AUTOCONTROL III B
AND
ALTIMATIC III B-1

Service Manual

PIPER AIRCRAFT CORPORATION

761 502

PIPER AIRCRAFT CORPORATION
LOCK HAVEN, PENNSYLVANIA 17745

THIS SERVICE MANUAL SUPERSEDES ALL PREVIOUS ALTIMATIC III B-1 SERVICE MANUALS ISSUED PRIOR TO JULY 1974.

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FOREWORD

This Service Manual is provided as a guide for Removal and Installation, Troubleshooting Procedures, Set-up Procedures and Repair Procedures for the Piper AutoControl III B and AltiMatic III B-1.

The information presented in this manual has been divided into two parts; the first having six (6) sections and the second having six (6) sections. An index is located in the front of the manual and preceding each section to provide a quick reference.

The information compiled in this manual will be kept current by revisions distributed to the manual owner through their local Piper Dealer or Distributor.

REVISIONS

There will be two (2) types of revisions used to keep this manual current. The material compiled in these revisions will consist of information necessary to maintain the present AutoControl III B and AltiMatic III B-1, therefore, it is imperative that this material be inserted in the Service Manual at the time it is received.

I. Temporary Revision

This type revision will be distributed at any time it is necessary to forward Technical Servicing Information to the field. The temporary revision will usually consist of one or two pages which may be inserted in the front of the manual. These revisions will include deletions and additions of material pertinent to different paragraphs of the service manual, therefore, when the temporary revision is received, review the manual and mark the affected paragraph with the code date of the latest revision for a ready reference.

II. Permanent Revision

This type revision will be distributed periodically and will supersede all previous temporary revisions. These revisions will be of complete page replacement and shall be inserted in the service manual as per the instructions given below.

1. Replace the obsolete pages with revised pages of the same page number.
2. Insert pages with page numbers followed by a small letter in direct sequence with the same common page number.
3. Insert pages with page numbers followed by a capital letter in direct sequence with the same common page number, but after any pages with the same common page number followed by a small letter.

III. Identification of Revised Material

Revised text and illustrations shall be indicated by a black vertical line along the left hand margin of the page opposite the change. A line opposite the page number or section title and printing date will indicate that the text or illustration was unchanged, but the material was relocated to a different page. Newly added material shall be identified by an arrow pointing toward either the text, text heading or illustration. When material is removed, an arrow will point away from the area from which the material was removed.

Symbols will indicate only current revisions with changes and additions to or deletions of existing text and illustrations. Changes in capitalization, spelling, punctuation or the physical location of the material on the page will not be identified by symbols.

TABLE OF CONTENTS

PART I

AUTOCONTROL III B AND ALTIMATIC III B-I

PART II

GLIDE SLOPE COUPLER

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (cont.)

LIST OF ILLUSTRATIONS (cont.)

LIST OF TABLES

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PART I

AUTOCONTROL III B AND ALTIMATIC III B-1

SECTION I

INTRODUCTION AND DESCRIPTION

SECTION I

INTRODUCTION AND DESCRIPTION

1-1. INTRODUCTION. This part of the service manual is divided into six sections. Section I contains a description of the AutoControl III B and AltiMatic III B-1. Section II, Theory of Operation, explains the theory of the Automatic Flight Control System including the Radio Coupling. Section III, Removal and Installation, provides the information necessary for removal and installation of all AutoControl III B and AltiMatic III B-1 components. Section IV, Test Equipment, provides information on the equipment used to verify, adjust and troubleshoot the system. Section V, Set-up Procedures, provides the information necessary to perform a sequential test of the system and Bench, Ground and Flight Adjustments. Section VI, Wiring Diagrams, provides the information for the AutoControl III B and AltiMatic III B-1 electrical cables and harnesses used for interconnecting the system.

1-2. DESCRIPTION. The Piper AutoControl III B and AltiMatic III B-1 Automatic Flight Control Systems are designed to provide smooth operation and high reliability with the minimum complexity possible in order to satisfy present day operational requirements. Design techniques and components utilized represent the latest advances in the state of the art both in electronics and light weight flight control systems. Except for air driven gyro instruments, the system operates entirely from the airplane DC electrical system.

The AutoControl III B is a lateral control system which has two basic operating modes. This system incorporates a threshold adjustment in the Console/Amplifier. With the addition of this threshold adjustment, the system has greater adaptability. The AutoControl III B incorporates a fail safe electrical engage and disengage mechanism in the roll servo which is operated by the A/P ON-OFF Rocker Switch in the console. When the A/P switch is placed in the ON position the system is responsive to the Roll Command Knob on the console. With the A/P switch in the ON position engaging the HDG mode removes the Roll Command Knob from the Autopilot circuit and adds the Directional Gyro (D.G.) course selector heading and Radio Coupler functions as basic Autopilot inputs. The Radio Coupler is a special analog computer which causes the system to fly with reference to a radio defined path. The D.G. course selector and radio coupler selector should be set prior to engaging the HDG mode of the AutoControl III B.

The AltiMatic III B-1 is a complete 3-axis two surface Autopilot and therefore contains all the features mentioned regarding the AutoControl III B including Radio Coupling. This system is designed for the heavier single and light to medium twin engine airplanes. The AltiMatic III B-1 automatically maneuvers the airplane in response to a preselected flight profile selected by the pilot. The AltiMatic III B-1 Autopilot features pitch and roll attitude, altitude, heading and automatic pitch trim. With the pitch axis engaged, the automatic trim system keeps the pitch trim properly set at all times. This not only enhances the ability of the system to fly the airplane but also improves safety by providing for the airplane to be turned over to the pilot in a trimmed condition when the Autopilot is disengaged.

The AltiMatic III B-1 offers an added safety feature during automatic trim system operation. On aircraft with a separate control wheel mounted disengage button, a trim warning device is installed. The function of this device is to provide the pilot with a visual indication of abnormally long or continuous pitch trim servo operation. The press to test trim warning light on the instrument panel will glow and continue to glow should a trim runaway occur. On aircraft with the control wheel mounted disengage button installed in the trim switch, a special trim sensor is installed. This special sensor has dual contacts which control pitch trim servo operation.

The AltiMatic III B-1 utilizes a 1C515-1 computing amplifier which incorporates a roll and a pitch threshold adjustment. There is no airspeed limiting feature in this system as in previous III Series Autopilots. With the addition of threshold adjustments, the system has greater adaptability. When in the altitude preselect mode, the angle of climb and descent may be increased or decreased at the discretion of the pilot by utilizing the Pitch Command Disc.

Certain AltiMatic III B-1 installations incorporate a backup system known as the Piper AutoFlite II. If the AltiMatic III B-1 malfunctions, or if a loss of vacuum or gyros occur, the pilot need not revert to flying the aircraft manually with needle and ball as the sole reference. The AutoFlite II is a stability system with the capacity to hold the wings level in calm or turbulent air. This system uses the electric rate gyro of the turn indicator combined with a solid state computer/amplifier to achieve reduced heading drift and constant monitoring of the roll attitude of the aircraft. The system operates electrically and is independent of other instruments.

The AltiMatic III B-1 incorporates the use of an Autopilot disengage button located on the pilot's control wheel which energizes the Autopilot Disengage Relay. The Disengage Relay interrupts A+ to the Autopilot, permitting the magnetically held Roll Switch to release and turn "OFF" the Autopilot.

NOTES

SECTION II

THEORY OF OPERATION

SECTION II

THEORY OF OPERATION

2-1. PIPER AUTOCONTROL III B AND ALTIMATIC III B-1 AUTOMATIC FLIGHT CONTROL SYSTEMS. The Piper AutoControl III B and AltiMatic III B-1 automatic flight control systems incorporate several unique concepts and circuits which provide smooth operation, simplified installation and maintenance, and high reliability. These systems may be operated from either a 14-volt DC or 28-volt DC airplane system. The most significant is the computing amplifier which eliminates the requirement for a control surface follow-up element. In simple terms, the control surface follow-up function (normally a potentiometer or synchro) is duplicated on a short term basis by an electronic analog circuit built into the amplifier.

To understand how this is accomplished, consider the steps which lead from the conventional position control systems to the Piper System, as outlined in the following discussion. Figure 2-1 shows a conventional system in which a follow-up element is connected to the control surface. An attitude deviation signal when acted upon by the amplifier causes the servo motor to drive the control surface. The feedback element connected to the control surface causes a signal to be subtracted from the attitude signal so that the motor is stopped when the control surface is deflected an amount proportional to the attitude deviation.

NOTE

The follow-up element causes control action to be proportional to the change in attitude that is required as would be the case when the human pilot is at the controls.

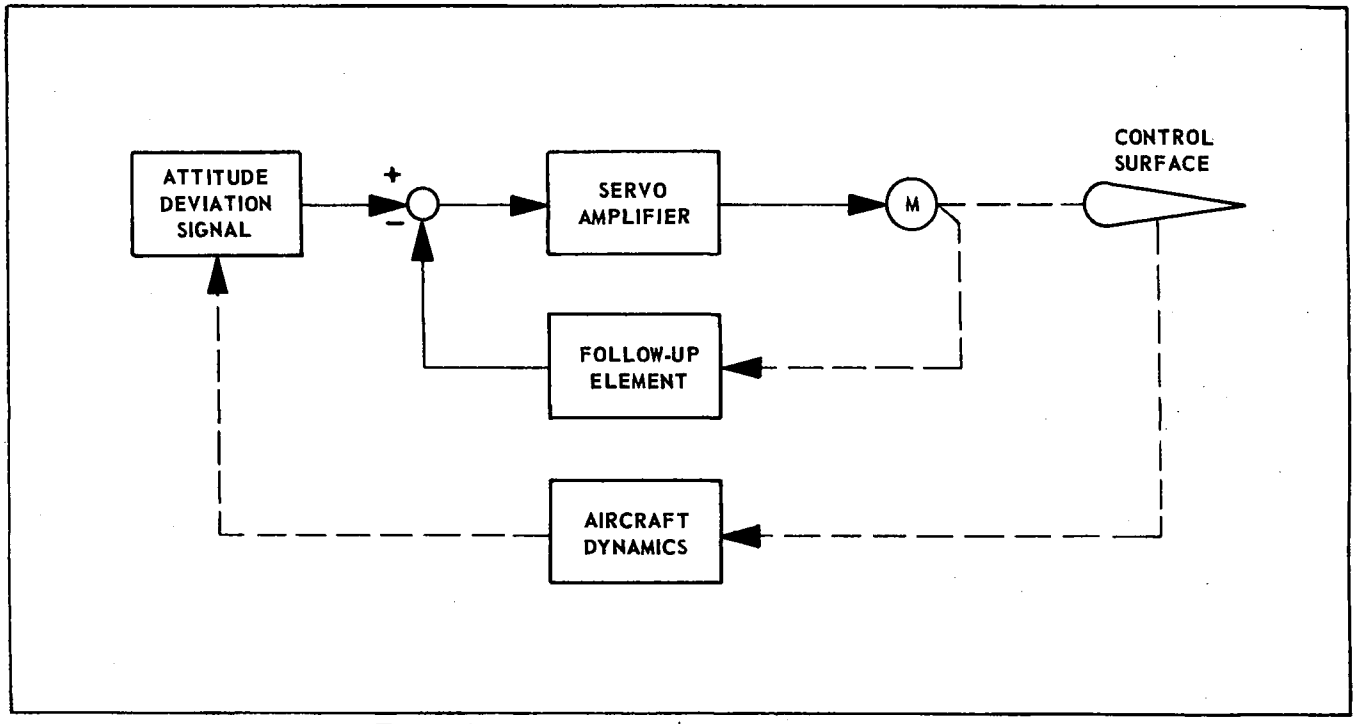


Figure 2-1. Conventional Flight Control System Employing Control Surface Follow-up

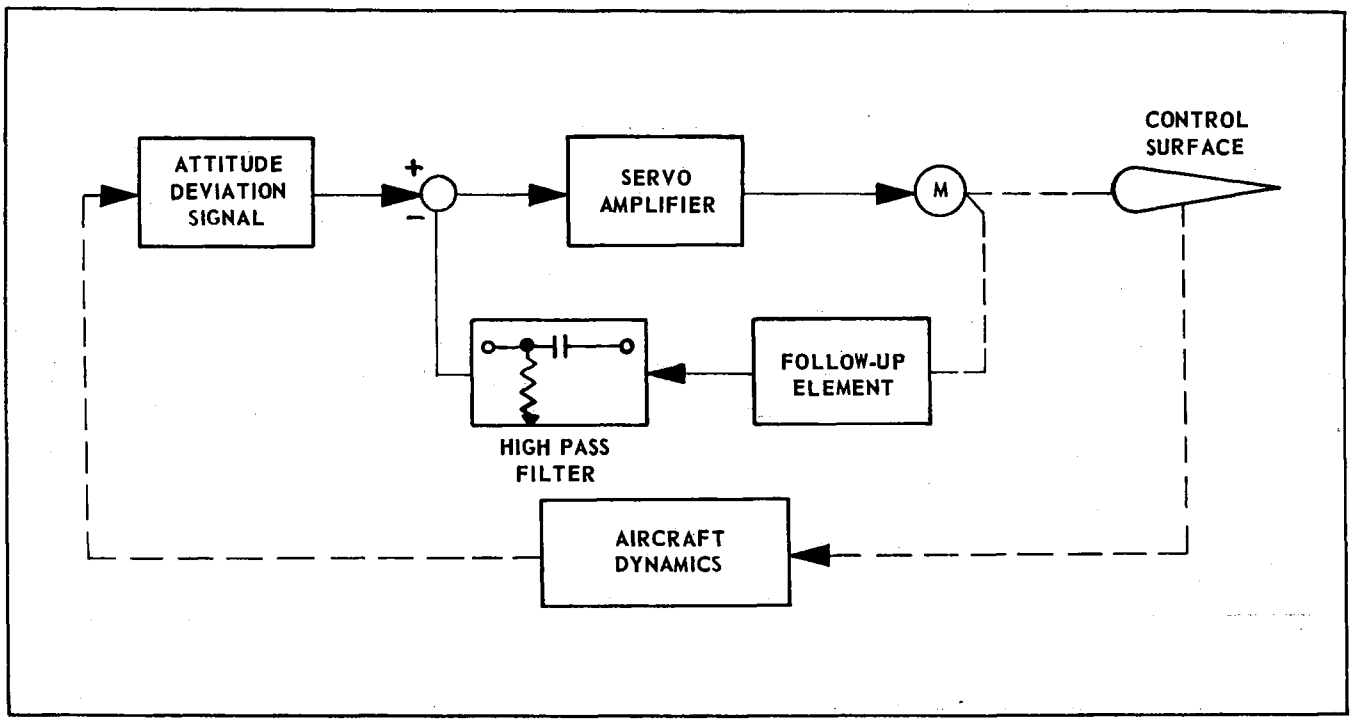


Figure 2-2. Conventional System With High Pass Filter Added

Figure 2-2 shows a system which differs from the one described previously in that the follow-up signal is run through a high pass filter. This is a technique commonly employed for the purpose of providing a control system which can fly the airplane with the controls at any quiescent or steady state position. For example, the different elevator positions required due to varying power or airspeed values. To understand that the feedback signal can be transmitted through a high pass filter, note that in flying the airplane every control action is shortly followed by a reverse action of about the same amplitude and that the minimum time in which these reversals occur is only a few seconds at the most. Therefore, control movement can be made proportional to attitude deviation on the short term basis (time less than 10 seconds) if the high pass filter is able to transmit reversing signals occurring at high frequencies approximately down to one cycle every two seconds. Note that long term equilibrium or condition of zero attitude deviation is provided as the airplane responds to the applied control action.

The next step as illustrated in Figure 2-3 is easily understood. In this system the follow-up element is now driven by a motor having speed versus input voltage characteristics which are similar to the control surface servo motor, so that the mechanical drive applied to the follow-up is equal to that applied to the control surface. With this step having been accomplished, it follows that all elements in the follow-up path (motor, follow-up element, and high pass filter) could be housed within the amplifier package, thus eliminating the follow-up element from the Servo unit. Of course, this would not be practical, but it is now apparent that the problem of eliminating the follow-up from the control surface Servo is one of duplicating the signal transmitting characteristics of a motor driving an element which generates a DC follow-up signal that is transmitted through a high pass filter.

The motor is an integrating element. That is to say, an input signal or drive voltage will cause the output to run continuously. The DC voltage derived from the follow-up is then the integral of the motor drive signal, since it is proportional to the motor output shaft position. It is now established that the combination comprising the motor and follow-up element is a form of electrical integrator in that a constant input signal will produce an ever changing output signal. When the signal from the follow-up is transmitted through the high pass filter, the integrating effect is cancelled and it can be shown by mathematics slightly beyond this discussion that the series combination comprising an integrator and a high

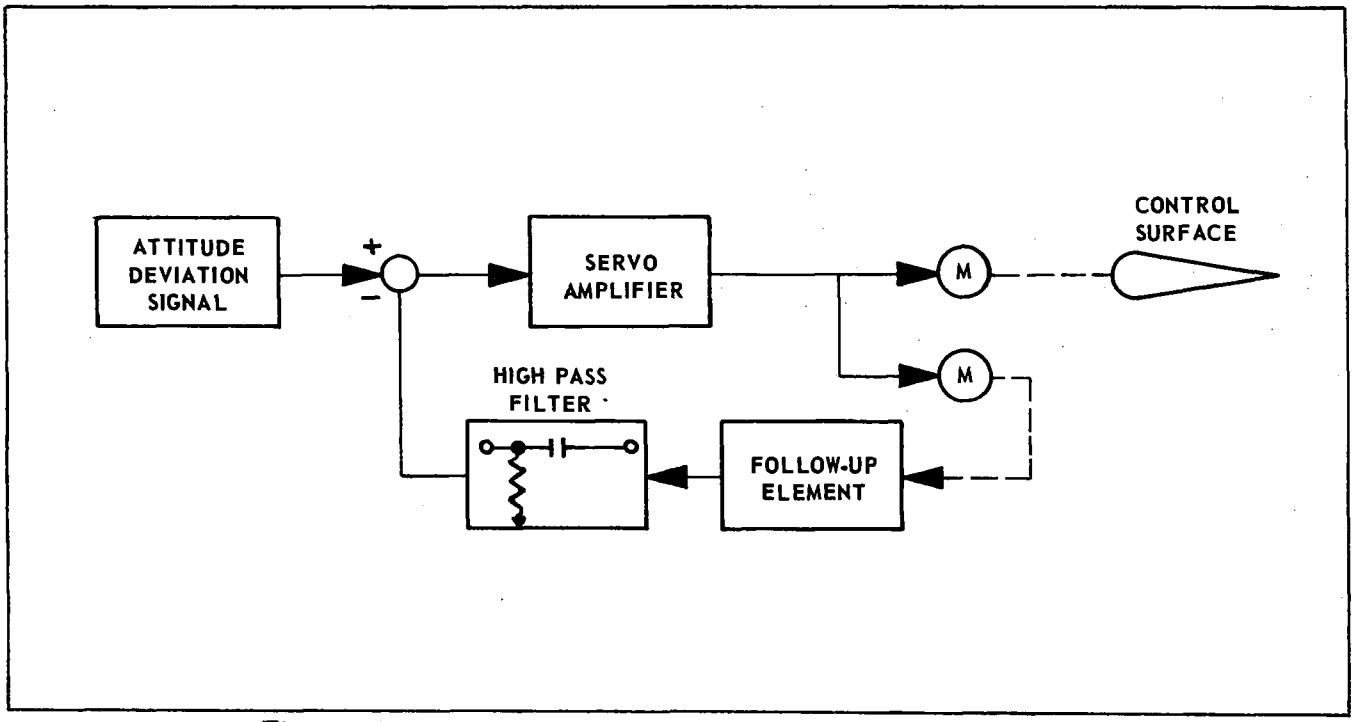


Figure 2-3. All Follow-up Components Removed From Servo Unit

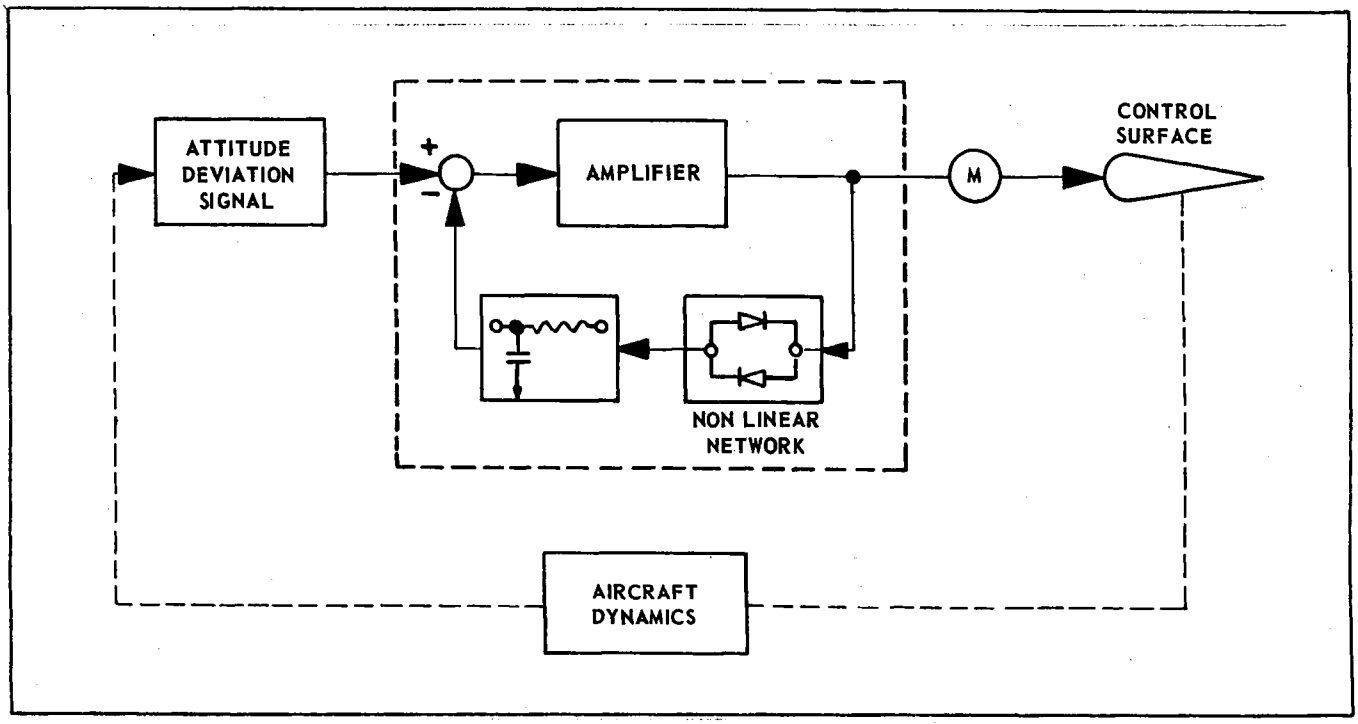


Figure 2-4. System With Electronic Follow-up

pass filter is simply equivalent to a low pass filter. Figure 2-4 is a system in which the amplifier output is applied to an internal feedback circuit consisting of the low pass filter element and a pair of back to back diodes. The diodes will not conduct until the amplifier output is about 3 volts, the amount required to start the servo motor. Therefore, it can be said that they simulate the lost motion inherent in the servo motor drive as it responds to the amplifier output. It should be noted that these diodes are essential to the satisfactory operation of the system, for without them the system is insensitive to slowly changing small signals, and the airplane will, therefore, oscillate slowly in smooth air without them. This is understood by noting that when the input signal is changing very slowly, there is time for the feedback network to pass cancelling signal without the amplifier output ever getting large enough to run the servo motor. The result then is that the airplane will continue to drift until the drive signal is large enough to run the motor even in the presence of a cancelling follow-up signal. This would show up as a very slow roll oscillation of about ± 3° bank.

NOTE

This discussion describing smooth air oscillation pertains to what happens without diodes; for with diodes in the feedback channel, reduction in amplifier gain is prevented until the output of the amplifier is equal to or greater than approximately 3-volts, the amount needed to start the servo motor.

2-2. LATERAL SYSTEM. The block diagram of Figure 2-5 illustrates a lateral control system that utilizes the electronic follow-up principles described in Paragraph 2-1. In this system primary roll stabilization and reference is provided by the roll attitude pick-off built into the attitude gyro (artificial horizon). In the 1C515-1 amplifier, the roll attitude (position) signal is split and a portion passes through a rate circuit (Figure 2-6) where the rate of change of the signal is detected and re-combined with the position signal so that a composite signal of position plus rate of change is applied to summing point Sm1.

Pilot command over the system is provided from two sources. (1) The course selector D.G. and (2) the manual bank command knob, which acts as a secondary reference device for the AutoPilot. The command method in use at any given time is determined by the position of the HDG switch on the console.

The HDG switch has two functions, it directly controls the signal path for the bank command signal and indirectly controls the D.G. signal through an electronic switch in the 1C515-1 amplifier.

When the HDG switch is in the "out" position, the bank command circuit is completed and the electronic switch controlling the D.G. signal is "open." When the HDG switch is in the "in" position, the bank command circuit is open and the D.G. signal is permitted to pass through the electronic switch circuit. The D.G. signal is passed through a pre-amplifier to increase its amplitude. A pre-amplifier is not necessary for the bank command signal because it is already of sufficiently high amplitude to be used directly. Either the bank command or the D.G. signal (depending on the position of the HDG switch) is applied to the first synchronous filter which is acting as an adjustable voltage limiter. It is here that the left and right bank angles are limited to the appropriate values for the bank command and the HDG mode.

After limiting, the chosen signal is acted upon by a roll lag circuit (low pass filter). This filter prevents any rapid bank command signal from being applied to the servo amplifier with the result being to limit the rate at which the airplane will roll into a bank. Also, it prevents the airplane from responding with excessive activity to random heading deviations which could be generated in turbulence. Further, it reduces the tendency for the system to become oscillatory at low airspeeds when the control characteristics of many airplanes become sloppy. (The oscillation referred to is one in which heading and roll deviations interchange or trade back and forth). Still another noticeable benefit provided by the lag filter is improved characteristics pertaining to rolling from a bank to commanded heading in the directional gyro mode of operation. Since the output from the directional gyro is acted upon by the lag filter, a reduction in bank command, which would normally occur as heading comes within about 20° of the commanded value, is delayed until the heading deviation is to about 5°. This results in a very positive roll out onto the commanded heading.

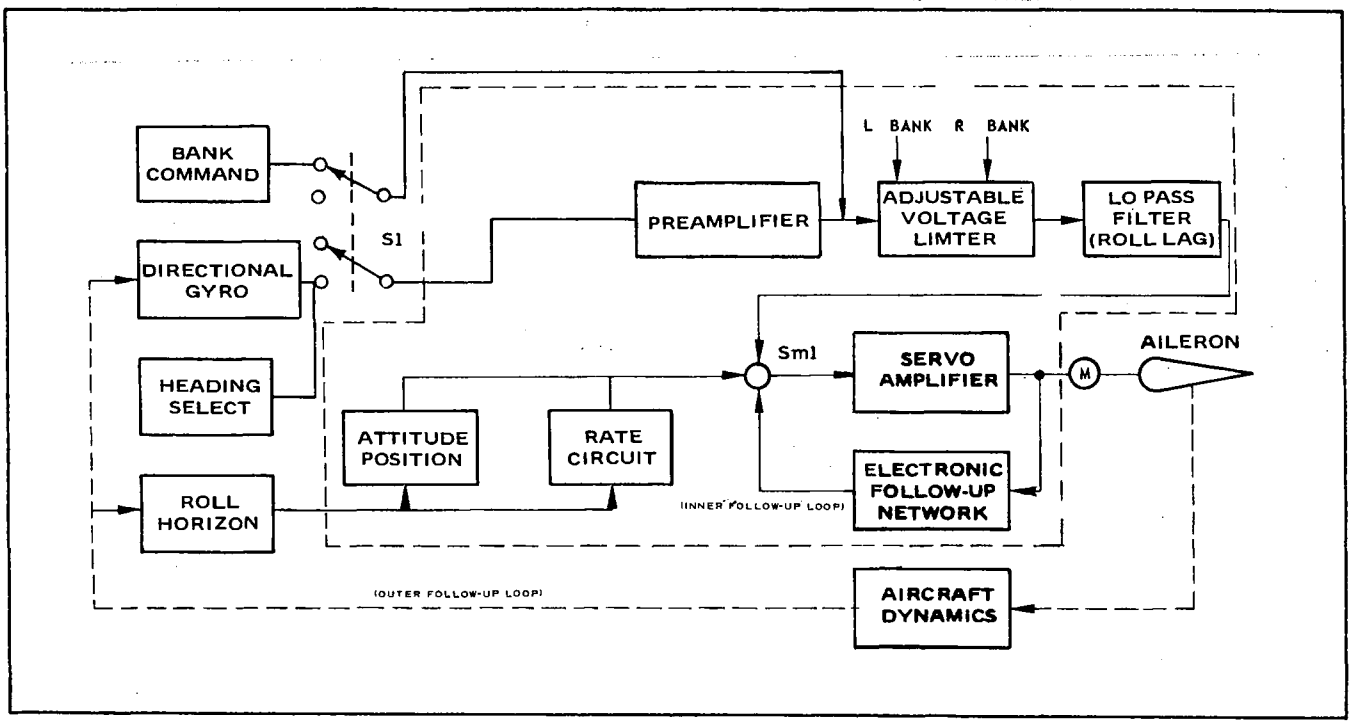


Figure 2-5. Lateral Axis Control System

The 1C515-1 amplifier roll lag network acts as a large capacitor with a time constant that allows it to discharge much faster than it charges. If a signal is applied in one direction and then reversed, the network will discharge quickly to zero then charge slowly in the opposite direction to full signal. This allows the aircraft to roll out of a bank rapidly and roll into the bank slowly which prevents overshooting the bank angle.

After the command signal has been completely processed it is applied to summing point Sm1 where it combines with the position and rate signals previously applied.

Action of the various signals arriving at the summing point Sm1 are the key to understanding basic AutoPilot theory. The signals from the attitude gyro are phased so that if the aircraft is in a "left" bank, the servo drives "right" to return to level flight. The signals from the command circuits are phased so that they drive the servo in the desired direction. To command a left bank, from level flight, the pilot turns the bank command left. The signal amplitude is limited and applied slowly to the summing point which causes the servo to drive left as the aircraft rolls left, the signal from the attitude gyro increases (with opposite phase) until its amplitude equals the amplitude of the command signal. At this point they cancel each other and the aircraft will remain banked at that angle until the command signal is reduced either by the pilot or the D.G. as the aircraft approaches the selected heading. As the command signal is reduced, the attitude gyro signal overrides the command signal and drives the servo "right" to return to level flight. When the aircraft reaches level flight the output from the attitude gyro is zero and if the command input is also zero, the aircraft will remain level until another command input is applied.

2-3. ROLL RATE CIRCUIT, 1C515-1 AMPLIFIER. The rate circuit adds a rate signal to the changing position signal. This rate signal is obtained by employing an electronic filter network which derives from the changing roll signal the desired rate information. This rate information is then added back to the position signal to provide a combination signal that contains both position and rate information. The pitch circuit contains a rate circuit similar to the one explained in the roll circuit and can be considered as accomplishing the same purpose. The roll signal from the Attitude Gyro is first amplified in a single stage phase reversing Amplifier and then applied to a synchronous lo-pass filter. The purpose of this filter is to

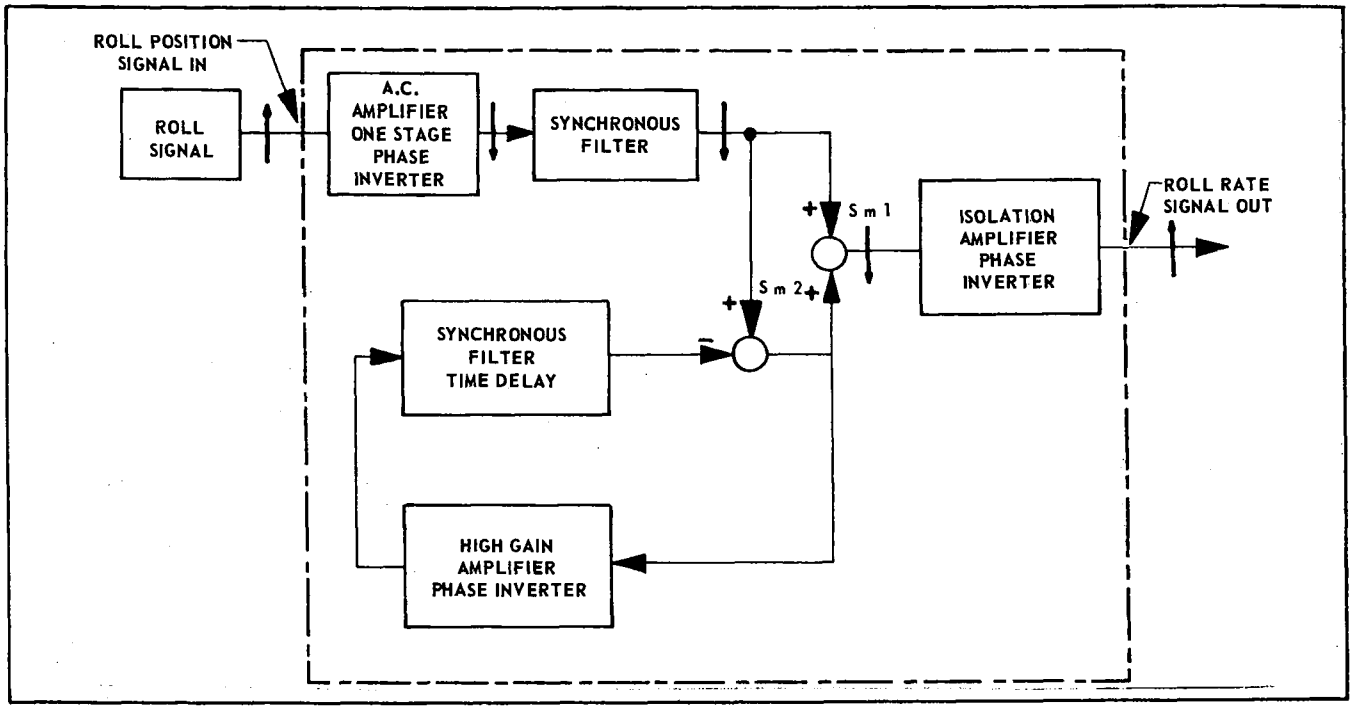


Figure 2-6. Roll Rate Circuit, 1C515-1 Amplifier

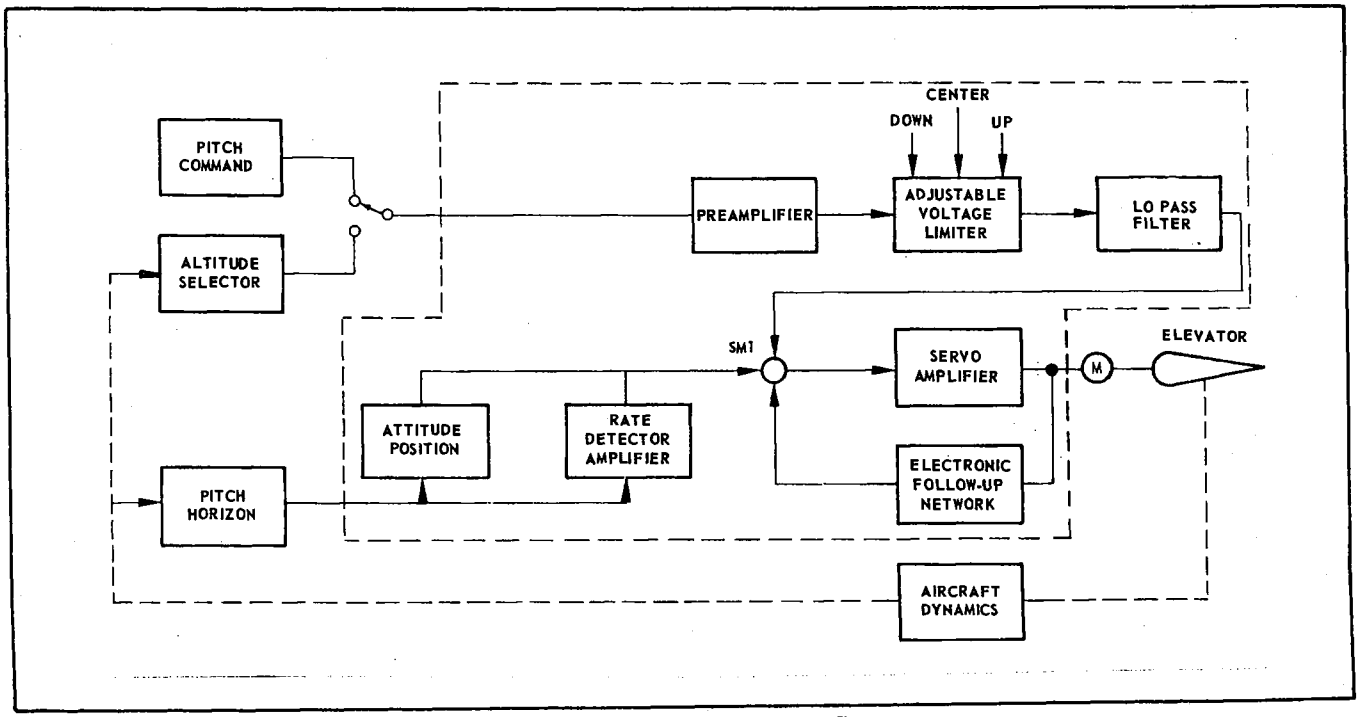


Figure 2-7. Pitch Axis Control System

translate the poor signal wave-form generated by the gyro into a perfect square wave. To obtain a rate signal, this square wave is then applied to the summing input of high gain negative feedback amplifier. The feedback network of this amplifier is another lo-pass synchronous filter which has a noticeable time delay (T = 1 sec). When this delayed feedback signal is subtracted from the roll position signal at the summing point, the difference is a signal that corresponds to roll velocity or rate. This can be understood by noting that when sufficient time is allowed for the output of the high gain amplifier to be transmitted through the lo-pass synchronous filter, the feedback signal will almost completely subtract out or cancel the input roll signal. This means that the only time a signal will appear at the output of summing point is when time has not allowed it to be cancelled by action of the negative feedback system. By proper selection of the time lag in the feedback lo-pass filter, this signal can then be made to correspond to roll rate.

Finally the composite output signal is generated by adding the roll rate signal to the roll signal and applying the combination to an isolation phase reversing amplifier. This is required in order to get the sensing or direction of the output signal back in correspondence with the incoming roll signal.

2-4. PITCH CONTROL SYSTEM. The diagram in Figure 2-7 illustrates a pitch control system based upon the same no follow-up principle. Note the similarity between this and the roll systems of Figure 2-5. In the pitch system, an altitude deviation signal corresponds to the Directional Gyro signal of the lateral system. The climb, dive and center attitude adjustments correspond to the adjustments described in the lateral system.

The pitch rate circuit corresponds to the roll rate circuit of the lateral system. The only significant difference to be considered in this system is the lag filter through which command signals are applied. In this system the lag is much greater than the corresponding lag in the lateral system command channel. This

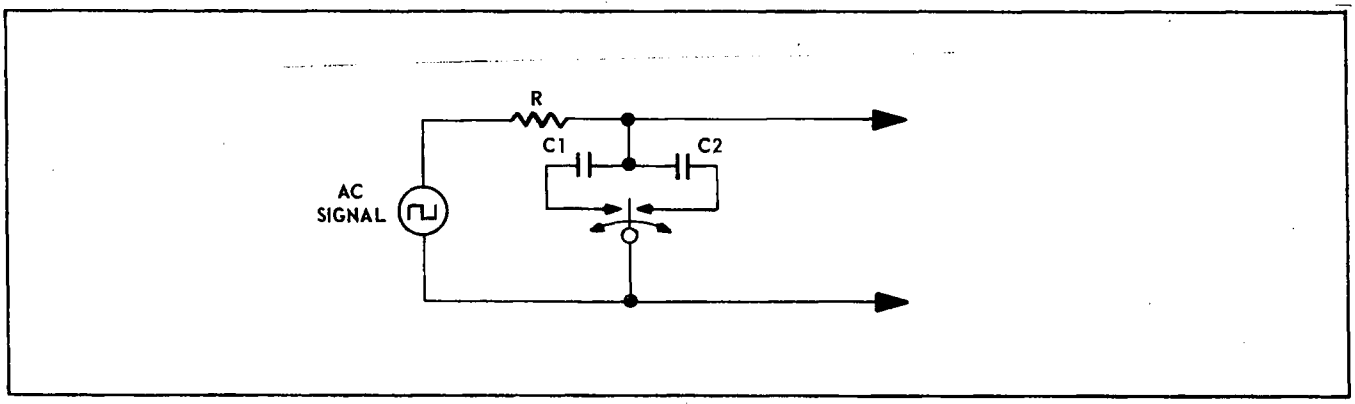


Figure 2-8. Simplified Synchronous Filter Circuit

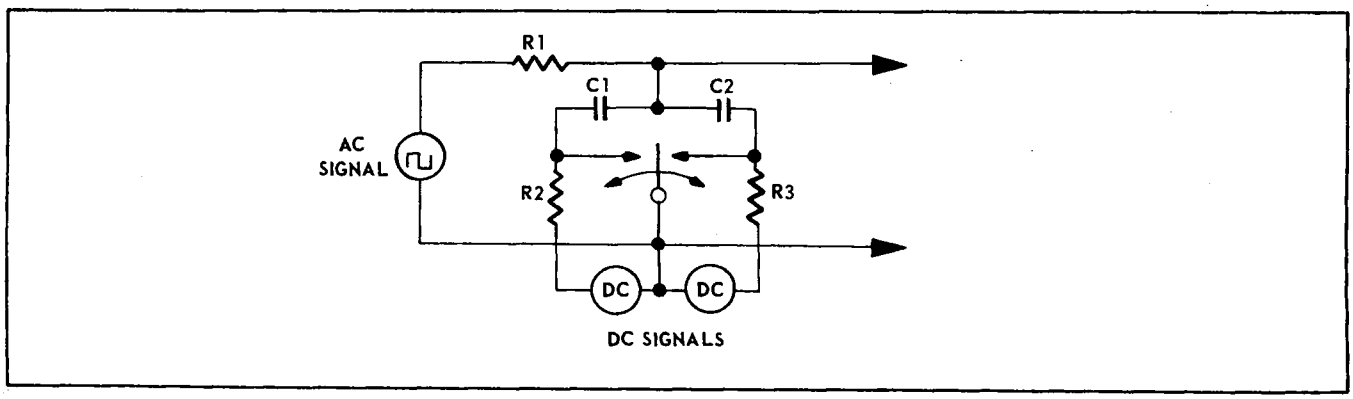


Figure 2-9. Simplified Synchronous Filter Circuit, With DC Signals Added

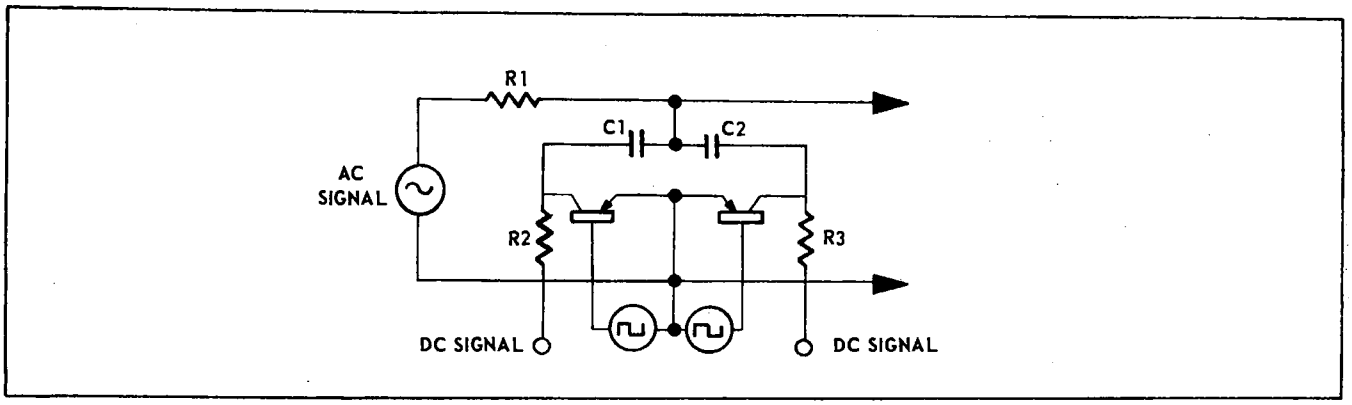


Figure 2-10. Equivalent Transistorized Synchronous Filter Circuit

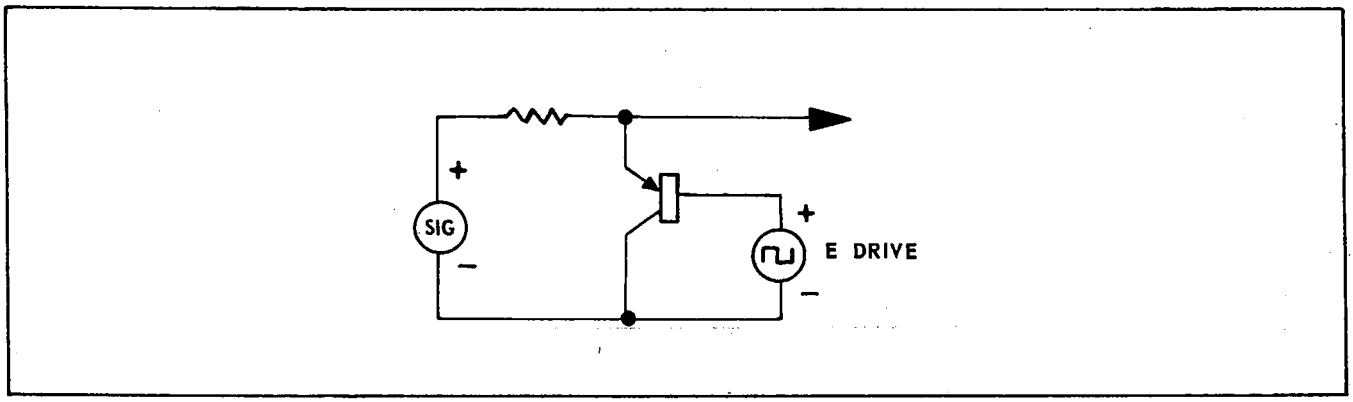


Figure 2-11. Synchronous Filter - Basic Circuit

feature is provided only for passenger comfort as it does not serve any other function in improving the dynamics of the system as is the case with the corresponding lag in the lateral system.

2-5. SYNCHRONOUS FILTER. The simplified filter circuit of Figure 2-8 consists of a vibrating switch that operates in synchronism with the AC signal to be filtered. Operation is such that the in or out of phase (0° or 180°) component of this signal will be translated into a perfect square wave and all other components of signal or noise, except odd harmonics of the fundamental mentioned above, will be eliminated. Consider the half cycle in which the switch is to the left. During this half cycle the net effect of the signal will be averaged and stored in C_1. (It is to be noted that the time constants RC_1 and RC_2 are very long compared to the duration of a half cycle so there is negligible voltage change across C_1 or C_2 during the half cycles in which they are connected to the signal). During the other half cycle C_2 is connected to the signal source as the switch closes to the right and a square wave of voltage is therefore generated at the filter output.

In Figure 2-9 it is shown the DC signals may also be applied at two points to the filter so that the filter output is the sum of the AC signal and the two DC signals. Operation of the DC sections is similar to the typical chopper circuit in which a DC signal acting through a "sag element" (R_2 or R_3) is translated into a square wave of voltage as it is shorted to common during alternate half cycles.

Figure 2-10 shows the transistor equivalent of the synchronous filter in which the mechanical switches are replaced with transistors operating as switches. In this application it should be noted that the transistor acts as an open switch when the base (in the case of a PNP) is more positive than the collector and that it is a closed switch regardless of collector polarity when adequate negative drive is applied to the base. It follows that NPN transistors will also work as switches when polarities are simply reversed.

2-6. SYNCHRONOUS FILTER AS VOLTAGE LIMITER. The synchronous filter may also be used as a voltage limiter in such a way that "in" or "out" of phase signals may be limited independently at different amplitude levels. In the lateral guidance AutoPilot this is used for separate left and right bank adjustments; however, this use of the filter is suited to many applications. In this application of the filter, limiting action occurs when the off condition of the transistor collector voltage tends to exceed the reverse voltage applied to the base. For the purpose of this discussion assume the transistor to be PNP, noting that NPN transistors behave the same with all polarities reversed. If the signal is negative during the off half cycle, the transistor switch will not conduct regardless of the magnitude of the signal (not considering exceeding design limits); but if the signal is positive; conduction will occur when the collector becomes more positive than the base. Figure 2-11 illustrates this by showing the fact that the two junctions (collector-base and emitter-base) of the transistor are actually diodes. When the signal voltage is more positive than the drive voltage, conduction occurs.

Figure 2-12 shows a synchronous filter in which the drive voltages to the two sides may be adjusted independently. Since it has already been noted that PNP transistor will only display limiting action (when functioning as an open switch) when the signal is positive; it follows that one will limit when the input is of "0°" phase while the other will limit when the signal is of "180°" phase. It will be noted that during the half cycle when the input is positive S_1 is shown to be open and S_2 is closed. The reverse voltage at the collector of S_1 is the sum of voltages stored in the two capacitors (E_C average of usable signal voltage during the half cycle) as would be noted by traversing the closed loop consisting of S_1, S_2, C_1 and C_2. When this voltage is greater than the voltage $E_d \times (R_2/R_1+R_2)$ which is applied to the base, S_1 conducts and the combined voltages V_{c1} and V_{c2} are thus limited. The level at which this occurs can be adjusted by varying R_1 or R_2. It follows from this discussion that should the phase of the input signal relative to that of switch excitation be reversed, transistor S_2 will become the limiter.

2-7. PHASE DETECTOR. Figure 2-13 illustrates the phase detector network used throughout the system (including radio coupler) at points when AC signals are to be translated into DC signals.

NOTE

The symmetry of this network, in which two equal AC square wave voltage generators acting in phase opposition (Push-Pull) provide what is called reference excitation.

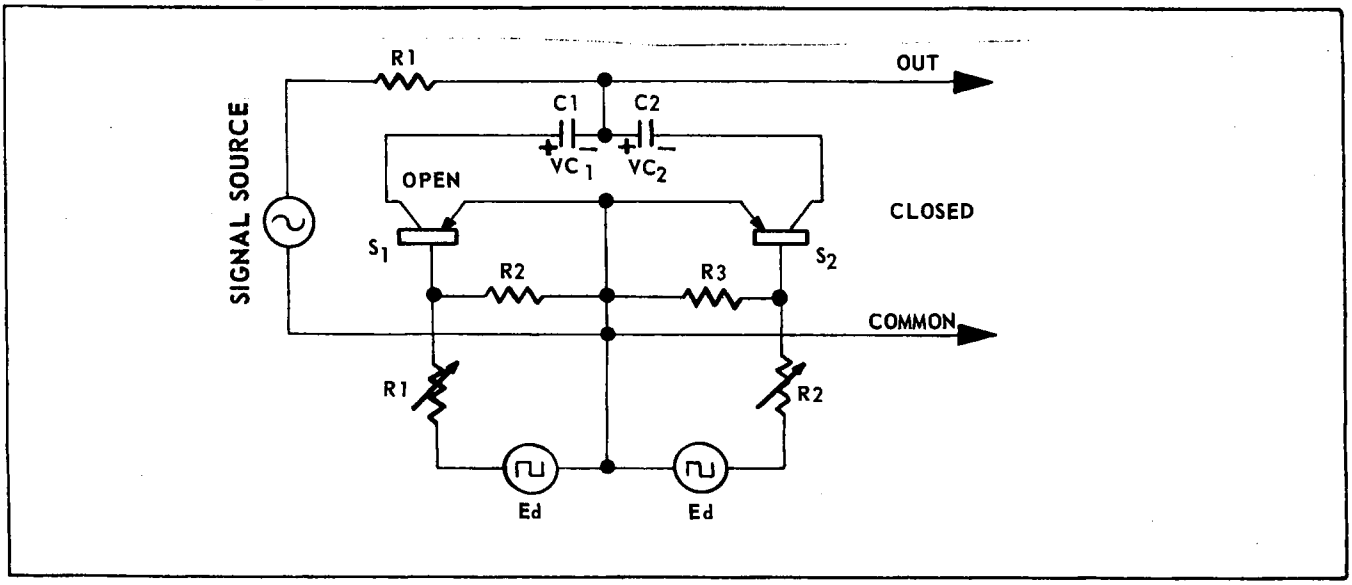


Figure 2-12. Synchronous Filter With Drive Voltages Independently Adjustable

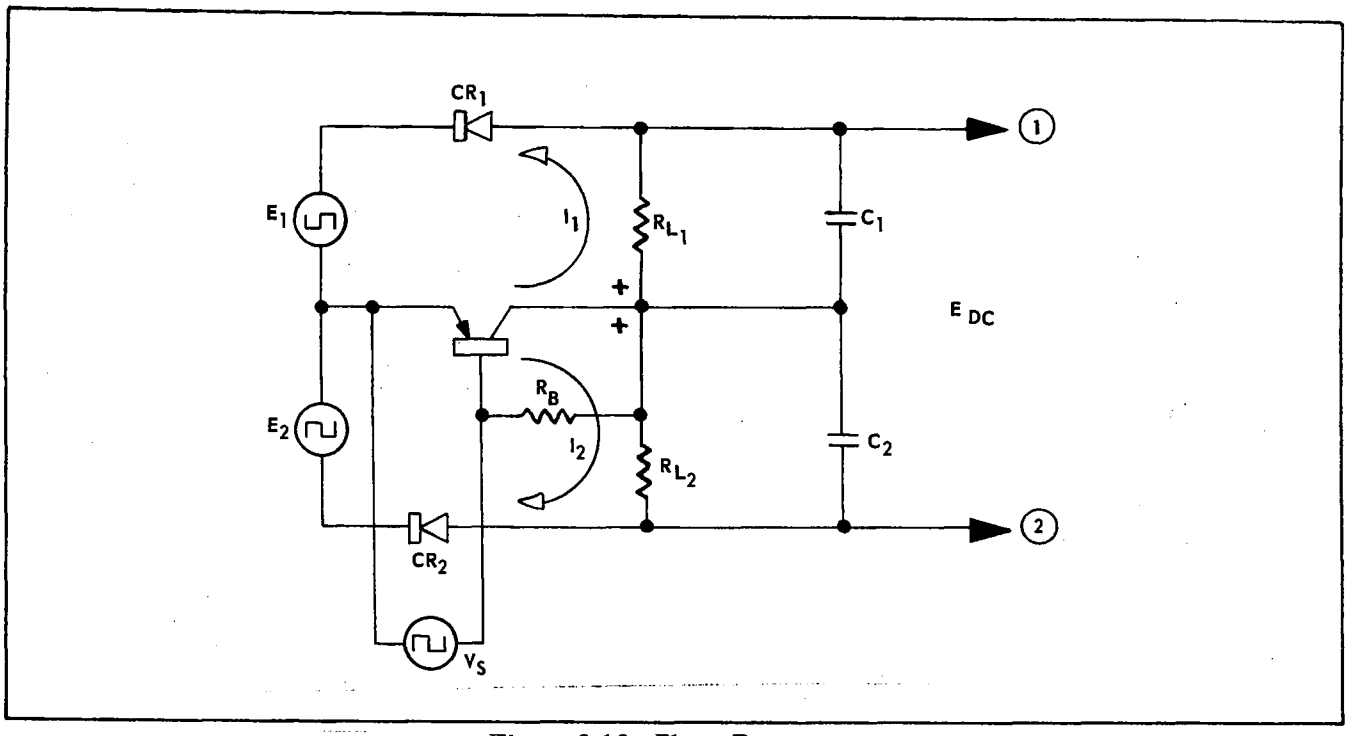


Figure 2-13. Phase Detector

Each of these generators drives a rectifier circuit consisting of a diode in series with a resistor and capacitor connected in parallel to form an AC eliminating filter. Since the voltages are out of phase (of opposite AC polarity) the rectification action takes place in opposite half cycles. Current will pass only if conduction can take place through the center branch of the network. In the absence of a signal applied to the base of the transistor in the center leg, conduction through the transistor will be determined by the bias resistor (R_B).

NOTE

This branch would be common to both rectifier circuits.

Since the diodes, resistors and capacitors of the outer circuits are respectively identical, it follows that the rectified voltages present in each RC combination should be equal if no signal is present in the center leg to vary the conductivity of the transistor from one half cycle to the next. If a control signal (V_S) is applied to the base of the transistor so that it is negative when generator voltage (E_1) is negative, current flow through RL_1 will be greater than that through RL_2 and the output voltage E_{DC} will be negative when measured from terminal (2) to terminal (1), increasing the amplitude of V_S will increase E_{DC} and reversing the phase or AC polarity will reverse the polarity of E_{DC}.

2-8. DC AMPLIFIER. Figure 2-14 is a schematic diagram of the DC power amplifier which translates the low power voltage output of the phase detector into a signal having sufficient power to drive the servo motor. When there is no input signal ($E_{DC} = 0$), all of the transistors are non-conducting or cut-off. Also, both motor terminals are almost at ground potential, and all of the line voltage is across the upper transistor (Q_1 thru Q_4). Note that if either motor terminal is elevated above ground potential, resulting current flow through either R_1 or R_2 to the base of either Q6 or Q5 respectively will cause conduction thru that transistor.

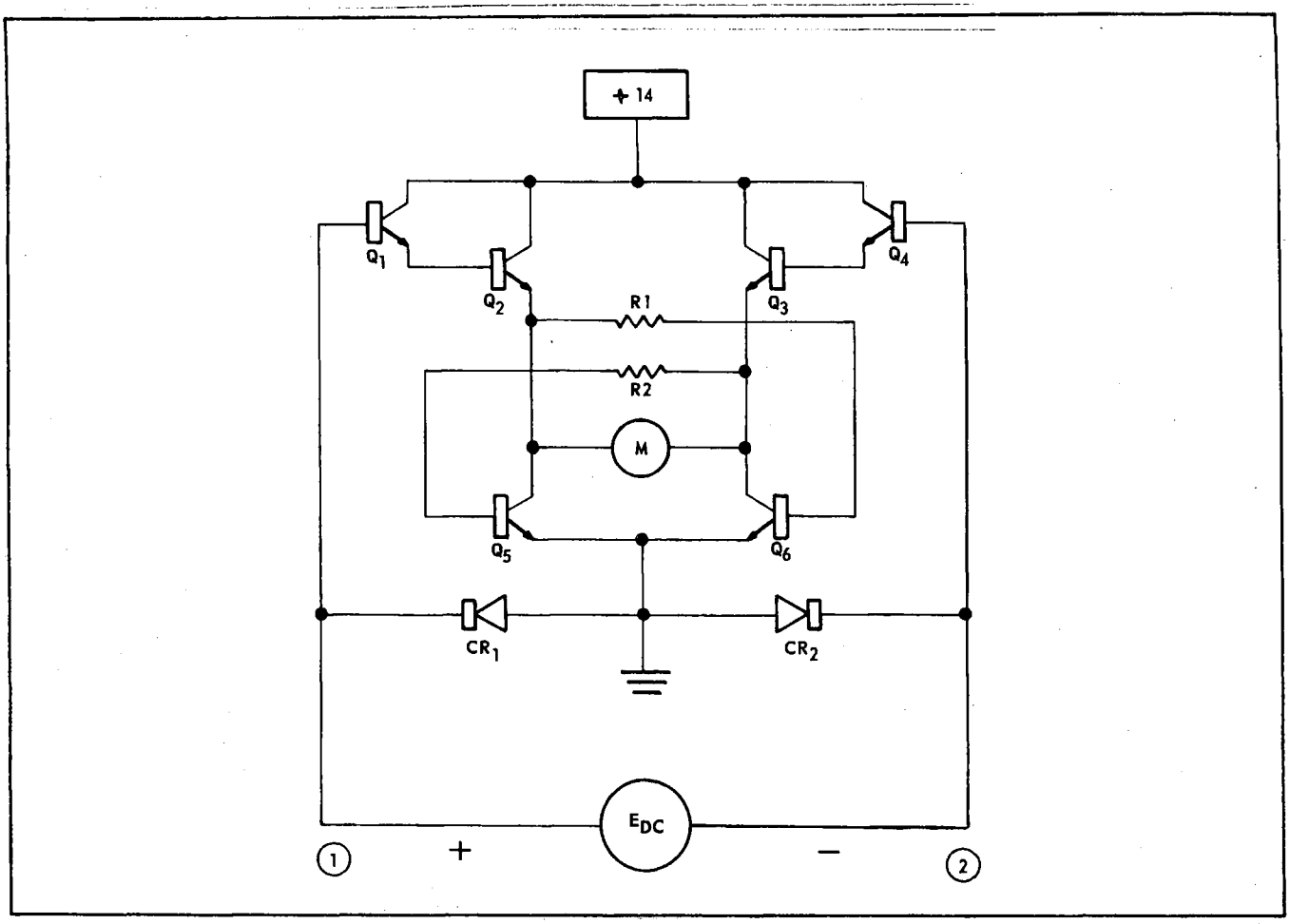


Figure 2-14. DC Amplifier

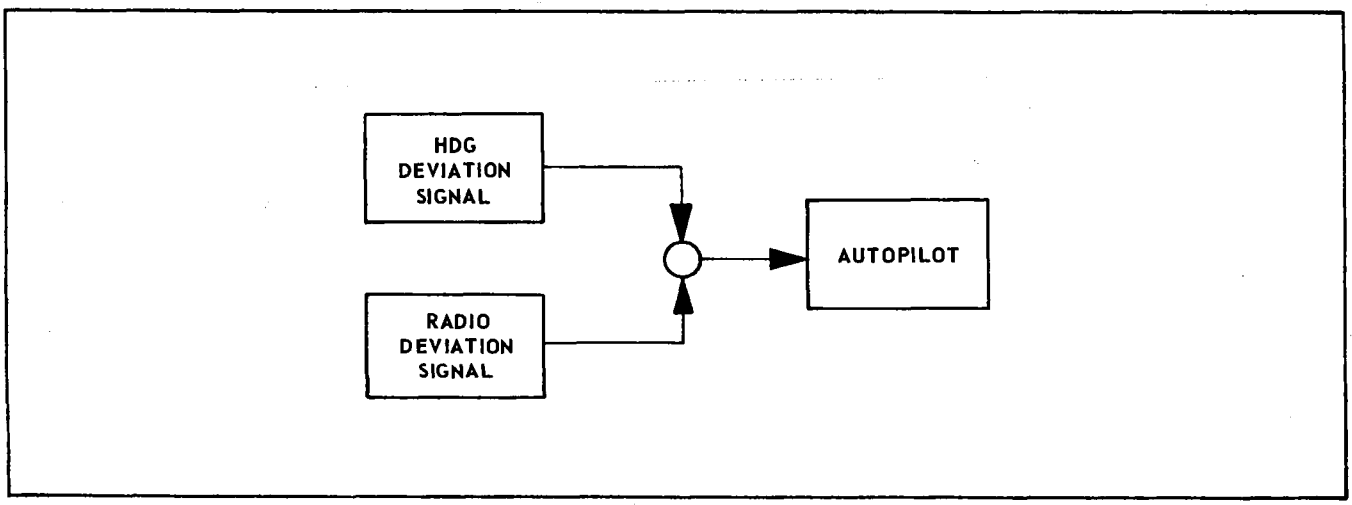


Figure 2-15. Basic System

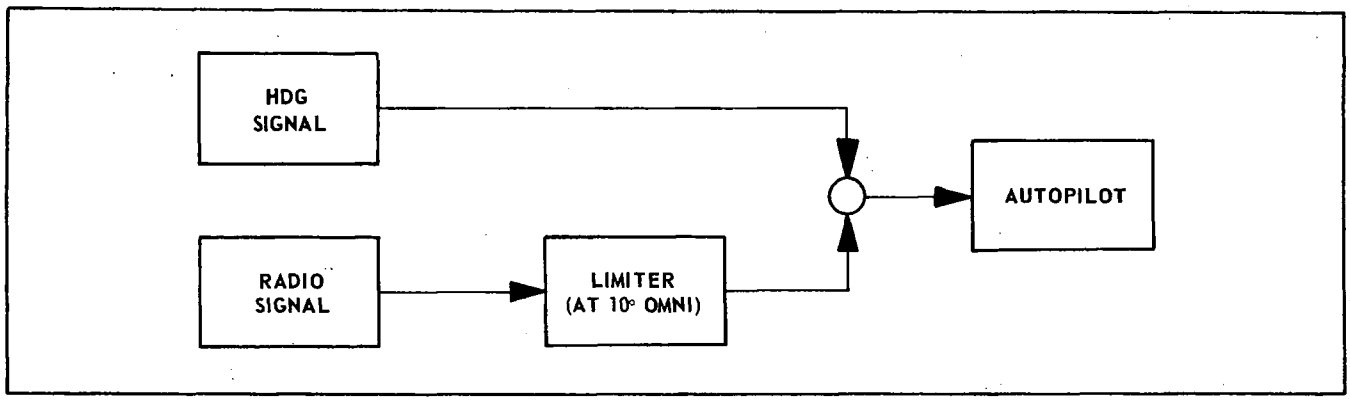


Figure 2-16. Basic System With Constant Intercept Angle Capabilities

Suppose the signal voltage (E_{DC}) has polarity so that terminal (1) is positive with respect to terminal (2). When this condition exists, conduction thru CR_2 prevents terminal (2) from going negative with respect to ground while terminal (1) goes positive. As terminal (1) goes positive, signal action thru transistors Q_1 and Q_2 causes the left terminal of the motor to go positive. Also, current thru R_1 to the base of Q_6 causes Q_6 to hold the right hand motor terminal at ground level. Note that transistors Q_5 and Q_6 always act as switches in that they conduct with practically no voltage drop, or else they do not conduct at all. From this discussion note that when signal terminal (1) is positive, the left motor terminal is positive and the converse is true regarding the condition when terminal (2) is positive. Also note the diodes (CR_1 and CR_2) prevent either signal terminal from going negative or they act as signal clamping diodes.

Other circuits within the system are sufficiently simple to require no explanation apart from the complete schematic diagram.

2-9. RADIO COUPLER. The fundamental principle of coupling through an AutoPilot to a radio course is to set the AutoPilot to fly a heading which corresponds to the direction of the course to be flown, and to introduce a radio deviation signal so that it causes heading to deviate an amount proportional to the radio deviation. Such a simplified system is illustrated in Figure 2-15. In such a system the airplane can only fly in the direction of the course when the radio deflection is zero. Therefore, in a crosswind situation that

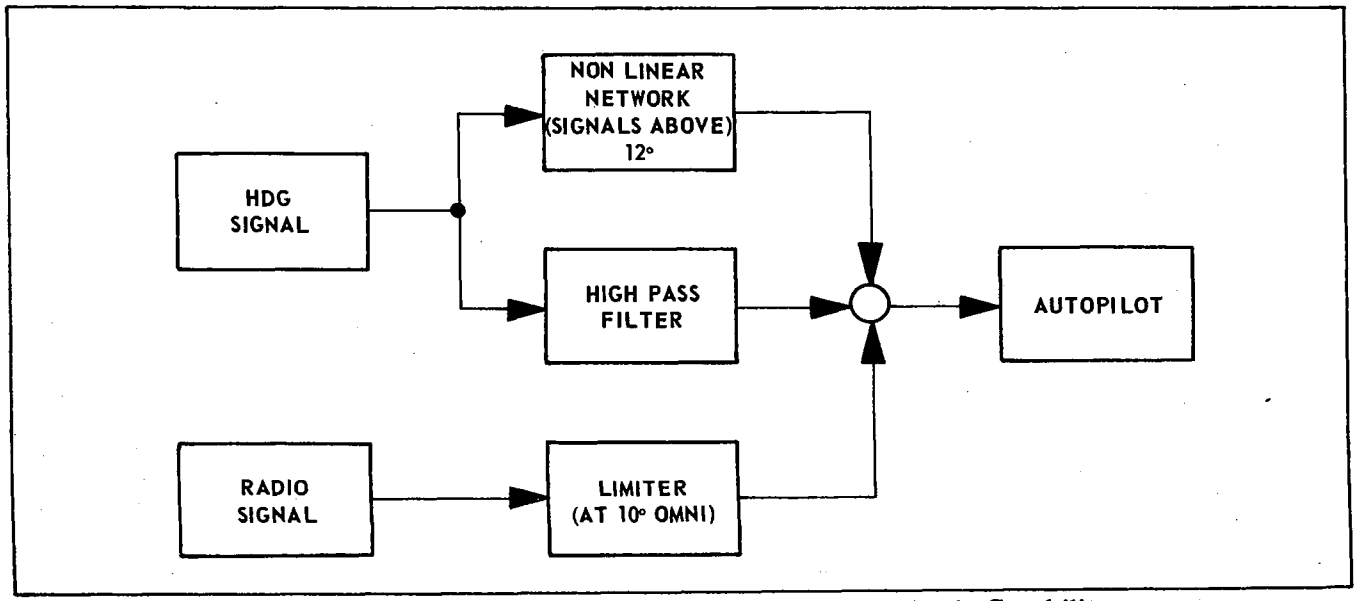


Figure 2-17. Basic System With Constant Intercept Angle Capability
And Crosswind Correction Capability

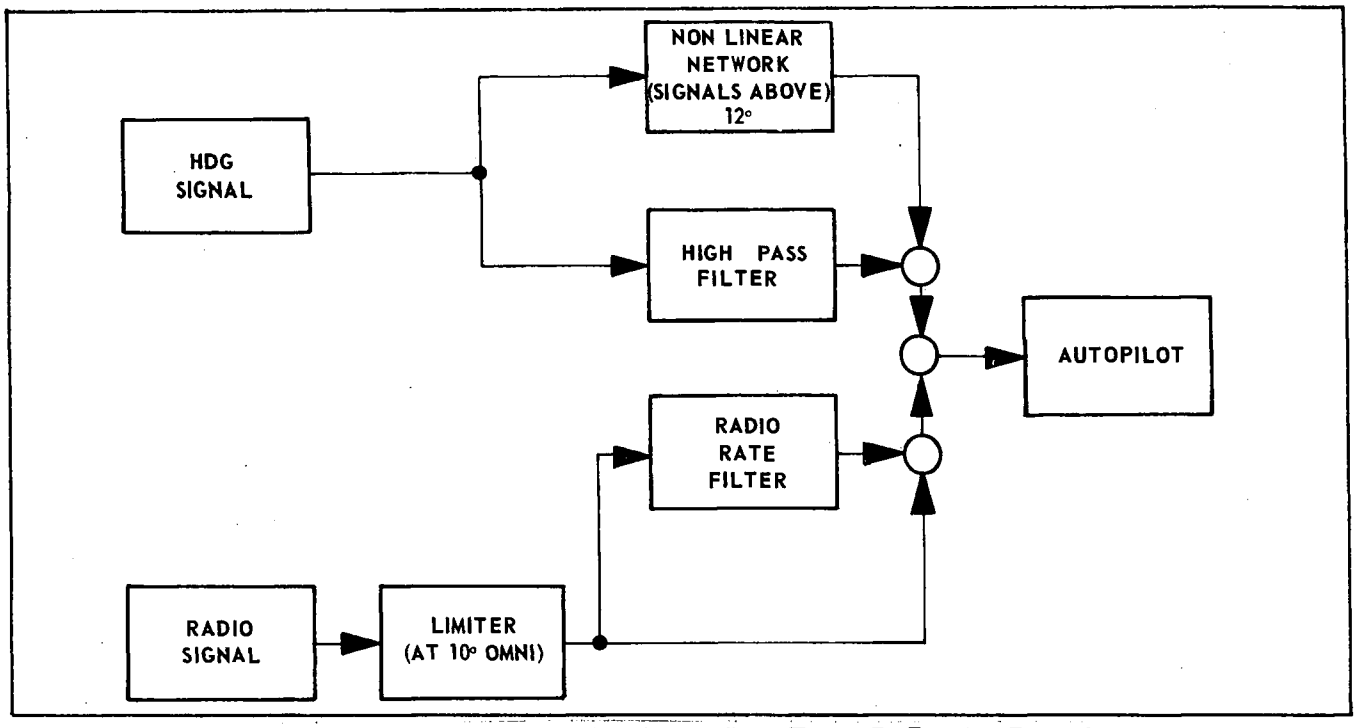


Figure 2-18. Basic System With Radio Rate Filter To Provide Damping

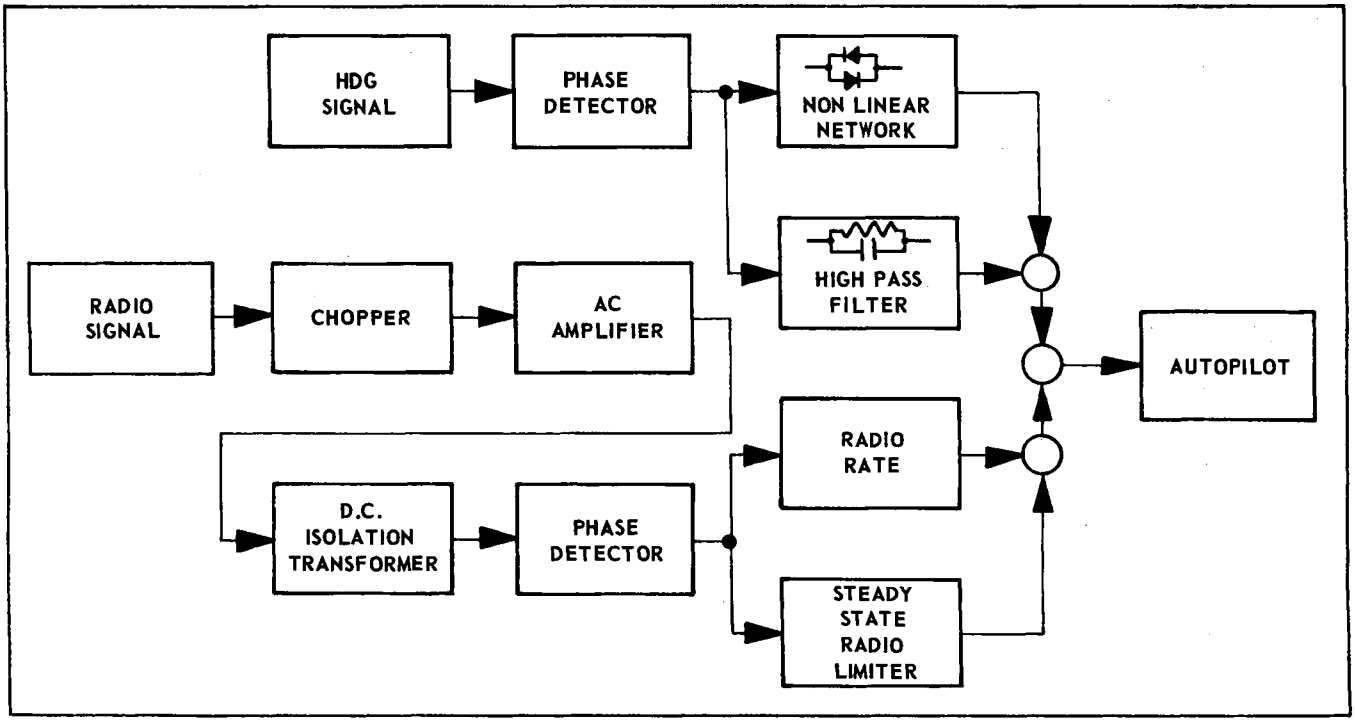


Figure 2-19. Complete Radio Coupler

requires heading crab the airplane would have to be off course an amount sufficient to cause the required heading deviation or "crab." Also, it will be noted that in such a simple system heading deviation continues to increase with radio deviation so that if 10° of radio causes 30° of heading (a reasonable value), some value of radio deviation will exceed the output capability of the heading source and then the airplane will fly in circles. This problem can be eliminated by inserting a network to limit the radio signal to that value which corresponds to 10° of radio deviation. Such a system, as shown in Figure 2-16, will have the capability of intercepting at a constant angle when beyond 10° of radio deviation regardless of the position relative to the omni station.

The system of Figure 2-16 even though capable of intercepting and tracking still provides no crosswind correction. This feature can be provided by splitting the heading signal into two separate channels as shown in the system of Figure 2-17. One channel passes only that portion of a heading deviation signal which is greater in amplitude than that which is developed by 12° of heading deviation. This signal when compared with the radio deviation signal determines the angle at which the airplane will intercept the active area (10° sector next to the omni radial). Through the other channel heading signals of 12° amplitude or less are transmitted. In this signal path there is a high pass filter, which means that only short term information (or variations in heading) is transmitted and that the long term or steady state signal is blocked. Since this steady state signal is blocked it follows that on a long term or average basis there is no heading offset (when crosswind correction or crab is less than 12°) to pull the aircraft off of the selected course as is the case when radio position must be traded for heading when crosswind correction is required.

The system illustrated in Figure 2-17 is capable of intercepting and tracking in a crosswind without requiring radio offset; however, additional refinements will provide significant improvements in the dynamic performance when close in on omni or when tracking localizer. Second, a very slight amount of heading is allowed to by-pass the high pass filter (signals less than 12°) so as to provide damping to an otherwise under damped system when operating very far out as would be the case when enroute. The block diagram of Figure 2-18 contains all of the features listed.

The diagram of Figure 2-19 shows in block form all of the elements which make up the complete radio coupler. The low level DC signal derived from the course deviation indicator is translated into AC in a transistor chopper and then amplified in an AC amplifier which has negative feedback to enhance gain stability. The output of this amplifier is then transformer coupled to a phase detector so as to provide DC isolation from the omni signal source. The high level DC voltage out of the phase detector is then applied to the computer filter network. Finally the DC output of the computer filter is translated again into AC by a transistor chopper and applied to the AutoPilot command channel as a signal having effectiveness equal to a directional gyro. The heading channel of the radio coupler consists only of a phase detector which translates the AC signal from the directional gyro into a DC heading deviation signal which is then applied to the computer filter network.

Detailed study of the coupler as set forth in schematic form will show that the computer filter network is altered so as to provide the desired performance in different modes. In the "NAV" mode, radio rate is greatly reduced so as to make the system less responsive to random movement of the omni needle. In the "OMNI" mode, radio rate gain is greatly increased to provide dynamic capability for close in maneuvering. In the "LOC" modes, radio rate effect is kept high while coupler output is attenuated to compensate for the narrow width of the localizer course.

2-10. CONSOLE. The flight profile is programmed by the pilot at the console and modified at his discretion. The console can be considered as a funnel for all inputs to the computing amplifier during AutoPilot operation. The service set-up adjustments are also located on the console. For information pertaining to set-up adjustments, refer to Section V of this manual. If the system employs radio coupling, the pilot selects the mode of operation at the coupler. The console provides AutoPilot engagement, Roll, Heading, Pitch and Altitude preselect modes of operation, also the Pitch Effort meter, Pitch Command Disk and Altitude Dial. Various combinations of mode selection are also available to the pilot.

2-11. AMPLIFIER. The computing amplifier, as in previous Piper Automatic Flight Control System Equipment, processes all input information according to the program modes selected by the pilot. The amplifier also contains the threshold adjustments required for the AltiMatic III B-1 AutoPilot. The amplifier is required to furnish a power output to both roll and pitch motors during AutoPilot operation. The AutoPilot mode of operation is controlled through the AutoPilot disengage relay. The AutoPilot can be disabled by the operator by pressing the control wheel disengage button, causing the relay to open the servo current path between the amplifier and roll and pitch servos.

NOTE

The Operator's Manual for the Piper AutoControl III B and the Piper AltiMatic III B-1 AutoPilots must be studied in depth by the serviceman if he is to interpret the indications and functions of the system in a manner to affect proper repairs and determine corrective action if and when required to the system.

2-12. ROLL AND PITCH SERVOS. The Roll and Pitch Servos of the Piper AltiMatic III B-1 are electrical servos similar to the AutoPilot servos used in previous Piper Automatic Flight Control Systems equipment. The servos engage electrically and are easily overridden. If the electrical system fails, they automatically disengage.

2-13. PITCH TRIM SERVO. As in previous Piper Automatic Flight Control Systems equipment, the Electric Pitch Trim Servo receives electrical power from both a manual and automatic source. When the AutoPilot is not engaged, the Pitch Trim Servo furnishes Manual Electric Trim via the control wheel trim switch. When the AutoPilot is engaged, control of the Pitch Trim Servo reverts to Automatic Electric Pitch Trim via the trim sensor and amplifier circuitry. The remainder of pertinent information for the Piper AltiMatic III B-1 Electric Pitch Trim System is covered in the Pitch Trim Service Manual, Piper P/N 753 771.

2-14. ALTITUDE SELECTOR. The Piper AltiMatic III B-1 offers altitude preselect as in previous Piper pitch axis Automatic Flight Control Systems equipment. The altitude selector features altitude hold which occurs when the altitude preselect function is engaged. With the altitude preselect function engaged, the altitude selected on the altitude dial will be maintained.

2-15. MODES OF OPERATION. Following is a brief description of the different modes of operation of the AutoControl III B and the AltiMatic III B-1 AutoPilot. The engage button for each mode of operation is explained in the following paragraphs.

2-16. ROLL MODE. Because Roll is first in logical sequence, the Roll engage acts as the AutoPilot master switch. As such, the Roll must be engaged for all other engage and mode switches to become operative. With the Roll switch only engaged, the AutoPilot is responsive only to the roll axis of the Attitude Gyro and the commands of the Roll Knob. Use of the Roll Knob permits bank angles up to 30° on both the AltiMatic III B-1 and the AutoControl III B.

2-17. HEADING MODE. The function of the Heading Mode Switch is to remove the Roll Command Knob from the AutoPilot circuit and add the Directional Gyro Heading Command and coupler functions to the basic Roll Attitude control. Prior to engagement of the heading mode, the DG Course Selector and coupler modes should be set. (See Coupler Mode, Paragraph 2-18.)

2-18. LATERAL GUIDANCE SYSTEM. (Radio Coupler.) The radio coupler contains a five position switch which selects the desired mode of lateral guidance.

2-19. OMNI MODE. When the Omni Mode is selected, the AutoPilot system is coupled to the NAV and OMNI/Converter C.D.I. When the DG Course Selector is set to match the Omni course selection, all headings are then controlled by the Omni Radio Signals. Intercept and track are automatic.

2-20. NAV MODE. The NAV Mode extends the coupler utility by making operation practical under the adverse conditions of unsteady or erratic Radio Omni Signals. This mode incorporates an extended time delay in the circuitry which reduces AutoPilot reaction to short term needle deflections of the Omni. The NAV Mode should not be used for close in Omni approach work.

2-21. HEADING MODE. When in the HDG Mode, the AutoPilot will function as described in Paragraph 2-17.

2-22. LOCALIZER (NORMAL) MODE). In the LOC NORM Mode, the coupler dynamics are set for optimum performance in tracking the localizer beam which is only 1/4 as wide as the omni beam. Intercept and track are automatic as in the OMNI Mode.

2-23. LOCALIZER (REVERSE) MODE. This mode permits automatic back course approaches and outbound tracking on the FRONT COURSE prior to procedure turn. The features of back course are identical to front course except that the AutoPilot response will be in reverse to the localizer indications and the Course Selector Directional Gyro must be set to the reciprocal of the front course heading.

NOTE

Pitch Mode and Altitude Selector Mode (Paragraphs 2-24 and 2-25) do not apply to the AutoControl III B.

2-24. PITCH MODE. The Pitch Mode Switch engages the AutoPilot pitch servo and makes the AutoPilot responsive to the Pitch Attitude of the Gyro Horizon and the commands of the pitch command disk. Attitude changes may be made by rotating the pitch command disk in the appropriate direction. Design of the system is such that commanded attitudes remain constant throughout power changes and gear and flap transitions.

2-25. ALTITUDE SELECTOR MODE. Engagement of the altitude preselect will remove the pitch command disk from control of the AutoPilot and make pitch responsive to the Altitude Selector. When the Altitude Selector Mode is engaged, the airplane will fly to and maintain the indicated altitude selected on the altitude drum. Altitude changes may be commanded while this mode is engaged, and the transition to the newly selected altitude will be smooth. The Pitch Command Disk may be used to increase or decrease the angle of climb or descent as desired during preselect function. Rate of climb and descent are controlled, as always, by throttle settings or engine power. It is important to note that the AutoPilot is connected only to the airplane control system and not the throttles.

SECTION III
REMOVAL AND INSTALLATION

SECTION III

REMOVAL AND INSTALLATION

3-1. INTRODUCTION. The instructions in this section provide removal and installation procedures for the AutoControl III B and the AltiMatic III B-1 components. Checks and adjustments are limited to those required for removal and installation of the components. Repairs, Bench Checks and Adjustments, and Set-up Procedures are found in the sections to follow.

On the following pages are two tables. Table III-I lists all the servos installed in each airplane. Table III-II lists all components of the AltiMatic III B-1 installed in each airplane.

Figure 3-1 is used to properly set up and check a servo prior to installation in the airplane. The use of this illustration will be discussed in Paragraph 3-2.

To help initially locate the AutoControl III B and AltiMatic III B-1 component parts in any given airplane, refer to Figures 3-3 through 3-12 inclusive. The Radio Coupler, which is optional equipment, is not shown in these illustrations. When the coupler is installed, it is easily located in the instrument panel.

When installing a servo bridle cable, reference is made to either Figure 3-13 or Figure 3-14. The illustrated airplane cable systems shown in these illustrations will help to properly adjust the bridle cable tension.

CAUTION

The Allen head set screw (Piper P/N 757 579) used in the servo capstan may have a nylon insert on the shank. The insert is used as a locking device and any screw with this on should be discarded after it has been removed because the locking capability of the nylon is limited to one installation.

3-2. PRE-INSTALLATION CHECKS AND ADJUSTMENTS OF ROLL AND PITCH SERVO ASSEMBLIES. Prior to installation of a roll or pitch servo assembly, certain checks and adjustments should be conducted according to Figure 3-1 and the following instructions.

NOTE

Figure 3-1 describes the set-up procedures for the 1C363-1, 1C465-1, 1C470-1 and 1C508-1 Servos.

a. Switch Position: Check the position of either the switch plate or the motor wiring to pin C and pin D of the servo connector with the appropriate table in Figure 3-1. To set the switch in the correct position, remove the two screws through the face of the switch plate. Move the slide switch to the left or right, as necessary, and reinstall the plate with the corresponding letter visible. If the servo does not feature a switch, the wiring from the motor to pin C and pin D of the servo motor connector must be checked. For clockwise rotation of the shaft, place the Blk wire on pin C and the Red wire on pin D. For counterclockwise rotation, place the Red wire on pin C and the Blk wire on pin D.

b. Cable Guards: Check the correct location and number of guards required for each servo. REMOVE ALL OTHER CABLE GUARDS FROM THE SERVO.

c. Torque Output Clutch Adjustment: The Clutch Adjustment Procedure is not authorized in the field at this time on copper/carbon type clutches as per manufacturer, EDO-AIRE MITCHELL.

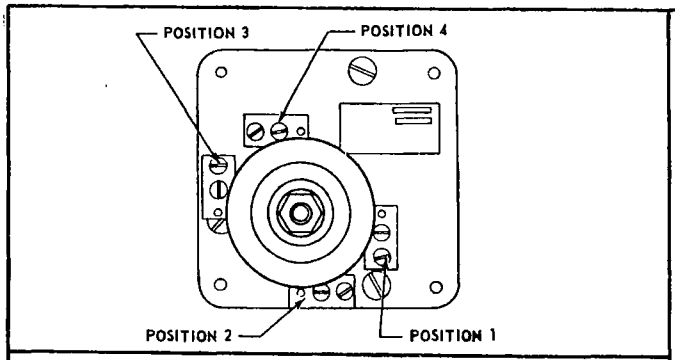
d. Servo Model Number: Three digits will identify the servo as to the model of the servo as installed in the airplane. Whether it is set up for a roll or a pitch servo will be identified by the letter placed after the three digits, either "R" or "P."

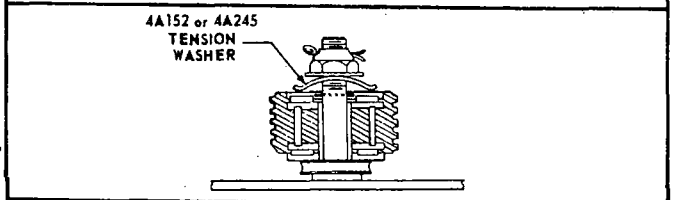
e. Whenever a safety sleeve (P/N 26100-02 for the PA-31, PA-31-350 and PA-31P roll servo installations or P/N 26100-00 for all other servo installations) is removed from a bridle cable installation, the sleeve MUST be discarded and replaced with a new one. The sleeve is installed as shown in Figure 3-2 with a maximum of .062 of an inch space between the bridle cable clamp and the safety sleeve. Installation of safety sleeve to be accomplished with "Water Pump" type pliers with a handle length no less than 6" or more than 8" to insure proper compression of the safety sleeve.

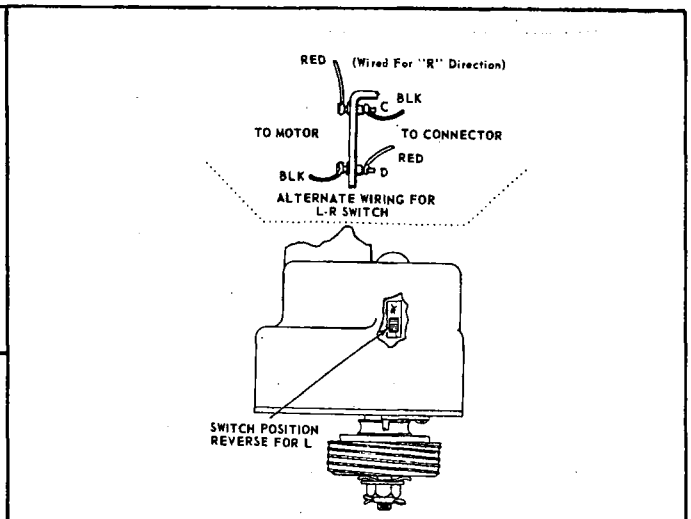
f. BRIDLE CABLE TENSION. The tension of the airplane control cable should be checked to assure that it is in accordance with the specifications for the particular model before attachment of the bridle cable is accomplished. Proper tension of the bridle cable is very important, as slack in the bridle cable will result in lost servo motion which may cause wing rock or porpoising in pitch. During installation of servo bridle cable clamps on either Roll or Pitch servo installations, ascertain the area on the cable where the clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives.

TABLE III-I. SERVO IDENTIFICATION MARKINGS

AIRPLANE MODEL	ROLL SERVO	PITCH SERVO
PA-23-250 (14-volt)	1C363-1-184R	1C508-1-184P
PA-23-250 (28-volt)	1C465-1-371R	1C470-1-371P
PA-23-250 (28-volt)	1C465-1-504R	
PA-24-260	1C363-1-161R	1C508-1-186P
PA-28/32	1C363-1-183R	
PA-28-151;-161;-181; -236;-201T	1C363-1-430R	
PA-28R-201;-201T	1C363-1-430R	
PA-28RT-201;-201T	1C363-1-430R	
PA-31	1C465-1-187R	1C470-1-187P
PA-31-350	1C465-1-413R	1C470-1-413P
PA-31P	1C465-1-290R	1C470-1-290P
PA-32R-300	1C363-1-269R	
PA-32RT-300;-300T	1C363-1-269R	
PA-32-301;-301T	1C363-1-269R	
PA-32R-301;-301T	1C363-1-269R	
PA-34-200	1C363-1-298R	1C508-1-298P
PA-34-200T	1C363-1-487R	
PA-39	1C363-1-161R	1C508-1-296P
PA-44-180	1C363-1-719R	
PA-44-180T	1C363-1-757R	







Airplane	Servo Model	Switch Position	Guard Position	Clutch Setting	Tension Washer
PA-23-250 (14-volt)	1C363-1-184R	R	1 & 3	35 lbs. ± 5	YES
PA-23-250 (14-volt)	1C508-1-184P	R	1, 3 & 4	17 lbs. ± 3	NO
PA-23-250 (28-volt)	1C465-1-371R	R	1 & 3	35 lbs. ± 5	YES
PA-23-250 (28-volt)	1C470-1-371P	R	1, 3 & 4	17 lbs. ± 3	NO
PA-23-250 (28-volt)	1C465-1-504R	R	1 & 3	35 lbs. ± 5	YES
PA-24-260	1C363-1-161R	R	1	39 lbs. ± 5	YES
PA-24-260	1C508-1-186P	L	1 & 3	20 lbs. ± 5	NO
PA-28/32	1C363-1-183R	R	3	43 lbs. + 7-8	YES
PA-32R-300	1C363-1-269R	R	2 & 4	43 lbs. + 7-8	YES
PA-32RT-300;-300T	1C363-1-269R	R	2 & 4	43 lbs. + 7-8	YES
PA-28-151;-161;-181;-236;-201T	1C363-1-430R	R	1 & 3	23 lbs. + 3-5	YES
PA-28R-201;-201T	1C363-1-430R	R	1 & 3	23 lbs. + 3-5	YES
PA-28RT-201;-201T	1C363-1-430R	R	1 & 3	23 lbs. + 3-5	YES
PA-31	1C465-1-187R	R	1 & 3	45 lbs. ± 3	YES
PA-31	1C470-1-187P	R	1 & 3	15 lbs. ± 3	NO
PA-31-350	1C465-1-413R	R	1 & 2	40 lbs. ± 5	YES
PA-31-350	1C470-1-413P	R	1 & 3	20 lbs. ± 5	NO
PA-31P	1C465-1-290R	R	1 & 3	45 lbs. ± 3	YES
PA-31P	1C470-1-290P	R	1 & 3	26 lbs. + 4-6	NO
PA-34-200	1C363-1-298P	R	2	49 lbs. + 6-8	YES
PA-34-200	1C508-1-298P	R	1	54 lbs. + 7-10	YES
PA-34-200T	1C363-1-487R	R	1 & 3	40 lbs. ± 5	YES
PA-39	1C363-1-161R	R	1	39 lbs. ± 5	YES
PA-39	1C508-1-296	L	1 & 3	16 lbs. ± 4	NO
PA-44-180	1C363-1-719R		1 & 3	31 lb.s ± 4	YES
→ PA-32-301;-301T	1C363-1-269R	R	3 & 4	43 lbs. + 7-8	YES
→ PA-32R-301;-301T	1C363-1-269R	R	2 & 4	43 lbs. + 7-8	YES
→ PA-44-180T	1C363-1-757R	R	1 & 3	26 lbs. ± 4	YES

Figure 3-1. Roll and Pitch Servo Guide

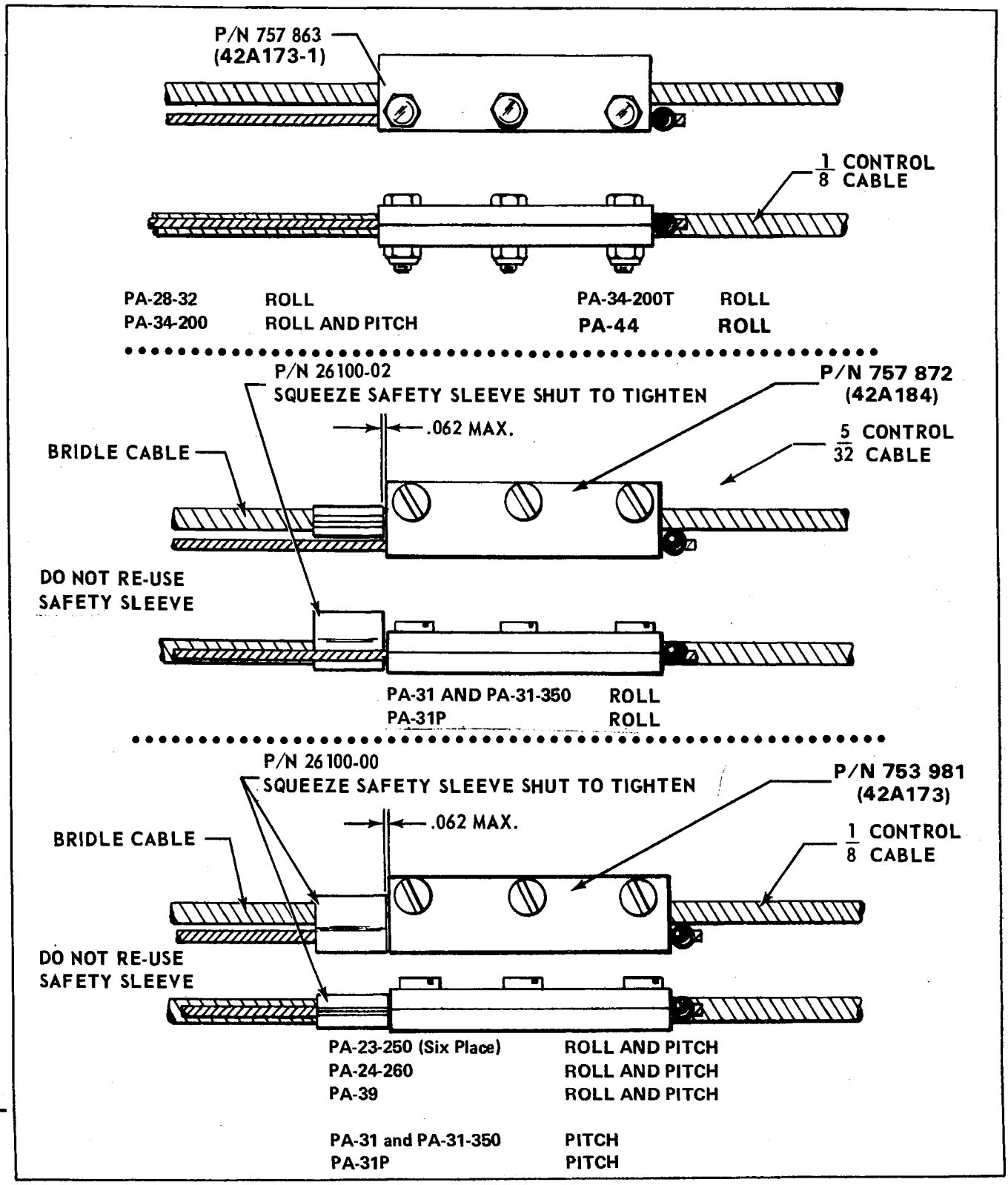


Figure 3-2. Safety Sleeve Installation

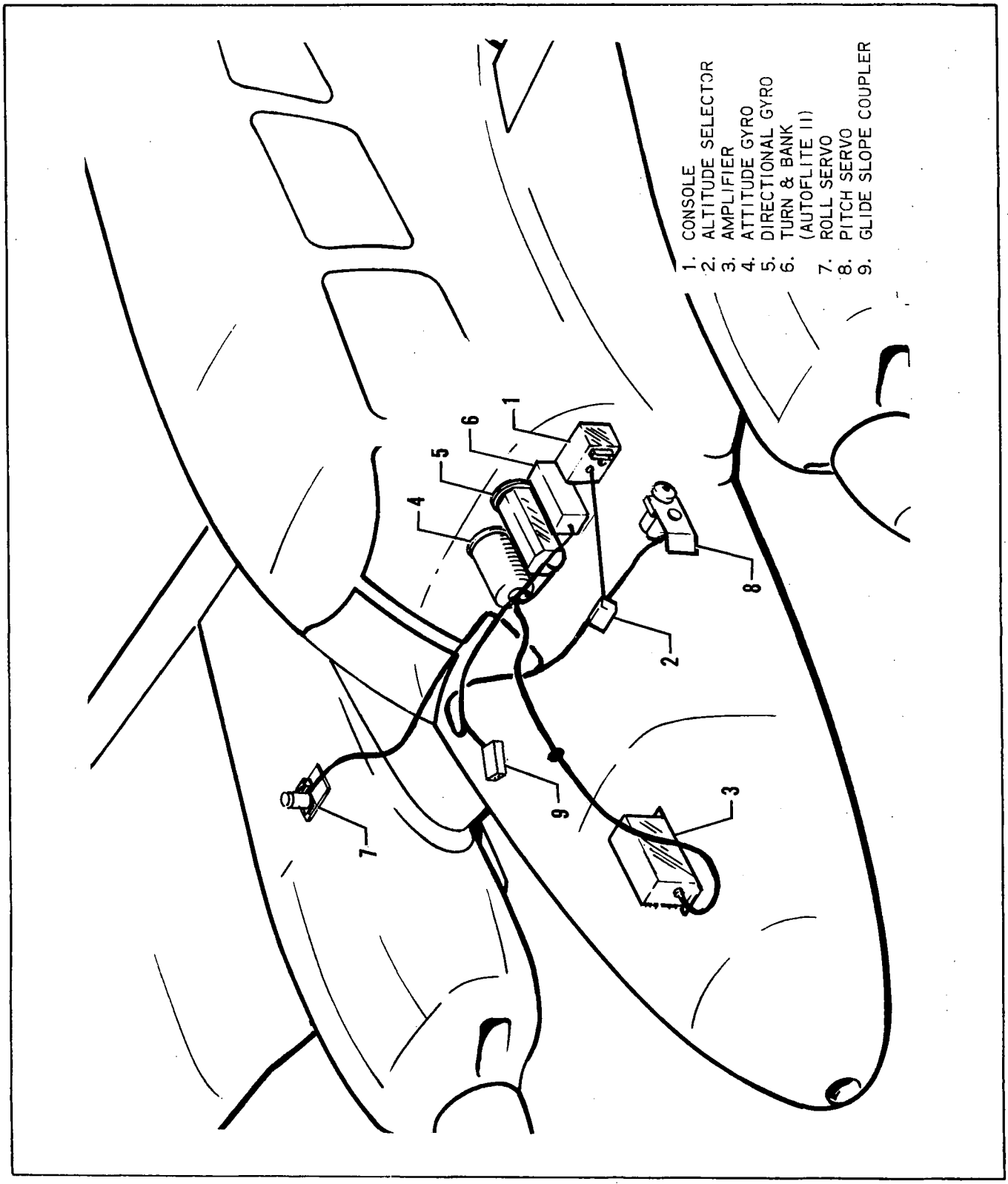


Figure 3-4. PA-23-250 (Six Place) AltiMatic III B-1 Layout

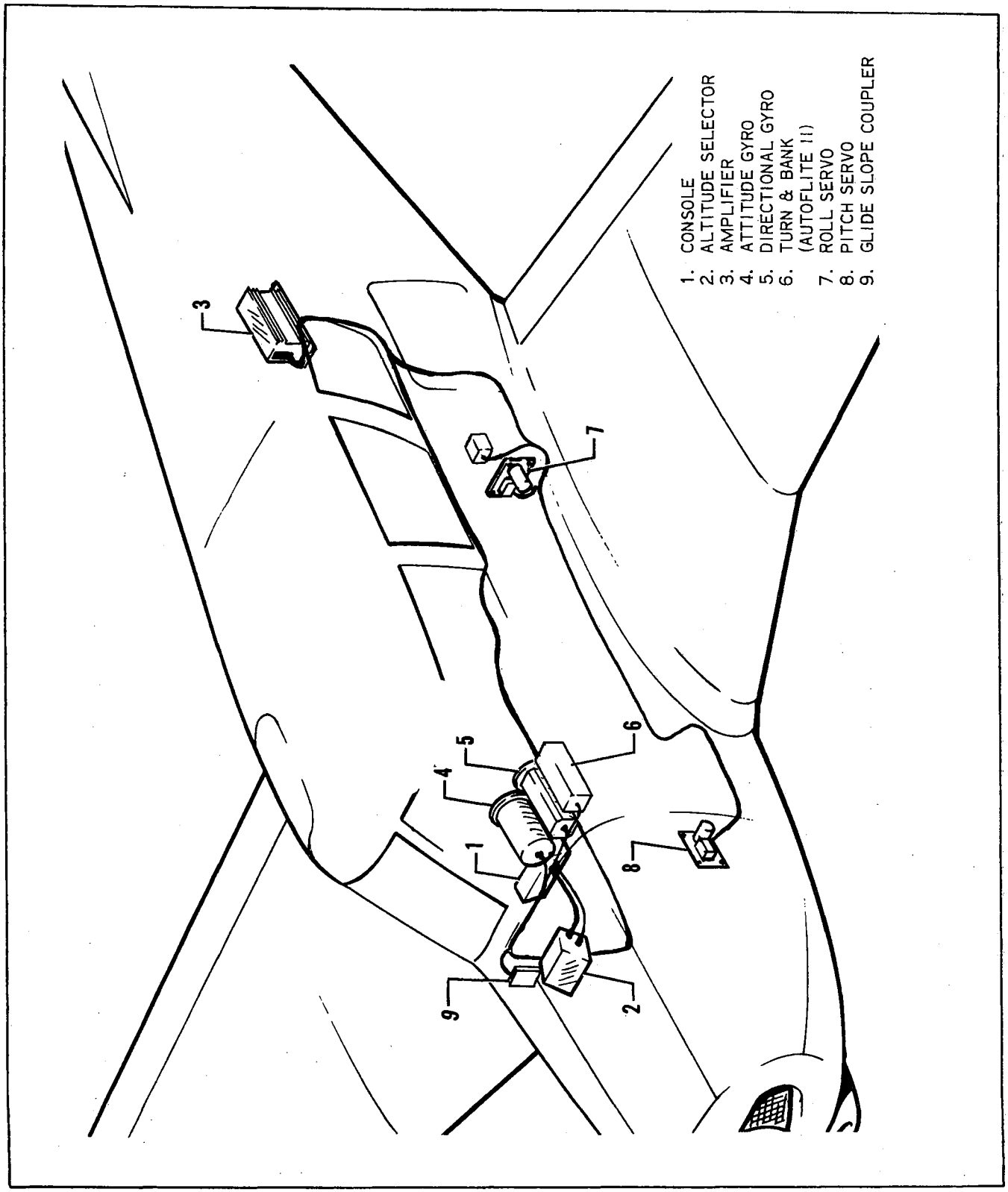


Figure 3-5. PA-24-260 AltiMatic III B-1 Layout

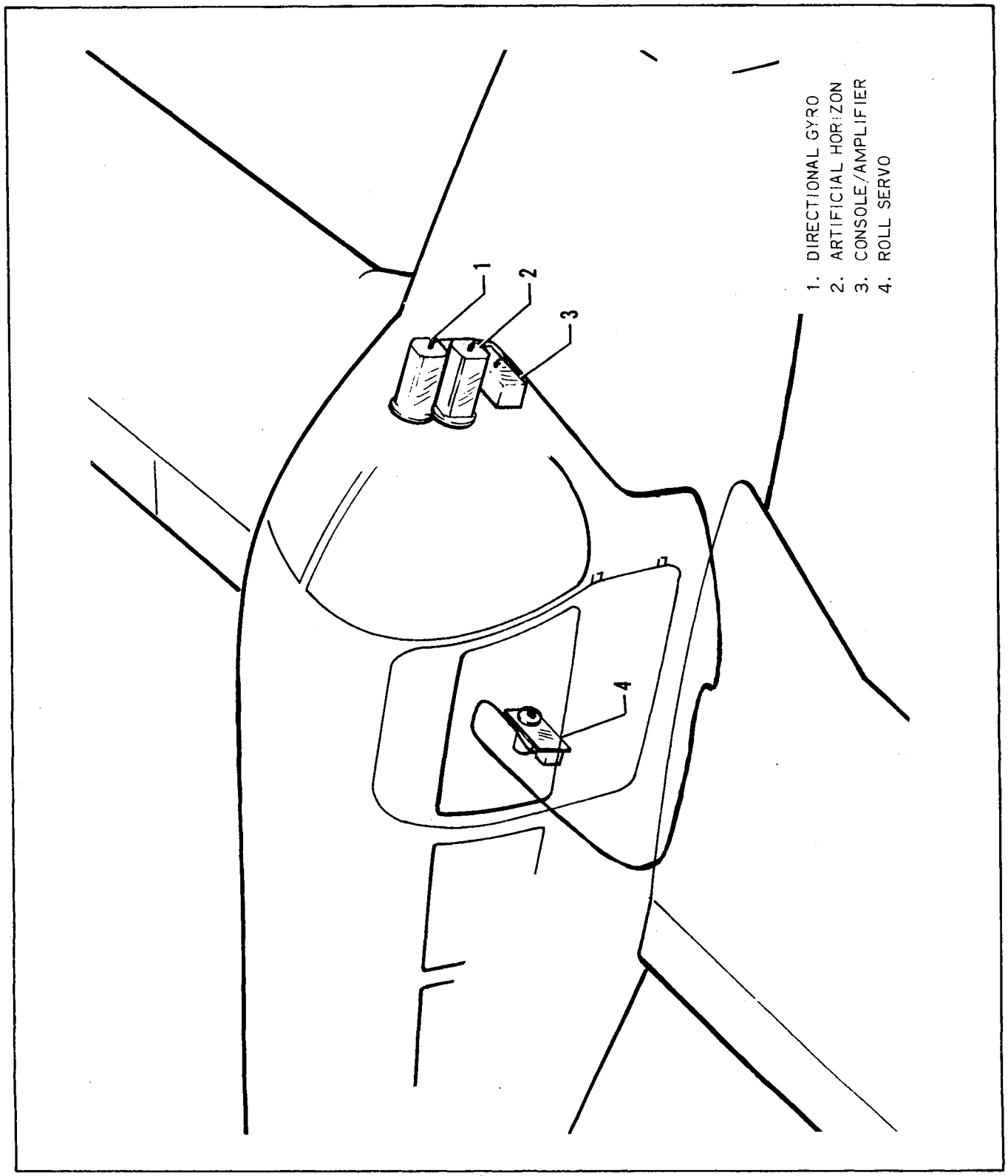


Figure 3-6. PA-28 Series AutoControl III B Layout

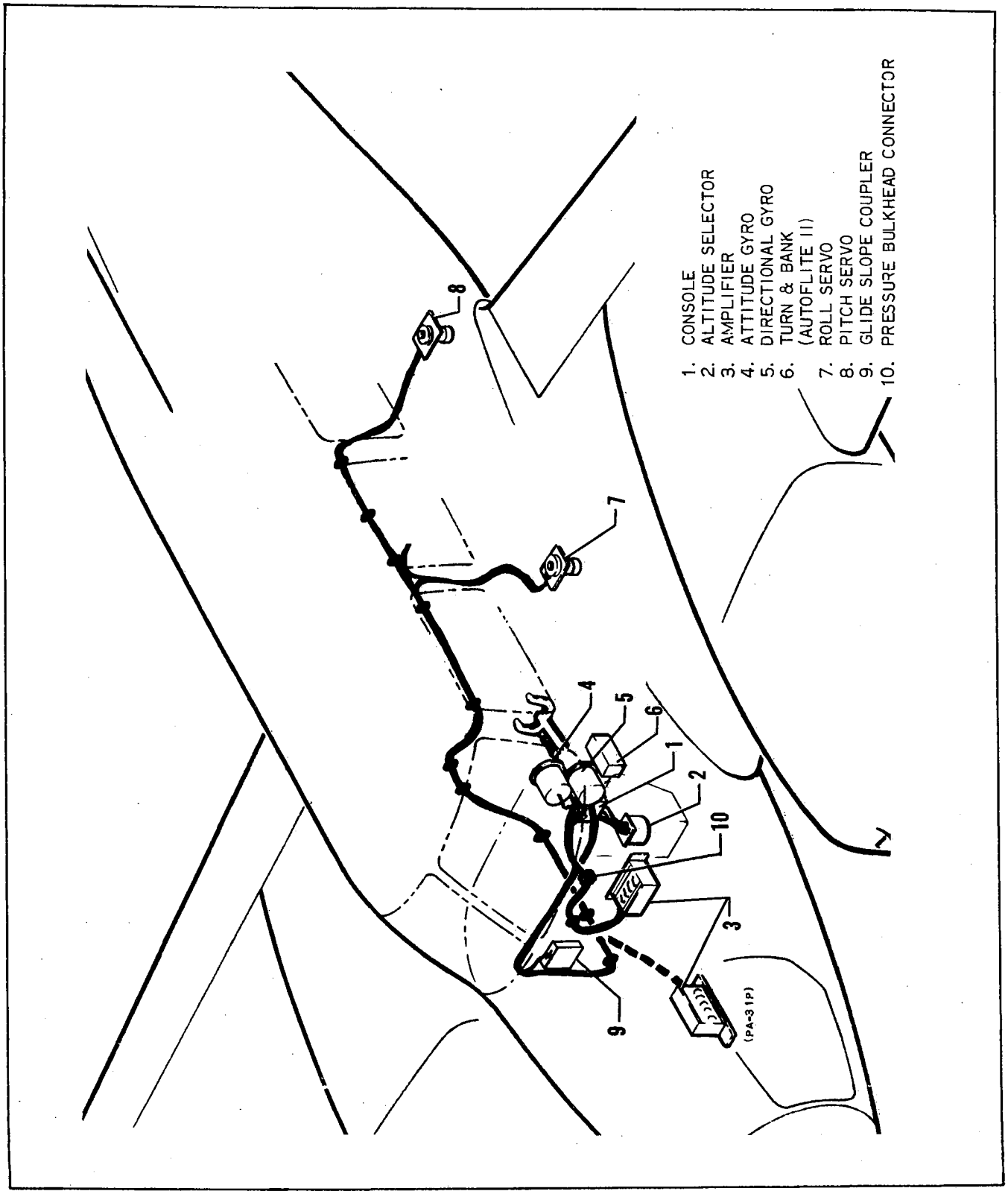


Figure 3-7. PA-31, PA-31-350 and PA-31P AltiMatic III B-1 Layout

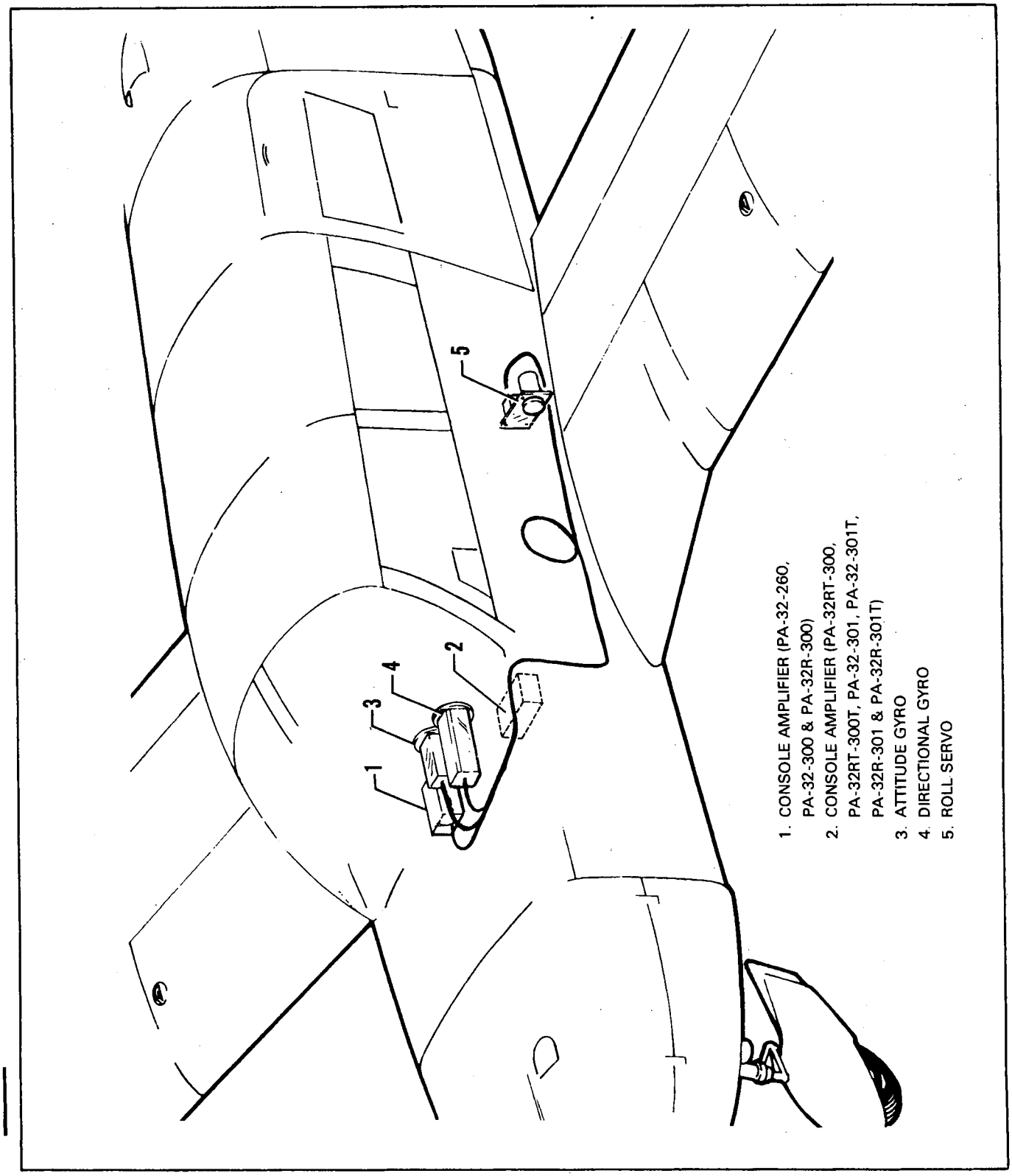


Figure 3-8. PA-32 AutoControl III B Layout

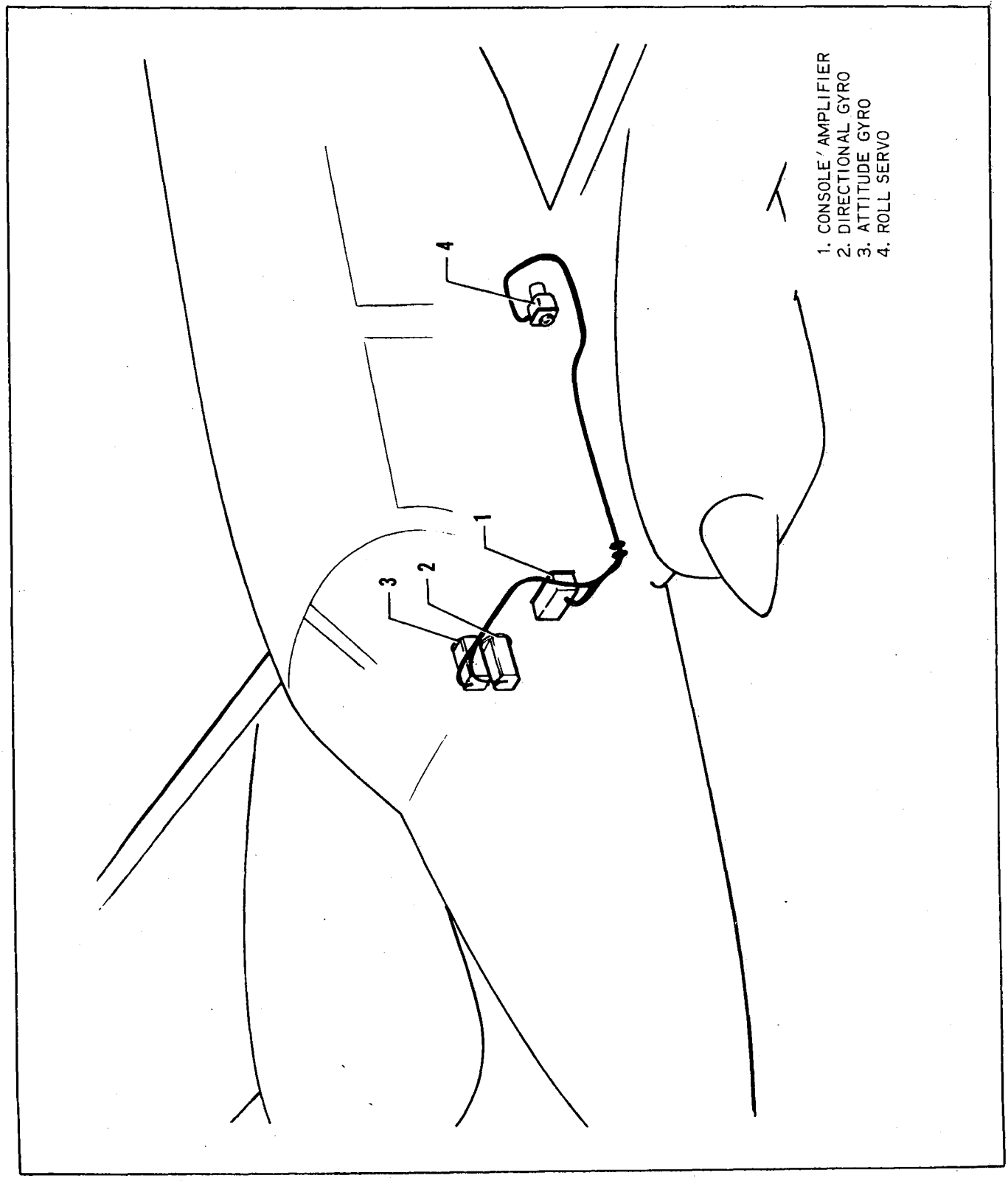


Figure 3-9. PA-34-200T and PA-44-180;-180T AutoControl III B Layout

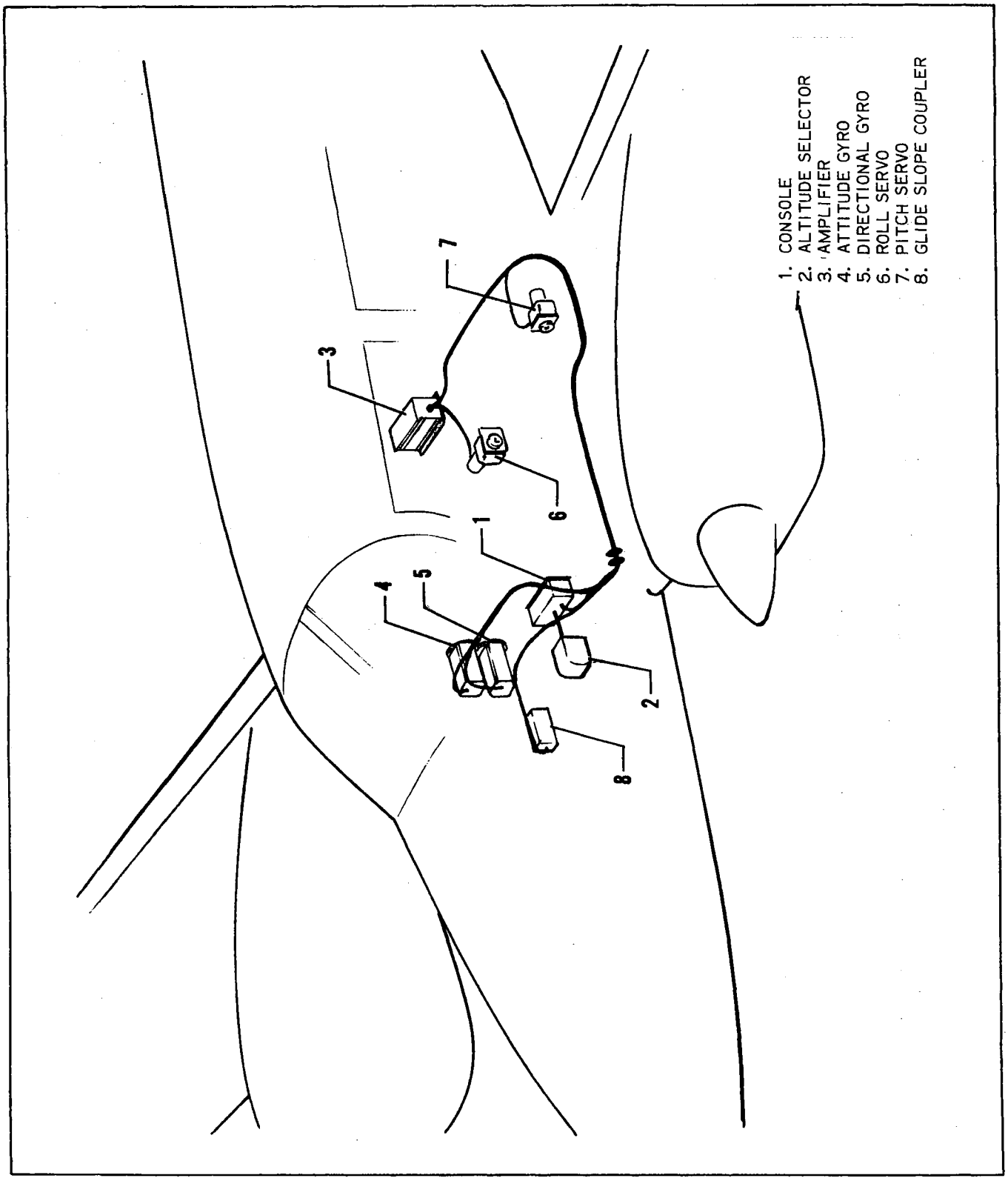


Figure 3-10. PA-34-200 AltiMatic III B-1 Layout

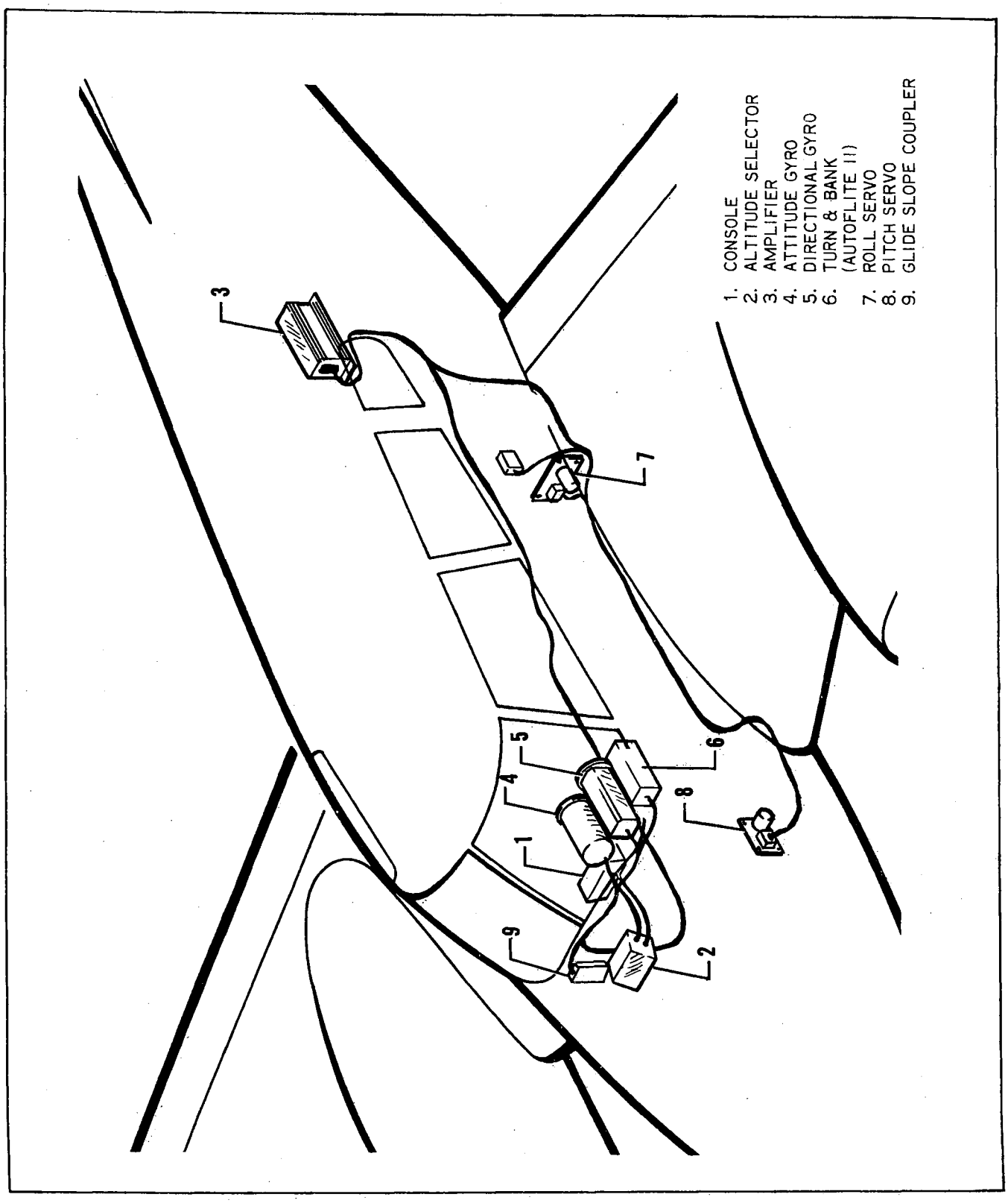


Figure 3-11. PA-39 AltiMatic III B-1 Layout

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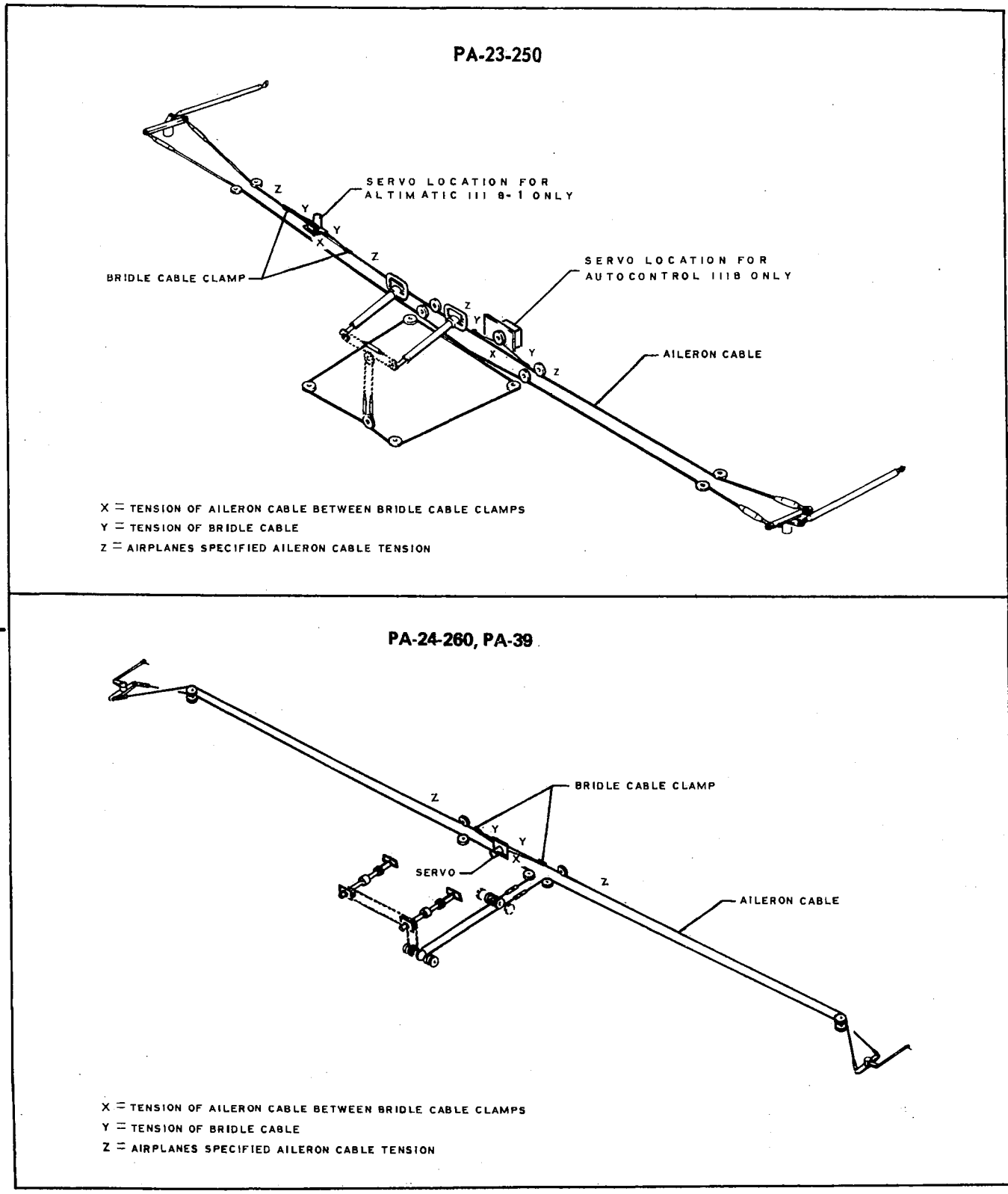

Figure 3-13. Roll Servo Cable Tension Diagrams

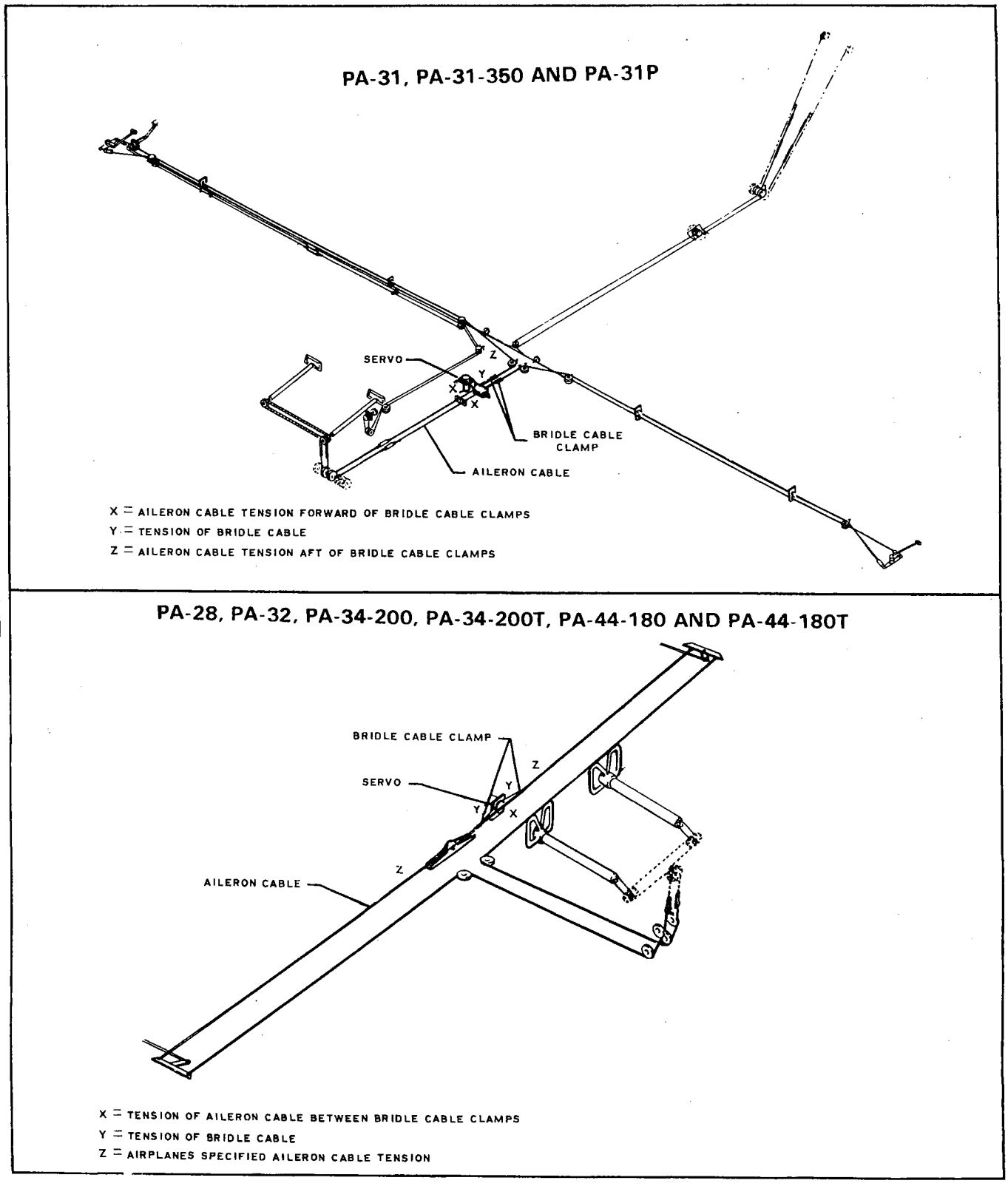

Figure 3-13. Roll Servo Cable Tension Diagrams (cont.)

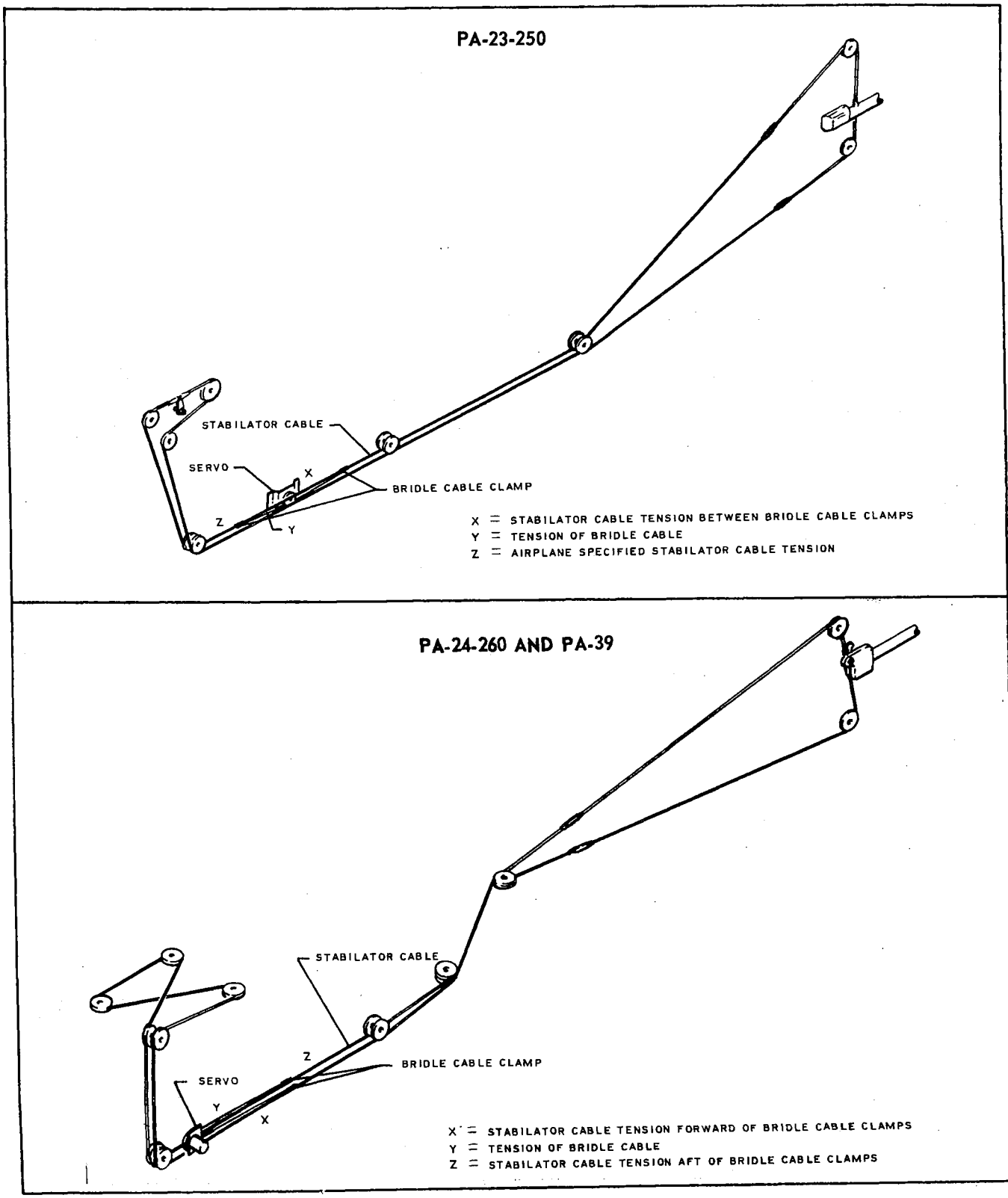

Figure 3-14. Pitch Servo Cable Tension Diagrams

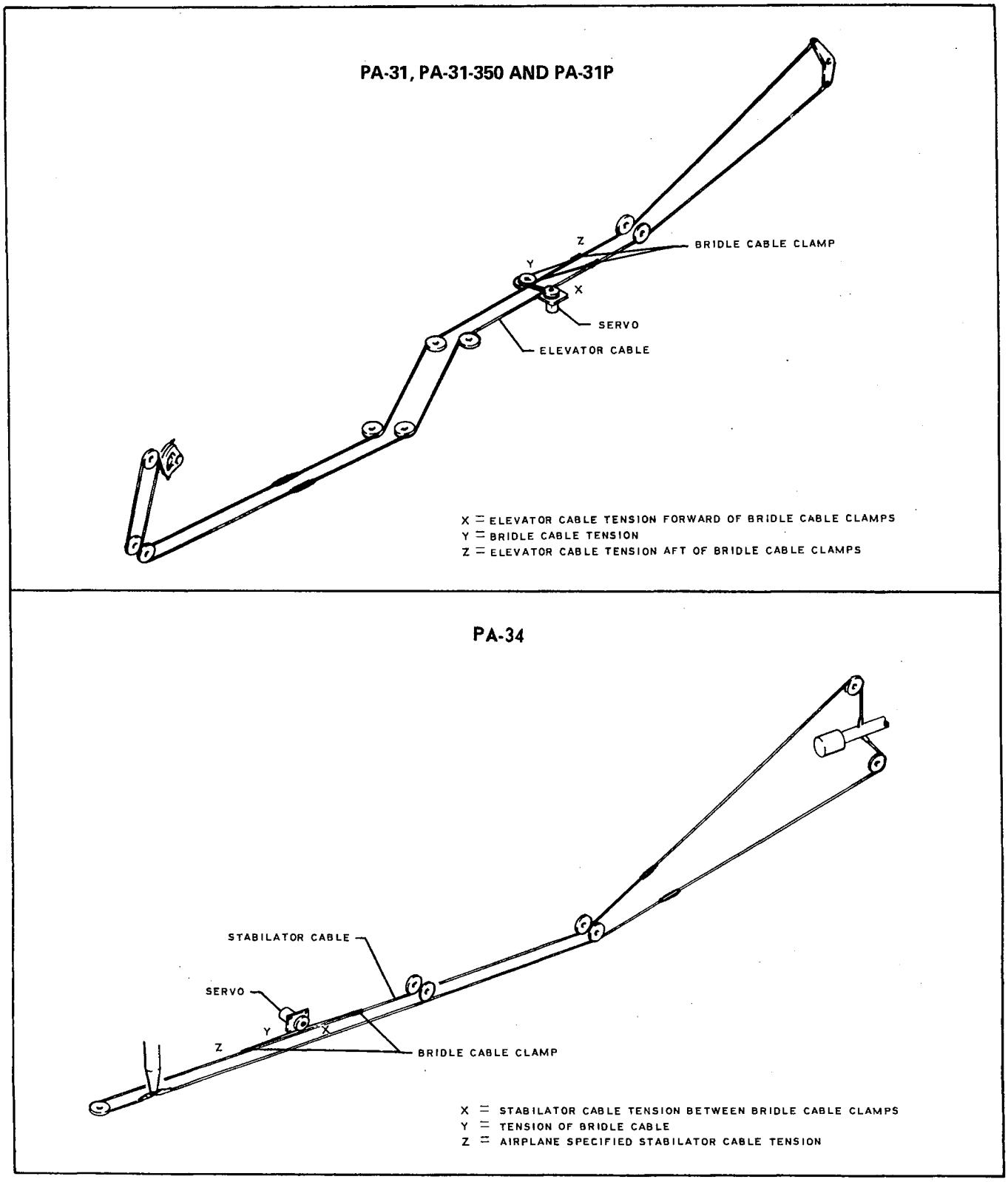

Figure 3-14. Pitch Servo Cable Tension Diagrams (cont.)

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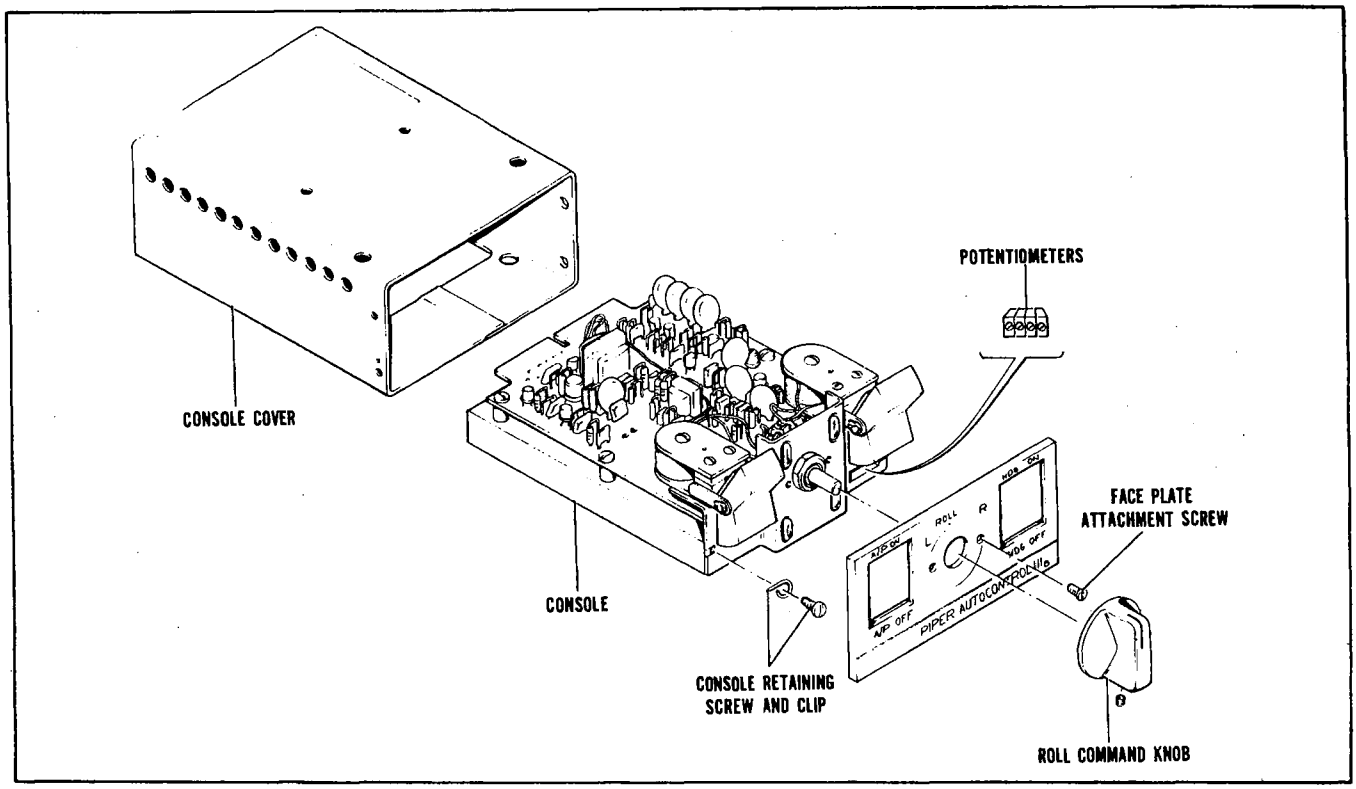

Figure 3-15. AutoControl III B Console/Amplifier

3-3. CONSOLE/AMPLIFIER (AUTOCONTROL III B). Figure 3-15 shows an exploded view of the AutoControl III B Console/Amplifier Installation. Although the location varies in each airplane, the Console/Amplifier is the same in all installations.

3-4. REMOVAL OF CONSOLE/AMPLIFIER. (PA-23-250 (six place), Serial Nos. 27-7554001 and up.) The Console/Amplifier is located in the lower left section of the instrument panel. The electrical connector for the console is bolted to the console case. When the console is removed from the case, it is automatically disconnected.

a. Remove the roll command knob.

b. Remove the two screws securing the face plate and remove face plate.

c. Remove the retaining clip, which is located on the left front side of the console, by removing the retaining clip screw from the console. Replace retaining clip screw prior to removing the console.

CAUTION

Do not apply pressure to the printed circuit board as it may cause damage to the board.

d. Remove the Console/Amplifier from its case by applying pressure on the heat sink at the rear of the console.

3-5. INSTALLATION OF CONSOLE/AMPLIFIER. (PA-23-250 (Six Place), Serial Nos. 27-7554001 and up) (Refer to Figure 3-15.)

a. Install the Console/Amplifier in the instrument panel cutout and secure by removing the retaining clip screw from the left side of the console and placing the retaining clip in its proper position.

b. Secure retaining clip with appropriate screw.
c. Install face plate and secure with appropriate screws.
d. Install roll command knob and secure.
e. Check Console/Amplifier operation. (Refer to Section V.)

3-6. REMOVAL OF CONSOLE/AMPLIFIER. (PA-28-140, Serial Nos. 28-7525001 and up; PA-28-151, Serial Nos. 28-7515001 and up; PA-28-161, Serial Nos. 28-7716001 and up; PA-28-180, Serial Nos. 28-7505001 and up; PA-28-181, Serial Nos. 28-7690001 and up; PA-28-235, Serial Nos. 28-7510001 and up; PA-28-236, Serial Nos. 28-7911001 and up; PA-28-201T, Serial Nos. 28-7921001 and up; PA-28R-200, Serial Nos. 28R-7535001 and up; PA-28R-201, Serial Nos. 28R-7737001 and up; PA-28R-201T, Serial Nos. 28R-7703001 and up; PA-28RT-201, Serial Nos. 28RT-7918001 and up; PA-28RT-201T, Serial Nos. 28RT-7931001 and up; PA-32-260, Serial Nos. 32-7500001 and up; PA-32-300, Serial Nos. 32-7540001 and up; PA-32R-300, Serial Nos. 32R-7680001 and up; PA-32RT-300, Serial Nos. 32RT-7885001 and up; PA-32RT-300T, Serial Nos. 32RT-7887001 and up; PA-32-301, Serial Nos. 32-8006002 and up; PA-32-301T, Serial Nos. 32-8024001 and up; PA-32R-301, Serial Nos. 32R-8013001 and up; and PA-32R-301T, Serial Nos. 32R-8029001 and up.) The Console/Amplifier is located on the lower left section of the instrument panel. The electrical connector for the console is bolted to the console case. When the console is removed from the case, it is automatically disconnected.

a. Remove the roll command knob.
b. Remove the two screws securing the face plate and remove the face plate.
c. Remove the retaining clip, which is located on the left front side of the console, by removing the retaining clip screw from the console. Replace retaining clip screw prior to removing the console.

CAUTION

Do not apply pressure to the printed circuit board as it may cause damage to the board.

d. Remove the Console/Amplifier from its case by applying pressure on the heat sink at the rear of the console.

3-7. INSTALLATION OF CONSOLE/AMPLIFIER. (PA-28-140, Serial Nos. 28-7525001 and up; PA-28-151, Serial Nos. 28-7515001 and up; PA-28-161, Serial Nos. 28-7716001 and up; PA-28-180, Serial Nos. 28-7505001 and up; PA-28-181, Serial Nos. 28-7690001 and up; PA-28-235, Serial Nos. 28-7510001 and up; PA-28-236, Serial Nos. 28-7911001 and up; PA-28-201T, Serial Nos. 28-7921001 and up; PA-28R-200, Serial Nos. 28R-7535001 and up; PA-28R-201, Serial Nos. 28R-7737001 and up; PA-28R-201T, Serial Nos. 28R-7703001 and up; PA-28RT-201, Serial Nos. 28RT-7918001 and up; PA-28RT-201T, Serial Nos. 28RT-7931001 and up; PA-32-260, Serial Nos. 32-7500001 and up; PA-32-300, Serial Nos. 32-7540001 and up; PA-32R-300, Serial Nos. 32R-7680001 and up; PA-32RT-300, Serial Nos. 32RT-7885001 and up; PA -32RT-300T, Serial Nos. 32Rt-7887001 and up; PA-32-301, Serial Nos. 32-8006002 and up; PA-32-301T, Serial Nos. 32-8024001 and up; PA-32R-301, Serial Nos. 32R-8013001 and up; and PA-32R-301T, Serial Nos. 32R-8029001 and up.) (Refer to Figure 3-15.)

a. Install the Console/Amplifier in the instrument panel cutout and secure by removing the retaining clip screw from the left side of the console and placing the retaining clip in its proper position.
b. Secure retaining clip with appropriate screw.
c. Install face plate and secure with appropriate screws.
d. Install roll command knob and secure.
e. Check Console/Amplifier operation (Refer to Section V.)

3-8. REMOVAL OF CONSOLE/AMPLIFIER. (PA-34-200T, Serial Nos. 34-7570001 and up; PA-44-180, Serial Nos. 44-7995001 and up; and PA-44-180T, Serial Nos. 44-8107001 and up.) The Console/Amplifier is located in the lower left section of the instrument panel. The electrical connector for the console is bolted to the console case. When the console is removed from the case, it is automatically disconnected.

a. Remove the roll command knob.

b. Remove the two screws securing the face plate and remove face plate.

c. Remove the retaining clip, which is located on the left front side of the console by removing the retaining clip screw from the console. Replace retaining clip screw prior to removing the console.

CAUTION

Do not apply pressure to the printed circuit board as it may cause damage to the board.

d. Remove the Console/Amplifier from its case by applying pressure on the heat sink at the rear of the console.

3-9. INSTALLTION OF CONSOLE/AMPLIFIER. (PA-34-200T, Serial Nos. 34-7570001 and up; PA-44-180, Serial Nos. 44-7995001 and up; and PA-44-180T, Serial Nos. 44-8107001 and up.) (Refer to Figure 3-15.)

a. Install the Console/Amplifier in the instrument panel cut-out and secure by removing the retaining clip screw from the left side of the console and placing the retaining clip in its proper position.

b. Secure retaining clip with appropriate screw.

c. Install face plate and secure with appropriate screws.

d. Install roll command knob and secure.

e. Check Console/Amplifier operation. (Refer to Section V.)

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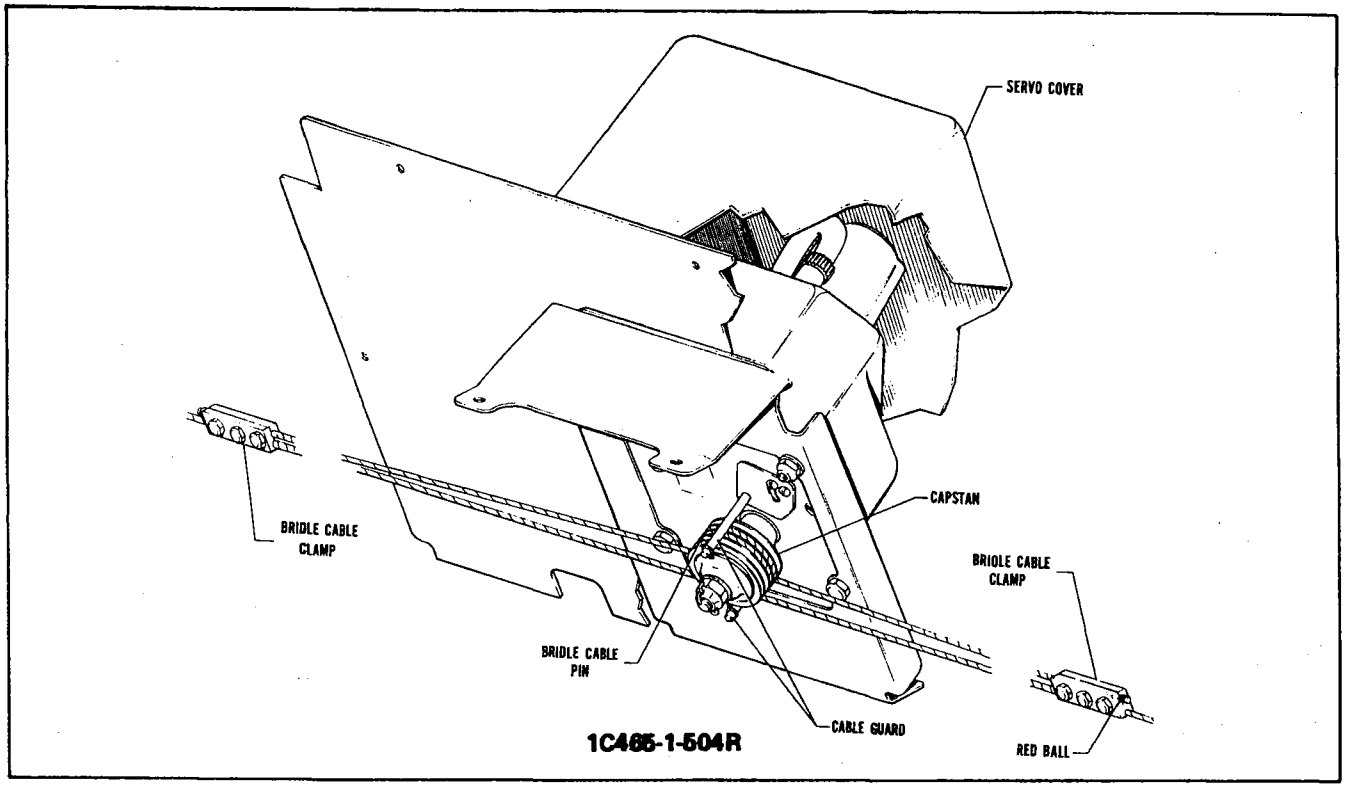

Figure 3-16. Roll Servo Installation, PA-23-250 (Six Place) (AutoControl III B)

3-12. ROLL SERVO (AUTOCONTROL III B ONLY).

3-13. REMOVAL OF ROLL SERVO. (PA-23-250 (six place), Serial Nos. 27-7554001 and up.) The roll servo is located on a mounting bracket beneath the pilot's seat forward of the **main** spar. The mounting bracket and roll servo is removed as one unit.

a. Remove the pilot's seat from the airplane.
b. Roll back carpet on tunnel beneath pilot's seat over the main spar.
c. Remove attaching screws in cover over servo assembly and remove cover.
d. Disconnect the electrical connection from the servo.
e. Paint the aileron balance cable where the bridle cable clamps are attached and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red to facilitate reinstallation.)
f. Remove the six bolts, washers and nuts that secures the bracket and roll servo to the airframe and remove servo and mounting bracket from the airplane.
g. Remove the four bolts, washers and nuts that secure the roll servo to the mounting bracket and remove roll servo from mounting bracket.

3-14. INSTALLATION OF ROLL SERVO. (PA-23-250 (six place), Serial Nos. 27-7554001 and up.) (Refer to Figure 3-16.)

a. Insert bridle cable pin in capstan and tighten bridle cable pin lock screw.
b. Wrap the bridle cable one half turn each direction around the capstan from the bridle cable pin.
c. Adjust the cable guards on the servo to provide a gap of .031 of an inch between the capstan and guard.

d. Position the roll servo on the mounting bracket and secure with the four bolts, washer and nuts previously removed.

e. Place the mounting bracket with roll servo installed in its proper position and secure with the six bolts, washers and nuts previously removed.

f. REFER TO FIGURE 3-13 AND CHECK THAT CONTROL CABLE TENSION (Z) IS ADJUSTED TO 40 +8 -0 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the aileron balance cable. The bridle cable is drawn to the balance cable and attached with clamps at the previously painted locations on the balance cable. The end of the bridle cable with the red ball extends toward the right side of the airplane. (Refer to Figure 3-16.) (Should the balance cable not be painted, position the control wheel in neutral and align the bridle cable pin, installed in the capstan, in the up position.) Adjust the bridle cable clamps so the bridle cable tension (Y) is equal to the control cable tension between the bridle cable clamps (X) as shown in Figure 3-13 without increasing the control cable tension from the bridle cable clamps outward. At no time shall the bridle cable tension be greater than the control cable tension between the clamps. Adjusting the bridle cable tension will lower the control cable tension between the two bridle cable clamps. Torque the bridle cable clamp bolts to 55 ± 5 inch-pounds.

g. Connect the electrical connection to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then turning the control wheel manually to the extreme left and right positions to ascertain the clamps and pin do not change position. Next operate the servo electrically. To do this, turn on the master switch. Place the A/P ON/OFF switch to the ON position. Rotate the roll command to its extreme left and right position. Examine the bridle cable to verify the clamps and pin do not change position. The clutch will slip during these operations.

h. **Install servo cover on tunnel over main spar and secure with appropriate screws.**

i. **Install carpet and pilot's seat and secure.**

3-15. REMOVAL OF ROLL SERVO. (PA-28-140, Serial Nos. 28-7525001 and up; PA-28-151, Serial Nos. 28-7515001 and up; PA-28-161, Serial Nos. 28-7716001 and up; PA-28-180, Serial Nos. 28-7505001 and up; PA-28-181, Serial Nos. 28-7690001 and up; PA-28-235, Serial Nos. 28-7510001 and up; PA-28-236, Serial Nos. 28-7911001 and up; PA-28-201T, Serial Nos. 28-7921001 and up; PA-28R-200, Serial Nos. 28R-7535001 and up; PA-28R-201, Serial Nos. 28R-7737001 and up; PA-28R-201T, Serial Nos. 28R-7703001 and up; PA-28RT-201, Serial Nos. 28RT-7918001 and up; PA-28RT-201T, Serial Nos. 28RT-7931001 and up; PA-32-260, Serial Nos. 32-7500001 and up; PA-32-300, Serial Nos. 32-7540001 and up; PA-32-301, Serial Nos. 32-8006002 and up; and PA-32-301T, Serial Nos. 32-8024001 and up.) The roll servo is located beneath the floor panel directly behind the main spar on the PA-28-140 and beneath the bench seat on the PA-28-151. On all other PA-28 series airplanes, the roll servo is located beneath the rear seat. On PA-32 series airplanes, the roll servo is located beneath the left center seat.

a. (PA-28-140 ONLY.) Lift up the hinged floor panel directly behind the main spar.

b. (PA-28-151 ONLY.) Unsnap the fasteners securing the lower section of the bench seat to the floor panel and lift the seat up.

c. (ALL OTHER PA-28 SERIES AIRPLANES.) Remove the rear seats and floor panel.

d. (PA-32 SERIES ONLY.) Remove the center seats and floor panel directly behind the main spar by removing the seat belts and screws. Remove the floor panel from the airplane.

e. Disconnect the electrical connector from the servo.

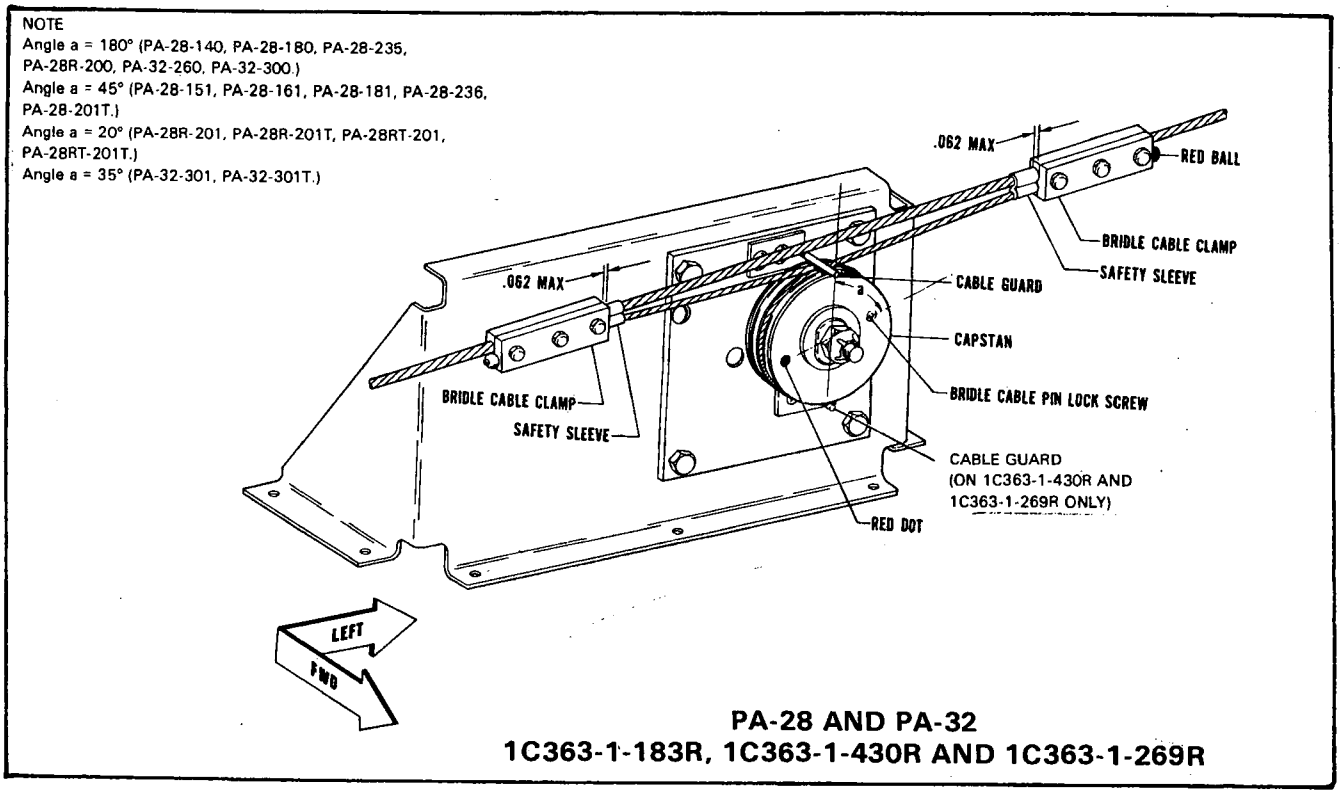

Figure 3-17. Roll Servo Installation (AutoControl III B)

PA-28-140, Serial Nos. 28-7525001 and up; PA-28-151, Serial Nos. 28-7515001 and up; PA-28-161, Serial Nos. 28-7716001 and up; PA-28-180, Serial Nos. 28-7505001 and up; PA-28-181, Serial Nos. 28-7690001 and up; PA-28-235, Serial Nos. 28-7510001 and up; PA-28-236, Serial Nos. 28-7921001 and up; PA-28-201T, Serial Nos. 28-7921001 and up; PA-28R-200, Serial Nos. 28R-7535001 and up; PA-28R-201, Serial Nos. 28R-7737001 and up; PA-28R-201T, Serial Nos. 28R-7703001 and up; PA-28RT-201, Serial Nos. 28RT-7918001 and up; PA-28RT-201T, Serial Nos. 28RT-7931001 and up; PA-32-260, Serial Nos. 32-7500001 and up; PA-32-300, Serial Nos. 32-7540001 and up; PA-32-301, Serial Nos. 32-8006001 and up; and PA-32-301T, Serial Nos. 32-8024001 and up.

f. Paint the aileron balance cable where the bridle cable clamps are located and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red to facilitate reinstallation.)

g. Remove the four bolts, washers and nuts that secure the roll servo to the mounting bracket.

h. Remove the roll servo from the airplane.

3-15a. REMOVAL OF ROLL SERVO. (PA-32R-300, Serial Nos. 32R-7680001 and up; PA-32RT-300, Serial Nos. 32RT-7885001 and up; PA-32RT-300T, Serial Nos. 32RT-7887001 and up; PA-32R-301, Serial Nos. 32R-8013001 and up; and PA-32R-301T, Serial Nos. 32R-8029001 and up.) The roll servo is located beneath the left center seat.

a. Remove the center seats and floor panel directly behind the main spar by removing the seat belts and screws. Remove the floor panel from the airplane.

b. Disconnect the electrical connector from the servo.

c. Paint the aileron balance cable where the bridle cable clamps are located and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red to facilitate reinstallation.)

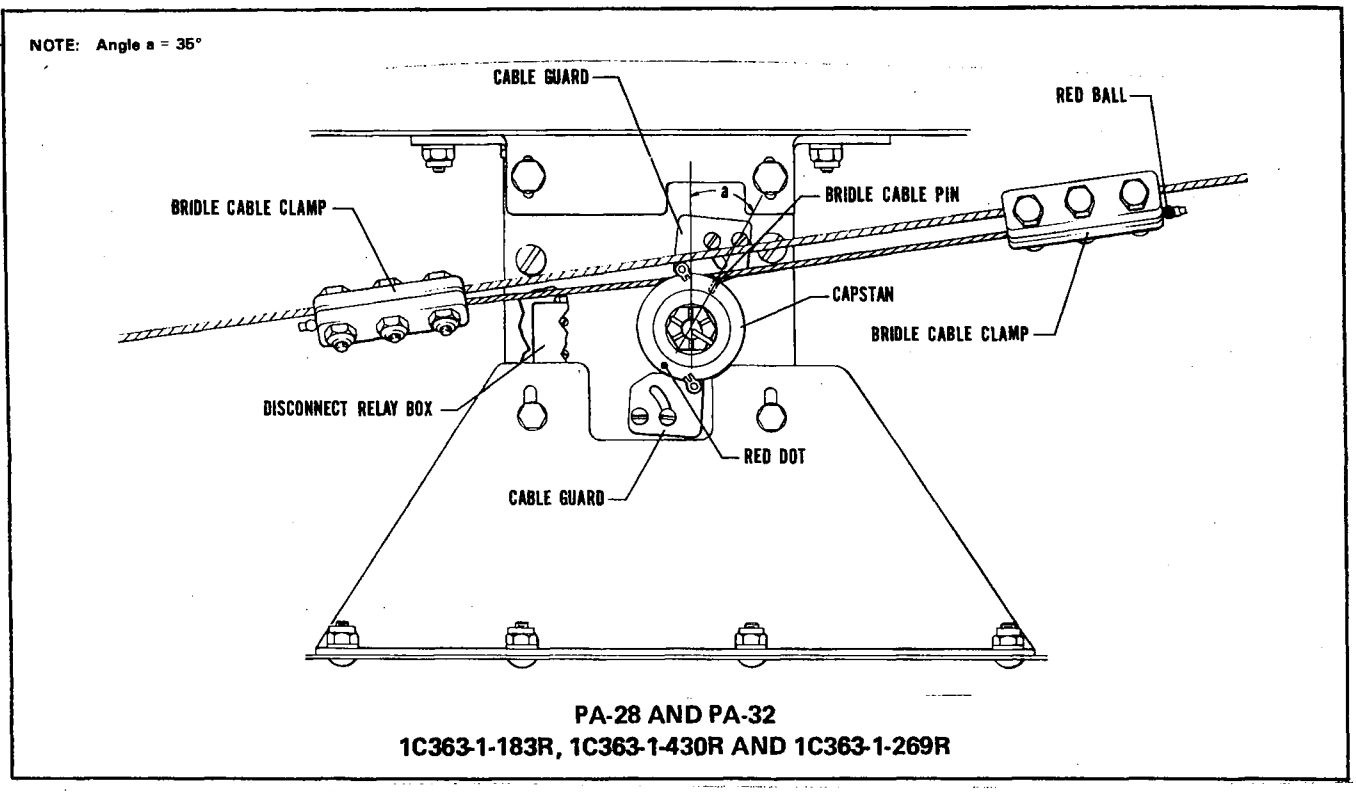

Figure 3-17a. Roll Servo Installation (AutoControl III B)

PA-32R-300, Serial Nos. 32R-7680001 and up; PA-32RT-300, Serial Nos. 32RT-7885001 and up; PA-32RT-300T, Serial Nos. 32RT-7887001 and up; PA-32R-301, Serial Nos. 32R-8013001 and up; and PA-32R-301T, Serial Nos. 32R-8029001 and up.

d. Remove the four bolts, washers, and nuts that secure the roll servo to the mounting bracket.
e. Remove the roll servo from the airplane.

3-16. INSTALLATION OF ROLL SERVO. (PA-28-140, Serial Nos. 28-7525001 and up; PA-28-151, Serial Nos. 28-7515001 and up; PA-28-161, Serial Nos. 28-7716001 and up; PA-28-180, Serial Nos. 28-7505001 and up; PA-28-181, Serial Nos. 28-7690001 and up; PA-28-235, Serial Nos. 28-7510001 and up; PA-28-236, Serial Nos. 28-7911001 and up; PA-28-201T, Serial Nos. 28-7921001 and up; PA-28R-200, Serial Nos. 28R-7535001 and up; PA-28R-201, Serial Nos. 28R-7737001 and up; PA-28R-201T, Serial Nos. 28R-7703001 and up; PA-28RT-201, Serial Nos. 28RT-7918001 and up; PA-28RT-201T, Serial Nos. 28RT-7931001 and up; PA-32-260, Serial Nos. 32-7500001 and up; PA-32-300, Serial Nos. 32-7540001 and up; PA-32-301, Serial Nos. 32-8006002 and up; and PA-32-301T, Serial Nos. 32-8024001 and up.) (Refer to Figure 3-17.)

a. Insert bridle cable pin in capstan and tighten bridle cable pin lock screw.
b. (PA-28-140, PA-28-180, PA-28-235, PA-28R-180, PA-28R-200, PA-32-260 and PA-32-300 ONLY.) Wrap the bridle cable one-half turn each direction around the capstan from the bridle cable pin.
c. (PA-28-151, PA-28-161, PA-28-181, PA-28-236, PA-28-201T, PA-28R-201, PA-28R-201T, PA-28RT-201, PA-28RT-201T, PA-32-301, and PA-32-301T ONLY.) Wrap the bridle cable one full turn each direction around the capstan from the bridle cable pin.
d. Adjust the cable guard (s) on the servo to provide a gap of .031 of an inch between the capstan and guard.
e. Position the roll servo on the mounting bracket located in the area beneath the floor aft of the main spar. Secure the servo to the mounting brackets.

f. REFER TO FIGURE 3-13 AND CHECK THAT THE CONTROL CABLE TENSION (Z) IS ADJUSTED TO 40 ± 5 POUNDS; (30 +0 -5 POUNDS PA-28-151 SERIAL NOS. 28-7515001 TO 28-7515449 ONLY.) PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the aileron balance cable. The bridle cable is drawn to the aileron balance cable and attached with clamps at the previously painted locations on the balance cable. The longest portion of the bridle cable or the end with the red ball extends outboard toward the left side of the airplane. (Refer to Figure 3-17.) (Should the balance cable not be painted, position the control wheel in neutral and the bridle cable pin, installed in the capstan, as shown in Figure 3-17.) Adjust the bridle cable clamps so the bridle cable tension (Y) is equal to 25 +0 -5 pounds. Recheck the control cable tension from the bridle cable clamps outward and adjust, if necessary. If the aileron cables require adjustment, it may be necessary to readjust the bridle cable tension. Torque the bridle cable clamp bolts to 55 +5 inch pounds.

g. Connect the electrical connector to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then turning the control wheel manually to the extreme left and right positions to ascertain the clamps and the pin do not change position. Next operate the servo electrically. To do this turn on the master switch. Place the A/P ON/OFF switch to the ON position. Rotate the roll command knob to its extreme left and right position. Examine the bridle cable to verify the clamps do not change position. The clutch will slip during these operations.

h. Install the floor panel, seat belts and seats.

3-16a. INSTALLATION OF ROLL SERVO. (PA-32R-300, Serial Nos. 32R-7680001 and up; PA-32RT-300, Serial Nos. 32RT-7885001 and up; PA-32RT-300T, Serial Nos. 32RT-7887001 and up; PA-32R-301, Serial Nos. 32R-8013001 and up; and PA-32R-301T, Serial Nos. 32R-8029001 and up.) (Refer to Figure 3-17a.)

a. Insert bridle cable pin in capstan and tighten bridle cable pin lock screw.

b. Wrap the bridle cable one full turn each direction around the capstan from the bridle cable pin.

c. Adjust the cable guards on the servo to provide a gap of .031 of an inch between the cable and guard.

d. Position the servo on the mounting brackets located in the area beneath the floor aft of the main spar. Secure the servo with the four bolts, washers and nuts previously removed.

e. REFER TO FIGURE 3-13 AND CHECK THAT THE CONTROL CABLE TENSION (Z) IS ADJUSTED TO 40 ± 5 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the aileron balance cable. The bridle cable is drawn to the aileron balance cable and attached with clamps at the previously painted locations on the balance cable. The longest portion of the bridle cable, or the end with the red ball, extends outboard toward the left side of the airplane. (Refer to Figure 3-17a.) (Should the balance cable not be painted, position the control wheel in neutral and align the bridle cable pin installed in the capstan, as shown in Figure 3-17a.) Adjust the bridle cable clamps so the bridle cable tension (Y) as shown in Figure 3-3 is the same as the balance cable tension +0 - 20%. Recheck the control cable tension from the bridle cable clamps outward and adjust, if necessary. If aileron cables require adjustment, it may be necessary to readjust the bridle cable tension. Torque the bridle cable clamp bolts to 55 + 5 inch pounds.

f. Connect the electrical connector to the servo.

CAUTION

Check the security of bridle clamps and the bridle cable capstan pin by first engaging the servo and then turning the control wheel manually to the extreme left and right positions to ascertain the clamps and the pin do not change position. Next operate the servo electrically. To do this, turn on the master switch. Place the A/P ON/OFF switch to the ON position. Rotate the roll command knob to its extreme left and right position. Examine the bridle cable to verify the clamps and pin do not change position. The clutch will slip during these operations.

g. Install the floor panel, seat belts and seat.

3-17. REMOVAL OF ROLL SERVO. (PA-34-200T, Serial Nos. 34-7570001 and up; PA-44-180, Serial Nos. 44-7995001 and up; and PA-44-180T, Serial Nos. 44-8107001 and up.) The roll servo is located on a mounting bracket in the center of the fuselage beneath the floor panel under the center set of seats.

a. Remove the center seats from the airplane.

b. Remove the floor panel directly behind the main spar by removing the seat belts and screws. Remove the floor panel from the airplane.

c. Disconnect the electrical connection from the servo.

d. Paint the aileron balance cable where the bridle cable clamps are located and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red to facilitate reinstallation.)

e. Remove the four bolts, washers and nuts that secure the roll servo to the mounting bracket.

f. Remove the roll servo from the airplane.

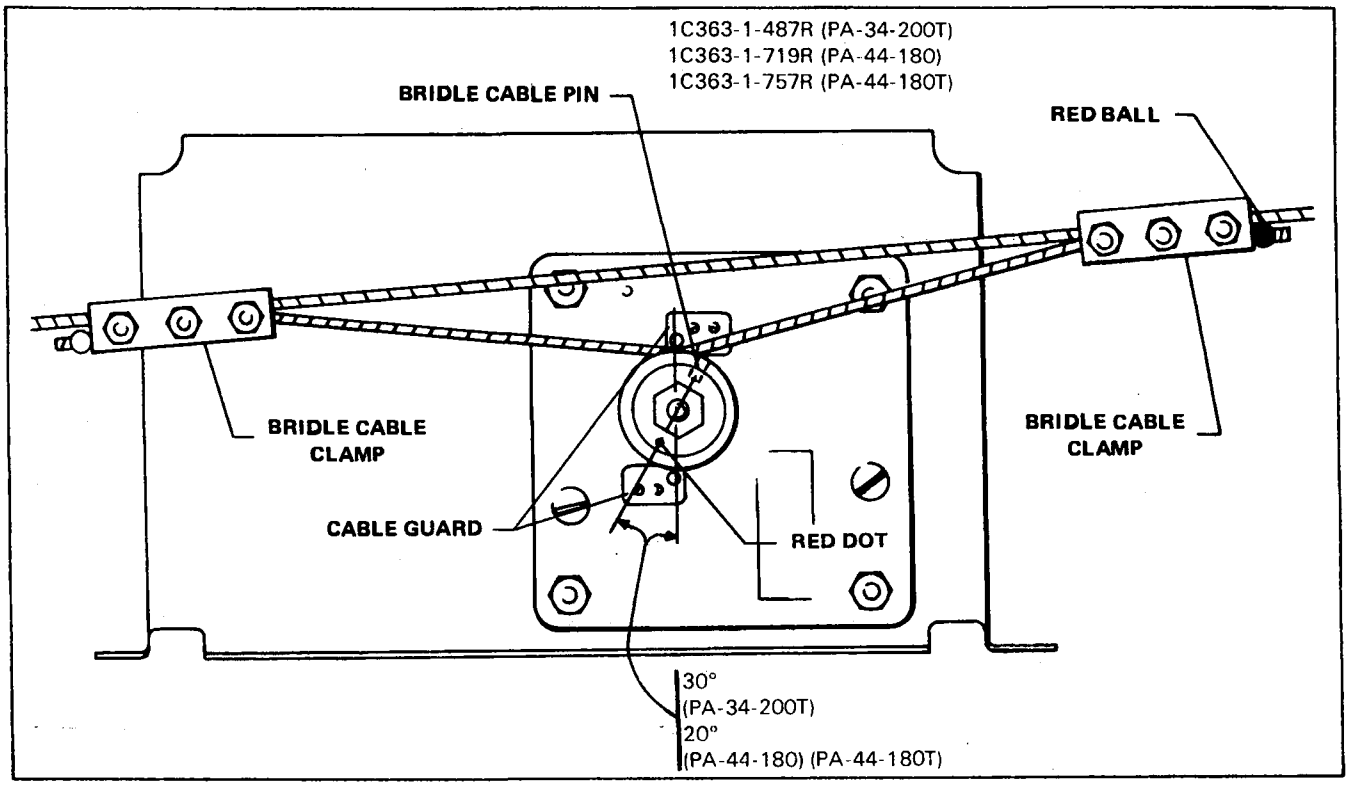

Figure 3-18. Roll Servo Installation, PA-34-200T, PA-44-180 and PA-44-180T (AutoControl III B)

3-18. INSTALLATION OF ROLL SERVO. (PA-34-200T, Serial Nos. 34-7570001 and up; PA-44-180, Serial Nos. 44-7995001 and up; and PA-44-180T, Serial Nos. 44-8107001 and up.) (Refer to Figure 3-18.)

a. Insert bridle cable pin in capstan and tighten bridle cable pin lock screw.

b. Wrap the bridle cable one full turn each direction around the capstan from the bridle cable pin.

c. Adjust the cable guard on the servo to provide a gap of .031 of an inch between the capstan and guard.

d. Position the servo on the mounting bracket located in the area beneath the floor aft of the main spar. Secure the servo with the four bolts, washers and nuts previously removed.

e. REFER TO FIGURE 3-13 AND CHECK THAT THE CONTROL CABLE TENSION (Z) IS ADJUSTED TO 40 ± 5 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the aileron balance cable. The bridle cable is drawn to the balance cable and attached with clamps at the previously painted locations on the balance cable. The longest portion of the bridle cable, or the end with red ball, extends outboard toward the left side of the airplanes. (Refer to

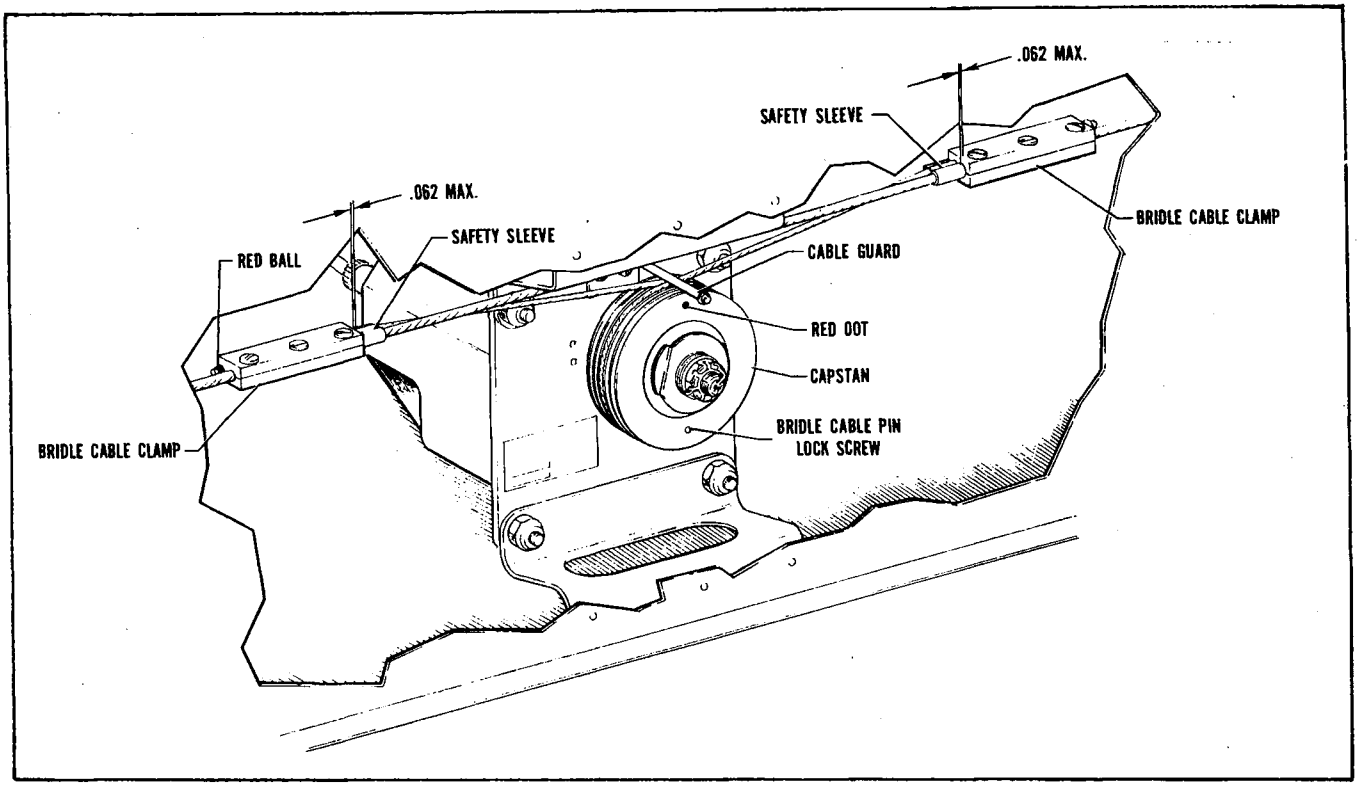

Figure 3-19. Roll Servo Installation, PA-40 (AutoControl III B)

Figure 3-18.) (Should the balance cable not be painted, position the control wheel in neutral and the bridle cable pin installed in the capstan, as shown in Figure 3-18.) Adjust the bridle cable clamps so the bridle cable tension (Y) is equal to the control cable tension +0 -15% between the bridle cable clamps (X) as shown in Figure 3-13 without increasing the control cable tension from the bridle cable clamps outward. At no time shall the bridle cable tension be greater than the control cable tension between the clamps. Adjusting the bridle cable tension will lower the control cable tension between the two bridle cable clamps. Torque the bridle cable clamp bolts to 55 ±5 inch-pounds.

f. Connect the electrical connection to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then turning the control wheel manually to the extreme left and right positions to ascertain the clamps and the pin do not change position. Next operate the servo electrically. To do this, turn on the master switch. Place the A/P ON/OFF switch to the ON position. Rotate the roll command knob to its extreme left and right position. Examine the bridle cable to verify the clamps and pin do not change position. The clutch will slip during these operations.

g. Install the floor panel, seat belts and seats.

3-19. INTENTIONALLY BLANK

3-20. INTENTIONALLY BLANK

the control cable tension from the bridle cable clamps outward. At no time shall the bridle cable tension be greater than the control cable tension between the clamps. Adjusting the bridle cable tension will lower the control cable tension between the two bridle cable clamps. Torque the bridle cable clamp screws to 15 ± 1 inch-pounds.

f. Connect the electrical connection to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then turning the control wheel manually to the extreme left and right positions to ascertain the clamps do not change position. Next operate the servo electrically. To do this, turn on the master switch. Place the A/P ON/OFF switch to the ON position. Rotate the roll command knob to its extreme left and right position. Examine the bridle cable to verify the clamps and pin do not change position. The clutch will slip during these operations.

g. Install a safety sleeve (P/N 26100-00) at both bridle cable clamps. (Refer to Figure 3-2.) Installation of safety sleeve to be accomplished with "Water Pump" type pliers with a handle length no less than 6" or more than 8" to insure proper compression of the safety sleeve.

h. Install center floor panels aft of the main spar and the access plate in the aft portion of the left rear seat foot well and secure.

i. Install carpet, seat belts, center seat tracks and the center and rear seats and secure.

j. Install the access plate on the bottom of the fuselage and secure.

3-21. CONSOLE (ALTIMATIC III B-1). The exploded view of the AltiMatic III B-1 Console is shown in illustration form in this section. Although the location varies in each airplane, the Console is the same in all installations.

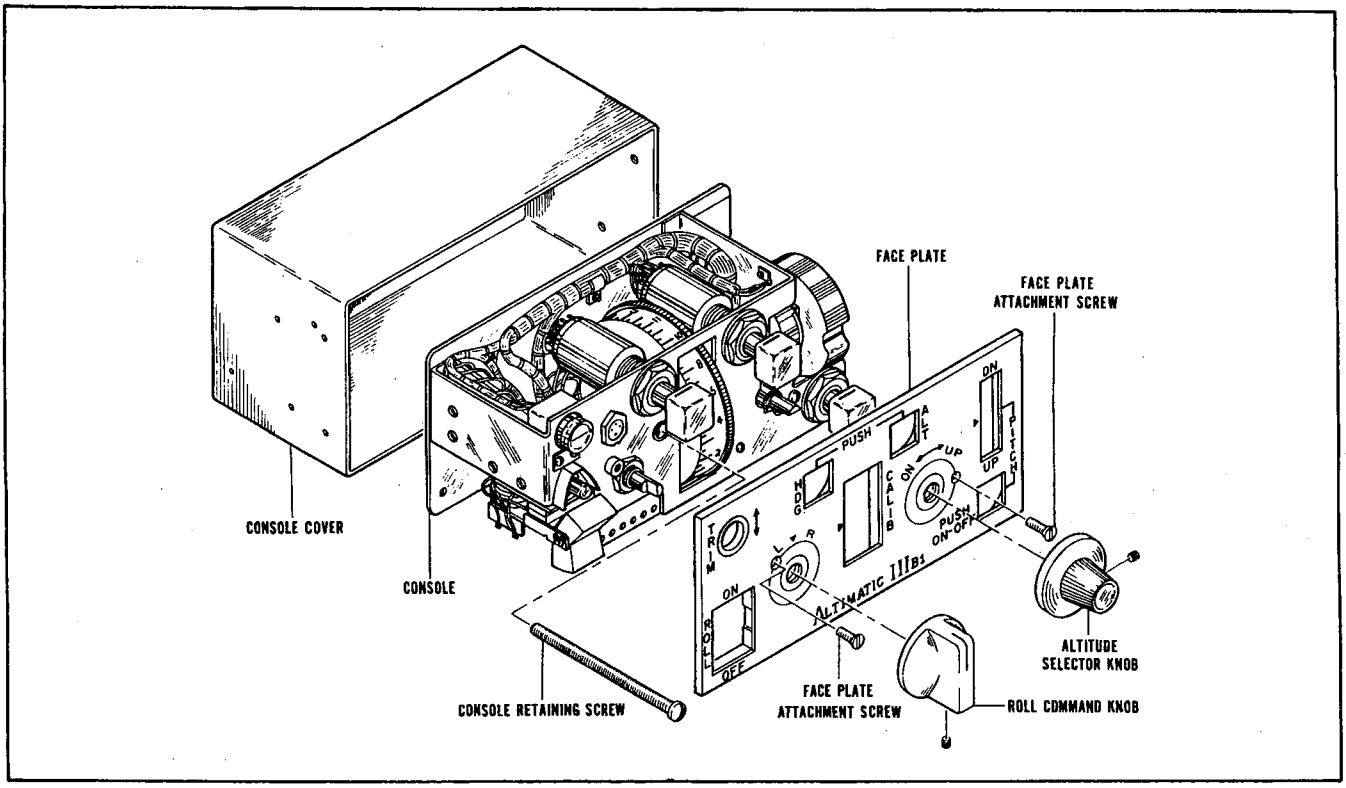

Figure 3-20. AltiMatic III B-1 Console

3-22. REMOVAL OF CONSOLE. PA-23-250 (six place).

The console is located in the lower left section of the instrument panel.

a. Rotate the Altitude Selector knob full down to position the altitude dial to the end of its travel to avoid changing the calibration of the Altitude Selector.

b. Remove the Roll Command and Altitude Selector knobs.

c. Remove the two screws securing the face plate and remove face plate.

d. Remove the console retaining screw. It is the screw located directly below the HDG. button on the console.

e. Disconnect the electrical harness plugs CD-20 and CD-40 also the flexible shaft from the rear of the console.

f. Remove the console from the airplane.

3-23. INSTALLATION OF CONSOLE. PA-23-250 (six place). (Refer to Figure 3-20.)

a. Place the console in the instrument panel cutout.

b. Connect the electrical harness plugs, CD-20 and CD-40, to the rear of the console. (Make sure spring clips on CD-20 are secured.)

c. Ascertain the Altitude Selector knob on the console being installed is rotated full down to position the altitude dial to the end of its travel.

d. Verify the altitude selector flex cable was not disturbed and proceed to step f. If unable to verify altitude selector flex cable was not disturbed proceed with next step.

e. Calibrate the altitude selector by the following procedure:

1. Obtain an accurate altimeter reading from an FAA source and set the airplane's altimeter to agree with this reading.

2. Verify the altimeter meets FAA Part 43 - Appendix E requirements. If altimeter does not meet FAA specifications, replace it or have it repaired before attempting to calibrate the AltiMatic III B-1 altitude preselect function.

3. Disconnect electrical connector CD-18 from the artificial horizon.

4. Set 29.92 inches and/or 1013 millibars in the altimeter window to obtain pressure altitude reading on altimeter.

5. With the console disconnected from the altitude selector shaft, find the mid point of the calibration range on the white plastic calibration dial. (Calibration dial travel is approximately 3000 ft., mid point is approximately 1500 ft. from either end of travel.)

6. Rotate the altitude selector knob on the console to set the calibration dial reading to the PRESSURE ALTITUDE given on the altimeter.

7. Turn the power on.

8. Engage the Roll Engage Switch and adjust roll command knob on console as required to stop aileron movement.

9. Engage the altitude preselect and pitch engage buttons.

10. With the one end of the flex cable connected to the altitude selector and the other end disconnected from the console, rotate the altitude selector flex cable until the trim needle, located on the console, is centered and pitch servo movement is stopped.

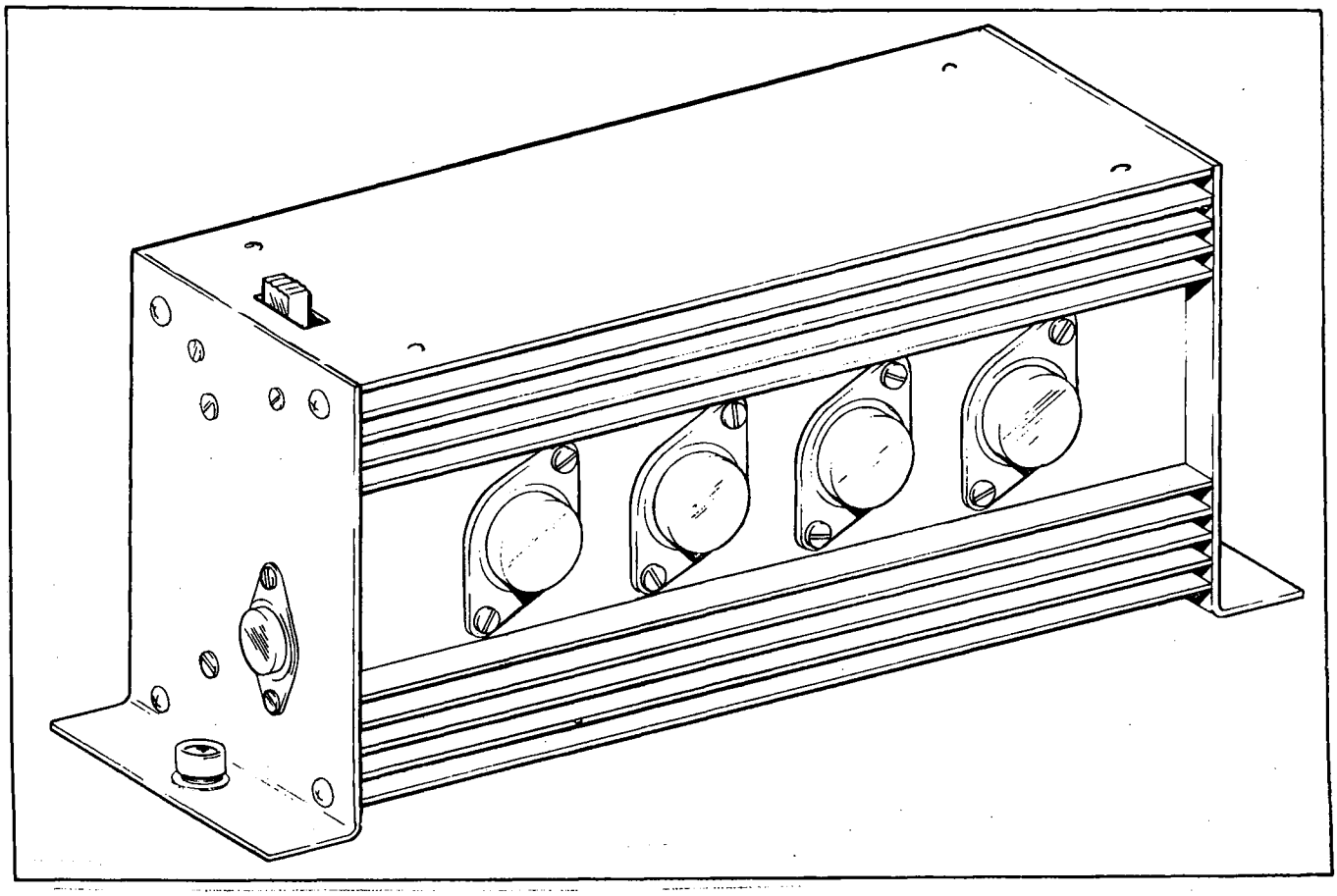

Figure 3-21. AltiMatic III B-1, 1C515-1 Amplifier

11. Turn OFF all power.

12. Connect the flexible shaft to the console. It maybe necessary to rotate the altitude selector knob on the console slightly to assure a proper mesh of the shaft.

13. Connect the electrical connector CD-18 to the artificial horizon.

f. Make sure the altitude selector shaft is secured correctly to the console.

g. Secure the console and install and secure the face plate.

h. Install the roll command and altitude selector knobs.

3-24. REMOVAL OF AMPLIFIER. PA-23-250 (six place).

The amplifier is located on the radio shelf in the aft section of the forward baggage compartment.

a. Access to the amplifier is through the forward baggage compartment door.

b. Disconnect the electrical harness from the amplifier by removing the two knurled screws from the large amplifier connector and removing the amplifier connector from the amplifier.

c. Unfasten two fasteners that secure the amplifier to the mounting bracket.

d. Remove the amplifier from the airplane.

3-25. INSTALLATION OF AMPLIFIER. PA-23-250 (six place). (Refer to Figure 3-21.)

a. With the large thirty pin receptacle facing forward, place the amplifier on the mounting bracket located on the radio shelf in the aft section of the forward baggage compartment and secure with the fasteners.

b. With the cables from the harness fanning to the left side of the airplane, connect the harness to the amplifier by securing with the two screws previously removed from the receptacle.

3-26. REMOVAL OF ALTITUDE SELECTOR. PA-23-250 (six place).

The altitude selector is located behind the instrument panel, directly forward of the console. Access may be through the access opening in the left side of the fuselage.

a. Remove the access panel located on the left side of the fuselage just forward of the leading edge of the wing.

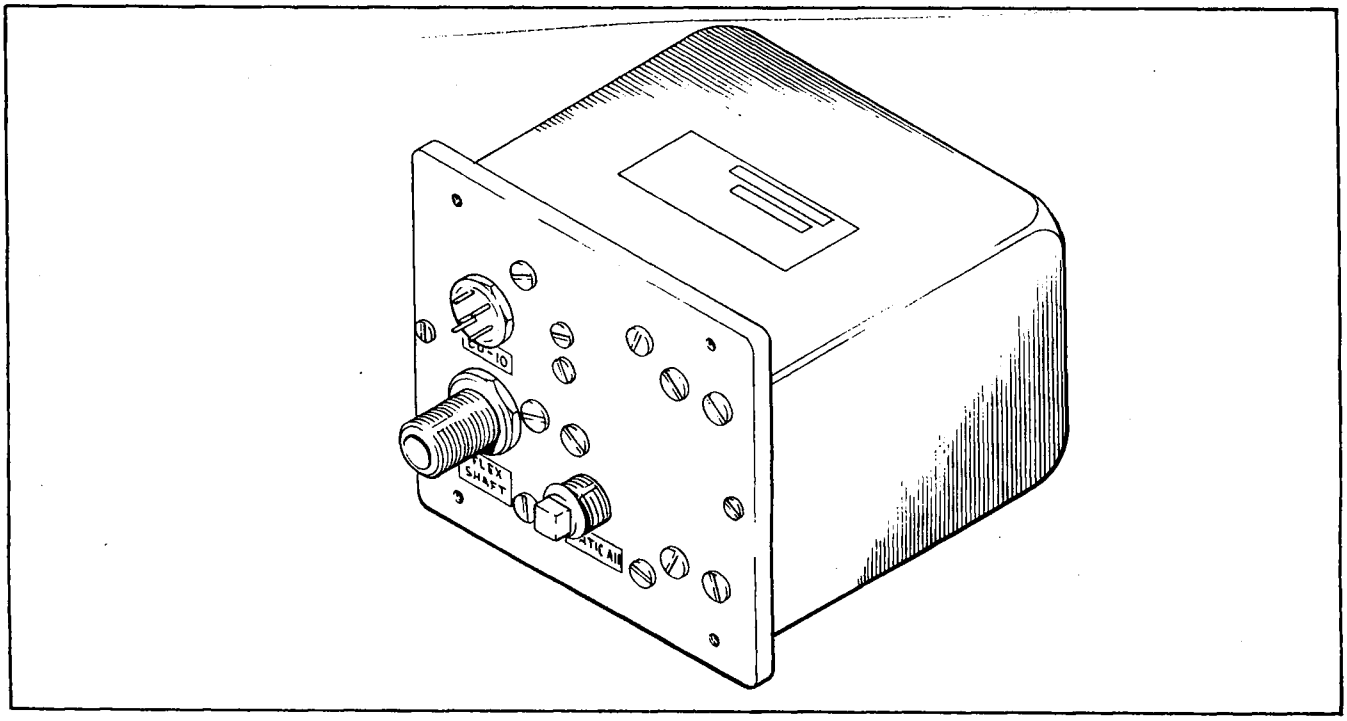

Figure 3-22. AltiMatic III B-1, 1D391-2 Altitude Selector

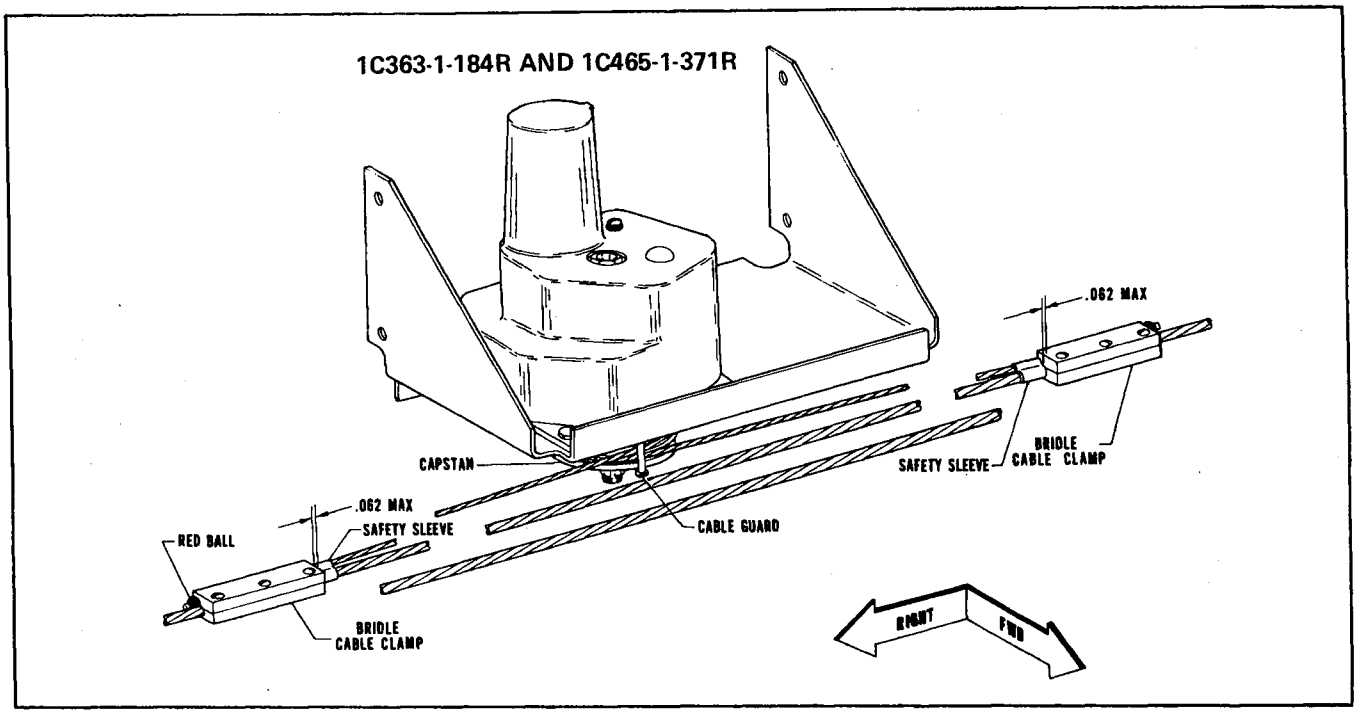

Figure 3-23. Roll Servo Installation, PA-23-250 (Six Place)

b. Disconnect the flexible shaft from the altitude selector.

c. Disconnect the CD-10 cable from the altitude selector.

d. Disconnect the static hose by releasing the clamp and sliding the hose off the port. To prevent contamination, place protective covers over the ends of the hose and the selector port.

e. Remove the nuts securing the altitude selector to the mounting bracket.

f. Remove the altitude selector from the airplane.

3-27. INSTALLATION OF ALTITUDE SELECTOR. PA-23-250 (six place). (Refer to Figure 3-22.)

a. Position the altitude selector on the mounting bracket that is behind the instrument panel, directly forward of the console. Secure the selector to the mounting bracket.

b. Remove any caps which have been placed over the ends of the hose and selector port.

c. Connect the hose from the rate of climb indicator to the port marked "static" on the selector. Secure with clamp.

d. Connect the CD-10 cable to the selector.

e. In order for the altitude preselect to be correct, the altitude selector must be calibrated. For these instructions, refer to Paragraph 3-23, e.

f. Install the access panel on the side of the fuselage.

3-28. REMOVAL OF ROLL SERVO. PA-23-250 (six place).

The roll servo is located in the right engine nacelle attached to the main spar.

a. Remove the upper right and left engine cowls from the right engine and the upper nacelle access panel aft of the firewall.

b. Disconnect the electrical connection from the servo.

c. Remove and discard safety sleeves.

d. Paint the aileron balance cable where the bridle cable clamps are located and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red for reinstallation reference.)

e. Remove the four bolts that secure the roll servo to the mounting bracket.
f. Remove the roll servo from the airplane.

3-29. INSTALLATION OF ROLL SERVO. PA-23-250 (six place). (Refer to Figure 3-23.)

a. Install bridle cable pin in capstan and tighten bridle cable pin lock screw.
b. Wrap the bridle cable one full turn each direction around the capstan from the bridle cable pin.
c. Adjust the cable guards on the servo to provide a gap of .031 of an inch between the capstan and guard.
d. Position the roll servo on the mounting bracket in the right engine nacelle at the main spar. Secure the servo with the previously removed bolts and nuts.
e. REFER TO FIGURE 3-13 AND CHECK THAT CONTROL CABLE TENSION (Z) IS ADJUSTED TO 40 +8 -0 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the aileron balance cable. The bridle cable is drawn to the balance cable and attached with clamps at the previously painted locations on the balance cable. The end of the bridle cable with the red ball extends toward the right side of the airplane. (Refer to Figure 3-23.) (Should the balance cable not be painted, position the control wheel in neutral and align the bridle cable pin, installed in the capstan, with the front guard pin. The red dot on the capstan should align with the rear guard pin.) Adjust the bridle cable clamps so the bridle cable tension (Y) is equal to the control cable tension between the bridle cable clamps (X) as shown in Figure 3-13 without increasing the control cable tension from the bridle cable clamps outward. At no time shall the bridle cable tension be greater than the control cable tension between the clamps. Adjusting the bridle cable tension will lower the control cable tension between the bridle cable clamps. Torque the bridle cable clamp screws to 15 ± 1 inch-pounds.
f. Connect the electrical connection to the servo.

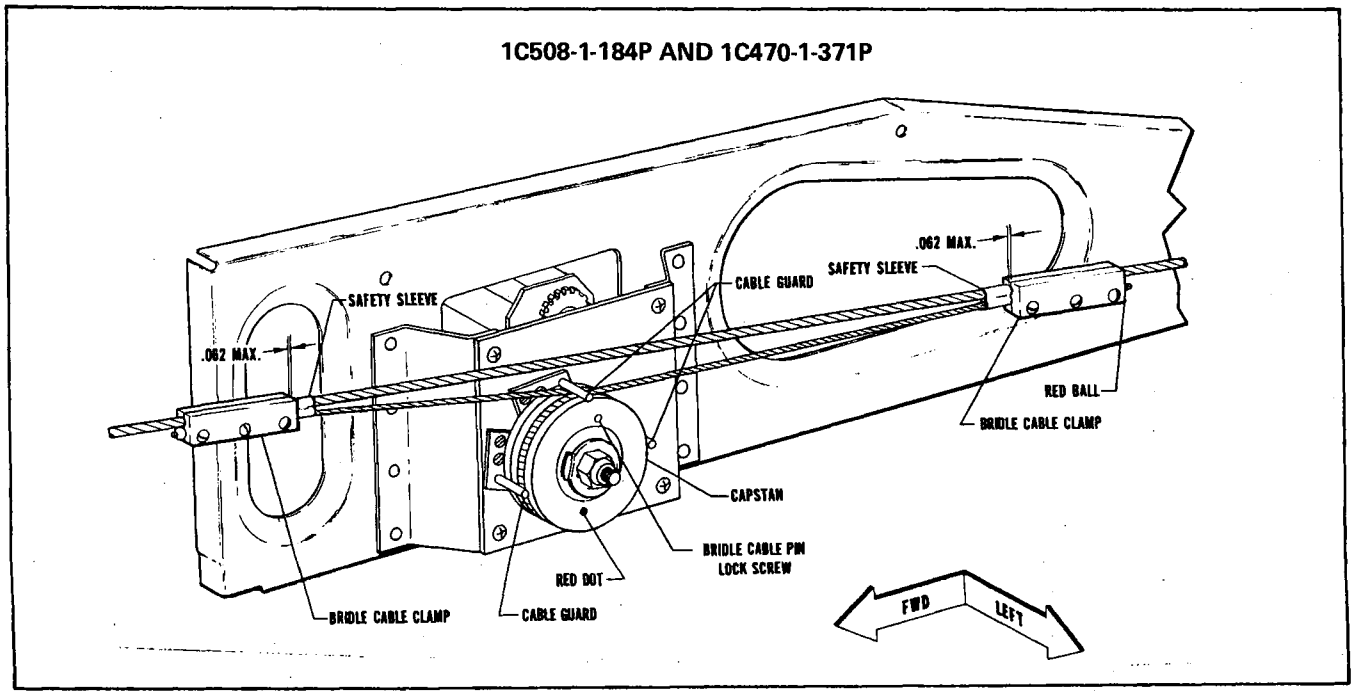

Figure 3-24. Pitch Servo Installation, PA-23-250 (Six Place)

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then turning the control wheel manually to the extreme left and right positions to ascertain the clamps and the pin do not change position. Next operate the servo electrically. To do this, turn on the master switch. Push in the roll engage button located on the lower left corner of the console and all other buttons to the out position. Rotate the roll command knob to its complete left and right. To ascertain the clamps and pin do not change position, examine the bridle cable. The clutch will slip during these operations.

g. Install a safety sleeve (P/N 26100-00) at both bridle cable clamps. (Refer to Figure 3-2.) Installation of safety sleeves to be accomplished with "Water Pump" type pliers with a handle length no less than 6" or more than 8" to insure proper compression of the safety sleeves.

h. Install the nacelle panel and engine cowling.

3-30. REMOVAL OF PITCH SERVO. PA-23-250 (six place).

The pitch servo is located beneath the left forward floor panel.

a. Remove the access panel on the underside of the fuselage just ahead of the main spar.

b. Disconnect the electrical connection from the servo.

c. Remove and discard safety sleeves.

d. Paint the stabilator control cable where the bridle cable clamps are located and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red for reinstallation reference.)

e. Remove the four bolts that secure the pitch servo to the mounting bracket.

f. Remove the pitch servo from the airplane.

3-31. INSTALLATION OF PITCH SERVO. PA-23-250 (six place). (Refer to Figure 3-24.)

a. Install bridle cable pin in capstan and tighten bridle cable pin lock screw.

b. Wrap the bridle cable one full turn each direction around the capstan from the bridle cable pin.

c. Adjust the cable guards on the servo to provide a gap of .031 of an inch between the capstan and guards.

d. From the underside of the airplane, position the pitch servo on the mounting bracket beneath the left forward floor panel. Secure the servo with the previously removed bolts and nuts.

e. REFER TO FIGURE 3-14 AND CHECK THAT THE CONTROL CABLE TENSION (Z) IS ADJUSTED TO 35 $\pm$ 4 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the stabilator control cables. The bridle cable is drawn to the right stabilator cable and attached with clamps at the previously painted locations on the cable. The end of the bridle cable with the red ball attaches to the aft attachment point on the stabilator cable. (Refer to Figure 3-24.) (Should the stabilator cable not be painted, position the control wheel full forward and with the servo disengaged, bring the end of the bridle cable with the red ball aft and clamp it to obtain a minimum of 1/4 inch between the trim sensor pulley and the end of the cable. Attach the other end of the bridle cable to the forward attachment point.) Adjust the bridle cable clamps so the bridle cable tension (Y) is equal to the control cable tension between the bridle cable clamps (X) as shown in Figure 3-14 without increasing the control cable tension from the bridle cable clamps outward. At no time shall the bridle cable tension be greater than the control cable tension between the clamps. Adjusting the bridle cable tension will lower the control cable tension between the two bridle cable clamps. Torque the bridle cable clamp screws to 15 $\pm$ 1 inch-pounds. Again move the control wheel forward and check clamp and sensor clearance.

f. Connect the electrical connection to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then moving the control wheel manually to the extreme fore and aft positions to ascertain the clamps do not change position. Next operate the servo electrically. To do this, turn on the master switch, push the roll engage button and the pitch ON/OFF button to their "IN" positions. All other buttons should be in the "OUT" position. Rotate the pitch command disk full up and down. To ascertain the clamps and the pin do not change position, examine the bridle cable. The clutch will slip during these operations.

g. Install a safety sleeve (P/N 26100-00) at both bridle cable clamps. (Refer to Figure 3-2.) Installation of safety sleeves to be accomplished with "Water Pump" type pliers with a handle length no less than 6" or more than 8" to insure proper compression of the safety sleeves.

h. Install the access panel on the underside of the fuselage.

3-32. REMOVAL OF CONSOLE. (PA-24-260 and PA-39.)

The console is located in the bottom center section of the instrument panel.

a. Rotate the altitude selector knob full down to position the altitude dial to the end of its travel to avoid changing the calibration of the altitude selector.

b. Remove the roll command and altitude selector knobs.

c. Remove the two screws securing the face plate and remove face plate.

d. Remove the console retaining screw. It is the screw located directly below the HDG. button on the console.

e. Disconnect the electrical harness plugs CD-20 and CD-40 also the flexible shaft from the rear of the console.

f. Remove the console from the airplane.

3-33. INSTALLATION OF CONSOLE. (PA-24-260 and PA-39.) (Refer to Figure 3-20.)

a. Place the console in the instrument panel cutout.

b. Connect the electrical harness plugs, CD-20 and CD-40, to the rear of the console. (Make sure spring clips on CD-20 are secured.)

c. Ascertain the altitude selector knob on the console being installed is rotated full down to position the altitude dial to the end of its travel.

d. Verify the altitude selector flex cable was not disturbed and proceed to step f. If unable to verify altitude selector flex cable was not disturbed proceed with next step.

e. Calibrate the altitude selector by the following procedure:

1. Obtain an accurate altimeter reading from an FAA source and set the airplane's altimeter to agree with this reading.

2. Verify the altimeter meets FAA Part 43 - Appendix E requirements. If altimeter does not meet FAA specifications, replace it or have it repaired before attempting to calibrate the AltiMatic III B-1 altitude preselect function.

3. Disconnect electrical connector CD-18 from the artificial horizon.

4. Set 29.92 inches and/or 1013 millibars in the altimeter window to obtain pressure altitude reading on altimeter.

5. With the console disconnected from the altitude selector shaft find the mid point of the calibration range on the white plastic calibration dial. (Calibration dial travel is approximately 3000 ft., mid point is approximately 1500 ft. from either end of travel.)

6. Rotate the altitude selector knob on the console to set the calibration dial reading to the PRESSURE ALTITUDE given on the altimeter.

7. Turn the power on.

8. Engage the Roll Engage Switch and adjust roll command knob on console as required to stop aileron movement.

9. Engage the altitude preselect and pitch engage buttons.

10. With the one end of the flex cable connected to the altitude selector and the other end disconnected from the console, rotate the altitude selector flex cable until the trim needle, located on the console, is centered and pitch servo movement is stopped.

11. Turn OFF all power.

12. Connect the flexible shaft to the console. It maybe necessary to rotate the altitude selector knob on the console slightly to assure a proper mesh of the shaft.

13. Connect the electrical connector CD-18 to the artificial horizon.

f. Make sure the altitude selector shaft is secured correctly to the console.

g. Secure the console and install and secure the face plate.

h. Install the roll command and altitude selector knobs.

3-34. REMOVAL OF AMPLIFIER. (PA-24-260 and PA-39.)

The amplifier is located on the rear radio shelf aft of the baggage area.

a. Remove the baggage area rear access panel.

b. Disconnect the electrical harness from the amplifier by removing the two knurled screws from the large amplifier connector and removing the amplifier connector from the amplifier.

c. Unfasten the two fasteners that secure the amplifier to the mounting bracket.

d. Remove the amplifier from the airplane.

3-35. INSTALLATION OF AMPLIFIER. (PA-24-260 and PA-39.) (Refer to Figure 3-21.)

a. With the large thirty pin receptacle facing forward, place the amplifier on the mounting bracket located on the rear radio shelf aft of the baggage area and secure with the two fasteners.

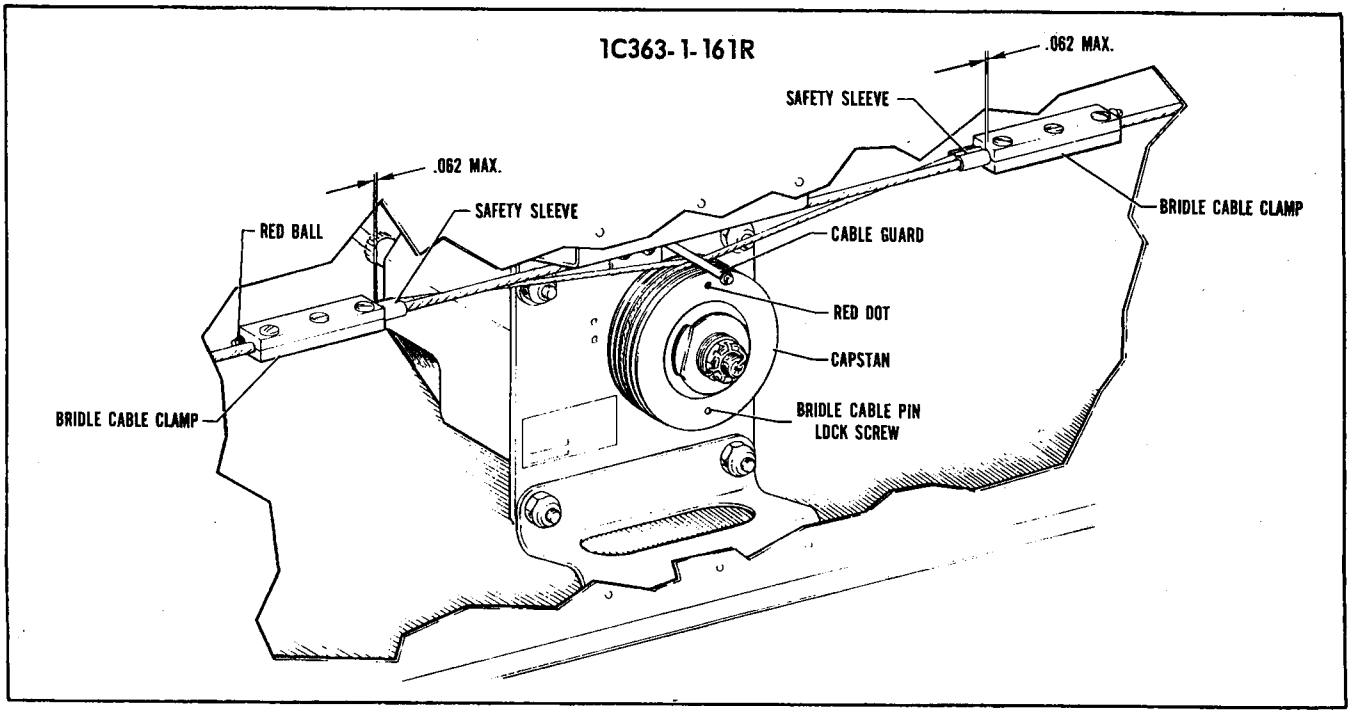

Figure 3-25. Roll Servo Installation, PA-24-260 and PA-39

b. With the cables from the harness fanning to the left side of the airplane, connect the harness to the amplifier by securing with the two screws previously removed from the receptacle.

c. Install the baggage area rear access panel.

3-36. REMOVAL OF ALTITUDE SELECTOR. (PA-24-260 and PA-39.)

The altitude selector is located behind the instrument panel, forward and to the right of the console.

a. Disconnect the flexible shaft from the altitude selector.

b. Disconnect the CD-10 Cable from the altitude selector.

c. Disconnect the static hose by releasing the clamp and sliding the hose off the port. To prevent contamination, place protective covers over the ends of the hose and the selector port.

d. Remove the screws securing the altitude selector to the mounting bracket.

e. Remove the altitude selector from the airplane.

3-37. INSTALLATION OF ALTITUDE SELECTOR. (PA-24-260 and PA-39.) (Refer to Figure 3-22.)

a. Position the altitude selector on the mounting bracket located behind the instrument panel, forward and to the right of the console. Secure the selector to the mounting bracket.

b. Remove any caps which have been placed over the ends of the hose and selector port.

c. Connect the hose from the rate of climb indicator to the port marked "static" on the selector. Secure with clamp.

d. Connect the CD-10 cable to the selector.

e. In order for the altitude preselect to be correct, the altitude selector must be calibrated. For these instructions, refer to Paragraph 3-33, e.

3-38. REMOVAL OF ROLL SERVO. (PA-24-260 and PA-39.)

The roll servo is located beneath the rear floor panel under the rear seats.

a. Remove the center and rear seats and center seat tracks.

b. Remove the seat belts and aft floor carpet.

c. Remove the two center floor panels aft of the main spar and the access plate in the aft portion of the left rear seat foot well.

d. Remove the aftmost access panel from the bottom of the fuselage.

e. Disconnect CD-47 electrical connection from the servo.

f. Remove the bottom two mounting bolts.

g. Remove and discard safety sleeves.

h. Paint the aileron balance cable where the bridle cable clamps are located and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red for reinstallation reference.)

i. Remove the two remaining bolts that secure the roll servo to the mounting bracket.

j. Remove the roll servo from the airplane.

3-39. INSTALLATION OF ROLL SERVO. (PA-24-260 and PA-39.) (Refer to Figure 3-25.)

a. Install bridle cable pin in capstan and tighten bridle cable pin lock screw.

b. Wrap the bridle cable one half turn each direction around the capstan from the bridle cable pin.

c. Adjust the cable guard on the servo to provide a gap of .031 of an inch between the capstan and guard.

d. Position the roll servo on the mounting bracket that is located beneath the center rear floor panel between the rear seat foot wells. Secure the servo with the previously removed bolts and nuts.

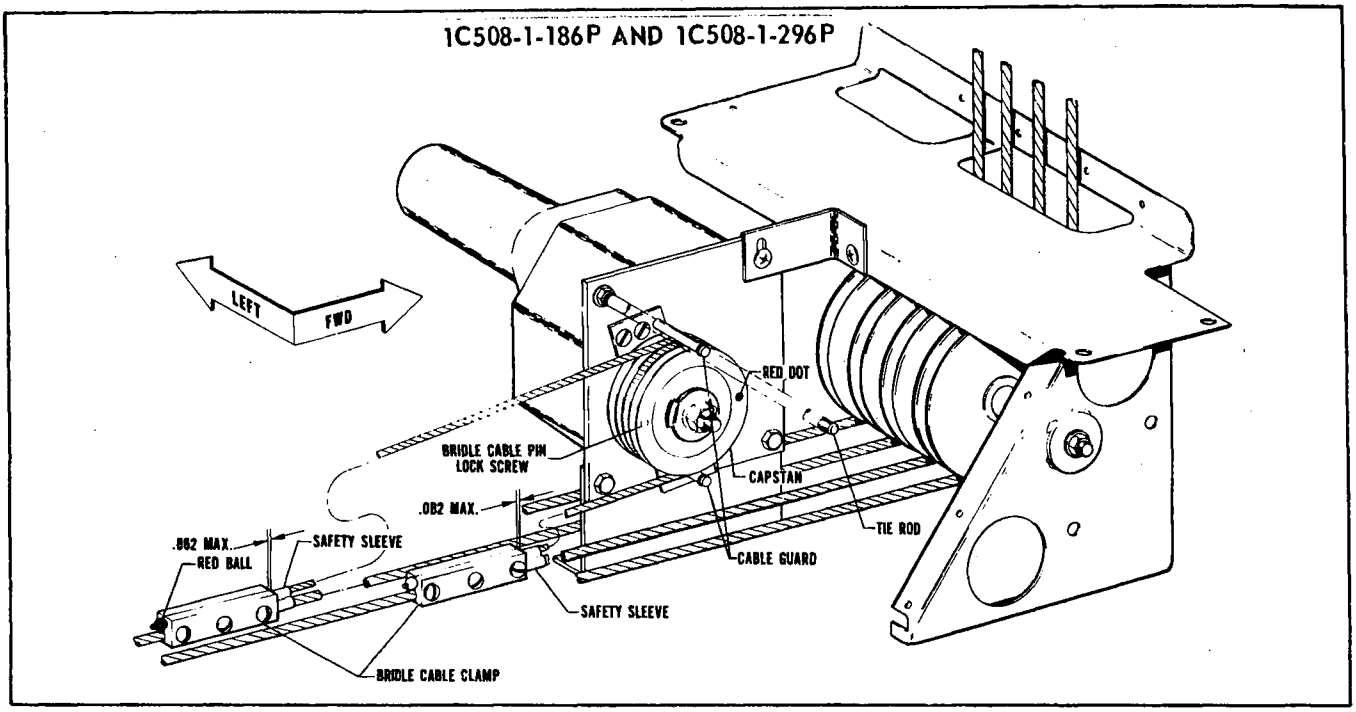

Figure 3-26. Pitch Servo Installation, PA-24-260 and PA-39

e. REFER TO FIGURE 3-13 AND CHECK THAT THE CONTROL CABLE TENSION (Z) IS ADJUSTED TO 26 ± 5 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the aileron balance cable. The bridle cable is drawn to the balance cable and attached with clamps at the previously painted locations on the balance cable. The end of the bridle cable with the red ball extends toward the left side of the airplane. (Refer to Figure 3-25.) (Should the balance cable not be painted, position the control wheel in neutral and the bridle cable pin, installed in the capstan, at 180 degrees from the balance cable.) Adjust the bridle cable clamps so the bridle cable tension (Y) is equal to the control cable tension between the bridle cable clamps (X) as shown in Figure 3-13 without increasing the control cable tension from the bridle cable clamps outward. At no time shall the bridle cable tension be greater than the control cable tension between the clamps. Adjusting the bridle cable tension will lower the control cable tension between the two bridle cable clamps. Torque the bridle cable clamp screws to 15 ± 1 inch-pounds.

f. Connect the electrical connection to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then turning the control wheel manually to the extreme left and right positions to ascertain the clamps and the pin do not change position. Next operate the servo electrically. To do this, turn on the master switch. Push in the roll engage button located on the lower left corner of the console and all other buttons to the out position. Rotate the roll command knob to its complete left and right. To ascertain the clamps and pin do not change position, examine the bridle cable. The clutch will slip during these operations.

g. Install a safety sleeve (P/N 26100-00) at both bridle cable clamps. (Refer to Figure 3-2.) Installation of safety sleeves to be accomplished with "Water Pump" type pliers with a handle length no less than 6" or more than 8" to insure proper compression of the safety sleeves.

h. Install center and rear seats and center seat tracks. Install the floor carpet and seat belts.

i. Install the access panel on the bottom of the fuselage.

3-40. REMOVAL OF PITCH SERVO. (PA-24-260 and PA-39.)

The pitch servo is located beneath the left forward floor panel to the left of the nose wheel well.

a. Remove right front seat from seat rails by removing track stop caps.

b. Remove pilot's seat, seat rails and lay back the left forward floor carpet.

c. Remove the left floor panels forward of the main spar.

d. Disconnect electrical connection from the servo.

e. Remove and discard safety sleeves.

f. Paint the stabilator control cable where the bridle cable clamps are located and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red for reinstallation reference.)

g. Remove outboard nut and loosen inboard bulkhead nut on tie rod at wheel well bulkhead and slide tie rod inboard to clear servo mounting plate.

h. Remove three bolts that secure the servo to the mounting brackets.

i. Remove the pitch servo from the airplane.

3-41. INSTALLATION OF PITCH SERVO. (PA-24-260 and PA-39.) (Refer to Figure 3-26.)

a. Install bridle cable pin in capstan and tighten bridle cable pin lock screw.

b. Wrap the bridle cable 3/4 of a turn in each direction around the capstan from the bridle cable pin.

c. Adjust the cable guards on the servo to provide a gap of .031 of an inch between the capstan and guard.

d. Position the pitch servo on the mounting brackets beneath the left forward floor panel to the left of the nose wheel well. Secure the servo to the mounting brackets and slide the tie rod through the servo mounting plate and adjust so the servo is parallel to the control cables.

e. REFER TO FIGURE 3-14 AND CHECK THAT CONTROL CABLE TENSION (Z) IS ADJUSTED TO 18 ± 3 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the stabilator control cable. The bridle cable is drawn to the stabilator cable and attached with clamps at the previously painted locations on the stabilator cable. The end of the bridle cable with the red ball is attached to the outboard (left) control cable. (Refer to Figure 3-26.) (Should the balance cable not be painted, position the control wheel midway between stops (fore and aft) and the bridle cable pin, installed in the capstan, aligned as shown in Figure 3-26.) The red dot on the capstan and the bridle cable set screw should horizontally align. Block the stabilator in the neutral position. Adjust the bridle cable clamps so that the bridle cable tension (Y) and the control cable tension is equal to each other forward (X) of the bridle cable clamps as shown in Figure 3-14. At no time should the bridle cable tension be greater than the control cable tension forward of the bridle cable clamps. Adjusting the bridle cable tension will lower the control cable tension forward of the bridle cable clamps. Torque the bridle cable clamp screws to 15 ± 1 inch-pounds.

f. Connect the electrical connection to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then moving the control wheel manually to the extreme fore and aft positions to ascertain the clamps do not change position. Next operate the servo electrically. To do this, turn on the master switch, push the roll engage button and the pitch ON/OFF button to their "IN" positions; all other buttons should be in the "OUT" position. Rotate the pitch command disk full up and down. To ascertain the clamps and the pin do not change position, examine the bridle cable. The clutch will slip during these operations.

g. Install a safety sleeve (P/N 26100-00) at forward bridle cable clamp. (Refer to Figure 3-2.) Installation of safety sleeves to be accomplished with "Water Pump" type pliers with a handle length no less than 6" or more than 8" to insure proper compression of the safety sleeves.

h. Install floor panels, carpet, seat rails and seats.

NOTE

On PA-39 airplanes, upon completion of pitch servo installation, the stabilator system must be checked for frictional resistance. Refer to the PA-39 Airframe Service Manual for this test procedure.

3-42. REMOVAL OF CONSOLE. (PA-31, PA-31-350 and PA-31P.)

The console is located in the top of the control quadrant pedestal.

a. Rotate the altitude selector knob full down to position the altitude dial to the end of its travel to avoid changing the calibration of the altitude selector.

b. Remove the roll command and altitude selector knobs.

c. Remove the two screws securing the face plate and remove face plate.

d. Remove the console retaining screw. It is the screw located directly below the HDG. button on the console.

e. Remove the largest access plate from the right side of the control pedestal.

f. Disconnect the electrical harness plugs CD-20 and CD-40 also the flexible shaft from the rear of the console.

g. Remove the console from the airplane.

3-43. INSTALLATION OF CONSOLE. (PA-31, PA-31-350 and PA-31P.) (Refer to Figure 3-20.)

a. Place the console in the cutout in the top of the control quadrant pedestal.

b. Connect the electrical harness plugs, CD-20 and CD-40, to the rear of the console. (Make sure spring clips on CD-20 are secured.)

c. Ascertain the altitude selector knob on the console being installed is rotated full down to position the altitude dial to the end of its travel.

d. Verify the altitude selector flex cable was not disturbed and proceed to step f. If unable to verify altitude selector flex cable was not disturbed proceed to next step.

e. Calibrate the altitude selector by the following procedure:

1. Obtain an accurate altimeter reading from an FAA source and set the airplane's altimeter to agree with this reading.

2. Verify the altimeter meets FAA Part 43 - Appendix E requirements. If altimeter does not meet FAA specifications, replace it or have it repaired before attempting to calibrate the AltiMatic III B-1 altitude preselect function.

3. Disconnect electrical connector CD-18 from the artificial horizon.

4. Set 29.92 inches and/or 1013 millibars in the altimeter window to obtain pressure altitude reading on altimeter.

5. With the console disconnected from the altitude selector shaft find the mid point of the calibration range on the white plastic calibration dial. (Calibration dial travel is approximately 3000 ft., mid point is approximately 1500 ft. from either end of travel.)

6. Rotate the altitude selector knob on the console to set the calibration dial reading to the PRESSURE ALTITUDE given on the altimeter.

7. Turn the power on.

8. Engage the Roll Engage Switch and adjust roll command knob on console as required to stop aileron movement.

9. Engage the altitude preselect and pitch engage buttons.

10. With the one end of the flex cable connected to the altitude selector and the other end disconnected from the console, rotate the altitude selector flex cable until the trim needle, located on the console, is centered and pitch servo movement is stopped.

11. Turn OFF all power.

12. Connect the flexible shaft to the console. It maybe necessary to rotate the altitude selector knob on the console slightly to assure a proper mesh of the shaft.

13. Connect the electrical connector CD-18 to the artificial horizon.

f. Make sure the altitude selector shaft is secured correctly to the console.

g. Secure the console and install and secure the face plate.

h. Install the roll command and altitude selector knobs.

i. Install the access plate on the right side of the pedestal and secure.

3-44. REMOVAL OF AMPLIFIER. (PA-31, PA-31-350 and PA-31P.)

(PA-31 and PA-31-350 only.) Access to the amplifier is through the forward baggage compartment. The amplifier is located on the right side of the bulkhead over the radio shelf as viewed from the baggage compartment door. (PA-31P only.) Access to the amplifier is through the right access plate on the nose section. The amplifier is mounted on a bracket on the nose wheel well.

a. If a screen is installed over the opening to the radio shelf, remove it by removing the tow bar from its bracket and removing the screws which secure the screen.

b. (PA-31P only.) Remove the screws securing the right access plate on the nose section.

c. If the airplane is equipped with a King DME, it will be necessary to remove the KDM-700 receiver from its mounting bracket which is directly in front of the AltiMatic III B-1 Amplifier. The King receiver is removed by removing all wiring connections and loosening the two knurled nuts.

d. Disconnect the electrical harness from the amplifier by removing the two knurled screws from the large amplifier connector and removing the amplifier connector from the amplifier.

e. Unfasten the two fasteners that secure the amplifier to the mounting bracket.

f. Remove the amplifier from the airplane.

3-45. INSTALLATION OF AMPLIFIER. (PA-31, PA-31-350 and PA-31P.) (Refer to Figure 3-21.)

a. With the large thirty pin receptacle facing inboard, place the amplifier on the mounting bracket and secure with the two fasteners.

b. (PA-31P only.) With the large thirty pin receptacle facing forward, place the amplifier on the mounting bracket over the nose wheel well and secure with appropriate screws.

c. With the cables from the harness fanning downward, connect the harness to the amplifier by securing with the two screws previously removed from the receptacle.

d. If the airplane has a King DME installed, place the KDM-700 receiver on its mounting bracket and secure with the knurled nuts. Connect the electrical and antenna connections.

e. (PA-31P only.) Install the right access panel on the nose section and secure with appropriate screws.

f. If previously installed, install the screen over the opening to the radio shelf.

3-46. REMOVAL OF ALTITUDE SELECTOR. (PA-31 and PA-31-350.)

The altitude selector is located on the bottom of the instrument panel directly in front of the control pedestal. For disconnecting of the connections, it is recommended that access be from the right side of the pedestal.

a. Disconnect the flexible shaft from the altitude selector. It is advisable to place tape around the shaft to prevent the locking ring from sliding down into the pedestal, making it difficult to reach for reinstallation.

b. Disconnect the CD-10 Cable from the altitude selector.

c. Disconnect the static hose by releasing the clamp and sliding the hose off the port. To prevent contamination, place protective covers over the ends of the hose and the selector port.

d. Remove the four nuts which secure the altitude selector to the mounting bracket.

e. The altitude selector is removed from the airplane by the following procedure.

1. If the airplane is equipped with radar, remove the indicator. The indicator is held in place by two bands. Remove these bands by loosening the screws which secure them. Disconnect the electrical connection from the rear of the indicator. If radar is not installed, there is a cover located directly in front of the pedestal on the instrument panel. Draw this cover off the instrument panel.

2. Remove the altitude selector by moving it forward and then bringing it out through the radar indicator opening.

3-47. INSTALLATION OF ALTITUDE SELECTOR. (PA-31 and PA-31-350.) (Refer to Figure 3-22.)

Place the altitude selector in the instrument panel through the opening where the radar indicator is located.

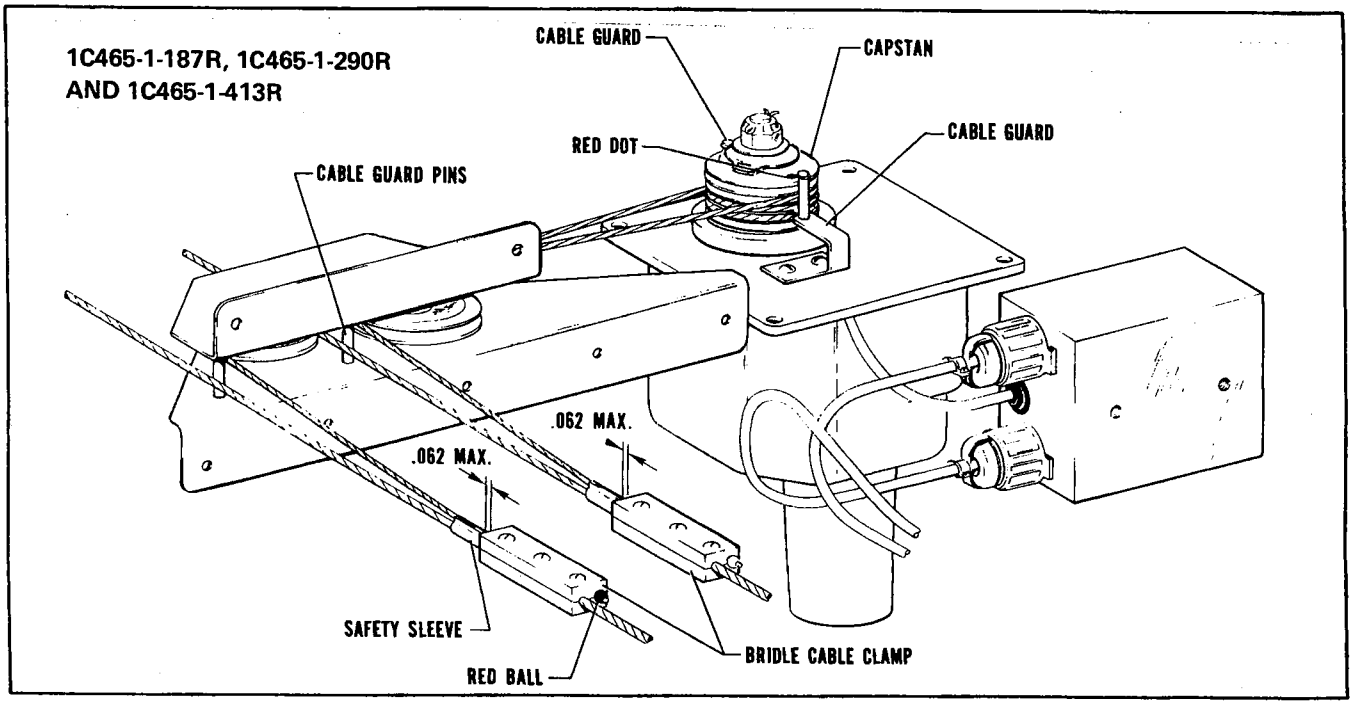

Figure 3-27. Roll Servo Installation, PA-31, PA-31-350 and PA-31P

a. Position the altitude selector on the mounting bracket so the static port of the altitude selector is toward the left side of the airplane.

b. Secure the altitude selector with the four nuts previously removed.

c. Remove any caps which may have been placed over the ends of the hose and selector port.

d. Connect the hose from the rate of climb indicator to the port marked "static" on the selector. Secure with clamp.

e. Connect the CD-10 Cable.

f. In order for the altitude preselect to be correct, the altitude selector must be calibrated. For these instructions, refer to Paragraph 3-25, e.

g. When the altitude selector is calibrated, secure the flexible shaft to the altitude selector with the locking ring.

h. Install the radar indicator or the cover over the opening in the instrument panel.

3-48. REMOVAL OF ALTITUDE SELECTOR. (PA-31P.)

The altitude selector is located in the lower right side of the control pedestal.

a. Remove the access plates from both the left and right side of the control pedestal.

b. Disconnect the flexible shaft from the altitude selector.

c. Disconnect the CD-10 Cable from the altitude selector.

d. Disconnect the static hose by releasing the clamp and sliding the hose off the port. To prevent contamination, place protective covers over the ends of the hose and the selector port.

e. Remove the four screws or nuts which secure the altitude selector to the mounting bracket.

f. Remove the altitude selector from the control pedestal by lowering it out through the upper right access hole of the control pedestal.

3-49. INSTALLATION OF ALTITUDE SELECTOR. (PA-31P.) (Refer to Figure 3-12.)

a. Place the altitude selector in the pedestal through the upper right access hole in the pedestal. Position the altitude selector on the mounting bracket and secure with the four screws or nuts previously removed.

b. Remove any caps which may have been placed over the ends of the hose and selector port. Connect the hose to the static port of the altitude selector.

c. Connect the CD-10 Cable.

d. In order for the altitude preselect to be correct, the altitude selector must be calibrated. For these instructions, refer to Paragraph 3-43, e.

e. Install the access plates on both sides of the control pedestal and secure with attaching screws.

3-50. REMOVAL OF ROLL SERVO. (PA-31, PA-31-350 and PA-31P.)

The roll servo is located beneath the center floor panel directly behind the main wing spar.

a. Remove passenger seats from left side of the airplane.

b. Remove carpet from over the center floor panel and left floor panel directly behind the main spar.

c. (PA-31 and PA-31-350 only.) Remove screws securing center floor panel and left forward floor panel and remove floor panels. (PA-31P only.) Remove screws securing center forward floor panel and left forward floor panel and remove panels. Handle panels carefully to avoid damaging sealing gaskets.

d. Disconnect the electrical connection from the roll servo.

e. Remove and discard safety sleeves.

f. Paint the aileron cables where the bridle cable clamps are located and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red for reinstallation reference.)

g. Remove the four cable guard pins next to the bridle cable pulleys.

h. Remove the four bolts that secure the roll servo to the mounting bracket.

i. Remove the roll servo from the airplane.

3-51. INSTALLATION OF ROLL SERVO. (PA-31, PA-31-350 and PA-31P.) (Refer to Figure 3-27.)

a. Install bridle cable pin in capstan and tighten bridle cable pin lock screw.

b. Wrap the short end of the bridle cable one full turn counterclockwise from the pin on the lower capstan grooves and the long end of the bridle cable with the red ball one and one-half turns clockwise on the upper capstan grooves.

c. Adjust the cable guard on the servo to provide a gap of .031 of an inch between the capstan and guard.

d. Position the roll servo on the mounting bracket located beneath the center floor panel directly behind the main spar. Secure the servo to the mounting bracket.

e. REFER TO FIGURE 3-13 AND CHECK THAT THE CONTROL CABLE TENSION IS ADJUSTED TO 35 ± 2 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the aileron control cables. The bridle cable is drawn around pulleys to the aileron control cables and attached with clamps at the previously painted locations on the control cables. The end of the bridle cable with the red ball attaches to the left aileron cable. (Refer to Figure 3-27.) (Should the aileron cables not be painted, position the control wheel in neutral and the bridle cable pin, installed in the capstan, with the red dot aligned as shown in Figure 3-27.) Adjust the bridle cable clamps so that the bridle cable tension (Y) as shown in Figure 3-13 is 10 ± 1 pounds. Check the control cable tension forward of the bridle cable clamps and adjust, if necessary, to obtain 35 ± 2 pounds. If aileron cables require adjustment, it will be necessary to readjust the bridle cable tension to 10 ± 1 pounds. Torque the bridle cable clamp screws to 15 ± 1 inch-pounds. (When control wheel is in neutral position, bridle cable clamps should be parallel.)

f. Install the four cable guard pins at the bridle cable pulleys.

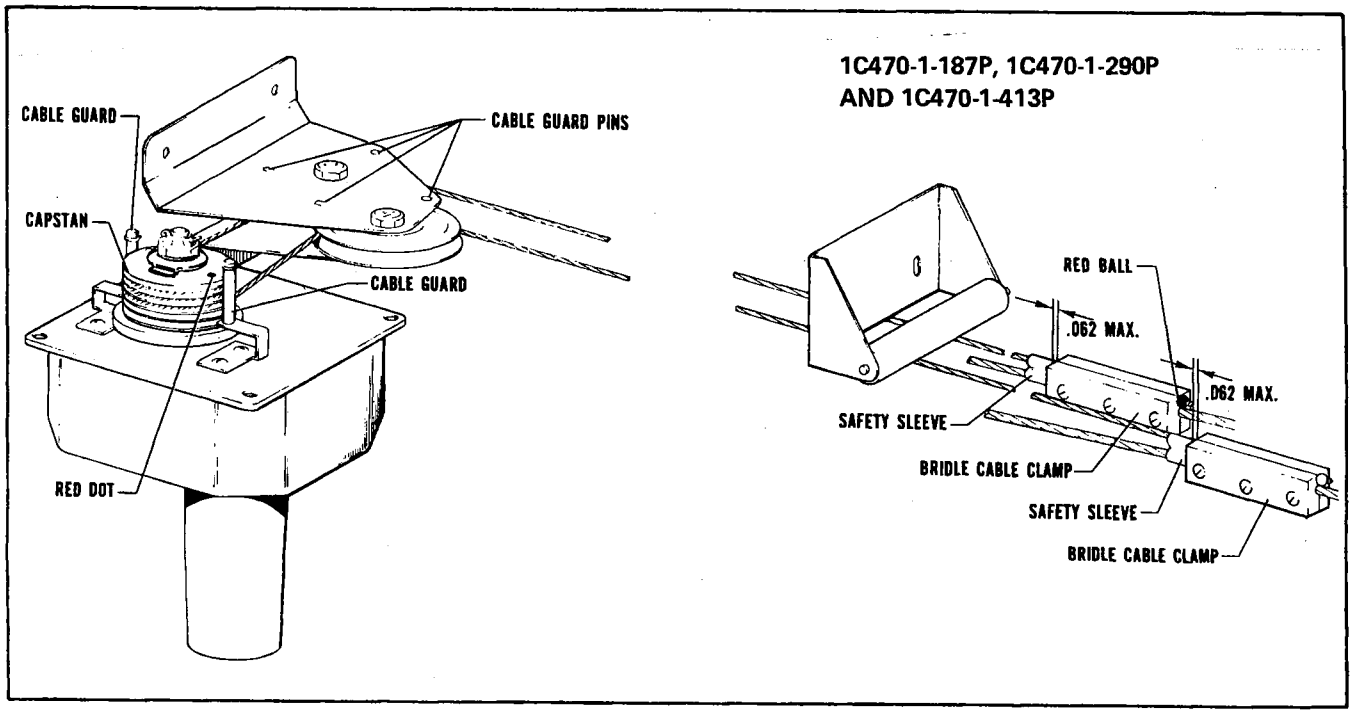

Figure 3-28. Pitch Servo Installation, PA-31, PA-31-350 and PA-31P

g. Connect the electrical connection to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then turning the control wheel manually to the extreme left and right positions to ascertain the clamps and the pin do not change position. Next, operate the servo electrically. To do this, turn on the master switch. Push in the roll engage button located on the lower left corner of the console and all other buttons to the out position. Rotate the roll command knob to its complete left and right. To ascertain the clamps and pin do not change position, examine the bridle cable. The clutch will slip during these operations.

h. Install a safety sleeve (P/N 26100-02) at both bridle cable clamps. (Refer to Figure 3-2.) Installation of safety sleeves to be accomplished with "Water Pump" type pliers with a handle length no less than 6" or more than 8" to insure proper compression of the safety sleeves.

i. (PA-31 and PA-31-350 only.) Install center floor panel and left forward floor panel and secure with appropriate screws.

j. (PA-31P only.) Ascertain that floor panel sealing gaskets are clean and undamaged prior to installation of panels. Install center forward floor panel and left forward floor panel and tighten all screws evenly around panels to prevent cabin pressure leaks.

k. Install carpets and seats previously removed in passenger section.

3-52. REMOVAL OF PITCH SERVO. (PA-31, PA-31-350 and PA-31P.)

The pitch servo is located beneath the center floor panel in the PA-31, PA-31-350 and beneath the aft section of center floor panel in the PA-31P.

a. Remove the carpet from over center floor panel.

b. (PA-31 and PA-31-350 only.) Remove screws securing center floor panel and remove panel from the airplane.

c. (PA-31P only.) Remove screws securing aft center floor panel in passenger section and center floor panel in entrance area and remove panels. Handle panels carefully to avoid damaging sealing gaskets.

d. Disconnect the electrical connection from the pitch servo.

e. Remove and discard safety sleeves.

f. Paint the elevator cables where the bridle cable clamps are located and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red for reinstallation reference.)

g. Remove the four bolts that secure the pitch servo to the mounting bracket.

h. (PA-31P only.) Remove the two bolts securing the pitch servo to the forward mounting bracket and the bolts securing the pitch servo and rear mounting bracket to the airplane.

i. (PA-31P only.) Remove the rear bracket from the pitch servo and remove the pitch servo from the airplane.

j. Remove the pitch servo from the airplane.

3-53. INSTALLATION OF PITCH SERVO. (PA-31, PA-31-350 and PA-31P.) (Refer to Figure 3-28.)

a. Install bridle cable pin in capstan and tighten bridle cable pin lock screw.

b. Wrap the long end of the bridle cable one and one-half turns counterclockwise from the pin on the lower capstan grooves and the short end of the bridle cable with the red ball one full turn clockwise on the upper capstan grooves.

c. Adjust the cable guards on the servo to provide a gap of .031 of an inch between the capstan and guard.

d. (PA-31 and PA-31-350 only.) Position the pitch servo on the mounting bracket located beneath the center floor panel. Secure the servo with the previously removed bolts and nuts.

e. (PA-31P only.) Install rear mounting bracket on the airplane bulkhead and secure.

f. (PA-31P only.) Position the pitch servo on the mounting brackets and secure with appropriate bolts and nuts.

g. REFER TO FIGURE 3-14 AND CHECK THAT CONTROL CABLE TENSION (X) IS ADJUSTED TO 25 ± 2 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the elevator control cables. The bridle cable is drawn around pulleys to the elevator control cables and attached with clamps at the previously painted locations on the control cables. The end of the bridle cable with the red ball attaches to the right elevator cable. (Refer to Figure 3-28.) (Should the elevator cable not be painted, position the elevator in neutral and the bridle cable pin, installed in the capstan, with the red dot aligned as shown in Figure 3-28.) Adjust the bridle cable clamps so that the bridle cable tension (Y) as shown in Figure 3-14 is 9 ± 1 pounds. Check the control cable tension forward of the bridle cable clamps and adjust, if necessary, to obtain 25 ± 2 pounds. If the control cables require adjustment, it will be necessary to readjust the bridle cable tension to 9 ± 1 pounds. Torque the bridle cable clamp screw to 15 ± 1 inch-pounds.

h. Install the four cable guard pins at the bridle cable pulleys.

i. Connect the electrical connection to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then move the control wheel manually to the extreme fore and aft positions to ascertain the clamps do not change position. Next operate the servo electrically. To do this, turn on the master switch, push the roll engage button and the pitch ON/OFF button to their "IN" positions. All other buttons should be in the "OUT" position. Rotate the pitch command disk full up and down. To ascertain the clamps and the pin do not change position, examine the bridle cable. The clutch will slip during these operations.

j. Install a safety sleeve (P/N 26100-00) at both bridle cable clamps. (Refer to Figure 3-2.) Installation of safety sleeves to be accomplished with "Water Pump" type pliers with a handle length no less than 6" or more than 8" to insure proper compression of the safety sleeves.

k. (PA-31 and PA-31-350 only.) Install center floor panel and secure with appropriate screws.

l. (PA-31P only.) Ascertain that floor panel sealing gaskets are clean and undamaged prior to installation of panels. Install aft center floor panel in passenger section and center panel in entrance area and tighten all screws evenly around panel to prevent cabin pressure leaks.

m. Install carpet and secure.

NOTE

With pitch servo installation completed, the stabilator system must be checked for frictional resistance. Depending on airplane being serviced, refer to either the PA-31, PA-31-350 or PA-31P Airframe Service Manual for this test procedure.

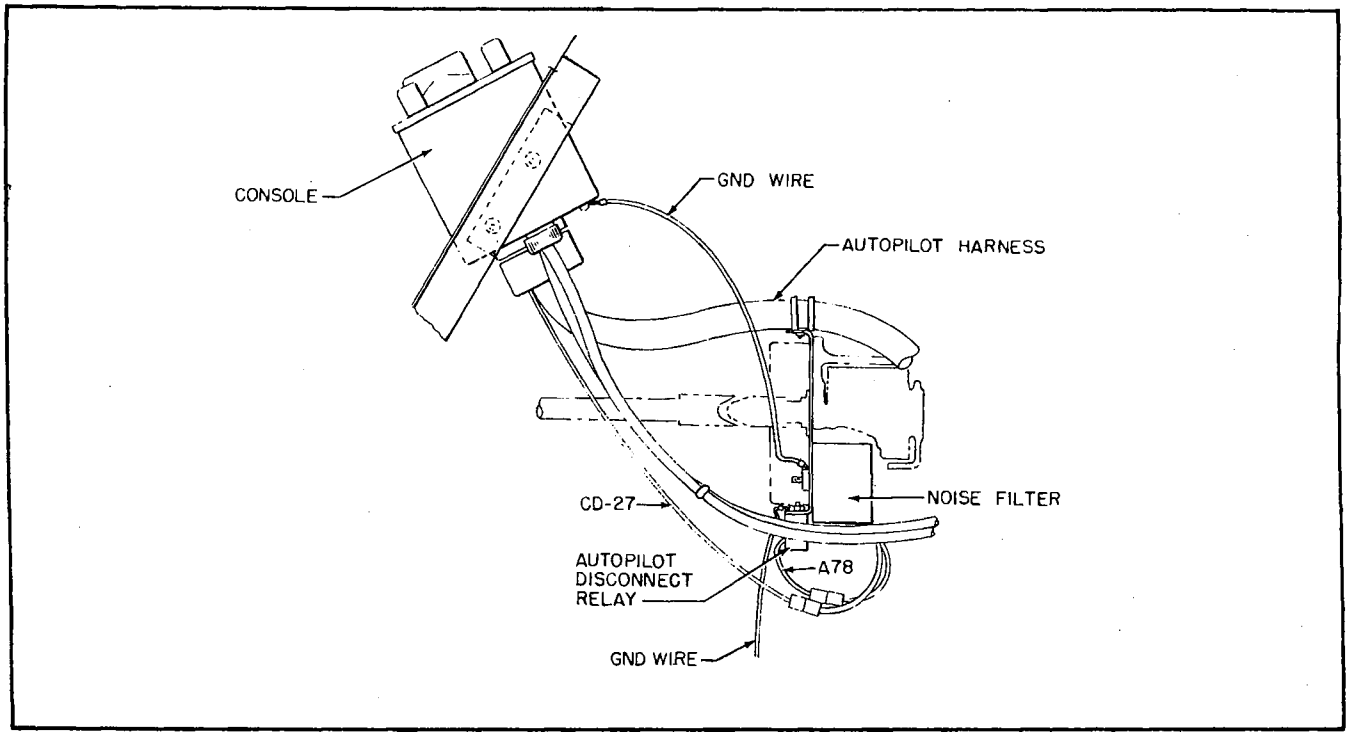

Figure 3-28a. Autopilot Disconnect Relay Location (PA-31)

3-53a. REMOVAL OF AUTOPILOT DISCONNECT RELAY. (PA-31)

The Autopilot Disconnect Relay is located in the control pedestal attached to the aileron trim drum mounting bracket.

a. Remove the access plates from both the left and right side of the control pedestal.
b. Locate the relay and disconnect all electrical connections to the relay, except the ground wire.
c. Remove ground wire which is attached to the relay mounting stud by removing nut.
d. Remove relay.

3-53b. INSTALLATION OF ATUOPILOT DISCONNECT RELAY. (PA-31)

a. Position relay at appropriate place on aileron trim drum mounting bracket and place ground wire on mounting stud. Secure with appropriate nut.
b. Reconnect all electrical connectors previously removed.
c. Attach access plates and secure.

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3-54. REMOVAL OF CONSOLE. (PA-34-200.)

The console is located in the lower left side of the instrument panel.

a. Rotate the altitude selector knob full down to position the altitude dial to the end of its travel to avoid changing the calibration of the altitude selector.

b. Remove the roll command and altitude selector knobs.

c. Remove the two screws securing the face plate and remove face plate.

d. Remove the console retaining screw. It is the screw located directly below the HDG. button on the console.

e. Disconnect the electrical harness plugs CD-20 and CD-40 also the flexible shaft from the rear of the console.

f. Remove the console from the airplane.

3-55. INSTALLATION OF CONSOLE. (PA-34-200.) (Refer to Figure 3-20.)

a. Place the console in the instrument panel cutout.

b. Connect the electrical harness plugs, CD-20 and CD-40, to the rear of the console. (Make sure spring clips on CD-20 are secured.)

c. Ascertain the altitude selector knob on the console being installed is rotated full down to position the altitude dial to the end of its travel.

d. Verify the altitude selector flex cable was not disturbed and proceed to step f. If unable to verify altitude selector flex cable was not disturbed proceed with next step.

e. Calibrate the altitude selector by the following procedure:

1. Obtain an accurate altimeter reading from an FAA source and set the airplane's altimeter to agree with this reading.

2. Verify the altimeter meets FAA Part 43 - Appendix E requirements. If altimeter does not meet FAA specifications, replace it or have it repaired before attempting to calibrate the AltiMatic III B-1 altitude preselect function.

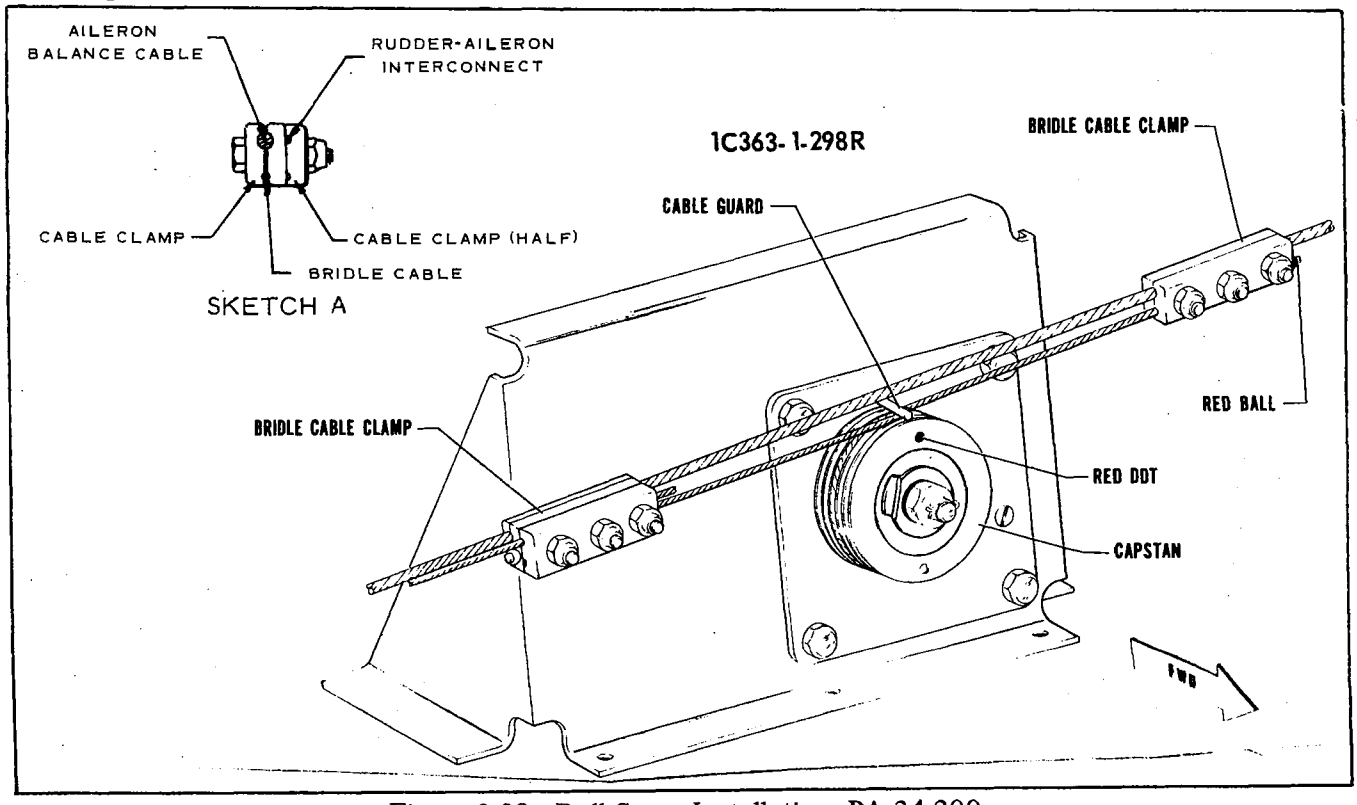


Figure 3-29. Roll Servo Installation, PA-34-200

3. Disconnect electrical connector CD-18 from the artificial horizon.

4. Set 29.92 inches and/or 1013 millibars in the altimeter window to obtain pressure altitude reading on altimeter.

5. With the console disconnected from the altitude selector shaft, find the mid point of the calibration range on the white plastic calibration dial. (Calibration dial travel is approximately 3000 ft., mid point is approximately 1500 ft. from either end of travel.)

6. Rotate the altitude selector knob on the console to set the calibration dial reading to the PRESSURE ALTITUDE given on the altimeter.

7. Turn the power on.

8. Engage the Roll Engage Switch and adjust roll command knob on console as required to stop aileron movement.

9. Engage the altitude preselect and pitch engage buttons.

10. With the one end of the flex cable connected to the altitude selector and the other end disconnected from the console, rotate the altitude selector flex cable until the trim needle, located on the console, is centered and pitch servo movement is stopped.

11. Turn OFF all power.

12. Connect the flexible shaft to the console. It maybe necessary to rotate the altitude selector knob on the console slightly to assure a proper mesh of the shaft.

13. Connect the electrical connector CD-18 to the artificial horizon.

f. Make sure the altitude selector shaft is secured correctly to the console.

g. Secure the console and install and secure the face plate.

h. Install the roll command and altitude selector knobs.

3-56. REMOVAL OF AMPLIFIER. (PA-34-200.)

The amplifier is located on the right side of the bulkhead aft of the main spar beneath the floor panel under the right center seat.

a. Remove the center seats from the airplane.

b. Remove the floor panel directly behind the main spar by removing the seat belts and screws. Remove the floor panel from the airplane.

c. Disconnect the electrical harness from the amplifier by removing the two knurled screws from the large amplifier connector and removing the amplifier connector from the amplifier.

d. Unfasten the two fasteners that secure the amplifier to the mounting bracket.

e. Remove the amplifier from the airplane.

3-57. INSTALLATION OF AMPLIFIER. (PA-34-200.) (Refer to Figure 3-21.)

a. With the large thirty pin receptacle facing inboard, place the amplifier on the mounting bracket located on the bulkhead aft of the main spar and secure with the fasteners.

b. With the cables from the harness fanning upward, connect the harness to the amplifier by securing with the two screws previously removed from the receptacle.

c. Install the floor panel, seat belts and seats.

3-58. REMOVAL OF ALTITUDE SELECTOR. (PA-34-200.)

The altitude selector is located beneath the instrument panel, directly forward of the console.

a. Access to the altitude selector is from underneath the instrument panel.

b. Disconnect the flexible shaft from the altitude selector.

c. Disconnect the CD-10 cable from the altitude selector.

d. Disconnect the static air hose by releasing the clamp and sliding the hose off of the selector port. To prevent contamination, place protective covers over the end of the hose and the selector port.

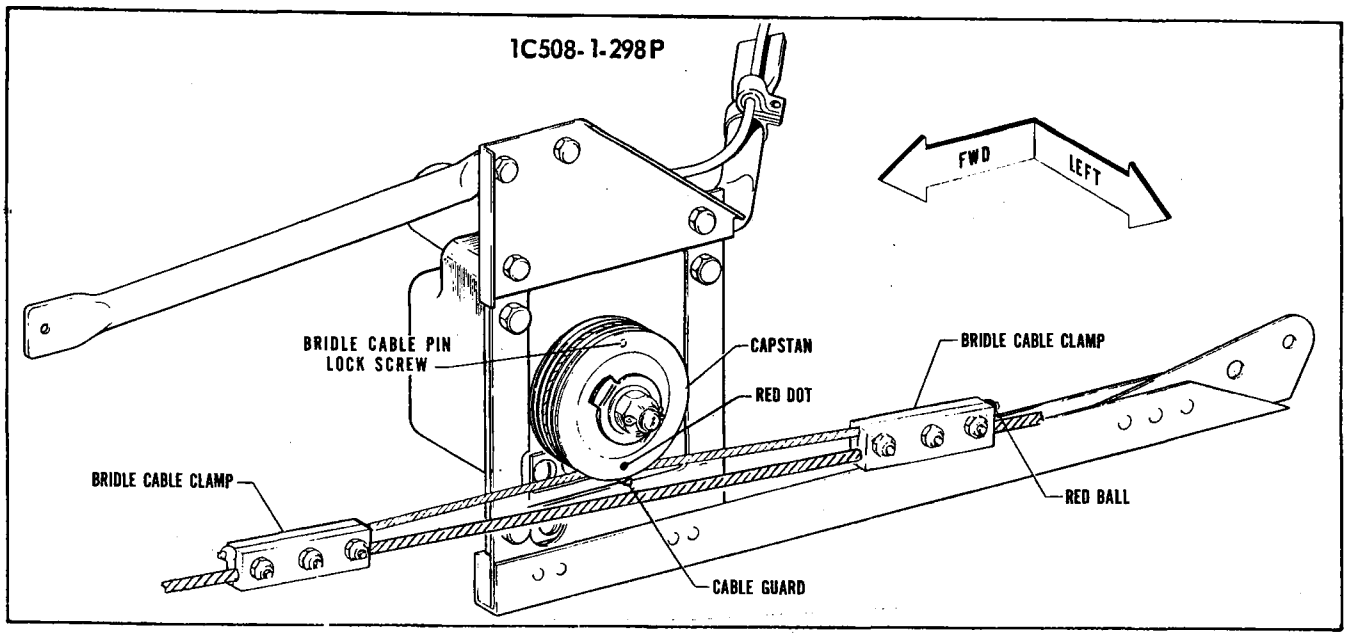


Figure 3-30. Pitch Servo Installation, PA-34-200

e. Remove the nuts securing the altitude selector to the mounting bracket.
f. Remove the altitude selector from the airplane.

3-59. INSTALLATION OF ALTITUDE SELECTOR. (PA-34-200.) (Refer to Figure 3-22.)

a. Position the altitude selector on the mounting bracket located forward of the console beneath the instrument panel. Secure the selector to the mounting bracket.
b. Remove any caps which have been placed over the ends of the hose and selector port.
c. Connect the hose from the rate of climb indicator to the port marked "static" and secure.
d. Connect the CD-10 cable to the selector.
e. In order for the altitude preselect to be correct, the altitude selector must be calibrated. For these instructions, refer to Paragraph 3-55, e.

3-60. REMOVAL OF ROLL SERVO. (PA-34-200.)

The roll servo is located under the left center seat.

a. Remove the center seats from the airplane.
b. Remove the floor panel directly behind the main spar by removing seat belts and screws securing the panel. Remove the floor panel from the airplane.
c. Disconnect the electrical connection from the servo.
d. Paint the aileron balance cable where the bridle cable clamps are located and also the end of the rudder-aileron interconnect cable attached to the inboard bridle cable clamp with a half bridle cable clamp and remove the bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red for reinstallation reference.)
e. Remove the four bolts that secure the roll servo to the mounting bracket.
f. Remove the roll servo from the airplane.

3-61. INSTALLATION OF ROLL SERVO. (PA-34-200.) (Refer to Figure 3-29.)

a. Install bridle cable pin in capstan and tighten bridle cable pin lockscrew.
b. Wrap the bridle cable one half turn each direction around the capstan from the bridle cable pin.
c. Adjust the cable guard on the servo to provide a gap of .031 of an inch between the capstan and guard.

d. Position the servo on the mounting bracket located in the area beneath the floor aft of the main spar. Secure the servo with the previously removed bolts and nuts.

e. REFER TO FIGURE 3-13 AND CHECK THAT THE CONTROL CABLE TENSION (Z) IS ADJUSTED TO 40 +5 -0 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the aileron balance cable. The bridle cable is drawn to the balance cable and attached with clamps at the previously painted locations on the balance cables. The longest portion of the bridle cable or the end with the red ball extends outboard toward the left side of the airplane. (Refer to Figure 3-29.) (Should the balance cable not be painted, position the control wheel in neutral and the bridle cable pin, installed in the capstan, at 180 degrees from the balance cable.) The rudder-aileron interconnect cable is attached to the inboard bridle cable clamp by the addition of a half of a bridle cable clamp. (Refer to Figure 3-29, Sketch A.) Adjust the bridle cable clamps so the bridle cable tension (Y) is equal to the control cable tension between the bridle cable clamps (X) as shown in Figure 3-13 without increasing the control cable tension from the bridle cable clamps outward. At no time shall the bridle cable tension be greater than the control cable tension between the clamps. Adjusting the bridle cable tension will lower the control cable tension between the two bridle cable clamps. Torque the bridle cable clamp nuts to 55 +5 -0 inch-pounds.

f. Connect the electrical connections to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then turning the control wheel manually to the extreme left and right positions to ascertain the clamps and the pin do not change position. Next operate the servo electrically. To do this, turn on the master switch. Push in the roll engage button located on the lower left corner of the console and all other buttons to the out position. Rotate the roll command knob to its complete left and right. To ascertain the clamps and pin do not change position, examine the bridle cable. The clutch will slip during these operations.

g. Install the floor panel, seat belts and seats.

3-62. REMOVAL OF PITCH SERVO. (PA-34-200.)

The pitch servo is located beneath the floor panel under the center set of seats.

a. Remove the center seats.

b. Remove the floor panel directly behind the main spar by removing the seat belts and screws. Remove the floor panel from the airplane.

c. Disconnect the electrical connection from the servo.

d. Paint the stabilator control cable where the bridle cable clamps are located and then remove the two bridle cable clamps. (DO NOT paint the bridle cable end terminals as one terminal is painted red for reinstallation reference.)

e. Remove the four bolts that secure the pitch servo to the mounting bracket.

f. Remove the pitch servo from the airplane.

3-63. INSTALLATION OF PITCH SERVO. (PA-34-200.) (Refer to Figure 3-33.)

a. Install bridle cable pin in capstan and tighten bridle cable pin lock screw.

b. Wrap the bridle cable one half turn each direction around the capstan from the bridle cable pin.

c. Adjust the cable guard on the servo to provide a gap of .031 of an inch between the capstan and guard.

d. Position the pitch servo on the mounting bracket located in the area beneath the floor aft of the main spar. Secure the servo with the previously removed bolts and nuts.

e. REFER TO FIGURE 3-14 AND CHECK THAT THE CONTROL CABLE TENSION (Z) IS ADJUSTED TO 40 +5 -0 POUNDS PRIOR TO ATTACHING THE BRIDLE CABLE CLAMPS. Ascertain area on cable where clamp attaches is clean, dry and free of all lubricants and anti-corrosive additives. Attach the bridle cable to the stabilator control cable. The bridle cable is drawn to the right stabilator control cable and attached with clamps at the previously painted locations on the control cable. The longest portion of the bridle cable or the end with the red ball extends aft. (Refer to Figure 3-30.) (Should the balance cable not be painted, place the control wheel midway between stops (fore and aft) and position the capstan pulley so that the bridle cable pin will be located 180 degrees (pin up) from the control cable.) Adjust the bridle cable clamps so the bridle cable tension Y is equal to the control cable tension between the bridle cable clamps (X) as shown in Figure 3-14 without increasing the control cable tension from the bridle cable clamps outward. At no time shall the bridle cable tension be greater than the control cable tension between the clamps. Adjusting the bridle cable tension will lower the control cable tension between the two bridle cable clamps. Torque the bridle cable clamp nuts to 55 $\pm$ 5 inch-pounds.

f. Connect the electrical connection to the servo.

CAUTION

Check security of bridle cable clamps and the bridle cable capstan pin by first engaging the servo and then moving the control wheel manually to the extreme fore and aft positions to ascertain the clamps do not change position. Next operate the servo electrically. To do this, turn on the master switch, push the roll engage button and the pitch ON/OFF button to their "IN" position. All other buttons should be in the "OUT" position. Rotate the pitch command disk full up and down. To ascertain the clamps and the pin do not change position, examine the bridle cable. The clutch will slip during these operations.

g. Install the floor panel, seat belts and seats.

SECTION IV

TEST EQUIPMENT

SECTION IV

TEST EQUIPMENT

4-1. INTRODUCTION - TEST EQUIPMENT REQUIREMENTS. AUTOPILOT TEST KIT, PIPER P/N 753 439 (66D141).

a. The 66D141 Test Kit is designed to facilitate testing the AutoControl III B and AltiMatic III B-1 Autopilot Systems on a substitution basis. Provisions are made to substitute into an operating system any major component except the amplifier. Each piece of test equipment can be used for various tests, not limited to what is given in this description.

b. The Test Kit consists of four major sections plus necessary connecting cables. These sections are listed as follows:

1. 66D141-1 Directional and Attitude Gyro Substitute.
2. 66D141-2 Power Section.
3. 66D141-3 Console Substitute.
4. 66D141-4 Radio Coupler Tester.

4-2. 66D141-1 GYRO SUBSTITUTE. (Refer to Figure 4-1.)

a. With this section, both the directional gyro and artificial horizon can be replaced (simultaneously) with substitute signal sources. The directional gyro signal is variable in steps to provide outputs corresponding to 0, 10 and 45 degrees left and right. The zero position is used to provide an accurate zero signal so that the roll centering adjustment can be accurately set or checked for range of control. The 10° outputs are used to check the heading sensitivity of the amplifier command channel and, by means of comparison, to determine whether or not the directional gyro in question provides a signal usable for operation with the system. The 45° outputs are provided for the purpose of checking radio coupler intercept angles and can be used to simulate the course selector of the directional gyro being moved to a new heading.

A large vernier knob, marked attitude gyro with a dual scale marked roll degrees and pitch degrees, is provided to give a measurement in degrees of deviation from straight and level flight in the roll or pitch mode of operation.

4-3. 66D141-2 POWER SECTION. (Refer to Figure 4-2.)

a. With this equipment, amplifier output and servo performance of either axis can be observed. Two connectors are provided so the cable to either servo can be intercepted. A pilot light is provided to indicate the presence of solenoid voltage. A voltmeter is provided to monitor the signal actually being applied to the servo motor. A five position selector switch is provided to select various modes of servo operation. These are: Two positions on the left side marked "BAT", which will allow the operator to apply a full signal directly to the servo motor to check operation in either direction. Two positions on the right side marked "AMPL." One is marked "RES." and serves to apply a resistive load to the amplifier in the event the servo motor is not available to the technician. The other position in this mode is marked "MTR.", and measures the signal being applied to the servo motor.

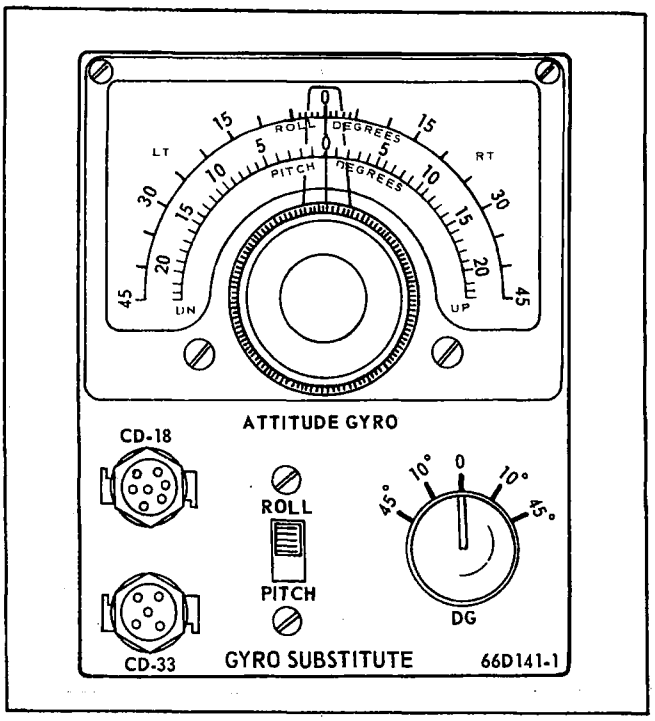


Figure 4-1. Gyro Substitute

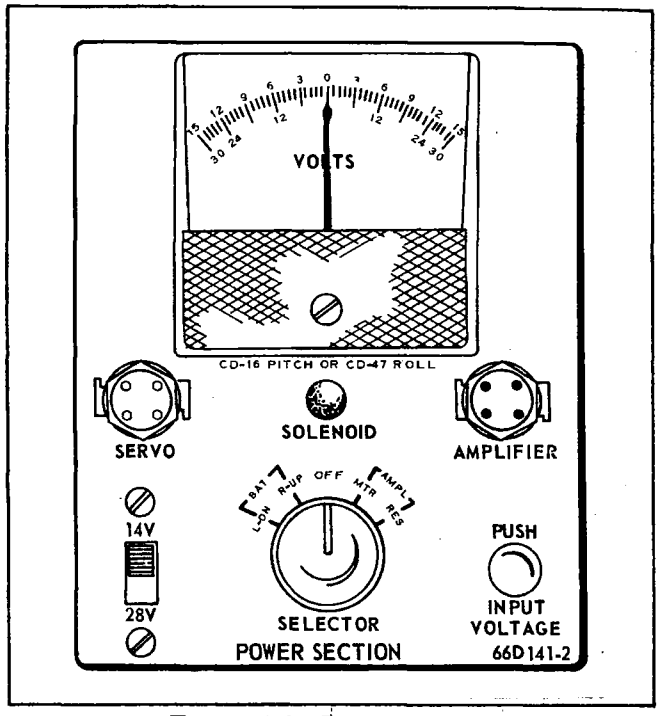


Figure 4-2. Power Section

4-4. 66D141-3 CONSOLE SUBSTITUTE. (Refer to Figure 4-3.)

a. Electrically, this console is interchangeable with the standard AutoPilot console for test purposes. Using the substitute console, it is possible to determine rapidly if the combination of signal sources and amplifier can be brought within usable limits by means of the adjustments provided on the standard console. Also, it serves as a substitute to aid in determining whether or not the installed console or altitude selector is defective.

b. An OFF-ON power switch and 4 two-position slide switches are provided. These are:

1. Selector switch for AutoPilot operating voltage.
2. Directional gyro or manual selector switch corresponding to the roll and HDG push button switches on the console.
3. Altitude control or manual selector switch corresponding to the pitch and altitude push button switches on the console.
4. Minimum and maximum limit selector switch, equivalent to Min. (Full CCW) and Max. (Full CW) positions of limit potentiometers on the console.

c. There are five adjustments provided. These are:

1. Roll manual knob corresponding to the roll manual control on the console.
2. Pitch manual knob corresponding to the pitch manual control on the console.
3. Roll trim knob corresponding to the roll centering adjustment potentiometer on the console.
4. Pitch trim knob corresponding to the pitch centering adjustment potentiometer on the console.
5. Altitude control knob simulating the altitude select knob on the console.

d. The connector from the console is plugged into the CD-20 receptacle. The CD-10 receptacle replaces the altitude selector for bench or in-airplane tests.

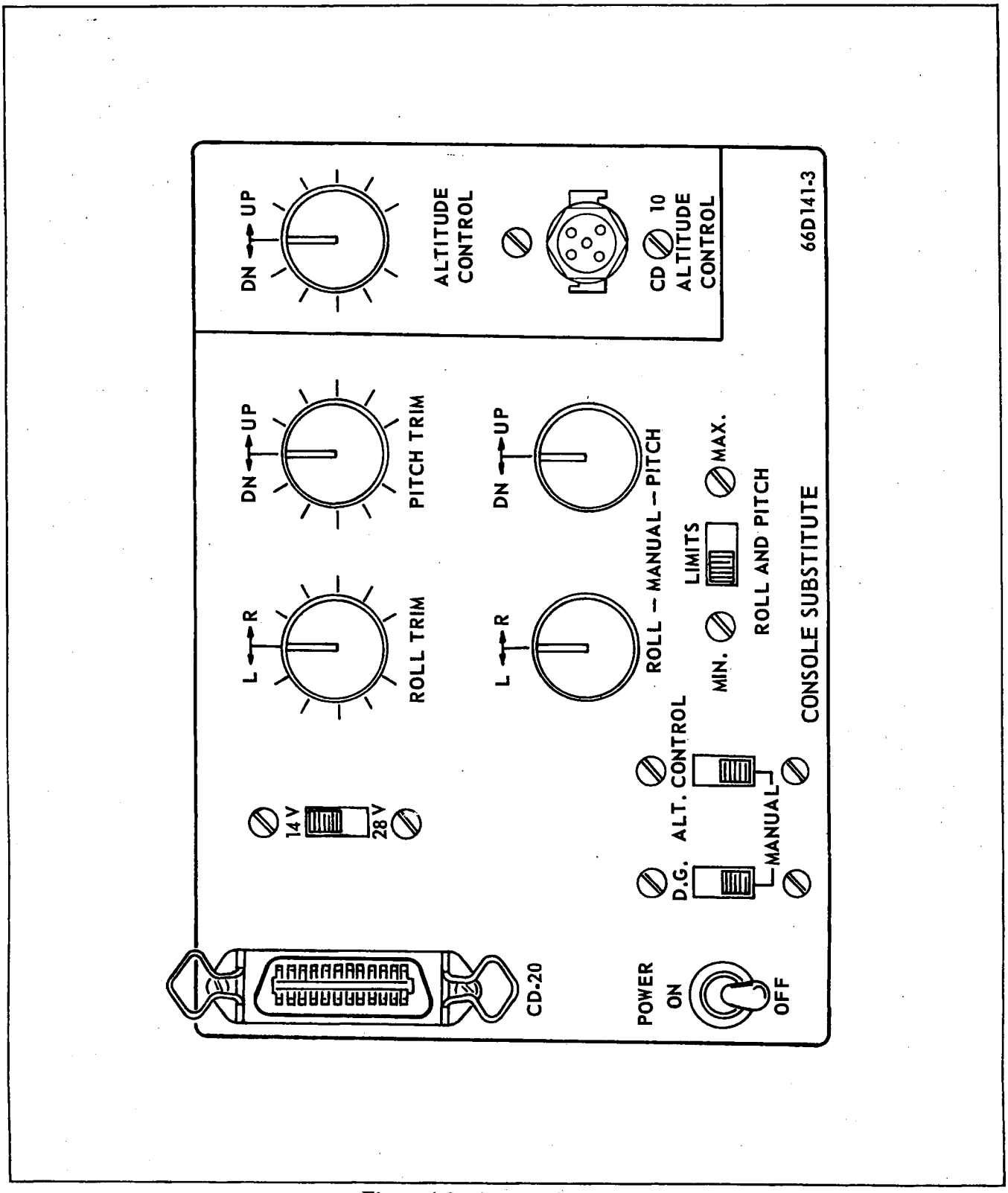


Figure 4-3. Console Substitute

4-5. 66D141-4 RADIO COUPLER TESTER. (Refer to Figure 4-4.)

a. The coupler tester contains a simulated radio signal source and intercepts the coupler output to provide direct monitoring of coupler performance. When used with the directional gyro signal source described in paragraph 4-2, and with an AutoPilot amplifier as a source of power, a complete static testing of coupler performance is possible. The radio coupler tester consists of the following functions:

1. Output meter to measure the output of the radio coupler.
2. Simulated OMNI meter to simulate an OMNI signal applied to the system or to measure the actual OMNI output signal from the airplane radio.
3. Three connectors, two of which are to intercept the lead from the amplifier to the Radio Coupler (CD-33) and the third (CD-34) to either apply a simulated radio signal or check the actual signal from the OBI to the Radio Coupler.
4. Radio signal substitute knob which corresponds to the OBS on the OBI.
5. A two position slide switch to select a corresponding AutoPilot operating voltage.
6. A MIC key push button corresponding to the MIC key in the airplane.
7. A push to null button is not used with the III Series AutoPilots.
8. Two DC input connectors for power to operate the MIC key portion of the tester and to supply power for the face plate lights of the coupler.

NOTE

The radio signal substitute portion of the tester has an internal power supply consisting of one 9V battery. When full deflection of the simulated OMNI signal can not be obtained under load, replace battery.

CAUTION

Do not attempt to troubleshoot a 1C-388-2 radio coupler thru by-passing it. By connecting the A/P harness connector directly into the NSD-360/360A CD-33 plug, the computer/amplifier oscillator will probably burn out. (A 1C-388 coupler may be by-passed directly to a 52D54 D.G. with "bug," but the same procedure will not work with an NSD.)

4-6. 66D141 TEST KIT AND CABLES.

a. Shown in Figure 4-5 is a block diagram of the complete test kit instruments and cable storage area. Each test kit has a serial number. Make sure the equipment in the kit has the correct serial number. When referring to the factory for service or calibration of any instrument, give serial number of the equipment.

b. The 66D141 Test Kit contains a set of test cables. They are marked with the number which corresponds with either the test equipment or the piece being tested. Refer to Section VI for Wiring Diagrams of the AltiMatic III B-1 AutoPilot System.

4-7. TROUBLESHOOTING.

a. By determining in advance from symptoms described by the pilot, the serviceman may decide which section of the AutoPilot may be causing the trouble and isolate the defective unit rapidly by a logical substitution method. Refer to Table IV-I before attempting to troubleshoot the AutoPilot System. Isolate the trouble into one of three groups. The first group corresponds to the inputs of the AutoPilot listed under the term input in the trouble isolation diagram. It is recommended that the technician, by use of the appropriate test equipment, reproduce the input signals of the forward group and observe the AutoPilot responds either correctly or incorrectly. The reason for this is that this group is the easiest group to work on. If, with the correct inputs, the AutoPilot still does not respond correctly (by noting the servo motor

rotation of the airplane control system) the component called out in the middle group should be removed, set up and monitored on the bench as outlined in Section V. If all inputs are correct and the components of the middle group are functioning properly, only then should the airplane control system, as given in the output group, be referred to for troubleshooting. Refer to Section III for proper cable tension and bridle cable installation.

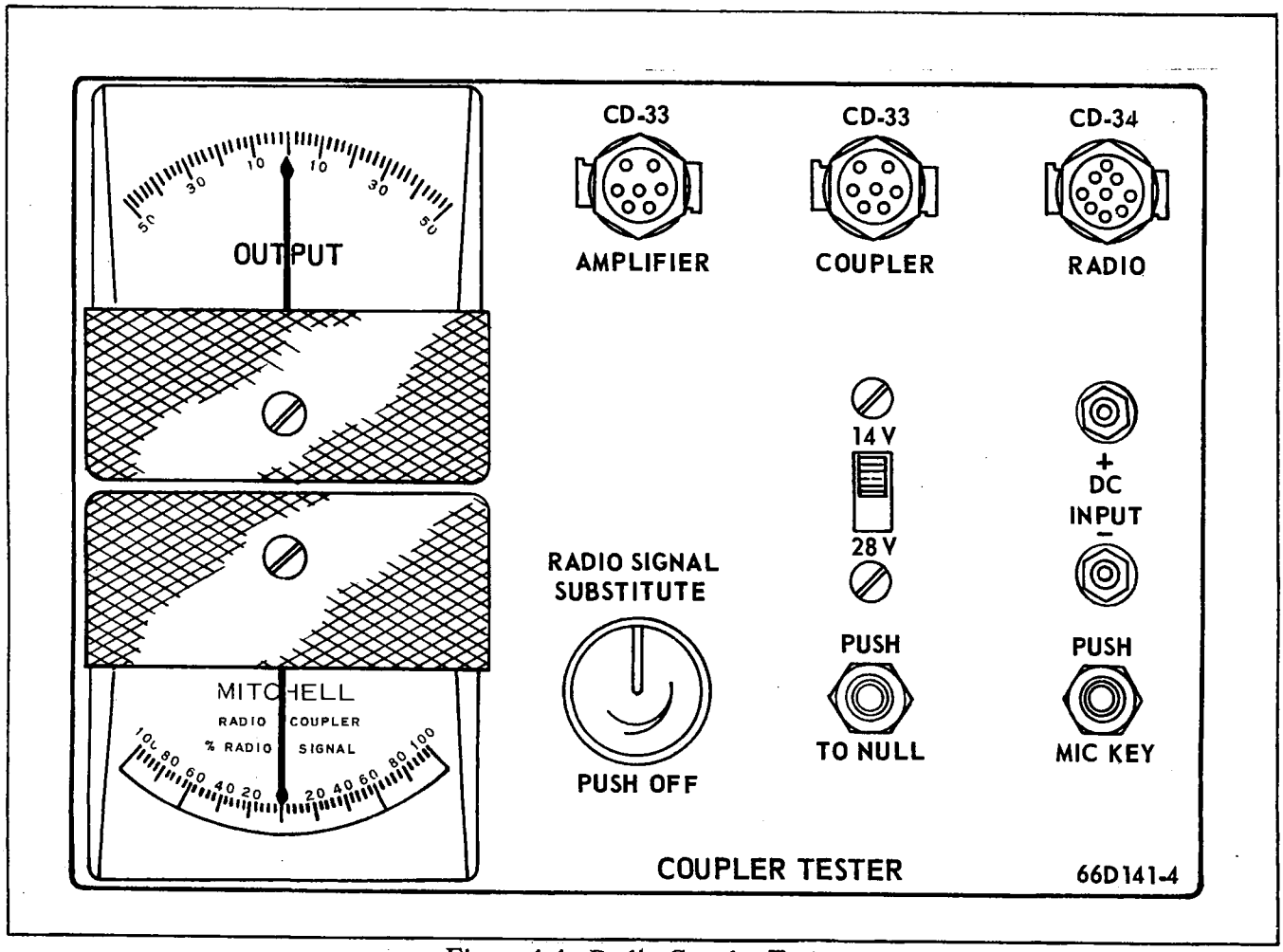


Figure 4-4. Radio Coupler Tester

b. To isolate troubles which appear to be in the AutoPilot, but may be originating in another system, the following may be helpful in determining the location of the trouble. With the AltiMatic III B-1 turned off, turn ON the AutoFlite II by turning on the airplane master switch and placing the AutoFlite II ON/OFF switch in the ON position. Ascertain the AutoFlite II is functioning properly by rotating the trim control knob (located on the lower left corner of the turn and bank instrument) left and then right and observe the control wheel turns left and right slowly. Rotate the turn control knob (located on lower right corner of turn and bank instrument) left and then right and observe control wheel turns left and right. If the AutoFlite II is not functioning properly, refer to the AutoFlite II Service Manual, Piper Part No. 761 481 for troubleshooting procedure. If the AutoFlite II is functioning properly, leave it turned on and engage the roll portion of the AltiMatic III B-1 by pushing the Roll Engage Button to the IN position. (All other buttons on the AltiMatic III B-1 console should be in the OUT position.) Rotate the Roll Command Knob to its complete left and right. If the AltiMatic III B-1 is operating properly, the control wheel will move in the direction the knob is being rotated. If it is not operating properly, turn off the AutoFlite II and if the AltiMatic III B-1 functions properly, trouble is at the 1B405 Relay Box. The CD-47 leads on top of the relay box are reversed. If, with the AutoFlite II OFF, the AltiMatic III B-1 continues to malfunction, isolate the trouble as described in the following procedures.

If there is a malfunction while both the pitch trim and the pitch portion of the AltiMatic III B-1 are operating, pull the pitch trim circuit breaker and if the trouble stops, refer to Pitch Trim Service Manual, Piper Part No. 753 771. If trouble does not stop, proceed to troubleshoot the AutoPilot as outlined in this paragraph.

c. For proper cable tensions and correct bridle cable positioning, refer to the appropriate paragraph in Section III for the unit and airplane being serviced.

d. The Clutch Adjustment Procedure is not authorized in the field at this time on copper/carbon type clutches as per manufacturer, EDO-AIRE MITCHELL.

e. The servo motor current drain test is outlined in the following paragraph.

f. For electronic troubleshooting of the AutoControl III B and AltiMatic III B-1, refer to the appropriate Bench Set-up Procedure in Section V.

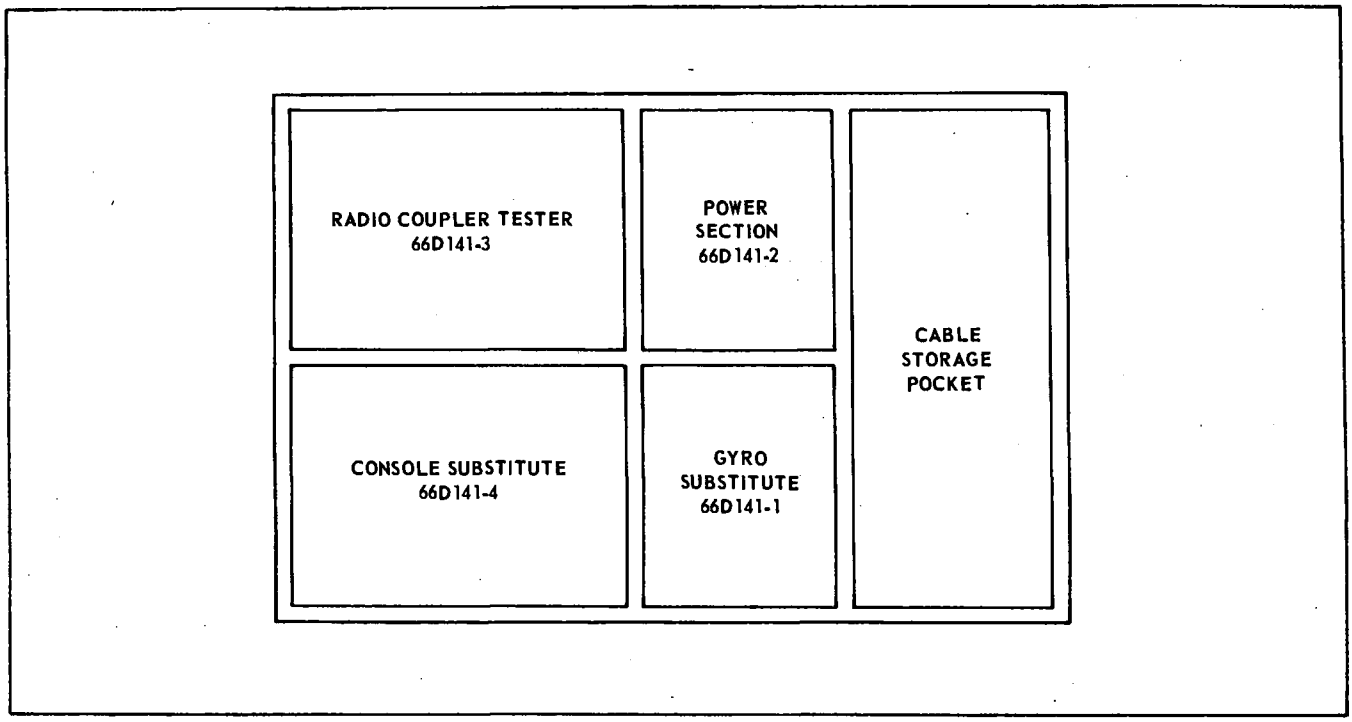


Figure 4-5. Block Diagram Of 66D141 Test Kit

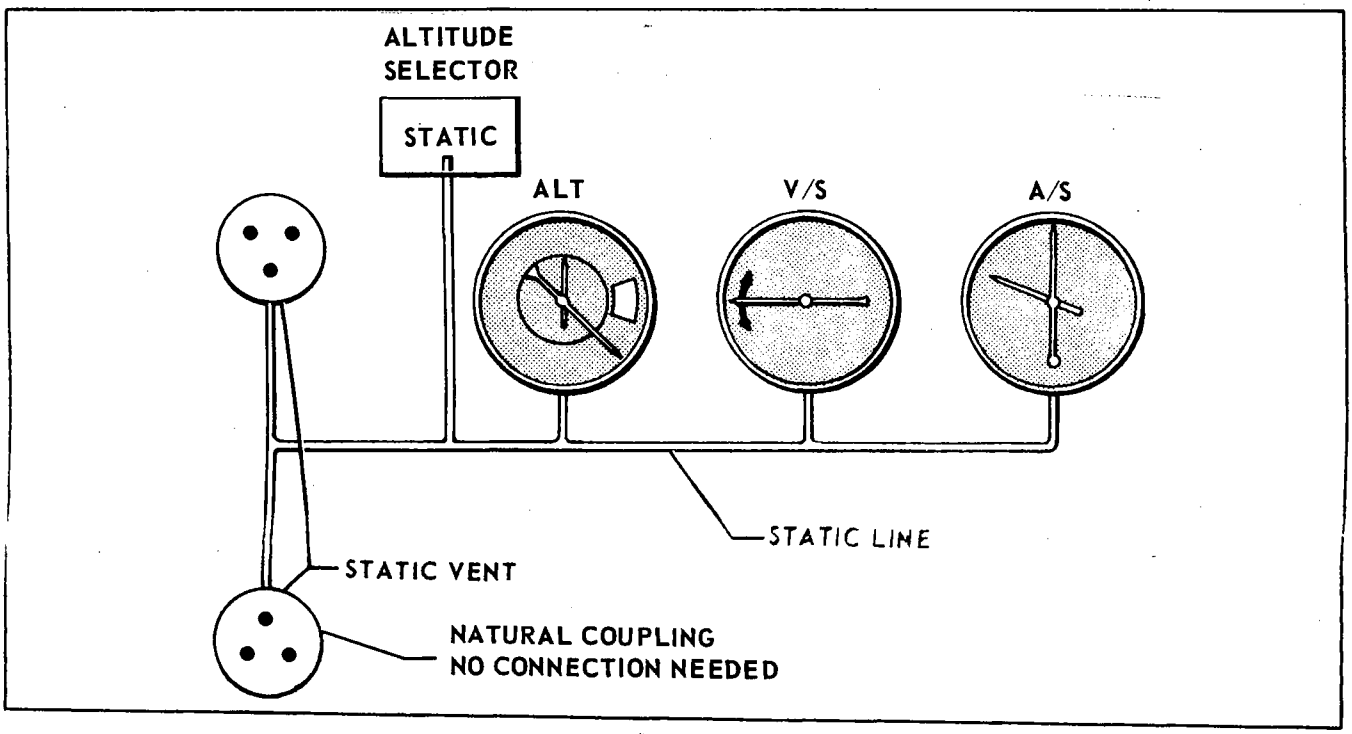


Figure 4-6. Static Connection for Altitude Selector (Alt. III B-1 Only)

4-8. CHECKING SERVO MOTOR CURRENT DRAIN (NO LOAD).

The servo motor may be checked in the airplane for current drain using a standard ammeter (or equivalent) in series with the motor. The following procedure will facilitate this check.

NOTE

If the servo motor current drain is over one-half amp, it must be replaced.

a. It shall be necessary to improvise an adapter for the CD-16 or CD-47 plug.
b. Connect the negative side of a 12-volt source to pin "C" on servo motor plug.
c. Connect pin "D" to one lead of the ammeter.
d. Connect the remaining ammeter lead to the positive side of the 12-volt source.

CAUTION

Before applying voltage as described in the following steps, note the initial application of voltage should only be for ONE SECOND to ascertain there are no shorts which will cause damage to the meter.

e. Apply voltage from the 12-volt source for ONE SECOND to ascertain no shorts exist.
f. Apply voltage from the 12-volt source and take current reading. Turn off voltage after reading has been obtained.
g. To check the motor operation in the opposite direction, reverse connections "C" and "D" on the servo motor plug and apply voltage and check current reading. If the reading is more than one-half amp, the servo motor must be replaced.

NOTE

Motor must be tested in both directions.

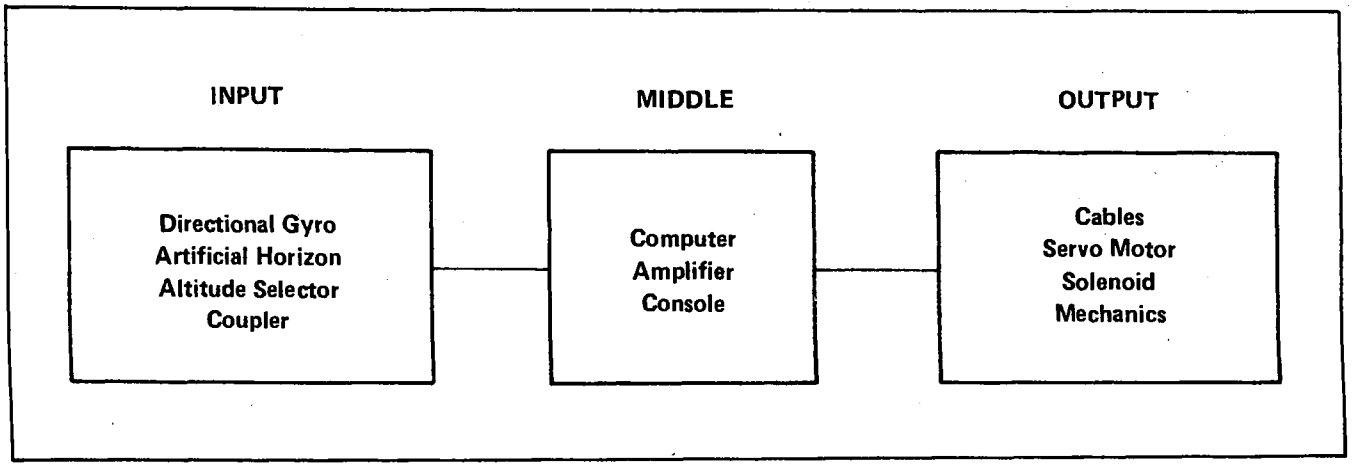


TABLE IV-I. TROUBLE ISOLATION BLOCK DIAGRAM

SECTION V

SET-UP PROCEDURES

SECTION V

SET-UP PROCEDURES

5-1. INTRODUCTION. This section contains information on how to set up the AutoControl III B and AltiMatic III B-1 on the bench. There is also information on checking the Autopilot on the ground. Flight Adjustments, which are the final adjustments, are given in this section also. For the removal and installation of the AutoControl III B and the AltiMatic III B-1 components, refer to Section III, Removal and Installation.

NOTE

It is MANDATORY that both the AutoControl III B and AltiMatic III B-1 be set up according to bench set up procedures in this section prior to installation in the airplane.

CAUTION

When either the AutoControl III B or AltiMatic III B-1 is being adjusted, excessive turning of the adjustment potentiometers should be avoided as this may cause premature failure of the potentiometer.

5-2. BENCH SET-UP AND ADJUSTMENT OF AUTOCONTROL III B CONSOLE/AMPLIFIER WITHOUT RADIO COUPLER.

a. The following equipment will be required from the Autopilot Test Kit, Piper P/N 753 439 (66D141):

1. Gyro Substitute Test Box, (66D141-1).
2. Power Section Test Box, (66D141-2).
3. AutoControl III test harness, identified by a 15-pin AMP connector feeding through three connecting cables labeled CD-18, CD-33 and CD-47. This cable also contains two white wires; one wire terminating at a Delco fitting labeled CD-27 and the other terminating at a knife connector labeled CD-26.
4. Servo motor extension cable approximately 3 feet long with a 4-pin female CD-47 plug on one end, and a 4-pin male CD-47 plug on the other end.

b. BENCH SET-UP AND ADJUSTMENT PROCEDURES ARE AS FOLLOWS:

1. Remove the Console/Amplifier face plate by removing the roll command knob and the two face plate mounting screws. After removing the face plate, reinstall the roll command knob to facilitate accomplishing Bench Set-up Adjustments.
2. Hold Console/Amplifier with controls facing you. Plug large AMP connector into rear of Console/Amplifier with the short CD-47 cable to the right.
3. Connect the female CD-47 plug of the Servo Motor Extension Cable into the short male CD-47 cable coming from the right side at the rear of the Console/Amplifier.
4. Plug the male end of the Servo Motor Extension Cable, also labeled CD-47, into the female 4-pin connector located on the face of the Power Section Test Box labeled AMPLIFIER.
5. Move SELECTOR KNOB of Power Section Test Box to the "OFF" or CENTERED position.
6. Place the SLIDE SWITCH located at the lower left corner of the Power Section Test Box to the 14 or 28-volt position.

7. Plug the two remaining cables labeled CD-18 and CD-33 into their proper receptacles which are mounted on the face of the Gyro Substitute Test Box.

8. Rotate the LARGE VERNIER CONTROL KNOB of the Gyro Substitute Test Box to the "ZERO" position.

9. Below the Large Vernier Knob find a SLIDE SWITCH labeled ROLL and PITCH. Place slide switch in the "UP" or "ROLL" position.

10. Immediately to the right of the slide switch, place the DIRECTIONAL GYRO SELECTOR KNOB to the "ZERO" or CENTERED position.

11. Verify the A/P ON/OFF and HDG ON/OFF switches on the Console/Amplifier are placed in the OFF position.

12. Connect the positive lead of a 14 or 28-volt DC power supply, whichever is applicable, to the white wire terminating in a DELCO fitting. (Connection must be fused at 3 amps.)

13. Connect the "GROUND" lead of the power source to the chassis at the front plate of the Console/Amplifier.

CAUTION

DO NOT PLACE THE GROUND WIRE NEAR CIRCUIT BOARD OR NEAR OUTPUT TRANSISTORS LOCATED NEAR COOLING FINS AT BOTTOM OF AMPLIFIER.

14. Touch the remaining white wire of the test cable which terminates in a KNIFE connector to the positive lead and observe all four Console/Amplifier lights glow. If some lights do not glow, replace light circuit board. If none of the lights glow, check DC power source and fuse.

15. Set aside the Knife connector wire since this wire is no longer needed.

16. Center the ROLL COMMAND KNOB on the Console/Amplifier.

17. Place the A/P ON/OFF switch on left side of Console/Amplifier in the "ON" position. Observe the LIGHT labeled SOLENOID glows on the Power Section Test Box. If SOLENOID light does not glow, replace Console/Amplifier.

18. Depress RED button located at bottom right corner of Power Section Test Box labeled Input Voltage. Test box needle should deflect to the right and read 12-14-volts DC or 24-28-volts DC.

19. Rotate SELECTOR KNOB on Power Section Test Box to the "RES" position, full "CLOCKWISE."

20. Place HDG ON/OFF switch on right side of Console in the "ON" position.

21. Verify the Large Vernier Knob on Gyro Substitute Test Box is centered and points to ZERO on TOP SCALE labeled ROLL DEGREES.

22. Rotate the ROLL COMMAND KNOB on Console/Amplifier full right and left and observe there is NO movement of the needle on the Power Section Test Box. If the needle moves, check that HDG ON/OFF switch on the right side of the Console/Amplifier is in the "ON" position. If the needle still moves, Console/Amplifier must be replaced. If there is no needle movement, proceed with next step.

23. With a small slot-head screwdriver, adjust the centering adjustment potentiometer (third potentiometer from left on front of console) (refer to Figure 5-1) as required to center the needle on the Power Section Test Box to zero.

CAUTION

When making ANY adjustments on the AutoControl III B, it is MANDATORY to wait at least 30 seconds for the computer to digest the new information.

24. After the needle has been centered, place HDG ON/OFF switch in the "OFF" position and observe needle on Power Section Test Box. If needle deflects off of zero, carefully adjust the needle back to zero by rotating the ROLL COMMAND KNOB on the Console/Amplifier, again waiting for the computer to digest the new command.

25. After the needle holds zero by adjusting the Roll Command Knob, place HDG Button switch in the "ON" position and observe no change occurs on Power Section Test Box needle indication. IF NEEDLE DOES CHANGE, repeat Steps 23 thru 25.

26. Observe the physical position of Roll Command Knob to verify it is straight "UP" ± approximately 3 degrees. If Roll Command Knob is out of tolerance, replace Console/Amplifier.

27. Verify HDG ON/OFF switch is in the "ON" position. Place DIRECTIONAL GYRO SELECTOR CONTROL KNOB, located on lower right-hand corner of Gyro Substitute Test Box, to the RIGHT-HAND 45 degree position or full "CLOCKWISE."

28. Observe needle deflects right on the Power Section Test Box.

29. Rotate LARGE VERNIER KNOB on Gyro Substitute Test Box CLOCKWISE to the RIGHT-HAND 20 degree position reading the TOP SCALE labeled ROLL DEGREES.

NOTE

Large increments represent 5 degrees each.

30. With small slot-head screwdriver, adjust right bank adjustment potentiometer (fourth potentiometer from left on front of console) (refer to Figure 5-1) as required to center the needle on the Power Section Test Box to zero.

31. Leaving the HDG switch in the "ON" position, rotate DIRECTIONAL GYRO SELECTOR CONTROL KNOB, located on lower right-hand corner of Gyro Substitute Test Box, to the LEFT-HAND 45 degree position or full COUNTERCLOCKWISE. Observe needle deflects left on Power Section Test Box.

32. Rotate LARGE VERNIER KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to the left-hand 20 degree position reading the TOP SCALE labeled ROLL DEGREES.

33. With small slot-head screwdriver, adjust left bank adjustment potentiometer (second potentiometer from left on front of console) (refer to Figure 5-1) as required to center the needle on the Power Section Test Box to zero.

34. Rotate the DIRECTIONAL GYRO SELECTOR KNOB, located on lower right-hand corner of Gyro Substitute Test Box, to the LEFT-HAND 10 degree position. Observe needle on Power Section Test Box deflects **RIGHT**.

35. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box CLOCKWISE to center the needle on the Power Section Test Box, again waiting for the computer to digest the new information until the needle stays centered after at least a 30 second wait.

36. Read the degree of bank on the Gyro Substitute Test Box from the TOP SCALE labeled ROLL DEGREES. The pointer must be between 8 to 13 degrees of bank angle. If out of tolerance, replace Console/Amplifier.

37. Rotate the DIRECTIONAL GYRO SELECTOR KNOB located on lower right-hand corner of Gyro Substitute Test Box to the RIGHT-HAND 10 degree position. Observe needle on Power Section Test Box deflects right.

38. Rotate LARGE VERNIER KNOB located on the Gyro Substitute Test Box CLOCKWISE to center the needle on the Power Section Test Box, again waiting for the computer to digest the new information until the needle stays centered after at least a 30 second wait.

39. Read the degree of bank on the Gyro Substitute Test Box from the TOP SCALE labeled ROLL DEGREES. The pointer must be between 8 to 13 degrees of bank angle. If out of tolerance, replace Console/Amplifier.

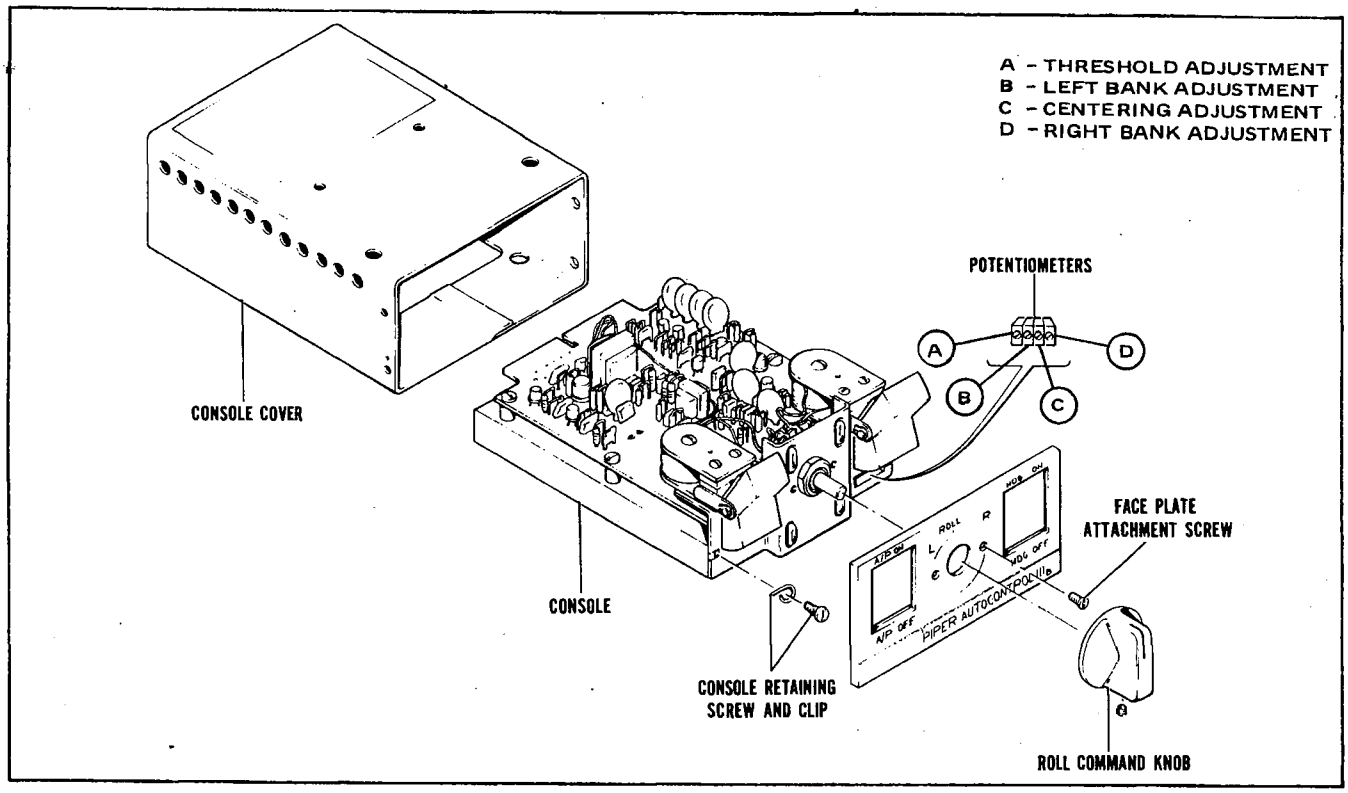


Figure 5-1. AutoControl III B Console

40. Place the HDG ON/OFF switch in the "OFF" position and rotate the ROLL COMMAND KNOB full right. Observe needle on Power Section Test Box deflects right.

41. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box CLOCKWISE to center the needle on Power Section Test Box, again waiting for the computer to digest the new information until the needle stays centered after at least a 30 second wait.

42. Read the degree of bank on the Gyro Substitute Test Box TOP SCALE labeled ROLL DEGREES, bank must be 28 ± 3 degrees. IF OUT OF TOLERANCE, REPLACE CONSOLE.

43. Rotate the ROLL COMMAND KNOB full LEFT. Observe needle on Power Section Test Box deflects left.

44. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box COUNTERCLOCKWISE to center the needle on Power Section Test Box, again waiting for the computer to digest the new information until the needle stays centered after at least a 30 second wait.

45. Read the degree of bank on the Gyro Substitute Test Box on the TOP SCALE labeled ROLL DEGREES, bank must be 28 ± 3 degrees. IF OUT OF TOLERANCE, REPLACE CONSOLE.

46. Recenter ROLL COMMAND KNOB to the center position. Rotate the POWER SECTION TEST BOX SELECTOR KNOB, turning COUNTERCLOCKWISE to the CENTER or "OFF" position. Place the A/P ON/OFF switch to the "OFF" position.

47. Refer to the following paragraph for AutoControl III B Threshold Adjustment Procedure.

5-3. THRESHOLD ADJUSTMENT PROCEDURE FOR AUTOCONTROL III B.

CAUTION

Threshold adjustments are to be accomplished with a 12-volt calibrated Bench Set-up. When adjusting 28-volt systems, convert Bench Set-up to 12-volt configuration until Threshold Adjustment Procedure is completed. Verify all switches are returned to the 28-volt position prior to reinstallation in 28-volt aircraft. Setting of the Large Vernier Control Knob on the Gyro Substitute Test Box is critical when doing this adjustment procedure.

1. Rotate SELECTOR KNOB, located on lower center of Power Section Test Box, CLOCKWISE to the "RES" position.
2. Ascertain the DIRECTIONAL GYRO SELECTOR KNOB, located on lower right-hand corner of Gyro Substitute Test Box, is in the ZERO or straight "UP" position.
3. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box to the centered ZERO position reading the TOP SCALE labeled ROLL DEGREES.
4. Place the A/P ON/OFF switch on left side of Console/Amplifier in the "ON" position. Observe the LIGHT labeled SOLENOID glows on the Power Section Test Box.
5. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE for a one (1) degree right bank.
6. Observe voltmeter on Power Section Test Box and record meter reading. (Refer to Figure 5-2 for enlarged view of voltmeter.)
7. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box, COUNTERCLOCKWISE for a one (1) degree left bank.
8. Observe voltmeter on Power Section Test Box and record meter reading. Average the meter readings obtained and refer to Table V-I for correct voltage settings.
9. If voltage setting is correct, proceed to next step. If voltage setting is incorrect, adjust threshold adjustment potentiometer (left potentiometer on front of console) (refer to Figure 5-1) as required to obtain an average of the voltage settings listed in Table V-I by repeating Steps 5 thru 8.
10. Place the A/P ON/OFF switch on the Console/Amplifier to the "OFF" position.
11. Rotate the Power Section Test Box Selector Knob COUNTERCLOCKWISE to the center or "OFF" position.
12. Turn Power Supply "OFF."
13. Disconnect test equipment and associated cables and reinstall component in the airplane.
14. Proceed with ground checks and flight adjustments.

5-4. AUTOCONTROL III B GROUND CHECK WITHOUT RADIO COUPLER. The only ground checks which can be accomplished are functional checks as described below because the AutoControl III B is an "Open Loop" system which requires the aerodynamics of the airplane in flight for feedback.

1. Place the A/P ON/OFF switch and the HDG ON/OFF switch to the "OFF" position and center ROLL COMMAND KNOB.
2. Start airplane engine to obtain gyro stability.
3. Rotate the airplane control wheel to level flight (neutral position). Place the A/P ON/OFF switch in the "ON" position. (Turn the control wheel right and left to check servo engagement.)

4. Rotate the ROLL COMMAND KNOB right and left and observe that the airplane control wheel is moving in the correct direction.

NOTE

The airplane control wheel can be stopped in any position and will not return to level position by centering the Roll Command Knob. The airplane control wheel will remain stationary at the time the Roll Command is approximately centered or is at its zero electrical output position.

5. Center the Course Selector of the Directional Gyro and place the HDG ON/OFF switch in the "ON" position. With the HDG switch in the "ON" position, THE ROLL COMMAND KNOB ON THE CONSOLE BECOMES INOPERATIVE.

6. Rotate the DIRECTIONAL GYRO COURSE SELECTOR right and left from center and observe the control wheel turns in the correct direction. Return Directional Gyro Course Selector to center.

7. Place A/P ON/OFF switch and the HDG ON/OFF switch in the "OFF" position. Rotate control wheel, left and right and observe servo disengaged.

5-5. AUTOCONTROL III B FLIGHT ADJUSTMENTS WITHOUT RADIO COUPLER.

1. Remove the Console/Amplifier face plate by removing the roll command knob and the two face plate mounting screws. After removing the face plate, reinstall the roll command knob to facilitate in flight adjustments.

2. Use 75% power during adjustments.

3. MAKE CERTAIN RUDDER TRIM IS ADJUSTED TO CENTER THE BALL. IF RUDDER IS INCORRECTLY TRIMMED, THE AUTOCONTROL III B WILL FLY THE AIRPLANE WITH A WING LOW TO COMPENSATE FOR THE OUT OF TRIM CONDITION.

NOTE

SMOOTH AIR IS REQUIRED.

4. Place the HDG ON/OFF switch on the console in the "ON" position. Set the COURSE SELECTOR to the Directional Gyro Heading.

5. Place the A/P ON/OFF switch to the "ON" position. If the airplane does not maintain the selected heading, within $\pm$ 2 degrees, correct by adjusting the centering adjustment.

6. Set the Directional Gyro Course Selector for a 150 degree heading change to the LEFT and observe the angle of bank on the Horizon. If necessary, adjust the LEFT bank adjustment to obtain approximately a 20 degree bank. Turning the adjustment screw clockwise will increase the angle of bank.

NOTE

Keep the Directional Gyro Course Selector at least 25 degrees from the Directional Gyro heading during adjustment.

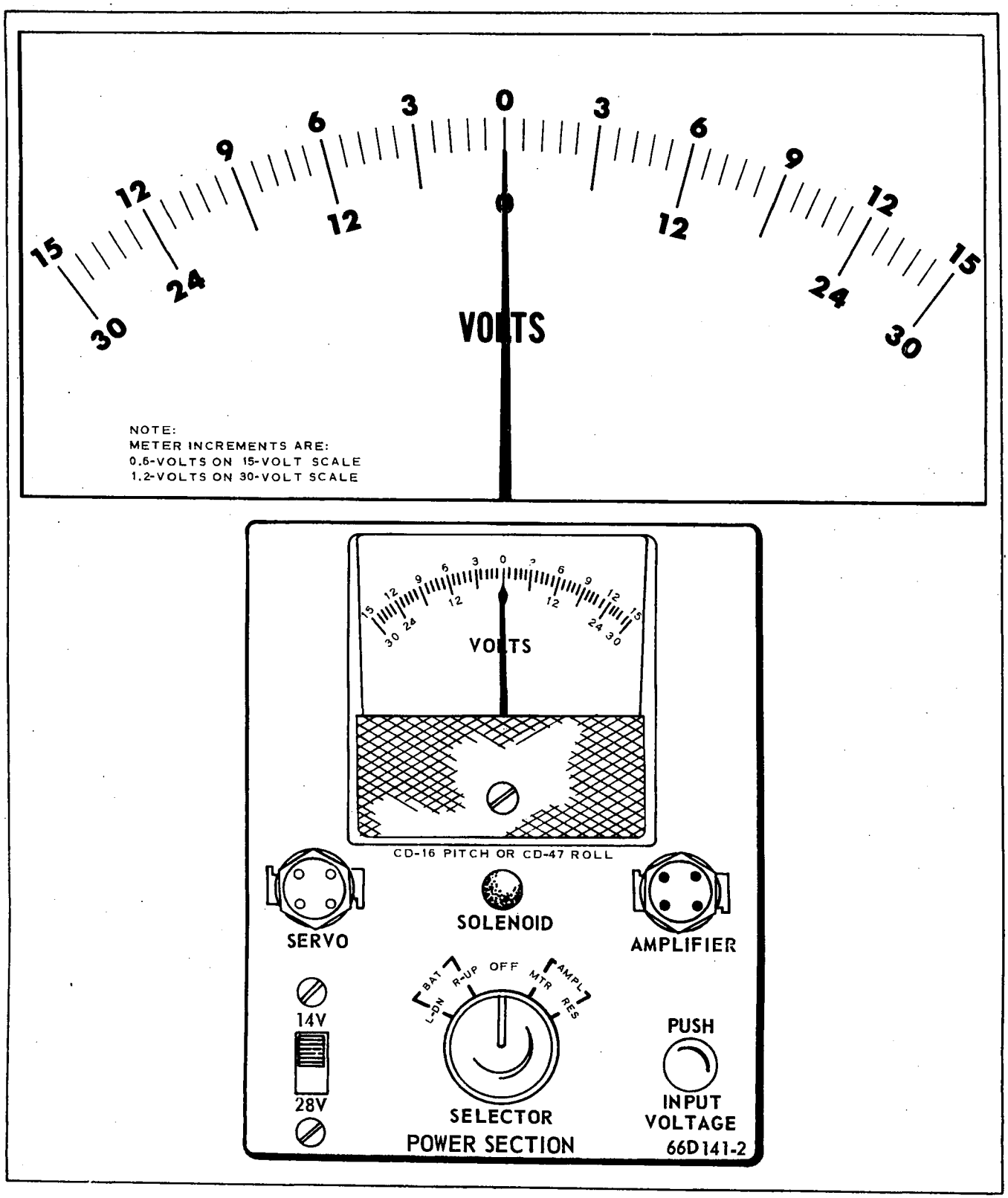


Figure 5-2. Power Section Test Box

7. Set the Directional Gyro Course Selector for a 150 degree heading change to the RIGHT and observe the angle of bank on the Horizon. If necessary, adjust the RIGHT bank adjustment to obtain approximately a 20 degree bank. Turning the adjustment screw clockwise will increase the angle of bank.

NOTE

Keep the Directional Gyro Course Selector at least 25 degrees from the Directional Gyro heading during adjustment.

8. Allow the airplane to return to level flight and selected heading. Observe that the Autopilot maintains selected heading within ± 2 degrees. If not, retouch centering adjustment until selected heading is maintained.

9. Place the HDG ON/OFF switch on the console to the "OFF" position and with ROLL COMMAND KNOB CENTERED, observe that airplane flies wings level within ± 2 degrees.

10. Rotate the ROLL COMMAND KNOB full LEFT and observe that airplane banks LEFT 28 ± 3 degrees.

11. Rotate the ROLL COMMAND KNOB full RIGHT and observe that airplane banks RIGHT 28 ± 3 degrees.

12. Recenter ROLL COMMAND KNOB.

13. Set the Course Selector to the Directional Gyro heading and place the HDG ON/OFF switch to the "ON" position.

14. Allow the airplane to stabilize in level flight on the selected heading.

15. Adjust the threshold adjustment potentiometer clockwise until a noticeable roll oscillation develops. (Clockwise rotation increases the sensitivity.)

16. Rotate the threshold adjustment potentiometer counterclockwise until lateral oscillation is eliminated.

NOTE

Counterclockwise rotation past the desired adjustment will cause long term lateral oscillation and possible wandering on established headings.

17. Grasp control wheel and displace aircraft in roll. If no oscillation is present, this completes the flight set-up. If roll oscillation is present, rotate threshold adjustment potentiometer counterclockwise until oscillation stops. Repeat until oscillation is eliminated.

5-6. BENCH SET-UP AND ADJUSTMENTS OF AUTOCONTROL III B CONSOLE/AMPLIFIER WITH RADIO COUPLER.

a. The following equipment will be required from the Autopilot Test Kit, Piper P/N 753 439 (66D141):

1. Gyro Substitute Test Box, (66D141-1).
2. Power Section Test Box, (66D141-2).
3. Radio Coupler Tester, (66D141-4).
4. AutoControl III test harness, identified by a 15-pin AMP connector feeding through three connecting cables labeled CD-18, CD-33 and CD-47. This cable also contains two white wires; one wire terminating at a Delco fitting labeled CD-27 and the other terminating at a knife connector labeled CD-26.
5. Servo motor extension cable approximately 3 feet long with a 4-pin female CD-47 plug on one end, and a 4-pin male CD-47 plug on the other end.

6. One amplifier extension cable, approximately 3 feet long, with a female 7-pin connector labeled CD-33 on one end and a male 7-pin connector also labeled CD-33 on the other end.

7. One radio extension cable approximately 3 feet long with a female 9-pin connector labeled CD-34 on each end.

8. One coupler test box power cable approximately 3 feet long with a RED and BLACK alligator clip on one end and a red and black male plug on the other end.

b. BENCH SET-UP AND ADJUSTMENT PROCEDURES ARE AS FOLLOWS:

1. Remove the Console/Amplifier face plate by removing the roll command knob and the two face plate mounting screws. After removing the face plate, reinstall the roll command knob to facilitate accomplishing Bench Set-up Adjustments.

2. Hold Console/Amplifier with controls facing you. Plug large AMP connector into rear of Console/Amplifier with the short CD-47 cable to the right.

3. Connect the female CD-47 plug of the Servo Motor Extension Cable into the short male CD-47 cable coming from the right side at the rear of the Console/Amplifier.

4. Plug the male end of the Servo Motor Extension Cable, also labeled CD-47, into the female 4-pin connector located on the face of the Power Section Test Box labeled AMPLIFIER.

5. Move SELECTOR KNOB of Power Section Test Box to the "OFF" or CENTERED position.

6. Place the SLIDE SWITCH located at the lower left corner of the Power Section Test Box to the 14 or 28-volt position.

7. Connect the CD-33 cable, coming from the LARGE AMP connector at the rear of the Console/Amplifier, into the male 7-pin connector, labeled AMPLIFIER, located on the face of the Radio Coupler Test Box at the upper left-hand corner.

8. Find the RADIO SIGNAL SUBSTITUTE KNOB located on the Radio Coupler Test Box, immediately to the right of the bottom Omni Meter. This Radio Signal Knob can be pulled or pushed "IN" and "OUT." Make sure this knob is in the "IN" position.

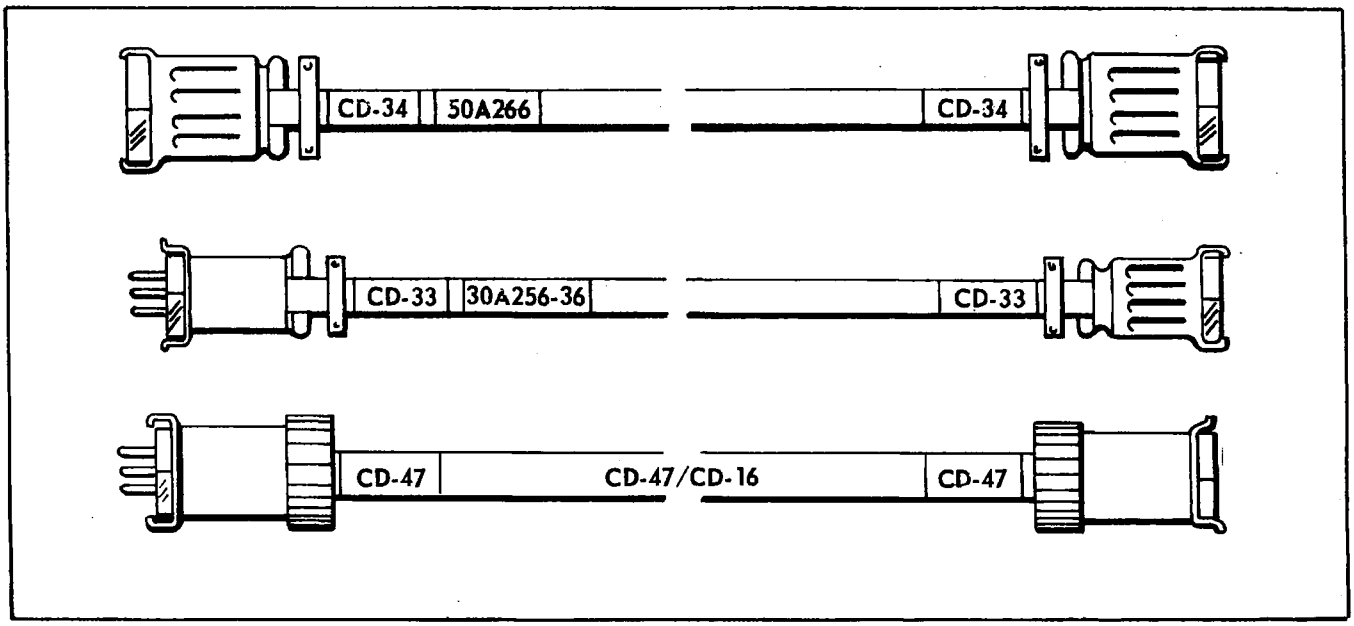


Figure 5-3. Extension Test Cables

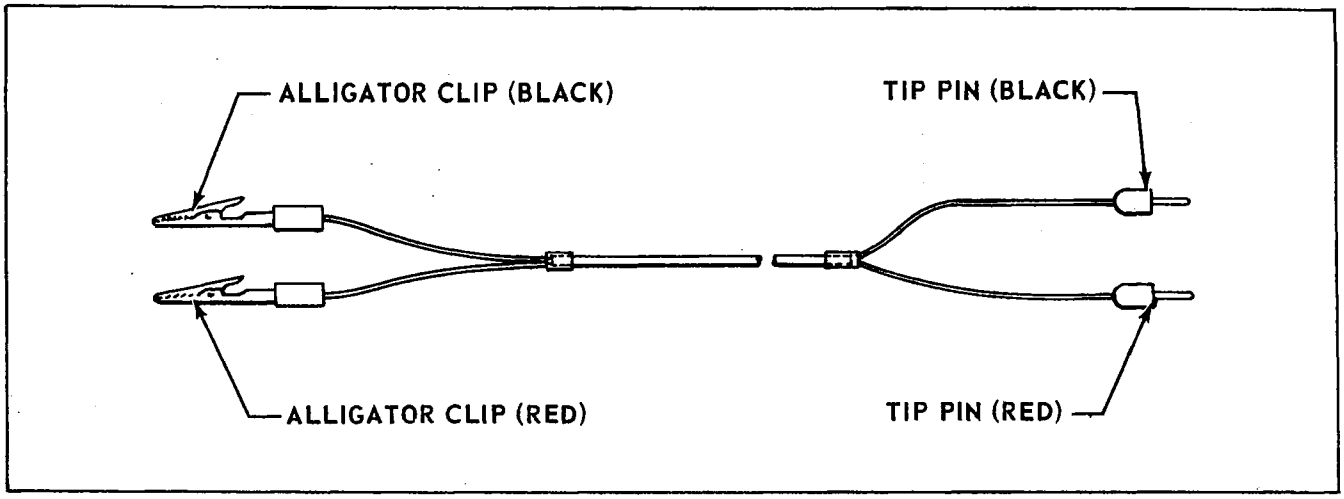


Figure 5-4. Radio Coupler Power Cable

9. Find the VOLTAGE SELECTOR SWITCH located immediately to the left of the red and black DC input terminals on the face of the Radio Coupler Test Box. Place this VOLTAGE SELECTOR SWITCH in the 14 or 28-volt position.

10. Connect the male CD-33 plug of amplifier extension cable to the 7-pin female connector labeled COUPLER, located on the face of the Radio Coupler Test Box. Connect the other end of the cable to the 7-pin male connector located on the REAR of the Radio Coupler labeled CD-33.

11. Find the radio extension cable with female connectors labeled CD-34 at both ends. Connect one end of this cable to the male 9-pin connector located on the rear of the Radio Coupler labeled CD-34. Connect the other female 9-pin connector CD-34 on this cable to the male 9-pin connector labeled RADIO, located on the face of the Radio Coupler Test Box.

12. Connect the short cable coming from inside the Radio Coupler with a 5-pin female connector labeled CD-33 on the end to the 5-pin male connector located on the face of the Gyro Substitute Test Box labeled CD-33.

13. Connect the CD-18 cable coming from the large AMP plug at the rear of the Console/Amplifier to the 7-pin male connector located on the face of the Gyro Substitute Test Box labeled CD-18.

14. Rotate LARGE VERNIER CONTROL KNOB on face of Gyro Substitute Test Box to the "ZERO" position on the TOP SCALE labeled ROLL DEGREES.

15. Below the Large Vernier Knob on the Gyro Substitute Test Box, find a SLIDE SWITCH labeled "ROLL" and "PITCH." Place this Slide Switch in the "UP" or "ROLL" position.

16. Immediately to the RIGHT of the SLIDE SWITCH, find a DIRECTIONAL GYRO SELECTOR KNOB. Place this Directional Gyro Selector Knob to the "ZERO" position.

17. Find the Radio Coupler Power Cable with the red and black alligator clips on one end. Plug the red and black male plugs at the other end of the coupler test box power cable into the color coded female receptacles located on the face of the Radio Coupler Test Box labeled DC input.

18. Connect the red and black alligator clips to a 14 or 28-volt DC power supply, whichever is applicable, FUSED AT 3 AMPS. USED TO CHECK MIKE KEY CIRCUIT AND LIGHTS ONLY.

CAUTION

OBSERVE POLARITY.

19. Ascertain the A/P ON/OFF and HDG ON/OFF switches are placed in the "OFF" position.

20. Find the WHITE lead coming from the LARGE AMP CONNECTOR at the rear of the Console/Amplifier which terminates in a Delco fitting. Connect this white lead to the POSITIVE lead of the 14 or 28-volt DC power source. (Connection must be fused at 3 amps.)

21. Connect a GROUND lead from the 14 or 28-volt DC power source to the chassis at the front plate of the Console/Amplifier.

CAUTION

DO NOT PLACE THE GROUND WIRE NEAR CIRCUIT BOARD OR NEAR OUTPUT TRANSISTORS LOCATED NEAR COOLING FINS AT BOTTOM OF AMPLIFIER.

22. Find the remaining white wire coming from the rear of the Console/Amplifier which terminates in a KNIFE connector.

23. Touch the Knife connector at the end of this white wire to the POSITIVE power lead and observe all four Console/Amplifier lights glow. If some lights do not glow, replace light circuit board. If none of the lights glow, check DC power source and fuse.

24. Set aside the Knife connector wire since this wire is no longer needed.

25. Center the ROLL COMMAND KNOB on the Console/Amplifier.

26. Place the A/P ON/OFF switch on left side of Console/Amplifier in the "ON" position. Observe the light labeled SOLENOID glows on the Power Section Test Box. If SOLENOID light does not glow, replace Computer/Amplifier.

27. Depress RED button located at bottom right corner of Power Section Test Box labeled Input Voltage. Test box needle should deflect to the right and read 12-14-volts DC or 24-28-volts DC.

28. Rotate SELECTOR KNOB on Power Section Test Box to the "RES" position or FULL CLOCKWISE.

29. Place HDG ON/OFF switch on right side of console in the "ON" position.

30. Verify the Large Vernier Knob on Gyro Substitute Test Box is centered and points to ZERO on TOP SCALE labeled ROLL DEGREES.

31. Place Radio Coupler SELECTOR SWITCH in the HEADING mode.

32. Rotate the ROLL COMMAND KNOB on Console/Amplifier full right and left and observe there is NO movement of the needle on the Power Section Test Box. IF NEEDLE MOVES, check that HDG ON/OFF switch is in the "ON" position. If needle still moves, Console/Amplifier must be REPLACED. If there is NO needle movement, proceed with the next step.

33. Place Radio Coupler SELECTOR SWITCH in the LOCALIZER/NORM mode.

34. Depress RED BUTTON on rear of Radio Coupler.

35. While holding IN the RED BUTTON on rear of the Radio Coupler, with a small slot head screwdriver, adjust the centering adjustment potentiometer (third potentiometer from left on front of console) (refer to Figure 5-1) as required to center the needle on the Power Section Test Box to zero.

CAUTION

When making ANY adjustments on the AutoControl III B, it is MANDATORY to wait at least 30 seconds for the computer to digest the new information.

36. After the needle has been centered, place the HDG ON/OFF switch in the "OFF" position.

37. Carefully adjust ROLL COMMAND KNOB on Console/Amplifier to center the needle on Power Section Test Box to ZERO. (REMEMBER TO WAIT at least THIRTY SECONDS before taking any readings.)

38. Place the HDG ON/OFF switch in the "ON" position and depress the RED BUTTON on the rear of the Radio Coupler and observe that needle on Power Section Test Box recenters on zero. If NEEDLE MOVES FROM ZERO, repeat Steps 35 thru 38 until centering is accomplished. If needle indicates an out of tolerance condition, after several attempts, REPLACE CONSOLE/AMPLIFIER.

39. Place the HDG ON/OFF switch in the OFF position.

40. Observe the physical position of the ROLL COMMAND KNOB on the Console/Amplifier to make sure it is straight up ± approximately 3 degrees. If Roll Command Knob is out of tolerance, REPLACE CONSOLE/AMPLIFIER.

41. Place the HDG ON/OFF switch in the "ON" position.

42. Place Radio Coupler Selector Switch in the HEADING MODE.

43. Place the DIRECTIONAL GYRO SELECTOR CONTROL KNOB located on the lower right-hand corner of the Gyro Substitute Test Box to the RIGHT-HAND 45 degree position or full CLOCKWISE.

44. Observe needle deflects right on Power Section Test Box.

45. Rotate LARGE VERNIER KNOB on Gyro Substitute Test Box CLOCKWISE to the right-hand 20 degree position, reading the TOP SCALE labeled ROLL DEGREES. Large increments represents 5 degrees each.

46. With a small slot-head screwdriver, adjust right bank adjustment potentiometer (fourth potentiometer from left on front of console) (refer to Figure 5-1) as required to center the needle on the Power Section Test Box to zero.

47. Observe needle of output meter, located on Radio Coupler Test Box, indicates RIGHT.

48. Leaving HDG ON/OFF switch in the "ON" position, rotate DIRECTIONAL GYRO SELECTOR Control Knob located in lower right-hand corner of the Gyro Substitute Test Box to the LEFT-HAND 45 degree position or full COUNTERCLOCKWISE. Observe needle deflects left on Power Section Test Box.

49. Rotate LARGE VERNIER KNOB on Gyro Substitute Test Box counterclockwise to the left-hand 20 degree position reading the TOP SCALE labeled ROLL DEGREES. Large increments represents 5 degrees each.

50. With a small slot-head screwdriver, adjust left bank adjustment potentiometer (second potentiometer from left on front of console) (refer to Figure 5-1) as required to center the needle on the Power Section Test Box to zero. WAIT a minimum of 30 seconds for computer to digest the information.

51. Observe needle of output meter, located on Radio Coupler Test Box, indicates LEFT.

52. Rotate the DIRECTIONAL GYRO SELECTOR KNOB located at the lower right-hand corner of the Gyro Substitute Test Box clockwise to the LEFT-HAND 10 degree position.

53. Observe needle on Power Section Test Box moves to the RIGHT.

54. Observe needle of output meter located on Radio Coupler Test Box indicates LEFT.

55. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box CLOCKWISE to center the needle on Power Section Test Box again waiting for computer to digest the new information.

56. Read the degree of bank on the Gyro Substitute Test Box from the TOP SCALE labeled ROLL DEGREES. The pointer must be between 8 to 13 degrees of bank angle. If out of tolerance, replace Console/Amplifier.

57. Rotate the DIRECTIONAL GYRO SELECTOR KNOB located at lower right-hand corner of the Gyro Substitute Test Box further clockwise to the RIGHT-HAND 10 degree position.

58. Observe the needle of Power Section Test Box moves to the RIGHT.

59. Observe the needle of output meter located on Radio Coupler Test Box indicates RIGHT.

60. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box CLOCKWISE to center the needle on the Power Section Test Box again waiting for the computer to digest the new information.

61. Read the degree of bank on the Gyro Substitute Test Box from the TOP SCALE labeled ROLL DEGREES. The pointer must be between 8 to 13 degrees of bank angle. If out of tolerance, replace Console/Amplifier.

62. Place the HDG ON/OFF switch in the "OFF" position and the ROLL COMMAND KNOB full right. Observe needle on Power Section Test Box deflects right.

63. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box CLOCKWISE to center the needle on Power Section Test Box, again waiting for the computer to digest the new information until the needle stays centered after at least a 30 second wait.

64. Read the degree of bank on the Gyro Substitute Test Box from the TOP SCALE labeled ROLL DEGREES, bank must be 28 ± 3 degrees. IF OUT OF TOLERANCE, REPLACE CONSOLE.

65. Rotate the ROLL COMMAND KNOB full LEFT. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box COUNTERCLOCKWISE to center the needle on the Power Section Test Box.

66. Read the degree of bank on the Gyro Substitute Test Box on the TOP SCALE labeled ROLL DEGREES, bank MUST be 28 ± 3 degrees. IF OUT OF TOLERANCE, REPLACE CONSOLE.

67. Place the HDG ON/OFF switch in the "ON" position.

68. Rotate LARGE VERNIER KNOB located on Gyro Substitute Test Box back to the zero degree position on the TOP SCALE labeled ROLL DEGREES.

69. Rotate DIRECTIONAL GYRO SELECTOR KNOB located on lower right-hand corner of this same test box counterclockwise to the ZERO DEGREE position.

70. Place the Radio Coupler Selector Switch in the LOCALIZER/NORM MODE.

71. While holding IN the RED BUTTON on the rear of the Coupler, observe the needle of the Power Section Test Box points to zero and needle of output meter on the Radio Coupler Test Box also reads zero ± two small divisions.

72. On the Radio Coupler Test Box, find RADIO SIGNAL SUBSTITUTE KNOB located immediately to the right of the lower omni meter.

73. PULL the Radio Signal Knob to the "OUT" or "ON" position.

74. Adjust Radio Signal Knob to center the LOWER meter needle on "ZERO."

75. Observe UPPER OUTPUT METER needle remains on ZERO. ,

76. Observe needle of Power Section Test Box remains on ZERO.

77. Rotate RADIO SIGNAL KNOB to deflect LOWER OMNI METER to the RIGHT 100% position.

78. Observe needle of UPPER output meter deflects RIGHT.

79. Observe needle of Power Section Test Box deflects RIGHT.

80. Rotate DIRECTIONAL GYRO SELECTOR KNOB on Gyro Substitute Test Box to the LEFT-HAND 45 degree position full COUNTERCLOCKWISE.

81. WAIT 90 SECONDS. After waiting the required minimum 90 seconds of time, adjust the right INTERCEPT POTENTIOMETER SCREW located on the side of the Radio Coupler to center the needle of the Power Section Test Box to ZERO.

82. With OUTPUT METER of Power Section Test Box adjusted to ZERO, observe OUTPUT METER NEEDLE of Radio Coupler Test Box also indicates ZERO.

CAUTION

REMEMBER TO WAIT A MINIMUM OF 30 SECONDS AFTER MAKING ANY INTERCEPT ADJUSTMENTS.

83. Rotate RADIO SIGNAL KNOB on Radio Coupler Test Box to place the needle of the LOWER OMNI METER to the LEFT-HAND 100% POSITION.

84. Rotate the DIRECTIONAL GYRO SELECTOR KNOB on Gyro Substitute Test Box CLOCKWISE to the RIGHT-HAND 45 DEGREE POSITION. WAIT 90 SECONDS.

85. Adjust the LEFT INTERCEPT POTENTIOMETER SCREW, located on the side of the Radio Coupler, to center the needle of the Power Section Test Box to indicate ZERO.

CAUTION

REMEMBER TO WAIT AT LEAST 30 SECONDS BEFORE TAKING ANY READINGS AFTER MAKING INTERCEPT ADJUSTMENTS.

86. After needle of Power Section Test Box indicates ZERO, observe that upper OUTPUT METER of Radio Coupler Test Box indicates ZERO.

87. Refer to Paragraph 5-24 and set radio gain of Coupler as outlined in Paragraph 5-24, Page 5-48 of this manual prior to completing the Roll Threshold Adjustment Procedure in the following paragraph.

5-7. THRESHOLD ADJUSTMENT PROCEDURE FOR AUTOCONTROL III B.

CAUTION

Threshold adjustments are to be accomplished with a 12-volt calibrated Bench Set-up. When adjusting 28-volt systems, convert Bench Set-up to 12-volt configuration until Threshold Adjustment Procedure is completed. Verify all switches are returned to the 28-volt position prior to reinstallation in 28-volt aircraft. Setting of the Large Vernier Control Knob on the Gyro Substitute Test Box is critical when doing this adjustment procedure.

1. Rotate SELECTOR KNOB, located on lower center of Power Section Test Box, CLOCKWISE to the "RES" position.

2. Ascertain the DIRECTIONAL GYRO SELECTOR KNOB, located on lower right-hand corner of Gyro Substitute Test Box, is in the ZERO or straight "UP" position.

3. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box to the centered ZERO position reading the TOP SCALE labeled ROLL DEGREES.

4. Place the A/P ON/OFF switch on left side of Console/Amplifier in the "ON" position. Observe the LIGHT labeled SOLENOID glows on the Power Section Test Box.

5. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE for a one (1) degree right bank.

6. Observe voltmeter on Power Section Test Box and record meter reading. (Refer to Figure 5-2 for enlarged view of voltmeter.)

7. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box, COUNTERCLOCKWISE for a one (1) degree left bank.

8. Observe voltmeter on Power Section Test Box and record meter reading. Average the meter readings obtained and refer to Table V-I for correct voltage settings.

9. If voltage setting is correct, proceed to next step. If voltage setting is incorrect, adjust threshold adjustment potentiometer (left potentiometer on front of console) (refer to Figure 5-1) as required to obtain an average of the voltage settings listed in Table V-I by repeating Steps 5 thru 8.

10. Place the A/P ON/OFF switch on the Console/Amplifier to the "OFF" position.
11. Rotate the Power Section Test Box Selector Knob COUNTERCLOCKWISE to the center or "OFF" position.
12. Turn Power Supply "OFF."
13. Disconnect test equipment and associated cables and reinstall component in the airplane.
14. Proceed with ground checks and flight adjustments.

5-8. AUTOCONTROL III B GROUND CHECKS WITH RADIO COUPLER.

1. Center the ROLL COMMAND KNOB. Place the A/P ON/OFF switch and HDG ON/OFF switch to the "OFF" position.
2. Start airplane engine to obtain gyro stability.
3. Rotate the airplane control wheel to the level flight (neutral position). Engage the AutoControl III B by placing the A/P ON/OFF switch to the "ON" position. Rotate control wheel right and left to check servo engagement.
4. Rotate the ROLL COMMAND KNOB right and left and observe that the airplane control wheel is moving in the correct direction. Recenter Roll Command Knob.

NOTE

Airplane control wheel will not necessarily be in any particular position when the roll command knob is centered. However, IT WILL REMAIN STATIONARY AT THE POSITION IT IS IN AT THE TIME THE ROLL COMMAND KNOB IS ROTATED TO ITS ZERO ELECTRICAL OUTPUT POSITION.

5. Center the COURSE SELECTOR of the Directional Gyro. Place the Coupler Radio Selector Switch in the NAV one (1) position and turn on number one (1) NAV receiver.
6. Place the Radio Coupler Selector Switch in the "OMNI" mode and place the HDG ON/OFF switch on the Console/Amplifier in the "ON" position.
7. Tune in any available Omni station and center the Course Deviation Indicator.
8. Rotate the DIRECTIONAL GYRO COURSE SELECTOR to the right and left from center and observe that the control wheel moves in the correct direction. (Control wheel should move to the same side as the directional gyro course selector is rotated to.) Return the DIRECTIONAL GYRO COURSE SELECTOR to the CENTER position.
9. Rotate the OMNI BEARING SELECTOR to cause the course deviation indicator to move to the right and to the left and observe that the control wheel moves to the same side as the Course Deviation Indicator Needle.
10. Repeat Steps 7 and 9 with number two (2) radio and Coupler Radio Selector Switch in the NAV 2 position.
11. Place the A/P ON/OFF switch and the HDG ON/OFF switch in the "OFF" position. Rotate control wheel right and left and observe that the servo disengaged.

5-9. AUTOCONTROL III B FLIGHT ADJUSTMENTS WITH RADIO COUPLER. (Refer to Figures 5-1, 5-8.)

1. Remove the Console/Amplifier face plate by removing the roll command knob and the two face plate mounting screws. After removing the face plate, reinstall the roll command knob to facilitate in flight adjustments.

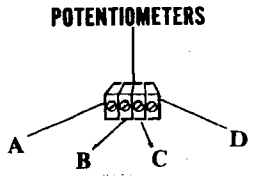
2. Use 75% power during adjustments.

3. MAKE CERTAIN RUDDER TRIM IS ADJUSTED TO CENTER THE BALL. IF RUDDER IS INCORRECTLY TRIMMED, THE AUTOCONTROL III B WILL FLY THE AIRPLANE WITH A WING LOW TO COMPENSATE FOR THE OUT OF TRIM RUDDER.

A - THRESHOLD ADJUSTMENT
B - LEFT BANK ADJUSTMENT
C - CENTERING ADJUSTMENT
D - RIGHT BANK ADJUSTMENT

NOTE

SMOOTH AIR IS REQUIRED.



4. Place the HDG ON/OFF switch on the console in the "ON" position.

5. Place the Coupler Radio Selector Switch in the NAV one (1) position and turn on number one (1) NAV receiver.

6. Place the Radio Coupler Selector Switch in the "OMNI" mode.

7. Set the DIRECTIONAL GYRO COURSE SELECTOR to match the DIRECTIONAL GYRO HEADING (centered).

8. Place the A/P ON/OFF switch in the "ON" position. Depress and hold in the RED BUTTON at the rear of the Radio Coupler throughout the adjustment.

9. Allow the airplane roll attitude to stabilize and if necessary, adjust centering adjustment screw for straight and level flight. After each adjustment, allow the airplane's attitude to stabilize and observe it for two minutes to insure the airplane is maintaining straight flight. Be sure to continue holding in the RED BUTTON on the coupler during this procedure.

10. Place the Radio Coupler Selector Switch in the HEADING mode and observe that the airplane maintains selected heading within + 2 degrees. (Red button on coupler released.)

11. Set the Directional Gyro Course Selector for a 150 degree heading change to the LEFT and observe the angle of bank on the Horizon. If necessary, adjust the LEFT bank adjustment to obtain approximately a 20 degree bank. Turning the adjustment screw clockwise will increase the angle of bank.

NOTE

Keep the Directional Gyro Course Selector at least 25 degrees left of the Directional Gyro Heading until adjustment is complete.

12. Set the Directional Gyro Course Selector for a 150 degree heading change to the RIGHT and observe the angle of bank on the Horizon. If necessary, adjust the RIGHT bank adjustment to obtain approximately a 20 degree bank. Turning the adjustment screw clockwise will increase the angle of bank.

NOTE

Keep the Directional Gyro Course Selector at least 25 degrees right of the Directional Gyro Heading until adjustment is complete.

13. Set the number one (1) OMNI Bearing Selector to obtain full needle deflection to the LEFT.

NOTE

Full omni needle deflection must be maintained until adjustment has been completed. It is advisable to be at least twenty miles from the omni station and fly either "TO" or "FROM" the station. COUPLER SET TO OMNI MODE.

14. To limit the required flying time, set the Directional Gyro Course Selector to the RIGHT-HAND 45 DEGREE index.

15. Allow the airplane heading to stabilize (two minutes).

16. Adjust the LEFT intercept adjustment screw, on the side of the Radio Coupler, as required to stabilize Course Selector at the 45 degree index. Turning the screw CLOCKWISE will INCREASE the intercept angle. (Refer to Figure 5-7.)

17. Set the OMNI Bearing Selector to obtain full needle deflection to the RIGHT.

NOTE

Full omni needle deflection must be maintained until adjustment has been completed. It is advisable to be at least 20 miles from the omni station and fly either "TO" or "FROM" the station. COUPLER SET TO OMNI MODE.

18. To limit the required flying time, set the DIRECTIONAL GYRO COURSE SELECTOR to the LEFT-HAND 45 DEGREE index.

19. Allow the airplane heading to stabilize (two minutes).

20. Adjust the RIGHT INTERCEPT ADJUSTMENT SCREW, on the side of the Radio Coupler, as required to stabilize Course Selector at the 45 degree index. Turning the adjustment screw CLOCKWISE will INCREASE the intercept angle. (Refer to Figure 5-7.)

21. Center the Omni needle with a "TO" flag and set the DIRECTIONAL GYRO COURSE SELECTOR to match the Omni bearing. Allow the airplane to fly to the Omni station and observe that the Omni needle stays "CENTERED." If the Omni needle DOES NOT remain centered, repeat Steps 4 thru 10.

22. Place the Coupler Radio Selector Switch to the center or OFF position.

23. Set the Course Selector to the Directional Gyro Heading and allow the airplane to stabilize in level flight on the selected heading.

24. Adjust the threshold adjustment potentiometer, clockwise until a noticeable roll oscillation develops. (Clockwise rotation increases the sensitivity.)

25. Rotate the threshold adjustment potentiometer counterclockwise until lateral oscillation is eliminated.

NOTE

Counterclockwise rotation past the desired adjustment will cause long term lateral oscillation and possible wandering on established headings.

26. Grasp control wheel and displace aircraft in roll. If no oscillation is present, this completes the flight set-up. If roll oscillation is present, rotate threshold adjustment counterclockwise until oscillation stops. Repeat until oscillation is eliminated.

5-10. BENCH SET-UP AND ADJUSTMENT OF ALTIMATIC III B-1 CONSOLE AND 1C515-1 AMPLIFIER WITHOUT RADIO COUPLER.

NOTE

If either the console or the amplifier is replaced, the console must be set up through its complete adjustment procedure.

a. The following equipment will be required from the AutoPilot Test Kit, Piper P/N 753 439 (66D141).

1. Gyro Substitute Test Box #66D141-1.
2. Power Section Test Box #66D141-2.
3. Console Substitute Box #66D141-3.
4. AltiMatic III test harness, identified by a large 30-pin AMP connector feeding through five connecting cables labeled CD-16, CD-18, CD-20, CD-33 and CD-47. This cable also contains two white wires, one wire terminating at a Delco fitting labeled CD-27 and the other terminating at a knife connector labeled CD-26.
5. Servo Extension Cable CD-47/CD-16 with a male CD-47 connector on one end and a female CD-47 connector on the other end.

b. BENCH SET-UP AND ADJUSTMENT PROCEDURES ARE AS FOLLOWS:

1. Remove the console face plate by removing the knobs and two face plate mounting screws. After removing the face plate, reinstall the knobs to facilitate accomplishing Bench Set-up Adjustments.
2. Determine that the VOLTAGE SELECTOR SWITCHES, located on top plate of amplifier and the right side of the console are in the same position (14 or 28-volts DC) as the bench power supply. This will insure proper AutoPilot operation and prevent damage to the components.
3. Hold the AMPLIFIER with 30-pin amplifier board facing you. Plug large 30-pin AMP connector of the test harness onto the amplifier board with the cable fanning out to your right. Identification placard on the amplifier should be visible.
4. Plug AMP connector CD-20 into the CD-20 receptacle located on the rear of the console.
5. Check that all WHITE ENGAGE BUTTONS are pushed to their "OUT" or "OFF" positions on the AutoPilot Console.

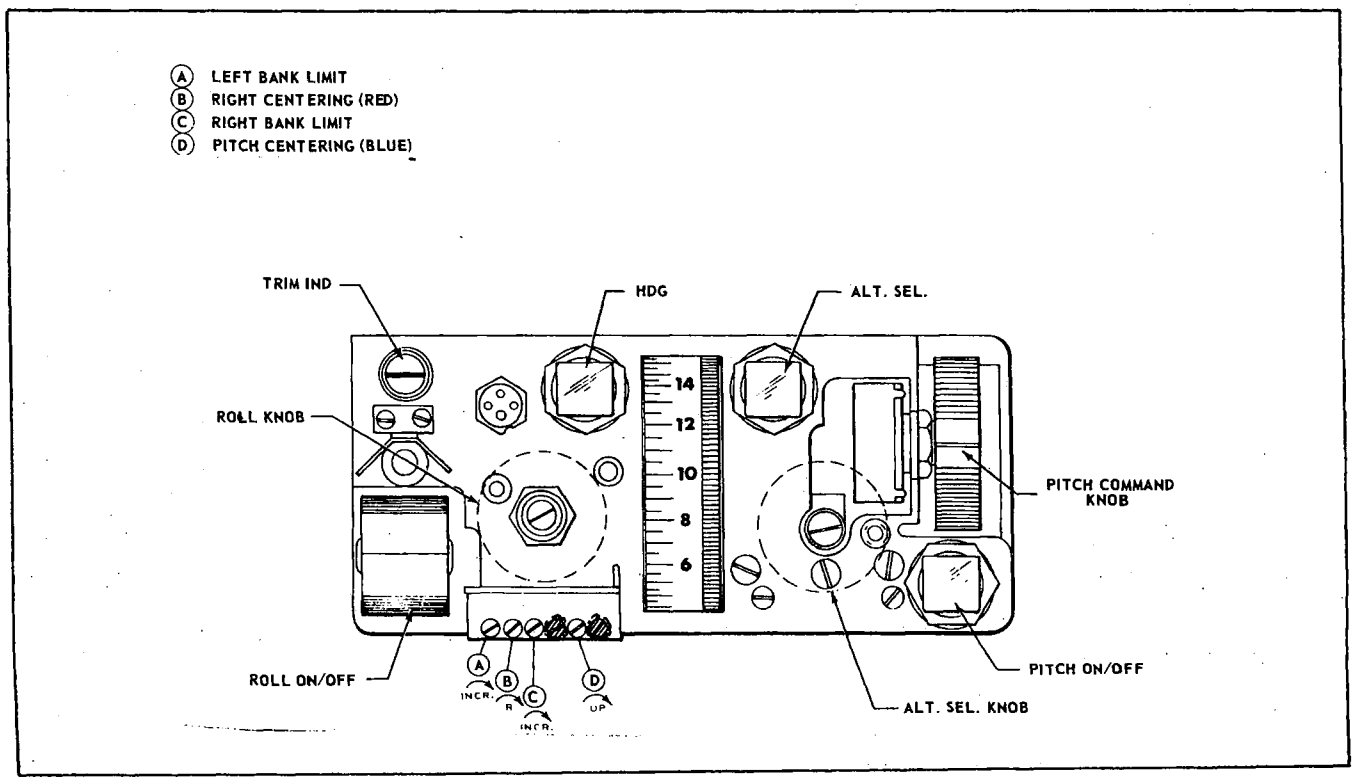


Figure 5-5. AltiMatic III B-1 Console

6. Plug the 4-pin male CD-47 connector into the female 4-pin receptacle, located on the right hand side of the Power Section Test Box. This receptacle is labeled AMPLIFIER. On the Power Section Test Box, find the VOLTAGE SELECTOR SWITCH on the lower left hand corner and insure that this switch is positioned to match the bench power supply and the Amplifier Voltage Selector Switch as in Step 2 (14 or 28-volts DC).

7. Rotate SELECTOR KNOB on Power Section Test Box to the CENTER or "OFF" position.

8. Plug the female 7-pin CD-33 connector into the male 5-pin CD-33 connector located on the bottom left hand corner of the Gyro Substitute Test Box.

9. Plug the 7-pin female CD-18 connector into the 7-pin male CD-18 connector on the left hand side of the Gyro Substitute Test Box.

10. Rotate the LARGE VERNIER CONTROL KNOB on the Gyro Substitute Test Box to the centered ZERO position reading the TOP SCALE labeled ROLL DEGREES.

11. Immediately below the Large Vernier Knob, find a ROLL or PITCH SELECTOR SLIDE SWITCH. Move this switch to the "ROLL" position.

12. Immediately to the right of the Slide Switch, find a DIRECTIONAL GYRO SELECTOR KNOB. Rotate this knob to ZERO or straight "UP" position.

13. Set aside the remaining cables labeled CD-16 and CD-10. Connect a ground lead to the bottom mounting flange of the AltiMatic III B-1 amplifier.

CAUTION

DO NOT place the ground lead near the output transistors located between the cooling fins along the side of the amplifier.

14. Connect the face plate to the console face plate lighting connector with servo extension cable CD-47/CD-16 (with large hole Pin A on connector matching blank on console). Find two WHITE WIRES originating at AMP connector CD-20 on rear of console, one wire terminating in a Delco fitting and one white wire terminating in a KNIFE connector. Connect the white wire CD-26 terminating in a knife connector to a positive 14 or 28-volt supply, whichever is applicable, and observe all face plate lights glow.

NOTE

Console translucent material glows very dimly, shield from external light source. If some lights do not glow, replace bulbs and/or console face plate as required. If none of the lights glow, check DC power source and fuse.

15. Disconnect A+ lead from the knife connector and remove the servo extension cable CD-47/CD-16 from the face plate and the console face plate lighting connector.

16. Attach the DELCO fitting from the remaining white wire to the positive side of the power supply.

17. Push the ROLL ENGAGE SWITCH, located on the lower left hand corner of the AutoPilot Console, to the "ON" position and observe that SOLENOID light located on the face of the Power Section Test Box glows.

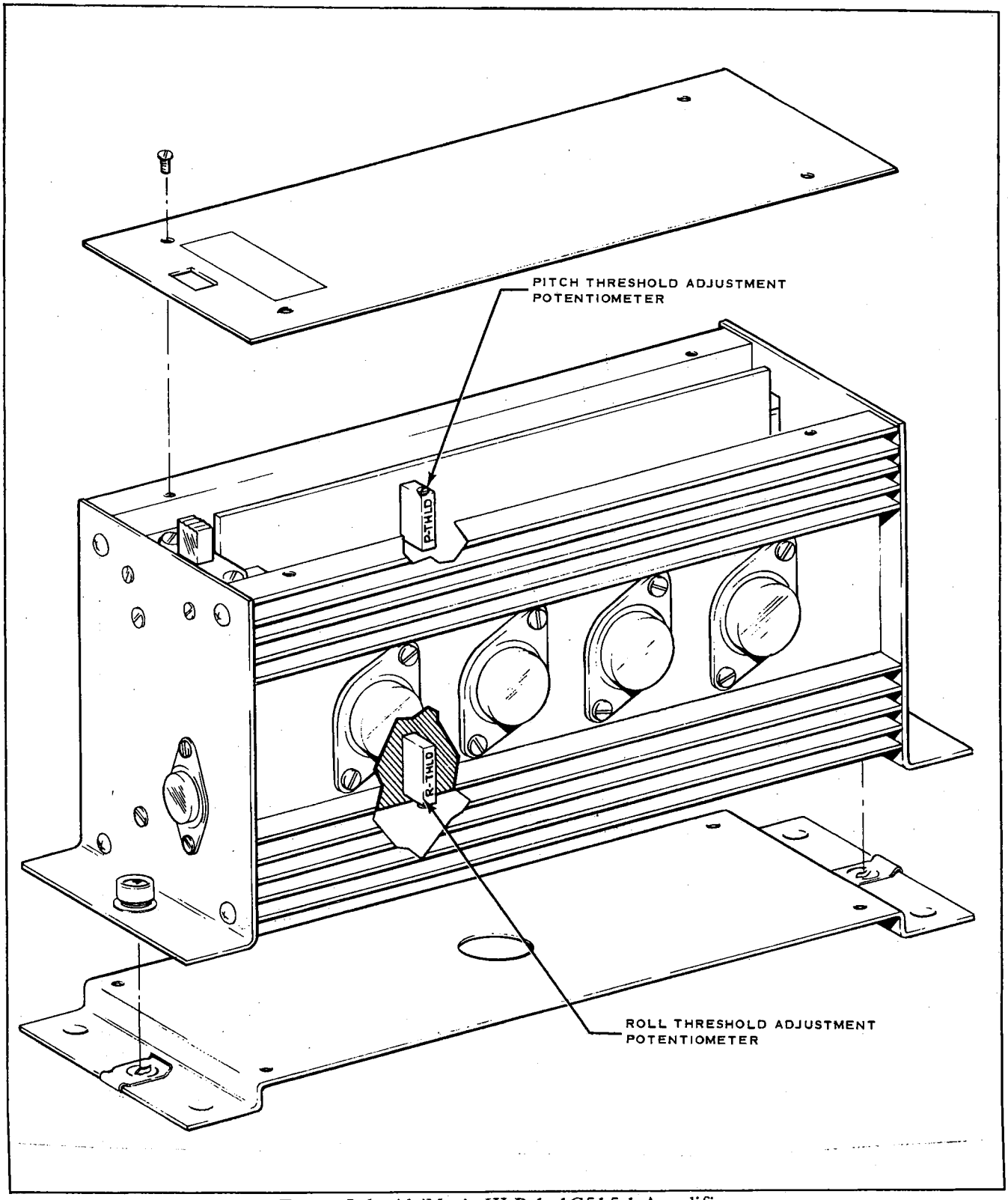


Figure 5-6. AltiMatic III B-1, 1C515-1 Amplifier Threshold Adjustment Potentiometers

NOTE

If solenoid light glows, proceed to Step 18. If solenoid light DOES NOT glow, recheck power supply voltage and wiring harness for correct connections. If solenoid light still does not glow with cables properly connected and proper voltage applied, turn off Power Supply and proceed to Step 22.

18. Disconnect A+ lead. The Roll Engage Switch should disengage.

19. Connect A+ lead. Push ALL switches to the ON position. Ascertain that the light above the Roll Engage Switch and the lights in the Heading, Pitch and Altitude Preselect Switches glow. If lights do not glow, replace bulbs with correct voltage rating. If bulbs still do not glow, replace console.

20. Touch the white wire CD-26 terminating at a knife connector to the 14 or 28-volt supply, whichever is applicable, and observe that all of the console lights dim by approximately 50%. If the console switch lights do not dim, replace the console.

21. Push all console switches to the OFF position except the ROLL ENGAGE SWITCH and proceed to Step 27.

22. Find CONSOLE SUBSTITUTE TEST BOX. Place the POWER SELECTOR SWITCH, located on the lower left hand corner of the Console Substitute Test Box, to the DOWN or "OFF" position.

23. Remove AMP connector CD-20 from the rear of the console and plug it into the CD-20 receptacle located on the top left corner of the Console Substitute Test Box.

24. Immediately to the right of the CD-20 AMP connector, find a 14 or 28-volt SLIDE SWITCH. Place this switch in the proper voltage position to agree with VOLTAGE SELECTOR SWITCH on top plate of amplifier, also the Selector Switch on the lower left hand corner of the Power Section Test Box.

25. Reapply voltage from power supply and place POWER SELECTOR SWITCH on lower left hand side of Console Substitute Box to the "ON" position. Observe SOLENOID LIGHT now glows on Power Section Test Box.

NOTE

If light DOES GLOW, replace AutoPilot CONSOLE. If light DOES NOT glow, replace AutoPilot AMPLIFIER. If component is replaced return to beginning of test sequence.

26. Disconnect AMP connector CD-20 from Console Substitute Test Box and connect it to the Console.

27. Depress RED BUTTON on lower right corner of Power Section Test Box labeled INPUT VOLTAGE. Test box needle should deflect to the right and read 12-14 volts DC or 24-28 volts DC.

28. Rotate SELECTOR KNOB, lower center of Power Section Test Box, CLOCKWISE to the full right position labeled "RES."

29. Rotate the ROLL COMMAND KNOB, located on left side of the Console, full left and observe Voltmeter on Power Section Test Box points LEFT to read approximately 12-volts.

30. Rotate ROLL COMMAND KNOB full right and observe voltmeter on Power Section Test Box indicates right approximately 12 volts. Proceed to Step 32 if correct indication is recorded.

NOTE

If voltmeter does not deflect when rotating Roll Command Knob, recheck that Heading Button, located upper left side of Console, is pushed to the "OUT" position.

31. If needle of Voltmeter on Power Section Test Box still does not respond to the Roll Command Knob rotation, substitute the Console with the Console Substitute Box. Remove the CD-20 plug from the rear of Console and plug it into the CD-20 receptacle on the Console Substitute Box. Place the DIRECTIONAL GYRO MANUAL SLIDE SWITCH IN THE MANUAL POSITION. Make sure the POWER SWITCH is in the "ON" position. Rotate the Roll Manual Knob full RIGHT and observe if voltmeter on Power Section Test Box points right. Rotate the Roll Manual Knob full LEFT, observe if voltmeter on Power Section Test Box points LEFT. If NEEDLE on Voltmeter now MOVES, REPLACE the CONSOLE. If not, replace the AMPLIFIER.

32. Make sure Large Vernier Knob on Gyro Substitute Test Box is centered and points to ZERO on TOP SCALE labeled ROLL DEGREES.

33. Push HEADING BUTTON (upper left side of Console) to the "IN" position. Rotate the Roll Command Knob on the Console full right and left and observe there is NO movement of the needle on the Power Section Test Box. If the needle moves, check that HEADING BUTTON is in the "IN" position. If needle still moves, Console MUST be replaced. If there is no needle movement, proceed with next step.

34. Find six adjustment potentiometers located on the front plate of the Console and directly under the Roll Command Knob. (Refer to Figure 5-5.) Insert SMALL slot head screwdriver in SECOND HOLE FROM LEFT (color coded red) and adjust the roll centering adjustment until needle of voltmeter of Power Section Test Box centers and holds on ZERO. If unable to adjust needle to ZERO by rotating the adjustment screw, replace Console.

CAUTION

When making any adjustment on the AltiMatic III B-1, it is MANDATORY to wait a minimum of 30 seconds before taking any readings until the computer has time to digest any new information.

NOTE

The fourth and sixth adjustment potentiometers on the AltiMatic III B-1 Console are not approved for adjustment in the field. They are preset and sealed at the factory and require no additional adjustment.

35. With needle holding ZERO on Power Section Test Box, push the HEADING BUTTON (upper left side of Console) to the "OUT" position and observe needle on Power Section Test Box. If needle DEFLECTS off of zero, carefully adjust it back to zero by ROTATING the ROLL COMMAND KNOB on the Console, again waiting for the Computer to digest the new command.

36. After the needle holds zero by adjusting the Roll Command Knob, press HEADING BUTTON (upper left side of Console) to the "IN" position and observe NO CHANGE occurs on the Test Box Needle Indication.

NOTE

If needle does change, repeat Steps 34 thru 36.

37. With needle holding zero in each mode, observe the physical position of the Roll Command Knob on the AutoPilot Console is straight up ± approximately 3 degrees. If ROLL COMMAND KNOB is out of tolerance, replace console.

38. Press HEADING BUTTON (upper left side of Console) to the "IN" position.

39. Place DIRECTIONAL GYRO SELECTOR CONTROL KNOB, located on the lower right hand corner of the Gyro Substitute Test Box, to the right hand 45 degree position or full CLOCKWISE. Observe needle deflects RIGHT on the Power Section Test Box.

40. Rotate LARGE VERNIER KNOB on Gyro Substitute Test Box CLOCKWISE to the right hand 20 degree position reading the TOP SCALE labeled ROLL DEGREES.

NOTE

Large increments represent 5 degrees each.

41. With small slot head screwdriver, adjust the potentiometer located inside the THIRD HOLE from the left DIRECTLY below the ROLL COMMAND KNOB on the Console to center the needle on the Power Section Test Box to zero. If unable to adjust to zero, replace console.

42. Leaving the HEADING BUTTON "IN", rotate the DIRECTIONAL GYRO SELECTOR CONTROL KNOB, located on lower right hand corner of the Gyro Substitute Test Box, to the LEFT HAND 45 degree position or full COUNTERCLOCKWISE. Observe needle on Power Section Test Box deflects far left on scale.

43. Rotate LARGE VERNIER KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to the LEFT HAND 20 degree position, reading the TOP SCALE labeled ROLL DEGREES. With small slot head screwdriver, adjust the POTENTIOMETER inside the LEFT HAND HOLE below the Roll Command Knob on Console to center the needle on the Power Section Test Box to zero. If unable to adjust to zero, replace console.

44. Rotate **DIRECTIONAL GYRO SELECTOR KNOB**, located on lower right-hand corner of Gyro Substitute Test Box, to the **LEFT-HAND** 10 degree position. Observe needle on Power Section Test Box moves to the **RIGHT**.

45. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box CLOCKWISE to center the needle on Power Section Test Box, again waiting for the computer to digest the new information until the needle stays centered after at least a 30 second wait.

46. Read the degree of bank in the Gyro Substitute Test Box from the TOP SCALE labeled ROLL DEGREES. The pointer must be between 8 and 13 degrees of bank angle. IF OUT OF TOLERANCE, REPLACE AMPLIFIER.

47. Rotate the DIRECTIONAL GYRO SELECTOR KNOB, located at the lower right hand corner of the Gyro Substitute Test Box, to the RIGHT HAND 10 degree position. Observe needle of Power Section Test Box deflects to the RIGHT.

48. Rotate the LARGE VERNIER KNOB, located on the Gyro Substitute Test Box, CLOCKWISE to center the needle of the Power Section Test Box. Again wait for the computer to digest the new information until the needle stays centered after at least a 30 second wait.

49. Read the degree of bank on the Gyro Substitute Test Box from the TOP SCALE labeled ROLL DEGREES. The pointer must be between 8 and 13 degrees of bank angle. IF OUT OF TOLERANCE, REPLACE AMPLIFIER.

50. Push the HEADING BUTTON (upper left side of Console) to the "OUT" position. Rotate the ROLL COMMAND KNOB full right. Observe needle on Power Section Test Box indicates right.

51. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box CLOCKWISE to center the needle on Power Section Test Box, again waiting for the computer to digest the new information until the needle stays centered after at least a 30 second wait.

52. Read the degree of bank on the Gyro Substitute Test Box TOP SCALE labeled ROLL DEGREES. Bank MUST be 28 degrees ± 3 degrees. IF OUT OF TOLERANCE, REPLACE CONSOLE.

53. Rotate the ROLL COMMAND KNOB full LEFT. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box COUNTERCLOCKWISE to center the needle on the Power Section Test Box.

54. Read the degree of bank on the Gyro Substitute Test Box on the TOP SCALE labeled ROLL DEGREES. Bank MUST be 28 degrees ± 3 degrees. IF OUT OF TOLERANCE, REPLACE CONSOLE.

55. Recenter ROLL COMMAND KNOB to the center position. Rotate the POWER SECTION TEST BOX SELECTOR KNOB, turning COUNTERCLOCKWISE to the CENTER or "OFF" position. Rotate the DIRECTIONAL GYRO SELECTOR KNOB, located on lower right hand corner of Gyro Substitute Test Box, to the ZERO or straight "UP" position.

56. Push ROLL ENGAGE BUTTON to the "OUT" position.

57. Refer to the following paragraph for Roll Threshold Adjustment Procedure.

5-11. ROLL THRESHOLD ADJUSTMENT FOR ALTIMATIC III B-1.

Remove the base plate from the bottom of the amplifier to gain access to the Roll Threshold Adjustment potentiometer. (Refer to Figure 5-6.)

CAUTION

Threshold adjustments are to be accomplished with a 12-volt calibrated Bench Set-up. When adjusting 28-volt systems, convert Bench Set-up to 12-volt configuration until Threshold Adjustment Procedure is completed. Verify all switches are returned to the 28-volt position prior to reinstallation in 28-volt aircraft. Setting of the Large Vernier Control Knob on the Gyro Substitute Test Box is critical when doing this adjustment procedure.

1. Disconnect the AMP connector CD-20 from the rear of the console and set the console aside.

2. Find CONSOLE SUBSTITUTE TEST BOX. Place the POWER SELECTOR SWITCH, located on the lower left hand corner of the Console Substitute Test Box, to the DOWN or "OFF" position.

3. Plug the AMP connector CD-20 into the receptacle, located on the top left corner of the Console Substitute Test Box.

4. Immediately to the right of the AMP connector CD-20 on the Console Substitute Test Box, find the (14 or 28-volt) SLIDE SWITCH. Place this switch in the 14-volt position.

5. Place the DIRECTIONAL GYRO Slide Switch, located on lower left of Console Substitute Test Box, in the UP or D.G. position.

6. Rotate SELECTOR KNOB, lower center of Power Section Test Box, CLOCKWISE to the "RES" position.

7. Ascertain the DIRECTIONAL GYRO SELECTOR KNOB, located on lower right hand corner of Gyro Substitute Test Box, is in the ZERO or straight "UP" position.

8. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box to the centered ZERO position reading the TOP SCALE labeled ROLL DEGREES.

9. Place the POWER SELECTOR SWITCH on lower left hand side of Console Substitute Test Box to the "ON" position. Observe SOLENOID LIGHT now glows on Power Section Test Box.

10. Rotate the ROLL TRIM KNOB on Console Substitute Test Box as required to center the needle on the Power Section Test Box to ZERO.

11. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE for a one (1) degree right bank.

12. Observe voltmeter on Power Section Test Box and record meter reading. (Refer to Figure 5-2 for enlarged view of voltmeter.)

13. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box, COUNTERCLOCKWISE for a one (1) degree left bank.

14. Observe voltmeter on Power Section Test Box and record meter reading. Average the meter readings obtained and refer to Table V-I for correct voltage settings.

15. If voltage setting is correct proceed to next step. If voltage setting is incorrect find the Roll Threshold Adjustment Potentiometer, located on the lower section of the amplifier printed circuit board (refer to Figure 5-6), and adjust to obtain an average of the voltage settings listed in Table V-I by repeating Steps 11 thru 14.

16. Rotate the Power Section Test Box Selector Knob COUNTERCLOCKWISE to the center or "OFF" position.

17. Place the POWER SELECTOR SWITCH on lower left hand side of Console Substitute Test Box to the "OFF" position.

18. Refer to the following paragraph for the Pitch Bench Set-up.

5-12. PITCH BENCH SET-UP FOR ALTIMATIC III B-1.

1. Disconnect AMP connector CD-20 from the Console Substitute Test Box and connect it to the console.

2. Unplug CD-47 connector attached to the face of the Power Section Test Box Amplifier receptacle. Set aside the CD-47 that was removed and in its place install the 4-pin male CD-16 connector.

3. Plug the 5-pin female CD-10 connector into the 5-pin male connector on right hand side of the Console Substitute Box.

4. Rotate the LARGE VERNIER CONTROL KNOB on the Gyro Substitute Test Box to read zero on the BOTTOM SCALE labeled PITCH DEGREES.

5. Immediately below the Vernier Control Knob, find a SLIDE SWITCH labeled ROLL and PITCH. Place this switch in the "DOWN" or PITCH position.

6. Ascertain that the VOLTAGE SELECTOR SWITCHES of all the components are in the same position (14 or 28-volts DC) as the bench power supply. This will insure proper AutoPilot operation and prevent damage to the components.

7. Engage the ALTIMATIC III B-1 by pushing the ROLL ENGAGE SWITCH, located at the lower left hand corner of the console, to the "ON" position. DO NOT EXPECT SOLENOID LIGHT TO GLOW.

8. Push PITCH ENGAGE BUTTON, located on the lower right hand corner of the console, to the "IN" position and observe Solenoid light, located on the face of the Power Section Test Box, glows. If light glows, proceed with Step 15.

   a. If solenoid light does not glow, recheck that CD-16 connector is installed in the receptacle on the face of the Power Section Test Box labeled Amplifier.
   b. If solenoid light does not glow, recheck power supply voltage and wiring harness for correct connections.
   c. If solenoid light still does not glow with cables properly connected and proper voltage applied, turn off power supply and proceed with next step.

9. Place the POWER SELECTOR SWITCH, located on the lower left hand corner of the Console Substitute Box to the DOWN or "OFF" position.

10. Remove the AMP connector CD-20 from the rear of the console and plug it into the CD-20 receptacle located on the top left corner of Console Substitute Test Box.

11. Immediately to the right of the CD-20 AMP connector, find a 14 or 28-volt SLIDE SWITCH. Ascertain the switch is in the proper voltage position to agree with both the Voltage Selector Switch on top plate of amplifier and the Selector Switch on the lower left corner of the Power Section Test Box.

12. Reapply voltage from Power Supply and place Power Selector Switch on lower left hand side of Console Substitute Test Box to the UP or "ON" position. Observe solenoid light now glows on Power Section Test Box.

NOTE

If light DOES glow, replace AutoPilot CONSOLE. If light DOES NOT glow, replace AutoPilot AMPLIFIER.

13. Place the POWER SELECTOR SWITCH, located on the lower left hand corner of the Console Substitute Box to the DOWN or "OFF" position.

14. Unplug the AMP connector CD-20 attached to the Console Substitute Test Box and connect it to the CD-20 receptacle on the rear of the console.

15. Rotate the Selector Knob, located on the face of the Power Section Test Box, full CLOCKWISE to the "RES" position.

16. Make sure LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box is reading ZERO on the BOTTOM SCALE labeled PITCH DEGREES.

17. Rotate the PITCH COMMAND DISK up on AltiMatic Console, for a full DOWN command and observe needle of Power Section Test Box deflects LEFT.

18. Rotate the PITCH COMMAND DISK down for a full UP command and observe needle of Power Section Test Box deflects to the RIGHT.

19. Recenter PITCH COMMAND DISK so that the indice calls for a level attitude.

20. Push the ALTITUDE PRESELECT BUTTON (located on top right of Console) to the "IN" position.

21. Adjust the Altitude Control Knob on the Console Substitute Test Box to center the TRIM METER ON THE CONSOLE.

22. With small slot head screwdriver, adjust the FIFTH POTENTIOMETER from the left (color coded BLUE) and located directly below the ROLL COMMAND KNOB on the Console to center the needle on the Power Section Test Box to ZERO. (Refer to Figure 5-5.)

NOTE

Keep in mind you MUST WAIT 30 SECONDS for the AutoPilot to digest any new information.

23. Rotate PITCH COMMAND DISK down for a full "UP" command and then up for a full "DOWN" command and note little change occurs on Power Section Test Box meter. Should a large amount of needle movement be present during Pitch Command Disk movement, recheck ALTITUDE PRESELECT BUTTON (located on top right of Console) is in the "IN" position. (If a large amount of needle movement is still present during Pitch Command Disk movement, replace Console.) Recenter the Pitch Command Disk.

24. Rotate the Altitude Control Knob on Console Substitute Test Box CLOCKWISE for a full "UP" command. Observe meter on Power Section Test Box, needle should deflect right and trim meter on console should deflect up.

25. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 8 degrees nose up.

26. Rotate PITCH COMMAND DISK up for a full "DOWN" command, observe meter on Power Section Test Box, needle should deflect left.

27. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 4 degrees nose up.

28. Rotate PITCH COMMAND DISK down for a full "UP" command, observe meter on Power Section Test Box, needle should deflect right.

29. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 9 degrees nose up.

30. Re-center PITCH COMMAND DISK.

31. Rotate the Altitude Control Knob on Console Substitute Test Box COUNTERCLOCKWISE for a full "DOWN" command. Observe meter on Power Section Test Box, needle should deflect left and trim meter on console should deflect down.

32. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 5 degrees nose down.

33. Rotate the PITCH COMMAND DISK down for a full "UP" command, observe meter on Power Section Test Box, needle should deflect right.

34. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 2 degrees nose down.

35. Rotate the PITCH COMMAND DISK up for a full "DOWN" command, observe meter on Power Section Test Box, needle should deflect left.

36. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 7 degrees nose down.

37. If the system fails to respond to any of the test procedure outlined in Steps 24 thru 35, replace the console.

38. Push all Console Switches to the OUT or "OFF" position.

39. Refer to the following paragraph for Pitch Threshold Adjustment Procedure.

5-13. PITCH THRESHOLD ADJUSTMENT FOR ALTIMATIC III B-1.

Remove the cover plate from the top of the amplifier to gain access to the Pitch Threshold Adjustment Potentiometer. (Refer to Figure 5-6.)

CAUTION

> Threshold adjustments are to be accomplished with a 12-volt calibrated Bench Set-up. When adjusting 28-volt systems, convert Bench Set-up to 12-volt configuration until Threshold Adjustment Procedure is completed. Verify all switches are returned to the 28-volt position prior to reinstallation in 28-volt aircraft. Setting of the Large Vernier Control Knob on the Gyro Substitute Test Box is critical when doing this adjustment procedure.

1. Disconnect the AMP connector CD-20 from the rear of the console and set the console aside.

2. Find CONSOLE SUBSTITUTE TEST BOX. Place the POWER SELECTOR SWITCH, located on the lower left hand corner of the Console Substitute Test Box, to the DOWN or "OFF" position.

3. Plug the AMP connector CD-20 into the receptacle, located on the top left corner of the Console Substitute Test Box.

TABLE V-I. ROLL THRESHOLD

AIRCRAFT MODEL	THRESHOLD VOLTAGE
PA-23-250	3.0-volts
PA-24-260	2.5-volts
PA-28	2.0-volts
PA-28R-200;-201;-201T PA-28RT-201;-201T	2.0-volts
PA-31	2.2-volts
PA-31-350	2.5-volts
PA-31P	2.4-volts
PA-32-260;-300	2.0-volts
PA-32R-300 PA-32RT-300;-300T	2.0-volts
PA-32-301;-301T	2.5-volts
PA-32R-301;-301T	2.5-volts
PA-34-200	2.5-volts
PA-34-200T	2.5-volts
PA-39	2.5-volts
PA-44-180	2.5-volts
PA-44-180T	2.5-volts

TABLE V-II. PITCH THRESHOLD

AIRCRAFT MODEL	THRESHOLD VOLTAGE
PA-23-250	4.0-volts
PA-24-260	3.0-volts
PA-31	3.0-volts
PA-31-350	3.4-volts
PA-31P	3.6-volts
PA-34-200	3.5-volts
PA-39	3.3-volts

4. Immediately to the right of the AMP connector CD-20 on the Console Substitute Test Box, find the (14 or 28-volt) SLIDE SWITCH. Place this switch in the 14-volt position.

5. Place the ALT. CONTROL Slide Switch, located on lower left of Console Substitute Test Box, in the UP or Alt. Control position.

6. Place the ALTITUDE CONTROL KNOB, located on upper right of Console Substitute Test Box, to the straight up or 12 o'clock position.

7. Rotate the SELECTOR KNOB, lower center of Power Section Test Box, CLOCKWISE to the "RES" position.

8. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box to the ZERO position on the BOTTOM SCALE labeled PITCH DEGREES.

9. Immediately below the Large Vernier Control Knob on Gyro Substitute Test Box, find a SLIDE SWITCH labeled ROLL and PITCH. Place this switch in the "DOWN" or PITCH position.

10. Place the POWER SELECTOR SWITCH on lower left hand side of Console Substitute Test Box to the "ON" position. Observe SOLENOID LIGHT now glows on Power Section Test Box.

11. Rotate the PITCH TRIM KNOB on Console Substitute Test Box as required to center the needle on Power Section Test Box to ZERO.

12. Rotate LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to indicate one (1) degree nose down, reading BOTTOM SCALE labeled PITCH DEGREES.

13. Observe voltmeter on Power Section Test Box and record meter reading. (Refer to Figure 5-2 for enlarged view of voltmeter.)

14. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE to indicate one (1) degree nose up, reading BOTTOM SCALE labeled PITCH DEGREES.

15. Observe voltmeter on Power Section Test Box and record meter reading. Average the meter readings obtained and refer to Table V-II for correct voltage settings.

16. If voltage setting is correct proceed to next step. If voltage setting is incorrect find the Pitch Threshold Adjustment Potentiometer, located on upper section of amplifier printed circuit board, (Refer to Figure 5-6) and adjust to obtain an average of the voltage setting listed in Table V-II by repeating Steps 12 thru 15.

17. Place the POWER SELECTOR SWITCH on Console Substitute Test Box to the "OFF" position.

18. Disconnect test equipment and associated cables and reinstall the components in the airplane.

19. Proceed with ground checks and flight adjustments.

5-14. ALTIMATIC III B-1 GROUND CHECK WITHOUT RADIO COUPLER (ROLL).

1. Remove the console face plate by removing the knobs and two face plate mounting screws. After removing the face plate, reinstall the knobs to facilitate accomplishing in-flight adjustments.

2. Center the Roll Knob and position HEADING and ROLL Engage Switches to the OUT or "OFF" position.

3. Start airplane engine to obtain gyro stability.

4. Place the airplane control wheel to approximately neutral aileron or level flight position. Push ROLL engage button to the "IN" position. Move control wheel right and left to check for servo engagement.

5. Rotate the ROLL KNOB to the right and to the left and observe that the airplane control wheel moves in the correct direction.

NOTE

The airplane control wheel can be stopped in any position and will not return to level position by centering the Roll Knob. The airplane control wheel will remain stationary at the time the Roll Knob is approximately centered or at its zero electrical output position.

6. Center the Course Selector of the Directional Gyro and push the console HEADING BUTTON "IN." WITH CONSOLE HEADING BUTTON PUSHED TO THE "IN" POSITION, THE ROLL KNOB ON THE CONSOLE BECOMES INOPERATIVE.

7. Rotate the DIRECTIONAL GYRO COURSE SELECTOR right and left from center and observe that the control wheel turns in the correct direction. Return Directional Gyro Course Selector to center.

8. Push ROLL ENGAGE SWITCH to the "OFF" position. Rotate the CONTROL WHEEL right and left and observe that the servo disengaged.

9. Refer to paragraph 5-21 and proceed with AltiMatic III B-1 Pitch Ground Check.

5-15. ALTIMATIC III B-1 FLIGHT ADJUSTMENTS WITHOUT RADIO COUPLER (ROLL).

1. Refer to the appropriate airplane Flight Manual for proper power settings during adjustments.

NOTE

For adjusting descent, 19 inches of mercury manifold pressure must be used on all airplanes except the PA-31 and PA-31-350 which must be adjusted at 20 inches of mercury and the PA-31P which must be adjusted at 25 inches of mercury.

2. MAKE CERTAIN RUDDER TRIM IS ADJUSTED TO CENTER THE BALL. IF RUDDER IS INCORRECTLY TRIMMED, THE ALTIMATIC WILL FLY THE AIRPLANE WITH A WING LOW TO COMPENSATE FOR THE OUT OF TRIM RUDDER.

NOTE

SMOOTH AIR IS REQUIRED.

3. Push console HEADING BUTTON to the "IN" position. Set the DIRECTIONAL GYRO COURSE SELECTOR to the Directional Gyro heading.

4. Push ROLL ENGAGE SWITCH to the "IN" or ON position. If the airplane does not maintain the selected heading, adjust Roll centering adjustment as necessary so that airplane remains on selected heading.

5. Rotate the DIRECTIONAL GYRO COURSE SELECTOR 150 degrees to the left of heading and observe the angle of bank on the Artificial Horizon. Adjust the left bank screw of the Console to obtain 20 degree bank. Rotating the adjustment screw clockwise will increase the bank angle.

CAUTION

Make certain COURSE SELECTOR does not get within 25 degrees of the airplane's heading until the adjustment is completed.

6. Rotate the DIRECTIONAL GYRO COURSE SELECTOR 150 degrees to the RIGHT and observe the angle of bank. Adjust the right bank adjustment screw of the console to obtain a 20 degree bank. Rotating adjustment screw CLOCKWISE INCREASES bank angle.

CAUTION

Make certain COURSE SELECTOR does not get within 25 degrees of the airplane's heading until the adjustment is completed.

7. Allow the airplane to become established on the selected heading. Observe that AutoPilot maintains a selected heading within ± 2 degrees. If not, repeat Step 4.

NOTE

Always recheck bank settings after adjusting Roll centering.

8. Make certain Roll Knob is centered. Push console HEADING BUTTON to the "OFF" or OUT position and observe that the airplane flies wings level within ± 2 degrees.
9. Turn the Roll Knob full LEFT and observe that airplane banks LEFT 28 ± 3 degrees.
10. Turn the Roll Knob full RIGHT and observe that airplane banks RIGHT 28 ± 3 degrees.
11. Refer to paragraph 5-23 and proceed with AltiMatic III B-1 Pitch Flight Check Adjustments.

5-16. BENCH SET-UP AND ADJUSTMENTS FOR ALTIMATIC III B-1 CONSOLE AND 1C515-1 AMPLIFIER WITH RADIO COUPLER.

NOTE

If either the console or the amplifier is replaced, the console must be set up through its complete adjustment procedure.

a. The following equipment will be required from the AutoPilot Test Kit, Piper P/N 753 439 (66D141).
1. Gyro Substitute Test Box #66D141-1.
2. Power Section Test Box #66D141-2.
3. Console Substitute Box #66D141-3.
4. Radio Coupler Tester #66D141-4.

5. AltiMatic III test harness, identified by a large 30-pin AMP connector feeding through five connecting cables labeled CD-16, CD-18, CD-20, CD-33 and CD-47. This cable also contains two white wires, one wire terminating at a Delco fitting labeled CD-27 and the other terminating at a knife connector labeled CD-26.

6. Servo Extension Cable CD-47/CD-16 with a male CD-47 connector on one end and a female CD-47 connector on the other end.

7. One radio extension cable approximately 3 feet long with a female 9-pin connector labeled CD-34 on each end.

8. Two amplifier extension cables, approximately 3 feet long, with a female 7-pin connector labeled CD-33 on one end and a male 7-pin connector also labeled CD-33 at the other end.

9. One Coupler Test Box power cable, approximately 3 feet long, with a RED and BLACK alligator clip on one end and a red and black male plug on the other end.

b. BENCH SET-UP AND ADJUSTMENT PROCEDURES ARE AS FOLLOWS:

1. Remove the console face plate by removing the knobs and two face plate mounting screws. After removing the face plate, reinstall the knobs to facilitate accomplishing Bench Set-up Adjustments.

2. Determine that the VOLTAGE SELECTOR SWITCHES, located on top plate of amplifier and the right side of the console are in the same position (14 or 28-volts DC) as the bench power supply. This will insure proper AutoPilot operation and prevent damage to the components.

3. Hold the AMPLIFIER with 30-pin amplifier board facing you. Plug large 30-pin AMP connector of the test harness onto the amplifier board with the cable fanning out to your right. Identification placard on the amplifier should be visible.

4. Plug AMP connector CD-20 from the test harness onto the CD-20 receptacle located on the rear of the console.

5. Check that all WHITE ENGAGE SWITCHES are pushed to their "OUT" or "OFF" positions on the AutoPilot Console.

6. Plug the 4-pin male CD-47 connector from the test harness into the female 4-pin receptacle located on the right hand side of the Power Section Test Box. This receptacle is labeled AMPLIFIER. On the Power Section Test Box, find the VOLTAGE SELECTOR SWITCH on the lower left hand corner and insure that this switch is positioned to match the bench power supply and the Amplifier Voltage Selector Switch in Step 2. (14 or 28-volts DC).

7. Rotate SELECTOR KNOB on Power Section Test Box to the CENTER or "OFF" position.

8. Connect the CD-33 CABLE coming from the large AMP connector of the Amplifier, into the male 7-pin connector located on the face of the Radio Coupler Test Box at the upper left hand corner (LABELED AMPLIFIER).

9. Find the RADIO SIGNAL SUBSTITUTE KNOB located on the RADIO COUPLER TEST BOX, immediately to the right of the Bottom Omni Meter. MAKE SURE THIS RADIO SIGNAL KNOB IS IN THE "IN" POSITION.

10. Find the VOLTAGE SELECTOR SWITCH located immediately to the left of the Red and Black DC input terminals on the face of the Radio Coupler Test Box. Place this VOLTAGE SELECTOR SWITCH in the proper voltage position.

11. Connect one of the two CD-33 EXTENSION CABLES to the 7-pin female connector LABELED COUPLER, located on the face of the Radio Coupler Test Box.

12. Connect the 7-pin female connector at the other end of the CD-33 cable to the 7-pin male connector located on the rear of the Radio Coupler LABELED CD-33.

13. Find the CD-34 EXTENSION CABLE with female connectors at both ends. Connect one end of this cable to the male 9-pin connector located on the rear of the Radio Coupler LABELED CD-34. Connect the other female 9-pin connector CD-34 on this cable to the male 9-pin connector located on the face of the Radio Coupler Test Box, LABELED RADIO, CD-34.

14. Connect the short cable coming from inside the Radio Coupler with a 5-pin female connector LABELED CD-33 on the end to the 5-pin male connector located on the face of the Gyro Substitute Test Box.

15. Connect the CD-18 cable coming from the large AMP plug at the amplifier to the 7-pin male connector located on the face of the Gyro Substitute Test Box LABELED CD-18.

16. Rotate LARGE VERNIER CONTROL KNOB on face of Gyro Substitute Test Box to the CENTER or "ZERO" position on the TOP SCALE labeled ROLL DEGREES.

17. Below the Large Vernier Knob on the Gyro Substitute Box, find a SLIDE SWITCH labeled "ROLL" and "PITCH." Place this slide switch in the "UP" or "ROLL" position.

18. Immediately to the right of the Slide Switch, find a DIRECTIONAL GYRO SELECTOR KNOB.

19. Place this DIRECTIONAL GYRO SELECTOR KNOB to the CENTER or "ZERO" position.

20. Find the RADIO COUPLER POWER CABLE with the RED and BLACK alligator clips on one end. (Refer to Figure 5-4.) Plug the RED and BLACK MALE PLUGS of the Coupler Test Box Power Cable into the red and black female receptacles located on the face of the Radio Coupler Test Box LABELED DC INPUT.

21. Connect the RED and BLACK ALLIGATOR CLIPS to a 14 or 28-volt DC power supply, whichever is applicable, FUSED at 3 AMPS USED TO CHECK COUPLER LIGHTS ONLY.

CAUTION

OBSERVE POLARITY.

22. Make sure all white buttons on the console are PUSHED to their "OUT" position.

23. Set aside the remaining cables labeled CD-16 and CD-10. Connect a ground lead to the bottom mounting flange of the AltiMatic III B-1 Amplifier.

CAUTION

DO NOT place the ground lead near the output transistors located between the cooling fins along the side of the amplifier.

24. Connect the face plate to the console face plate lighting connector with servo extension cable CD-47/CD-16 (with large hole Pin A on connector matching blank on console). Find two WHITE WIRES originating at AMP connector CD-20 on rear of console, one wire terminating in a Delco fitting and one white wire terminating in a knife connector. Connect the white wire CD-26 terminating in a knife connector to a positive 14 or 28-volt supply, whichever is applicable, and observe all face plate lights glow.

NOTE

Console translucent material glows very dimly, shield from external light source. If some lights do not glow, replace bulbs and/or console face plate as required. If none of the lights glow, check DC power source and fuse.

25. Disconnect A+ lead from the knife connector and remove the servo extension cable CD-47/CD-16 from the face plate and the console face plate lighting connector.

26. Attach the DELCO fitting from the remaining white wire to the positive side of the power supply.

27. Push the ROLL ENGAGE SWITCH, located on the lower left hand corner of the AutoPilot Console, to the "ON" position and observe that SOLENOID light located on the face of the Power Section Test Box glows.

NOTE

If solenoid light glows, proceed to Step 28. If solenoid light DOES NOT glow, recheck power supply voltage and wiring harness for correct connections. If solenoid light still does not glow with cables properly connected and proper voltage applied, turn off Power Supply and proceed to Step 32.

28. Disconnect A+ lead. The Roll Engage Switch should disengage.

29. Connect A+ lead. Push ALL switches to the ON position. Ascertain that the light above the Roll Engage Switch and the lights in the Heading, Pitch and Altitude Preselect Switches glow. If lights do not glow, replace bulbs with correct voltage rating. If Roll Switch remains engaged and bulbs still do not glow, replace console.

30. Touch the white wire CD-26 terminating at a knife connector to the 14 or 28-volt supply, whichever is applicable, and observe that all of the console lights dim by approximately 50%. If the console switch lights do not dim, replace the console.

31. Push all console switches to the OFF position except the ROLL ENGAGE SWITCH and proceed to Step 37.

32. Find CONSOLE SUBSTITUTE TEST BOX. Place the POWER SELECTOR SWITCH, located on the lower left hand corner of the Console Substitute Test Box, to the DOWN or "OFF" position.

33. Remove AMP connector CD-20 from the rear of the console and plug it into the CD-20 receptacle located on the top left corner of the Console Substitute Test Box.

34. Immediately to the right of the AMP connector CD-20 find a 14 or 28-volt SLIDE SWITCH. Place this switch to the proper voltage position to agree with VOLTAGE SELECTOR SWITCH on the top plate of the amplifier, also the Selector Switch on the lower left hand corner of the Power Section Test Box.

35. Reapply voltage from power supply and place POWER SELECTOR SWITCH on lower left hand side of Console Substitite Box to the "ON" position. Observe SOLENOID LIGHT now glows on Power Section Test Box.

NOTE

If light DOES glow, replace AutoPilot CONSOLE. If light DOES NOT glow, replace AutoPilot AMPLIFIER. If component is replaced return to beginning of test sequence.

36. Disconnect AMP connector CD-20 from Console Substitute Test Box and connect it to the Console.

37. Depress RED BUTTON on lower right corner of Power Section Test Box labeled INPUT VOLTAGE. Test box needle should deflect to the right and read 12-14 volts DC or 24-28 volts DC.

38. Rotate SELECTOR KNOB, lower center of Power Section Test Box, CLOCKWISE to the full right position labeled "RES."

39. Rotate the ROLL COMMAND KNOB, located on left side of the Console, full left and observe voltmeter on Power Section Test Box points LEFT to read approximately 12-volts.

40. Rotate ROLL COMMAND KNOB full right and observe voltmeter on Power Section Test Box indicates right approximately 12-volts. Proceed to Step 42 if correct indication is recorded.

NOTE

If voltmeter DOES NOT deflect when rotating Roll Command Knob, recheck that Heading Button, located upper left side of Console, is pushed to the "OUT" position.

41. If needle of Voltmeter on Power Section Test Box still does not respond to the Roll Command Knob rotation, substitute the Console with the Console Substitute Box. Remove the CD-20 plug from the rear of Console and plug it into the CD-20 receptacle on the Console Substitute Box. Place the DIRECTIONAL GYRO MANUAL SLIDE SWITCH in the MANUAL POSITION. Make sure the POWER SWITCH is in the "ON" position. Rotate the Roll Manual Knob full RIGHT and observe if voltmeter on Power Section Test Box points RIGHT. Rotate the Roll Manual Knob full LEFT. Observe if voltmeter on Power Section Test Box points LEFT. If needle on voltmeter now MOVES, REPLACE the CONSOLE. If not, replace the AMPLIFIER.

42. Make sure the Large Vernier Knob on Gyro Substitute Test Box is centered and points to ZERO on TOP SCALE labeled ROLL DEGREES.

43. Place Radio Coupler SELECTOR SWITCH to the LOC/NORM mode and push HEADING BUTTON to "IN" position.

44. Depress the RED BUTTON on rear of the Radio Coupler.

45. Find six adjustment potentiometers located on the front plate of the console and directly under the Roll Command Knob. (Refer to Figure 5-5.) While holding IN the RED BUTTON on rear of Radio Coupler, insert small slot-head screwdriver in SECOND HOLE FROM LEFT (color coded red) and adjust roll centering adjustment until needle of voltmeter of Power Section Test Box centers and holds on ZERO. If unable to adjust needle to ZERO by rotating the adjustment screw, replace Console.

CAUTION

When making any adjustment on the AltiMatic III B-1, it is MANDATORY to wait a minimum of 30 seconds before taking any readings until the computer has time to digest any new information.

NOTE

The fourth and sixth adjustment potentiometers on the AltiMatic III B-1 Console are not approved for adjustment in the field. They are preset and sealed at the factory and require no additional adjustment.

46. Push the HEADING BUTTON (upper left side of the Console) to the "OUT" position.

47. Carefully adjust the ROLL COMMAND KNOB on the console to center the needle of the Power Section Test Box to ZERO. Remember to wait at least 30 seconds before taking any readings.

48. Push in the HEADING BUTTON (upper left side of Console) to the "IN" position and also press in RED BUTTON on rear of Radio Coupler to observe the needle of the Power Section Test Box recenters on ZERO.

a. If needle does not recenter on ZERO, repeat Steps 42 thru 48 until centering is accomplished.

49. Push HEADING BUTTON (upper left side of Console) to the "OUT" position.

50. Observe the physical position of the Roll Command Knob on the console. Make sure the knob is straight up ± approximately 3 degrees. If ROLL COMMAND KNOB is out of tolerance, replace console.

51. Press HEADING BUTTON (upper left side of Console) to the "IN" position.

52. Place Radio Coupler SELECTOR SWITCH to the HEADING mode. Place the DIRECTIONAL GYRO SELECTOR CONTROL KNOB, located on the lower right hand corner of the Gyro Substitute Test Box, to the RIGHT HAND 45 degree position or full CLOCKWISE. Observe needle deflects RIGHT on the Power Section Box.

53. Rotate LARGE VERNIER KNOB on Gyro Substitute Test Box CLOCKWISE to the RIGHT HAND 20 degree position, reading the TOP SCALE labeled ROLL DEGREES.

NOTE

Large increments represent 5 degrees each.

54. With small slot head screwdriver, adjust the POTENTIOMETER SCREW, located inside the THIRD HOLE from the LEFT directly below the ROLL COMMAND KNOB on the console to center the needle on the Power Section Test Box to zero. If unable to adjust to zero, replace console.

55. Observe NEEDLE OF OUTPUT METER, located on Radio Coupler Test Box, indicates RIGHT.

56. Leaving HEADING BUTTON "IN", rotate DIRECTIONAL GYRO SELECTOR CONTROL KNOB, located on lower right hand corner of the Gyro Substitute Test Box, to the LEFT HAND 45 degree position or full COUNTERCLOCKWISE. Observe needle on Power Section Test Box deflects far left on scale.

57. Rotate LARGE VERNIER KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to the LEFT HAND 20 degree position, reading the TOP SCALE labeled ROLL DEGREES. With a small slot head screwdriver, adjust the POTENTIOMETER inside the LEFT HAND HOLE below the Roll Command Knob on the console to center the needle on the Power Section Test Box to zero. Wait a minimum of 30 seconds for the computer to digest the information.

58. Observe the NEEDLE OF THE OUTPUT METER, located on Radio Coupler Test Box, indicates LEFT.

59. Rotate the DIRECTIONAL GYRO SELECTOR KNOB, located at the lower right hand corner of the Gyro Substitute Test Box, to the LEFT HAND 10 degree position. Observe needle on Power Section Test Box moves to the RIGHT.

60. Observe the NEEDLE of the Output Meter on Coupler Test Box indicates LEFT.

61. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box CLOCKWISE to center the needle on Power Section Test Box, again waiting for computer to digest the new information.

62. Read the degree of bank on the Gyro Substitute Test Box from the TOP SCALE labeled ROLL DEGREES. The pointer must be between 8 and 13 degrees of bank angle.

NOTE

If out of tolerance, replace amplifier.

63. Rotate the DIRECTIONAL GYRO SELECTOR KNOB, located at the lower right hand corner of the Gyro Substitute Test Box, to the RIGHT HAND 10 degree position. Observe the needle of Power Section Test Box moves to the RIGHT.

64. Observe the NEEDLE of Output Meter on Coupler Test Box indicates RIGHT.

65. Rotate LARGE VERNIER KNOB, located on the Gyro Substitute Test Box CLOCKWISE to center the needle on the Power Section Test Box, again waiting for the computer to digest the new information.

66. Read the DEGREE OF BANK on the Gyro Substitute Test Box from the TOP SCALE labeled ROLL DEGREES. The pointer must be between 8 and 13 degrees of bank angle.

NOTE

If out of tolerance, replace amplifier.

67. Rotate LARGE VERNIER KNOB, located on Gyro Substitute Test Box, back to the ZERO DEGREE position on the TOP SCALE labeled ROLL DEGREES.

68. Rotate DIRECTIONAL GYRO SELECTOR KNOB, located on lower right hand corner of the Gyro Substitute Test Box, COUNTERCLOCKWISE to the ZERO DEGREE position.

69. Push the HEADING BUTTON (upper left side of Console) to the "OUT" position.

70. Rotate the ROLL COMMAND KNOB full right. Observe needle on Power Section Test Box indicates right.

71. Rotate the LARGE VERNIER KNOB on the Gyro Substitute Test Box CLOCKWISE to center the needle on Power Section Test Box, again waiting for the computer to digest the new information until the needle stays centered after at least a 30 second wait.

72. Read the degree of bank on the Gyro Substitute Test Box TOP SCALE labeled ROLL DEGREES. Bank must be 28 degrees $\pm$ 3 degrees.

NOTE

If out of tolerance, replace console.

73. Rotate the ROLL COMMAND KNOB full LEFT.

74. Rotate LARGE VERNIER KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to center the needle on Power Section Test Box.

75. On the Gyro Substitute Test Box, read the degree of bank on the TOP SCALE labeled ROLL DEGREES. Bank must be 28 degrees $\pm$ 3 degrees.

NOTE

If out of tolerance, replace console.

76. Recenter ROLL COMMAND KNOB to CENTER position. Recenter LARGE VERNIER KNOB on Gyro Substitute Test Box back to ZERO on TOP SCALE labeled ROLL DEGREES.

77. Push the HEADING BUTTON to the "IN" position.

78. Place the Radio Coupler SELECTOR SWITCH to the LOC/NORM mode and while holding IN the RED BUTTON on the rear of the coupler, observe needle on the Power Section Test Box points to zero $\pm$ 2 divisions and the needle on the Output Meter on the Radio Coupler Test Box also reads zero $\pm$ 2 small divisions.

79. Place the Radio Coupler SELECTOR SWITCH to the OMNI mode.

80. On the Radio Coupler Test Box, find RADIO SIGNAL SUBSTITUTE KNOB immediately to the right of the lower Omni Meter. Pull this KNOB to the OUT or "ON" position.

81. Rotate the RADIO SIGNAL KNOB to deflect lower OMNI METER to the RIGHT 100% POSITION. Observe needle of upper OUTPUT METER deflects RIGHT.

82. Rotate DIRECTIONAL GYRO SELECTOR KNOB on Gyro Substitute Test Box to the LEFT HAND 45 degree position full COUNTERCLOCKWISE.

83. WAIT 90 SECONDS. After waiting the required minimum 90 seconds of time, adjust the right INTERCEPT POTENTIOMETER SCREW located on the side of the Radio Coupler to center the needle of the Power Section Test Box to ZERO.

84. With OUTPUT METER of Power Section Test Box adjusted to ZERO, observe OUTPUT METER NEEDLE of Radio Coupler Test Box also indicates ZERO.

CAUTION

REMEMBER TO WAIT A MINIMUM OF 30 SECONDS AFTER MAKING ANY INTERCEPT ADJUSTMENTS.

85. Rotate RADIO SIGNAL KNOB on Radio Coupler Test Box to place the needle of the lower Omni Meter to the LEFT HAND 100% POSITION.

86. Rotate the DIRECTIONAL GYRO SELECTOR KNOB on Gyro Substitute Test Box CLOCKWISE to the RIGHT HAND 45 DEGREE POSITION. WAIT 90 SECONDS.

87. Adjust the LEFT INTERCEPT POTENTIOMETER SCREW, located on the side of the Radio Coupler, to center the needle of the Power Section Test Box to indicate ZERO.

CAUTION

REMEMBER TO WAIT AT LEAST 30 SECONDS BEFORE TAKING ANY READINGS AFTER MAKING INTERCEPT ADJUSTMENTS.

88. After needle of Power Section Test Box indicates ZERO, observe that upper OUTPUT METER of Radio Coupler Test Box indicates ZERO.

89. Refer to Paragraph 5-24 and set radio gain of Coupler as outlined in Paragraph 5-24, Page 5-48 of this manual prior to completing the Roll Threshold Adjustment Procedure in the following paragraph.

5-17. ROLL THRESHOLD ADJUSTMENT FOR ALTIMATIC III B-1.

Remove the base plate from the bottom of the amplifier to gain access to the Roll Threshold Adjustment potentiometer. (Refer to Figure 5-6.)

CAUTION

Threshold adjustments are to be accomplished with a 12-volt calibrated Bench Set-up. When adjusting 28-volt systems, convert Bench Set-up to 12-volt configuration until Threshold Adjustment Procedure is completed. Verify all switches are returned to the 28-volt position prior to reinstallation in 28-volt aircraft. Setting of the Large Vernier Control Knob on the Gyro Substitute Test Box is critical when doing this adjustment procedure.

1. Disconnect the AMP connector CD-20 from the rear of the console and set the console aside.

2. Find CONSOLE SUBSTITUTE TEST BOX. Place the POWER SELECTOR SWITCH, located on the lower left hand corner of the Console Substitute Test Box, to the DOWN or "OFF" position.

3. Plug the AMP connector CD-20 into the receptacle, located on the top left corner of the Console Substitute Test Box.

4. Immediately to the right of the AMP connector CD-20 on the Console Substitute Test Box, find the (14 or 28-volt) SLIDE SWITCH. Place this switch in the 14-volt position.

5. Place the DIRECTIONAL GYRO Slide Switch, located on lower left of Console Substitute Test Box, in the UP or D.G. position.

6. Rotate SELECTOR KNOB, lower center of Power Section Test Box, CLOCKWISE to the "RES" position.

7. Ascertain the DIRECTIONAL GYRO SELECTOR KNOB, located on lower right hand corner of Gyro Substitute Test Box, is in the ZERO or straight "UP" position.

8. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box to the centered ZERO position reading the TOP SCALE labeled ROLL DEGREES.

9. Place the POWER SELECTOR SWITCH on lower left hand side of Console Substitute Test Box to the "ON" position. Observe SOLENOID LIGHT now glows on Power Section Test Box.

10. Rotate the ROLL TRIM KNOB on Console Substitute Test Box as required to center the needle on the Power Section Test Box to ZERO.

11. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE for a one (1) degree right bank.

12. Observe voltmeter on Power Section Test Box and record meter reading. (Refer to Figure 5-2 for enlarged view of voltmeter.)

13. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box, COUNTERCLOCKWISE for a one (1) degree left bank.

14. Observe voltmeter on Power Section Test Box and record meter reading. Average the meter readings obtained and refer to Table V-I for correct voltage settings.

15. If voltage setting is correct proceed to next step. If voltage setting is incorrect find the Roll Threshold Adjustment Potentiometer, located on the lower section of the amplifier printed circuit board (Refer to Figure 5-6), and adjust to obtain an average of the voltage settings listed in Table V-I by repeating Steps 11 thru 14.

16. Rotate the Power Section Test Box Selector Knob COUNTERCLOCKWISE to the center or "OFF" position.

17. Place the POWER SELECTOR SWITCH on lower left hand side of Console Substitute Test Box to the "OFF" position.

18. Refer to the following paragraph for the Pitch Bench Set-up.

5-18. PITCH BENCH SET-UP FOR ALTIMATIC III B-1.

1. Disconnect the AMP connector CD-20 from the Console Substitute Test Box and connect it to the console.

2. Unplug CD-47 connector attached to the face of the Power Section Test Box Amplifier receptacle. Set aside the CD-47 that was removed and in its place install the 4-pin male CD-16 connector.

3. Plug the 5-pin female CD-10 connector into the 5-pin male connector on right hand side of the Console Substitute Test Box.

4. Rotate the LARGE VERNIER CONTROL KNOB on the Gyro Substitute Test Box to read zero on the BOTTOM SCALE labeled PITCH DEGREES.

5. Immediately below the Vernier Control Knob, find a SLIDE SWITCH labeled ROLL and PITCH. Place this switch in the "DOWN" or PITCH position.

6. Ascertain that the VOLTAGE SELECTOR SWITCHES of all the components are in the same position (14 or 28-volts DC) as the bench power supply. This will insure proper AutoPilot operation and prevent damage to the components.

7. Engage the ALTIMATIC III B-1 by pushing the ROLL ENGAGE SWITCH, located at the lower left hand corner of the console, to the "ON" position. DO NOT EXPECT SOLENOID LIGHT TO GLOW.

8. Push PITCH ENGAGE BUTTON, located on the lower right hand corner of the console, to the "IN" position and observe Solenoid light, located on the face of the Power Section Test Box, glows. If light glows, proceed with Step 15.

a. If solenoid light does not glow, recheck that CD-16 connector is installed in the receptacle on the face of the Power Section Test Box labeled Amplifier.

b. If solenoid light does not glow, recheck power supply voltage and wiring harness for correct connections.

c. If solenoid light still does not glow with cables properly connected and proper voltage applied, turn off power supply and proceed with next step.

9. Place the POWER SELECTOR SWITCH, located on the lower left hand corner of the Console Substitute Box to the DOWN or "OFF" position.

10. Remove the AMP connector CD-20 from the rear of the console and plug it into the CD-20 receptacle located on the top left corner of Console Substitute Test Box.

11. Immediately to the right of the AMP connector CD-20 find a 14 or 28-volt SLIDE SWITCH. Ascertain the switch is in the proper voltage position to agree with both the Voltage Selector Switch on top plate of amplifier and the Selector Switch on the lower left corner of the Power Section Test Box.

12. Reapply voltage from Power Supply and place Power Selector Switch on lower left hand side of Console Substitute Test Box to the UP or "ON" position. Observe solenoid light now glows on Power Section Test Box.

NOTE

If light DOES glow, replace AutoPilot CONSOLE. If light DOES NOT glow, replace AutoPilot AMPLIFIER.

13. Place the POWER SELECTOR SWITCH, located on the lower left hand corner of the Console Substitute Box to the DOWN or "OFF" position.

14. Unplug the AMP connector CD-20 attached to the Console Substitute Test Box and connect it to the CD-20 receptacle on the rear of the console.

15. Rotate the Selector Knob, located on the face of the Power Section Test Box, full CLOCKWISE to the "RES" position.

16. Make sure LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box is reading ZERO on the BOTTOM SCALE labeled PITCH DEGREES.

17. Rotate the PITCH COMMAND DISK up on AltiMatic Console, for a full DOWN command and observe needle of Power Section Test Box deflects LEFT.

18. Rotate the PITCH COMMAND DISK down for a full UP command and observe needle of Power Section Test Box deflects to the RIGHT.

19. Recenter PITCH COMMAND DISK so that the indice calls for a level attitude.

20. Push the ALTITUDE PRESELECT BUTTON (located on top right of Console) to the "IN" position.

21. Adjust the Altitude Control Knob on the Console Substitute Test Box to center the TRIM METER ON THE CONSOLE.

22. With small slot head screwdriver, adjust the FIFTH POTENTIOMETER from the left (color coded BLUE) and located directly below the ROLL COMMAND KNOB on the Console to center the needle on the Power Section Test Box to ZERO. (Refer to Figure 5-5.)

NOTE

Keep in mind you MUST WAIT 30 SECONDS for the AutoPilot to digest any new information.

23. Rotate PITCH COMMAND DISK down for a full "UP" command and then up for a full "DOWN" command and note little change occurs on Power Section Test Box meter. Should a large amount of needle movement be present during Pitch Command Disk movement, recheck ALTITUDE PRESELECT BUTTON (located on top right of Console) is in the "IN" position. (If a large amount of needle movement is still present during Pitch Command Disk movement, replace Console.) Recenter the Pitch Command Disk.

24. Rotate the Altitude Control Knob on Console Substitute Test Box CLOCKWISE for a full "UP" command. Observe meter on Power Section Test Box, needle should deflect right and trim meter on console should deflect up.

25. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 8 degrees nose up.

26. Rotate PITCH COMMAND DISK up for a full "DOWN" command, observe meter on Power Section Test Box, needle should deflect left.

27. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 4 degrees nose up.

28. Rotate PITCH COMMAND DISK down for a full "UP" command, observe meter on Power Section Test Box, needle should deflect right.

29. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 9 degrees nose up.

30. Recenter PITCH COMMAND DISK.

31. Rotate the Altitude Control Knob on Console Substitute Test Box COUNTERCLOCKWISE for a full "DOWN" command. Observe meter on Power Section Test Box, needle should deflect left and trim meter on console should deflect down.

32. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 5 degrees nose down.

33. Rotate the PITCH COMMAND DISK down for a full "UP" command, observe meter on Power Section Test Box, needle should deflect right.

34. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box CLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 2 degrees nose down.

35. Rotate the PITCH COMMAND DISK up for a full "DOWN" command, observe meter on Power Section Test Box, needle should deflect left.

36. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to center needle on Power Section Test Box to ZERO. Reading should be approximately 7 degrees nose down.

37. If the system fails to respond to any of the test procedure outlined in Steps 24 thru 35, replace the console.

38. Push all Console Switches to the OUT or "OFF" position.

39. Refer to the following paragraph for Pitch Threshold Adjustment Procedure.

5-19. PITCH THRESHOLD ADJUSTMENT FOR ALTIMATIC III B-1.

Remove the cover plate from the top of the amplifier to gain access to the Pitch Threshold Adjustment Potentiometer. (Refer to Figure 5-6.)

CAUTION

Threshold adjustments are to be accomplished with a 12-volt calibrated Bench Set-up. When adjusting 28-volt systems, convert Bench Set-up to 12-volt configuration until Threshold Adjustment Procedure is completed. Verify all switches are returned to the 28-volt position prior to reinstallation in 28-volt aircraft. Setting of the Large Vernier Control Knob on the Gyro Substitute Test Box is critical when doing this adjustment procedure.

1. Disconnect the AMP connector CD-20 from the rear of the console and set the console aside.

2. Find CONSOLE SUBSTITUTE TEST BOX. Place the POWER SELECTOR SWITCH, located on the lower left hand corner of the Console Substitute Test Box, to the DOWN or "OFF" position.

3. Plug the AMP connector CD-20 into the receptacle, located on the top left corner of the Console Substitute Test Box.

4. Immediately to the right of the AMP connector CD-20 on the Console Substitute Test Box, find the (14 or 28-volt) SLIDE SWITCH. Place this switch in the 14-volt position.

5. Place the ALT. CONTROL Slide Switch, located on lower left of Console Substitute Test Box, in the UP or Alt. Control position.

6. Place the ALTITUDE CONTROL KNOB, located on upper right of Console Substitute Test Box, to the straight up or 12 o'clock position.

7. Rotate the SELECTOR KNOB, lower center of Power Section Test Box, CLOCKWISE to the "RES" position.

8. Rotate the LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box to the ZERO position on the BOTTOM SCALE labeled PITCH DEGREES.

9. Immediately below the Large Vernier Control Knob on Gyro Substitute Test Box, find a SLIDE SWITCH labeled ROLL and PITCH. Place this switch in the "DOWN" or PITCH position.

10. Place the POWER SELECTOR SWITCH on lower left hand side of Console Substitute Test Box to the "ON" position. Observe SOLENOID LIGHT now glows on Power Section Test Box.

11. Rotate the PITCH TRIM KNOB on Console Substitute Test Box as required to center the needle on Power Section Test Box to ZERO.

12. Rotate LARGE VERNIER CONTROL KNOB on Gyro Substitute Test Box COUNTERCLOCKWISE to indicate one (1) degree nose down, reading BOTTOM SCALE labeled PITCH DEGREES.

13. Observe voltmeter on Power Section Test Box and record meter reading. (Refer to Figure 5-2 for enlarged view of voltmeter.)

14. Rotate the LARGE VERNIER CONTROL KNOB on Console Substitute Test Box CLOCKWISE to indicate one (1) degree nose up, reading BOTTOM SCALE labeled PITCH DEGREES.

15. Observe voltmeter on Power Section Test Box and record meter reading. Average the meter readings obtained and refer to Table V-II for correct voltage settings.

16. If voltage setting is correct proceed to next step. If voltage setting is incorrect find the Pitch Threshold Adjustment Potentiometer, located on upper section of amplifier printed circuit board, (Refer to Figure 5-6) and adjust to obtain an average of the voltage setting listed in Table V-II by repeating Steps 12 thru 15.

17. Place the POWER SELECTOR SWITCH on Console Substitute Test Box to the "OFF" position.

18. Disconnect test equipment and associated cables and reinstall the components in the airplane.

19. Proceed with ground checks and flight adjustments.

5-20. ALTIMATIC III B-1 GROUND CHECKS WITH RADIO COUPLER. (ROLL).

1. Remove the console face plate by removing the knobs and two face plate mounting screws. After removing the face plate, reinstall the knobs to facilitate accomplishing in-flight adjustments.

2. Center the Roll Knob and position HEADING and ROLL Engage Switches to the OUT or "OFF" position.

3. Start airplane engine to obtain gyro stability.

4. Place the airplane control wheel to approximately neutral aileron or level flight position. Push ROLL engage switch to the "ON" position. Move control wheel right and left to check for servo engagement.

5. Rotate the Roll Knob to the right and to the left and observe that the airplane control wheel moves in the correct direction. (The airplane control wheel can be stopped in any position and will not return to level position by centering the Roll Knob. The airplane wheel will remain stationary at the time the Roll Knob is approximately centered or at its zero electrical output position.)

6. Center the Course Selector of the Directional Gyro and push the console HEADING BUTTON "IN." (Place Coupler mode switch to HEADING position.) WITH THE CONSOLE HEADING BUTTON PUSHED TO THE "IN" POSITION, THE ROLL KNOB ON THE CONSOLE BECOMES INOPERATIVE.

7. Rotate the Directional Gyro Course Selector right and left from center and observe that the control wheel turns in the correct direction. Return Directional Gyro Course Selector to center.

8. Place Coupler Radio Selector Switch to Omni #1 position. Turn on #1 radio and tune Nav Receiver to any available Omni signal and center needle with a "TO" reading.

9. Place Radio Coupler in Omni Mode. Rotate the OMNI BEARING SELECTOR to cause the course deviation indicator to move to the right and to the left and observe that the control wheel moves to the same side as the Course Deviation Indicator Needle.

10. Repeat Steps 8 and 9 with #2 radio and Coupler Radio Selector Switch in Omni #2 position.

11. Push ROLL ENGAGE SWITCH to the "OFF" position. Rotate the control wheel right and left and observe that the servo disengaged.

5-21. GROUND CHECK - PITCH.

1. Plug the CD-18 lead from Attitude Horizon into the CD-18 plug of the Gyro Substitute Test Box.

2. Place the Roll/Pitch Selector Switch on Gyro Substitute Test Box to the PITCH position.

3. Rotate the Large Vernier Control Knob on Gyro Substitute Test Box to read ZERO on BOTTOM SCALE labeled PITCH DEGREES.

4. Pull AUTOMATIC PITCH TRIM CIRCUIT BREAKER and/or place panel mounted trim switch to the OUT position.

5. Turn ON airplane Master Switch.

6. Push Roll Engage Button "ON" and stop control wheel rotation by adjusting ROLL COMMAND KNOB.

7. Push ALTITUDE SELECTOR BUTTON (upper right hand corner) to the "ON" position.

NOTE

DO NOT ENGAGE PITCH. MAKE SURE PITCH ENGAGE (LOWER RIGHT HAND BUTTON) IS IN THE "OUT" POSITION.

8. Dial an altitude with ALTITUDE SELECTOR KNOB 2000 feet higher than field elevation and observe Trim Meter reads "UP."

9. Steps 10 thru 14 apply to PA-23, PA-24, PA-30 and PA-34 series airplanes only. For PA-31 airplanes, proceed to Steps 15 thru 22.

10. Push Pitch Engage Button IN and dial for a lower altitude than field elevation. Observe control column moves forward.

11. Dial a higher altitude than field elevation. Observe control column moves aft.

12. Center PITCH COMMAND KNOB. Push ALTITUDE SELECTOR BUTTON OUT.

NOTE

Control column may not move to or maintain neutral position when Pitch Command Knob is centered, but will cease movement anytime Pitch Axis is at its electrical center as indicated by a centered Trim needle.

13. Rotate PITCH COMMAND DISK full up and observe that control column moves aft.

14. Rotate PITCH COMMAND DISK full down and observe that control column moves forward.

NOTE

On the PA-31, PA-31-350 and PA-31P airplanes, when checking the pitch portion of the AutoPilot on the ground, due to the weight of the elevator and the down spring in the elevator control system, with the pitch servo engaged, the pitch servo clutch will slip instead of moving the elevator.

15. Push Pitch Engage Button IN. Move control column fore and aft and note that pitch servo engaged. Listen for an audible sound.

16. Push Pitch Engage Button OUT. Move control column fore and aft and note that pitch servo disengaged.

17. Push Altitude Button IN. Dial a lower altitude than field elevation; listen that pitch servo motor is operating. Pitch trim indicator should indicate DOWN.

18. Dial a higher altitude than field elevation; listen that pitch servo motor is operating. Pitch trim indicator should indicate UP.

19. Center Pitch Command Knob. Push Altitude Selector Button OUT.

20. Rotate Pitch Command Disk full UP; listen that pitch servo motor is running. Pitch Trim Indicator should indicate UP.

21. Rotate Pitch Command Disk full DOWN; listen that pitch servo motor is running. Pitch Trim Indicator should indicate DOWN.

22. Disconnect the CD-18 from the Gyro Substitute Test Box and connect it to the Artificial Horizon.

NOTE

PA-31, PA-31-350 and PA-31P airplanes ONLY. In the event it cannot be determined by an audible sound that the pitch servo motor is running in response to pitch signals from either the Altitude Selector or the Pitch Command Disk, it will be necessary to remove the center floor panel. When removing panel on PA-31P airplanes, handle panel carefully to avoid damaging panel sealing gasket. Ascertain panel sealing gasket is clean and undamaged prior to installation to prevent cabin pressure leaks. Connect the CD-16 connector to the amplifier connector on the Power Section Test Box and the CD-16 extension to the servo and the servo connector also on the Power Section Test Box. Place the Selector Switch on the Power Section Test Box to the MTR position. Check for pitch amplifier output on the meter of the Power Section Test Box and verify the servo motor is operating when performing Steps 15 thru 22.

5-22. ALTIMATIC III B-1 FLIGHT ADJUSTMENT WITH RADIO COUPLER. (ROLL).

1. Remove the console face plate by removing the knobs and two face plate mounting screws. After removing the face plate, reinstall the knobs to facilitate in-flight adjustments.
2. Fly the airplane to smooth air and trim for level flight.

NOTE

Check for correct rudder trim. If rudder is incorrectly trimmed, the AltiMatic III B-1 will fly the airplane with a wing low to compensate for the rudder out of trim condition.

3. Set Coupler Selector Switch to Omni.
4. Set DIRECTIONAL GYRO COURSE SELECTOR to match Directional Gyro HEADING. (centered.)
5. Push ROLL Switch "ON." Depress RED BUTTON on rear of Coupler and push HEADING BUTTON IN. Keep Coupler Switch depressed during next adjustment.
6. Allow airplane Roll Attitude to stabilize and if necessary, adjust for straight and level flight (wings level and ball centered). To do this, use the center red adjustment screw in the console. After each adjustment, allow the airplane attitude to stabilize and observe it for two minutes to insure airplane is maintaining level flight. Release coupler adjustment switch.
7. Place COUPLER SELECTOR SWITCH in the HEADING mode and observe that airplane maintains selected heading $\pm$ 2 degrees.
8. Rotate DIRECTIONAL GYRO COURSE SELECTOR 150 degrees left and observe airplane bank angle. Adjust left bank screw of console to obtain 20 degree bank. Rotate ADJUSTMENT SCREW clockwise to increase bank angle.

NOTE

Keep Directional Gyro Course Selector at least 25 degrees left of Directional Gyro HEADING until adjustment is complete.

9. Rotate DIRECTIONAL GYRO COURSE SELECTOR 150 degrees right and observe airplane bank angle. Adjust right bank screw of console to obtain 20 degree bank. Rotate ADJUSTMENT SCREW clockwise to increase bank angle.

NOTE

Keep Directional Gyro Course Selector at least 25 degrees right of Directional Gyro HEADING until adjustment is complete.

10. Turn on Radio and set Omni Bearing Selector to obtain full left deflection.

NOTE

Full left needle deflection must be maintained until adjustment is complete. This can be accomplished by being at least 20 miles from the Omni station and flying approximately to or from the station.

11. Push HEADING BUTTON "OFF" and set DIRECTIONAL GYRO COURSE SELECTOR 45 degrees right of center index. Place COUPLER in OMNI mode.

12. Push HEADING BUTTON "IN" and allow the airplane heading to stabilize for 90 seconds.

13. Adjust LEFT INTERCEPT SCREW on side of Radio Coupler as necessary to stabilize Course Selector 45 degrees right of center index. Turn adjustment screw CLOCKWISE to increase intercept angle. Allow 90 seconds for HEADING to stabilize after each adjustment.

14. To adjust right intercept angle, repeat Steps 10 thru 13 with Omni needle deflected full right and Course Selector 45 degrees to left of center index.

15. Center Omni needle on a "TO" bearing and set Course Selector to match Omni Bearing. Allow airplane to fly to the Omni station and observe that Omni needle stays CENTERED. If Omni needle does not maintain center, adjust ROLL centering toward Omni needle. Repeat Steps 7, 8 and 9.

5-23. ALTIMATIC III B-1 FLIGHT ADJUSTMENT - PITCH.

1. Refer to the appropriate airplane Flight Manual for proper power settings during adjustments.

2. Airplane should be loaded with full fuel and no more than two people, front seats only and no baggage.

NOTE

Prior to engagement of the Pitch section, the Trim Meter will indicate the direction in which the airplane will move upon engagement and can be centered by adjustment of the Pitch Command Knob.

After engagement of the Pitch section, the Trim Indicator transfers to the Altitude Selector and will indicate whether the airplane is above or below the selected altitude. An "UP" indication can be centered by dialing the Altitude Selector downward.

NOTE

SMOOTH AIR IS ESSENTIAL to make accurate adjustments. If smooth air is not available, do not attempt to set up the Pitch.

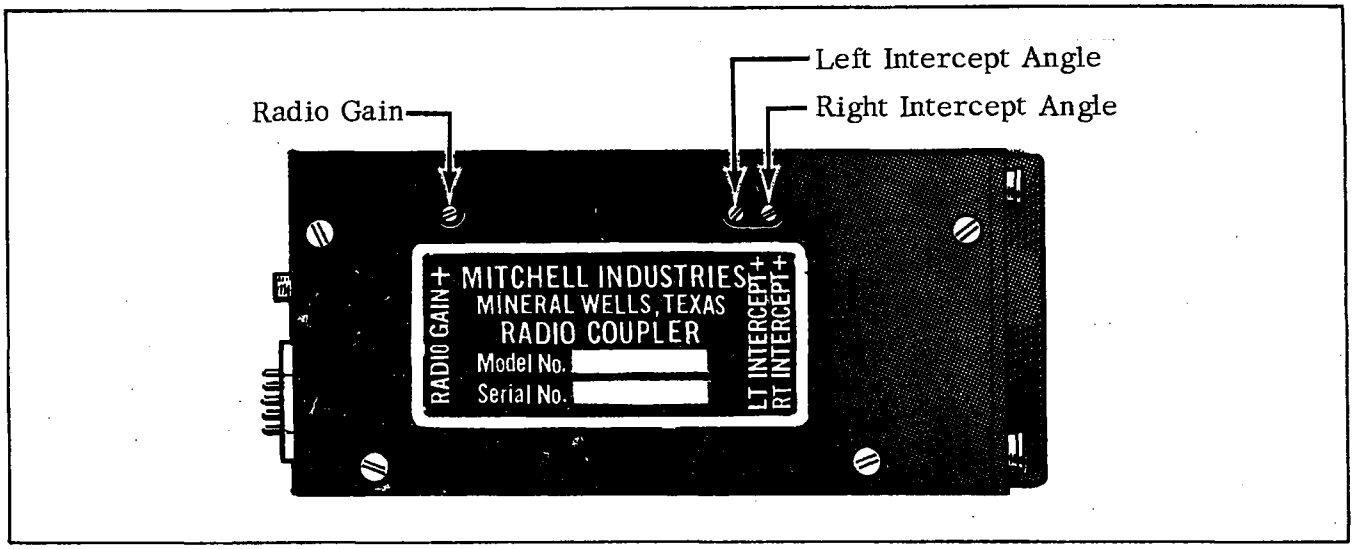


Figure 5-7. Radio Coupler Adjustment Points

3. With the console Altitude Button and the Pitch Engage Button in the "OFF" position, center Trim Indicator by rotating the Pitch Command Disk.

NOTE

Roll must be engaged for the Trim Indicator and the Pitch Axis of the AltiMatic III B-1 to be operative.

4. Engage the PITCH BUTTON. Rotate the PITCH COMMAND DISK as necessary to maintain level flight. Disengage console PITCH BUTTON momentarily, attitude of the airplane should not change an appreciable amount. Re-engage pitch and observe that Trim crank does not turn in either direction in excess of 1/3 of a complete turn. If it does, it would indicate Trim Sensor of the Pitch Trim System has not been correctly centered. (See Electric Pitch Trim Systems Service Manual, Piper Part No. 753 771.)

5. Center the Trim Indicator by rotating the Altitude Selector Knob.

NOTE

If an "UP" indication is observed at the Trim Indicator, this would indicate a signal from the Altitude Selector is calling for a nose up condition. To center the Trim Indicator, the Altitude Selector Knob would have to be turned down or counterclockwise. With the Trim Indicator showing level flight, calibrate the Altitude Selector Dial to read the flight altitude recorded on the Altimeter.

6. Push the Console ALTITUDE BUTTON "IN." Allow the airplane to stabilize on altitude and observe that Trim Indicator needle remains centered. If needle does not remain centered, adjust Pitch centering adjustment to center the indicator, turning screw CLOCKWISE will cancel an up indication, COUNTERCLOCKWISE will cancel a down indication. Allow two to three minutes after each adjustment for airplane to stabilize.

7. Rotate the Altitude Calibration Disk as required, so the setting on the Altitude Dial reads the flight altitude recorded on the altimeter.

8. Advance power to recommended setting in appropriate airplane Flight Manual and after the airplane has stabilized in level flight, center the PITCH COMMAND DISK and push console ALTITUDE BUTTON to the "OFF" or OUT position.

9. ROTATE PITCH COMMAND DISK, if necessary, to maintain level flight. After the airplane is stabilized, observe that Pitch Command Disk is centered within + 1/8".

10. Rotate the PITCH COMMAND DISK full up and allow the airplane to stabilize in the climb. Attitude should be slightly higher (lower airspeed) than climb in the Altitude Preselect mode.

11. Reduce the power setting per appropriate airplane Flight Manual and rotate the PITCH COMMAND DISK full DOWN. After the airplane has stabilized in descent, observe that descent attitude is greater than descent attitude in Altitude Selector mode. It may be necessary to further reduce power to prevent excessive descent speed.

12. This completes the Flight Set-up.

5-24 CHECK AND ADJUSTING RADIO GAIN. Although the radio gain on all couplers from the factory is preset, the following procedures are for bench adjustment of the radio coupler gain. For omni converters with standard ARINC meter outputs, it will be necessary to set up the AutoPilot on the bench as per paragraph 5-16 for the AltiMatic III B-1. After the equipment is connected and functioning, perform the following adjustments and steps.

NOTE

The Piper Omni/Localizer Coupler presents a high impedance load (greater than 10K ohms) to the radio installation. Therefore, it will not "load down" the Omni converter.

a. Adjusting Coupler Gain for Standard ARINC.

1. VERY SLOWLY rotate the RADIO SIGNAL SUBSTITUTE KNOB in the direction required to cause the Omni Meter Needle to move slowly back toward center.

2. While Omni Meter Needle is traveling slowly toward center, observe upper output meter (directly above Omni meter on Coupler Test Box) and note the moment the upper output meter begins to respond.

3. The instant the upper output meter needle shows response, stop rotation of the RADIO SIGNAL SUBSTITUTE KNOB.

4. Read the lower Omni needle and determine what percentage on the dial was reached when upper output meter needle shows response.

NOTE

At 100% (± one meter division) the upper output meter should just begin to move. Adjust the Radio Gain Screw on the coupler until the above indication can be obtained.

5. If radio gain has been adjusted, recheck both intercept angles and adjust if necessary.

6. Upon completion of Radio Gain Adjustment, refer to Paragraph 5-17, page 5-38 of this manual for Roll Threshold Adjustment Procedure.

b. Adjusting Coupler Gain for unknown Omni Converter: It is necessary to determine the output signal capabilities of the unknown Omni Converter as compared to a standard ARINC signal.

1. Remove the airplane cable CD-34 connector from the rear of the Radio Coupler in the airplane.

2. Plug this airplane cable CD-34 plug into the CD-34 connector located on the top right corner of Radio Coupler Test Box labeled "RADIO."

NOTE

The CD-34 extension cable can be used to make this connection.

3. Make sure RADIO SIGNAL SUBSTITUTE KNOB on Coupler Test Box is in the "IN" position.
4. Turn on Master Switch.
5. Turn on VOR Radio.
6. Tune in a local OMNI station.

CAUTION

Make sure you are receiving a strong usable OMNI signal before taking any readings. It is good practice to use an OMNI signal generator.

7. Center CDI on OMNI set with OBS by rotating OBS with a "TO" reading.
8. Note OMNI Meter Needle on Radio Coupler Test Box is centered.
9. Rotate the OBS of the radio enough to drive CDI just to the end of its travel (off scale) to a full deflection.
10. Read the OMNI Meter Needle on the Coupler Test Box and note the reading in percent.
11. Turn off airplane Master Switch and remove Coupler Test Box from airplane.
12. Proceed with the following steps if the roll set-up has been completed. If the roll has not been set up, complete set-up at this time.
13. After completing roll set-up, pull OUT the RADIO SIGNAL SUBSTITUTE KNOB on the Coupler Test Box.
14. Place the switch on the Radio Coupler to the LOCALIZER/NORM position.
15. Place roll switch "ON."
16. Place heading switch "OFF."
17. Place DG to "ZERO."
18. Rotate the RADIO SIGNAL SUBSTITUTE KNOB right or left until OMNI Meter Needle indicates the same percentage figure as read in the airplane.
19. Wait three minutes to insure Coupler Memory Bank is filled.
20. VERY SLOWLY rotate the RADIO SIGNAL SUBSTITUTE KNOB in the direction required to cause the OMNI Meter Needle to move slowly back towards center.
21. While OMNI Meter Needle is traveling slowly towards center, observe upper output meter and note the moment the upper output meter needle begins to respond.
22. The instant the upper output meter needle shows response, stop rotation of the Radio Signal Substitute Knob.
23. Read the lower OMNI Meter Needle and determine what percentage on the dial was reached when upper output meter needle shows response.

NOTE

Adjust radio gain on coupler so that Upper Output Meter Needle responds within $\pm$ 1 lower meter division of the percentage as originally read on airplane radio.

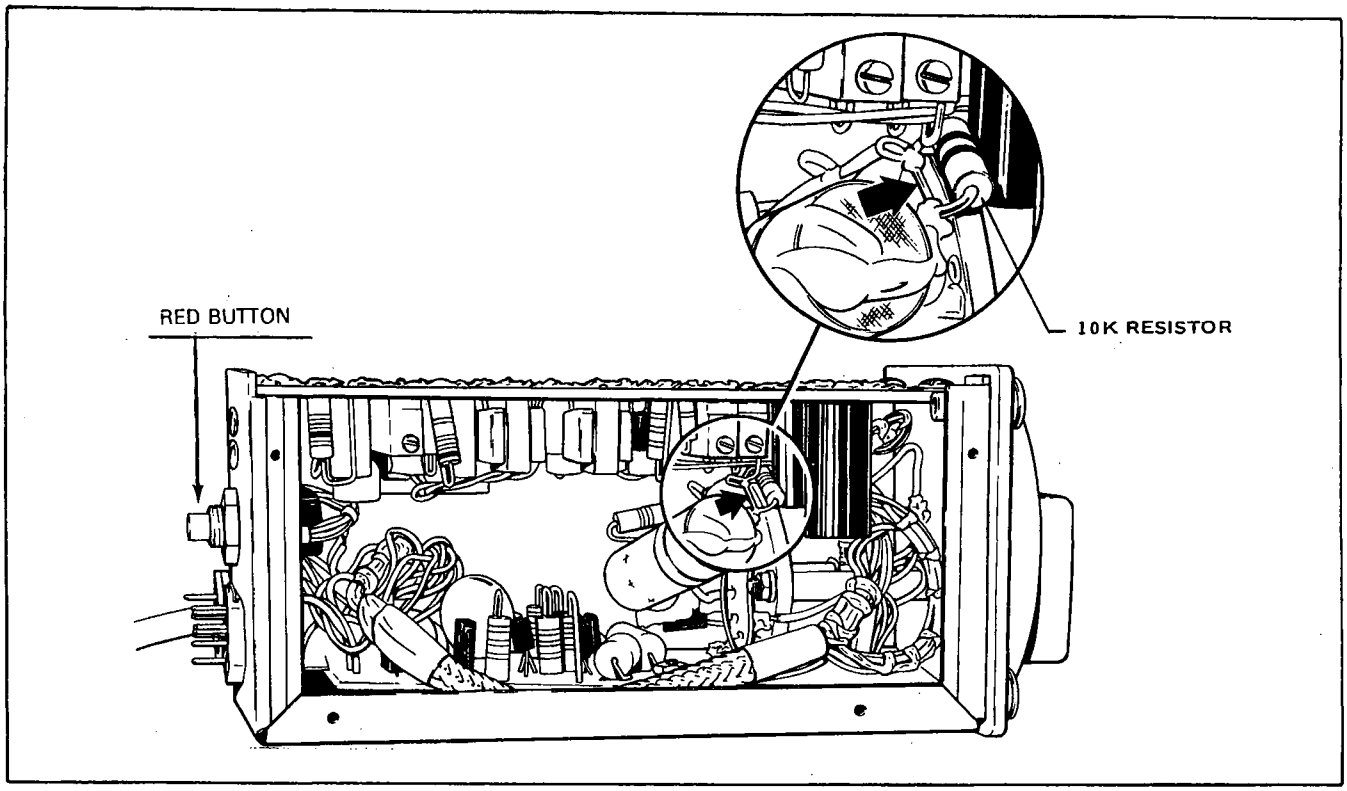


Figure 5-8. Piper Omni/Localizer Coupler Modification Detail

24. If Coupler gain has been adjusted, recheck both intercept angles and adjust if necessary.

5-25. PIPER OMNI/LOCALIZER COUPLER MODIFICATION (1C388 SERIES). The Piper Omni/Localizer Coupler is used in conjunction with various configurations of avonics equipment. Depending on the type avionics equipment installed in the airplane, the coupler should be modified as follows:

a. When the coupler is used in conjunction with the VOA-4, -5, -8 or -9 and/or other converters where 20° = 150 microamps, modify as follows:

1. Identify the 1C388 coupler as "F" mod or higher (letter F at end of serial nos.).
2. Remove eight screws and cover of radio coupler.
3. Locate clipped jumper across 10K resistor. (Refer to Figure 5-8.)
4. Using small soldering iron, carefully re-solder jumper. (Exercise extreme caution to prevent inadvertent damage with soldering iron.)
5. Replace cover and secure with eight screws.

b. When the coupler is used in conjunction with VOA-40 or VOA-50 and/or other converters where 10° = 150 millivolts, the jumper is clipped so the 10K resistor is in the circuit.

SECTION VI

WIRING DIAGRAMS

SECTION VI

WIRING DIAGRAMS

6-1. INTRODUCTION. This section of the manual consists of wiring diagrams of the electrical harnesses and mating connectors of the AutoControl III B and AltiMatic III B-1 Autopilot. The wiring diagrams should be utilized for troubleshooting the system for defective wiring and mating connectors. A continuity test of the system can be performed with an ohmmeter. This test will clarify the harness is good and capable of carrying current. Should any wire or connector fail to produce a reading on the ohmmeter, they are defective and must be replaced. Refer to the following pages for the Wiring Diagrams for the AutoControl III B and AltiMatic III B-1 installations on the various Piper airplanes.

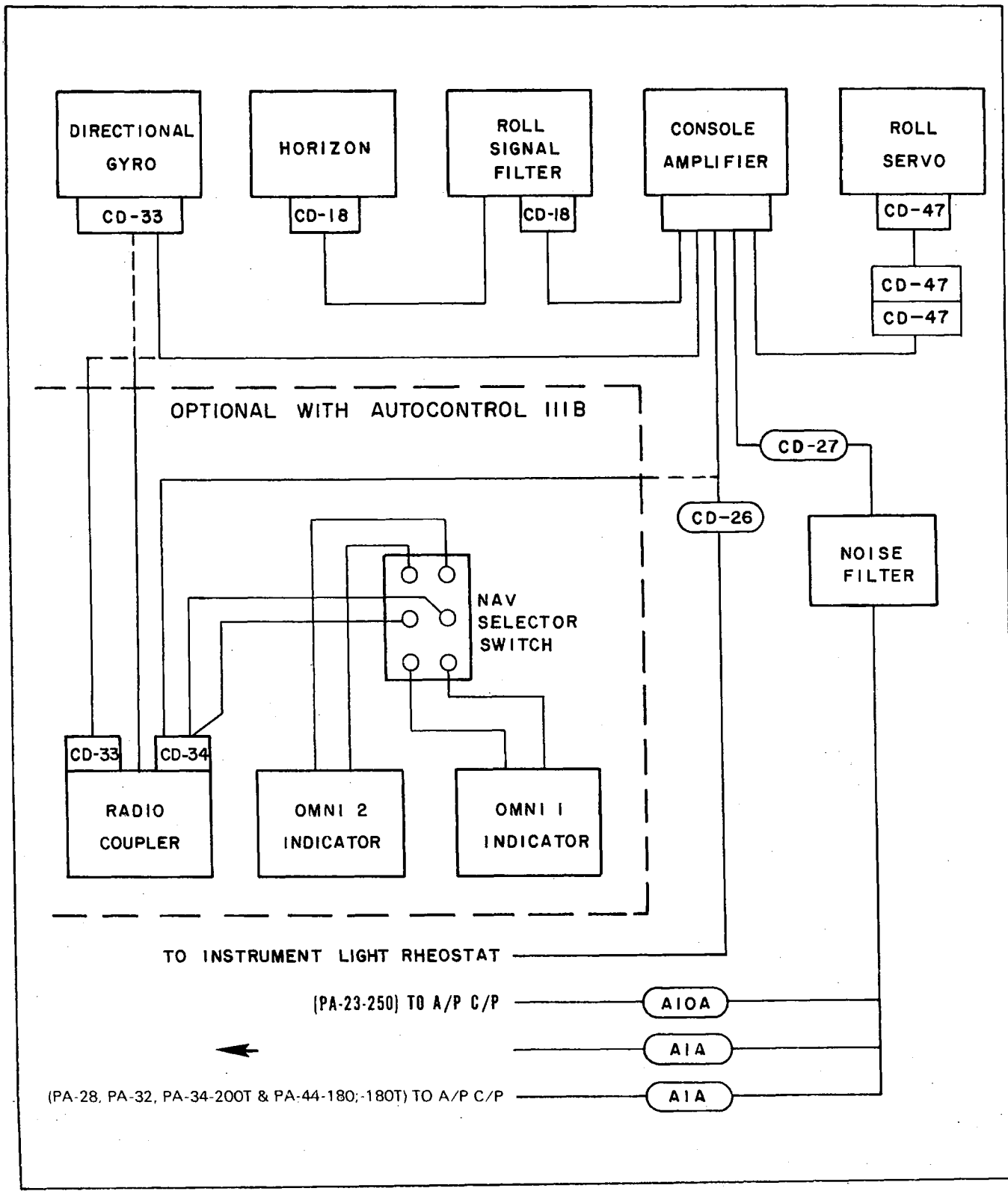


Figure 6-1. AutoControl III B Block Diagram

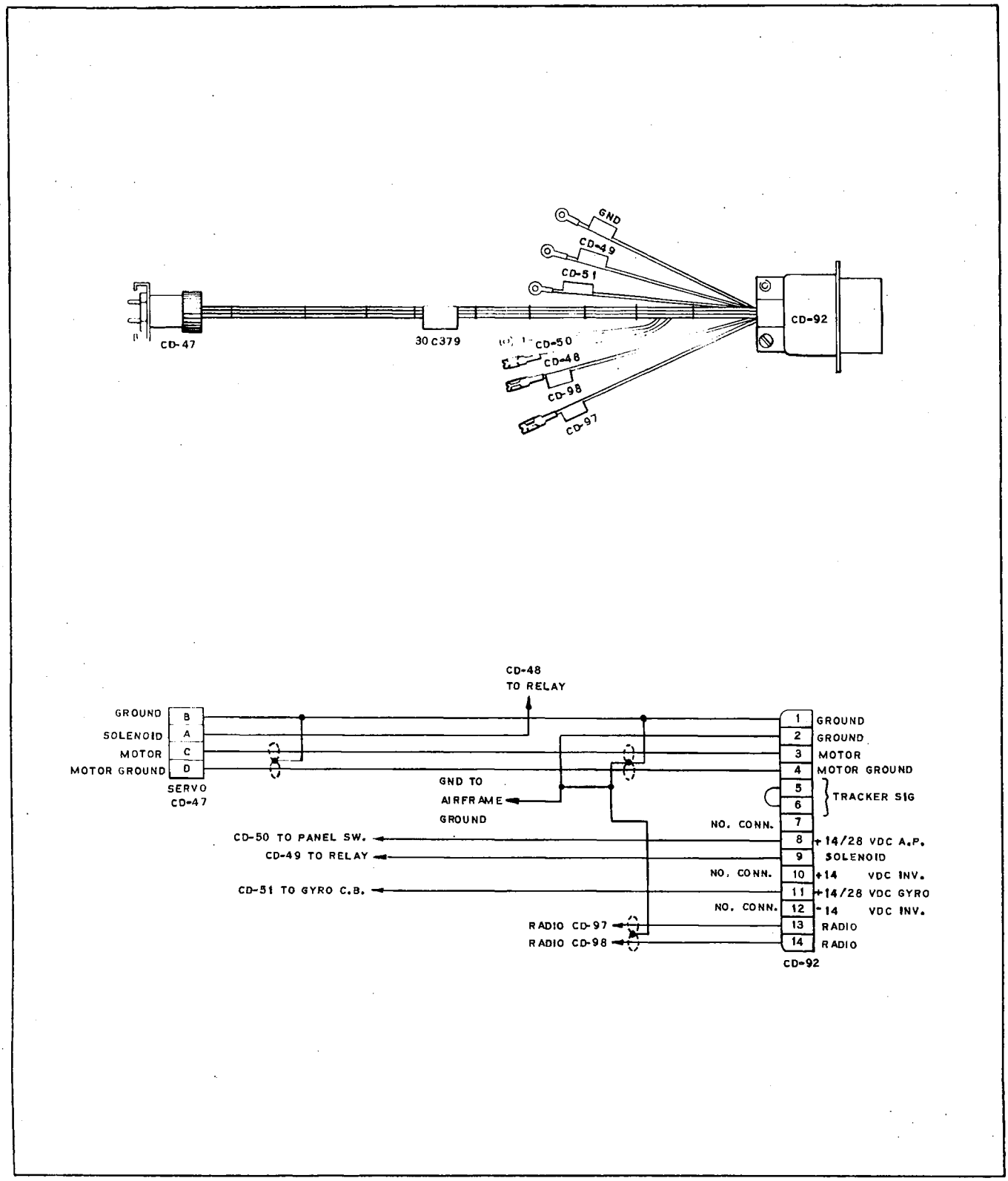


Figure 6-10. AltiMatic III B-1 Cable Assembly, Turn and Bank

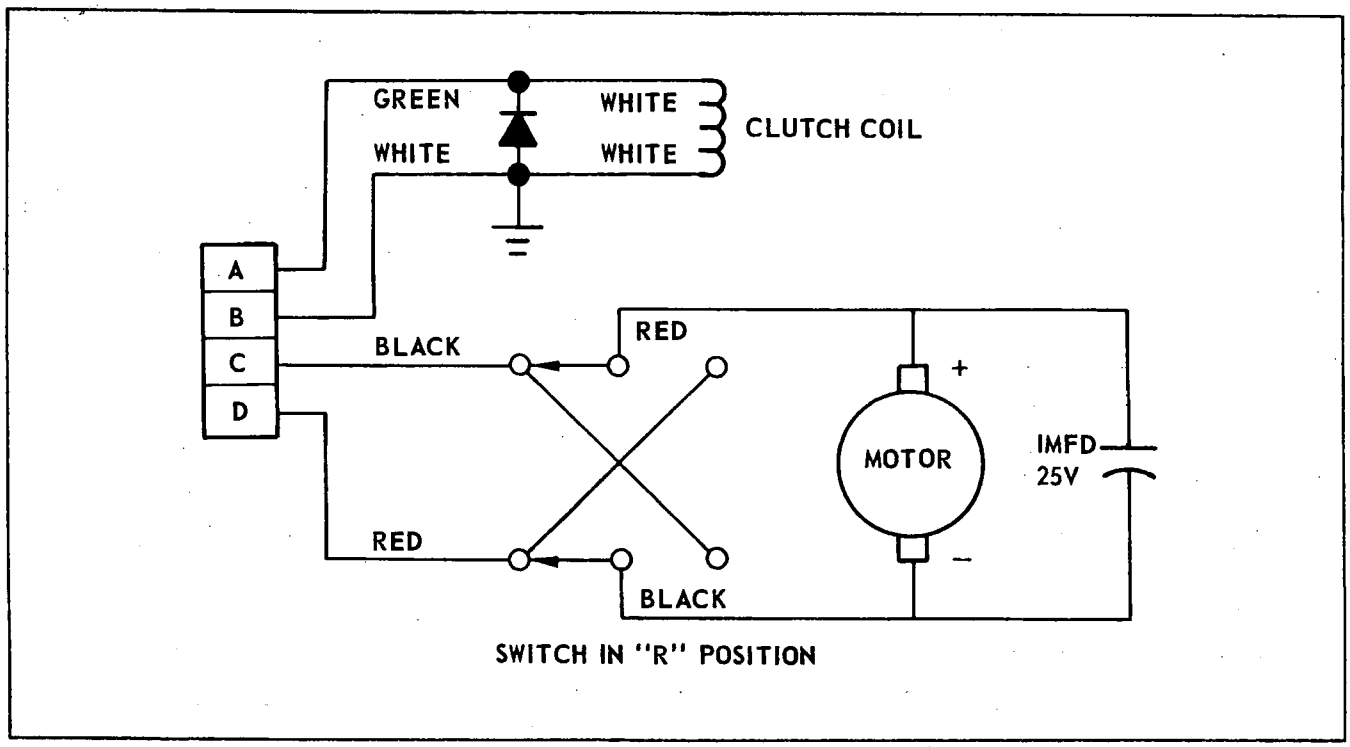


Figure 6-11. Servo Schematic

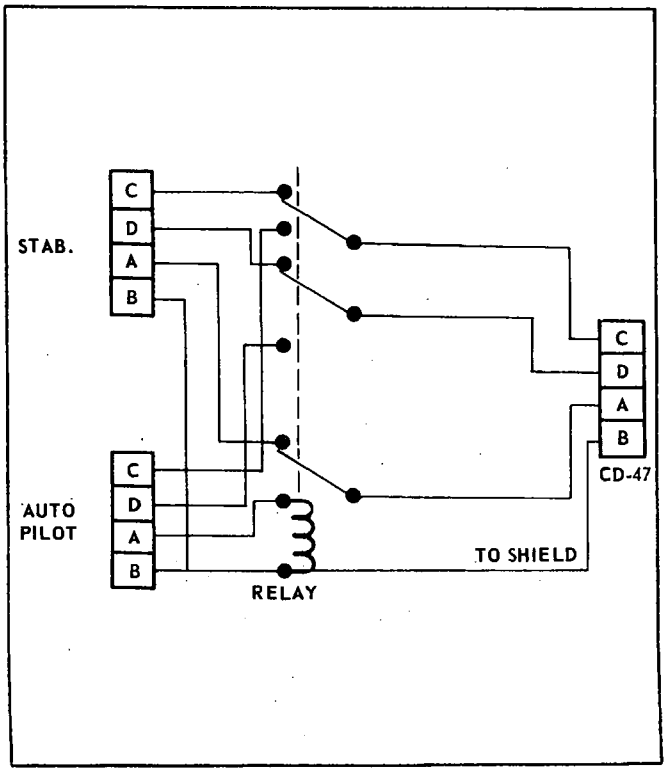


Figure 6-12. Relay Switching Box Schematic

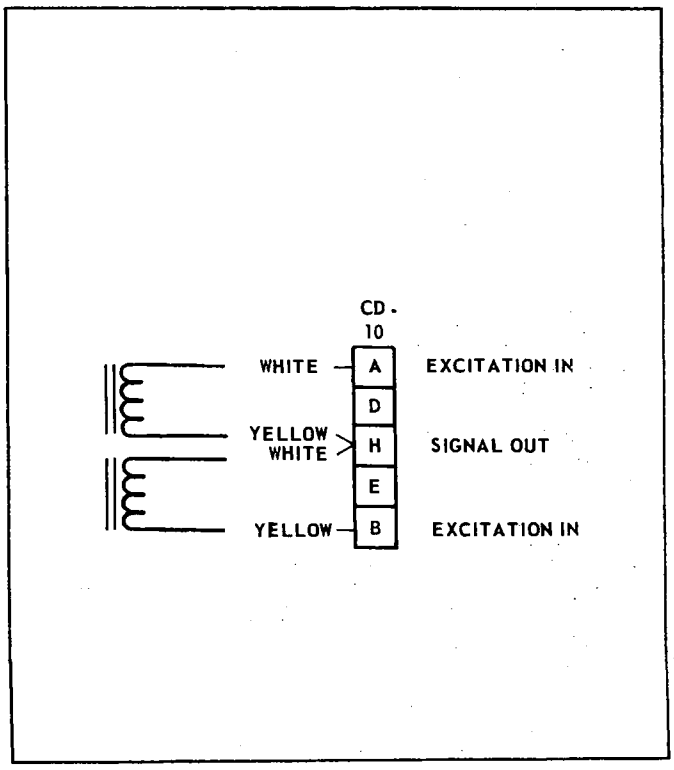


Figure 6-13. Altitude Selector Schematic

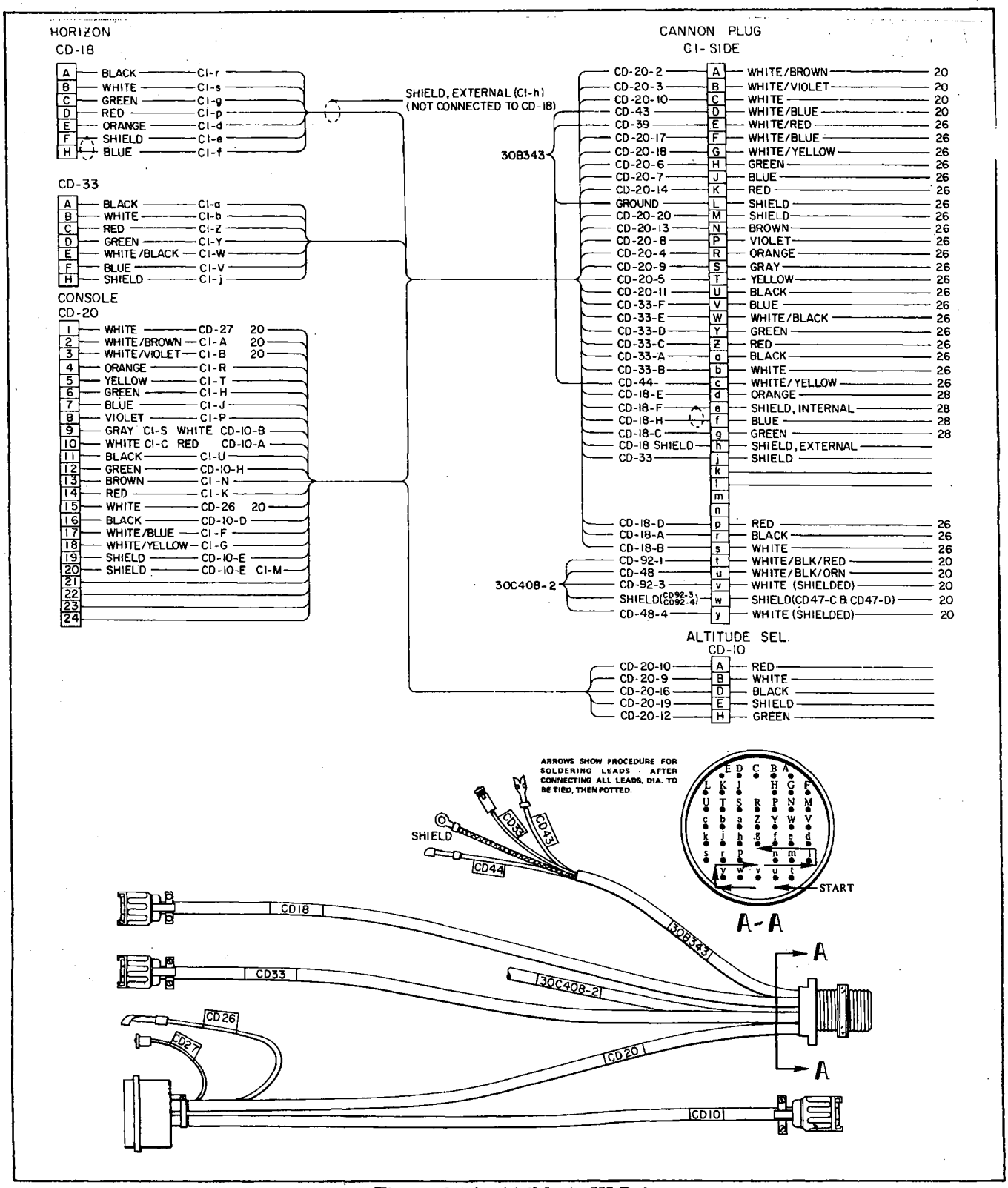


Figure 6-14. AltiMatic III B-1
Pressure Bulkhead Connectors (PA-31P)

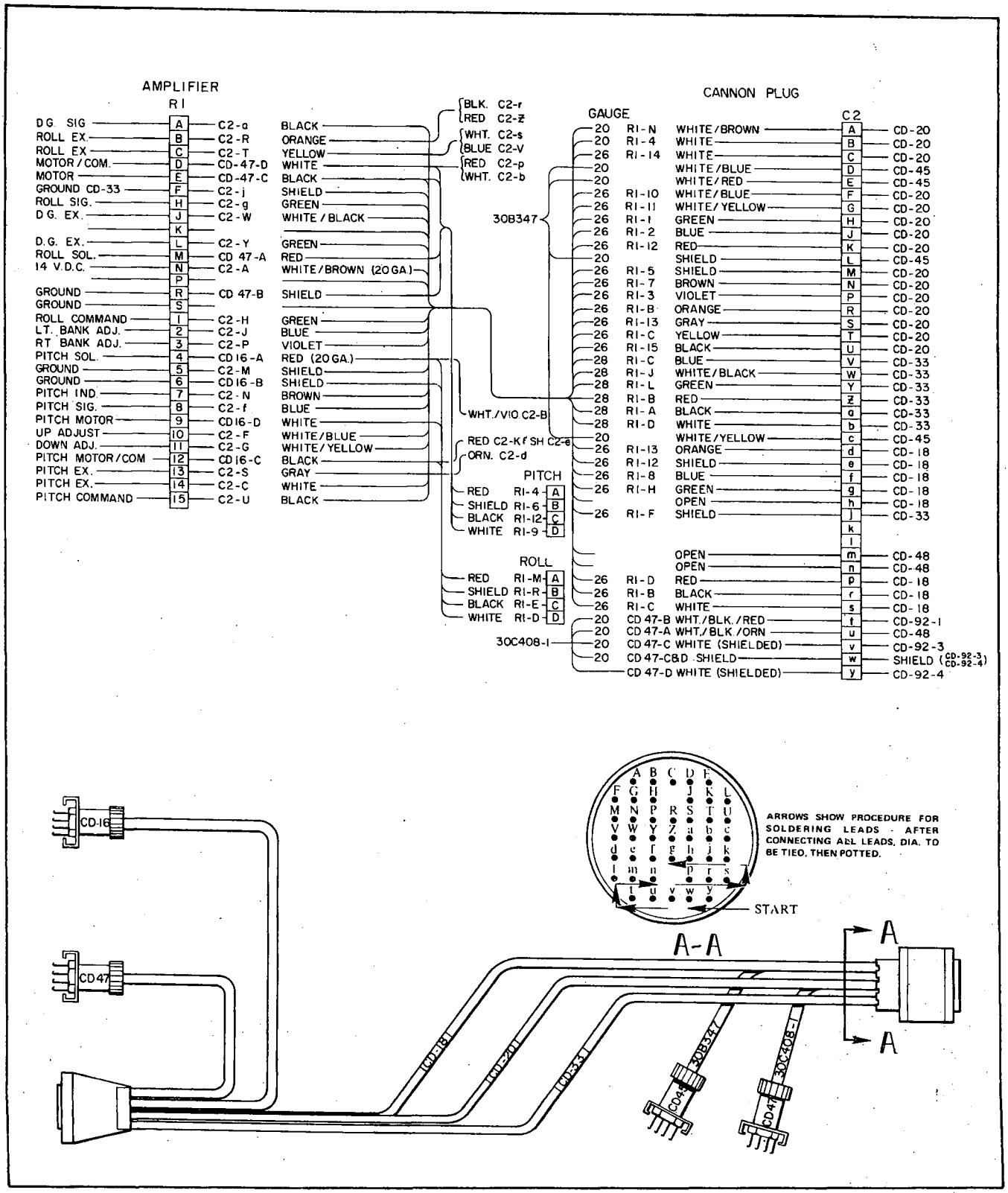


Figure 6-14. AltiMatic III B-1
Pressure Bulkhead Connectors (PA-31P) (cont.)

PART II

GLIDE SLOPE COUPLER

SECTION VII

DESCRIPTION

SECTION VII

DESCRIPTION

7-1. DESCRIPTION. The Glide Slope Coupler is an optional supporting system to the AltiMatic III B-1. It is a completely Automatic Analog Computer that directs the AutoPilot around the lateral axis to intercept and track the approach glide path. The system automatically provides for variances in glide path angle, wind direction and various approach configurations of the airplane.

When the Glide Slope is properly adjusted and normal approach power is applied, the airplane will accurately follow the glide path. (Refer to Figure 7-1.)

A self contained logic circuit provides for certain conditions to be prevalent before "Lock On" or coupling will occur. This will prevent the Glide Slope from being "Armed" under unfavorable conditions.

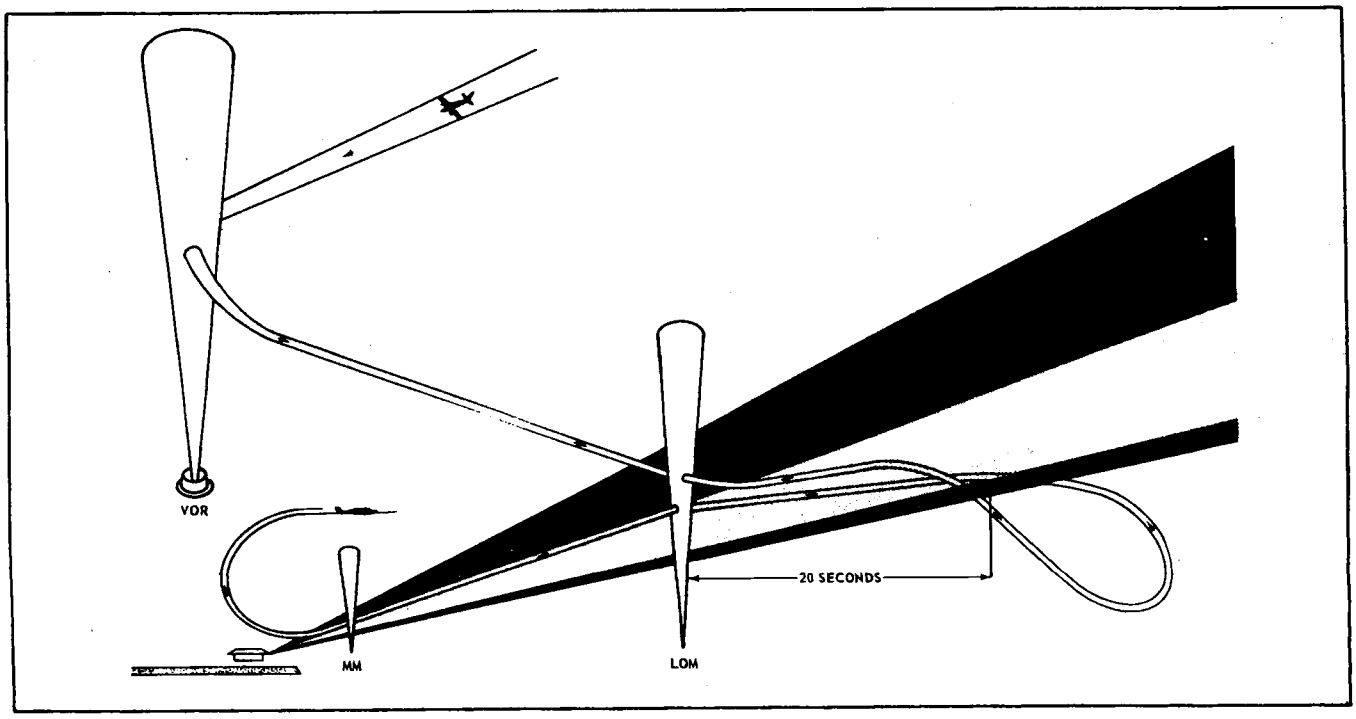


Figure 7-1. AltiMatic III B-1 Glide Slope Coupler Approach

SECTION VIII

THEORY OF OPERATION

SECTION VIII

THEORY OF OPERATION

8-1. THEORY OF OPERATION. The fundamental principle of the Glide Slope Coupler is to couple the Glide Slope to the AutoPilot. The AutoPilot will then allow the airplane to descend at an angle which corresponds to the Glide Slope to be flown and to introduce a radio deviation signal that will cause descent angle to deviate an amount proportional to the radio signal deviation from the Glide Slope Indicator.

Note in Figure 8-1 that the Glide Slope Coupler is connected in series with the Gyro Horizon and the Altitude Selector. Figure 8-2 shows the Glide Slope Coupler with the complete AltiMatic III B-1 system.

Shown in Figure 8-3 is a block diagram of the elements which make up the Glide Slope Coupler. The low level DC signal is derived from the Glide Slope Deviation Indicator and is converted into AC in the low level chopper and then amplified in the AC amplifier. From the amplifier the signal is transformer coupled to a phase detector. This will provide DC isolation from the Glide Slope Indicator. The high level DC voltage out of the phase detector is applied to the integrator circuit. The detector furnishes a signal to a rate network which supplies a DC input to the high level chopper. The high level chopper then receives a signal from the integrator. The AC output of the high level chopper is fed into the output amplifier which is fed in series with the pitch output from the Gyro Horizon.

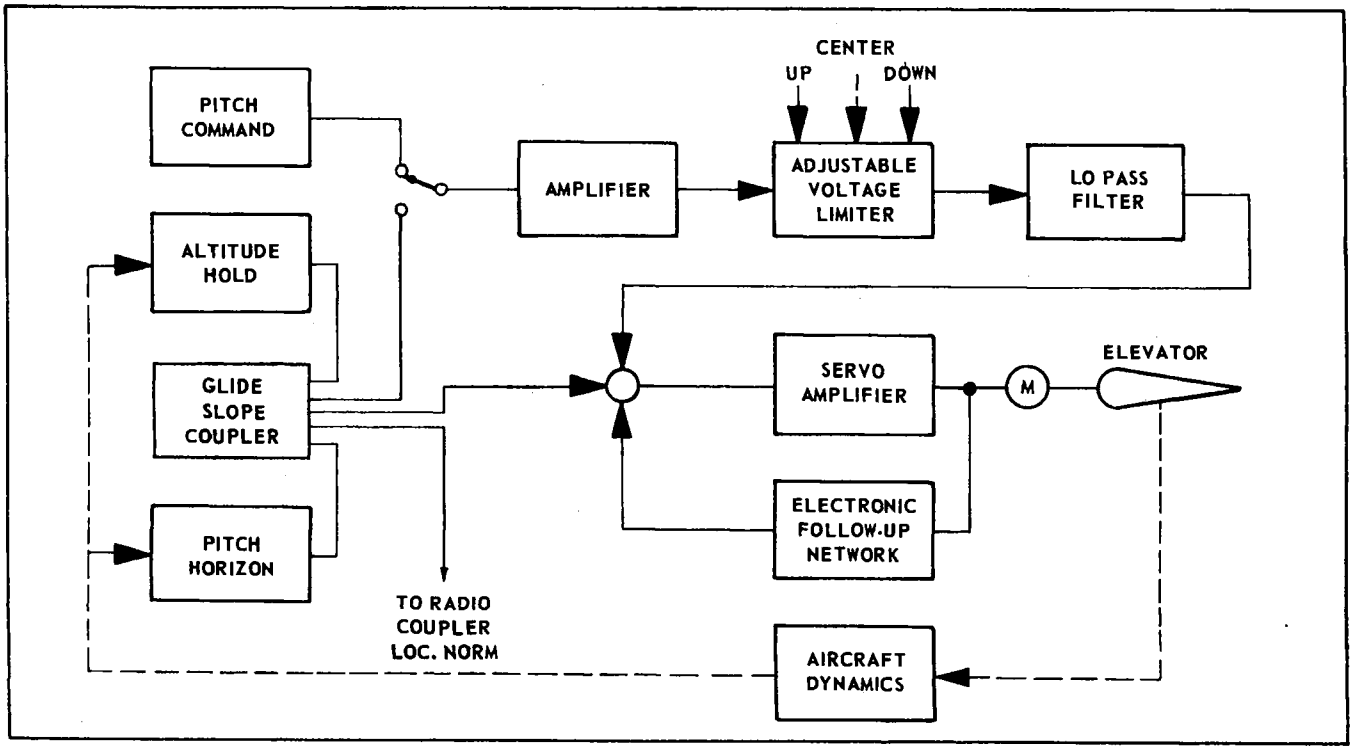


Figure 8-1. Pitch Axis Control System with Glide Slope Coupler

8-2. COUPLING. Coupling or "Arming" will occur ONLY when three conditions have been met, these conditions are:

1. The airplane must be in Altitude Select Mode.
2. The Radio Coupler must be in Localizer Normal Mode.
3. The airplane must be flown under the glide path (at least 60% up indication) for 20 seconds.

The logic circuit, which consists of a bistable multivibrator circuit, insures that all the above conditions prevail prior to arming the coupler. The logic circuit also has a reset function which disarms the circuit if any one of the three inputs are interrupted. After any one of the inputs are interrupted all three conditions must be met again prior to rearming.

SECTION IX

REMOVAL AND INSTALLATION

SECTION IX

REMOVAL AND INSTALLATION

9-1. INTRODUCTION. This section covers the removal and installation of the Glide Slope Coupler.

NOTE

For continuous AutoPilot use with the Glide Slope Coupler removed, it will be necessary to install a jumper plug, Mitchell P/N 9A88 (Piper P/N 757 325), in the 24-pin CD-63 receptacle of the Glide Slope Cable Harness.

9-2. REMOVAL OF GLIDE SLOPE COUPLER. PA-23-250 (six place). The Glide Slope Coupler is located under the instrument panel on the right side of the fuselage and is attached to the fuselage frame.

a. Remove the Glide Slope Coupler from the mounting brackets by removing the screws and nuts which secure the mounting brackets.

b. Release the spring clips on the CD-63 connector. Disconnect CD-63 from the Glide Slope Coupler.

c. If the airplane will be flown prior to reinstallation of the Glide Slope Coupler install jumper plug, Mitchell P/N 9A88 (Piper P/N 757 325), in the CD-63 harness connector.

9-3. INSTALLATION OF GLIDE SLOPE COUPLER. PA-23-250 (six place). (Refer to Figure 9-1.)

a. If the jumper plug, Mitchell P/N 9A88 (Piper P/N 757 325), has been installed in the Glide Slope Harness connector CD-63, remove it.

b. Connect CD-63 24-pin connector and make sure the spring clips are snapped in place.

c. Place the Glide Slope on the mounting brackets on the fuselage frame. Position it so the end with the CD-63 receptacle is aft.

d. Secure it with the screws and nuts previously removed.

9-4. REMOVAL OF GLIDE SLOPE COUPLER. (PA-24-260 and PA-39.) The Glide Slope Coupler is located on the support bracket immediately to the right of the right control wheel.

a. Disconnect the CD-63 connector according to the following procedure:

1. Remove the cover from the top of the instrument panel by removing the retaining screws and lifting it off the instrument panel.

2. Release the spring clips on the CD-63 connector. A screwdriver may be used to do this. Be careful not to damage the lines which connect to the fuel flow indicator.

3. Disconnect CD-63 from the Glide Slope Coupler by lifting straight up on the connector.

b. If the airplane will be flown prior to reinstallation of the Glide Slope Coupler, install jumper plug, Mitchell P/N 9A88 (Piper P/N 757 325), in the CD-63 harness connector.

c. Gain access to the Glide Slope Coupler from underneath the instrument panel and remove the two screws which secure the Glide Slope Coupler to the mounting bracket.

9-5. INSTALLATION OF GLIDE SLOPE COUPLER. (PA-24-260 and PA-39.) (Refer to Figure 9-2.)

a. Place the Glide Slope Coupler on the mounting bracket located to the right of the right control wheel. Orient the coupler so the 24-pin receptacle is up and the mounting flange is on the forward side.

b. Secure the Glide Slope Coupler with the two screws previously removed.

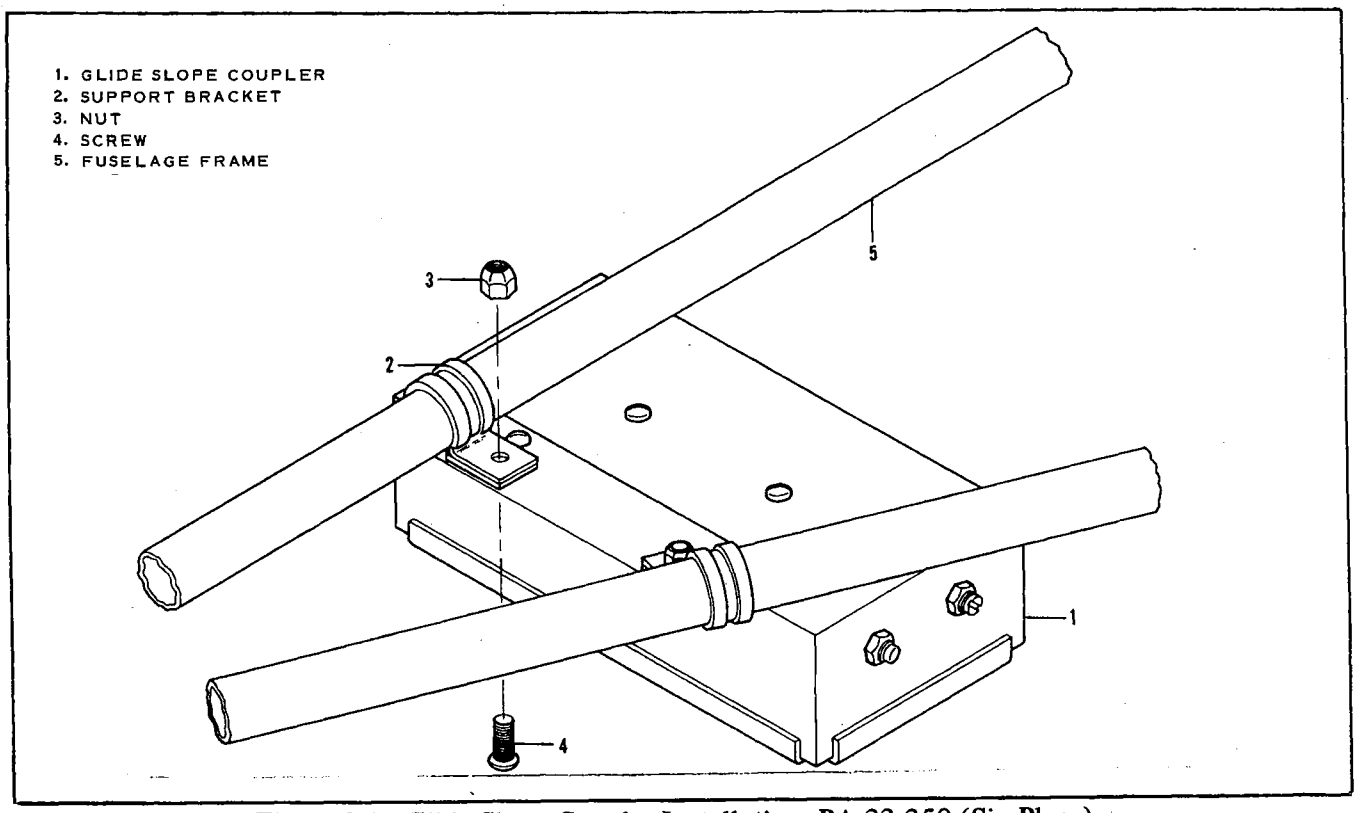


Figure 9-1. Glide Slope Coupler Installation, PA-23-250 (Six Place)

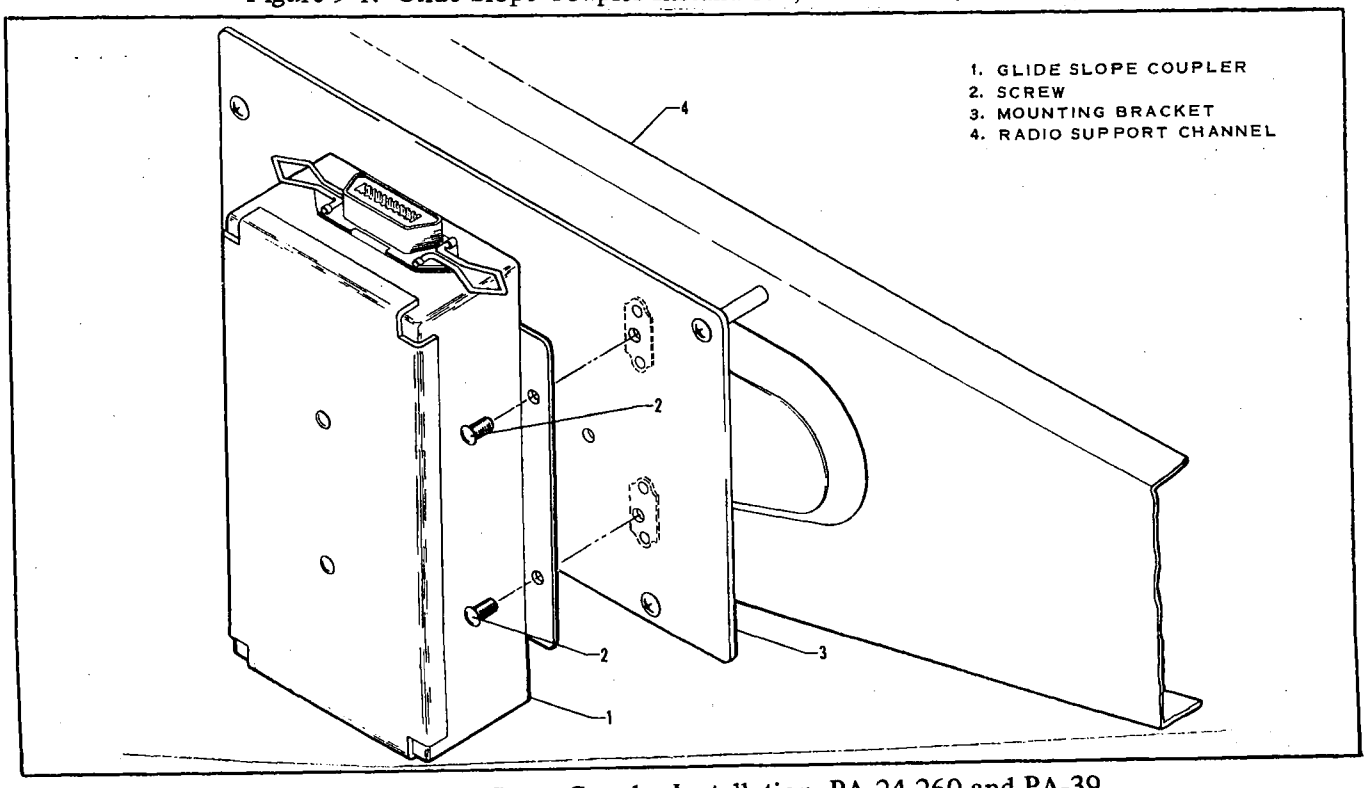


Figure 9-2. Glide Slope Coupler Installation, PA-24-260 and PA-39

c. If the jumper plug has been installed in the Glide Slope Harness connector CD-63, remove it.

d. From the top of the instrument panel, connect the CD-63, 24-pin connector and make sure the spring clips are snapped in place.

e. Install the cover on top of the instrument panel.

9-6. REMOVAL OF GLIDE SLOPE COUPLER. (PA-31, PA-31-350 and PA-31P.)

(PA-31 only.) The Glide Slope Coupler is located under the right side of the instrument panel. (PA-31P only.) The Glide Slope Coupler is located under the center of the instrument panel to the rear of the pedestal.

a. (PA-31P only.) Remove the screws securing the center instrument panel and move panel slightly aft to gain access to Glide Slope Coupler.

b. Release the spring clips on CD-63 connector. Disconnect CD-63 from the Glide Slope Coupler.

c. If the airplane will be flown prior to reinstallation of the Glide Slope Coupler, install jumper plug. Mitchell P/N 9A88 (Piper P/N 757 325), in the CD-63 harness connector.

d. Remove the two screws which secure the Glide Slope Coupler to the mounting bracket.

e. (PA-31P only.) Remove the two screws which secure the Glide Slope mounting bracket to the instrument panel and remove coupler and mounting bracket.

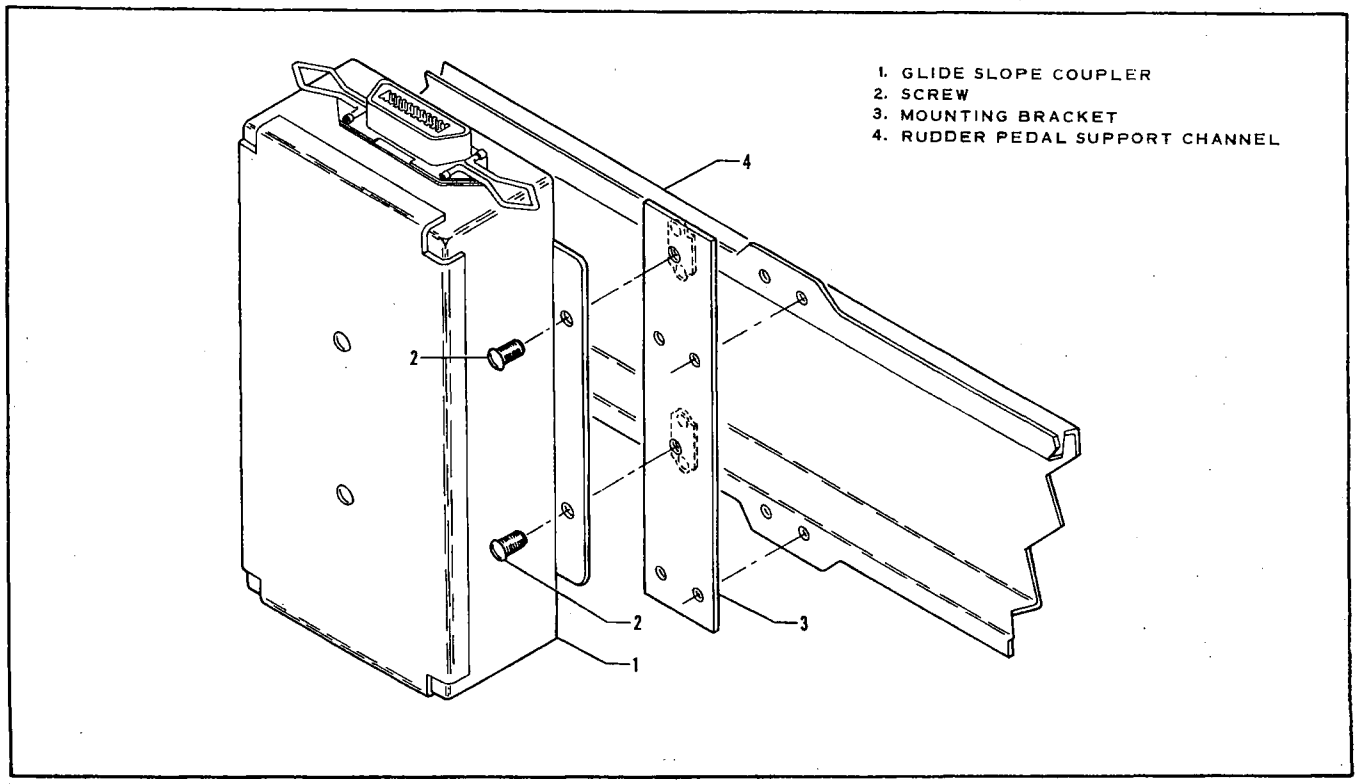


Figure 9-3. Glide Slope Coupler Installation, PA-31 and PA-31-350

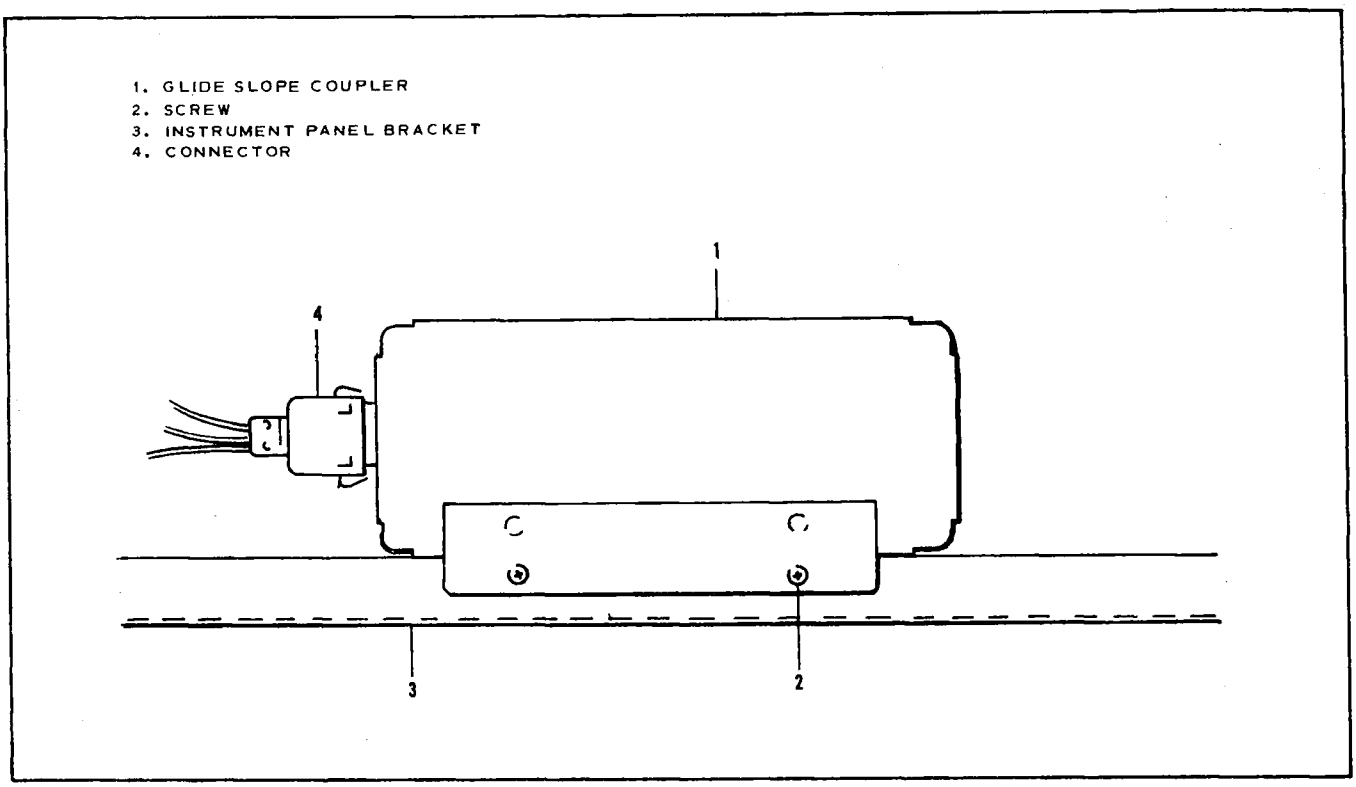


Figure 9-4. Glide Slope Coupler Installation, PA-31P

9-7. INSTALLATION OF GLIDE SLOPE COUPLER. (PA-31, PA-31-350 and PA-31P.) (Refer to Figure 9-3 or Figure 9-4.)

a. (PA-31P only.) Place the Glide Slope Coupler with mounting bracket under the center of the instrument panel. Position it so the 24-pin receptacle is to the left of the pedestal.

b. Place the Glide Slope Coupler on the mounting bracket under the right side of the instrument panel. Position it so the 24-pin receptacle is on top of the Glide Slope Coupler.

c. (PA-31P only.) Secure the Coupler with mounting bracket to the instrument panel with two screws.

d. Secure the Coupler to the mounting bracket with two screws.

e. If the jumper plug has been installed in the Glide Slope Harness connector CD-63, remove it.

f. Connect the CD-63, 24-pin connector and make sure the spring clips are snapped in place.

9-8. REMOVAL OF GLIDE SLOPE COUPLER. (PA-34-200.)

The Glide Slope Coupler is located beneath the instrument panel and is attached to the forward left side of the brake channel.

a. Release the spring clips on CD-63 connector and disconnect the CD-63 connector from the Glide Slope Coupler.

b. Remove the screws and nuts which secure the Glide Slope Coupler to the brake channel and remove coupler.

c. If the airplane will be flown prior to reinstallation of the Glide Slope Coupler, install jumper plug, Mitchell P/N 9A88 (Piper P/N 757 325), in the CD-63 harness connector.

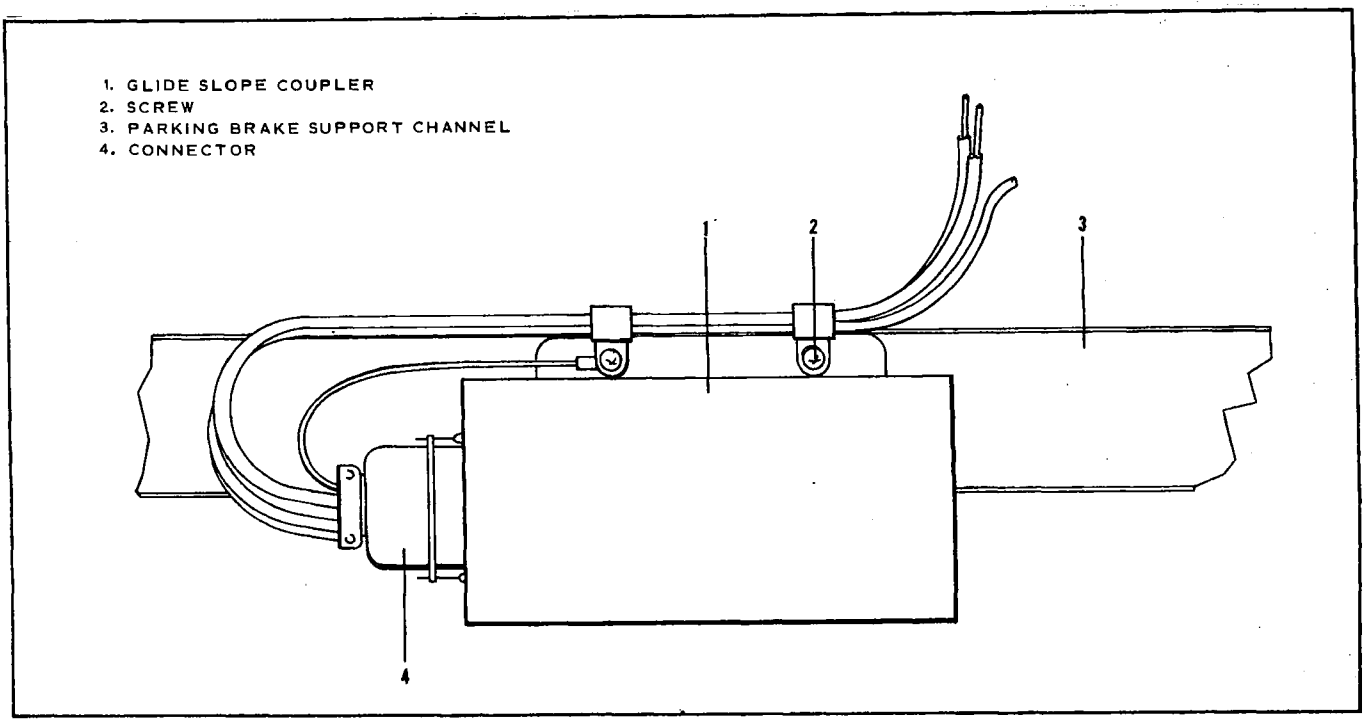


Figure 9-5. Glide Slope Coupler Installation, PA-34-200

9-9. INSTALLATION OF GLIDE SLOPE COUPLER. (PA-34-200.) (Refer to Figure 9-5.)

a. If the jumper plug, Mitchell P/N 9A88 (Piper P/N 757 325), has been installed in the Glide Slope Coupler Harness Connector CD-63, remove it.

b. Place the Glide Slope Coupler on the left side of the brake channel with the CD-63 receptacle of the coupler forward.

c. Ascertain the ground wire CD-60 from the CD-63 connector harness is placed under the forward mounting screw of the coupler.

d. Secure the Glide Slope Coupler to the brake channel with the appropriate screws and nuts.

e. Connect the CD-63 24-pin connector to the coupler and make sure the spring clips are snapped in place.

SECTION X

TEST EQUIPMENT

SECTION X

TEST EQUIPMENT

10-1. TEST EQUIPMENT REQUIREMENTS. AutoPilot Test Kit Piper P/N 753 439 (66D141). In addition to this test equipment, there are several additional cables which will be required.

The use of the 66D141-1, 66D141-2 and 66D141-3 is not explained because they are used the same as described in Section IV of this manual. The 66D141-4 Radio Coupler Tester is used differently. This is explained in Paragraph 10-2.

10-2. 66D141-4 RADIO COUPLER TESTER. The Radio Coupler Tester contains a simulated radio signal source to provide Glide Slope Signal Deviation thus allowing the system to be static tested. The Radio Coupler Test Box will perform the following functions:

a. The Lower Radio Signal Meter simulates a Glide Slope Deviation Indicator. Blue represents UP and yellow represents DOWN.

b. The Radio Signal Substitute Knob, located to the right of the Lower Omni Meter, when pulled out "ON" and rotated will give either a fly "UP" or "DOWN" signal.

c. The 9-pin CD-34 Connector connects to Test Cable 30A300 to provide simulated Glide Slope information to the Glide Slope Coupler.

10-3. GLIDE SLOPE CABLES. Given in this paragraph are the additional items which are used for testing the Glide Slope Coupler. (Refer to Figure 10-1.)

a. Glide Slope Coupler Light Cable, Mitchell P/N 30B317 (Piper P/N 757 873).

b. Glide Slope Coupler Test Cable, Mitchell P/N 30A300 (Piper P/N 757 874).

c. Glide Slope Coupler Cable, Mitchell P/N 30C291 (Piper P/N 752 010). This is the same cable used for installation in the airplane and is not shown in Figure 10-1.

d. Glide Slope Coupler Extension Cable, Mitchell P/N 30C267 (Piper P/N 757 875). Used for flight adjustment.

e. Jumper Plug, Mitchell P/N 9A88 (Piper P/N 757 325). This is not used for testing. It is installed in the airplane Glide Slope Harness while the Glide Slope Coupler is removed.

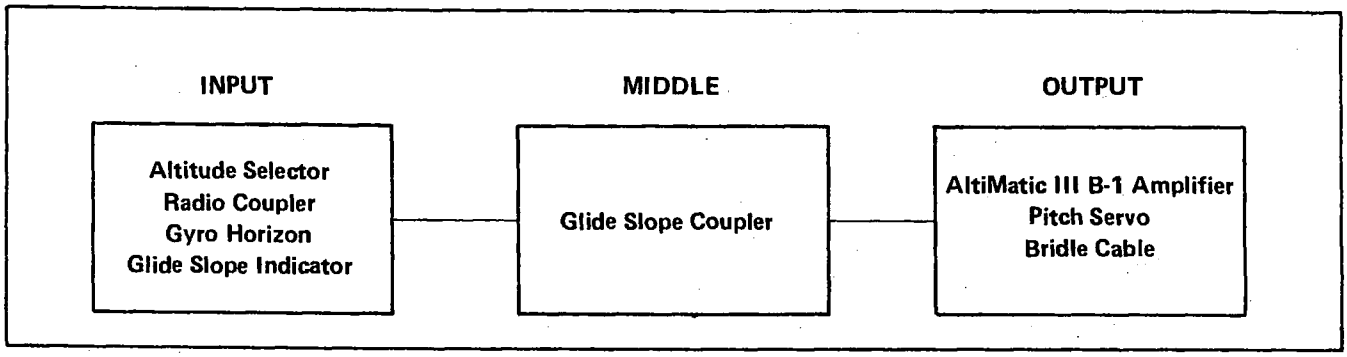
10-4. TROUBLESHOOTING.

a. It is recommended that the technician determine the nature and specific area of trouble as accurately as possible by questioning the pilot.

b. Refer to Table X-I before attempting to troubleshoot the system. Isolate the trouble into one group.

1. The first group concerns the inputs to the Glide Slope Coupler. It is recommended that the technician, by use of the appropriate test equipment, reproduce the input signals and observe that the output, in this case, the AutoPilot, responds either correctly or incorrectly. The reason is that this group is the easiest to work on.

TABLE X-I. TROUBLE ISOLATION BLOCK DIAGRAM



2. If, with the correct inputs, the AutoPilot does not respond correctly, the middle group (in this case the Glide Slope Coupler) should be removed and bench checked in accordance with Section XI.

3. If the inputs are correct and the middle section (Glide Slope Coupler) performs satisfactorily on the bench check, the output group should be checked. Since the output group is the pitch portion of the AltiMatic AutoPilot, it is recommended that it be checked out in accordance with Section V of this manual.

c. Since the Glide Slope Coupler signal is an additional input to the pitch portion of the AltiMatic AutoPilot it is essential that it be established as to whether or not the problem is peculiar to the Glide Slope Coupler operation, an example: Complaint, aircraft "porpoises while making ILS approach." This problem could be caused by malfunctions other than the Glide Slope Coupler such as AltiMatic Amplifier, loose control or bridle cable and faulty electric trim. At this point it would be wise to check out the AltiMatic pitch system without the Glide Slope Coupler engaged.

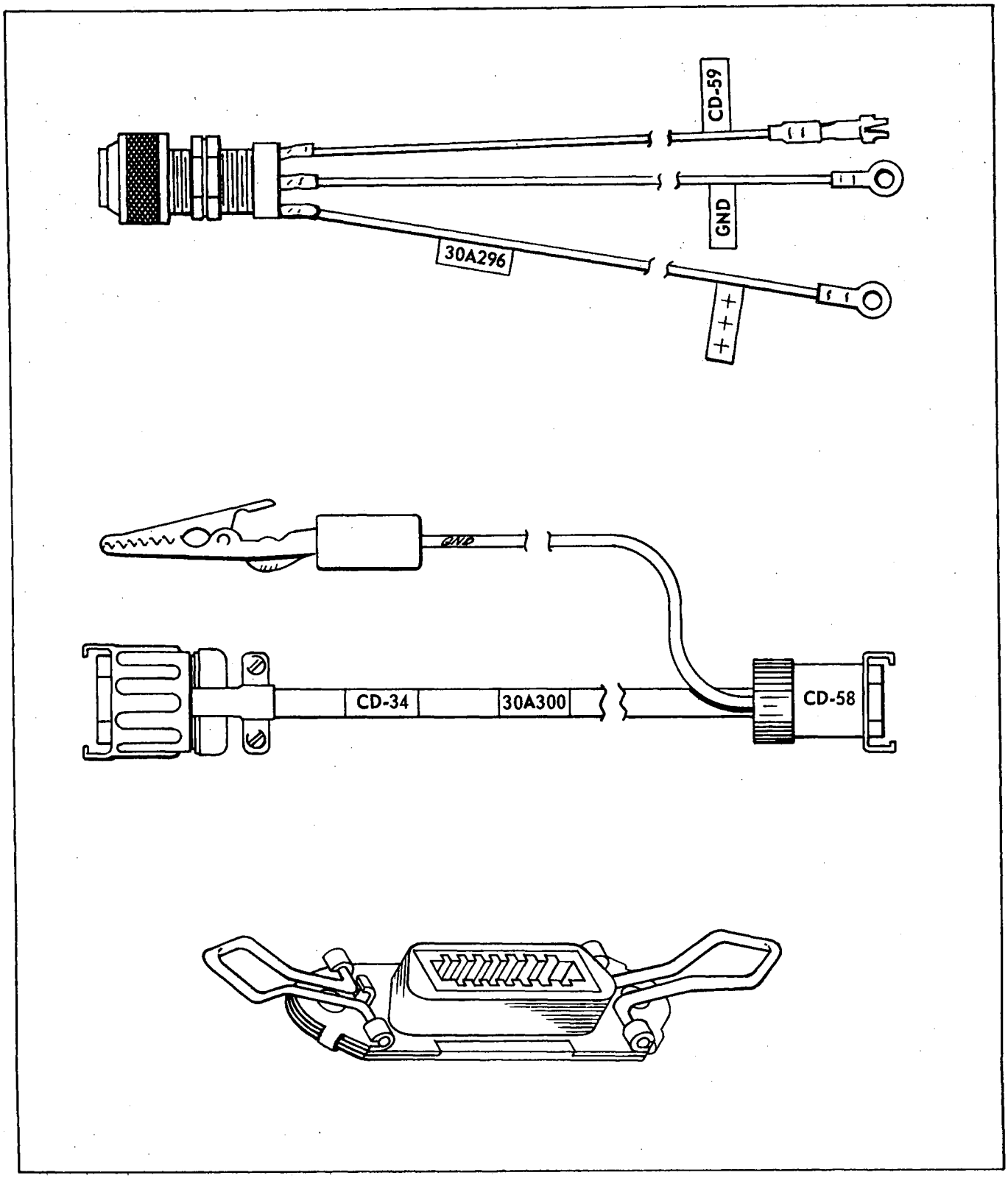


Figure 10-1. Glide Slope Coupler Test Cables and Jumper Plug

SECTION XI

BENCH SET-UP PROCEDURES

SECTION XI

BENCH SET-UP PROCEDURES

11-1. INTRODUCTION. The information in this section will list the equipment necessary to bench check the Glide Slope Coupler and the proper procedure for connecting this equipment. The bench set-up procedure is also described. For red button and adjusting pot location on Glide Slope Amplifier, refer to Figure 11-1. For functional ground and flight checks, refer to Section XII. For Schematics, refer to paragraph 11-4 of this section.

11-2. EQUIPMENT REQUIRED FOR BENCH CHECK. The following test equipment will be required to bench check the Glide Slope Coupler.

a. Gyro Substitute Test Box, #66D141-1.
b. Power Section Test Box, #66D141-2.
c. Radio Coupler Tester, #66D141-4.
d. Console Substitute Test Box, #66D141-3.
e. AltiMatic III Cable Harness, #30D207.
f. Glide Slope Coupler Cable, #30C291.
g. Glide Slope Coupler Test Cable, #30A300.
h. Glide Slope Light and Cable, #30B317.
i. AltiMatic III Amplifier.
j. 14-Volt DC Power Supply or 28-Volt DC Power Supply if a Glide Slope from a PA-31 is being tested.

11-3. BENCH CHECKING OF THE GLIDE SLOPE COUPLER.

a. Use the 66D141 Test Kit and make the following connections. After all connections are made as described in Steps 1 to 27 incl. proceed to bench check.

1. Make sure VOLTAGE SELECTOR SWITCH, located on top plate of amplifier is in correct position (14-Volt DC or 28-Volt DC) to match bench power supply.
2. Position amplifier so that 30-pin amplifier board is visible.
3. Plug large 30-pin AMP connector of the AltiMatic III test harness onto the amplifier board with the cable fanning out to the right. Identification placard on the amplifier should be visible.
4. Plug AMP connector CD-20 from the test harness into the CD-20 receptacle located on the Console Substitute Test Box.
5. Plug the 4-pin male CD-16 connector from the test harness into the female 4-pin receptacle located on the right hand side of the Power Section Test Box. This receptacle is labeled AMPLIFIER. On the Power Section Test Box, find the Voltage Selector Switch on the lower left hand corner and insure that this switch is positioned to match the bench power supply and the Amplifier Voltage Selector Switch in Step 1. (14-volts DC or 28-volts DC.)
6. Rotate SELECTOR KNOB on Power Section Test Box to the CENTER or "OFF" position.
7. Find the RADIO SIGNAL SUBSTITUTE KNOB located on the RADIO COUPLER TEST BOX, immediately to the right of the bottom Omni Meter. MAKE SURE THIS RADIO SIGNAL KNOB IS IN THE "IN" POSITION.
8. Find the VOLTAGE SELECTOR SWITCH located immediately to the left of the Red and Black DC input terminals on the face of the Radio Coupler Test Box. Place this VOLTAGE SELECTOR SWITCH in the proper voltage position.

9. Rotate LARGE VERNIER CONTROL KNOB on face of Gyro Substitute Test Box to the CENTER or "ZERO" position on the BOTTOM SCALE labeled PITCH DEGREES.

10. Below the Large Vernier Knob on the Gyro Substitute Box find a SLIDE SWITCH labeled "ROLL" and "PITCH." Place this slide switch in the "DOWN" or "PITCH" position.

11. Connect a ground lead to the bottom mounting flange of the AltiMatic Amplifier.

CAUTION

DO NOT PLACE THE GROUND LEAD NEAR THE OUTPUT TRANSISTORS LOCATED BETWEEN THE COOLING FINS ALONG THE SIDE OF THE AMPLIFIER.

12. Place the POWER SELECTOR SWITCH located on the lower left hand corner of the Console Substitute Test Box to the DOWN or "OFF" position.

13. Attach the DELCO fitting from the white wire CD-27 to the positive side of the power supply.

14. Immediately to the right of the AMP connector CD-20, find a 14-volt or 28-volt SLIDE SWITCH, place this switch to the proper voltage position to agree with Voltage Selector Switch on the top plate of the amplifier.

15. On the Console Substitute Test Box, place the Altitude Selector Switch in the Altitude Control position.

16. Connect the 24-pin Male Plug of the 30C291 harness to the Glide Slope Coupler.

17. Connect the FEMALE CD-10 of Glide Slope Coupler Harness (30C291) to the CD-10 connector on the Console Substitute Box.

18. Connect the MALE CD-10 of Glide Slope Coupler Harness (30C291) to the Female CD-10 of the AltiMatic Test Harness.

19. Connect FEMALE CD-18 of the Glide Slope Coupler Harness to CD-18 on the Gyro Substitute Box.

20. Connect MALE CD-18 of the Glide Slope Coupler Harness to the Female CD-18 connector of the AltiMatic Harness.

21. Connect Power Supply of either 14-volts or 28-volts A+ whichever is applicable to Glide Slope Harness as listed below:

14-volt A+ connects to CD-61
28-volt A+ connects to CD-62

22. Connect ground lead from 30B317 Light Assembly to Power Supply Ground.

23. Connect Glide Slope Harness CD-60 to Power Supply Ground.

24. Connect Glide Slope Coupler Harness CD-59 to the appropriate (14 or 28 volts) CD-59 of the 30B317 Light Assembly.

25. Connect the CD-34 end of the 30A300 Test Cable to the CD-34 (Radio) receptacle of the 66D141-4 Coupler Tester.

26. Connect the CD-58 end of 30A300 Test Cable to CD-58 of the Glide Slope Coupler Harness.

27. Connect the single lead of the 30A300 Test Cable to ground.

NOTE

Normally the Glide Slope Coupler logic circuit receives its ground from Pin K (loc norm) of the Radio Coupler; however, when using test cable 30A300 ground is obtained through an external lead which permits normal Glide Slope Coupler operation regardless of Radio Coupler Mode.

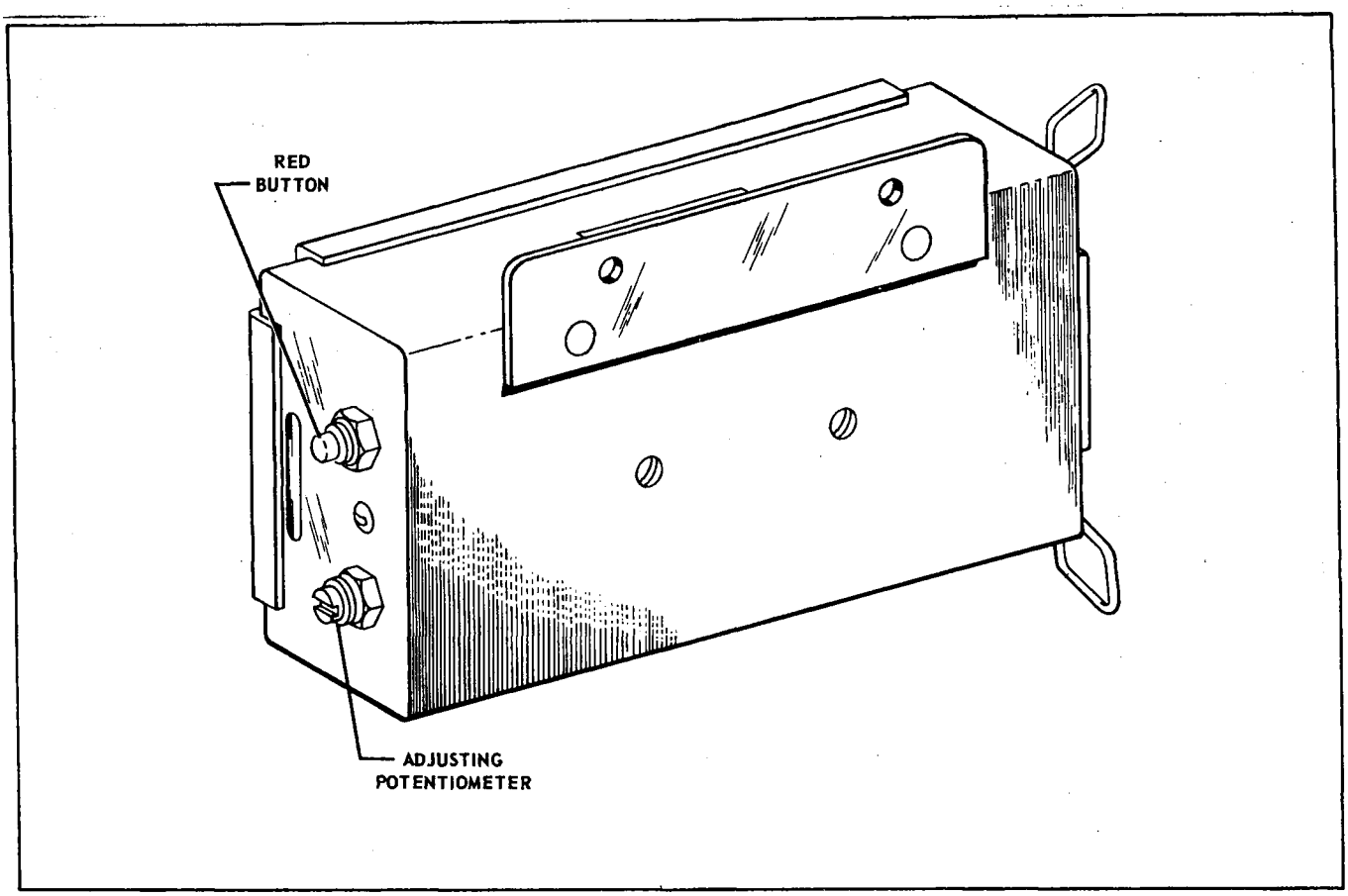


Figure 11-1. Glide Slope Coupler

28. Turn Power Supply "ON."

29. Place the ON/OFF switch, located in the lower left corner of the Console Substitute Test Box in the ON position. Depress RED BUTTON located at BOTTOM RIGHT corner of Power Section Test Box labeled INPUT VOLTAGE. Test box needle should deflect to the right and read 12-14 or 24-28 volts DC, whichever is applicable, on TOP SCALE.

30. Place the Selector Switch on the Power Section Test Box to the "Res" position.

31. On the Console Substitute Test Box, center the Altitude Control Knob and adjust the Pitch Trim Knob to center the needle on the Power Section Test Box.

32. Pull OUT radio signal knob on Radio Coupler Tester, rotate COUNTERCLOCKWISE to obtain 60% in the blue.

NOTE

With reference to the Glide Slope Coupler, blue is UP and yellow is DOWN.

33. To ARM the Glide Slope Coupler, maintain 60% for 20 seconds.

34. Reduce radio signal slowly by rotating the Radio Signal Knob clockwise until "LOCK ON" occurs. This can be determined by the green indicator light coming on. Also, an audible "click" will be detected from the relay.

35. Push Radio Signal Knob OFF. (This keeps needle centered).

36. Rotate slot head potentiometer on Glide Slope Coupler full clockwise. (Refer to Figure 11-1.)

37. With red button depressed, center output meter on Power Section Test Box by rotating the large vernier knob clockwise. On the scale labeled "Pitch Degrees", record the degrees required to center the needle.

38. Rotate slot head potentiometer on Glide Slope Coupler full counterclockwise.

39. Depress red button on Glide Slope Coupler and center output meter on Power Section Test Box by rotating the Large Vernier Knob counterclockwise. On the scale labeled "Pitch Degrees", record the degrees required to center the needle.

40. The total separation between the reading obtained in Step 37 and the reading obtained in Step 39 should be 6° -2 +3.

41. Center the Attitude Gyro Knob.

42. Adjust the Potentiometer on the Glide Slope Coupler to approximately MID POINT.

43. Depress red button on Glide Slope Coupler. Pull out Radio Signal Knob and rotate it counterclockwise to obtain 100% UP (blue). Zero the Output Meter by rotating the Large Vernier Knob clockwise. Record the degrees required to zero the Output Meter on the Power Section Test Box.

44. Continue to depress Red Button on Glide Slope Coupler. Rotate Radio Signal Knob to deflect the Radio Signal Meter to 100% DOWN (yellow). Zero the Output Meter by rotating the Large Vernier Knob counterclockwise. Record the degrees required to zero the Output Meter on the Power Section Test Box.

45. The total separation between the reading obtained in Step 43 and the reading obtained in Step 44 should be $7^{\circ} \pm 2^{\circ}$.

46. With red button released and the Radio Signal Meter indicating 100% DOWN (yellow) rotate the large vernier knob on the Gyro Substitute Test Box counterclockwise until the output meter is centered. WAIT 90 SECONDS. Record the reading on the "Pitch Degrees" Scale.

47. With red button released and the Radio Signal Meter indicating 100% UP (blue), rotate the Large Vernier Knob on the Gyro Substitute Test Box clockwise until the output meter is centered. WAIT 90 SECONDS.

48. The total separation between Step 46 and 47 should not exceed $10^{\circ} \pm 2^{\circ}$.

b. INTEGRATOR RATE TEST.

1. Push Radio Signal Substitute Knob "IN" and momentarily depress red button on Glide Slope Coupler.

2. Center the output meter on Power Section Test Box by rotating the Large Vernier Knob on the Gyro Substitute Test Box. WAIT 30 SECONDS after final rotation of knob.

3. Pull Radio Signal Substitute Knob "OUT."

4. With button released, obtain 20% UP (blue) indication on Radio Signal Meter, allow 90 seconds for Integrator to stabilize. Reverse Radio Signal to 20% DOWN (yellow). IMMEDIATELY record the time required for the needle on the Power Section Test Box to pass through zero from a right deflection. Time should be 15 to 35 seconds, observe needle now deflects left.

5. Push Radio Signal Knob "IN."

6. Rotate the Large Vernier Knob counterclockwise 2° nose down.

7. Depress Red Button on Glide Slope Coupler and adjust potentiometer on Glide Slope Coupler to center Output Meter on Power Section Test Box.

c. This completes Bench Set-Up.

11-4. WIRING DIAGRAMS. The following pages consist of wiring diagrams of the electrical harnesses and mating connectors which pertain to the Glide Slope Coupler. This information should be utilized when troubleshooting the system for defective wiring. A continuity test of wiring can be performed with an ohmmeter. This test will verify the harness is good and capable of carrying current. Should any wire or connector fail to produce a reading on the ohmmeter, they are defective and must be repaired or replaced.

SECTION XII

GROUND CHECK AND FLIGHT SET-UP PROCEDURES

SECTION XII

GROUND CHECK AND FLIGHT SET-UP PROCEDURES

NOTE

Normally the Glide Slope Coupler logic circuit receives its ground from Pin K (loc norm) of the Radio Coupler; however, when using test cable 30A300 ground is obtained through an external lead which permits normal Glide Slope Coupler operation regardless of Radio Coupler Mode.

12-1. GROUND OPERATIONAL CHECK.

a. Remove aircraft harness connector CD-58 from Glide Slope Coupler and connect test cable 30A300 CD-58 to Glide Slope Coupler. Connect CD-34 end of the 30A300 test cable to the receptacle labeled CD-34 (radio) on the coupler tester, 66D141-4. Attach the lead labeled "Ground" of the 30A300 test cable to the airplane ground.

b. On the 66D141-4 Radio Coupler Tester, adjust the Lower Radio Signal Meter for 60% UP (Blue).

c. Connect CD-18 of the Glide Slope Harness to the 66D141-1 Gyro Substitute Test Box.

d. With the aircraft master switch ON engage the AltiMatic III B-1, make sure it is in the Altitude Select Mode.

e. After 20 seconds slowly decrease the Radio Simulator Signal, the Coupler should lock ON when zero output is indicated on the Radio Signal Meter. The green light also indicates lock ON.

f. Alternately rotate the Radio Signal Substitute Knob to UP (blue) and DOWN (yellow) 60% positions. Note that the stabilator or elevator moves accordingly.

NOTE

Response will not be immediate when reversing radio signal as it will take time for the integrator to stabilize.

12-2. FLIGHT SET-UP PROCEDURES. The flight adjustment is provided for the purpose of establishing the correct pitch attitude required to maintain the Glide Path Track. This minimizes the corrective action required of the error integrator to maintain tracking with the Glide Slope Converter centered.

a. Remove the Glide Slope Coupler by removing the two mounting screws which are located on the mounting flange.

b. Connect one end of CD-63 extension cable to the 30C291 harness installed in the airplane. Connect the other end of this extension cable to the CD-63 receptacle on the Glide Slope Coupler. When checking a PA-24-260 or PA-39, it is recommended the extension cable be routed through the opening in the top of the instrument panel.

c. Connect CD-58 cable from Glide Slope Coupler to CD-58 of the Mitchell P/N 30A300 Test Cable (Piper P/N 757 874). Connect CD-34 of the Test Cable to CD-34 receptacle on the Radio Coupler Tester 66D141-4. Connect the single lead of the 30A300 test cable to the airplane ground.

d. Fly to an area clear of traffic and off the airways. Also fly to an altitude sufficient to make a simulated approach and descent.

e. With the AutoPilot operating, engage Altitude Control.

f. Establish approach speed with gear down and flaps set in accordance with appropriate Airplane Flight Manual. (Not to exceed 15°).

g. PULL Radio Signal Substitute Knob, on 66D141-4 Test Box, OUT and rotate it counterclockwise to 100% blue indication. This is equivalent to being under the Glide Slope which is necessary to arm the Glide Slope Coupler.

h. Maintain 100% UP signal for approximately 20 seconds then slowly rotate the Radio Signal Substitute Knob to center the needle.

i. As needle crosses center, Glide Slope Coupler will "Lock ON", which can be noted by the green indicator light coming on. The aircraft will pitch slightly to a nose down attitude.

j. Push Radio Signal Substitute Knob OFF (in). This is equivalent to Glide Slope Coupler Needle being centered.

k. Adjust power to maintain approach airspeed.

l. Depress red button on Glide Slope Coupler and adjust adjacent potentiometer to set a 500 feet per minute descent. (Clockwise is UP.)

m. Repeat procedure to be sure adjustment is satisfactory.

n. Disconnect test cable 30A300 and connect Glide Slope Coupler CD-58 to Glide Slope Indicator CD-58 connector.

o. Disconnect extension cable CD-63 and connect aircraft CD-63 to the Glide Slope Coupler. Make a coupled ILS approach.

p. Reinstall Glide Slope Coupler in the airplane.

TABLE III-II. ALTIMATIC III B-1 APPLICABILITY CHART

AIRPLANE	CONSOLE	AMPLIFIER	PITCH SERVO	ROLL SERVO	ALTITUDE SELECTOR	RADIO COUPLER (OPT.)	REMARKS
PA-23-250 (14 Volt) PA-23-250 (28 Volt)	1C519-2 1C519-2	1C515-1 1C515-1	1C508-1-184P 1C470-1-371P	1C363-1-184R 1C465-1-371R	1D391-2 1D391-2	1C388* (Any Modification) 1C388* (Any Modification)	
PA-24-260	1C519-2	1C515-1	1C508-1-186P	1C363-1-161R	1D391-2	1C388* (Any Modification)	
PA-31 PA-31-350	1C519-2 1C519-2	1C515-1 1C515-1	1C470-1-187P 1C470-1-413P	1C465-1-187R 1C465-1-413R	1D391-2 1D391-2	1C388* (Any Modification) 1C388* (Any Modification)	
PA-31P	1C519-2	1C515-1	1C470-1-290P	1C465-1-290R	1D391-2	1C388* (Any Modification)	
PA-34-200	1C519-2	1C515-1	1C508-1-298P	1C363-1-298R	1D391-2	1C388* (Any Modification)	
PA-39	1C519-2	1C515-1	1C508-1-296P	1C363-1-161R	1D391-2	1C388* (Any Modification)	*Airplanes equipped with VOA-40/50 series Omni/ Loc converters must have Radio Coupler Piper P/N 757 898 installed.

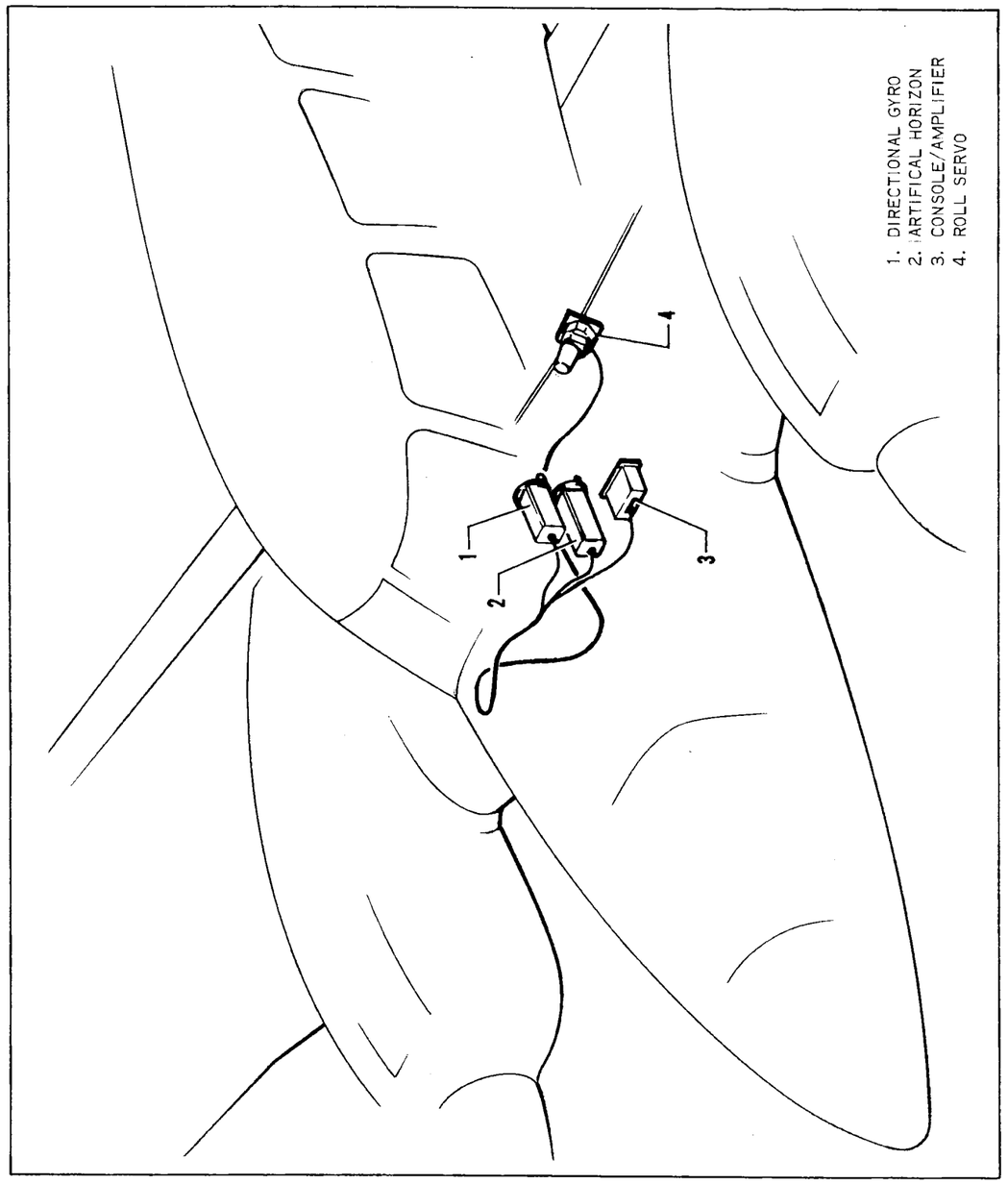


Figure 3-3. PA-23-250 (Six Place) AutoControl III B Layout

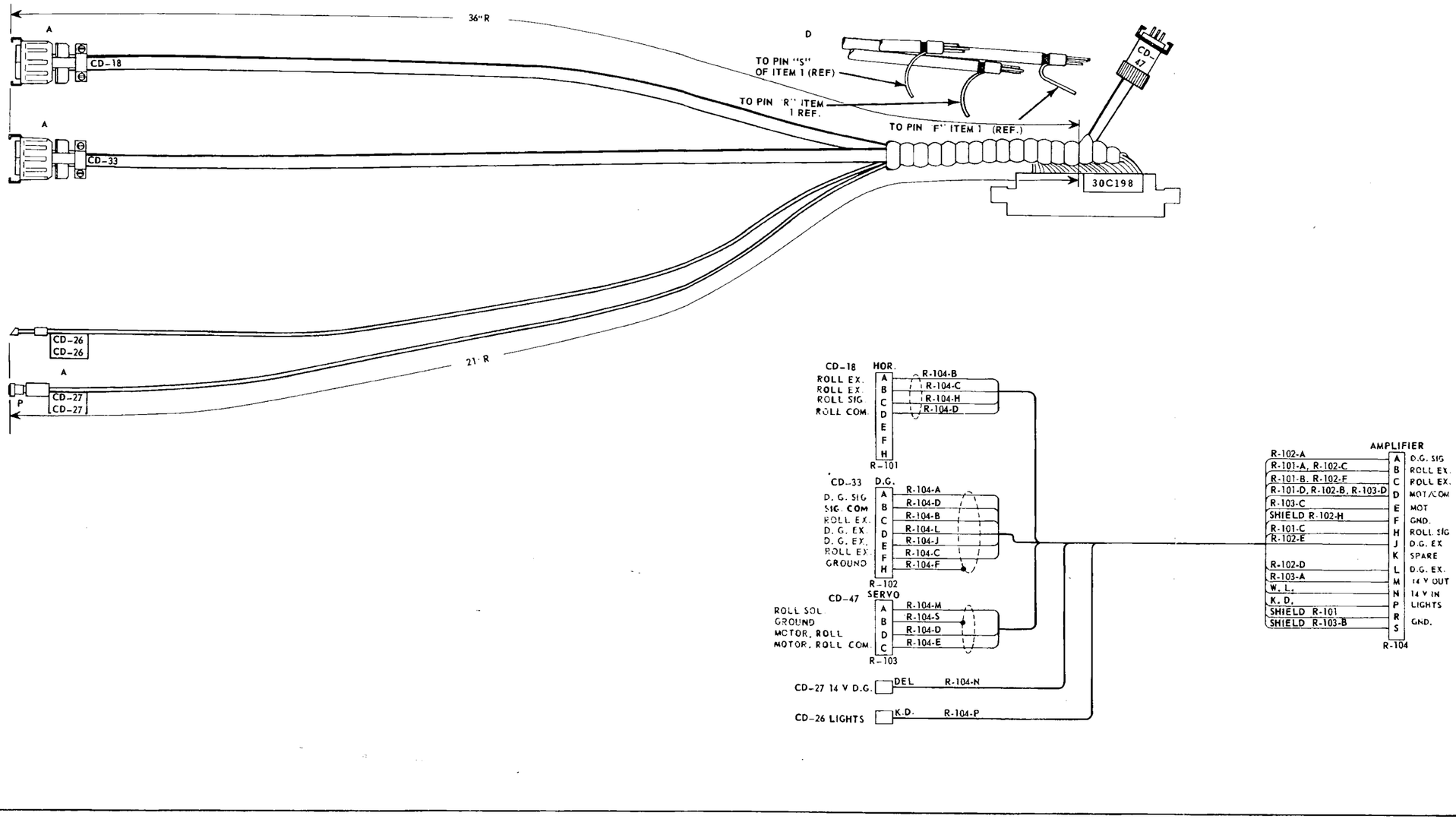


Figure 6-2. AutoControl III B Cable Harness

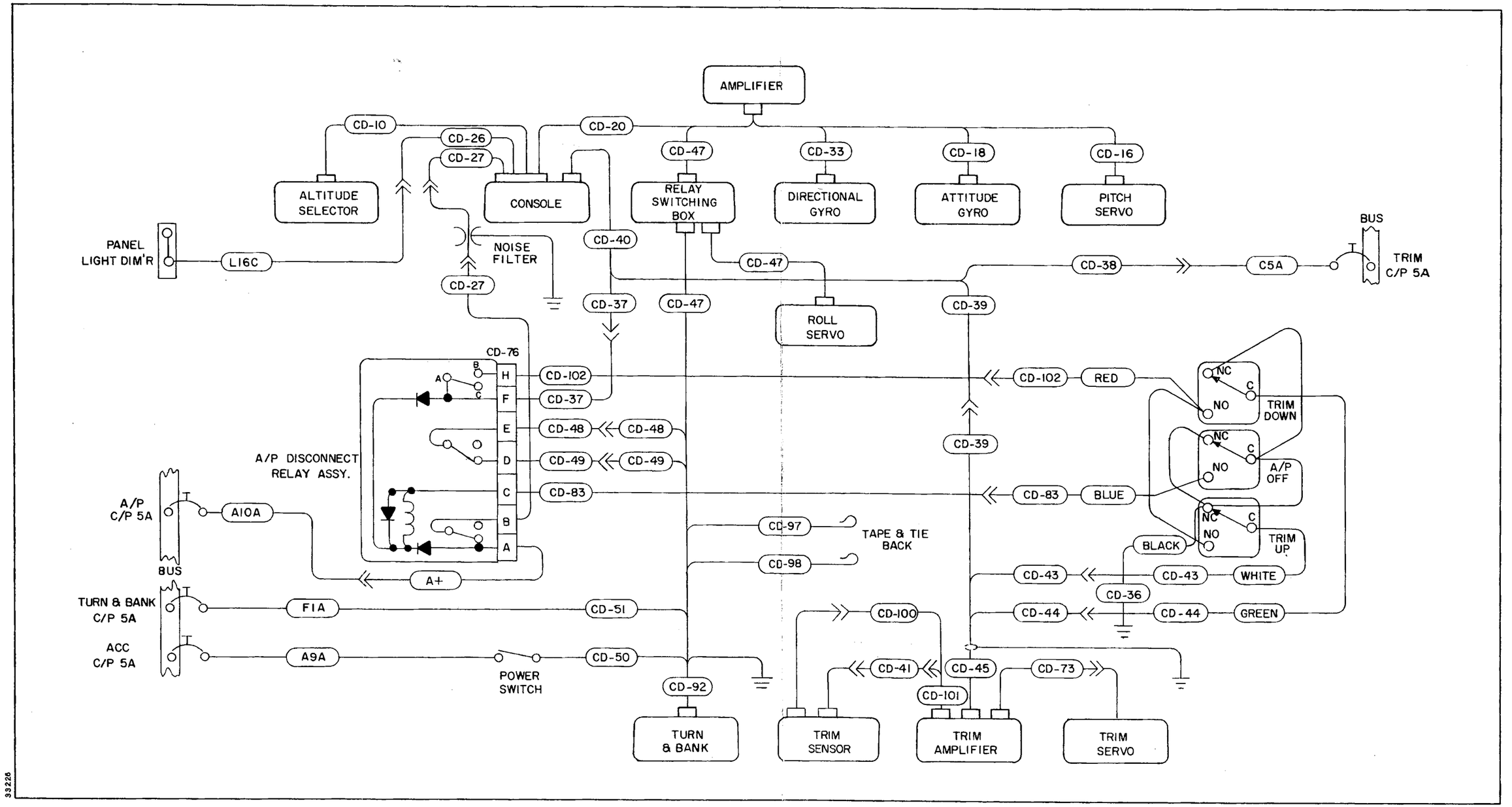


Figure 6-3. AltiMatic III B-1 Block Diagram, PA-23-250 (Six Place)

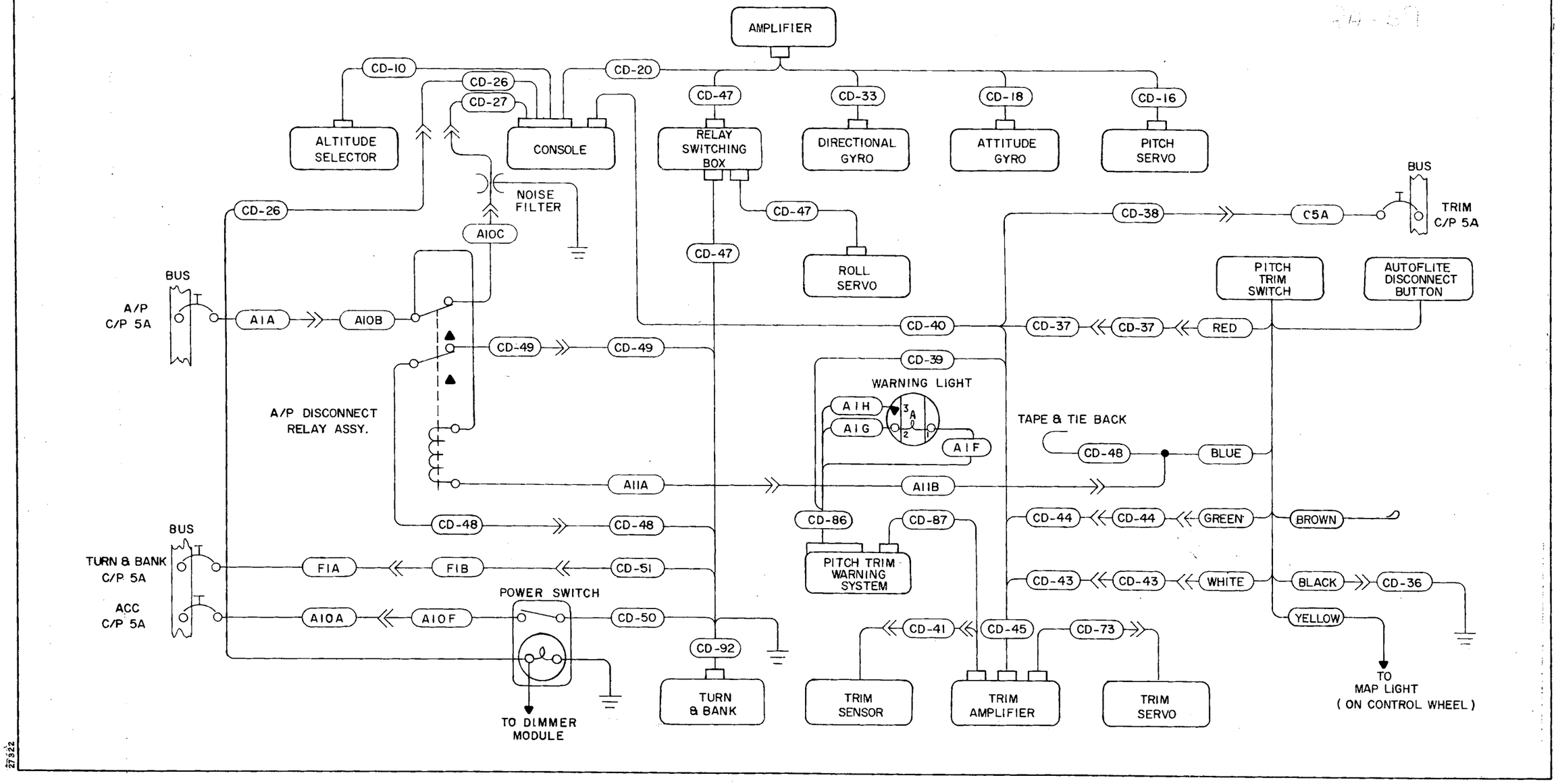


Figure 6-4. AltiMatic III B-1 Block Diagram, PA-24-260 and PA-39

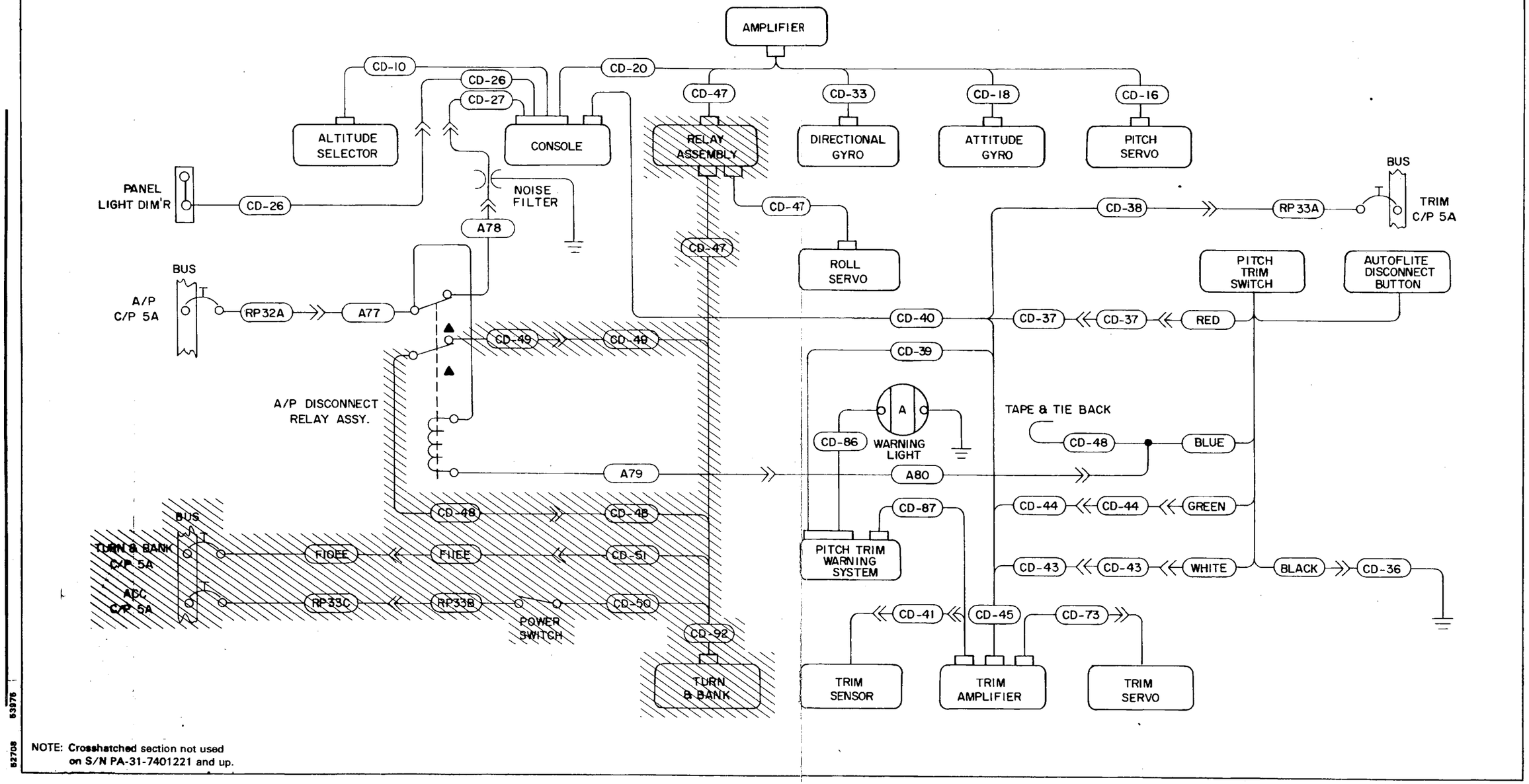


Figure 6-5. AltiMatic III B-1 Block Diagram, PA-31

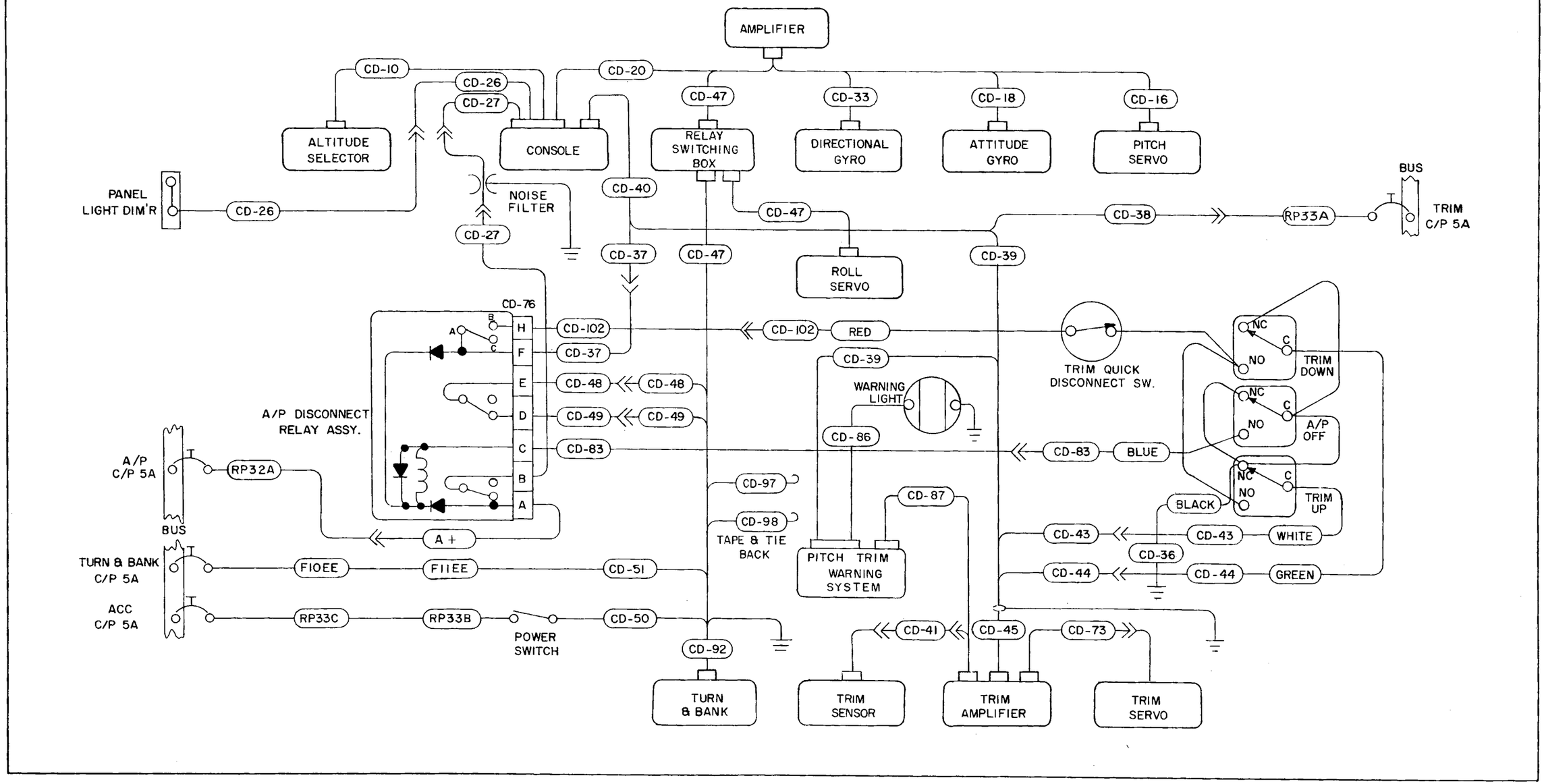


Figure 6-6. AltiMatic III B-1 Block Diagram, PA-31-350

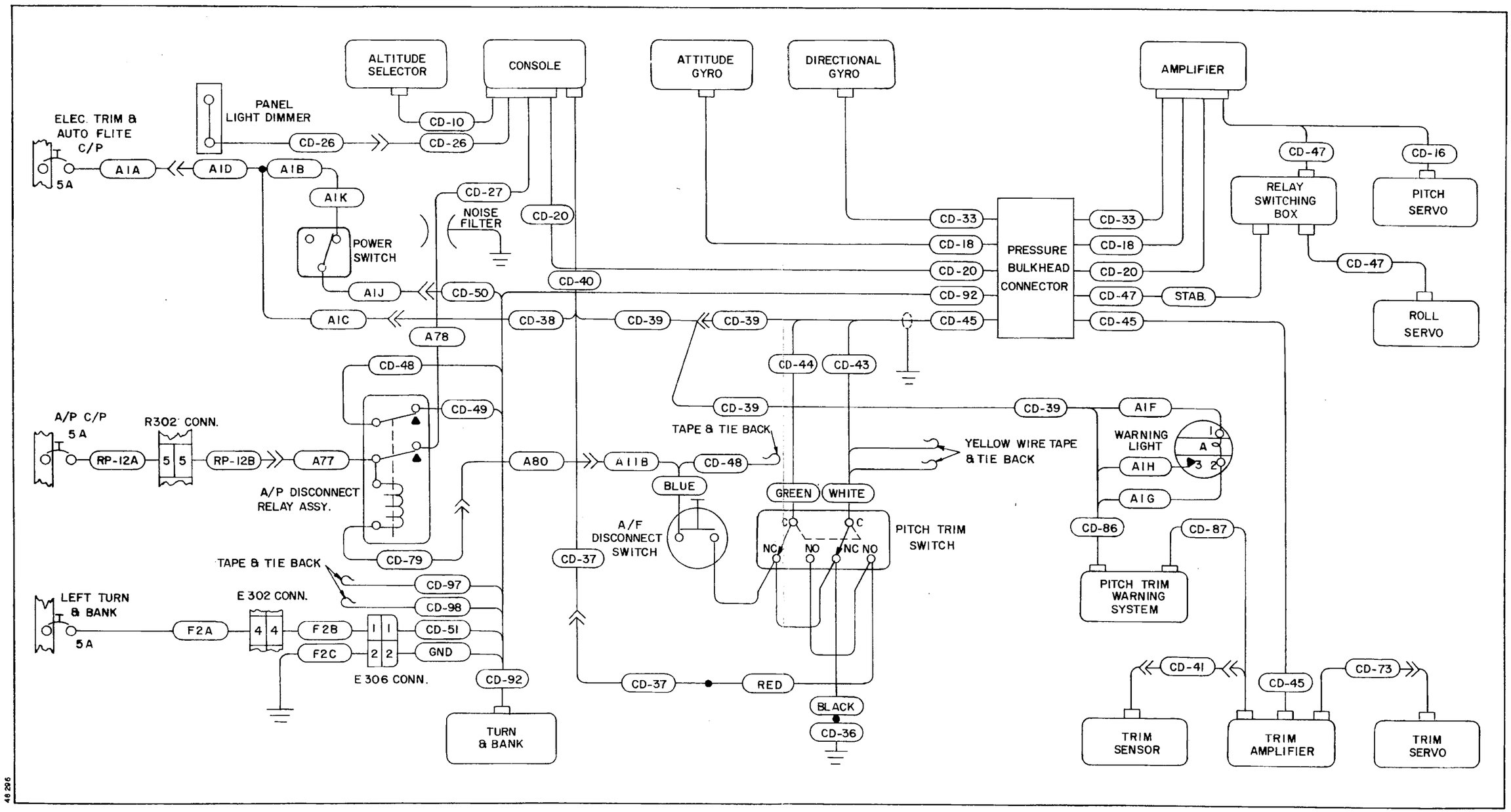


Figure 6-7. AltiMatic III B-1 Block Diagram, PA-31P

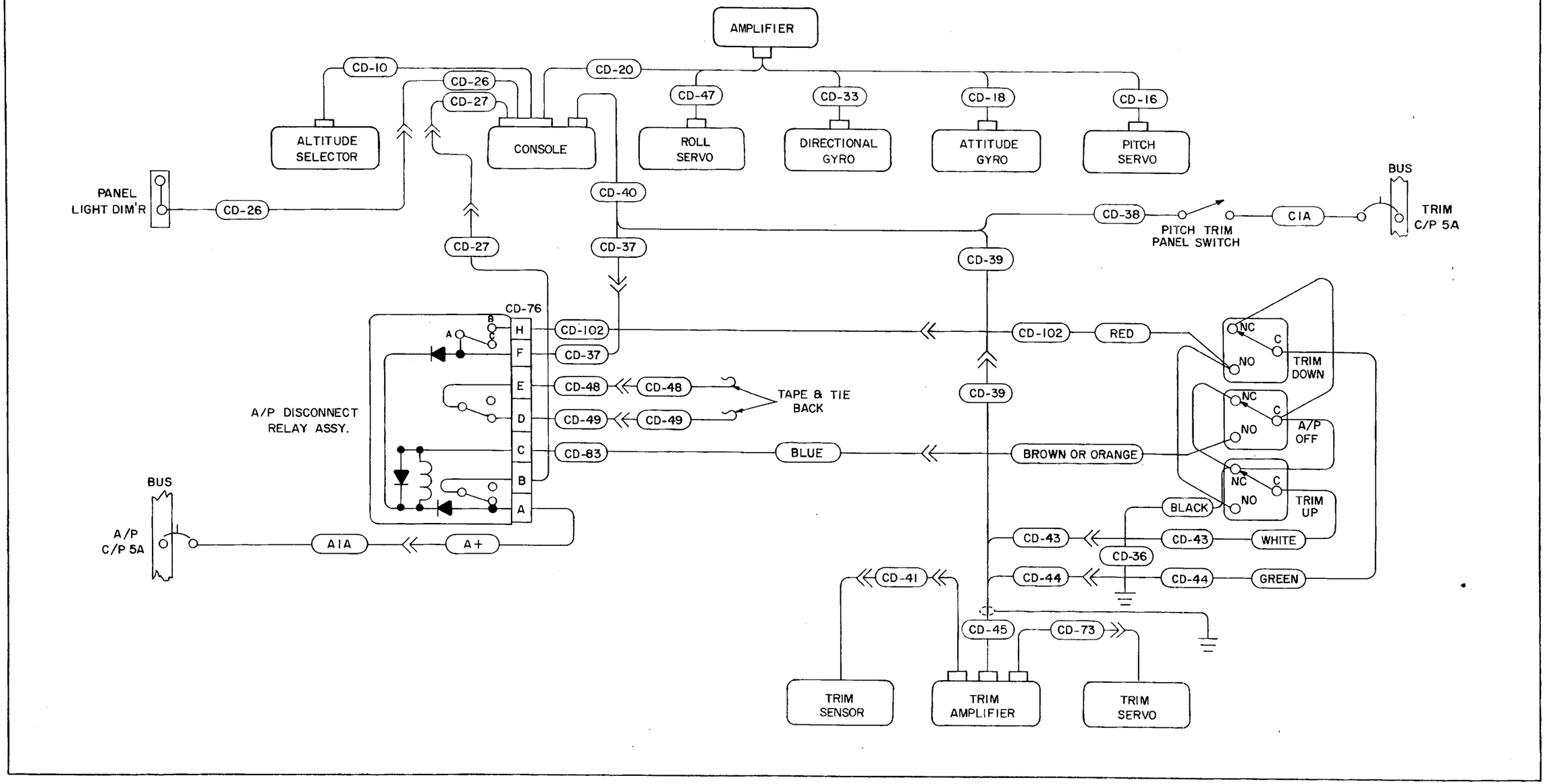


Figure 6-8. AltiMatic III B-1 Block Diagram, PA-34-200

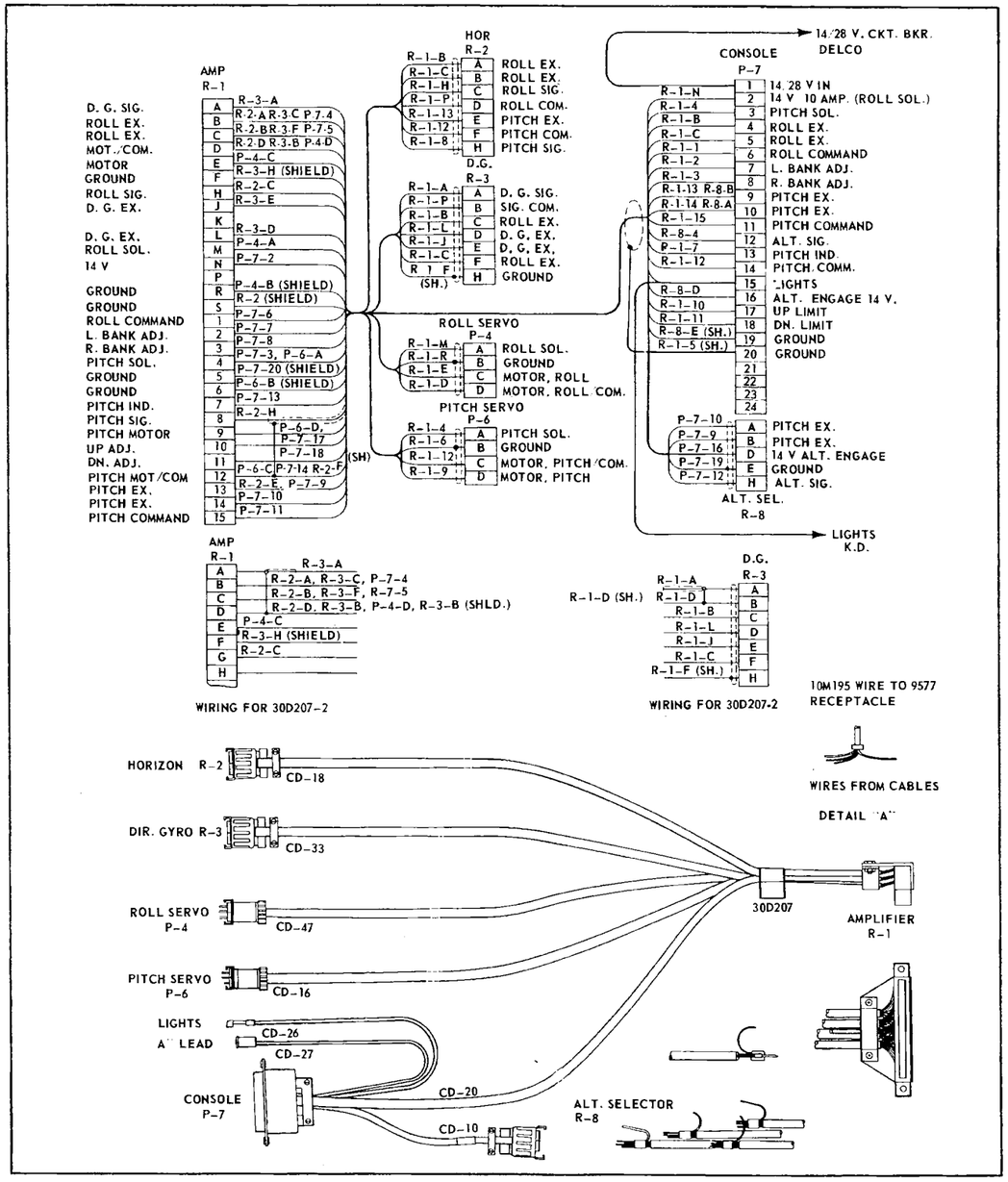


Figure 6-9. AltiMatic III B-1 Cable Harness

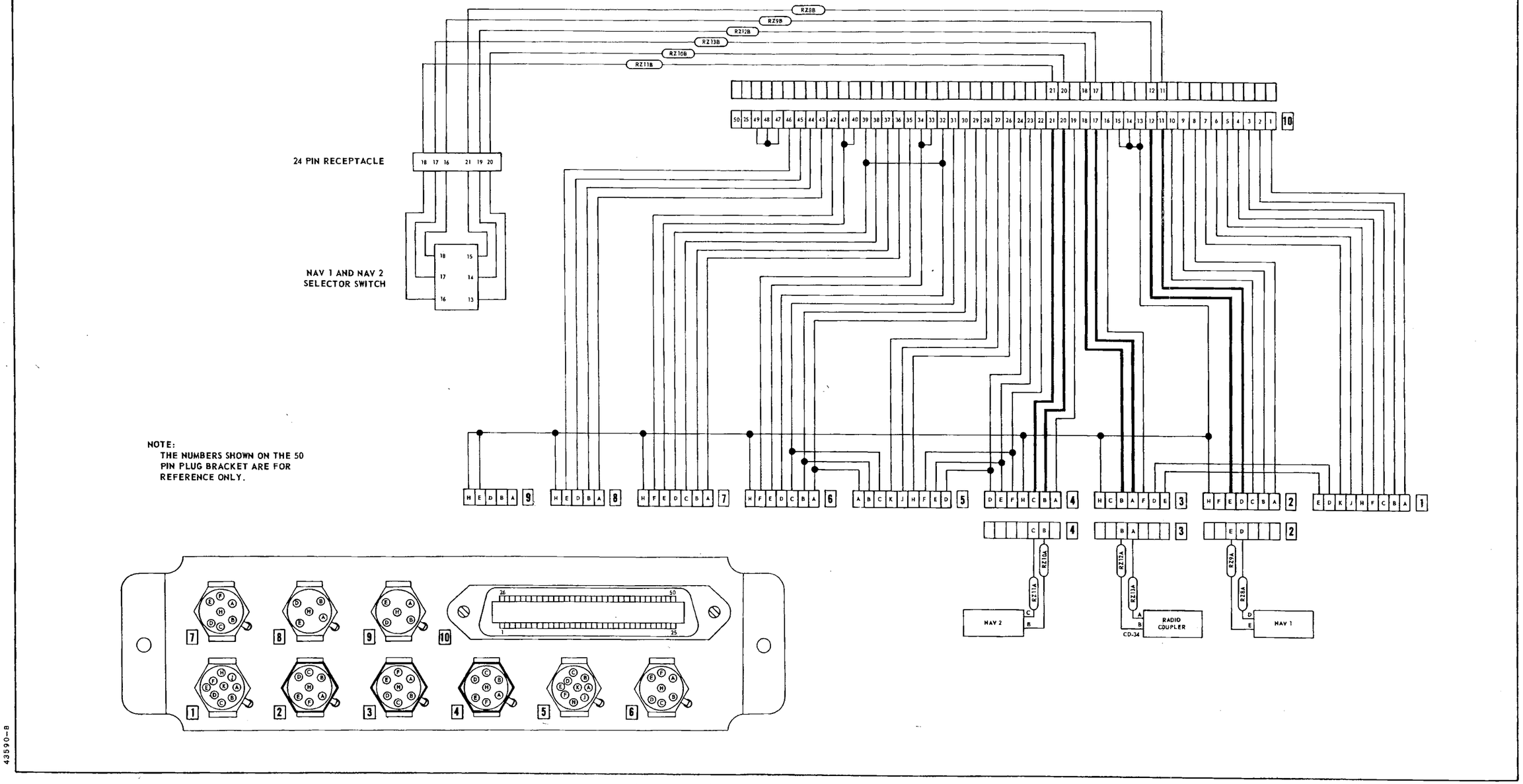


Figure 6-15. Plug Bracket Schematic for AltiMatic III B-1 (PA-31)

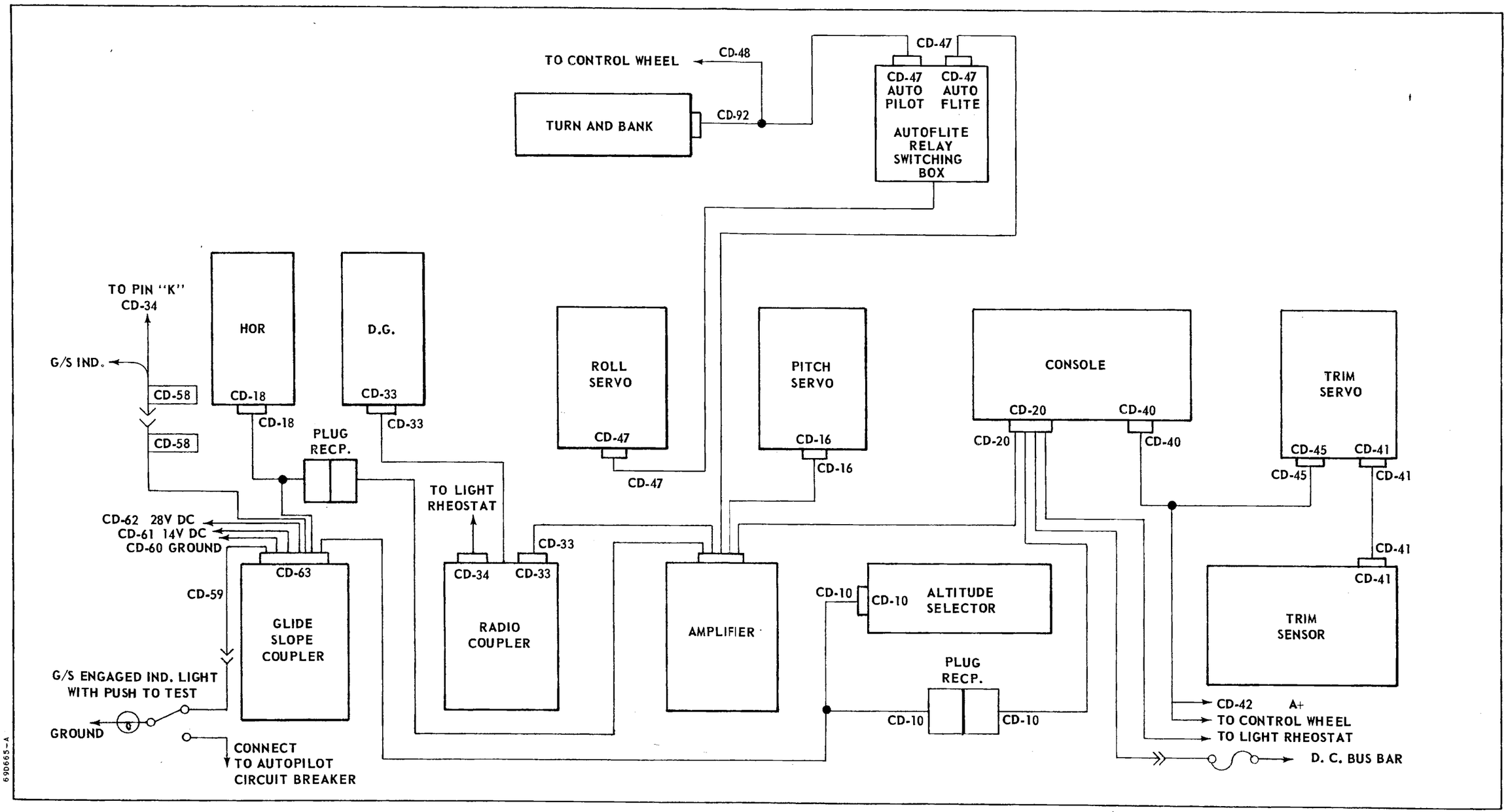


Figure 8-2. Block Diagram of AltiMatic III B-1 with Glide Slope Coupler

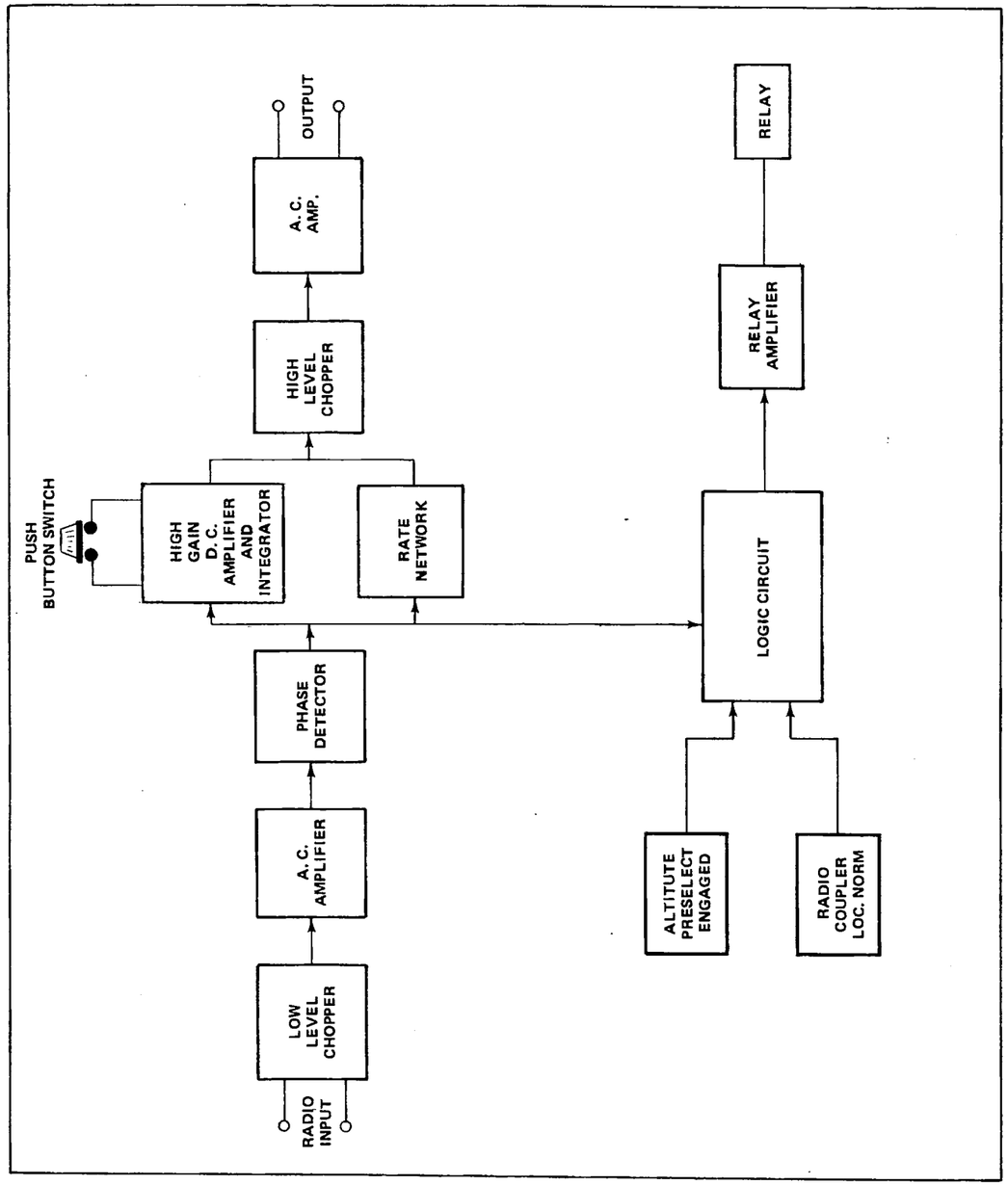


Figure 8-3. Glide Slope Coupler Block Diagram

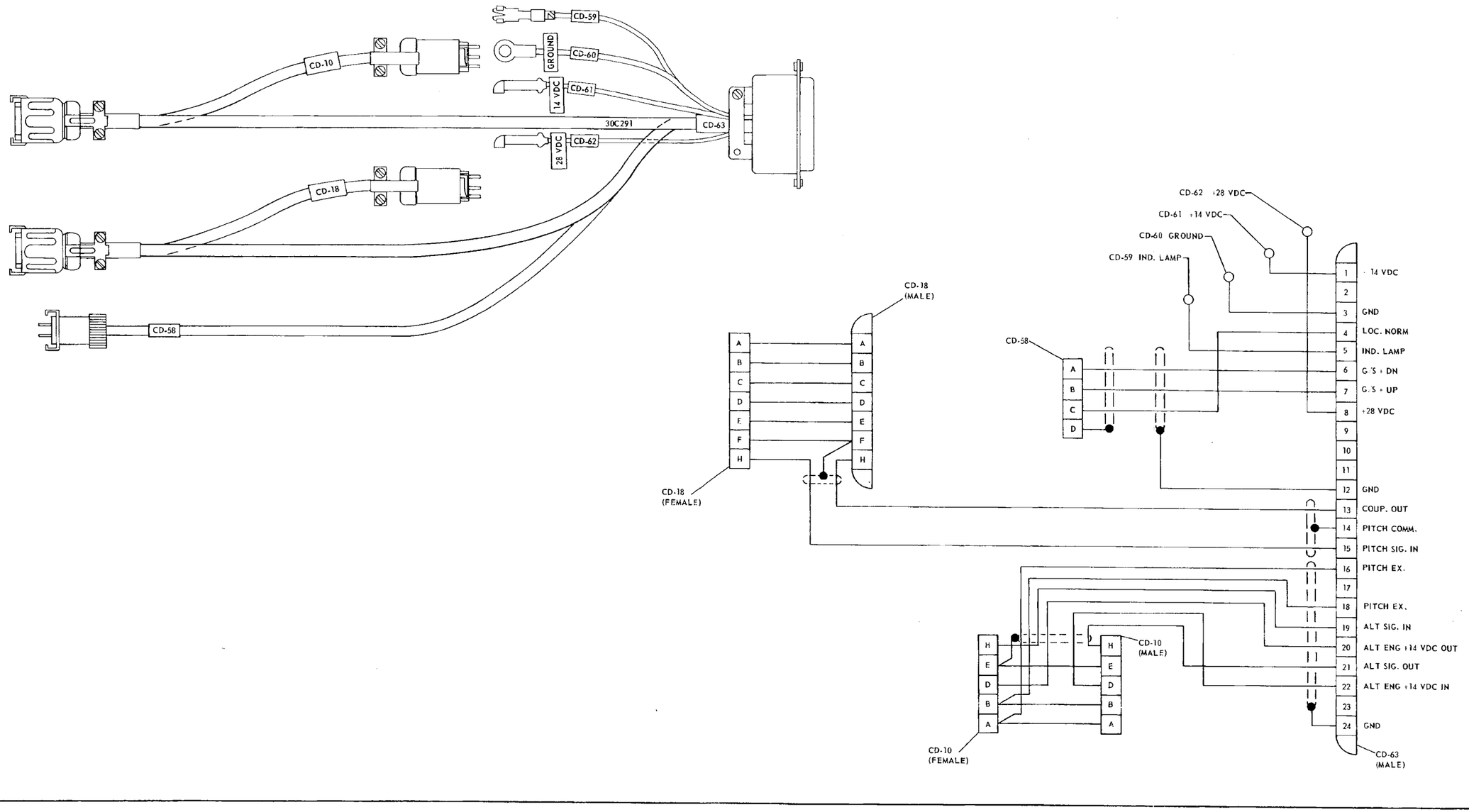


Figure 11-2. Glide Slope Coupler Harness Schematic

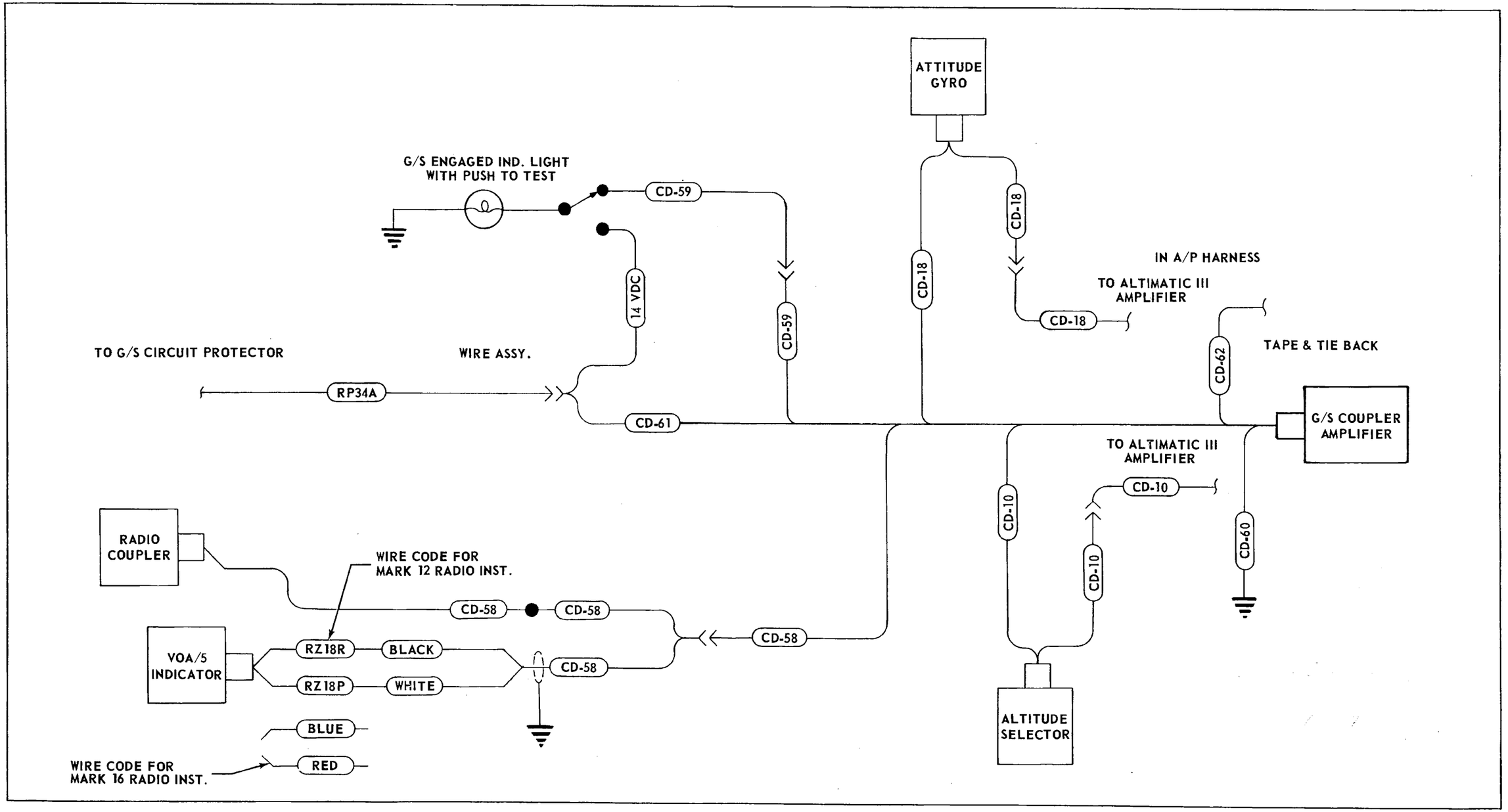


Figure 11-3. Wiring Diagram with Narco Radios, PA-23-250 (Six Place) and PA-39

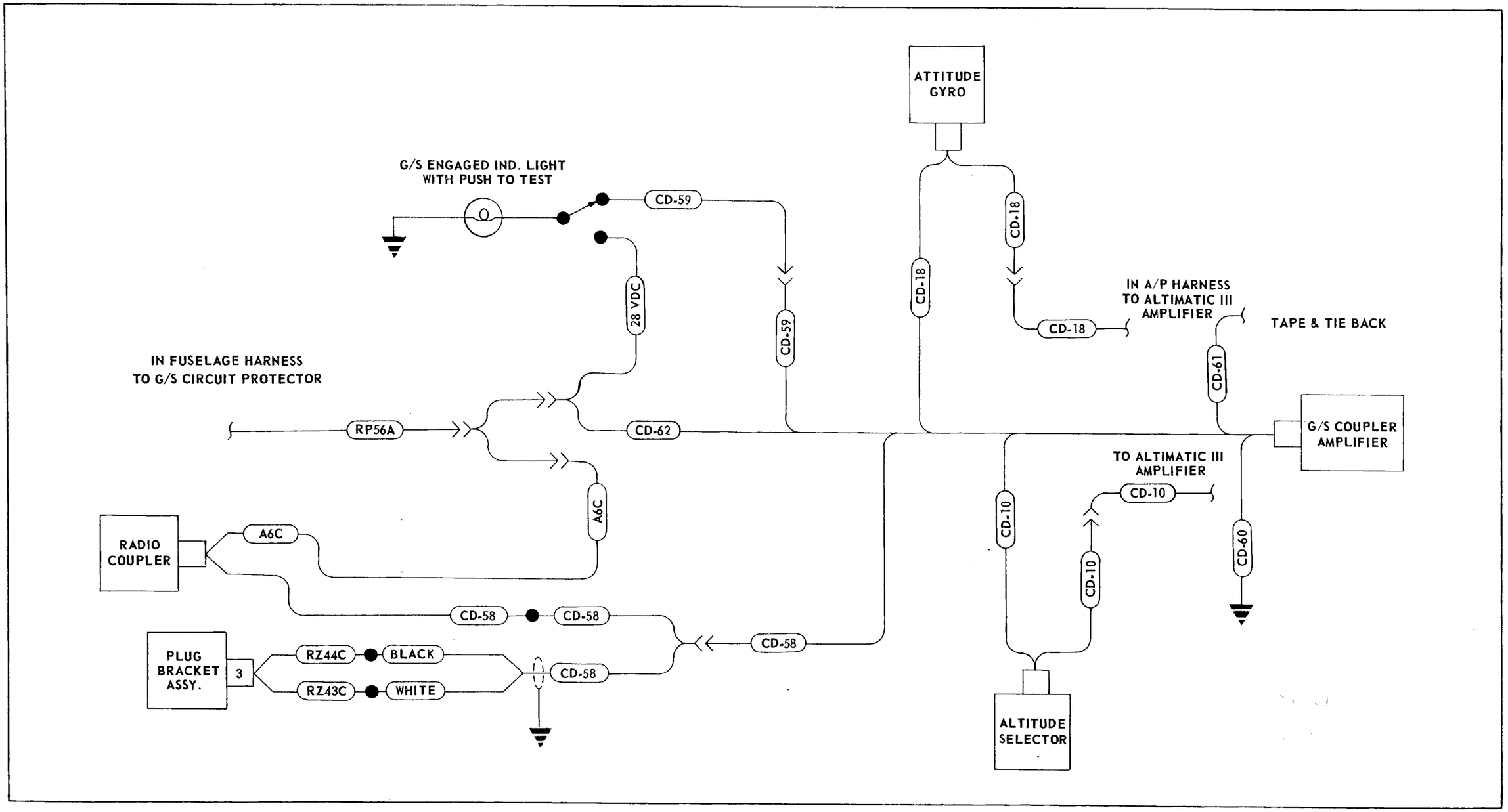


Figure 11-4. Wiring Diagram with King Radios, PA-31

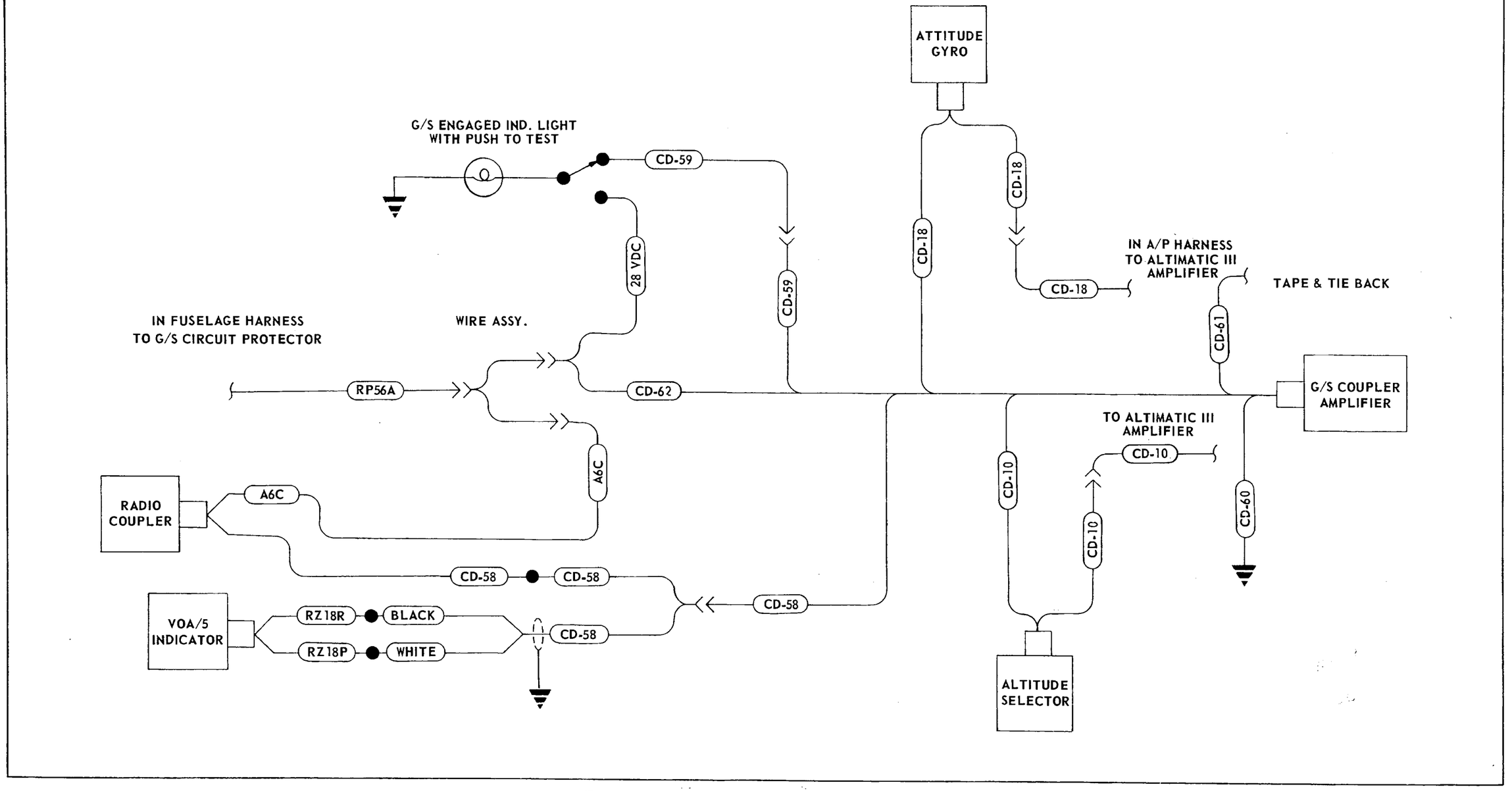


Figure 11-5. Wiring Diagram with Narco Radios, PA-31

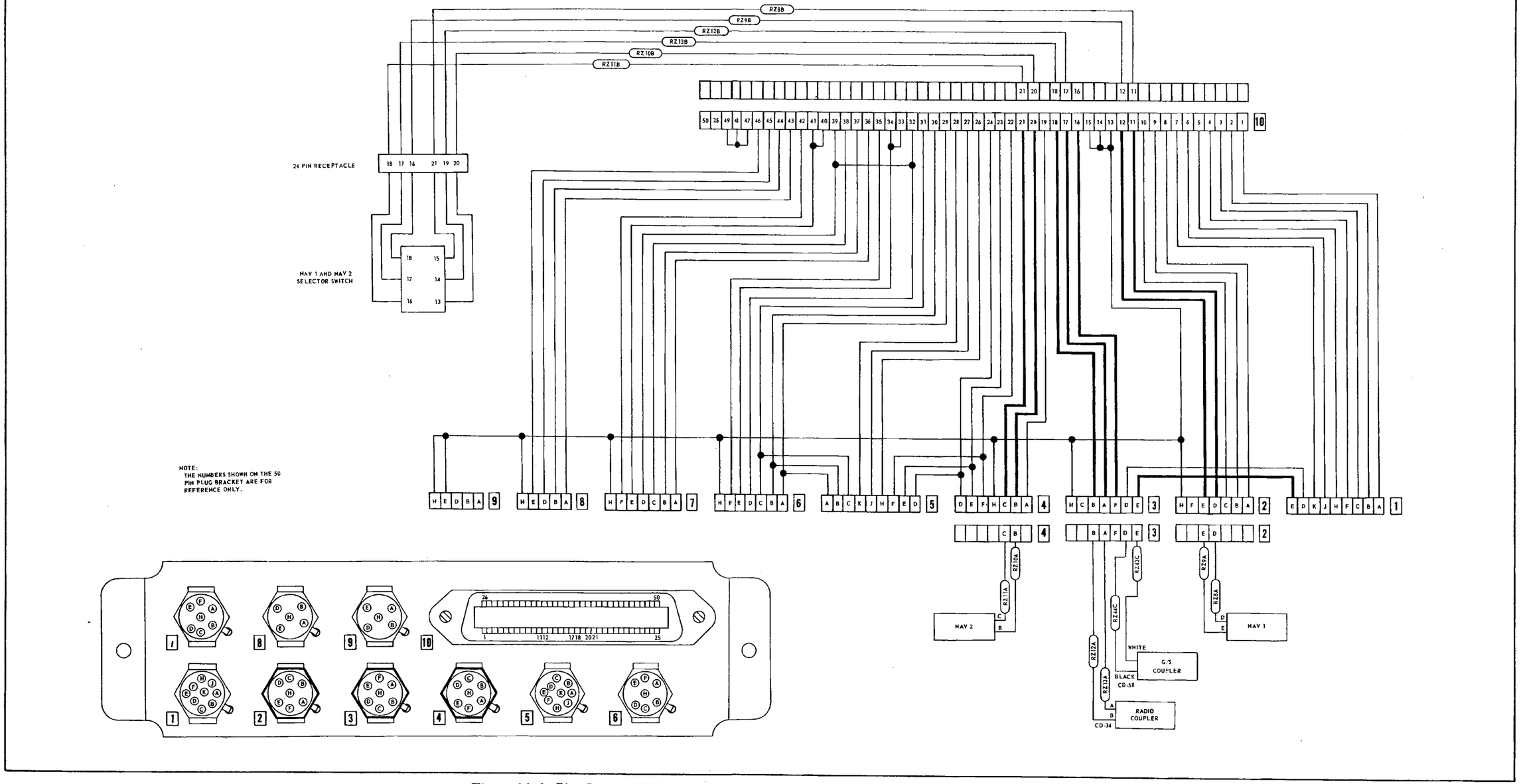


Figure 11-6. Plug Bracket Schematic for AltiMatic III B-1 with Glide Slope Coupler, PA-31