overall receiver bandwidth. Transmits the filtered 3.05 MHz signal to the dual AM-FM i-f amplifier.

L. Separates the 3.05 MHz signal into a data signal (FM) and audio ADF (AM) signal. Supplies the audio signal to the audio amplifier, ADF amplifier and squelch amplifier for processing. Supplies the data content signal (FM) to the data amplifier.

M. Amplifies the data signal and routes the signal to the digital data converter (220) unit and to the input of the self test amplifier for checking the receiver operation when SELF TEST S1 is pressed.

N. When SELF TEST S1 is pressed, data content signal from the data amplifier and +28v are supplied to the self test amplifier. The test amplifier rejects all signals except 200 microsecond pulses which comprise the synchronization portion of the data link message. Proper receiver operation is indicated by test lamp DS1 pulsing at an approximate rate of 30 Hz during data link reception.

O. Amplifies the audio signal to a level required to drive the external audio circuits.

P. Provides noise cancelling in the absence of voice or ADF signals in the audio amplifier. Squelch disable signal from the SQUELCH disable switch located in the cockpit provides minimum signal level reception at the audio amplifier.

Q. Provides signal isolation and impedance matching during ADF function.

R. When operating in the ADF mode, the ADF filter applies additional capacitance coupling between the AGC signal and ground. This permits ADF signals to appear in the audio output by preventing AGC signal opposition to the incoming ADF signals.

S. DATA LINK ANT switch located on the cockpit AUTO-NAV control panel selects either the tail antenna only or both (forward and tail) data link antennas. When the switch is closed (TAIL ONLY), +28 v is applied to the r-f switch which disconnects the forward antenna from the signal circuitry and connects a dummy load in its place. This causes the antenna receiving pattern to be pointed to the rear of the aircraft. When the switch is opened (normal), the dummy load is disconnected and both antennas are utilized causing a circular antenna receiving pattern.

T. When BRG SEL (V) (463) or MODE (R)(181) is set to ADF-DL, relays K13A and K13B (606) are energized. K13A disconnects the data link antenna from the receiver (667) and along with K13B connects the ADF antenna (117) in its place.

U. Switches the ADF antenna or data link antennas to the receiver (667).

Figure 9-6. Data Link (Sheet 3 of 6)

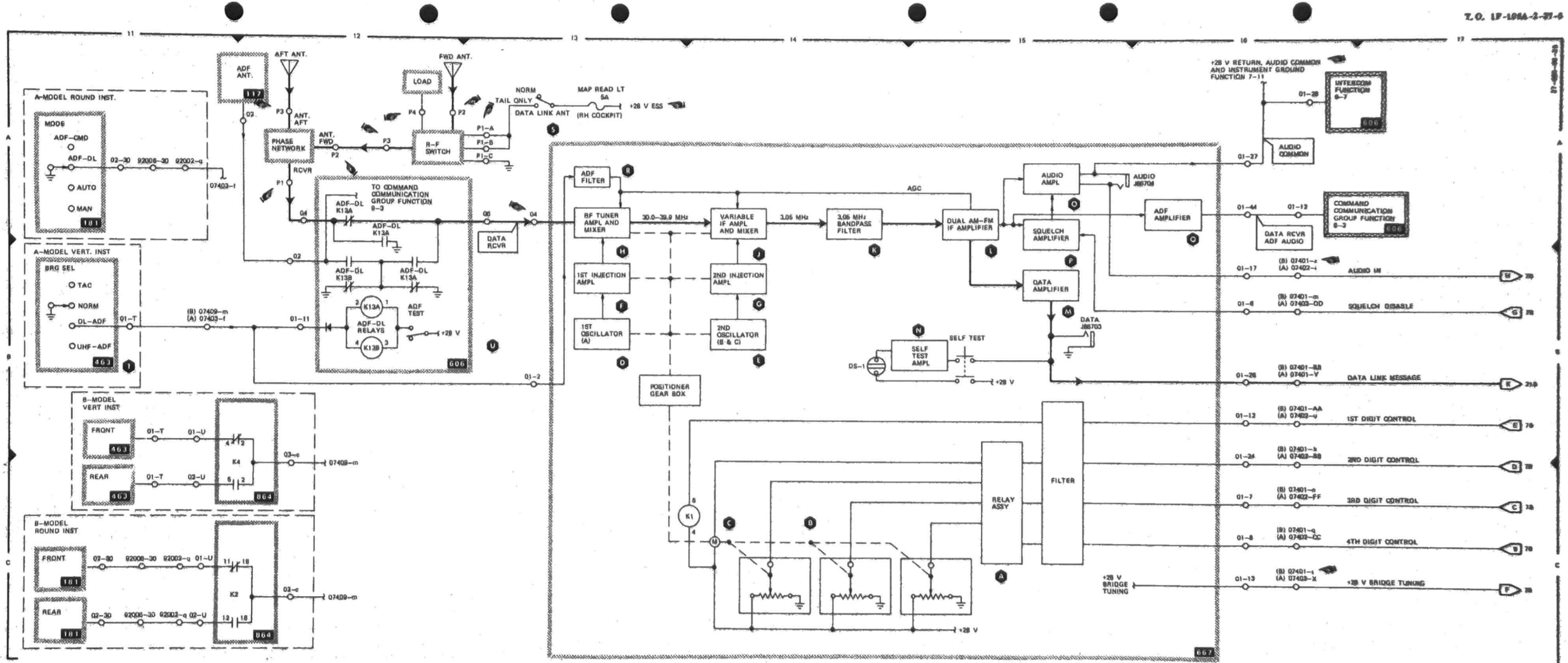


Figure 9-6. Data Link (Sheet 4 of 6)

The digital converter (220) processes incoming digital serial messages received by the data link receiver (667). The incoming data is checked for proper synchronization, address and parity, and if all are found to be correct, the digital converter then temporarily stores the label and words of the message in the high speed shift register. A ready signal is then generated by the digital converter (220) to the MA-1 computer (140) signifying that data is available. The MA-1 computer in turn generates interrogate and clock reference signals causing the digital converter (220) to output the stored data in proper time sequence. If either the address or parity of the message do not check, reject and reset circuits in the converter will be activated and they will disable the timing circuits, stopping the digital converter action on the present message.

A. Differentiates between a valid message bit and noise. Filters out low level noise and amplifies the inhibit gate signal from the inhibit gate channel and applies it to the synchronization gate. Reconstitutes 5 KHz signal and transmits it to the filter and amplifier section and the reshaper, self-test and logic gates.

B. Filters and amplifies 5 KHz reconstituted synchronization signal to 2 volts peak-to-peak.

C. Detects the 5 KHz synchronization signal and provides time delay. Outputs the delayed synchronization enable pulse to the synchronization gate circuitry. Inhibit channel searches the incoming signal for a correct synchronization pattern and outputs a logic inhibit pulse to the noise limiter and reconstitution amplifier to be amplified and then applied to the synchronization gate.

D. Generates synchronization, set and start pulses signifying that a valid synchronization pattern is present and the message proper may proceed.

E. Reshapes the message bit from the noise limiter and reconstitution amplifier into logic level signals. Logic outputs are referenced at either zero or -6 volt levels representing binary one or zero and are coupled to the input of the low speed shift register. Also rejects invalid messages by stopping the shift pulses at the clock and reset circuitry. Checks the parity of the message supplied by the check gate and if the parity is incorrect, supplies a stop signal through the count recognition gate amplifier to the stop-enable gate located in the clock and reset circuitry. Self test circuitry processes the (+) store pulses from the count recognition gate amplifier and transmits pulses to the fault indicator lamp signifying that data link messages are being processed.

F. Contains an 80 KHz oscillator which provides the base frequency for the timing circuitry. The oscillator output is applied to a start/stop gate amplifier which provides the triggering pulses to the A counter. When the message bits have been shifted into the low speed shift register, inhibit pulse from the count recognition gate amplifier is applied to the shift pulse gate preventing the shift pulses from triggering the shift register stages. The same inhibit signal is applied to the stop gate in the clock and reset circuitry to reset the stop-enable gate.

G. Sends a signal to parity flip-flop when the message contains a mark and the A counter is in its 9th or 10th count. This allows momentary sampling of message bits for use in parity checks.

H. Counts the square wave output of the 80 KHz oscillator and provides 16 counts for each message time slot. Provides gating and time correlation for processing the incoming message.

J. Functions electrically the same as A counter except it is triggered by the output of the A counter.

K. Applies a 15 B count pulse that sets the parity logic gate at the end of the 27th message time slot to indicate that each message bit thereafter is to be applied to the message check gate. Also generates a ready signal to the MA-1 computer (140) to indicate that a valid message has been received and is temporarily stored in the low speed shift register.

L. The combined inputs to the shift pulse gate amplifier are gated and amplified to initiate the shift pulses. The pulses are applied to the low speed shift register at each message time slot.

M. Temporarily stores the digital information contained in the message bit received from the noise limiter and reconstitution amplifier. Outputs the 13 address bits to the address select gate to check for proper address.

N. Receives the parallel data from the low speed shift register upon receipt of a (+) store pulse from the count recognition gate amplifier. When an interrogate and timing pulse are received from the MA-1 computer (140), the stored data is shifted in serial readout to the computer (140) in proper time sequence.

O. ADDRESS SELECT switches that manually set eight bits of the thirteen bits of the address code. Setting the switches vertically represents space (binary 0) and laterally represents mark (binary 1).

P. Contains five address relays that are energized by the setting of the ADDRESS SELECT switch located on the converter control unit (019). Proper address selection is accomplished when the five address relays and eight address switches connect the outputs of the low speed shift register to diodes of the address gates. Also contains a universal address gate circuit which receives the data link message with the universal code to check the proper operation of the data link equipment.

Q. Receives the correct address bits from the address select circuit and compares them with the message address bits received from the low speed shift register. If the incoming address is incorrect, an inhibit signal is transmitted to the count recognition gate amplifier. This amplifier in turn inhibits the start-stop gate, located in the clock and reset circuitry, from triggering the counter with the 80 KHz pulses. Hence there is no shift pulses and the message is rejected.

R. FAULT INDICATOR lamp located on the front of the digital converter indicates that complete and valid messages are being accepted in the low speed register by flashing for each message. A steady on or off condition of the lamp indicates that the low speed register is either not receiving a message or that an invalid message has been rejected.

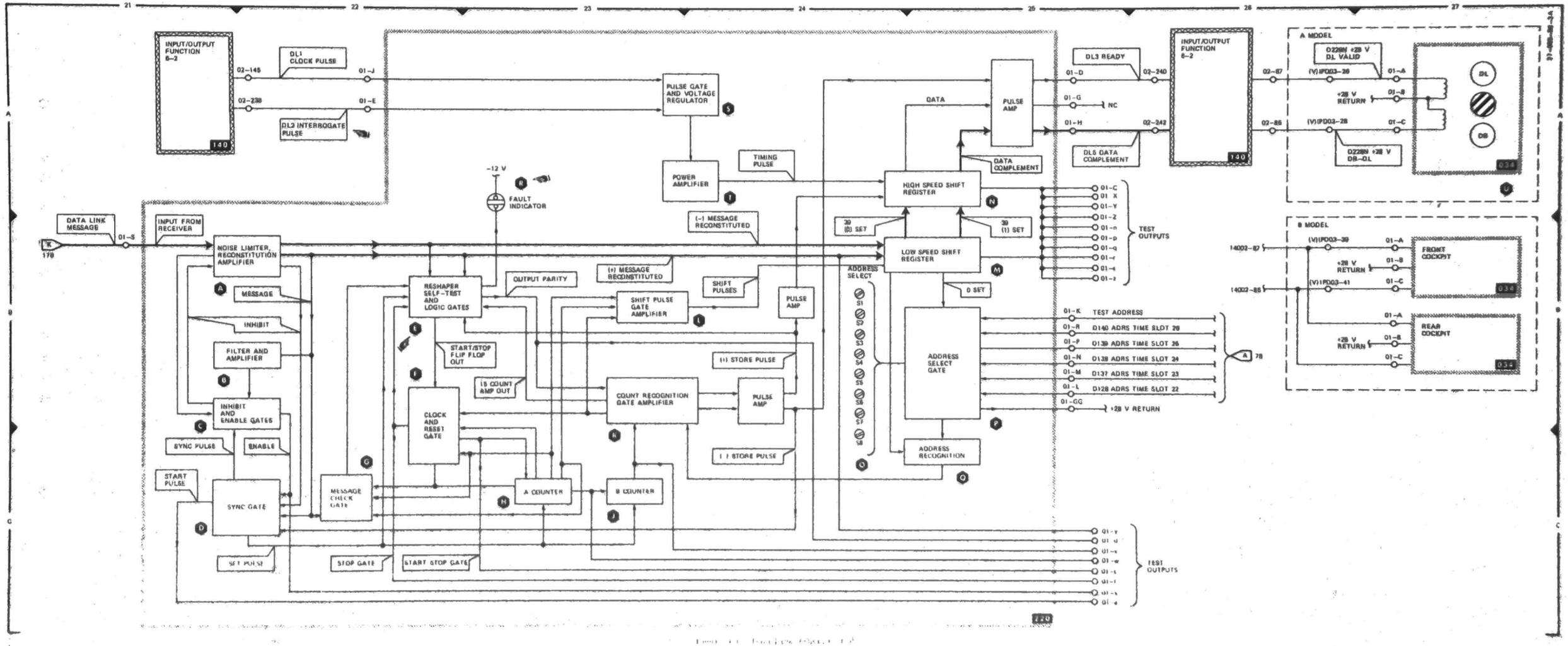
S. Receives the clock and interrogate pulses and gates these signals and applies the resultant signals to the power amplifier.

T. Amplifies the gated pulse from the pulse gate and voltage regulator circuit and applies a triggering pulse to the high speed shift register to shift the digital data out to the MA-1 computer (140).

U. Displays any one of three indications (DL, DR or "barber pole") to show the validity of data link. DL is displayed if close control (CC) is the primary mode of control and CC is valid. DR is displayed if modified close control (MCC) is primary mode of control and MCC is valid. "Barber pole" is displayed if both MCC and CC are invalid.

UNIT	RELAY	CONTACT	FIGURE/ZONE
606	K13A	COIL 1 AND 2	9-6/12B
	K13B	COIL 3 AND 4	9-6/12B

Figure 9-6. Data Link (Sheet 5 of 6)


INPUT/OUTPUT FUNCTION 6-2
140
DL1 CLOCK PULSE
DL3 INTERROGATE PULSE
PULSE GATE AND VOLTAGE REGULATOR
POWER AMPLIFIER
TIMING PULSE
-12 V
FAULT INDICATOR
(-) MESSAGE RECONSTITUTED
DATA LINK MESSAGE
INPUT FROM RECEIVER
NOISE LIMITER, RECONSTITUTION AMPLIFIER
MESSAGE
INHIBIT
FILTER AND AMPLIFIER
INHIBIT AND ENABLE GATES
SYNC PULSE
ENABLE
START PULSE
SYNC GATE
SET PULSE
RESHAPER SELF-TEST AND LOGIC GATES
OUTPUT PARITY
(+) MESSAGE RECONSTITUTED
SHIFT PULSES
SHIFT PULSE GATE AMPLIFIER
START/STOP FLIP FLOP OUT
CLOCK AND RESET GATE
MESSAGE CHECK GATE
STOP GATE
START STOP GATE
A COUNTER
B COUNTER
LS COUNT AMP OUT
COUNT RECOGNITION GATE AMPLIFIER
(1) STORE PULSE
(-) STORE PULSE
PULSE AMP
PULSE AMP
DATA
DATA COMPLEMENT
HIGH SPEED SHIFT REGISTER
LOW SPEED SHIFT REGISTER
30 (0) SET
30 (1) SET
0 SET
ADDRESS SELECT
ADDRESS SELECT GATE
ADDRESS RECOGNITION
TEST OUTPUTS
TEST ADDRESS
D140 ADRS TIME SLOT 26
D139 ADRS TIME SLOT 25
D138 ADRS TIME SLOT 24
D137 ADRS TIME SLOT 23
D128 ADRS TIME SLOT 22
+28 V RETURN
DL3 READY
DL5 DATA COMPLEMENT
NC
INPUT/OUTPUT FUNCTION 6-2
140
A MODEL
D228N +28 V DL VALID
+28 V RETURN
D228N +28 V DB-DL
DL
DB
034
B MODEL
FRONT COCKPIT
REAR COCKPIT
034
220

The intercom function provides voice communication between the pilot (or pilots in the F-106B aircraft) and ground crew while the aircraft is on the ground. It also provides the pilot with vital information from navigation system receivers necessary for the safe operation of the aircraft. This information is the communications and guard channel voice, localizer voice (ILS), data link voice, TACAN audio and IR aural tone. A warning tone is also provided to alert the pilot for landing gear position, altitude and air speed of the aircraft in a landing pattern. All of these signals are amplified by the ADF and audio electronic control amplifier (606) unit and applied to the pilot's headphones. Volume of all audio signals entering the headphones except the warning tone is controlled by the 605 unit. In F-106B aircraft the audio level between the front and rear cockpits is controlled by the 005 units.

A Applies a lockout signal to the warning tone relay K12 and altitude warn tone relay KA to deenergize K11 and remove the warning tone generator +24V power supply. K12 and KA remains energized as long as the warning tone signal is applied through energized contacts 8 and 5 of K12. KA will lockup through contacts 5 and 2 if an altitude warn signal is present. As soon as the pilot corrects the conditions that caused the warning tone signal to appear, the warning control signal will disappear and K12 and KA will deenergize allowing K11 to re-energize when an unsafe condition exists again.

B Generates a continuously changing warning tone between 1KHz and 3KHz whenever warning tone relay K11 is energized. This tone is modulated 2 Hz/Sec for landing gear warning and 6 Hz/Sec for altitude warning.

C Tests the operation of the warning tone generator

D Energized by the warning tone control signal. Factors controlling this signal are centered around up or down positioning of the landing gear, combined condition of airspeed and altitude of the aircraft, and presence of "full military power" for the aircraft engine.

E Audio transformer provides matching impedance between the output of the preamplifier and the input to the transmitter (RT-749).

F Amplifies microphone audio signals with an overall voltage gain between 0.4 and 12.8 over a frequency range of 300 - 10,000 Hz

G Controls an oscillator in the RT-749 unit that generates a 1020 Hz tone signal used to modulate the UHF transmission carrier.

H Self test unit used to initiate short system ground check.

J Energized whenever a ground interphone communication set (AN/GIC-3) is plugged into the J08 (MWW), which provides communication between ground crew and cockpit or cockpits in the case of F-106B aircraft.

K Amplifies all the audio input signals and applies them to the pilot's headphones thru the attenuation pad (505)

L When energized by the TONE button (505) or GROUND TEST INTERROGATE button (796) or push to talk buttons located on the throttle and hand consol, it applies the command receiver and sidetone audio transmission signal to the audio amplifier and attenuates all other receiver noise/signals except data link and IFF

M Attenuation pad which controls the audio level of all the communication signals, except the audio warning tone, to the pilot's headphones

N Presents a constant matching impedance of 150 ohms between the audio amplifier and pilot's headphones

P When KA is energized a landing gear warning tone is generated. When KA is deenergized an altitude warning signal is generated.

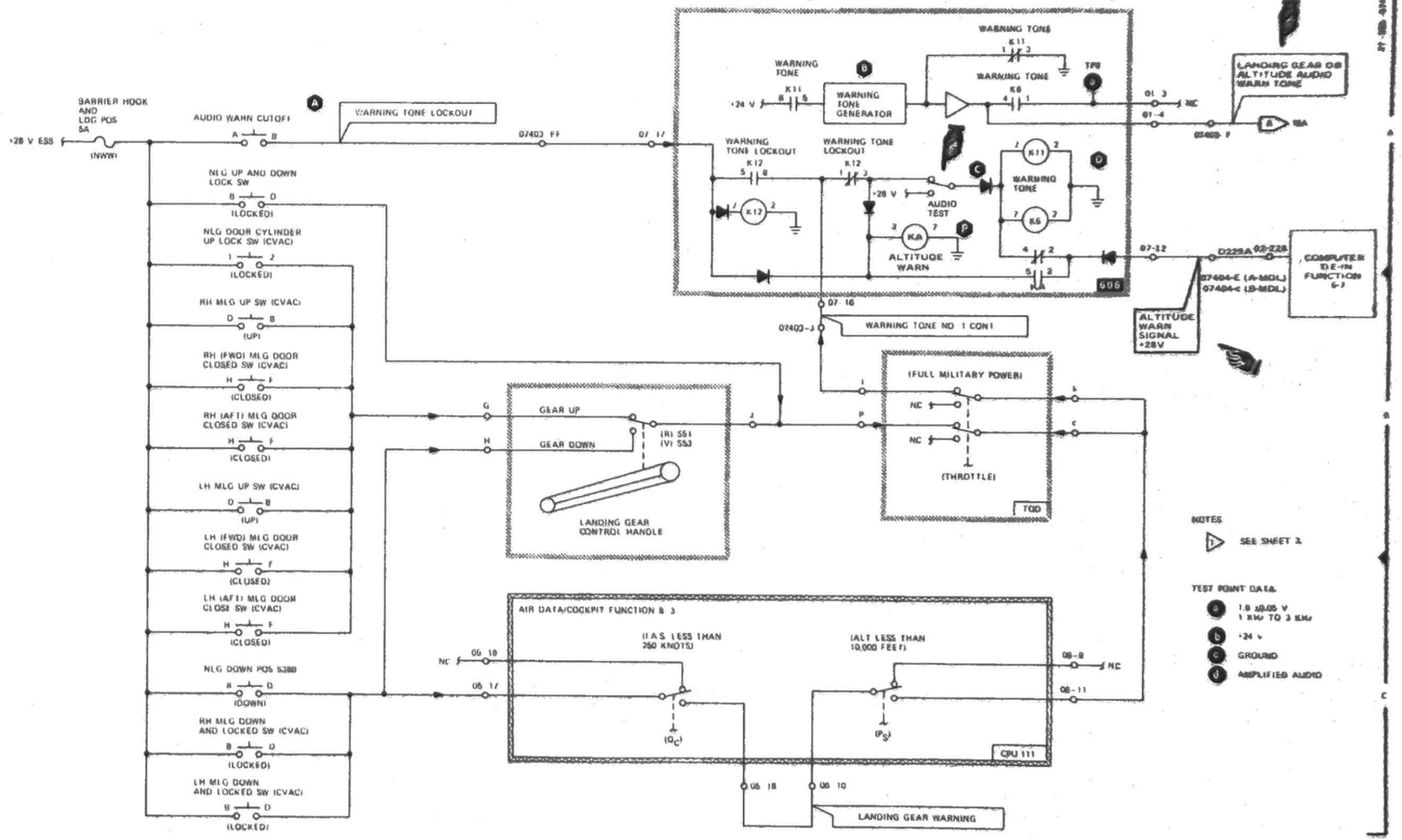


Figure 9-7. Intercomm (Sheet 1 of 4)

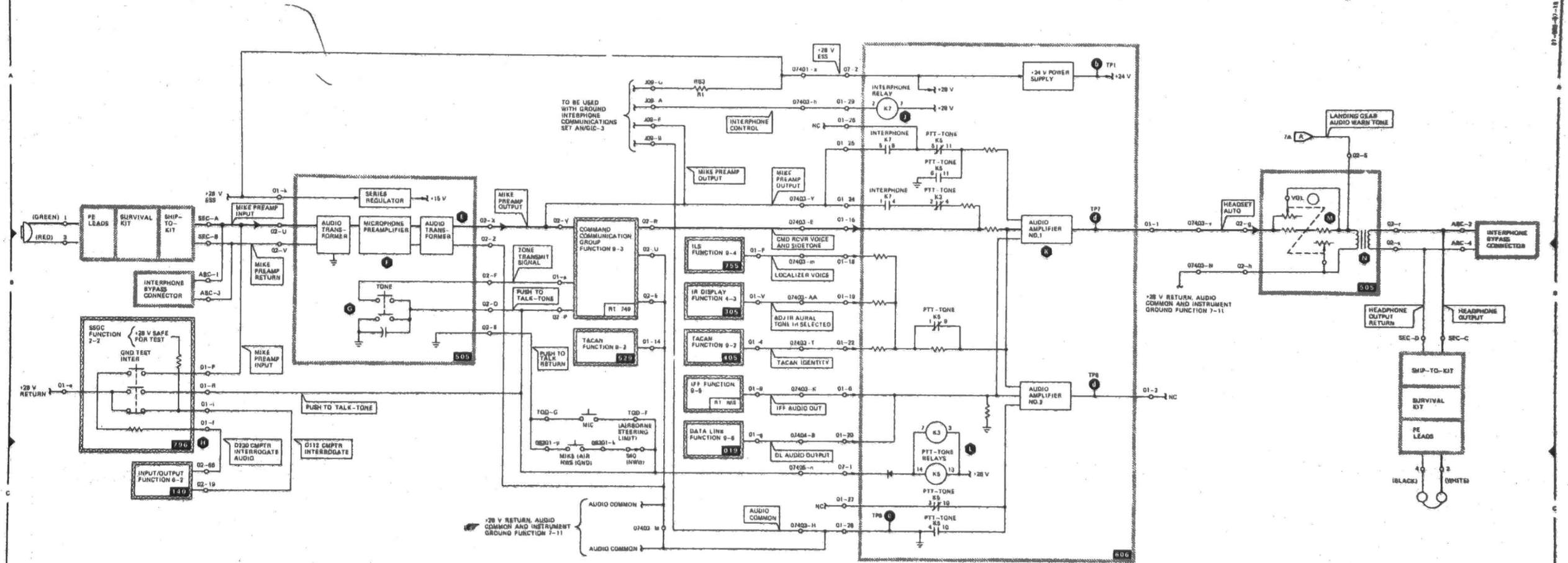


Figure 9-7. Intercomm (Sheet 2 of 4)

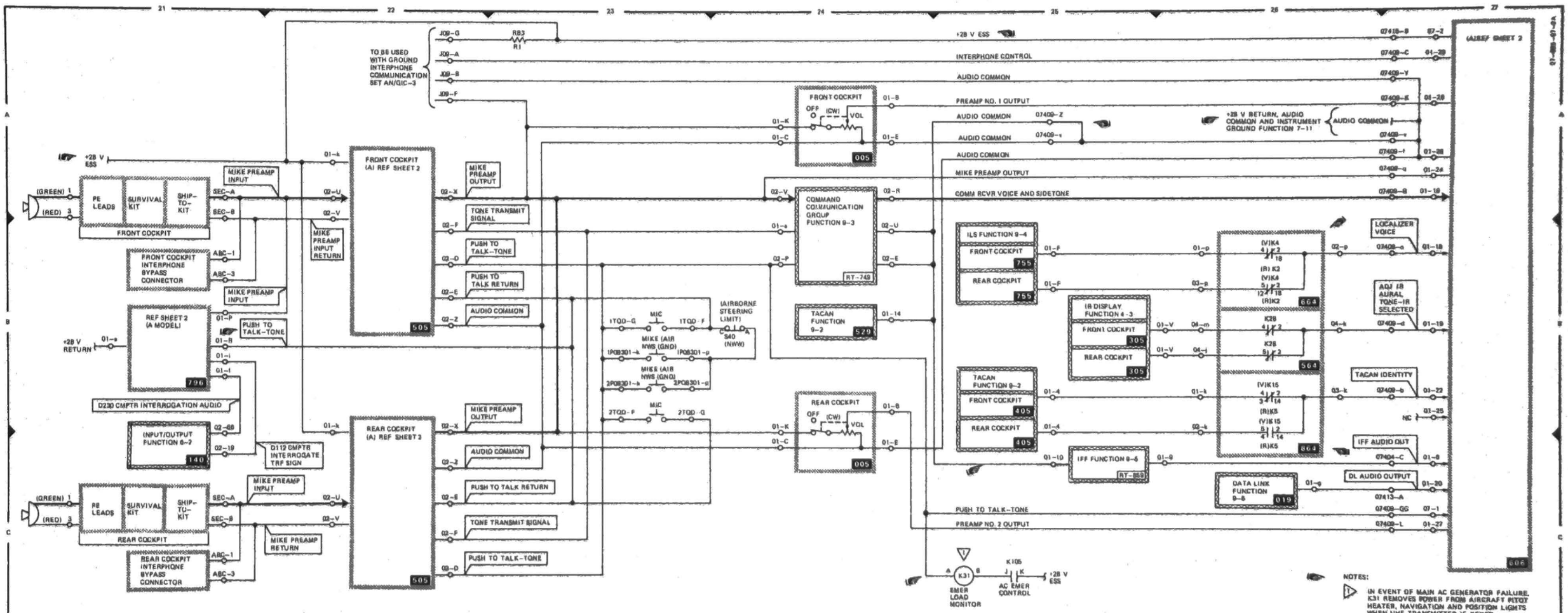


Figure 9-7. Intercomm (Sheet 3 of 4)

★U.S. GOVERNMENT PRINTING OFFICE: 1977- 775-053

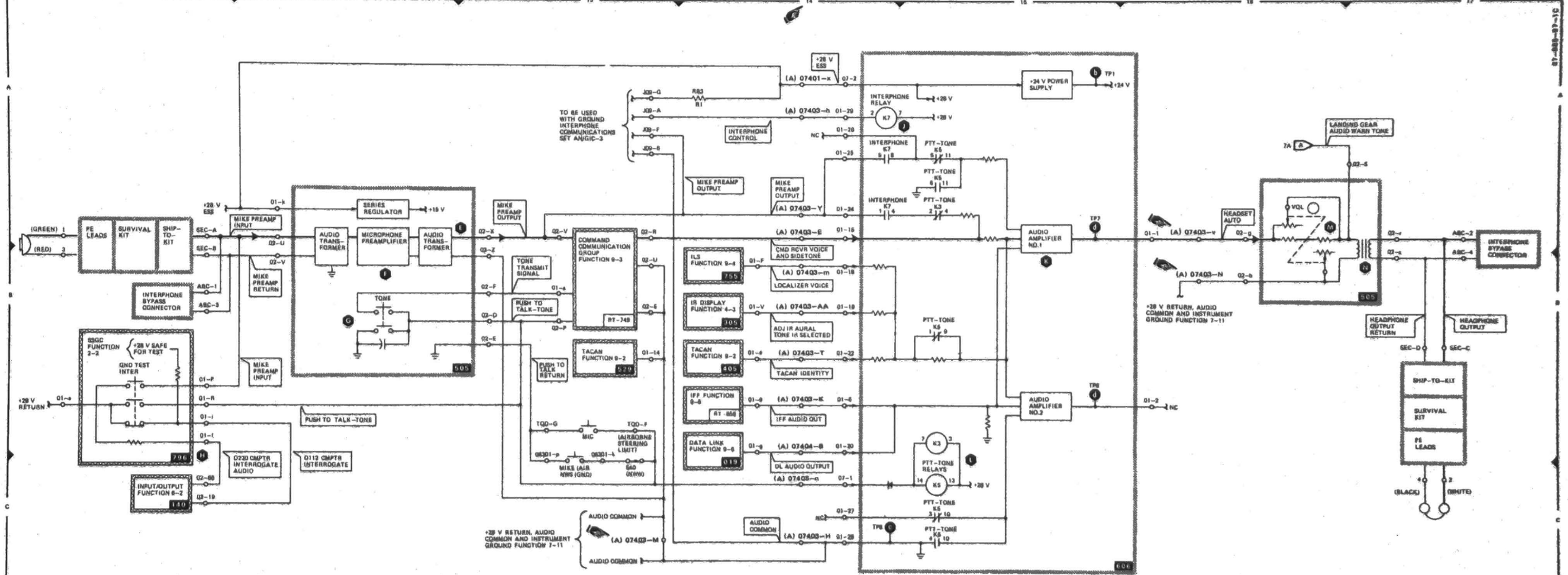


Figure 9-7. Intercomm (Sheet 2 of 4)

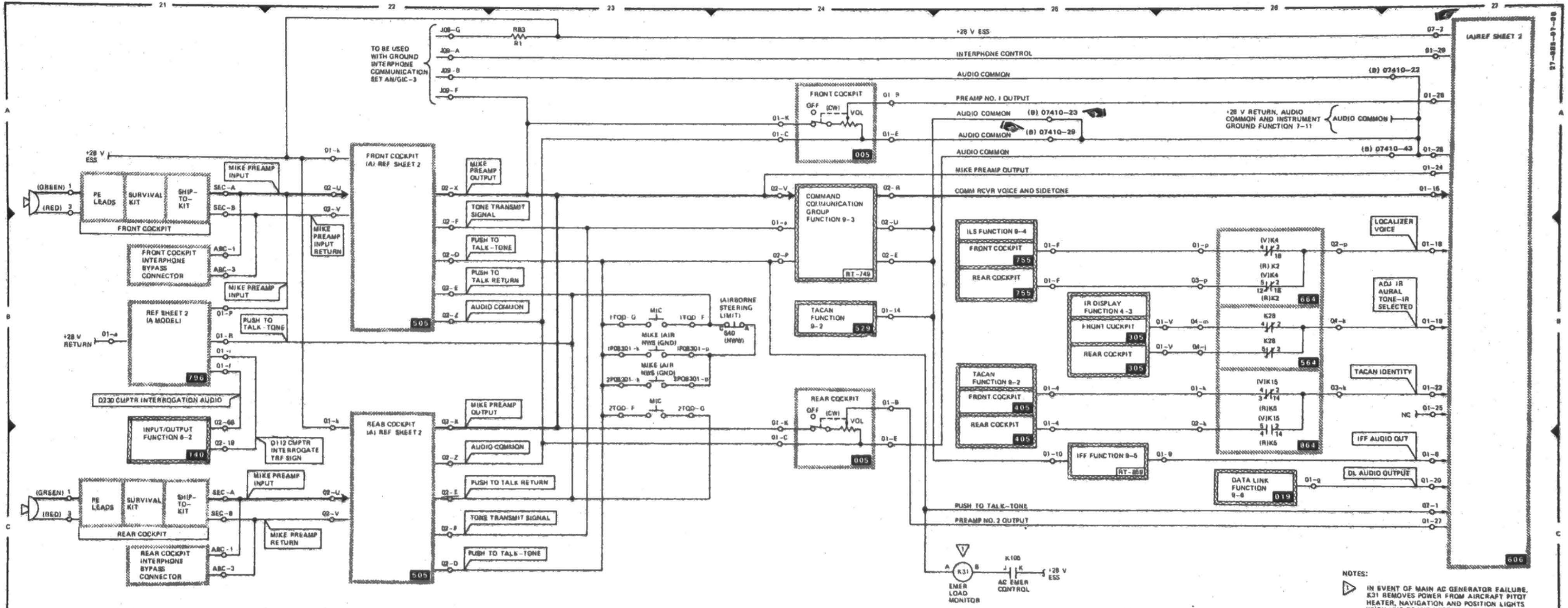
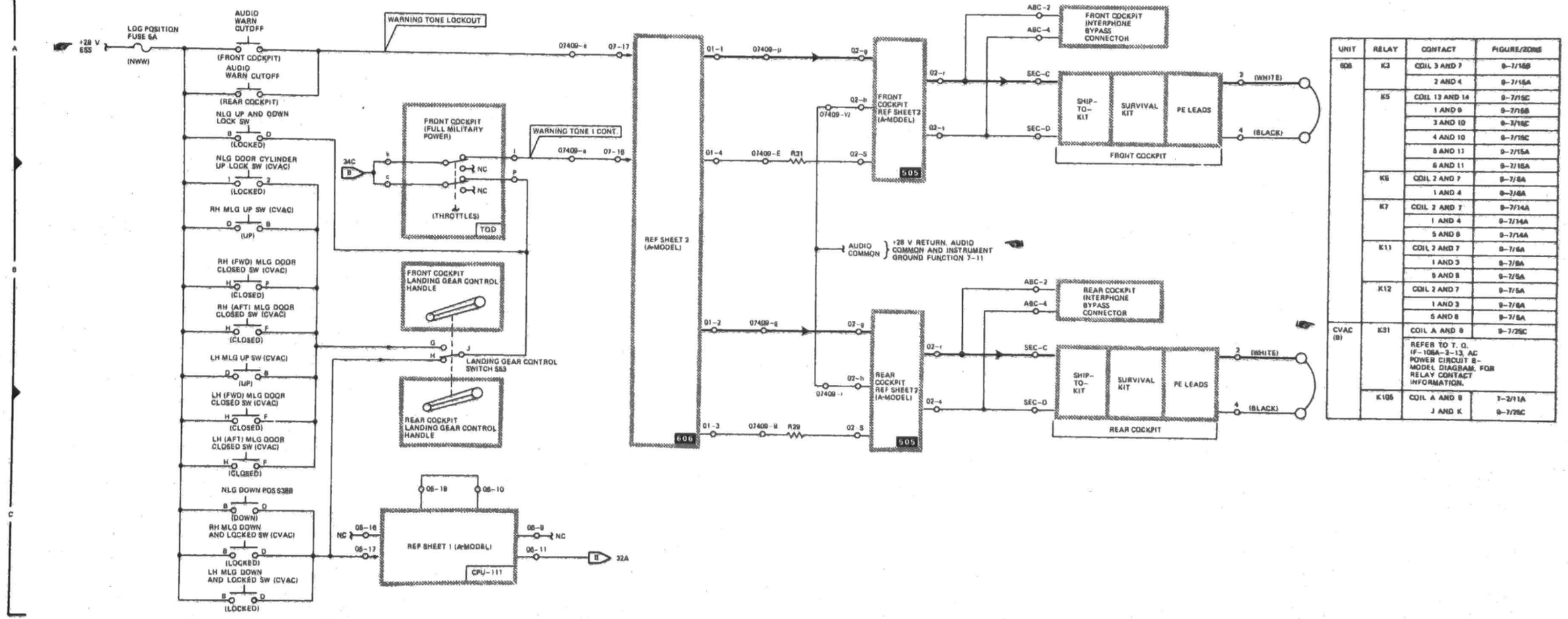


Figure 9-7. Intercomm (Sheet 3 of 4)

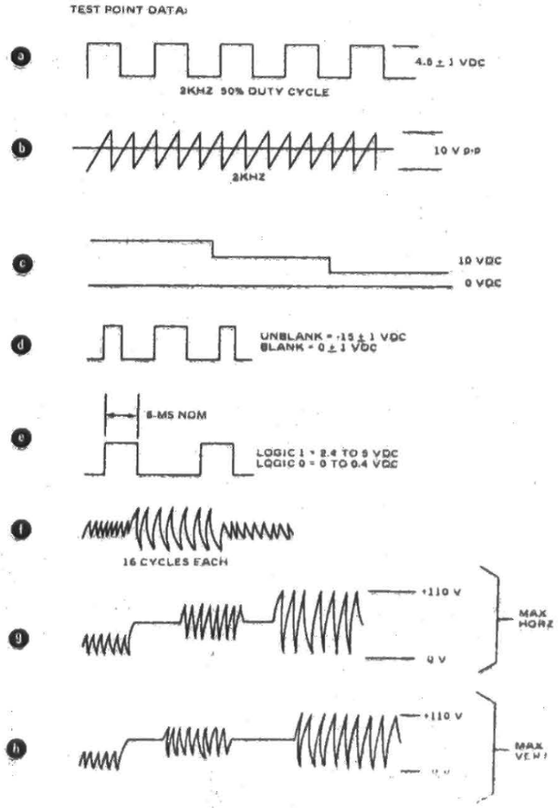


UNIT	RELAY	CONTACT	FIGURE/ZONE
606	K3	COIL 3 AND 7	9-7/15B
		2 AND 4	9-7/15A
	K5	COIL 13 AND 14	9-7/15C
		1 AND 9	9-7/15B
		3 AND 10	9-7/15C
		4 AND 10	9-7/15C
		8 AND 11	9-7/15A
		6 AND 11	9-7/15A
	K6	COIL 2 AND 7	9-7/8A
		1 AND 4	9-7/8A
	K7	COIL 2 AND 7	9-7/14A
		1 AND 4	9-7/14A
		5 AND 8	9-7/14A
	K11	COIL 2 AND 7	9-7/6A
		1 AND 3	9-7/8A
		5 AND 8	9-7/5A
	K12	COIL 2 AND 7	9-7/5A
		1 AND 3	9-7/6A
		5 AND 8	9-7/8A
CVAC (B)	K31	COIL A AND B	9-7/25C
		REFER TO T. O. 1F-106A-2-13, AC POWER CIRCUIT B-MODEL DIAGRAM, FOR RELAY CONTACT INFORMATION.	
	K105	COIL A AND B	7-2/11A
		J AND K	9-7/25C

Figure 9-7. Intercomm (Sheet 4 of 4)

CHAPTER 10

SNAPSHOOT SYSTEM



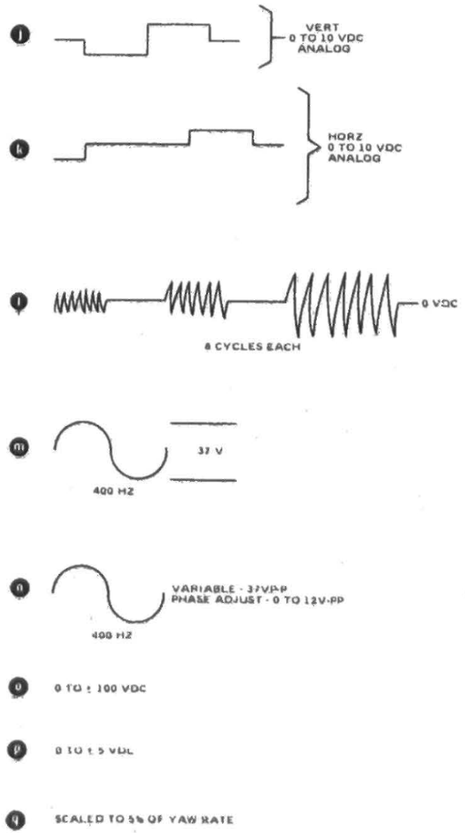


Figure 10-1. SnapShoot System Symbology (Sheet 1 of 2)

Ⓐ The support electronics directs the SnapShoot display of the MMST. From the computer system digital input lines, information about the position and size of the symbols to be displayed is decoded. Symbol position, size, and time-sequencing data is determined and transmitted directly to the MMST for real-time symbol display.

Ⓑ Divides the 2-kHz clock signal down to 41.67 Hz, producing the required display frame time.

Ⓒ Decodes the output of the counter to obtain the time intervals for horizontal and vertical bars of each symbol. The SMB signals define the time during which both parts of the symbols will be on the MMST deflection plates. The deflection beam is unblanked for only a small period for each mark (once for the vertical line and once for the horizontal line).

Ⓓ Decodes the blanking signal from the counters and produces the proper voltage levels.

Ⓔ Scales and centers the 2-kHz triangular signal; the generates and scales the product of the RAD signals and triangular signal. The resultant signal is called TROT (track-range on target) and is a triangle whose peak-to-peak amplitude is determined by the value of the applicable RAD signal when the applicable SMB signal is high. TROT forms the horizontal portion of the symbol. The vertical portion of the symbol is derived by dividing TROT by 3 with potentiometer R72 and is called ATROT (angle track-range on target).

Ⓕ Adds the applicable vertical signal to the ATROT signal to draw the vertical portion of the symbol on the MMST.

Ⓖ Adds the applicable horizontal signal to the TROT signal to draw the horizontal portion of the symbol on the MMST.

Ⓗ Converts and scales the YAW rate signal to the input range of the ILS channel.

Ⓙ Phase detects, rectifies, and scales the Beta signal (side slip information) from an amplitude-and phase modulated 400-Hz synchro signal to a -5 volts to +5 volt dc signal.

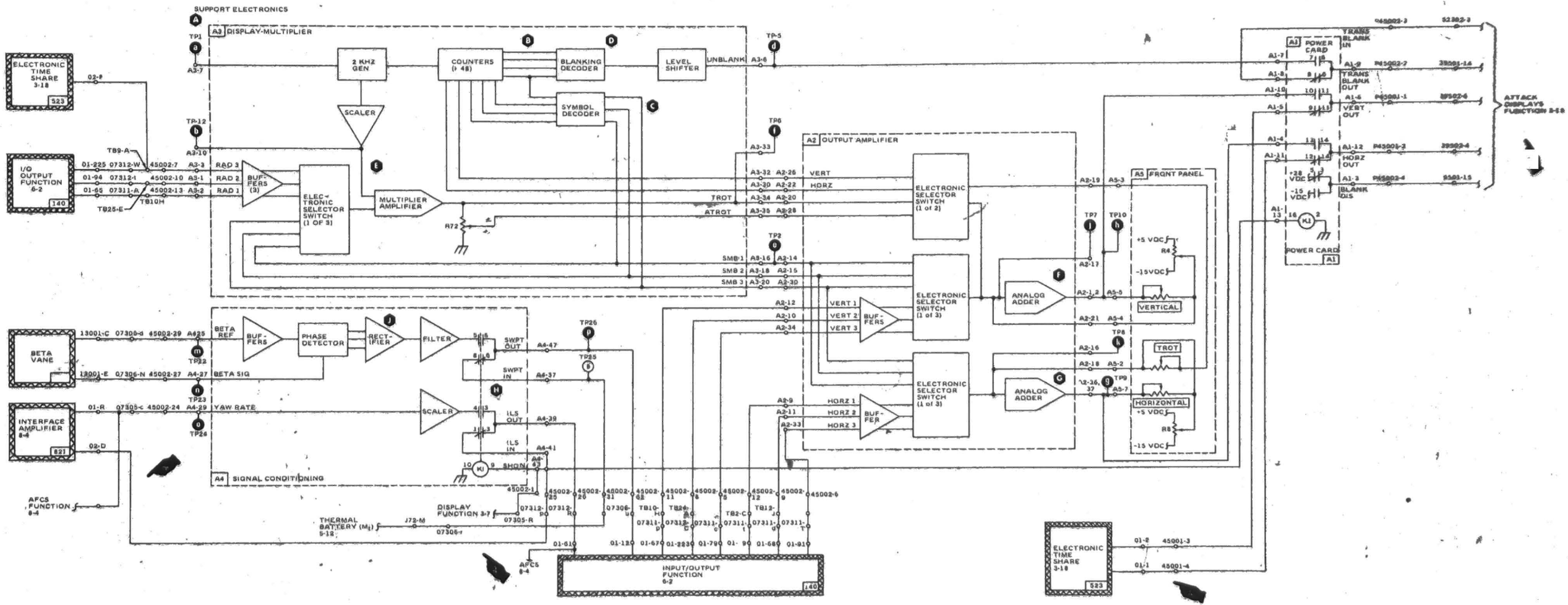


Figure 10-1. SnapShoot System Symbology (Sheet 2 of 2)