MAINTENANCE MANUAL

BEECHCRAFT
H-14 AUTOPILOT

Part No. 130333F

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RECORD OF REVISIONS

PAGE NO.	REV. NO.	REV. DATE	INSERTION DATE	PAGE NO.	REV. NO.	REV. DATE	INSERTION DATE

Retain this record in the front of the Manual. On receipt of revisions, insert revised pages in the Manual then enter page number, revision number, revision date, and date inserted.

SERVICE BULLETIN RECORD

SERVICE BULLETIN NUMBER	DATE ISSUED	EQUIPMENT TYPE	SUBJECT

The above chart is provided for your use in listing KING Service Bulletins covering the equipment in this manual. We suggest that you file these Service Bulletins in your Master Service Bulletin Notebook for future reference.

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The information in this maintenance manual does not profess to include all the details of design, production, or variations of the equipment, or to cover all the possible contingencies which may arise during operation, installation, or maintenance. Should special problems arise or further information be desired, please contact the KING Customer Service Department.

SECTION I

SYSTEM DESCRIPTION

1. CONTROL FUNCTIONS. The H 14 Autopilot combines stability augmentation, autopilot, and navigational functions into an integrated aircraft automatic flight control system. By using an advanced concept of uniform control, the H 14 provides these functions for a variety of aircraft models without critical gain and parameter adjustments, without air data scheduling, and without calibration by either knobs or circuit replacement. The autopilot functions are provided in both standard and optional configurations as follows:

   A. Standard

      (1) Three-axis stability augmentation (stabilization).

      (2) Attitude and heading hold.

      (3) Full time automatic turn coordination.

      (4) Turn command.

      (5) Climb-descent command.

      (6) Engine failure recovery.

      (7) Automatic lift compensation in turns.

   B. Optional

      (1) Altitude hold.

      (2) Automatic ILS localizer and glide slope coupling.

      (3) Automatic VOR coupling.

      (4) Heading select and preselect.

      (5) Automatic pitch trim.

      (6) Integration with slaved compass, flight director, or pictorial navigational systems.

2. CONTROL ELEMENTS

A. General. The typical autopilot contains four types of control elements which function in the aircraft flight control loop as shown in figure 1-1. These elements are:

(1) Command elements for receiving pilot inputs and for coupling navigational signals into the control system.

(2) Sensing elements for measuring aircraft attitude or altitude changes and for generating electrical signals corresponding to these changes.

(3) Computing elements for generating control commands based on pilot, sensor, or navigational information.

(4) Output elements for controlling the aircraft's aerodynamic surfaces in response to computer commands.

B. Element Components. The components comprising the autopilot control elements are shown in figure 1-2. Relate these components to the system block diagram, figure 1-5 to locate their positions in the aircraft control loop.

3. PITCH AXIS OPERATION

A. Stabilization

(1) The basic control loop in the pitch axis consists of the stabilization circuit. In this circuit, pitch attitude signals from the vertical gyro in the attitude indicator are fed through a rate derivation circuit and a high gain servo amplifier and shaping circuit into the servo modulator. The signal is modulated into a time sharing 22Hz square wave which controls the two valves of the electro-pneumatic servo to provide the required torque or control system hinge movement.

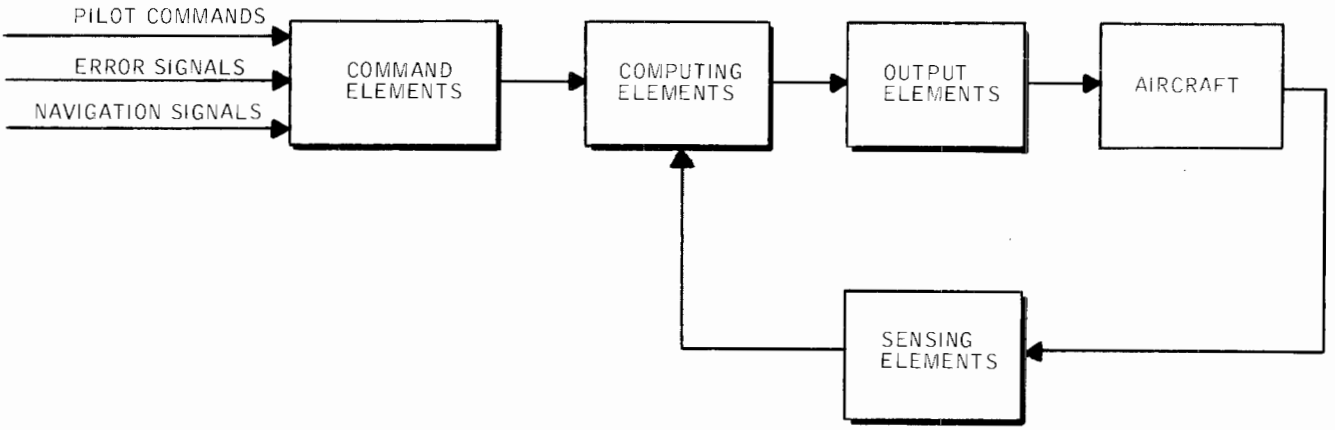
(2) The characteristics of the torque-limited pneumatic servo are incorporated during system installation through fixed orifices and the proper size cable drum on the servo actuator. System compensation then occurs around this established reference.

(3) Since the autopilot is concerned only with the response characteristics of the vehicle and not of the control system no followup potentiometer is included in the servo actuator.

B. Pitch Attitude and Command Control

(1) Pitch attitude control is achieved by summing a pitch command signal from the flight controller PITCH wheel with the pitch attitude signals from the vertical gyro. The signals are summed at the input of the servo amplifier.

(2) The pilot can command climb or descent attitudes of up to 18 degrees 22.5° with CG515through the PITCH wheel.



Control Elements of Aircraft Flight Control Loop

Figure 1-1

C. Altitude Hold Mode

(1) The altitude hold mode is engaged through the ALT switch on the flight controller provided the autopilot (MASTER) switch is first engaged. When this mode is engaged, altitude deviations are sensed by variations in barometric pressure from a pressure altitude reference. Electrical outputs of these variations maintain altitude through pitch attitude changes.

(2) The altitude hold mode is automatically disengaged by either a pitch command through the PITCH wheel or by manual disengagement of the ALT or MASTER engage switch. Altitude control authority is limited for pilot safety.

D. Glide Path Coupling Mode

(1) The glide path coupling mode is armed by the engagement of the ILS localizer (described under paragraph E. Roll Axis Operation). Once armed, the glide path electrical circuit senses the approach to beam center, automatically engages the coupler, automatically disengages altitude hold if the mode is engaged, captures the glide path, and commands pitch attitude control to guide the aircraft down to approach minimum altitude.

(2) Integration of beam error is provided to eliminate steady offset due to headwind components and to provide tight accurate control along the beam. The pitch authority of the glide path coupler is limited to ± 12 degrees maximum. Glide path control is uncoupled with disengagement of the ILS mode.

E. Automatic Trim System

Automatic pitch trim is provided by addition of the DG1009 electric pitch trim adapter, or addition of the differential pressure switch and pitch trim actuator to the basic system.

(1) The DG1009 Autotrim Adapter detects steady state elavator loads reflected back to the autpilot. The detected signal is used to switch 28vdc to an output load. The output load is part of the aircraft system and may be a relay coil motor or other device with an input impedance greater than 100 ohms.

(2) An automatic pitch trim system consisting of a trim actuator and a differential pressure switch mounted on the valve of the elevator servo actuator is also available. The differential pressure switch supplies pneumatic pressure to drive the trim actuator. When an appropriate differential pressure is detected by the switch, one of the two valves actuates. The valve which actuates determines the direction of pitch trim change. Pressure released by the differential pressure switch drives a turbine in this trim actuator. The turbine drives the trim actuator output shaft through a 2,000:1 ratio in a compound epicyclic gear train. The output shaft is disengaged from the gear train until a pneumatic signal is received at the turbine. This prevents drag on aircraft control cables.

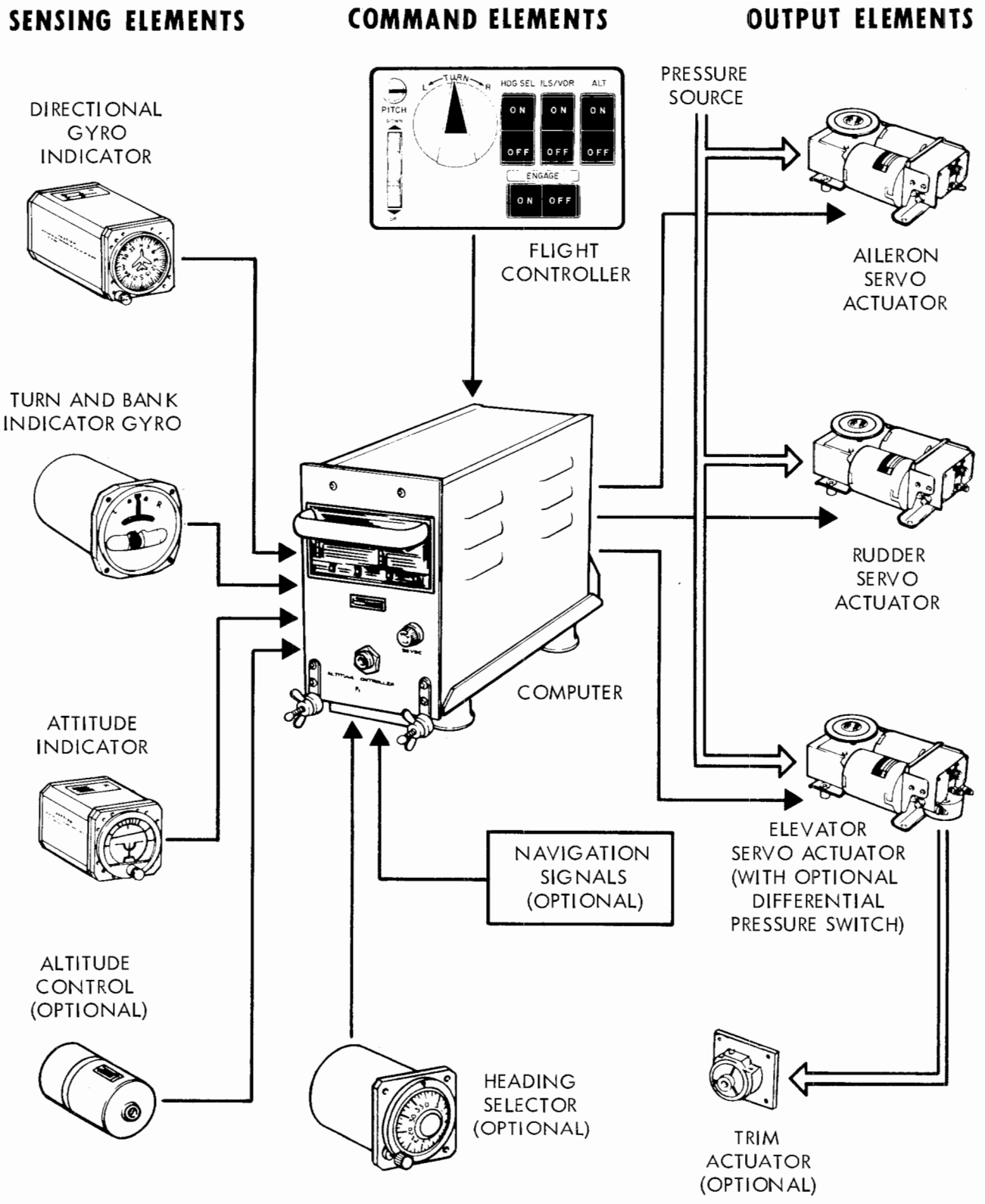
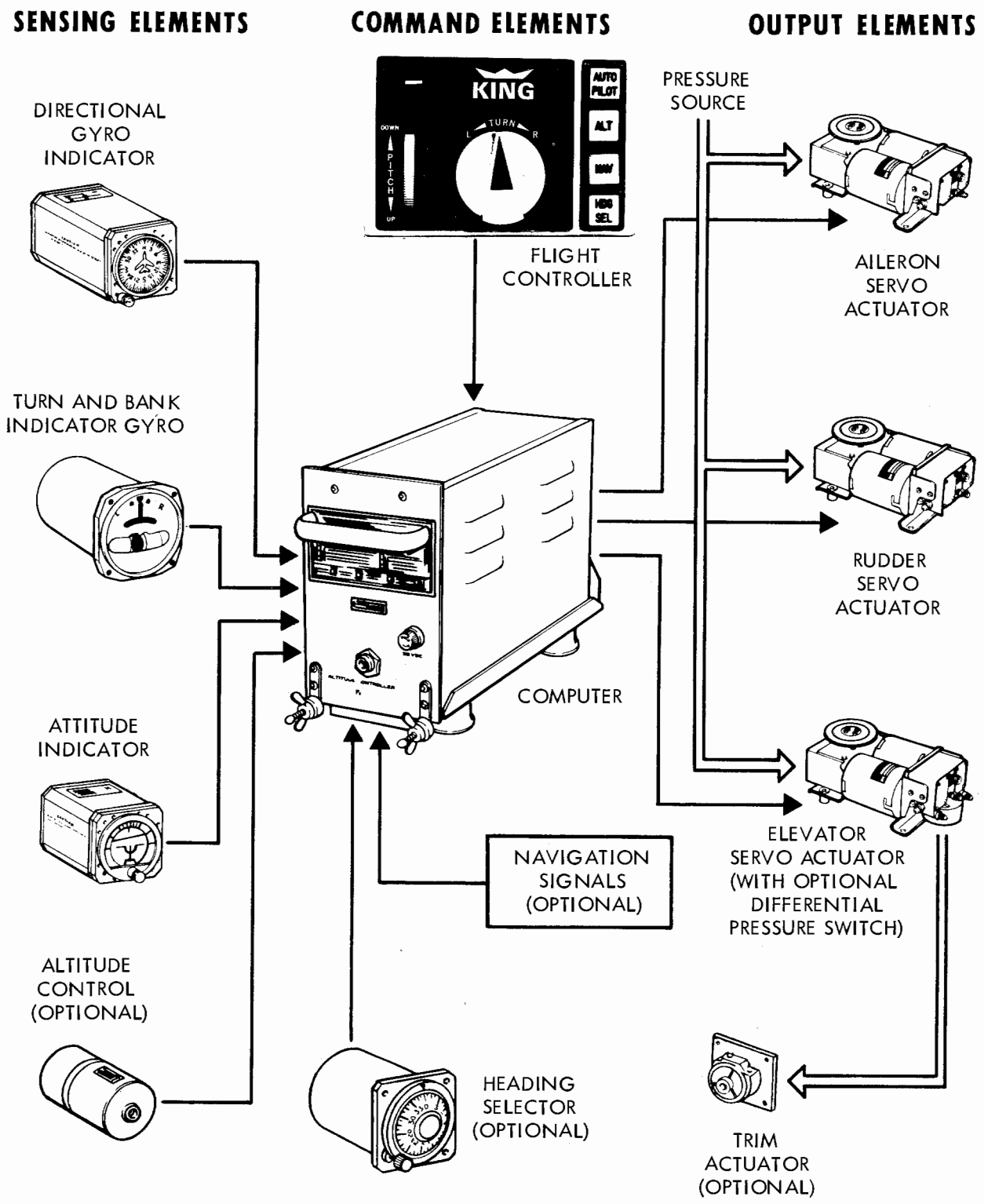
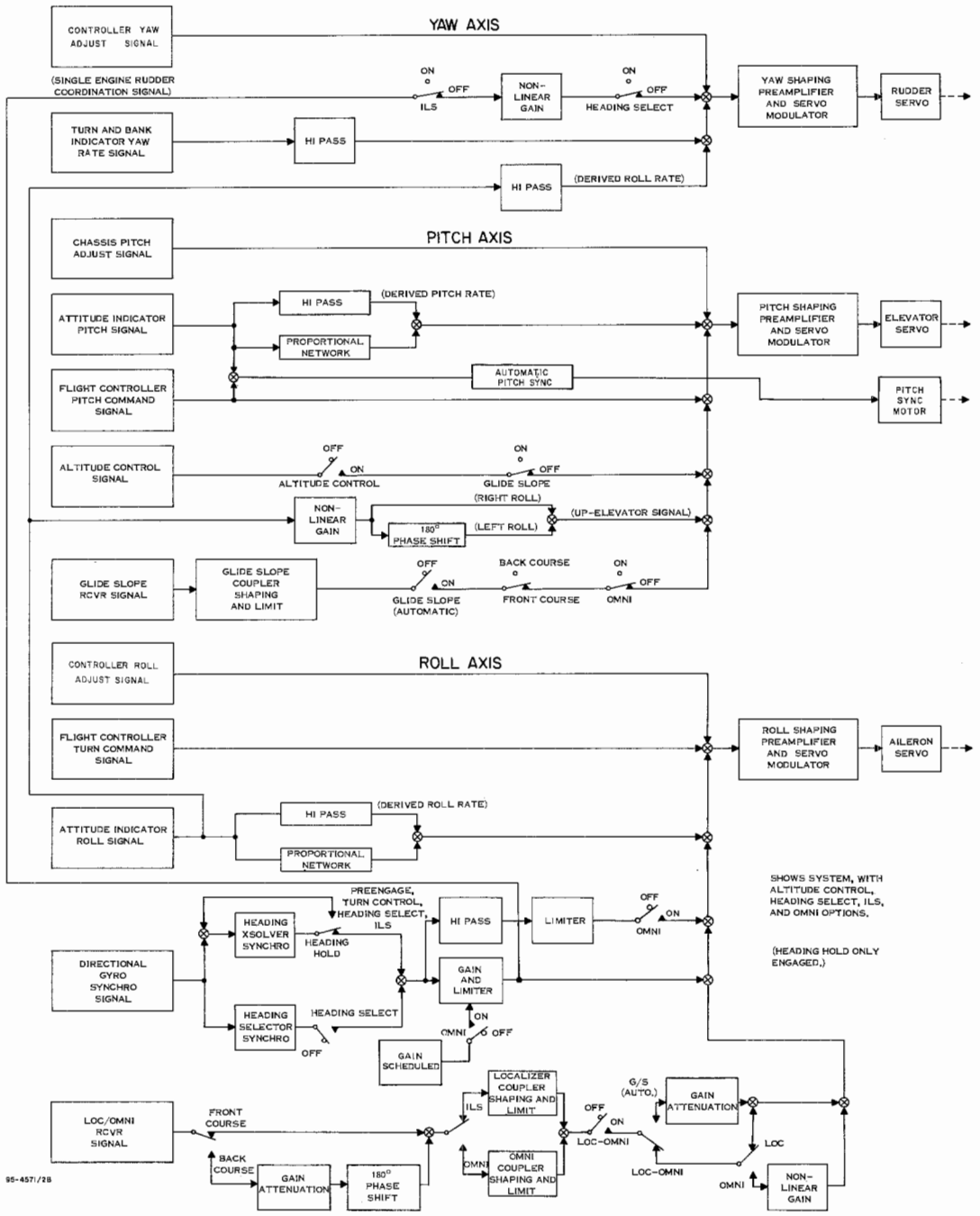


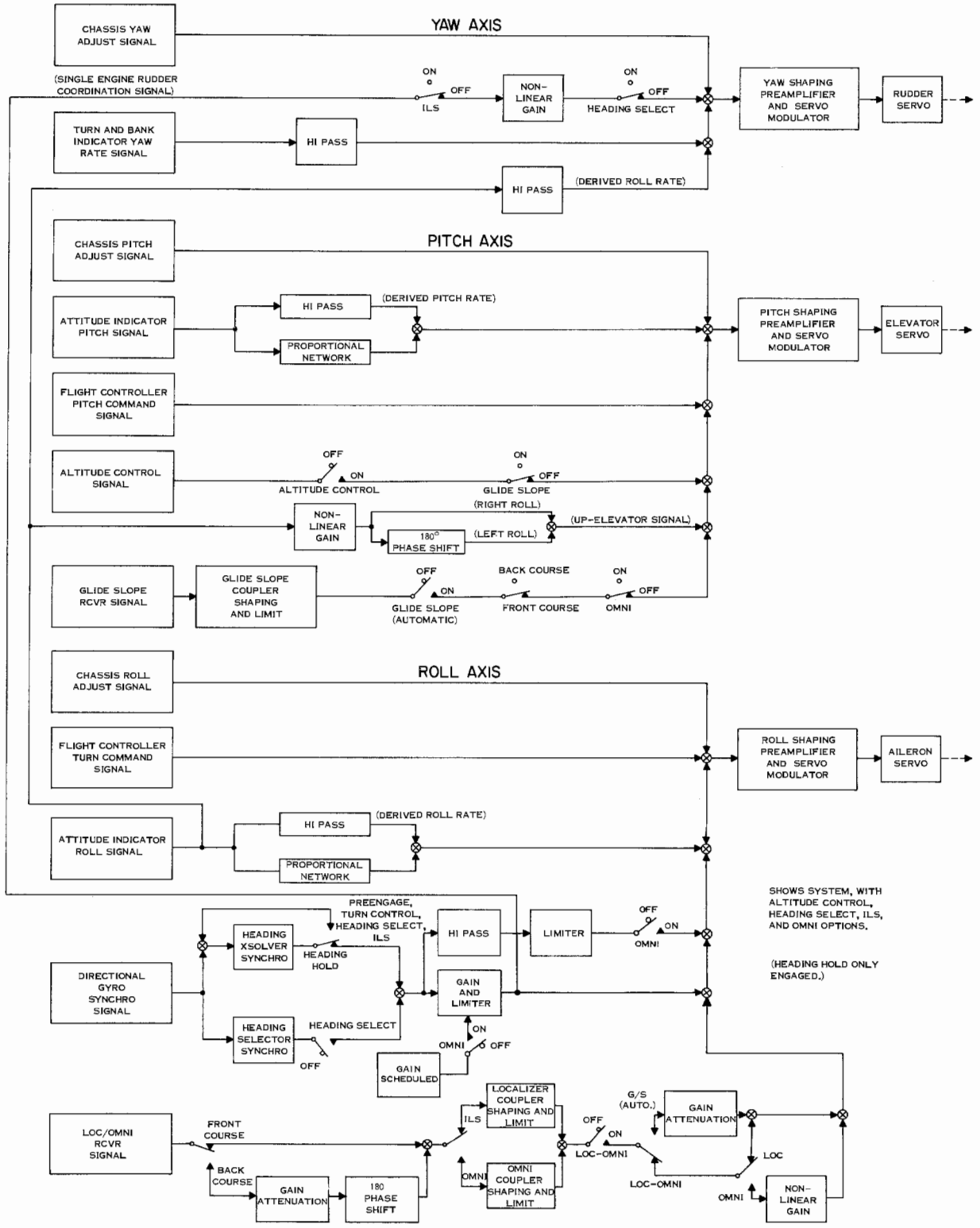
FIGURE 1-2 TYPICAL COMPONENTS OF H 14 AUTOPILOT



TYPICAL COMPONENTS OF H 14 AUTOPILOT WITH CG 515 FLIGHT CONTROLLER
FIGURE 1-3



BLOCK DIAGRAM OF H 14 AUTOPILOT WITH CG 515 FLIGHT CONTROLLER
FIGURE 1-4



BLOCK DIAGRAM OF H 14 AUTOPILOT
FIGURE 1-5

4. ROLL AXIS OPERATION

A. Stabilization. Stabilization in the roll axis is achieved through circuitry identical to that for the pitch axis, with similar shaping characteristics and system gain.

B. Roll Attitude and Command Control

(1) Roll attitude control is achieved by summing a turn command signal from the flight controller TURN knob with the roll attitude signals from the vertical gyro. The signals are summed at the input of the servo amplifier.

(2) The pilot can command ±30 ±2 degrees of band angle through the TURN knob.

C. Heading Hold Mode

(1) The heading hold mode is automatically engaged when the system is engaged (MASTER switch at ON), provided the TURN control is in the center (or detent) position. When a band is commanded, heading hold is temporarily disabled but reengages when the TURN control is recentered. A 3-second lag after recentering allows the aircraft to stabilize at a wings-level attitude prior to heading reengagement.

(2) Heading signals are generated by the directional gyro. The heading signals are summed with the attitude signals at the input to the servo amplifier.

D. Heading Select and Preselect Modes.

(1) The heading select and preselect modes are optional functions obtained by adding a heading selector in the installation. Heading select allows the pilot to preselect any desired heading and execute a shortest way turn to the selected heading. A knob on the heading selector is used to preselect the desired heading and to engage the mode. (on installations having four-switch controllers, the heading select engage switch is located on the controller)

(2) Interlocks are designed into the system to automatically disengage heading select upon a turn command or ILS engagement. The heading select mode controls the aircraft through a full 360 degrees.

E. Automatic ILS Coupling

(1) Fully automatic ILS coupling is available as an option. This mode utilizes ILS localizer receiver beam error signals to develop bracket and tracking commands into the aileron axis. Upon interception of the ILS beam edge

(three to five dots on the OBI), the aircraft is commanded through the roll axis to fly a computer course onto the beam center with a minimum overshoot, and inbound to the outer marker. Bank angle is limited to ±24 degrees. Unlimited cross wind control is maintained throughout the localizer bracket and approach phase.

(2) At the outer marker, the system senses glide slope beam phasing and approach rate and automatically captures the glide slope beam. The localizer coupler bank command limits are also reduced to 12 degrees to provide smooth safe control to approach minimum altitude.

(3) Back course ILS intercept and tracking can also be provided by installation of a switch on the instrument panel which reverses the phasing of the navigational indication to the pilot, as well as steering commands to the autopilot.

F. VOR Coupling

(1) Automatic VOR bracket and tracking are mechanized by blending stabilized beam error signals from the VOR receiver with heading reference signals from the directional gyro for smooth beam following. Cross wind correction is provided by integrating steady state off beam errors as the beam is tracked.

(2) Intercept angles af 45 degrees are automatically computed from beam displacement heading signals. As with the ILS mode, the use of proper signal blending and phasing eliminates the need for separate capature and track modes.

5. YAW AXIS OPERATION

A. Stabilization and Engine Failure Recovery. The yaw stabilization loop is identical to that of the pitch and roll axes, except that primary sensing is from a yaw rate gyro in the turn and bank indicator gyro, which provides full time yaw damping. Safety during and after engine failure is obtained by coupling between heading control and the rudder. The heading signal is blocked from the yaw circuit by a nonlinear diode, until it reaches a given high level signal strength caused by a heading error of the aircraft. Both aileron and rudder corrections stabilize and control the aircraft through the transient and steady yaw disturbance which results from failure of an engine.

B. Turn Coordination. Turn coordination is mechanized by coupling properly phased roll rate signals into the rudder axis. A high pass network is used to avoid adverse rudder motion during turn commands.

6. SYSTEM CHARACTERISTICS. A summary of the system characteristics is provided in figure 1-6.

PERFORMANCE:	
Heading control:	±1 degree
Pitch and Roll Attitude:	±1 degree
Altitude Control:	
During wings-level flight:	±20 ft.
During turns:	±150 ft.
Maximum Bank Angles:	
Turn command:	30 degrees
Heading select:	24 degrees
ILS localizer:	24 degrees
Glide slope:	12 degrees
VOR:	15 degrees
Maximum Pitch Angle Command:	±18 degrees (±22 with CG515)
Bracket Angles:	
ILS:	90 degrees (30 degrees to 60 degrees recommended)
VOR:	45 ± 5 degrees (automatically computed)
POWER REQUIREMENTS:	
Electrical:	28vdc, 3 amperes, or 14vdc, 6 amperes*
Pneumatic:	2.5scfm at 7.5 to 30.0 psig
WEIGHT:	
Uninstalled:	
Basic system:	25.9 lb. **
Complete all option system:	31.9 lb.
Installed #:	50.0 lb.

* Requires auxiliary power converter.
** Less gyros which replace existing panel instruments.
\# Typical twin-engine aircraft including bracketry, wiring, pneumatic lines, fittings, etc.

System Characteristics

Figure 1-6

SECTION II

COMPONENT DESCRIPTION

1. GENERAL. This section describes the design and mechanism features of the individual components of the H-14 Autopilot. Part numbers listed in this section are typical numbers. Part numbers for your installation are listed under Supplementary Data, Section VIII.

2. FLIGHT CONTROLLER (THREE SWITCH - CG217, CG317, and CG517, FOUR-SWITCH - CG417 and CG515)

   A. The flight controller provides the controls necessary for system engagement, selection of mode of operation, and introduction of pilot turn and pitch commands. The controller is back-lighted, and contains a TURN command knob, a PITCH command wheel, a PITCH trim indicator, and either three or four, illuminated, solenoid-held, rocker type switches in the CG117-517 and 4 Push Type solenoid Hold Switches in the CG515. The three switch controllers contain MASTER, ALT, and ILS/VOR switches. The four-switch controllers contain an additional HDG SEL switch.

   —NOTE— Other switch legends used on some controllers are: A/P, AUTOPILOT, or ENGAGE (equivalent to MASTER); ILS or NAV (equivalent to ILS/VOR).

   B. Functions of the controller switches and knobs are as follows:

      (1) The MASTER switch engages and disengages the autopilot by controlling 28vdc operating power to the autopilot computer and in the CG515 removes, Q +20vdc from the servo amplifier of the pitch trim synchronizer. The MASTER switch does not control electrical power to the turn and bank indicator gyro or vacuum power to the attitude indicator and directional gyro. These inputs are provided whenever the aircraft is operating. This arrangement allows the indicators to be used for visual indications when the autopilot is not engaged. The MASTER switch also operates an engage valve which closes upon engagement and diverts pneumatic pressure to the autopilot servo actuators. Interlocks with the MASTER switch return all other mode switches to the disengaged position upon disengagement of the autopilot.

      (2) The ALT switch engages and disengages the optional altitude controller. When depressed, the autopilot controls the aircraft to hold the pressure altitude existing at the time of engagement.

(3) The ILS/VOR or NAV switch engages and disengages the optional automatic ILS and VOR coupling functions When depressed, the switch introduces ILS and VOR beam displacement signals from the navigation receiver into the computer. A signal from the navigation receiver discriminates between ILS and VOR frequencies and allows use of the ILS/VOR switch for both functions.

(4) The TURN command knob allows the pilot to establish bank angles up to 30 degrees. The knob mechanism also operates switches which disengage other heading control modes which are incompatible with manual turn command. Thus, the TURN knob has priority over all other heading functions.

(5) The pilot uses the PITCH command wheel to establish climb or descent attitudes during autopilot operation. An automatic interlock is provided, which disengages the altitude hold mode when a climb or descent command is inititated.

(6) Prior to engagement, the PITCH trim indicator gives autopilot trim indications relative to aircraft trim. After engagement, it indicates operation of the optional automatic trim system or the need for manual retrim if the automatic trim is not installed.

C. The alternate four-switch flight controller includes all of the functions previously described and also provides an additional HDG SEL switch. This switch controls the heading select/preselect command from the optional heading selector or from a flight director or pictorial navigation system. Switch orientation has been changed on this controller for pilot convenience.

D. In addition to the above, the CG515 Flight Controller (four switch provides for pre-engage automatic pitch trim synchronization. This eliminates the need for pilot adjustment of the pitch command wheel (pitch meter centering) prior to engagement thus preventing attitude changes once the Autopilot is engaged.

3. HEADING SELECTOR (CG136A or CG136B)

A. The CG136A Heading Selector is a panel-mounted control which allows the pilot to select or preselect a desired heading. The selector provides a heading reference dial which can be rotated to the desired heading by a heading set knob. The dial is mechanically connected to a synchro control transformer, which develops a heading error signal as a function of dial position and is referenced to directional gyro transmitter position. The heading set knob is mechanically linked to a switch which introduces the preselected error signal into the autopilot roll axis when the knob is pushed in. (On installations where the four-switch flight controller is used, engagement is made by the HDG SEL switch on

the controller.) Rotation of the heading set knob, while pushed in, causes immediate turning of the aircraft. Thus, the control operates as a turn control, except that the aircraft seeks and maintains a selected heading.

B. When the optional VOR coupling mode is installed, the heading selector provides a heading reference signal for long period beam follow stability. In this mode, the heading set knob must be set to the desired VOR radial.

C. The heading select function is interlocked through the flight controller so that the heading select switch is disengaged when the ILS/VOR switch is engaged or when the TURN command knob is rotated from its detent position.

D. The heading selector mounts in a standard 2-inch instrument panel cutout in standard mounting fashion.

E. An alternate CG136B Heading Selector configuration is available which is a functional mate to the four-switch flight controllers. This selector does not include the switch on the heading set knob since that function is provided by the HDG SEL switch on the flight controller.

4. ATTITUDE INDICATOR (GG201 or GG301)

A. The attitude indicator is a vacuum-driven, panel-mounted, attitude horizon indicator containing a vertical gyro to develop roll and pitch reference signals for the autopilot. The gyro has two degrees of freedom. Bank and pitch attitude visual indications are in relation to the earth's horizon.

B. Either the GG201 or GG301 Attitude Indicator is used in the autopilot. The rotor of each model requires a driving power of 4.6 inches of mercury. The GG201 Attitude Indicator requires a maximum flow rate of 2.8 standard cubic feet per minute; the GG301 requires a maximum flow rate of 2.0 standard cubic feet per minute.

5. ATTITUDE REFERENCE COUPLER (DG114)

A. The autopilot can also be coupled to remote vertical reference gyros with synchro outputs slaved attitude or flight director horizon indicators. This is achieved through the use of the DG114 Attitude Reference Coupler. This unit is designed to demodulate and shape ARINC standard, pitch and roll attitude, ac synchro signals to the dc scale factor required for the autopilot.

B. The unit includes trimming adjustments for scale factor calibration according to gyro synchro loading.

6. DIRECTIONAL GYRO (GG202 OR GG302).

A. The directional gyro provides a gyroscopically stabilized visual heading reference for the pilot and an electrical heading signal for the autopilot. The gyro is vacuum driven.

B. Either the GG202 or GG302 Directional Gyro is used in the autopilot. The rotor of each model requires a driving power of 4.6 inches of mecury. The GG202 Directional Gyro requires a flow rate of 2.6 standard cubic feet per minute; the GG302 requires 1.8 standard cubic feet per minute.

—NOTE— In place of the GG202 or GG302 Directional Gyro, the autopilot can be coupled to any ARINC standard heading output or magnetically slaved gyro system as well as to any flight director type navigation reference system. Coupling of the autopilot to a flight direction system is accomplished by obtaining heading reference signals from existing synchro transmitters within the directional gyro or compass system used to drive the flight director course indicator, or from repeater synchros in the course indicator. If a heading error synchro is available in the course indicator, this transmitter can be used to develop heading select/preselect information for the autopilot. Integration of the autopilot with the navigation system eliminates the need for the autopilot directional gyro and heading selector.

7. TURN AND BANK INDICATOR GYRO (GG205)

A. The GG205 Turn and Bank Indicator Gyro provides a visual indication of the direction of turn, rate of turn reference, and slip indication for the pilot. It also generates an electrical yaw rate signal for the autopilot.

B. The gyro rotor requires 27.5 vdc, 0.380 ampere. The unit is designed for mounting in a standard 3-1/8-inch instrument panel cutout.

8. COMPUTER

A. The computer contains the plug-in circuit cards and related components that constitute the electronic circuitry of the system. The upper portion supports the printed circuit cards assembled into two-card modules, the heading synchronizer, electrical supply current regulating tube, trim adjustment potentiometer, and assorted electronic parts. The lower chassis contains mounting provisions for the optional PG51A Altitude Control and electrical harness.

B. The chassis is housed in a 1/2 ATR short ARINC standard case supported in a shock isolating rack. The electrical connector is a Cannon DPX-57-34P.

C. The nominal 28vdc, 3 ampere input voltage is applied to the computer circuits through an amperite regulating tube and a 20V zener diode. The amperite tube acts as a variable resistance to absorb the difference between the 20V zener reference and the applied dc line voltage while supplying a constant current of one ampere to the computer. Therefore, the zener reference is ideally supplied by a constant current source and is loaded by a nearly constant load impedance. This Q-regulated 20V supply excites all the servo modulators, a 400Hz inverter on the power supply card,provides isolated voltages to all amplifiers and the voltage for the servo valve solenoids.

D. Most of the computer electronic parts are mounted on six printed circuit cards. One circuit card is allocated to each major control function: pitch, yaw, and roll signal amplification and modulation for servo commands, power supply, heading and navigational coupling. The six cards are mounted in pairs to form three plug-in modules. Since all control axes of the system are similar, the servo amplifier cards can easily be interchanged or removed to locate malfunctions. The following paragraphs provide a description of the cards:

(1) The power supply card A4 supplies the following excitations from the regulated 20vdc input:

(a) 26v, 400Hz excitation to the computer transolver and directional gyro heading synchro transmitter.

(b) 40V isolated dc excitation to sensor pickoffs and preamplifiers.

(c) 40V ac excitation to the heading demodulators (56V ac on later card configurations).

(2) An alternate power supply card with an additional transformer is available for the installations requiring more than the 7.8V ampere power that can be supplied by the 26V 400Hz inverter. The 26V ac excitation from an external aircraft power source is then brought into the computer and transformed for use in the heading demodulator circuit and transolver excitation.

(3) Each pitch, yaw, and roll servo amplifier card (A1, A2, or A3) has both a summing and a modulating function as follows:

(a) A current summing amplifier sums dc sensor, rate and coupler signals. The amplifier contains two direct-coupled stages of gain employing complementary sets of transistors for high interstage coupling

efficiency. A first-order lead network provides a stabilizing phase margin to the system inner loop. Each amplifier contains two channels of amplification: a high gain channel for outer loop functions and a low gain channel for inner loop functions. The pitch amplifier output is also presented on a null indicator on the flight controller to provide pitch trim indication.

(b) A servo modulator generates a basic frequency of nominally 22Hz. Two directly out of phase outputs are obtained. The pulse widths of these outputs are modulated in accordance with the summing amplifier output, and the resulting out of phase signals are applied respectively to the two servo valve solenoids in the servo actuator.

(4) The heading/model card provides the networks for sensor signal shaping and summing rate stabilization elements for the roll, pitch, and yaw axes as well as demodulation for the ac heading signal.

(a) Nonlinear networks are provided for coupling heading error signals to the yaw axis for enginer failure trim correction and for coupling roll attitude information to the pitch axis (up-elevator) for increased lift during turns.

(b) The networks which provide signal shaping and summing establish the relative authority between sensor and command signals. These circuits also have nonlinear elements for limitation on maximum signal for safety-of-flight considerations.

(5) The heading/omni/model card A5 is a replacement for the heading/model card when the optional capability of VOR coupling is required.

(a) The additional circuitry on this card includes a separate VOR-heading demodulator with a heading high pass function to provide long term stability. The circuitry provides 45 degree interception of the selected VOR radial in addition to automatic beam bracketing and tracking.

(b) The electrical output of the beam coupler amplifier is summed directly with a nonlinear heading signal to establish the basic 45 degree intercept angle. The nonlinear heading signal provides cross wind correction and long term stability necessary to overcome VOR beam noise characteristics. Because of the heading reference signal supplied by the heading selector, the aircraft automatically intercepts, brackets, and tracks a VOR radial from any random aircraft heading.

(6) The ILS card A6 provides the necessary dynamics and amplification to the localizer, VOR, and glide slope receiver output signals for summing into the roll and pitch axis servo amplifier.

(a) When operated in the ILS mode, the localizer receiver output is given a large lead time constant, and amplification summing networks couple the localizer coupler output into the roll axis serve amplifier.

(b) In the ILS mode the glide slope receiver output is integrated and amplified and automatically introduced into the pitch axis when the aircraft closes on the center of the glide slope beam at the outer marker. Automatic interlock circuits decouple the altitude hold mode upon engagement of the glide slope portion of the ILS coupler.

(c) The VOR coupler amplifier is the same basic amplifier used for localizer coupling in the ILS mode with different dynamics. The switching function from localizer to VOR is accomplished by relays energized by the receiver for the ILS frequencies and deenergized for VOR frequencies. These relays switch the amplifier lead function to a long time constant third-order lead-lag function with nonlinear elements providing limiting for VOR use. This provides the shorter term stability necessary for good beam bracketing capability.

E. Three attitude trim potentiometers are mounted on the computer chassis, one each for roll, pitch, and yaw attitude trim adjustment. These potentiometers are adjusted for initial system installation to accommodate the electrical and mechanical mounting tolerance variations of the particular system installation.

—NOTE— In D computers there are only pitch and yaw trim adjust pots. The CG515 contains the roll adjust and also provides in flight adjustments of pitch and yaw.

9. ALTITUDE CONTROL (PG51)

A. The altitude control enables the autopilot to control the aircraft to a constant pressure altitude within close limits. This function is particularly useful in maintaining the altitude legally designated for vfr cruising flight on a particular compass heading, ATC-assigned altitude under ifr conditions, and a safe altitude to the outer marker during an automatic ILS approach.

B. The altitude controller consists of an aneroid type pressure sensitive bellows system which is mechanically linked to a pickoff. An output signal is developed that is proportional to change in barometer pressure from a reference level.

Prior to engagement, the output bellows is vented to atmosphere. Upon engagement, a solenoid valve is closed, trapping the air in the output bellows as the reference. Tendencies of the aircraft to gain or lose altitude are reflected in bellows deflection. The pickoff then develops a proportional output signal which is introduced into the autopilot pitch axis to command corrective control to return to the reference altitude.

10. SERVO ACTUATORS (MG113)

A. The servo actuators convert computer commands into force to move the aircraft control surfaces in response to corrective signals or pilot commands. Electropneumatic servos are used for unusually smooth system response and high reliability. The servos are controlled by electrical command signal from the autopilot computer and are powered by pneumatic pressure from an appropriate aircraft pressure source, a vacuum system pump, or turbine engine bleed air. The operating pressure of the system is determined by aircraft characteristics, within a range from 7.5 to 30 psig.

B. The actuators consists of two major assemblies: the electro-magnetic valve assembly and the output linkage assembly. The valve assembly is composed of dual poppet valves which, by necessary porting and an orifice, are connected to the linkage assembly. This unit consists of two cylinders with pistons sealed against pressure loss by rolling diaphragms, as shown in figure 2-1. The piston rods are designed to drive against an output linkage which converts the linear force to torque introduced to the aircraft control system through the servo cable drum.

C. The electronic control input to each poppet valve solenoid is a 22Hz, pulse width modulation, square wave signal. This frequency is chosen for minimum pressure disturbance and maximum valve life. The poppet valves are operated alternately open and closed by the input pulses. With no command input, the valve to each cylinder is open an equal length of time, causing the pressure in the cylinders to be equalized and no actuator output torque to be developed. When a control command is introduced, the open time of one valve is increased, the open time of the other valve is decreased, and a differential pressure is developed in the two cylinders. One piston extends while the other retracts, causing a rotational output of the linkage assembly in a direction determined by the open-closed time ratio of the two valves. When the servo is disengaged, the valves are depressurized and vented to atmosphere.

D. A fixed orifice is installed at the inlet to each actuator cylinder to establish the response rate. These orifices are selected during initial flight testing of each new model of aircraft and then becomes standard installation items for that model.

E. The operating detail of the output linkage assembly is further illustrated in figure 2-2. When the autopilot is disengaged, the links and piston shafts are retracted allowing 120 degree free rotation of the output shaft and cable drum which is geared into the control system to equal or exceed the stop-to-stop travel of the surface. Since only the output shaft follows control movement, no frictional load is added to the aircraft control system.

F. When the servo is pressurized upon engagement, the shafts and links slowly advance into contact with the output shaft arm which has a normal rotational authority of 60 degrees. Thus, the nominal command control authority of the autopilot does not exceed 50 percent of aircraft control authority.

G. To provide full control travel for pilot overpower, the linkage assembly is articulated but is normally held rigid by overpower springs. Application of overpower force allows deflection of the springs and provides an additional 60 degrees of servo rotation to the aircraft control system mechanical limits.

H. The servo actuators have been built in MG113A and E configurations. The MG113A models are no longer in production.

11. AUTOMATIC TRIM SYSTEM

A. The DG1009 Auto-Trim Adapter is used to switch 28vdc to an output load. The output load is part of the aircraft system and may be a relay coil or motor or other device with an input impedance greater than 100 ohms. The adapter is enclosed in a metal case and is secured to the aircraft structure by four screws.

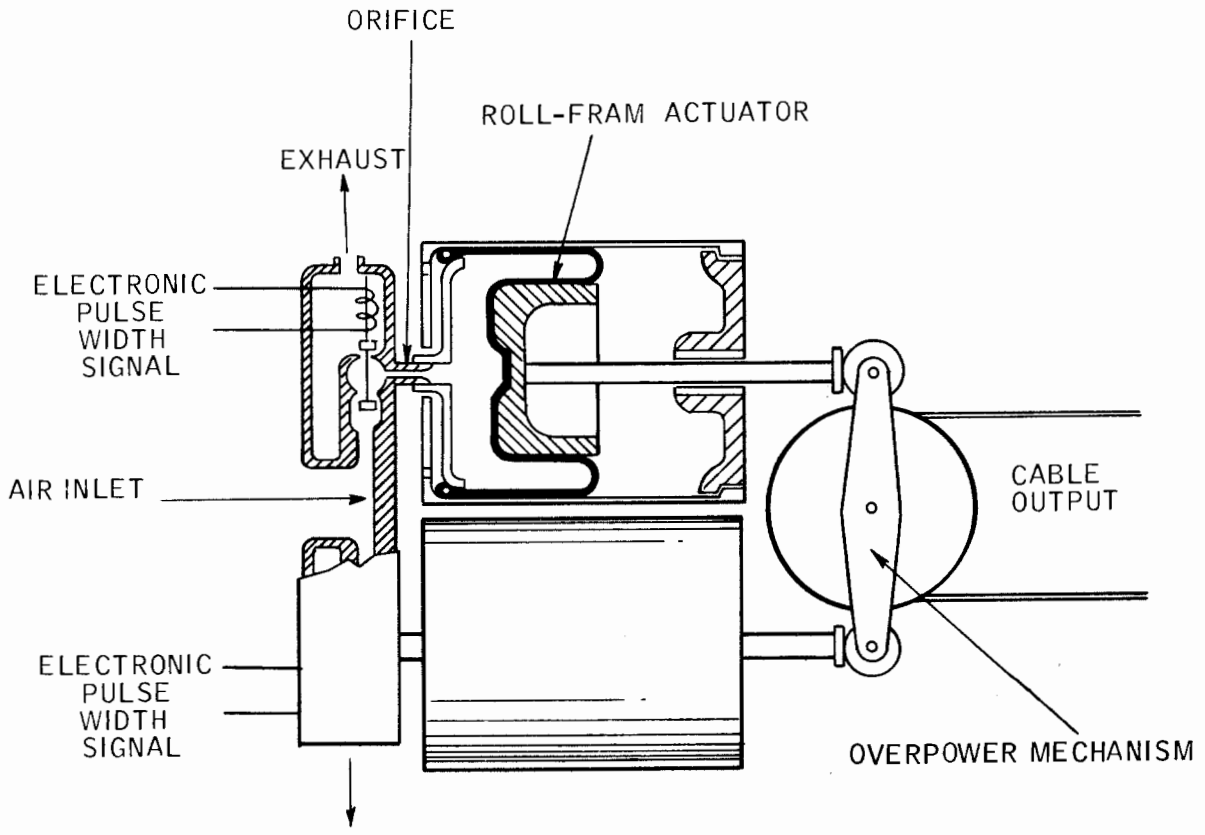
Steady state elevator loads reflected back to the autopilot are detected by the trim adapter in the form of an unsymmetrical 25Hz square wave being fed to the elevator servo actuator. This square wave is filtered and summed into the TRIM UP or TRIM DOWN switching circuits depending on the signal polarity. When the filtered signal reaches the preselected trim level, the first half of the appropriate trim switch operates, thus shorting one side of the output load to ground. After a 5-10 second delay, determined by the magnitude of the "out of trim" signal, the second half of the switch operates, connecting the other side of the output load to 28vdc. As soon as the input signal drops below the threshold value, both sides of the trim switch return to the OFF condition.

A failure alarm circuit is included which gives a visual warning to the pilot whenever a substantial out-of-trim signal is present, but the trim actuator is not operating; or when the actuator is running without a valid command signal.

B. Automatic pitch trim may also be provided by addition of the optional differential pressure switch and pitch trim actuator to the basic system. The switch is

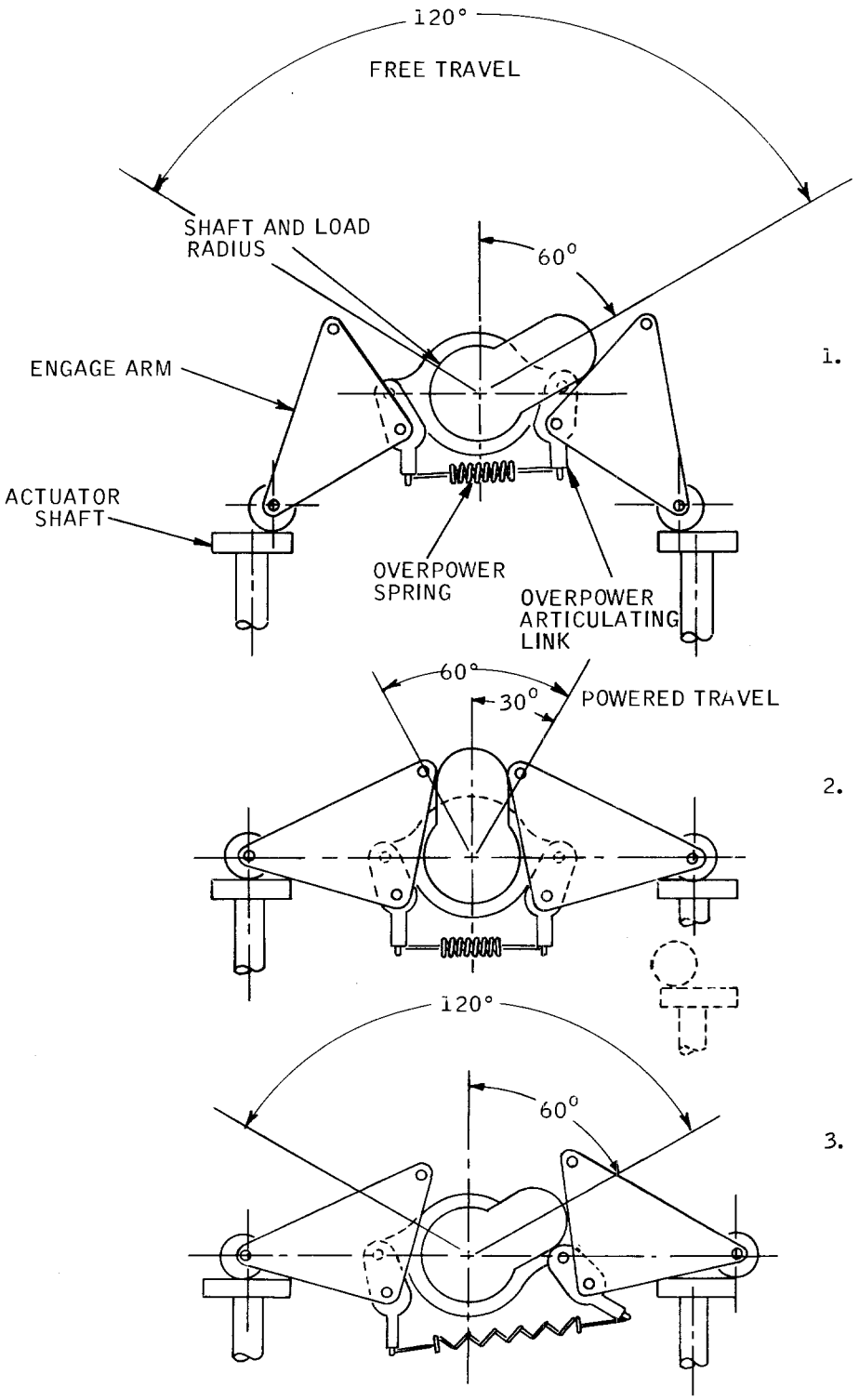
mounted on the pitch servo actuator, and the trim actuator is installed to drive the aircraft elevator trim system.

C. The differential pressure switch (SG28) is the primary sensor of the automatic pitch trim system. It is actually a pressure sensitive valve which is mounted on the pitch servo actuator valve assembly.



Functional Diagram of Servo Actuator

Figure 2-1



1. DISENGAGED OPERATION: ACTUATOR SHAFTS ARE RETRACTED AND CABLE DRUM HAS UNRESTRICTED ±60 DEGREE FREEDOM.

2. ENGAGED OPERATION: ACTUATOR SHAFTS ARE EXTENDED AND THE LINKAGE ENGAGES THE CABLE DRUM.

3. OVERPOWER OPERATION: AN APPLIED TORQUE OF A SLIGHTLY GREATER VALUE THAN THE ACTUATOR OUTPUT TORQUE ARTICULATES THE LINKAGE TO ALLOW AN ADDITIONAL +30 DEGREES OF ROTATION.

Functional Diagram of Servo Actuator Overpower Mechanism

Figure 2-2

(1) The differential pressure switch has two pressure sensing ports which are connected to the output stage of the servo valves. These ports sense the differential pressure maintained in the servo actuating cylinders when the pitch servo is holding a steady state mistrim load.

(2) When a differential pressure equal to the adjusted cut-in pressure setting of the switch is detected, the internal diaphragms are deflected and autopilot system supply pressure is applied to either the clockwise or counterclockwise inlets of the trim actuator through ports, depending upon the direction of the mistrim condition.

D. The pitch trim actuator (MG112) is a pneumatically driven motor operated by autopilot supply pressure. The trim actuator positions the aircraft elevator trim system in response to signals from the differential pressure switch.

(1) The trim actuator consists of a turbine wheel driving an output cable drum through an epicyclic gear train for speed reduction and torque increase. The cable drum is connected to the elevator trim system cables.

(2) The pitch trim indicator monitors an electrical equivalent of the servo differential pressure sensed by the differential pressure switch or applied to electric trim adapter, and provides the pilot with an indication of proper automatic trim operation.

(3) The automatic trim system responds to and corrects for trim changes due to changes in center of gravity, power setting, and extension of landing gear and flaps. It also ensures a no-load condition on the elevator upon system disengagement.

12. NAVIGATION RECEIVER ADAPTER (DG104A or DG104B)

A. The DG104A and DG104B Navigation Receiver Adapters are used to connect navigation receiver systems with other than ARINC standard output signals to the autopilot beam coupling amplifiers.

B. The normal gain of the DG104A adapter is a one-volt output for a one-volt input but an output gain of 2 or 3 volts can also be obtained. The gain of the DG104B adapter is also one volt/volt and cannot be changed.

C. The normal load impedance of the DG104A adapter is 1,000 ohms, but an impedance of 3,000 ohms can also be obtained. The load impedance of the DG104B adapter is 5,000 ohms and cannot be changed.

SECTION III

ADJUSTMENTS AND CHECKOUT

1. GENERAL. The autopilot adjustment and checkout prodecures in this section must be performed on new autopilot installations to ensure that the autopilot is correctly installed. These procedures should also be performed:

   A. As a periodic check.

   B. After replacement of an autopilot component (applicable tests should be performed to check signal flow between newly installed devices and other devices).

   C. Whenever a malfunction in the autopilot is suspected.

2. REQUIRED EQUIPMENT. A multimeter, such as the model 260 of the Simpson Electric Co., Chicago, Ill., and a patch cable as shown in figure 4-1 are required. (A ST140 System Tester can be used in lieu of patch cable).

3. ADJUSTMENTS AND CHECKOUT.

   A. General. The adjustment and checkout procedures are provided in figure 3-1. These procedures are divided into two groups: ground adjustment and checkout (group A) and airborne adjustment and checkout (group B). On new autopilot installations, the ground procedures should be performed before performing the airborne procedures.

      —NOTE— The ground adjustments (group A) are coarse adjustments. Precise adjustments must be made while airborne, as instructed in group B. If the ground adjustments cannot be made because of an autopilot malfunction, troubleshoot and repair the autopilot before continuing with these adjustments. The checkout procedures show whether the autopilot is operating properly.

   B. Preparation

      (1) Provide dc power to the autopilot.

      (2) Connect the autopilot computer through a patch cable (see figure 4-1).

      (3) Uncage the directional gyro.

(4) If servo actuators are not installed, use a load simulator such as that shown in figure 4-2 to provide an electrical load for each servo amplifier.

TEST	STEP	REQUIREMENT
GROUP A GROUND ADJUSTMENTS AND CHECKOUT (Tests 1 thru 9)		
1. Yaw axis	1. Connect multimeter (10-or 12V scale) to patch cable jacks 41 and 42.	
	2. Push flight controller MASTER switch to ON.	
	3. Adjust computer R3 YAW ADJ resistor to null the multimeter.	
	4. Turn R3 YAW ADJ resistor fully cw and ccw **—NOTE—** Run same test using the YAW adjust pot in CG-515 (2R5)	Voltage must vary. Maximum voltage must be greater than 6.0vdc in each direction.
	5. Move instrument panel to agitate turn and bank indicator.	Voltage on multimeter must change to reflect the movement.
	6. Adjust R3 YAW ADJ resistor to null the multimeter.	
	7. Disengage autopilot. Disconnect multimeter.	
2. Pitch axis	1. Connect multimeter to patch cable jacks 38 and 39.	

ADJUSTMENTS AND CHECKOUTS (Sht 1 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	2. Remove attitude indicator signals by setting patch cable ATT GYRO switch at TEST or by disconnecting aircraft cable from attitude indicator.	
	3. Center flight controller PITCH command wheel.	
	—NOTE— With CG515 set PITCH command wheel to give zero volts between pin 35(+) and 1(-).	
	4. Push flight controller MASTER switch to ON.	
	5. Adjust computer R1 PITCH ADJ resistor to null the multimeter. Check PITCH indicator on flight controller.	PITCH indicator must be centered.
	6. Move flight controller PITCH command wheel to UP and DOWN.	Voltage must vary as wheel is moved. Maximum voltage must be greater than 6.0vdc in each direction.
	7. If autopilot has an altitude control, perform the following:	
	a. Push flight controller ALT switch to ON.	Null indication must not change.
	—NOTE— Adjust pitch ATT ADJ in CG515 for 0.0vdc at pin I-35.	Null will change if pitch ATT ADJ in CG-515 is not zeroed.
	b. Blow lightly across altitude controller port on computer front.	Multimeter must deflect and return to null.
	c. Move flight controller PITCH command wheel to UP	ALT switch must go to OFF.

ADJUSTMENTS AND CHECKOUTS (Sht 2 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	d. Push ALT switch to ON.	
	e. Move flight controller PITCH command wheel to down.	ALT switch must go to OFF.
	8. Disengage autopilot. Disconnect multimeter.	
	—NOTE— In D computer roll axis check out is in airborne section.	
3. Roll axis	1. Connect multimeter to patch cable jacks 22 and 23.	
	2. Remove attitude indicator signals by placing patch cable ATT GYRO switch at TEST or by disconnecting the attitude indicator.	
	3. Center flight controller TURN command knob.	
	4. Cage the directional gyro to remove heading signals. (Jumpering patch cable jacks 2 and 3 simulates mechanical caging).	
	5. Push flight controller MASTER switch to ON.	
	6. Adjust computer R2 ROLL ADJ resistor to null the multimeter.	
	—NOTE— With CG515 adjust ROLL ADJ in CG515.	
	7. Rotate TURN command knob in each direction.	Voltage must vary as knob is turned. Maximum voltage must be greater than 6.0vdc in each direction.

ADJUSTMENTS AND CHECKOUTS (Sht 3 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	8. Uncage directional gyro or remove jumper installed in step 4. **—NOTE—** If a change greater than 1.0 vdc occurs, continue with the adjustment and checkout. Remedial action is explained at the beginning of test 8. 9. Disengage autopilot. Leave multimeter as connected.	After 3 seconds, voltage must not change more than 1.0vdc.
4. Heading hold and phasing	To perform this test, determine what directional gyro system the autopilot is coupled with. Then use one of the two following procedures. Standard H 14 Heading Coupling (using 5- or 3- inch air-driven gyros either slaved or nonslaved. 1. Perform roll axis adjustment in test 3 if it has not already been done. Leave multimeter as connected and ATT GYRO switch at TEST upon completion. 2. Push flight controller MASTER switch to ON. 3. Move flight controller TURN command knob ccw (L) and note direction of multimeter needle deflection. Recenter the knob. 4. If patch cable has DIR GYRO switch, perform the following: a. Set patch cable DIR GYRO switch at TEST.	

ADJUSTMENTS AND CHECKOUTS (Sht 4 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	b. Cage the directional gyro.	
	c. Turn directional gyro cage knob for an increasing heading indication from 0 degrees toward 90 degrees.	Multimeter must deflect in same direction as noted in step 3.
	5. If patch cable does not have DIR GYRO switch, perform the following.	
	a. Cage the directional gyro.	
	b. Rotate directional gyro cage knob to spin indicator so that heading indication is increasing. (Rate of spin must keep indicator moving more than 3 seconds).	
	c. Uncage the directional gyro.	After 3 seconds, signal from turning directional gyro must deflect multimeter in same direction as in step 3.
	6. Set patch cable DIR GYRO switch at NORMAL. Disengage autopilot.	
	Optional Heading Couplings (for systems using Collins PN101, FD108 or other slaved gyro systems)	
	1. Perform roll axis adjustment in test 3 if it has not already been done. Leave multimeter as connected and ATT GYRO switch at TEST upon completion.	
	2. Turn on all necessary power to operate the system which provides autopilot heading.	

ADJUSTMENTS AND CHECKOUTS (Sht 5 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	3. Push flight controller MASTER switch to ON. 4. Move flight controller TURN command knob ccw (L) and note direction of multimeter needle deflection. Recenter knob. 5. On the KPI 550 pull out and rotate the heading knob to cause an increase heading on azimuth card. (For other types of slaved gyro systems, use slaving switch to slave gyro in an increasing heading direction) 6. Set patch cable DIR GYRO switch at NORMAL. Disengage autopilot.	Multimeter must deflect in same direction as in step 4.
5. Localizer centering	1. Perform roll axis adjustment in test 3 if it has not already been done. Leave multimeter as connected and ATT GYRO switch at TEST upon completion. 2. Leave navigation receiver turned off. 3. Set patch cable OMNI-LOC switch at LOC or jumper jacks 57 and 47. 4. Push flight controller MASTER and ILS/VOR switches to ON. **—NOTE—** If excessive voltage appears, adjust variable resistor at top of A6 card (orange decal). Make small adjustments and wait for reading to stabilize. Adjust slightly beyond required point (voltage decays slightly)	Multimeter must indicate 0.0 ± 0.2vdc after about 30 seconds.

ADJUSTMENTS AND CHECKOUTS (Sht 6 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	5. If the A6 card is adjusted, repeat the roll axis adjustment in test 3 and the A6 card adjusting until both localizer centering and roll axis requirements are met without further adjustments.	
	6. With ILS/VOR switch at ON, turn heading selector knob without engaging heading selector. (This checks ILS/omni interlocks).	Multimeter must show no voltage change.
	7. Set patch cable OMNI/LOC switch at OMNI.	
	8. Disengage autopilot.	
6. Heading selector (H14 or Pictorial Navigation Indicator such as the KPI 550	1. Perform roll axis adjustment in test 3 if it has not already been done. Leave multimeter as connected upon completion.	
	2. Push flight controller MASTER switch to ON.	
	3. Engage the heading select function and adjust heading select knob for a null on multimeter.	Heading select indicator must show a heading within 2 degrees of directional gyro heading or lubber line reading of flight director indicator.
	—NOTE— If heading select indication is not correct, adjust it as follows:	
	a. If a pictorial navigation indicator heading selector is used refer to the manufacturer's instructions.	

ADJUSTMENTS AND CHECKOUTS (Sht 7 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENTS
	b. If an H 14 type heading selector is used, remove cap in center of dial and loosen machine screw. Hold dial at the directional gyro heading and turn slotted shaft for a null voltage. Tighten screw and replace cap after adjusting.	
	4. Check that phasing is the same as the flight controller TURN command knob. (Heading bug left corresponds to left turn command etc).	Turning heading select indicator causes multimeter deflection in same direction as an equivalent turn command.
	5. Disengage autopilot.	
7. Omni centering	To perform this test, determine how the heading information for omni coupling is provided. Then use the appropriate procedure. Procedure 1 (standard omni coupling when no heading selector course datum information is coupled to the autopilot). 1. Perform roll axis adjustment in test 3 and localizer centering in test 5 if they have not already been done. Leave multimeter as connected upon completion. The patch cable OMNI-LOC switch must be at OMNI and ATT GYRO switch must at TEST. Leave navigation receivers turned off. 2. Push flight controller MASTER switch to ON.	

ADJUSTMENTS AND CHECKOUTS (Sht 8 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENTS
	3. Push flight controller ILS/VOR switch to ON.	If multimeter deflects noticeably, it must decay toward and stabilize near zero volts after about 60 seconds.
	—NOTE— If indication does not stabilize near zero, adjust A5 card (green decal) variable resistor. Adjust in small increments so that multimeter needle initially deflects away from zero. Voltage decays back toward a null. Wait about 30 seconds between adjustments.	
	—NOTE— On A5 cards 200-0097-00 (Z95085) Z96075 and 200-0097-00/03, the adjustments resistor is not provided. Omni is properly centered when the localizer coupler is centered.	
	4. If A5 card resistor has been adjusted or if omni centering is out of tolerance on cards without the adjustment, repeat roll axis adjustment in test 3 and localizer centering in test 5 until all three null voltages are within 0.2V without further adjustments.	
	5. Disengage autopilot.	
	Procedure II (standard omni coupling when used with either the H 14 heading selector or a pictorial navigation type heading selector such as the KPI 550.	

ADJUSTMENTS AND CHECKOUTS (Sht 9 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENTS
	1. Perform roll axis adjustment in test 3 and localizer centering in test 5 if they have not already been done. Leave multimeter as connected upon completion. The patch cable OMNI LOC switch must be at OMNI and ATT GYRO switch at TEST. Leave navigation receivers turned off.	
	2. Push flight controller MASTER switch to ON.	
	3. Engage heading select function and adjust heading select knob for a null on multimeter.	
	4. Push flight controller ILS/VOR switch to ON.	Heading selector must disengage. If multimeter deflects noticeably, it must decay toward and stabilize near zero volts after about 60 seconds.
	—NOTE— If indication does not stabilize near zero, adjust A5 card (grn. decal) variable resistor. Adjust in small increments so that multimeter needle initially deflects away from zero. Voltage decays back toward a null. Wait about 30 seconds between adjustments.	
	—NOTE— On A5 cards 200-0097-00 (Z950851), Z960751 and 200-0092-00/03, the adjustment resistor is not provided. Omni is properly centered when the localizer coupler is centered.	

ADJUSTMENTS AND CHECKOUTS (Sht 10 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	5. If A5 card resistor has been adjusted or if omni centering is out of tolerance on cards without the adjustment, repeat roll axis adjustment in test 3 and localizer centering in test 5 until all three null voltages are within 0.2 volt without further adjustments.	
	6. With heading selector disengaged and ILS/VOR switch ON, rotate the heading selector (checks localizer-omni interlocks).	Multimeter must react to the heading selector.
	7. Disengage autopilot.	
	Procedure III (optional omni coupling when used with a pictorial navigation system that provides heading to omni coupler from separate course datum synchro, such as the KPI 550 indicator used with King KPI 550 system).	
	1. Be sure navigation receivers are off. If external 26vac is coupled to autopilot, turn the aircraft inverter on.	
	2. Perform roll axis adjustment in test 3 and localizer centering in test 5 if they have not already been done. Leave multimeter as connected upon completion. The patch cable OMNI-LOC switch must be at OMNI and ATT GYRO switch at TEST.	
	3. Push flight controller MASTER switch to ON.	
	4. Connect jumpers between patch cable jacks 2 and 3 and between jacks 54 and 28.	

ADJUSTMENTS AND CHECKOUTS (Sht 11 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	5. Using course selector knob on navigation indicator, set course selector needle under the lubber line. Then rotate knob right and left.	Multimeter must react to indicate a right and left turn command.
	6. Check that phasing is the same as the flight controller TURN command knob. (Heading left corresponds to left turn command, etc)	Turning course selector causes multimeter deflection in same direction as an equivalent turn command.
	7. Adjust course selector knob for null on multimeter.	Course needle must be within ±2 degrees of lubber line of indicator.
	–NOTE– If course needle position cannot be maintained at null, the indicator must be replaced or repaired in accordance with the manufacturer's instructions.	
	8. Leave course indicator set for null on multimeter.	
	9. Remove jumper from jacks 2 and 3 and from jacks 54 and 28.	
	10. Push flight controller ILS/VOR switch to ON.	If multimeter deflects noticeably, it must decay toward and stabilize near zero volts after about 60 seconds.
	–NOTE– If indication does not stabilize near zero, adjust in small increments so that multimeter needle initially deflect away from zero. Voltage decays back toward a null. Wait about 30 seconds between adjustments.	

ADJUSTMENTS AND CHECKOUTS (Sht 12 of 24)
FIGURE 12 of 24

TEST	STEP	REQUIREMENT
	—NOTE— On A5 cards 200-0097-00 (Z950851) Z960751, and (200-0097-00/03) the adjustment resistor is not provided. Omni is properly centered when the localizer coupler is centered. 11. If A5 card resistor has been adjusted or if omni centering is not full on card without the adjustment, repeat roll axis adjustment in test 3, localizer centering in test 5, and omni adjustments until all null voltages are within 0. 2 volt. 12. Disengage autopilot. **—NOTE—** If uncaging the directional gyro produced a voltage shift greater than 1. 0 volt in roll axis test 3, and continues to do so at this point, replace autopilot computer or heading transolver according to computer overhaul manual.	
8. Glide-slope	1. Push flight controller MASTER and ALT switches to ON. 2. Set patch cable OMNI-LOC switch at LOC or jumper jacks 57 and 47. 3. Push flight controller ILS/VOR switch to ON. 4. Set multimeter at its RX100 or RX1000 scale and connect it to patch cable jacks 10 and 11 to drive glideslope needle down. 5. Disengage autopilot.	ALT switch must go to OFF. Flight controller PITCH indicator then follows glideslope needle.

ADJUSTMENTS AND CHECKOUTS (Sht 13 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	6. Set ILS back course switch at its back course position.	
	7. Repeat steps 1 through 5.	ALT switch remains ON (glideslope does not operate in back course).
	8. Disengage autopilot.	
9. Other ground checks	1. Check navigation receiver omni signal.	A course selector change of 10 degrees must produce five dots deflection on omni indicator.
	2. Check localizer and glideslope signals	A 150mv signal must produce a five dot needle deflection.
	3. Check phasing of localizer and omni signals to autopilot using a procedure similar to heading select and phasing procedure in test 4.	Needle left must correspond to left turn command, etc.
	4. Check operation of back course switch.	Switch must operate properly
	5. Check heading to yaw signal (single-engine signal) by repeating heading hold and phasing test 4, except connect multimeter to patch cable jacks 41 and 42.	Signal must appear only after 7 or 8 degrees of heading changes are introduced.
	—NOTE— Signal in step 5 must appear only on heading hold mode but never on heading select, ILS, or omni modes.	
	6. Check for correct air pressure at servos.	Refer to appropriate aircraft manual for proper pressures.

ADJUSTMENTS AND CHECKOUTS (Sht 14 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	GROUP B-1 AIRBORNE ADJUSTMENTS AND CHECKOUT (Tests 10 thru 13) Perform these procedures to compensate for any misalignment between the aircraft and autopilot. Be sure ground adjustments have first been accomplished. It is necessary to have access to the computer while in flight. If normal location of computer is inaccessible, use a pitch cable. Place computer in aircraft cockpit. Fly the aircraft in smooth air, in cruise configuration, and at cruise airspeed. Manually trim for straight and level flight with autopilot disengaged, before making adjustments.	
10. Pitch centering	1. Center flight controller PITCH command wheel. 2. With a zero rate of climb, adjust R1 PITCH ADJ variable resistor on computer to center flight controller PITCH indicator.	
11. Roll centering	1. Cage the directional gyro or connect a jumper between jacks 2 and 3 on patch cable to prevent heading from engaging. 2. Center flight controller TURN command knob. 3. Push flight controller MASTER switch to ON. **–NOTE–** The autopilot may require adjusting to fly the aircraft so the attitude indicator indicates wings level. Disregard actual wing orientation at this time.	

ADJUSTMENTS AND CHECKOUTS (Sht 15 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	4. Adjust computer R2 ROLL ADJ variable resistor to obtain a wings level indication on attitude indicator. 5. Proceed to yaw centering adjustment -**NOTE**- It is possible for the attitude indicator to be indicating wings level with aircraft flying with one wing slightly low.	
12. Yaw centering	1. Be sure roll centering adjustment has been made. Leave autopilot engaged. 2. Uncage the directional gyro or remove jumpers between patch cable jacks 2 and 3. 3. After 3 seconds, heading hold engages. -**NOTE**- Heading hold engagement can be verified by manually overpowering the autopilot to roll the aircraft. When control wheel is released, aircraft must bank in opposite direction and return to the original heading. 4. Allow autopilot system to stabilize. 5. If aircraft is flying with one wing low (disregard attitude indicator indication), adjust computer R3 YAW ADJ variable resistor. Make small adjustments and wait at least 10 seconds between adjustments to observe the results. Turn variable resistor cw	

ADJUSTMENTS AND CHECKOUTS (Sht 16 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	to raise the right wing; and ccw to raise the left wing. The heading changes one degree for a one degree change in wing orientation. At this point it is possible for the aircraft wings to be level with the attitude indicator indicating a nonlevel condition. 6. Repeat roll and yaw centering procedures five times to assure good centering. If after flying straight and level for at least 3 minutes, the attitude indicator does not show the proper attitude, level the indicator by shifting its position in the instrument panel. This does not affect autopilot centering.	
13. Other airborne checks	1. Check maximum autopilot turn command.	Bank angle commanded must be 30 ± 2 degrees.
	2. Check maximum heading select command by turning heading select knob 90 degrees to each side of selected heading.	Bank angle commanded must 24 ± 2 degrees in each direction.
	3. Check altitude hold performance as follows:	
	a. Engage altitude control.	Autopilot must hold aircraft steady at the engagement altitude.
	b. Overpower the autopilot and descend about 40 feet.	Aircraft must climb back to within ±20 feet

ADJUSTMENTS AND CHECKOUTS (Sht 17 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	Then slowly release pressure on control wheel.	of the engagement altitude.
	4. To check single-engine recovery performance, overpower the autopilot with the control wheel to change heading 20 degrees during heading hold engagement.	Aircraft rudder must move in a direction opposite of the turn.
	5. Check omni coupling performance as follows:	
	a. Start at least 20 miles from the VOR station, choosing a test VOR radial that is in line with the wind.	
	b. Turn aircraft to a heading which is 10 degrees to either side of the test radial and set the OBS and heading selector (disengaged) to the test radial heading.	
	c. Push flight controller ILS/VOR switch ON.	Aircraft must turn to an intercept angle of 45 ± 5 degrees from the test radial and must approach and turn onto the test radial and hold within one dot of OBS needle displacement.
	—**NOTE**— After crossing the VOR station (signified by the needle shifting from TO to FROM), the autopilot must capture the outboard radial in less than one minute.	
	6. Check ILS coupling performance as follows:	

ADJUSTMENTS AND CHECKOUTS (Sht 18 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	a. Tune ILS receivers (flight controller ILS/VOR switch at OFF). b. At the prescribed procedure altitude, push ALT switch ON (autopilot must be engaged). c. Approach the localizer beam at an angle of 15 degrees for each mile that the aircraft is outside the outer marker. A good approach would be at an angle of 45 degrees at three miles outside the outer marker. Use TURN knob or heading selector to control the aircraft. d. After localizer needle is off the peg and moving toward center (wait until displacement is less than four dots), push ILS/VOR to ON. The autopilot must control the aircraft and fulfill the following requirements: REQUIREMENTS: a. At localizer beam intercept, autopilot must turn aircraft onto beam with no more than three dots overshoot and with little or no second overshoot. b. When glideslope needle is centered ±1 dot, flight controller ALT switch must snap to OFF and autopilot must engage glideslope beam and control the aircraft onto the beam. c. Autopilot must hold aircraft	See requirements at left

ADJUSTMENTS AND CHECKOUTS (Sht 19 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	within ±1 dot displacement on both the localizer and glideslope beams as far in as the middle marker.	
	-**NOTE**- Maximum bank angles are limited to ±24 degrees before glideslope engagement and to ±12 degrees after glideslope engagement. These limits need not be check unless aircraft bank angle appears to be excessive on the approach. The angles are checked by overpowering the autopilot to turn aircraft more than five dots off the beam to get full autopilot command in turning back toward the beam. The aircraft bank angle must not exceed the limits in turning back toward the beam.	
	7. Check automatic pitch trim operation as follows:	
	a. With autopilot engaged and aircraft in level flight, turn manual PITCH trim wheel enough to change aircraft attitude. Release the wheel.	Wheel must turn in opposite direction.
	b. Repeat step "a" in opposite direction.	
	c. Allow aircraft and trim system to stabilize. Note position of PITCH indicator on flight controller.	PITCH needle must be centered within one-half needle width.
	d. Disengage the autopilot	Any bump resulting from mistrim must not exceed about 1/10g.

ADJUSTMENTS AND CHECKOUTS (Sht 20 of 24)
FIGURE 3-1

GROUP B-2

AIRBORNE ADJUSTMENTS AND CHECKOUT

FOR CG515 AND D COMPUTERS
(Tests 14 through 18)

Perform these procedures to compensate for any misalignment between the aircraft and autopilot. Be sure ground adjustments have first been accomplished.

Fly the aircraft in smooth air, in cruise configuration, and cruise airspeed. Manually trim for straight and level flight with autopilot disengaged, before making adjustments.

TEST	STEP	REQUIREMENT
14. Roll adjust	1. Cage Directional Gyro or temporarily place a jumper between computer connector pins 2 and 3 to prevent heading from engagin. 2. Center flight controller TURN command knob. 3. Push flight controller autopilot switch ON. **–NOTE–** The autopilot may require adjusting to fly the aircraft to the attitude indicator indicates wings level. Disregard actual wing orientation at this time. 4. Adjust the roll variable resistor on the bottom of the flight controller to obtain a wings level indication on the attitude indicator. 5. Proceed to yaw adjustment.	
15. Yaw adjustment	1. Be sure roll adjust has been made. Leave autopilot engaged.	

ADJUSTMENTS AND CHECKOUTS (Sht 21 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	2. Uncage the directional gyro or remove the jumper between computer pins 2 and 3. REQUIREMENTS: After 3 seconds heading hold will engage. **—NOTE—** Heading hold engagement can be verified by manually overpowering the autopilot to roll the aircraft. Once the control wheel is released the aircraft will bank in the opposite direction and return to the original heading if engagement took place. 3. Allow autopilot system to stabilize. 4. If aircraft is flying with one wing low (disregard attitude indicator display) adjust the yaw variable resistor on the bottom of the flight controller. Make small adjustments and wait at least 10 seconds between them to observe the results. Turn the variable resistor cw to raise the right wing and CCW to raise the left wing. The heading changes are degree for each degree change in wing orientation. At this point it is possible for the aircraft wings to be level with the attitude indicator displaying a non-level condition.	See requirement at left.

ADJUSTMENTS AND CHECKOUTS (Sht 22 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
	5. Repeat roll and yaw adjustment procedures at least 5 times to assure good centering. If after 3 minutes of straight and level flying the attitude indicator does not show the proper attitude, level the indicator by shifting its position in the instrument panel. This will not affect the autopilot adjustments.	
16. Pitch adjustment	1. Be sure roll and yaw adjustments have been made. Leave the autopilot engaged. 2. Level the aircraft with the pitch wheel. 3. Record the aircraft altitude and engage the ALT hold switch. 4. Allow the aircraft to stabilize. 5. Recheck the altitude reading. If the aircraft is above the previously recorded altitude, adjust the pitch variable resistor on the bottom of the flight controller in a CW direction. If the aircraft is below the previously recorded altitude, adjust it in a ccw direction. Make small adjustments until the aircraft stabilizes at the recorded altitude. 6. Disengage the ALT hold switch and repeat the procedure until the altitude difference is negligible.	
17. In flight checks	Check the maximum autopilot turn command. This is accomplished by rotating the TURN command as far as it will rotate in one direction, allowing the aircraft to stabilize and then repeating it in the opposite direction. The bank angle command must be 90 ± 2 ° in each direction.	

ADJUSTMENTS AND CHECKOUTS (Sht 23 of 24)
FIGURE 3-1

TEST	STEP	REQUIREMENT
18. Other adjustments	A variable resistor is located inside the controller to adjust the panel function switch light intensity.	

ADJUSTMENTS AND CHECKOUTS (Sht 24 of 24)
FIGURE 3-1

SECTION IV

TROUBLESHOOTING

1. GENERAL. This section contains troubleshooting data for troubleshooting the autopilot. The following diagrams are included in this section.

2. TROUBLESHOOTING

A. How to Use This Section

(1) Determine the nature of the trouble as accurately as possible. Question the pilot to narrow the complaint down to one of the troubles listed in the troubleshooting table (figure 4-3). If the pilot is not available, a flight test is helpful in narrowing the complaint to a particular trouble.

(2) Before referring to the troubleshooting table, perform the preliminary checks of paragraph B. Do not proceed to the troubleshooting table until all the requirements of the preliminary checks are met.

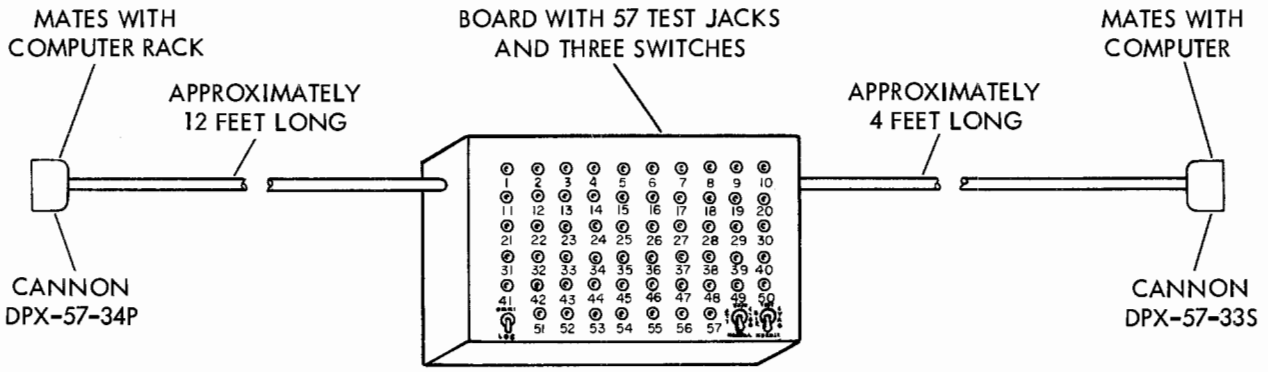
(3) Use a patch cable such as that illustrated in figure 4-1 or ST 140 system tester and a multimeter such as the Simpson model 260 for the troubleshooting. When instructions call for using a jack, the jacks referred to are on the patch cable or system tester. Figure 4-2 illustrates a simulated servo amplifier load which should be used in place of any missing servo actuators. (Simulated load not need if system tester is used)

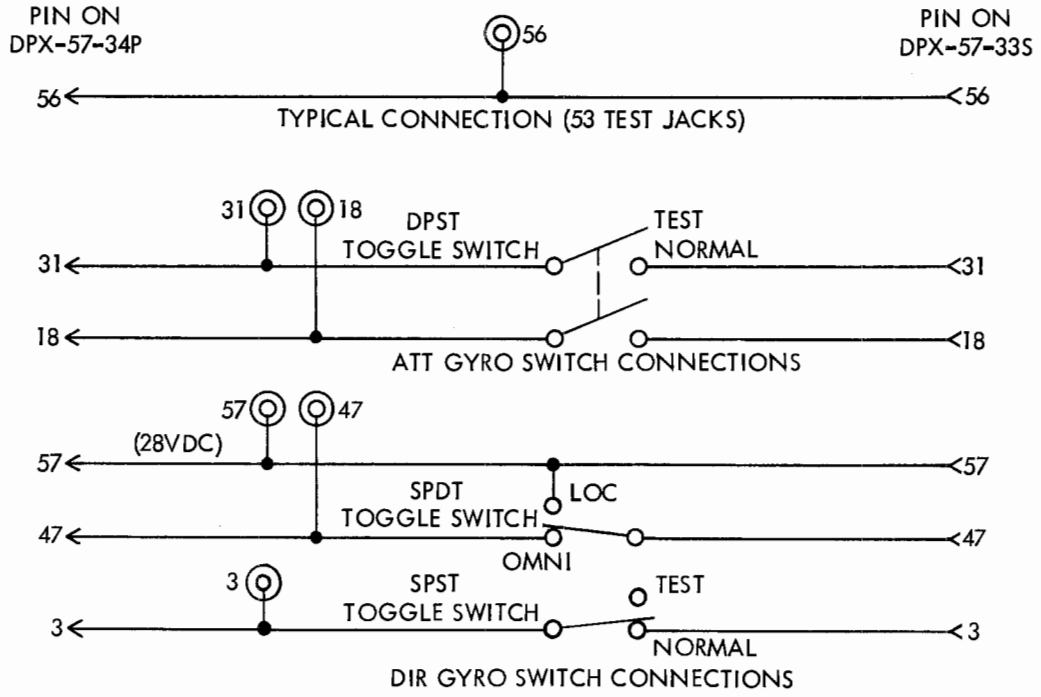
(4) When electric or pneumatic power is required to perform test procedures, electric power can be obtained by starting an aircraft engine, by connecting an external 28vdc supply to the aircraft, or by using the aircraft battery. Pneumatic power can be obtained either by starting an engine or by connecting an external pressure source which supplies pressure equal to that supplied by the aircraft pump.

(5) After making the preliminary checks of paragraph B, refer to the troubleshooting table (figure 4-3) and the schematic diagrams (figure 404 through 4-24) for the general area of complaint. Example: For a pitch control problem refer to the pitch axis test. Check to make sure that troubles listed ahead of the reported trouble are not present. Do not proceed unless all previously listed troubles have been cleared.

(6) Make only the replacements called for in the CORRECTIVE ACTION column. If the system is still in warranty, return any defective components to the aircraft manufacturer. If the system is no longer in warranty, further repairs may be made according to the instructions in the series of overhaul manuals for the components.

(7) For all test procedures, pneumatic power must be applied and the autopilot must be engaged unless otherwise specified. The patch cable switches must be at the NORMAL and OMNI positions unless otherwise specified. Turn power off to make continuity checks.





Patch Cable Diagram

Figure 4-1

B. Preliminary Checks

(1) Perform the ground adjustments and checkout of Section III.

(2) Check all electrical connectors for proper mating.

(3) Check the position of the computer option selector plug and the application of the 1K3 relay. The following table explains these requirements:

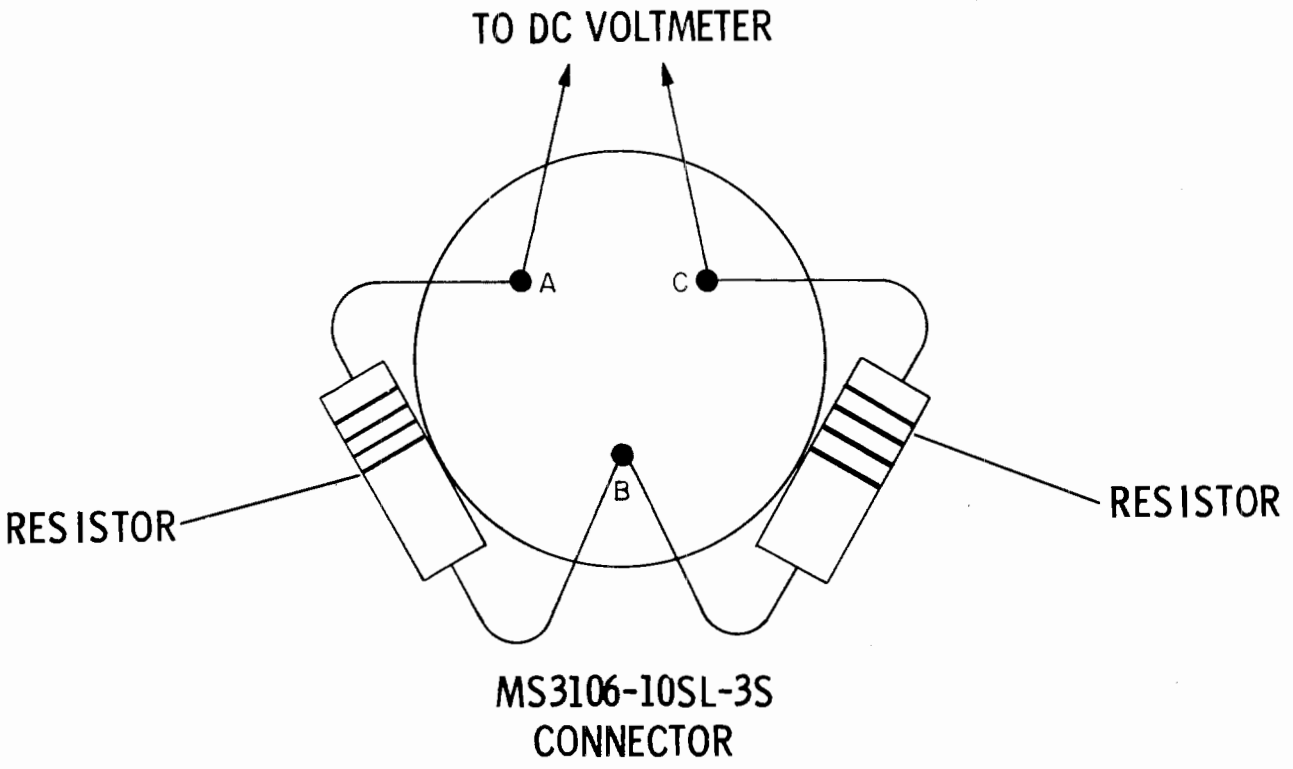
AUTOPILOT FUNCTIONS	OPTIONAL SELECTOR PLUG POSITION	THIS MUST BE IN THE 1K3 SOCKET
Heading hold only	1	Socket not used
Heading hold and ILS	2	Dummy relay 032-0014-00 (Z983983)
Heading select (without omni)	4	Dummy relay 032-0014-00 (Z983983)
Omni coupling (without heading select	2	Armature relay 032-0013-05 (Z937796-6)

—NOTE— If heading select is installed, the option selector must be at position 4 no matter which other options are installed.

(4) Disconnect the pneumatic line from a servo actuator and look for any sign of oil in the line. If oil is discovered, remove and replace (or clean according to the overhaul manual) all servo actuators and servo actuator valves. Look for the reason for oil being in the pneumatic line and make repairs according to the proper aircraft manual.

(5) If aileron or elevator jitter has been reported and the ground adjustments of Section III are satisfactorily performed, replace the attitude indicator.

(6) Check the isolation of the power and signal grounds. Check the voltage between patch cable jacks 1 (+) and 51. There must be approximately 10vdc between them. If they are not properly isolated, check the coupling of the navigation receivers for shorts between the grounds.



NOTE: USE TWO RESISTORS OF THE SAME VALUE. THE VALUE CAN BE BETWEEN 150 AND 250 OHMS. USE 1/2 WATT OR LARGER RESISTORS.

Load Resistor and Voltmeter Hookup

Figure 4-2

Index to Troubleshooting Table

—NOTE— To obtain the maximum benefit from the troubleshooting procedures, follow the tests by tracing the circuits on the system schematic diagrams in this section. Also, refer to the applicable device schematic diagrams in this section when necessary.

1. Autopilot System

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
All switching operates properly, but autopilot is inoperative (all three axes).	1. Check to make sure pneumatic pressure is reaching servo actuators.	If pressure is available proceed to step 7. If pressure is not available proceed to step 2.
	2. Check bypass air valve. It should release air air pressure only when autopilot is disengaged.	If valve releases air when autopilot is engaged, proceed to step 3.
	3. Check for 28vdc at bypass air valve when autopilot is engaged.	If voltage is present valve is defective. If voltage is not present, proceed to step 4.
	4. Check for 28vdc at jacks 55 (+) and 50.	If voltage appears, aircraft wiring from computer to valve is defective. If no voltage appears, proceed to step 5.

TROUBLESHOOTING (Sht 1 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	5. Check for 28vdc at jacks 5 (+) and 50.	If voltage appears, check wiring in computer chassis from pin 5 to pin 55. Repair as necessary. If no voltage appears, proceed to step 6.
	6. Check aircraft wiring from computer connector pin 5 to flight controller connector pin 3.	If wiring is good, check flight controller wiring and master engage switch 2S1B. Repair as necessary.
	7. Listen for servo actuator valve chattering with autopilot engaged.	If chattering is audible, proceed to step 9. If chattering is not audible proceed to step 8.
	8. Check for 20 ± 2vdc from jacks 43, 40 and 24 to gnd. jack 50.	If voltage is not present check zener diode and then current regulating tube in computer. Do not replace tube before checking zener diode.
	9. Check for 10vdc at jacks 1 (signal gnd) and 50 (power gnd).	If voltage is below 8vdc, check for a short or low resistance short between signal and power ground.
2. SWITCHING Perform the following tests or a specific test if a switch fails to engage or disengage properly. In many cases, improper switching is the cause of other reported troubles.		
Aircraft circuit breaker does not hold in.	Remove computer from its rack and check to see whether trouble is eliminated.	If trouble is elimated, troubleshoot computer for a short to ground. If

TROUBLESHOOTING (Sht 2 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
		trouble is not eliminated, trouble is not caused by the autopilot.
MASTER switch does not hold at ON.	1. Check that aircraft master switch or circuit breaker is on.	If switch or circuit breaker is on, proceed to step 2.
	2. Check for 28vdc at jacks 57 (+) and 50. Be sure that voltage is not excessively low (not less than 22vdc).	If power is available to autopilot, proceed to step 3.
	3. Check fuse on front of computer.	Replace fuse if it is open. If fuse is not open, proceed to step 4.
	4. Check for 28vdc at jacks 2(+) and 50.	If no voltage appears, check for open wiring in computer. Repair as necessary. If voltage appears, proceed to step 5.
	5. Remove flight controller and check for 28vdc between pin 1 (+) of connector which mates with flight controller and jack 50.	If no voltage appears, aircraft wiring is defective. If voltage appears, proceed to step 6.
	6. Check for continuity between jack 51 and pin 36 of connector which mates with flight controller.	If no continuity, exists, aircraft wiring is defective. If continuity exists, check flight controller for defective master engage switch 2S1B (CG515 2SI-2).

TROUBLESHOOTING (Sht 3 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
Control wheel emergency disengage switch does not disengage autopilot.	1. Check disengage switch for make and break action.	Replace switch if it is defective. If switch is good, proceed to step 2.
	2. Remove flight controller and monitor voltage between pin 1 (+) of connector which mates with flight controller and jack 50. Push emergency disengage switch. The 28V must drop when switch is pushed.	If pushing switch does not cause a drop in voltage, replace emergency disengage switch. If voltage drops properly or if replacing emergency disengage switch does not remove trouble, check operation of flight controller master engage switch 2S1B (CG 515, 2S2-2).
ALT switch does not hold ON. (If altitude hold is not installed, switch does not hold ON in TSO configuration autopilots.	1. Remove flight controller and check for continuity between flight controller pins 3 and 7 with ALT switch held ON.	If continuity does not exist, check operation of switches 2S2A and 2S5, (2S26-CG515) Repair as necessary. If continuitry exists, check resistance between pins 7 and 32 (2S2 coil). Resistance must be 430 ± 86 ohms. If correct, proceed to step 2. All but CG515 on CG515 do not make resistance check, refer to CG515 maintenance manual.
	2. Remove flight controller. Check for continuity between pin 32 of connector which mates with flight controller and jack 8.	If there is no continuity, repair aircraft wiring. If continuity exists, proceed to step 3.

TROUBLESHOOTING (Sht 4 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	3. Remove A6 card (orange decal labled ILS/HDG) and check for continuity between pins A and N connector on card.	If continuity exists, check computer wiring from A6 card pin A to computer pin 8. If continuity does not exist, check wiring on A6 card. Repair as necessary.
ALT switch does not release to OFF when PITCH command wheel is turned.	Remove flight controller and check mechanical operation of altitude interlock switch 2S5. (CG515 check electronic switch. See CG515 overhaul manual.)	Repair switch operation or replace switch.
ALT switch does not move to OFF when ILS/VOR switch is at ON and glide slope engages.	Refer to troubles listed in test 10, ILS Localizer Coupling.	See corrective action for referenced checks.
In systems with three-switch flight controllers, ILS/VOR switch does not remain ON. (TURN knob must be centered and heading selector must be disengaged. If omni and/or ILS are not coupled, ILS/VOR switch may not hold on due to aircraft wiring.)	1. Remove flight controller and check for continuity between pins 14 (+) and 1 (-) on flight controller connector while holding MASTER switch ON and TURN knob in detent. (A diode resistance appears)	If continuity does not exist, check for continuity between flight controller pins 14 and 34. If no continuity, repair and replace turn command switch 2S4. If continuity exists between pins 14 and 1, proceed to step 2.
	2. Check for continuity between pins 12 and 36 on flight controller connector. The circuit must be open. Push ILS/VOR switch to ON and continuity must exist.	If proper results are not obtained, check wiring from pins 12 and 36 to flight controller navigation switch 2S3. Repair or replace wiring or switch 2S3 as necassary.

TROUBLESHOOTING (Sht 5 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	3. Check for continuity between pin 36, on connector which mates with flight controller, and aircraft ground.	If continuity does not exist, there is a fault in aircraft wiring. If continuity exists, proceed to step 4.
	4. Remove heading selector and disconnect electrical cable. Check for continuity between L and J on heading selector connector.	If continuity does not exist, open heading selector and check wiring and switch. If continuity exits, proceed to step 5.
	5. Check for continuity between pin 12 of connector which mates with flight controller and pin L of connector which mates with heading selector. Check between pin 14 and pin J of the same connectors.	If continuity does not exist, repair aircraft wiring.
In systems with CG417 and CG515 flight controllers, ILS/VOR switch does not remain at ON. (TURN knob must be centered and heading selector must be disengaged. If omni and/or ILS are not coupled, ILS/VOR switch may not hold in due to aircraft wiring). Pin 14 and 27 must be interlocked or jumpered on CG515.	1. Remove flight controller and check for continuity between flight controller connector pins 1 and 27 while holding ENGAGE switch at ON. (A diode resistance must appear on CG417 + on pin 1)	If an open circuit exists, disengage ENGAGE switch and check for continuity between pins 1 and 5. If continuity exists, check CG417 wiring to pin 34. If no continuity, check ENGAGE switch 2S1B. Repair or replace as necessary. (CG515 check from pin 27 to 3, if no continuity check S4A and S6-5)

TROUBLESHOOTING (Sht 6 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	2. Check resistance between pins 27 and 36 on flight controller with ILS/VOR switch held at ON. The resistance must be 430 ± 86 ohms. (CG515 use 14 + and 36 - should be 480 ± 80Ω)	If an open circuit or high resistance exits, check wiring from pins 27 (14 on CG515) and 36 to ILS/VOR switch 2S3 (S3-6 or CG515). Check switch 2S3. Repair or replace as necessary.
ILS/VOR switch does not move to OFF when TURN command knob is moved.	Remove flight controller and check mechanical operation of ILS/VOR switch 2S3 and electrical operation of TURN command switch 2S4.	Replace switches as necessary.
ILS/VOR switch does not move to OFF when ENGAGE switch is moved to OFF.	1. Check directional gyro to see if it is caged.	If the directional gyro is uncaged, proceed to step 2.
	2. Remove directional gyro and check for continuity between pins F and H on directional gyro connector. With gyro uncaged, an open condition must exist.	If there is continuity, repair or replace switch in directional gyro.
ILS/VOR switch does not disengage when heading select function is engaged.	1. For systems with three-switch flight controllers, remove heading selector and check operation of engage switch 9S1A.	Repair or replace as necessary.
	2. For systems with CG417 four-switch flight controllers, remove flight controller and check operation of HDG SEL switch 2S6.	Repair or replace as necessary.

TROUBLESHOOTING (Sht 7 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
Heading selector does not engage (with TURN command knob centered).	1. For systems with three-switch flight controllers proceed as follows:	
	a. Remove engage knob from heading selector. Push shaft to attempt to engage heading selector.	If heading selector can be engaged with knob off, knob must be repositioned. Place knob on shaft. Tighten setscrews when knob is positioned so that shaft can go fully in. If trouble is not removed, proceed to step b.
	b. Remove flight controller and make continuity checks at connector of flight controller. Check between pins 14 (+) and 1 (-) with MASTER switch held at ON, and check between pins 13 and 36. Continuity must exist.	If continuity does not exist, check for continuity between pins 14 and 34. If no continuity, check wiring to switch 2S4. Repair wiring or replace switch 2S4 as necessary.
	c. Disconnect electrical connector from heading selector. Check for continuity between pin 14 of connector which mates with flight controller and pin J of connector which mates with heading selector. Check between pins 13 and K of same connectors.	If continuity does not exist there is fault in aircraft wiring. If continuity does exist, proceed to step 4.

TROUBLESHOOTING (Sht 8 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	d. Remove heading selector and check for a resistance between pins J and K on its connector when engage knob is pushed in.	If there is either a short or an open condition, open heading selector and check wiring of switch solenoid. Repair wiring or replace solenoid as necessary.
	2. For systems with four-switch flight controllers proceed as follows:	
	a. Remove flight controller and check for continuity between flight controller connector pins 1 and 35, and between pins 1 and 10 with the ENGAGE and HDG SEL switches held at ON. (A diode resistance must exist on CG417)	If an open circuit exists check wiring from pin 1 to ENGAGE switch and from pins 35 and 10 to HDF SEL switch. Check ENGAGE switch 2S1 and HDG SEL switch 2S6. Repair or replace as necessary. If continuity exists, proceed to step b.
	b. Check for continuity between pins 10 and 2 on aircraft wiring connector which mates with flight controller.	If an open circuit exists remove heading selector and check for continuity between pins T and S on its connector. If no continuity, open heading selector and check wiring. Repair as necessary. If continuity exists in heading selector but not between pins 10 and 2 aircraft wiring is faultly. If continuity exists between 10 and 2 proceed to step c.

TROUBLESHOOTING (Sht 9 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	c. Check resistance between pins 2 and 36 on flight controller connector. The resistance must be 270 ± 54 ohms (CG515 + on 36 - on 2 gives diode drop, - on 36 + on 2 gives 480Ω ±10%.	If an open circuit exists or a high resistance appears, check between pin 2 and HDG SEL switch and between pin 36 and ILS/VOR switch. Check HDG SEL switch coil. Repair or replace as necessary.
In systems with three-switch flight controllers, heading selector does not disengage when the TURN command knob is moved.	Engage heading selector and then remove flight controller.	If heading selector disengages, check wiring and operation of flight controller switch 2S4. Repair wiring or replace switch as necessary. If it does not disengage, remove heading selector from panel and check for binding of shaft. Open case if necessary and check spring action. Repair as necessary.
In systems with four-switch flight controllers, HDG SEL switch does not disengage when TURN command knob is moved.	Engage HDG SEL switch and then remove flight controller.	If HDG SEL switch does not disengage, check for binding of switch. Repair as necessary. If HDG SEL switch disengages, refer to flight controller schematic diagram and check wiring and switch action of TURN command knob. Repair or replace as necessary.

TROUBLESHOOTING (Sht 10 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
In systems with three-switch flight controllers, heading selector does not disengage when ILS/VOR switch is turned ON.	Engage autopilot and then remove flight controller.	If heading selector disengages check for gnd. at pin 13 of flight controller with ILS/VOR switch held ON. If gnd. exists, locate and remove it. If heading selector does not disengage, repeat above corrective actions for shaft binding.
In systems with four-switch flight controllers, HDG SEL switch does not disengage when ILS/VOR switch is turned ON.	Refer to flight controller schematic diagram and check wiring and switch operation of HDG SEL and ILS/VOR switches.	Repair wiring or replace switches as necessary.
	3. YAW AXIS	
Engagement causes mistrim in yaw axis (ball off center) or an objectionable rudder kick.	1. Check rigging of rudder servo cable drum. Servo must be centered for streamlined rudder.	If adjustment is needed perform step 4 before flight check.
	2. Check servo actuator diaphragms for leakage.	Replace diaphragms as necessary. If no leakage, proceed to step 3.
	3. If pressure gages are available, install a gage on each side of servo valve test ports. Proceed to step 4.	
	4. Perform roll and yaw axis adjustments of figure 3-1 while observing gages.	If adjustments can be made, pressure gages must read equal pressure when electrical voltage is zero. If not zero, adjust servo valve

TROUBLESHOOTING (Sht 11 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
		according to overhaul manual. If adjustments in step 4 cannot be made proceed to step 5.
	5. Check continuity between pin A of connector which mates with rudder servo actuator, and jack 41. Check between pin C and jack 42 and between pin B and jack 43.	If continuity does not exist in any check, repair that wire in aircraft cabling. If trouble is not removed, proceed to step 6.
	6. Check resistance of servo valve coils A to B and A to C. Resistance must be within 20% of each other.	Replace valve coil if resistance check shows an open winding or a short circuit. If resitances are within tolerances, proceed to step 7.
	7. Replace A2 card (blue decal labeled YAW AXIS) (This may be done by pulling connected pair of cards and turning them so that they exchange positions in receptacles).	If problem is removed, repair or replace bad card. If not, proceed to step 8.
	8. Check that voltage between patch cable jacks 26 and 1 is zero with autopilot engaged.	If voltage is not zero, refer to test 8, Heading, for heading system troubleshooting. If voltage is zero, proceed to step 9.
	9. Disconnect turn and bank indicator gyro.	If problem disappears, proceed to step 10. If not, proceed to step 11.

TROUBLESHOOTING (Sht 12 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	10. Check capacitor 1A5C3 on A5 card.	Replace capacitor if shorted and check turn and bank indicator for proper operation.
	11. Adjust computer YAW ADJ R3 resistor for zero volt. Use pins 12 to 62 (gnd) for checking adjustment.	If voltage cannot be adjusted to zero, replace resistor R3.
No apparent yaw damping.	1. With autopilot engaged & pneumatic pressure applied, push on instrument panel near turn and bank indicator gyro. The rate needle, on turn and bank indicator gyro, and rudder of aircraft must deflect. If possible, yaw the aircraft. That should produce the same results.	If needle deflects but no rudder action is apparent, proceed to step 2. If needle does not deflect proceed to step 7.
	2. Connect dc voltmeter between patch cable jacks 27 and 1. Repeat step 1. Voltmeter needle should deflect when gyro is moved.	If voltage changes, perform steps 3 thru 11 of first trouble listed under YAW AXIS. If trouble does not change or if no voltage is shown, proceed to step 3.
	3. Disconnect turn and bank indicator. With dc power on, check for 40vdc between pins C and E on connector going to turn and bank indicator.	If voltage appears, proceed to step 4. If no voltage, proceed to step 5.

TROUBLESHOOTING (Sht 13 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	4. Check for 7K resistance between turn and bank indicator pins C to E. Check for 3.5K resistance between turn and bank indicator pins D to E and D to C.	If resistances are not correct, replace variable resistor in turn and bank indicator.
	5. Check for +20vdc between patch cable jacks 14 (+) and 1. Check for -20vdc between jacks 15 (-) and 1.	If voltage of proper value appears, repair aircraft wiring from computer pin 14 to turn and bank indicator pin E and from pin 15 to pin C. If no voltage, proceed to step 6.
	6. On terminal board TB1 on underside of computer, check for +20vdc between terminals 49 and 62 (-) (between 13 and 60 on B2 suffix computers). Check for -20vdc vdc between terminals 52 (-) and 62 (between 14 and 60 on B2 suffix computers).	If voltage is correct, repair wiring. If no voltage, repair red dc power supply card.
	7. Disconnect electrical connector from turn and bank indicator gyro. Make certain 28vdc circuit breaker is in. Check for 28vdc between pins A (+) and B of connector which mates with the gyro.	If no voltage appears, repair aircraft wiring or turn and bank indicator gyro circuit breaker. If voltage appears, repair turn and bank indicator gyro.

TROUBLESHOOTING (Sht 14 of 55)
FIGURE 4-3

4. PITCH AXIS

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
No response to PITCH command wheel movement in either aircraft or PITCH trim indicator.	1. Check for 10vdc at jacks 1 (signal ground) and 50 (power ground).	If voltage is below 8vdc, check for a short or low resistance short between signal and power gnd. If voltage is correct, proceed to step 2.
	2. Substitute a good A1 card by switching A1 and A2 cards.	If trouble is corrected, repair or replace bad card. If trouble is still present, proceed to step 3.
	3. Check voltage at jacks 35 and 1 (-) while moving PITCH command wheel.	If voltage varies, proceed to step 4. If voltage does not vary, proceed to step 7.
	4. Turn computer over and check voltage between terminal board TB1 terminals 83 and 62 while moving PITCH command wheel (between 37 and 60 on B2 suffix computers).	If voltage does not vary, repair wiring between computer connector pin 35 and terminal 83. If voltage varies, proceed to step 5.
	5. Disconnect computer connector and check for 387K resistance between TB1 terminals 83 and 77 (between 37 and 38 on B2 suffix computers).	If an open circuit exists, replace resistor. If resistance is correct, proceed to step 6.
	6. With computer disconnected, check continuity between TB1 terminal 77 and connector 1A1 pin R (between 38 and R on B2 suffix computers).	If open, repair wiring.

TROUBLESHOOTING (Sht 15 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	7. Disconnect flight controller. Check continuity from pins of aircraft mating connector to computer connector pins as follows: Aircraft Connector — Computer Connector 24 to 35 22 to 17 20 to 16	If no continuity, repair aircraft wiring. If continuity exists, proceed to step 8.
	8. On flight controller, check continuity from pin 24 to wiper of pitch command resistor, and from pin 20 to the other end.	If open, repair wiring. If continuity exists, replace pitch command resistor.
Aircraft does not respond to PITCH wheel command, but PITCH trim indicator does respond.	1. Check shear pin on elevator cable drum and check control cables for proper tension.	If shear pin is broken, replace it as instructed in Section V. If trouble is not removed, proceed to step 2.
	2. Check for air pressure at elevator servo.	If pressure is correct proceed to step 3. If not correct, check pressure source.
	3. Move PITCH command wheel, monitor voltage at jacks 38 and 39, and watch PITCH indicator. The needle must react to PITCH wheel movement. Note reaction for reference in a later step.	If voltage varies, check aircraft wiring to servo. If wiring is good, proceed to step 4. If voltage does not vary, proceed to step 5.

TROUBLESHOOTING (Sht 16 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	4. Check servo actuator diaphragms for leakage.	If leakage is detected, replace diaphragms. If no leakage, proceed to step 5.
	5. Check servo valve according to test 12, Servo Valves (Installed in Aircraft).	Repair or replace as necessary.
Autopilot will not hold pitch attitude.	1. Make "Aircraft does not respond to PITCH wheel command, but PITCH trim indicator does respond" trouble check.	If proper results are obtained, proceed to step 2.
	2. Check to make certain that attitude indicator is connected. Observe indicator for proper operation.	If indicator does not operate mechanically, repair or replace it. If it appears to be mechanically accurate, proceed to step 3.
	3. Check for continuity between pin F, of connector which mates with attitude indicator and jack 31, between pin D and jack 17, and between pin E and jack 16 (with CG515 check continuity of pin 13 to pin 12 with ALT disengaged).	If no continuity exists, there is a fault in aircraft wiring. If there is continuity, proceed to step 4.
	4. Check for continuity from computer connector pin 31 to computer A5 card connector pin J5U.	If no continuity exists, repair wiring. If continuity exists, proceed to step 5.
	5. Remove A5 card. Check resistor 1A5R1 for 261K resistance (pin U to P).	If open, repair wiring or replace resistor 1A5-R1. If resistance is correct, proceed to step 6.

TROUBLESHOOTING (Sht 17 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	6. On card A5, check resistors 1A5R2 and 1A-5R3 and capacitors 1A-5C1 and 1A5C2 for proper values and connections (refer to A5 card schematic).	Repair or replace as necessary. If all parts are good, proceed to step 7.
	7. Remove and cage attitude indicator. Check for approximately 2. 6K resistance between pins D and F and between pins E and F on it electrical connector.	If improper results obtained, repair or replace indicator. If proper results are obtained, proceed to step 8.
	8. Perform tests under test 11, Automatic Trim.	
Pitch hardover when autopilot is engaged.	1. Attempt to center PITCH indicator needle by turning PITCH command wheel. (Attitude indicator must be erected or pitch cable ATT GYRO switch must be at TEST).	If PITCH indicator needle does not center, proceed to step 2. If PITCH indicator centers, proceed to step 8. (With CG515 if pitch wheel drives hard over one side. See controller overhaul manual.)
	2. Replace A1 card (blue decal), by interchanging A1 and A2 cards.	If problem disappears, repair or replace bad card. If problem still exists, proceed to step 3.
	3. Connect dc voltmeter between patch cable jacks 35 and 1 (-). Rotate PITCH command wheel in both directions and check that voltage passes	If voltage does not pass through zero, proceed to step 4. If voltage is correct, check wiring from computer pin 35 to terminal board 83.

TROUBLESHOOTING (Sht 18 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	through zero (with CG 515 engage ALT switch If voltage at jack 35 is not zero ± 1.0vdc. Null pitch adj. 2R24).	Check resistor 1R21 between terminals 83 and 77, and wiring from terminal 77 thru terminal 76 to A1 card connector pin R. (On B2 suffix computers, check wiring from pin 35 to terminal 37. Check resistor 1R17 between terminals 37 and 38 and wiring from terminal 38 through terminal 51 to pin R).
	4. While watching PITCH indicator, disconnect flight controller.	If indicator centers, proceed to step 5. If it does not center, proceed to step 7.
	5. Check continuity of aircraft wiring between computer connector and flight controller pins as follows: Computer Connector — Flight Controller 35 to 24 17 to 22 16 to 20	If no continuity exists, repair wiring. If continuity exists, proceed to step 6.
	6. Inside flight controller, check continuity from pin 24 to pitch command resistor wiper and from pins 22 and 20 to each side of resistor. Check that resistor resistance is 5K. Check that wiper provides continuous continuity from end to end.	If open wiring, repair as necessary. If open resistor, replace it.

TROUBLESHOOTING (Sht 19 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	(CG515 also check pitch adjust 2R24 and wiring; see schematic for details)	
	7. Check for a ground or open circuit in wiring from pitch indicator circuit to power ground (pins 18 and 17 in flight controller and aircraft wiring).	Remove ground or repair wiring. Replace pitch indicator if necessary.
	8. Replace A1 card (blue decal) by interchanging A1 and A2 cards.	If problem still exists, proceed to step 9.
	9. Check continuity from computer connector pin 39 to computer A1 card connector pin J1C and from pin 38 to pin J1A.	If open, repair wiring. If continuity exists, proceed to step 10.
	10. Check continuity of aircraft wiring between computer connector pin 39 to elevator servo connector pin A and from pin 38 to pin C.	If open, repair wiring. If continuity exists, proceed to step 11.
	11. Check for a ground condition at four pins listed in step 10.	If ground condition exists, repair as necessary. If no ground exists, proceed to step 12.
	12. Check that resistances of elevator servo coils are equal within ±20%.	If open coil exits, replace it. If resistances are within tolerance, proceed to step 13.

TROUBLESHOOTING (Sht 20 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	13. Check servo diaphragms for leakage.	If leakage is detected, replace diaphragm. If no leakage, proceed to step 14.
	14. Test servo valves according to test 12, Servo Valves (Installed in Aircraft).	Repair or replace valve as necessary.
PITCH wheel commands chage in only one direction.	Perform "Pitch hardover when autopilot is engaged" test procedures.	
PITCH indicator does not react when PITCH command wheel is turned.	1. Check for 10vdc from computer connector pins 1 (signal ground) to pin 50 (power ground).	If voltage is below 8vdc, check for a short or low resistance short between signal and power ground.
	2. Perform "Pitch hardover when the autopilot is engaged" test procedures.	
PITCH indicator is not centered when aircraft is flying straight and level.	1. If an automatic pitch trim system is installed, see troubles listed for that system (test 11). If automatic trim system is not installed, use manual trim to center needle.	If neither of these procedures correct the problem, proceed to step 2.
	2. Perform "Pitch hardover when autopilot is engaged" test procedures.	
Computer R1 PITCH ADJ resistor does not control pitch axis during checkout procedures.	1. Set patch cable ATT GYRO switch at TEST, or disconnect electrical connector from attitude indicator. Monitor voltage at patch cable jacks 38 and 39 while rotating	If PITCH command wheel operates normally, proceed to step 2. If not, perform "Pitch hardover when autopilot is engaged" test procedures.

TROUBLESHOOTING (Sht 21 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	PITCH command wheel. Voltage must vary up to ±6vdc minimum.	
	2. On computer terminal board TB1, check voltage between terminals 60 and 62 while rotating PITCH ADJ resistor R1 (between terminals 20 and 60 on B2 suffix computers). Voltage must vary and pass through zero.	If voltage does not vary or pass through zero, proceed to step 3. If voltage is correct, proceed to step 4.
	3. On computer terminal board TB1, check continuity from terminal 60 (terminal 20 on B2 suffix computers) to resistor wiper and from terminals 53 and 48 to ends of resistor (terminals 14 and 13 on B2 suffix computers).	If circuitry is open, repair wiring and repeat step 2. If circuitry is correct, replace PITCH ADJ resistor R1.
	4. Remove A1 card. Check continuity from terminal board TB1 terminals 68 to 67 (terminal 19 and A1 card connector pin J1P on B2 suffix computers). Check for 1.21 mego resistance (1R14) between terminals 60 and 68 (between terminals 20 and 19 on B2 suffix computers).	Repair wiring as necessary. Replace resistor 1R14 if necessary.

TROUBLESHOOTING (Sht 22 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
PITCH command wheel commands unequal nose-up versus nose-down response.	1. Place patch cable ATT GYRO switch at TEST or disconnect electrical connector from attitude indicator. Center PITCH command wheel and note whether PITCH indicator needle is centered. (Check null adjustment of 2R24 pitch adj on CG515). See controller manual.	If PITCH indicator does not react to PITCH command wheel, see listing for that trouble. If PITCH indicator needle is not centered, but can be controlled, center PITCH wheel and adjust computer R1 PITCH ADJ variable resistor to center needle. If needle is centered, proceed to step 2.
	2. Check control cable rigging (particularly servo actuator cable drum centering).	If control cables are properly rigged, make tests listed for trouble, "Aircraft does not respond to PITCH wheel command but PITCH trim indicator does respond".
Excessive shear pin breakage.	None	Check aircraft control cable rigging.
Marginal pitch axis performance (porpoise, sluggishness, etc.)	1. Check aircraft pneumatic and vacuum system for low pressure.	If pressure and vacuum are within specified tolerances for aircraft, proceed to step 2.
	2. Check aircraft electrical system for low voltage.	If electrical power is within specified tolerances for aircraft, proceed to step 3.
	3. Inspect elevator servo actuator for presence of oil (or other contaminants)	If contamination is found, replace (or clean according to overhaul manual) ALL servo

TROUBLESHOOTING (Sht 23 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
		actuators. Flush pneumatic lines and install new (or cleaned) servo actuators. Replace air filter.
	4. Check control cable rigging (particularly servo actuator cable drum centering).	If control cable is properly rigged, proceed to step 5.
	5. Visually check attitude indicator to determine if it is operating mechanically.	If indicator does not appear to operate, repair or replace it. If it operates properly, proceed to step 6.
	6. Check servo actuator for proper pneumatic pressure.	If proper pressure is at servo, proceed to step 7.
	7. Check servo diaphragms for leakage.	If leakage is detected, replace diaphragms. If no leakage, proceed to step 8.
	8. Perform servo valve test according to overhaul manual.	If servo valve is good, proceed to step 9.
	9. Perform tests under test 11, Automatic Trim.	
5. ALTITUDE HOLD Prior to troubleshooting the altitude hold function, the pitch axis and automatic trim system must be functioning properly.		
Autopilot does not hold altitude with ALT switch at ON. No response in pitch axis.	1. Check to make sure that electrical connector is securely connected with altitude control.	If connected, proceed to step 2.

TROUBLESHOOTING (Sht 24 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	2. Check voltage at jacks 38 and 39. Disconnect static line from altitude control. Engage autopilot and push ALT switch ON. Apply a slight pressure to altitude control. (A good method is to connect a pliable rubber tube to static port and then to squeeze tube) The voltage must be affected.	If voltage varies, trouble is in aircraft static pressure system. If there is no reaction, proceed to step 3.
	3. Check for a resistance between pins D and E on altitude control electrical connector. There must be approximately 300Ω resistance. Check between pin A and H. There must be approximately 6.5K resistance. Check between B and H should be approximately 6.5K.	If proper resistances do not appear, repair or replace altitude control. If proper resistances appear, proceed to step 4.
	4. Check for continuity between pin D of connector which mates with altitude control and jack 9. Check between pin E and pin A of A6 card.	If continuity doesn ot exist, repair wire in computer chassis. If continuity exists, proceed to step 5.
	5. Remove A6 card. Check continuity from A6 card connector pins A to N.	If no continuity, repair wire on A6 card or replace K8 relay if card is so equipped. If continuity exists, proceed to step 6.
	6. On A6 card mating connector in computer (J6) check between pin N and	If no continuity, repair wire in computer. If continuity exists,

TROUBLESHOOTING (Sht 25 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	ground lug in computer.	remove altitude control and checking according to overhaul manual. Repair or replace as necessary.
Autopilot exhibits porpoising or small sharp pitch corrections only while on altitude hold.	1. Check aircraft static system for clear lines.	Make repairs according to airframe manufacturer's instructions. If trouble is not corrected proceed to step 2.
	2. Perform tests under test 11, Automatic Trim.	If trouble is not corrected, proceed to step 3.
	3. Replace altitude control and check according to overhaul manual.	Repair or replace as necessary.
Aircraft does not hold altitude (drifts off over a 10 to 15 minute period)	1. Perform tests under trouble "Autopilot does not hold altitude with ALT switch ON. No response in pitch axis."	If trouble is not corrected, proceed to step 2.
	2. On computer terminal board TB1, monitor voltage between terminal 79 and ground terminal 62 (between terminals 36 and 60 on B2 suffix computers). Engage ALT switch. Apply pressure on static port and hold for 5 to 10 minutes.	If voltage does not stabilize, repair or replace altitude control.

TROUBLESHOOTING (Sht 26 of 55)
FIGURE 4-3

6. ILS GLIDESLOPE COUPLING Before referring to the following troubles, the pitch axis must be operating properly and the ILS/VOR switch must be functioning. The glide-slope indicator must also be operating properly.		
TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
Autopilot does not engage glide path.	1. Use glideslope simulator or tune-in localizer frequency to obtain glide-slope needle deflection. Check signal between pitch cable jacks 10 and 11.	If same signal is between jacks 10 and 11 as on glideslope meter, proceed to step 2. If signal is different, repair aircraft wiring.
	2. On computer terminal board TB1 check voltage between terminal 70 and ground terminal 62 (between terminals 18 and 60 on B2 suffix computers).	Signal must be same as glideslope needle. If not, repair computer wiring. If same, proceed to step 3.
	3. Make sure back course ILS switch is at front course position. Check for continuity between jacks 30 and 4.	If continuity does not exist, there is a fault in aircraft wiring or in back course switch. If continuity exists, proceed to step 4.
	4. Check continuity between patch cable jack 4 and computer A4 card connector pin K.	If no continuity, repair computer wiring. If continuity exists, proceed to step 5.
	5. Disconnect patch cable from computer pin 47 and 50 (-). Check continuity from computer pin 30 to A6 card connector pin J.	If no continuity, check wiring to relay K3. Replace relax K3 is necessary. If continuity exists proceed to step 6.

TROUBLESHOOTING (Sht 27 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	6. Connect computer to aircraft connector. Check for -20vdc between A4 card connector pins L and K. 7. Replace A6 card (orange decal labeled ILS/HDG).	If no voltage, repair or replace A4 card. If voltage is present, proceed to step 7.
Aircraft porpoises along glideslope beam.	1. Check glide slope receiver for proper impedance matching and check proper capacitance ballast across glideslope meter. 2. Perform tests under test 11, Automatic Trim. 3. Replace A6 card (orange decal labeled ILS/HDG)	If trouble is not found, proceed to step 2. If trouble is not corrected, proceed to step 3.
Autopilot engages with glideslope but flies beam at an offset.	1. Turn glideslope receiver on and tune it to a channel which is not used locally. Check signal appearing at jacks 10 and 11. Less than 5mv must appear. 2. Check for continuity between jacks 10 and 1. 3. Replace A6 card (orange decal labeled ILS/HDG).	If more than 5mv appear, glideslope receiver is source of trouble. If less than 5mv appear, proceed to step 2. If continuity does not exist, repair wiring in computer. If continuity exists, proceed to step 3.

TROUBLESHOOTING (Sht 28 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
ALT switch does not disengage when glide slope engages.	1. Remove A5 and A6 cards and check resistance between jacks 8 and 51. There must be infinite resistance.	If continuity exists, locate and remove short to ground. If no continuity, proceed to step 2.
	2. Install A5 and A6 cards. Perform glideslope test in ground checkout procedures of figure 3-1 while monitoring jacks 8 to 50 with an ohmmeter. Upon completion of the check there must be no continuity.	If continuity exists, remove A6 card and check operation of A6K8 relay and A6Q9 transistor according to overhaul manual. Repair or replace A6 card.
The glideslope engages prior to reaching glide slope beam **—NOTE—** An erratic signal from glideslope transmitter can cause premature engagement.	1. Check glideslope receiver for proper impedance matching and check for proper capacitance ballast across glideslope meter.	Make changes if necessary. If trouble is not removed, proceed to step 2.
	2. Check A6 card according to computer overhaul manual.	Repair or replace as necessary.
Aircraft assumes a climb after glideslope engages.	1. Turn glideslope receiver on. Check polarity of signal at jacks 10 and 11. Pin 11 must be positive for an OBS down needle.	If necessary, change wiring. If signal is correct, proceed to step 2.
—NOTE— If PITCH wheel is in a climb position and altitude hold was being used, aircraft usually climbs. That happens because altitude hold is disengaged when glide-	2. Check A6 card according to computer overhaul manual.	Repair or replace as necessary.

TROUBLESHOOTING (Sht 29 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
slope engages. The PITCH wheel command then is fed to autopilot. It has enough authority to override a glide-slope down signal.		
7. ROLL AXIS When troubles are reported in the roll axis, the trouble may be in the heading function (troubleshooting test 8).		
Autopilot does not hold roll attitude	1. Perform autopilot adjustment and checkout procedure for roll axis figure 3-1. Check pneumatic pressure to servo. Check servo for diaphragm leakage.	If roll axis checks out, proceed to step 2. If not, repair the inoperative function and then proceed to step 2 if necessary.
	2. Disconnect electrical connector from attitude indicator and check for continuity between pin C, of the connector which mates with attitude indicator, and jack 18.	If continuity does exist, proceed to step 3. If continuity does not exist, repair fault in aircraft wiring.
	3. Apply 28vdc to aircraft. Check for 40vdc between pins A and C of attitude indicator connector.	If voltage is correct, proceed to step 4. If no voltage, check aircraft wiring for an open circuit to attitude indicator.
	4. Remove attitude indicator and cage it. Check resistance between pins A and C on its connector. There must be no more than 3K resistance.	If proper resistance appears, proceed to step 5. If resistance is not correct, attitude indicator must be repaired.

TROUBLESHOOTING (Sht 30 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	5. Have attitude indicator checked for proper gyro operation.	If problem still exists, proceed to step 6.
	6. Check servo valve operation according to test 12 Servo Valves (Installed in Aircraft).	
TURN command knob does not produce aileron reaction.	1. Place patch cable ATT GYRO switch at TEST or disconnect electrical connector from attitude indicator, and center TURN command knob. Check voltage at jacks 22 and 23. Move TURN knob in each direction.	If meter shows electrical reaction to TURN knob, check shear pin. Check pneumatic pressure at servo. Check servo diaphragms for leakage. If they are all satisfactory, proceed to step 8. If no electrical reaction occurs, proceed to step 2.
	2. While monitoring patch cable jacks 22 and 23, rotate ROLL ADJ R2 resistor on computer (with CG515 use roll adjust in flight controller)	If meter shows electrical reaction, proceed to step 4. If no electrical reaction, proceed to step 3.
	3. Substitute a known good A3 card (blue decal labeled ROLL AXIS) by interchanging with the yaw or pitch card.	This should correct the problem. Remove and repair bad card according to computer overhaul manual.
	4. Check voltage at jacks 20 (+) and 1. Move TURN knob in each direction. The voltage must go positive for right command and negative for left command.	If voltage reacts to TURN command knob, proceed to step 7. If there is no voltage or voltage did not change, proceed to step 5.

TROUBLESHOOTING (Sht 31 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	5. Remove flight controller and check continuity between flight controller aircraft connector to patch cable jacks as follows: Flight Controller — Patch Cable 30 to 20 28 to 15 26 to 14	If continuity exists, proceed to step 6. If no continuity, repair aircraft wiring.
	6. In flight controller check continuity between TURN command resistor output pins 28 and 26, and 30 to 28 or 26.	If no continuity, repair wiring or replace TURN command resistor.
	7. Check for 383K resistance between computer pin 20 and computer A3 card connector pin J3R.	Replace resistor R7 (R15 on B2 suffix computers), or repair wiring.
	8. Check continuity of aircraft wiring between computer pins and roll servo pins as follows: Computer — Roll Servo 22 to A 23 to C 24 to B	If no continuity repair wiring. If continuity exists, check out operation of roll servo actuator.
Roll hardover occurs when autopilot is engaged.	1. Set patch ATT GYRO switch at TEST. Engage autopilot and center TURN command knob. Check voltage between jacks 22 and 23.	If voltage is zero or close to zero, check out operation of roll servo actuator. If voltage is large, proceed to step 2.

TROUBLESHOOTING (Sht 32 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	2. Remove A5 and A6 cards from computer.	If trouble is removed, troubleshoot heading system. If trouble still remains, procced to step 3.
	3. Replace A3 card with a known good card (interchange with yaw or pitch card).	If trouble is removed, repair bad card. If trouble still remains, proceed to step 4.
	4. Set TURN know in center detent. Check for zero volt between jacks 20 and 1 (-).	If voltage is zero, proceed to step 5. If not zero, perform "TURN command knob does not produce aileron reaction" tests 5 to the end.
	5. On computer, check for vero volts between terminals 11 and 62 (between terminals 30 and 60 on B2 suffix computers).	If not at zero, attempt to obtain zero by adjusting with ROLL ADJ resistor. If zero cannot be obtained, check wiring to resistor R2 and check resistance of R2. Repair wiring or replace resistor as necessary (CG515 ROLL ADJ in controller 2R7).
TURN command knob produces unequal turns to left and right.	1. Perform roll axis test of autopilot adjustments and checkout in figure 3-1.	If problem still exists, proceed to step 2.
	2. Check voltage between jacks 2 and 1 while rotating TURN command fully cw and ccw.	Voltage at extreme positions must be equal to ±10 percent. If not equal replace turn command resistor. If voltages are correct, proceed to step 3.

TROUBLESHOOTING (Sht 33 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	3. Remove attitude indicator, have it checked for linear and equal output.	Repair attitude indicator as necessary.
Autopilot does not maintain a bank angle selected	1. Make test of test 2, Switching, which are concerned with TURN command knob.	See corrective action for listed test. If trouble is not removed, proceed to step 2.
	2. Make "Autopilot does not hold roll attitude" tests. (When checking heading synchronizer, be sure relay K1 operates properly).	See corrective action for listed test. If trouble is not removed, proceed to step 3.
	3. Make "Autopilot does not hold heading"tests in test 8, Heading.	See corrective action for listed test.
Autopilot flies one wing low (with aircraft manually trimmed for wings level flight).	1. Perform roll axis and yaw adjustments of figure 3-1.	If trouble is not cleared, proceed to step 2.
	2. Refer to the trouble "Autopilot does not hold heading" in test 8, Heading.	Perform corrective action for referenced paragraph.
Marginal roll axis performance (sluggish action, roll oscillation, aileron jitter, etc.)	1. Check for proper pneumatic system pressure and vacuum.	If pneumatic system is performing satisfactorily, proceed to step 2.
	2. Perform roll axis and yaw axis adjustments of figure 3-1.	
	3. Check out operation of roll servo actuator.	

TROUBLESHOOTING (Sht 34 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	4. Visually inspect attitude indicator for proper operation.	If indicator does not show attitude of aircraft as it should, replace attitude indicator. If instrument works satisfactorily, proceed to step 5.
	5. Inspect for oil contamination in servo actuator as instructed in Section V.	See instructions in referenced section. If no oil is present, proceed to step 6.
	6. Check aileron control cable rigging for proper tension.	If rigging is satisfactory, proceed to step 7.
	7. Check servo actuator valves for proper orifice and cable drum installation. (See supplementary data in SectionVIII).	Install proper orifices or cable drum. If trouble is not removed, proceed to step 8.
	8. Check aircraft electrical system for low voltage.	If voltage is within tolerance, proceed to step 9.
	9. Replace A3 card (blue decal labeled ROLL AXIS) and conduct a flight check.	If performance is not improved, proceed to step 10.
	10. Replace A5 card (green decal labeled MODEL) and conduct a flight check.	

TROUBLESHOOTING (Sht 35 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	8. HEADING Heading and roll axis troubles are sometimes difficult to distinguish. It may be necessary to also refer to trouble shooting test 7, Roll Axis.	
Autopilot does not hold heading (heading selector either not installed or if installed, not engaged).	1. Check position of option selector plug on computer. (See Section VII for installation instructions).	Place option selector plug in proper position. If trouble is not removed, proceed to step 2.
	2. Turn computer upside down. Engage autopilot. Set TURN command knob out of detent and then return to detent while observing transolver brake in computer. With TURN command knob out of detent, brake must be off (away from transolver). Three seconds after returning control to detent, brake must pull in.	If brake is not operating (pulling in), proceed to step 3. If brake is pulled in and does not release, proceed to steps 3 and 4. If brake is operating properly, proceed to step 16.
	3. Check voltage between jacks 3 and 50 (-) with autopilot disengaged and engaged. Voltage must be 28vdc with autopilot disengaged and zero volt with autopilot engaged (28vdc with TURN command knob out of detent or zero volt with knob in detent.)	If voltage is not correct proceed to step 8. If correct, proceed to step 13.
	4. Check for zero volt between jacks 25 and 50 (-). (There must be no voltage until heading select is engaged).	If 28vdc is present, check out heading select switch. Then return to step 1. If zero volt, proceed to step 5.

TROUBLESHOOTING (Sht 36 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	5. With patch cable disconnected from computer, check resistance from computer terminal board terminal 63 to chassis ground. Resistance must be approximately 10 to 50 ohms (from terminal 40 on B2 suffix computers).	If resistance is correct, proceed to step 6. If no resistance, proceed to step 7.
	6. Check that continuity exists between terminal 8 of relay 1K1 and chassis ground. Apply 28vdc between terminal board TB1 terminal 24 and chassis ground (between terminal 6 and ground on B2 suffix computers). When 28vdc is applied, open circuit exists between terminal 8 and ground.	If continuity does not disappear when 28vdc is applied, check wiring to relay 1K1. Replace relay 1K1 if necessary. If relay 1K1 operates normally, replace transolver brake assembly.
	7. Check resistance between terminal board TB1 terminal 24 and pin 8 of relay 1K1. Resistance must be 10 to 50 ohms.	If no resistance, replace transolver brake assembly. If resistance is correct, repeat step 6.
	8. Remove flight controller and check for resistance between mating aircraft connector pins 33 and 34.	If no resistance, proceed to step 10. If short appears, proceed to step 9.
	9. Check aircraft wiring to determine type directional gyro caging switch used. Check out switch operation.	Repair or replace switch. (When directional gyro is not caged, no short exists between pins 33 and 34.) Repeat step 3.

TROUBLESHOOTING (Sht 37 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	10. Check continuity of aircraft cabling between computer connector pin 3 and flight controller pin 5.	If continuity exists, proceed to step 11. If no continuity, repair wiring and proceed to step 11.
	11. Check diode 2CR2 in flight controller (between connector pins 5 and 6 in CG117-517. Not used in CG515).	Replace diode 2CR2 if defective and proceed to step 12. If diode is good, proceed to step 12.
	12. Check turn command switch operation in flight controller between connector pins 34 and 5 CG117-517 (open circuit with TURN command knob in center detent: short circuit when out of detent). On CG515 use pin 2-33 instead of 33.	If switch continuity cannot be obtained, repair wiring or replace switch as necessary. Return to step 3. In CG515, if open circuit exists, check 2CR10 as well as TURN switch.
	13. Check continuity between computer connector pin 3 to computer terminal board TB1 terminal 34 (terminal 63 on B2 suffix computers).	If continuity exists, proceed to step 14. If no continuity, repair wiring in computer and proceed to step 14.
	14. Check diode 1CR3 between computer connector pins 34 and 26 (diode CR7 between pins 63 and 6 in B2 suffix computers).	If diode is good, proceed to step 15. If diode is defective, replace it and proceed to step 15.
	15. Check wiring in computer from TB1 terminal 26 to relay K1 pin 3 (from terminal 63 in B2 suffix computers).	If wiring is good, return to step 5. If wire is open, repair and return to step 1.

TROUBLESHOOTING (Sht 38 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	16. With an ac voltmeter connected between jacks 28 and 1, perform the heading hold and phasing ground check out of figure 3-1.	If ac voltmeter shows a voltage change, but multimeter does not (connected as instructed in figure 3-1), remove A5 card and troubleshoot it according to overhaul manual. If no voltage change, proceed to step 17.
	17. Repeat step 16 with ac voltmeter connected between jacks 53 and 1.	If ac voltmeter shows voltage change, check aircraft wiring from computer connector pins 53 and 28 to the normally closed contacts on heading select switch. If no voltage change, proceed to step 18.
	18. If in steps 16 and 17 there was a voltage (other than zero) at the start, connect the ac voltmeter between jacks 54 and 1 and repeat steps 16 and 17.	If ac voltage is same as appeared in steps 16 and 17, proceed to step 19. If ac voltage is different, proceed to step 23.
	19. Check voltage at computer jacks 48 and 50 (-) before and while engaging autopilot. It must be a constant 28vdc.	If 28vdc is present prior to engagement, but not after engagement, proceed to step 20. If 28vdc is constant, proceed to step 22.
	20. Move TURN command knob out of detent while monitoring jacks 48 and	If 28vdc appears, proceed to step 21. If 28 vdc does not appear,

TROUBLESHOOTING (Sht 39 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	50 (28vdc must reappear). **—NOTE—** Tests 20 and 21 in systems with CG117 -517 only.	check diode 2CR2 in flight controller (between pins 5 and 6). Replace as necessary.
	21. Check normally closed contacts of flight control turn command switch 2S4. Check diode 2CR3 in flight controller and the normally closed contacts of NAV switch 2S3B.	Replace switch, diode, or repair flight controller wiring as necessary.
	22. Check continuity of wiring from computer connector pin 48 to TB1 terminal 29, to terminal 37, to relay K3 pin 4 (from pin 48 to TB1 terminal 8, to terminal 7, to relay K3 pin 4 in B2 suffix computers). Check diode 1CR9 (diode 1CR3 in B2 suffix computers).	Repair wiring or replace diode as necessary. If wiring and diode are good, replace 1K3 relay.
	23. Check directional gyro transmitter for 26vac on rotor pin 52 to ground.	If no voltage, refer to aircraft wiring and trouble shoot ac source voltage. If 26vac is present, proceed to step 24.
	24. Check directional gyro transmitter for open in rotor and stator windings (across pin 52 to ground for rotor; pins 44, 45 and 46 for stator).	If transmitter is bad, repair or replace gyro. If transmitter is good, proceed to step 25.

TROUBLESHOOTING (Sht 40 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	25. Disconnect patch cable from computer. Check continuity of transolver stator windings (pins 44, 45, and 46 on computer connector).	If windings are open, replace transolver. If windings are good, proceed to step 26.
	26. Check resistance of signal winding between TB1 terminal 10 and relay 1K1 pin 2. It must be 10 to 50 ohms.	If winding is open, replace transolver. If winding is good, proceed to step 27.
	27. Check continuity from relay 1K1 terminal 2 to TB1 terminal 63.	If relay 1K1 contact is open, replace relay.
After engagement, aircraft shifts to and holds an incorrect heading (for a system without heading selector).	Perform roll and yaw centering adjustments of figure 3-1.	If procedures cannot be performed, troubleshoot according to first trouble listed under test 8, Heading.
Autopilot always takes up same heading (for a system without heading selector).	Perform checks of test 2, Switching.	Troubleshoot according to first trouble listed under test 8, Heading.
Marginal heading performance exhibited by sluggishness, roll oscillation, heading wander, etc.	1. Perform checks of test 7, Roll Axis.	Perform corrective action which is called for in referenced test. If trouble is not removed, proceed to step 2.
	2. Have directional gyro system checked for proper gyro action.	If trouble is not removed, proceed to step 3.
	3. Troubleshoot heading system according to first trouble listed under test 8, Heading.	

TROUBLESHOOTING (Sht 41 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	The following heading selector problems apply to H 14 type heading selectors (CG136). When troubleshooting a flight director type heading selector, the same general procedures can be used, but refer to the aircraft wiring for connector pins.	
With heading selector engaged, aircraft does not fly selected heading	1. Check option selector plug on computer. It must be at position 4 and either a dummy or good relay must be in K3 relay position.	If it is in proper position and relay is in place, proceed to step 2.
	2. Make checks of test 2, Switching, which concern heading selector engagement and disengagement.	Corrective action is listed in reference test. If switch is good, proceed to step 3.
	3. Check directional gyro for caging and uncaging. It must be uncaged to permit heading selector to operate. (If pilot neglects to uncage gyro, he experiences this trouble).	If directional gyro cannot be uncaged, replace it. If directional gyro uncages properly, proceed to step 4.
	4. Remove heading selector and check for a resistance between pins N and P on its connector.	If either a short circuit or an open circuit appears repair heading selector. If a resistance appears, proceed to step 5.
	5. Hold heading selector engage knot in and check for a resistance (same resistance obtained in step 4) between pins P and F on its connector.	If either resistance is different than in step 4, open circuit exists. Repair heading selector engage switch. If resistance is correct, proceed to step 6.

TROUBLESHOOTING (Sht 42 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	-NOTE- On systems with four-switch flight controllers, refer to flight controller schematic diagram and check HDG SEL switch and relay coil.	
	6. Check heading selector for resistances between pins A and C, B and C, and B and A. The resistances must be identical.	If improper results are obtained, repair heading selector. If proper results are obtained, proceed to step 7.
	7. Check continuity of aircraft cabling between pin P on connector which mates with heading selector and jack 1 and between pin F and jack 28.	Repair aircraft wiring if continuity is not obtained. If wiring is good, proceed to step 8.
	8. Check continuity of aircraft cabling between pin A on the connector which mates with the heading selector and jack 33, between pin B and jack 34, and between pin C and jack 32.	If an open circuit is found, repair aircraft wiring. If continuity to first trouble listed under test 8, Heading.
Heading selector commands heading even when disengaged.	1. With autopilot engaged, connect ac voltmeter between jacks 53 and 1. Rotate heading selector without engaging. Voltage on ac voltmeter must not change.	If voltage changes, troubleshoot relay 1K3 operation as in first trouble under test 8, Heading. If voltage does not change, proceed to step 2.

TROUBLESHOOTING (Sht 43 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	2. Connect ac voltmeter to jacks 28 and 1 and repeat step 1.	If voltage varies, troubleshoot heading selector switch.
Yaw mistrim with heading selector engaged (performs satisfactorily when heading selector is not engaged).	Remove heading selector and check for continuity between pins E and H of heading selector. There must be continuity when heading selector engage knob is at its out position and no continuity when engage knob is at its in position.	If continuity exists with switch engaged, replace relay 9K4 in heading selector (or in four-switch flight controllers if so equipped).
9. OMNI COUPLING Before referring to any of the following troubles, be sure the roll axis and heading functions are operating properly.		
Autopilot does not react to an omni signal, NAV switch stays engaged.	1. Check that option selector plug is in proper position. Check that relay K3 is installed. Check that A5 and A6 cards have correct part numbers.	If these are correct, proceed to step 2.
	2. Turn navigation receiver on to test VOR frequency or to frequency that causes needle movement. Check jacks 12 and 13 for same voltage as is at VOR needle.	If signal into autopilot is different or is not present, troubleshoot aircraft wiring to navigation receiver. If signal is correct, proceed to step 3.
	3. Repeat step 2 between TB1 terminals 72 and 61 (between terminals 16 and 60 on B2 suffix computers).	If no voltage, repair wiring from pins 12 and 13 on terminals 72 and 61 (or 16 and 60). If voltage is correct, proceed to step 4.

TROUBLESHOOTING (Sht 44 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	4. Tune in a localizer frequency that deflects needle on VOR indicator. With NAV switch on, check for autopilot responses.	If autopilot responds, repair omni/ILS option card. If system does not respond, proceed to step 5.
	5. Remove flight controller. Check continuity between flight controller connector pins 14 and 4 with NAV switch held ON.	If no continuity, replace switch 2S3B. If continuity exists, proceed to step 6.
	6. Check aircraft wiring from flight controller connector pin 4 to computer connector pin 6.	If no continuity, repair aircraft wiring.
Aircraft flies off selected omni radial.	1. Perform checkout procedures for roll axis, and omni and localizer centering in figure 3-1.	If problem still exists, proceed to step 2.
—NOTE— A direct cross wind produces about one-half dot offset for each 10 knots of wind.	2. Calibrate omni signal to autopilot according to VOR requirements (refer to coupling requirements in Section VII).	If problem still exists, check out omni/localizer option card according to overhaul manual.
Aircraft flies "S" turns along a selected omni radial.	1. Perform checkout procedures for roll axis, and omni and localizer centering in figure 3-1. (Particular attention should be made to heading input when checking omni).	If checkout is satisfactory proceed to step 2. If checkout is not satisfactory, troubleshoot the area causing problem.
	2. Calibrate signal to autopilot according to VOR requirements (refer to coupling requirements in Section VII).	If problem still exits, proceed to step 3.

TROUBLESHOOTING (Sht 45 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	3. Calibrate heading input on omni.	If problem still exists, troubleshoot omni card according to overhaul manual.
10. ILS LOCALIZER COUPLING Before referring to the following troubles, be sure the TURN command knob, the ILS/VOR switch and the OBS needle are operating properly. Also, the roll axis adjustments in figure 3-1 must first be performed.		
Autopilot does not react to or couple on to a localizer beam.	Troubleshoot same as first trouble under test 9, Omni Coupling.	
Hardover reaction when ILS/VOR is engaged.	1. With a localizer frequency selected on receiver, rotate heading selector. There must be no reaction in roll axis.	If autopilot reacts to heading selector, troubleshoot relay 1K3 in computer. If no reaction, proceed to step 2.
	2. Check the signal at jacks 12 and 13. The signal must be less than 5mv.	If the signal is high, the navigation receiver is the source of trouble. If signal is normal, trouble shoot the ILS card A6 according to the overhaul manual.
Aircraft initially turns the wrong way at ILS engagement but then tracks the beam satisfactorily. —**NOTE**— Engagement before reaching three dots offset may cause this symptom.	Check calibration of localizer signal being applied to autopilot (refer to coupling requirements in Section VII).	If calibration is correct, troubleshoot A6 card according to overhaul manual.

TROUBLESHOOTING (Sht 46 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
Autopilot flies aircraft more than one-half dot off beam center.	1. Turn navigation receiver on and tune it to an unused localizer channel. Check for less than 5mw at jacks 12 and 13.	If signal is higher than 5mv, trouble is in localizer receiver. If a proper signal is obtained, proceed to step 2.
	2. Check for continuity between jacks 13 and 1.	If continuity does not exist, replace computer chassis. If trouble is not removed, proceed to step 3.
	3. Perform roll axis and localizer centering adjustments in figure 3-1.	If trouble is still present, troubleshoot A6 card according to overhaul manual.
After glideslope engages localizer beam tracking becomes erratic.	Check calibration of localizer signal being applied to autopilot (refer to coupling requirements in Section VII).	If calibration is correct, troubleshoot A6 card according to overhaul manual.
11. AUTOMATIC TRIM (Pneumatic MG112 for DG1009, see Section 11. A) Perform all of the test procedures for any automatic trim trouble listed and for any automatic trim trouble that is not listed. See unit overhaul manual.		
Typical indications of automatic pitch trim troubles are as follows: Does not appear to be operating.	1. Check name plate on differential pressure switch for the proper number. 2. Check trim cable tension (10 lb. minimum)	Replace switch if necessary. Adjust tension if necessary. Clean trim cable if it shows signs

TROUBLESHOOTING (Sht 47 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
Runs constantly. Runs in one direction only.		of slipping as evidenced by the presence of aluminum dust.
Causes a bump and a mistrimmed condition when autopilot is disengaged. Corrections are sluggish.	3. Use a spring scale to determine force required to pull pitch trim cable and move pitch trim system. (Autopilot must be disengaged.) Force must not exceed 15 lbs.	If force is over 15 lbs, proceed to step 4. If force is below minimum, proceed to step 6.
	4. Relieve pitch trim cable tension and check pitch trim servo drive pulley for freedom of movement.	If drive pulley is not free, repair or replace pitch trim servo. If drive pulley is free, proceed to step 5.
	5. Check the force required to pull cable with pitch trim servo disconnected. Force must be less than 15 lbs.	Find any remaining high friction points in pitch trim system. Relieve friction as necessary.
	6. Check air pressure to elevator servo for proper pressure.	If pressure is low, correct it. If proper pressure is indicated, proceed to step 7.
	7. Check for leaks in pneumatic lines from pitch trim switch to pitch trim servo.	If leakage occurs, replace lines. Proceed to step 8.
	8. Disconnect pressure lines from pitch trim servo. Using a flashlight, look into the pitch trim servo fittings to check for	If nozzle size is correct proceed to step 9.

TROUBLESHOOTING (Sht 48 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	proper nozzle size. (To check size, refer to color code in the supplementary data, Section VIII).	
	9. Install a pressure gauge using a tee fitting to each of the pressure lines (0 to 15psi) from pitch trim switch to pitch trim servo. Connect air pressure to autopilot system with computer connected to patch cable, connect a dc meter to jacks 38 and 39. Engage the autopilot and center dc meter with PITCH command wheel. There must be no pressure to either side of pitch trim servo.	If there is no pressure to either side of pitch trim servo, proceed to step 10. If pressure is present, remove elevator servo valve and interchange it with rudder valve. Mount trim switch on new valve and repeat step 9. If pressure is still present, overhaul the differential pressure switch.
	10. Rotate PITCH command wheel to obtain a differential voltage reading of 2 to 3 volts. Pressure must switch to indicate approximately 75% of system pressure at one of the gauges. At this time the pitch trim servo must start to turn. Rotate PITCH command wheel in opposite direction to establish null on dc meter. Pressure must indicate zero on both gauges before differential voltage indicates zero. Pitch trim servo should stop.	If the pressure indication does not switch to one gauge, overhaul the pitch trim switch. If the pressure switches normally, but the pitch trim servo does not run overhaul the servo. If the pressure switches on and off and the pitch trim servo runs and stops normally, proceed to step 11.

TROUBLESHOOTING (Sht 49 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	11. Reverse rotation of PITCH command wheel to conduct tests to the opposite side of the pitch command system. Tests and results must be same as step 10.	Same as step 10.
11A. AUTOMATIC TRIM (Electric DG1009) Perform all of the test procedures for any automatic trim trouble listed.		
Typical indications of automatic pitch troubles are as follows: Does not appear to be operating. Runs constantly. Runs in one direction only. Causes a bump and a mistrimmed condition when autopilot is disengaged. Corrections are sluggish.	1. Make sure that pitch servo amplifier is functioning properly. Check by moving pitch command wheel and watch for pitch trim meter indications 2. Check failure monitor light. If it lights after a pitch mistrim has been present for 20 seconds, indicates malfunction. 3. If trim runs constantly remove connector from DG1009. If motor continues to run, problem is in aircraft wiring or trim motor circuit.	Check to see if drive voltage is being applied to trim motor. If manual electric trim is available check for proper operation of it. Check for shorted relay.

TROUBLESHOOTING (Sht 50 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	If trim runs only in one direction check output voltage from DG1009. Up trim should give 25 ± 2vdc between pin L (+) and M (-). Down trim should give 25 ±2vdc between pins N (+) and P (-).	If no output check DG 1009 as per overhaul manual.
	If trim runs slowly check motor and gearing for binding.	See manufacturers recommended procedure.
12. SERVO VALVES (INSTALLED IN AIRCRAFT)		
Conduct all of the test procedures listed for any suspected servo valve trouble.	1. Install test gauges in servo valve test ports. 2. Connect a dc meter to applicable patch cable jacks of servo valve being tested as follows: (a) Rudder jacks 41 and 42. (b) Aileron jacks 22 and 23. (c) Elevator jacks 38 and 39. 3. Apply pneumatic pressure to the autopilot. With ATT GYRO switch on patch cable at TEST, engage the autopilot.	

TROUBLESHOOTING (Sht 51 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	4. Adjust the applicable centering adjustment on the computer chassis to obtain a reading of zero on meter connected to servo test jacks. When servo test meter reads zero, test gauges must read equal pressure within 10%.	If the meter cannot be adjusted to zero, proceed with testing. The computer adjustable resistor does not control that particular axis during checkout procedure. (See example in test 4, Pitch Axis, for computer R1 PITCH ADJ resistor.) If the pressure gauges do not equalize when meter is at zero, remove valve and check it according to the overhaul manual. This check may be performed in the aircraft if valve adjustments are accessible. If the pressure gauges equalize, proceed to step 5.
	5. Rotate centering adjustment to read 6.0V minimum on meter.	If voltage on meter cannot be adjusted to a reading above 6.0V, troubleshoot the system for short or high resistance between signal and power grounds. The computer adjustable resistor does not control that particular axis during the checkout procedure. (See example in test 4, Pitch Axis, for computer R1 PITCH ADJ resistor) If the voltage does adjust above 6.0V, the pressure gauges should read 0 to

TROUBLESHOOTING (Sht 52 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
		1psi on one side and the following minimums per system on the other side: a. 7.0 for a 7.5 system. b. 9.0 for a 10.0 system. c. 11.5 for a 12.5 system. d. 13.0 for a 15.0 system. If these readings can or cannot be obtained, proceed to step 6.
	6. Reverse indicated voltage by rotating the adjustment in opposite direction.	Readings should be the same as procedure 5, except to the opposite side of the system. If these readings cannot be obtained, check servo diaphragms for leakage. Then adjust the valve according to the overhaul instructions. If valve cannot be adjusted it must be overhauled.

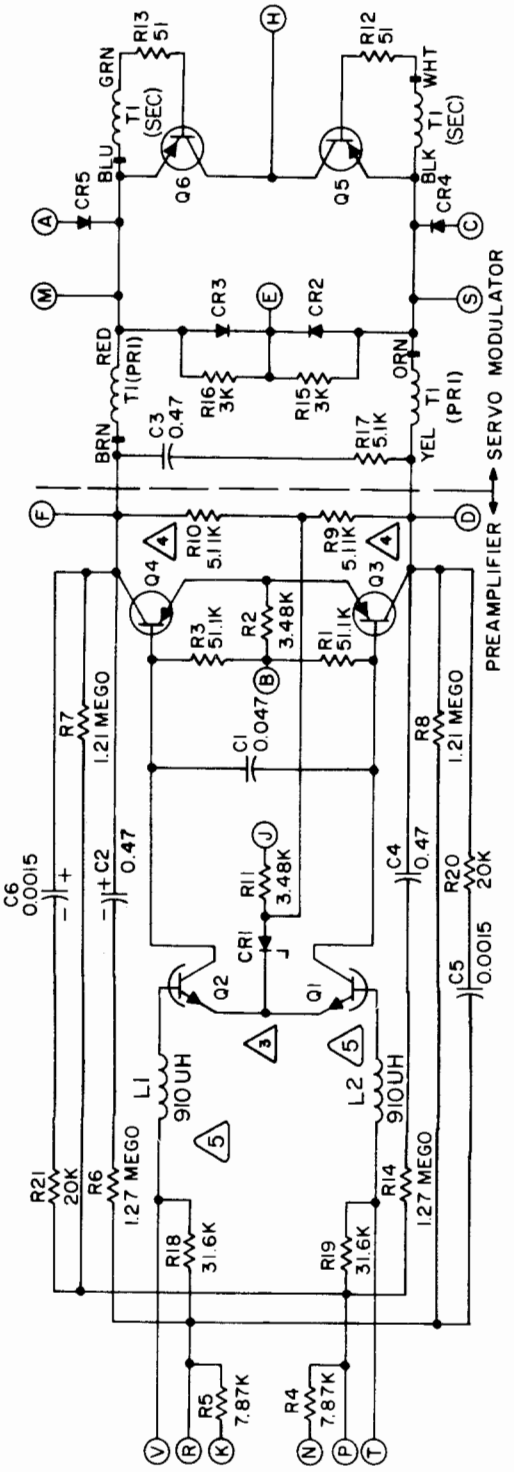
TROUBLESHOOTING (Sht 53 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
13. ATTITUDE REFERENCE COUPLER (INSTALLED IN AIRCRAFT) The following test procedures check out coupler calibration.		
Attitude reference coupler out of calibration.	Roll Axis 1. Perform roll axis autopilot checkout procedure in Figure 3-1 prior to performing the following steps. 2. Connect a dc meter to roll axis jacks 22 and 23 as indicated in the autopilot checkout procedure. 3. Loosen attitude gyro that drives coupler. 4. Engage the autopilot and rotate TURN command knob to a full right turn. 5. Tilt attitude gyro so that instrument panel indicator reads 30 degrees bank. 6. Adjust the coupler roll adjust variable resistor so that meter connected to roll servo reads zero. 7. Check the left turn command by performing steps 1 through 6 in the opposite direction. Pitch Axis 1. Perform the autopilot checkout procedure in figure 3-1 prior to performing the following steps:	If the meter cannot be adjust to zero with roll adjust variable resistor, replace coupler.

TROUBLESHOOTING (Sht 54 of 55)
FIGURE 4-3

TROUBLE	TEST PROCEDURE	CORRECTIVE ACTION
	2. Connect a dc meter to jacks 35 and 1. Adjust the PITCH command knob on flight controller for zero volt on the meter.	
	3. Move meter leads to jacks 38 and 39. With ATT GYRO switch at TEST and autopilot engaged, adjust 1R1 pitch adjust resistor for zero volt on meter.	
	4. Move ATT GYRO switch to NORMAL.	
	5. Move PITCH command knob to full nose DOWN command.	
	6. Tilt attitude gyro nose down until attitude indicator on instrument panel reads 18 degrees nose down.	
	7. Adjust pitch adjust resistor on coupler for zero volt on meter connected to jacks 38 and 39.	If meter cannot be adjusted to zero, replace coupler.
	8. Repeat steps 5, 6, and 7 for nose up condition.	Same as step 7.

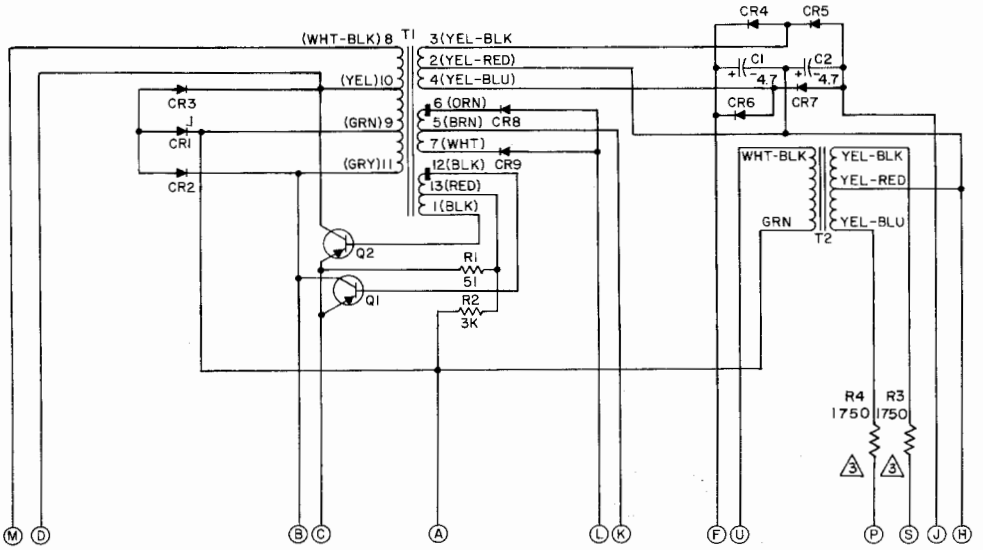
TROUBLESHOOTING (Sht 55 of 55)
FIGURE 4-3



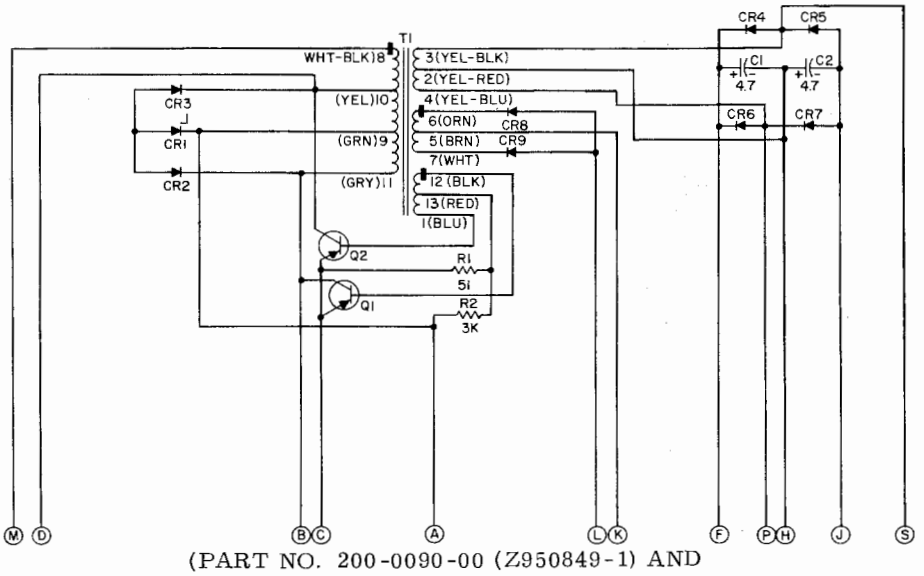
NOTES:

1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES IN UF UNLESS OTHERWISE SPECIFIED.
2. INDICATES PIN ON CONNECTOR J1.
3. TRANSISTORS Q1 AND Q2 ARE A MATCHED PAIR.
4. TRANSISTORS Q3 AND Q4 ARE A MATCHED PAIR.
5. L1 AND L2 USED ONLY ON 200-0091-01 (Z951197-2).

FIGURE 4-4 SERVO AMPLIFIER AND MODULATOR CARD (A1, A2, A3) - SCHEMATIC DIAGRAM



(PART NO. 200-0102-00/01 (Z951349-1, 2) AND
200-0092-00/01 (Z956328-1, 2)

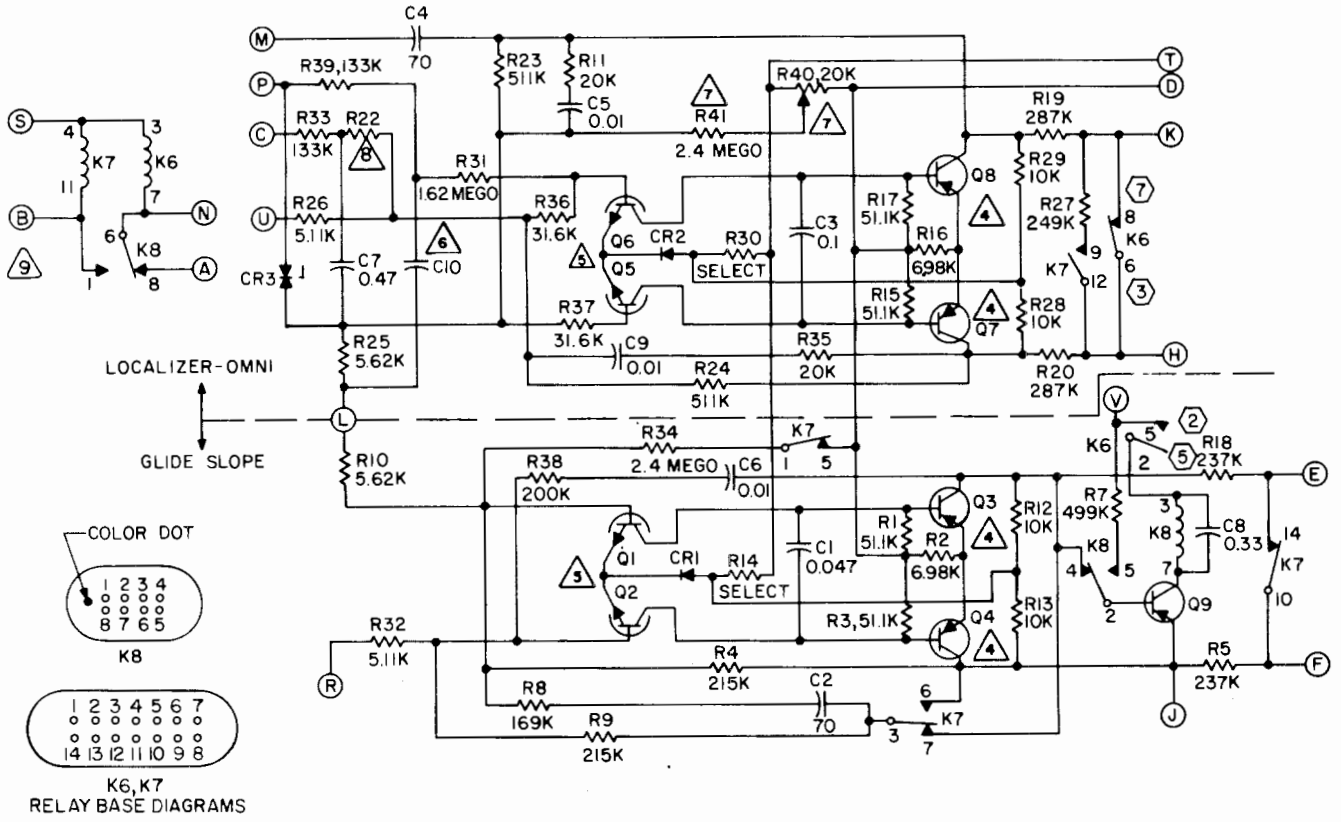


(PART NO. 200-0090-00 (Z950849-1) AND
200-0101-00 (Z956329-1)

NOTES:

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN UF UNLESS OTHERWISE SPECIFIED.
2. INDICATES PIN ON CONNECTOR J1.
3. USED ON 200-0102-01 (Z951349-2) AND 200-0092-01 (Z956328-2) ONLY

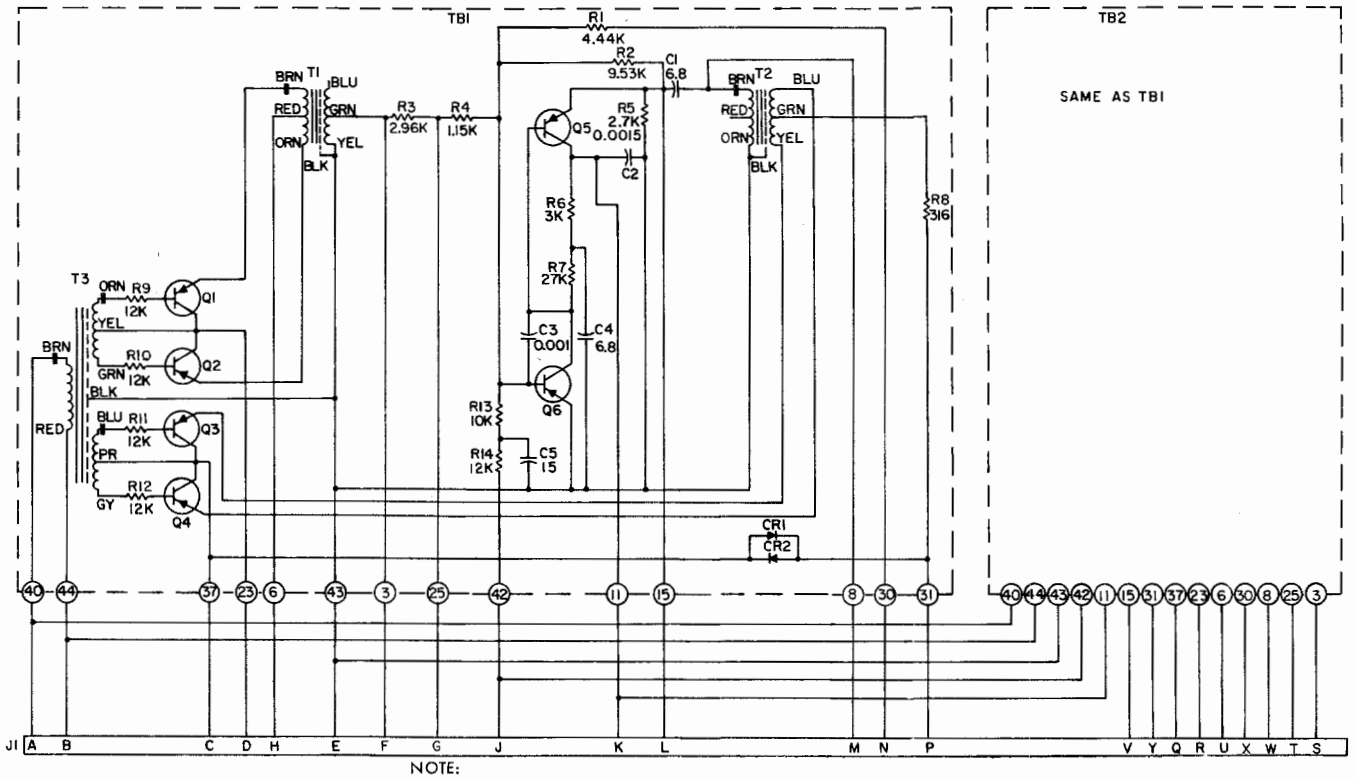
FIGURE 4-5 POWER SUPPLY CARD (A4) - SCHEMATIC DIAGRAM



NOTES:

1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. -INDICATES PIN ON CONNECTOR J1.
3. -INDICATES RELAY K6 CONTACT USED ON PART NO. 200-0096-00/01 (Z950852-1, 2) CARDS.
4. TRANSISTORS Q3 AND Q4, AND Q7 AND Q8 ARE MATCHED PAIRS.
5. TRANSISTORS Q1 AND Q2, AND Q5 AND Q6 ARE MATCHED PAIRS.
6. CAPACITOR C10 IS 10 UF ON PART NO. 200-0096-00 (Z950852-1) CARD, 14UF ON PART NO. 200-0096-01 (Z950852-2) CARDS.
7. NOT USED ON PART NO. (Z950852-1) CARD.

ILS CARD (A6) SCHEMATIC DIAGRAM
FIGURE 4-7



NOTE:
ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.

FIGURE 4-11 DG104A NAVIGATION RECEIVER ADAPTER - SCHEMATIC DIAGRAM

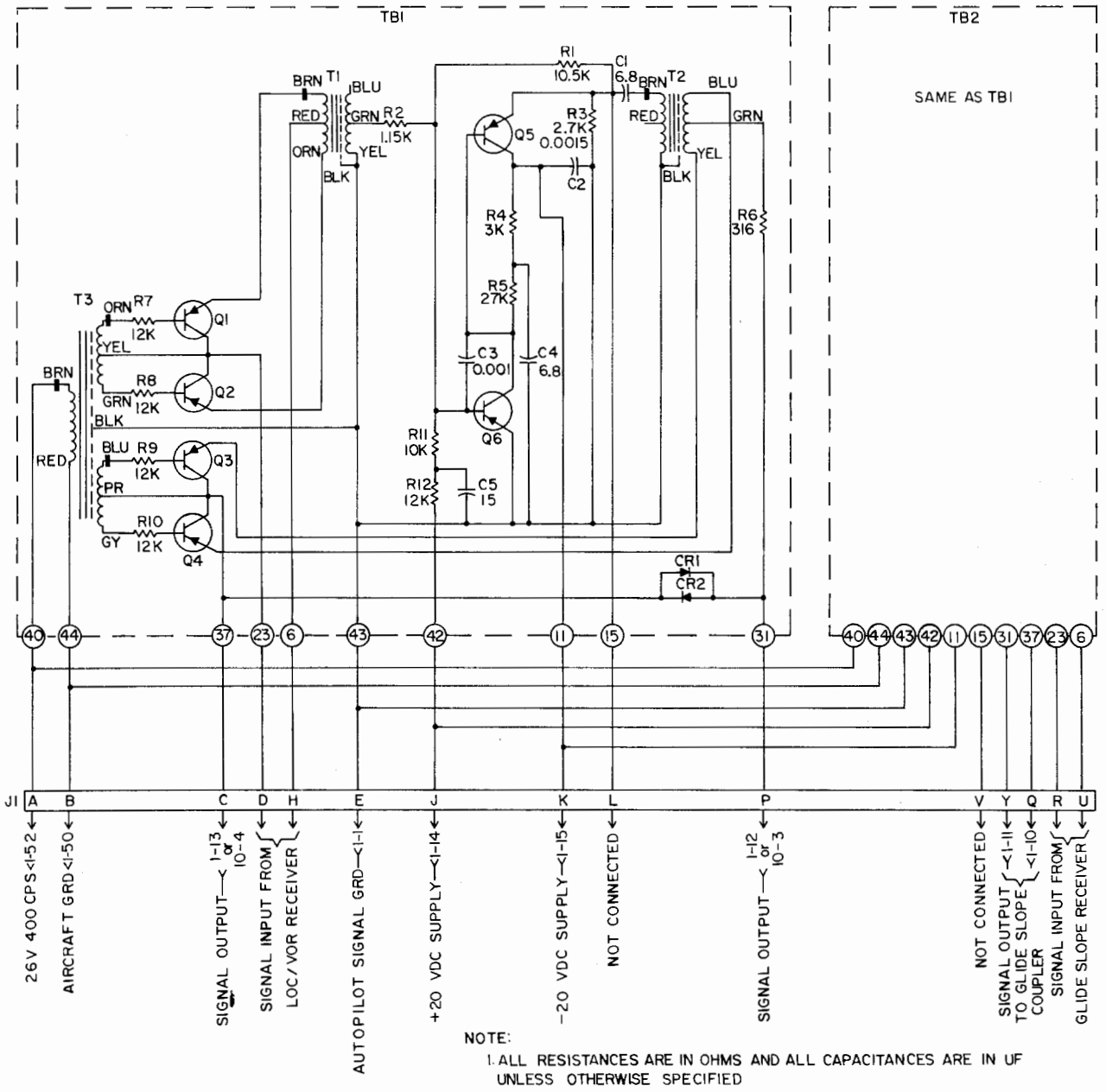


FIGURE 4-12 DG104B NAVIGATION RECEIVER ADAPTER - SCHEMATIC DIAGRAM

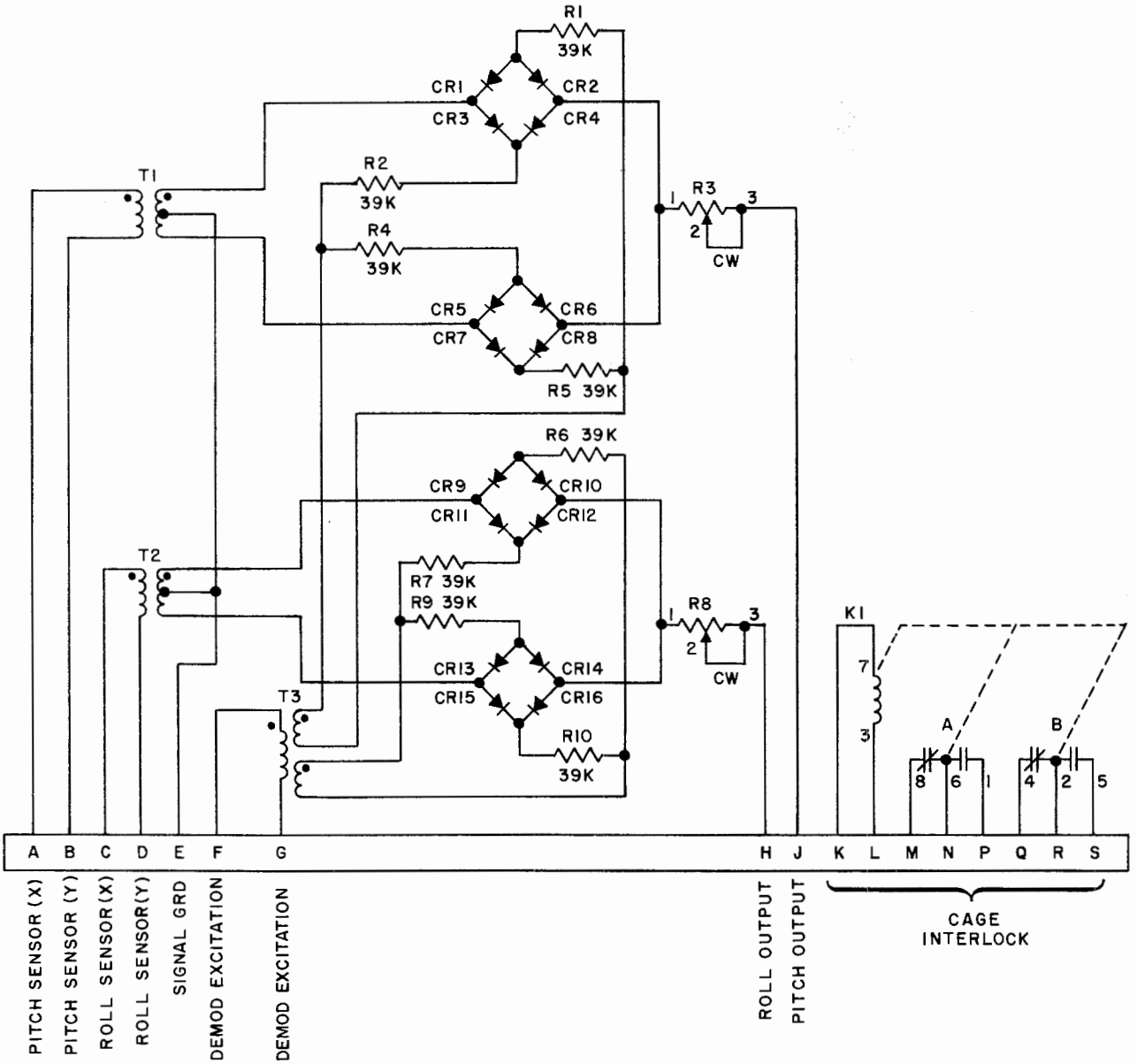
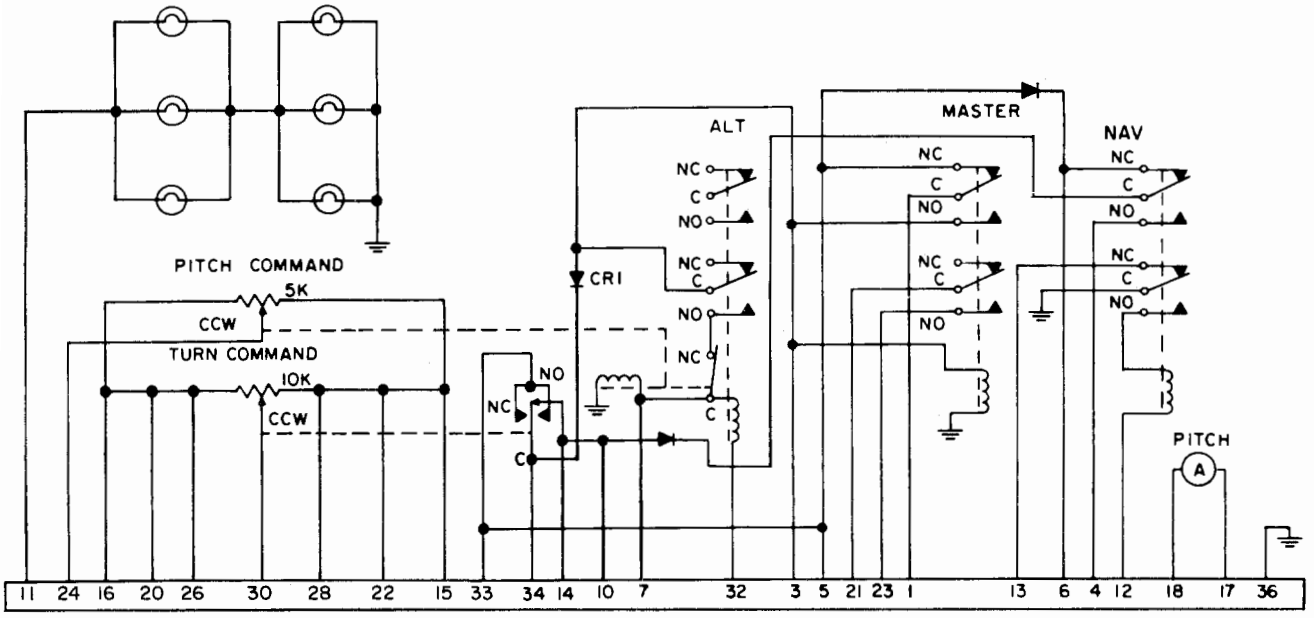
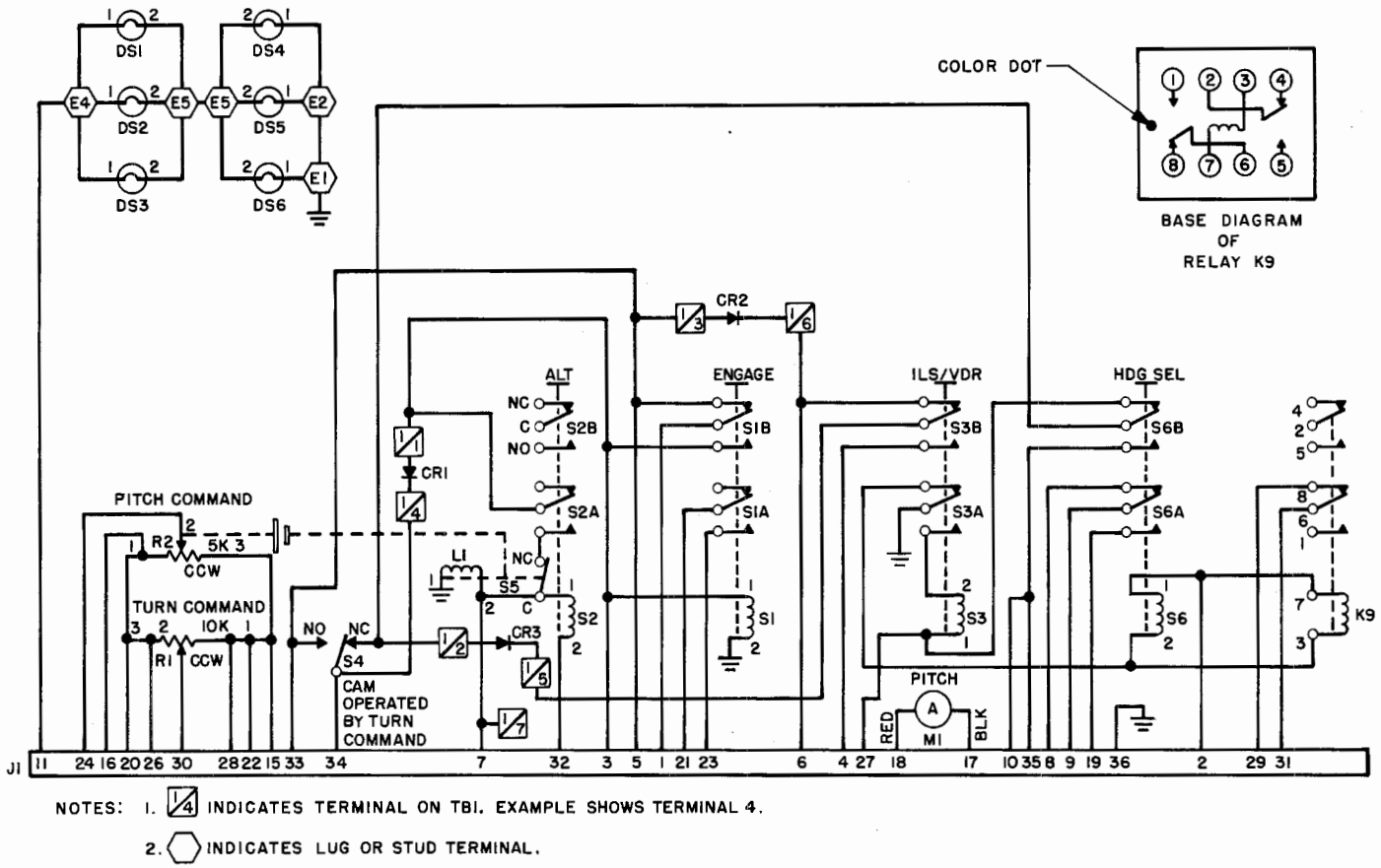


FIGURE 4-14 DG114A ATTITUDE REFERENCE COUPLER - SCHEMATIC DIAGRAM



NOTE: ON OLDER MODELS PINS 16,26,28, AND 15 ARE NOT USED.

FIGURE 4-15 FLIGHT CONTROLLER (THREE-SWITCH ROCKER TYPE) - SCHEMATIC DIAGRAM



NOTES: 1. 1/4 INDICATES TERMINAL ON TB1. EXAMPLE SHOWS TERMINAL 4.

2. ⬡ INDICATES LUG OR STUD TERMINAL.

FIGURE 4-16 FLIGHT CONTROLLER (FOUR-SWITCH ROCKER TYPE) - SCHEMATIC DIAGRAM

Section V
MAINTENANCE

1. GENERAL. Maintenance of the H-14 Autopilot is simplified due to design features that allow individual components to be removed quickly from the aircraft, checked, replaced if necessary, and returned to full operation. Standard shop tools are used to replace the components. Aircraft down time is thus kept at a minimum.

2. MAINTENANCE.

   A. Shop Practices. Maintenance of the autopilot consists of the following standard shop practices:

      (1) Periodic inspection.

      (2) Periodic replacement.

      (3) Periodic cleaning.

      (4) Periodic lubrication.

      (5) Periodic operational checkout of system.

   B. Instructions. The periodic inspection, replacement, cleaning, and lubrication instructions are listed in figure 5-1. Perform the inspection and cleaning instructions at the specified intervals to ensure that no contaminants of any kind have or are entering the system. Perform the replacement and lubrication instructions as directed.

   C. Operational Checkout. The periodic operational checkout procedures are provided in Section III. These procedures may also be required before maintenance to isolate a malfunction.

3. REPAIR/REPLACEMENT.

   A. General. When a component of the autopilot requires repair, refer to the applicable overhaul manual for repair and/or replacement instructions. A recommended spare parts list for all components is provided in Section VI. Replacement instructions requiring special precautions are provided in the following paragraphs.

   B. Replacing Shear Pins. When replacing a shear pin, refer to the appropriate illustration and parts list in the supplementary data, Section VIII, and observe the following instructions:

      (1) Obtain a new shear pin (King part number 076-0319-00 (Z944991).

      (2) Loosen the eccentric lock (8). Remove all pieces of the sheared pin from the shear capstan (13) and shear plates (18, 19).

      (3) Place a new shear pin (12) in the shear plates (18, 19) and aline the pin with the groove in the shear capstan (13). Tap the shear plates opposite the shear pin to seat the pin in the shear capstan groove.

      (4) Position the eccentric lock (8) firmly against the shear plates (18, 19) and tighten the screw which holds the eccentric lock.

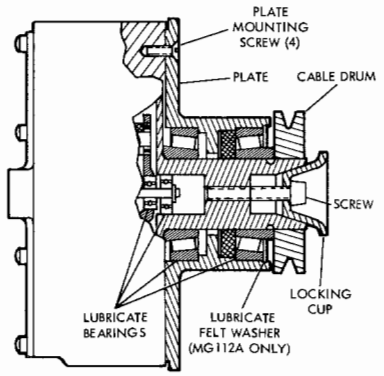
COMPONENT	INTERVAL	PROCEDURE	ACTION
INSPECTION/REPLACEMENT			
Air filter in attitude indicator and directional gyro			
Systems with no central air filter	50 hours	Remove and discard filter	Replace with new air filter*
Systems with central air filter	Once a year	Remove and check filter	Replace if necessary*
–**CAUTION**– FAILURE TO REPLACE FILTERS AS INSTRUCTED CAN CAUSE PREMATURE FAILURE OF THE ATTITUDE INDICATOR AND DIRECTIONAL GYRO			
* For the GG201 Attitude Indicator and GG202 Directional Gyro, use Sperry or Garwin 149828 Filters for replacement. For the GG301 Attitude Indicator and GG302 Directional Gyro, use Aviation Instrument Mfg Corp 243-69 Filters			
Air filter on pneumatic systems that use a wet vacuum pump	100 hours	Check for oil on autopilot side	Replace filter cartridge if oil is found. Clean all three servo actuators. Flush pneumatic system thoroughly. Reinstall servo actuators
–**CAUTION**– SERVO ACTUATORS ARE SUBJECT TO RAPID FAILURE IF OIL ENTERS THEM FROM THE PNEUMATIC SYSTEM. THE AUTOPILOT SYSTEM BECOMES SLUGGISH. NEVER ATTEMPT TO CORRECT THE PROBLEM BY REPLACING SERVO ACTUATOR VALVES ONLY			
Oil separator on pneumatic system	100 hours	Check for cleanliness	Clean as necessary
Relief valves on pneumatic system	100 hours	Check for cleanliness	Clean as necessary
All autopilot components	As required	Check for dents and physical damage to cases, broken glass, bent or broken connector pins, damaged seals between parts, poor solder connections, etc	Repair or replace as necessary
Air filter cartridge on pneumatic systems that are dry	500 hours	Remove and discard	Replace with new air filter cartridge

Maintenance Data (Sheet 1 of 2)

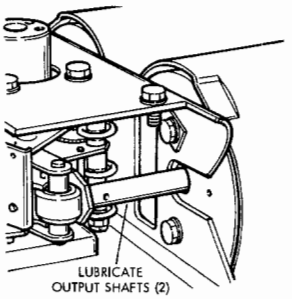
Figure 5-1

COMPONENT	INTERVAL	PROCEDURE	ACTION
CLEANING			
Oil separator on pneumatic system	100 hours	Check for cleanliness	Clean as necessary
Relief valves on pneumatic system	100 hours	Check for cleanliness	Clean as necessary
All autopilot components	As required	Check for heavy deposits of grease and dirt	Clean with a soft brush or clean cloth dipped into dry cleaning solvent or an alcohol base cleaner
–CAUTION– DO NOT USE CHEMICAL CLEANING AGENTS ON COMPUTER CIRCUIT CARDS			
LUBRICATION			
Trim actuator (MG112)	300 to 500 hours	Lubricate according to procedure below	

1. Remove four screws from plate. Pull plate away from actuator (see illustration below)
2. Apply General Electric Co Versilube F-50 lubricant to bearings that are visible. Be careful not to get lubricant on any other part of actuator
3. Install plate and tighten four screws
4. On MG112A actuator, lubricate felt washer by first removing cable drum (apply 10-psi pressure as in paragraph 3D). Saturate felt washer with F-50 lubricant. Apply lubricant to roller bearing behind washer. Install felt washer. Install cable drum as in paragraph 5D



MG112 TRIM ACTUATOR

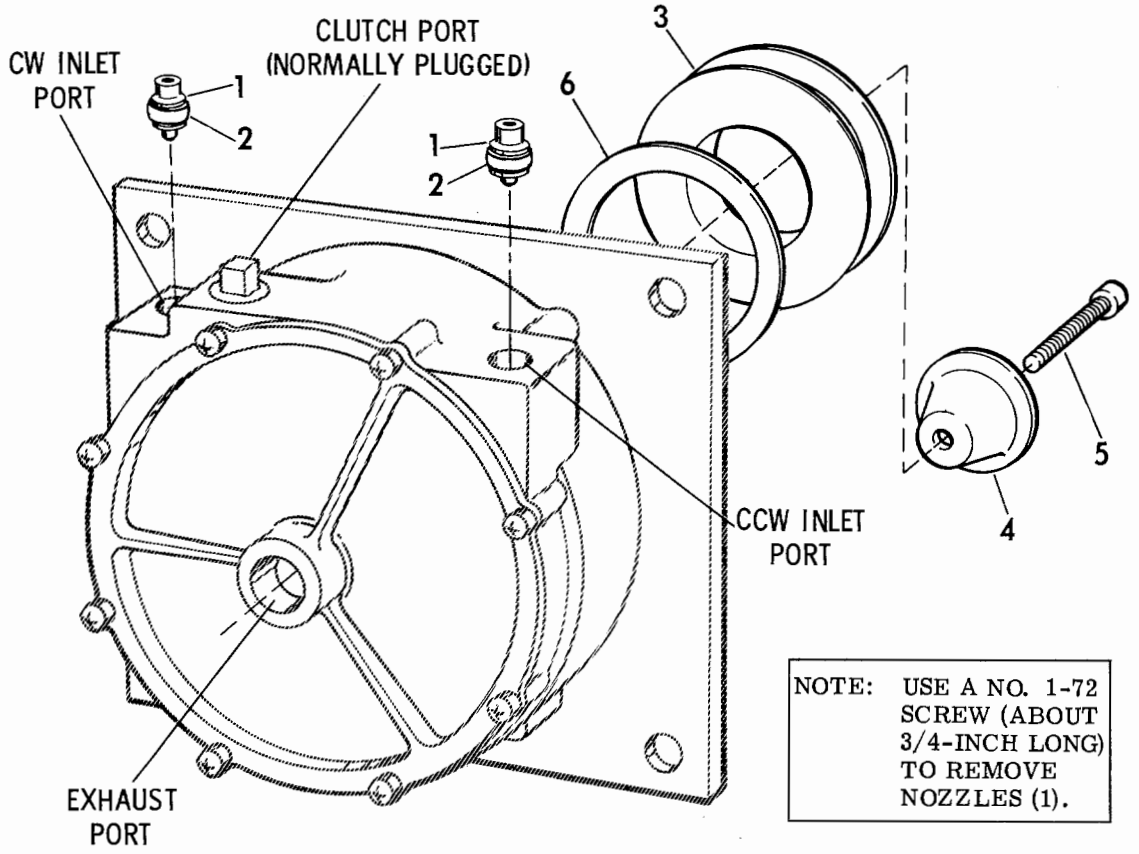


MG113 SERVO ACTUATOR

Servo actuators (MG113)	300 to 500 hours, or as necessary	Lubricate both output shafts with machine oil (see illustration above)	

Maintenance Data (Sheet 2 of 2)

Figure 5-1



1* Nozzle [0.040-inch, 0.045-inch, or 0.49-inch diameter] (2)

2 O-ring seal (2)

3* Cable drum (1.25-inch or 2.0-inch diameter)

4 Locking cup

5 Nylok screw

6 Felt washer (not used on MG112B)

NOTES:
1. MG112A illustrated.
2. * See the supplementary data in Section VIII for part number and aircraft application of nozzles and cable drums.
3. ( ) Indicates quantity other than one.

FIGURE 5-2 MOUNTING CABLE DRUM ON TRIM ACTUATOR

C. Replacing Trim Actuators. (See figure 5-2.) Whenever a trim actuator is replaced, save the nozzles (1). New trim actuators are not supplied with the nozzles. Nozzles are removed by installing a number 1-72 screw (about 3/4-inch long) in the nozzle and pulling it out of the O-ring seat.

D. Mounting Cable Drum on Trim Actuator. (See figure 5-2.) When mounting a cable drum on the trim actuator, observe the following instructions:

(1) Apply filtered air at 10-psi pressure to the CW and CCW inlet ports to keep the output shaft from turning.

(2) On MG112A Trim Actuators, lubricate the felt washer (6) and actuator bearing as instructed in the maintenance chart, figure 5-1. Install the felt washer. Turn the cable drum (3) into place on the output shaft until it lightly contacts the output shaft bearings. Loosen the cable drum one-eighth turn.

(3) Disconnect the filtered air supply from CW port. Install the locking cup (4) and nylock screw (5) to secure the cable drum (3) in place.

E. Replacing Servo Actuator Diaphragms. (See figure 5-3.) When replacing the diaphragm in the servo actuator, observe the following instructions:

(1) Remove magnetic valve (3) by removing four screws (1) and lock washers (2).

(2) Remove two orifices (4).

—**NOTE**— Inspect O-ring seals (5) on each orifice for damage. Replace if necessary.

(3) Remove bracket (16) by removing four nuts (17) and key washers (18). Remove four key washers (19).

—**NOTE**— Inspect key washers (18, 19) for signs of breaking. Replace if necessary. Key washers can normally be bent four to six times before breaking.

(4) Remove items 20, 21, 22, and 23 as an assembly by turning caps (20) to disengage the assembly from slots in housing.

(5) Remove caps (20) by removing four nuts (21). Separate caps from cup assembly (23).

(6) Remove diaphragm (22) from cup assembly (23). Discard diaphragm.

—**NOTE**— When installing a new diaphragm and reassembling the parts, refer to the inset view (figure 5-3) and observe the following precautions:

(a) Dust diaphragm with talcum powder prior to installation.

(b) Diaphragm must be installed on cup assembly with bead facing in.

(c) Key washers must fit in slots on bracket (16) and not overlap onto bracket.

(d) Torque nuts (17, 21) to 35 inch-pounds.

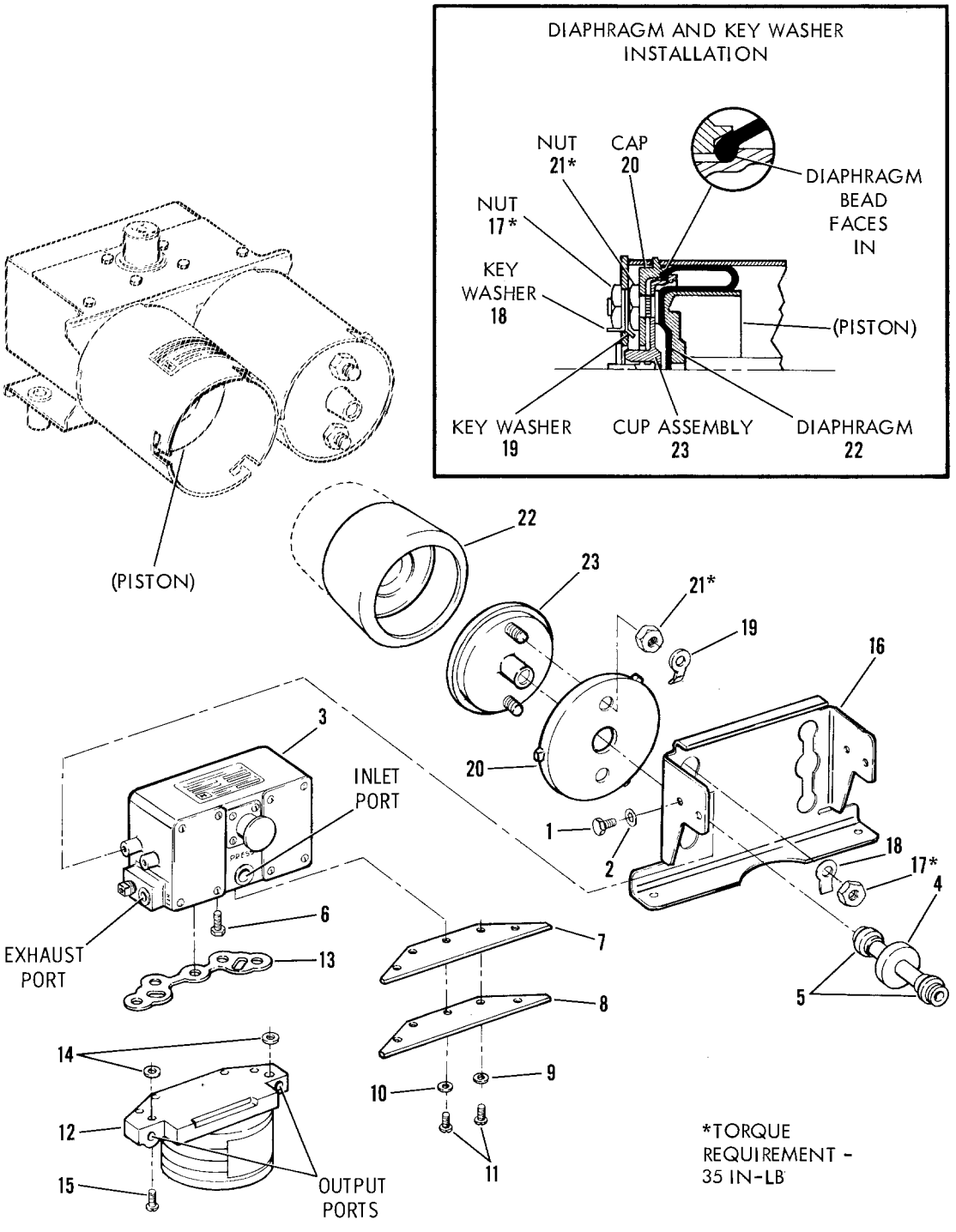


FIGURE 5-3 REPLACING SERVO ACTUATOR DIAPHRAGM

Index to Figure 5-3

1	Nylok screw (4)	13	Gasket
2	Lock washer (4)	14	Washer (gasket) (2)
3	Magnetic valve	15	Nylok screw (6)
4*	Connector orifice (2)	16	Bracket
5	O-ring seal (4)	17	Hexagon plain nut (4)
6	Nylok screw (2)	18	Key washer (4)
7	Gasket	19	Key washer (4)
8	Cover plate	20	Cap (2)
9	Washer (4)	21	Hexagon plain nut (4)
10	Washer	22	Diaphragm (2)
11	Nylok screw (5)	23	Cup assembly (2)
12**	Pressure switch		

—NOTE— 1. * See the supplementary data in Section VIII for part numbers and aircraft application of orifices in each axis. Each servo actuator uses two orifices of the same part number.

2. ** Installed only on the elevator servo actuator in a system which has the pneumatic optional automatic pitch trim system. When installed, items 12 through 15 replace items 6 through 11.

3. ( ) Indicates quantity other than one.

Section VI
RECOMMENDED SPARES LIST

1. GENERAL. This section provides a listing of the recommended spare parts for the various components of the H-14 Autopilot. This listing is based on the following assumptions:

   A. Spares list is based on field level repair in a qualified instrument shop using the applicable overhaul manual of the latest issue.

   B. Quantities are based on support of 10 aircraft systems with all options included.

2. RECOMMENDED SPARES LIST. The following spares list is divided into three basic areas: H-14 components (or devices), an assembly or part of the device, and a piece part of an assembly. The assembly or part of the device is indented one space under the device and the piece parts are indented one space under its applicable assembly.

Recommended Spares List

PART NO.	DESCRIPTION	RECOMMENDED SPARES
BG174, BG274, or BG374	COMPUTER	1
Z938877-1	. Semiconductor device, diode (CR1)	1
Z938875	. Tube, current regulating (RT1)	2
Z986840-1	. Resistor assy	1
Z968996-1	. Transolver and brake assy (A8)	1
Z983983-1	. Relay, dummy (K3)	1
Z951197-2	. Servo amplifier and modulator card A1, A2, A3	1
Z938673	. . Transistor (Q3, Q4)	2
Z983291-2	. . Transistor, dual (Q1, Q2)	1
Z938696-2	. . Transistor (Q5, Q6)	1
Z951161-1 or Z937463-1	. . Transformer (T1)	1
Z956329-1	. Power supply card A4 (standard)	1
Z956328-2	. Power supply card A4 (external 26 vac)	1
Z938696-1	. . Transistor (Q1, Q2)	1
Z937463-4	. . Transformer (toroid assy) (T1)	1
Z951038-1	. . Transformer (T2)	1
Z974770-1	HEADING HOLD ONLY CARD ASSY. A5, A6	1
Z974772-5	HEADING/ILS/OMNI/CARD ASSY A5, A6	1
CG136A or CG136B	HEADING SELECTOR (No spares recommended)	1
CG515	FLIGHT CONTROLLER With Pitch Sync	1
088-0162-05	Panel Front	1
133-0057-01	Variable Resistor and Switch Assy.	1
133-0064-00	Variable Resistor 5K	1
148-5007-00	Motor and Gear Head	1
031-0121-00	Push Button Switch	2
031-0122-00	Push Button Switch	2

Recommended Spares List (Cont)

PART NO.	DESCRIPTION	RECOMMENDED SPARES
CG217, CG317, CG417, or CG517	FLIGHT CONTROLLER	1
*	. Panel, front	1
Z951653-2	. Variable resistor and switch assy	1
433058-24	. Resistor, variable	1
941337-2	. Switch	3
* Refer to overhaul manual for part number of front panel		
GG205	TURN AND BANK INDICATOR GYRO	1
SK86697	. Wiper block assy	1
SK86362	. Resistance element	1
GG301	ATTITUDE INDICATOR	1
Z949590-1	. Block, brush	1
Z971589-1	. Contact arm subassy	1
Z971589-2	. Contact arm subassy	1
Z949588-1	. Variable resistor assy	1
434563	. Clamp, mounting, variable resistor	2
Z949591-1	. Slip ring assy	1
Z971582-1	. Pin, spacer	1
Z971583-1	. Variable resistor assy	1
GG302	ATTITUDE INDICATOR (Order spare parts from Aviation Instrument Mfg Corp, Houston 17, Texas)	1
MG112A or MG112B	TRIM ACTUATOR	1
MG112A	TRIM ACTUATOR	-
Z938525	. Gasket, cover, turbine	1
Z940055	. Washer, nonmetallic (felt)	1
939735	. Bearing, roller, cylindrical	2
Z945459	. Seal, shaft	1
Z945461	. Gasket, base, mounting	1
Z938515	. Gear, internal	1
Z938517	. Hub, actuator	1
456926-2	. Bearing, ball	2
457282-1	. Bearing, ball	2
Z938511	. Shaft, pinion	1
Z938518	. Gear, planetary	1
Z938519	. Gear, planetary	1
432712-2	. Bearing, ball	2
Z1990485-1	. Brake and gear assy	1

Recommended Spares List (Cont)

PART NO.	DESCRIPTION	RECOMMENDED SPARES
Z938527	. Plate, pressure	1
Z938526	. Diaphragm	2
MG112B	TRIM ACTUATOR	-
Z987206-1	. Bearing, ball	2
Z1990484-1	. Hub and gear assy	1
456926-2	. Bearing, ball	2
457282-1	. Bearing, ball	2
Z938518	. Gear, planetary	1
Z938519	. Gear, planetary	1
432712-2	. Bearing, ball	2
Z1990485-1	. Brake and gear assy	1
Z938527	. Plate, pressure	1
Z987223-1	. Ring, gear retainer	1
Z938526	. Diaphragm	2
MG113A	SERVO ACTUATOR	1
314183	. Sleeve, bearing	2
314903	. Diaphragm	2
Z944991	. Pin, shear	6
314350A	. Valve assy	1
305437	. . Plug, machine thread	4
314366	. . Gasket	2
Z954851-1	. . Air filter	4
314356A	. . Plunger	4
314361A	. . Coil	4
314369	. . Stud, extension	12
314353A	. . Lever and spacer assy	4
Z950773-1	. . Washer, nonmetallic	4
Z949684-1	. . Pin and spring assy	4
Z950328-1	. . Gasket	2
PG51A	ALTITUDE CONTROL	1
Z972313-1	. Valve, solenoid	1
Z938076-1	. Resistance element	1
MS28775-12	. Packing, preformed, O-ring	2
MS28775-146	. Packing, preformed, O-ring	2
SG28A	DIFFERENTIAL PRESSURE SWITCH	1
314895	. Gasket	2
304890	. Washer, nonmetallic	4
MS28784-12	. Packing, preformed, O-ring	2
314885A	. Restriction assy	4
314896	. Gasket	4
DG1009	PITCH TRIM ADAPTER	1

Honeywell to King Part Number Conversion List

Honeywell Part Number	King Part Number
BG174, BG274 or BG374	
Z938877-1	007-5017-00
Z938875	021-0032-00
Z986840-1	200-0103-00
Z968996-1	200-0094-00
Z983983-1	032-0014-00
Z951197-2	200-0091-01
Z938673	007-0126-00
Z983281-2	007-0127-01
Z938696-2	007-0125-00
Z951161-1 or Z937463-1	019-7026-00
Z956329-1	200-0101-00
Z956328-2	200-0092-01
Z938696-1	007-0125-00
Z937463-4	019-7026-04
Z951038-1	019-7024-01
Z974770-1	200-0095-01
Z974772-5	200-0095-00
CG217, CG317, CG417 or CG517	
Z951653-2	133-0057-00
433-58-24	133-0056-23
941337-2	031-0124-00
GG205	
SK86697	133-0077-00
SK86362	133-0078-00
GG301	
Z949590-1	020-0011-00
Z971589-1	133-0068-00
Z971589-2	133-0068-01
Z949588-1	133-0065-00
434563	047-2037-00
Z949591-1	020-0010-00
Z971582-1	076-0414-00
Z971583-1	133-0069-00

Honeywell to King Part Number Conversion List (continued)

Honeywell Part Number	King Part Number
MG112B	
Z987206-1	147-5018-00
Z1990484-1	073-0136-02
456926-2	047-5016-01
457282-1	147-5015-00/04
Z938518	029-0122-00
Z938519	029-0121-00
432712-2	147-5017-01
Z19908485-1	029-0120-01
Z987223-1	047-2079-00
Z938526	012-1044-00
PG51A	
Z972313-1	148-2002-00
Z938076-1	133-0076-00
MS28775-12	187-1050-00
MS28775-146	187-1050-01
SG28A	
314895	012-1034-00
304890	091-0115-00
MS28784-12	187-1040-00
314885A	076-0393-01
314896	012-1035-00
MG113 Super "E"	
1989608-2	015-0013-00
1989570-1	012-1029-00
1989672-1	012-1025-00
1989600-1	012-1030-00
1989603-1	012-1028-00
1989609-1	090-0164-00
	147-5009-00
	047-1951-00
1989620-1	047-1963-00
1989650-1	012-1026-00

Honeywell to King Part Number Conversion List (continued)

Honeywell Part Number	King Part Number
MG113 Super "E" (Continued)	
1989649-1	012-1027-00
10020696-1 (Modif)	015-0014-00
1989572-1	012-1050-00

Section VII
INSTALLATION AND COUPLING

1. GENERAL. This section contains component preparation, installation information, and coupling information for the H-14 Autopilot. Figure 7-1 lists the autopilot components and their leading particulars. Figure 7-2 lists the changes which must be made to add autopilot options.

2. SERVO ACTUATOR AND TRIM ACTUATOR KIT NUMBERS. Refer to the supplementary data in Section VIII for kit numbers for a particular aircraft.

3. GENERAL INSTALLATION INSTRUCTIONS.

   A. Materials and Workmanship. Use only approved aircraft materials and techniques to install the H-14 Autopilot. Careful workmanship insures trouble free operation of the autopilot.

   B. Permanence. All components of the H-14 Autopilot must be mounted in the aircraft as a permanent type installation.

   C. Location. All equipment must be located as specified in the FAA Type Certificate or FAA Autopilot Supplemental Type Certificate for the aircraft. Deviations from these locations are subject to FAA approval. The following criteria must be used in selecting alternate installation locations.

      (1) The flight controller must be easily accessible and visible to both pilots when they are in normal sitting positions. Select a position where the flight controller will not be damaged by pilot movement in the cockpit or by seat belt buckles.

      (2) The computer must be easily accessible for removal. It must be in a well-ventilated location where it will not be subjected to physical damage by other aircraft equipment. Allowance must be made for sway space.

      (3) The servo actuators must be located so that they and the servo control cables do not interfere with other aircraft equipment. They must be accessible for easy removal.

      (4) The three gyros must be located on the instrument panel so that they are visible to both pilots. The gyros must be within ±2 degrees of vertical in relation to cruise attitude of the aircraft.

      (5) The differential pressure switch must be mounted on the servo actuator which is used in the pitch axis.

      (6) The DG1009 Pitch Trim Adapter shall be securely mounted on any convenient place of airframe.

      (7) The trim actuator must be located so that it and the trim control cables do not interfere with other aircraft equipment.

      (8) The heading selector must be located on the instrument panel so that it is visible and easily accessible to the pilot.

   D. Mounting. See figures 7-3 through 7-11 for component space requirements, mounting hole spacing, and cutout dimensions.

PART NUMBER**	TITLE	WEIGHT (POUNDS)	DIMENSIONS (INCHES) W	H	D	POWER REQUIRED	NOTES
CG136*	Heading selector	0.8	2.4	2.4	6.9	28 vdc	Necessary power is supplied by the computer
CG217 CG317 CG417 or CG517	Flight controller	1.3	5.1	3.4	2.8	28 vdc	Necessary power is supplied by the computer
CG515		2.0	5.1	3.4	4.85		
BG174 BG274 or BG374	Computer	8.0	5.4	9.4	15.8	28 vdc, 1 amp	Weight is 9.4 lb with PG51A Altitude Control installed
DG104*	Navigation receiver adapter	1.0	4.6	2.2	4.5		
DG114*	Attitude reference coupler	0.8	4.6	2.2	4.5		
GG201 or	Air-driven vertical gyro	4.6	4.7	4.7	8.3	Vacuum, 4.6 in. mercury	
GG301	Air-driven vertical gyro	2.7	3.4	3.4	7.4	Vacuum, 4.6 in. mercury	Can be substituted for a GG201 Vertical Gyro
GG202 or	Air-driven directional gyro	4.4	4.6	5.5	6.1	Vacuum, 4.6 in. mercury	
GG302	Air-driven directional gyro	2.7	3.4	3.4	9.0	Vacuum, 4.6 in. mercury	Can be substituted for a GG202 Directional Gyro
GG205	Turn and bank indicator gyro	1.9	3.3	3.3	6.4	28 vdc, 0.38 amp (running)	
MG112*	Trim actuator	2.5	5.3	4.4	4.0	Pneumatic, 0.6 scfm	
MG113	Servo actuator	5.8	7.0	4.1	11.0	Pneumatic, 0.6 scfm	Dimensions do not include cable drum. Three servo actuators are used in each aircraft
PG51*	Altitude control	1.4	2.9	2.9	5.4		Necessary power is supplied by the computer
SG28*	Differential pressure switch	0.8	3.9	1.7	2.7	Pneumatic, 0.6 scfm	
DG1009*	Pitch Trim Adapter	.94	5.2	4.6	2.2	+28vdc +20vdc	Necessary power is supplied by the computer.

*Designates an optional component.
**An additional suffix letter and number are used to identify specific models.

Leading Particulars

Figure 7-1

4. PREPARATION OF COMPONENTS.

A. Flight Controller. The flight controller is shipped ready for use. The case for the CG117-CG517 forms the back of the flight controller and should be permanently mounted in the aircraft. The flight controller may be removed from the case by removing three mounting screws. Figure 7-3 provides mounting information applicable to both three- and four-switch controllers. The CG515 is permanently mounted in the case. The flight controller fastens with 4 screws in the bezel. Figure 7-4 provides mounting information.

B. Computer. One or more of the following procedures must be performed to prepare the computer for use. If no options are to be installed, perform step (1) only. If options are to be installed, perform the procedures in the applicable steps. Figure 7-14 shows the location of parts on the computer. Refer to figure 7-5 for mounting information.

—NOTE— The top of each plug-in card is colored to match a computer decal color. Match colors to insure that plug-in cards are inserted in proper chassis receptacles.

(1) Heading Hold. Insert the 200-0095-00/01 Heading/Hold Only Assembly into the computer receptacles. Set the chassis option selector plug at POS 1 position. Install a K3 Dummy Relay, 032-0014-00, if a heading selector is installed.

(2) Heading Omni and ILS Coupling. Insert the 200-0095-00 or 200-0095-02 Heading-Omni ILS Card Assembly into the computer receptacles. Set the option selector plug at POS 2 position. Install the K3 Relay, 013-0032-05.

(3) Directional Gyro Coupling. The gyro synchro transmitter and the autopilot heading circuits must be energized by the same 26-volt ac power. If the directional gyro

TO ADD THIS OPTION	MAKE THESE CHANGES TO THE BASIC AUTOPILOT
Heading select	Install CG136 Heading Selector and set option selector plug on computer at POS 4 position. Install a K3 dummy relay, 032-0014-00 if it or a K3 relay is not already installed.
Back Course ILS	Add back course switch after having added ILS coupling to the autopilot. See figure 7-16 and paragraph 6.
Omni and ILS coupling	Make changes in computer according to paragraph 4B(2). See paragraph 6 for coupling information.
Altitude hold	Install parts in computer according to paragraph 4B(4).

AUTOPILOT OPTIONS
Figure 7-2

TO ADD THIS OPTION	MAKE THESE CHANGES TO THE BASIC AUTOPILOT
Pneumatic Automatic pitch trim	Install the proper KG343 Kit and an MG112 Trim Actuator
Automatic Electric pitch trim	Install the DG1009 as an interface between H14 Computer and aircraft trim motor.
Directional gyro or navigation system	Install parts in computer according to paragraph 4B(3). See paragraph 6 for coupling information.
Vertical gyro with synchro outputs	See paragraph 6 for coupling information

AUTOPILOT OPTIONS (continued)
Figure 7-2

being coupled requires greater than 7.8 volt-amperes, install a 200-0092-01 Power Supply Card in Computer and use the aircraft 26-volt 400-cps power for the synchro transmitter and the autopilot. If the directional gyro requires less power than 7.8 volt-amperes, no changes need to be made to the computer.

(4) Altitude Hold Mode. Install a PG51A Altitude Control on the underside of the chassis (see figures 7-5 and 7-14). Insert the altitude control pneumatic fitting through the hole in the front of the computer and install the nut on that fitting. Do not tighten the nut at this time. Be sure that the unit does not jam wiring onto the bottom of the transolver. Tighten the altitude control in place with the clamp which surrounds the body. Do not tighten excessively or the unit may be damaged. Then tighten the nut on the front pressure fitting. Connect electrical plug P1 of the computer to the electrical receptacle on the rear of the altitude control.

—NOTE— If a heading selector is installed in the system, the option selector plug must be at POS 4 regardless of other options installed.

C. Servo Actuators. The proper orifices and cable drums for each servo avtuator are shipped in the installation kit. Orifices and cable drums must be installed on the servo actuators before the servo actuators are installed on the aircraft. The proper orifices and cable drums for each aircraft are specified on the installation kit drawing. Refer to figure 7-5 for mounting information. Refer to figure 7-15 and install the orifices and cable drums as follows:

(1) Remove the servo actuator valve from the servo actuator by removing the four screws at the sides of the valve.

(2) Select the proper color-coded orifices for the axis in which the servo actuator is used. Install O-rings on the orifices and insert the orifices in the servo actuator valve as shown. Replace the servo actuator valve on the servo actuator and replace and tighten the screws.

—**NOTE**— Be sure that the servo actuator is installed only in the axis for which the orifices were selected.

(3) Refer to the installation kit drawing and select the cable drum designated for the axis in which the servo actuator is used. Mount the cable drums as shown on the Honeywell cable drum drawings included in the installation kit.

(4) If the automatic pneumatic pitch trim option is being installed, mount the SG28A Differential Pressure Switch (supplied in a KG343 Automatic Pitch Trim Installation Kit) on the servo actuator valve of the elevator servo actuator as shown.

—**NOTE**— Two screws must be removed from the pressure ports on the bottom of the servo actuator before installing the differential switch.

D. Gyro Indicators. Refer to figure 7-7 for air-driven vertical gyro (attitude indicator) mounting information. Refer to figure 7-8 for air-driven directional gyro mounting information. Refer to figure 7-9 for turn and bank indicator gyro mounting information.

E. Trim Actuator. See figure 7-10 for mounting information. Mount cable drum on the trim actuator as follows:

(1) Apply filtered air at 10-psi pressure to the CW and CCW inlet ports to keep the output shaft from turning.

(2) Place the felt washer in place around the output shaft after first saturating the washer with General Electric Versilube F-50 lubricant. (The MG112B does not have this washer.)

(3) Turn the cable drum onto the output shaft until it lightly contacts the output shaft bearings. If the actuator is an MG112A, back the cable drum off one-eighth turn. If the actuator is an MG112B, leave the cable drum against the bearings.

(4) Disconnect the filtered air from the CW port. Install the locking cup on the output shaft. Tighten the screw which holds the locking cup in place.

(5) Disconnect the filtered air supply.

F. Heading Selector. The heading selector is shipped ready for use. Refer to figure 7-10 for mounting information. Use a CG136A1 with a three-switch flight controller and use the CG136B1 with a four-switch flight controller.

G. Electric Pitch Trim Adapter. The DG1009 Electric Pitch Trim Adapter is shipped ready for use. Refer to figure 7-12 for mounting information.

H. Attitude Reference Coupler. The coupler is shipped ready for use. Refer to figure 7-13 for mounting information. Calibrate the coupler as follows:

(1) Roll Axis.

(a) Perform the roll axis autopilot checkout procedure in Section III prior to making this calibration.

(b) Connect a dc meter to the roll axis jacks 22 and 23 as indicated in the autopilot checkout procedure.

(c) Loosen the attitude gyro that drives the coupler.

(d) Engage the autopilot and rotate the TURN command knob to a full right turn.

(e) Tilt the attitude gyro so that the instrument panel indicator reads 30 degrees bank.

(f) Adjust the roll adjust variable resistor on the coupler so that the meter connected to the roll servo reads zero. If the variable resistor cannot be adjusted to a meter reading of zero, replace the coupler.

(g) Check the left turn command be performing steps (a) through (f) in the opposite direction.

(2) Pitch Axis.

(a) Perform the pitch axis autopilot checkout procedure in Section III prior to making this calibration.

(b) Connect a dc meter to jacks 35 and 1. Adjust the pitch command for zero volt on the meter.

(c) Move the meter leads to jacks 38 and 39. With the ATT GYRO switch at TEST, adjust the pitch adjust resistor for zero volt on the meter.

(d) Move the ATT GYRO switch to NORMAL.

(e) Move the PITCH command to full nose DOWN command.

(f) Tilt the attitude gyro nose down until the attitude indicator on the instrument panel reads 18 degrees nose down.

(g) Adjust the pitch adjustment on the coupler for zero volt on the meter connected to jacks 38 and 39. If the meter cannot be adjusted to zero, replace the coupler.

(h) Repeat steps (e), (f), and (g) for the nose up condition.

5. ADJUSTMENTS AND CHECKOUT. Immediately after installation of components, perform the adjustments and checkout procedures in Section III.

6. GENERAL COUPLING REQUIREMENTS. The H-14 Autopilot can be coupled to various types of navigation receivers and directional gyros. The data in this paragraph lists the requirements for various types of couplings. If further information is needed, contact the autopilot distributor or autopilot manufacturer.

—NOTE— Figures 7-16 through 7-27 illustrate coupling requirements for H-14 devices and related equipment. Use these illustrations for signal reference only, as the actual cabling in the aircraft may be different than shown on these diagrams. Refer to the aircraft manual for cabling information.

A. Heading Requirements.

(1) Transmitter for Directional Information.

(a) Excitation: 26 volts ac supplied from pin J7-52 on computer.

(b) Sensitivity: 206 mv/degree between any two of three wye windings.

(c) Approximated impedances: Z_{RO} = 32 + j 180 ohms, Z_{SO} = 7.5 + j 31 ohms, Z_{RSS} = 47 + j 16 ohms. These impedances are those presently used with H-14 installations. Small variations can be tolerated. The computer transolver provides a variable load on the transmitter, depending on the mode of autopilot operation. Therefore, there should be no parallel loads other than autopilot loads connected to the transmitter.

(d) Scale factor: The scale factor at computer connector pins J7-28 to J7-1 must be 300 mv rms/degree of aircraft movement in the heading hold mode of operation.

(2) Control Transformer for Heading Select Information.

(a) Excitation: Provided from three-wire stator connections to the same directional gyro (DG) transmitter that gives heading information.

(b) Sensitivity of rotor: 393 mv rms/degree, measured across the error winding.

(c) Approximated impedances: Z_{RC} = 650 + j 3,000 ohms, Z_{SO} = 105 + j 550 ohms, and Z_{RSS} = 540 + j 270 ohms. Due to the 10-volt dc reference voltage to which the signal ground side of the rotor error winding is connected, there should be no parallel loads connected to the error winding.

(d) Scale factor: The scale factor at computer connector pins J7-28 to J7-1 must be 300 mv rms/degree of heading select rotation in the heading select mode of operation.

B. ILS Requirements.

(1) Localizer Receiver.

(a) Scale factor required: 30 mv dc/dot of deflection (60 mv dc/degree of beam error).

(b) Source impedance: 200 to 330 ohms, looking into receiver output terminals.

(c) Autopilot load: 1,000 ohms.

(d) The input connections (computer pins J7-12 to J7-13) are (+) 10-volt dc potential with respect to power ground. Therefore, they should be connected only to a full-floated (ARINC) receiver output.

(e) Receiver output must be damped by approximately 1,250-microfarad capacitance.

(f) Localizer frequency: 28 volts dc required on localizer frequency at computer pin J7-47.

(2) Glide Slope Receiver.

(a) Scale factor required: 30 mv dc/dot deflection (300 mv dc/degree beam of error).

(b) Source impedance: 200 to 330 ohms looking into receiver output terminals.

(c) Autopilot load: 1,000 ohms.

(d) The input connections (computer pins J7-10 to J7-11) are (+) 10-volt dc potential with respect to power ground. Therefore, they should be connected only to a full-floated (ARINC) receiver output.

(e) Receiver output must be damped by approximately 1,250-microfarad capacitance.

C. Omni Requirements.

(1) Omni Receiver.

(a) Scale factor required: 30 mv dc/dot of deflection (15 mv dc/degree of beam error).

(b) Source impedance: 200 to 330 ohms looking into receiver autopilot terminal.

(c) Autopilot load: 1,000 ohms.

(d) The input connections (computer pins J7-12 to J7-13) are at (+) 10-volt dc potential with respect to power ground. Therefore, they should be connected only to a full-floated (ARINC) receiver output.

(e) Receiver output must be damped by approximately 3,500-microfarad capacitance.

(f) Zero voltage required on omni frequency at computer pin J7-47.

(2) OBS Scale Factor. The OBS scale factor must be five dots (150 mv dc/10 degrees of bug displacement from radial selected).

D. Attitude Inputs.

(1) Roll Axis.

(a) Sensitivity: 0.33 volt dc/degree roll attitude, 1.05 ua/degree roll attitude.

(b) Limits: ±60 degrees roll attitude.

(c) Sensor voltage excitation: 40 volts dc isolated from power ground supplied by computer power supply.

(2) Pitch Axis.

(a) Sensitivity: 0.66 volt dc/degree pitch attitude, 2.52 ua/degree pitch attitude.

(b) Limits: ±30 degrees pitch attitude.

(c) Sensor voltage excitation: 40 volts dc isolated from power ground supplied by computer power supply.

(3) Yaw Axis.

(a) Sensitivity: 3.33 volts dc/degree/second.

(b) Limits: ±6 degrees/second yaw rate.

(c) Sensor voltage excitation: 40 volts dc isolated from power ground supplied by computer power supply.

7. COUPLING TO NAVIGATION SYSTEMS.

A. General. The autopilot computer must be prepared for ILS and/or omni coupling according to paragraph 4B before coupling is performed. If a directional system other than the one supplied with the H-14 Autopilot is to be installed, see paragraph 4B(4). Coupling diagrams 7-16 through 7-27 show how various ARINC standard equipment can be coupled to the autopilot.

B. Non-ARINC Navigation Receivers.

(1) The H-14 Autopilot requires ARINC standard localizer, VOR, and glide slope signals. If a non-ARINC navigation receiver is to be coupled, either a DG104A1 or DG104B1 Navigation Receiver Adapter must be used to adapt the signals for use by the autopilot. The following table shows the application of each of the adapters:

USE DG104A1 ADAPTER WITH	USE DB104B1 ADAPTER WITH
1. Narco VOA-4 2. Narco VOA-5 3. Motorola M135 4. Any other receiver having 50-, 100-, or 150-mv sensitivity for five dots deflection and capable of supplying signals to an additional 1, 000-ohm load	1. ARC Starflite II 2. ARC Starflite III 3. Any other receiver having a 150-mv sensitivity for five dots deflection and capable of supplying signals to an additional, 5, 000-ohm load

(2) The normal load impedance of the DG104A1 adapter is 1,000 ohms. This load impedance can be changed to 3,000 ohms by removing the external short between connector pins F and G (channel 1) and between connector pins S and T (channel 2). The gain of this adapter can be changed as shown in the following table.

CHANNEL	PROCEDURE	GAIN
1 (Loc/VOR)	Short pin M to N	1 v/v ± 5%
1 (Loc/VOR)	Connect 13. 26k resistor between pins M and N	2 v/v ± 5%
1 (Loc/VOR)	Open between pins M and N	3 v/v ± 5%
2 (Glide slope)	Short pin X to W	1 v/v ± 5%
2 (Glide slope)	Connect 13. 26k resistor between pins X and W	2 v/v ± 5%
2 (Glide slope)	Open between pins X and W	3 v/v ± 5%

(3) The gain of the DG104B1 adapter is one v/v and the load impedance is 5,000 ohms. Neither the gain nor load impedance can be changed.

(4) Input and output signal lead lengths of the adapters should be kept at a minimum due to the low levels of signal strength and the high levels of noise pickup. Mounting the adapter where long lead lengths become necessary requires that unified, shielded two-conductor cable be used. The input cable shield should be connected to pin B of the adapter and the output cable shield should be connected to pin E of the adapter.

(5) Connect the adapter as follows:

CONNECT	TO ADAPTER CONNECTOR J1, PIN	INSTEAD OF THESE POINTS
Loc/VOR receiver (sig)	H	H-14 computer pin 12
Loc/VOR receiver (grd)	D	H-14 computer pin 13
Glide slope receiver (sig)	U	H-14 computer pin 11
Glide slope receiver (grd)	R	H-14 computer pin 10
H-14 computer pin 12	P	Loc/VOR receiver (sig)
H-14 computer pin 13	C	Loc/VOR receiver (grd)
H-14 computer pin 11	Y	Glide slope receiver (sig)
H-14 computer pin 10	Q	Glide slope receiver (grd)
H-14 computer pin 52*	A	
H-14 computer pin 50*	B	
H-14 computer pin 1*	E	
H-14 computer pin 14*	J	
H-14 computer pin 15*	K	

*This pin must also be connected to other points as indicated on the cabling diagrams.

C. Coupling a Vertical Gyro with Synchro Outputs. The H-14 Autopilot requires dc pitch and roll attitude signals. A vertical gyro which produces synchro (ac) pitch and roll attitude signals must be coupled to the autopilot through a DG114A Attitude Reference Coupler. Figure 7-25 shows, as a part of a Collins FD108 Flight Director Installation, how to connect a Collins 332D-10 Vertical Gyro and a DG114A Coupler to the autopilot. Figure 7-26 shows how to connect a Honeywell GG53H1 or a Sperry VG203 Vertical Gyro and DG114A Coupler to the autopilot. A separate visual attitude indicator driven by the vertical gyro must be installed for pilot reference.

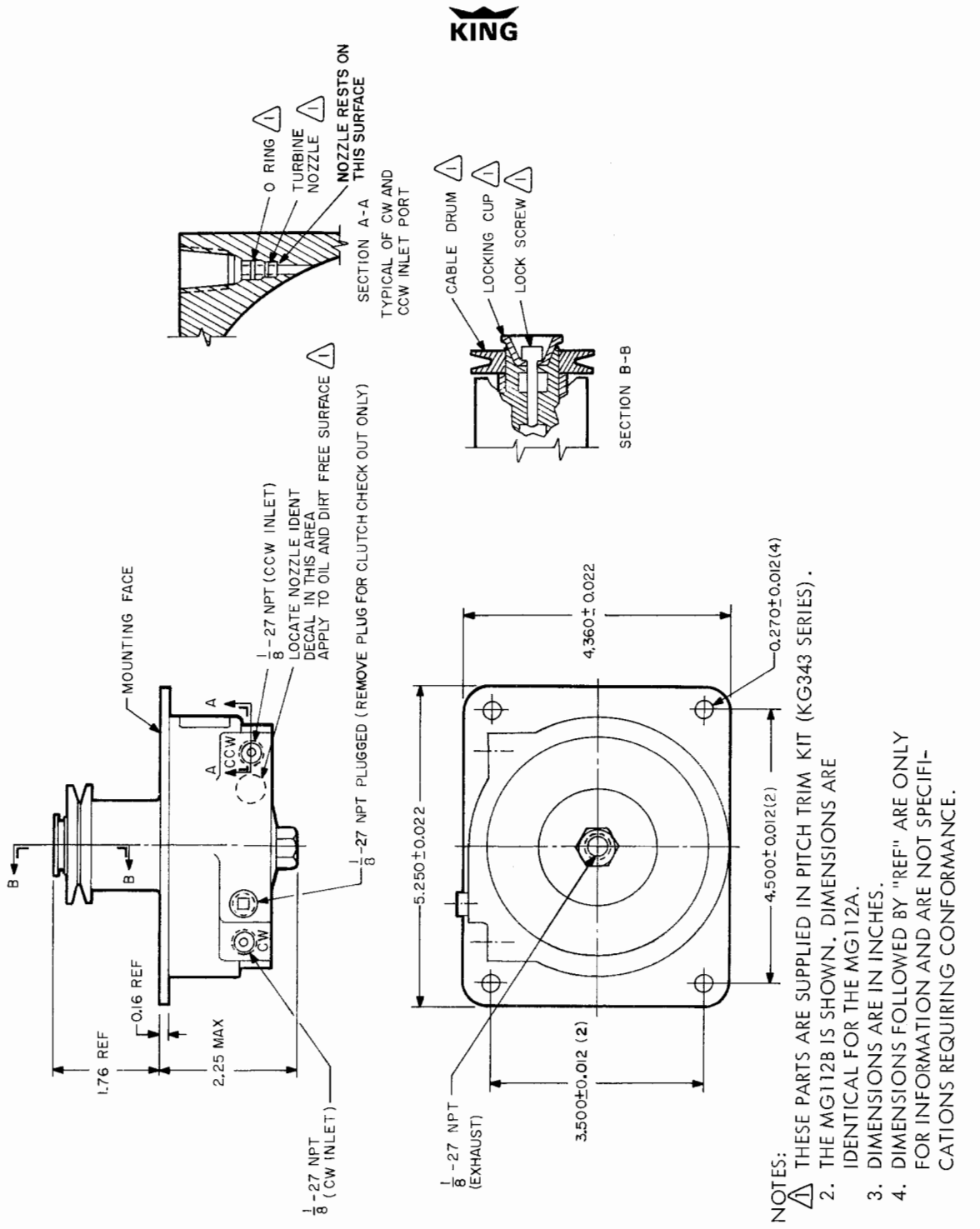
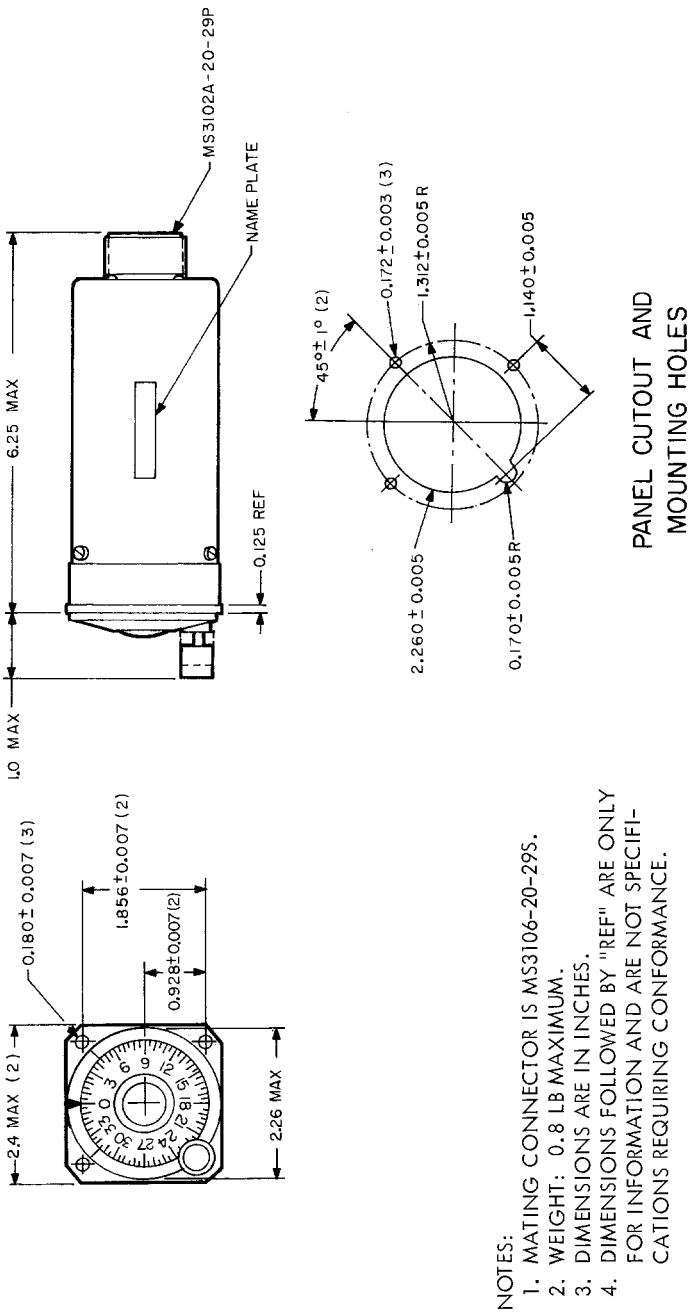


FIGURE 7-10 TRIM ACTUATOR - INSTALLATION DIAGRAM



NOTES:
1. MATING CONNECTOR IS MS3106-20-29S.
2. WEIGHT: 0.8 LB MAXIMUM.
3. DIMENSIONS ARE IN INCHES.
4. DIMENSIONS FOLLOWED BY "REF" ARE ONLY FOR INFORMATION AND ARE NOT SPECIFICATIONS REQUIRING CONFORMANCE.

FIGURE 7-11 HEADING SELECTOR - INSTALLATION DIAGRAM

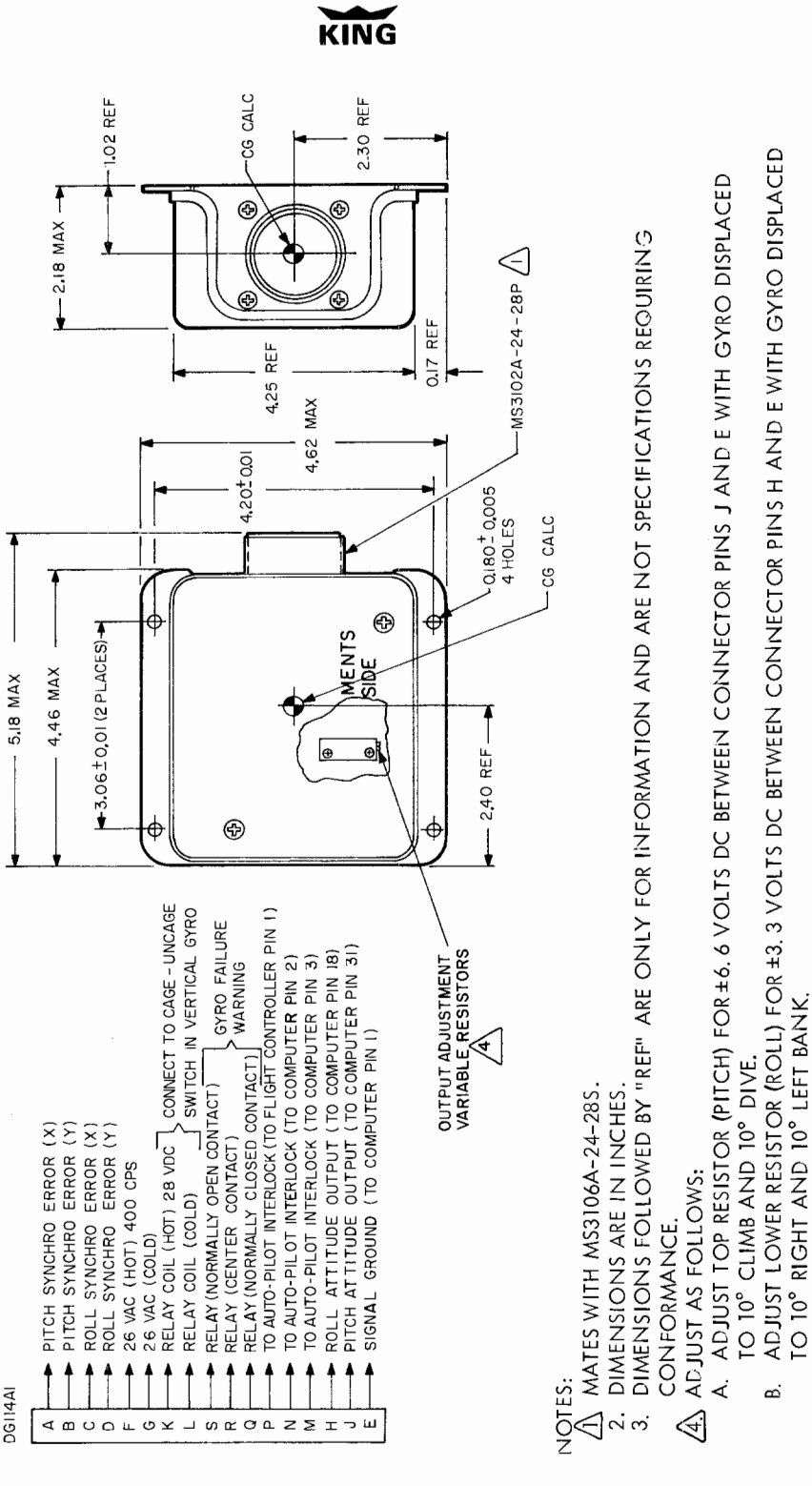


FIGURE 7-13 ATTITUDE REFERENCE COUPLER - INSTALLATION DIAGRAM

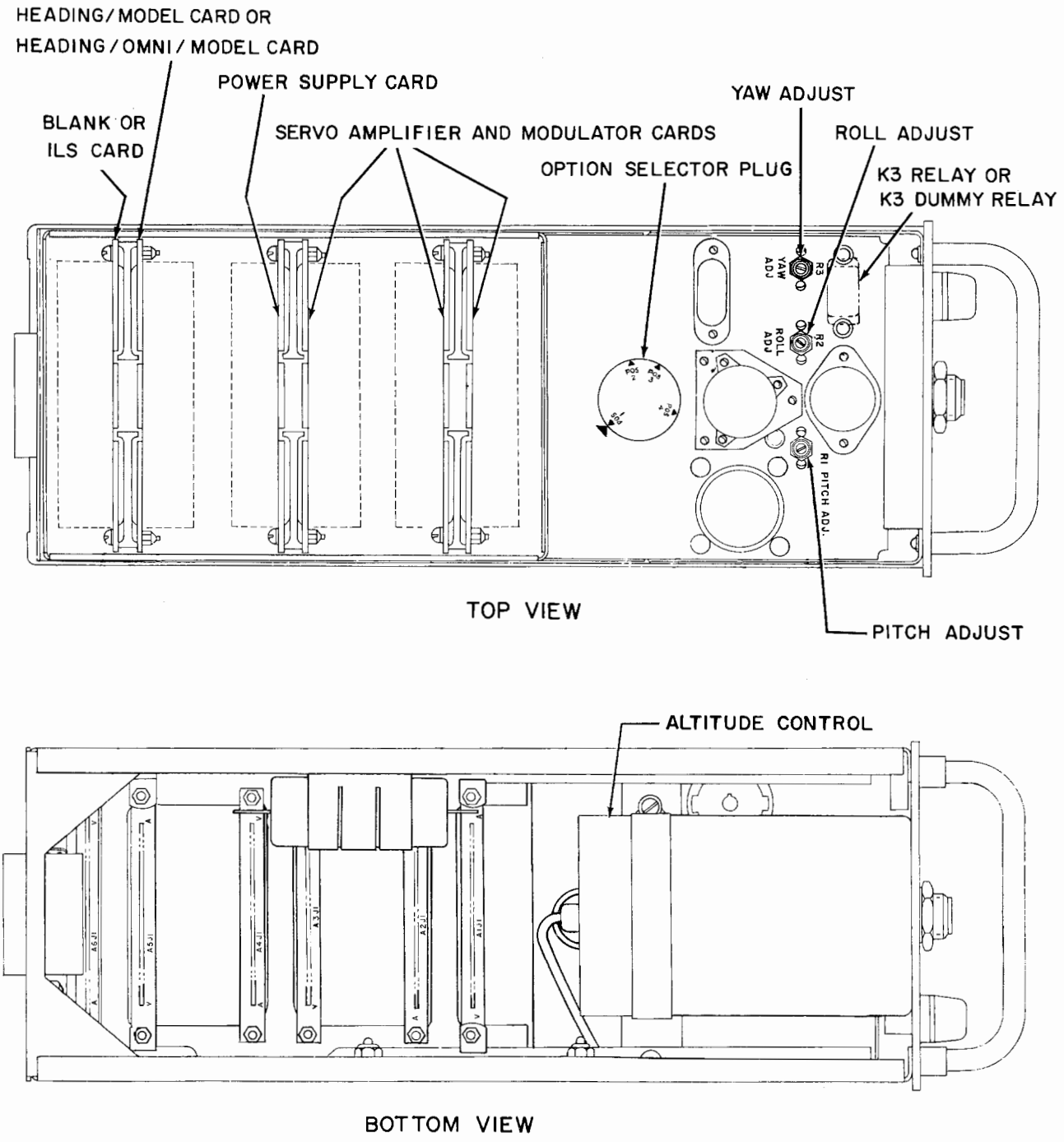


FIGURE 7-14 COMPUTER - PARTS LOCATIONS

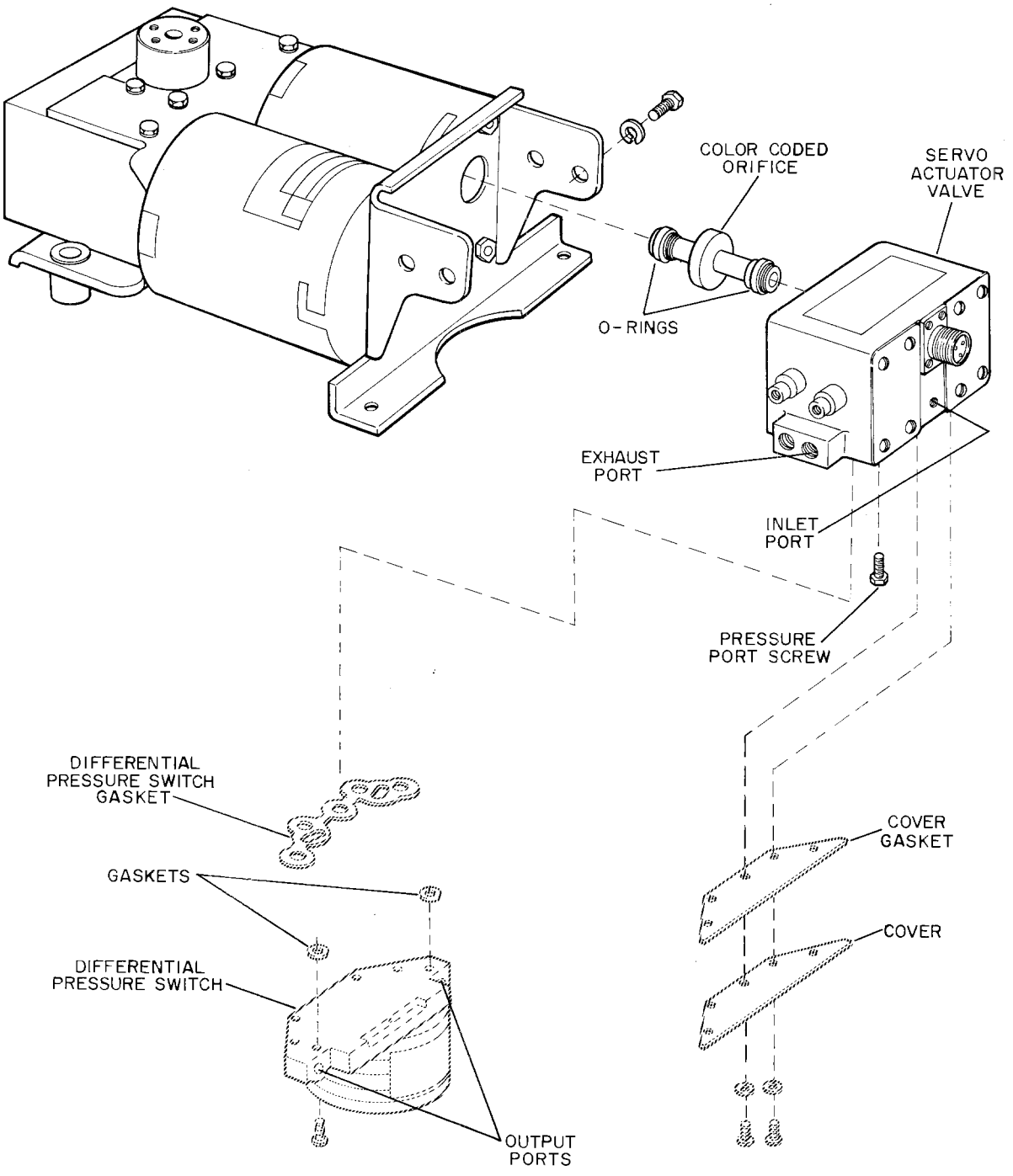
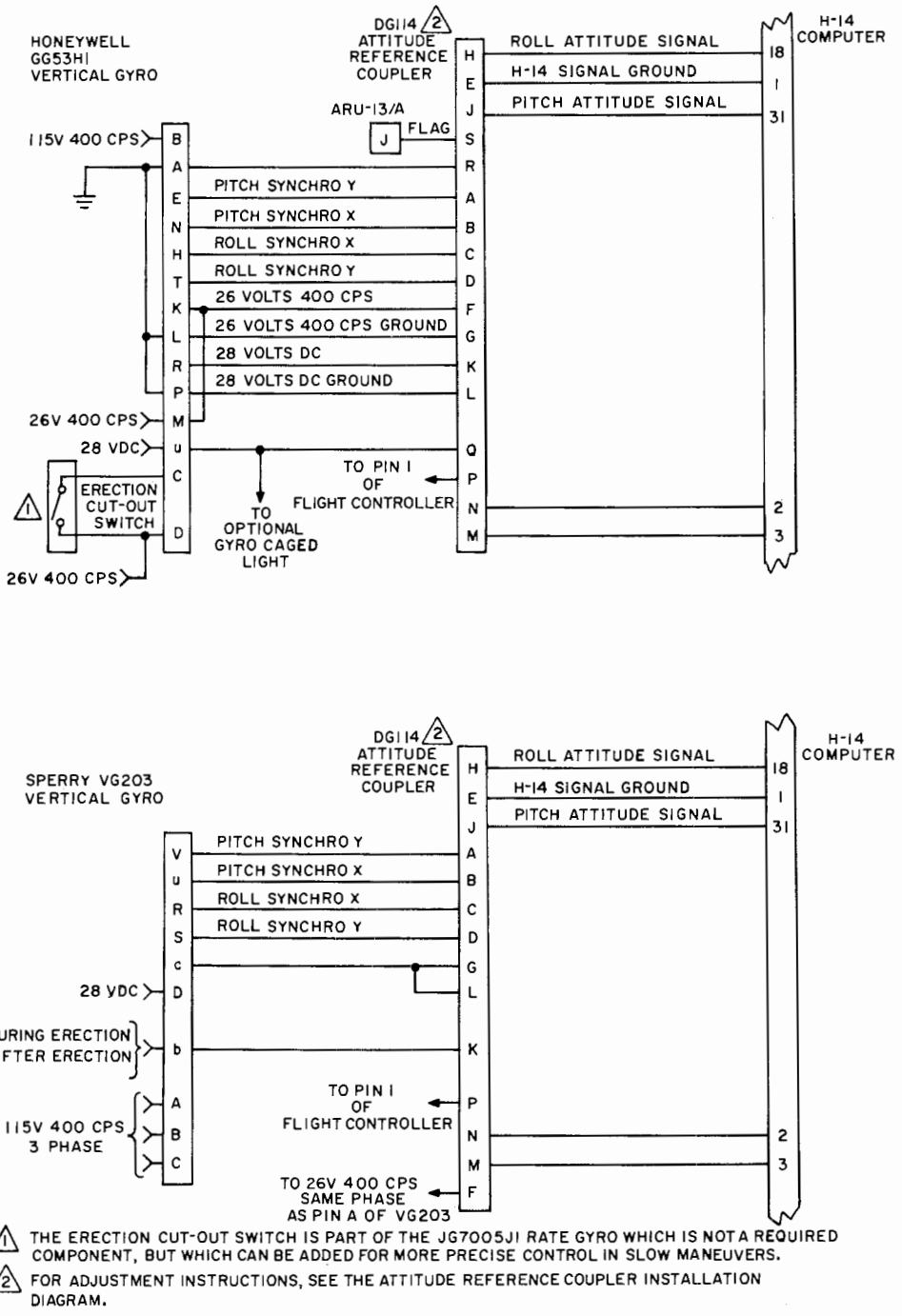


FIGURE 7-15 SERVO ACTUATOR AND OPTIONAL DIFFERENTIAL SWITCH - PARTS PLACEMENT VIEW



NOTES: (1) THE ERECTION CUT-OUT SWITCH IS PART OF THE JG7005J1 RATE GYRO WHICH IS NOT A REQUIRED COMPONENT, BUT WHICH CAN BE ADDED FOR MORE PRECISE CONTROL IN SLOW MANEUVERS.

(2) FOR ADJUSTMENT INSTRUCTIONS, SEE THE ATTITUDE REFERENCE COUPLER INSTALLATION DIAGRAM.

FIGURE 7-26 HONEYWELL GG53H1 AND SPERRY VG203 VERTICAL GYRO - COUPLING DIAGRAM

SECTION VIII

SUPPLEMENTAL DATA

Servo Kit and Trim Actuator numbers etc. This data is to be placed in Manual by aircraft manufacturer.

BEECHCRAFT
H-14 AUTOPILOT

MAINTENANCE MANUAL SUPPLEMENT

Part No. 98-30603

Issued: March, 1971

LIST OF EFFECTIVE PAGES

INTRODUCTION

This supplement, containing information applicable to the BEECHCRAFT H-14 Autopilot installations, should be used in conjunction with the basic H-14 Autopilot Maintenance Manual.

SECTION VIII
SUPPLEMENTARY DATA

1. GENERAL. This section contains information applicable to installations of the BEECHCRAFT H-14 Autopilot. The data in this section modifies or supplements the information contained in Sections I through VII.

2. SUPPLEMENTARY DATA.

A. Applicability to Beech Aircraft. The H-14 devices that can be used in BEECHCRAFT airplanes are listed in table 8-1. The right-hand column of table 8-1 should be used to list the actual H-14 devices and related equipment installed in your aircraft. The BEECHCRAFT application information for the cable drums, orifices, nozzles, and trim switch is provided in table 8-2.

B. Parts Lists. Parts ordering information for the cable drums and shear pin assemblies is provided in table 8-3. Refer to the Recommended Spares List in Section VI and to the applicable overhaul manual for ordering all other parts. Order parts from Beech Aircraft Corp., Wichita, Kansas 67201; Attention: Parts and Service Operation.

C. Diagrams. The diagrams applicable to the BEECHCRAFT airplanes listed in table 8-2 are provided in figures 8-2 through 8-25.

D. The information contained in this supplement data section is designed to be used in conjunction with the latest H-14 Maintenance Manual.

SUPPLEMENTARY DATA

DEVICE	DEVICE MODEL NUMBERS		NOTES	RECORD DATA IN THIS COLUMN
	BASIC NO.	SUFFIX		
Computer	BG274	B2, C1, C2 D1, D2, D3, D4	1	
Heading/Model Card	Z974770	(no dash), -1		
Heading/ILS/Omni Card	Z974772	(no dash), -2, -3, -4, -5		
Flight Controller	CG217	B1, B2, B3	3	
Flight Controller	CG417	B1, B2	3	
Flight Controller	CG515	B1, B2	2	
Heading Selector	CG136	A1, B1	4	
Navigation Receiver Adapter	DG104	A1, B1	5	
Attitude Reference Coupler	DG114	A1	6	
Attitude Indicator	GG201	A1, B1	7	
Directional Gyro	GG202	A1, B1	7	
Turn and Bank Indicator Gyro	GG205	A1, A3, A4, B4	8	
Attitude Indicator	GG301	A1, A2, B1, B2	9	
Directional Gyro	GG302	A1, B1	10	
Trim Actuator	MG112	A1, B1	--	
Servo Actuator	MG113	A1, A2, A3, E1, E3	11	
Altitude Control	PG51	A1	--	
Electric Trim Adapter	DG1009		12	
Electric Trim Adapter	DG1010		13	

Record basic no., suffix, and series no. of actual devices installed in aircraft.

NOTES:

1. The BG274B2 and C1 contain a standard power supply card (Z950849-1 or Z956329-1). The BG274C2 contains an alternate power supply card (Z951349-1 or Z956328-1, or Z951349-2 or Z956328-2) for use when externally generated 26-vac power is required for the heading system.

2. CG515 B1 designates blue/white lights (CG515 B2) designates red lights. The BG274D computer is used only with the CG515 controller.

3. The CG217B1 and B2 have red lighting; the B3 has white lighting. The CG417B1 has red lighting; the B2 has white lighting.

Device Applicability Table (Sheet 1 of 2)

Table 8-1.

SUPPLEMENTARY DATA

4. The CG136A1 is used with CG217 Flight Controller; CG136B1 used with CG417.
5. Used when coupling to a VHF navigation radio with one side of output grounded.
6. The DG114A1 is used to interface the H-14 attitude inputs to vertical gyros having a synchro transmitter output.
7. The GG201A1 and GG202A1 do not have a BEECHCRAFT logo; the GG201B1 and GG202B1 have a BEECHCRAFT logo.
8. The GG205A4 does not have a BEECHCRAFT logo; the GG205B4 has a BEECHCRAFT logo. (The GG205A1 and A3 are no longer in production.)
9. The GG301A1 does not have a BEECHCRAFT logo, the GG301B1 has a BEECHCRAFT logo. The GG301A2 and B2 are the same as the GG301A1 and B1 respectively, except they have heavier rotors and multifinger type potentiometer wipers.
10. The GG302A1 does not have a BEECHCRAFT logo; the GG302B1 has a BEECHCRAFT logo.
11. The MG113A2 or A3 are used on BEECHCRAFT Super 18 aircraft.
12. Used with Model 99 and 100.
13. Used on Model 60 airplanes equipped with optional electric pitch trim.

RELATED EQUIPMENT INSTALLED IN AIRCRAFT:

NOTES:

Device Applicability Table (sheet 2 of 2)

Table 8-1.

SUPPLEMENTARY DATA

AIRCRAFT MODEL AND PRESSURE REQUIREMENT	SERVO ACTUATORS			TRIM ACTUATOR			
	KIT NO.	CABLE DRUM AND SHEAR PIN ASSY*	ORIFICES**	KIT NO.	CABLE DRUM	NOZZLES	TRIM SWITCH
Super 18 (15.0 psi)	KG342B52	Z944997-13 (rudder)	Z945538-7 orange (rudder)	KG343B52	Z946284-2 (2.0-inch)	Z945943-5 orange (0.049-inch)	SG28A3
		Z944997-14 (aileron)	Z945538-10 gold (aileron)				
		Z944997-16 (elevator)	Z945538-10 gold (elevator)				
Baron 56TC Baron 55, A55, B55 and D55 7.5 psi; model C55 (10.0 psi)	KG342B21	Z944997-7 (rudder)	Z945538-7 orange (rudder)	KG343B21	Z946284-3 (1.25-inch)	Z945943-2 red (0.030-inch)	SG28A2
		Z944997-8 (aileron)	Z945538-8 green (aileron)				
		Z944997-9 (elevator)	Z945538-5 red (elevator)				
Duke 60,A60(A) Elevator & Rudder(11.5 psi) Ailerons(5.5 psi)	KG342B71	Z944997-36 (rudder)	Z945538-14 blue (rudder)	KG343B61 May have electric trim using DG1010 trim adapter.	Z946284-3 (1.25-inch)	Z945943-1 black (0.040-inch)	SG28A3
		Z944997-36 (aileron)	Z945538-8 green (aileron)				
		Z944997-26 (elevator)	Z945538-8 green (elevator)				
Queen Air 65, A65, 80, A80 (10.0 psi)	KG342B41	Z944997-10 (rudder)	Z945538-5 red (rudder)	KG343B41	Z946284-3 (1.25-inch)	Z945943-1 black (0.040-inch)	SG28A3
		Z944997-11 (aileron)	Z945538-10 gold (aileron)				
		Z944997-12 (elevator)	Z945538-5 red (elevator)				

Table of Cable Drum, Orifice, and Nozzle Applications (sheet 1 of 3)

Table 8-2.

AIRCRAFT MODEL AND PRESSURE REQUIRE-MENT	SERVO ACTUATORS			TRIM ACTUATOR			
	KIT NO.	CABLE DRUM AND SHEAR PIN ASSY*	ORIFICES**	KIT NO.	CABLE DRUM	NOZZLES	TRIM SWITCH
Queen Air 70 B80 (10.0 psi)	KG342B42	Same as for Queen Air 65 and 80, except uses a Z944997-35 cable drum and shear pin assy on elevator servo actuator.		Same as for Queen Air 65 and 80.			
Queen Air 88, King Air 90 (12.5 psi)	KG342B61	Z944997-10 (rudder)	Z945538-4 (rudder)	KG343B61	Z946284-3 (1.25-inch)	Z945943-1 black (0.040-inch)	SG28A3
		Z944997-11 (aileron)	Z945538-10 gold (aileron)				
		Z944997-12 (elevator)	Z945538-5 red (elevator)				
King Air A90 (12.5 psi)	KG342B62	Z944997-10 (rudder)	Z945538-4 yellow-green (rudder)	KG343B61	Z946284-3 (1.25-inch)	Z945943-1 black (0.040-inch)	SG28A3
		Z944997-11 (aileron)	Z945538-14 black (aileron)				
		Z944997-31 (elevator)	Z945538-14 black (elevator)				
King Air B90 & C90 Rudder & Elevator (12.5 psi) Ailerons (6.0 psi)	KG342B64	Z968636-1 (aileron)	Z945538-5 red (aileron)	KG343B61	Z946284-3 (1.25-inch)	Z945943-1 black (0.040 inch)	SG28A3
		Z944997-10 (rudder)	Z945538-4 yellow-green (rudder)				
		Z944997-31 (elevator)	Z945538-14 black (elevator)				
99 rudder (14 psi)	KG342B91	Z944997-40 (rudder)	Z945538-8 green (rudder)				

Table of Cable Drum, Orifice, and Nozzle Applications (sheet 2 of 3)

Table 8-2.

SUPPLEMENTARY DATA

AIRCRAFT MODEL AND PRESSURE REQUIRE-MENT	SERVO ACTUATORS			TRIM ACTUATOR			
	KIT NO.	CABLE DRUM AND SHEAR PIN ASSY*	ORIFICES**	KIT NO.	CABLE DRUM	NOZZLES	TRIM SWITCH
Aileron & elevator (8 psi)		Z944997-38 (aileron)	Z945538-8 green (aileron)	DG1009	NOT APPLICABLE Electric Trim Standard		
		Z944997-2 (elevator)	Z945538-5 red (elevator)				
King Air 100 Rudder (14 psi) Aileron & elevator (8 psi)	KG342B100	SAME AS 99					

NOTE

All pressure settings stated in Table 8-2 are + ? 4 psi - 0 psi.

(A) The electric trim system is optional equipment on the Model 60, A60.

NOTE: *Cable drum sizes for Z944997 cable drum and shear pin assemblies are as follows:

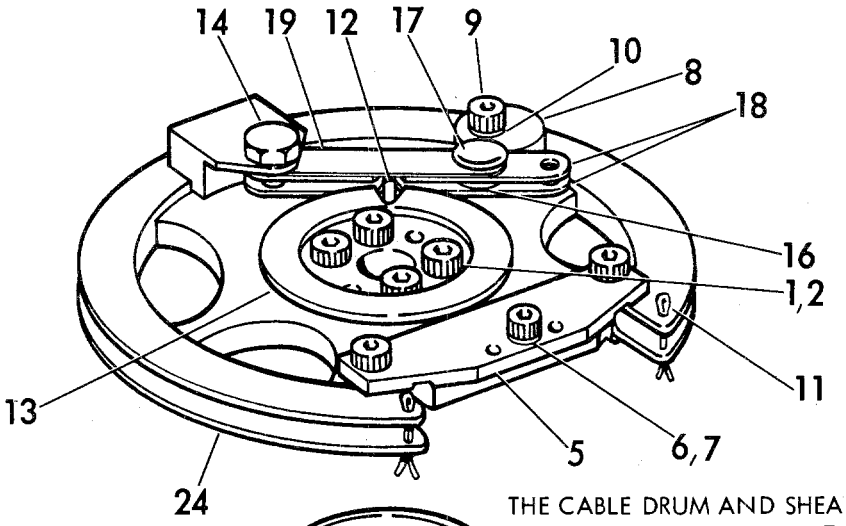
-2 (5.0 inch)	-10 (6.0-inch)	-14 (5.0-inch)	-35 (10.0-inch)
-7 (3.0-inch)	-11 (3.5-inch)	-16 (non-linear)	-36 (4.0-inch)
-8 (3.5-inch)	-12 (9.0-inch)	-26 (9.0-inch)	-38 (6.0-inch)
-9 (10.0-inch)	-13 (5.0-inch)	-31 (13.5-inch)	-40 (6.0-inch)

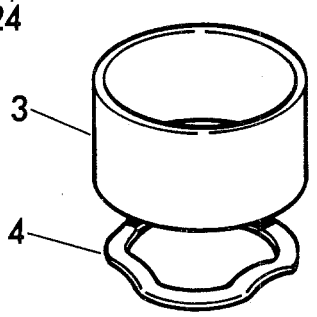
**Sizes of Z945538 orifices are as follows:

-4 (0.35-inch)	-7 (0.050-inch)	-10 (0.065-inch)
-5 (0.040-inch)	-8 (0.055-inch)	-14 (0.085-inch)

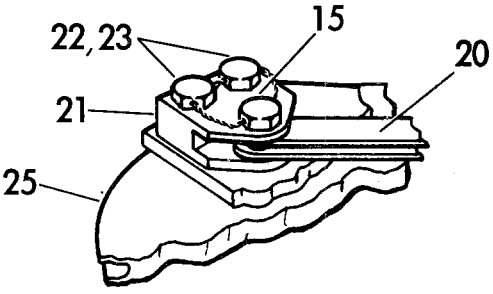
Table of Cable Drum, Orifice, and Nozzle Applications (Sheet 3 of 3)

Table 8-2.





THE CABLE DRUM AND SHEAR PIN ASSEMBLY SHOWN IS Z944997-8 OR Z944997-11 WITH A Z968634 CAST CABLE DRUM. THE OTHER CAST CABLE DRUM DIFFERS IN APPEARANCE, BUT PARTS ARE ARRANGED IN THE SAME RELATIVE POSITIONS ON IT. THE INSET SHOWS THE ARRANGEMENT OF PARTS WHICH ARE USED ONLY ON THE MACHINED CABLE DRUMS.



PARTS USED ONLY ON MACHINED CABLE DRUMS

95-4727/1

Cable Drum and Shear Pin Assembly-Replaceable Parts

Figure 8-1.

PARTS LIST FOR FIGURE 8-1

INDEX NUMBER	PART NUMBER	DESCRIPTION	QUANTITY	USABLE ON CODE (1)
	Z944997-2	CABLE DRUM AND SHEAR PIN ASSEMBLY		A
	Z944997-7	CABLE DRUM AND SHEAR PIN ASSEMBLY		B
	Z944997-8	CABLE DRUM AND SHEAR PIN ASSEMBLY		C
	Z944997-9	CABLE DRUM AND SHEAR PIN ASSEMBLY		D
	Z944997-10	CABLE DRUM AND SHEAR PIN ASSEMBLY		E
	Z944997-11	CABLE DRUM AND SHEAR PIN ASSEMBLY		F
	Z944997-12	CABLE DRUM AND SHEAR PIN ASSEMBLY		G
	Z944997-13	CABLE DRUM AND SHEAR PIN ASSEMBLY		H
	Z944997-14	CABLE DRUM AND SHEAR PIN ASSEMBLY		I
	Z944997-16	CABLE DRUM AND SHEAR PIN ASSEMBLY		J
	Z944997-26	CABLE DRUM AND SHEAR PIN ASSEMBLY		K
	Z944997-31	CABLE DRUM AND SHEAR PIN ASSEMBLY		L
	Z944997-35	CABLE DRUM AND SHEAR PIN ASSEMBLY		M
	Z944997-36	CABLE DRUM AND SHEAR PIN ASSEMBLY		N
	Z944997-38	CABLE DRUM AND SHEAR PIN ASSEMBLY		O
	Z944997-40	CABLE DRUM AND SHEAR PIN ASSEMBLY		P
1	NAS608C3H14	SCREW, machine	4	
2	MS35338-43	WASHER, lock	4	
3	946625	TUBE	1	
4	946621	WASHER, wave	1	
5	Z968459-1	CLAMP, cable drum (used with cast cable drums)	1	
	Z944984	CLAMP, cable drum (used with machined cable drum)	1	
		(ATTACHING PARTS)		
6	NAS608C832H6	SCREW, machine	3	A,B,C,F,J,N
	NAS608C832H6	SCREW, machine	4	D,E,G,H,I,K L,M.O,P
7	MS35333-38	WASHER, lock	3	A,B,C,F,J,N
	MS35333-38	WASHER, lock	4	D,E,G,H,I,K L,M,O,P
8	Z944992	LOCK, eccentric	1	
		(ATTACHING PARTS)		
9	NAS608C832-LE8	SCREW, locktight 3	1	
10	MS35333-38	WASHER, lock	2	
11	AN381-2-7	PIN, cotter	2	
12	Z944991	PIN, shear	1	
13	Z944985-1	CAPSTAN, shear	1	A,B,K
	Z944985-3	CAPSTAN, shear	1	P
	Z944985-4	CAPSTAN, shear	1	C,F,N,O
	Z944985-5	CAPSTAN, shear	1	D
	Z944985-6	CAPSTAN, shear	1	E
	Z944985-7	CAPSTAN, shear	1	G,L,M
	Z944985-8	CAPSTAN, shear	1	H,I,J
14	AN3CH5A	BOLT (used on cast cable drums)	1	
15	Z944988	SCREW, pivot, (used on machined cable drums)	1	
16	Z944995	SPACER, shear plate	2	
17	432439-5	RIVET, semitubular, trusshead	1	
18	Z944993	PLATE, shear (used on machined cable drums)	2	
	Z968400	PLATE, shear (used on cast cable drums)	2	
19	Z968399	RETAINER, pin (used on cast cable drums)	1	

Table 8-3. (Sheet 1 of 2)

SUPPLEMENTARY DATA

PARTS LIST OF FIGURE 8-1 (Cont'd)

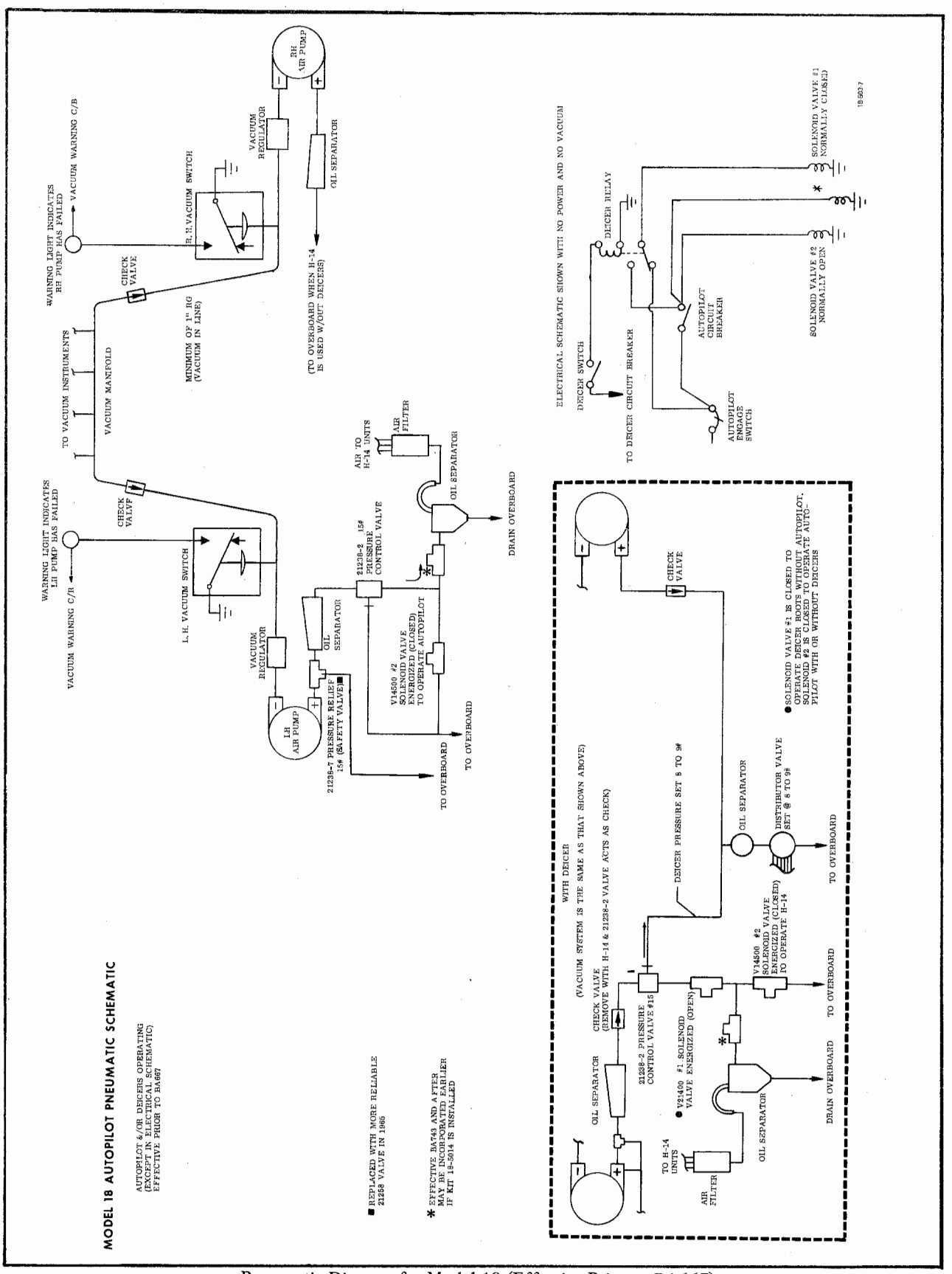
INDEX NUMBER	PART NUMBER	DESCRIPTION	QUANTITY	USABLE ON CODE (1)
20	Z944990	RETAINER, pin (used on machined cable drums)	1	
21	Z944989	BLOCK, pivot (used on machined cable drums)	1	
22	AN3HC4A	BOLT, machine (used on machined cable drums)	2	
23	MS35333-39	WASHER, lock (used on machined cable drums)	2	
24	047-1808-00*	DRUM, cable (3.0 inch)	1	B
	073-0109-01*	DRUM, cable (3.5 inch)	1	C,F
	047-1810-00*	DRUM, cable (10.0 inch)	1	D,K,M
	047-1812-00*	DRUM, cable (6.0 inch)	1	E,O,P
	047-1813-00*	DRUM, cable (9.0 inch)	1	G
	073-0110-01*	DRUM, cable (5.0 inch)	1	A,H,I
	047-1815-04*	DRUM ASSEMBLY, cam cable (non-linear)	1	J
	047-1809-00*	DRUM, cable (13.5 inch)	1	L
	073-0108-01*	DRUM, cable (4.0 inch)	1	N

*King Radio Corp. part number

NOTES:

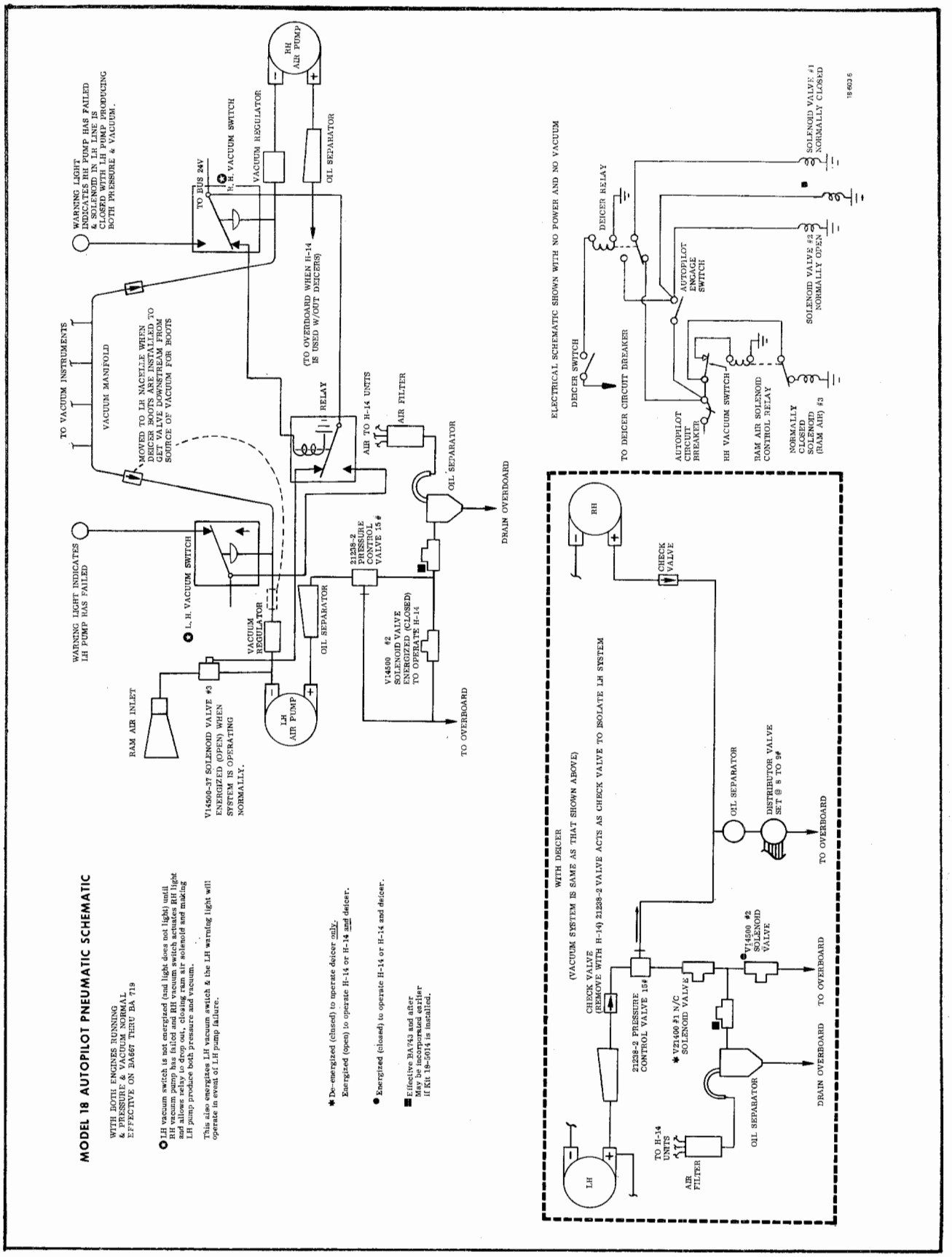
1. The USABLE ON CODE column indicates the application of a specific part number to the cable drum and shear pin assembly having the same code letter. Where no code letter appears, the part is used in the stated quantity for all assemblies.
2. The parts identified by index numbers 1 through 4 are used to join the cable drum and shear pin assembly to the servo actuator.
3. The cable drum and shear pin assemblies may have either of the similarly coded cable drums (items 24, 25). The cast cable drums and machined cable drums require different hardware, as noted in the descriptions for items 5, 14, 15 and 18 through 23.

Table 8-3. (Sheet 2 of 2)



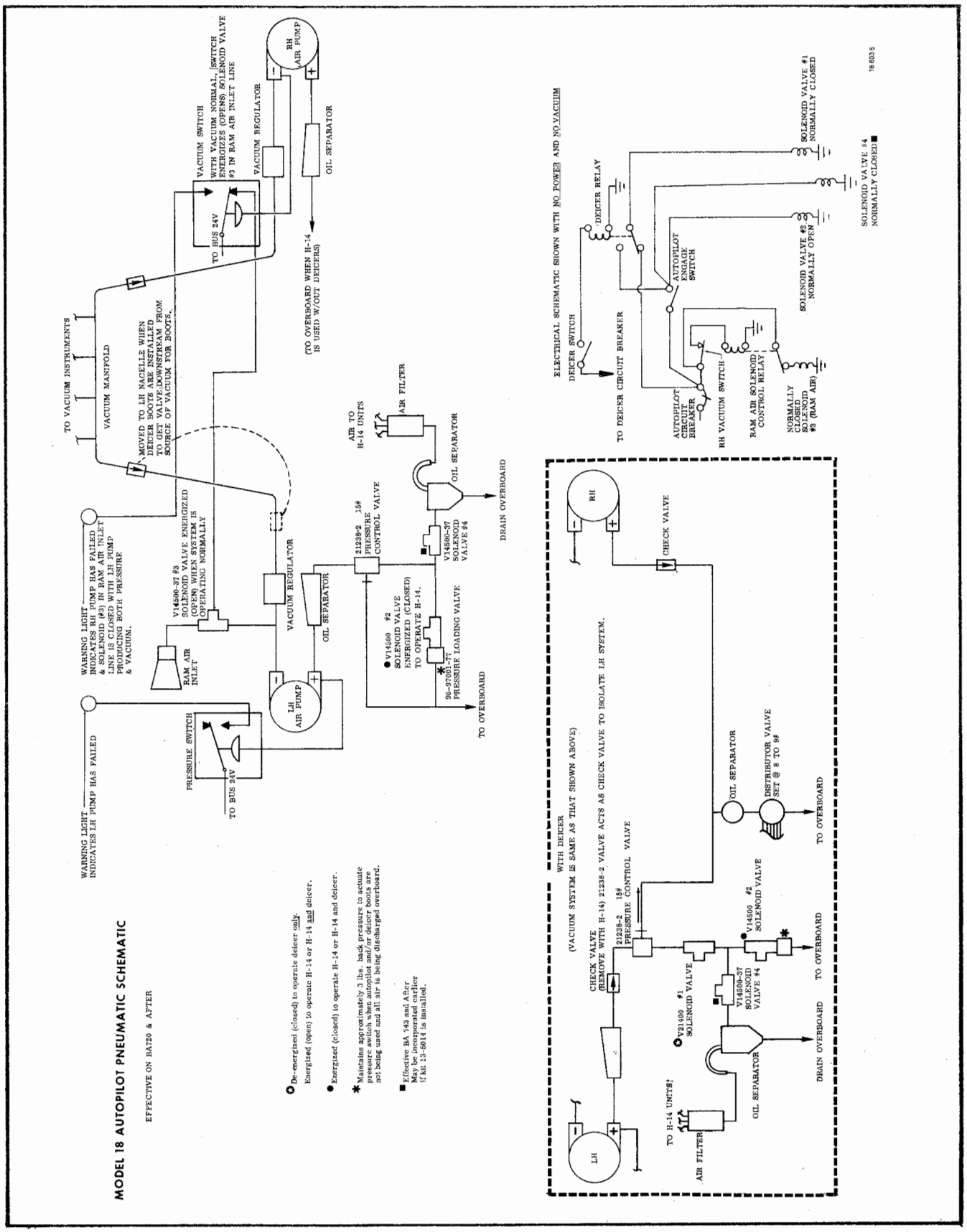
Pneumatic Diagram for Model 18 (Effective Prior to BA667)

Figure 8-2.



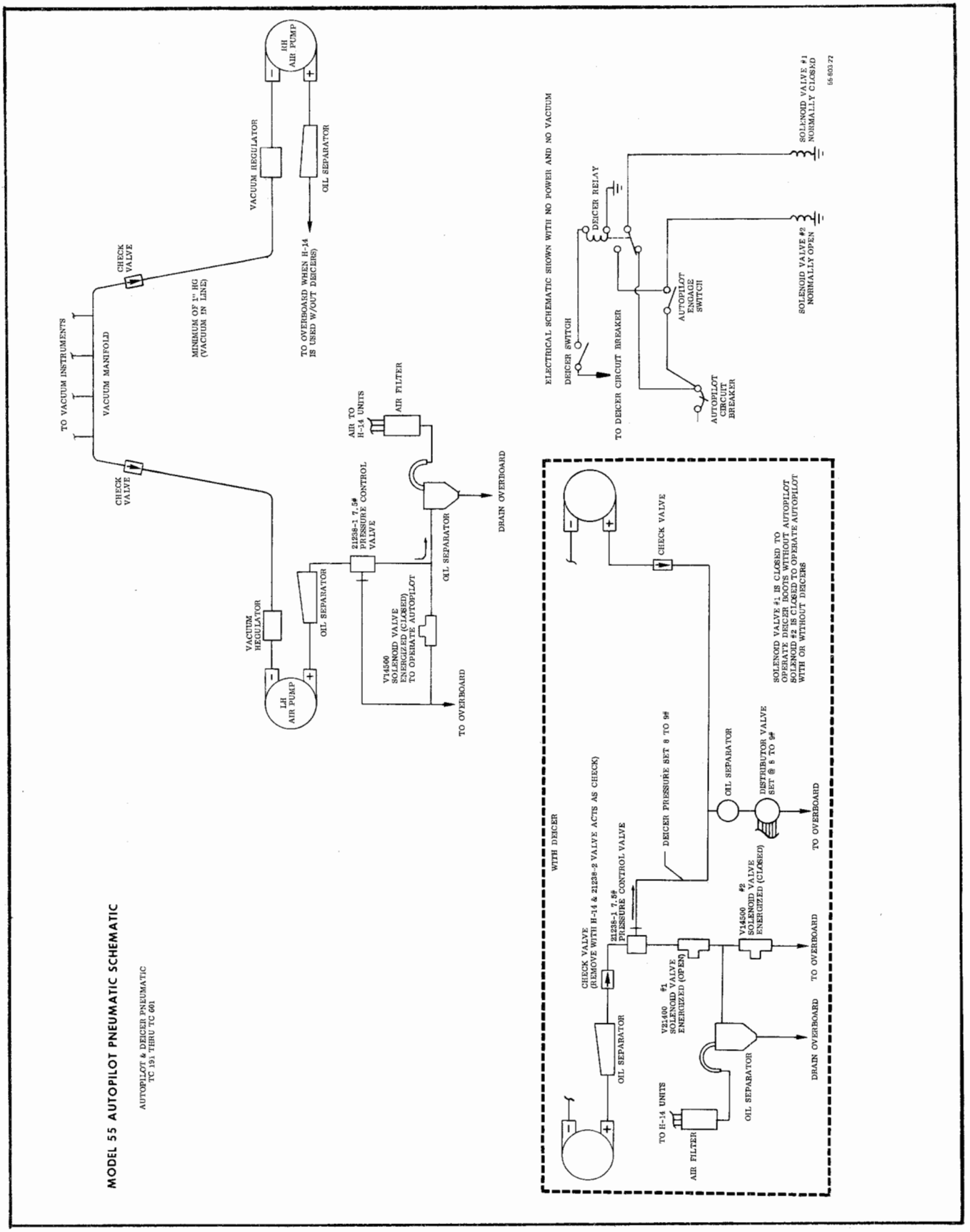
Pneumatic Diagram for Model 18 (Effective on BA667 through BA719)

Figure 8-3.



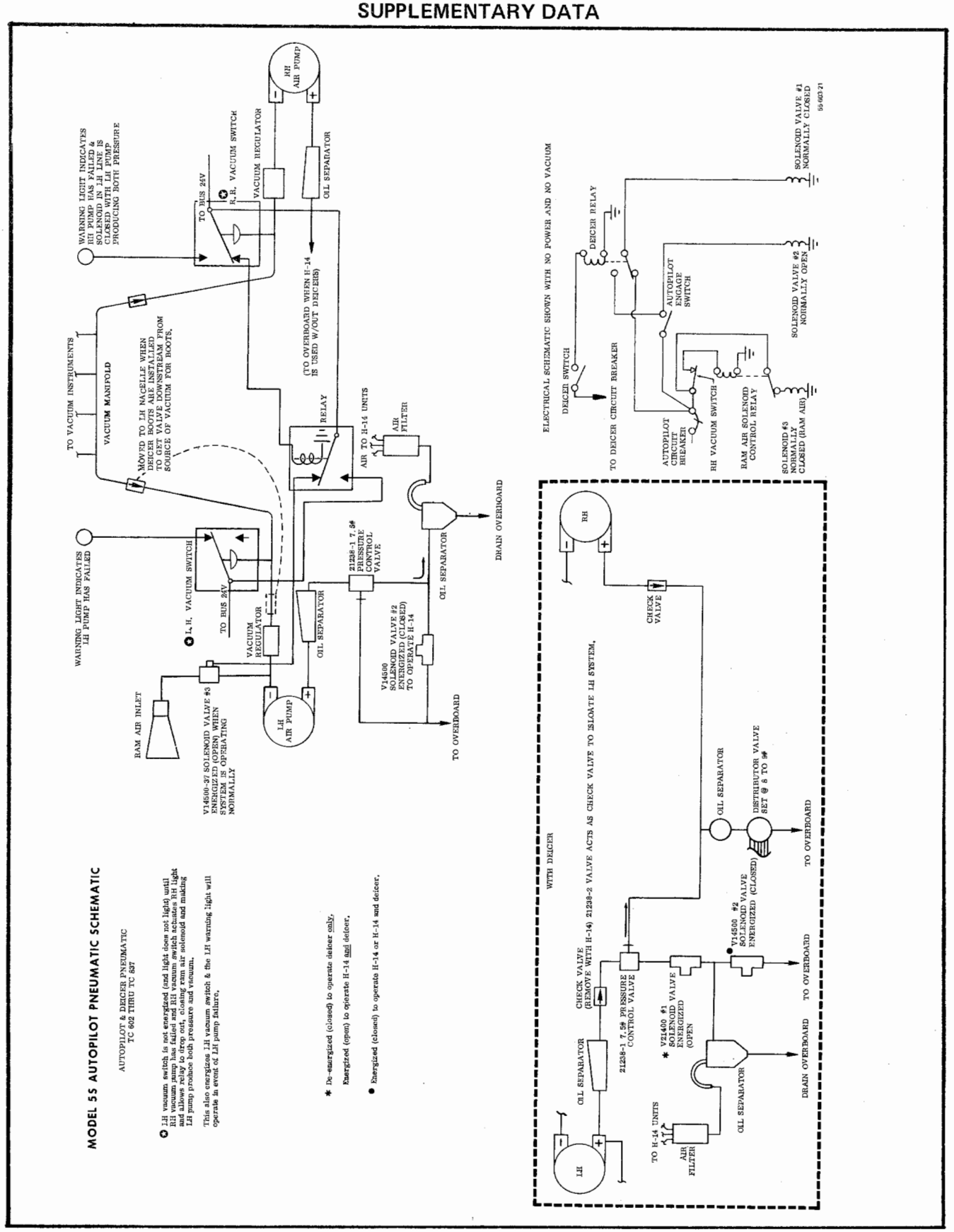
Pneumatic Diagram for Model 18 (Effective on BA720 and after)

Figure 8-4.



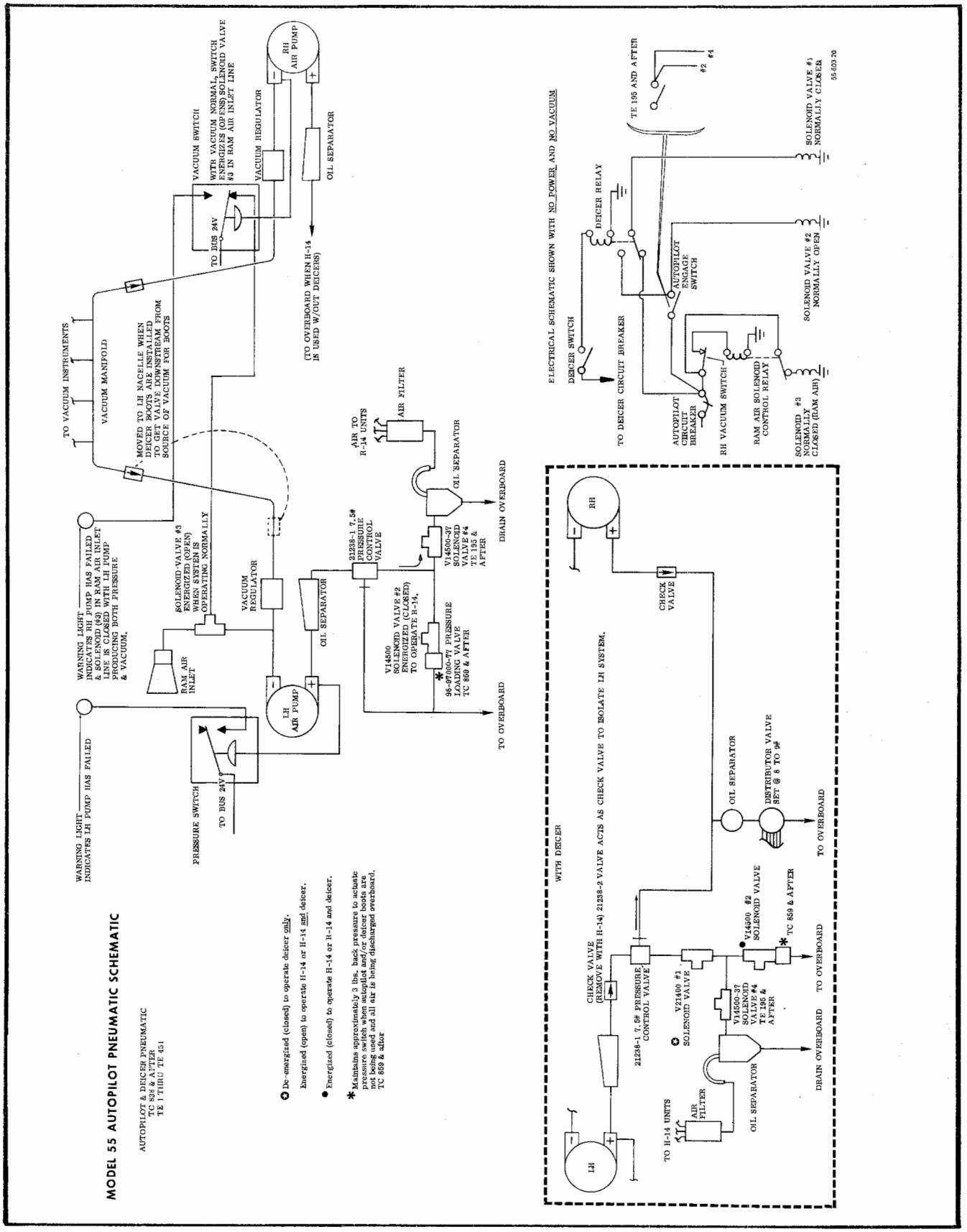
Pneumatic Diagram for Baron 55 (Effective on TC191 through TC601)

Figure 8-5.



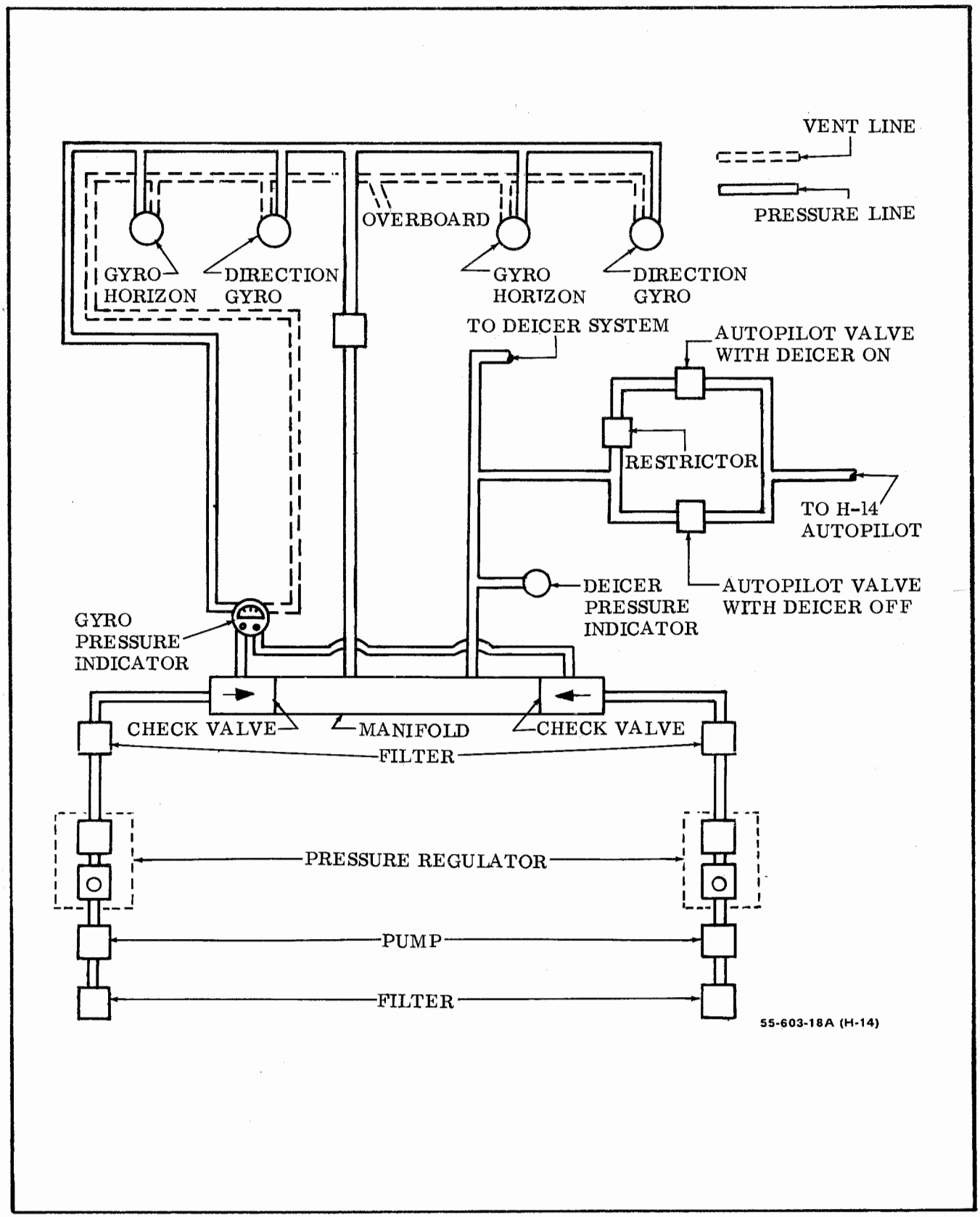
Pneumatic Diagram for Baron 55 (Effective on TC602 through TC837)

Figure 8-6.



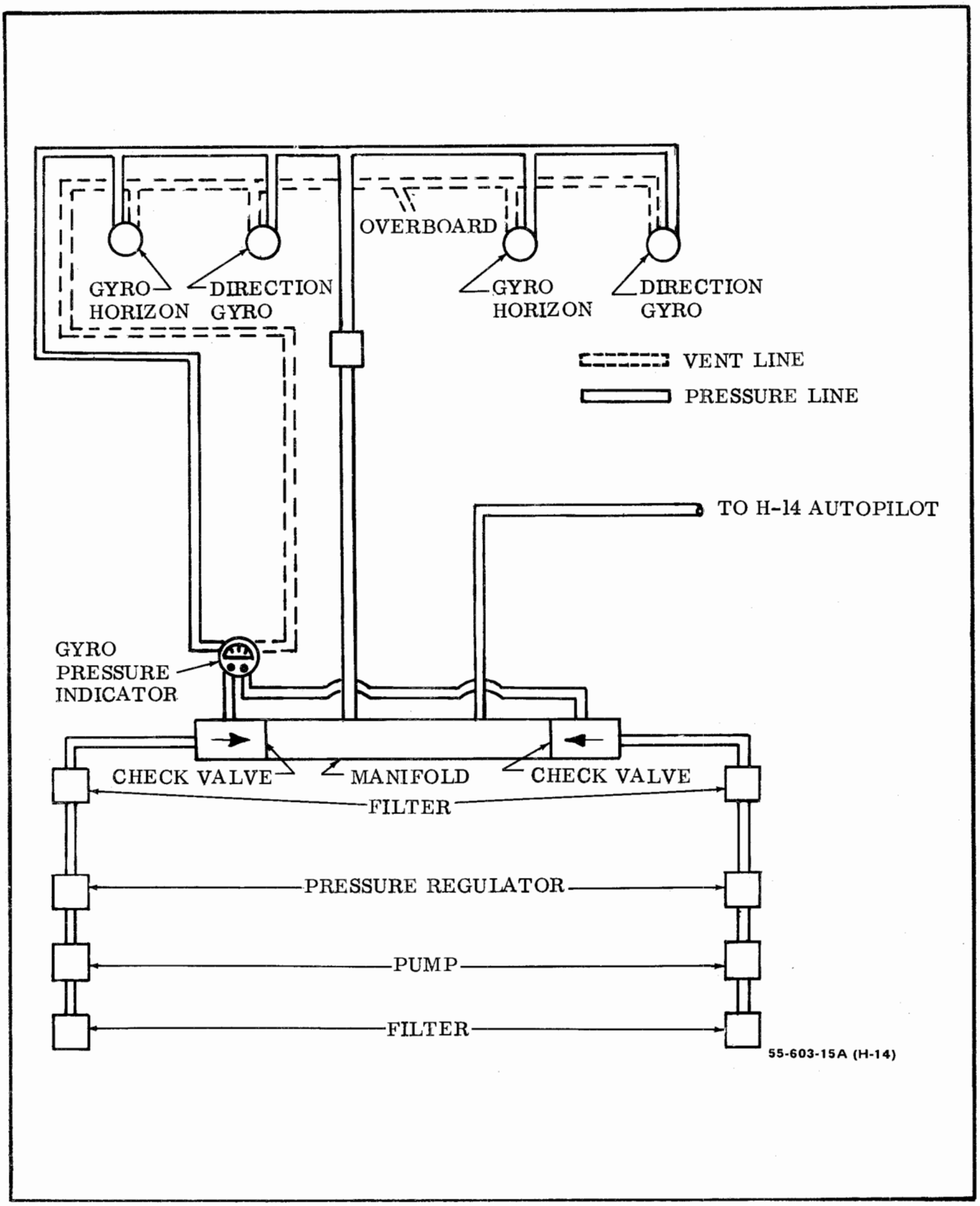
Pneumatic Diagram for Baron 55 (Effective on TC838 and after, TE1 through TE451)

Figure 8-7.



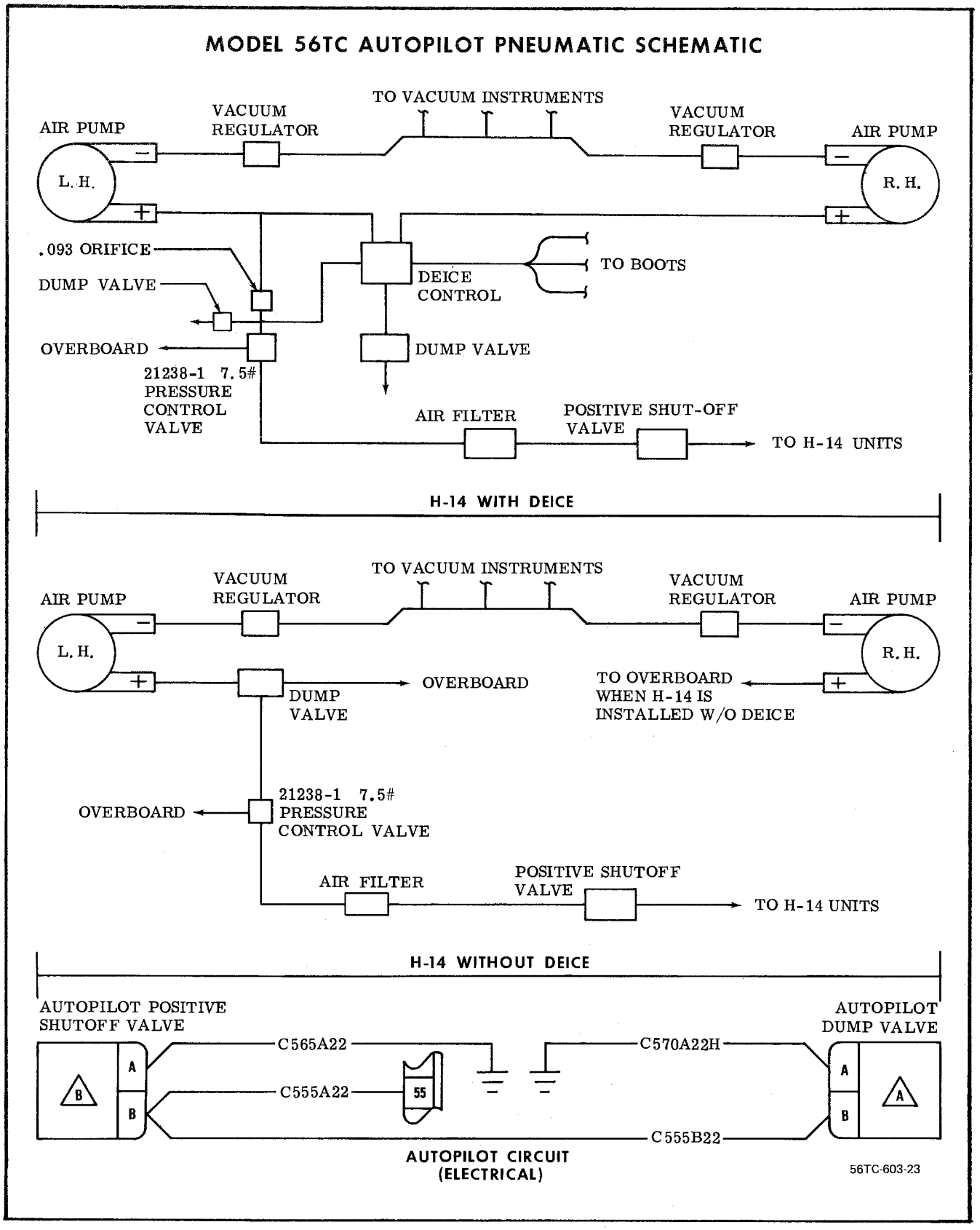
Pneumatic Diagram for Baron 55 with Deicer (Effective TE452 through TE767)

Figure 8-8.



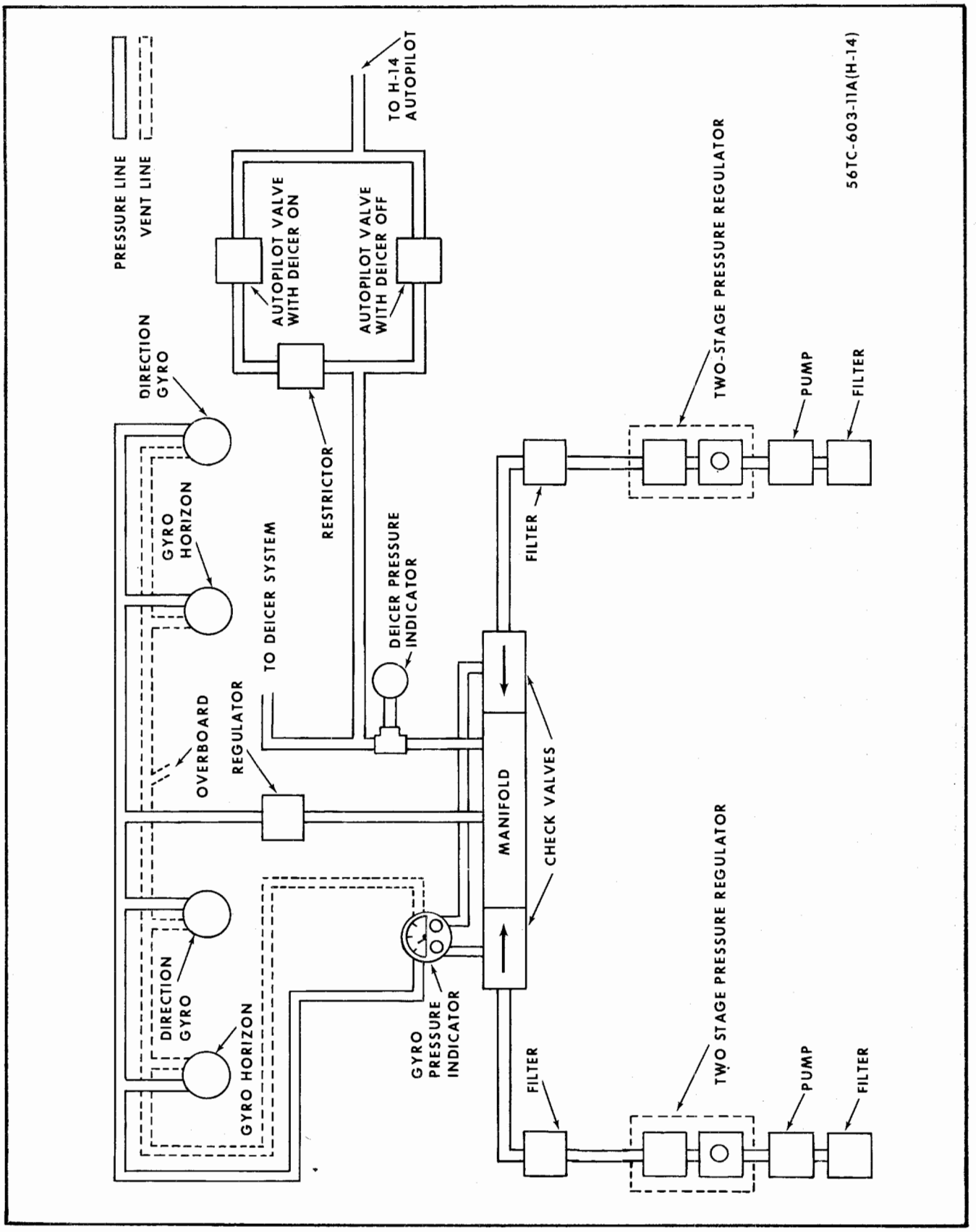
Pneumatic Diagram for Baron 55 without Deicer (Effective TE452 through TE767)

Figure 8-9.



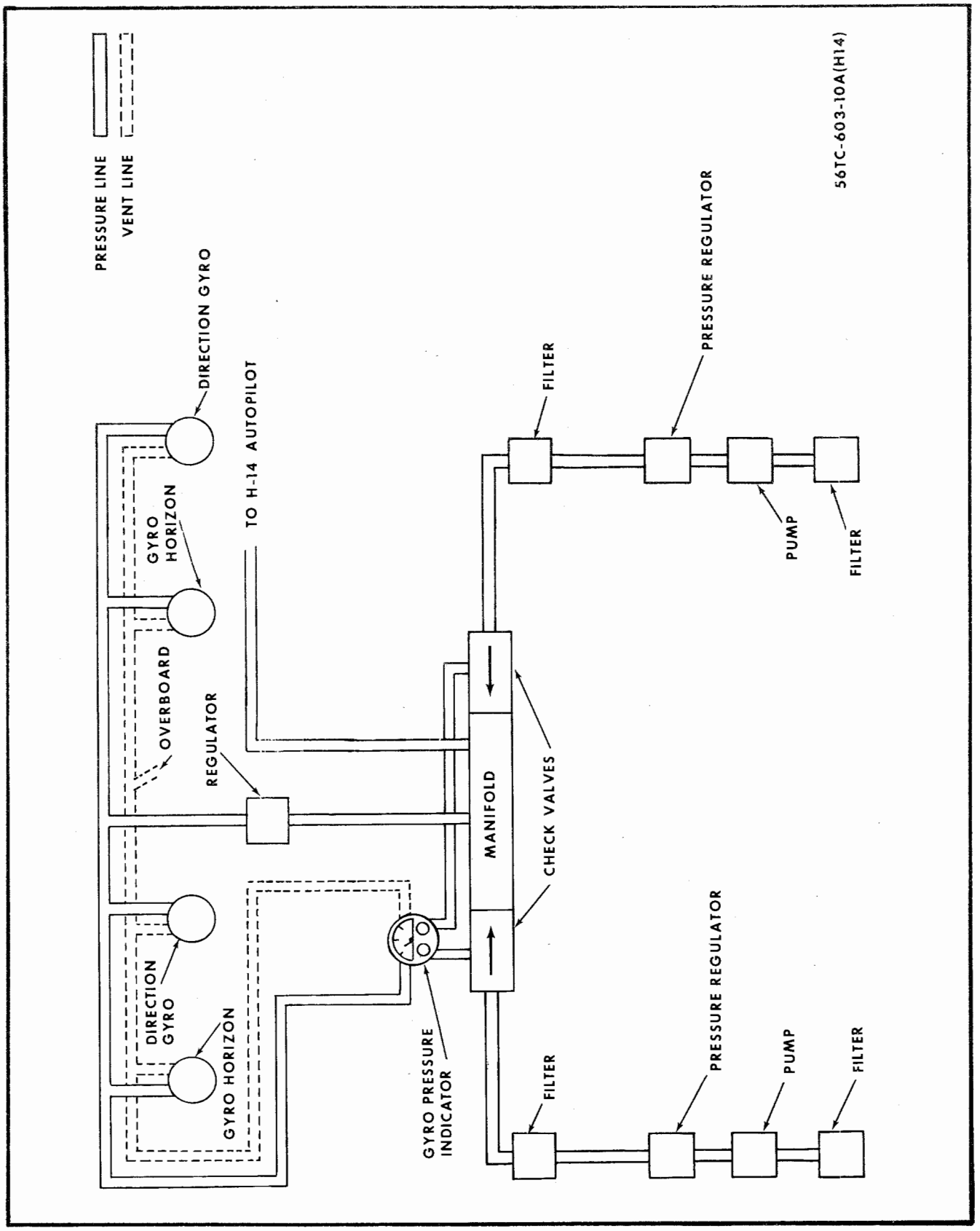
Pneumatic Diagram for 56TC Turbo Baron (Effective TG1 through TG51)

Figure 8-10.



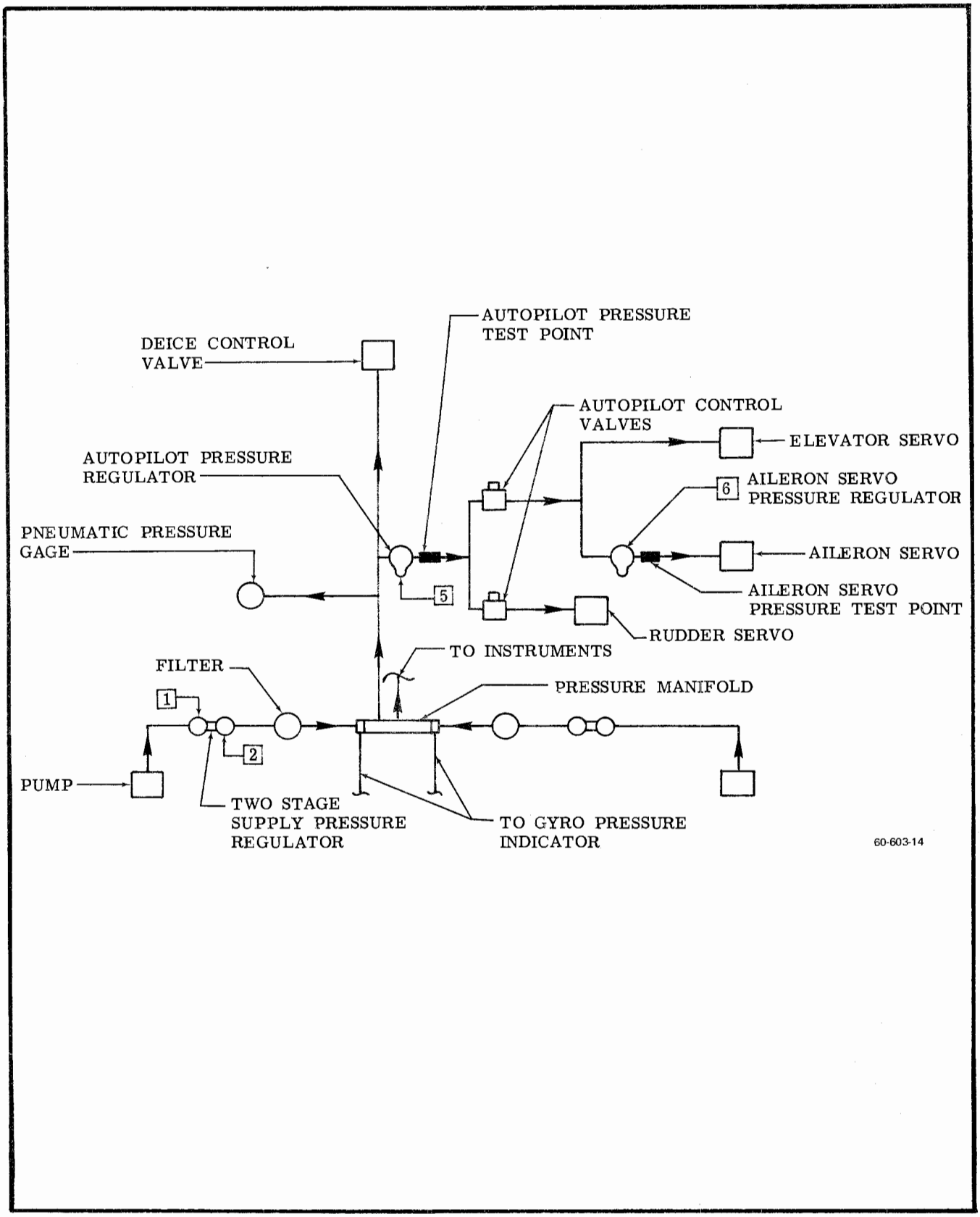
Pneumatic Diagram for 56TC Turbo Baron with Deicer (Effective TG52 and after)

Figure 8-11.



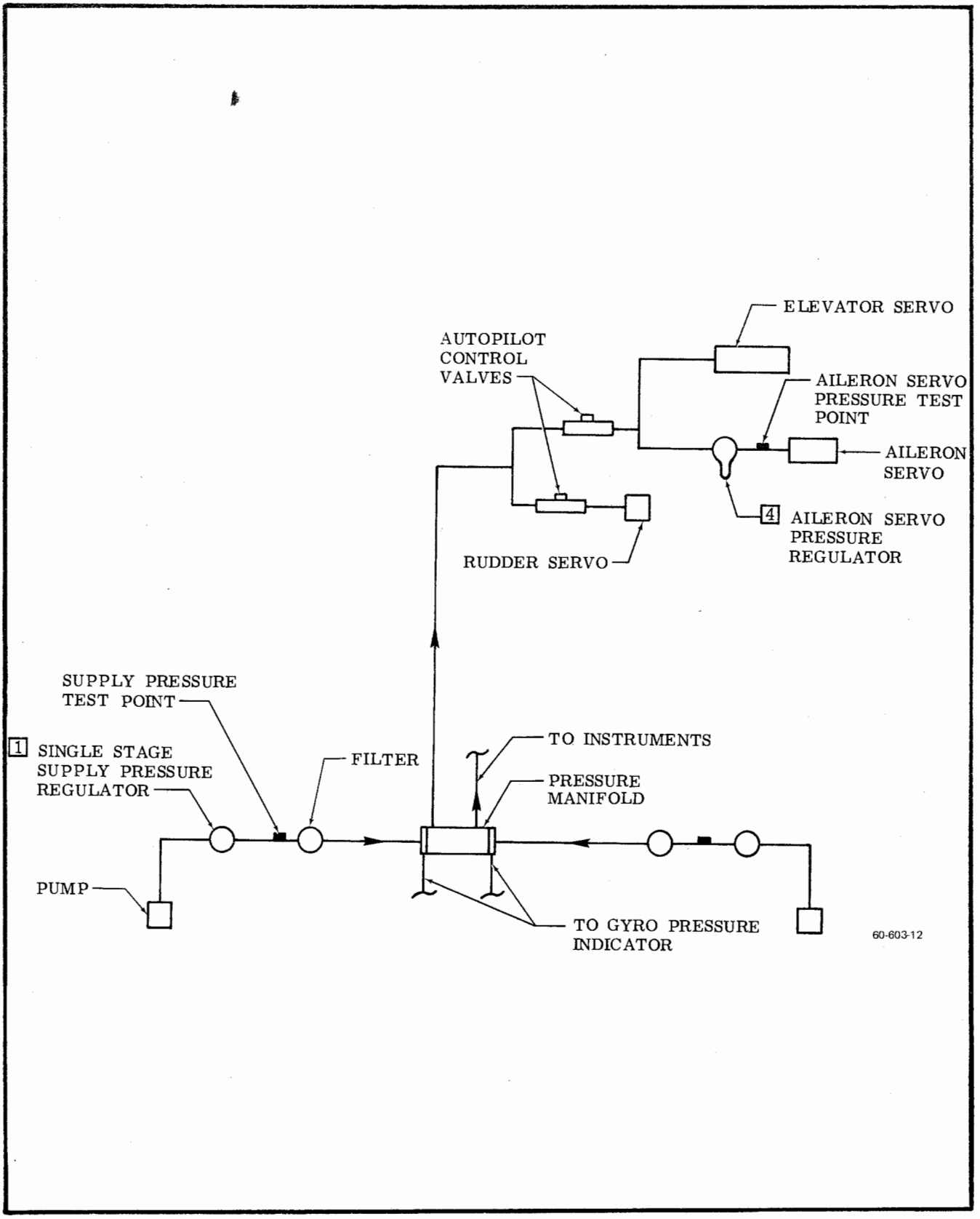
Pneumatic Diagram for 56TC Turbo Baron Without Deicer (Effective TG-52 and after)

Figure 8-12.



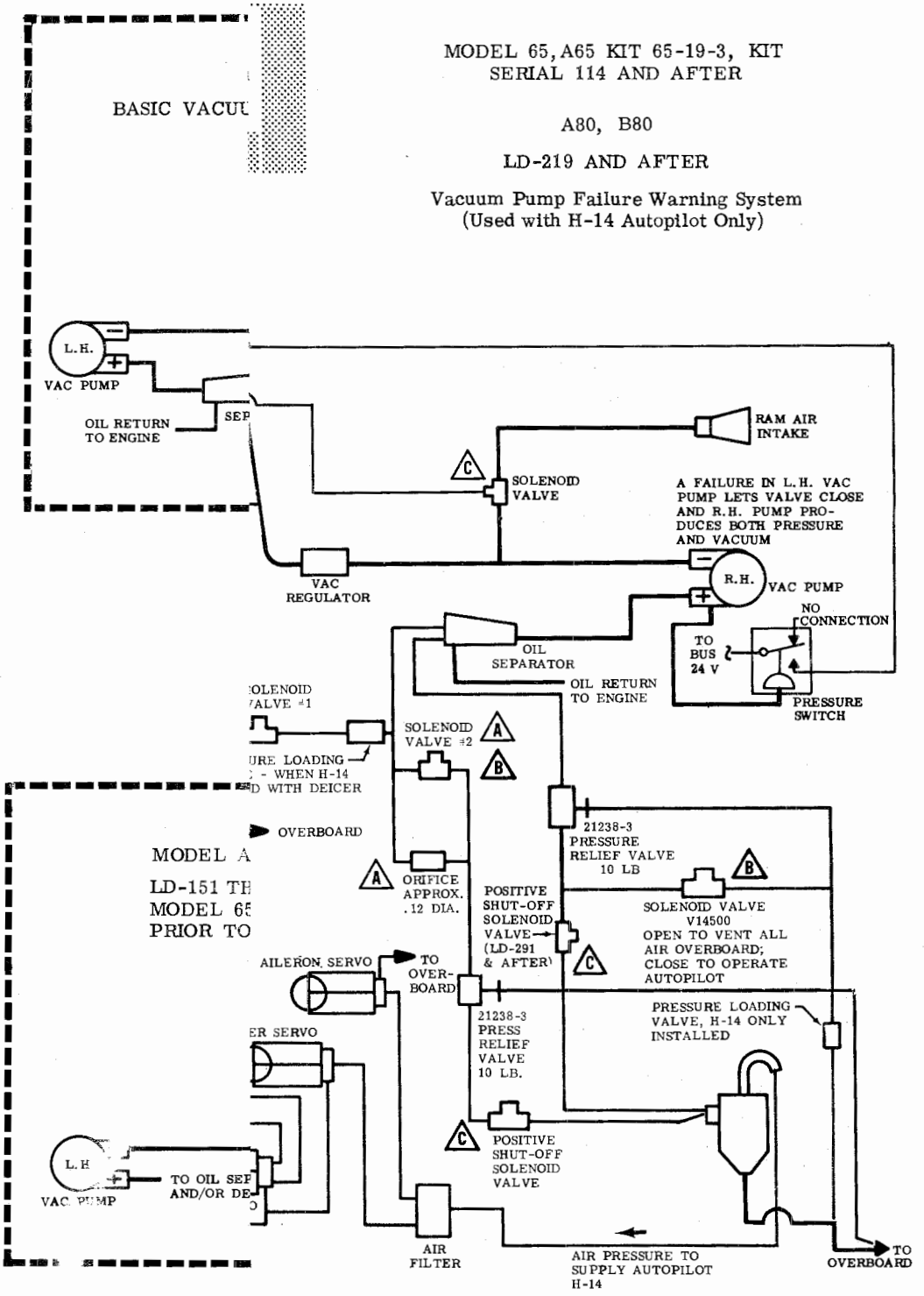
Pneumatic Diagram for Duke 60 With Deicer (Effective P1 and after)

Figure 8-13.



Pneumatic Diagram for Duke 60 Without Deicer (Effective P1 and after)

Figure 8-14.

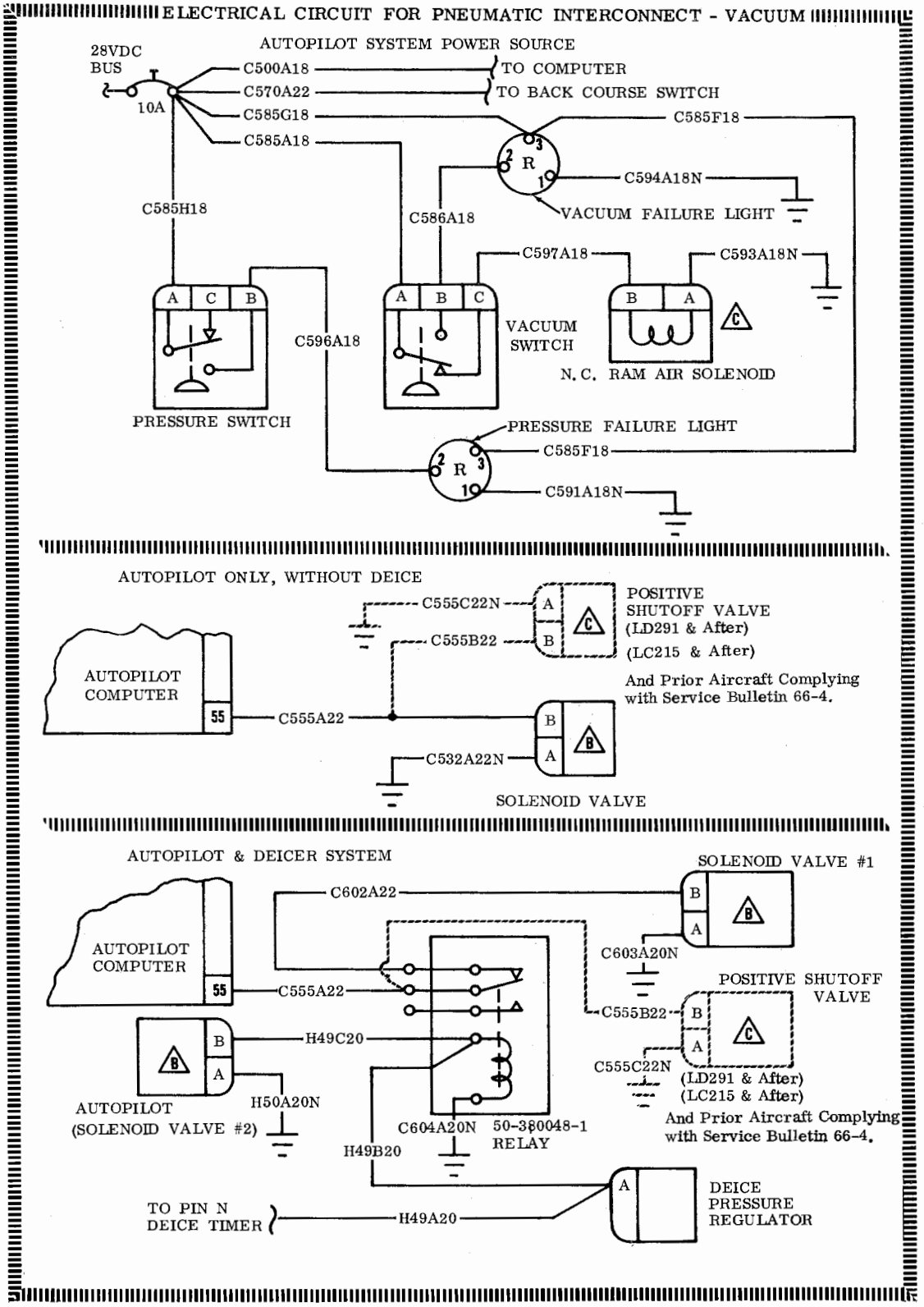


A Solenc
are in 500 VALVE, NORMALLY OPEN,
thru t RGIZED TO CLOSE.
While
Valve 500-37 VALVE, NORMALLY CLOSED,
flow o RGIZED TO OPEN.

80-603-3

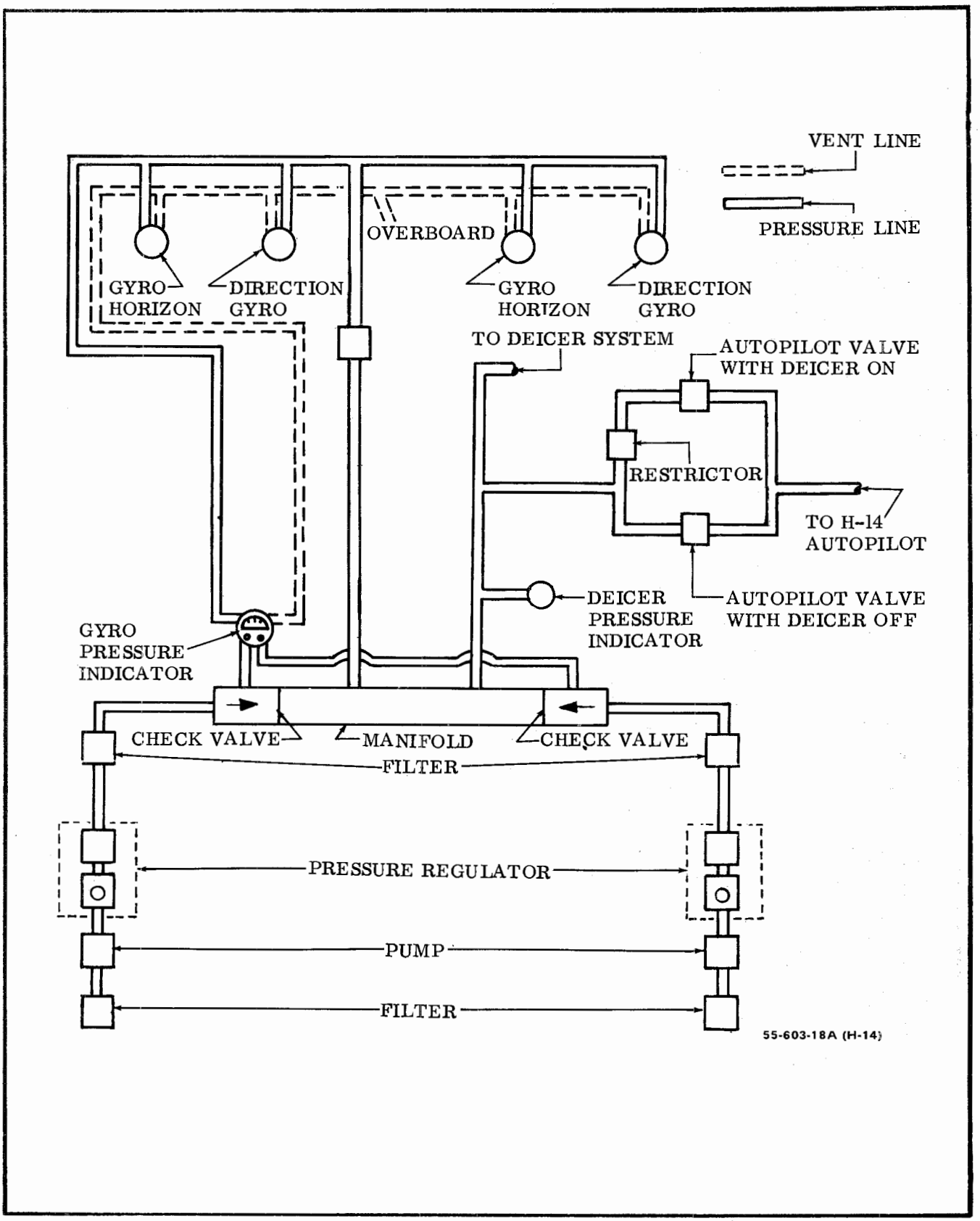
e LC1 through LC270, LD1 through LD361) (Sheet 1 of 2)

Figure 8-15.



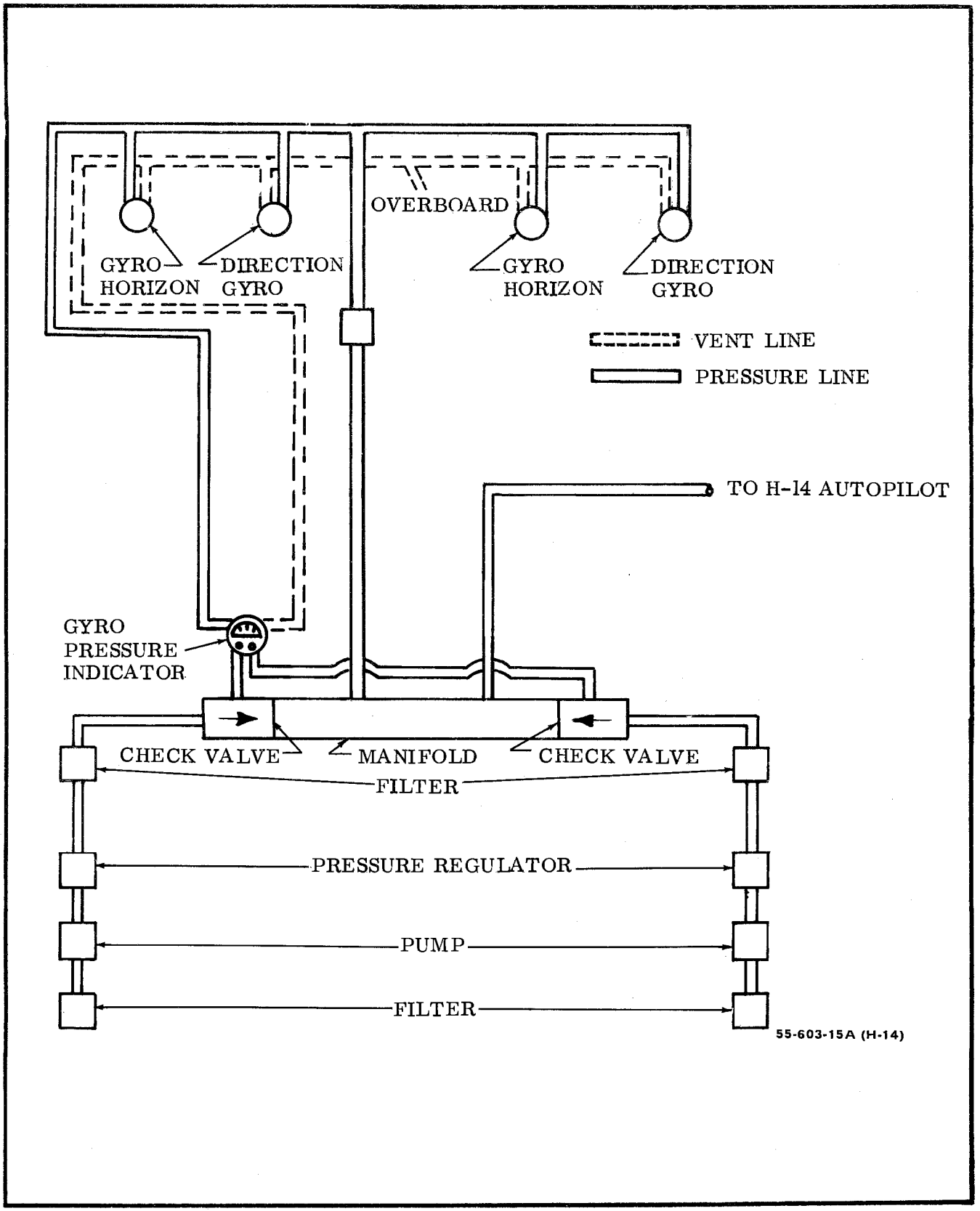
Pneumatic Diagram for Queen Air 65 and 80 (Effective LC1 through LC270, LD1 through LD361) (Sheet 2 of 2)

Figure 8-15.



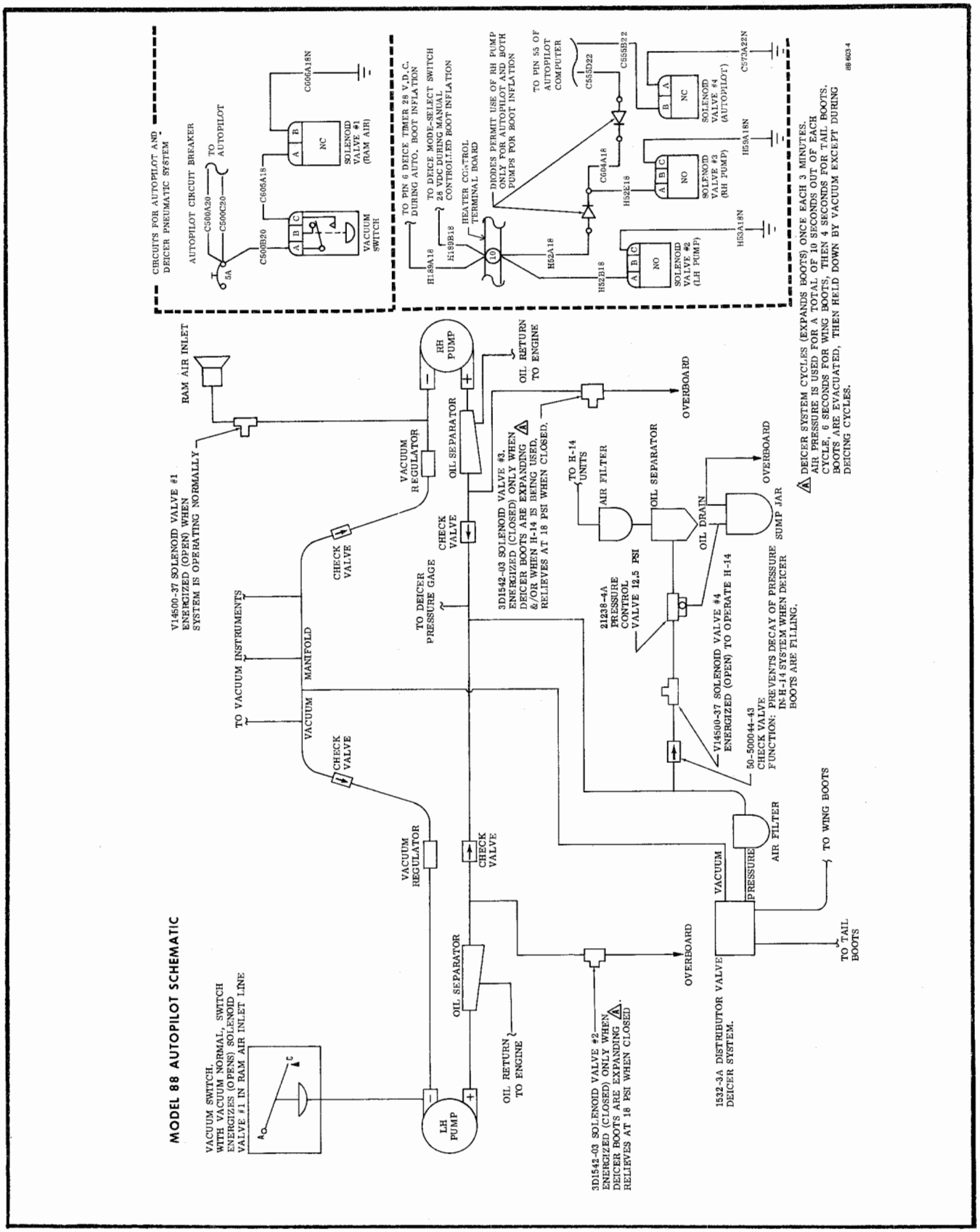
Pneumatic Diagram with Deicer for Queen Air 65, 70 and 80 (Effective LB1 and after, LC271 and after, LD362 and after)

Figure 8-16.



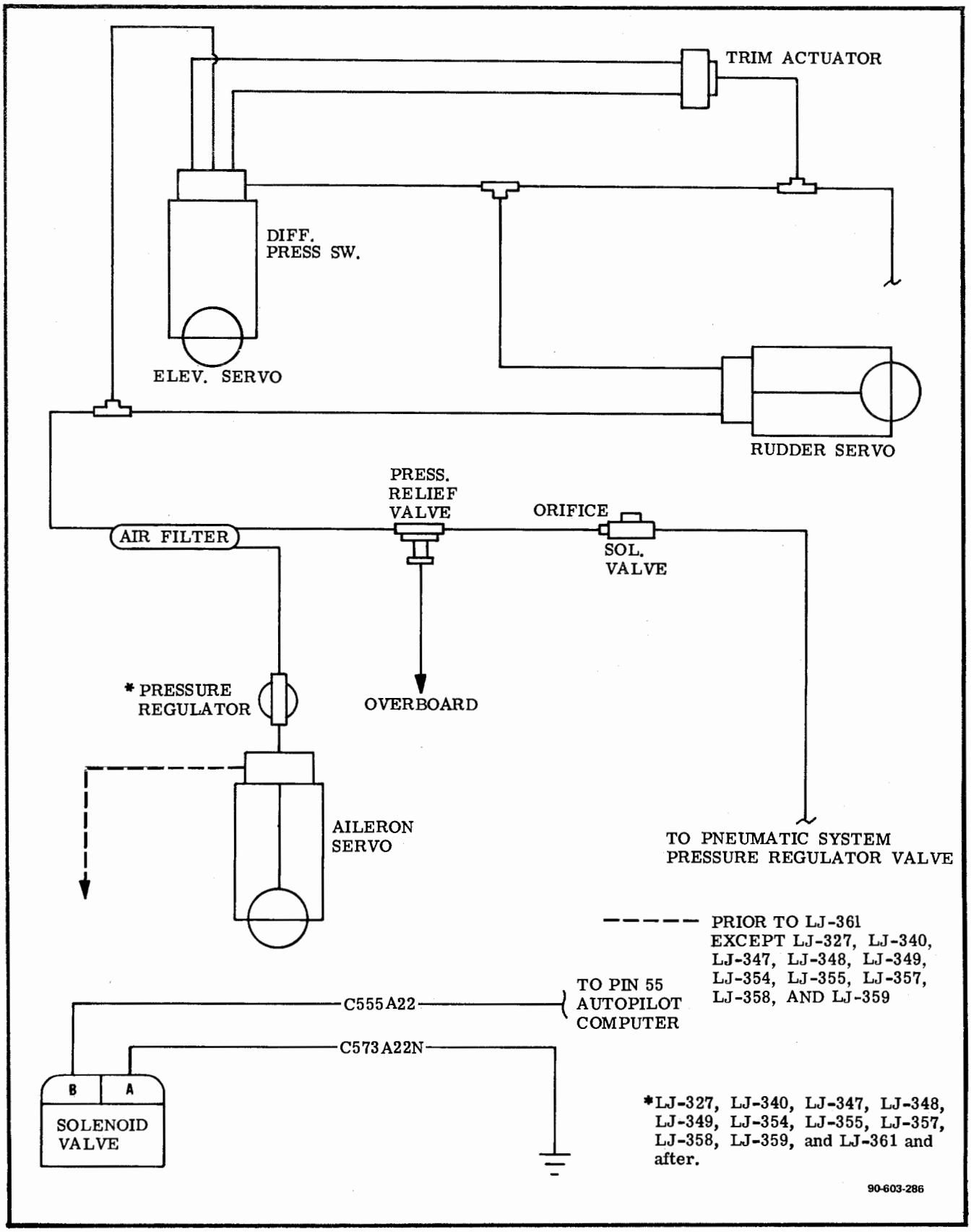
Pneumatic Diagram Without Deicer for Queen Air 65, 70 and 80 (Effective LB1 and after, LC271 and after, LD362 and after)

Figure 8-17.



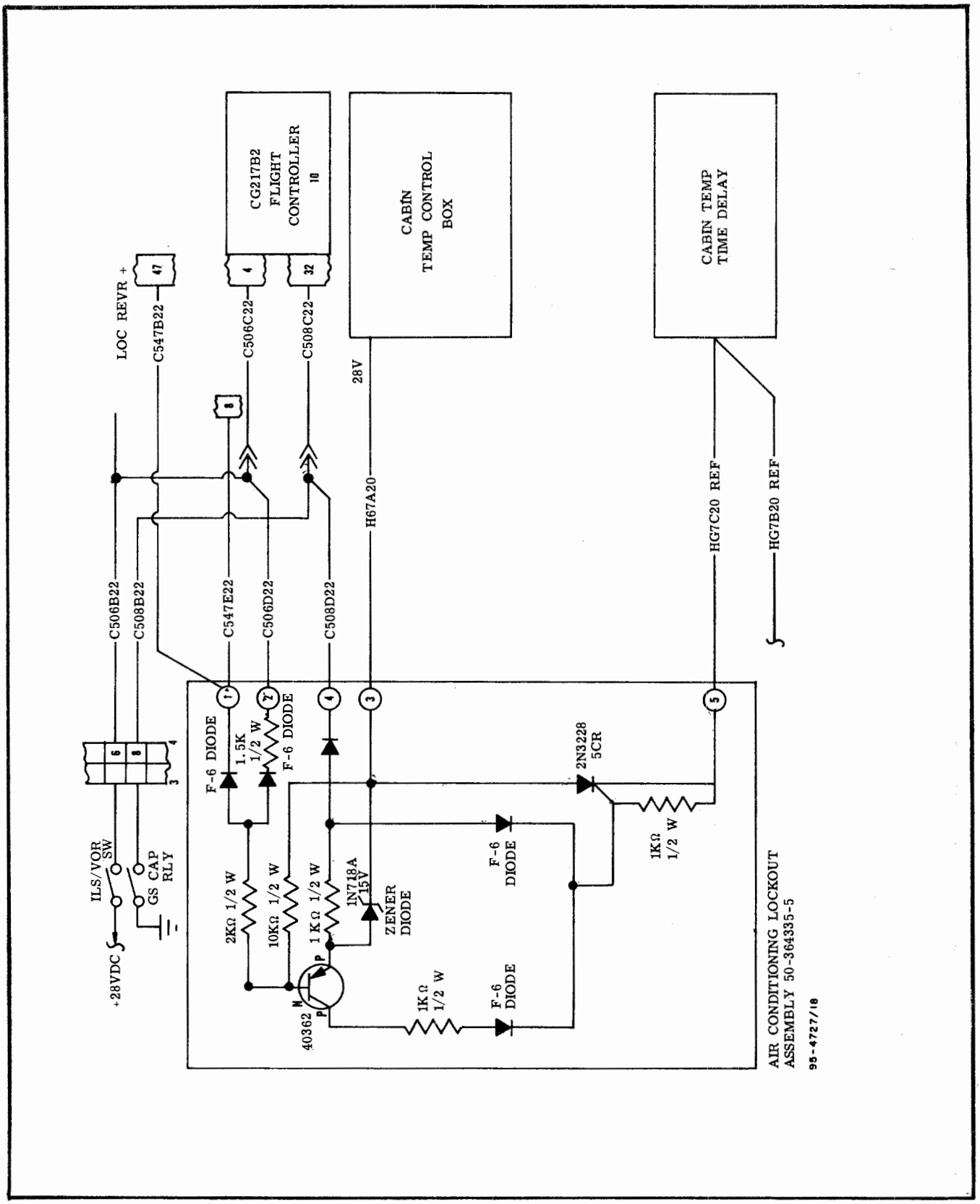
Pneumatic Diagram for Queen Air 88

Figure 8-18.



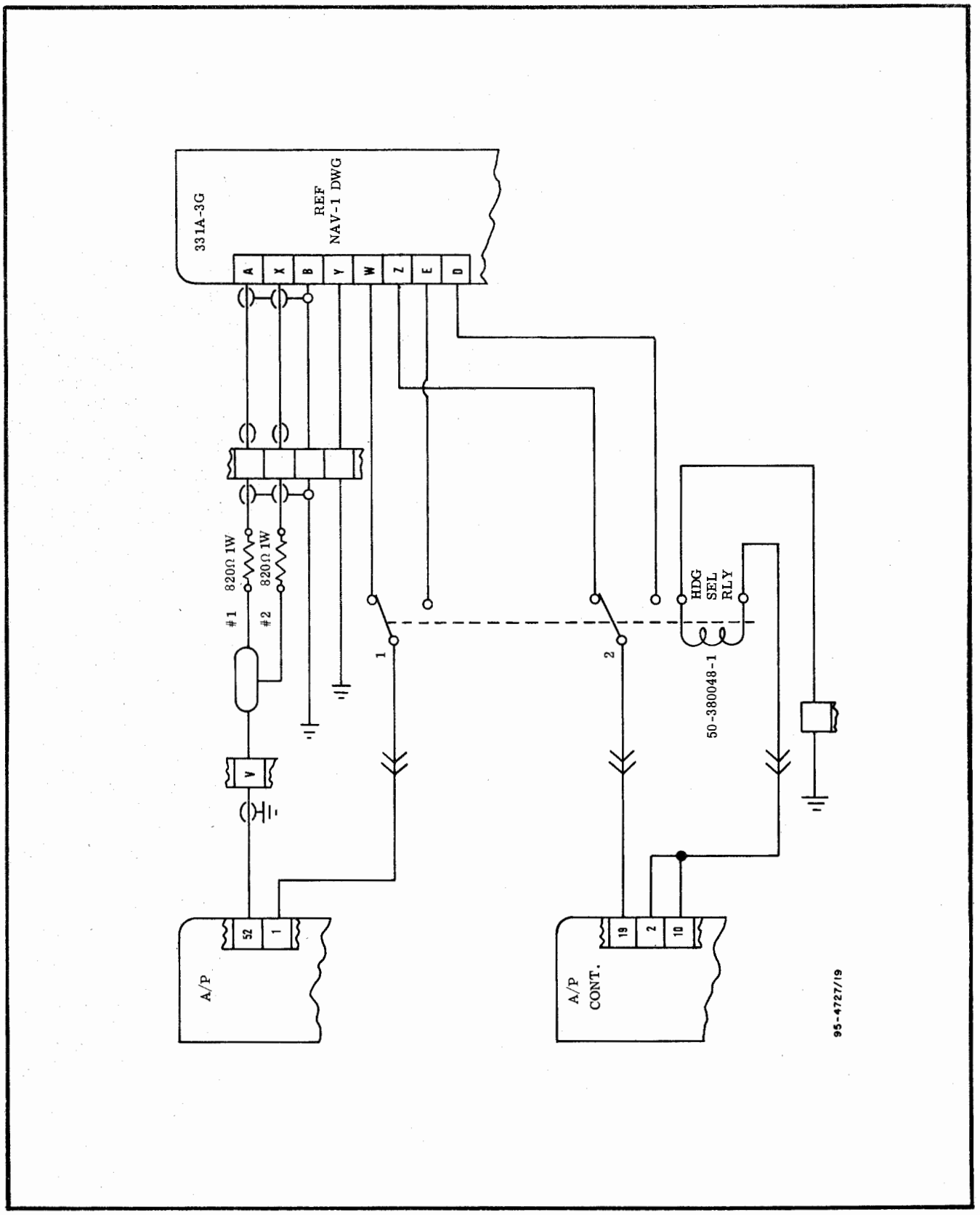
Pneumatic Diagram for King Air's 90, A90, B90 and C90

Figure 8-19.



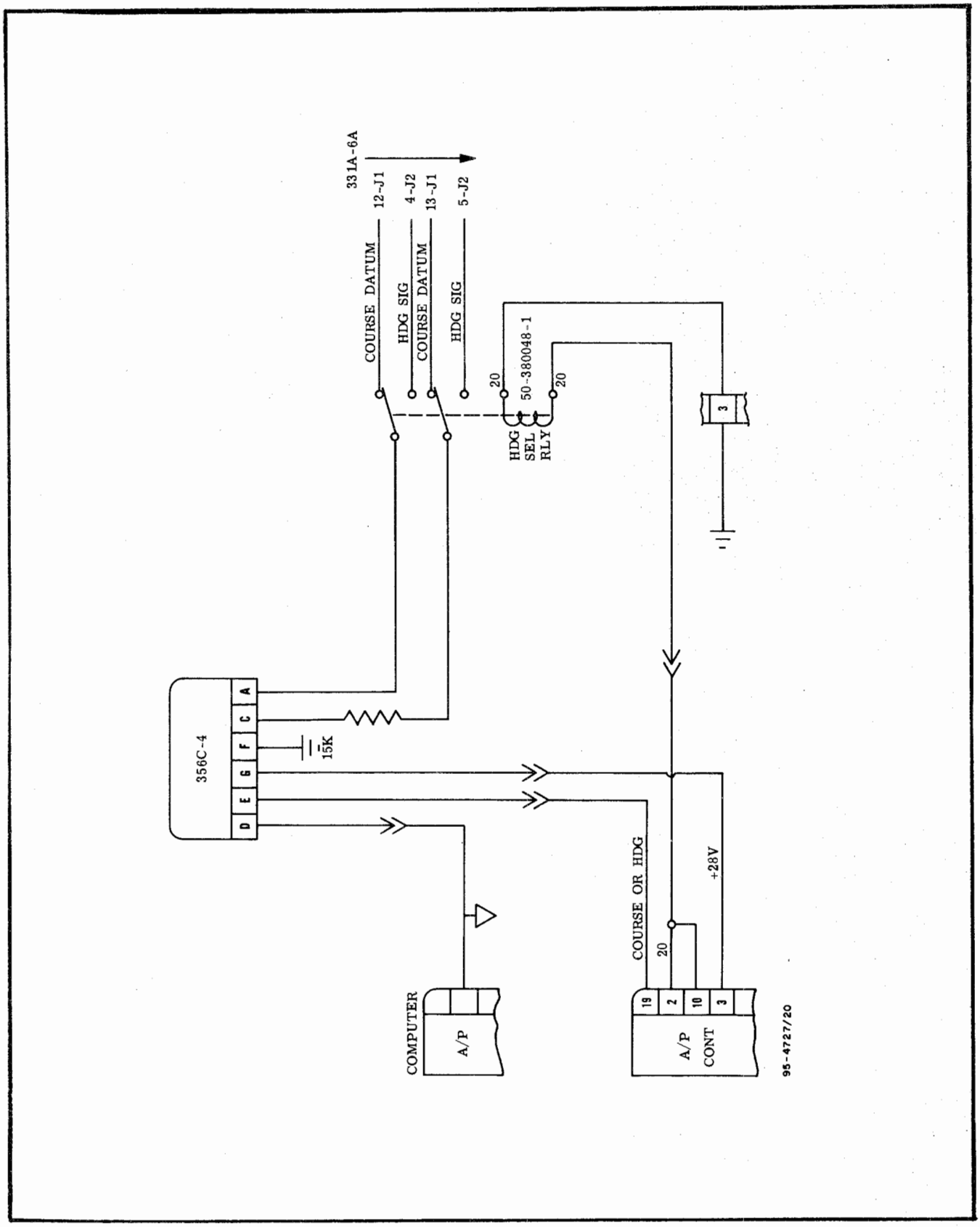
Air Conditioning Lock-Out Diagram for Queen Air Model 88 and King Air Model 90, A90 and B90

Figure 8-20



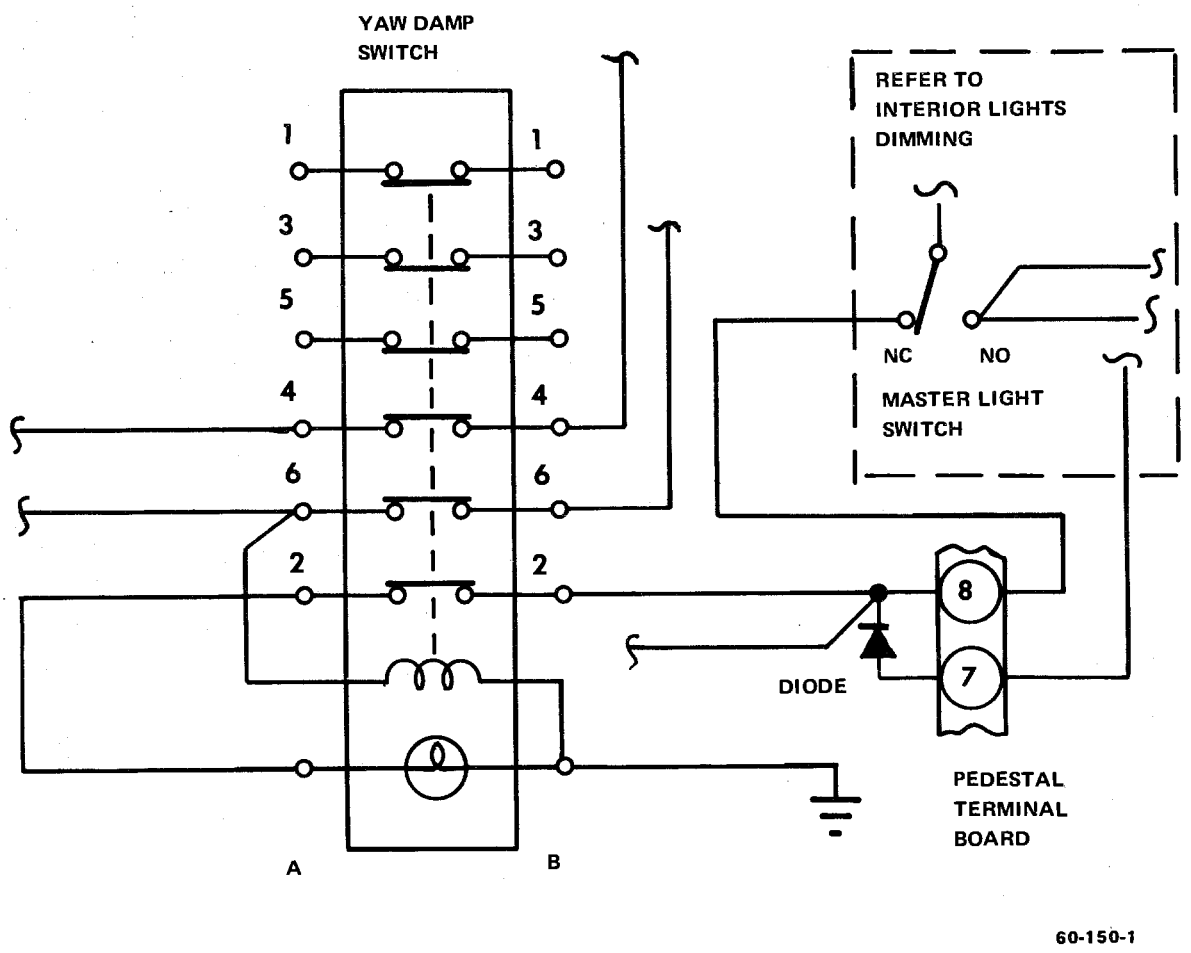
Interconnecting PN101 Flight Director With Autopilot Heading Selector

Figure 8-21.



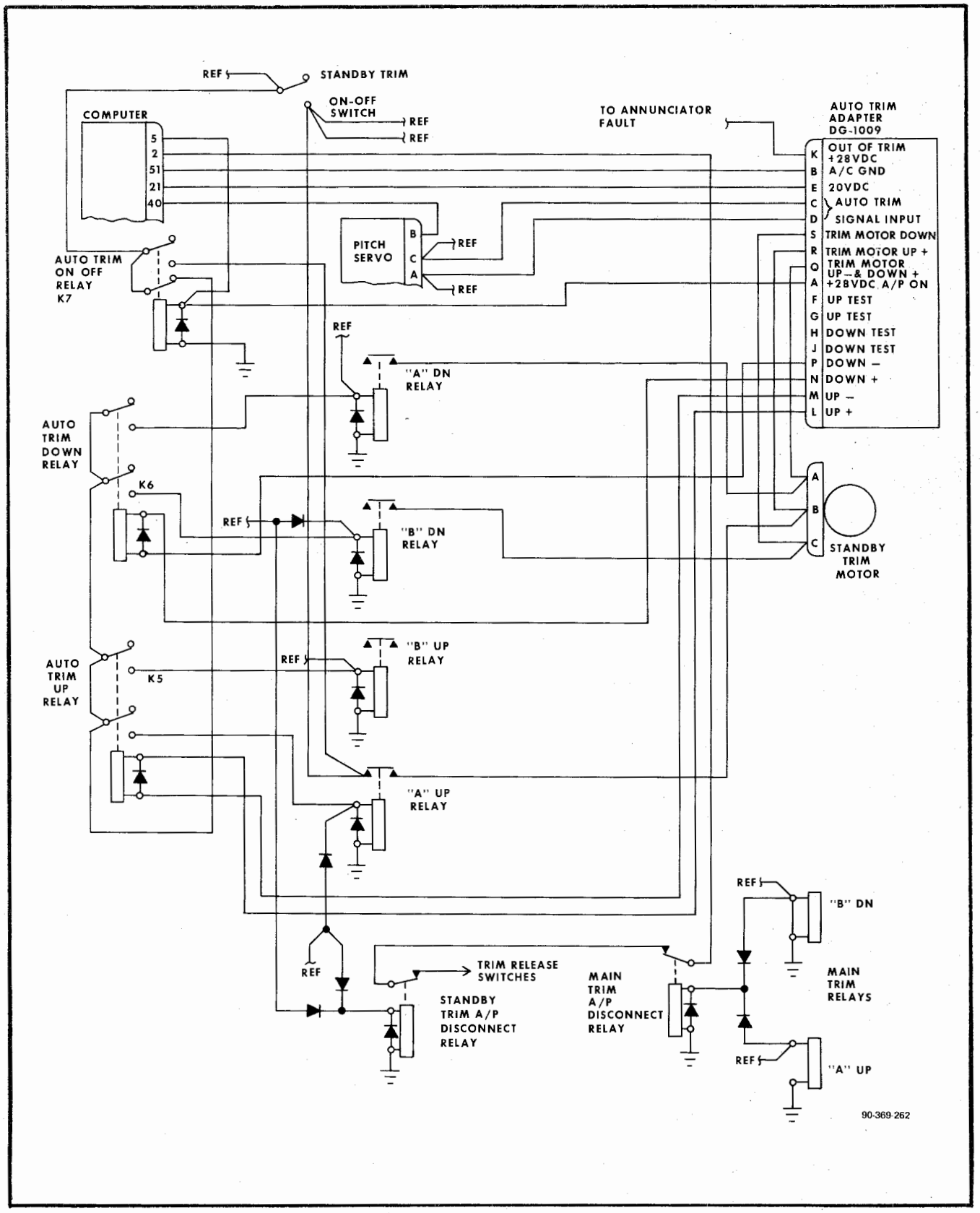
Interconnecting Flight Director and Autopilot With 356C-4 Audio Amplifier

Figure 8-22.



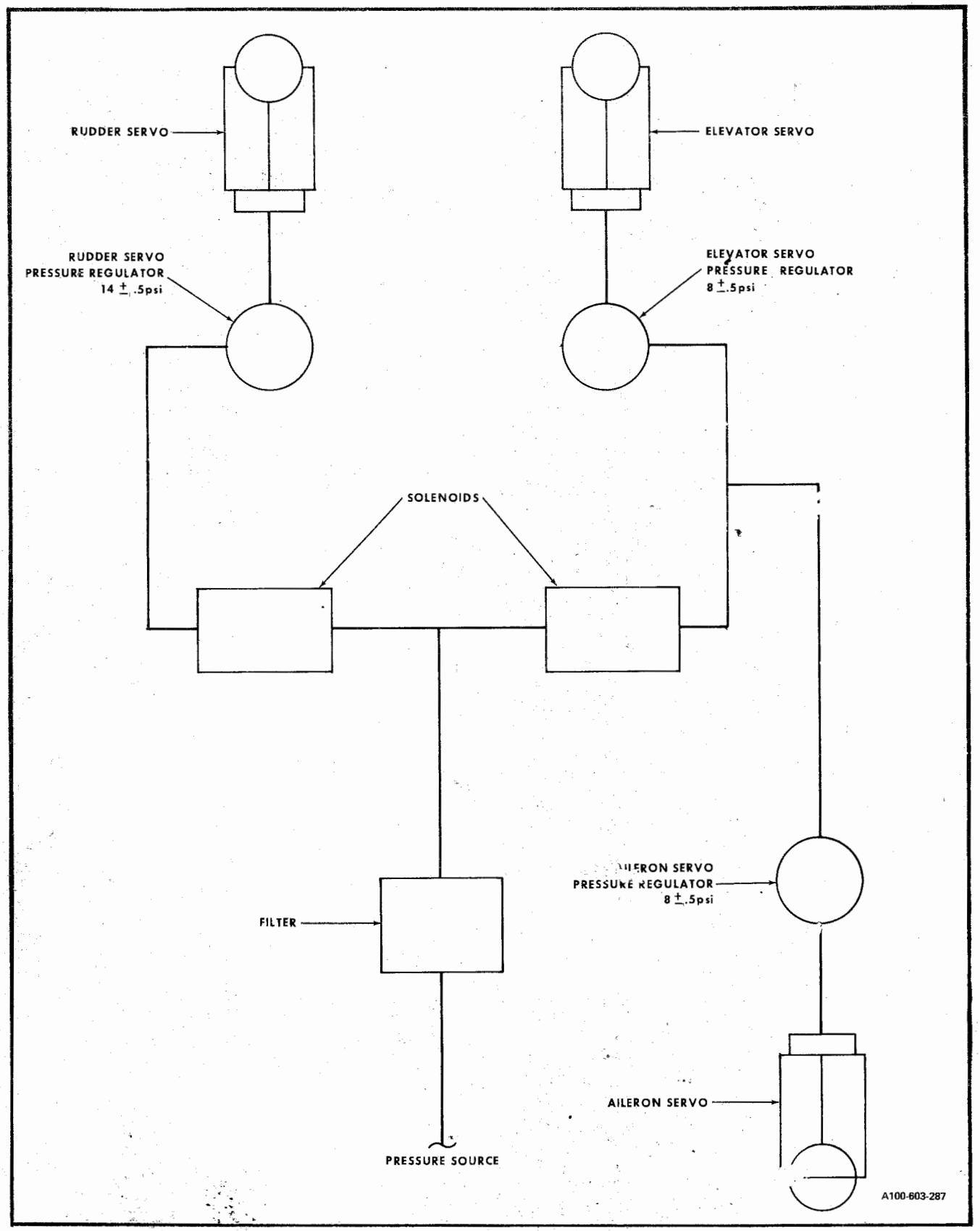
Yaw Dampener Connector for Duke Model 60

Figure 8-23.



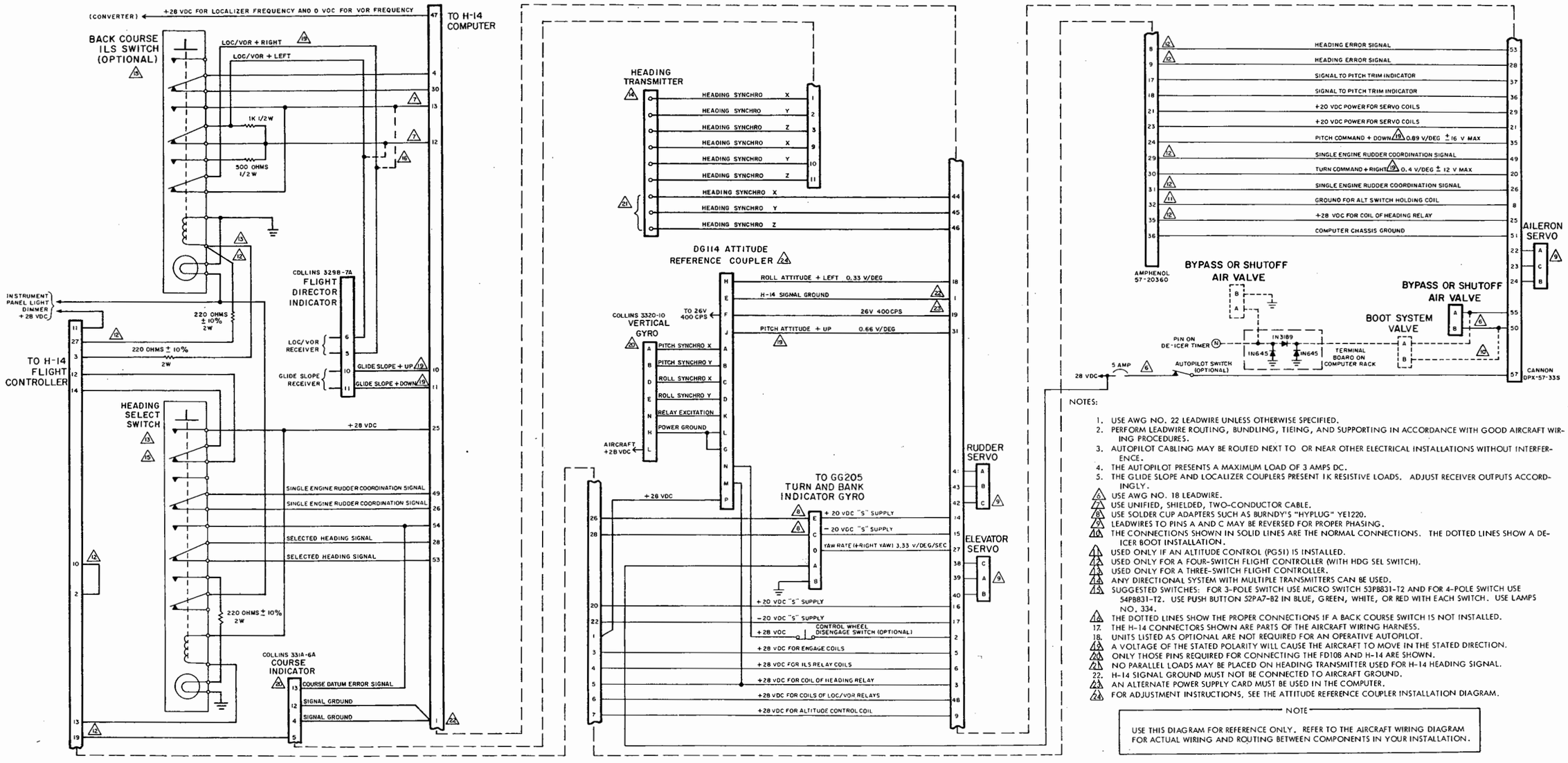
Auto Trim Connection for Model 100

Figure 8-24.



Pneumatic Diagram for King Air Models 100 and A100

Figure 8-25.



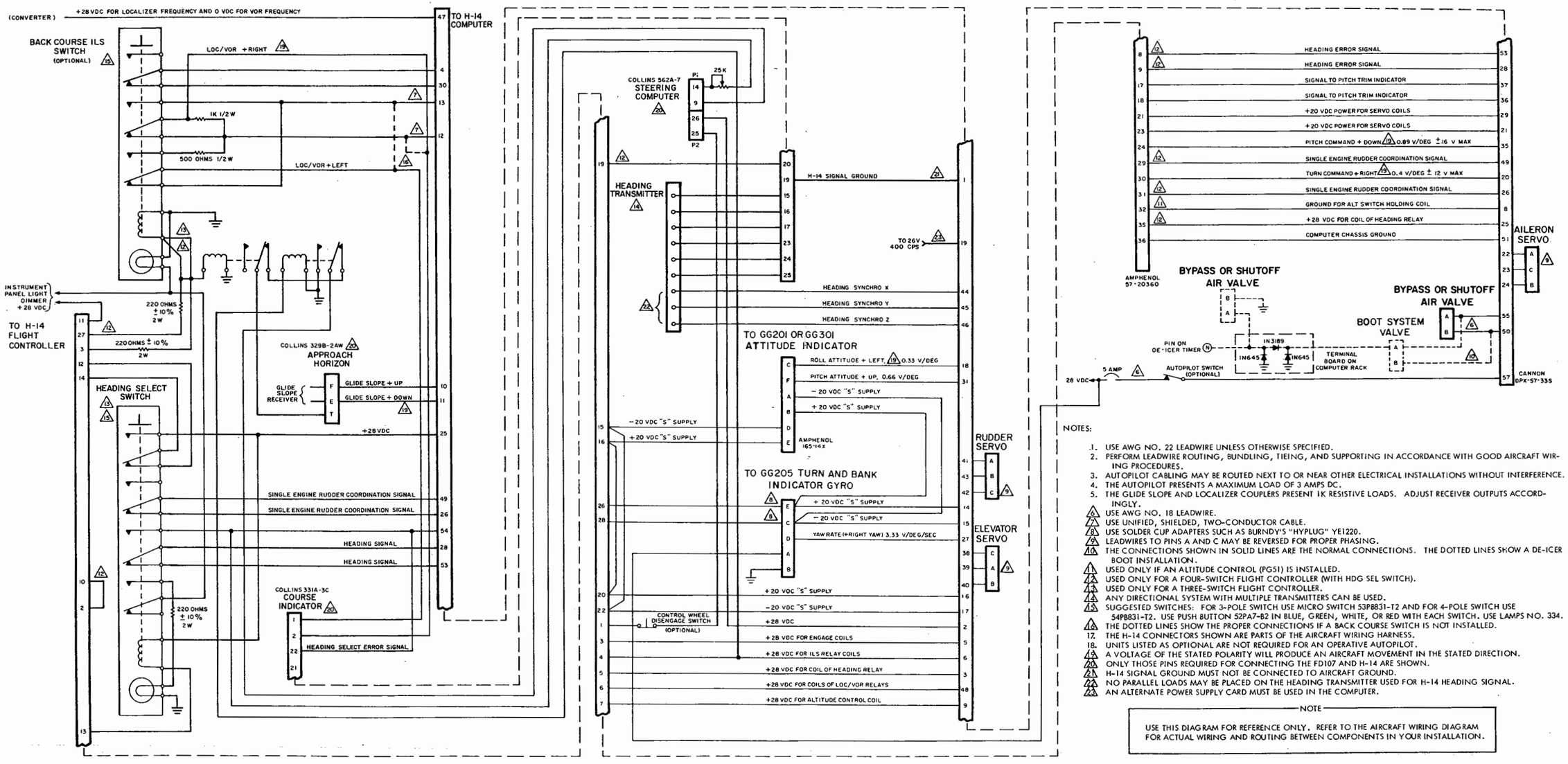
NOTES:

1. USE AWG NO. 22 LEADWIRE UNLESS OTHERWISE SPECIFIED.
2. PERFORM LEADWIRE ROUTING, BUNDLING, TIEING, AND SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.
3. AUTOPILOT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.
4. THE AUTOPILOT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.
5. THE GLIDE SLOPE AND LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJUST RECEIVER OUTPUTS ACCORDINGLY.
6. USE AWG NO. 18 LEADWIRE.
7. USE UNIFIED, SHIELDED, TWO-CONDUCTOR CABLE.
8. USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S "HYPLUG" YE1220.
9. LEADWIRES TO PINS A AND C MAY BE REVERSED FOR PROPER PHASING.
10. THE CONNECTIONS SHOWN IN SOLID LINES ARE THE NORMAL CONNECTIONS. THE DOTTED LINES SHOW A DE-ICER BOOT INSTALLATION.
11. USED ONLY IF AN ALTITUDE CONTROL (PG51) IS INSTALLED.
12. USED ONLY FOR A FOUR-SWITCH FLIGHT CONTROLLER (WITH HDG SEL SWITCH).
13. USED ONLY FOR A THREE-SWITCH FLIGHT CONTROLLER.
14. ANY DIRECTIONAL SYSTEM WITH MULTIPLE TRANSMITTERS CAN BE USED.
15. SUGGESTED SWITCHES: FOR 3-POLE SWITCH USE MICRO SWITCH 53PB831-T2 AND FOR 4-POLE SWITCH USE 54PB831-T2. USE PUSH BUTTON 52PA7-B2 IN BLUE, GREEN, WHITE, OR RED WITH EACH SWITCH. USE LAMPS NO. 334.
16. THE DOTTED LINES SHOW THE PROPER CONNECTIONS IF A BACK COURSE SWITCH IS NOT INSTALLED.
17. THE H-14 CONNECTORS SHOWN ARE PARTS OF THE AIRCRAFT WIRING HARNESS.
18. UNITS LISTED AS OPTIONAL ARE NOT REQUIRED FOR AN OPERATIVE AUTOPILOT.
19. A VOLTAGE OF THE STATED POLARITY WILL CAUSE THE AIRCRAFT TO MOVE IN THE STATED DIRECTION.
20. ONLY THOSE PINS REQUIRED FOR CONNECTING THE FD108 AND H-14 ARE SHOWN.
21. NO PARALLEL LOADS MAY BE PLACED ON HEADING TRANSMITTER USED FOR H-14 HEADING SIGNAL.
22. H-14 SIGNAL GROUND MUST NOT BE CONNECTED TO AIRCRAFT GROUND.
23. AN ALTERNATE POWER SUPPLY CARD MUST BE USED IN THE COMPUTER.
24. FOR ADJUSTMENT INSTRUCTIONS, SEE THE ATTITUDE REFERENCE COUPLER INSTALLATION DIAGRAM.

NOTE

USE THIS DIAGRAM FOR REFERENCE ONLY. REFER TO THE AIRCRAFT WIRING DIAGRAM FOR ACTUAL WIRING AND ROUTING BETWEEN COMPONENTS IN YOUR INSTALLATION.

FIGURE 7-25 COLLINS FD108 FLIGHT DIRECTOR SYSTEM AND BACK COURSE SWITCH - COUPLING DIAGRAM



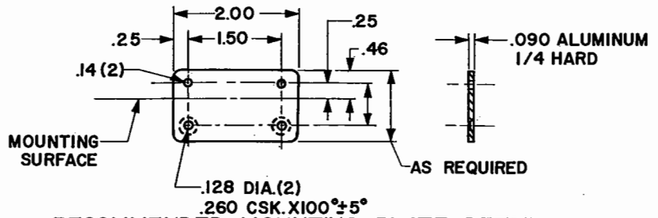
NOTES:

1. USE AWG NO. 22 LEADWIRE UNLESS OTHERWISE SPECIFIED.
2. PERFORM LEADWIRE ROUTING, BUNDLING, TIEING, AND SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.
3. AUTOPILOT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.
4. THE AUTOPILOT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.
5. THE GLIDE SLOPE AND LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJUST RECEIVER OUTPUTS ACCORDINGLY.
6. USE AWG NO. 18 LEADWIRE.
7. USE UNIFIED, SHIELDED, TWO-CONDUCTOR CABLE.
8. USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S "HYPLUG" YE1220.
9. LEADWIRES TO PINS A AND C MAY BE REVERSED FOR PROPER PHASING.
10. THE CONNECTIONS SHOWN IN SOLID LINES ARE THE NORMAL CONNECTIONS. THE DOTTED LINES SHOW A DE-ICER BOOT INSTALLATION.
11. USED ONLY IF AN ALTITUDE CONTROL (PG51) IS INSTALLED.
12. USED ONLY FOR A FOUR-SWITCH FLIGHT CONTROLLER (WITH HDG SEL SWITCH).
13. USED ONLY FOR A THREE-SWITCH FLIGHT CONTROLLER.
14. ANY DIRECTIONAL SYSTEM WITH MULTIPLE TRANSMITTERS CAN BE USED.
15. SUGGESTED SWITCHES: FOR 3-POLE SWITCH USE MICRO SWITCH 53PB831-T2 AND FOR 4-POLE SWITCH USE 54PB831-T2. USE PUSH BUTTON 52PA7-B2 IN BLUE, GREEN, WHITE, OR RED WITH EACH SWITCH. USE LAMPS NO. 334.
16. THE DOTTED LINES SHOW THE PROPER CONNECTIONS IF A BACK COURSE SWITCH IS NOT INSTALLED.
17. THE H-14 CONNECTORS SHOWN ARE PARTS OF THE AIRCRAFT WIRING HARNESS.
18. UNITS LISTED AS OPTIONAL ARE NOT REQUIRED FOR AN OPERATIVE AUTOPILOT.
19. A VOLTAGE OF THE STATED POLARITY WILL PRODUCE AN AIRCRAFT MOVEMENT IN THE STATED DIRECTION.
20. ONLY THOSE PINS REQUIRED FOR CONNECTING THE FD107 AND H-14 ARE SHOWN.
21. H-14 SIGNAL GROUND MUST NOT BE CONNECTED TO AIRCRAFT GROUND.
22. NO PARALLEL LOADS MAY BE PLACED ON THE HEADING TRANSMITTER USED FOR H-14 HEADING SIGNAL.
23. AN ALTERNATE POWER SUPPLY CARD MUST BE USED IN THE COMPUTER.

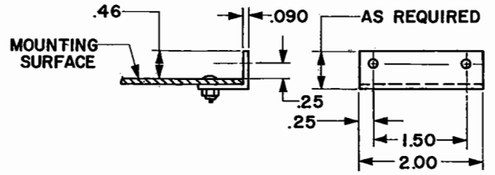
NOTE

USE THIS DIAGRAM FOR REFERENCE ONLY. REFER TO THE AIRCRAFT WIRING DIAGRAM FOR ACTUAL WIRING AND ROUTING BETWEEN COMPONENTS IN YOUR INSTALLATION.

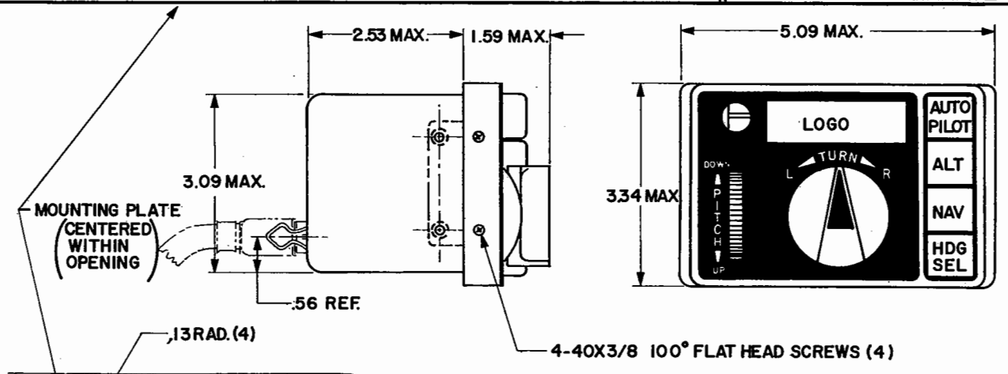
FIGURE 7-24 COLLINS FD107 FLIGHT DIRECTOR SYSTEM AND BACK COURSE SWITCH - COUPLING DIAGRAM

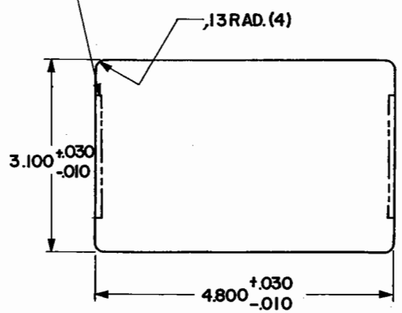


RECOMMENDED MOUNTING PLATE DETAIL

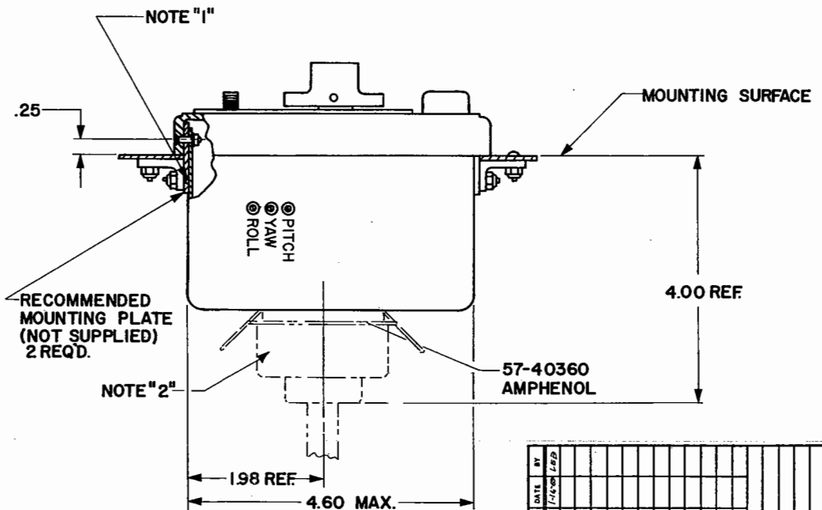


ALTERNATE MOUNTING PLATE DETAIL





RECOMMENDED HOLE PATTERN



NOTES:

1. NOT SUPPLIED, "4" #4-40, 100° FLATHEAD, MOUNT WITH HEAD INTERNAL AS SHOWN.
2. MATING CONN. AMPHENOL 57-30360, NOT SUPPLIED.

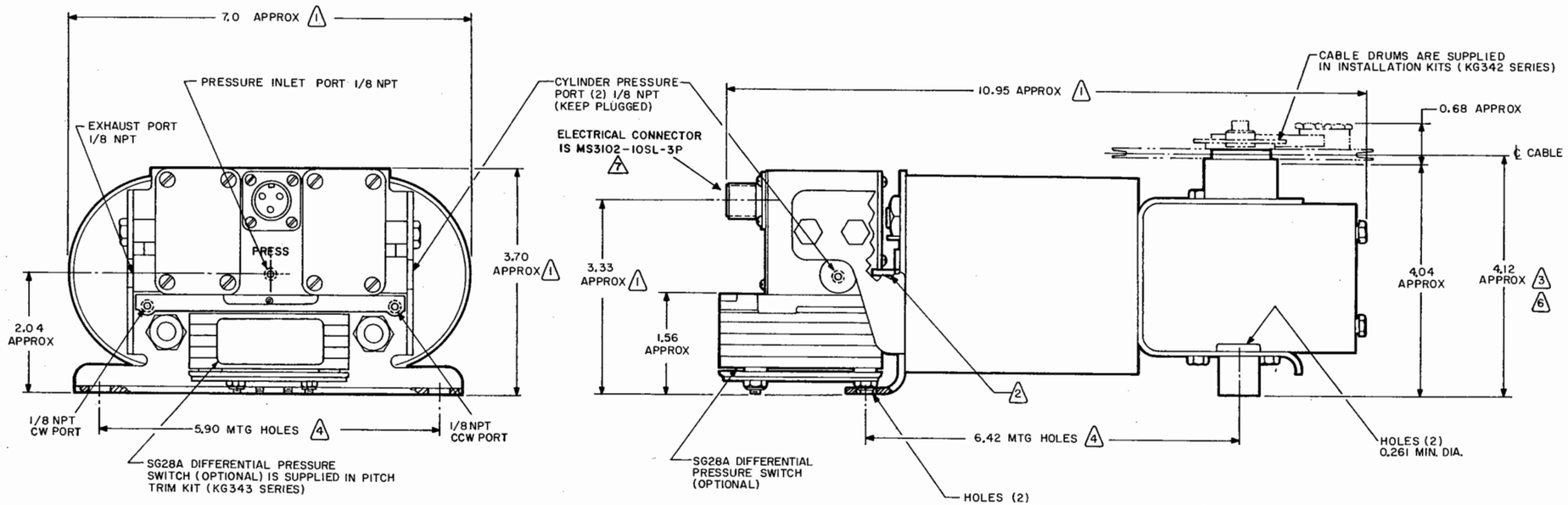
REV	C.O. NO	DATE	BY
1	5155	1/4/08	LBB

REQ	PART NO.	DESCRIPTION	ITEM

SCALE 1:1

NAME FLIGHT CONTROLLER CG-515
INSTALLATION DRAWING

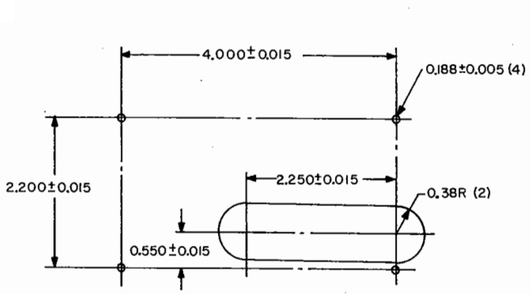
ELEC ENG | TOL UNLESS NOTED | MAT'L
MECH ENG
DRWN DATE 7-29-70
CHK DATE
NUMBER 155-5032-00
SHT 1 OF 1



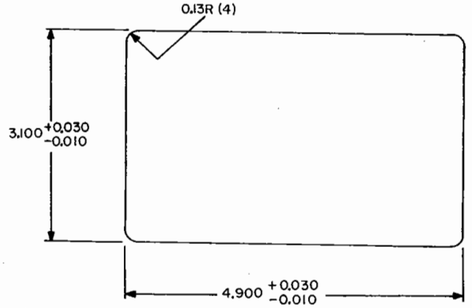
NOTES:

1. IT IS RECOMMENDED THAT THE ENTIRE SPACE ENVELOPE BE INCREASED BY 1/2 INCH ON ALL PACKAGE INSTALLATION DIMENSIONS TO AVOID INTERFERENCE DUE TO TOLERANCE VARIATIONS AND STRAIN DEFLECTIONS.
2. APPROPRIATE ORIFICES ARE SUPPLIED IN INSTALLATION KITS (KG342 SERIES).
3. FOR CABLE DRUMS WITH LESS THAN 4.0 INCH DIAMETER, THE DIMENSION IS APPROXIMATELY 3.94 INCHES.
4. BASE MOUNTING SURFACE PLANE VARIATION MAY NOT EXCEED ONE POINT VARIATION OF 0.02 MAX.
5. DIMENSIONS ARE IN INCHES.
6. DIMENSION IS 0.25 INCH GREATER IF Z959191-1 SPACER IS USED.
7. MATING CONNECTOR IS MS3106-10SL-3S (NOT SUPPLIED).

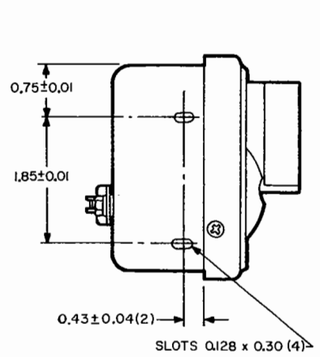
FIGURE 7-6 SERVO ACTUATOR AND DIFFERENTIAL PRESSURE SWITCH - INSTALLATION DIAGRAM

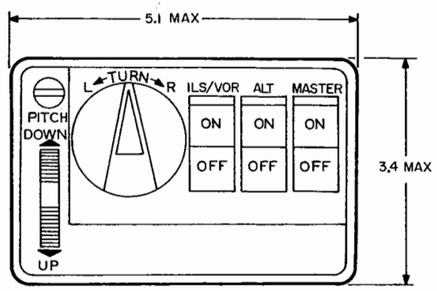


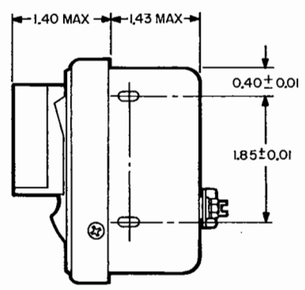
HOLE PATTERN FOR
MOUNTING METHOD II

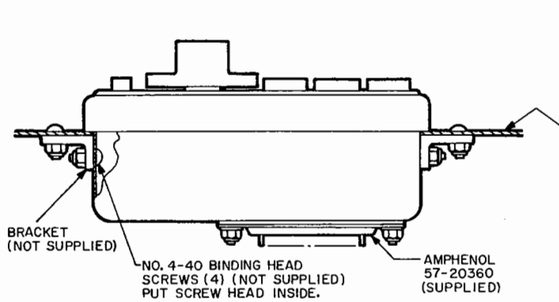


HOLE PATTERN FOR
MOUNTING METHOD I

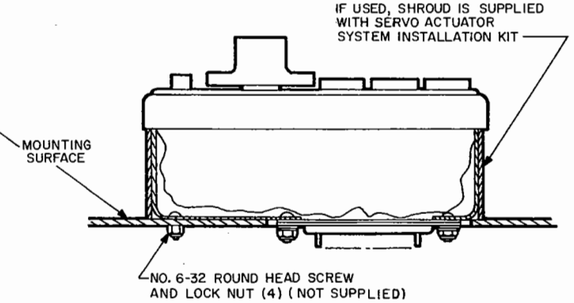








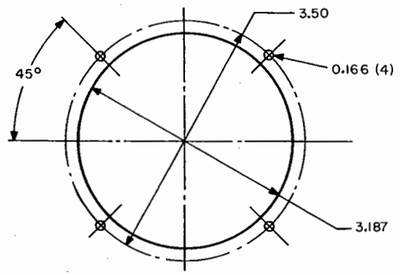
MOUNTING METHOD I



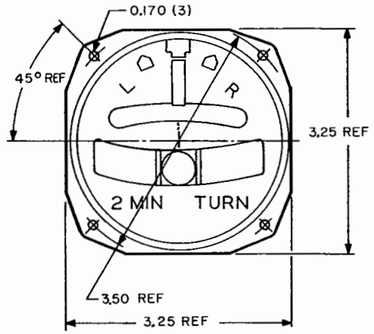
MOUNTING METHOD II

NOTES:
1. DIMENSIONS ARE IN INCHES.
2. THREE SWITCH FLIGHT CONTROLLER SHOWN, BUT DIMENSIONS ARE IDENTICAL FOR FOUR SWITCH MODEL.

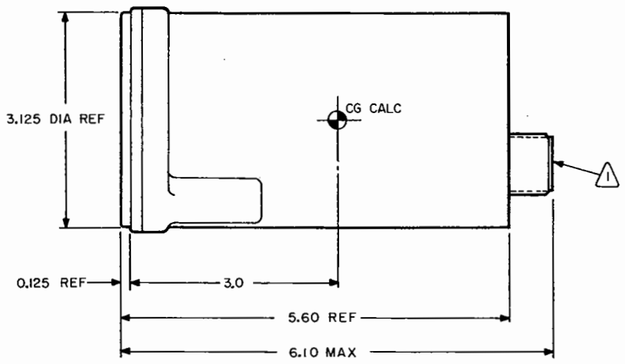
FIGURE 7-3 FLIGHT CONTROLLER - INSTALLATION DIAGRAM



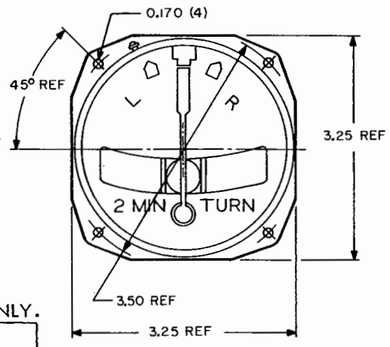
PANEL CUTOUT AND MOUNTING HOLES



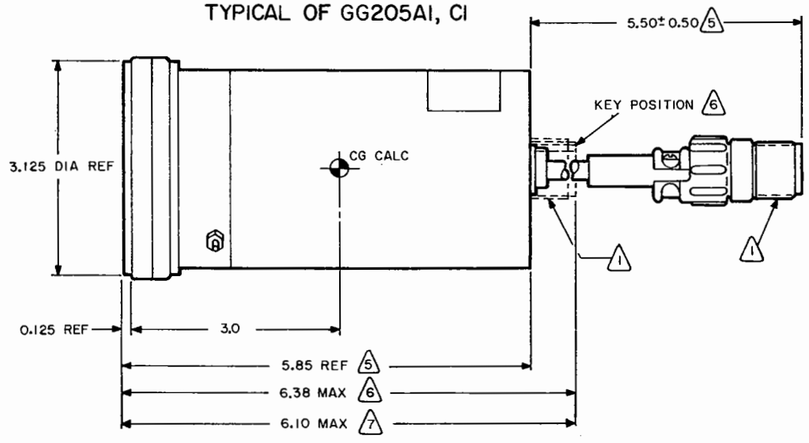
TYPICAL OF
GG205A4, A5, A6, B4, C4



TYPICAL OF GG205A1, C1



TYPICAL OF
GG205A2, C2, A3, C3



TYPICAL OF GG205A2, C2, A3, C3, A4

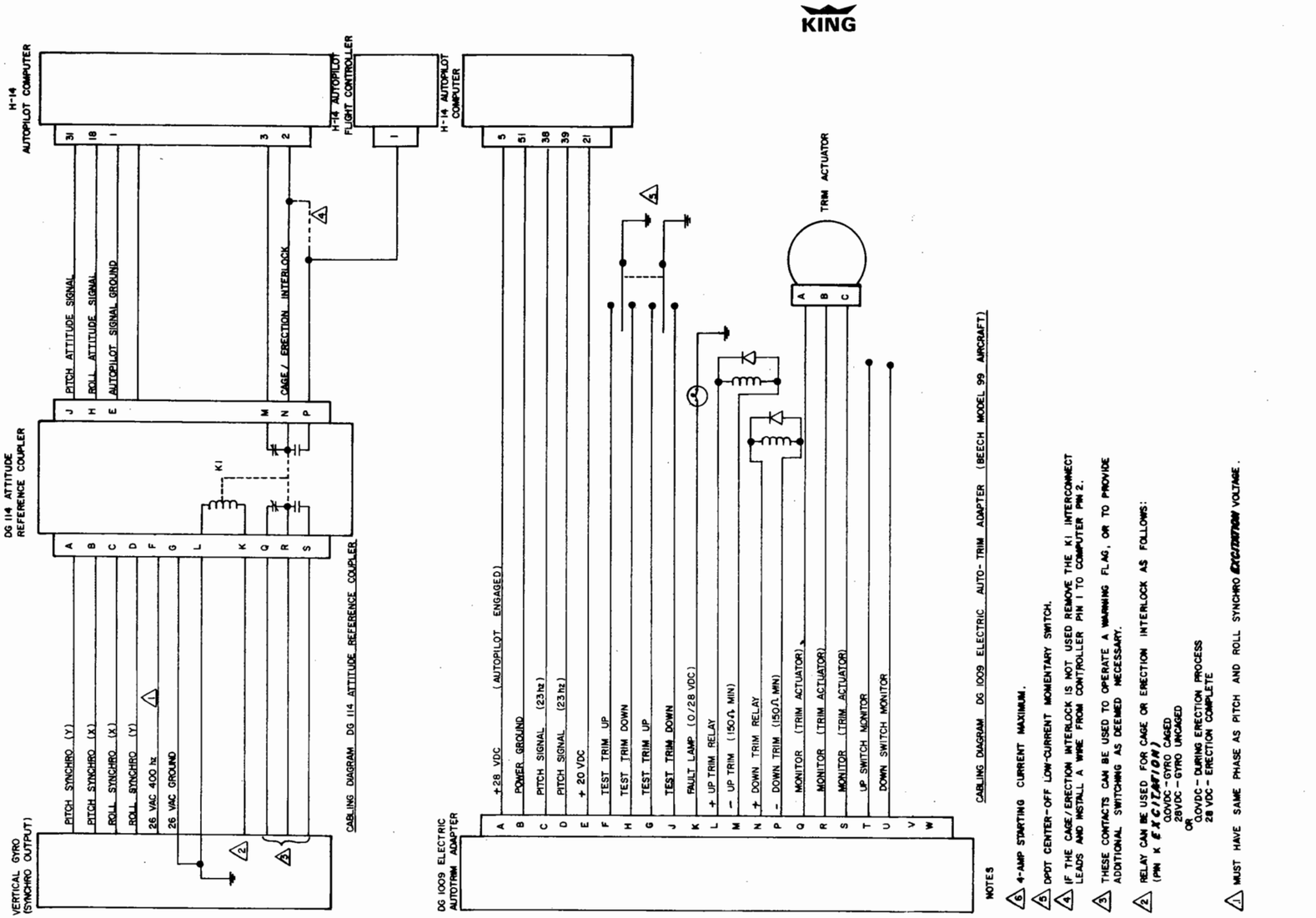
NOTES:

1. MATING ELECTRICAL CONNECTOR IS MS3106-14S-5S.
2. THE RATE GYRO INDICATOR SHOULD BE INSTALLED IN A SHOCK-MOUNTED INSTRUMENT PANEL. THE MOUNTING MUST BE SUCH THAT, WHEN THE AIRPLANE IS IN ITS NORMAL CRUISING ATTITUDE, THE INSTRUMENT WILL BE LEVEL LATERALLY AND ITS FACE WILL BE VERTICAL.
3. THE INSTRUMENT FACES DIFFER AND THE LOCATION OF THE ELECTRICAL CONNECTOR DIFFERS AMONG THE VARIOUS MODELS.
4. GG205A2, A3, A4, A6, B4, C2, C3, C4 ARE FUNCTIONALLY INTERCHANGEABLE WITH GG205A1, C1.
5. APPLICABLE TO GG205A2, C2 ONLY.
6. APPLICABLE TO GG205A3, C3 ONLY.
7. APPLICABLE TO GG205A4, A5, A6, B4, C4 ONLY.
8. WEIGHTS:

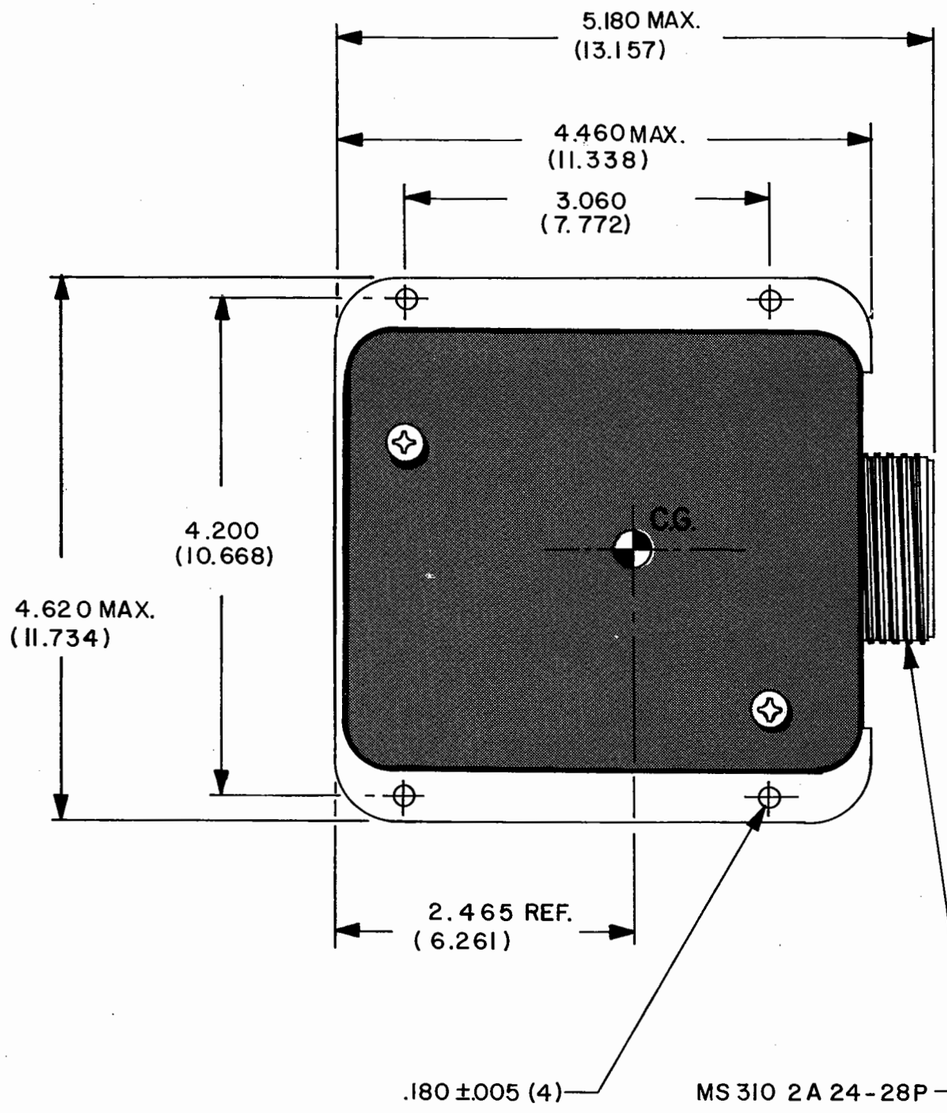
MODEL NO.	MAX WEIGHT (POUNDS)
GG205A1, A4, A5, A6, GG205B4, C1, C4	1.9
GG205A3, C3	2.1
GG205A2, C2	2.2

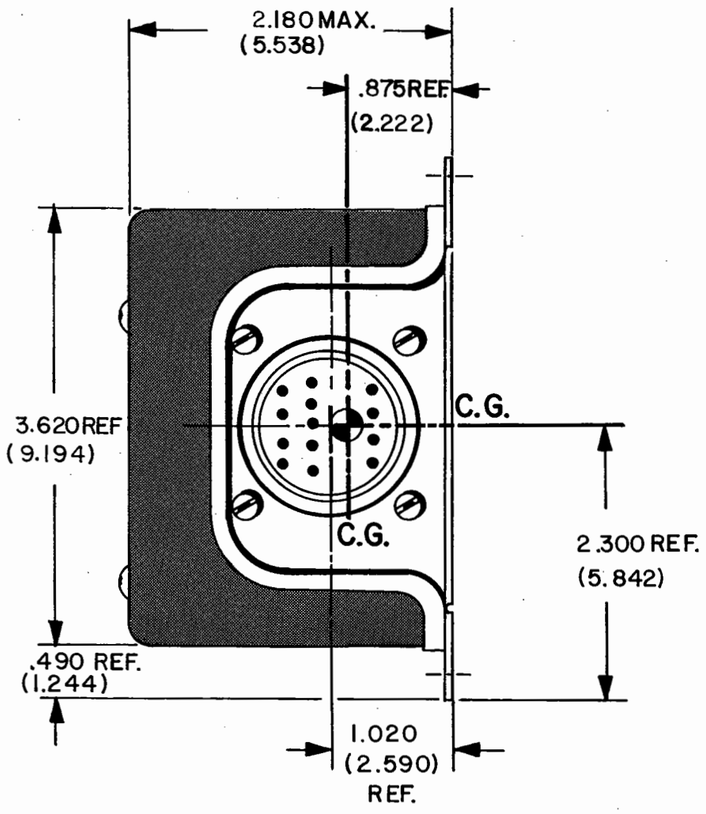
9. DIMENSIONS ARE STATED IN INCHES.
10. DIMENSIONS FOLLOWED BY "REF" ARE ONLY FOR INFORMATION AND ARE NOT SPECIFICATIONS REQUIRING CONFORMANCE.

FIGURE 7-9 TURN AND BANK INDICATOR GYRO - INSTALLATION DIAGRAM



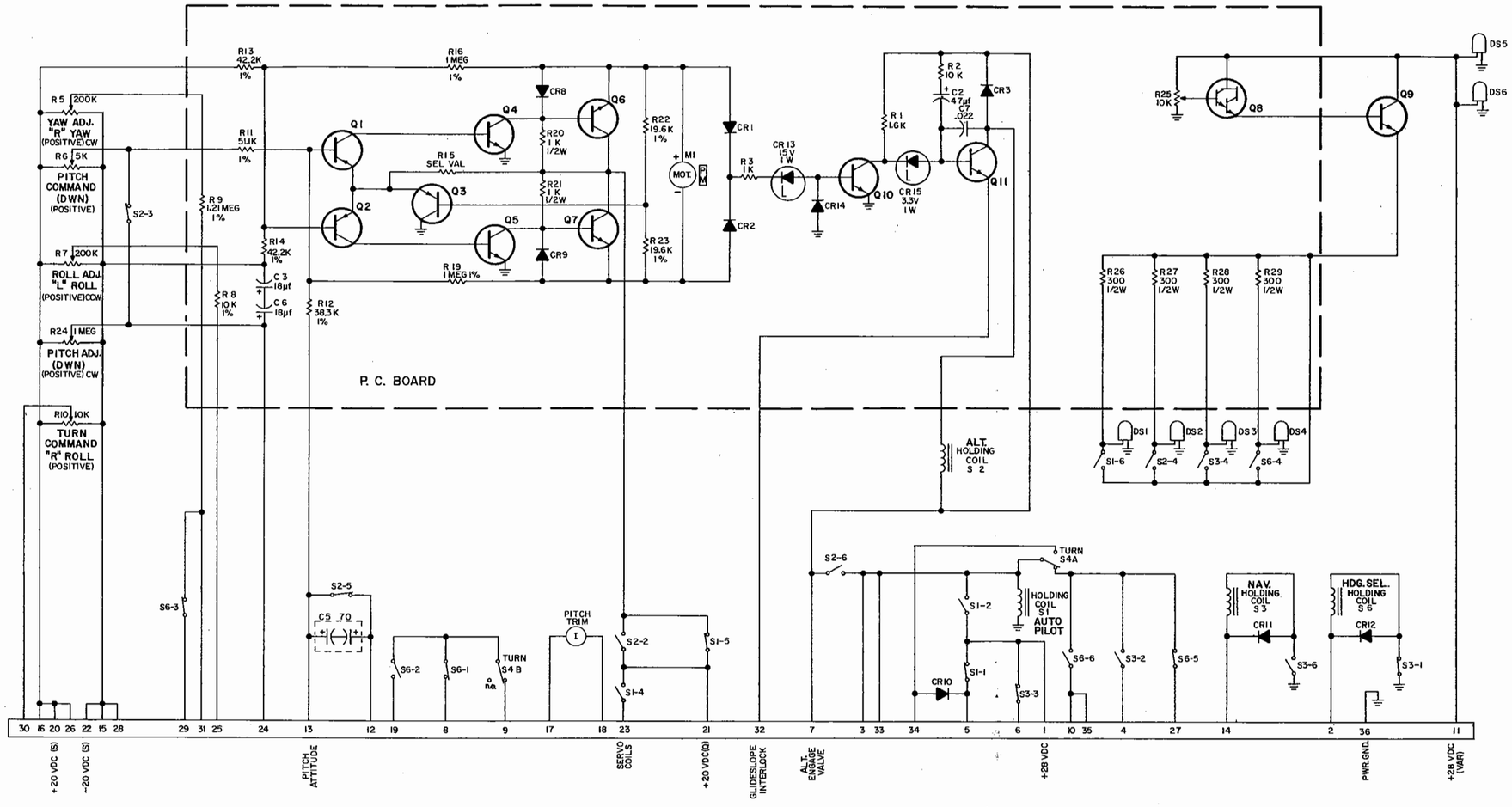
H 14 SUPPLEMENTAL ADAPTER INTERCONNECT DIAGRAMS
FIGURE 7-27





NOTE:
1. DIMENSIONS IN PARENTHESES ARE IN CENTIMETERS.
2. WEIGHT: .94 LBS.

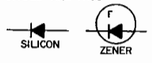
FIGURE 7-12 DG1009 INSTALLATION DRAWING



NOTES

1. UNLESS NOTED: ALL CAPACITANCES ARE IN MICROFARADS(µf)
   ALL RESISTANCES ARE IN OHMS, 1/4W, 5 %.

2. DIODES ARE THUS:



3. BOTTOM VIEW OF TRANSISTORS:

4. REAR VIEW OF S1, S2, S3, AND S6.

CG 515 FLIGHT CONTROLLER SCHEMATIC DIAGRAM
FIGURE 4-17

NOTES:

1. OPTION SELECTOR PLUG (A9) SHOWN IN POSITION 1.
2. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
3. SCHEMATIC DIAGRAMS FOR PLUG-IN CARDS (A1 THRU A6) ARE SHOWN ON SEPARATE DIAGRAMS.
4. □ INDICATES TERMINALS ON TERMINAL BOARD TB1.
5. P1 CONNECTS TO PG51A1 ALTITUDE CONTROL WHEN INSTALLED.
6. EITHER THE K3 RELAY OR K3 DUMMY RELAY MUST BE INSTALLED.
7. ▽ INDICATES SIGNAL GROUND.
8. ⏚ INDICATES CHASSIS POWER GROUND.

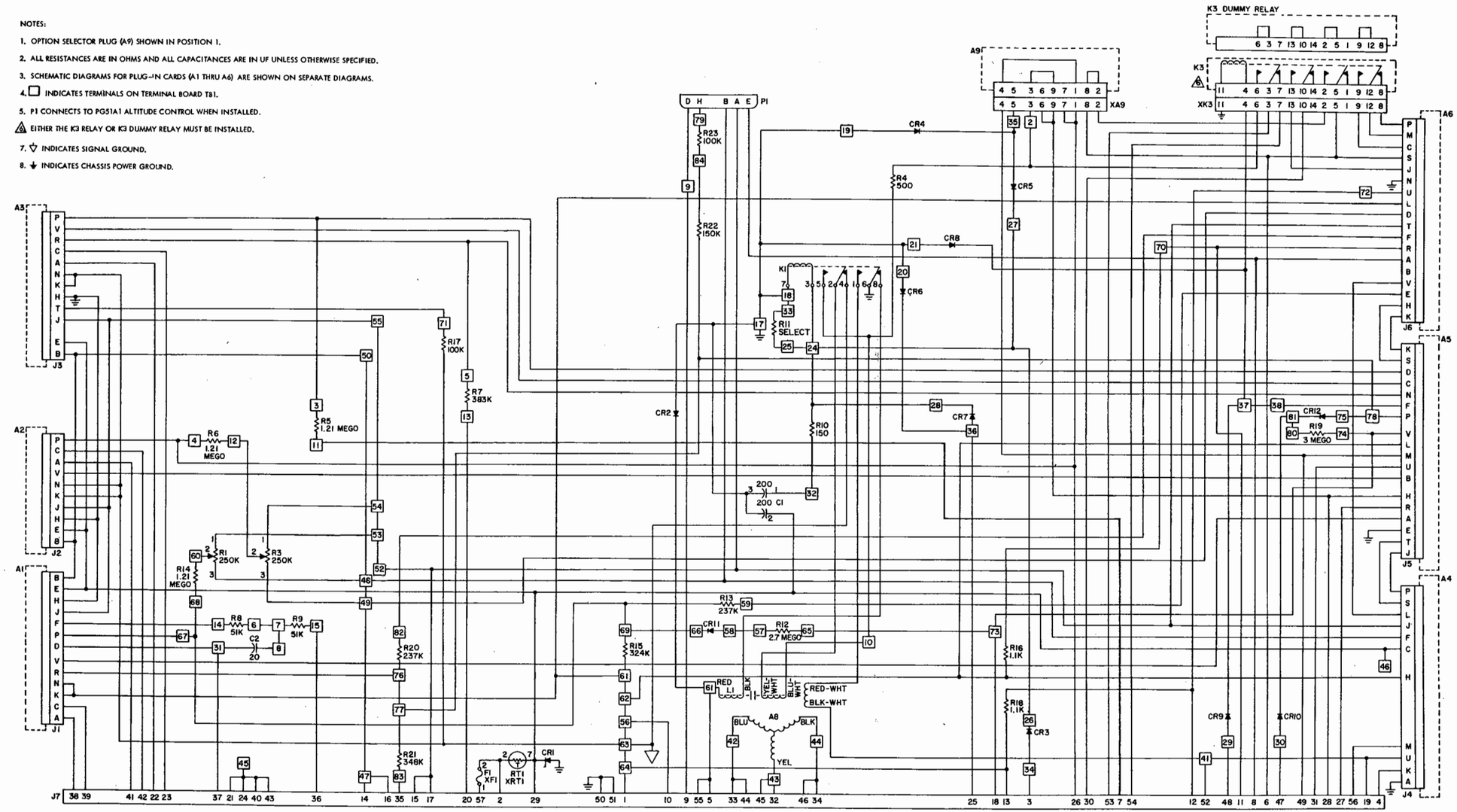


FIGURE 4-10 COMPUTER CHASSIS (BG174D, BG274D, BG374D) - SCHEMATIC DIAGRAM

NOTES:

1. OPTION SELECTOR PLUG (A9) SHOWN IN POSITION 1.
2. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
3. SCHEMATIC DIAGRAMS FOR PLUG-IN CARDS (A1 THRU A6) ARE SHOWN ON SEPARATE DIAGRAMS.
4. □ INDICATES TERMINALS ON TERMINAL BOARD T81.
5. P1 CONNECTS TO PGS1A1 ALTITUDE CONTROL WHEN INSTALLED.
6. ⚠6 EITHER THE K3 RELAY OR K3 DUMMY RELAY MUST BE INSTALLED.
7. ▽ INDICATES SIGNAL GROUND.
8. ⏚ INDICATES CHASSIS POWER GROUND.

⚠2 C3 IS COMPOSED OF TWO 33UF CAPACITORS IN SERIES.

⚠10 NOT USED ON SERIES 1 AND 2.

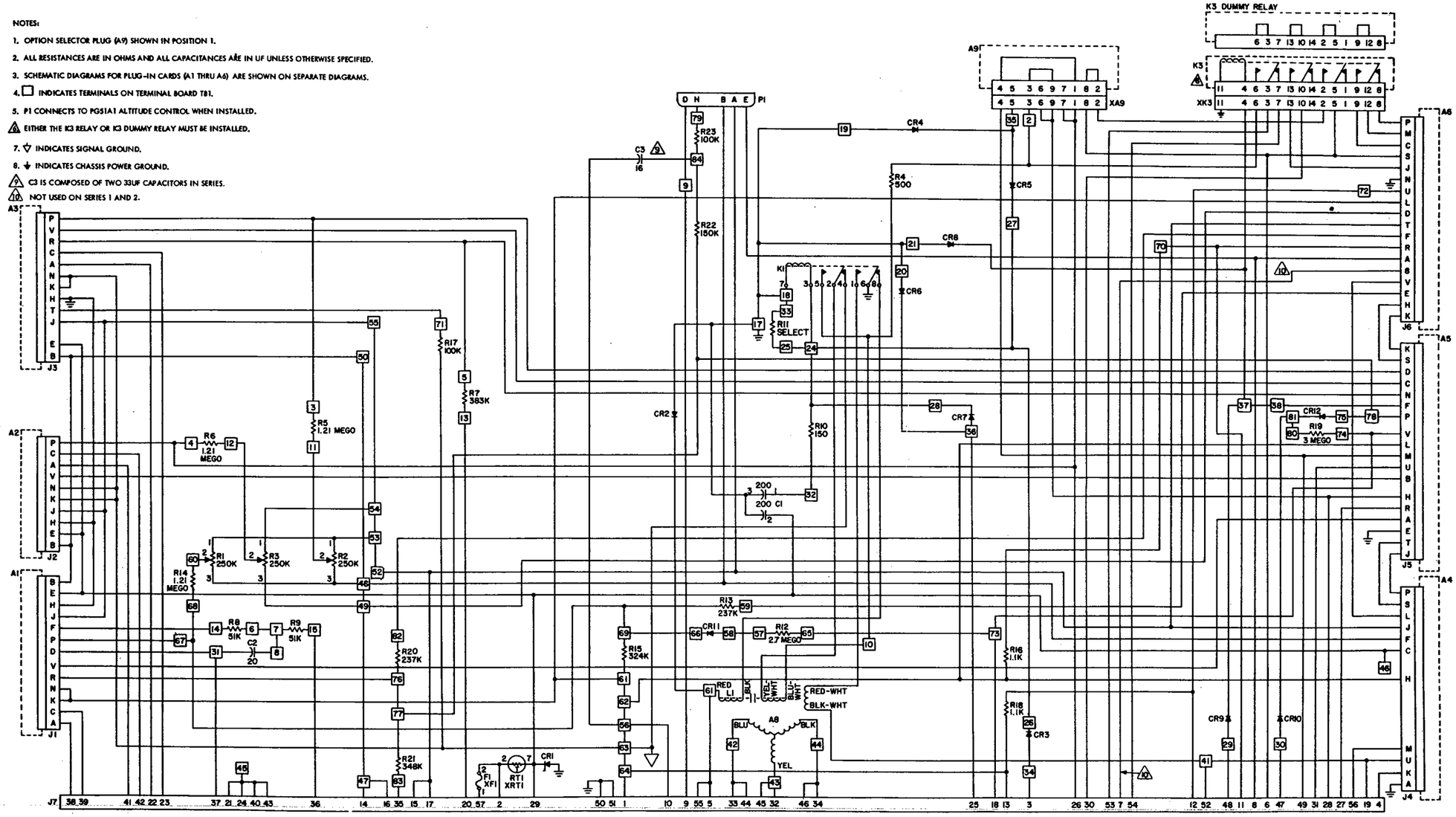


FIGURE 4-9 COMPUTER CHASSIS (BG174C, BG274C, BG374C) - SCHEMATIC DIAGRAM

KING

NOTES:

1. OPTION SELECTOR PLUG (A9) SHOWN IN POSITION 1.
2. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
3. SCHEMATIC DIAGRAMS FOR PLUG-IN CARDS (A1 THRU A6) ARE SHOWN ON SEPARATE DIAGRAMS.
4. ☐ INDICATES TERMINALS ON TERMINAL BOARD TB1.
5. P1 CONNECTS TO PG51A1 ALTITUDE CONTROL WHEN INSTALLED.
6. ⚠ EITHER THE K3 RELAY OR K3 DUMMY RELAY MUST BE INSTALLED.
7. ▽ INDICATES SIGNAL GROUND.
8. ⏚ INDICATES CHASSIS POWER GROUND.

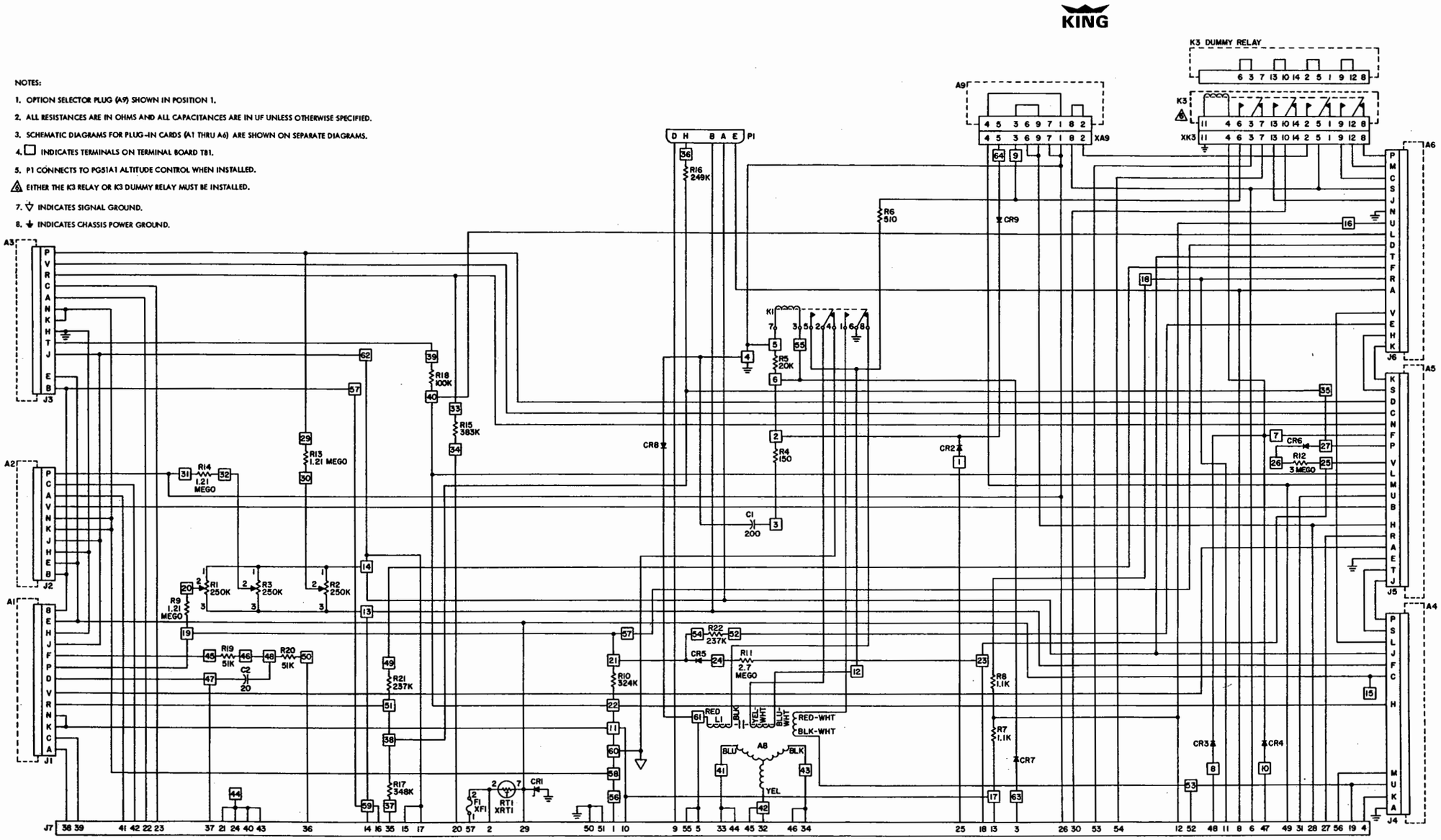
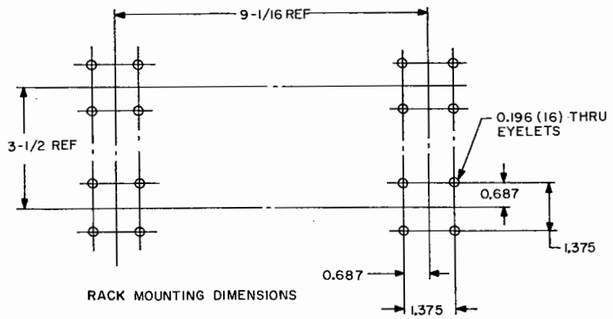
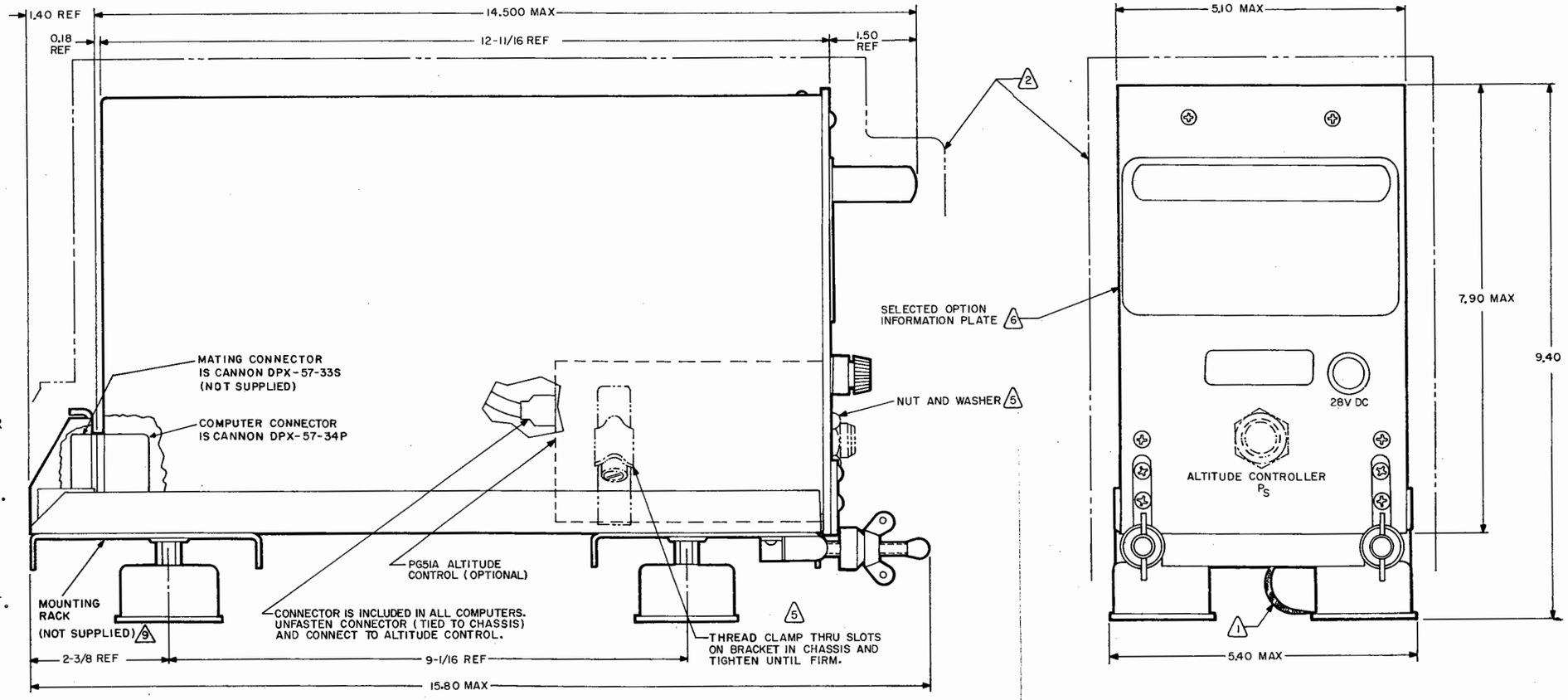


FIGURE 4-8 COMPUTER CHASSIS (BG174B, BG274B) - SCHEMATIC DIAGRAM



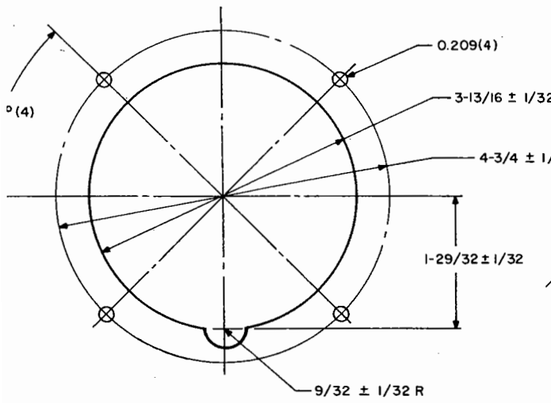
RACK MOUNTING DIMENSIONS



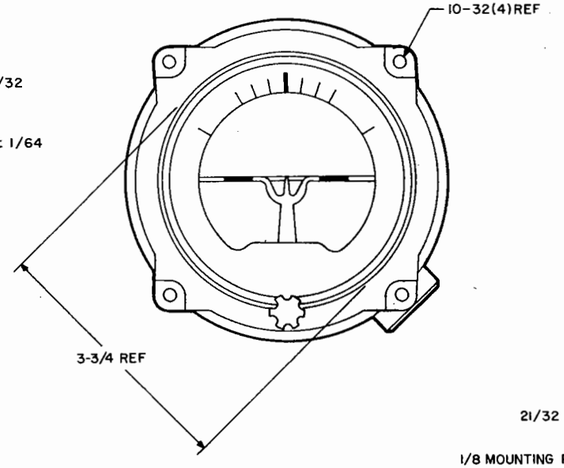
ES:

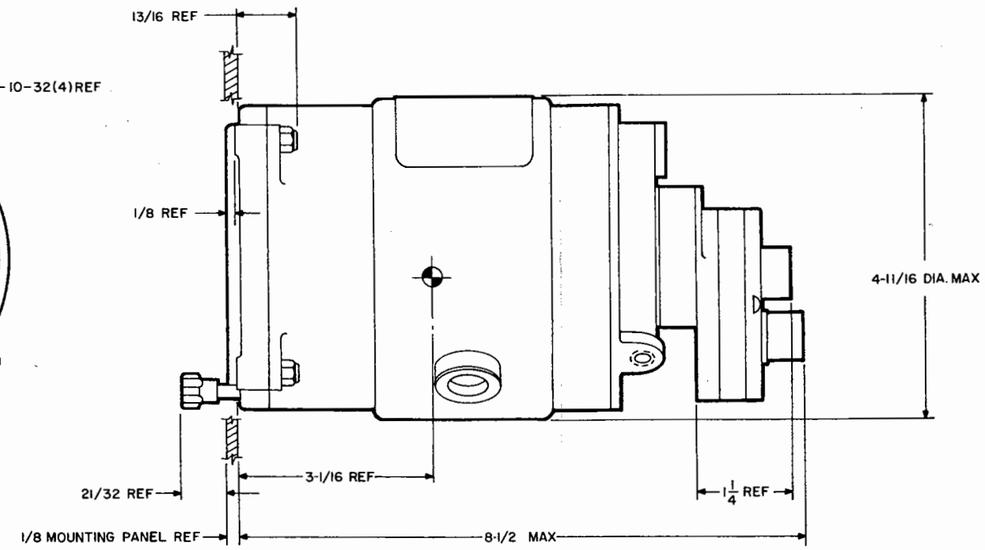
1. LOOSE END OF GROUND STRAP TO BE FASTENED UNDER ISOLATOR MOUNTING SCREWS AT THE TIME OF MOUNTING BASE INSTALLATION.
2. 0.5 INCH SWAY SPACE AROUND UNIT.
   OBSERVE COLOR CODING WHEN INSERTING CARDS INTO CHASSIS. THIS DEVICE IS NOT FUNCTIONAL UNLESS ONE OF THE OPTIONS IS INSTALLED.
3. CLAMP, NUT AND WASHER ARE FURNISHED WITH PG51A ALTITUDE CONTROL.
4. SELECTED OPTION INFORMATION PLATE SHOULD BE MARKED IN APPROPRIATE BLOCKS WHEN COMPUTER IS INSTALLED IN AIRCRAFT.
   DIMENSIONS ARE IN INCHES.
   DIMENSIONS FOLLOWED BY "REF" ARE ONLY FOR INFORMATION AND ARE NOT SPECIFICATIONS REQUIRING CONFORMANCE.
5. PURCHASE FROM K. W. JOHNSON & CO, DAYTON, OHIO, PART NO. 6187.

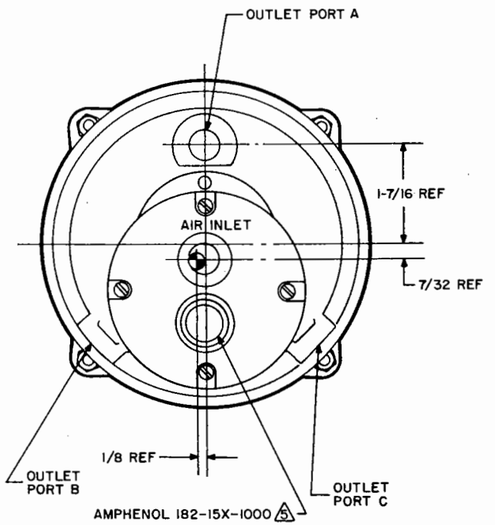
FIGURE 7-5 COMPUTER AND ALTITUDE CONTROL - INSTALLATION DIAGRAM



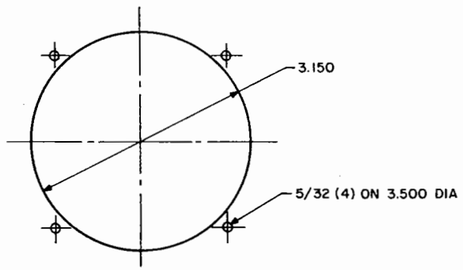
PANEL CUTOUT AND MOUNTING HOLES FOR GG201



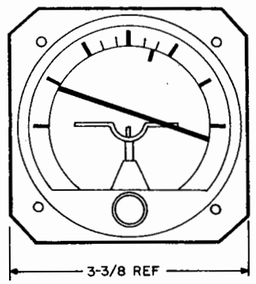


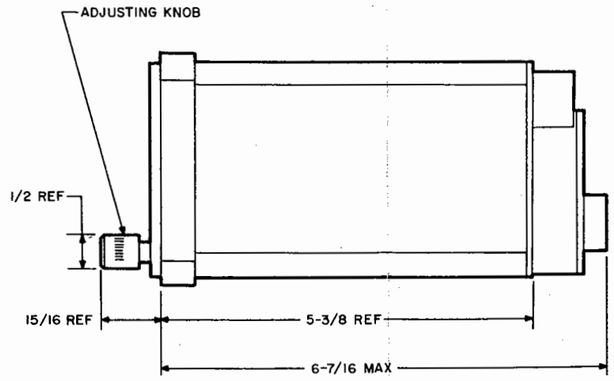


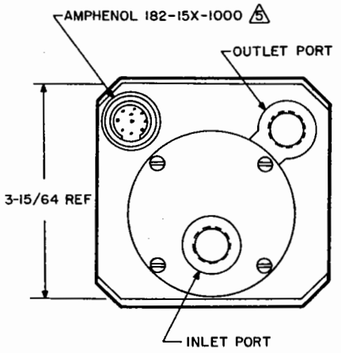
GG201



PANEL CUTOUT AND MOUNTING HOLES FOR GG301







GG301

FIGURE 7-7 AIR DRIVEN VERTICAL GYRO - INSTALLATION DIAGRAM

HOCK-MOUNTED
LEVEL
AL IN CRUISE
TS MUST TOUCH THE
) THAT THE
EWS ARE
32 x 7/8
WS FOR THE
4X) ROUNDHEAD
.

RT (FOR THE
)). INSERT A
T. ATTACH THE
O THE CONNECTOR.
E LINE TO LIMIT
CUUM MUST BE
: GG302 IT MUST
PEED. THE
TIGHTLY SEALED.

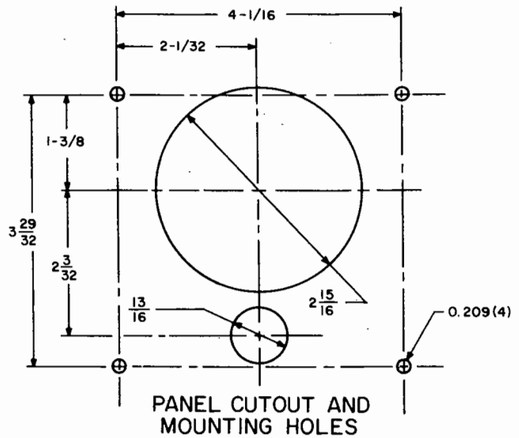
PORT.
IR FILTER,
AND THE AIR
H O.D.

; POSSIBLE
T THE LINES
NCHED, TWISTED

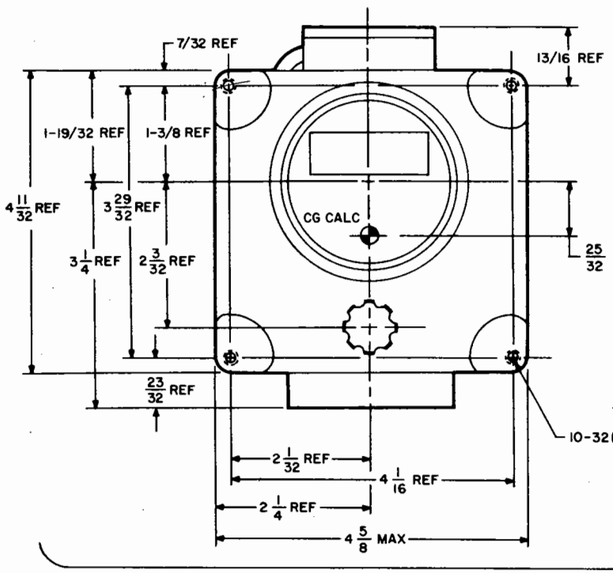
RO IN PANEL.

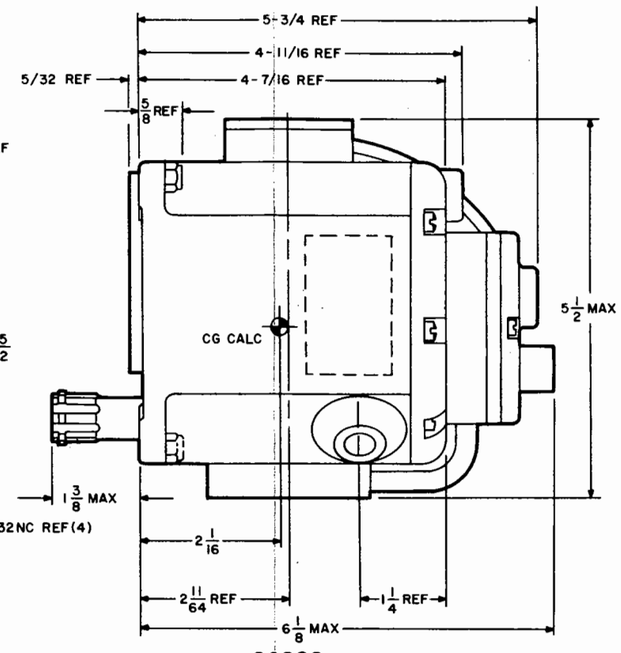
3302 2.7 LB MAXIMUM.

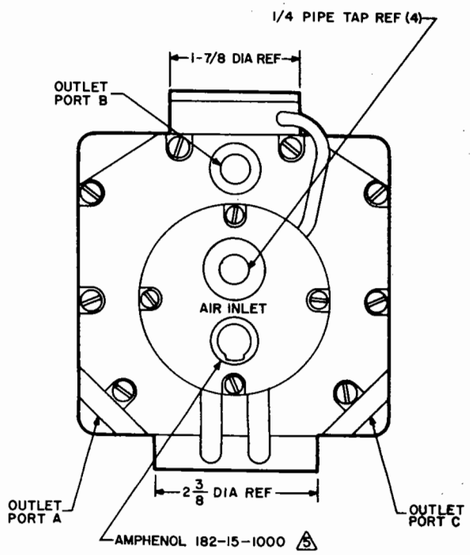
NLY FOR INFORMATION
NG CONFORMANCE.



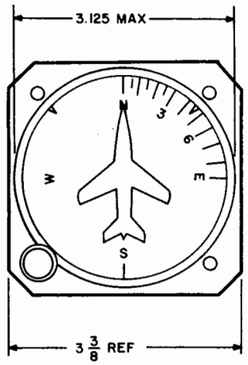
PANEL CUTOUT AND MOUNTING HOLES FOR GG202

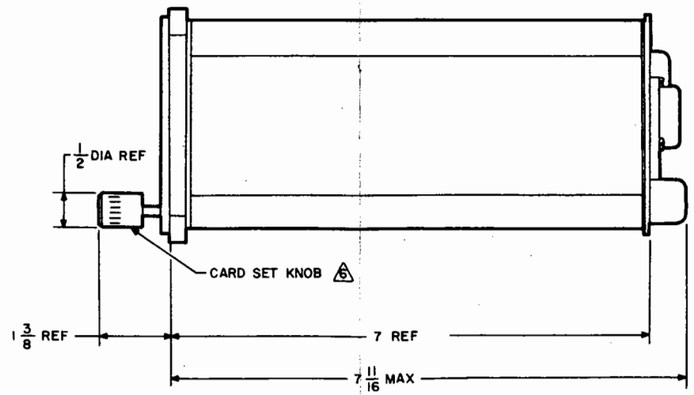


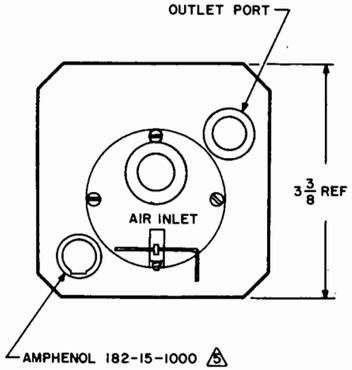




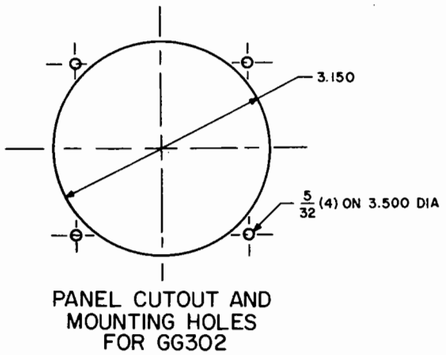
GG202





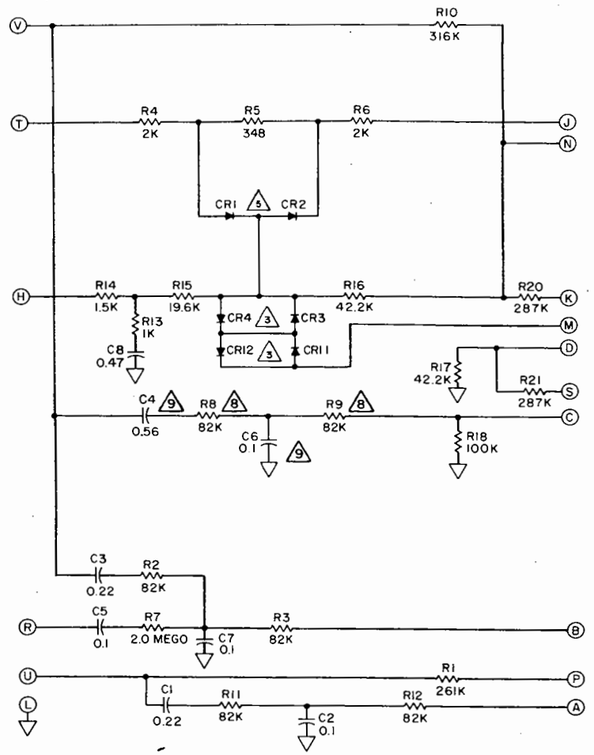


GG302



PANEL CUTOUT AND MOUNTING HOLES FOR GG302

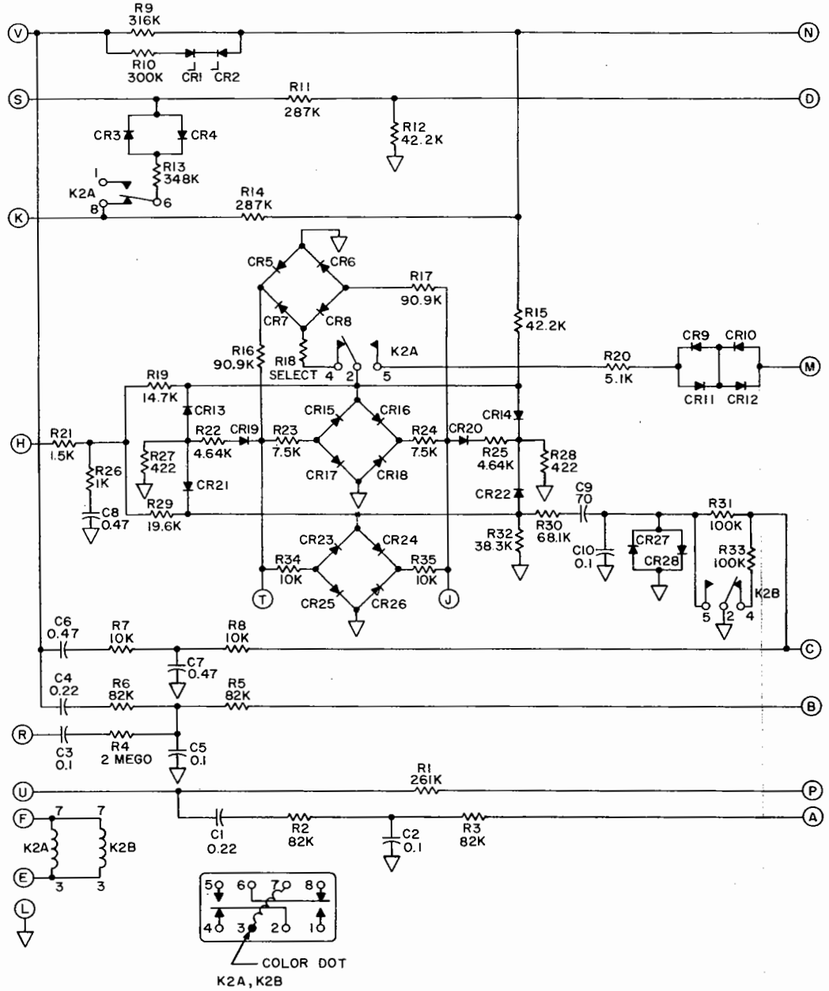
FIGURE 7-8 AIR DRIVEN DIRECTIONAL GYRO - INSTALLATION DIAGRAM



(PART NO. 200-0118-00/01 (Z950850-1, 2)

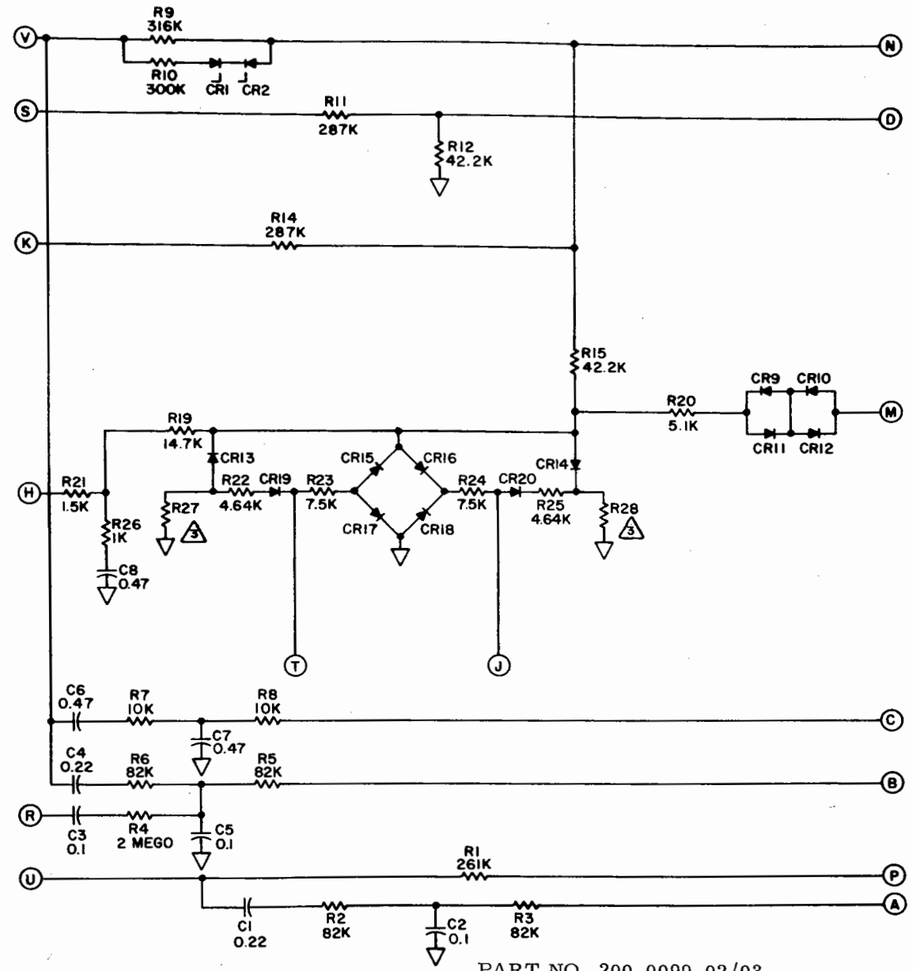
	VALUE ON PART NO. 200-0097-00 (Z950851-1)	VALUE ON PART NO. 200-0097-01 (Z950851-2)
R20	100K	68.1K
R23	51.1K	SELECTED
R25	348 OHMS	422 OHMS
R26	2K	4.75K
R27	42.2K	SELECTED

USED ONLY ON PART NO. 200-0097-01 (Z059851-2) CARD.
R8 AND R9 ARE 10K ON 200-0118-01 (Z950850-2) CARD.
C4 AND C6 ARE 0.47 UF ON 200-0118-01 (Z950850-2) CARD.



(PART NO 200-0099-00/01 (Z960751-1)

KING

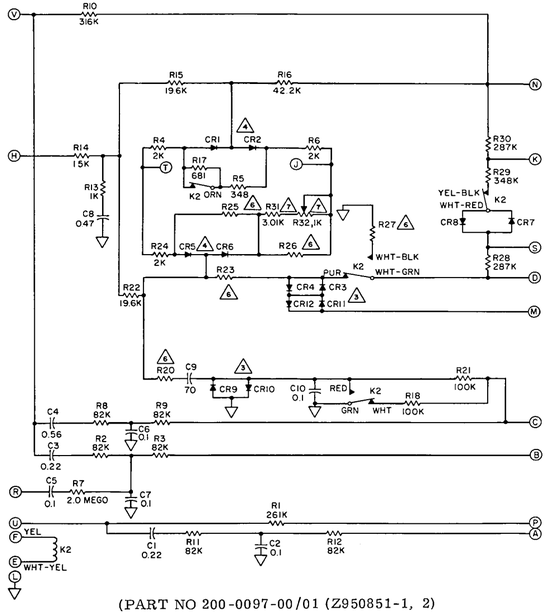


PART NO. 200-0099-02/03

NOTES:

1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE NOTED.
2. - INDICATES PIN ON CONNECTOR J1.
3. R27 & R28 422 OHMS ON EARLY MODEL, NOW 357Ω.

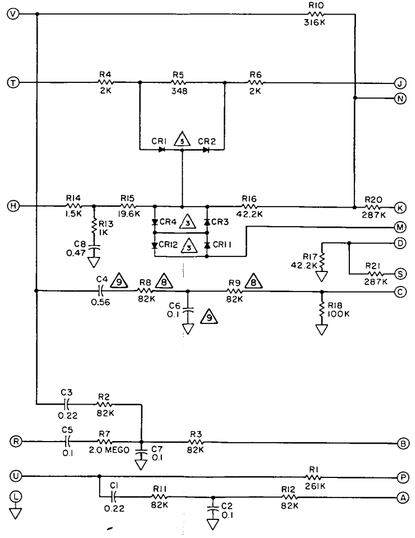
FIGURE 4-6 HEADING/MODEL CARD (A5) - SCHEMATIC DIAGRAM



(PART NO 200-0097-00/01 (Z950851-1, 2)

NOTES:

1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. INDICATES PIN ON CONNECTOR J1.
3. DIODES CR3 AND CR4, CR9 AND CR10, AND CR11 AND CR12 ARE MATCHED PAIRS.
4. DIODES CR1, CR2, CR5, AND CR6 ARE MATCHED.
5. DIODES CR1 AND CR2 ARE MATCHED.

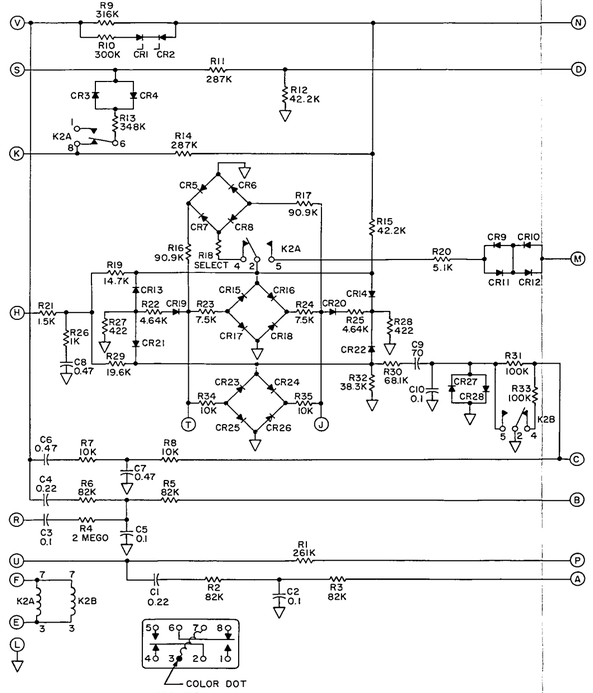


(PART NO. 200-0118-00/01 (Z950850-1, 2)

6.

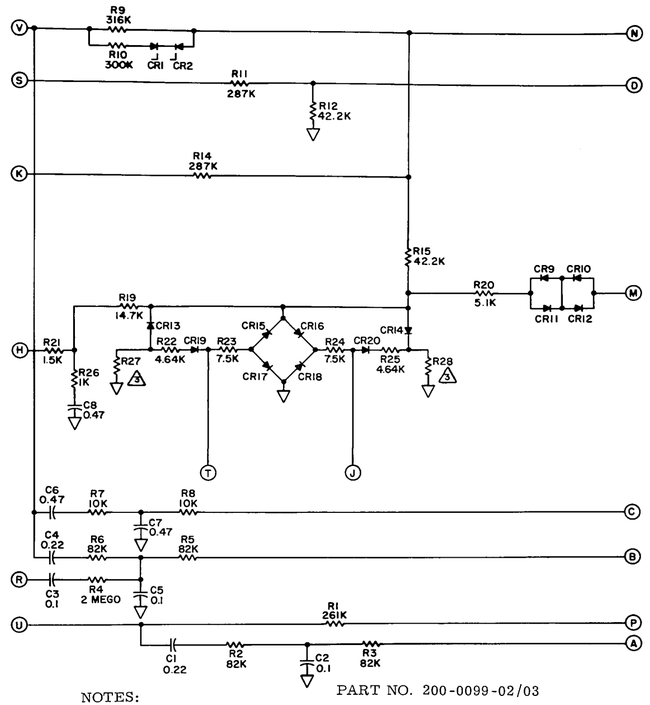
	VALUE ON PART NO. 200-0097-00 (Z950851-1)	VALUE ON PART NO. 200-0097-01 (Z950851-2)
R20	100K	68.1K
R23	51.1K	SELECTED
R25	348 OHMS	422 OHMS
R26	2K	4.75K
R27	42.2K	SELECTED

7. USED ONLY ON PART NO. 200-0097-01 (Z059851-2) CARD.
8. R8 AND R9 ARE 10K ON 200-0118-01 (Z950850-2) CARD.
9. C4 AND C6 ARE 0.47 UF ON 200-0118-01 (Z950850-2) CARD.



(PART NO 200-0099-00/01 (Z960751-1)

KING

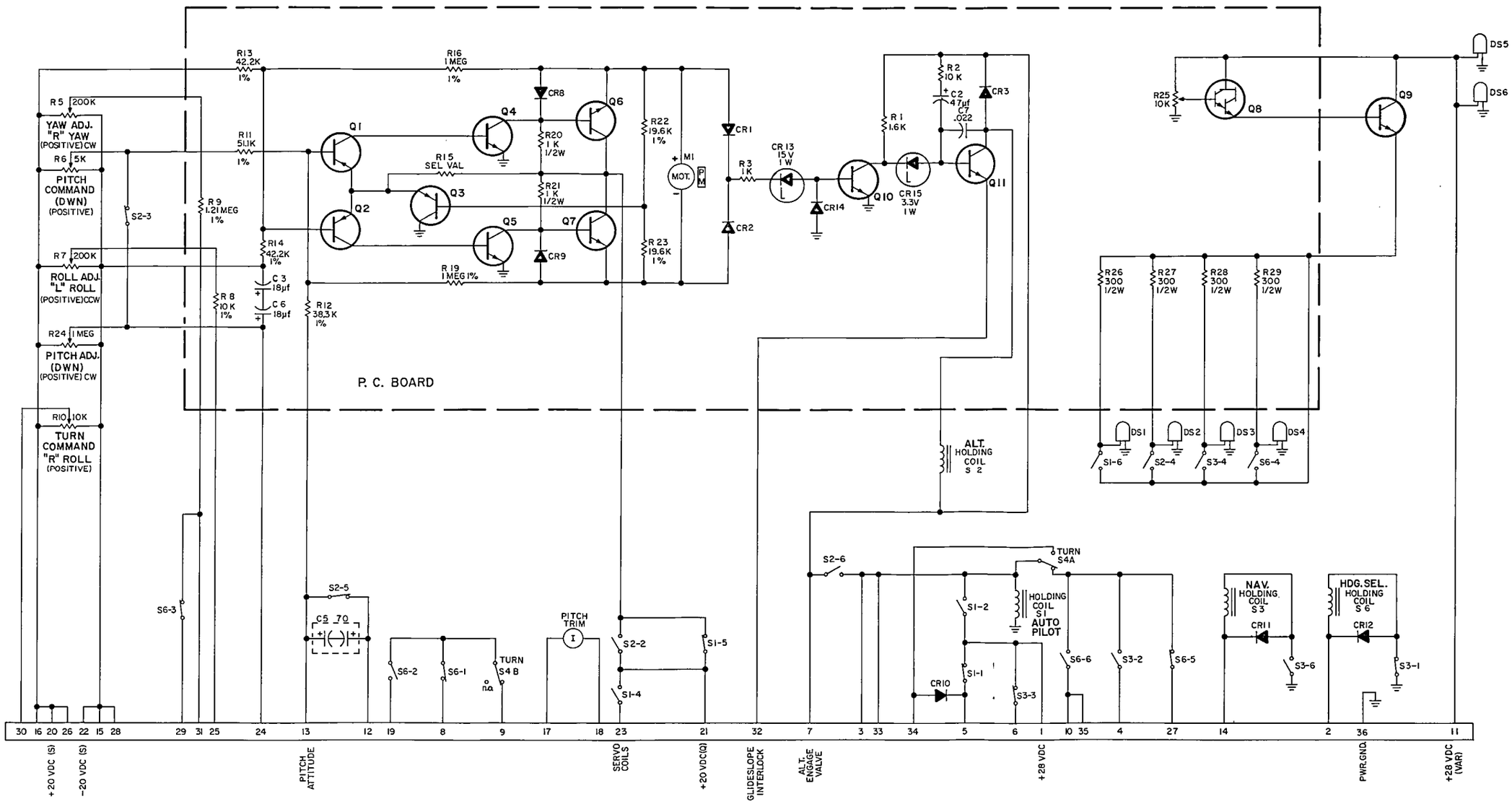


PART NO. 200-0099-02/03

NOTES:

1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE NOTED.
2. - INDICATES PIN ON CONNECTOR J1.
3. R27 & R28 422 OHMS ON EARLY MODEL, NOW 357Ω.

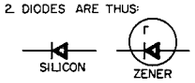
FIGURE 4-6 HEADING/MODEL CARD (A5) - SCHEMATIC DIAGRAM



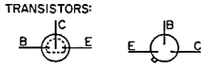
NOTES

1. UNLESS NOTED: ALL CAPACITANCES ARE IN MICROFARADS(µf)
   ALL RESISTANCES ARE IN OHMS, 1/4W, 5 %.

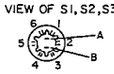
2. DIODES ARE THUS:



3. BOTTOM VIEW OF TRANSISTORS:



4. REAR VIEW OF S1, S2, S3, AND S6.



CG 515 FLIGHT CONTROLLER SCHEMATIC DIAGRAM
FIGURE 4-17

NOTES:

1. OPTION SELECTOR PLUG (A9) SHOWN IN POSITION 1.
2. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
3. SCHEMATIC DIAGRAMS FOR PLUG-IN CARDS (A1 THRU A6) ARE SHOWN ON SEPARATE DIAGRAMS.
4. □ INDICATES TERMINALS ON TERMINAL BOARD TB1.
5. P1 CONNECTS TO PG51A1 ALTITUDE CONTROL WHEN INSTALLED.
6. EITHER THE K3 RELAY OR K3 DUMMY RELAY MUST BE INSTALLED.
7. ▽ INDICATES SIGNAL GROUND.
8. ⏚ INDICATES CHASSIS POWER GROUND.

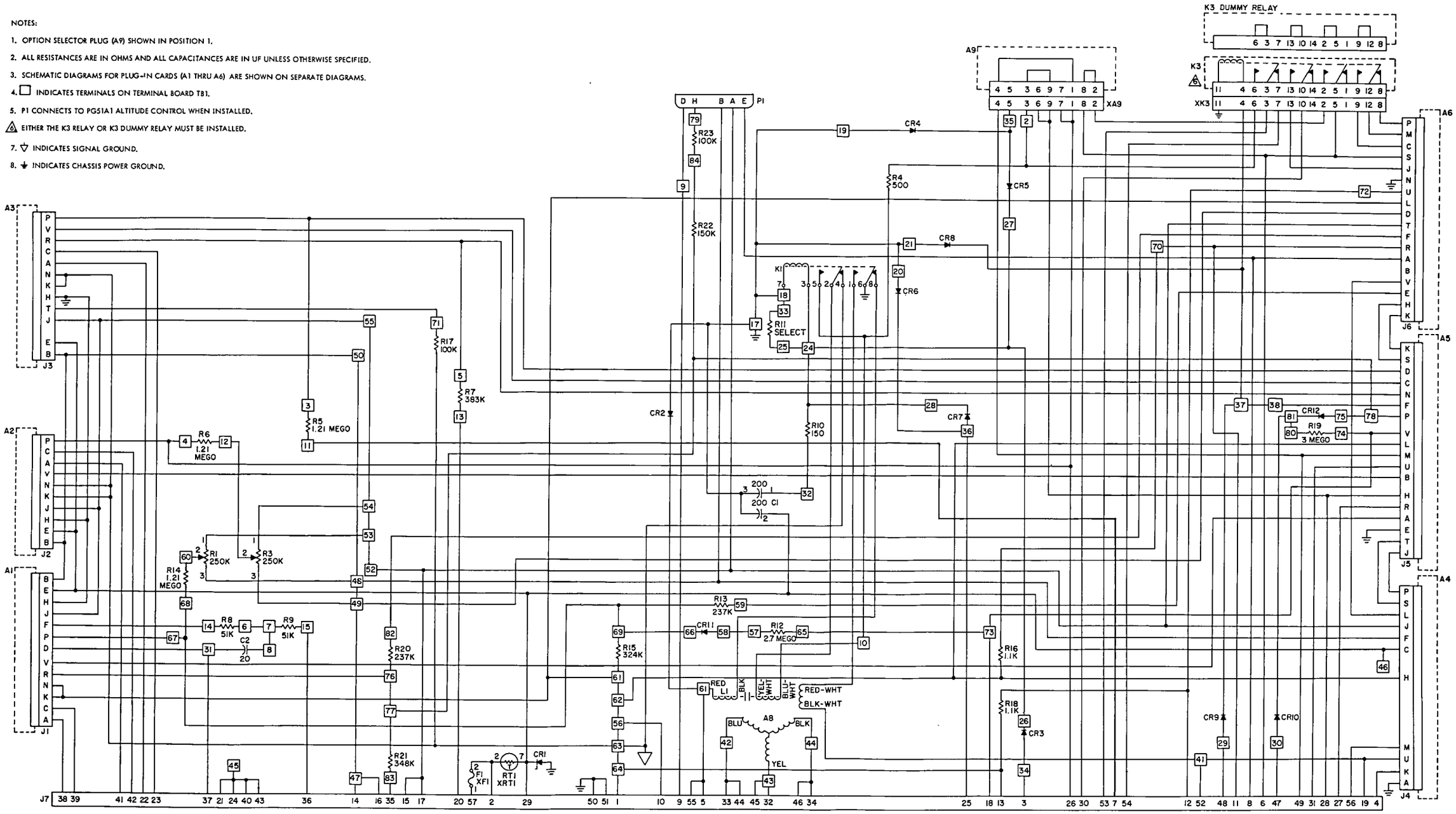


FIGURE 4-10 COMPUTER CHASSIS (BG174D, BG274D, BG374D) - SCHEMATIC DIAGRAM

NOTES:

1. OPTION SELECTOR PLUG (A9) SHOWN IN POSITION 1.
2. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
3. SCHEMATIC DIAGRAMS FOR PLUG-IN CARDS (A1 THRU A6) ARE SHOWN ON SEPARATE DIAGRAMS.
4. □ INDICATES TERMINALS ON TERMINAL BOARD TB1.
5. P1 CONNECTS TO PG51A1 ALTITUDE CONTROL WHEN INSTALLED.
6. EITHER THE K3 RELAY OR K3 DUMMY RELAY MUST BE INSTALLED.
7. ▽ INDICATES SIGNAL GROUND.
8. ⏚ INDICATES CHASSIS POWER GROUND.
9. C3 IS COMPOSED OF TWO 33UF CAPACITORS IN SERIES.
10. NOT USED ON SERIES 1 AND 2.

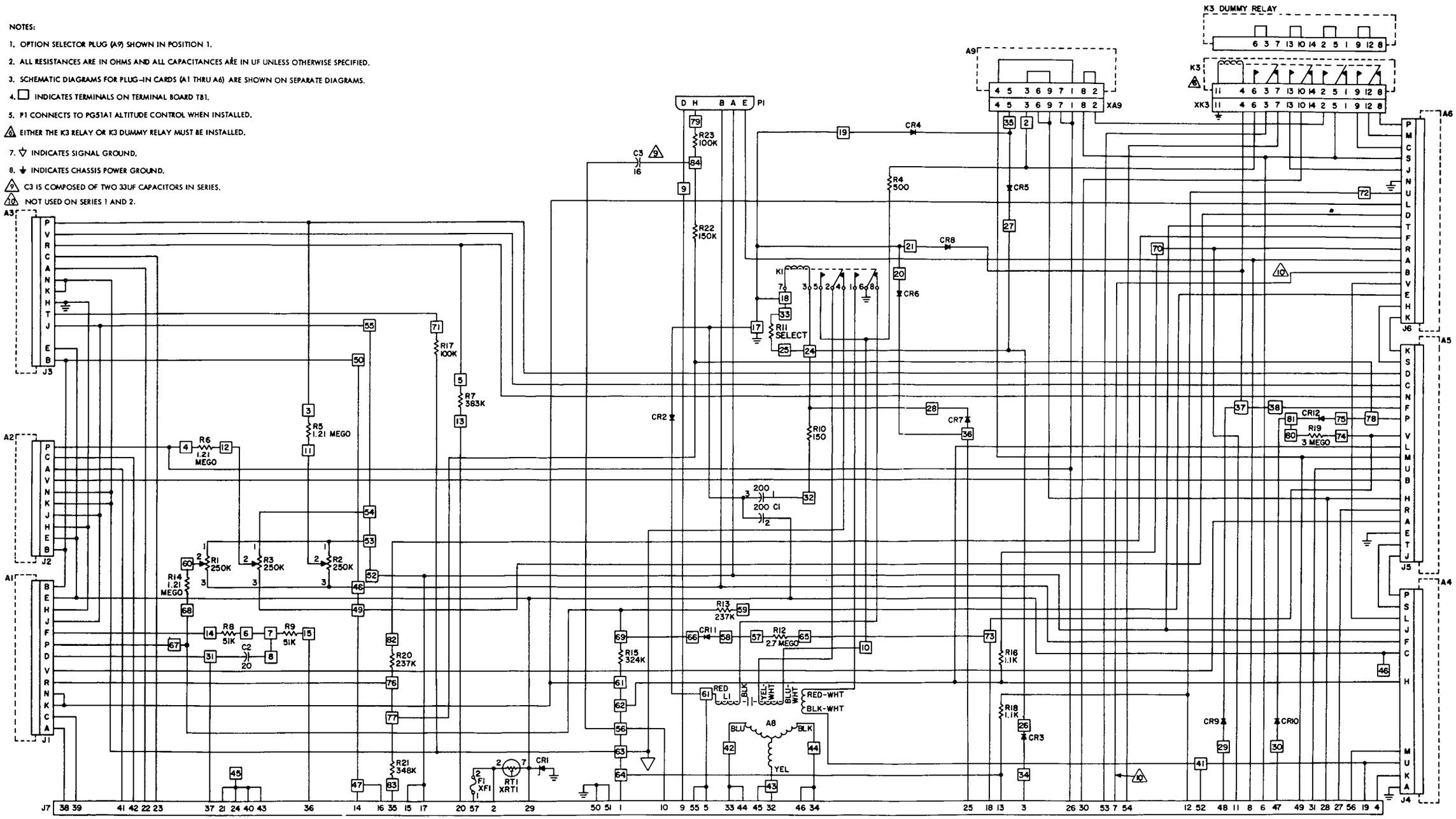


FIGURE 4-9 COMPUTER CHASSIS (BG174C, BG274C, BG374C) - SCHEMATIC DIAGRAM

NOTES:

1. OPTION SELECTOR PLUG (A9) SHOWN IN POSITION 1.
2. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
3. SCHEMATIC DIAGRAMS FOR PLUG-IN CARDS (A1 THRU A6) ARE SHOWN ON SEPARATE DIAGRAMS.
4. □ INDICATES TERMINALS ON TERMINAL BOARD TB1.
5. P1 CONNECTS TO PG51A1 ALTITUDE CONTROL WHEN INSTALLED.
6. EITHER THE K3 RELAY OR K3 DUMMY RELAY MUST BE INSTALLED.
7. ▽ INDICATES SIGNAL GROUND.
8. ⏚ INDICATES CHASSIS POWER GROUND.

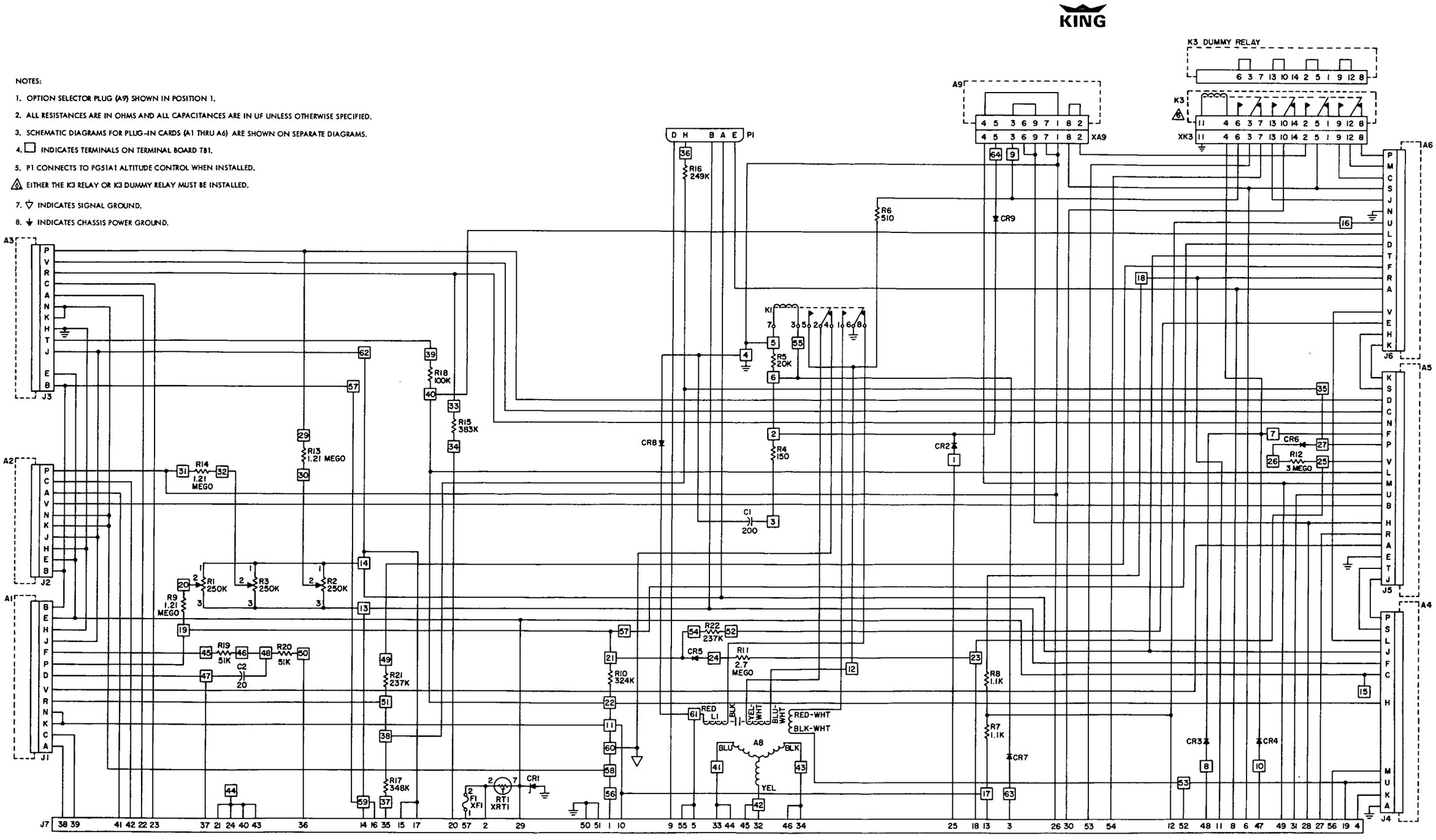
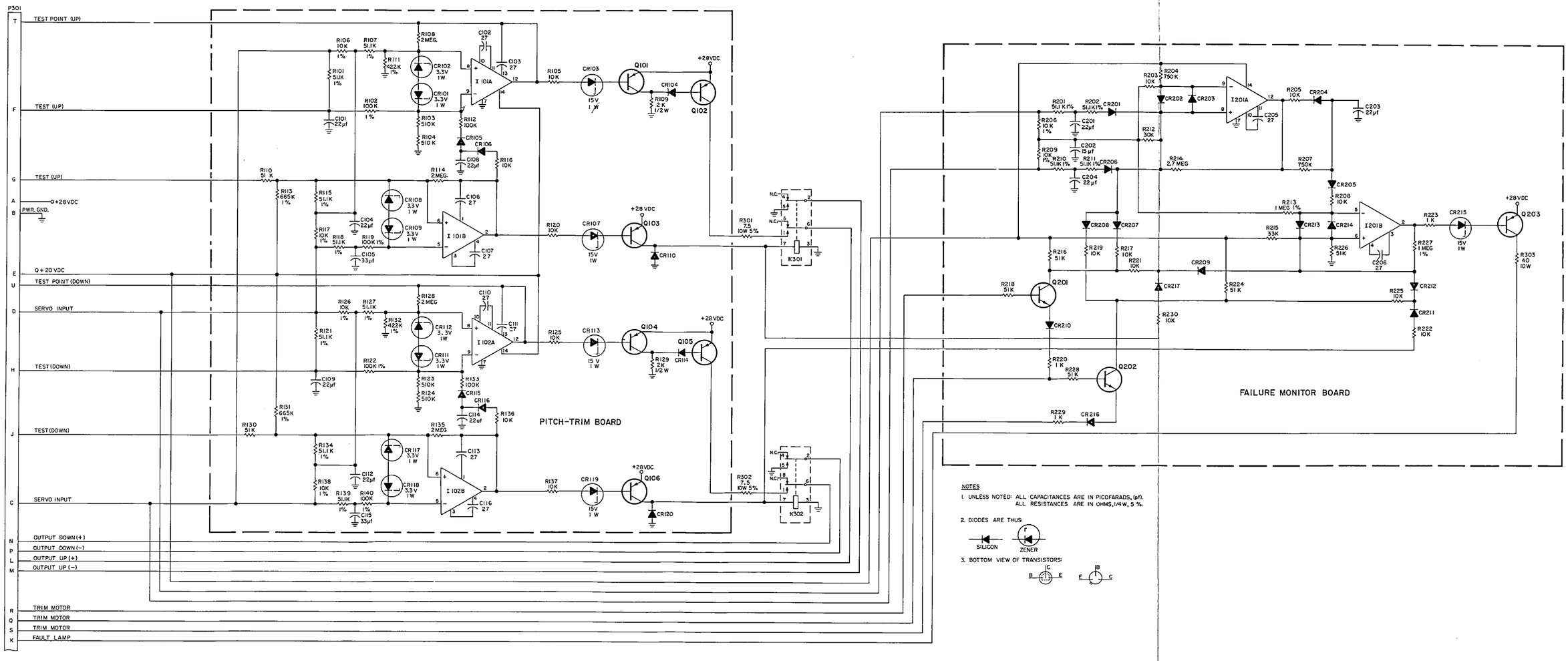


FIGURE 4-8 COMPUTER CHASSIS (BG174B, BG274B) - SCHEMATIC DIAGRAM



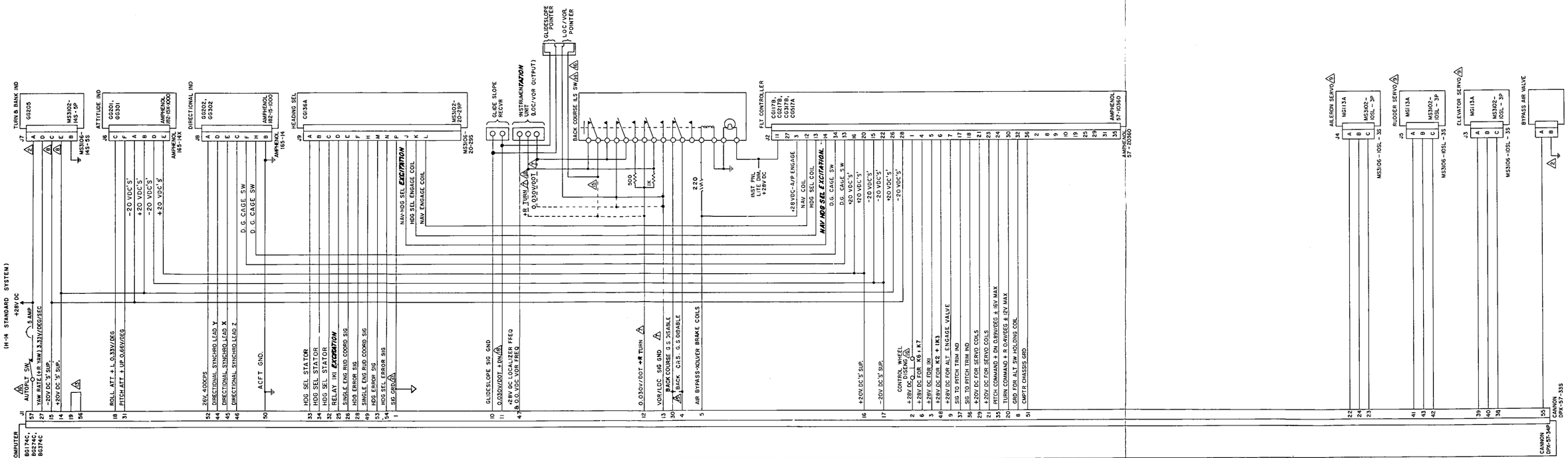
NOTES

1. UNLESS NOTED: ALL CAPACITANCES ARE IN PICOFARADS, (pf). ALL RESISTANCES ARE IN OHMS, 1/4W, 5 %.
2. DIODES ARE THUS:

SILICON ZENER

3. BOTTOM VIEW OF TRANSISTORS:

DG 1009 ELECTRIC PITCH TRIM ACTUATOR SCHEMATIC DIAGRAM
FIGURE 4-13



NOTES-

1- ALL LEADWIRE AWG NO 22 UNLESS OTHERWISE SPECIFIED.

2- USE AWG NO 18 LEADWIRE.

3- PERFORM LEADWIRE ROUTING, BUNDLING, TYING & SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.

4- AUTOPLT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.

5- THE AUTOPLT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.

6- THE GLIDE SLOPE & LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJ RECVR OUTPUTS ACCORDINGLY.

7- USE UNIFIED, SHIELDED, TWO CONDUCTOR CABLE.

8- USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S 'HYPLUG' YE1220.

9- LEADWIRE TO PINS A&C MAY BE REVERSED FOR PROPER PHASING

10- USE ONLY IF ALT CONTROL (PG51) IS INSTALLED.

11- NAV HOLDING COIL INTERLOCK. DELETE IF NAV FUNCTION NOT INSTALLED

12- CG-515 HAS INTERNAL LIGHT LEVEL ADJUSTMENT

13- TO USE EXT GENERATED 26V AC, REM JUMPER & CONNECT PWR TO PIN 19 AN ALT PWR SUP. CARD MUST BE USED IN THE CMPTR.

14- SUGGESTED SW.: MICRO SW 54PB831-T2 WITH PUSH BUTTON 52PA7-B2 IN BLU, GRN, WHT OR RED AS DESIRED. USE LAMP NO. 334.

15- THE DOTTED LINES SHOW PROPER CONNECTIONS IF A BACK COURSE IS NOT INSTALLED.

16- DENOTES OPTIONAL UNITS

17- UNITS DESIGNATED AS OPTIONAL ARE NOT REQD FOR AN OPERATIONAL AUTOPLT.

18- A VOLTAGE OF THE STATED POLARITY WILL PRODUCE AN AIRCRAFT MOVEMENT IN THE STATED DIRECTION.

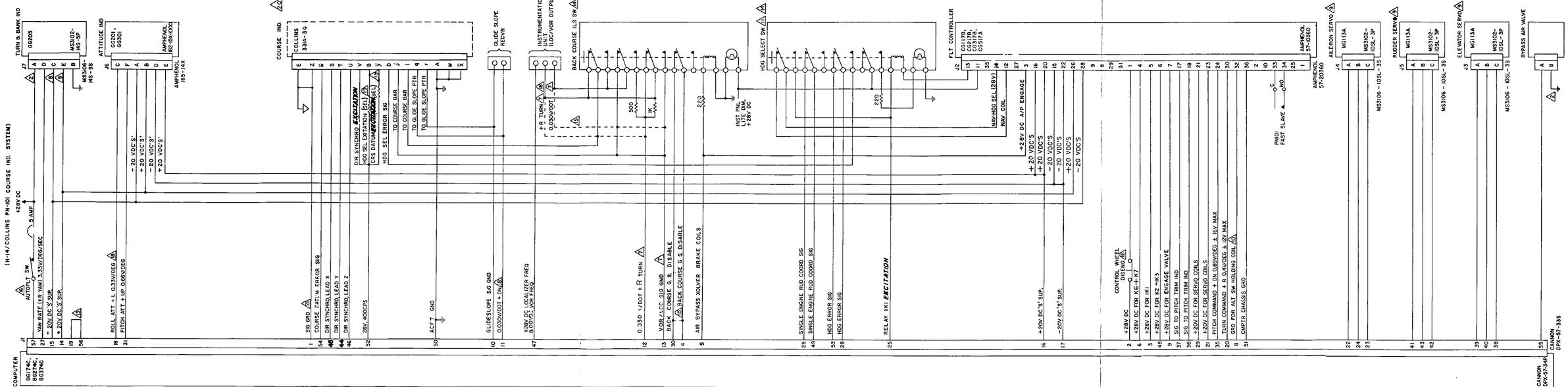
19- SEL VALUE FOR RES WHICH WILL PRODUCE 118 VOLTS MAX BETWEEN LOW SIDE OF RES TO PWR GND, ½ ; NORMINALLY 750 Ω, 1 WATT.

20- ONLY THOSE PINS USED FOR CONNECTING THE PN101 & KPI550 TO THE H-14 ARE SHOWN.

21- H-14 SIG GRD MUST NOT BE CONNECTED TO AIRCRAFT GND.

22- KPI-550 UNITS PRIOR TO S.N. 1220 MAY GROUND A/P SIGNAL SUPPLY

H 14 3-SWITCH STANDARD SYSTEM INTERCONNECT DIAGRAM
FIGURE 7-16



NOTES-

1- ALL LEADWIRE AWG NO 22 UNLESS OTHERWISE SPECIFIED.

2. USE AWG NO 18 LEADWIRE.

3- PERFORM LEADWIRE ROUTING, BUNDLING, TYING & SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.

4- AUTOPLT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.

5- THE AUTOPLT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.

6- THE GLIDE SLOPE & LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJ RECVR OUTPUTS ACCORDINGLY.

7. USE UNIFIED, SHIELDED, TWO CONDUCTOR CABLE.

8. USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S 'HYPLUG' YEI220.

9. LEADWIRE TO PINS A&C MAY BE REVERSED FOR PROPER PHASING

10. USE ONLY IF ALT CONTROL (PG51) IS INSTALLED.

11. NAV HOLDING COIL INTERLOCK. DELETE IF NAV FUNCTION NOT INSTALLED

12. CG-515 HAS INTERNAL LIGHT LEVEL ADJUSTMENT

13. TO USE EXT GENERATED 26V AC, REM JUMPER & CONNECT PWR TO PIN 19 AN ALT PWR SUP CARD MUST BE USED IN THE CMPTR.

14. SUGGESTED SW.: MICRO SW 54PB831-T2 WITH PUSH BUTTON 52PA7-B2 IN BLU, GRN, WHT OR RED AS DESIRED. USE LAMP NO. 334.

15. THE DOTTED LINES SHOW PROPER CONNECTIONS IF A BACK COURSE IS NOT INSTALLED.

16. DENOTES OPTIONAL UNITS

17. UNITS DESIGNATED AS OPTIONAL ARE NOT REQD FOR AN OPERATIONAL AUTOPLT.

18. A VOLTAGE OF THE STATED POLARITY WILL PRODUCE AN AIRCRAFT MOVEMENT IN THE STATED DIRECTION.

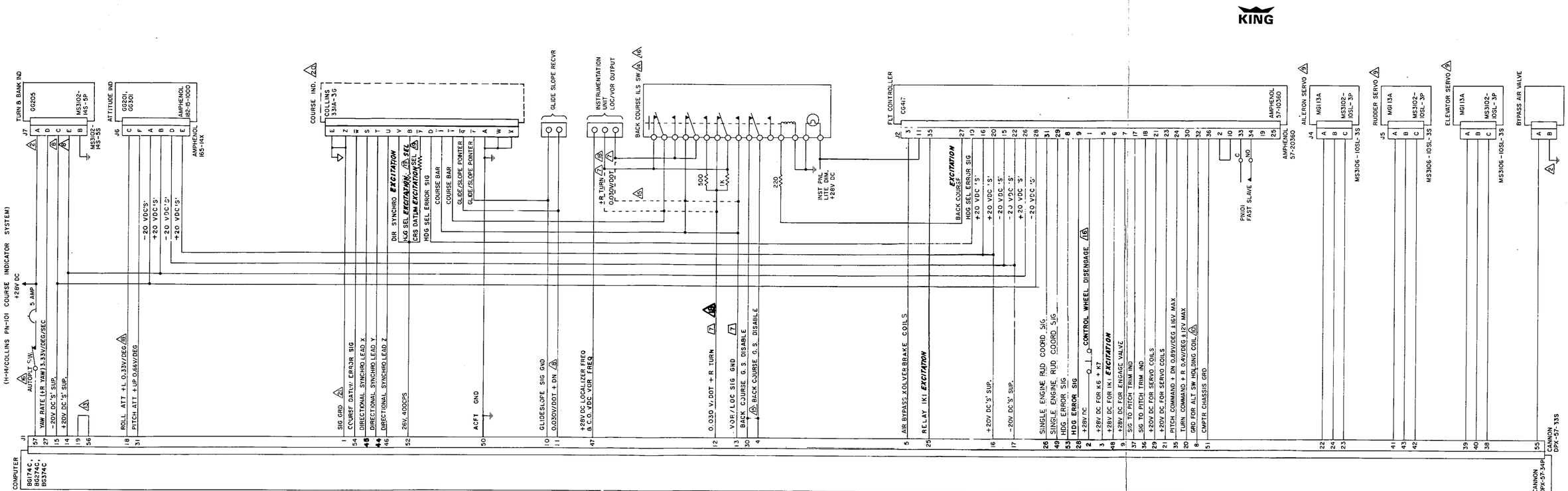
19. SEL VALUE FOR RES WHICH WILL PRODUCE 118 VOLTS MAX BETWEEN LOW SIDE OF RES TO PWR GND, ⏚; NORMINALLY 750 Ω, 1 WATT.

20. ONLY THOSE PINS USED FOR CONNECTING THE PNIOI & KPI550 TO THE H-14 ARE SHOWN.

21. H-14 SIG GRD MUST NOT BE CONNECTED TO AIRCRAFT GND.

22. - KPI-550 UNITS PRIOR TO S N. 122C MAY GROUND A/P SIGNAL SUPPLY

H14/COLLINS PN-101 COURSE INDICATOR 3-SWITCH SYSTEM
INTERCONNECT DIAGRAM
FIGURE 7-17



NOTES-

1- ALL LEADWIRE AWG NO 22 UNLESS OTHERWISE SPECIFIED.

2. USE AWG NO 18 LEADWIRE.

3- PERFORM LEADWIRE ROUTING, BUNDLING, TYING & SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.

4- AUTOPLT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.

5- THE AUTOPLT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.

6- THE GLIDE SLOPE & LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJ RECVR OUTPUTS ACCORDINGLY.

7. USE UNIFIED, SHIELDED, TWO CONDUCTOR CABLE.

8. USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S 'HYPLUG' YEI220.

9. LEADWIRE TO PINS A&C MAY BE REVERSED FOR PROPER PHASING

10. USE ONLY IF ALT CONTROL (PG51) IS INSTALLED.

11. NAV HOLDING COIL INTERLOCK. DELETE IF NAV FUNCTION NOT INSTALLED

12. CG-515 HAS INTERNAL LIGHT LEVEL ADJUSTMENT

13. TO USE EXT GENERATED 26V AC, REM JUMPER & CONNECT PWR TO PIN 19 AN ALT PWR SUP. CARD MUST BE USED IN THE CMPTR.

14. SUGGESTED SW.: MICRO SW 54PB831-T2 WITH PUSH BUTTON 52PA7-B2 IN BLU, GRN, WHT OR RED AS DESIRED. USE LAMP NO. 334.

15. THE DOTTED LINES SHOW PROPER CONNECTIONS IF A BACK COURSE IS NOT INSTALLED.

16. DENOTES OPTIONAL UNITS

17. UNITS DESIGNATED AS OPTIONAL ARE NOT REQD FOR AN OPERATIONAL AUTOPLT.

18. A VOLTAGE OF THE STATED POLARITY WILL PRODUCE AN AIRCRAFT MOVEMENT IN THE STATED DIRECTION.

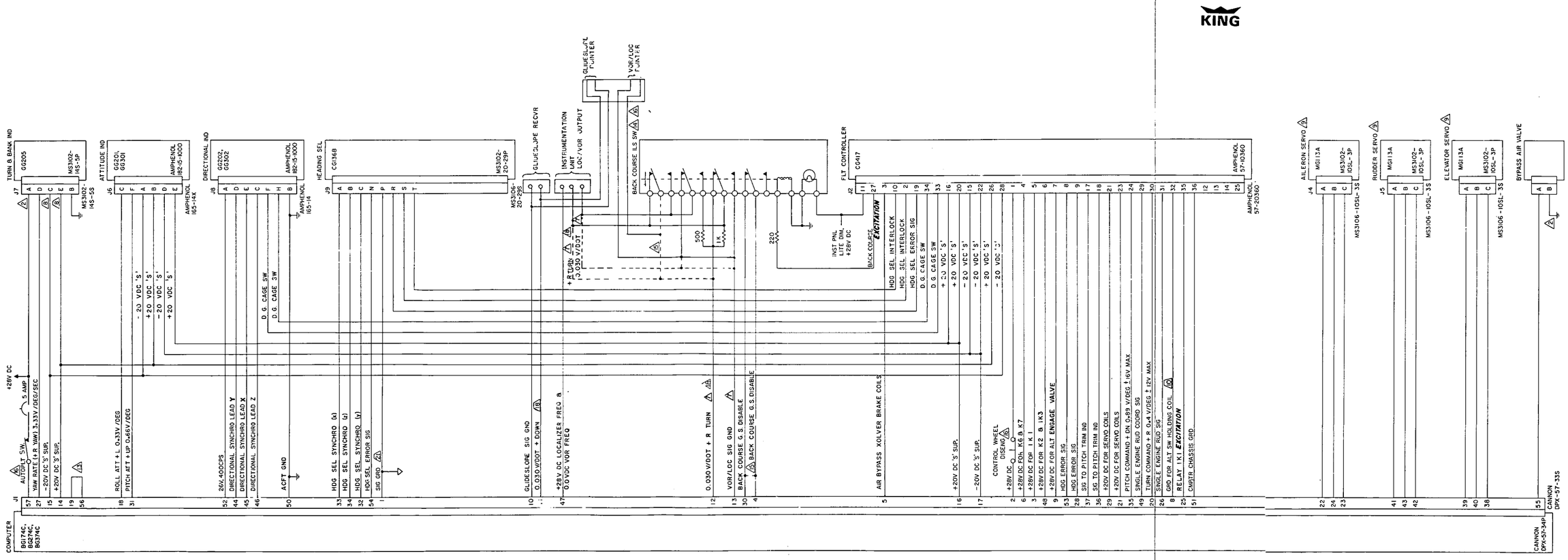
19. SEL VALUE FOR RES WHICH WILL PRODUCE 118 VOLTS MAX BETWEEN LOW SIDE OF RES TO PWR GND, ⏚; NORMINALLY 750Ω., 1 WATT.

20. ONLY THOSE PINS USED FOR CONNECTING THE PN101 & KPI550 TO THE H-14 ARE SHOWN.

21. H-14 SIG GRD MUST NOT BE CONNECTED TO AIRCRAFT GND.

22. - KPI-550 UNITS PRIOR TO S/N 1220 MAY GROUND A/P SIGNAL SUPPLY

H 14/COLLINS PN-101 COURSE INDICATOR 4-SWITCH SYSTEM
INTERCONNECT DIAGRAM WITHOUT PITCH SYNC
FIGURE 7-19



NOTES-

1- ALL LEADWIRE AWG NO 22 UNLESS OTHERWISE SPECIFIED.

2 USE AWG NO 18 LEADWIRE.

3- PERFORM LEADWIRE ROUTING, BUNDLING, TYING & SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.

4- AUTOPLT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.

5- THE AUTOPLT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.

6- THE GLIDE SLOPE & LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJ RECVR OUTPUTS ACCORDINGLY.

7 USE UNIFIED, SHIELDED, TWO CONDUCTOR CABLE.

8 USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S 'HYPLUG' YEI220.

9 LEADWIRE TO PINS A&C MAY BE REVERSED FOR PROPER PHASING

10 USE ONLY IF ALT CONTROL (PG51) IS INSTALLED.

11 NAV HOLDING COIL INTERLOCK. DELETE IF NAV FUNCTION NOT INSTALLED

12 CG-515 HAS INTERNAL LIGHT LEVEL ADJUSTMENT

13 TO USE EXT GENERATED 26V AC, REM JUMPER & CONNECT PWR TO PIN 19 AN ALT PWR SUP CARD MUST BE USED IN THE CMPTR.

14 SUGGESTED SW.: MICRO SW 54PB831-T2 WITH PUSH BUTTON 52PA7-B2 IN BLU, GRN, WHT OR RED AS DESIRED. USE LAMP NO. 334.

15 THE DOTTED LINES SHOW PROPER CONNECTIONS IF A BACK COURSE IS NOT INSTALLED.

16 DENOTES OPTIONAL UNITS

17 UNITS DESIGNATED AS OPTIONAL ARE NOT REQD FOR AN OPERATIONAL AUTOPLT.

18 A VOLTAGE OF THE STATED POLARITY WILL PRODUCE AN AIRCRAFT MOVEMENT IN THE STATED DIRECTION.

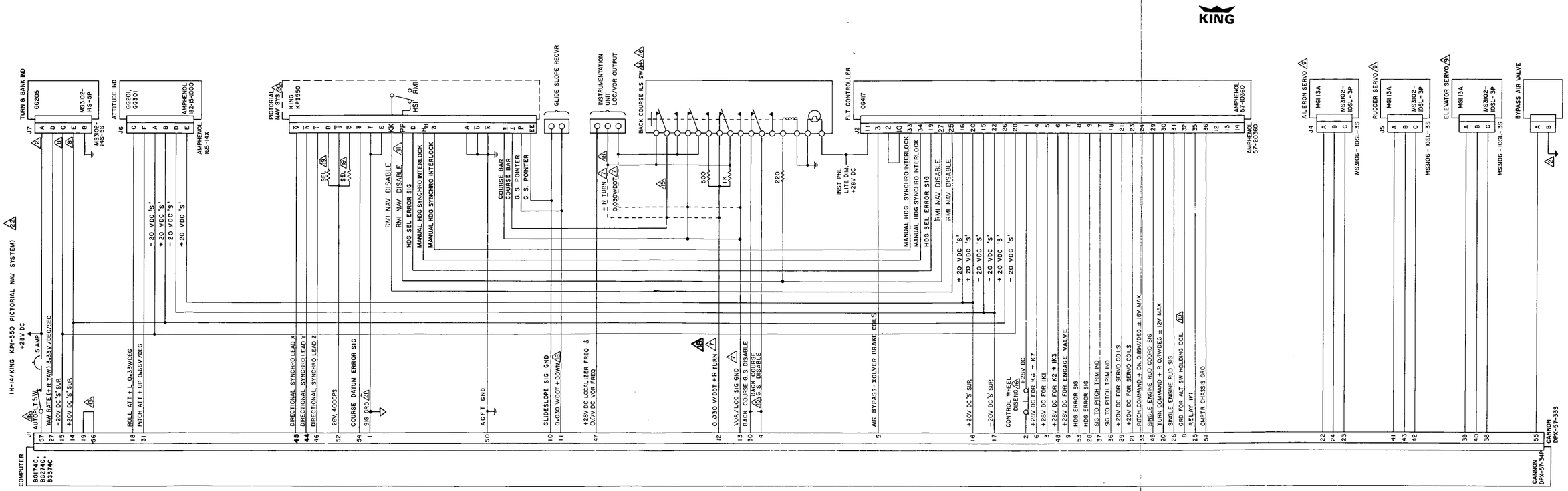
19 SEL VALUE FOR RES WHICH WILL PRODUCE 118 VOLTS MAX BETWEEN LOW SIDE OF RES TO PWR GND, ±; NORMINALLY 750 Ω, 1 WATT.

20 ONLY THOSE PINS USED FOR CONNECTING THE PNI01 & KPI550 TO THE H-14 ARE SHOWN.

21 H-14 SIG GRD MUST NOT BE CONNECTED TO AIRCRAFT GND.

22 - KPI-550 UNITS PRIOR TO S.N. 122C MAY GROUND A/P SIGNAL SUPPLY

H 14 4-SWITCH STANDARD SYSTEM INTERCONNECT DIAGRAM
WITHOUT PITCH SYNC
FIGURE 7-18



NOTES

1- ALL LEADWIRE AWG NO 22 UNLESS OTHERWISE SPECIFIED.

2. USE AWG NO 18 LEADWIRE.

3- PERFORM LEADWIRE ROUTING, BUNDLING, TYING & SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.

4- AUTOPLT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.

5- THE AUTOPLT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.

6- THE GLIDE SLOPE & LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJ RECVR OUTPUTS ACCORDINGLY.

7. USE UNIFIED, SHIELDED, TWO CONDUCTOR CABLE.

8. USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S 'HYPLUG' YE1220.

9. LEADWIRE TO PINS A&C MAY BE REVERSED FOR PROPER PHASING

10. USE ONLY IF ALT CONTROL (PG51) IS INSTALLED.

11. NAV HOLDING COIL INTERLOCK. DELETE IF NAV FUNCTION NOT INSTALLED

12. CG-515 HAS INTERNAL LIGHT LEVEL ADJUSTMENT

13. TO USE EXT GENERATED 26V AC, REM JUMPER & CONNECT PWR TO PIN 19 AN ALT PWR SUP CARD MUST BE USED IN THE CMPTR.

14. SUGGESTED SW1 MICRO SW 54PB831-T2 WITH PUSH BUTTON 52PA7-B2 IN BLU, GRN, WHT OR RED AS DESIRED. USE LAMP NO. 334.

15. THE DOTTED LINES SHOW PROPER CONNECTIONS IF A BACK COURSE IS NOT INSTALLED.

16. DENOTES OPTIONAL UNITS

17. UNITS DESIGNATED AS OPTIONAL ARE NOT REQD FOR AN OPERATIONAL AUTOPLT.

18. A VOLTAGE OF THE STATED POLARITY WILL PRODUCE AN AIRCRAFT MOVEMENT IN THE STATED DIRECTION.

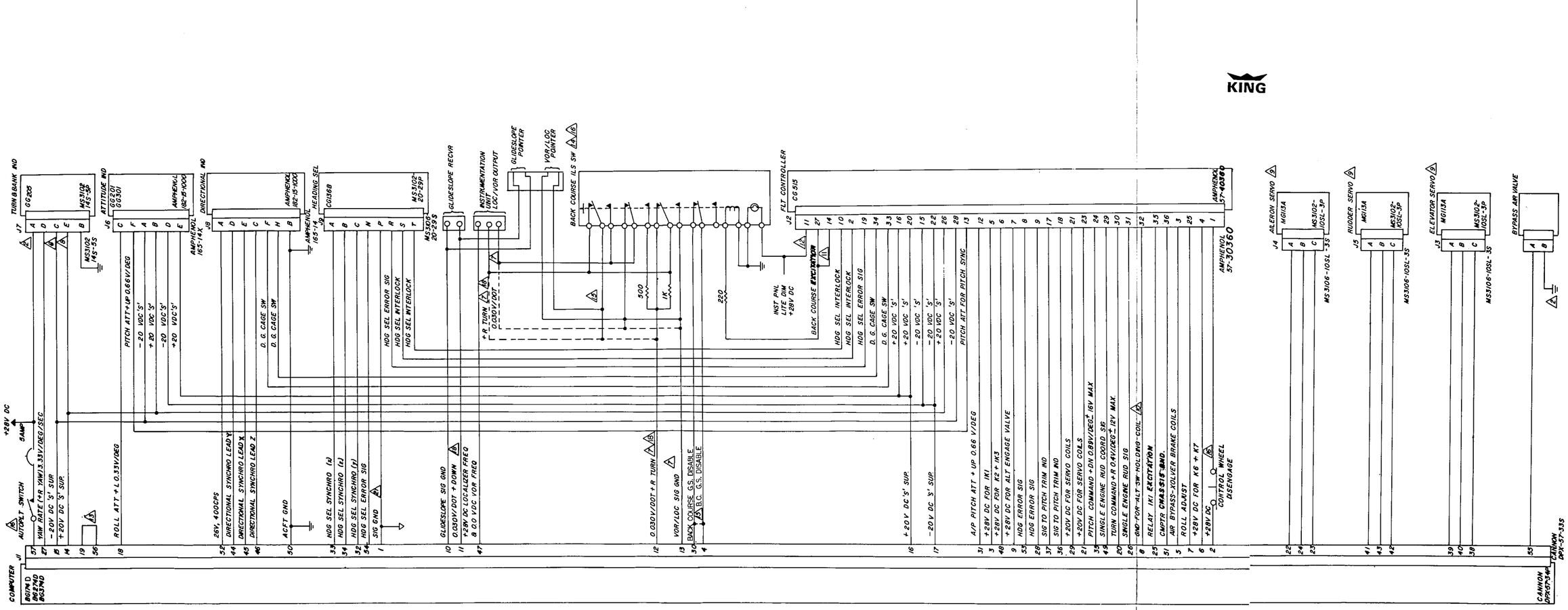
19. SEL VALUE FOR RES WHICH WILL PRODUCE 118 VOLTS MAX BETWEEN LOW SIDE OF RES TO PWR GND, ⏚; NORMINALLY 750 Ω, 1 WATT.

20. ONLY THOSE PINS USED FOR CONNECTING THE PN101 & KPI550 TO THE H-14 ARE SHOWN.

21. H-14 SIG GRD MUST NOT BE CONNECTED TO AIRCRAFT GND.

22. - KPI-550 UNITS PRIOR TO S.N. 122C MAY GROUND A/P SIGNAL SUPPLY

H 14/KING KPI 550 PICTORIAL NAV 4-SWITCH SYSTEM INTERCONNECT DIAGRAM WITHOUT PITCH SYNC
FIGURE 7-20



NOTES-

1- ALL LEADWIRE AWG NO 22 UNLESS OTHERWISE SPECIFIED.

2 USE AWG NO 18 LEADWIRE.

3- PERFORM LEADWIRE ROUTING, BUNDLING, TYING & SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.

4- AUTOPLT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.

5- THE AUTOPLT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.

6- THE GLIDE SLOPE & LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJ RECVR OUTPUTS ACCORDINGLY.

7 USE UNIFIED, SHIELDED, TWO CONDUCTOR CABLE.

16 DENOTES OPTIONAL UNITS

17 UNITS DESIGNATED AS OPTIONAL ARE NOT REQD FOR AN OPERATIONAL AUTOPLT.

18 A VOLTAGE OF THE STATED POLARITY WILL PRODUCE AN AIRCRAFT MOVEMENT IN THE STATED DIRECTION.

19 SEL VALUE FOR RES WHICH WILL PRODUCE 118 VOLTS MAX BETWEEN LOW SIDE OF RES TO PWR GND, ±5%, NORMINALLY 750Ω, 1 WATT.

20- ONLY THOSE PINS USED FOR CONNECTING THE PNI01 & KPI550 TO THE H-14 ARE SHOWN.

21 H-14 SIG GRD MUST NOT BE CONNECTED TO AIRCRAFT GND.

22 - KPI-550 UNITS PRIOR TO S.N. 122C MAY GROUND A/P SIGNAL SUPPLY

8 USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S 'HYPLUG' YEI220.

9 LEADWIRE TO PINS A&C MAY BE REVERSED FOR PROPER PHASING

10 USE ONLY IF ALT CONTROL (PG51) IS INSTALLED.

11 NAV HOLDING COIL INTERLOCK. DELETE IF NAV FUNCTION NOT INSTALLED

12 CG-515 HAS INTERNAL LIGHT LEVEL ADJUSTMENT

13 TO USE EXT GENERATED 26V AC, REM JUMPER & CONNECT PWR TO PIN 19 AN ALT PWR SUP. CARD MUST BE USED IN THE CMPTR.

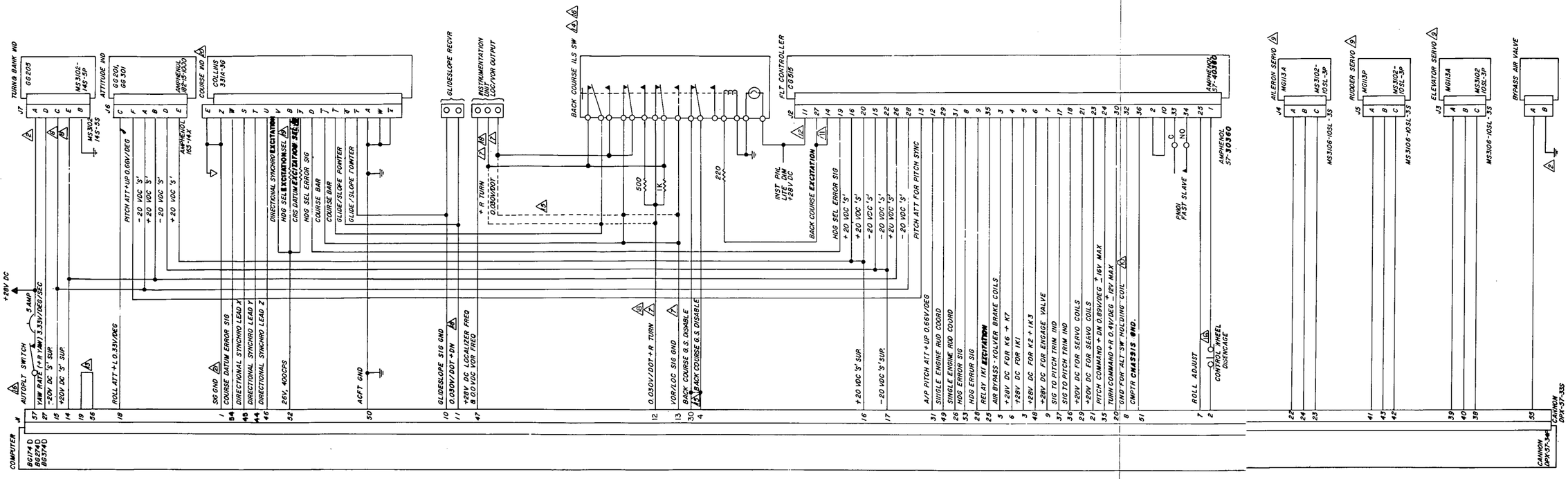
14 SUGGESTED SW.: MICRO SW 54PB831-T2 WITH PUSH BUTTON 52PA7-B2 IN BLU, GRN, WHT OR RED AS DESIRED. USE LAMP NO. 334.

15 THE DOTTED LINES SHOW PROPER CONNECTIONS IF A BACK COURSE IS NOT INSTALLED.

H 14 4-SWITCH STANDARD SYSTEM INTERCONNECT DIAGRAM
WITH PITCH SYNC
FIGURE 7-21

H-14 4-SWITCH SYSTEMS WITH PITCH SYNC

(H-14/COLLINS PN101 COURSE INDICATOR SYSTEM)



NOTES-

1- ALL LEADWIRE AWG NO 22 UNLESS OTHERWISE SPECIFIED.

2 USE AWG NO 18 LEADWIRE.

3- PERFORM LEADWIRE ROUTING, BUNDLING, TYING & SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.

4- AUTOPLT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.

5- THE AUTOPLT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.

6- THE GLIDE SLOPE & LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJ RECVR OUTPUTS ACCORDINGLY.

7 USE UNIFIED, SHIELDED, TWO CONDUCTOR CABLE.

8 USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S 'HYPLUG' YEI220.

9 LEADWIRE TO PINS A&C MAY BE REVERSED FOR PROPER PHASING

10 USE ONLY IF ALT CONTROL (PG51) IS INSTALLED.

11 NAV HOLDING COIL INTERLOCK. DELETE IF NAV FUNCTION NOT INSTALLED

12 CG-515 HAS INTERNAL LIGHT LEVEL ADJUSTMENT

13 TO USE EXT GENERATED 26V AC, REM JUMPER & CONNECT PWR TO PIN 19. AN ALT PWR SUP CARD MUST BE USED IN THE CMPTR.

14 SUGGESTED SW.: MICRO SW 54PB831-T2 WITH PUSH BUTTON 52PA7-B2 IN BLU, GRN, WHT OR RED AS DESIRED. USE LAMP NO. 334.

15 THE DOTTED LINES SHOW PROPER CONNECTIONS IF A BACK COURSE IS NOT INSTALLED.

16 DENOTES OPTIONAL UNITS

17 UNITS DESIGNATED AS OPTIONAL ARE NOT REQD FOR AN OPERATIONAL AUTOPLT.

18 A VOLTAGE OF THE STATED POLARITY WILL PRODUCE AN AIRCRAFT MOVEMENT IN THE STATED DIRECTION.

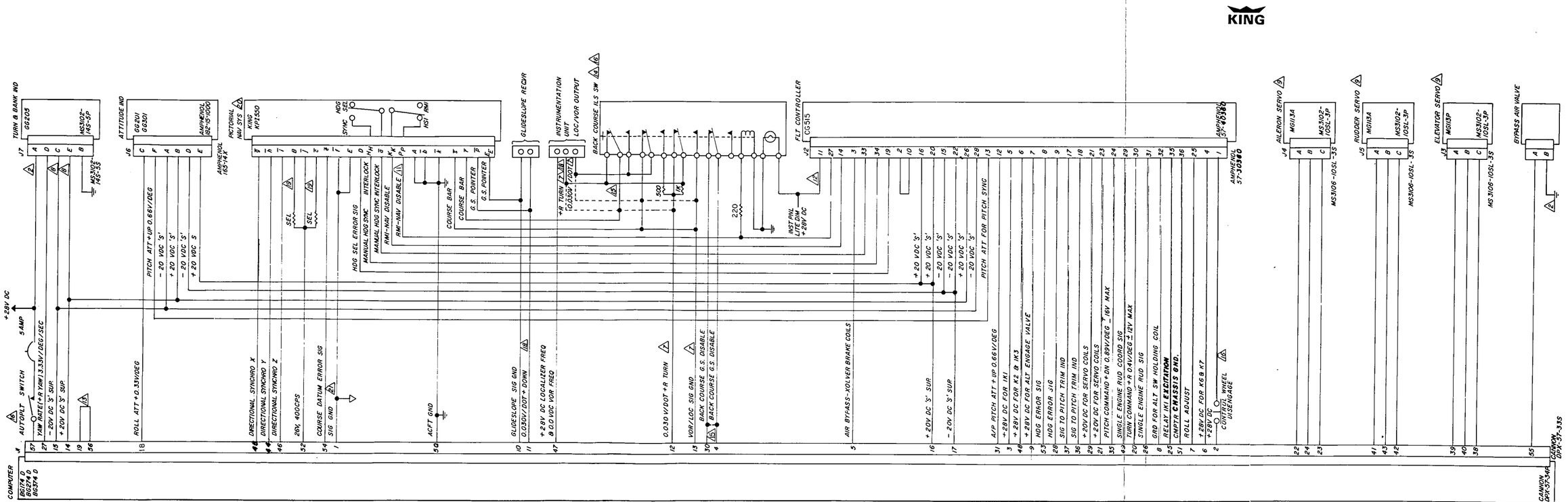
19 SEL VALUE FOR RES WHICH WILL PRODUCE 118 VOLTS MAX BETWEEN LOW SIDE OF RES TO PWR GND, ⏚; NORMINALLY 750 Ω., 1 WATT.

20 - ONLY THOSE PINS USED FOR CONNECTING THE PN101 & KPI550 TO THE H-14 ARE SHOWN

21 H-14 SIG GRD MUST NOT BE CONNECTED TO AIRCRAFT GND.

22 - KPI-550 UNITS PRIOR TO S N "122" MAY GROUND A/P SIGNAL SUPPLY

H 14/COLLINS PN-101 COURSE INDICATOR 4-SWITCH SYSTEM
INTERCONNECT DIAGRAM WITH PITCH SYNC
FIGURE 7-22



NOTES-

1- ALL LEADWIRE AWG NO 22 UNLESS OTHERWISE SPECIFIED.

2. USE AWG NO 18 LEADWIRE.

3- PERFORM LEADWIRE ROUTING, BUNDLING, TYING & SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.

4- AUTOPLT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.

5- THE AUTOPLT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.

6- THE GLIDE SLOPE & LOCALIZER COUPLERS PRESENT IK RESISTIVE LOADS. ADJ RECVR OUTPUTS ACCORDINGLY.

7. USE UNIFIED, SHIELDED, TWO CONDUCTOR CABLE.

8. USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S 'HYPLUG' YE1220

9. LEADWIRE TO PINS A&C MAY BE REVERSED FOR PROPER PHASING

10. USE ONLY IF ALT CONTROL (PG51) IS INSTALLED.

11. NAV HOLDING COIL INTERLOCK. DELETE IF NAV FUNCTION NOT INSTALLED

12. CG-515 HAS INTERNAL LIGHT LEVEL ADJUSTMENT

13. TO USE EXT GENERATED 26V AC, REM JUMPER & CONNECT PWR TO PIN 19. AN ALT PWR SUP. CARD MUST BE USED IN THE CMPTR.

14. SUGGESTED SW.: MICRO SW 54PB831-T2 WITH PUSH BUTTON 52PA7-B2 IN BLU, GRN, WHT OR RED AS DESIRED. USE LAMP NO. 334.

15. THE DOTTED LINES SHOW PROPER CONNECTIONS IF A BACK COURSE IS NOT INSTALLED.

16. DENOTES OPTIONAL UNITS.

17. UNITS DESIGNATED AS OPTIONAL ARE NOT REQD FOR AN OPERATIONAL AUTOPLT.

18. A VOLTAGE OF THE STATED POLARITY WILL PRODUCE AN AIRCRAFT MOVEMENT IN THE STATED DIRECTION.

19. SEL VALUE FOR RES WHICH WILL PRODUCE 11.8 VOLTS MAX BETWEEN LOW SIDE OF RES TO PWR GND, ±; NORMINALLY 750 Ω., 1 WATT.

20. ONLY THOSE PINS USED FOR CONNECTING THE PNIOI & KPI550 TO THE H-14 ARE SHOWN.

21. H-14 SIG GRD MUST NOT BE CONNECTED TO AIRCRAFT GND.

22. - KPI-550 UNITS PRIOR TO S.N. 1220 MAY GROUND A/P SIGNAL SUPPLY

H 14/KING KPI 550 PICTORIAL NAV 4-SWITCH SYSTEM
INTERCONNECT DIAGRAM WITH PITCH SYNC
FIGURE 7-23

NOTES:

1. THE GYRO SHOULD BE INSTALLED IN A SHOCK-MOUNTED INSTRUMENT PANEL SO THAT IT WILL BE LEVEL LATERALLY AND ITS FACE WILL BE VERTICAL IN CRUISE ATTITUDE. ALL FOUR MOUNTING POINTS MUST TOUCH THE PANEL BEFORE SCREWS ARE INSTALLED SO THAT THE GYRO WILL NOT BE STRAINED WHEN SCREWS ARE INSTALLED. USE FOUR (0.190 INCH) 10-32 x 7/8 INCH ROUNDHEAD BRASS MACHINE SCREWS FOR THE GG201 AND USE FOUR 6-32 x 1 INCH (MAX) ROUNDHEAD BRASS MACHINE SCREWS FOR THE GG301.

2. REMOVE THE PLUG FROM THE OUTLET PORT (FOR THE GG201, USE PORT A, B, OR C AS DESIRED). INSERT A FLEXIBLE HOSE CONNECTOR IN THE PORT. ATTACH THE VACUUM SUPPLY LINE (1/2 INCH O.D.) TO THE CONNECTOR. A REGULATING VALVE SHOULD BE IN THE LINE TO LIMIT THE VACUUM. FOR THE GG201, THE VACUUM MUST BE 4.75 ±0.25 INCH MERCURY AND FOR THE GG301 IT MUST BE 4.6 ±0.1 INCH MERCURY AT CRUISE SPEED. THE UNUSED PORTS ON THE GG201 MUST BE TIGHTLY SEALED. DO NOT USE THE RED SHIPPING PLUGS.

3. REMOVE THE PLUG FROM THE AIR INLET PORT. IF A LINE IS TO BE RUN TO A CENTRAL AIR FILTER, INSTALL A FLEXIBLE HOSE CONNECTOR AND THE AIR FILTER LINE. THE LINE MUST BE 1/2 INCH O.D.

4. KEEP ALL PNEUMATIC LINES AS SHORT AS POSSIBLE AND AVOID SHARP BENDS. BE SURE THAT THE LINES AND FLEXIBLE CONNECTORS ARE NOT PINCHED, TWISTED OR KINKED.

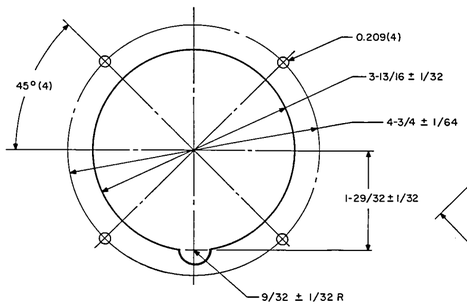
5. MATES WITH AMPHENOL 165 - 14X CONNECTOR.

6. CAGE FLAG IS OPTIONAL. GYROS WITH NO CAGE FLAG WILL HAVE A DECAL WITH INSTRUCTIONS FOR UNCAGING THE GYRO.

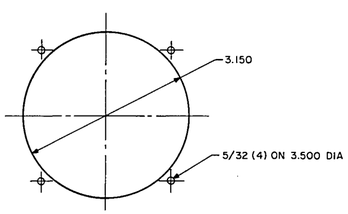
7. WEIGHTS: GG201 4.6 LB MAXIMUM, GG301 2.7 LB MAXIMUM.

8. DIMENSIONS ARE IN INCHES.

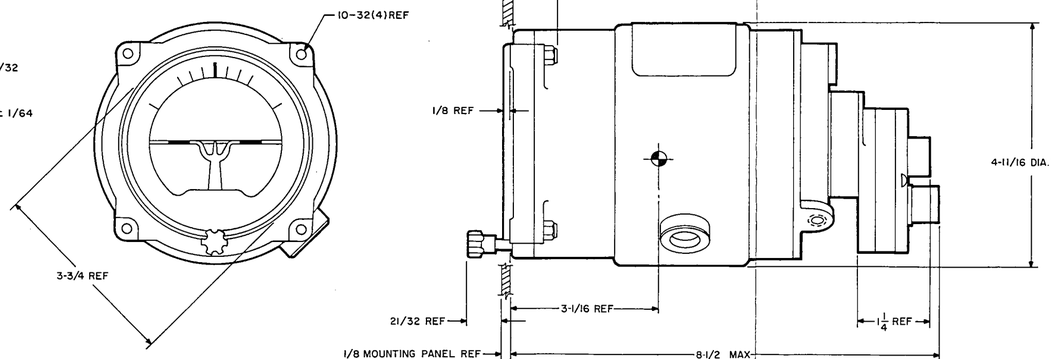
9. DIMENSIONS FOLLOWED BY "REF" ARE FOR INFORMATION AND ARE NOT SPECIFICATIONS REQUIRING CONFORMANCE.



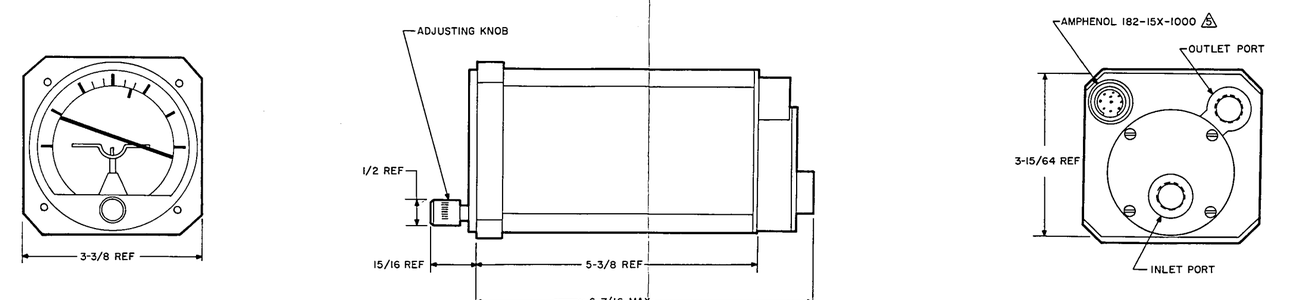
PANEL CUTOUT AND MOUNTING HOLES FOR GG201



PANEL CUTOUT AND MOUNTING HOLES FOR GG301



GG201



GG301

FIGURE 7-7 AIR DRIVEN VERTICAL GYRO - INSTALLATION DIAGRAM

NOTES:

1. THE GYRO SHOULD BE INSTALLED IN A SHOCK-MOUNTED INSTRUMENT PANEL SO THAT IT WILL BE LEVEL LATERALLY AND ITS FACE WILL BE VERTICAL IN CRUISE ATTITUDE. ALL FOUR MOUNTING POINTS MUST TOUCH THE PANEL BEFORE SCREWS ARE INSTALLED SO THAT THE GYRO WILL NOT BE STRAINED WHEN SCREWS ARE INSTALLED. USE FOUR (0.190 INCH) 10-32 x 7/8 INCH ROUNDHEAD BRASS MACHINE SCREWS FOR THE GG202 AND USE THREE 6-32 x 1 INCH (MAX) ROUNDHEAD BRASS MACHINE SCREWS FOR THE GG302.

2. REMOVE THE PLUG FROM THE OUTLET PORT (FOR THE GG202, USE PORT A, B, OR C AS DESIRED). INSERT A FLEXIBLE HOSE CONNECTOR IN THE PORT. ATTACH THE VACUUM SUPPLY LINE (1/2 INCH O.D.) TO THE CONNECTOR. A REGULATING VALVE SHOULD BE IN THE LINE TO LIMIT THE VACUUM. FOR THE GG202, THE VACUUM MUST BE 4-1/2 ±1/2 INCH MERCURY AND FOR THE GG302 IT MUST BE 4.6 ±0.1 INCH MERCURY AT CRUISE SPEED. THE UNUSED PORTS ON THE GG202 MUST BE TIGHTLY SEALED. DO NOT USE THE RED SHIPPING PLUGS.

3. REMOVE THE PLUG FROM THE AIR INLET PORT. IF A LINE IS TO BE RUN TO A CENTRAL AIR FILTER, INSTALL A FLEXIBLE HOSE CONNECTOR AND THE AIR FILTER LINE. THE LINE MUST BE 1/2 INCH O.D.

4. KEEP ALL PNEUMATIC LINES AS SHORT AS POSSIBLE AND AVOID SHARP BENDS. BE SURE THAT THE LINES AND FLEXIBLE CONNECTORS ARE NOT PINCHED, TWISTED OR KINKED.

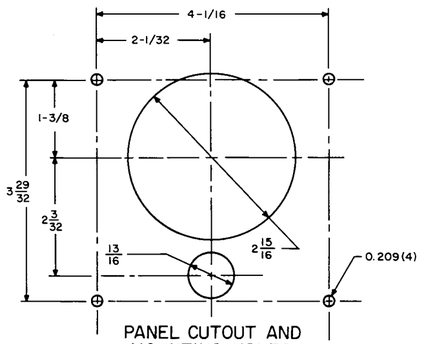
5. MATES WITH AMPHENOL 165 - 14

6. REMOVE CARD SET KNOB TO INSTALL GYRO IN PANEL.

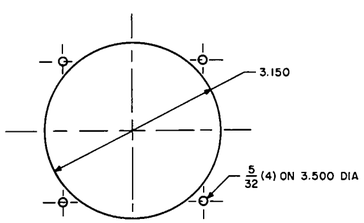
7. WEIGHTS: GG202 4.4 LB MAXIMUM, GG302 2.7 LB MAXIMUM.

8. DIMENSIONS ARE IN INCHES.

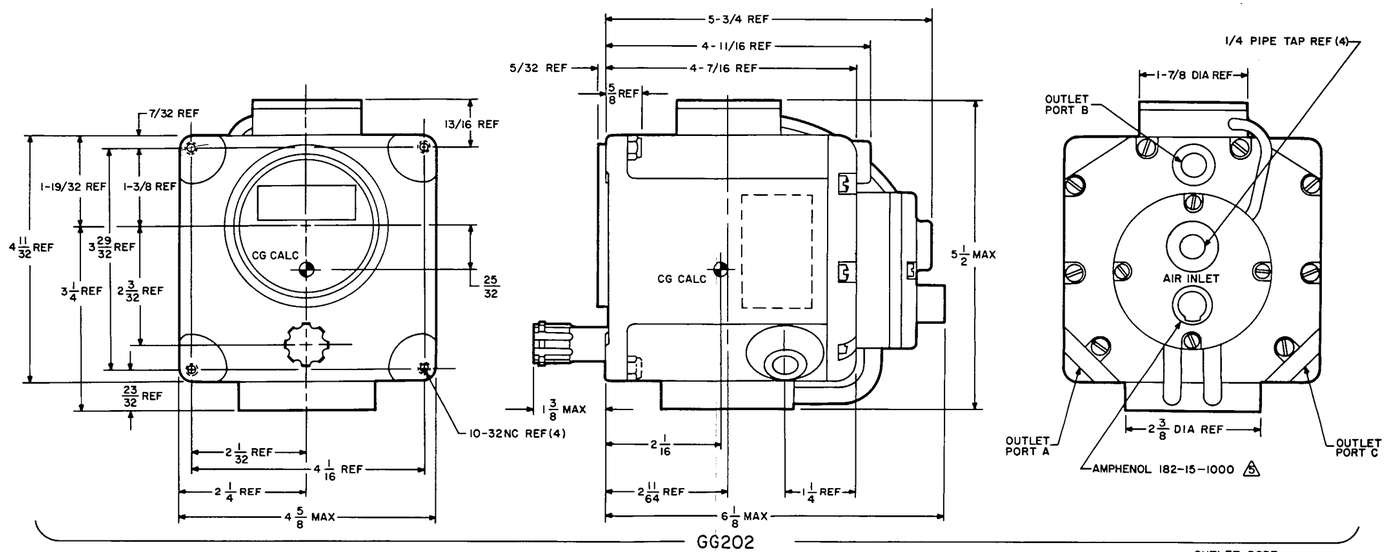
9. DIMENSIONS FOLLOWED BY "REF" ARE ONLY FOR INFORMATION AND ARE NOT SPECIFICATIONS REQUIRING CONFORMANCE.



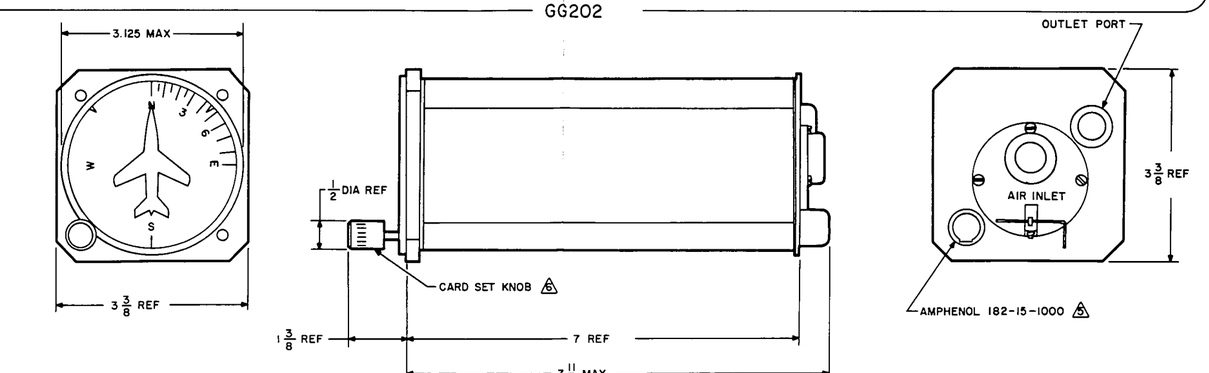
PANEL CUTOUT AND MOUNTING HOLES FOR GG202



PANEL CUTOUT AND MOUNTING HOLES FOR GG302

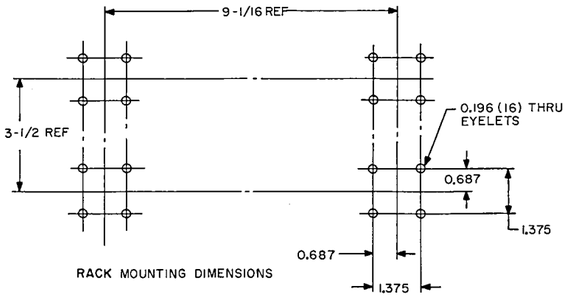


GG202

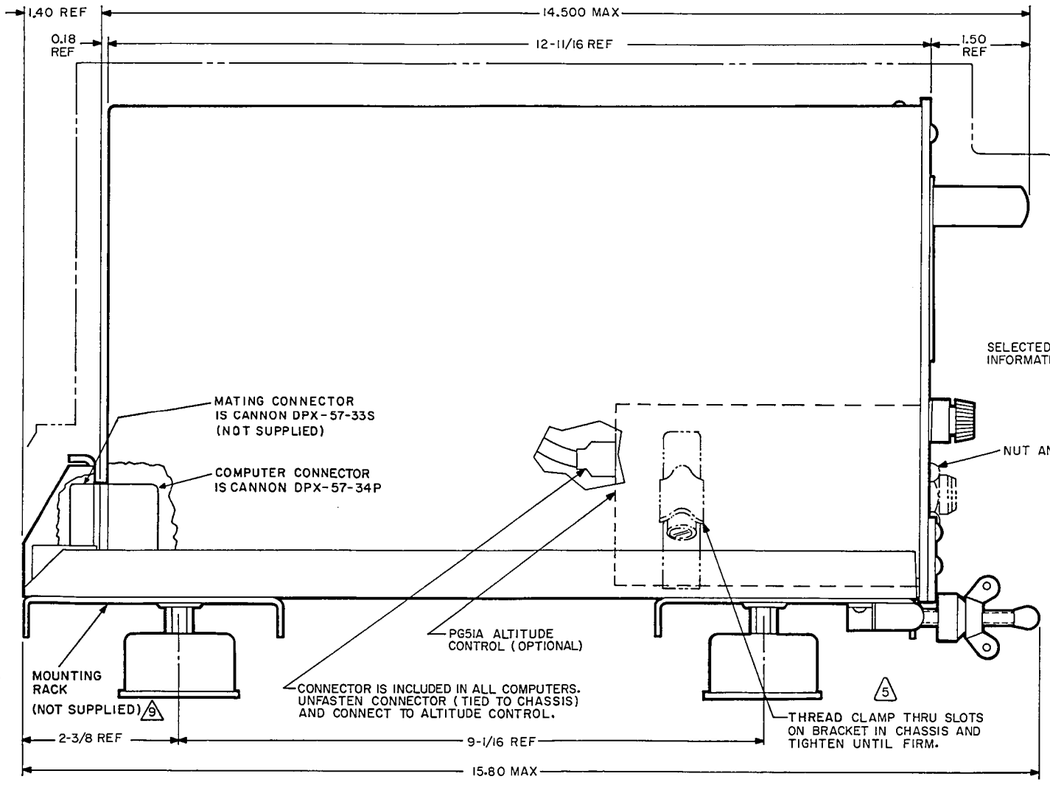


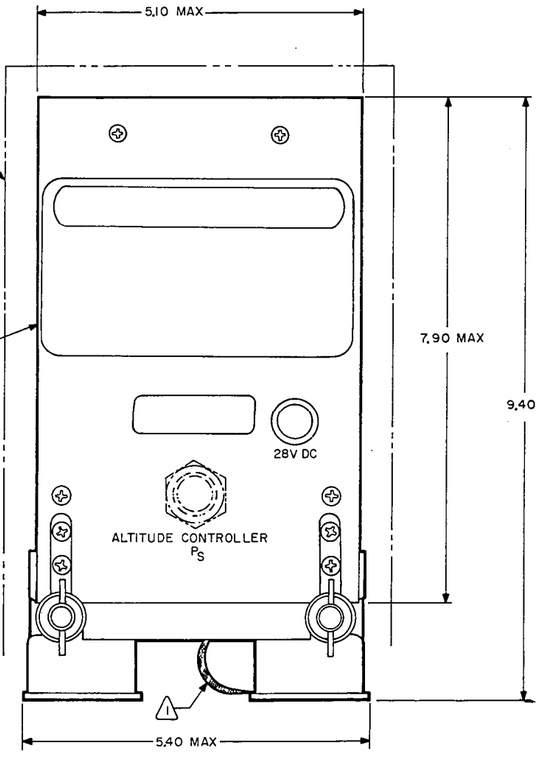
GG302

FIGURE 7-8 AIR DRIVEN DIRECTIONAL GYRO - INSTALLATION DIAGRAM



RACK MOUNTING DIMENSIONS

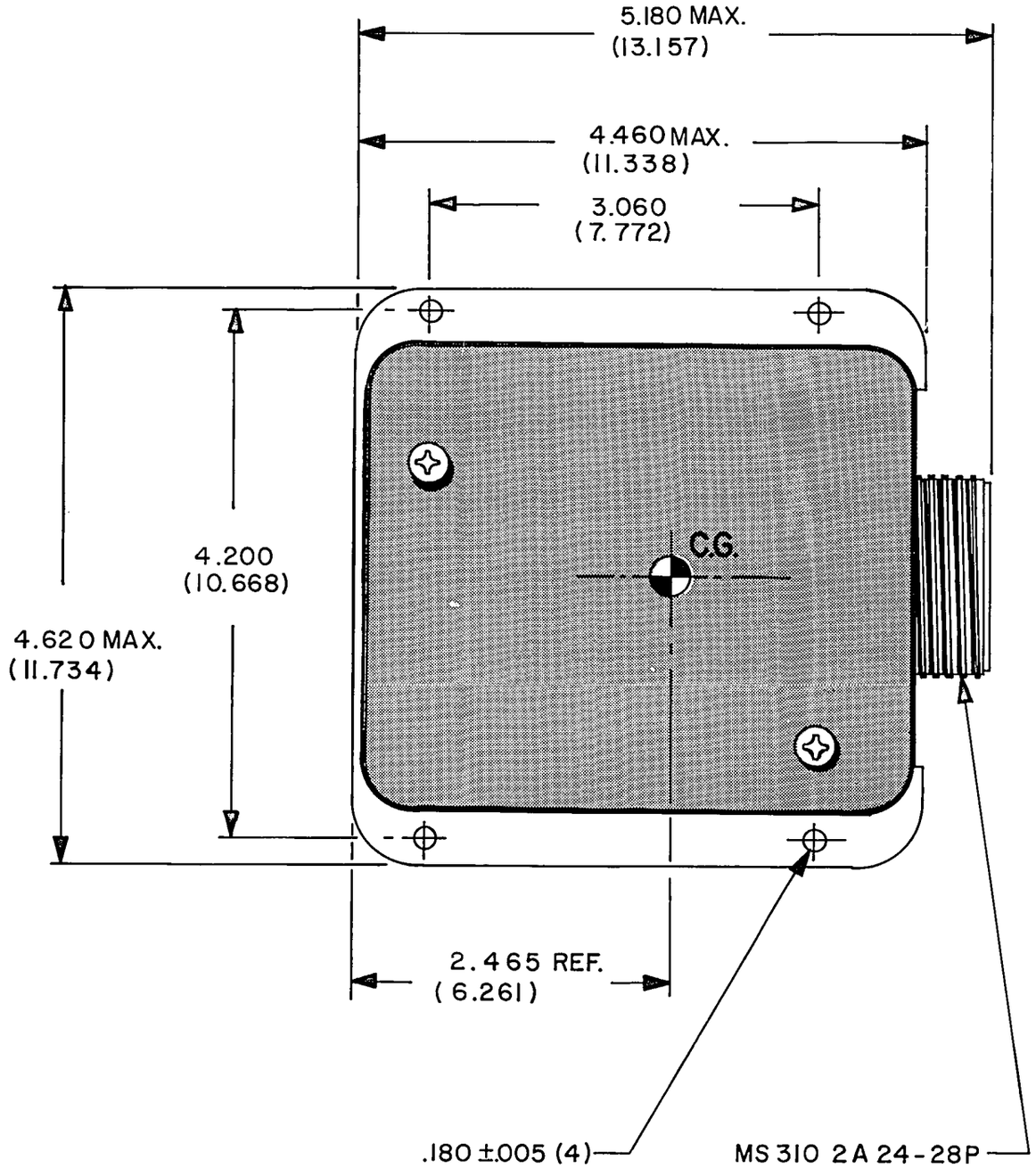


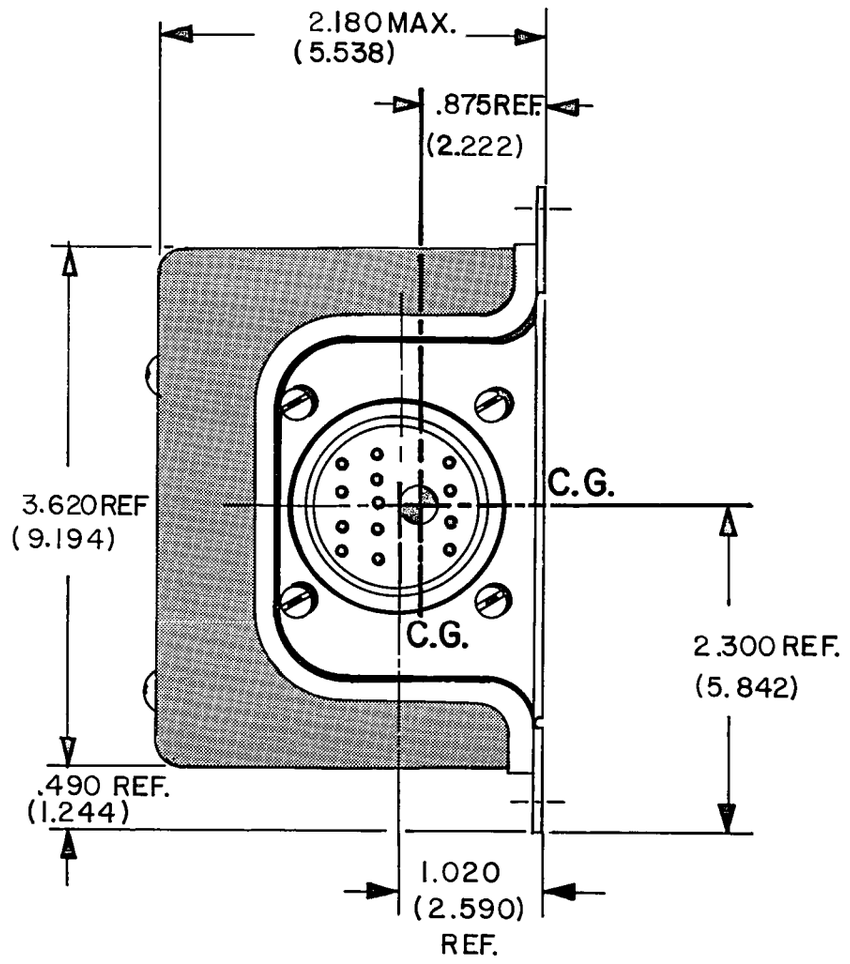


NOTES:

1. LOOSE END OF GROUND STRAP TO BE FASTENED UNDER ISOLATOR MOUNTING SCREWS AT THE TIME OF MOUNTING BASE INSTALLATION.
2. 0.5 INCH SWAY SPACE AROUND UNIT.
3. OBSERVE COLOR CODING WHEN INSERTING CARDS INTO CHASSIS.
4. THIS DEVICE IS NOT FUNCTIONAL UNLESS ONE OF THE OPTIONS IS INSTALLED.
5. CLAMP, NUT AND WASHER ARE FURNISHED WITH PG51A ALTITUDE CONTROL.
6. SELECTED OPTION INFORMATION PLATE SHOULD BE MARKED IN APPROPRIATE BLOCKS WHEN COMPUTER IS INSTALLED IN AIRCRAFT.
7. DIMENSIONS ARE IN INCHES.
8. DIMENSIONS FOLLOWED BY "REF" ARE ONLY FOR INFORMATION AND ARE NOT SPECIFICATIONS REQUIRING CONFORMANCE.
9. PURCHASE FROM K. W. JOHNSON & CO, DAYTON, OHIO, PART NO. 6187.

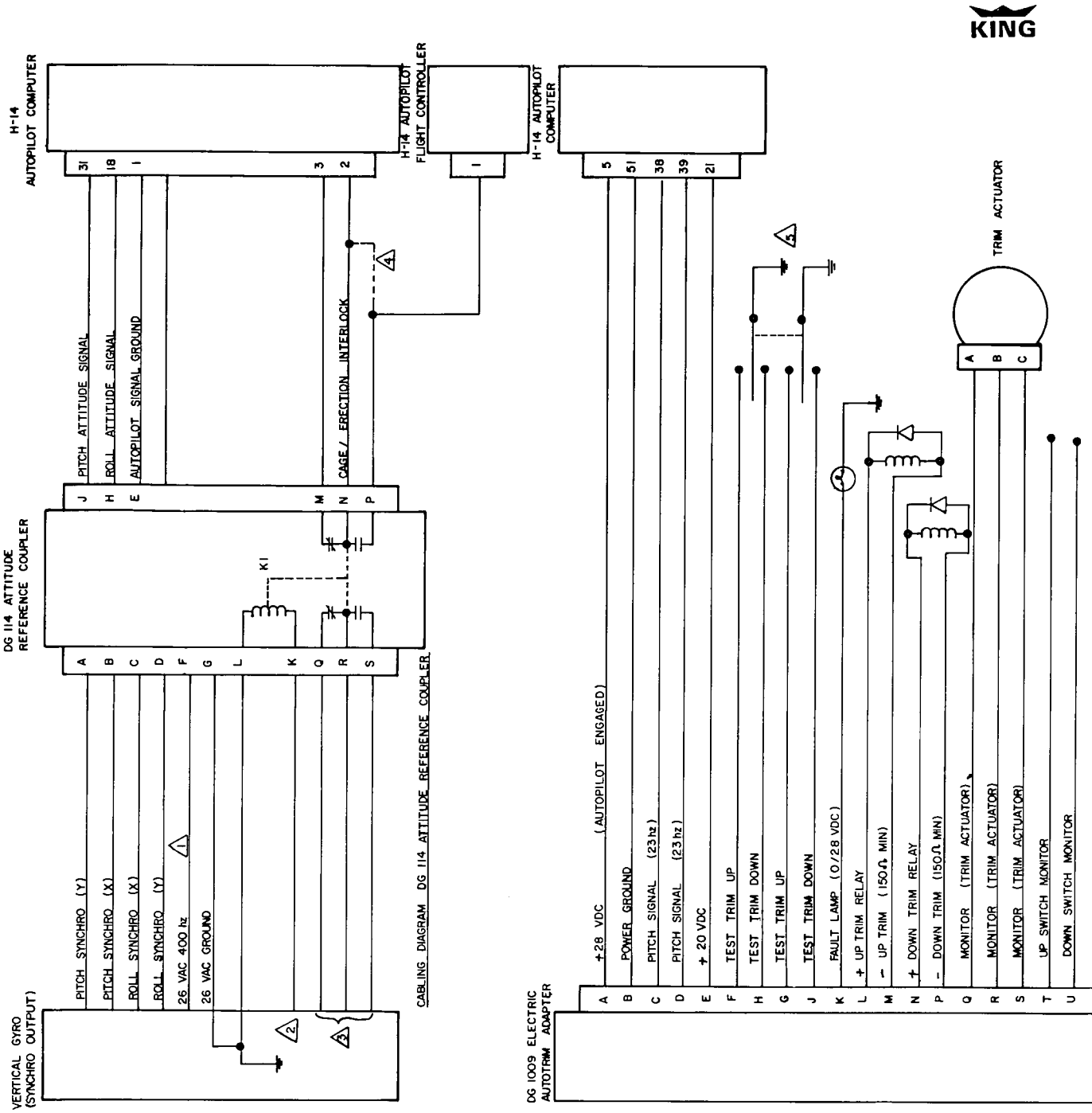
FIGURE 7-5 COMPUTER AND ALTITUDE CONTROL - INSTALLATION DIAGRAM





NOTE:
1. DIMENSIONS IN PARENTHESES ARE IN CENTIMETERS.
2. WEIGHT: .94 LBS.

FIGURE 7-12 DG1009 INSTALLATION DRAWING



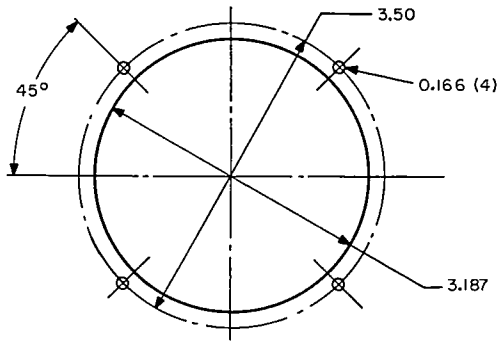
CABLING DIAGRAM DG 114 ATTITUDE REFERENCE COUPLER

CABLING DIAGRAM DG 1009 ELECTRIC AUTO-TRIM ADAPTER (BEECH MODEL 99 AIRCRAFT)

NOTES

6. 4-AMP STARTING CURRENT MAXIMUM.
5. DPDT CENTER-OFF LOW-CURRENT MOMENTARY SWITCH.
4. IF THE CAGE/ERECTION INTERLOCK IS NOT USED REMOVE THE K1 INTERCONNECT LEADS AND INSTALL A WIRE FROM CONTROLLER PIN 1 TO COMPUTER PIN 2.
3. THESE CONTACTS CAN BE USED TO OPERATE A WARNING FLAG, OR TO PROVIDE ADDITIONAL SWITCHING AS DEEMED NECESSARY.
2. RELAY CAN BE USED FOR CAGE OR ERECTION INTERLOCK AS FOLLOWS:
   (PIN K *EXCITATION*)
   0.0VDC - GYRO CAGED
   28VDC - GYRO UNCAGED
   OR
   0.0VDC - DURING ERECTION PROCESS
   28 VDC - ERECTION COMPLETE
1. MUST HAVE SAME PHASE AS PITCH AND ROLL SYNCHRO *EXCITATION* VOLTAGE.

H 14 SUPPLEMENTAL ADAPTER INTERCONNECT DIAGRAMS
FIGURE 7-27



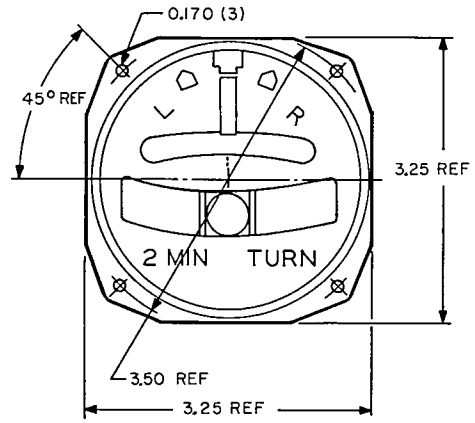
PANEL CUTOUT AND MOUNTING HOLES

NOTES:

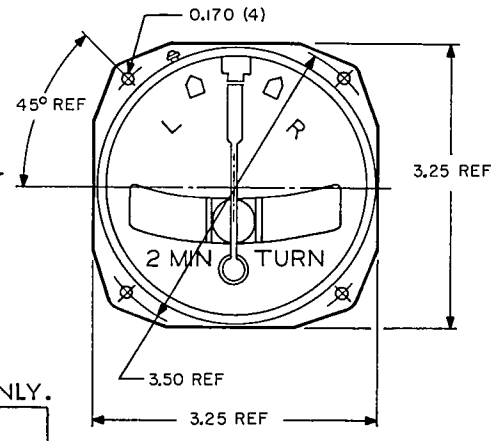
1. MATING ELECTRICAL CONNECTOR IS MS3106-14S-5S.
2. THE RATE GYRO INDICATOR SHOULD BE INSTALLED IN A SHOCK-MOUNTED INSTRUMENT PANEL. THE MOUNTING MUST BE SUCH THAT, WHEN THE AIRPLANE IS IN ITS NORMAL CRUISING ATTITUDE, THE INSTRUMENT WILL BE LEVEL LATERALLY AND ITS FACE WILL BE VERTICAL.
3. THE INSTRUMENT FACES DIFFER AND THE LOCATION OF THE ELECTRICAL CONNECTOR DIFFERS AMONG THE VARIOUS MODELS.
4. GG205A2, A3, A4, A6, B4, C2, C3, C4 ARE FUNCTIONALLY INTERCHANGEABLE WITH GG205A1, C1.
5. APPLICABLE TO GG205A2, C2 ONLY.
6. APPLICABLE TO GG205A3, C3 ONLY.
7. APPLICABLE TO GG205A4, A5, A6, B4, C4 ONLY.
8. WEIGHTS:

MODEL NO.	MAX WEIGHT (POUNDS)
GG205A1, A4, A5, A6, GG205B4, C1, C4	1.9
GG205A3, C3	2.1
GG205A2, C2	2.2

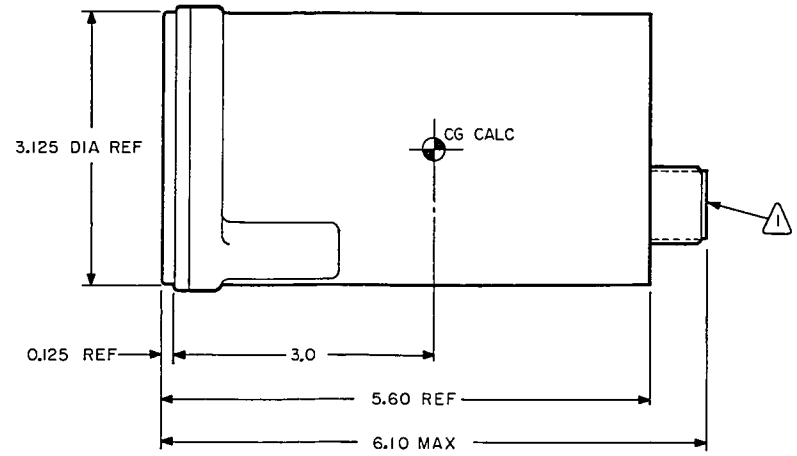
9. DIMENSIONS ARE STATED IN INCHES.
10. DIMENSIONS FOLLOWED BY "REF" ARE ONLY FOR INFORMATION AND ARE NOT SPECIFICATIONS REQUIRING CONFORMANCE.



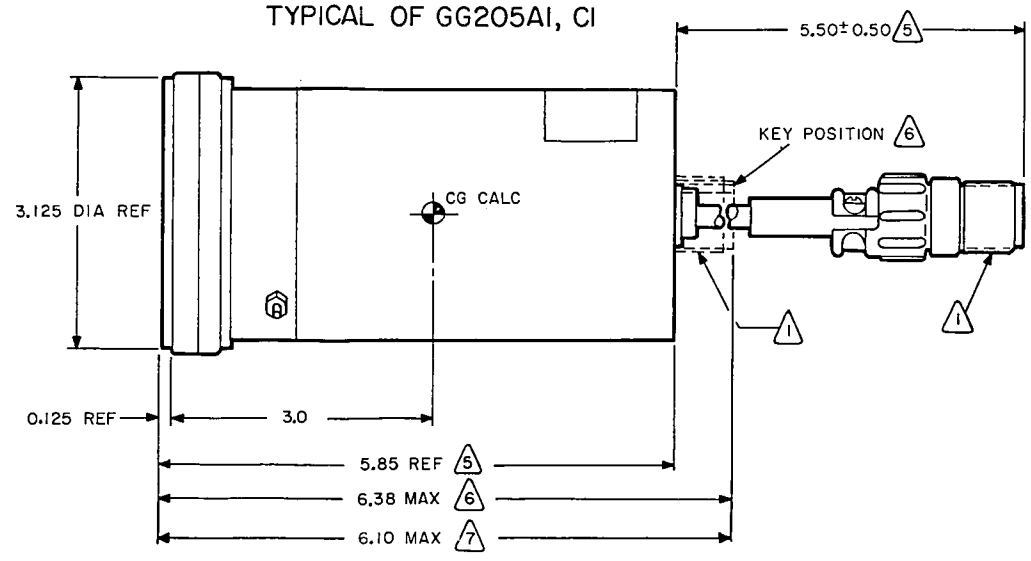
TYPICAL OF
GG205A4, A5, A6, B4, C4



TYPICAL OF
GG205A2, C2, A3, C3

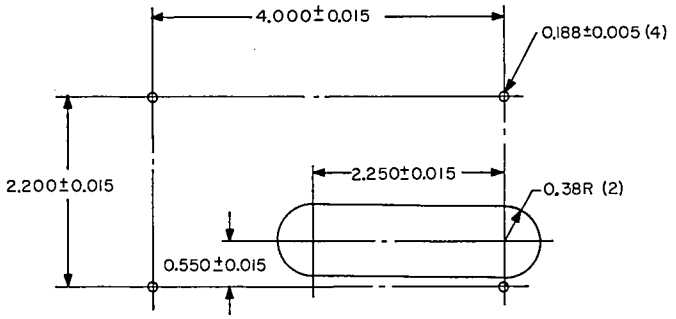


TYPICAL OF GG205A1, C1

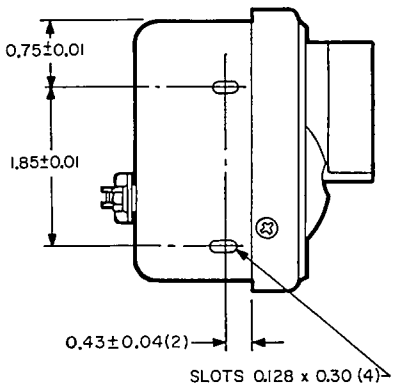


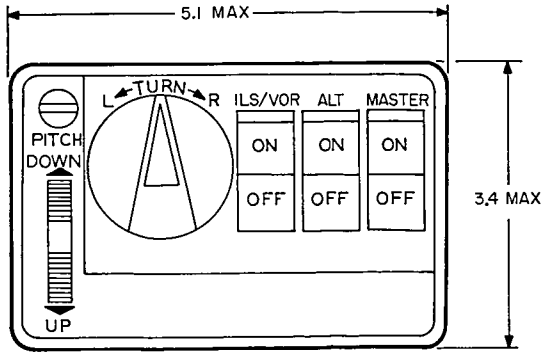
TYPICAL OF GG205A2, C2, A3, C3, A4

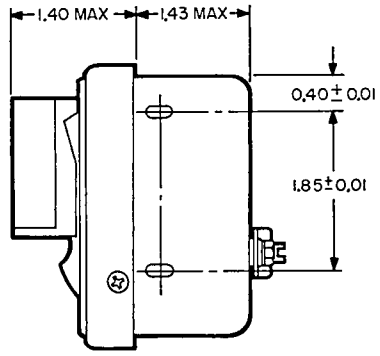
FIGURE 7-9 TURN AND BANK INDICATOR GYRO - INSTALLATION DIAGRAM

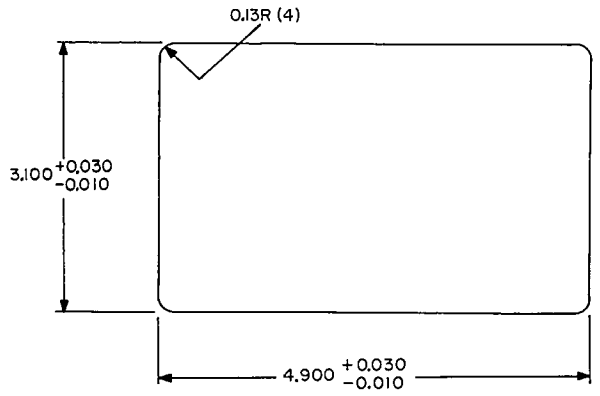


HOLE PATTERN FOR
MOUNTING METHOD II

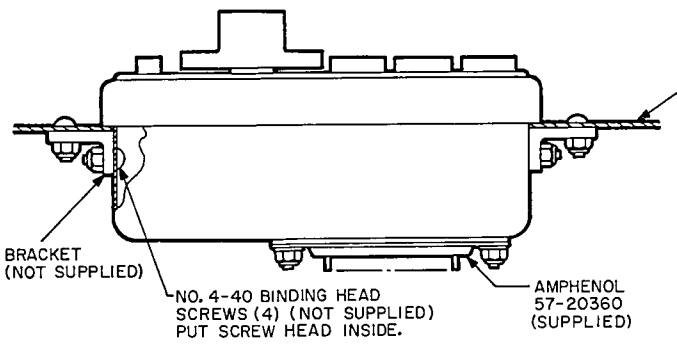




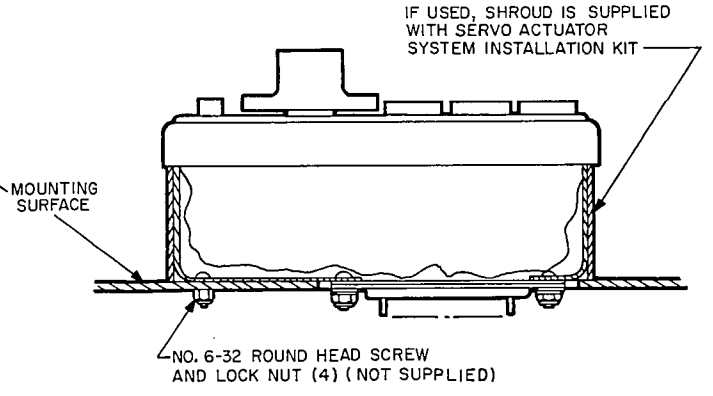




HOLE PATTERN FOR
MOUNTING METHOD I



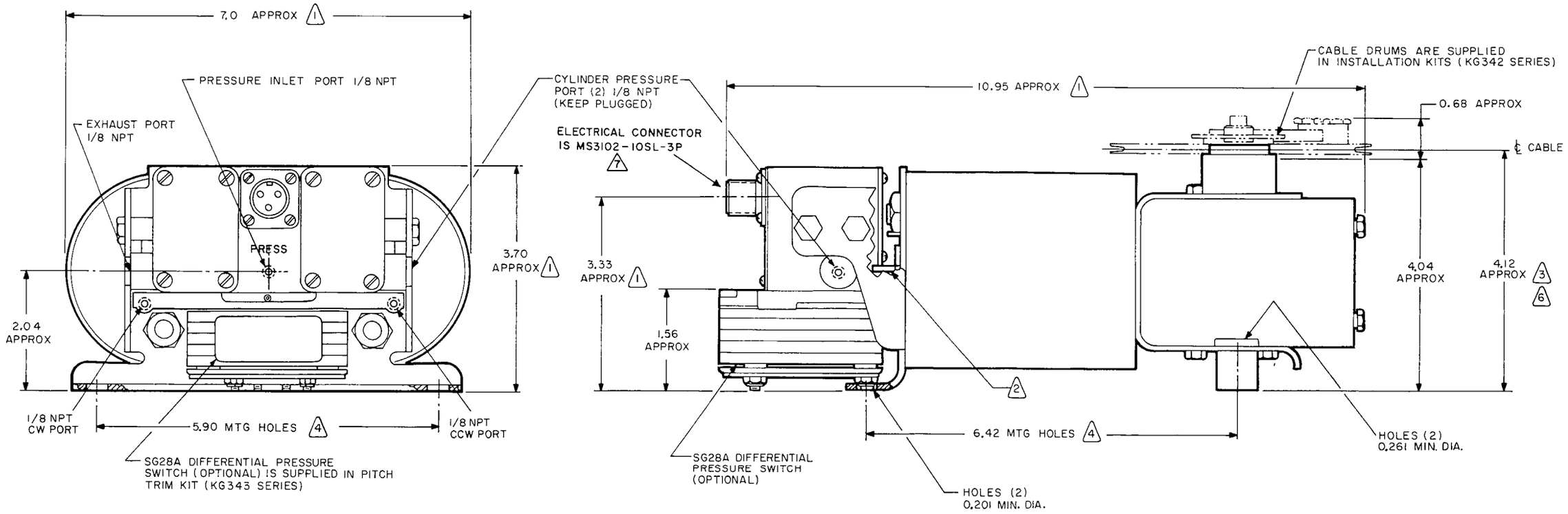
MOUNTING METHOD I



MOUNTING METHOD II

NOTES:
1. DIMENSIONS ARE IN INCHES.
2. THREE SWITCH FLIGHT CONTROLLER SHOWN, BUT DIMENSIONS ARE IDENTICAL FOR FOUR SWITCH MODEL.

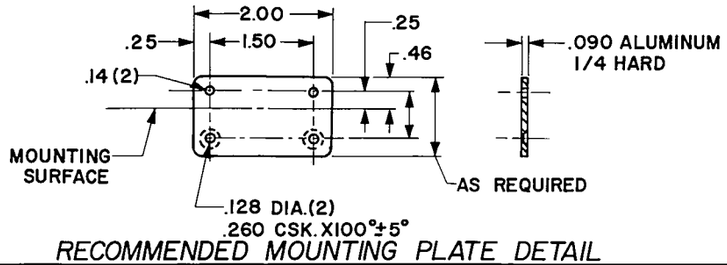
FIGURE 7-3 FLIGHT CONTROLLER - INSTALLATION DIAGRAM



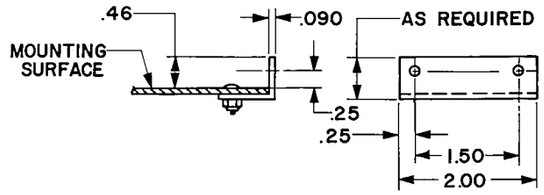
NOTES:

1. IT IS RECOMMENDED THAT THE ENTIRE SPACE ENVELOPE BE INCREASED BY 1/2 INCH ON ALL PACKAGE INSTALLATION DIMENSIONS TO AVOID INTERFERENCE DUE TO TOLERANCE VARIATIONS AND STRAIN DEFLECTIONS.
2. APPROPRIATE ORIFICES ARE SUPPLIED IN INSTALLATION KITS (KG342 SERIES).
3. FOR CABLE DRUMS WITH LESS THAN 4.0 INCH DIAMETER, THE DIMENSION IS APPROXIMATELY 3.94 INCHES.
4. BASE MOUNTING SURFACE PLANE VARIATION MAY NOT EXCEED ONE POINT VARIATION OF 0.02 MAX.
5. DIMENSIONS ARE IN INCHES.
6. DIMENSION IS 0.25 INCH GREATER IF Z959191-1 SPACER IS USED.
7. MATING CONNECTOR IS MS3106-10SL-3S (NOT SUPPLIED).

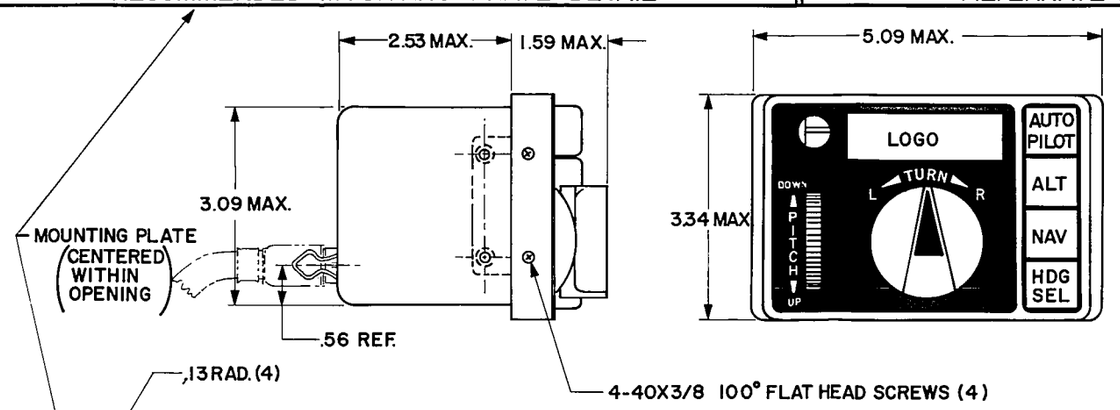
FIGURE 7-6 SERVO ACTUATOR AND DIFFERENTIAL PRESSURE SWITCH - INSTALLATION DIAGRAM

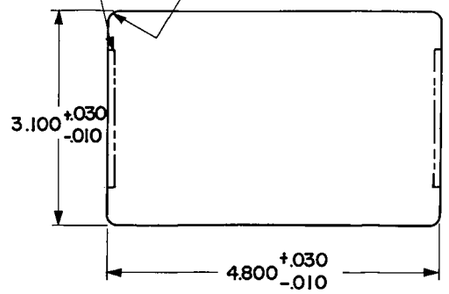


RECOMMENDED MOUNTING PLATE DETAIL

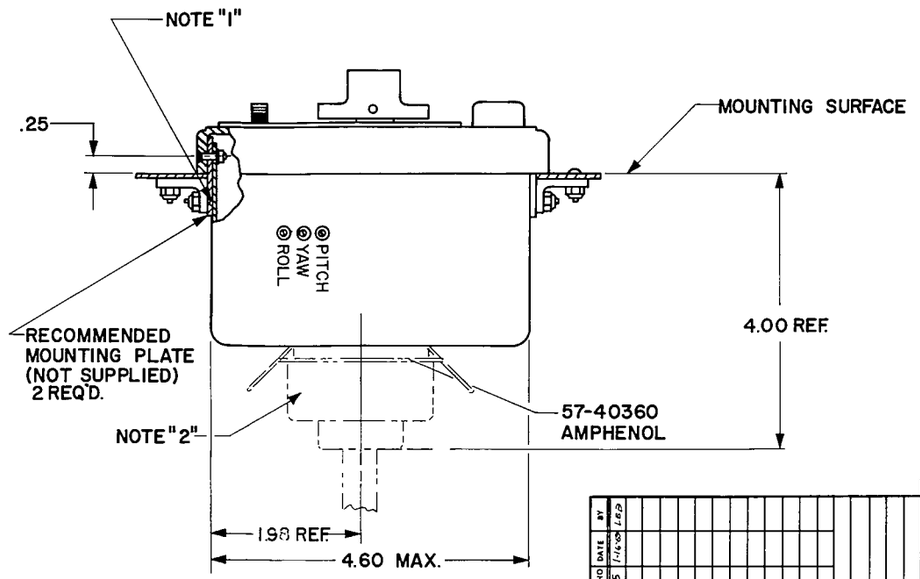


ALTERNATE MOUNTING PLATE DETAIL





RECOMMENDED HOLE PATTERN



NOTES:

1. NOT SUPPLIED, "4" #4-40, 100° FLATHEAD, MOUNT WITH HEAD INTERNAL AS SHOWN.
2. MATING CONN. AMPHENOL 57-30360, NOT SUPPLIED.

REV	C.O. NO	DATE	BY
/	5155	1/14/69	

REQ	PART NO	DESCRIPTION	ITEM

SCALE 1:1 — KING RADIO CORPORATION — OLATHE KANSAS 66061

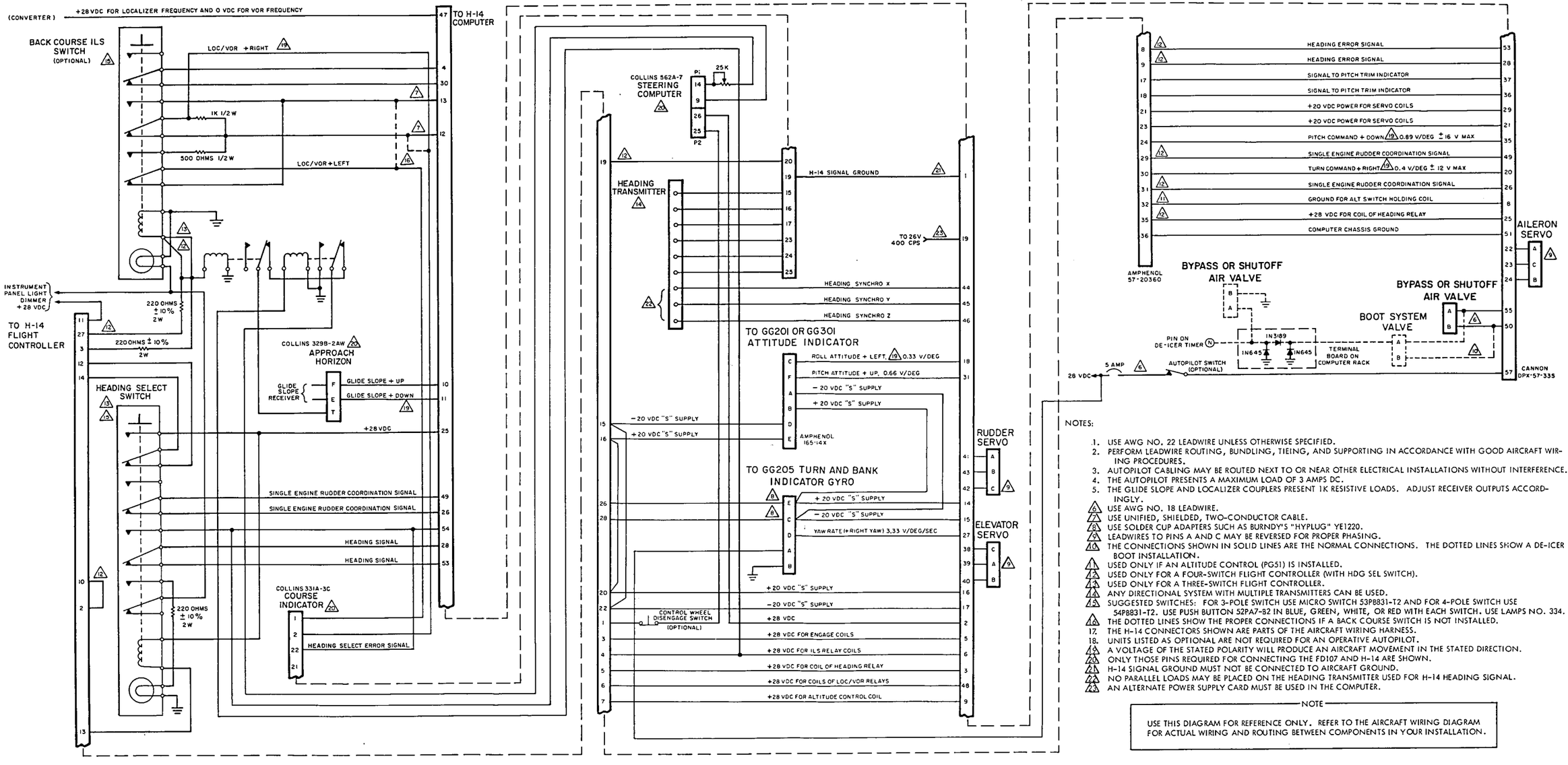
NAME FLIGHT CONTROLLER CG-515
INSTALLATION DRAWING

ELEC ENG | TOL UNLESS NOTED | MAT'L

MECH ENG

DRWN | DATE 7-29-70 | NUMBER 155-5032-00 | SHT 1 OF 1

CHK | DATE



NOTES:

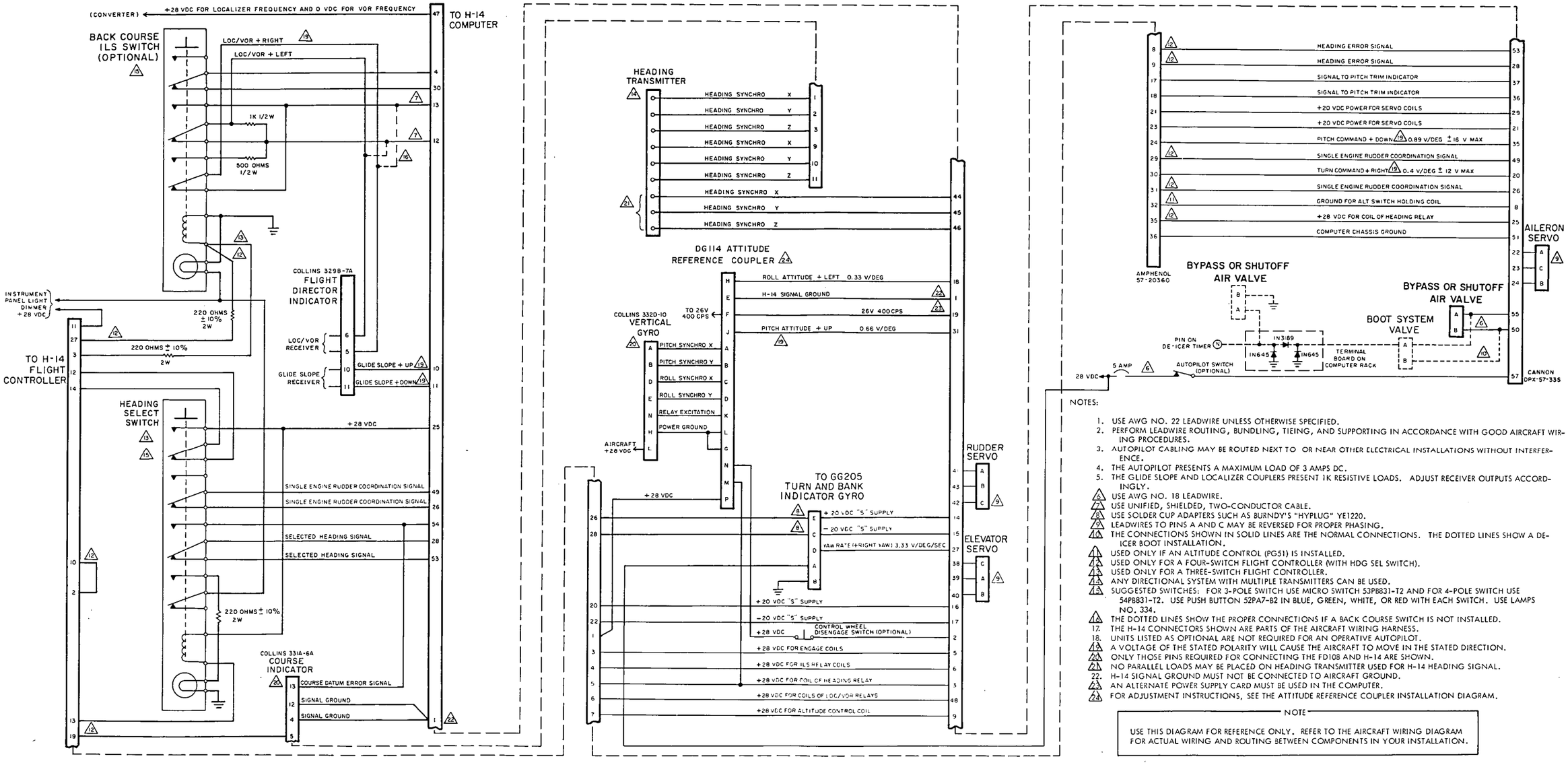
1. USE AWG NO. 22 LEADWIRE UNLESS OTHERWISE SPECIFIED.
2. PERFORM LEADWIRE ROUTING, BUNDLING, TIEING, AND SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.
3. AUTOPILOT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.
4. THE AUTOPILOT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.
5. THE GLIDE SLOPE AND LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJUST RECEIVER OUTPUTS ACCORDINGLY.

△5 USE AWG NO. 18 LEADWIRE.
△7 USE UNIFIED, SHIELDED, TWO-CONDUCTOR CABLE.
△8 USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S "HYPLUG" YE1220.
△9 LEADWIRES TO PINS A AND C MAY BE REVERSED FOR PROPER PHASING.
△10 THE CONNECTIONS SHOWN IN SOLID LINES ARE THE NORMAL CONNECTIONS. THE DOTTED LINES SHOW A DE-ICER BOOT INSTALLATION.
△11 USED ONLY IF AN ALTITUDE CONTROL (PG51) IS INSTALLED.
△12 USED ONLY FOR A FOUR-SWITCH FLIGHT CONTROLLER (WITH HDG SEL SWITCH).
△13 USED ONLY FOR A THREE-SWITCH FLIGHT CONTROLLER.
△14 ANY DIRECTIONAL SYSTEM WITH MULTIPLE TRANSMITTERS CAN BE USED.
△15 SUGGESTED SWITCHES: FOR 3-POLE SWITCH USE MICRO SWITCH 53PB831-T2 AND FOR 4-POLE SWITCH USE 54PB831-T2. USE PUSH BUTTON 52PA7-82 IN BLUE, GREEN, WHITE, OR RED WITH EACH SWITCH. USE LAMPS NO. 334.
△16 THE DOTTED LINES SHOW THE PROPER CONNECTIONS IF A BACK COURSE SWITCH IS NOT INSTALLED.
17. THE H-14 CONNECTORS SHOWN ARE PARTS OF THE AIRCRAFT WIRING HARNESS.
18. UNITS LISTED AS OPTIONAL ARE NOT REQUIRED FOR AN OPERATIVE AUTOPILOT.
△19 A VOLTAGE OF THE STATED POLARITY WILL PRODUCE AN AIRCRAFT MOVEMENT IN THE STATED DIRECTION.
△20 ONLY THOSE PINS REQUIRED FOR CONNECTING THE FD107 AND H-14 ARE SHOWN.
△21 H-14 SIGNAL GROUND MUST NOT BE CONNECTED TO AIRCRAFT GROUND.
△22 NO PARALLEL LOADS MAY BE PLACED ON THE HEADING TRANSMITTER USED FOR H-14 HEADING SIGNAL.
△23 AN ALTERNATE POWER SUPPLY CARD MUST BE USED IN THE COMPUTER.

NOTE

USE THIS DIAGRAM FOR REFERENCE ONLY. REFER TO THE AIRCRAFT WIRING DIAGRAM FOR ACTUAL WIRING AND ROUTING BETWEEN COMPONENTS IN YOUR INSTALLATION.

FIGURE 7-24 COLLINS FD107 FLIGHT DIRECTOR SYSTEM AND BACK COURSE SWITCH - COUPLING DIAGRAM



NOTES:

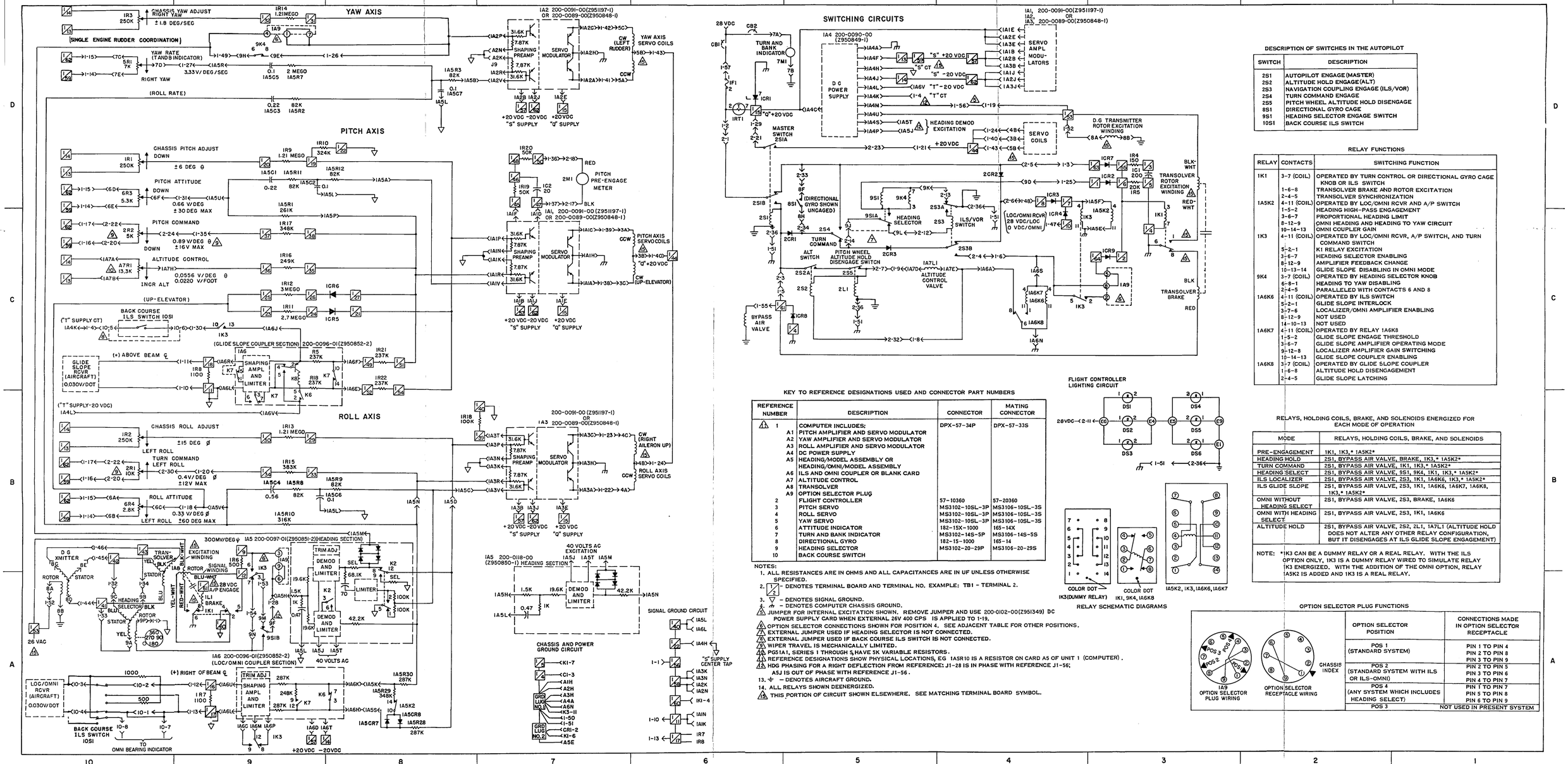
1. USE AWG NO. 22 LEADWIRE UNLESS OTHERWISE SPECIFIED.
2. PERFORM LEADWIRE ROUTING, BUNDLING, TIEING, AND SUPPORTING IN ACCORDANCE WITH GOOD AIRCRAFT WIRING PROCEDURES.
3. AUTOPILOT CABLING MAY BE ROUTED NEXT TO OR NEAR OTHER ELECTRICAL INSTALLATIONS WITHOUT INTERFERENCE.
4. THE AUTOPILOT PRESENTS A MAXIMUM LOAD OF 3 AMPS DC.
5. THE GLIDE SLOPE AND LOCALIZER COUPLERS PRESENT 1K RESISTIVE LOADS. ADJUST RECEIVER OUTPUTS ACCORDINGLY.

△1 USE AWG NO. 18 LEADWIRE.
△2 USE UNIFIED, SHIELDED, TWO-CONDUCTOR CABLE.
△3 USE SOLDER CUP ADAPTERS SUCH AS BURNDY'S "HYPLUG" YE1220.
△4 LEADWIRES TO PINS A AND C MAY BE REVERSED FOR PROPER PHASING.
△5 THE CONNECTIONS SHOWN IN SOLID LINES ARE THE NORMAL CONNECTIONS. THE DOTTED LINES SHOW A DE-ICER BOOT INSTALLATION.
△6 USED ONLY IF AN ALTITUDE CONTROL (PG51) IS INSTALLED.
△7 USED ONLY FOR A FOUR-SWITCH FLIGHT CONTROLLER (WITH HDG SEL SWITCH).
△8 USED ONLY FOR A THREE-SWITCH FLIGHT CONTROLLER.
△9 ANY DIRECTIONAL SYSTEM WITH MULTIPLE TRANSMITTERS CAN BE USED.
△10 SUGGESTED SWITCHES: FOR 3-POLE SWITCH USE MICRO SWITCH 53PB831-T2 AND FOR 4-POLE SWITCH USE 54PB831-T2. USE PUSH BUTTON 52PA7-B2 IN BLUE, GREEN, WHITE, OR RED WITH EACH SWITCH. USE LAMPS NO. 334.
△11 THE DOTTED LINES SHOW THE PROPER CONNECTIONS IF A BACK COURSE SWITCH IS NOT INSTALLED.
△12 THE H-14 CONNECTORS SHOWN ARE PARTS OF THE AIRCRAFT WIRING HARNESS.
△13 UNITS LISTED AS OPTIONAL ARE NOT REQUIRED FOR AN OPERATIVE AUTOPILOT.
△14 A VOLTAGE OF THE STATED POLARITY WILL CAUSE THE AIRCRAFT TO MOVE IN THE STATED DIRECTION.
△15 ONLY THOSE PINS REQUIRED FOR CONNECTING THE FD108 AND H-14 ARE SHOWN.
△16 NO PARALLEL LOADS MAY BE PLACED ON HEADING TRANSMITTER USED FOR H-14 HEADING SIGNAL.
△17 H-14 SIGNAL GROUND MUST NOT BE CONNECTED TO AIRCRAFT GROUND.
△18 AN ALTERNATE POWER SUPPLY CARD MUST BE USED IN THE COMPUTER.
△19 FOR ADJUSTMENT INSTRUCTIONS, SEE THE ATTITUDE REFERENCE COUPLER INSTALLATION DIAGRAM.

NOTE

USE THIS DIAGRAM FOR REFERENCE ONLY. REFER TO THE AIRCRAFT WIRING DIAGRAM FOR ACTUAL WIRING AND ROUTING BETWEEN COMPONENTS IN YOUR INSTALLATION.

FIGURE 7-25 COLLINS FD108 FLIGHT DIRECTOR SYSTEM AND BACK COURSE SWITCH - COUPLING DIAGRAM



KEY TO REFERENCE DESIGNATIONS USED AND CONNECTOR PART NUMBERS

REFERENCE NUMBER	DESCRIPTION	CONNECTOR	MATING CONNECTOR
⚠1	COMPUTER INCLUDES:	DPX-57-34P	DPX-57-33S
A1	PITCH AMPLIFIER AND SERVO MODULATOR		
A2	YAW AMPLIFIER AND SERVO MODULATOR		
A3	ROLL AMPLIFIER AND SERVO MODULATOR		
A4	DC POWER SUPPLY		
A5	HEADING/MODEL ASSEMBLY OR HEADING/OMNI/MODEL ASSEMBLY		
A6	ILS AND OMNI COUPLER OR BLANK CARD		
A7	ALTITUDE CONTROL		
A8	TRANSOLVER		
A9	OPTION SELECTOR PLUG		
2	FLIGHT CONTROLLER	57-10360	57-20360
3	PITCH SERVO	MS3102-10SL-3P	MS3106-10SL-3S
4	ROLL SERVO	MS3102-10SL-3P	MS3106-10SL-3S
5	YAW SERVO	MS3102-10SL-3P	MS3106-10SL-3S
6	ATTITUDE INDICATOR	182-15X-1000	165-14X
7	TURN AND BANK INDICATOR	MS3102-14S-5P	MS3106-14S-5S
8	DIRECTIONAL GYRO	182-15-1000	165-14
9	HEADING SELECTOR	MS3102-20-29P	MS3106-20-29S
10	BACK COURSE SWITCH		

NOTES:
1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. 1/2 - DENOTES TERMINAL BOARD AND TERMINAL NO. EXAMPLE: TB1 - TERMINAL 2.
3. ▽ - DENOTES SIGNAL GROUND.
4. ⏚ - DENOTES COMPUTER CHASSIS GROUND.
5. JUMPER FOR INTERNAL EXCITATION SHOWN. REMOVE JUMPER AND USE 200-0102-00(Z951349) DC POWER SUPPLY CARD WHEN EXTERNAL 26V 400 CPS IS APPLIED TO 1-19.
6. OPTION SELECTOR CONNECTIONS SHOWN FOR POSITION 4. SEE ADJACENT TABLE FOR OTHER POSITIONS.
7. EXTERNAL JUMPER USED IF HEADING SELECTOR IS NOT CONNECTED.
8. EXTERNAL JUMPER USED IF BACK COURSE ILS SWITCH IS NOT CONNECTED.
9. WIPER TRAVEL IS MECHANICALLY LIMITED.
10. PGS1A1, SERIES 1 THROUGH 5, HAVE 5K VARIABLE RESISTORS.
11. REFERENCE DESIGNATIONS SHOW PHYSICAL LOCATIONS, EG 1A5R10 IS A RESISTOR ON CARD A5 OF UNIT 1 (COMPUTER).
12. HDG PHASING FOR A RIGHT DEFLECTION FROM REFERENCE: J1-28 IS IN PHASE WITH REFERENCE J1-56; A5J IS OUT OF PHASE WITH REFERENCE J1-56.
13. ⏚ - DENOTES AIRCRAFT GROUND.
14. ALL RELAYS SHOWN DEENERGIZED.
15. THIS PORTION OF CIRCUIT SHOWN ELSEWHERE. SEE MATCHING TERMINAL BOARD SYMBOL.

DESCRIPTION OF SWITCHES IN THE AUTOPILOT

SWITCH	DESCRIPTION
2S1	AUTOPILOT ENGAGE (MASTER)
2S2	ALTITUDE HOLD ENGAGE (ALT)
2S3	NAVIGATION COUPLING ENGAGE (ILS/VOR)
2S4	TURN COMMAND ENGAGE
2S5	PITCH WHEEL ALTITUDE HOLD DISENGAGE
8S1	DIRECTIONAL GYRO CAGE
9S1	HEADING SELECTOR ENGAGE SWITCH
10S1	BACK COURSE ILS SWITCH

RELAY FUNCTIONS

RELAY	CONTACTS	SWITCHING FUNCTION
1K1	3-7 (COIL)	OPERATED BY TURN CONTROL OR DIRECTIONAL GYRO CAGE KNOB OR ILS SWITCH
	1-6-8	TRANSOLVER BRAKE AND ROTOR EXCITATION
	2-4-5	TRANSOLVER SYNCHRONIZATION
1A5K2	4-11 (COIL)	OPERATED BY LOC/OMNI RCVR AND A/P SWITCH
	1-5-2	HEADING HIGH-PASS ENGAGEMENT
	3-6-7	PROPORTIONAL HEADING LIMIT
	8-12-9	OMNI HEADING AND HEADING TO YAW CIRCUIT
	10-14-13	OMNI COUPLER GAIN
1K3	4-11 (COIL)	OPERATED BY LOC/OMNI RCVR, A/P SWITCH, AND TURN COMMAND SWITCH
	5-2-1	K1 RELAY EXCITATION
	3-6-7	HEADING SELECTOR ENABLING
	8-12-9	AMPLIFIER FEEDBACK CHANGE
	10-13-14	GLIDE SLOPE DISABLING IN OMNI MODE
9K4	3-7 (COIL)	OPERATED BY HEADING SELECTOR KNOB
	6-8-1	HEADING TO YAW DISABLING
	2-4-5	PARALLELED WITH CONTACTS 6 AND 8
1A6K6	4-11 (COIL)	OPERATED BY ILS SWITCH
	5-2-1	GLIDE SLOPE INTERLOCK
	3-7-6	LOCALIZER/OMNI AMPLIFIER ENABLING
	8-12-9	NOT USED
	14-10-13	NOT USED
1A6K7	4-11 (COIL)	OPERATED BY RELAY 1A6K8
	1-5-2	GLIDE SLOPE ENGAGE THRESHOLD
	3-6-7	GLIDE SLOPE AMPLIFIER OPERATING MODE
	9-12-8	LOCALIZER AMPLIFIER GAIN SWITCHING
	10-14-13	GLIDE SLOPE COUPLER ENABLING
1A6K8	3-7 (COIL)	OPERATED BY GLIDE SLOPE COUPLER
	1-6-8	ALTITUDE HOLD DISENGAGEMENT
	2-4-5	GLIDE SLOPE LATCHING

RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS ENERGIZED FOR EACH MODE OF OPERATION

MODE	RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS
PRE-ENGAGEMENT	1K1, 1K3,* 1A5K2*
HEADING HOLD	2S1, BYPASS AIR VALVE, BRAKE, 1K3,* 1A5K2*
TURN COMMAND	2S1, BYPASS AIR VALVE, 1K1, 1K3,* 1A5K2*
HEADING SELECT	2S1, BYPASS AIR VALVE, 9S1, 9K4, 1K1, 1K3,* 1A5K2*
ILS LOCALIZER	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1K3,* 1A5K2*
ILS GLIDE SLOPE	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1A6K7, 1A6K8, 1K3,* 1A5K2*
OMNI WITHOUT HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, BRAKE, 1A6K6
OMNI WITH HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6
ALTITUDE HOLD	2S1, BYPASS AIR VALVE, 2S2, 2L1, 1A7L1 (ALTITUDE HOLD DOES NOT ALTER ANY OTHER RELAY CONFIGURATION, BUT IT DISENGAGES AT ILS GLIDE SLOPE ENGAGEMENT)

NOTE: *1K3 CAN BE A DUMMY RELAY OR A REAL RELAY. WITH THE ILS OPTION ONLY, 1K3 IS A DUMMY RELAY WIRED TO SIMULATE RELAY 1K3 ENERGIZED. WITH THE ADDITION OF THE OMNI OPTION, RELAY 1A5K2 IS ADDED AND 1K3 IS A REAL RELAY.

OPTION SELECTOR PLUG FUNCTIONS

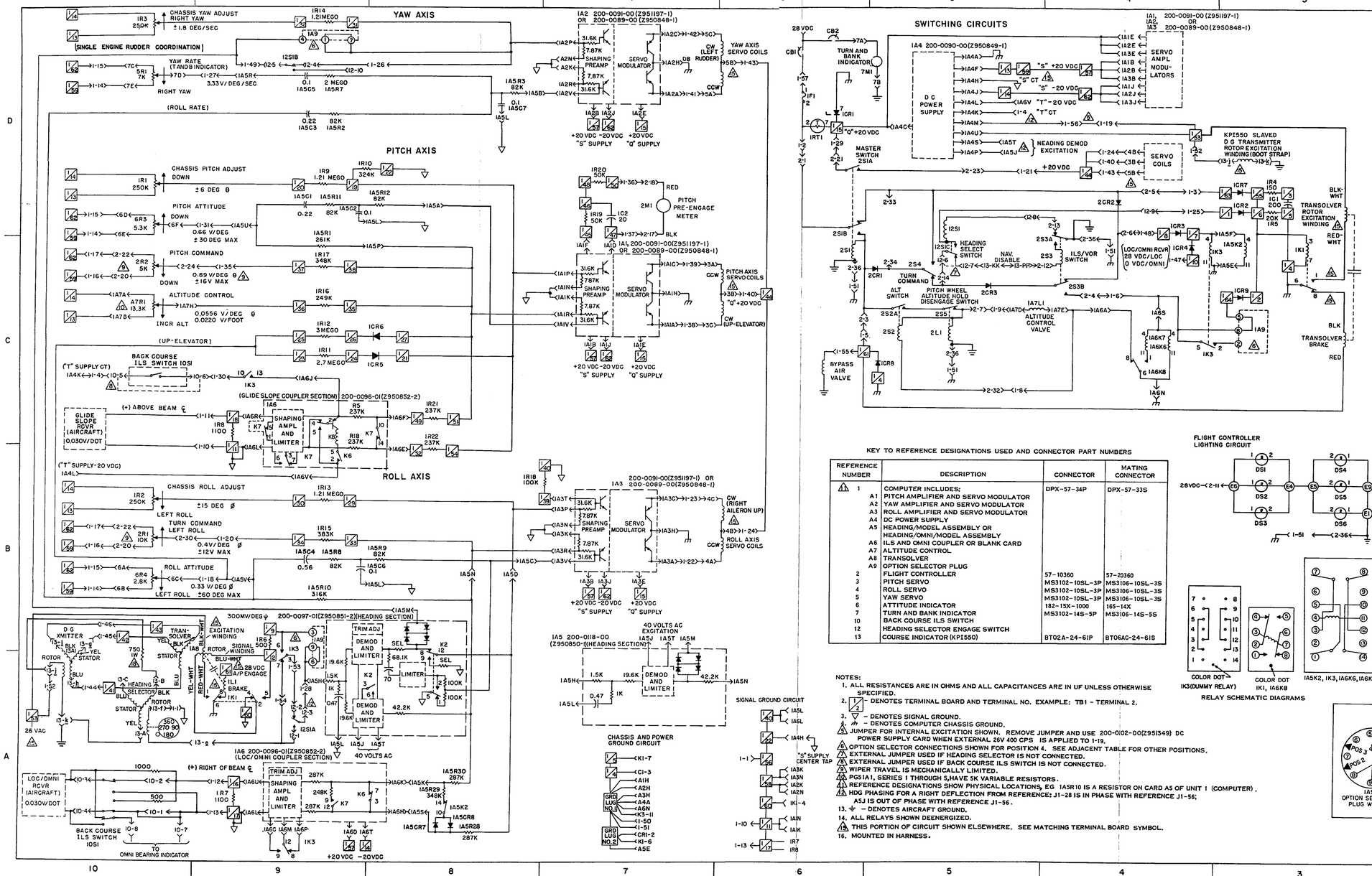
OPTION SELECTOR POSITION	CONNECTIONS MADE IN OPTION SELECTOR RECEPTACLE
POS 1 (STANDARD SYSTEM)	PIN 1 TO PIN 4 PIN 2 TO PIN 8 PIN 3 TO PIN 9
POS 2 (STANDARD SYSTEM WITH ILS OR ILS-OMNI)	PIN 2 TO PIN 5 PIN 3 TO PIN 6 PIN 4 TO PIN 7
POS 4 (ANY SYSTEM WHICH INCLUDES HEADING SELECT)	PIN 1 TO PIN 7 PIN 5 TO PIN 8 PIN 6 TO PIN 9
POS 3	NOT USED IN PRESENT SYSTEM

IA9 OPTION SELECTOR PLUG WIRING

OPTION SELECTOR RECEPTACLE WIRING

CHASSIS INDEX

FIGURE 4-18 H-14 AUTOPILOT - SCHEMATIC DIAGRAM



DESCRIPTION OF SWITCHES IN THE AUTOPILOT

SWITCH	DESCRIPTION
2S1	AUTOPILOT ENGAGE (MASTER)
2S2	ALTITUDE HOLD ENGAGE (ALT)
2S3	NAVIGATION COUPLING ENGAGE (ILS VOR)
2S4	TURN COMMAND ENGAGE
2S5	PITCH WHEEL ALTITUDE HOLD DISENGAGE
12S1	HEADING SELECTOR ENGAGE SWITCH
10S1	BACK COURSE ILS SWITCH

RELAY FUNCTIONS

RELAY	CONTACTS	SWITCHING FUNCTION
1K1	3-7 (COIL)	OPERATED BY TURN CONTROL OR DIRECTIONAL GYRO CAGE KNOB OR ILS SWITCH
	1-6-8	TRANSOLVER BRAKE AND ROTOR EXCITATION
	2-4-5	TRANSOLVER SYNCHRONIZATION
1A5K2	4-11 (COIL)	OPERATED BY LOC/OMNI RCVR AND A P SWITCH
	1-5-2	HEADING HIGH-PASS ENGAGEMENT
	3-6-7	PROPORTIONAL HEADING LIMIT
	8-12-9	OMNI HEADING AND HEADING TO YAW CIRCUIT
	10-14-13	OMNI COUPLER GAIN
1K3	4-11 (COIL)	OPERATED BY LOC/OMNI RCVR, A P SWITCH, AND TURN COMMAND SWITCH
	5-2-1	K1 RELAY EXCITATION
	3-6-7	HEADING SELECTOR ENABLING
	8-12-9	AMPLIFIER FEEDBACK CHANGE
	10-13-14	GLIDE SLOPE DISABLING IN OMNI MODE
1A6K5	4-11 (COIL)	OPERATED BY ILS SWITCH
	5-2-1	GLIDE SLOPE INTERLOCK
	3-7-6	LOCALIZER/OMNI AMPLIFIER ENABLING
	8-12-9	NOT USED
	14-10-13	NOT USED
1A6K7	4-11 (COIL)	OPERATED BY RELAY 1A6K8
	1-5-2	GLIDE SLOPE ENGAGE THRESHOLD
	3-6-7	GLIDE SLOPE AMPLIFIER OPERATING MODE
	9-12-8	LOCALIZER AMPLIFIER GAIN SWITCHING
	10-14-13	GLIDE SLOPE COUPLER ENABLING
1A6K8	3-7 (COIL)	OPERATED BY GLIDE SLOPE COUPLER
	1-6-8	ALTITUDE HOLD DISENGAGEMENT
	2-4-5	GLIDE SLOPE LATCHING

KEY TO REFERENCE DESIGNATIONS USED AND CONNECTOR PART NUMBERS

REFERENCE NUMBER	DESCRIPTION	CONNECTOR	MATING CONNECTOR
⚠1 1	COMPUTER INCLUDES:	DPX-57-34P	DPX-57-33S
A1	PITCH AMPLIFIER AND SERVO MODULATOR		
A2	YAW AMPLIFIER AND SERVO MODULATOR		
A3	ROLL AMPLIFIER AND SERVO MODULATOR		
A4	DC POWER SUPPLY		
A5	HEADING/MODEL ASSEMBLY OR HEADING/OMNI/MODEL ASSEMBLY		
A6	ILS AND OMNI COUPLER OR BLANK CARD		
A7	ALTITUDE CONTROL		
A8	TRANSOLVER		
A9	OPTION SELECTOR PLUG		
2	FLIGHT CONTROLLER	57-10360	57-20360
3	PITCH SERVO	MS3102-10SL-3P	MS3106-10SL-3S
4	ROLL SERVO	MS3102-10SL-3P	MS3106-10SL-3S
5	YAW SERVO	MS3102-10SL-3P	MS3106-10SL-3S
6	ATTITUDE INDICATOR	182-15X-1000	165-14X
7	TURN AND BANK INDICATOR	MS3102-14S-5P	MS3106-14S-5S
10	BACK COURSE ILS SWITCH		
12	HEADING SELECTOR ENGAGE SWITCH		
13	COURSE INDICATOR (KPI550)	BT02A-24-6IP	BT06AC-24-6IS

NOTES:
1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. 1/2 - DENOTES TERMINAL BOARD AND TERMINAL NO. EXAMPLE: TB1 - TERMINAL 2.
3. ▽ - DENOTES SIGNAL GROUND.
4. ⏚ - DENOTES COMPUTER CHASSIS GROUND.
5. JUMPER FOR INTERNAL EXCITATION SHOWN. REMOVE JUMPER AND USE 200-0102-00(Z951349) DC POWER SUPPLY CARD WHEN EXTERNAL 26V 400 CPS IS APPLIED TO 1-19.
6. ⚠6 OPTION SELECTOR CONNECTIONS SHOWN FOR POSITION 4. SEE ADJACENT TABLE FOR OTHER POSITIONS.
7. ⚠7 EXTERNAL JUMPER USED IF HEADING SELECTOR IS NOT CONNECTED.
8. ⚠8 EXTERNAL JUMPER USED IF BACK COURSE ILS SWITCH IS NOT CONNECTED.
9. ⚠9 WIPER TRAVEL IS MECHANICALLY LIMITED.
10. ⚠10 PGS1A1, SERIES 1 THROUGH 5, HAVE 5K VARIABLE RESISTORS.
11. ⚠11 REFERENCE DESIGNATIONS SHOW PHYSICAL LOCATIONS, EG 1A5R10 IS A RESISTOR ON CARD AS OF UNIT 1 (COMPUTER).
12. ⚠12 HDG PHASING FOR A RIGHT DEFLECTION FROM REFERENCE; J1-28 IS IN PHASE WITH REFERENCE J1-56; A5J IS OUT OF PHASE WITH REFERENCE J1-56.
13. ⏚ - DENOTES AIRCRAFT GROUND.
14. ALL RELAYS SHOWN DEENERGIZED.
15. ⚠15 THIS PORTION OF CIRCUIT SHOWN ELSEWHERE. SEE MATCHING TERMINAL BOARD SYMBOL.
16. MOUNTED IN HARNESS.

RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS ENERGIZED FOR EACH MODE OF OPERATION

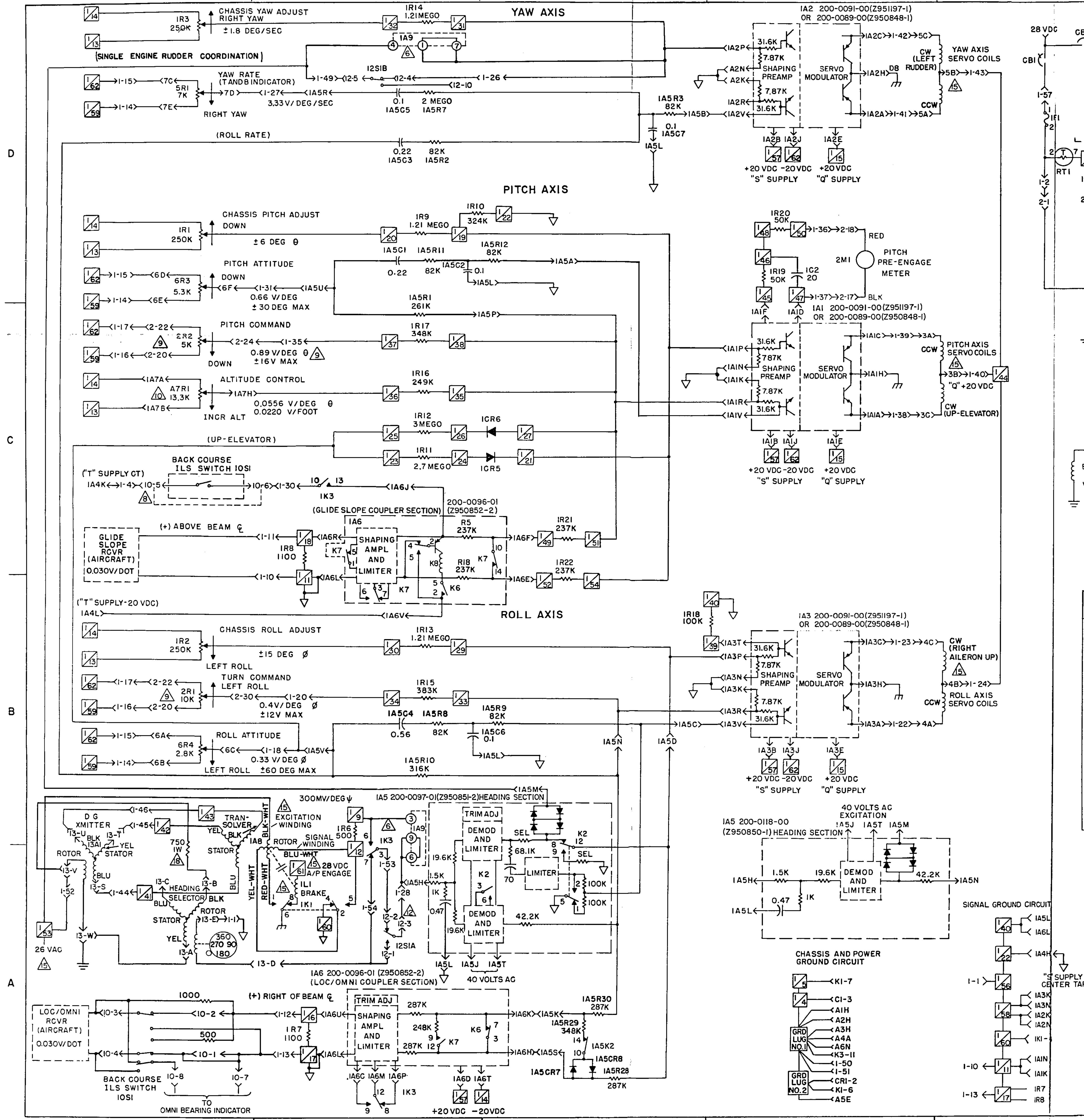
MODE	RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS
PRE-ENGAGEMENT	1K1, 1K3,* 1A5K2*
HEADING HOLD	2S1, BYPASS AIR VALVE, BRAKE, 1K3,* 1A5K2*
TURN COMMAND	2S1, BYPASS AIR VALVE, 1K1, 1K3,* 1A5K2*
HEADING SELECT	2S1, BYPASS AIR VALVE, 2S1, 9K4, 1K1, 1K3,* 1A5K2*
ILS LOCALIZER	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1K3,* 1A5K2*
ILS GLIDE SLOPE	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1A6K7, 1A6K8, 1K3,* 1A5K2*
OMNI WITHOUT HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, BRAKE, 1A6K6
OMNI WITH HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6
ALTITUDE HOLD	2S1, BYPASS AIR VALVE, 2S2, 2L1, 1A7L1 (ALTITUDE HOLD DOES NOT ALTER ANY OTHER RELAY CONFIGURATION, BUT IT DISENGAGES AT ILS GLIDE SLOPE ENGAGEMENT)

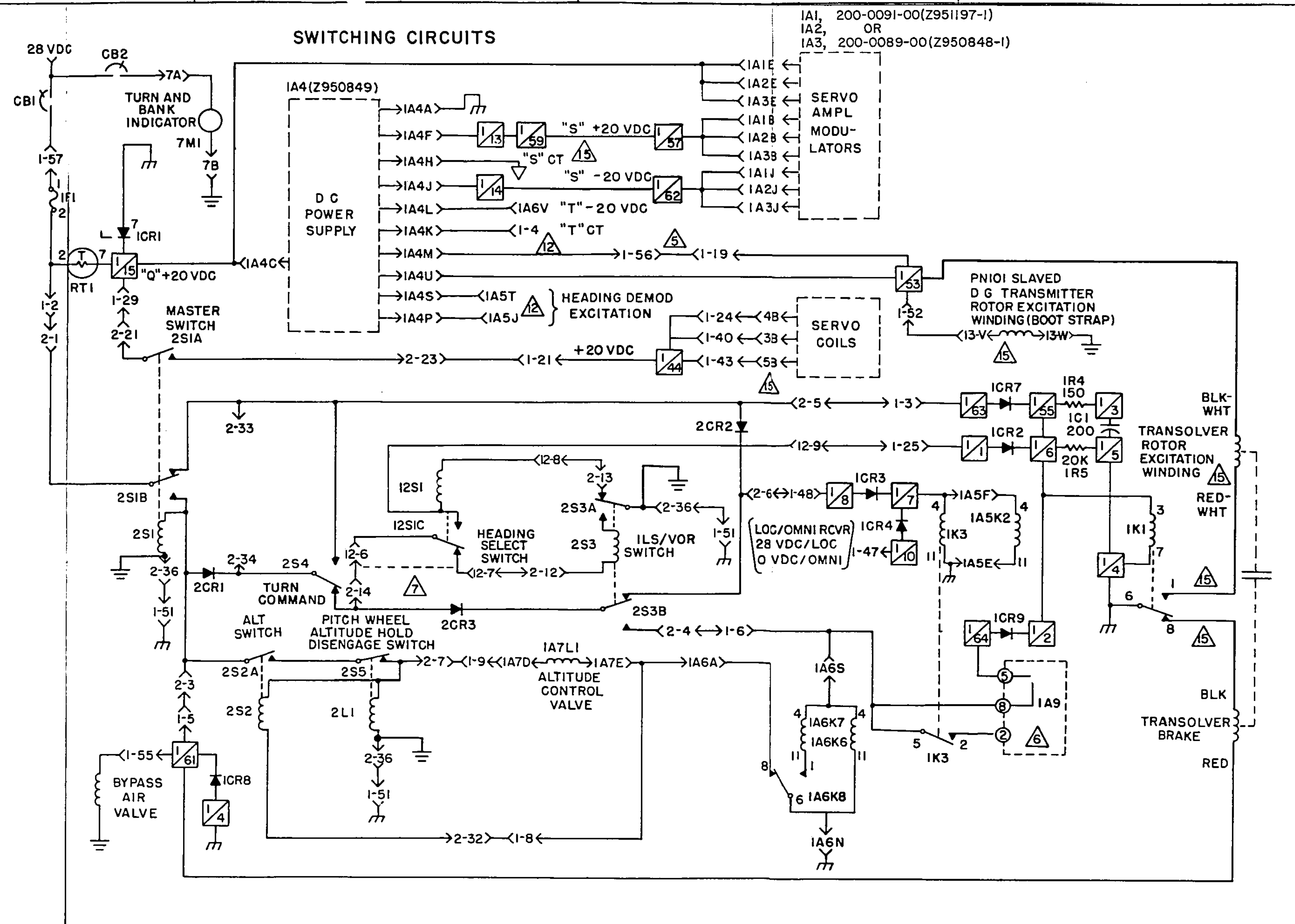
NOTE: *1K3 CAN BE A DUMMY RELAY OR A REAL RELAY. WITH THE ILS OPTION ONLY, 1K3 IS A DUMMY RELAY WIRED TO SIMULATE RELAY 1K3 ENERGIZED. WITH THE ADDITION OF THE OMNI OPTION, RELAY 1A5K2 IS ADDED AND 1K3 IS A REAL RELAY.

OPTION SELECTOR PLUG FUNCTIONS

OPTION SELECTOR POSITION	CONNECTIONS MADE IN OPTION SELECTOR RECEPTACLE
POS 1 (STANDARD SYSTEM)	PIN 1 TO PIN 4 PIN 2 TO PIN 8 PIN 3 TO PIN 9
POS 2 (STANDARD SYSTEM WITH ILS OR ILS-OMNI)	PIN 2 TO PIN 5 PIN 3 TO PIN 6 PIN 4 TO PIN 7
POS 4 (ANY SYSTEM WHICH INCLUDES HEADING SELECT)	PIN 1 TO PIN 7 PIN 5 TO PIN 8 PIN 6 TO PIN 9
POS 3	NOT USED IN PRESENT SYSTEM

FIGURE 4-19 H-14 AUTOPILOT INTEGRATED WITH KING KPI 550 PICTORIAL NAVIGATION SYSTEM - SCHEMATIC DIAGRAM



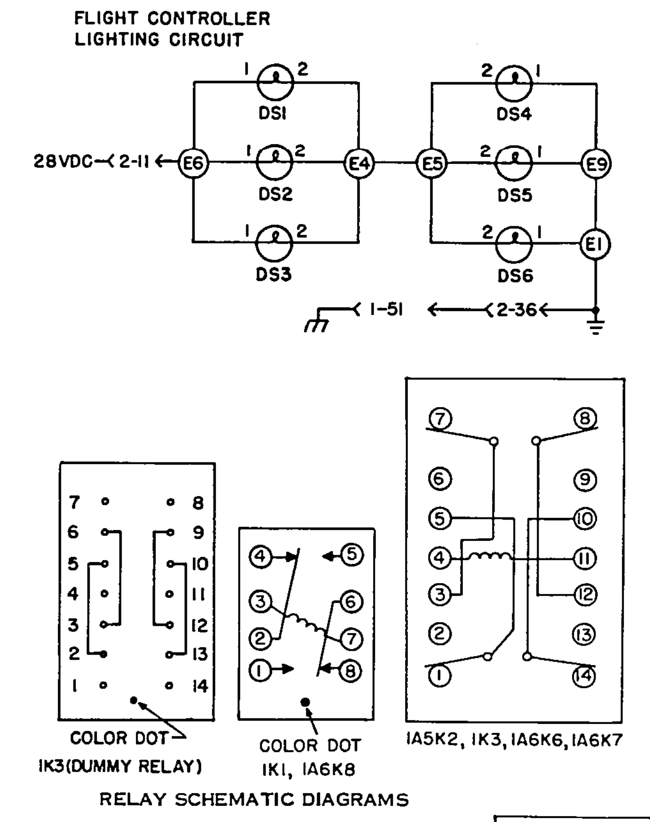


DESCRIPTION OF SWITCHES IN THE AUTOPILOT

SWITCH	DESCRIPTION
2S1	AUTOPILOT ENGAGE (MASTER)
2S2	ALTITUDE HOLD ENGAGE (ALT)
2S3	NAVIGATION COUPLING ENGAGE (ILS VOR)
2S4	TURN COMMAND ENGAGE
2S5	PITCH WHEEL ALTITUDE HOLD DISENGAGE
12S1	HEADING SELECTOR ENGAGE SWITCH
10S1	BACK COURSE ILS SWITCH

RELAY FUNCTIONS

RELAY	CONTACTS	SWITCHING FUNCTION
1K1	3-7 (COIL)	OPERATED BY TURN CONTROL OR DIRECTIONAL GYRO CAGE KNOB OR ILS SWITCH
	1-6-8	TRANSOLVER BRAKE AND ROTOR EXCITATION
	2-4-5	TRANSOLVER SYNCHRONIZATION
1A5K2	4-11 (COIL)	OPERATED BY LOC OMNI RCVR AND A P SWITCH
	1-5-2	HEADING HIGH-PASS ENGAGEMENT
	3-6-7	PROPORTIONAL HEADING LIMIT
	8-12-9	OMNI HEADING AND HEADING TO YAW CIRCUIT
	10-1[illegible]	OMNI COUPLER GAIN [illegible]
1K3	4-11 (COIL)	OPERATED BY LOC OMNI RCVR, A P SWITCH, AND TURN COMMAND SWITCH
	5-2-1	K1 RELAY EXCITATION
	3-6-7	HEADING SELECTOR ENABLING
	8-12-9	AMPLIFIER FEEDBACK CHANGE
	10-13-14	GLIDE SLOPE DISABLING IN OMNI MODE
1A6K6	4-11 (COIL)	OPERATED BY ILS SWITCH
	5-2-1	GLIDE SLOPE INTERLOCK
	3-7-6	LOCALIZER/OMNI AMPLIFIER ENABLING
	8-12-9	NOT USED
	14-10-13	NOT USED
1A6K7	4-11 (COIL)	OPERATED BY RELAY 1A6K8
	1-5-2	GLIDE SLOPE ENGAGE THRESHOLD
	3-6-7	GLIDE SLOPE AMPLIFIER OPERATING MODE
	9-12-8	LOCALIZER AMPLIFIER GAIN SWITCHING
	10-14-13	GLIDE SLOPE COUPLER ENABLING
1A6K8	3-7 (COIL)	OPERATED BY GLIDE SLOPE COUPLER
	1-6-8	ALTITUDE HOLD DISENGAGEMENT
	2-4-5	GLIDE SLOPE LATCHING



KEY TO REFERENCE DESIGNATIONS USED AND CONNECTOR PART NUMBERS

REFERENCE NUMBER	DESCRIPTION	CONNECTOR	MATING CONNECTOR
⚠11 1	COMPUTER INCLUDES;	DPX-57-34P	DPX-57-33S
A1	PITCH AMPLIFIER AND SERVO MODULATOR		
A2	YAW AMPLIFIER AND SERVO MODULATOR		
A3	ROLL AMPLIFIER AND SERVO MODULATOR		
A4	DC POWER SUPPLY		
A5	HEADING/MODEL ASSEMBLY OR HEADING/OMNI/MODEL ASSEMBLY		
A6	ILS AND OMNI COUPLER OR BLANK CARD		
A7	ALTITUDE CONTROL		
A8	TRANSOLVER		
A9	OPTION SELECTOR PLUG		
2	FLIGHT CONTROLLER	57-10360	57-20360
3	PITCH SERVO	MS3102-10SL-3P	MS3106-10SL-3S
4	ROLL SERVO	MS3102-10SL-3P	MS3106-10SL-3S
5	YAW SERVO	MS3102-10SL-3P	MS3106-10SL-3S
6	ATTITUDE INDICATOR	182-15X-1000	165-14X
7	TURN AND BANK INDICATOR	MS3102-14S-5P	MS3106-14S-5S
10	BACK COURSE ILS SWITCH		
12	HEADING SELECTOR ENGAGE SWITCH		
13	COURSE INDICATOR (331A-3G)	PTO2A-22-55P	PTO6A-22-55S

NOTES:

1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. [1/2] - DENOTES TERMINAL BOARD AND TERMINAL NO. EXAMPLE: TB1 - TERMINAL 2.
3. ▽ - DENOTES SIGNAL GROUND.
4. ⏚ - DENOTES COMPUTER CHASSIS GROUND.

⚠5 JUMPER FOR INTERNAL EXCITATION SHOWN. REMOVE JUMPER AND USE 200-0102-00(Z951349) DC POWER SUPPLY CARD WHEN EXTERNAL 26V 400 CPS IS APPLIED TO 1-19.

⚠6 OPTION SELECTOR CONNECTIONS SHOWN FOR POSITION 4. SEE ADJACENT TABLE FOR OTHER POSITIONS.

⚠7 EXTERNAL JUMPER USED IF HEADING SELECTOR IS NOT CONNECTED.

⚠8 EXTERNAL JUMPER USED IF BACK COURSE ILS SWITCH IS NOT CONNECTED.

⚠9 WIPER TRAVEL IS MECHANICALLY LIMITED.

⚠10 PG51A1, SERIES 1 THROUGH 5, HAVE 5K VARIABLE RESISTORS.

⚠11 REFERENCE DESIGNATIONS SHOW PHYSICAL LOCATIONS, EG 1A5R10 IS A RESISTOR ON CARD A5 OF UNIT 1 (COMPUTER).

⚠12 HDG PHASING FOR A RIGHT DEFLECTION FROM REFERENCE: J1-28 IS IN PHASE WITH REFERENCE J1-56; A5J IS OUT OF PHASE WITH REFERENCE J1-56.

13. ⏚ - DENOTES AIRCRAFT GROUND.
14. ALL RELAYS SHOWN DEENERGIZED.

⚠15 THIS PORTION OF CIRCUIT SHOWN ELSEWHERE. SEE MATCHING TERMINAL BOARD SYMBOL.

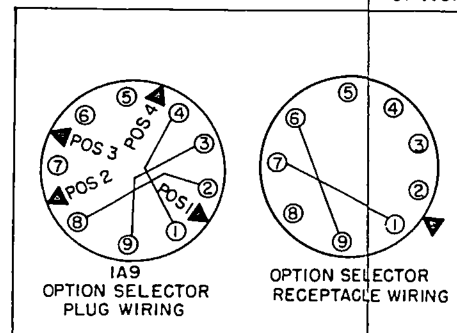
16. MOUNTED IN HARNESS.

RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS ENERGIZED FOR EACH MODE OF OPERATION

MODE	RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS
PRE-ENGAGEMENT	1K1, 1K3,* 1A5K2*
HEADING HOLD	2S1, BYPASS AIR VALVE, BRAKE, 1K3,* 1A5K2*
TURN COMMAND	2S1, BYPASS AIR VALVE, 1K1, 1K3,* 1A5K2*
HEADING SELECT	2S1, BYPASS AIR VALVE, 9S1, 9K4, 1K1, 1K3,* 1A5K2*
ILS LOCALIZER	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1K3,* 1A5K2*
ILS GLIDE SLOPE	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1A6K7, 1A6K8, 1K3,* 1A5K2*
OMNI WITHOUT HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, BRAKE, 1A6K6
OMNI WITH HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6
ALTITUDE HOLD	2S1, BYPASS AIR VALVE, 2S2, 2L1, 1A7L1 (ALTITUDE HOLD DOES NOT ALTER ANY OTHER RELAY CONFIGURATION, BUT IT DISENGAGES AT ILS GLIDE SLOPE ENGAGEMENT)

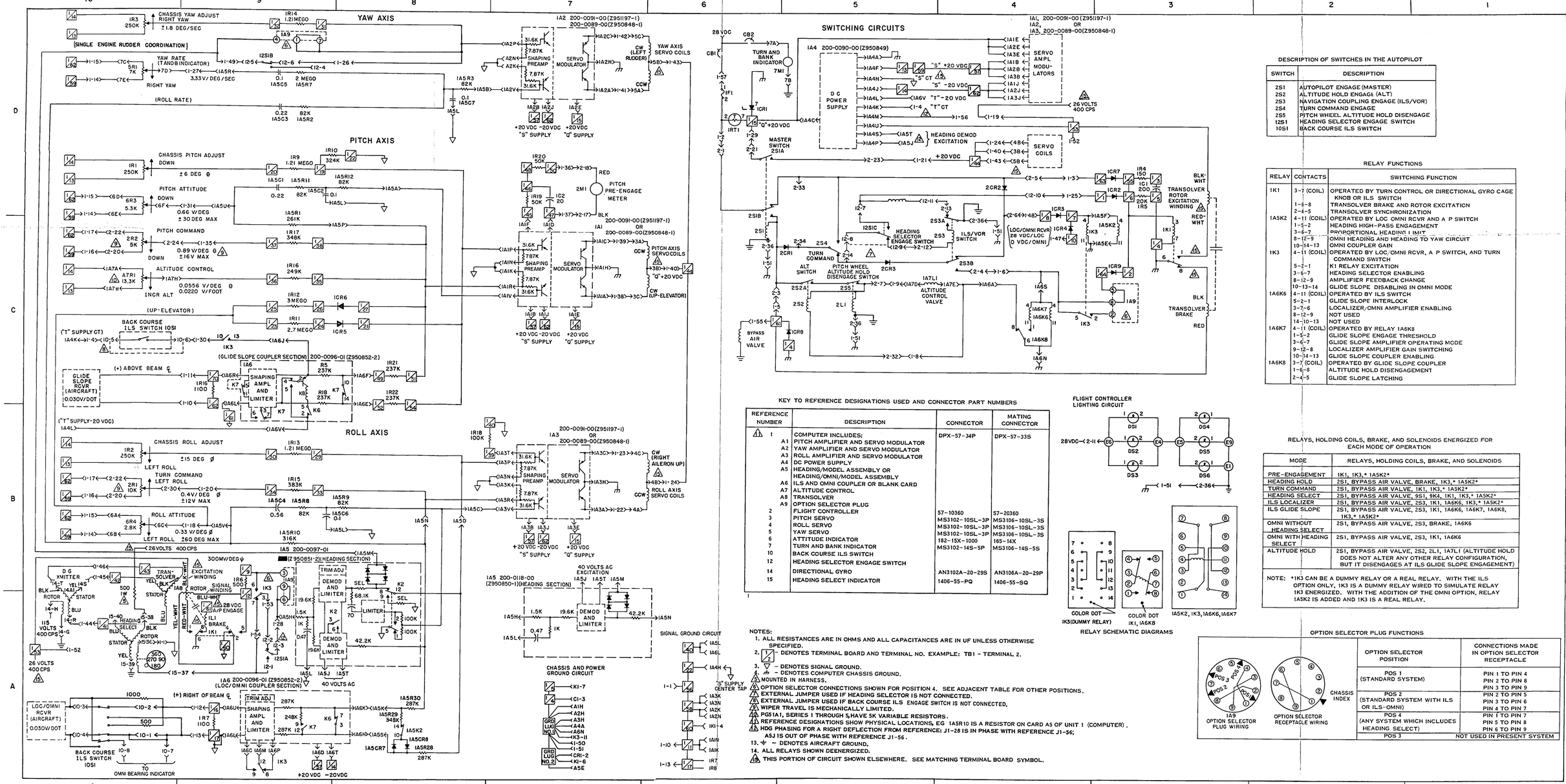
NOTE: *1K3 CAN BE A DUMMY RELAY OR A REAL RELAY. WITH THE ILS OPTION ONLY, 1K3 IS A DUMMY RELAY WIRED TO SIMULATE RELAY 1K3 ENERGIZED. WITH THE ADDITION OF THE OMNI OPTION, RELAY 1A5K2 IS ADDED AND 1K3 IS A REAL RELAY.

OPTION SELECTOR PLUG FUNCTIONS



OPTION SELECTOR POSITION	CONNECTIONS MADE IN OPTION SELECTOR RECEPTACLE
POS 1 (STANDARD SYSTEM)	PIN 1 TO PIN 4 PIN 2 TO PIN 8 PIN 3 TO PIN 9
POS 2 (STANDARD SYSTEM WITH ILS OR ILS-OMNI)	PIN 2 TO PIN 5 PIN 3 TO PIN 6 PIN 4 TO PIN 7
POS 4 (ANY SYSTEM WHICH INCLUDES HEADING SELECT)	PIN 1 TO PIN 7 PIN 5 TO PIN 8 PIN 6 TO PIN 9
POS 3	NOT USED IN PRESENT SYSTEM

FIGURE 4-20 H-14 AUTOPILOT INTEGRATED WITH COLLINS PICTORIAL NAVIGATION SYSTEM - SCHEMATIC DIAGRAM



DESCRIPTION OF SWITCHES IN THE AUTOPILOT

SWITCH	DESCRIPTION
2S1	AUTOPILOT ENGAGE (MASTER)
2S2	ALTITUDE HOLD ENGAGE (ALT)
2S3	NAVIGATION COUPLING ENGAGE (ILS/VOR)
2S4	TURN COMMAND ENGAGE
2S5	PITCH WHEEL ALTITUDE HOLD DISENGAGE
12S1	HEADING SELECTOR ENGAGE SWITCH
10S1	BACK COURSE ILS SWITCH

RELAY FUNCTIONS

RELAY	CONTACTS	SWITCHING FUNCTION
1K1	3-7 (COIL)	OPERATED BY TURN CONTROL OR DIRECTIONAL GYRO CAGE KNOB OR ILS SWITCH
	1-6-8	TRANSOLVER BRAKE AND ROTOR EXCITATION
	2-4-5	TRANSOLVER SYNCHRONIZATION
1A5K2	4-11 (COIL)	OPERATED BY LOC OMNI RCVR AND A P SWITCH
	1-5-2	HEADING HIGH-PASS ENGAGEMENT
	3-6-7	PROPORTIONAL HEADING LIMIT
	8-12-9	OMNI HEADING AND HEADING TO YAW CIRCUIT
	10-14-13	OMNI COUPLER GAIN
1K3	4-11 (COIL)	OPERATED BY LOC/OMNI RCVR, A P SWITCH, AND TURN COMMAND SWITCH
	5-2-1	K1 RELAY EXCITATION
	3-6-7	HEADING SELECTOR ENABLING
	8-12-9	AMPLIFIER FEEDBACK CHANGE
	10-13-14	GLIDE SLOPE DISABLING IN OMNI MODE
1A6K6	4-11 (COIL)	OPERATED BY ILS SWITCH
	5-2-1	GLIDE SLOPE INTERLOCK
	3-7-6	LOCALIZER/OMNI AMPLIFIER ENABLING
	8-12-9	NOT USED
	14-10-13	NOT USED
1A6K7	4-11 (COIL)	OPERATED BY RELAY 1A6K8
	1-5-2	GLIDE SLOPE ENGAGE THRESHOLD
	3-6-7	GLIDE SLOPE AMPLIFIER OPERATING MODE
	9-12-8	LOCALIZER AMPLIFIER GAIN SWITCHING
	10-14-13	GLIDE SLOPE COUPLER ENABLING
1A6K8	3-7 (COIL)	OPERATED BY GLIDE SLOPE COUPLER
	1-6-8	ALTITUDE HOLD DISENGAGEMENT
	2-4-5	GLIDE SLOPE LATCHING

KEY TO REFERENCE DESIGNATIONS USED AND CONNECTOR PART NUMBERS

REFERENCE NUMBER	DESCRIPTION	CONNECTOR	MATING CONNECTOR
1	COMPUTER INCLUDES:	DPX-57-34P	DPX-57-33S
A1	PITCH AMPLIFIER AND SERVO MODULATOR		
A2	YAW AMPLIFIER AND SERVO MODULATOR		
A3	ROLL AMPLIFIER AND SERVO MODULATOR		
A4	DC POWER SUPPLY		
A5	HEADING/MODEL ASSEMBLY OR HEADING/OMNI/MODEL ASSEMBLY		
A6	ILS AND OMNI COUPLER OR BLANK CARD		
A7	ALTITUDE CONTROL		
A8	TRANSOLVER		
A9	OPTION SELECTOR PLUG		
2	FLIGHT CONTROLLER	57-10360	57-20360
3	PITCH SERVO	MS3102-10SL-3P	MS3106-10SL-3S
4	ROLL SERVO	MS3102-10SL-3P	MS3106-10SL-3S
5	YAW SERVO	MS3102-10SL-3P	MS3106-10SL-3S
6	ATTITUDE INDICATOR	182-15X-1000	165-14X
7	TURN AND BANK INDICATOR	MS3102-14S-5P	MS3106-14S-5S
10	BACK COURSE ILS SWITCH		
12	HEADING SELECTOR ENGAGE SWITCH		
14	DIRECTIONAL GYRO	AN3102A-20-29S	AN3106A-20-29P
15	HEADING SELECT INDICATOR	1406-55-PQ	1406-55-SQ

NOTES:
1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. 1/2 - DENOTES TERMINAL BOARD AND TERMINAL NO. EXAMPLE: TB1 - TERMINAL 2.
3. ▽ - DENOTES SIGNAL GROUND.
4. ⏚ - DENOTES COMPUTER CHASSIS GROUND.
5. △ MOUNTED IN HARNESS.
6. ◇ OPTION SELECTOR CONNECTIONS SHOWN FOR POSITION 4. SEE ADJACENT TABLE FOR OTHER POSITIONS.
7. △ EXTERNAL JUMPER USED IF HEADING SELECTOR IS NOT CONNECTED.
8. △ EXTERNAL JUMPER USED IF BACK COURSE ILS ENGAGE SWITCH IS NOT CONNECTED.
9. △ WIPER TRAVEL IS MECHANICALLY LIMITED.
10. △ PG51A1, SERIES 1 THROUGH 5, HAVE 5K VARIABLE RESISTORS.
11. △ REFERENCE DESIGNATIONS SHOW PHYSICAL LOCATIONS, EG 1A5R10 IS A RESISTOR ON CARD A5 OF UNIT 1 (COMPUTER).
12. △ HDG PHASING FOR A RIGHT DEFLECTION FROM REFERENCE: J1-28 IS IN PHASE WITH REFERENCE J1-56; A5J1S OUT OF PHASE WITH REFERENCE J1-56.
13. ⏚ - DENOTES AIRCRAFT GROUND.
14. ALL RELAYS SHOWN DEENERGIZED.
15. △ THIS PORTION OF CIRCUIT SHOWN ELSEWHERE. SEE MATCHING TERMINAL BOARD SYMBOL.

RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS ENERGIZED FOR EACH MODE OF OPERATION

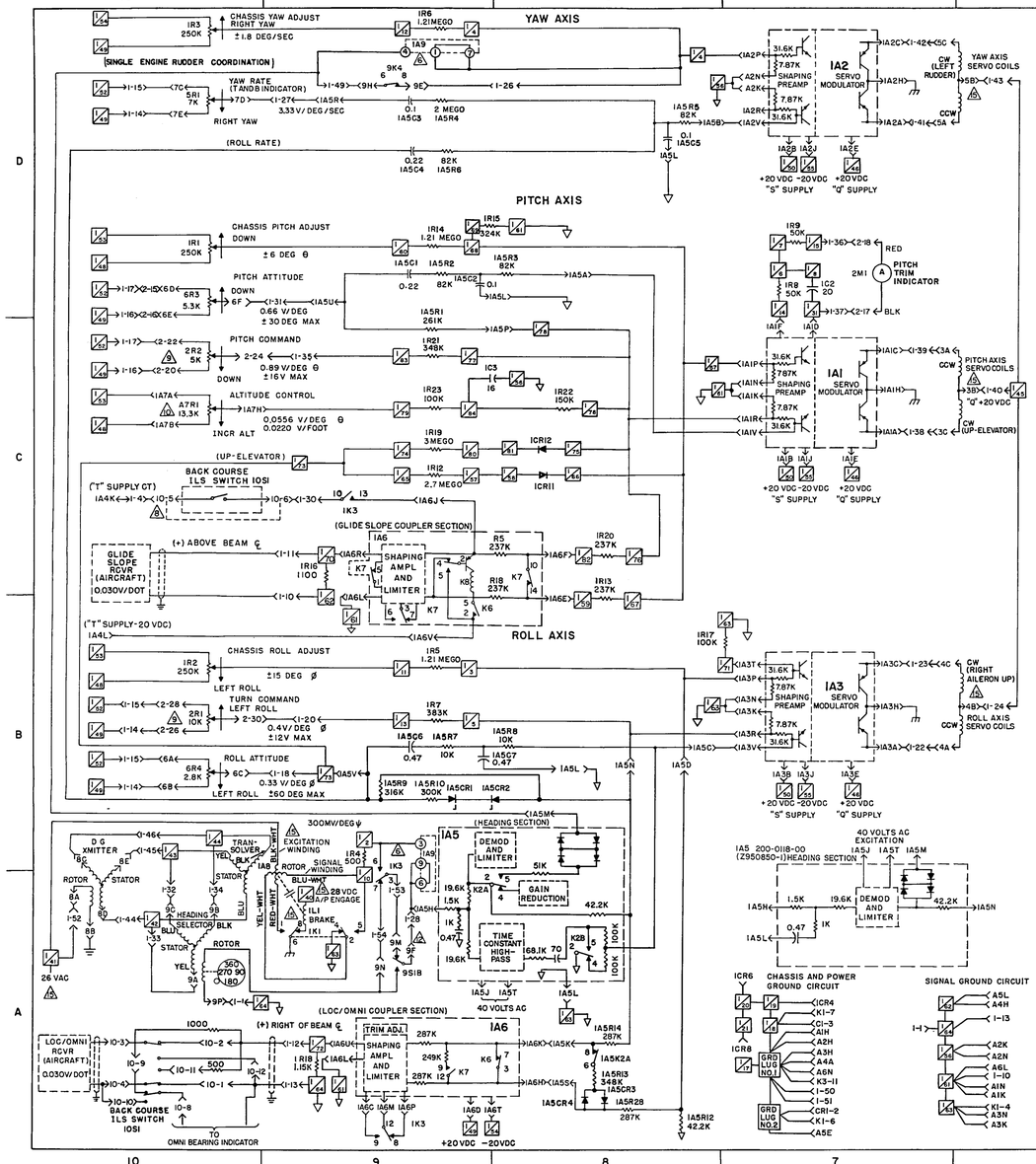
MODE	RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS
PRE-ENGAGEMENT	1K1, 1K3,* 1A5K2*
HEADING HOLD	2S1, BYPASS AIR VALVE, BRAKE, 1K3,* 1A5K2*
TURN COMMAND	2S1, BYPASS AIR VALVE, 1K1, 1K3,* 1A5K2*
HEADING SELECT	2S1, BYPASS AIR VALVE, 9S1, 9K4, 1K1, 1K3,* 1A5K2*
ILS LOCALIZER	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1K3,* 1A5K2*
ILS GLIDE SLOPE	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1A6K7, 1A6K8, 1K3,* 1A5K2*
OMNI WITHOUT HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, BRAKE, 1A6K6
OMNI WITH HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6
ALTITUDE HOLD	2S1, BYPASS AIR VALVE, 2S2, 2L1, 1A7L1 (ALTITUDE HOLD DOES NOT ALTER ANY OTHER RELAY CONFIGURATION, BUT IT DISENGAGES AT ILS GLIDE SLOPE ENGAGEMENT)

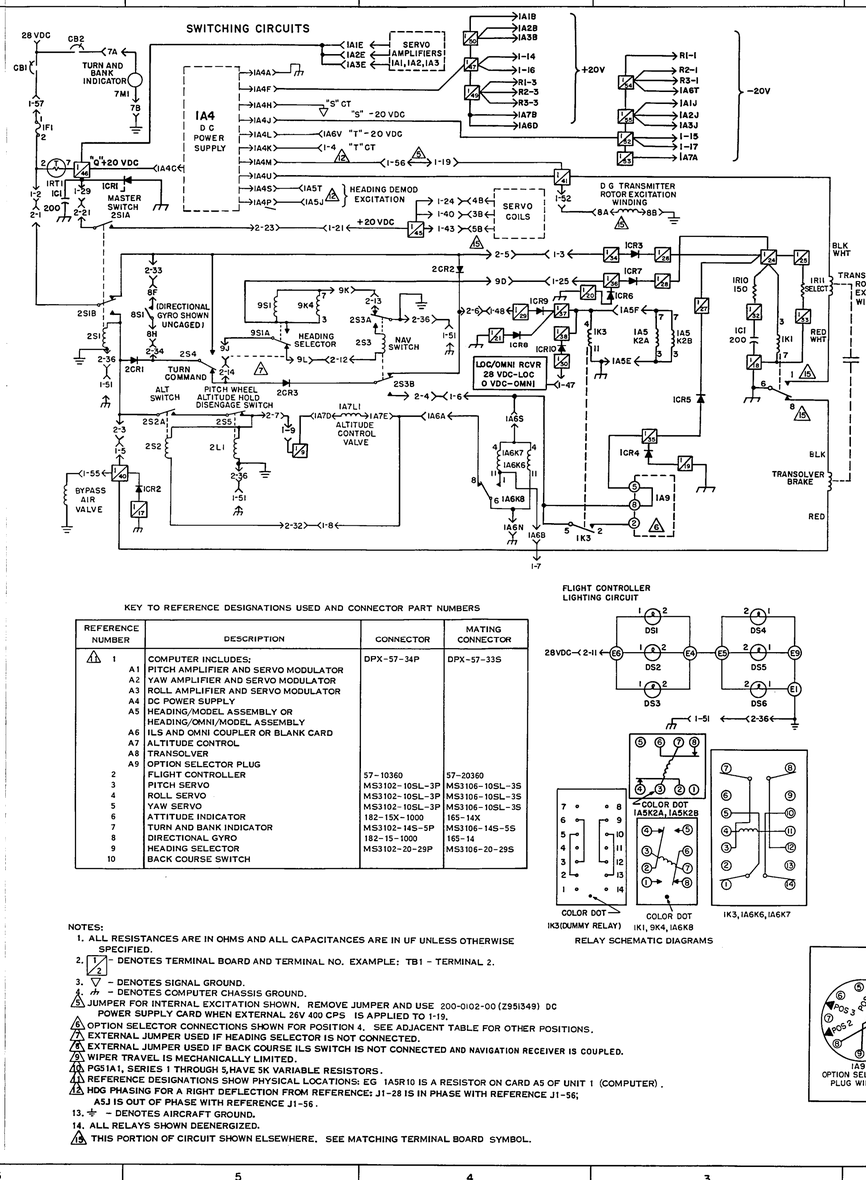
NOTE: *1K3 CAN BE A DUMMY RELAY OR A REAL RELAY. WITH THE ILS OPTION ONLY, 1K3 IS A DUMMY RELAY WIRED TO SIMULATE RELAY 1K3 ENERGIZED. WITH THE ADDITION OF THE OMNI OPTION, RELAY 1A5K2 IS ADDED AND 1K3 IS A REAL RELAY.

OPTION SELECTOR PLUG FUNCTIONS

OPTION SELECTOR POSITION	CONNECTIONS MADE IN OPTION SELECTOR RECEPTACLE
POS 1 (STANDARD SYSTEM)	PIN 1 TO PIN 4 PIN 2 TO PIN 8 PIN 3 TO PIN 9
POS 2 (STANDARD SYSTEM WITH ILS OR ILS-OMNI)	PIN 2 TO PIN 5 PIN 3 TO PIN 6 PIN 4 TO PIN 7
POS 4 (ANY SYSTEM WHICH INCLUDES HEADING SELECT)	PIN 1 TO PIN 7 PIN 5 TO PIN 8 PIN 6 TO PIN 9
POS 3	NOT USED IN PRESENT SYSTEM

FIGURE 4-21 H-14 AUTOPILOT INTEGRATED WITH SPERRY C6 INTEGRATED INSTRUMENT SYSTEM - SCHEMATIC DIAGRAM





DESCRIPTION OF SWITCHES IN THE AUTOPILOT

SWITCH	DESCRIPTION
2S1	AUTOPILOT ENGAGE (MASTER)
2S2	ALTITUDE HOLD ENGAGE (ALT)
2S3	NAVIGATION COUPLING ENGAGE (NAV)
2S4	TURN COMMAND ENGAGE
2S5	PITCH WHEEL ALTITUDE HOLD DISENGAGE
8S1	DIRECTIONAL GYRO CAGE
9S1	HEADING SELECTOR ENGAGE SWITCH
10S1	BACK COURSE ILS SWITCH

RELAY FUNCTIONS

RELAY	CONTACTS	SWITCHING FUNCTION
1K1	3-7 (COIL)	OPERATED BY TURN CONTROL OR DIRECTIONAL GYRO CAGE KNOB OR ILS SWITCH
	1-6-8	TRANSOLVER BRAKE AND ROTOR EXCITATION
	2-4-5	TRANSOLVER SYNCHRONIZATION
1A5K2A	4-11 (COIL)	OPERATED BY LOC/OMNI RCVR, MASTER SWITCH, AND TURN SWITCH
	2-4-5	OMNI HEADING AND HEADING TO YAW
	6-8-11	OMNI COUPLER GAIN
1A5K2B	4-11 (COIL)	OPERATED BY LOC/OMNI RCVR, MASTER SWITCH, AND TURN SWITCH
	2-4-5	HEADING HIGH-PASS ENGAGEMENT
	6-8-11	NOT USED
K3	4-11 (COIL)	OPERATED BY NAV RCVR, MASTER SWITCH AND TURN SWITCH
	K1	RELAY EXCITATION
	3-6-7	HEADING SELECTOR ENABLING
	8-12-9	AMPLIFIER FEEDBACK CHANGE
	10-13-14	GLIDE SLOPE DISABLING IN OMNI MODE
9K4	3-7 (COIL)	OPERATED BY HEADING SELECT SWITCH
	6-8-1	HEADING TO YAW DISABLING
	2-4-5	PARALLELED WITH CONTACTS 6 AND 8
1A6K6	4-11 (COIL)	OPERATED BY NAVIGATION ENGAGE SWITCH
	5-2-1	GLIDE SLOPE INTERLOCK
	3-7-6	LOCALIZER/OMNI AMPLIFIER ENABLING
	8-12-9	NOT USED
	14-10-13	NOT USED
1A6K7	4-11 (COIL)	OPERATED BY RELAY 1A6K8
	1-5-2	GLIDE SLOPE ENGAGE THRESHOLD
	3-6-7	GLIDE SLOPE AMPLIFIER OPERATING MODE
	9-12-8	LOCALIZER AMPLIFIER GAIN SWITCHING
	10-14-13	GLIDE SLOPE COUPLER ENABLING
1A6K8	3-7 (COIL)	OPERATED BY GLIDE SLOPE COUPLER
	1-6-8	ALTITUDE HOLD DISENGAGEMENT
	2-4-5	GLIDE SLOPE LATCHING

KEY TO REFERENCE DESIGNATIONS USED AND CONNECTOR PART NUMBERS

REFERENCE NUMBER	DESCRIPTION	CONNECTOR	MATING CONNECTOR
⚠1	COMPUTER INCLUDES:	DPX-57-34P	DPX-57-33S
A1	PITCH AMPLIFIER AND SERVO MODULATOR		
A2	YAW AMPLIFIER AND SERVO MODULATOR		
A3	ROLL AMPLIFIER AND SERVO MODULATOR		
A4	DC POWER SUPPLY		
A5	HEADING/MODEL ASSEMBLY OR HEADING/OMNI/MODEL ASSEMBLY		
A6	ILS AND OMNI COUPLER OR BLANK CARD		
A7	ALTITUDE CONTROL		
A8	TRANSOLVER		
A9	OPTION SELECTOR PLUG		
2	FLIGHT CONTROLLER	57-10360	57-20360
3	PITCH SERVO	MS3102-10SL-3P	MS3106-10SL-3S
4	ROLL SERVO	MS3102-10SL-3P	MS3106-10SL-3S
5	YAW SERVO	MS3102-10SL-3P	MS3106-10SL-3S
6	ATTITUDE INDICATOR	182-15X-1000	165-14X
7	TURN AND BANK INDICATOR	MS3102-14S-5P	MS3106-14S-5S
8	DIRECTIONAL GYRO	182-15-1000	165-14
9	HEADING SELECTOR	MS3102-20-29P	MS3106-20-29S
10	BACK COURSE SWITCH		

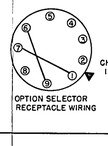
NOTES:
1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. 1/2 - DENOTES TERMINAL BOARD AND TERMINAL NO. EXAMPLE: TB1 - TERMINAL 2.
3. ▽ - DENOTES SIGNAL GROUND.
4. ⏚ - DENOTES COMPUTER CHASSIS GROUND.
5. ⚠ JUMPER FOR INTERNAL EXCITATION SHOWN. REMOVE JUMPER AND USE 200-0102-00 (Z951349) DC POWER SUPPLY CARD WHEN EXTERNAL 26V 400 CPS IS APPLIED TO 1-19.
6. ⚠ OPTION SELECTOR CONNECTIONS SHOWN FOR POSITION 4. SEE ADJACENT TABLE FOR OTHER POSITIONS.
7. ⚠ EXTERNAL JUMPER USED IF HEADING SELECTOR IS NOT CONNECTED.
8. ⚠ EXTERNAL JUMPER USED IF BACK COURSE ILS SWITCH IS NOT CONNECTED AND NAVIGATION RECEIVER IS COUPLED.
9. ⚠ WIPER TRAVEL IS MECHANICALLY LIMITED.
10. ⚠ PG51A1, SERIES 1 THROUGH 5, HAVE 5K VARIABLE RESISTORS.
11. ⚠ REFERENCE DESIGNATIONS SHOW PHYSICAL LOCATIONS: EG 1A5R10 IS A RESISTOR ON CARD A5 OF UNIT 1 (COMPUTER).
12. ⚠ HDG PHASING FOR A RIGHT DEFLECTION FROM REFERENCE: J1-28 IS IN PHASE WITH REFERENCE J1-56; A5J IS OUT OF PHASE WITH REFERENCE J1-56.
13. ⏚ - DENOTES AIRCRAFT GROUND.
14. ALL RELAYS SHOWN DEENERGIZED.
15. ⚠ THIS PORTION OF CIRCUIT SHOWN ELSEWHERE. SEE MATCHING TERMINAL BOARD SYMBOL.

RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS ENERGIZED FOR EACH MODE OF OPERATION

MODE	RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS
PRE-ENGAGEMENT	1K1, 1K3,* 1A5K2 A AND B*
HEADING HOLD	2S1, BYPASS AIR VALVE, BRAKE, 1K3,* 1A5K2 A AND B*
TURN COMMAND	2S1, BYPASS AIR VALVE, 1K1, 1K3,* 1A5K2 A AND B*
HEADING SELECT	2S1, BYPASS AIR VALVE, 9S1, 9K4, 1K1, 1K3,* 1A5K2 A AND B*
ILS LOCALIZER	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1K3,* 1A5K2 A AND B*
ILS GLIDE SLOPE	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1A6K7, 1A6K8, 1K3,* 1A5K2 A AND B*
OMNI WITHOUT HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, BRAKE, 1A6K6
OMNI WITH HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6
ALTITUDE HOLD	2S1, BYPASS AIR VALVE, 2S2, 2L1, 1A7L1 (ALTITUDE HOLD DOES NOT ALTER ANY OTHER RELAY CONFIGURATION, BUT IT DISENGAGES AT ILS GLIDE SLOPE ENGAGEMENT)

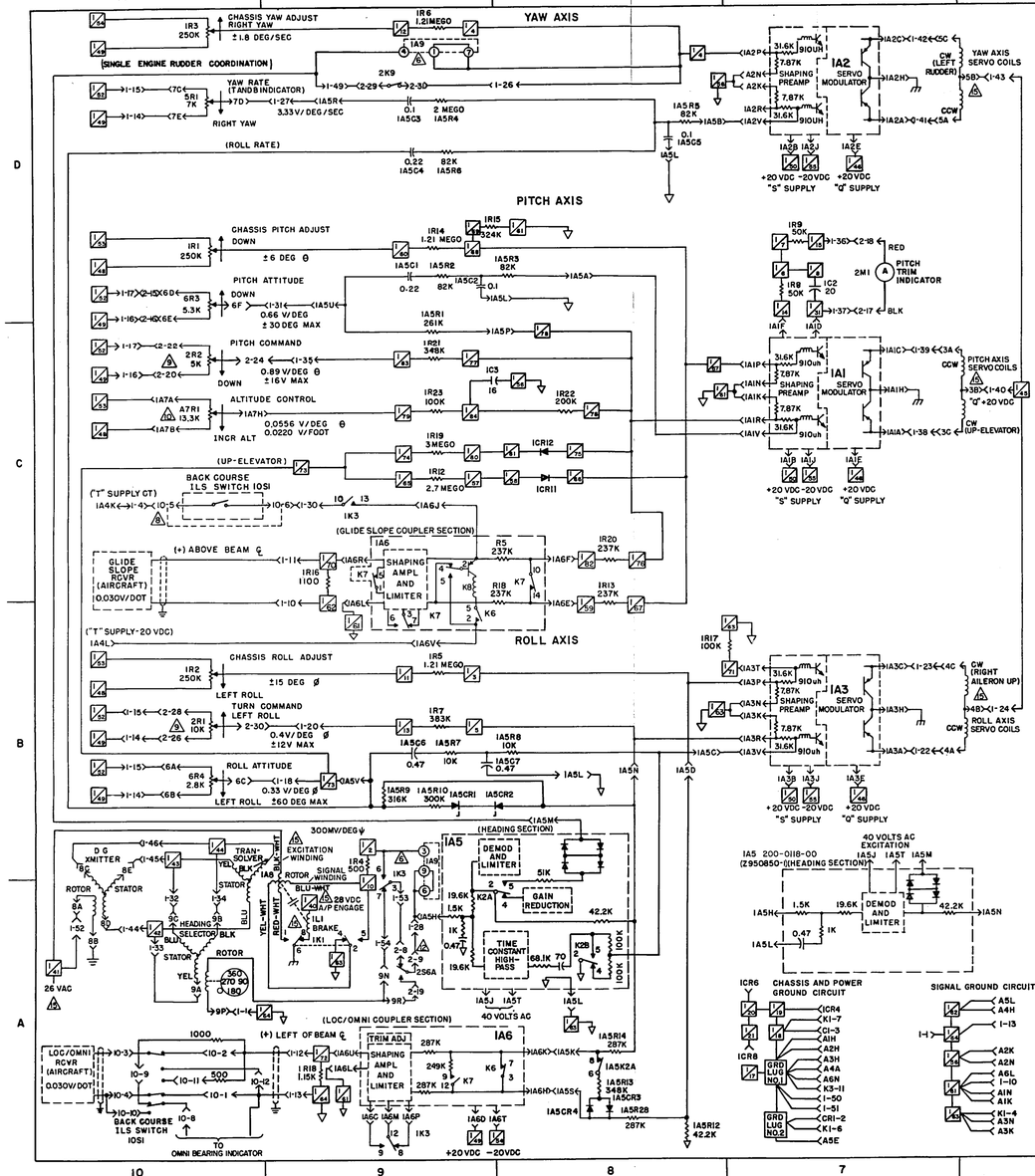
NOTE: *1K3 CAN BE A DUMMY RELAY OR A REAL RELAY. WITH THE ILS OPTION ONLY, 1K3 IS A DUMMY RELAY WIRED TO SIMULATE RELAY 1K3 ENERGIZED. WITH THE ADDITION OF THE OMNI OPTION, RELAYS 1A5K2A AND 1A5K2B ARE ADDED AND 1K3 IS A REAL RELAY.

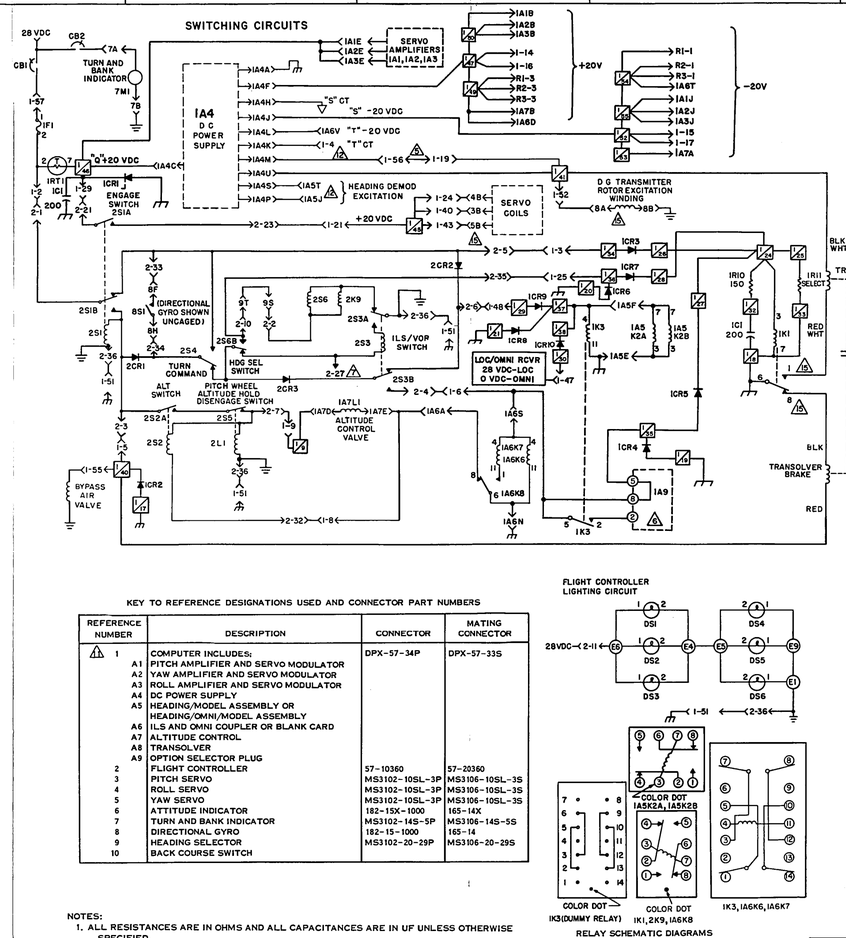
OPTION SELECTOR PLUG FUNCTIONS



OPTION SELECTOR POSITION	CONNECTIONS MADE IN OPTION SELECTOR RECEPTACLE
POS. 1 (STANDARD SYSTEM)	PIN 1 TO PIN 4 PIN 2 TO PIN 8 PIN 3 TO PIN 9
POS 2 (STANDARD SYSTEM WITH ILS OR ILS-OMNI)	PIN 2 TO PIN 5 PIN 3 TO PIN 6 PIN 4 TO PIN 7
POS 4 (ANY SYSTEM WHICH INCLUDES HEADING SELECT)	PIN 1 TO PIN 7 PIN 5 TO PIN 8 PIN 6 TO PIN 9
POS 3	NOT USED IN PRESENT SYSTEM

FIGURE 4-22 H-14 AUTOPILOT (TSO CONFIGURATION) SCHEMATIC DIAGRAM





KEY TO REFERENCE DESIGNATIONS USED AND CONNECTOR PART NUMBERS

REFERENCE NUMBER	DESCRIPTION	CONNECTOR	MATING CONNECTOR
⚠1	COMPUTER INCLUDES:	DPX-57-34P	DPX-57-33S
A1	PITCH AMPLIFIER AND SERVO MODULATOR		
A2	YAW AMPLIFIER AND SERVO MODULATOR		
A3	ROLL AMPLIFIER AND SERVO MODULATOR		
A4	DC POWER SUPPLY		
A5	HEADING/MODEL ASSEMBLY OR HEADING/OMNI/MODEL ASSEMBLY		
A6	ILS AND OMNI COUPLER OR BLANK CARD		
A7	ALTITUDE CONTROL		
A8	TRANSOLVER		
A9	OPTION SELECTOR PLUG		
2	FLIGHT CONTROLLER	57-10360	57-20360
3	PITCH SERVO	MS3102-10SL-3P	MS3106-10SL-3S
4	ROLL SERVO	MS3102-10SL-3P	MS3106-10SL-3S
5	YAW SERVO	MS3102-10SL-3P	MS3106-10SL-3S
6	ATTITUDE INDICATOR	182-15X-1000	165-14X
7	TURN AND BANK INDICATOR	MS3102-14S-5P	MS3106-14S-5S
8	DIRECTIONAL GYRO	182-15-1000	165-14
9	HEADING SELECTOR	MS3102-20-29P	MS3106-20-29S
10	BACK COURSE SWITCH		

NOTES:
1. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. 1/2 - DENOTES TERMINAL BOARD AND TERMINAL NO. EXAMPLE: TB1 - TERMINAL 2.
3. ▽ - DENOTES SIGNAL GROUND.
4. ⏚ - DENOTES COMPUTER CHASSIS GROUND.
5. ⚠ JUMPER FOR INTERNAL EXCITATION SHOWN. REMOVE JUMPER AND USE 200-0102-00(Z951349) DC POWER SUPPLY CARD WHEN EXTERNAL 26V 400 CPS IS APPLIED TO 1-19.
6. ⚠ OPTION SELECTOR CONNECTIONS SHOWN FOR POSITION 4. SEE ADJACENT TABLE FOR OTHER POSITIONS.
7. ⚠ TO HOLDING COIL OF BACK COURSE ILS SWITCH, IF USED.
8. ⚠ EXTERNAL JUMPER USED IF BACK COURSE ILS SWITCH IS NOT CONNECTED.
9. ⚠ WIPER TRAVEL IS MECHANICALLY LIMITED.
10. ⚠ PG51A1, SERIES 1 THROUGH 5,HAVE 5K VARIABLE RESISTORS.
11. ⚠ REFERENCE DESIGNATIONS SHOW PHYSICAL LOCATIONS, E.G. 1A5R10 IS A RESISTOR ON CARD A5 OF UNIT 1 (COMPUTER).
12. ⚠ HDG PHASING FOR A RIGHT DEFLECTION FROM REFERENCE; J1-28 IS IN PHASE WITH REFERENCE J1-56; A5J1 IS OUT OF PHASE WITH REFERENCE J1-56.
13. ⏚ - DENOTES AIRCRAFT GROUND.
14. ALL RELAYS SHOWN DEENERGIZED.
15. ⚠ THIS PORTION OF CIRCUIT SHOWN ELSEWHERE. SEE MATCHING TERMINAL BOARD SYMBOL.

FLIGHT CONTROLLER LIGHTING CIRCUIT

DESCRIPTION OF SWITCHES IN THE AUTOPILOT

SWITCH	DESCRIPTION
2S1	AUTOPILOT ENGAGE
2S2	ALTITUDE HOLD ENGAGE(ALT)
2S3	NAVIGATION COUPLING ENGAGE (ILS/VOR)
2S4	TURN COMMAND ENGAGE
2S5	PITCH WHEEL ALTITUDE HOLD DISENGAGE
2S6	HEADING SELECTOR ENGAGE SWITCH (HDG SEL)
8S1	DIRECTIONAL GYRO CAGE
1051	BACK COURSE ILS SWITCH

RELAY FUNCTIONS

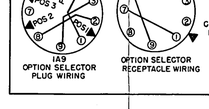
RELAY	CONTACTS	SWITCHING FUNCTION
1K1	3-7 (COIL)	OPERATED BY TURN CONTROL OR DIRECTIONAL GYRO CAGE KNOB OR ILS SWITCH
	1-6-8	TRANSOLVER BRAKE AND ROTOR EXCITATION
	2-4-5	TRANSOLVER SYNCHRONIZATION
1A5K2A	4-11 (COIL)	OPERATED BY LOC/OMNI RCVR, MASTER SWITCH, AND TURN SWITCH
	2-4-5	OMNI HEADING AND HEADING TO YAW
	6-8-1	OMNI COUPLER GAIN
1A5K2B	4-11(COIL)	OPERATED BY LOC/OMNI RCVR, MASTER SWITCH, AND TURN SWITCH
	2-4-5	HEADING HIGH-PASS ENGAGEMENT
	6-8-1	NOT USED
K3	4-11(COIL)	OPERATED BY NAV RCVR, MASTER SWITCH AND TURN SWITCH
	5-2-1	K1 RELAY EXCITATION
	3-6-7	HEADING SELECTOR ENABLING
	8-12-9	AMPLIFIER FEEDBACK CHANGE
	10-13-14	GLIDE SLOPE DISABLING IN OMNI MODE
2K9	3-7 (COIL)	OPERATED BY HEADING SELECT SWITCH
	6-8-1	HEADING TO YAW DISABLING
	2-4-5	NOT USED
1A6K6	4-11 (COIL)	OPERATED BY NAVIGATION ENGAGE SWITCH
	5-2-1	GLIDE SLOPE INTERLOCK
	3-7-6	LOCALIZER/OMNI AMPLIFIER ENABLING
	8-12-9	NOT USED
	14-10-13	NOT USED
1A6K7	4-11 (COIL)	OPERATED BY RELAY 1A6K8
	1-5-2	GLIDE SLOPE ENGAGE THRESHOLD
	3-6-7	GLIDE SLOPE AMPLIFIER OPERATING MODE
	9-12-8	LOCALIZER AMPLIFIER GAIN SWITCHING
	10-14-13	GLIDE SLOPE COUPLER ENABLING
1A6K8	3-7 (COIL)	OPERATED BY GLIDE SLOPE COUPLER
	1-6-8	ALTITUDE HOLD DISENGAGEMENT
	2-4-5	GLIDE SLOPE LATCHING

RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS ENERGIZED FOR EACH MODE OF OPERATION

MODE	RELAYS, HOLDING COILS, BRAKE, AND SOLENOIDS
PRE-ENGAGEMENT	1K1, 1K3,* 1A5K2 A AND B*
HEADING HOLD	2S1, BYPASS AIR VALVE, BRAKE, 1K3,* 1A5K2 A AND B*
TURN COMMAND	2S1, BYPASS AIR VALVE, 1K1, 1K3,* 1A5K2 A AND B*
HEADING SELECT	2S1, BYPASS AIR VALVE, 2S6, 2K9, 1K1, 1K3,* 1A5K2 A AND B*
ILS LOCALIZER	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1K3,* 1A5K2 A AND B*
ILS GLIDE SLOPE	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6, 1A6K7, 1A6K8, 1K3,* 1A5K2 A AND B*
OMNI WITHOUT HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, BRAKE, 1A6K6
OMNI WITH HEADING SELECT	2S1, BYPASS AIR VALVE, 2S3, 1K1, 1A6K6
ALTITUDE HOLD	2S1, BYPASS AIR VALVE, 2S2, 2L1, 1A7L1 (ALTITUDE HOLD DOES NOT ALTER ANY OTHER RELAY CONFIGURATION, BUT IT DISENGAGES AT ILS GLIDE SLOPE ENGAGEMENT)

NOTE: *1K3 CAN BE A DUMMY RELAY OR A REAL RELAY. WITH THE ILS OPTION ONLY, 1K3 IS A DUMMY RELAY WIRED TO SIMULATE RELAY 1K3 ENERGIZED. WITH THE ADDITION OF THE OMNI OPTION, RELAYS 1A5K2A AND 1A5K2B ARE ADDED AND 1K3 IS A REAL RELAY.

OPTION SELECTOR PLUG FUNCTIONS



OPTION SELECTOR POSITION	CONNECTIONS MADE IN OPTION SELECTOR RECEPTACLE
POS 1 (STANDARD SYSTEM)	PIN 1 TO PIN 4 PIN 2 TO PIN 8 PIN 3 TO PIN 9
POS 2 (STANDARD SYSTEM WITH ILS OR ILS-OMNI)	PIN 2 TO PIN 5 PIN 3 TO PIN 6 PIN 4 TO PIN 7
POS 4 (ANY SYSTEM WHICH INCLUDES HEADING SELECT)	PIN 1 TO PIN 7 PIN 5 TO PIN 8 PIN 6 TO PIN 9
POS 3	NOT USED IN PRESENT SYSTEM

FIGURE 4-23 H-14 AUTOPILOT WITH FOUR-SWITCH ROCKER TYPE FLIGHT CONTROLLER - SCHEMATIC DIAGRAM

NOTES:
1. ALL RESISTANCES ARE IN OHMS ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED
2. ⊠ DENOTES TERMINAL BOARD ONE TERMINAL EIGHT
3. P05IAL SERIES I THRU 5 HAVE 5K VARIABLE RESISTORS
4. EXTERNAL JUMPER BETWEEN 9J & 9L IF HEADING SELECTOR IS NOT CONNECTED
5. EXTERNAL JUMPER BETWEEN 10-9 & 10-6 IF BACK COURSE ILS SWITCH IS NOT CONNECTED
6. ⊕ DENOTES TEST POINTS AVAILABLE ON AUTOPILOT ANALYZER (ANALYZER SWITCH S4 MUST BE IN 'POSITION I FOR A "SYSTEM" CONFIGURATION
7. ⊕ DENOTES TEST POINTS AVAILABLE ON AUTOPILOT ANALYZER ONLY WITH COMPUTER CARDS PLUGGED INTO ANALYZER (ANALYZER SWITCHES S4 AND S3 MUST BE IN POSITIONS 1 AND 2 RESPECTIVELY FOR A "SYSTEM" CONFIGURATION
8. SERVO WIRING AND CONTROL CABLE CONNECTIONS MAY BE REVERSED IN CERTAIN INSTALLATIONS
9. GROUNDS: ⏚ SIGNAL, ⏚ CHASSIS, ⏚ AIRCRAFT
10. ALL RELAY CONTACTS SHOWN DE-ENERGIZED

CROSS REFERENCE OF PART NUMBERS SHOWN ON SCHEMATIC

KING PART NUMBER	HONEYWELL PART NUMBER
050-2111-00	2937788-1
050-2112-00	2937795-1
052-1004-00	2983983-1
200-0091-01	2951197-1
200-0092-01	2956328-2
200-0095-00	2974772-5
200-0095-01	NONE(REPLACES 2974770-1)
200-0095-02	10025203-101
200-0098-03	NONE(REPLACES 10025209-101
200-0098-04	2954609-1
200-0099-00	2960751-1
200-0099-01	10125204-101
200-0099-02	NONE(REPLACES 2950650-2)
200-0099-03	NONE(REPLACES 10025202-101
200-0101-00	2956329-1
200-0149-00	2937924
200-0150-00	2974769-1

SWITCHES AND RELAYS IN THE AUTOPILOT

SWITCH	CONTACTS	SWITCHING FUNCTION
2S1	1,2,4 5	AUTOPILOT ENGAGE SWITCH POWER TO FUNCTION SWITCHES & SERVO COILS POWER TO PITCH SYNC MOTOR AMPLIFIER
2S2	1,2,5 3	TURN COMMAND SWITCH POWER TO ALTITUDE INTEGRATION & DELAY CIRCUITS AND THE ALTITUDE ENGAGE VALVE
2S3	1,6 2,3	PITCH COMMAND DISCONNECT DURING ALTITUDE HOLD ILS/OMNI ENGAGE SWITCH
2S4	N/C NO	NAV. HDG SEL INTERLOCK ENGAGES NAVIGATION COUPLERS K2,K3,K6,K7 TURN COMMAND DETENT
2S6	1,2 5 5,6	NAV AND HDG SEL INTERLOCK HEADING SYNC DURING TURN BY K1 HEADING SELECT ENGAGE SWITCH HEADING TRANSFER SWITCH SINGLE ENGINE YAW DISABLE
10S1	1,2,3,4 5,6	NAV. HDG SEL INTERLOCK BACK COURSE ILS SWITCH REVERSES ILS/OMNI SIGNAL POLARITY REDUCES ILS GAIN BY 1/2 INTERLOCKS GLIDE SLOPE COUPLER

RELAY	C	NC	NO	
1K1	5-7 (COIL)			
	6	8	1	SYNCHRO RELAY OPERATED BY TURN CONTROL OR
	2	4	5	DIRECTIONAL GYRO CAGE KNOB OR ILS SWITCH OR HDG SWITCH
1A3K2ABB	3-7 (COIL)			TRANSLUCER BRAKE & ROTOR EXCITATION
1A3K2B	2	4	5	TRANSDUCER SYNCHRONIZATION
1A3K2B	3	6	1	OPERATED BY LOC/OMNI RCVR, AUTOPLT SW & TURN CONT SW
1A3K2A	2	4	5	HEADING HIGH-PASS ENGAGE
1A3K2A	3	6	1	NOT USED
				OMNI HEADING & HEADING TO YAW CKT
1K3	4-11 (COIL)			OMNI COUPLER GAIN
	1	3	4	OPERATED BY LOC/OMNI RCVR, AUTOPLT SW & TURN CONT SW
	3	7	6	#1 RELAY EXCITATION
	12	8	9	HEADING SELECTOR ENABLING
	10	14	13	AMPLIFIER FEEDBACK ENABLING
				GLIDE SLOPE DISABLING ON OMNI MODE
1A4K6	4-11 (COIL)			OPERATED BY ILS SW
	1	3	4	GLIDE SLOPE INTERLOCK
	3	7	6	LOCALIZER/OMNI AMPLIFIER ENABLING
	12	8	9	NOT USED
	10	14	13	NOT USED
1A4K7	4-11 (COIL)			OPERATED BY RELAY 1A4K6
	1	3	4	GLIDE SLOPE ENGAGE THRESHOLD
	3	7	6	GLIDE SLOPE AMPLIFIER OPERATING MODE
	12	8	9	LOCALIZER AMPLIFIER GAIN SWITCHING
	10	14	13	GLIDE SLOPE COUPLER ENABLING
1A4K8	3-7 (COIL)			OPERATED BY GLIDE SLOPE COUPLER
	6	8	1	ALTITUDE HOLD DISENGAGEMENT
	2	4	5	GLIDE SLOPE LATCHING

REFERENCE DESIGNATION	DESCRIPTION	CONNECTOR	MATING CONNECTOR
1	COMPUTER INCLUDES: A1 PITCH SERVO AMPLIFIER & MODULATOR A2 YAW SERVO AMPLIFIER & MODULATOR A3 ROLL SERVO AMPLIFIER & MODULATOR A4 DC PWR SUPPLY A5 HEADING/MODEL ASSEMBLY OR HEADING/OMNI/MODEL ASSEMBLY A6 ILS & OMNI COUPLER OR BLANK CARD AT ALTITUDE CONTROL A8 TRANSDUCER A9 OPTION SELECTOR PLUG	DPX-57-344P KPN030-2311-00	DPX-57-335 KPN030-2111-00 NONE KPN200-0049-00 517-1034-00 MS3102-16S-1P MS3102-10SL-3P MS3102-10SL-3P 182-153-1000 MS3102-14S-5P 182-153-1000 MS3102-20-29P
2	FLIGHT CONTROLLER		
3	PITCH SERVO		
4	ROLL SERVO		
5	YAW SERVO		
6	ATTITUDE INDICATOR(VERT. GYRO)	57-20360 MS3106-10SL-3S	
7	TURN & BANK INDICATOR (YAW GYRO)	MS3106-14S-5S	
8	DIRECTIONAL GYRO	182-153-1000 MS3102-20-29S	
9	HEADING SELECTOR	MS3106-20-29S	
10	BACK COURSE SWITCH		

SYSTEM CONFIGURATION	HEADING SELECT CO126	OPTION SELECTOR PLUG POSITION	K3 PLUG IN	A5 NUMBER	A6 NUMBER	A5 & A6 COMBINATION NUMBER
HEADING (BASIC SYSTEM)	NO	1	DUMMY	KPN200-0099-02 OR KPN200-0099-03	KPN200-0150-00 ↓ OR KPN200-0093-03	KPN200-0099-01 OR KPN200-0095-03
HEADING WITH SELECTOR	YES	4	DUMMY	KPN200-0099-02 OR KPN200-0099-03	KPN200-0150-00 ↓ OR KPN200-0093-03	KPN200-0095-00 OR KPN200-0095-03
HEADING/OMNI/ILS WITHOUT HEADING SELECTOR	NO	2	IK3	KPN200-0099-00 OR KPN200-0099-01	KPN200-0098-01 ↓ OR KPN200-0099-01	KPN200-0095-00 OR KPN200-0095-02
HEADING/OMNI/ILS WITH HEADING SELECTOR	YES	4	IK3	KPN200-0099-00 OR KPN200-0099-01	KPN200-0098-01 ↓ OR KPN200-0099-01	KPN200-0095-00 OR KPN200-0095-02
ALTITUDE	CAN BE USED WITH ANY COMBINATION					

H 14 AUTOPILOT WITH FOUR SWITCH PUSH BUTTON SOLENOID HELD TYPE FLIGHT CONTROLLER - SCHEMATIC DIAGRAM
FIGURE 4-24