PIPER Customer Services

AUTOCONTROL I & II
ALTIMATIC I & II

Service Manual

PIPER AIRCRAFT CORPORATION

753 798

PIPER AIRCRAFT CORPORATION
LOCK HAVEN, PENNSYLVANIA

THIS SERVICE MANUAL ISSUED JUNE 1961

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This Service Manual (P/N 753 798) has been compiled to include the following publications: Piper Altimatic Service Manual (P/N 753 616), Electronic Letters (EL-Letters), Electronics Service Letters (SE-Letters), Omni-Localizer Coupler Service Manual (P/N 753 691) and Piper AutoControl Service Manual (P/N 751 532).

Any of the above mentioned publications released prior to May 1969 should be considered obsolete.

REVISIONS ISSUED

Current, Permanent and Temporary Revisions to this AutoControl I and II and AltiMatic I and II Service Manual compiled May 1969 are as follows:

753 798 (PR710920)	Permanent Revision	Dated September 20, 1971
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FOREWORD

This Service Manual is provided as a guide for installing, servicing and maintaining the Piper AltiMatic Pilot and Omni-Localizer Coupler.

The information presented in this manual has been divided into three sections: Theory of Operation, Installation and Servicing. An index is located in the front of the manual 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.

REVISION

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 equipment, 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 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 arabic letter in direct sequence with the same common page numbers.
3. Insert pages with page numbers followed by a capital arabic letter in direct sequence with the same common page number but after any pages with the same common page number followed by a small arabic letter.

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PART I

ALTIMATIC

SECTION I

THEORY OF OPERATION

1-1. GENERAL.

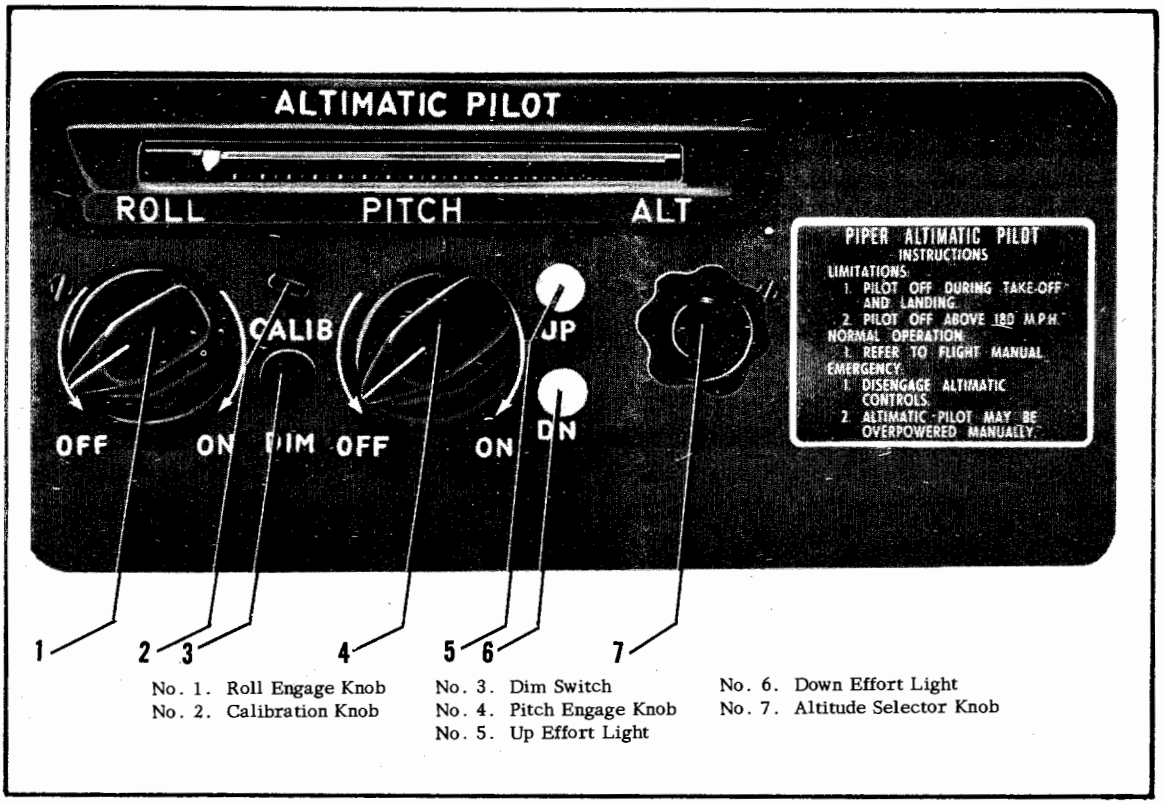
1-2. This manual contains service and maintenance information necessary to maintain and operate the Piper Altimatic Pilot. The maintenance instructions given for each system includes troubleshooting, testing and corrective maintenance. (It is recommended that only qualified personnel perform the operation described herein.)

1-3. DESCRIPTION. The Piper Altimatic Pilot is a high quality, light weight, four control AutoPilot designed specifically for the Piper single engine Comanche and the twin engine Apache and Aztec. The purpose of the Altimatic is to hold the aircraft on a selected course and altitude setting.

The Piper Altimatic consists of eight principle units: The Directional and Gyro Horizon with transistorized Amplifiers, the Automatic Altitude Selector, Pitch and Roll Servos, and the Console unit which houses the controls for the Altimatic.

The Amplifiers are mounted on the backs of the Directional and Horizon Gyros, each amplifier has a control protruding through the instrument panel to the right of the gyro instrument it affects. The Roll and Pitch Servo units are a motor and gear device which are attached to the aileron and stabilator controls of the aircraft. On the Apache and Aztec the Roll Servo unit is attached to the control wheel shaft of the co-pilot's wheel, while on the Comanche the unit is attached to the pilot's control. The Pitch Servo unit on the Apache and Aztec is attached to the right portion of the control column under the instrument panel. On the Comanche the Pitch Servo is located under the removable portion of the floorboard to the left of the nose wheel housing.

Both the Directional Gyro and the Horizon Gyro have internal modifications to include electronic sensing elements which are used to send signals to the amplifiers. The Console which contains the controls for the Altimatic is positioned in the lower left corner of the instrument panel on the Apache and Aztec, while on the Comanche it is located below the radio stack. This Console (See figure 1-1) serves several purposes: (1) It engages the Servo units to the controls by meshing a set of gears and (2) at the same time, operates an electric switch in the Servos, energizing the electronic components of the Altimatic.



No. 1. Roll Engage Knob
No. 2. Calibration Knob
No. 3. Dim Switch
No. 4. Pitch Engage Knob
No. 5. Up Effort Light
No. 6. Down Effort Light
No. 7. Altitude Selector Knob

Figure 1-1. Altimatic Console

(3) It also contains two ("up" and "down") effort lights which indicates the direction the pilot will have to trim the aircraft before fully engaging the Pitch Control knob, the effort lights will also indicate an out-of-trim condition , which is corrected by trimming the aircraft up or down depending on which light is operating. These two effort lights and the Console dial lights are connected to a rheostat on the Console, so that their intensity can be lowered for night flying. The Console also contains the Automatic Altitude Control which makes it possible for the pilot to select the desired Altitude while in flight or before the take-off is made if the pilot so desires.

The Altimatic requires .04 ampere of current for standby operation and 2 amperes during servo operation. A 5 ampere circuit breaker is installed to protect electrical components. No warm-up period is necessary as the transistors in the amplifiers are operational immediately upon activation. There is only 10 pounds additional weight added to an aircraft already equipped with the Gyro instruments.

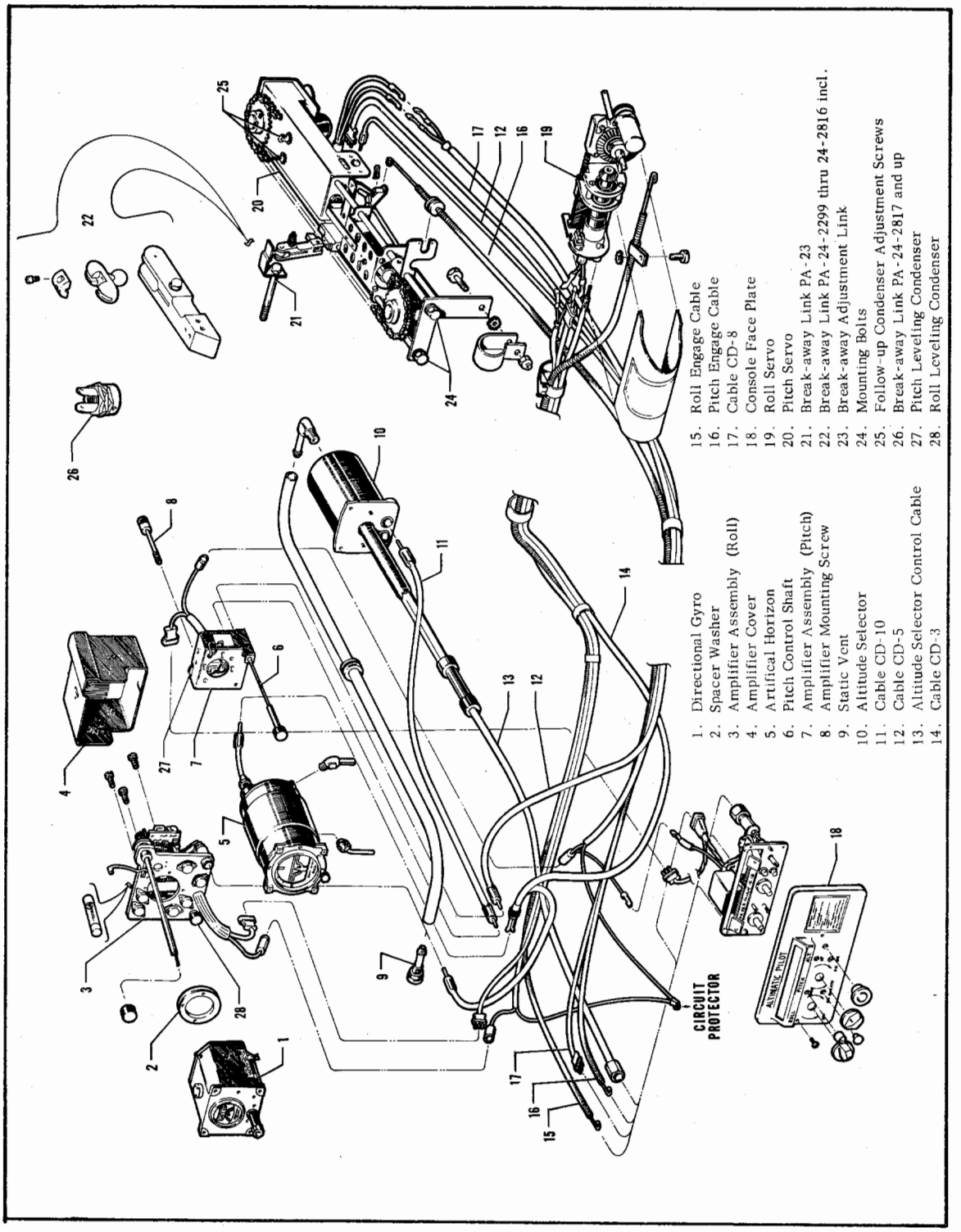


Figure 1-2. Altimatic System

1-5. THEORY-GENERAL.

To understand the Piper Altimatic, visualize it as a closed circuit radio that is tuned to a particular frequency (10 Meg) and which has the ability to re-tune itself when displaced from this frequency.

In this case it is a radio in an airplane with a set of flight instrument sensors in the radio circuit. These sensors are in tune (on frequency) when the airplane is in level flight and on heading.

If the airplane is disturbed from this level flight condition, the sensors will signal the amplifier, which will send voltage to the appropriate servo. In effect, the radio circuit re-tunes itself with the aerodynamic effect of the ailerons or elevator as the need may be.

Two components of any tuned circuit are INDUCTANCE and CAPACITANCE. To produce a desired frequency, the correct relation must exist between these two factors.

An increase in inductance will require a decrease in capacitance in order to maintain a frequency and of course the reverse is true, i.e. a decrease in inductance will require an increase in capacitance in order to maintain a desired frequency.

This is the basic electronic principle used in the Altimatic for sensing flight attitude changes.

1-6. THEORY-ROLL SECTION

A. INDUCTANCE: The pitch and roll circuits are two separate systems, however, they are identical electrically and the same theory applies to both. Figure 1-3 typifies one of these systems in its simpliest form.

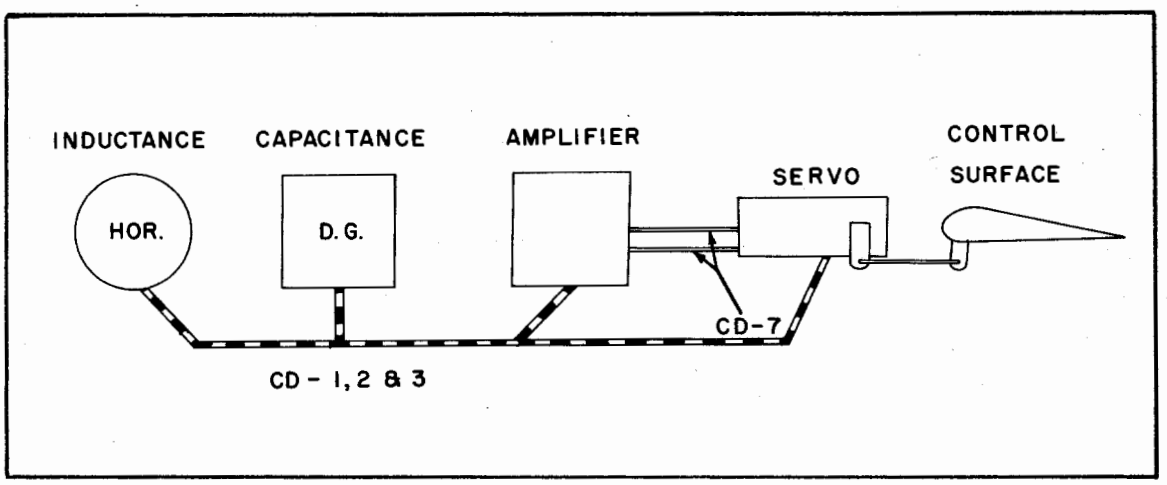


Figure 1-3.

The inductance portion of the frequency, shown as a circle in figure 1-3, is in the roll coil of the artificial horizon. This coil is mounted in the top rear of the horizon case. The coil protrudes into the case and is in close proximity to a set of vanes (as shown in Figure 1-4) that are attached to the gyro gimbal assembly.

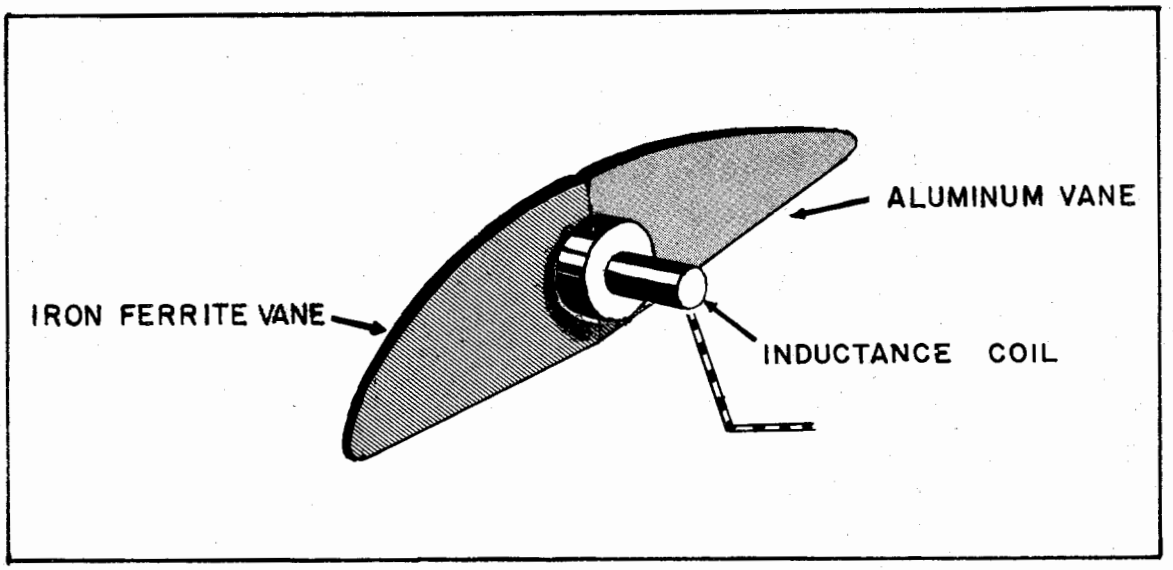


Figure 1-4.

The vanes are made of two different materials, the one on the right of the coil, as viewed from the rear, is made of aluminum and the one to the left is made of ferris iron.

The vanes, being attached to the gimbal, will remain level with the horizon, while the roll coil, being attached to the case, moves about the longitudinal axis of the airplane and thus changes the relative position of the coil to the vanes. A change in the inductance is accomplished by this movement as indicated in Figure 1-5.

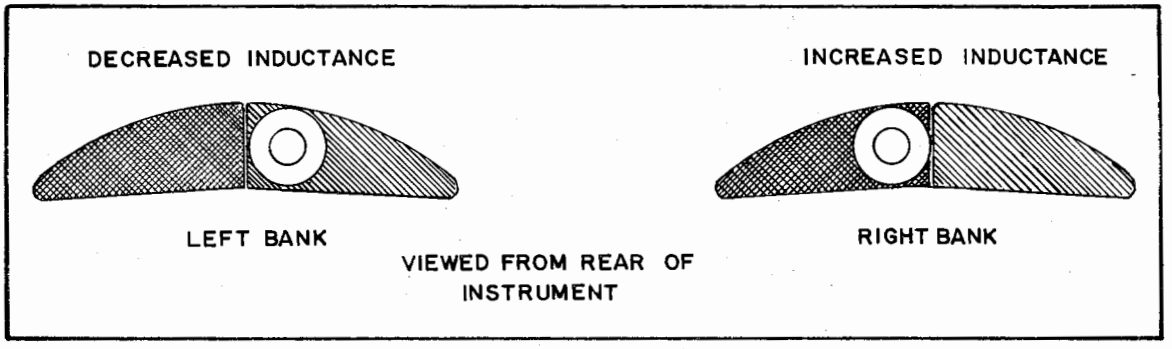


Figure 1-5.

One of the outstanding features of the Altimatic is that the sensing accomplished by this method requires no contact between the sensors and imposes no additional loads on the delicately balanced gyro mechanism.

This system also produces a smooth change in signal and because of the amplification method and type of servos used, will result in a desirably smooth control movement of the proper amount for the displacement.

This control movement can be shown on a graph. The horizontal component being the bank displacement and the vertical component being the wheel movement in degrees. Figure 1-6 illustrates these responses.

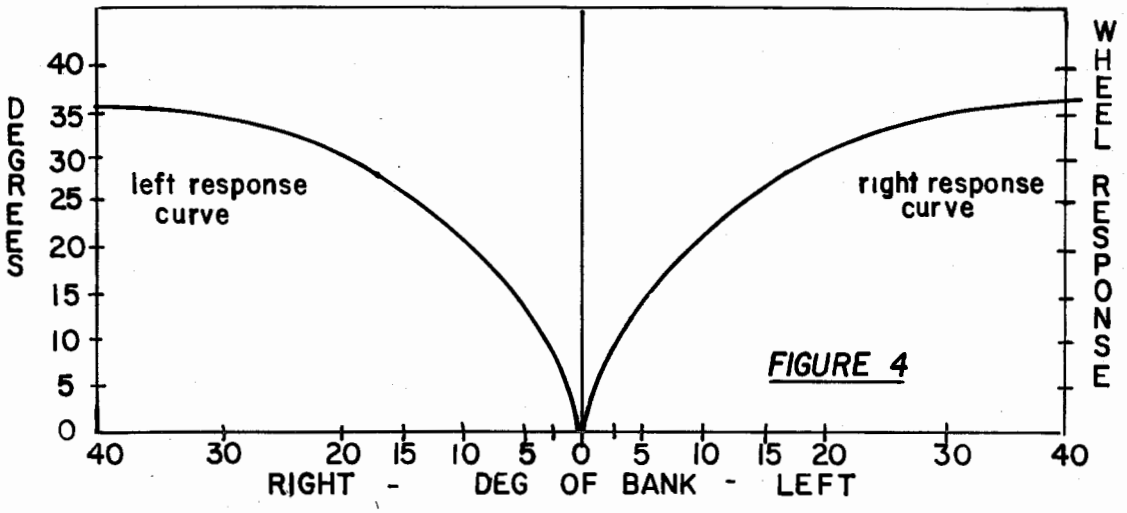


Figure 1-6.

This curve is held to precise limits by factory adjustment of the coil and vane relationship. Overhaul of the instrument and adjustment of this relationship should not be attempted without the Mitchell Instrument Test Console and the knowledge of its use.

B. CAPACITANCE: The necessary capacitance of the roll circuit, shown in Figure 1-3, is found in a series of variable condensers. These variable condensers are in the D.G. heading sensor, the manual trim control, roll follow-up, and leveling condenser in the amplifier.

While their design and appearance may vary according to the location and the function performed, they all have the common effect of changing the capaci-

tance of the roll circuit.

These condensers can be likened to the variable condensers found in any radio tuning circuit. By changing the position of the intermeshing plates, a change in the capacitance, or the ability of an RF signal to pass, is accomplished.

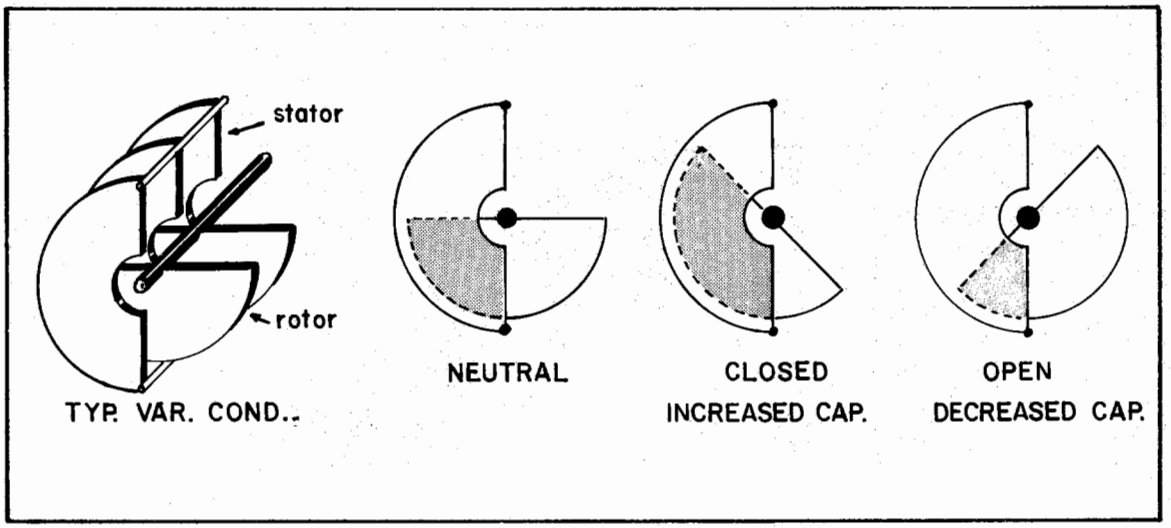


Figure 1-7.

Figure 1-7 shows a typical variable condenser and the effect of the plate position on the capacitance of a circuit.

Now lets see how this basic design of a variable condenser is changed to meet the heading sense requirements in the directional gyro.

The 52D22 Course Selector D.G. is different from the zero heading D. G. only in that it has a moveable stator instead of a fixed stator.

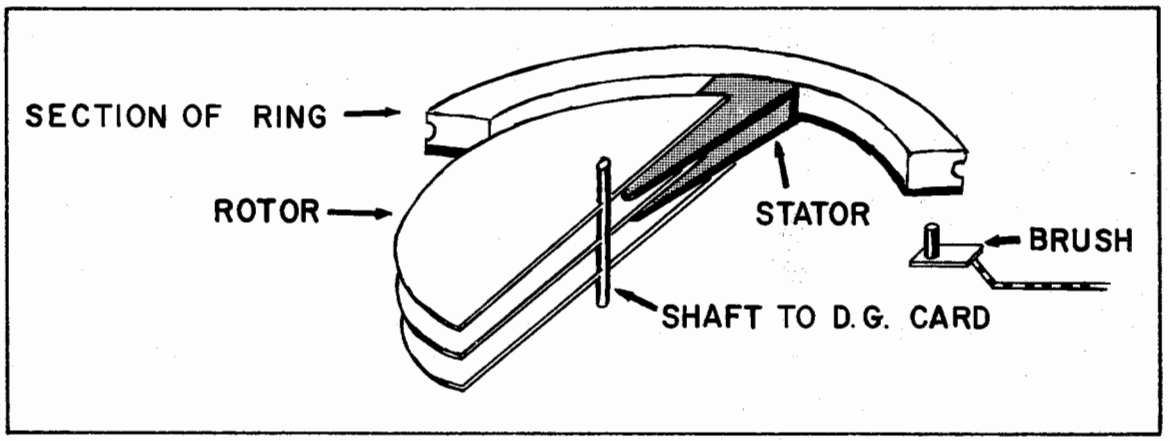


Figure 1-8.

The moveable stator is attached to a fibre ring gear. The ring is rotated by the gear train which is driven by the course selector dial. (Figure 1-9)

Any time the selected course matches the course presented on the inner card, the null position exists between the rotor and stator.

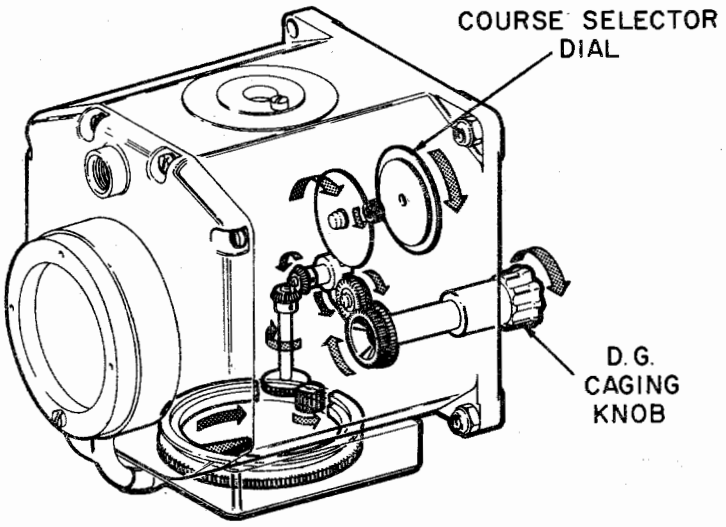


Figure 1-9.

C. FOLLOW-UP CONDENSER: The follow-up is another part of the capacitance of the roll circuit. It is a part of the aileron roll servo and the variable condenser plates move with the control wheel. (Figure 1-10)

The follow-up condenser moves in the opposite direction from the other condensers in the roll circuit so that it will cancel the frequency shift of other sensors when the correct control response is reached, thereby preventing over-control.

The follow-up is set to the null, or half intermeshed position, when the control wheel is in neutral.

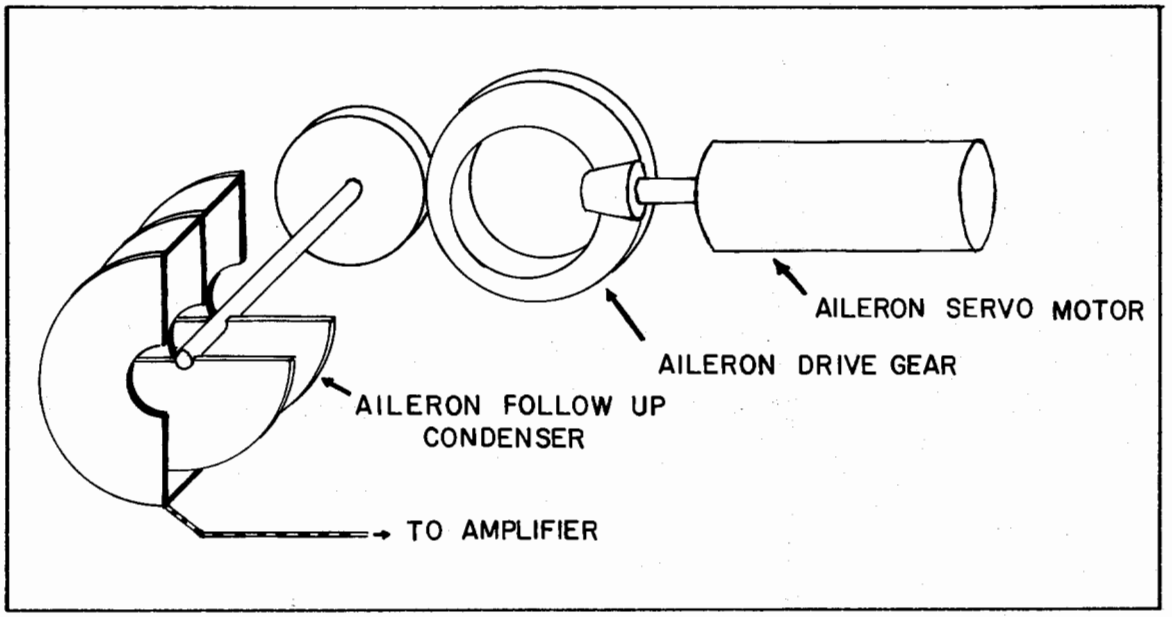


Figure 1-10.

The function of the follow-up in the roll circuit can be visualized by tracing the sequence of electrical and aerodynamic changes in the following drawings.

In figure 1-11: Dialing the course selector to a heading to the right causes the capacitance to be lowered.

This causes a frequency change and the amplifier sends current to the servo for right aileron.

The right aileron action closes the follow-up condenser increasing the capacitance to off set the loss of D.G. capacitance.

The roll system has now temporarily returned to the desired frequency of 10 megacycles.

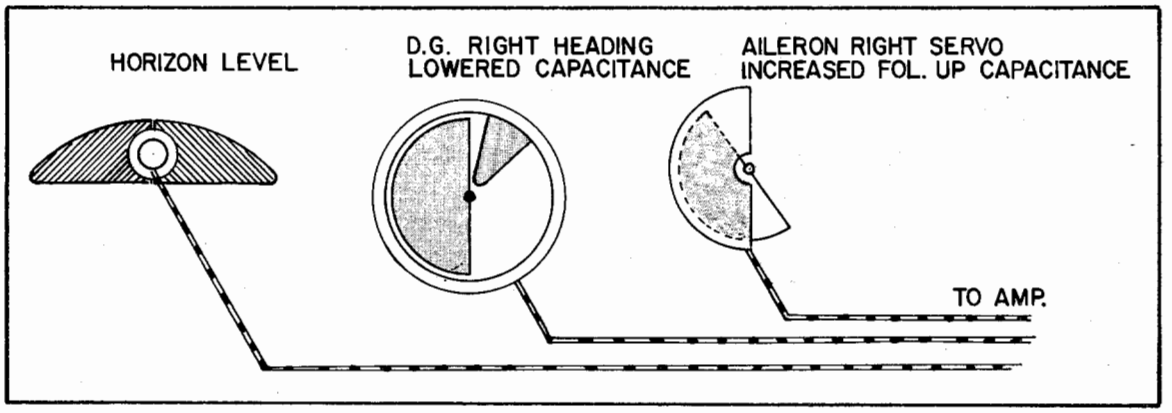


Figure 1-11.

The aerodynamic effect of this condition will cause the airplane to bank to the right.

Right bank of the horizon increases inductance and the resulting frequency shift will produce left servo returning the control wheel to neutral. (Figure 1-12)

The circuit has again returned to 10 megacycles with lowered capacitance and increased inductance.

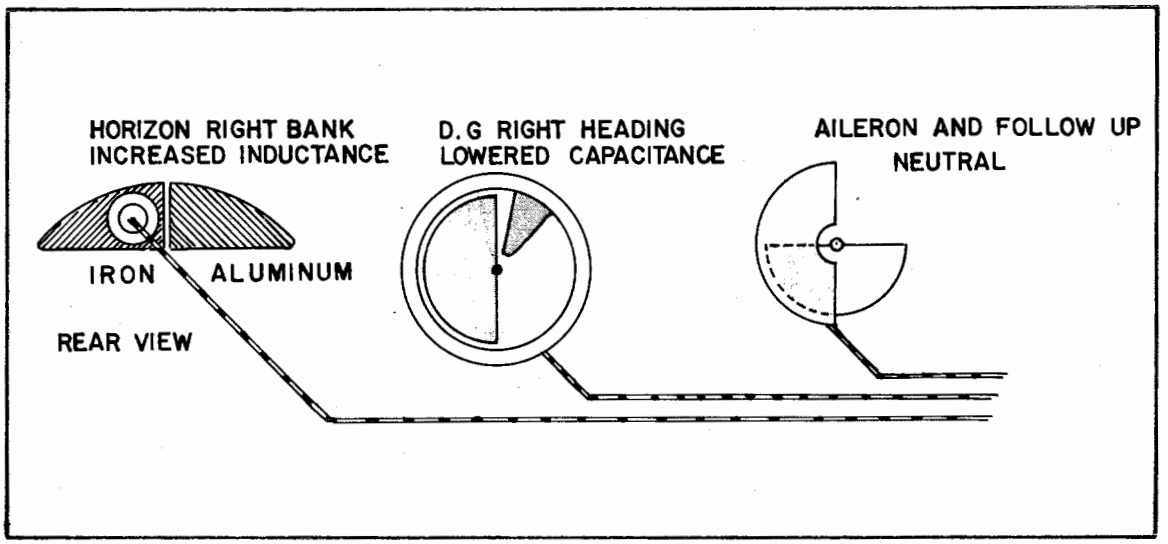


Figure 1-12.

The right bank will bring the airplane to the new selected heading and the sequence will reverse to level the airplane as it approaches the heading.

You can visualize the roll follow-up working to any degree depending on the amount of bank produced by aerodynamic response.

D. LEVELING CONDENSER: The adjustment knob at the amplifier is provided to adjust the roll circuit frequency so that it is on frequency when the airplane is in level flight on heading. This variable condenser is the final or adjustment stage and is tuned to produce level when all other components are in the correct positions shown in the completed circuit. (Figure 1-13)

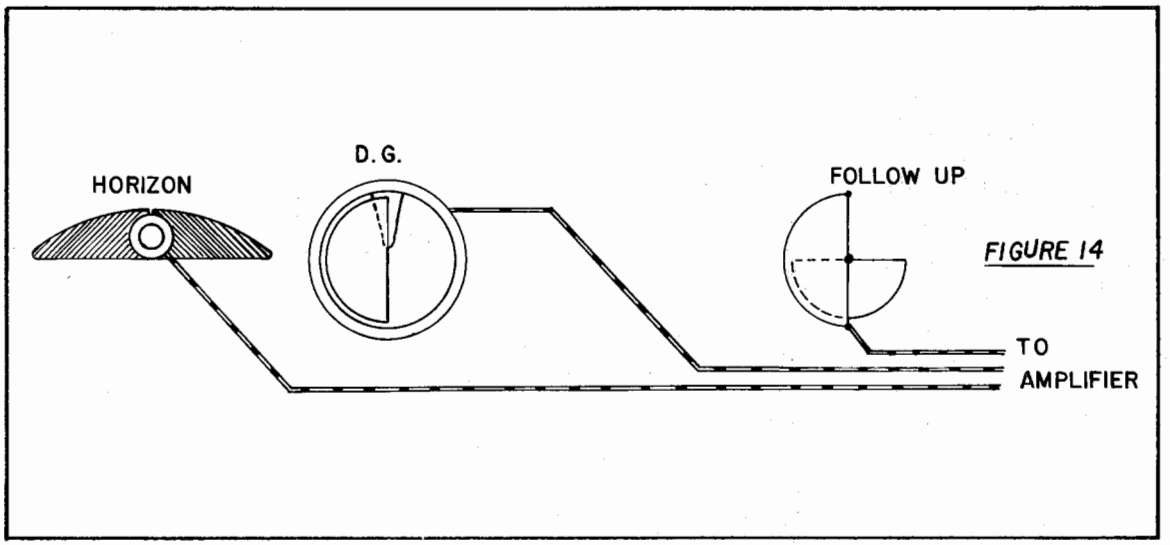


Figure 1-13.

The coaxial harness assembly CD-1, 2 and 3 is manufactured to specific lengths and since the cable is a part of the tuned circuit, these lengths must not be altered.

The three wire servo leads CD-7 carry 12 volt DC current and their length is not critical, therefore, they can be altered if required by an unusual installation.

The sensor leads are made of very fine wires that are fed through a hollow insulator. (Figure 1-14)

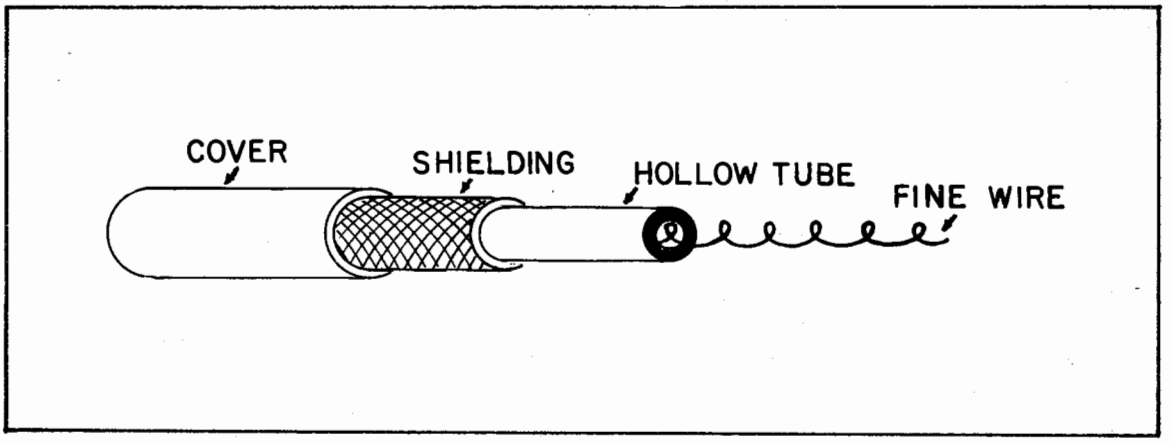


Figure 1-14.

Note that the fine wire has been coiled to provide flexibility and reduce the possibility of breaking and causing an open in the circuit.

1-7. THEORY-PITCH CIRCUIT.

A. INDUCTANCE: The pitch circuit uses the same type inductance coil as the roll circuit. It is mounted on the rotor gimbal frame and is in close proximity to the aluminum pitch vane. (Figure 1-15)

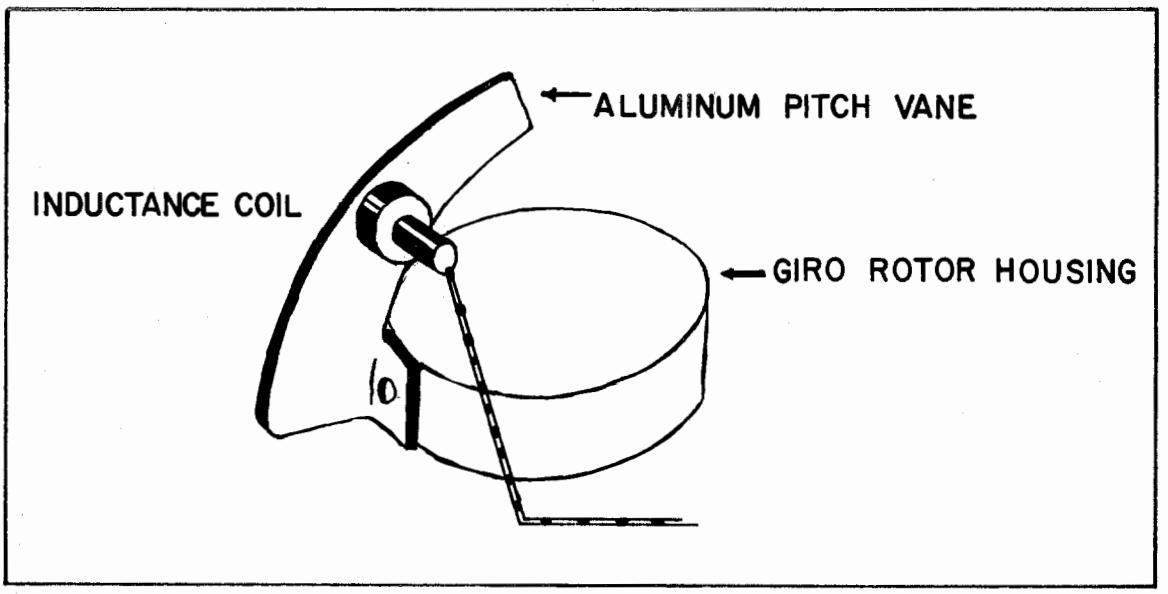


Figure 1-15.

The pitch vane is mounted on the rotor shroud and as the gimbal moves about the pitch axis of the airplane the relationship of the inductance coil to the aluminum pitch vane is changed.

The curve of the vane along with the variation in mass has the effect of increasing or decreasing the inductance just as the bimetal vanes of the roll coil act to vary the inductance.

In this case inductance is increased as the nose comes up and decreases as the nose of the airplane goes down.

The curve and gap are precisely set at the factory to product the correct pitch response, as shown in Figure 1-16. Overhaul of the instrument and adjustment of this vane should not be attempted by the instrument shop without the Mitchell Instrument Test Console and knowledge of its use.

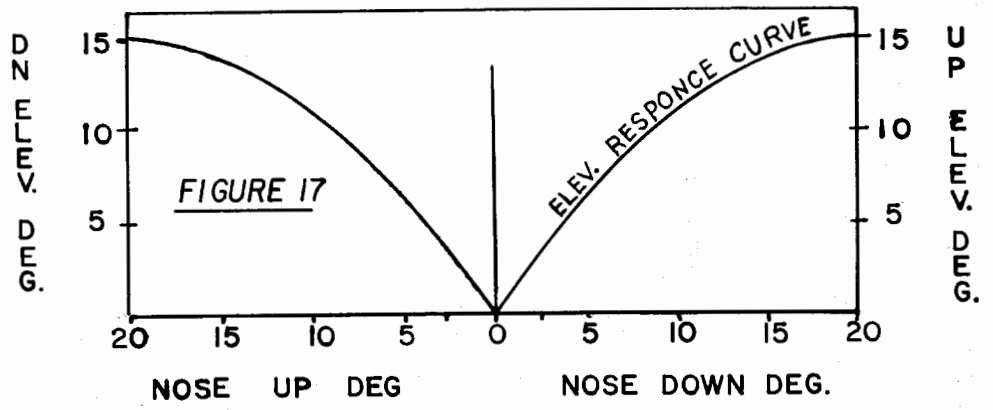


Figure 1-16.

B. ALTITUDE CONTROL: The altitude control or altitude selector is a variable condenser that is linked to operate from the action of a set of altitude sensing bellows. Pressure can be applied to the bellows through a spring and screw assembly controlled by the pilot.

In Figure 1-17, it can be noted that if pressure is applied to the bellows, the condenser will open and signal for up servo and a resulting nose up attitude. The airplane will then climb until the outside air pressure is lowered sufficiently to expand the bellows and return the altitude condenser to a neutral position. This action will of course return the airplane to level flight.

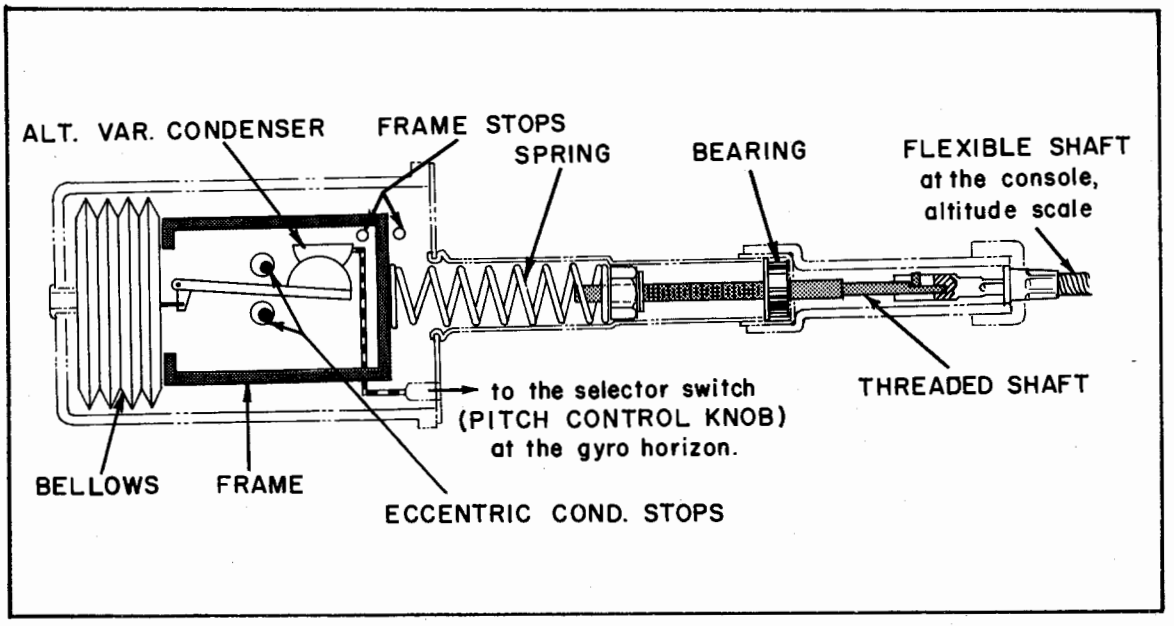


Figure 1-17.

When spring pressure is reduced, (pilot dials lower altitude) the condenser vanes will close signalling for a nose down attitude. The airplane will descend until the outside air pressure increases sufficiently to compress the bellows and return the condenser to neutral.

C. ATTITUDE CONTROL: The pitch attitude control variable condenser is a variable condenser to change the aircrafts attitude.

The mode switch shown in Figure 1-18 takes the altitude control in or out of the pitch circuit. Note that the attitude control remains in the circuit with this switch operation to give the pilot over-ride control of the altitude condenser.

A ceramic trimmer is provided in the off altitude portion of this circuit so that it may be trimmed to the exact same capacitance as the altitude condenser in neutral. With this trimmer properly adjusted the pilot can switch from on altitude to off altitude without pitch changes. (Figure 1-18)

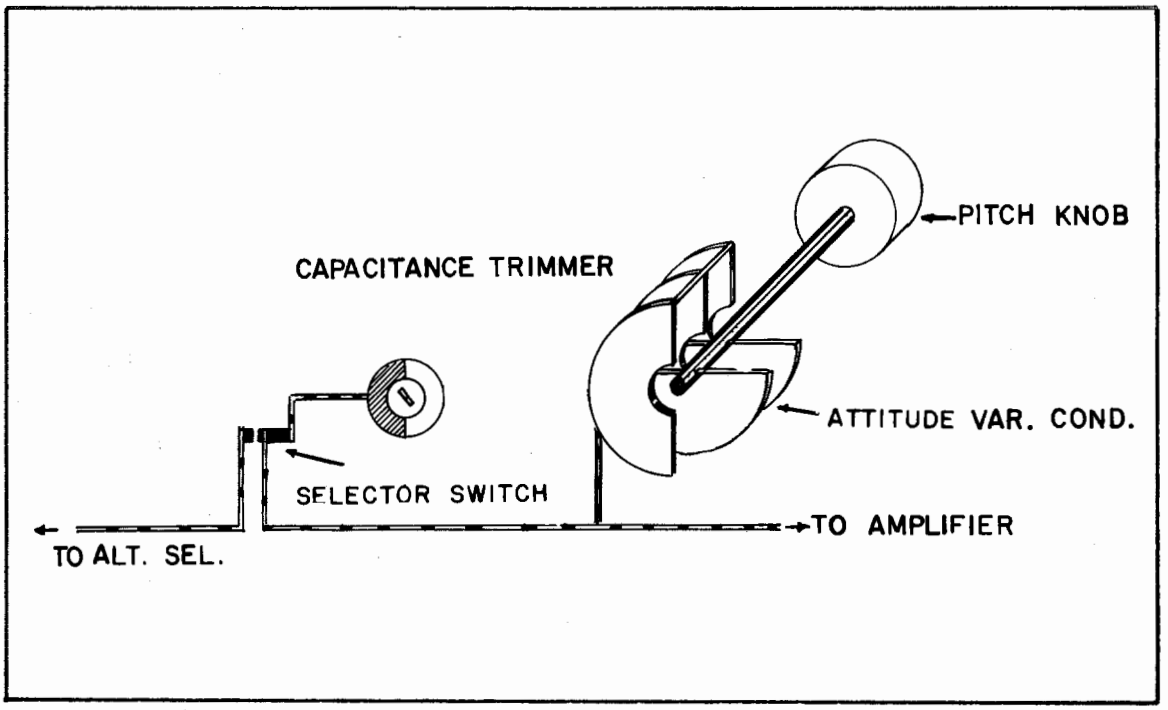


Figure 1-18.

D. PITCH FOLLOW-UP: The pitch follow-up has the same effect on the pitch circuit as in the roll circuit, it moves in a direction opposite that of the other variable condensers and prevents overcontrolling by temporarily cancelling capacitance or inductance changes. (Figure 1-19)

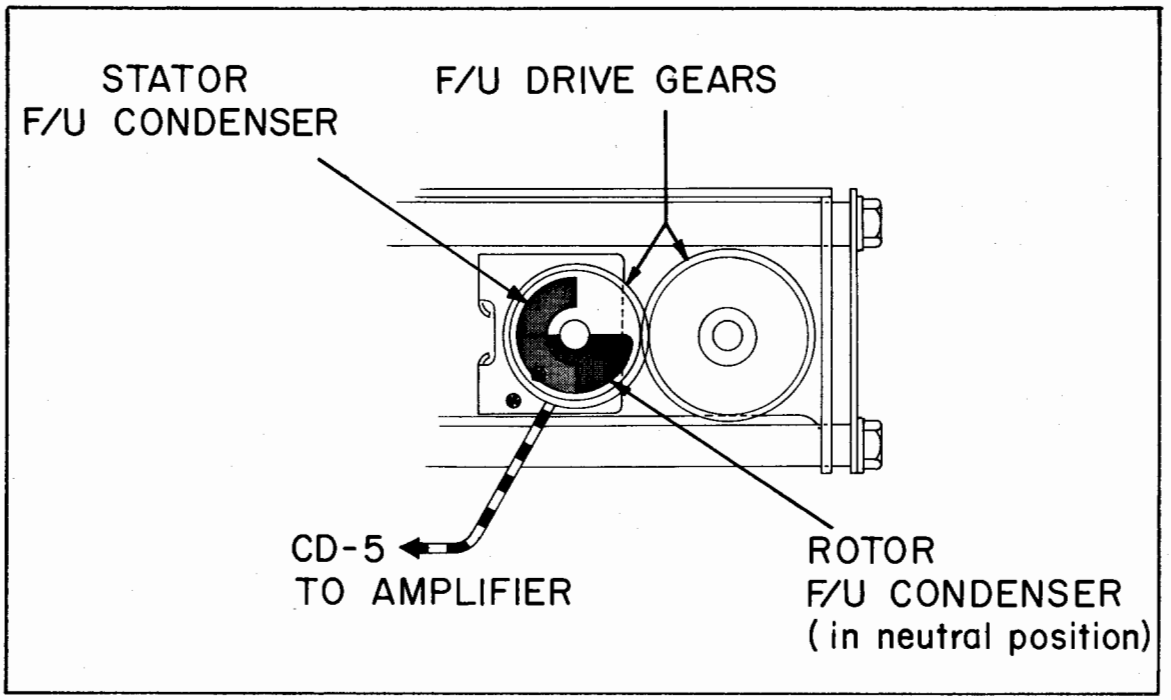


Figure 1-19.

Lets trace a signal change through the completed pitch circuit and note how the various components are affected and how they react to control the airplane.

Figure 1-20 shows the completed pitch circuit without the amplifier. The position of the sensors indicate level flight and on altitude.

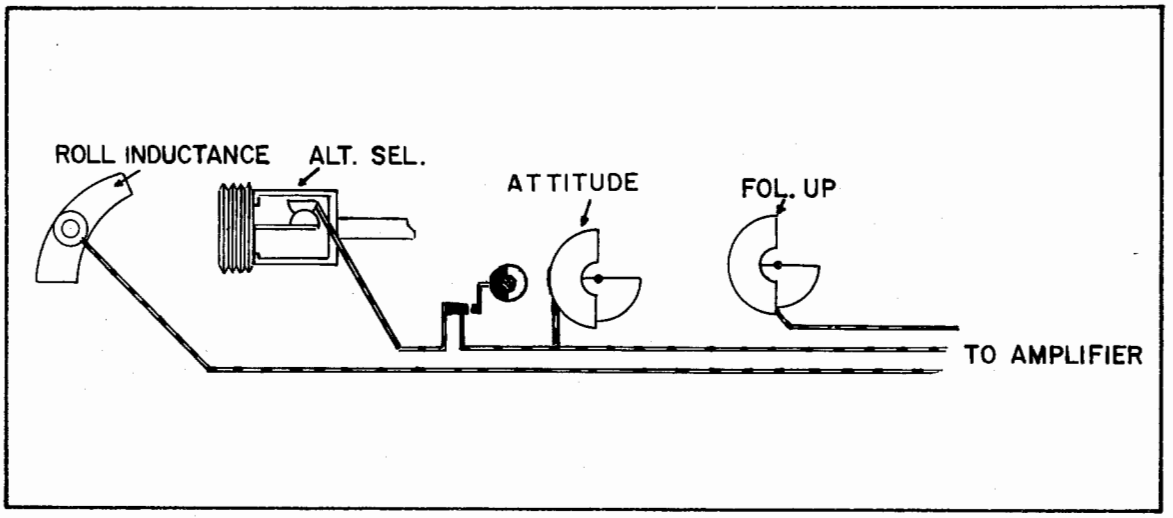


Figure 1-20.

Should the airplane encounter an up draft causing it to rise above the selected altitude, the bellows would expand and move the condenser arm in the altitude selector toward the closed position, thereby increasing the circuit capacitance. (Figure 1-21)

This increase in capacitance shifts the frequency and causes the amplifier to send current to the servo for down elevator.

Elevator down movement opens the follow-up condenser which decreases the circuit capacitance sufficiently to off set the increase which occurred in the altitude control. (Figure 1-21)

THE CIRCUIT IS NOW TEMPORARILY BACK ON FREQUENCY BUT THE AIRPLANE IS ABOVE ALTITUDE WITH DOWN ELEVATOR.

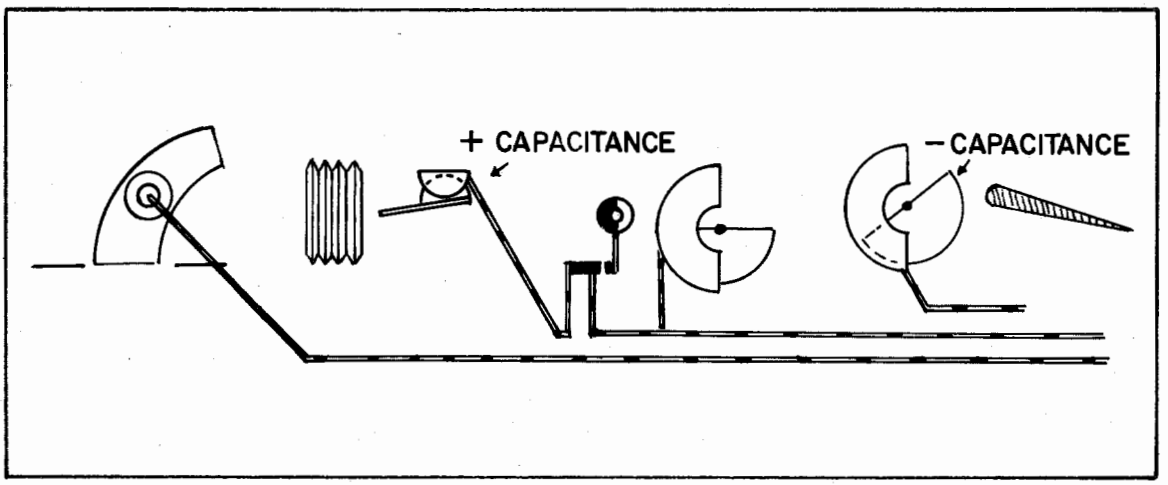


Figure 1-21.

Elevators cause the airplane to nose down and the movement of the pitch inductance coil in the horizon decreases inductance.

This decrease in inductance causes the amplifier to send an up current to the servo, the elevator and follow-up condenser return toward level flight position, holding just enough down pressure to maintain a preset airspeed.

THE CIRCUIT IS AGAIN ON FREQUENCY BUT THE AIRPLANE IS ABOVE THE SELECTED ALTITUDE WITH THE NOSE DOWN.

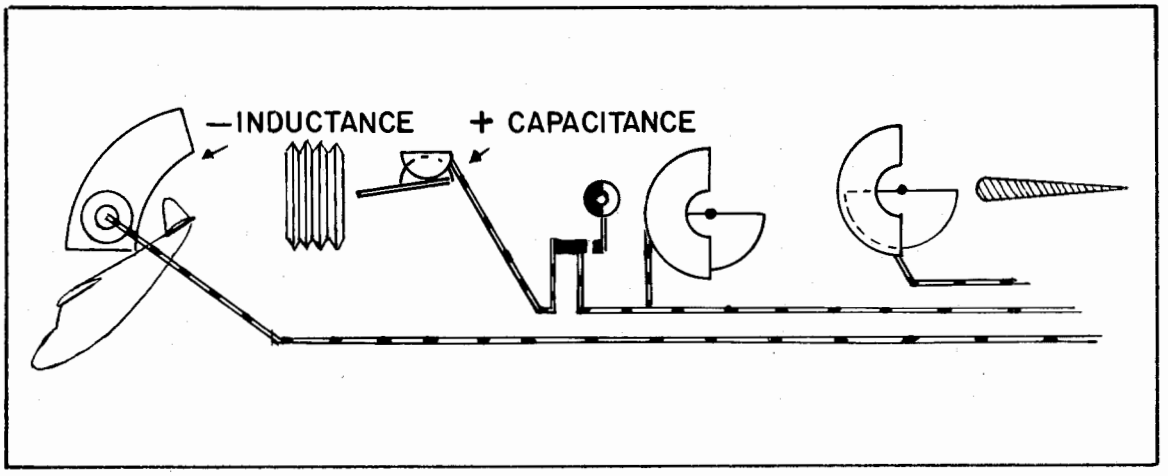


Figure 1-22.

Nose down attitude causes descent and the altitude bellows contract moving the condenser arm to neutral. This leaves the circuit with decreased inductance which causes the amplifier to apply up servo. (Figure 1-23)

Up elevator and resulting follow-up movement increases capacitance to offset the reduced inductance. (Figure 1-23)

THE CIRCUIT IS RETURNED TO THE FREQUENCY AND THE AIRPLANE IS ON ALTITUDE, NOSE DOWN AND UP ELEVATOR.

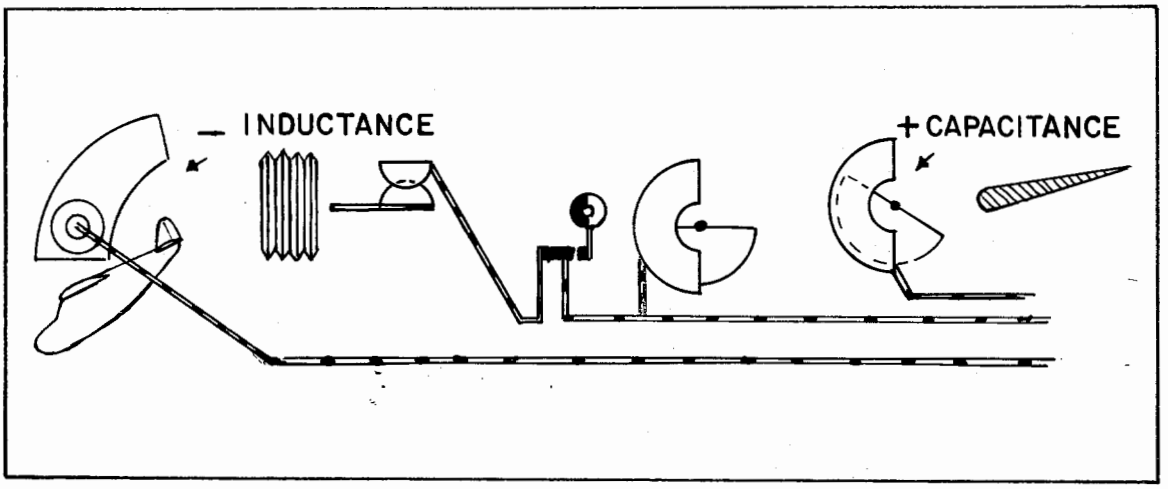


Figure 1-23.

The up elevator returns airplane to level flight and with the inductance back to neutral the servo returns the elevator to the level flight position. (Figure 1-24)

THE CIRCUIT IS NOW BACK ON FREQUENCY WITH THE AIRPLANE IN LEVEL FLIGHT AND ON SELECTED ALTITUDE.

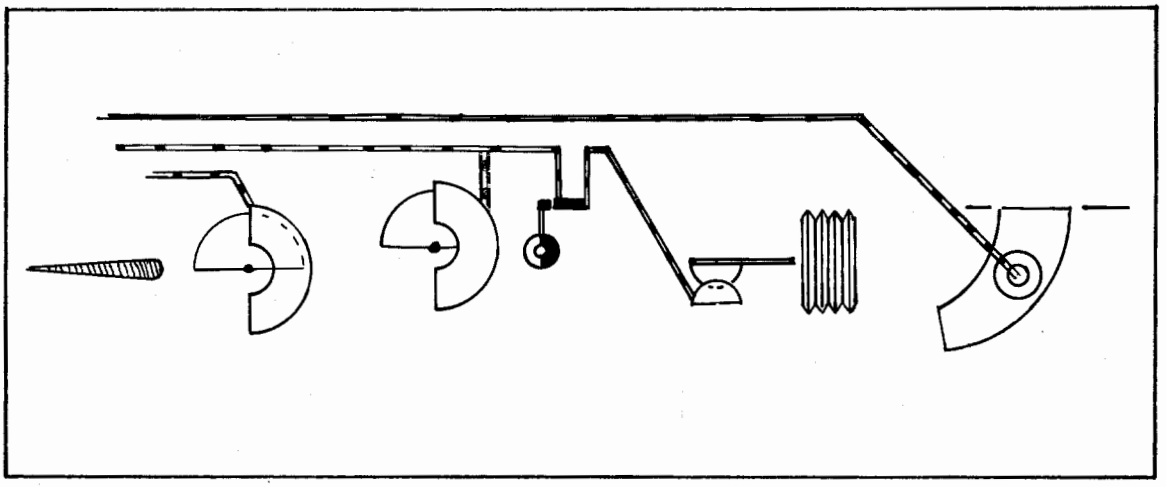


Figure 1-24.

OPERATING TIPS:

a. It takes 5 to 10 minutes for the rotor to gain operating speed. This does not mean that it should take 5 to 10 minutes before the Horizon errects but the Directional Gyro can drift and the horizon lag or be not fully errected until the rotor attains full speed. A horizon should errect in 1-1/2 to 3 minutes.

b. The Directional Gyro caging knob should be pushed and pulled GENTLY.

c. Never cage the Directional Gyro in flight or on the ground except for seting the card. A Directional Gyro caged in an aircraft moving on the ground or in the air throws excessive loads on the gimbol ring bearings.

d. The Horizon rotor has a built-in 2-1/2 degree tilt, this is to compensate for turn error. If shallow banks are made, giving less than 3 degrees per second turn, the error can be from 3 to 6 degrees. If a standard rate turn of approximately 3 degrees per second is made, there will be no noticeable error in the Horizon.

e. Hard landings can damage instruments.

f. Vacuum set too high by only 1.0 inch can cut gyro lift by 60%. 1.0 inch increase in vacuum can result in 1225 rpm increase in rotor speed.

g. Normally the hollow shaft rotor will operate with a moderately loud noise coming in cycles. There will usually be present a very mild vibration as compared to the standard pivot rotor. This is due to the type of bearing, also because the hallow shaft turns up at a much greater speed.

h. The Air Filter located at the back of each instrument case is designed to prevent dust, dirt and etc. from entering the instrument. If these conditions are excessive the filter should be periodically inspected and replaced as required.

SECTION II

INSTALLATION AND ADJUSTMENTS

2-1. GENERAL. The section will pertain to removal, replacement and adjustments of the different component of the Altimatic Pilot. As the Altimatic is used in three different airplanes, the Comanche, Apache and Aztec, the installation will vary to some extent between the single engine airplanes and the twin engine aircraft. Operation of the Altimatic will remain the same regardless of the airplane it is installed in.

2-2. REMOVAL AND REPLACEMENT OF ALTIMATIC COMPONENTS.

2-3. INSTRUMENTS. The instruments of the Piper Altimatic are no more fragile than any others, but like any gyro instruments they must be handled with care. Keep the instruments caged any time they are being handled.

a. Remove the instrument access panel by removing the retaining screws and lifting off the panel. (Note position of Pitch Control knob when removed.)

b. Remove the face panel by removing the screws from around the perimeter of the panel.

c. With the face panel removed, the mounting screws for the individual instruments will be exposed. Remove the connections to the instrument and Amplifier prior to removing the mounting screws.

NOTE

When removing the Artifical Horizon the Pitch Control Shaft (See 2, figure 2-2) must be removed from the Amplifier Assembly prior to removing the instrument.

d. After the mounting screws have been removed, the instrument and Amplifier can be removed as a unit.

e. Installation of the instruments will be in the reverse given for removal. After the installation is completed and before replacing the instrument access panel, check all components for security and clearance of the control column.

2-4. AMPLIFIERS. In order to remove the Amplifier from the instrument it will be necessary to remove the instrument and Amplifier as a unit. Refer to para-

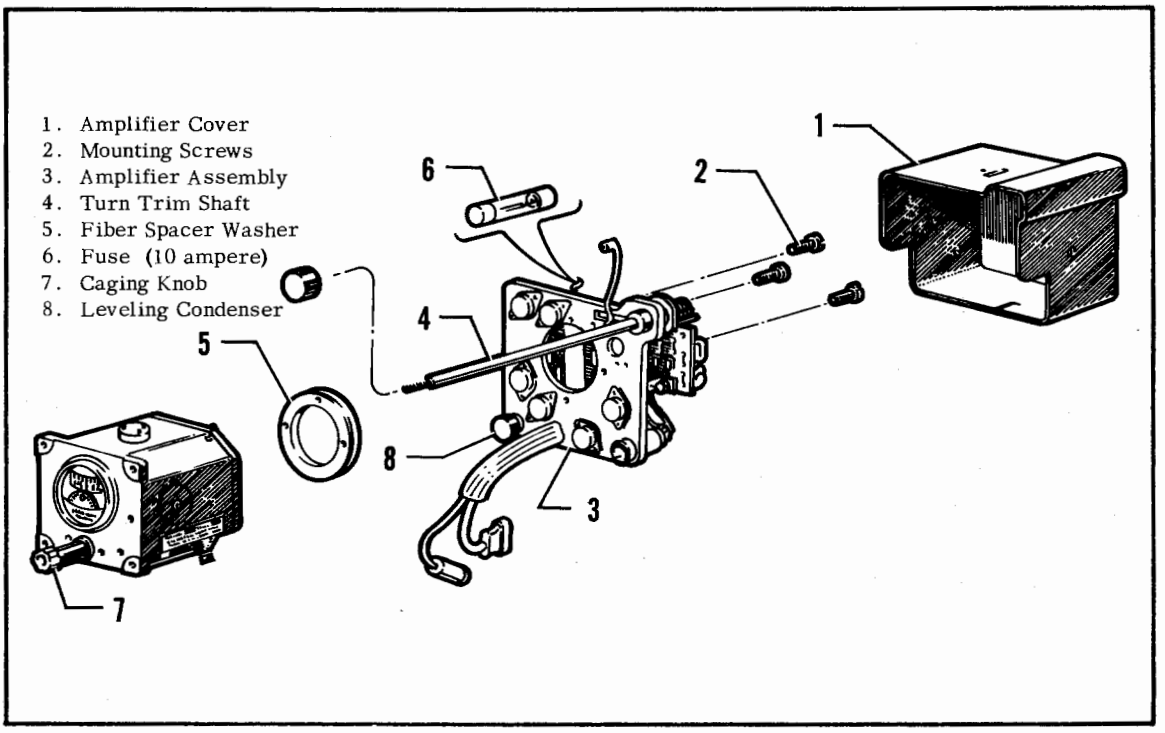


Figure 2-1. Directional Gyro with Amplifier

graph 2-3.

a. Directional Gyro Amplifier.

1. Remove the Amplifier cover. (See 1, figure 2-1)

2. At the back of the Amplifier remove two screws attaching the stitchboard to brackets and move stitchboard to one side.

3. Remove three screws (2) and separate the Amplifier from the instrument.

NOTE

If fibre spacer (5) ring remains on the Directional Gyro, remove and retain it. The Amplifier cannot be mounted on the Directional Gyro without the spacer ring.

4. Install Amplifier in reverse order of removal instruction.

b. Artifical Horizon Amplifier.

1. Disconnect the two wires (2), (See 3, figure 2-2) which connects the Amplifier to the instrument.

2. At the back of the Amplifier remove one mounting screw (7), then

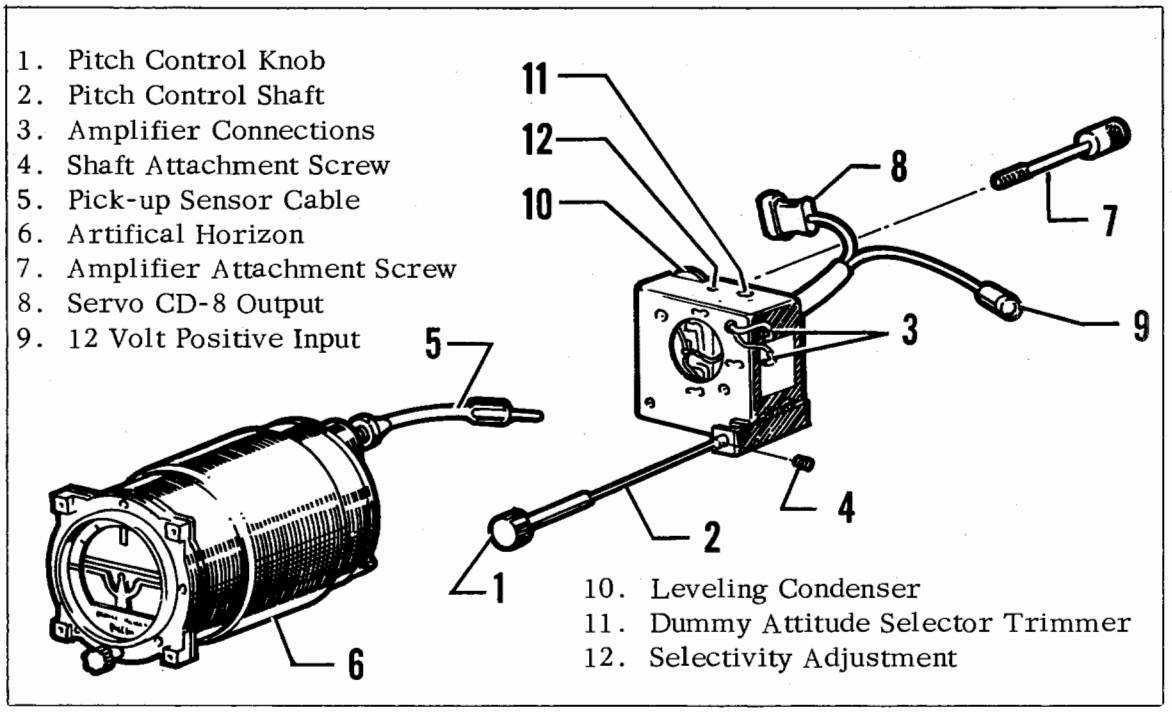


Figure 2-2. Artifical Horizon with Amplifier

facing the front of the instrument move the Amplifier Assembly to the left, this will separate the Amplifier from the instrument.

3. Install the Amplifier in reverse order of removal instruction. When replacing wires on the Horizon, the red wire goes on upper terminal. Refer to paragraph 2-6 for installation of the Pitch Control knob.

2-5. CONSOLE. The Console for the Altimatic is positioned in the lower left corner of the instrument panel on the Apache and Aztec, while on the Comanche it is located below the radio stack. Removal of the Console is the same for all airplanes. Refer to figure 2-3.

a. Remove the face plate from the Console by removing the Roll (1), Pitch (2), Calibration (3), Dim (4) and Altitude Selector Knobs (5) from the Console Assembly. Also remove the two face plate retain screws (8) and the plate (6).

b. Before removing the Console Assembly from the instrument panel, rotate the Altitude Selector Control (7) as far counter-clockwise as possible. Remove the four Console mounting screws and pull the Console away from the panel, disconnect the electrical leads. Disconnect the Roll. Pitch and Altitude Selector Cable from behind the panel and remove the Console.

c. Install the Console in reverse order of removal instructions. Refer to the following note when connection the Altitude Selector Cable.

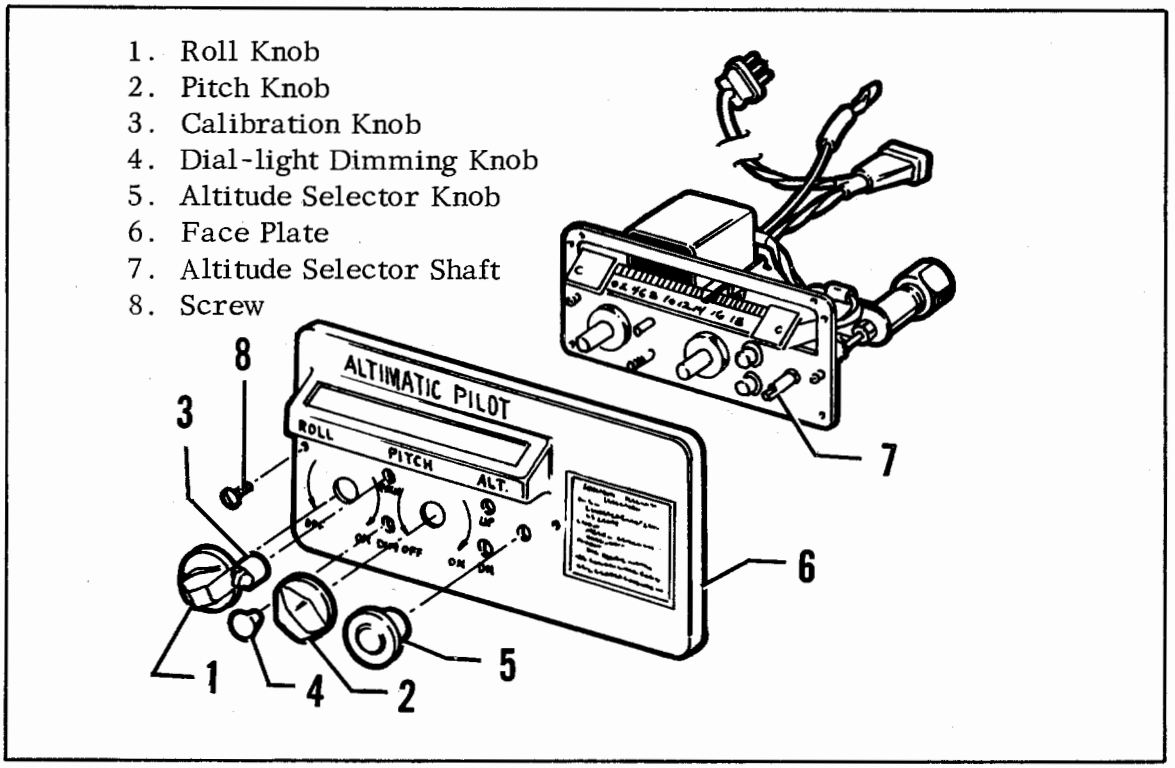


Figure 2-3. Altimatic Console

NOTE

When connecting the Altitude Selector Cable to the Altitude Selector unit, insure that the control cable is properly seated in the unit, do not rotate the cable after it has been installed, as the Altitude Selector has been preset. Before connecting the Altitude Selector Cable to the Console, insure the Altitude Selector knob on the Console is rotated fully counter-clockwise and the block which rides on the worm gear in the back of the Console is against the stop; connect the cable to the Console control. The cable should seat within the first quarter turn on the control knob. After the cable has been installed, tighten the jam nut to secure the cable housing to the Console.

2-5A. RESETTING THE 1X225 ALTITUDE SELECTOR WHEN SYSTEM IS IN THE AIRCRAFT. To reset the 1X225 Altitude Selector if it has been disconnected from the Console without first dialing the console against its down stop.

a. Remove CD-10 cable from J-17 and move to J-16 receptacle in selector.

b. Remove CD-8 pitch servo motor cable from pitch servo and insert it in CD-8 of 66B10 test box.

c. Remove CD-5 pitch F/U cable from pitch servo and insert it in CD-5 of 66B10 test box using the proper CD-5 adapter (Comanche or Apache/Aztec adapter).

d. Connect ampere meter of test box to pitch amplifier "A" lead line.

e. Cage the horizon.

f. Pitch control knob pulled out or aft to altitude selector position and centered for level.

g. Disconnect flexible shaft from altitude selector to console at the console end.

h. Set the altimeter to 29.92 and read the altimeter.

i. Master switch of aircraft on. Engage pitch knob to "ON" position.

There will now be either the up or down light of the test box lite. Get both lights out by turning the pitch knob of the test box.

CD-10 must now be moved from J-16 to the J-17 receptacle of the altitude selector.

At this point either the up or down light of the test box should come on again. Using a screw driver on end of flexible shaft (or place a knob on flexible shaft) removed from console, turn shaft until both lights are out again.

If the up light of test box is on, turn flexible shaft counter-clockwise or if down light of test box is on, turn flexible shaft clockwise to get lights out.

When both lights are out, this represents the elevation of the location at that pressure altitude. Now the selector must be brought down to sea level plus 4/5 of a turn more before it is coupled to the console.

NOTE

The 4/5 of a turn required after the selector has been set to sea level is to insure that the stops on the console will engage prior to the stops in the selector.

For example: After both lights are out (CD-10 in J-17 receptacle), the ampere meter is reading quiescence of between .02 to .03 amperes, the number of turns counter-clockwise which the flexible shaft will have to be turned will be determined by the altimeter which was set to 29.92.

In step "h" above, the altimeter reads 2,500 feet. This will require 5 full

turns counter-clockwise of the flexible shaft to set the selector for sea level. See note below. (A down light will be glowing on test box.) Another 4/5 turn counter-clockwise must be made. The selector is set and ready to couple to the console.

Before coupling the reset altitude selector to the console, make certain that the altitude selector knob of the console (See 5, figure 2-3) has been turned fully counter-clockwise so that the console dial is against its down stop. The position of the calibrator knob (See 3, figure 2-3) or dial scale is unimportant as it does no more than move the scale and has no effect on this adjustment.

If at another time the pressure of the day changed and the altimeter set at 29.92 read 2,100 feet instead of 2,500 at the same location, the flexible shaft would only be rotated 4 full turns counter-clockwise for the 2,000 feet and 1/5 turn more for the 100 feet. The selector would be at sea level for that pressure. As in the above examples, 4/5 turn counter-clockwise will be necessary prior to coupling to the console.

NOTE

One full turn of the flexible shaft is equal to 500 feet.

→ 2-6. INSTALLING PITCH CONTROL KNOB.

a. Ascertain whether the Pitch Control shaft (See 2, figure 2-2) is in the manual or automatic position. (In manual position the shaft can be rotated 180°, while in the automatic position only 90° of travel is used.) (Refer to figures 2-4 and 2-5.)

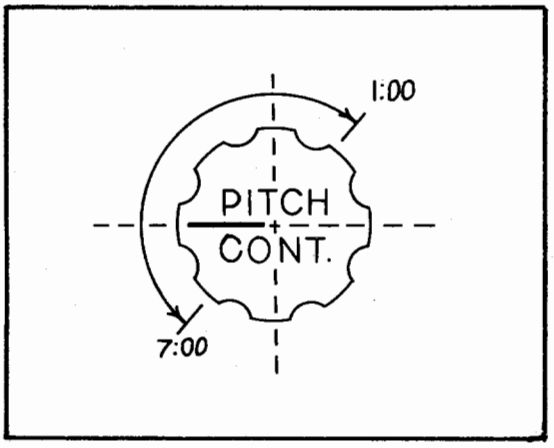


Figure 2-4. Manual Position

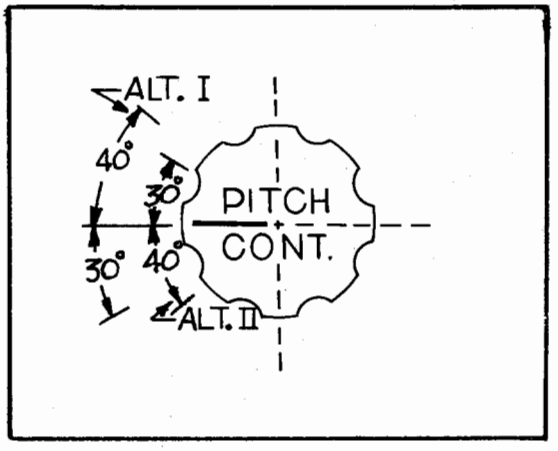


Figure 2-5. Automatic Position

b. Place the shaft in the manual position being careful that the shaft is halfway between full up and full down. (If this position is not maintained the internal stop ring will be damaged when the control is shifted from manual to automatic.)

c. With the shaft in manual position rotate to the full up position, clockwise.

d. Position and secure the knob to the shaft so that the index line is located in the center of the upper right hand quarter.

e. Check travel of the control by rotating the knob in both directions, the control should stop in the position shown in figure 2-4.

f. When the knob is pulled aft it should have the amount of travel shown in figure 2-5.

2-7. REMOVING ROLL SERVO.

a. Roll Servo. Comanche PA-24 and PA-24-250.

1. Disconnect engage-disengage control clamp (See 1, figure 2-6) and cable (2) from the Roll Servo unit.

2. Disconnect Roll Servo Cable, Roll Assembly Cable and power Switch Cable at the disconnect points.

3. Remove Roll Servo cover (3) by removing attaching screws.

4. Remove roll pin (4) from the end of the shaft by pressing it out. Do not hammer. (Refer to Service Aid TP-1006)

5. Slide Roll Servo unit off the shaft.

6. Install Roll Servo unit in reverse order of removal instructions. Refer to paragraph 2-9 for timing of the unit.

b. Roll Servo. Apache PA-23 and Aztec PA-23-250.

1. Disconnect engage-disengage control clamp (See 1, figure 2-6) and cable (2) from Roll Servo unit.

2. Disconnect Roll Servo Cable, Roll Assembly Cable and Power Switch Cable at disconnect points.

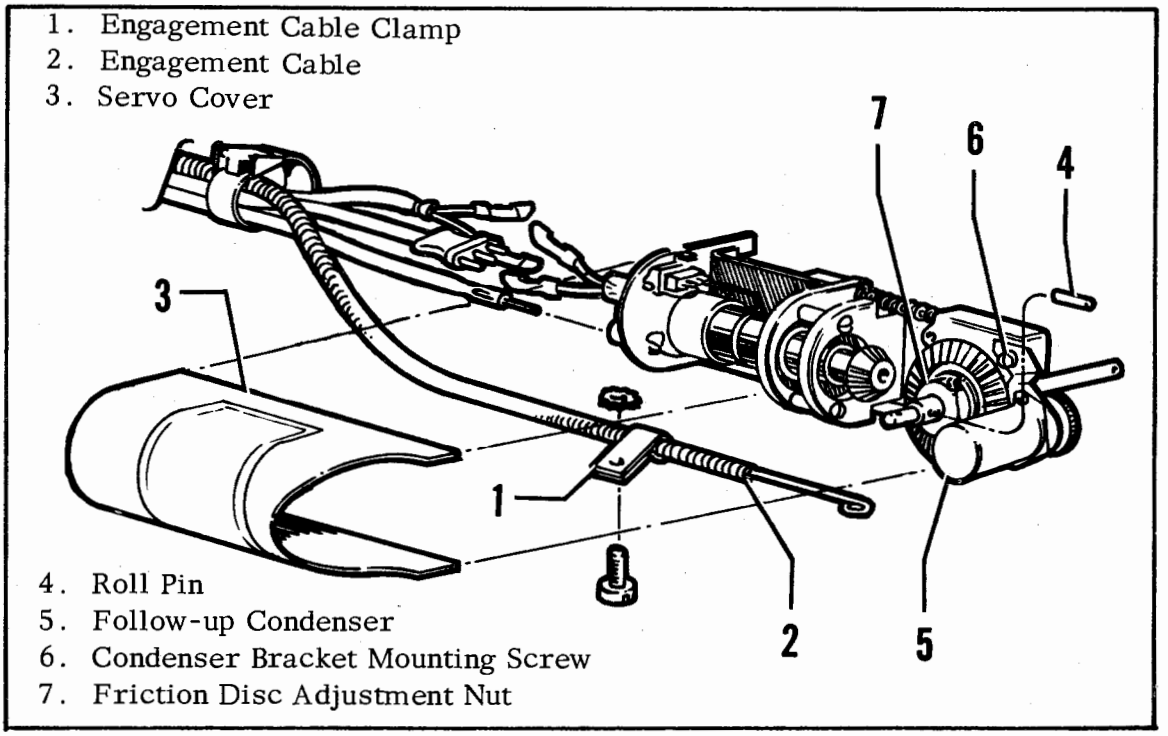


Figure 2-6. Roll Servo

3. Remove the nut and bolt holding the universal joint to the Servo Shaft and pull the co-pilots wheel toward the rear of the airplane.

4. Remove roll pin from end of shaft by pressing it out. Do not hammer. (Refer to Service Aid TP-1006)

5. Slide Roll Servo unit off the shaft.

6. Install Roll Servo unit in reverse order of removal instructions. Refer to paragraph 2-9 for timing the Roll Servo.

2-8. REMOVING PITCH SERVO. The removal of the Pitch Servo will vary between the different airplanes due to the location and mounting of the unit.

a. Pitch Servo. PA-24.

1. Remove the inspection plate and floorboard plate located to the left of the wheel well dome. (Refer to figure 2-7)

2. Disconnect the engage-disengage control cable (2) from the servo unit.

3. Disconnect the Pitch Servo Cable, Pitch follow-up cable and Power Cable at the disconnect points.

4. Disconnect the break away link (See 22, figure 1-2) from the control cable by snapping the ball out of connecting link.

5. Remove the four mounting bolts (See 1, figure 2-7) from the Servo and remove the assembly.

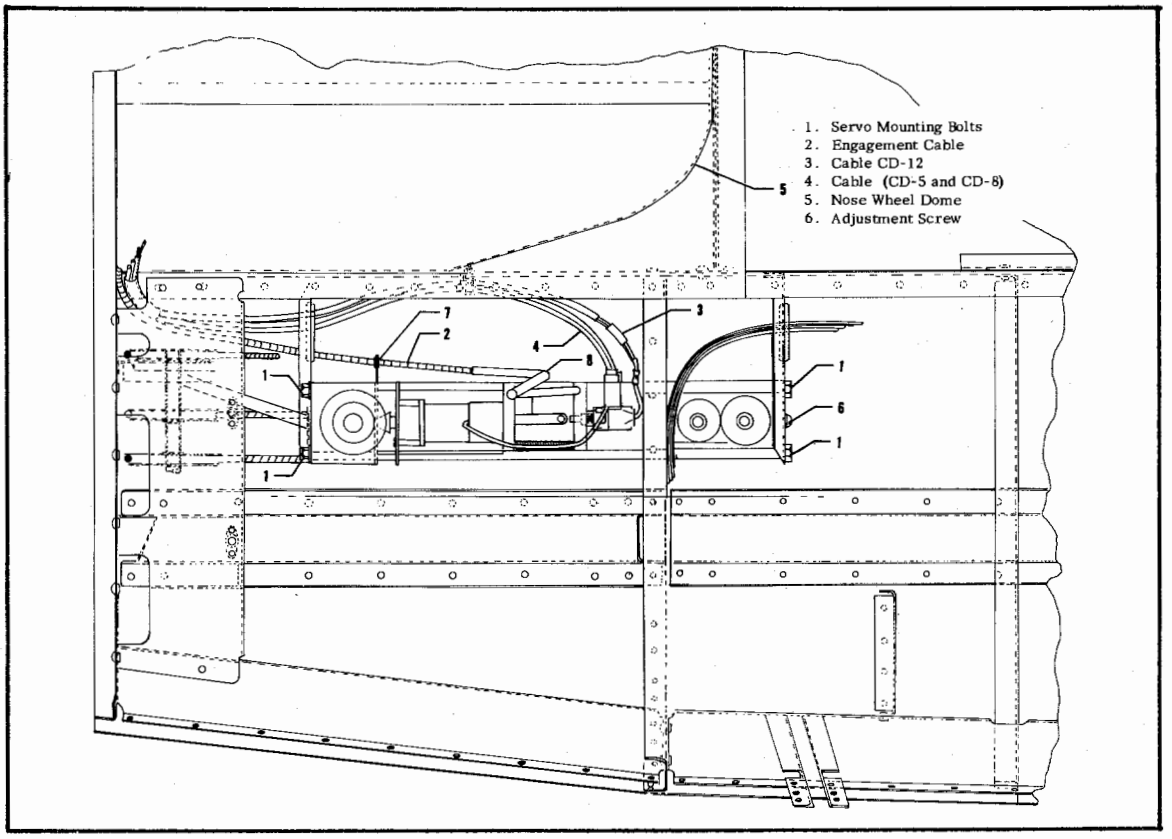


Figure 2-7. Pitch Servo Installation
PA-24 and PA-24-250

6. Reinstall the Pitch Servo in reverse of removal instruction. Use two upper mounting holes on rear bracket and two lower holes on forward bracket. Refer to paragraph 2-10 for timing of the Servo.

b. Pitch Servo. Apache PA-23 and Aztec PA-23-250.

1. Disconnect the engage-disengage cable at points 7 and 8 in figure 2-7.

2. Disconnect the Pitch Servo Cable, Pitch Follow-up Cable and Power Switch Cable at the disconnect points.

3. Disconnect the break away link from the control column by (See 21, figure 1-2) snapping the ball out of connecting link.

4. Remove the two mounting bolts (See 24, figure 1-2) from the aft end of the Servo, and the two bolts holding the clamp at the forward end, remove the Servo.

5. Reinstall the Pitch Servo in reverse order of the removal instruction. Check to insure the travel of Servo coincides with the travel of the Control Column. Refer to paragraph 2-10 for timing the Servo.

→ 2-8a. REMOVAL OF PITCH SERVO (#1X312C). The Pitch Servo is located under the floorboard to the left of the nose wheel well housing.

a. Pitch Servo - PA-24-250, PA-24-260, PA-24-400 and PA-30. (Refer to Figure 2-7a.)

1. Remove the inspection and floorboard plate located to the left of the wheel well dome.

2. Disconnect the engage/disengage control cable from the servo unit.

3. Disconnect the Pitch Servo Cable, Pitch Follow-up Cable and the Power Cable at the disconnect points on the servo.

4. Disconnect the break away link from the control cable by snapping the ball out of the connecting link.

5. Remove the bolts securing the servo to the mounting brackets and remove servo from the airplane.

→ 2-8b. INSTALLATION OF PITCH SERVO (#1X312C).

a. Pitch Servo - PA-24-250, PA-24-260, PA-24-400 and PA-30. (Refer to Figure 2-7a.)

1. Position the Pitch servo unit on the mounting brackets and insert bolts.

2. Slide the Pitch servo sideways on the pulley spacer until break away link evenly straddles stabilator cable.

3. Install the break away link on the swaged ball and tighten the servo mounting bolts.

4. Position the control wheel 7.5 inches from the instrument panel. (Measurement is taken from the instrument panel plate, along the underside of the control column to the control wheel hub.) (Refer to Figure 2-7a, Sketch A.)

5. Refer to page A-9, paragraph F, for servo timing procedure.

6. With timing adjustment complete, move control column both fore and aft to ascertain control column moves freely. Check control column travel to ascertain control column travel is the same as it was prior to servo installation.

7. Connect the engage/disengage control cable to the servo.

8. Connect the Pitch Servo Cable, Pitch Follow-up Cable and the Power Cable to the servo unit.

9. Check servo operation.

10. Install floorboard plate and inspection plate and secure.

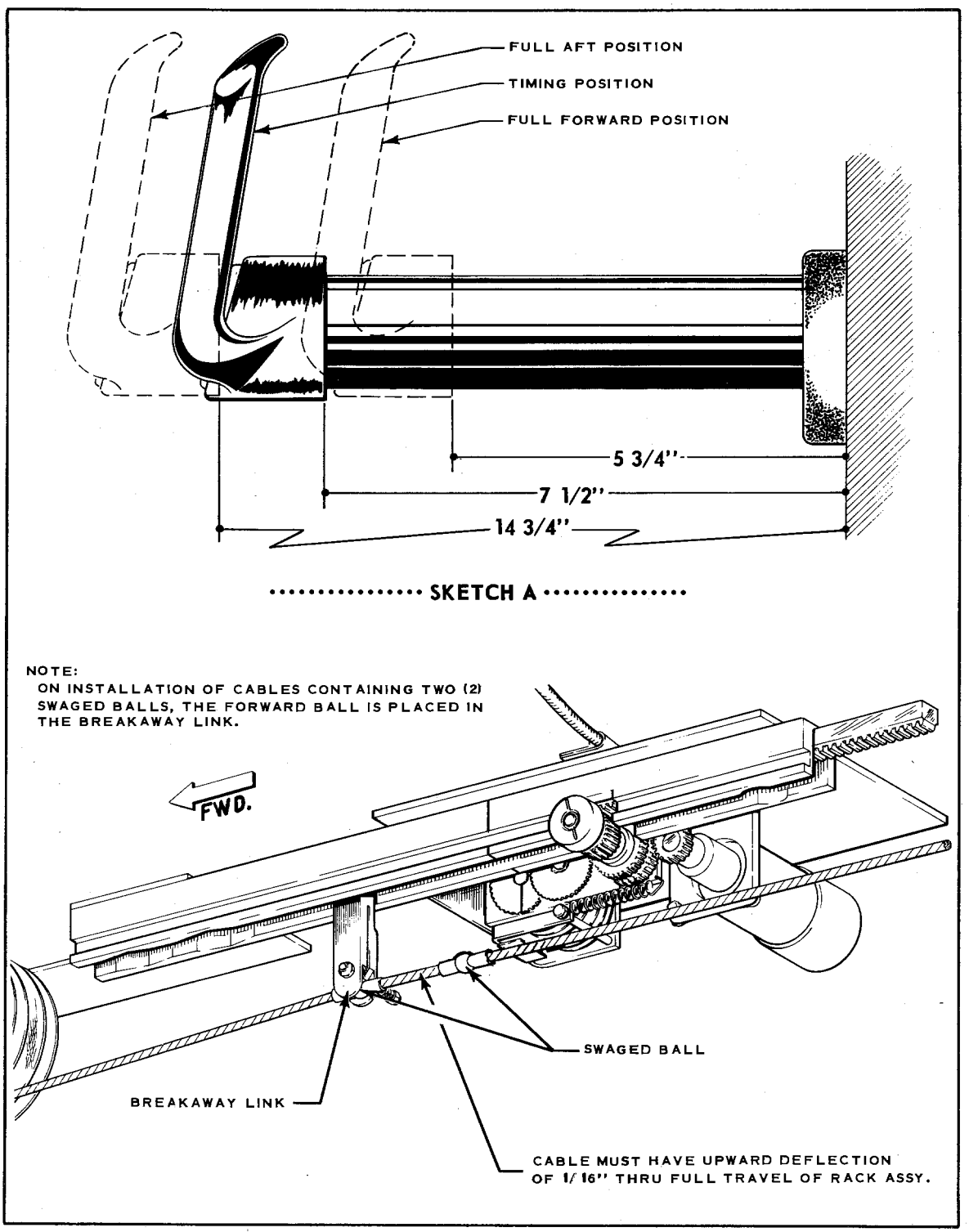


Figure 2-7a. Pitch Servo (1X312C) Installation
PA-24 and PA-30

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2-9. TIMING ROLL SERVO UNIT.

a. Place the Control Wheel in position for level flight and check to insure that the ailerons are in the neutral position

b. Locate the gear which operates the follow-up condenser (See 5, figure 2-6) at the extreme right side of the Roll Servo unit

c. To time the Roll Servo unit loosen the upper screw (6) holding the follow-up bracket and move the bracket outward until the follow-up gear can be rotated to line-up timing hole in gear and bracket.

d. Retighten the screw holding the follow up bracket, making sure that all backlash is removed between the gears

2-10. TIMING PITCH SERVO UNIT.

a Place the control column in the neutral position which is found by positioning the control wheel a specified distance from the instrument panel. Refer to the note below for specific measurements for the different airplanes

NOTE

These measurements are taken from the back of the pilots control wheel to the metal instrument panel

Comanche:	8-1/8 inches
Apache:	5-15/16 inches
Aztec:	7 inches

b. Locate the follow-up Condenser on the Pitch Servo, loosen the two thumb screws. (See 25, figure 1-2)

c. To time the Pitch Servo, move the follow up Condenser away from the drive gear far enough so it can be rotated to line-up the timing marks, then re-engage the gears and tighten the two thumb screws finger tight. Insure that all backlash is removed between the gears.

2-11. ROLL SERVO FRICTION DISC ADJUSTMENT.

a Loosen the Allen cap screw locking the 15/16 split nut (See 7, figure 2-6) of the gear assembly.

b. Turn the 15/16 split nut clockwise to increase the torque. Turn the nut no more than 1/2 turn at a time or damage may result to tension washer.

c. Before checking over-ride force be sure Allen cap screw is tightened to lock the split nut. If it is not, in one direction it will result in the split nut backing off and in other, drawing up and damaging the tension washer.

d Check slip disc for 16 lbs. $\pm$ 3 with a scale at the outer edge of the pilot or co-pilots wheel.

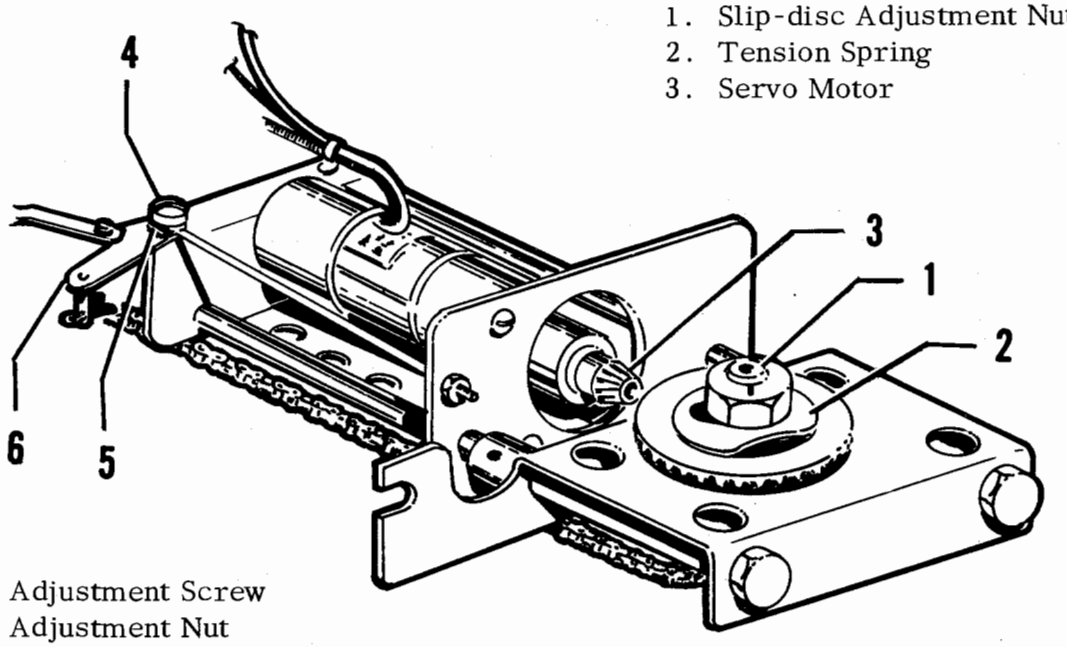


Figure 2-8. Pitch Servo Adjustment

2-12. PITCH SERVO OVER-RIDE ADJUSTMENT. The procedure for making the Pitch over-ride adjustment is the same as was used for adjustment of the Roll Servo. (Refer to Paragraph 2-11)

The amount of force required to over-ride the slip-disc varies with the different airplanes. The Comanche will require 20 lbs. $\pm$ 5 while the Apache and Aztec will require 14 lbs. $\pm$ 3. These are the amounts of pressure required to over-ride the Pitch Servo while in flight. Therefore, when the Servo is adjusted on the ground the weight of the stabilator must be taken into consideration. The weight of the stabilator will usually add 12 to 14 lbs. on Comanche and 7 to 9 lbs. on the Aztec. These figures are obtained by measuring the amount of pressure required to move the control column from the full forward position to approximately four inches aft.

EXAMPLE

Adjusting the Servo on the ground in a Comanche.
20 lbs. + 12 to 14 lbs. = required pressure to over-ride Servo.

On the Apache the trim tab can be set to remove the weight of the elevator and the scale can be read without adding the weight of the elevator provided the

movement is held to approximately three inches.

When checking the pressures to over-ride the Pitch Servo, it will be necessary to have the Pitch Servo operating. This can be done by either applying vacuum to the Horizon or caging it, then engaging the Pitch Control knob. On the Comanche and Aztec allow the control column to go as far forward as possible by placing the Pitch Control knob in manual position and rotating it full down. On the Apache the torque can be checked while the Control Column is in the three inch area the trim mechanism has been set to hold it.

With the Pitch System operating and the dimmer switch on the Console in the bright position, attach a scale to the control wheel and pull rearward until the down effort light just comes on, read the scale at this time.

NOTE

The break-away link of the Pitch Servo is set to actuate at 40 lbs. $\pm$ 5 on all models.

2-13. BACKLASH ADJUSTMENT OF ROLL SERVO. There should be zero backlash between these gears. Do not mistake the backlash in the motor reduction gears as backlash between the motor and bevel gear.

a. Remove servo from aircraft. (Refer to paragraph 2-7)

b. The block supporting the engage lever is held in place with two Allen set screws, these must be loosened.

c. Place the engage lever in "Engaged" position and hold servo in this position with small "C" clamp or similar device.

d. Lock the Engage Arm Support Block in place with two Allen set screws which were loosened in step "b".

2-14. PITCH SERVO CHAIN ADJUSTMENT. There are two adjustments of the Servo chain: one for the disengaged position and the other for when the Servo is engaged.

The disengaged position should be adjusted first, and is accomplished through the 8-32 filister head screw in the center of the end plate (See 6, figure 2-7) Disengaged Position.

1. Completely disengage the Servo.

2. Measuring on the opposite side of the slide bushing or break-away link in the center of the Servo the chain should have approximately 7/16" slack.

3. By turning the adjusting screw clockwise the chain can be drawn up.

Engaged Position

1. Engage the Servo.

2. Loosen filister head screw (See 4, figure 2-8) enough so the 7/16" nut

can be turned.

3. Turn the cam nut just a small amount. (See 5, figure 2-8)
4. Hold cam nut and retighten screw.
5. Measure as is in step "b" above, but for approximately 5/16".

If chain is too tight in the engaged position this will make it difficult to engage and disengage the Pitch Servo at the Console.

2-15. ADJUSTMENTS.

CAUTION

The most critical adjustment of the Amplifier is the setting of the Quiescence Current as this determines not only the Selectivity of the Amplifier but also controls the current drain during stand-by operation. Should this be set too high it can cause four of the six power transistors to be ruined. It is suggested that this adjustment be made only with personnel trained to do so.

2-16. GENERAL. In order for the Altimatic to function properly it will be necessary to make a few adjustments and corrections of the units operation. The procedures outlined in the following paragraphs should be thoroughly understood before any attempt is made at adjusting the Altimatic components.

Two of the most important adjustments of the Amplifier are the Discriminator and Selectivity, the Selectivity is directly connected with the Quiescence Current. Normally it will not be necessary to adjust the Selectivity or the Quiescence Current of the Roll Amplifier because of replacing either of the gyros. The Pitch Amplifier requires that at anytime either the Horizon Gyro or the Amplifier is replaced the Selectivity and Quiescence Current must be checked and adjusted as necessary.

NOTE

Should the Selectivity be too low (low quiescence current) on the Pitch Amplifier it usually results in porpoising. If the Selectivity is set too high (quiescence current will also be high) this will result in the burning up of four of the power transistors.

2-17. SELECTIVITY AND QUIESCENCE CURRENT ADJUSTMENT.

2-18. GENERAL. To adjust the Selectivity and Quiescence Current of the Pitch Amplifier it will be necessary to cage the Horizon, this should be done with the

caging mechanism of the Gyro. Due to a small amount of vibration of the instrument it is not recommended the Gyro be operated while making the adjustment.

a. Remove the top cover from the instrument panel. To cage the Horizon determine if the instrument has the usual caging plate or the ring with a thumb nut. If the caging plate is used, it can be sprung with a screw driver enough so that a second screw driver can be used to turn the caging gear until the Horizon is completely caged. If the ring and thumb nut is used, it requires removal of either the center or lower instrument of the three in a row along side the radios. If no instrument is in the lower hole simply remove a few of the screws holding face panel and pry out blank instrument plate. With the Horizon completely caged, replace the ring and tighten the thumb nut as the Horizon must remain completely caged.

b. Insert the test cable 30A78-62T into CD5 receptacle of Pitch Amplifier for a PA-24 or cable 30A78-42T for the PA-23. (62T and 42T stand for 62 and 42 inches, the T means test calibrated cable). Insert 30A79T CD10 test cable in CD10 receptacle of the Pitch Amplifier. Dummy Altitude Selector, Part No. 66A24, is to be installed on other end of CD10 cable. Again depending on whether it is a PA-24 or PA-23 use the proper follow-up adapter, 66A38 or 66A39 on the end of the CD5 test cable and insert the adapter into the CD5 receptacle of the 66B10-A test box.

c. The Delco fittings of the test box must be connected to the corresponding fittings of the Pitch Amplifier.

d. Connect the servo motor cable CD7 to the mating receptacle of the Pitch Amplifier and the other end of CD7 into CD8 of the test box.

e. Engage the Pitch Control knob clockwise and turn on aircraft master switch. At this time either the "UP" or the "DOWN" light will be lit on the test box.

f. Set the lower left hand knob marked Selectivity on zero. (The calibrations of this Selectivity knob are in m.m.f's. (From zero to the first index either side represents 1/2 m.m.f.)

g. Set the upper left hand knob to any position necessary to get both effort lights out. (The Pitch Control knob on the instrument panel should have index marks aligned indicating level flight) Do not touch the leveling condenser of the Pitch Amplifier or it will require flight test of the aircraft to reset it.

h. With both lights out depress the button directly over the amp meter of the test box and at the same time rotate the Selectivity knob, the smallest amount possible to either side in order to obtain the lowest meter reading, this is the Quiescence Current. It must not exceed .03 which is just slightly over half way between zero and the green area on the meter, if it reads higher be sure you are finding the "bottom" by rotating the Selectivity knob just a slight amount from side to side. If through movement of the Selectivity knob it cannot be made to read .02 to .03, an adjustment must be made. The adjustment is made through the small hole closest to the Horizon and just to the right of center. Using a

NOTE

Heat is very important: Increase in heat will result in increase of selectivity. If temperature is over 80^{O} selectivity will be sharper and allowance must be made for this condition. If temperature is under 75^{O} the selectivity must be set broader or damage will result when unit operates in high temperatures.

small slot screw driver, with the handle generally leaning about 10 degrees toward the rear of the aircraft, carefully engage the slot in the adjusting screw. Turning the screw counter-clockwise will lower the Selectivity and Quiescence Current.

i. Check the Selectivity by setting the lower left hand knob EXACTLY on zero. Rotate the upper left hand knob until the right light just starts to glow and the meter is at the beginning of the green area or .5 ampere. (Do not depress the knob over amp meter) At the time the "UP" light is on, rotate the lower Selectivity knob to the left until the light goes out, the meter returns to zero and the "DOWN" light just starts to glow and the meter returns to .5 ampere. Note the position of the lower knob. It should be between .5 and .6 of m.m.f. or somewhere between zero and a pointer width past the first calibration. If the knob goes beyond the .6 m.m.f. indication to .8 or 1. m.m.f. then the adjustment screw mentioned in paragraph 2-18 (h) must be turned clockwise until the Selectivity is not over .6 m.m.f. It will be necessary to recheck the Quiescence Current as it cannot be over .03 with the knob over the amp meter depressed, if it is proceed as follows: (Temperature must be between 75^{o} to 80^{o} F.

1. Remove the two wires from the Amplifier to the Horizon (Red and Blue) using care and small needle nose pliers. Plug these wires onto the Dummy Horizon (Part No. 66A36) be certain the red wire is attached to the pin colored red. (When replacing these wires on the Horizon the red wire goes on the upper terminal.)

2. With the Dummy Horizon attached to the Amplifier see if the required Selectivity and Quiescence can be obtained. If so, then it means the Horizon will have to be replaced as the "Q" of the pick-up coil is not up to standard.

j. The procedure for setting and checking of the Roll Amplifier is the same, however two types of adjustable resistance is employed in the Roll Amplifiers. If the Roll Amplifier cover has a small plug on the left side it is adjusted the same as the pitch, if not the Amplifier and Directional Gyro must be removed and the cover taken off the Amplifier. In the same area will be found a group of resistors, moving the small wire soldered to the bottom of one of the group either one tap higher, or lower will accomplish the adjustment. Moving this small wire toward the end of the group having the loop will increase both Selectivity and Quiescence Current.

NOTE

Do not fail to uncage the Horizon after completion of this work.

2-19. ROLL ADJUSTMENTS.

a. With the Directional Gyro uncaged, set the course Selector to read with the Directional Gyro, also insure Turn Trim knob is indicating neutral.

b. Engage the Roll Servo and adjust the leveling condenser to hold a heading. (Make a note of the Heading) Turn the Course Selector knob 90 degrees to the left and observe the degree of bank. Turn the Course Selector 90 degrees to the right of the original heading, and observe the degree of bank. Both the right and left bank should be equal. Adjust the Leveling Condenser as necessary.

c. Recheck the heading by turning the Course Selector Dial to the original heading. Allow sufficient time for the aircraft to return to the selected heading. The Altimatic must maintain the selected heading within 4 degrees.

NOTE

When setting the angle of bank and checking the heading accuracy, maintain the same heading as was determined in paragraph 2-19 (b). For turns pull and keep the Directional Gyro caging knob full aft.

2-20. BENCH CHECKING PITCH AMPLIFIER.

a. Connect the 66B10-A test box to the "A" lead of the Pitch Amplifier.

b. Test Cable CD5, Part No. 30A78-62T (PA-24) or 30A78-42T (PA-23) must be inserted in Amplifier CD5 receptacle.

c. Follow-up adapter 66A38 (PA-24) or 66A39 (PA-23) must be installed on the end of CD5 and inserted into CD5 receptacle of the 66B10-A test box.

d. Test Cable CD10, Part No. 30A79T and adapter 66A24 must be installed into Amplifier receptacle CD10.

e. Servo motor cable CD7 must be connected to Amplifier and CD8 receptacle of test box.

f. Either cage the horizon or install Dummy Horizon, Part No. 66A36. (Observe polarity of red and blue leads)

g. Check that the Pitch Control knob has been properly installed on the shaft, place knob to indicate level flight on the Altitude Selector position. (Refer to paragraph 2-6)

h. Engage Pitch Control - Master Switch "ON".

i. Selectivity knob of test box on zero. Upper knob when turned clockwise should turn on "UP" light and counter-clockwise should give a "DOWN" light.

j. Quiescence Current should not run over .03.

k. Maximum Current drain from 3/4 to 1 ampere.

NOTE

Steps "j" and "k" will vary some between Horizons, therefore if Dummy Horizon is used in the check do not change Quiescence Current unless checking the Horizon proves it necessary. (Refer to paragraph 2-17)

2-20A. RESETTING THE 1X225 ALTITUDE SELECTOR ON THE BENCH.

Resetting the altitude selector on the bench will require the following:

1. The Altimatic Adapter Kit Part No. 754 390
2. The 66B10-A Test Box
3. 1X219 Pitch Amplifier
4. Power Source, 12 Volt battery or power supply.
5. Altimeter or get reading from one set at 29.92.

a. Connect the Dummy horizon (Mitchell Part No. 66A36) to the 1X219 pitch amplifier. Make certain red wire goes to red feed-thru of dummy horizon.

b. Connect a CD-5 test cable to the CD-5 receptacle of the 1X219 pitch amplifier and to the CD-5 receptacle of the test box. Do not fail to use the proper CD-5 F/U adapter in the test box. The proper adapter is determined by the CD-5 cable. The CD-5 Comanche cable is 60 inches in length and requires the Comanche Adapter. The CD-5 Apache/Aztec cable is 40 inches and will require the Apache/Aztec adapter be used with it. Either cable and adapter can be used, the model of aircraft the equipment is installed in is not important. The important thing is that the proper adapter be used to match the cable then the follow-up at the servo end of CD-5 will look the same to the amplifier.

c. Connect the CD-10 cable to the CD-10 receptacle of the amplifier and the remaining end to J-16 of the altitude selector.

d. Connect the 3 conducter motor cable from the amplifier to the CD-8 receptacle of the test box.

e. Connect the "A" lead of the amplifier to the test box; 12 volts positive to the test box. Use an in line fuse from power source to test box.

f. Install a Pitch Control shaft to the amplifier and pull shaft outward to altitude selector position. (Looking at side of amplifier which butts against horizon, pull shaft toward you.) Use caution to determine shaft is in center position before pulling so damage will not be done to internal stops. DO NOT ATTEMPT TO OPEN AMPLIFIER UNLESS KNOWLEDGE IS AVAILABLE AS TO TIMING OF PITCH CONTROL SHAFT IN AMPLIFIER.

Leveling condenser of amplifier (See 27, figure 1-2) should be in center position, red dot on disk upward as viewed when installed in aircraft.

Connect a jumper wire from negative of power source to any part of test box.

There will be either the up or down light of the test box lite. Get both lights out by turning the pitch knob of the test box.

The CD-10 cable must now be removed from the J-16 and moved to J-17 receptacle of the altitude selector.

At this point either the up or down light of the test box should come on again. Using a screw driver on end of flexible shaft (or place a knob on flexible shaft) removed from console, turn shaft until both lights are out again.

If the up light of test box is on, turn flexible shaft counter-clockwise, if down light of test box is on, turn flexible shaft clockwise to get light out.

When both lights are out, this represents the elevation of the location at that pressure altitude. Now the selector must be brought down to sea level plus 4/5 of a turn more before it is coupled up to the console.

NOTE

The 4/5 of a turn required after the selector has been set to sea level is to insure that the stops on the console will engage prior to the stops in the selector.

For example: After both lights are out (CD-10 in J-17 receptacle), the ampere meter is reading quiescence of between .02 to .03 amperes, the number of turns counter-clockwise which the flexible shaft will have to be turned will be determined by the altimeter which was 29.92.

In this example, the altimeter reads 2,500 feet. This will require 5 full turns counter-clockwise of the flexible shaft to set the selector for sea level. See note below. (There will be a down light lite on test box.) Another 4/5 of a turn counter-clockwise must be made and then the selector is set and ready to couple to the console.

Before coupling the reset altitude selector to the console, make certain that the altitude selector knob of the console (See 5, figure 2-3) has been turned fully counter-clockwise so that the console dial is against its down stop. The position of the calibrator knob (See 3, figure 2-3) or dial scale is unimportant as it does no more than move the scale and has no effect on this adjustment.

If at another time, the pressure of the day were to change and the altimeter set at 29.92 were to read 2,100 feet instead of 2,500 at the same location, the flexible shaft would only be rotated 4 full turns counter-clockwise for the 2,000 feet and then 1/5 of a turn more for the 100 feet. Then the selector would be at sea level for that pressure. As in the above example, 4/5 of a turn counter-clockwise will be necessary prior to coupling to the console.

NOTE

One full turn of the flexible shaft is equal to 500 feet.

1. If all connections are made properly and it is not possible to get both "UP" and "DOWN" lights, and have the Quiescence and Maximum Current as required, the Amplifier must be replaced.

2-21. TEST FLIGHT. Adjusting leveling condenser for correct climb and descent airspeeds for Altitude Selector without external stop adjustments:

a. See note below as to Altitude. Using 75% of power trim aircraft for level flight. Observe airspeed for level flight.

NOTE

It requires approximately 2000 feet to adjust the up and down speed of the Pitch leveling condenser. It is suggested that 2000 to 6000 feet be used because at higher altitudes required power cannot be obtained and this results in a different position of the Horizon Bar and Yoke.

TABLE I

Model	Climb Speed MPH	Descent Speed MPH
PA-23-250	120 - 140	20 M.P.H. above I.A.S. at 75% power trimmed for level flight.
PA-23-160	110 - 130	
PA-24-250	125 - 140	

b. The Pitch Control knob located to the right of the Artifical Horizon must be turned to indicate level flight and pulled aft. (Index marks aligned) Do not attempt to pull or push the Pitch Control knob if the index marks are not aligned as damage to the internal stop rings will result.

c. Turn the Calibration knob located on the Console fully clockwise, also set the Altitude Selector dial to read approximately 2000 feet above the Altitude as shown on the Altimeter by turning the Altitude Selector knob on the Console. The Dimmer knob on the Console must be checked to insure it is in the full forward position to give the effort lights their most brilliant intensity.

d. Partially engage the Pitch Control knob on the Console until one of the effort lights come on, adjust the Leveling Condenser of the Pitch Amplifier until the "UP" effort light shows maximum brilliance.

e. Fully engage the Pitch Control knob and adjust the Leveling Condenser (on

the Pitch Amplifier) so the airspeeds will come within the limits as shown in Table I with 75% of power and trimmed for level flight. Allow sufficient time in the climb and descent for the aircraft to stabilize while adjusting the Leveling Condenser for the suggested reduction in airspeed. This will be an approximate adjustment of the leveling condenser. The final adjustment is made in the descent altitude.

f. Rotate the Altitude Selector knob counter-clockwise until the first indication of a down effort light is observed. Give the aircraft time to come up to level flight speed again. At this time it should be possible to rotate the Altitude Selector knob in either direction and have the up and down effort lights follow the knob action. This indicates the Altitude Selector is at the altitude indicated by the Altimeter. Set the altitude scale of the console to indicate the correct altitude.

g. Rotate the Altitude Selector knob counter-clockwise to a setting of 2000 feet below the indicated altitude, observe the airspeed during the descent. Adjust the Leveling Condenser to have the aircraft descent at an airspeed of 20 M.P.H. above the airspeed for level flight (Refer to step "a"). While adjusting the Leveling Condenser insure the Pitch Control knob is centered according to the index marks.

h. Recheck the climb airspeed. If the climb airspeed is under that which is recommended in Table I it will be necessary to use the Altitude Selector Adapter (Part No. 1X236). This will cut down on the amount of control the selector has in both climb and descent, therefore it will require a new adjustment of the leveling condenser (Refer to step "g").

i. Select an altitude on the Altitude Selector and allow the aircraft sufficient time to level out and maintain cruise speed. Push the Pitch Control knob in toward the panel, and note if there is a change in the Attitude of the airplane, if a change is noted, adjust the Dummy Altitude Selector in the Pitch Amplifier until level flight is maintained.

NOTE

When the Pitch Control knob is pushed in, insure the knob is not rotated and that the index marks are aligned.

2-22. ALTITUDE SELECTOR ADAPTER (PART NUMBER 1A236). This adapter is required in the Aztec only. Its purpose is to cut down the amount of control the altitude selector has in the system.

The table calls for setting of the leveling condenser of the pitch amplifier to be adjusted so as to have the climb speed 120-140 and the descent speed 20 MPH higher. These airspeeds are governed by the condenser in the altitude selector. The selector is very carefully set for proper spread, however, in some installations with tolerances all on one side, it becomes necessary to

further cut down the control of this instrument. This is accomplished by simply inserting the ALTITUDE SELECTOR ADAPTER #1A236 into J-17 of the selector and the CD-10 cable then goes into the adapter.

By way of an example. An Aztec which when set to give a down airspeed of 200 and will climb as slow as 90 to 100 would require this adapter. The adapter when installed will require that the leveling condenser be again reset to give the down speed of 200 and the up speed should now come down to something between 120 and 140.

SECTION III

TROUBLESHOOTING

3-1. GENERAL. Troubles peculiar to the Piper Altimatic Pilot are listed in the following table along with their probable causes, isolation procedures and suggested remedies. When troubleshooting the Altimatic special test kits Part No. 751 412 and 754 390 are required. (See figure 3-1) The test kit can be used to check all components and system of the Altimatic, it is also used as a substitution standard for any component of the Altimatic. In servicing or troubleshooting the Altimatic it should be treated as two separate systems. In reality it is two complete and independent systems, the only unit common to both is the Artifical Horizon. The Horizon houses both the pick-off censor for the Roll (CD2) and the pick-off censor for the Pitch. The 5 ampere circuit protector is also common to both the Roll and the Pitch. There can be only one time when it will be a little difficult to decide whether the Roll or the Pitch section of the Altimatic is the cause of the trouble and this will be when the circuit protector opens. It is possible that either or both systems can open the circuit protector. Any other malfunction can always be traced to the Roll or Pitch section and the proper components checked and replaced. Should the problem be the circuit protector opening it will be necessary to employ the 66B10-A test box for the check. The Delco fittings of the test box should be connected to either the Roll or Pitch Amplifier and proceed with the test as outlined in Table II.

3-2. EQUIPMENT REQUIRED FOR TROUBLESHOOTING.

a. 66B10-A Test Box
b. 66X14-A Roll F/U Adapter
c. 30A61 Roll Assembly Cable CD1, 2 and 3
d. 30A53-36 Roll Servo Motor Cable CD7
e. 66A37 Dummy 52D22 Directional Gyro
f. 66A24 Dummy Altitude Selector
g. 66A38 Pitch F/U Adapter Comanche
h. 66A39 Pitch F/U Adapter Apache/Aztec
i. 66A36 Dummy 52B21 Horizon
j. 30A78-62T F/U Cable Comanche CD5
k. 30A78-42T F/U Cable Apache/Aztec CD5
l. 30A79T Altitude Selector Cable CD10
m. 50 lb. scale equal to or better than a Hanson Model 895; Northbrook, Illinois.

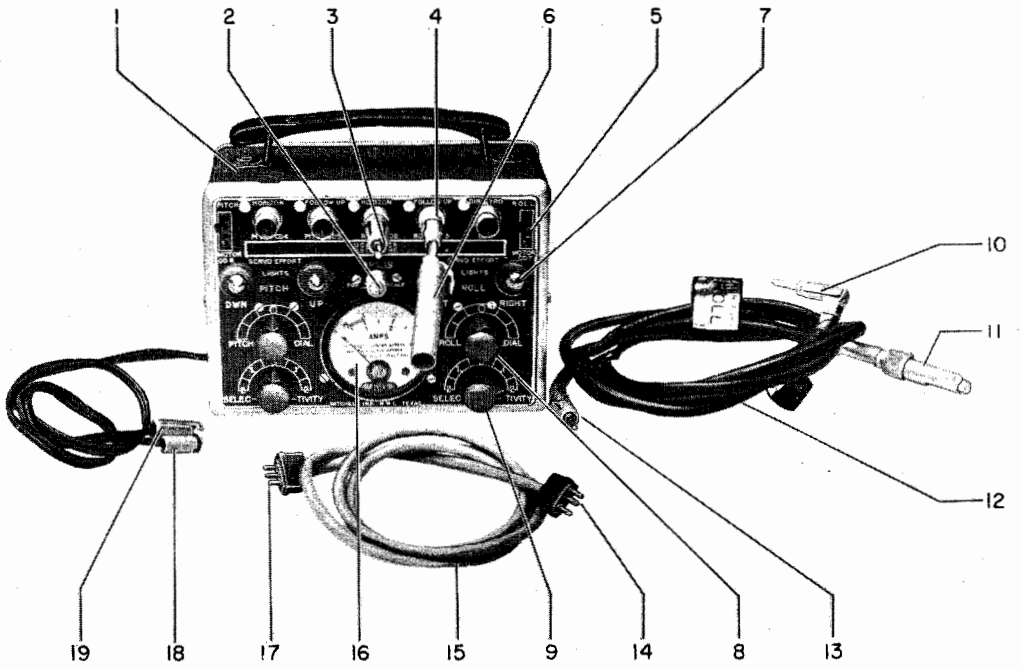
NOTE

Items "a" thru "d" are purchased under Piper Part No. 751 412.

Items "e" thru "l" are purchased under Piper Part No. 754 390.

NOTE

Items "a" through "e" are required to check the Roll System. Items "f" through "m" are required for checking the Pitch System. If it is desired to test the amplifiers or the complete system on the bench a power source of 12 volts D.C. is required. The power supply must be stable enough so that a change from 0.1 to 1.0 ampere will not change the voltage over 1/2 volt. If the power does not come within this requirement then a 12 volt battery should be floated across the line.



1. Test Box
2. Knob 3
3. Receptacle CD-2
4. Receptacle CD-3
5. Receptacle CD-7
6. Adapter P/N 66X14
7. Right Servo Light
8. Knob 1
9. Knob 2
10. Plug CD-1
11. Plug CD-2
12. Roll Assembly Cable
13. Plug CD-3
14. Plug CD-7
15. Roll Servo Cable
16. Ammeter
17. Plug CD-7
18. Plug A
19. Receptacle B

Figure 3-1. Piper Test Kit P/N 751 412

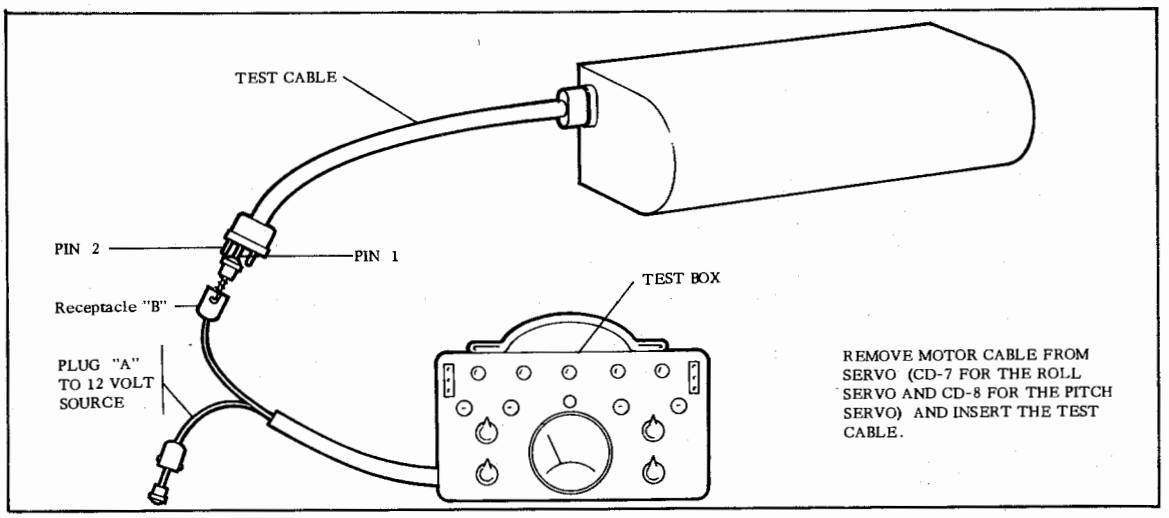


Figure 3-2. Testing Servo Motor

Use the following procedure for checking the Servo Motor, if there is an indication the trouble may be in the Servo. (Refer to figure 3-2)

a. Disconnect the motor cable from the servo.

b. Using motor test cable from test box, plug in one end at Servo where motor cable was just disconnected.

c. Supply plug A of test box with 12 volts positive either from the buss bar or external supply.

d. Plug B from test box must be touched to pin 1 of test cable. (See figure 3-2)

e. Disengage the Engage-Disengage Control; motor should not have load of flight controls on at time of test.

f. Connect a ground lead from negative or ground of ship to Pin 2 of test cable and at same time observe the amp meter of test box.

g. The reading of amp meter must not exceed .5 amp.

h. Reverse Plug B and touch it to Pin 2 of test cable and connect the ground lead to Pin 1 of test cable. This will reverse the drive of the Servo Motor. The amp meter must not read over .5 amp.

Should this test show the Servo Motor to read 1 amp or 1.5 amps, then the Servo must be replaced and is the cause for the fuse blowing in amplifier. (Remember Servo must be free of flight controls, disengaged.)

The Motor Cable CD-7 should be checked for a short if both the amplifier and Servo Motor check normal.

The maximum current drain for a full left or right signal of the Altimatic with the weight of the flight controls should not exceed 1.5 amps.

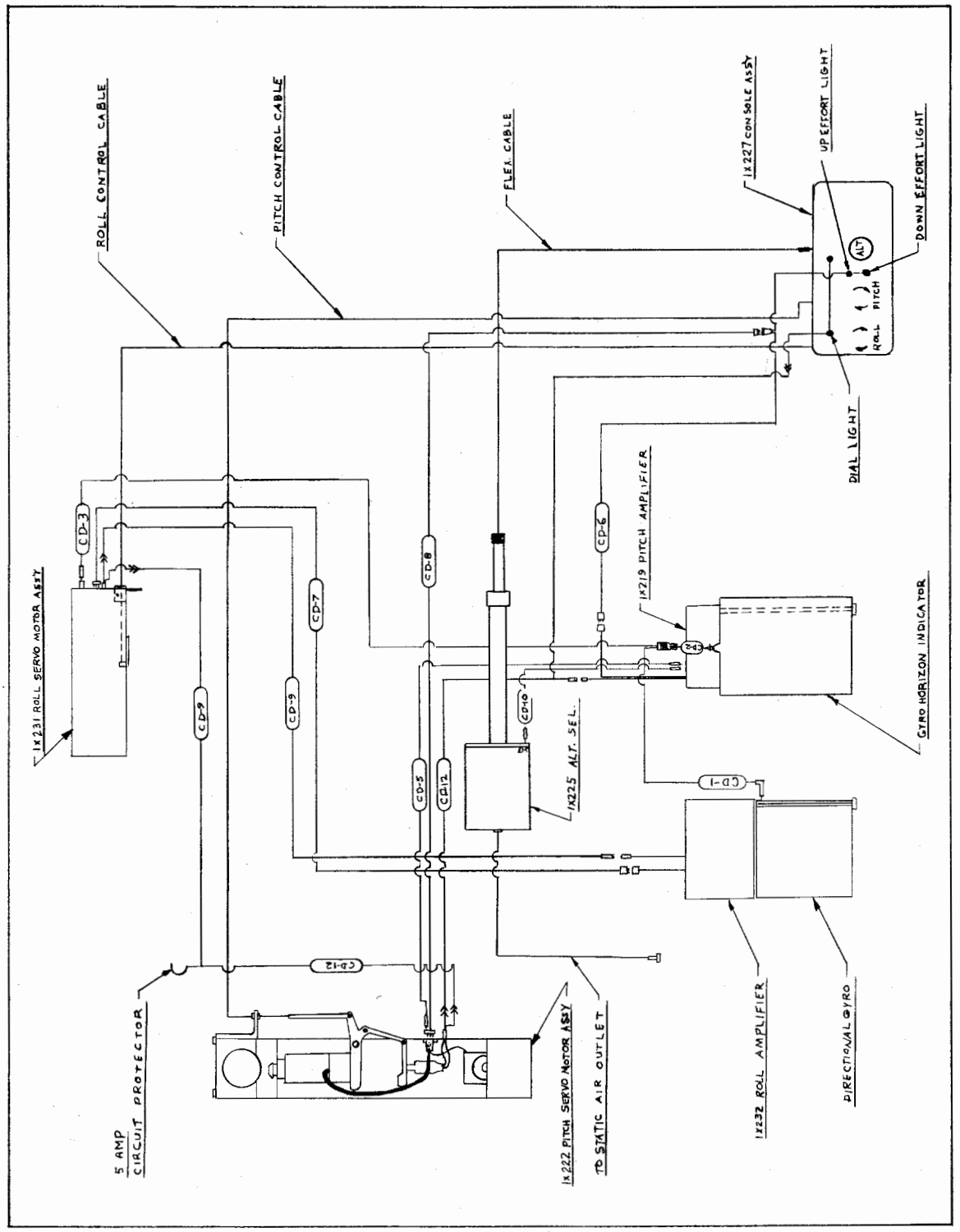


Figure 3-3. Wiring Diagram

TABLE II. ALTIMATIC TROUBLESHOOTING

Trouble	Probable Cause	Isolation Procedure	Remedy
I. Circuit Protector opens.	a. Defective Amplifier	a. (1) Connect the test box in the circuit to the roll amplifier. a. (2) Either cage or errect horizon by vacuum. a. (3) Set course selector to correspond to Directional Gyro card. a. (4) Master switch on, engage roll knob on console a. (5) Reset circuit protector, wheel should move to neutral position. a. (6) Observe the ampere meter of the test box	a. If amplifier meter reads 2 amp or more after making the check, replace amplifier unless between checks a. (6), (7) and (10) it proves the trouble to be the servo motor, then the servo must be replaced.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
I. Circuit Protector opens. (cont)		a. (6) (cont) while rotating the trim knob full left to full right. a. (7) Ampere meter should never read higher than 1-1/2 amperes, normal 3/4 to 1 amperes. a. (8) If ampere meter reads over 1-1/2 amperes turn off aircraft master switch. a. (9) Disconnect CD7 from roll amplifier and connect test cable CD7 from Roll Amplifier to CD7 receptacle of test box. a. (10) Aircraft master on re-check item a. (6) and (7)	

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
I. Circuit Protector opens. (cont)		a. (10) (cont) above. a. (11) If ampere meter still reads over 1-1/2 amperes this check proves the trouble in the amplifier and not the servo. a. (12) If the steps above prove the maximum current drain to be satisfactory then the Quiescent Current must be checked. Quiescent Current on either amplifier must not exceed .02 to .03 amperes as read on meter with knob over meter depressed. a. (13) If roll section proves normal check the pitch using the same method.	a. (12) If necessary adjust Quiescence Current according to instructions. Refer to paragraph 2-17.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
I. Circuit Protector opens. (cont)		NOTE The rotating of either the trim knob or the pitch (A6) control knob should be accomplished quickly from one extreme to the other over a period of several times.	
	b. Excessive heat in area of amplifier.	b. Better ventilation must be given to the amplifier area.	b. If after making the checks above on both roll and pitch and the system proves out normal then it will have to be determined if the protector opens up only each time either heat or defroster is applied.
	c. CD9 or CD12 shorting out.	c. Check cable for shorts.	c. Replace if necessary.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
I. Circuit Protector opens. (cont)	d. CD7 or CD8 shorting out.	d. Check cable for shorts.	d. Replace if necessary.
	e. Servo motor, Pitch or Roll drawing too much current.	e. Check servo motor for current drain, should not be over .5 of an ampere. Refer to Figure 3-2.	e. Replace if over .5 ampere current drain.
II. Roll completely inoperative.	a. Poor connection at CD2.	a. Inspect and make certain cable is fully inserted in connector of pick-off censor.	a. If not, correct as necessary.
	b. Defective Coaxial Cable CD1, 2 and 3 usually at CD2.	b. Continuity or hot lead of CD2 to center or hot tip of plug at CD3. Check also continuity of shielding to plugs CD2 or CD3 continuity test of CD2 to CD1.	b. Replace if necessary.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
II. Roll completely inoperative. (cont)	c. Defective power switch at servo.	c. Check for 12 volt on both knife disconnects at servo of the CD9 power cable.	c. Replace switch if necessary.
	d. Defective Servo Motor Cable CD7.	d. Continuity test of CD7 cable.	d. Replace if necessary.
	e. Defective Amplifier.	e. Connect ampere meter of 66B10-A test box to Amplifier. Test Cable 30A61 must be connected to test box and CD1 to amplifier. Test Cable CD7 connected to amplifier and box. If at this time it is not possible to get the normal right and left lights or amp meter only read about .02 amperes the trouble is in amplifier.	e. Replace Amplifier.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
II. Roll completely inoperative. (cont)	f. Defective Roll Pick-off censor.	f. Run a continuity test of the pick-off coil from the center pin of CD2 to ground if open pick-off censor is defective.	f. Replace Horizon. Pick-off censor cannot be replaced in field.
III. Roll operates intermittently.	a. See 2, a and b above.	a. See 2, a and b above.	a. See 2, a and b above.
	b. Condenser in Directional Gyro defective.	b. Using a continuity meter, remove red wire from Roll Amplifier and Directional Gyro feed thru. Connect one side of meter to this feed thru the other to ground. Uncage the Directional Gyro and slowly rotate the course selector dial through 360° first in one direction then the other. At no time should the meter read unless the condenser is shorting out.	b. If meter gives any indication at any point replace Directional Gyro.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
IV. Aircraft goes into a hard right bank only.	a. Poor connection at CD3.	a. Apply vacuum to errect horizon. Set course selector to correspond with Directional Gyro card. Engage Roll. Wheel should be neutral, if not check CD3 connection at the servo.	a. If this returns wheel to neutral determine if it was just a poor connection at CD3 or if coaxial cable is broken in area of CD3.
	b. Wire either broken or off from Amplifier to Directional Gyro.	b. If wire from the Amplifier to the Directional Gyro appears to be making good contact to the Directional Gyro feed-thru, very carefully inspect the 90° elbow of this wire. It can be broken, however the plastic sleeving holds it in place.	b. Connect wire or repair as necessary.
	c. Defective circuit in Amplifier.	c. Connect Test Box 66B10-A to "A" lead of Roll Amplifier. Connect test cable 30A61 and	c. Replace Amplifier.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
IV. Aircraft goes into a hard right bank only. (cont)		c. (cont) 66X14-A adapter to test box and CD1 to Roll Amplifier. Connect Dummy Directional Gyro Part No. 66A37 to Amplifier in place of 52D22 Directional Gyro. Connect CD7 wire from test box to Amplifier, Engage Roll. If right light is on set lower right hand selectivity knob to zero and turn upper right hand knob to the left. If left light does not come on turn leveling condenser knob on Roll Amplifier fully counterclockwise. If this does not get the left light on, Amplifier is defective.	
	d. Defective Directional Gyro, contact bushing to stator ring opening.	d. Connect test equipment as in a (3) above. With horizon errected, Course Selector set to corre-	d. Replace or have authorized instrument shop inspect.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
IV. Aircraft goes into a hard right bank only. (cont)		d. (cont) spond to Directional Gyro card. Directional Gyro uncaged and by rotating the Amplifier leveling condenser fully counter-clockwise the right light cannot be turned out then connect Dummy Directional Gyro Part No. 66A37 to Amplifier in place of 52D22 Directional Gyro. Rotate the leveling condenser fully counter-clockwise and if then the right light goes out and the left light comes on recheck the Directional Gyro. Connect up the red wire to the Directional Gyro and remove the Dummy Directional Gyro. Set Directional Gyro to zero and uncage, rotate course selector card from 359° to 190° and the left light should be on (from 1° to 170° right light) The left light must remain on constantly from approximately 359° to 190° if it should go out at any point in between the Directional Gyro is defective.	
V. Uneven degrees of bank from right to left.	a. Leveling condenser not properly set.	a. In flight, make a right and left bank and observe the degree of bank.	a. Adjust as necessary. Refer to paragraph 2-21.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
VI. Wheel jumpy in left banks only.	a. Directional Gyro capacitor not properly adjusted.	a. Remove Directional Gyro and have it checked by authorized instrument shop.	a. Replace or have Directional Gyro repaired.
VII. Aircraft rocking slowly from side to side in real still air only.	a. Follow-up gear has back lash.	a. Check for back lash at follow-up gear. There can be absolutely NO BACK LASH.	a. Adjust as necessary.
	b. Follow-up condenser defective.	b. If a. (1) above is complied with and trouble still exists it is follow-up condenser.	b. Replace either follow-up condenser. If not set up to do so, exchange servo.
VIII. Appears slow to recover.	a. Friction disc set too low.	a. Check with scale at outer edge of wheel for 16 lbs. $\pm$ 3 with Roll activated. Servo motor should just start.	a. Reset if necessary.

TABLE II. ALTIMATIC TROUBLESHOOTING. (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
VIII. Appears slow to recover. (cont)	b. Defective Amplifier.	b. Connect amp meter of test box to "A" lead of amplifier. Errect horizon, Course Selector set to correspond with Directional Gyro card. Engage Roll. Override the servo to the right and to the left, amp meter should read 1 to 1-1/2 amps. CAUTION Do not continue to override friction disc longer than necessary.	b. If one leg of amplifier reads 1 or 1-1/2 and the other .5 or both sides less than 1. amp replace amplifier.
IX. Altimatic will not go down but will go up on Altitude Selector Position.	a. Leveling condenser not set properly.	a. See Flight Test Procedure. (Refer to paragraph 2-21)	a. Correct if necessary.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
IX. Altimatic will not go down but will go up on Altitude Selector Position. (cont)	b. Pitch Control knob not properly installed.	b. See Flight Test Procedure.	b. Correct if necessary.
	c. Defective Amplifier.	c. (1) To avoid the work of getting the Pitch Circuit connected to the 66B10-A test box, a quick check can be made as follows: c. (2) Check follow-up timing, if timing is correct mark the yoke with a pencil for the timed position. c. (3) Errect the Gyro Horizon by either starting engine or caging. c. (4) Push Pitch Control knob in on manual.	c. Replace Amplifier if necessary.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
IX. Altimatic will not go down but will go up on Altitude Selector Position. (cont)		c. (5) Engage Pitch Control just enough to activate Pitch but not enough to engage servo gears. c. (6) Holding yoke in timed position rotate Pitch Control knob full up to full down, this should give up and down effort lights (if bulbs are not burned out) however it is possible to hear the servo motor running and also the reversal if bulbs are defective. NOTE Effort lights can be replaced by simply turning them counter-clockwise. It is not necessary to remove face plate.	

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
IX. Altimatic will not go down but will go up on Altitude Selector Position. (cont)		c. (7) If in manual position there is both up and down servo effort lights, then either "a" or "b" above must be corrected.	
		c. (8) If in manual position it is not possible to get a down effort light it will be necessary to connect the Pitch to the test box. See instructions on testing Pitch Amplifier.	c. (8) If test proves Amplifier defective, replace.
	d. CD10 cable is not connected to Altitude Selector or the CD10 Receptacle at Pitch Amplifier.	d. Visually inspect.	d. Correct if necessary.
X. Altimatic will not go up but will go down on Altitude Selector Position.	a. See "a" thru "c" above.	a. See "a" thru "c" above.	a. See "a" thru "c" above.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
XI. Altimatic will not go down on Manual Pitch Control.	a. Leveling condenser not properly set.	a. See flight test procedure. (Refer to paragraph 2-21)	a. Adjust if necessary.
	b. Defective Amplifier.	b. See instruction on Testing Pitch Amplifier.	b. Replace if necessary.
XII. Altimatic will not go up on Manual Pitch Control.	a. See "a" and "b" above.	a. See "a" and "b" above.	a. See "a" and "b" above.
XIII. Altimatic will not go up or down on Altitude Selector.	a. CD10 Cable in J-16 of Altitude Selector instead of J-17.	a. Visual Inspection. PA-23 lower right hand receptacle. PA-24 upper left hand receptacle as viewed from right side of the aircraft.	a. Correct if necessary.
	b. Trouble between the Console and Altitude Selector.	b. Check if flexible shaft between Console and Selector is properly connected.	b. Refer to paragraph 2-5.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
XIII. Altimatic will not go up or down on Altitude Selector. (cont)		CAUTION Do not disconnect this flexible shaft from either Console or Altitude Selector without reading instruction on Selector to Console connecting.	
	c. Defective micro switch in Amplifier, not shifting from manual to Altitude Selector.	c. In flight with Pitch Control knob in Altitude Selector position, rotate it full up and note airspeed. Full down and note airspeed. Set knob to manual position and rotate from full up to full down. There should be a big difference in airspeeds up and down in Manual position but only an increase or decrease of 10 m.p.h. each way on the Altitude Selector position	c. If not, Amplifier must be replaced.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
XIV. Airspeed down is above or below recommended airspeed.	a. Leveling condenser not properly set.	a. See Flight Test Procedure. (Refer to paragraph 2-21)	a. Adjust if necessary.
	b. Pitch Control knob has been changed from the time that the down and up airspeeds were set.	b. See knob position under Flight Test procedure. (Refer to paragraph 2-21)	b. Adjust if necessary.
XV. Aircraft porpoising in level flight on Altitude Selector.	a. Backlash at follow-up gear.	a. Check for zero backlash between follow-up gear and drive gear.	a. Reset if necessary.
	b. Follow-up timed incorrectly.	b. Check follow-up timing. (Refer to paragraph 2-10)	b. Adjust if necessary.
	c. Selectivity not correct, too low.	c. Using test box, check Selectivity. (Refer to paragraph 2-17)	c. Reset if necessary. Note Caution on oversensitivity results in destroying Amplifier.

TABLE II. ALTIMATIC TROUBLESHOOTING (cont)

Trouble	Probable Cause	Isolation Procedure	Remedy
XV. Aircraft porpoising in level flight on Altitude Selector. (cont)	d. Defective Altitude Selector.	d. At time of porpoising, push Pitch Control knob in on Manual Position, if this corrects it the Altitude Selector unit or static port is at fault.	d. Replace if necessary.
	e. Defective Horizon.	e. Hand fly the aircraft and observe Horizon bar, if bar floats, Horizon must be checked by instrument shop.	e. Replace Horizon if Instrument Shop test proves Horizon Bar floats.

APPENDIX I

References:

The information contained in this Appendix is compiled from previously issued Electronic Letters (EL Letters) and Electronics Service Letters (SE Letters).

A. AltiMatic Selectivity (Replaces EL-2.)

Please be advised that in the AltiMatic Pilot, the selectivity is no longer adjustable.

In the past it has been necessary to adjust the selectivity of the pitch amplifier anytime either the pitch amplifier or the artificial horizon was changed. This is no longer necessary. The selectivity is factory set and cannot be adjusted.

Selectivity is being set at .6 MMF. The selectivity in the past has varied considerably with temperature changes. In the new circuit, the selectivity will remain at approximately .6 from a -10 degrees fahrenheit to 140 degrees fahrenheit.

The amplifiers which use this new circuit are as follows:

AltiMatic, both roll and pitch amplifiers, Serial Numbers 300 and up.

B. Selectivity Adjustment in the Original AltiMatic (Replaces EL-10.)

Under the subject of "Altimatic Selectivity" dated May 21, 1962, numbered EL-2, we sent you a letter stating: "Altimatic, both Roll and Pitch Amplifiers, Serial Numbers 300 and up" will have the new circuitry in which it will no longer be necessary or possible to adjust the selectivity of the amplifier.

Unfortunately, due to a condition beyond our control, it will no longer be possible to make an easy identification of either the Roll or Pitch Amplifier as to whether or not it has the self-adjusting selectivity. Serial Numbers can no longer be used for this inspection. Amplifiers which have numbers below 300 could possibly have the latest circuitry if they have gone through the exchange program.

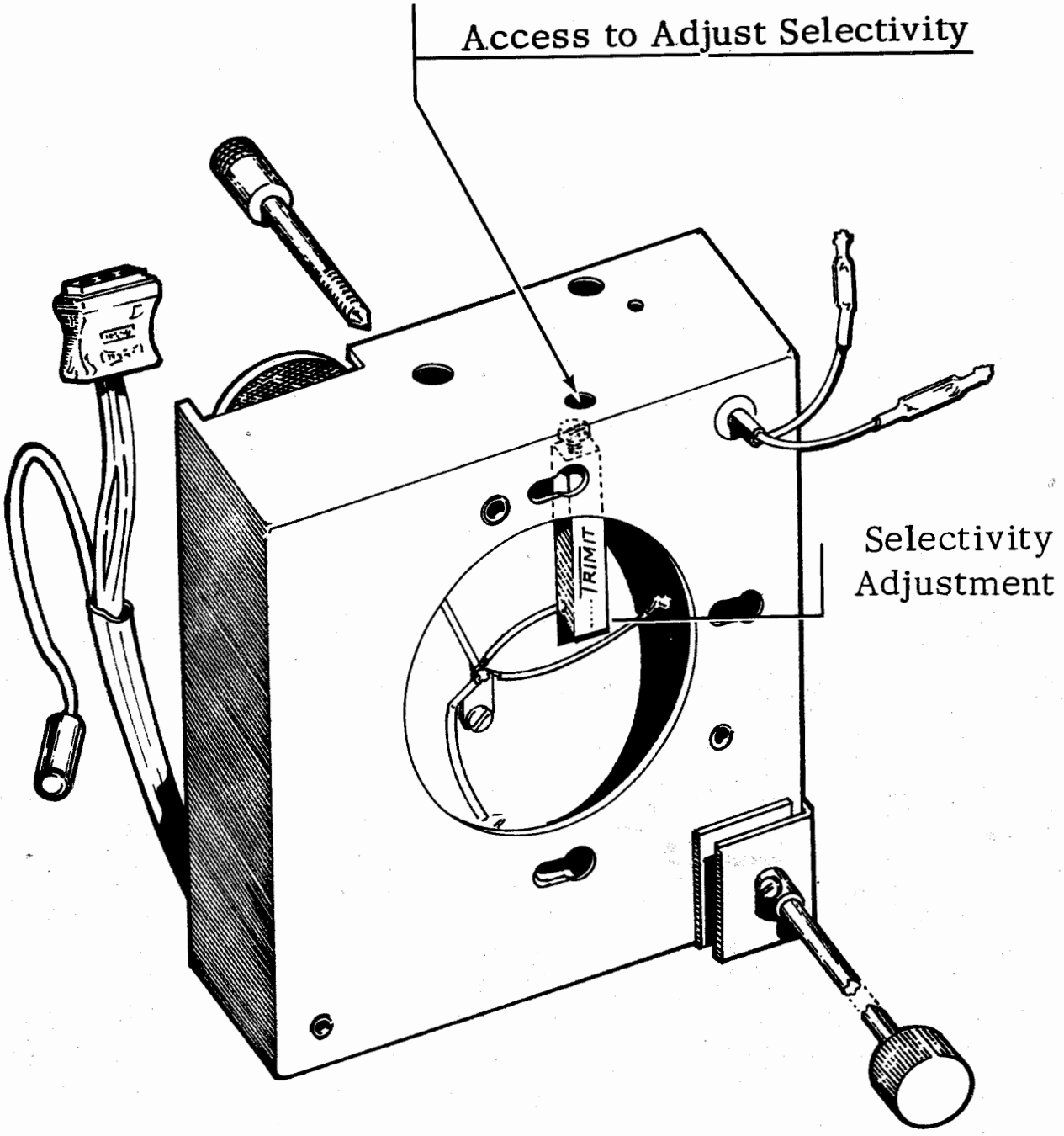
For a positive identification of the Roll Amplifier, both for the AutoControl and the original Altimatic, it will be necessary to make an inspection of the left hand side of the Roll Amplifier. Remove the snap plug on the left hand side of the amplifier cover. Using a mirror, determine whether a small slot-head screw which is part of the "Trim It" can be seen. If so, it has the earlier adjustable selectivity. (To adjust selectivity, see Altimatic Service Manual.) If no snap plug is on the left hand side of the amplifier cover, the amplifier definitely has adjustable selectivity.

To check the Pitch Amplifier, it is suggested a plastic tuning wrench (a toothpick or a wooden match may be substituted) might be inserted into the very small hole through which the selectivity is adjusted. See attached sketch. Insert the wrench absolutely straight, not at an angle to either side. If the wrench cannot be inserted beyond 1/2 inch it will mean the amplifier has adjustable selectivity.

If the amplifier should be removed from the instrument, inspection is very simple. See Sketch. If the "Trim It" is visible in the Pitch or Roll Amplifier, it has adjustable selectivity.

It is important that Pitch Amplifiers which have adjustable selectivity have this adjustment accurately accomplished. If selectivity is too sharp or hot it will result in circuit breaker opening, if not sharp enough the aircraft will porpoise.

This applies only to the original Altimatic. The Altimatic II in all cases has the self adjustable selectivity. No selectivity adjustment is necessary in Roll or Pitch.

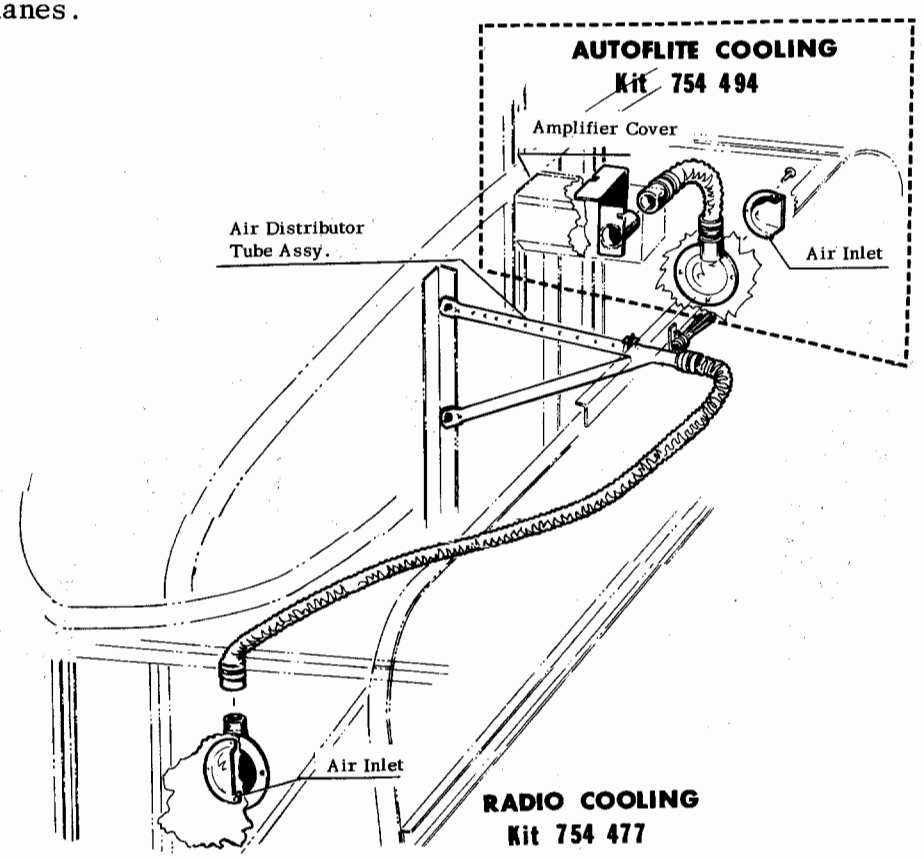

Access to Adjust Selectivity
TRIMIT
Selectivity
Adjustment

C. Cooling of Radio and AutoPilot in Cherokees (Replaces EL-18.)

To determine if the Cherokee has the proper cooling for the above mentioned electronic components, it will be necessary to examine the installation behind the instrument panel. The proper cooling system must consist of an air hose connected to the air scoop on the right side of the fuselage, and routed to a distributing assembly which directs air on the radios as well as the Omni Converter. When an AutoControl is installed, an air hose is connected to the air scoop on the left side of the fuselage and routed to the shroud located on the AutoControl Amplifier which is mounted on the back of the Directional Gyro.

There are some aircraft which have only the two (right and left) air scoops which directs air back of the instrument panel. This system has been found insufficient when operating in areas of high temperatures. Therefore, it is strongly recommended that kits 754 777 - Radio Cooling and 754 494 - Auto-Flite Cooling be installed.

Below is a sketch showing the kits and method of directing cooling air to the radio, O-1 Omni Converter and AutoControl when installed in Cherokee airplanes.



D. Instrument Panel Shock Mounting (Replaces EL-19.)

If a field installation of the Jack and Heintz Directional Gyro Model 52D27E, Piper Code No. 752 092 has been made in any PA-23-160, PA-23-235 Serial Nos. 27-505 to 27-531 inclusive, PA-23-250 Serial Nos. 27-1 to 27-504 inclusive or PA-23-250 (six place) Serial Nos. 27-2000 to 27-2257 inclusive the shock mounted panel should be checked for proper installation.

It is important that the new bracket in the upper left hand corner be clear of the upper bracket which is secured to the rigid part of the instrument panel.

First, check to determine if the proper number of spacers have been installed so that the bracket on the floating panel does not bear against the rivets of the upper bracket which holds the shock mount assembly.

Second, check the rigid portion of the panel in the area of the bracket to insure it has been reshaped sufficiently to clear the radius of the new bracket under all vibration conditions. (For example; when shutting down the engines)

Third, the 6-32 screw used to hold the shock assembly must not be so long that it will protrude through the lower bracket and seat against the Directional Gyro Condenser box cover. The approximate length of this screw should be 1 inch.

If any of the above conditions are present the life of the Directional Gyro and Artificial Horizon will be approximately 10 to 14 hours.

To summarize:

The new bracket must be installed with the proper amount of spacers to enable the Gyro instrument panel to remain floating under all conditions, no matter how severe the vibration or jar to the airframe.

The right hand, upper shock mounting must be spaced so that the instrument panel is level in level flight. The number of spacers required for the right hand bracket will be determined according to the number required to keep the left hand bracket floating.

E. AutoControl II and AltiMatic II Amplifiers (Replaces EL-35.)

Please be advised of the new models and part numbers of the amplifiers, when used in conjunction with the radio coupler.

AutoControl II amplifier, for use with the coupler, is model 1X217E-3; Piper Code number 751 262. Serial number P-939 and up no longer requires the cooling tube between the Directional Gyro and amplifier.

AltiMatic II amplifier, for use with the coupler, is model 1X293; Piper Code number 751 263. Serial number A-782 and up no longer requires the cooling tube between the Directional Gyro and amplifier.

In the past, all AutoControl II amplifiers shipped to you as replacements (Model 1X214E/753 877) have come to you with the D. G. wire positioned for use with a zero heading Directional Gyro. (See last page of EL-27 letter.)

The new model 1X217E-3/751 262 will be shipped to you with the D. G. wire positioned for a Course Selector Directional Gyro. It is not possible to use a zero heading Directional Gyro with radio coupling.

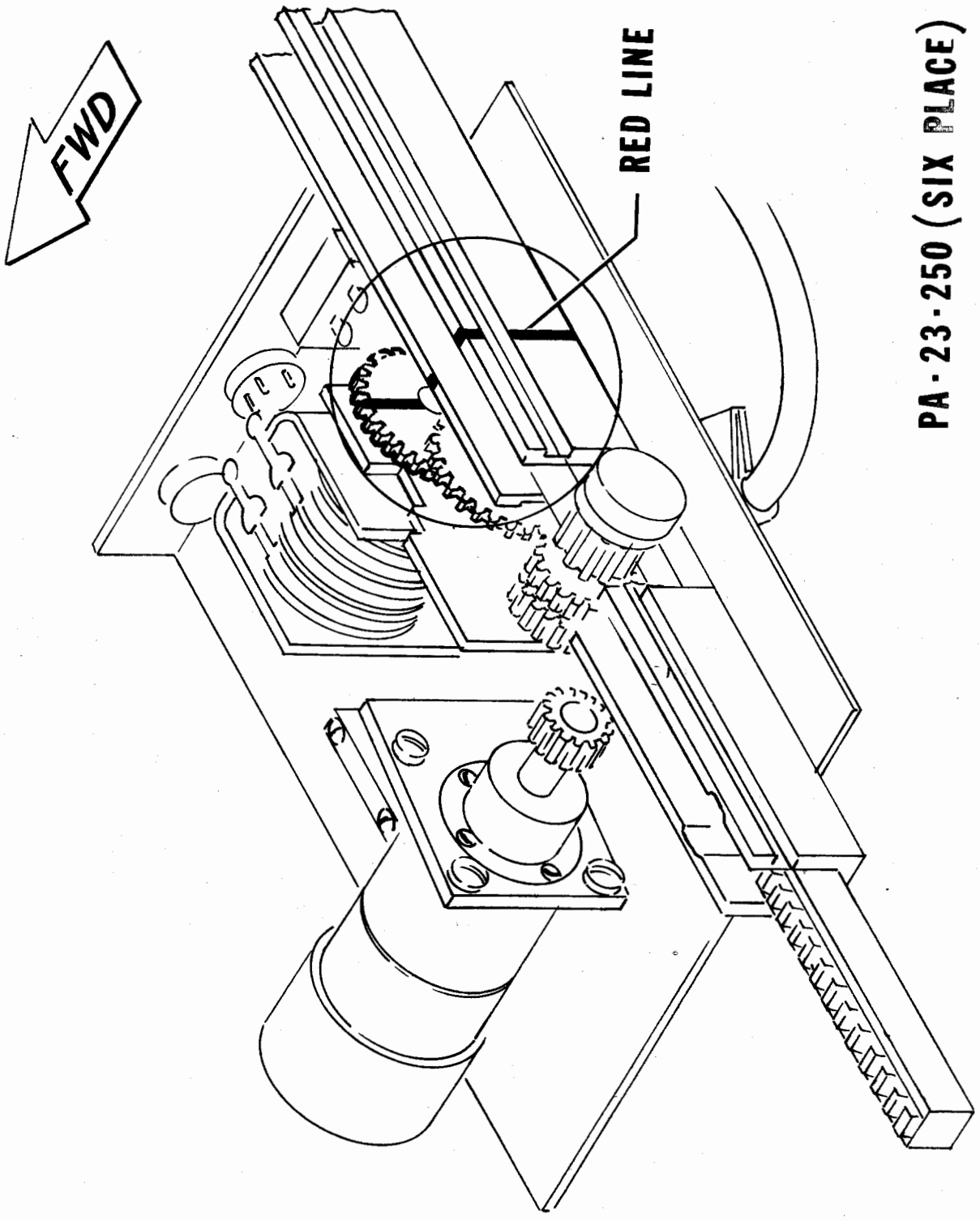
F. Timing of the New Rack and Pinion Pitch Servo (Replaces EL-39.)

In the past, it has been the practice to time either the Roll or Pitch follow-up Condenser to a single either dot or line on the follow-up gear, with one located on the adjacent bracket.

With the new Rack and Pinion type servo, you will find the follow-up gear now has two timing marks; one being a line and the other a double dot. Care must be exercised in the timing of this follow-up condenser so that the wrong timing mark is not used, which would result in the follow-up being timed 180° out. If the condenser is timed 180° off, this results in porpoising under flight conditions.

The reason for the double mark on this gear is brought about due to the fact that in the PA-30 and PA-24 type aircraft, the Rack and Pinion servo is mounted in the inverted position, which makes it rather difficult to time the follow-up. To assist in the timing, in these models of aircraft, the servo mounting plate has now been drilled with an elongated hole and a dot placed on either side of this inspection hole. Two procedures can be followed for timing the Pitch follow-up condenser; (1) Not requiring the use of a mirror and light, would be to simply line up the two dots on the follow-up gear with the dots on the inspection hole; (2) Using a mirror and light, align the follow-up gear so that the red line on the gear lines up with the red line on the rack. Refer to sketch on reverse side of this letter.

To check if the follow-up condenser has been properly timed, place the control wheel in position for level flight; move control wheel forward approximately two inches and observe that the condenser rotor is opening or reducing capacity.



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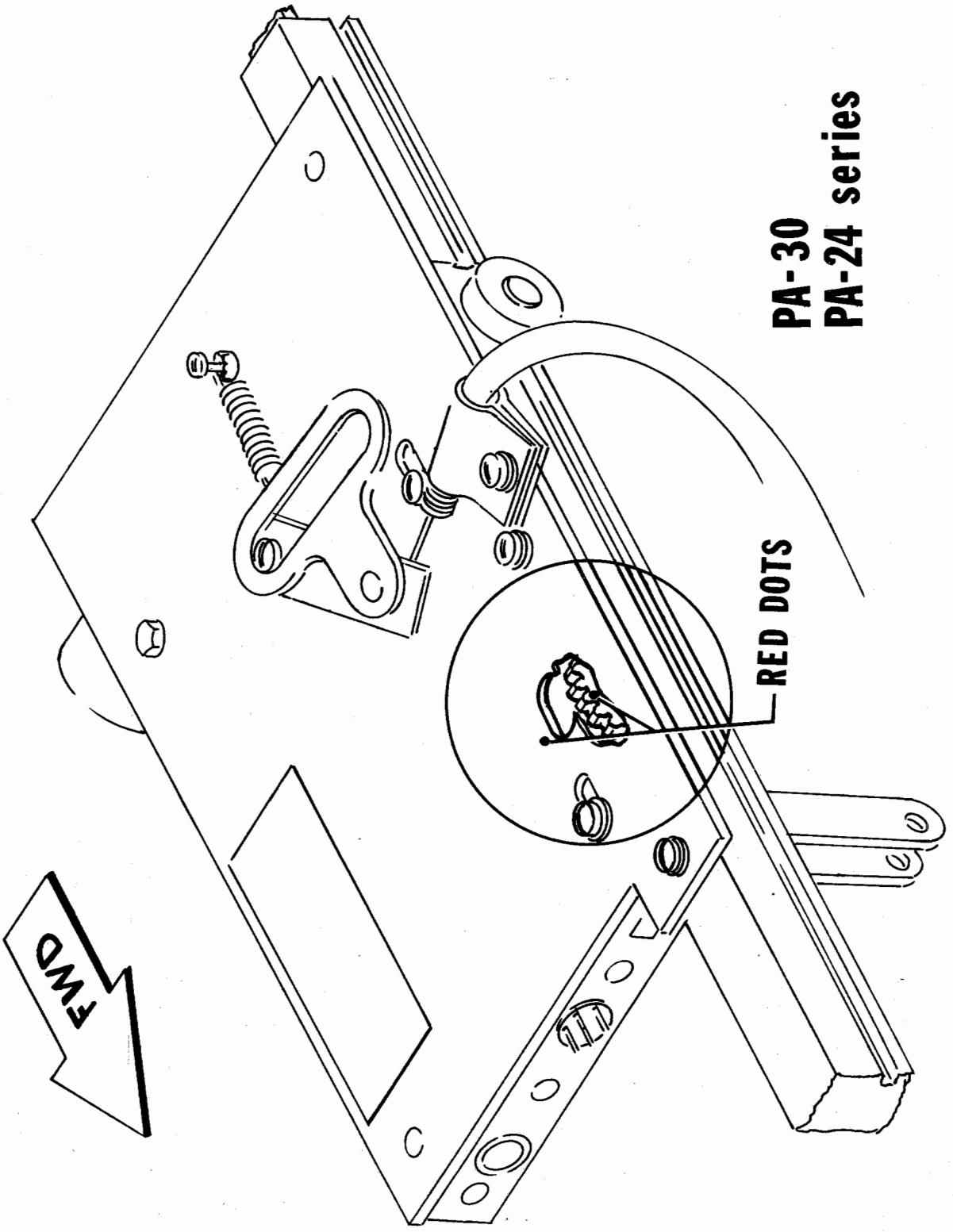

PA-30
PA-24 series
RED DOTS
FWD

G. Course Selector Directional Gyro for the AutoControl II in the PA-28 (Replaces EL-41.)

The Course Selector Directional Gyro, Piper Part No. 752 092, is available for use with the AutoControl II in the PA-28 Cherokee, for both factory installation as well as retrofit.

There are a small number of Cherokees out which will not accomodate the afore mentioned Directional Gyro without a slight modification to the instrument top deck.

The modification kit required to facilitate the use of the Course Selector Directional Gyro is Piper Part No. 756 890 and applies to the following aircraft:

KIT REQUIRED

PA-28-150-160-180 Cherokee. Serial No. 28-1761, up to and including No. 28-2052 will require this modification kit.

PA-28-235 Cherokee, Serial No. 28-10487, up to and including Serial No. 28-10590 will require the modification kit.

KIT NOT REQUIRED

PA-28-150-160-180 Cherokee, Serial No. 28-1 thru and including 28-1760A and Serial No. 28-2053 and up will not require the modification kit to accomodate the Course Selector.

PA-28-235 Cherokee, Serial No. 28-10000, up to and including 28-10486 and Serial No. 28-10591 and up, will not require the modification kit.

PA-28-140 Cherokee, Serial No. 28-20000 and up will not require the modification kit.

H. Lubrication of AltiMatic and AltiMatic II Pitch Servo (Replaces EL-48.)

The following applies to the AltiMatic Pitch Servo, model 1X222 (the original AltiMatic chain type servo) and the model 1X312 incorporated in the AltiMatic II. (Rack and pinion type servo.)

When it is deemed necessary that the slide-a-bushing of the chain servo or the rack of the rack and pinion servo require lubrication, the lubrication should be applied sparingly. The lubrication recommended is:

GENERAL ELECTRIC
Silicone Lubricant G-322L

This lubricant may be ordered from EDO-AIRE Mitchell, P/N 11M291 or it may be purchased from General Electric as their Silicone Lubricant, P/N G-322L.

NO OTHER LUBRICANT SHOULD BE APPLIED TO THIS SERVO.

If lubricant other than the above is applied, (or excessive lubricant is applied) it will be noted when operating the AltiMatic in sub-zero temperatures, the current drain may become excessive, causing the circuit breaker to open. In some instances, the amplifier has been thought defective or the cause for the circuit breaker to open, when actually the improper lubrication of the pitch servo in these models of aircraft and sub-zero temperatures causes the excessive current drain.

Also if the aircraft becomes cold soaked at sub-zero temperatures the force required to move the control wheel fore and aft may become excessive. Below -30°F the force required to overcome the servo actuator begins to rise substantially. However, in all installations the aircraft control systems are protected by the break-away linkage which will automatically disconnect when the control force exceeds a safe value.

The correct procedure to relubricate the chain type servo is to remove all previous lubrication from that rod which guides the slide-a-bushing. In applying the new lubricant, simply coat the rod over that area in which the slide-a-bushing operates. It is not necessary to remove the servo.

In the case of the rack and pinion servo, it will require the removing of the servo, as the rack must be removed from the servo for lubrication. With the rack removed from the servo, clean off all lubrication from both the rack and the channel. In relubricating, simply cover those surfaces of the rack, which come in contact with the channel, with a light film of Silicone Lubricant.

CAUTION

Do not get any lubrication on the friction disc of the rack and pinion servo.

I. AutoControl I and II/Altimatic I and II Test Equipment.(Replaces SE-7D.)

The test equipment and adapters required to check the I and II Piper Automated Flight Control System are listed below.

AUTOCONTROL I

66B10A Test Box
66A14A or 66X14A Roll Follow-up Adapter
30A61-T Roll Coaxial Cable
30A53-36 Servo Motor Cable
66A37 Dummy 52D22 Course Selector Directional Gyro
66B83-1 Output Meter

ALTIMATIC I

Roll only:

66B10A Test Box
66A14A or 66X14A Roll Follow-up Adapter
30A61-T Roll Coaxial Cable
30A53-36 Servo Motor Cable
66A37 Dummy 52D22 Course Selector Directional Gyro
66B83-1 Output Meter

Pitch only:

66B10A Test Box
30A53-36 Servo Motor Cable
66A24 Dummy Altitude Selector
66A36 Dummy 52B21 Horizon
* 66A38 Pitch Follow-up Adapter-Comanche
* 66A39 Pitch Follow-up Adapter-Apache/Aztec
* 30A78-42-T Follow-up Cable-Apache/Aztec CD-5
* 30A78-62-T Follow-up Cable-Comanche CD-5
30A79-T Altitude Selector Cable CD-10
66B83-1 Output Meter

* These items are employed according to model of aircraft.

AUTOCONTROL II

66B10A Test Box
30A53-36 Servo Motor Cable
* 66A44 Dummy Zero Heading Directional Gyro
30B116-1-T Coaxial Harness
* 66B58-A AltiMatic II Test Box Adapter (CD-1, CD-4, CD-29 and CD-30) Use CD-1 for Course Selector Direction Gyro.
66B83-1 Output Meter
* These items are employed according to type of Directional Gyro installed.

ALTIMATIC II

Roll only:

66B10A Test Box
66B58-A AltiMatic II Test Box Adapter (CD-1, CD-4, CD-29 and CD-30)
30D131-T Harness
66B83-1 Output Meter

Pitch only:

66B10A Test Box
* 66A24 Dummy Altitude Selector
* 30A79-T Altitude Selector Cable CD-10
66B58-A AltiMatic II Test Box Adapter (CD-1, CD-4, CD-29 and CD-30)
30D131-T Harness
66B83-1 Output Meter
* These items are not required unless the Pitch Command Box is being tested.

II SERIES RADIO COUPLER

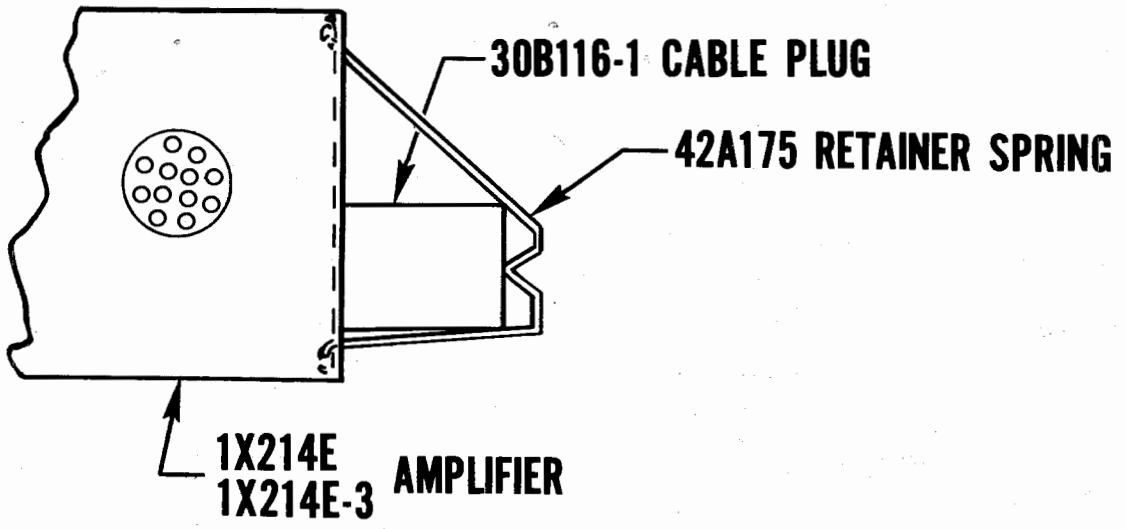
66D94 Omni Loc Coupler Tester
30B152 Coupler Cable

J. AutoControl II Harness Retainer Spring. (Replaces SE-4A.)

MODELS AFFECTED: PA-23-235, PA-23-250 (six place), PA-24, PA-28, PA-30 and PA-32.

The coaxial harness can becomes loose or disconnected at the AutoControl II amplifier causing erratic operation. To remedy this situation, we suggest the installation of a retainer spring (Piper part number 756 257).

The installation is very simple as it is a snap-on affair and this spring retainer is available to you on a no charge basis.

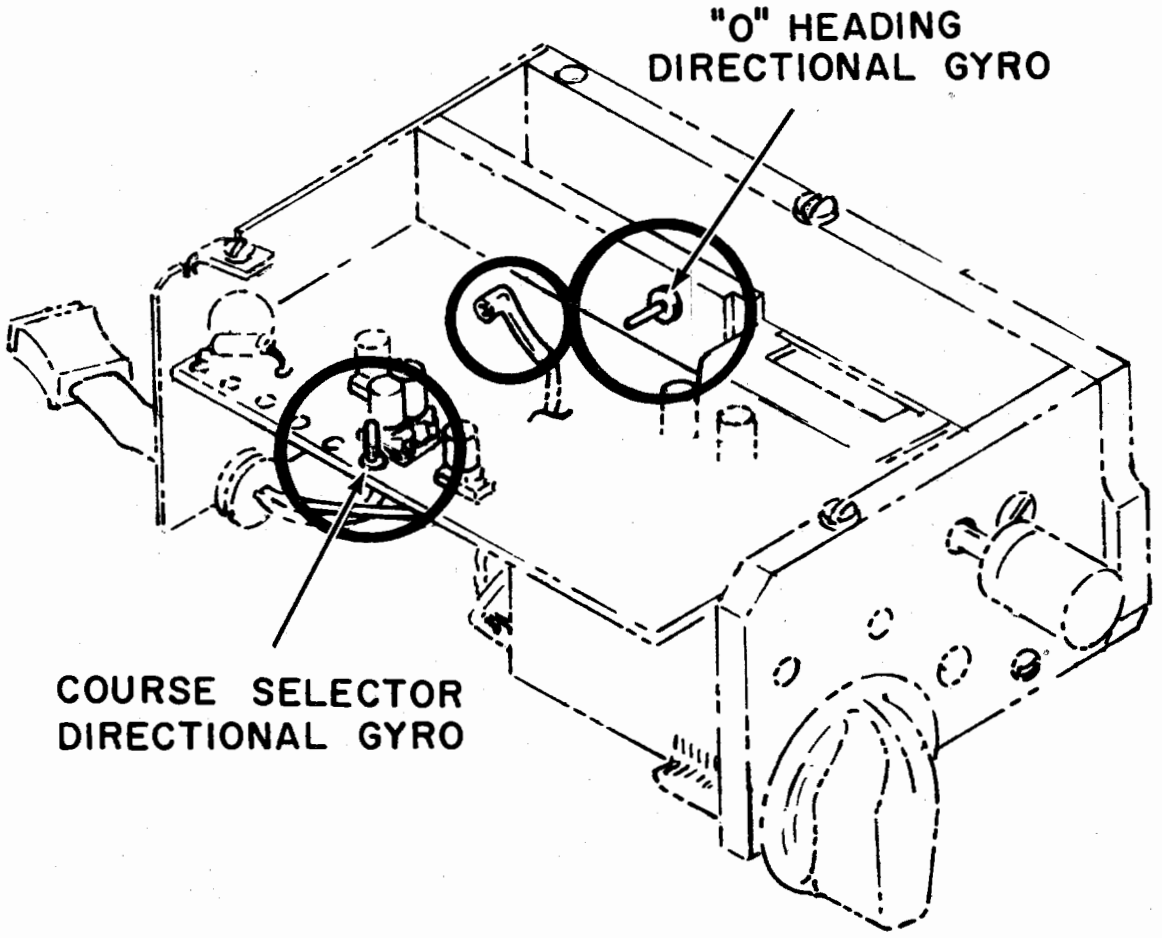


K. AutoControl II Set-up and Adjustment Procedures. (Replaces SE-25.)

SERVICE PERSONNEL

To assist you in setting-up the AutoControl II, we suggest you adhere to the following adjustment procedure.

You will please note that the AutoControl II Amplifier is so constructed as to accommodate its use on either the Zero Heading Directional Gyro or the Course Selector Directional Gyro by simply making a change of position of the blue wire located in the center of the stitch board. It will be necessary to remove the five (5) screws in the Amplifier cover, slide out the chassis and locate the blue wire as indicated in the drawing below.



AUTO CONTROL AMPLIFIER

Added: 5/1/69

AUTOCONTROL II SETUP PROCEDURE
PA-23, PA-24 and PA-30 AIRCRAFT

Before attempting ground or flight adjustments of the AutoControl, a check of the follow-up (F/U) of the roll servo should be made. Make certain "O" backlash exists between the gears and that the timing is correct.

To make adjustments of both the leveling condenser and the dummy D. G. will require the console face plate to be removed. The Turn/Trim knob should be re-installed after the face plate has been removed. (The console face plate should not be reinstalled until after in-flight checks have been completed.)

ZERO HEADING DIRECTIONAL GYRO

GROUND SETUP PROCEDURE:

A1. Follow-up timing. Ailerons neutral, timing mark should be lined up. Check for "O" backlash. (Backlash between the follow-up gears causes rocking in still air.)

A2. Artificial Horizon must indicate level flight, either apply external vacuum or start the engine.

A3. Vacuum regulator should be set for 4.8 to 5.1 inches.

A4. Set the Zero Heading Directional Gyro on 0^{o} and uncage.

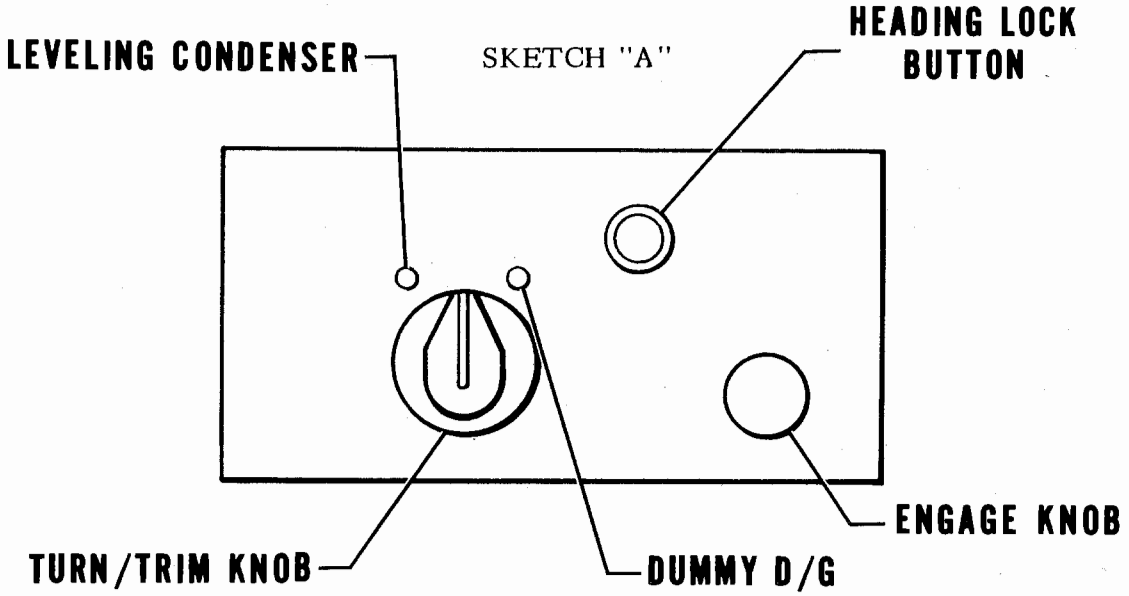
A5. Center the Turn/Trim knob.

A6. Set Heading Lock button on the console to the "IN" position. (D. G. in the circuit.)

A7. Push engage knob to "IN" position.

A8. If ailerons are not in neutral position, adjust roll leveling condenser through a small access hole on the amplifier for neutral ailerons. See Sketch A. (Use a small slot screwdriver and exercise care not to pry against trimmer.)

A9. Push Heading Lock button to "OUT" position, making certain Turn/Trim knob is centered. If control wheel does not stay in the same position, adjust the dummy Directional Gyro trimmer through small access hole. (See Sketch A.)



A10. If the adjustment, as outlined in the previous step (Step 9) has been made properly, the control wheel will not move as the Heading Lock button is pushed "IN" or "OUT" with the Directional Gyro set on 0°.

COURSE SELECTOR TYPE DIRECTIONAL GYRO

If the AutoControl II system incorporates the use of the Course Selector Directional Gyro in place of the zero heading Directional Gyro, ground setup procedures are the same, with the exception of item A4. The Directional Gyro can be set on any heading and the Course Selector must be carefully lined up to read the same heading.

ZERO HEADING DIRECTIONAL GYRO

FLIGHT SETUP PROCEDURE:

B1. 75% of power.

B2. MAKE CERTAIN RUDDER TRIM IS ADJUSTED TO CENTER THE BALL.

B3. Center the Roll/Trim knob.

B4. Push Heading Lock button to "IN" position.

B5. Set Directional Gyro on 0° and uncage.

B6. Engage roll by pushing the engage knob "IN". Aircraft should remain level and continue holding "O" heading.

B7. If the Directional Gyro drifts to either side of "O", a very slight adjustment of the roll leveling condenser will correct this condition.

B8. Push the Heading Lock button to "OUT" position and observe that control wheel did not move. If wheel moves, it will require touch up of the dummy D. G.

B9. With Heading Lock button in the "OUT" position, check both right and left banks made through the use of the Turn/Trim knob. Banks should not exceed 20^{o}, $\pm 4^{o}$. Right and left bank angles should be within 4^{o} of each other.

B10. Cage Directional Gyro and set on 0^{o} and uncage.

B11. Push Heading Lock button to "IN" position. (Turn/Trim Knob centered.)

B12. Cage the Directional Gyro and set to 90^{o} and uncage. Observe the degree of bank should be 16^{o}, $\pm 4^{o}$.

B13. Cage the Directional Gyro and set to 270^{o} and uncage. Observe the degree of bank should be 16^{o}, $\pm 4^{o}$.

B14. Check override. Should be 16 lbs., $\pm$ 3 lbs using a Hanson scale, Model #895 or similiar.

COURSE SELECTOR TYPE DIRECTIONAL GYRO

C1. Cage the Directional Gyro and set to same heading as the compass.

C2. Set Course Selector to same heading as Directional Gyro.

C3. Turn/Trim knob centered.

C4. Heading Lock button pushed to "IN" position.

C5. Engage by pushing in on engage knob.

C6. Aircraft should maintain this heading within $\pm 4^{o}$ on the remanufactured instruments or 1^{o} on new 3" instruments.

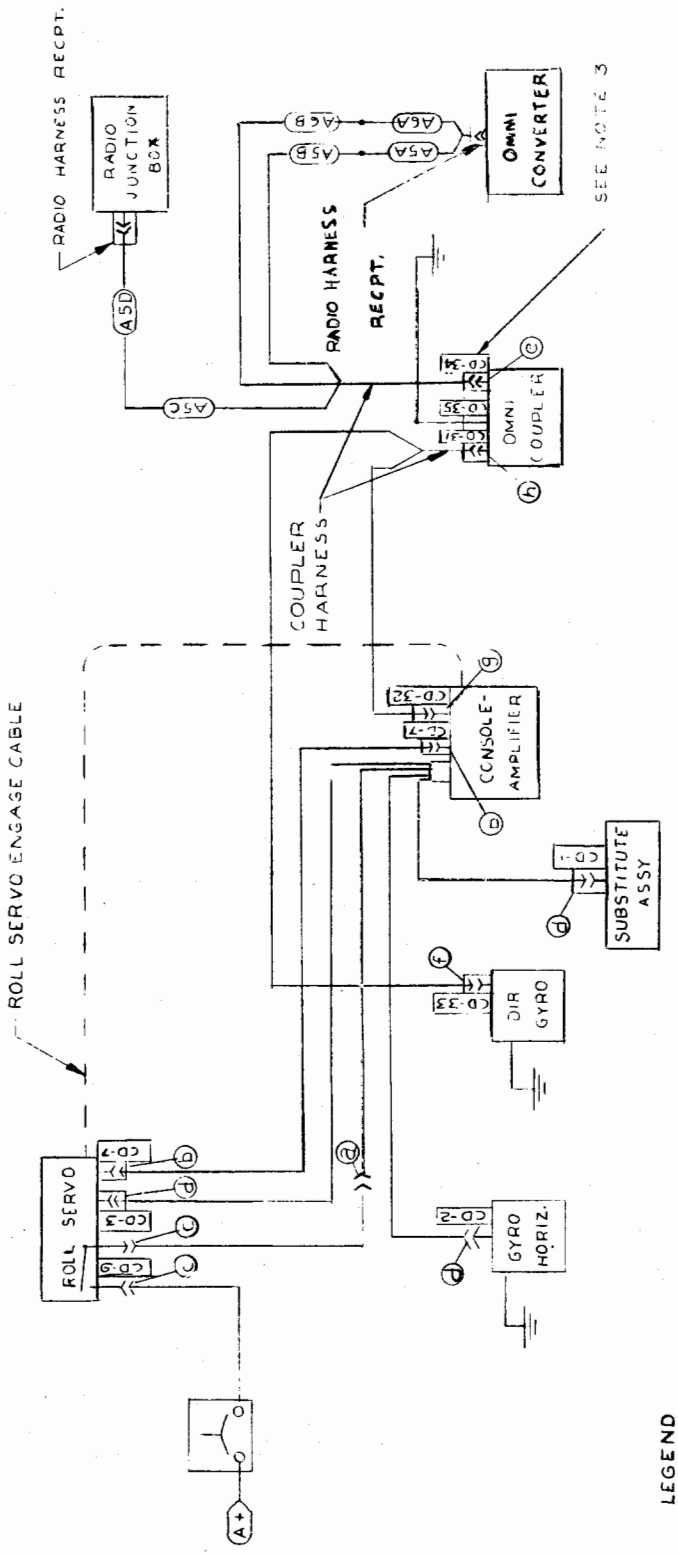
C7. Turn Course Selector 90° to the right of heading and observe bank angle on Artificial Horizon.

C8. Turn Course Selector 90° to the left and observe bank angle on Artificial Horizon.

C9. Adjust roll leveling condenser for equal banks.

C10. Check manual turns, both right and left, as in step #B9.

C11. Check override as in step B14 above.



LEGEND

CONNECTOR TYPE:

ⓐ DELCO
ⓑ ALDEN (3 PIN)
ⓒ WRISTLOCK
ⓓ BAYONET
ⓔ AMPHENOL (4 CONTACT)
ⓕ AMPHENOL (5 CONTACT)
ⓖ AMPHENOL (7 CONTACT)
ⓗ AMPHENOL (9 CONTACT)

WIRE CODE:

[XX-XX] AUTOPILOT (NO'S. APPLY TO TEST EQUIPMENT AND PROCEDURES)

(XXX) PIPER AIRCRAFT

NOTE:

1 ROLL CIRCUIT
CD-1 CD-2 & CD-3 (RADIO FREQ.)
CD-7 & CD-9 (12 V-D.C.)

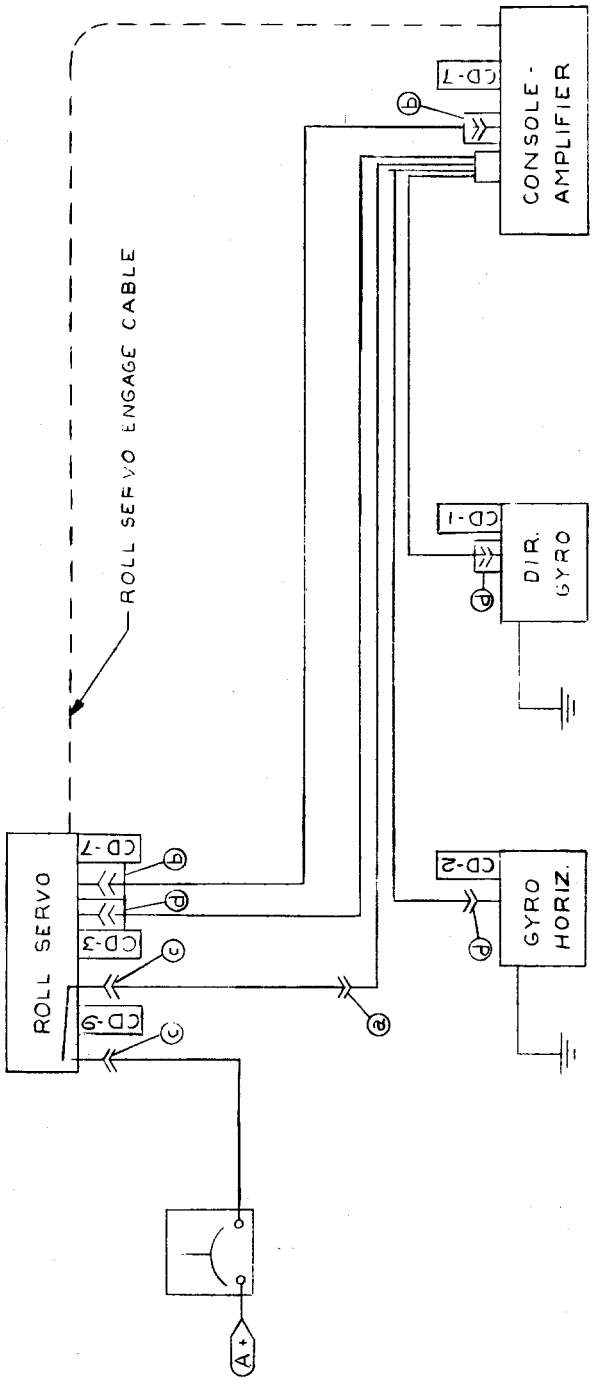
2 RADIO COUPLER CURCUIT
CD-31, CD-32, CD-33 & CD-34 (AUDIO FREQ)
CD-35 (LIGHT GND.)

3.

CD-34	CONNECTOR WIRES	VOR-4 ORS PLUG	JUNCTION BOX
PIN A TO	A5B/A5A TO	PIN I	—
PIN B TO	A6B/A6A TO.	PIN J	—
PIN C TO	A5C/A5D TO	—	MIKE KEY
PIN D TO	OPEN	—	—

4. Omit wire from pin C to A5C/A5D in Installations wherein loss of the Omni/Localizer signal does not occur on receiver to which coupler is connected at time of transmission on any available transmitter.

DRAWING 31669



NOTE:
1. ROLL CIRCUIT:
CD-1, CD-2 & CD-3 (RADIO FREQ)
CD-7 & CD-9 (12 V-D C)

LEGEND
. CONNECTOR TYPE:
ⓐ DELCO
ⓑ ALDEN (3 PIN)
ⓒ WRISTLOCK
ⓓ BAYONET
WIRE CODE.
[XX-XX] AUTOPILOT (NO'S APPLY TO TEST EQUIPMENT & PROCEDURES)

DRAWING 31668

L. AltiMatic II Set-Up Procedures. (Replaces SE-5.)

SERVICE PERSONNEL

To assist you in the setting-up of the AltiMatic II, which incorporates the use of the Automatic Pitch Trim, use these set-up procedures.

It is recommended that you study the information contained in this procedure at the time any components of the AltiMatic system (either Gyros, Amplifier, Harness or Servos) are changed. These procedures will then assure you that the AutoPilot will again control the aircraft correctly.

These set-up procedures can also be used on the AltiMatic II which does not incorporate the use of the Automatic Pitch Trim, by just omitting any reference to the Automatic Pitch Trim section.

ALTIMATIC II SETUP PROCEDURE
PA-23, PA-24 and PA-30 AIRCRAFT

Before attempting ground or flight adjustments of the AltiMatic, a check of the follow-up, (F/U) in both Roll and Pitch servos should be made.

GROUND SETUP PROCEDURE

ROLL CONTROL:

1. Check follow-up timing. Ailerons neutral, timing marks should be lined up. Make certain "zero" backlash is present. Backlash between the follow-up gears causes rocking in still air.

2. Cage Artificial Horizon or apply vacuum so Artificial Horizon indicates straight and level.

3. Adjust COURSE SELECTOR to match Directional Gyro heading.

4. Center TURN TRIM knob. (Position index straight up with equal travel available right and left.)

5. Turn aircraft master switch ON.

6. Rotate ROLL ENGAGE KNOB clockwise to full engage. Rock wheel, if necessary, to insure full gear mesh.

7. Adjust ROLL LEVELING CONDENSER as necessary to neutralize ailerons.

NOTE

Roll leveling condenser is located on the end of amplifier that the coaxial harness plugs into.

8. Turn COURSE SELECTOR clockwise 90° from Directional Gyro reading and note the approximate angle the wheel turns to. (Approximately 1 1/2" aileron deflection.)

9. Turn COURSE SELECTOR counterclockwise 90° to the left of the Directional Gyro reading and note that the wheel turns left approximately the same amount as it turned to the right.

10. Return COURSE SELECTOR dial to match with Directional Gyro.

11. Rotate TURN TRIM knob to full right and left travel and note that the wheel responds a few degrees each way.

12. Grasp wheel firmly and turn right and left to insure that the roll servo override operates.

NOTE

Approximately fifteen (15) pound force at the wheel rim is required to override servo. (See specifications for aircraft model.)

13. Roll ground setup is now complete. Minor adjustments may be necessary in flight test.

PITCH CONTROL:

1. The control wheel column should be marked as per Table I. (It is necessary to fly the aircraft to determine the Level Flight position. The flight should be made with full gas, no more than two people.)

2. Check follow-up timing. Pilot's control wheel positioned as per Table I under TIMING should find timing marks lined up. (To assist in holding control wheel in correct position, the aircraft master switch should be off. Engage the Pitch Knob, clockwise; this will lock the control wheel, enabling the timing to be checked or reset if necessary.)

3. Pull Trim circuit breaker for pitch ground check.

4. Install CD-10 cable in ALTITUDE SELECTOR receptacle J-16. (See figure 1.)

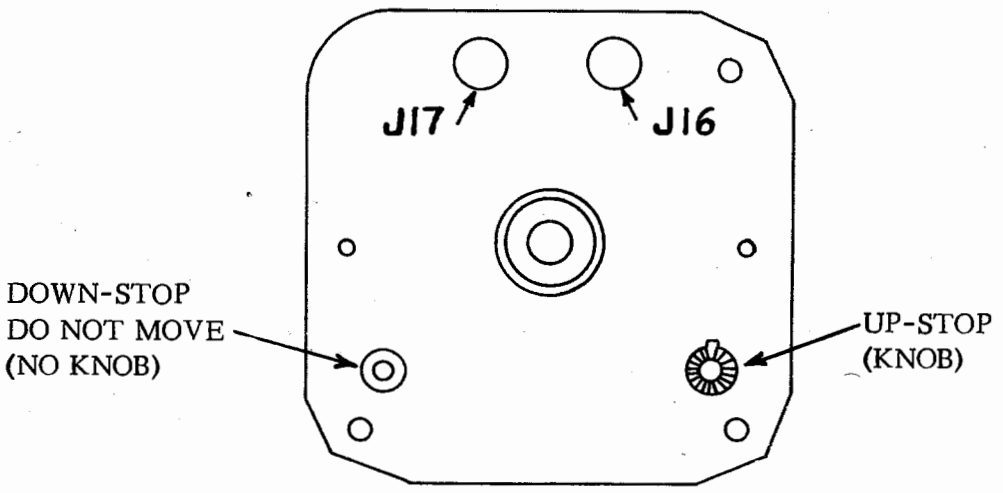


Figure 1. Altitude Selector

TABLE I		
MODEL	**75% POWER, FIND LEVEL FLIGHT POSITION BY FLIGHT CHECK**	**TIMING POSITION**
PA-23-160	Mark	L. F.
PA-23-250 and 235	Mark	L. F.
PA-24-250 and 260	Mark	L. F. + 1/2"
PA-24-400	Mark	L. F. + 1/2"
PA-30	Mark	L. F. + 3/8"
Measurement is taken from the instrument panel plate, along the under side of the control column, to the pilot's control wheel hub. After Level Flight position has been determined, pull pilot's control wheel rearward amount indicated in "TIMING POSITION" column and set follow-up.		

5. **Assure that PITCH CONTROL KNOB IS PULLED AFT and index is set to level flight position.**

NOTE

Make certain Pitch Control knob is properly installed on its shaft. In altitude position, (pulled aft) knob should travel approximately 10° more down than up. In manual position, (pushed in) knob should travel approximately 7:00 o'clock to 1:00. (See installation instructions.)

6. **With stabilator held in level flight position per step #1, adjust Pitch leveling condenser as necessary to cause both effort lights to go out.**

NOTE

Pitch leveling condenser is located on the end of the amplifier opposite the coaxial harness plug.

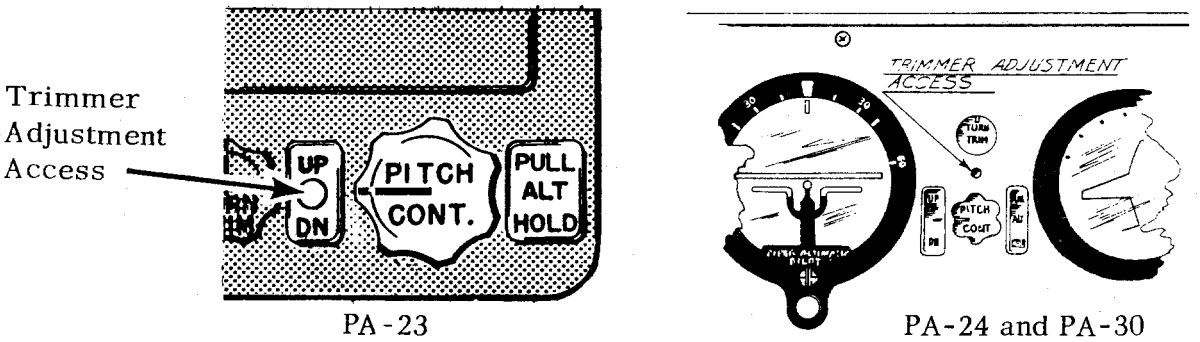
7. Rotate PITCH ENGAGE KNOB clockwise to full engagement. Rock stabilator if necessary to assure full gear mesh.

8. Push PITCH CONTROL knob forward to manual pitch position.

9. Adjust "dummy" altitude selector trimmer as necessary to retain level flight position of stabilator. (Step #1.)

NOTE

Trimmer access hole is located between TURN TRIM and PITCH CONTROL knobs. (See Figure 2.)



PA-23 PA-24 and PA-30

Figure 2. Trimmer Access Hole

10. Push and pull PITCH CONTROL KNOB fore and aft and note that no change in control column position results.

11. Push PITCH CONTROL knob into manual pitch position.

12. Install CD-10 cable in Altitude Selector receptacle J-17. (See Figure 1.)

13. Pull PITCH CONTROL knob aft to Altitude control position.

14. Rotate ALTITUDE SELECTOR KNOB counterclockwise until control column stops traveling forward. Adjust Pitch leveling condenser on amplifier so that control column stops aft of the level flight mark, as indicated in Table II.

15. Rotate ALTITUDE SELECTOR KNOB clockwise until control column stops traveling rearward. Adjust UP stop of Altitude Selector until control column stops forward of the level flight mark, as indicated in Table II.

16. Rotate ALTITUDE SELECTOR KNOB counterclockwise until level flight position is obtained on control column.

17. Adjust CALIBRATOR KNOB to have Altitude Selector dial read, FIELD ELEVATION.

18. Pitch is now set up as close as possible on the ground. Minor adjustments will be necessary during flight test.

19. Reset Trim circuit breaker.

TABLE II

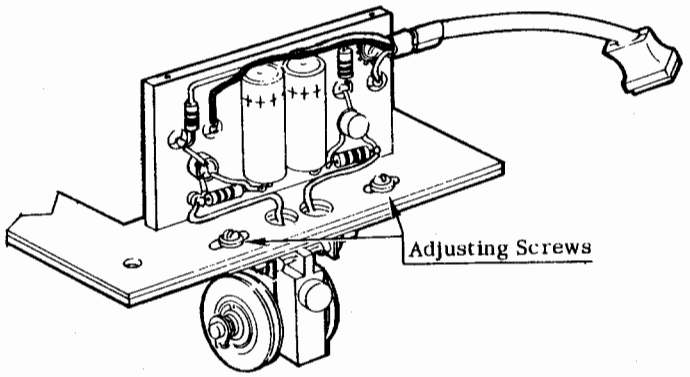
MODEL	REARWARD TRAVEL FROM LEVEL FLIGHT	FORWARD TRAVEL FROM LEVEL FLIGHT
PA-23-160	.6 in.	.25
PA-23-250 and 235	.6 in.	.25
PA-24-250 and 260	.8 in.	.4 in.
PA-24-400	.8 in.	.4 in.
PA-30	.8 in.	.4 in.

TRIM SENSOR

CENTERING SENSOR CONTACT POINTS:

There are three types of Trim Sensors employed. The original was the 1D310-124 (128) series. A replacement for the original type is the 1D310-124 (128) Dash 1 series. The 1C365-152 (151) series is similar to the replacement series less Amplifier.

1. Remove sensor cover and loosen adjusting screws. (See Fig. 3, Page 6.) It is not necessary to completely remove screws holding cover, as cover is slotted.



Piper Pt. No. 756 198 (1D310-124)
756 212 (1D310-128)

Figure 3. Trim Sensor

2. The stabilator should be blocked to approximately LEVEL FLIGHT position. (A suggested method would be to insert, between the lower portion of the tail cone and the Trim tab tube, some folded cardboard.)

3. With the adjusting screws able to move freely in their slots, grasp the two stabilator cables and evenly pull upward, then release. This allows the sensor to find its own center of cable tension.

4. Tighten adjusting screws.

*5. With the master switch ON, partially engage the PITCH engage knob. (Engage just enough to activate micro-switch on Pitch Servo, but not to engage the Pitch Servo gears.) This will electrically activate the Pitch Trim Servo circuit.

6. Check for correct centering by exerting a slight forward pressure on the control wheel then immediately removing the pressure while observing the Trim crank. Trim crank should start trimming DOWN. Servo may or may not stop after pressure is released, but should not reverse direction.

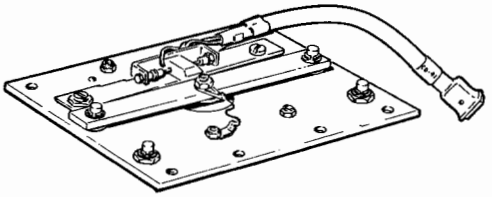
   A slight amount of back pressure should next be applied to the control wheel and immediately released. Trim crank should trim UP. Servo may or may not stop after pressure is released, but should not reverse direction.

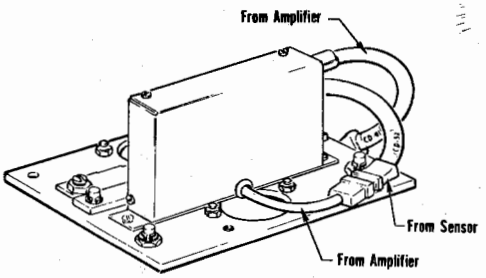
* An alternate method of centering Trim Sensor would be through the use of the Output Meter, #66B83-1 (753 649).

6. (con't.) If it is necessary to change the position of the Sensor contacts, moving the dual contacts to the outboard side of the aircraft on the PA-24 and PA-30 series, results in DOWN trim. The opposite is true on the PA-23, moving the contacts to the outboard side results in UP trim.

7. Completely disengage Pitch engage knob (counterclockwise).

8. Unblock Stabilator.





Piper Pt. No. 756 248 (1C365-152)
756 249 (1C365-151)

Piper Pt. No. 756 255 (1D310-124-1)
756 254 (1D310-128-1)

Figure 4. Trim Sensor

1. The stabilator should be blocked to approximately level flight position. (A suggested method would be to insert some folded cardboard between the lower portion of the tail cone and the trim tab tube.)

2. The stabilator cables should be threaded through the sensor pulleys as shown below.

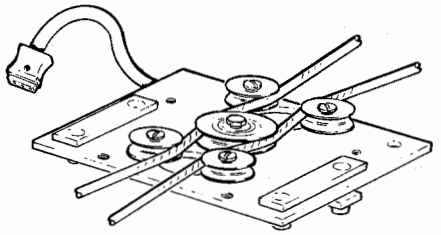


Figure 5. Trim Sensor

3. Before tightening the sensors support brackets, make sure the sensor pulleys are parallel to the stabilator cables. If the pulleys are parallel to the stabilator cables, the sensor will be self centering.

4. Tighten the sensor and support brackets in place, being careful not to apply pressure to the sensor or the support brackets so as not to effect the sensors self centering ability.

5. To insure the sensor has been properly installed, reach below the sensor plate and check that each pulley can be moved up and down along its supporting shaft. (All four of the outside idler pulleys must be floating between their limits.) Recheck to insure that the cables are on all pulleys.

6. With master-switch ON, partially engage the PITCH ENGAGE KNOB. (Engage just enough to activate the micro-switch on the Pitch Servo but do not engage the pitch servo gears.)

7. Check for correct centering by exerting a slight forward pressure on the control wheel and then immediately removing the pressure while observing the Trim Crank. Trim Crank should start trimming DOWN. Servo may or may not stop after pressure is released, BUT SHOULD NOT REVERSE DIRECTION.

8. A slight amount of back pressure should be applied to the control wheel and immediately released. Trim Crank should start trimming UP. Servo may or may not stop after pressure is released, but SHOULD NOT REVERSE DIRECTION. DON'T FORGET THERE WILL BE A THREE SECOND TIME DELAY, BEFORE THE TRIM CRANK WILL BEGIN TURNING AFTER PRESSURE IS APPLIED.

*9. If steps SEVEN and EIGHT cannot be accomplished, it is necessary to adjust the trim sensor contacts. Loosen the BOTH screws of the Contact Support Bar. (See Fig. 6.) By rotating the Eccentric Nut (found under the one screw) it is possible to center the contact points as required. After adjusting the Eccentric Nut, lock contact points in position by tightening the BOTH screws of the Contact Support Bar. REPEAT steps 6 through 8.

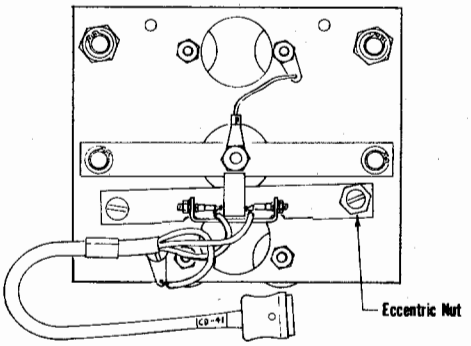


Figure 6. Trim Sensor

* An alternate method of centering the trim sensor contacts would be through the use of OUTPUT METER, #66B83-1 (753 649).

NOTE: When the new "plate type" replacement Trim Sensors, 756 255 (1D310-124-1) and 756 254 (1D310-128-1) are installed in an aircraft, it will no longer be necessary to remove the Trim Sensor when replacing the amplifier. If an amplifier fails, simply unplug the faulty amplifier and remove from the amplifier support bar and replace the new amplifier in place of the faulty one. This will eliminate having to reset the Trim Sensor contacts.

TOGGLE SWITCH ELECTRIC TRIM:

Check Pitch Trim for manual electric operation by pushing Trim Toggle Switch on pilot's control wheel forward. Trim Crank should trim DOWN. Moving toggle switch rearward should result in UP trim.

If trim fails to operate with use of toggle switch, check to make certain Pitch Engage Knob is full OFF. If so, then micro-switch in Pitch Servo has not been correctly set. Toggle switch is inoperative when AutoPilot is engaged. The toggle switch completes the ground path for Trim circuit only with Pitch Servo in the disengaged position. (See drawing No. 31969.)

PUSH-BUTTON ELECTRIC TRIM:

The earlier systems incorporated a push-button on the pilot's control wheel in place of the toggle switch. In this system, the foregoing steps apply, except Item 9 above. It will require the push-button to be depressed and at the same time, push control wheel to its forward stop. The pressure must be held for three seconds before the Trim crank will start. (This is the time delay in the circuit.)

To check UP trim, pull control wheel full back, at same time depressing button, Trim crank should crank in UP trim. (See drawing No. 25240.)

LOCATION OF SENSOR:

PA-24 and PA-30 series - under rear seat - left side.

PA-24 and PA-30 series, six place - under floor, behind spar, in front of left center seat.

PA-23 - under floor, behind spar, in front of left center seat.

Remove from front seat end of each track, one screw, slide carpet rearward, remove access plate over sensor. (Later models have access plate in carpet.)

FLIGHT SETUP PROCEDURE

To assure full utility of the AltiMatic II AutoPilot under various flight conditions of load, power and speed, the AutoPilot should be setup in the flight configuration as outlined below:

1. Full fuel load.
2. No more than two people aboard. (Front seats only.)
3. No baggage load.
4. 75% power.
5. MAKE CERTAIN RUDDER TRIM IS ADJUSTED TO CENTER THE BALL.

NOTE

If 75% power cannot be maintained at altitudes above 6,000 feet, allowance must be made under circumstances where flights must be made above 6,000 feet.

ROLL CONTROL:

1. Set Directional Gyro to read with compass.
2. Set Course Selector to same heading as Directional Gyro.
3. Set TURN TRIM knob with index mark straight up.
4. Rotate ROLL ENGAGE knob fully clockwise. Rock wheel, if necessary, to assure full gear mesh on roll servo. (Check ball is centered.)
5. Set Course Selector for a 90° heading change to the right. Observe the bank angle as indicated on Artificial Horizon during turn.
6. Set Course Selector for a 90° heading change to the left. Observe bank angle during aircraft turn.
7. If left and right banks are unequal, adjust the roll leveling condenser as necessary to obtain equal banks.

8. Allow aircraft to stabilize on heading and note that selected course and Directional Gyro read the same. Minor variations (up to 4°) may be corrected with the TURN TRIM knob for precise alignment of Directional Gyro and selected course.

9. Roll setup is now complete.

PITCH CONTROL:

1. Pull PITCH CONTROL knob aft to altitude control position. (Note that knob index indicates level flight.)

2. Pull out TRIM circuit breaker. Trim aircraft for hands-off level flight.

*3. Insert CD-10 cable in Altitude Selector receptacle J-16. (See Figure 1.)

*4. Observe effort lights. If either light is on, adjust pitch leveling condenser until both lights are out.

*5. Rotate PITCH ENGAGE knob fully clockwise. Slightly rock stabilator, if necessary, to assure full gear mesh of the pitch servo.

*6. Note that aircraft maintains level flight. Adjust pitch leveling condenser if necessary, to maintain level flight.

*7. Disengage pitch servo.

*8. Install CD-10 cable in Altitude Selector receptacle J-17. (See Figure 1.)

9. Turn Altitude Selector knob in the proper direction to cause both effort lights to go out. Example: If DOWN effort light is on, Altitude Selector knob must be turned clockwise toward a higher indicated altitude.

10. Engage pitch servo. Aircraft is now on altitude control.

11. Adjust altitude calibration knob until altitude selector dial reads the same as altimeter.

12. Slowly turn Altitude Selector knob counterclockwise to at least 2,000 feet below indicated altitude.

* Steps 3 thru 8 can be omitted if CD-10 is not easily accessible in flight.

13. Allow aircraft speed to stabilize. Maintain 75% power.

14. Adjust Pitch leveling condenser as necessary to obtain descent speed as shown on speed table. (See Table III.)

TABLE III

Model	Climb Speed MPH	Descent Speed MPH
PA-23-250-235	130 - 140	No more than 15 M.P.H. above I.A.S. at 75% power trimmed for level flight.
PA-23-160	120 - 130	
PA-24-250-260	130 - 140	
PA-30	130-140	
PA-24-400	145-155	200 - 210 at 75% power.

15. Turn Altitude Selector knob clockwise until UP effort light comes on. Slowly continue clockwise rotation until Altitude Selector dial reads at least 2,000 feet above indicated altitude.

16. Allow aircraft speed to stabilize. Maintain 75% power.

17. Adjust UP stop on Altitude Selector, if necessary, to obtain climb speed as shown on speed table. (See Figure 1 and Table III.)

18. Allow aircraft to seek and maintain an altitude until full cruise speed is obtained. Maintain 75% power.

19. Push Pitch control knob in and quickly pull back to altitude control position. Do not rotate knob.

20. Observe if either effort light came on momentarily at time knob was pushed in.

21. Adjust Altitude Selector "dummy" trimmer until PITCH CONTROL knob can be pushed in and out with no appreciable change in pitch attitude. (See Figure 2.)

22. Check Altitude Selector dial and recalibrate to altimeter if necessary.

23. Pitch setup is now complete.

24. Reset TRIM circuit breaker.

25. A recheck of the climb and descent airspeed can be made with the Trim now active. It will be noted there is approximately a five m.p.h. airspeed increase in descent.

NOTE

Do not rotate the shaft on the Altitude Selector that has no knob. This is the DOWN stop and can only be adjusted with special equipment. (See Figure 1.)

TRIM SENSOR FLIGHT CHECK:

1. To determine if Trim Sensor is correctly centered on stabilator cables, allow the aircraft to lock on a selected altitude and the airspeed stabilize. Disengage Pitch Engage Knob momentarily, aircraft should maintain level flight. Dial in a 500' UP altitude change and after airspeed has stabilized, again disengage Pitch Axis and aircraft should maintain this attitude. Make same check DOWN.

2. If Trim Sensor has been correctly centered, the aircraft will not change attitude upon disengaging the Pitch Axis. If an appreciable attitude change does take place, it will require recentering of the Trim Sensor as called out in Items 1 thru 6 under "Ground Setup Procedure".

PA-23:
If too much <u>down</u> trim; move sensor contacts <u>outboard</u> for <u>up</u> trim. (On 756 198 and 756 212 series Sensors.)

PA-24 and PA-30:
If too much <u>down</u> trim; move sensor contacts <u>inboard</u> for <u>up</u> trim. (On 756 198 and 756 212 series Sensors.)

OUTPUT METER NO. 66B83-1
(Piper Part No. 753 649)

The output meter, #66B83-1, comes complete with a special cable, #30B177 and special Adaptor, Part No. 66A119. (See EL-15E, Item 17.)

1. Checking the output of AutoControl or AltiMatic amplifiers.

2. Finding the "center" of the contact points on the automatic Pitch Trim Sensor.

SELECTIVITY CHECK:

To check the output or selectivity of the AutoControl or AltiMatic amplifier, it is not necessary to use the special cable, #30B177. The CD-7 plug of the harness is connected directly to the meter to check roll or CD-8, to check pitch. The meter incorporates a dummy load and can be read direct. From the green dot to the green dot, amplifier selectivity should be .5 mmf as read in conjunction with selectivity knob of the #66B10-A test box. (.4 to .7 is acceptable.)

CENTERING TRIM SENSOR CONTACTS:

CAUTION: The transistors of the Trim Sensor will be damaged unless the sensor is connected to ground. This is particularly important in checking the sensor on the bench. If sensor is installed in the aircraft, it is grounded through the installation of the sensor to the airframe.

1. Block stabilator in LEVEL FLIGHT position.

2. Aircraft master "OFF".

3. Connect either end of the cable, #30B177, to output meter.

4. Connect the other end of the cable to Trim Sensor at CD-41.

5. Connect the alligator clip of cable #30B177 to 12 Volts POSITIVE.

6. Aircraft master switch "ON".

The contact points are properly centered when the meter reads zero output.

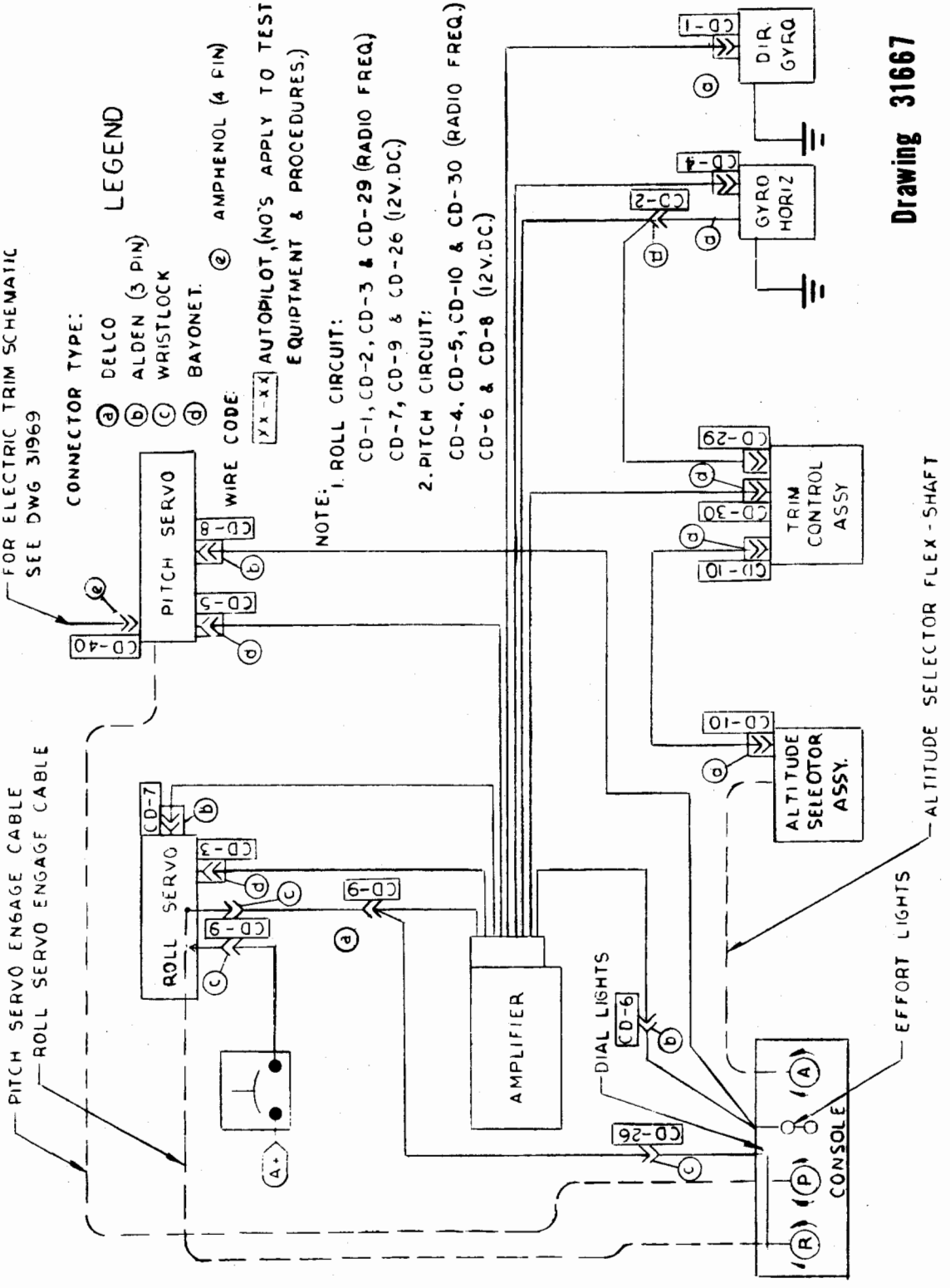
TRIM SENSOR DELAY CIRCUIT:

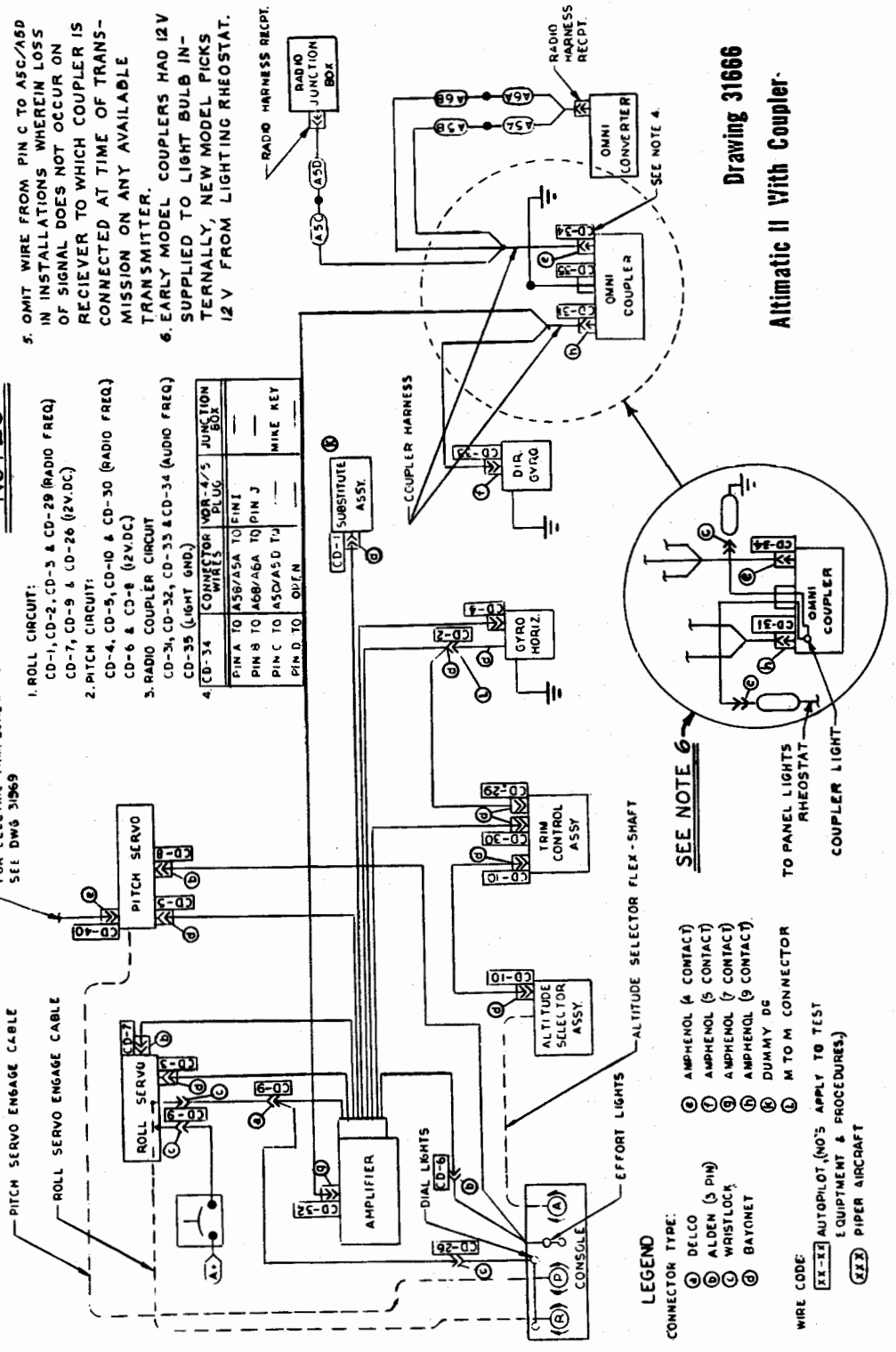
To check if the delay circuit of the Trim Sensor is functioning properly, cause the sensor contact to "make" on either side and at the same time observe meter movement. The needle should show immediate movement during the initial part of its' travel, and then the rate of needle movement should taper off until the needle comes to rest in the region of the green dot. (Approximately .25 on scale.)

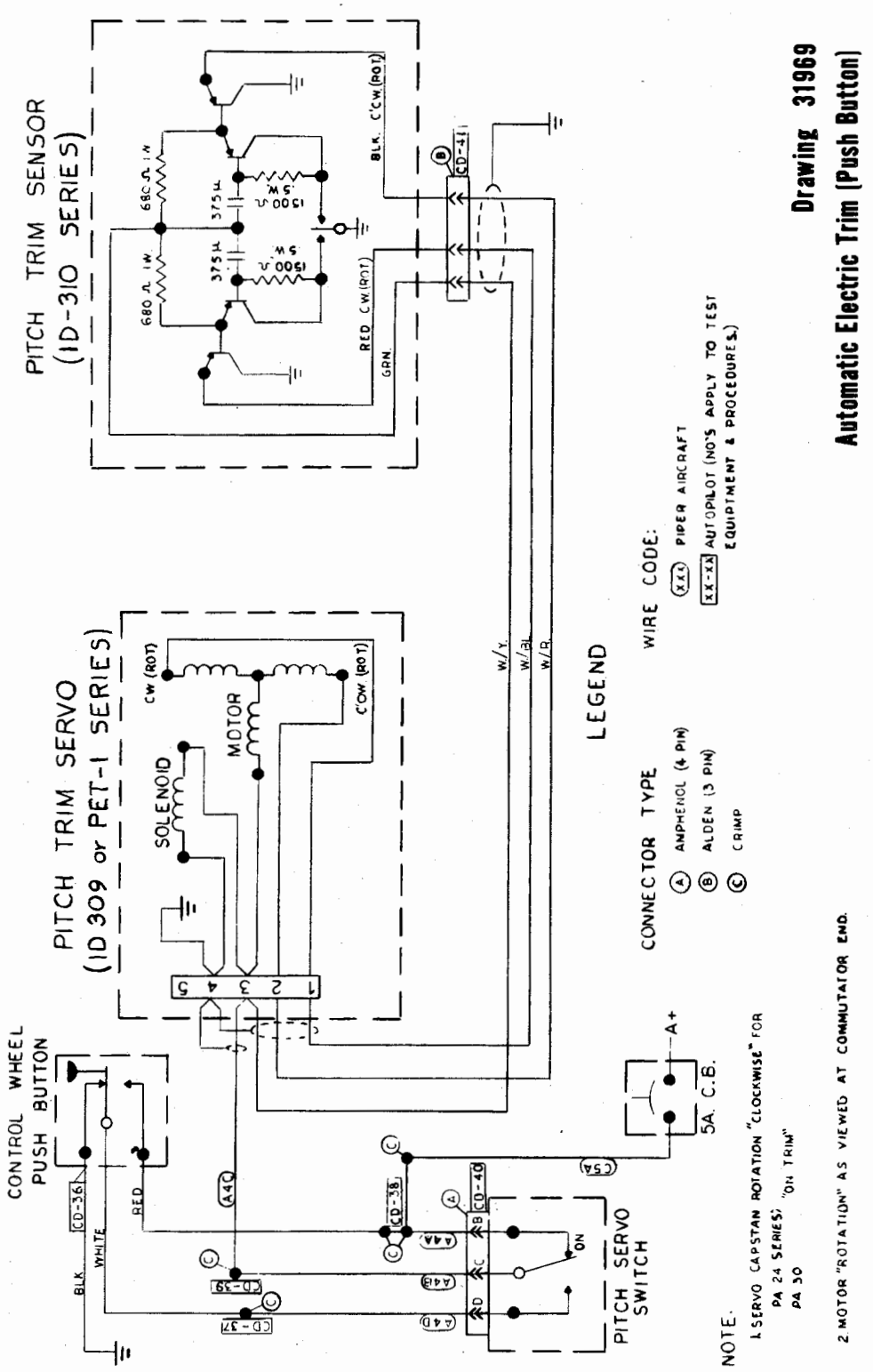
Make the same check of the opposite contact; this will check both UP or full DOWN trim action of the sensor.

If meter does not show this change of movement, it is an indication that the delay circuit is not functioning. This would show up in flight as an overactive or oversensitive trim.

If meter deflects only to one side, at the time contacts on sensor are switched, this would show up in flight by trim servo cranking in either full UP or full DOWN trim while on the AltiMatic.

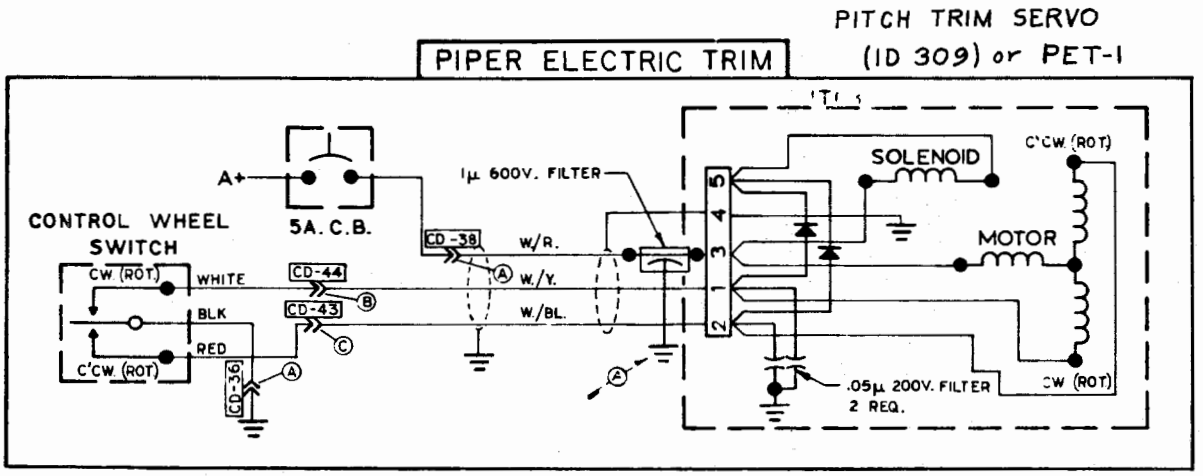

Drawing 31667
LEGEND
CONNECTOR TYPE:
ⓐ DELCO
ⓑ ALDEN (3 PIN)
ⓒ WRISTLOCK
ⓓ BAYONET
ⓔ AMPHENOL (4 PIN)
WIRE CODE: XX-XX AUTOPILOT, (NO'S APPLY TO TEST EQUIPTMENT & PROCEDURES.)
NOTE: 1. ROLL CIRCUIT:
CD-1, CD-2, CD-3 & CD-29 (RADIO FREQ)
CD-7, CD-9 & CD-26 (12V.DC.)
2. PITCH CIRCUIT:
CD-4, CD-5, CD-10 & CD-30 (RADIO FREQ.)
CD-6 & CD-8 (12V.DC.)
FOR ELECTRIC TRIM SCHEMATIC SEE DWG 31969
PITCH SERVO ENGAGE CABLE
ROLL SERVO ENGAGE CABLE
ALTITUDE SELECTOR FLEX-SHAFT
EFFORT LIGHTS
DIAL LIGHTS
PITCH SERVO
ROLL SERVO
AMPLIFIER
DIR. GYRO
GYRO HORIZ
TRIM CONTROL ASSY
ALTITUDE SELECTOR ASSY.
CONSOLE
CD-1
CD-2
CD-4
CD-5
CD-6
CD-7
CD-8
CD-9
CD-10
CD-26
CD-29
CD-30
CD-40


Drawing 31666
Altimatic II With Coupler
NOTES:
1. ROLL CIRCUIT:
CD-1, CD-2, CD-3 & CD-29 (RADIO FREQ)
CD-7, CD-9 & CD-26 (12V.DC.)
2. PITCH CIRCUIT:
CD-4, CD-5, CD-10 & CD-30 (RADIO FREQ.)
CD-6 & CD-8 (12V.DC.)
3. RADIO COUPLER CIRCUIT
CD-31, CD-32, CD-33 & CD-34 (AUDIO FREQ)
CD-35 (LIGHT GND.)
4. CD-34 CONNECTOR WIRES | VOR-4/5 PLUG | JUNCTION BOX
PIN A TO A56/A5A TO FIN I — —
PIN B TO A60/A6A TO PIN J — —
PIN C TO A50/A5D TO — MIKE KEY —
PIN D TO GVIN — —
5. OMIT WIRE FROM PIN C TO A5C/A5D IN INSTALLATIONS WHEREIN LOSS OF SIGNAL DOES NOT OCCUR ON RECIEVER TO WHICH COUPLER IS CONNECTED AT TIME OF TRANSMISSION ON ANY AVAILABLE TRANSMITTER.
6. EARLY MODEL COUPLERS HAD 12V SUPPLIED TO LIGHT BULB INTERNALLY, NEW MODEL PICKS 12V FROM LIGHTING RHEOSTAT.
FOR ELECTRIC TRIM SCHEMATIC SEE DWG 31969
PITCH SERVO ENGAGE CABLE
ROLL SERVO ENGAGE CABLE
PITCH SERVO
ROLL SERVO
AMPLIFIER
DIAL LIGHTS CD-6
EFFORT LIGHTS
CONSOLE
ALTITUDE SELECTOR FLEX-SHAFT
ALTITUDE SELECTOR ASSY.
TRIM CONTROL ASSY
GYRO HORIZ.
DIR. GYRO
SUBSTITUTE ASSY.
COUPLER HARNESS
RADIO JUNCTION BOX
RADIO HARNESS RECPT.
OMNI CONVERTER
OMNI COUPLER
SEE NOTE 4.
SEE NOTE 6
TO PANEL LIGHTS RHEOSTAT
COUPLER LIGHT
LEGEND
CONNECTOR TYPE:
A DELCO
B ALDEN (3 PIN)
C WRISTLOCK
D BAYONET
E AMPHENOL (4 CONTACT)
F AMPHENOL (5 CONTACT)
G AMPHENOL (7 CONTACT)
H AMPHENOL (9 CONTACT)
K DUMMY DG
L M TO M CONNECTOR
WIRE CODE:
XX-XX AUTOPILOT, (NO'S APPLY TO TEST EQUIPTMENT & PROCEDURES.)
(XX) PIPER AIRCRAFT

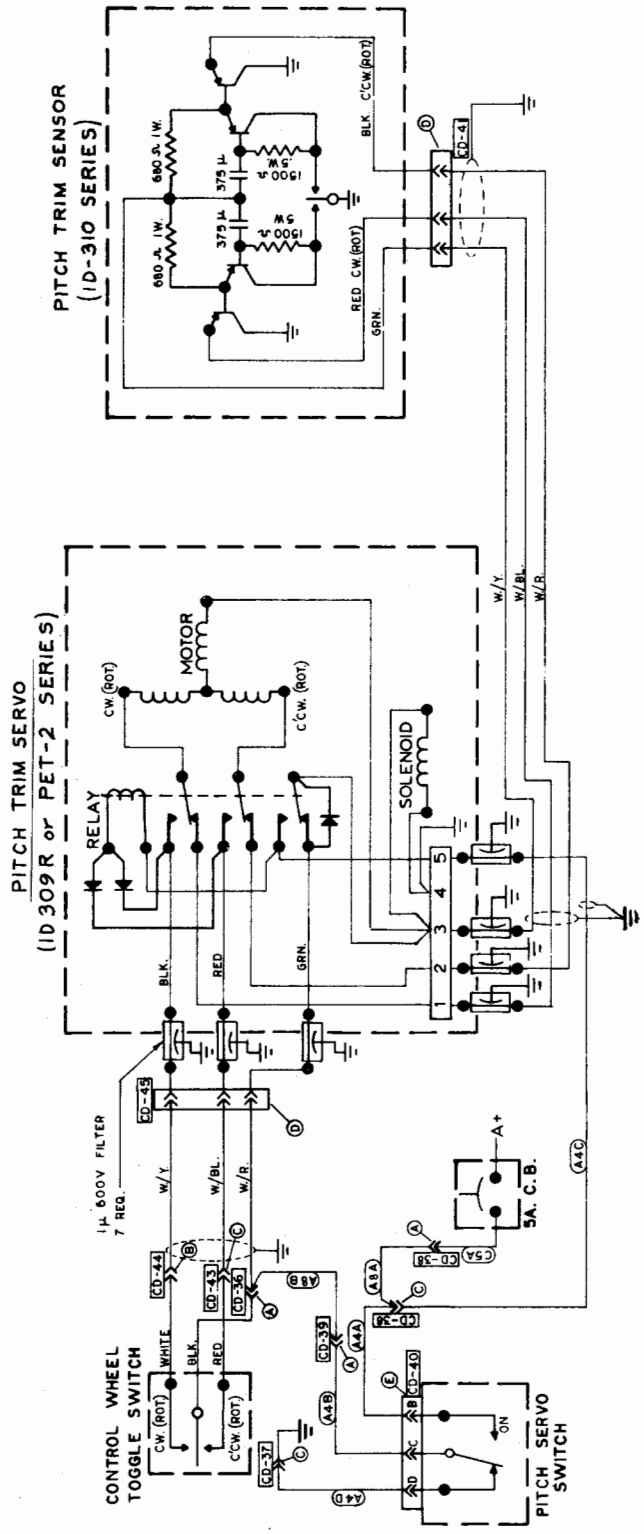


Drawing 31969

Automatic Electric Trim (Push Button)



Drawing 25240
Piper (Manual) Electric Trim (Toggle Switch)
PET-1



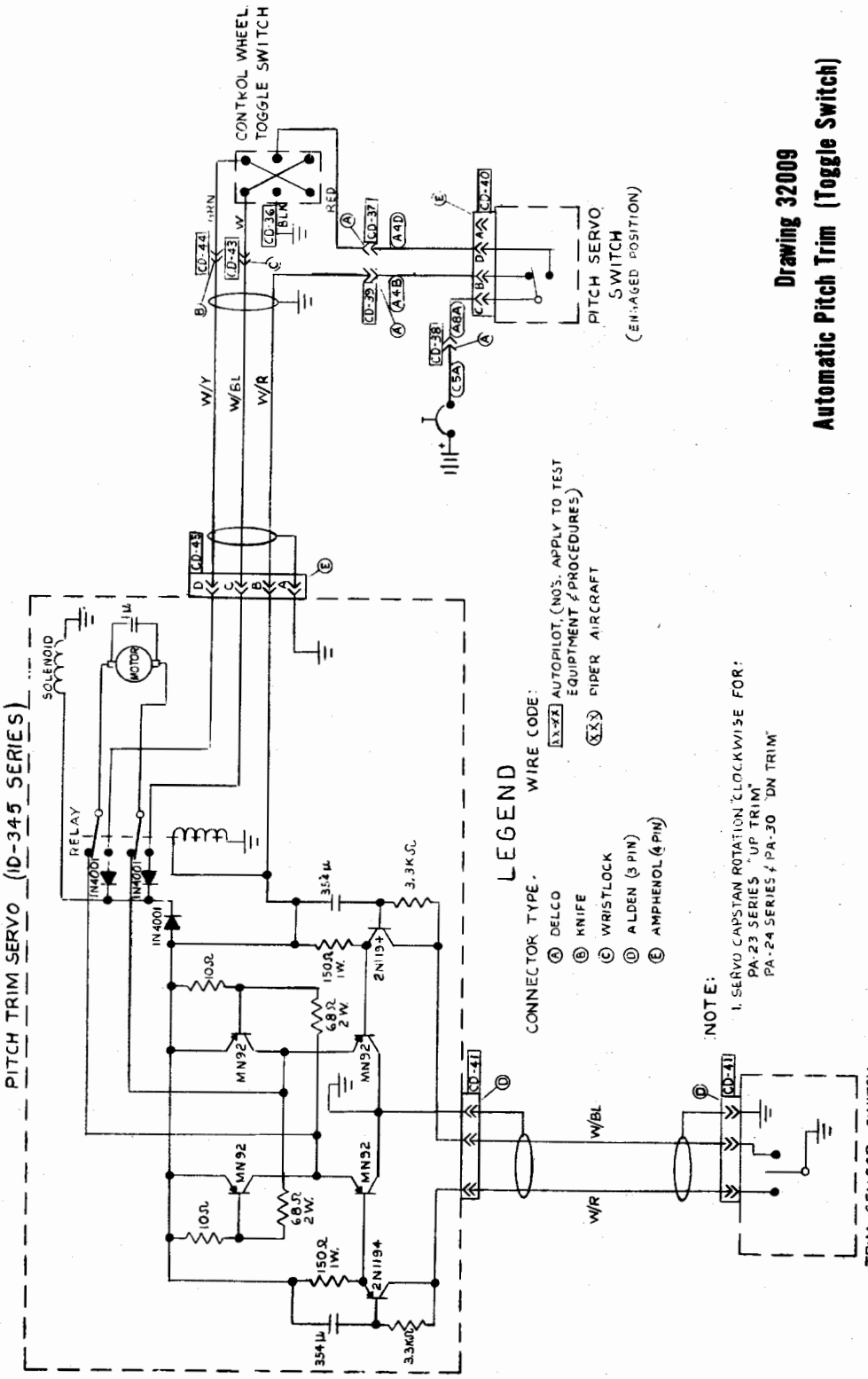
LEGEND

CONNECTOR TYPE:
- (A) DELCO
- (B) KNIFE
- (C) WRISTLOCK
- (D) ALDEN (3 PIN)
- (E) AMPHENOL (4 PIN)

WIRE CODE:
- (XXX) PIPER AIRCRAFT
- (XX-XX) AUTOPILOT (NO'S APPLY TO TEST EQUIPTMENT & PROCEDURES.)

NOTE:
1. SERVO CAPSTAN ROTATION "CLOCKWISE" FOR:
   PA-23 SERIES "UP TRIM"
   PA 24 SERIES "DN TRIM"
   PA 30
2. MOTOR ROTATION" AS VIEWED AT COMMUTATOR END.

Drawing 25240
Automatic Pitch Trim (Toggle Switch)
PET-2


Drawing 32009
Automatic Pitch Trim (Toggle Switch)
CONTROL WHEEL TOGGLE SWITCH
PITCH SERVO SWITCH (ENGAGED POSITION)
PITCH TRIM SERVO (ID-345 SERIES)
SOLENOID
MOTOR
RELAY
IN4001
MN92
2N1194
LEGEND
CONNECTOR TYPE:
(A) DELCO
(B) KNIFE
(C) WRISTLOCK
(D) ALDEN (3 PIN)
(E) AMPHENOL (4 PIN)
WIRE CODE:
XX-XX AUTOPILOT (NOS. APPLY TO TEST EQUIPTMENT & PROCEDURES)
(XX) PIPER AIRCRAFT
NOTE:
1. SERVO CAPSTAN ROTATION CLOCKWISE FOR:
PA-23 SERIES "UP TRIM"
PA-24 SERIES & PA-30 "DN TRIM"
TRIM SENSOR SWITCH (IC-365 SERIES)
W/Y
W/BL
W/R
RED
BLK
CD-35
CD-36
CD-37
CD-38
CD-39
CD-40
CD-41
CD-42
CD-43
CD-45

M. Omni/Localizer Coupler Set-up Procedures, AutoControl II and AltiMatic II only. (Replaces SE-26.)

SERVICE PERSONNEL

The following procedures will assist you in setting-up either the AutoControl II or the AltiMatic II roll axis which incorporates the Piper Omni/Localizer Coupler.

It is important that the set-up procedures be followed in sequence as outlined.

PIPER OMNI/LOCALIZER COUPLER SET-UP PROCEDURES
PA-23, PA-24 and PA-30 SERIES
COUPLER WITH AUTOCONTROL II

GENERAL:

The coupler must be accessible for in-flight adjustments. Do not mount in the instrument panel until in-flight adjustments have been made.

The information supplied the coupler from the Omni converter, is magnetic. The Directional Gyro and Omni converter feed a signal into the coupler simultaneously. The coupler is constantly sampling heading information from both the Directional Gyro and the Omni Indicator which makes it absolutely necessary that the Directional Gyro not only have a minimum amount of precession, but that it has been correctly set with an accurate compass.

VACUUM:

Suction gauge should read between 4.8 to 5.1 inches of vacuum.

COMPLETE KITS FOR FIELD INSTALLATION:

When installing a complete kit, including radio coupler, for either an AutoControl II or AltiMatic II, no adjustments should be necessary to the coupler, as these adjustments are preset on the bench at the factory. It will require one in-flight adjustment of the leveling condenser as described further on.

COMPONENT CHANGES IN THE FIELD:

If at any time, any of the following components are replaced in the field, it will require in-flight adjustments be made as indicated:

Component	Adjust Amplifier Leveling Condenser	Adjust Coupler Bank Angles	Adjust Coupler Intercept Angles
Directional Gyro	No	No	Yes
Horizon	Yes	Yes	No
Amplifier	Yes	Yes	No
Coaxial Harness	Yes	Yes	No
Roll Servo	Yes	No	No
Coupler	No	Yes	Yes

ABBREVIATIONS:

C/S - Course Selector of the Directional Gyro
OBS - Omni Bearing Selector
CDI - Course Deviation Indicator (omni needle)
DG - Directional Gyro

GROUND SET-UP:

A1. Follow-up timing. Ailerons neutral, timing mark should be lined up. Check for "O" backlash. (Backlash between the follow-up gears causes rocking in still air.)

A2. Remove console face plate, exposing adjustment access holes of leveling condenser and dummy D. G. trimmers. (See SE-25)

A3. Reinstall Turn/Trim Knob on shaft and place index in center position.

A4. Erect horizon, must indicate level flight. (Use external vacuum source or start engine.)

A5. Set D. G. and C/S to indicate same heading.

A6. D. G. mode selector button on console to pushed "IN" position. (D. G. in the circuit.)

A7. Unplug CD-33 at the rear of the D. G.

A8. Aircraft master switch ON.

A9. Fully engage roll. (Might be necessary to rock the control wheel for full gear mesh of servo.)

A10. Adjust the leveling condenser of the amplifier for neutral ailerons. Use caution not to pry against adjustment, align screwdriver with slot in trimmer. (Do not make any further adjustments of the leveling condenser!)

A11. D. G. mode selector button pushed to OUT position. (D. G. is out of the circuit.)

A12. If wheel moved off to either side, adjust dummy D. G. trimmer to bring wheel back to original position. (See SE-25)

A13. Push D. G. mode selector button to IN position and again push to OUT position to determine no wheel movement takes place between the IN position and the OUT position of the D. G. mode selector

A14. This completes the ground set-up or adjustments. A further check should be made, however, to determine that all functions of the coupler are working prior to flight. (Plug CD-33 back into the D. G.) Proceed to coupler ground check on the following page.

COUPLER GROUND CHECK

HEADING POSITION GROUND CHECK:

B1. Position coupler mode selector to HEADING.

B2. D. G. mode button on console pushed IN. (D. G. incircuit.)

B3. D. G. and C/S set to same heading.

B4. Engage AutoControl

B5. Set C/S 90 degrees to left and observe that control wheel moves to the left.

B6. Make same check to right.

INTERCEPT ANGLE GROUND ADJUSTMENTS:

If it is possible to receive an Omni signal, the following check can be made, if not, use Radio Coupler Test Box in place of Omni Converter.

C1. D. G. mode button on console pushed IN. (D. G. in circuit.)

C2. Coupler mode selector set to OMNI.

C3. Radio, which the coupler is coupled to, must be turned ON.

C4. Center the CDI with a TO flag.

C5. Horizon must be erected.

C6. D. G. and C/S set to read same heading as OBS.

C7. Engage the AutoControl.

C8. Turn the OBS to cause the CDI to deflect fully to either side, control wheel should move to same side CDI deflected to. If wheel moves in opposite direction, the two leads from CD-34 to Omni plug are reversed. Make certain to have TO reading or control wheel will correct to opposite side.

C9. Recenter CDI for an "ON-COURSE" indication.

C10. Deflect CDI by rotating OBS for a full needle deflection to the RIGHT. Make sure CDI is placed just at the EDGE OF ITS TRAVEL.

C11. Place C/S under the LEFT HAND 45 DEGREE INDEX on the FACE OF THE D. G. by using the HDG. Knob n LOWER RIGHT HAND CORNER OF D. G.

C12. WAIT 90 SECONDS! and observe ailerons slowly take up (neutral) position.

C13. If ailerons do not return to neutral, adjust the Potentiometer located on the side of the Radio Coupler, LABELED INTERCEPT ANGLE (see page 13) until ailerons stay in a neutral position.

C14. Recenter C/S to original "ON-COURSE" Hdg. and recenter CDI by rotating OBS.

C15. Rotate OBS to deflect CDI to the LEFT EDGE of its travel.

C16. Place C/S under the RIGHT HAND 45 DEGREE INDEX on the FACE of the D. G. by using the Hdg. Knob in the LOWER RIGHT HAND CORNER of the D. G.

C17. WAIT 90 SECONDS! and observe ailerons slowly take up a neutral position.

C18. If ailerons do not return to neutral, cage the D. G. by using the cage knob on the LOWER LEFT HAND CORNER of D. G. and rotate azimuth card of D. G. until ailerons do neutralize.

C19. Observe C/S is within $\pm$ 3^{o} of the RIGHT HAND 45 DEGREE INDEX on FACE of D. G.

C20. If C/S is beyond tolerance, adjust same INTERCEPT ANGLE on side of RADIO COUPLER to bring C/S just into tolerance.

C21. After Intercept is adjusted, slowly rotate OBS to cause CDI to move SLOWLY back toward center.

(1) Watch ailerons and as soon as movement is noticed, STOP rotation of OBS and observe CDI has not yet fallen into the color bar.

(2) After step (1), place CDI just at the OUTER EDGE OF THE COLOR BAR by rotating OBS.

(3) Adjust ailerons to neutral by CAGING D. G. with CAGE KNOB located on LOWER LEFT HAND CORNER OF D. G.

(4) Observe C/S is at a position of 10 degrees less than before.

C22. If above (C21) cannot be seen, remove Radio Coupler and adjust RADIO GAIN on BENCH using Radio Coupler Test Box #753 873 and Radio Coupler Service Manual Part #753 601, page 8.

IN-FLIGHT ADJUSTMENTS

BANK ANGLES:

It requires smooth air for correct adjustments. ACCURATELY SET THE DIRECTIONAL GYRO TO THE CORRECT MAGNETIC HEADING PRIOR TO TAKE OFF.

D1. Trim up the aircraft for hands-off level flight with the BALL OF THE TURN AND BANK CENTERED.

D2. Unplug CD-33 at the rear of the D. G.

D3. D. G. mode selector button on console pushed to IN. (D. G. in the circuit.)

D4. Fully engage servo.

D5. Make certain Turn/Trim Knob has its index straight up.

D6. Carefully adjust amplifier leveling condenser for absolute level flight. (Access hole to the left of the Turn/Trim Knob.) Allow at least two minutes, during which time the D. G. should be observed to determine aircraft is not turning to either side.

D7. Set Coupler mode selector to HEADING position.

D8. Plug CD-33 back into the D. G.

D9. Turn on radio, which the coupler is coupled to and tune in an Omni station.

D10. Set the C/S 90 degrees to the left of the heading being flown and observe the degree of bank on the horizon.

D11. If necessary, adjust LEFT BANK adjustment on coupler for 16 degrees, ± 2 degree bank. (Do not adjust radio gain control, this is a bench adjustment.) If adjustment is not accomplished quickly, make certain aircraft is not coming up on the called for heading as bank angle decreases 15 degrees before selected heading. Turning adjustment clockwise increases bank.

D12. Set the course selector 90 degrees to the right of the present heading and observe degree of bank on the horizon.

D13. If necessary, adjust RIGHT BANK adjustment on coupler for 16 degrees, ± 2 degree bank. (Right and left banks should be within 2 degrees of each other.)

INTERCEPT ANGLES:

E1. Coupler mode selector set to OMNI position.

E2. Center the CDI with a TO reading (location should be approximately 30 miles from the VOR.)

E3. Turn OBS just enough to give a full scale needle deflection to the right side. (TO flag if heading is to the station.)

E4. Set C/S to read same heading as the OBS.

E5. The C/S, after 90 seconds, should be located under the 45 degree left hand index within ± 3 degrees. If necessary, adjust the INTERCEPT angle a adjustment on the coupler for 45 degrees, ± 3 degrees. (Clockwise - increased intercept angle.)

E6. Turn OBS to cause the CDI to deflect fully to the left side. (TO flag if heading is to the station.)

E7. Set C/S to same heading as OBS.

E8. The C/S, after 90 seconds, should be located under the 45 degree right hand index within ± 3 degrees.

NOTE

There's only a single adjustment for both left and right intercept angles.

RADIO GAIN:

This adjustment is factory set for the standard ARINC output of 150 MV for full scale CDI deflection. It requires no adjustment when coupled to the Narco VOA-4 or VOA-5. If adjustment is necessary, see Coupler Service Manual. It will require the Coupler Test Kit for this adjustment. (See Electronics News Letter, EL-15E for test kit information.)

The gain adjustment can be checked, in the air, in the following manner.

F1. About 30 miles out from the VOR, tune in the station.

F2. Set the coupler mode selector to the OMNI mode.

F3. Head toward the VOR and center the CDI with a TO flag.

F4. Turn OBS just enough to cause CDI to deflect full scale to the right side.

F5. Set the C/S of the Directional Gyro to the same heading as read on the OBS. (Make certain D. G. is set to correct magnetic heading.)

F6. Allow approximately 90 seconds after the C/S has reached the 45^{o} intercept point, then adjust the OBS so that the CDI starts back toward center. Turn OBS slowly, reducing the intercept angle. A heading change should start prior to the CDI entering the color bar and hold approximamately a 10^{o} less intercept angle with CDI just at the outer edge of the color bar, than was noted for the full scale needle deflection.

If it is deemed necessary to change the radio gain adjustment, this should be accomplished on the bench.

LOCALIZER-NORMAL: (Front course in-bound)

G1. Tune in a localizer frequency.

G2. Coupler mode selector set to LOC-NORM for in-bound.

G3. Set C/S to published in-bound heading.

Localizer check should be made beyond the outer marker within the normal approach distance. Aircraft should be flown at approach speed.

LOCALIZER-REVERSE:

To check LOC-REV, either fly the back course in-bound or fly out bound on front course.

For out bound on the front course:

H1. Radio tuned to localizer frequency.

H2. Coupler mode selector to LOC-REV.

H3. C/S set to published out bound heading.

Check should be made from the outer marker out bound within the normal distance for the procedure turn. Use approach airspeed.

When mode selector is in REV position, the aircraft will correct away from CDI.

For complete instructions covering the operation of the Piper Omni/Localizer Coupler, see Operator's Manual #753 687.

PIPER OMNI/LOCALIZER COUPLER SET-UP PROCEDURES
PA-23, PA-24 and PA-30 SERIES
COUPLER WITH ALTIMATIC II

GENERAL:

The coupler must be accessible for in-flight adjustments. Do not mount in the instrument panel until in-flight adjustments have been made.

The information supplied the coupler, from the Omni Converter, is magnetic. The Directional Gyro and Omni converter feed a signal into the coupler simultaneously. The coupler is constantly sampling heading information from both the D. G. and the Omni Indicator which makes it absolutely necessary that the D. G. not only have a minimum amount of precession, but that it has been correctly set with an accurate compass.

VACUUM:

Suction gauge should read between 4.8 to 5.1 inches of vacuum.

COMPLETE KITS FOR FIELD INSTALLATION:

When installing a complete kit, including radio coupler, for either an Auto-Control II or AltiMatic II, no adjustments should be necessary to the coupler, as these adjustments are preset on the bench at the factory. It will require one in-flight adjustment of the leveling condenser as described further on.

COMPONENT CHANGES IN THE FIELD:

If at any time, any of the following components are replaced in the field, it will require in-flight adjustments be made as indicated:

Component	Adjust Amplifier Leveling Condenser	Adjust Coupler Bank Angles	Adjust Coupler Intercept Angles
Directional Gyro	No	No	Yes
Horizon	Yes	Yes	No
Amplifier	Yes	Yes	No
Coaxial Harness	Yes	Yes	No
Roll Servo	Yes	No	No
Coupler	No	Yes	Yes

ABBREVIATIONS:

C/S - Course Selector of the Directional Gyro
OBS - Omni Bearing Selectc
CDI - Course Deviation Indicator (Omni needle)
DG - Directional Gyro

GROUND SET-UP: - ROLL ONLY (For Pitch information, see AltiMatic II Set-up

A1. Follow-up timing. Ailerons neutral, timing mark should be lined up. Check for "O" backlash. (Backlash between the follow-up gears causes rocking in still air.)

A2. The Horizon must be erected and indicating level flight position. (External vacuum source or run-up the engine.)

A3. Unplug CD-33 at the rear of the D. G.

A4. Engage Roll Knob. (Turn fully clockwise, rocking wheel if necessary to completely engage servo.)

A5. Adjust the roll leveling condenser of the amplifier for neutral ailerons. (Adjustment is on same end of amplifier as the 8 pin Jones plug with the coaxial harness.) (Do not make any further adjustments of the Leveling Condenser!)

A6. This completes the ground set-up or adjustments. A further check should be made, however, to determine that all functions of the coupler are working prior to flight as follows: (Plug CD-33 back into the D. G.)

COUPLER GROUND CHECK

HEADING POSITION GROUND CHECK:

B1. Coupler mode selector positioned to HEADING.

B2. Turn Course Selector of D. G. 90 degrees to the left and observe control wheel turns left.

B3. Turn Course Selector 90 degrees to the right, wheel should turn approximately same number of degrees to the right as it did to the left.

INTERCEPT ANGLE GROUND ADJUSTMENTS:

If it is possible to receive an Omni signal, the following check can be made, if not use Radio Coupler Test Box in place of Omni Converter.

C1. Turn on radio, which the coupler is coupled to.

C2. Coupler selector set to OMNI.

C3. Set the OBS to center the CDI with a TO flag.

C4. Set the C/S and the D. G. to read same heading as that which is read on the OBS.

C5. Engage Roll.

C6. Turn the OBS Knob to cause the CDI to deflect fully to either side, control wheel should move to same side CDI deflected to. If wheel moves in the opposite direction, the two leads from CD-34 to the Omni plug are reversed (Make certain to have a TO reading or control wheel will correct to the opposite side.)

C7. Recenter CDI for an "ON-COURSE" indication.

C8. Deflect CDI by rotating OBS for a full needle deflection to the RIGHT. Make sure CDI is placed just at the EDGE OF ITS TRAVEL.

C9. Place C/S under the LEFT HAND 45 DEGREE INDEX on the FACE OF THE D. G. by using the HDG. Knob on LOWER RIGHT HAND CORNER OF D. G.

C10. WAIT 90 SECONDS! and observe ailerons slowly take up (neutral) position.

C11. If ailerons do not return to neutral, adjust the Potentiometer located on the side of the Radio Coupler. LABELED INTERCEPT ANGLE (see page 92) until ailerons stay in a neutral position.

C12. Recenter C/S to original "ON-COURSE" Hdg. and recenter CDI by rotating OBS.

C13. Rotate OBS to deflect CDI to the LEFT EDGE of its travel.

C14. Place C/S under the RIGHT HAND 45 DEGREE INDEX on the FACE of the D. G. by using the Hdg. Knob in the LOWER RIGHT HAND CORNER of the D. G.

C15. WAIT 90 SECONDS! and observe ailerons slowly take up a neutral position.

C16. If ailerons do not return to neutral, cage the D. G. by using the cage knob on the LOWER LEFT HAND CORNER of D. G. and rotate azimuth card of D. G. until ailerons do neutralize.

C17. Observe C/S is within $\pm$ 3° of the RIGHT HAND 45 DEGREE INDEX on FACE of D. G.

C18. If C/S is beyond tolerance, adjust same INTERCEPT ANGLE on side of RADIO COUPLER to bring C/S just into tolerance.

C19. After Intercept is adjusted, slowly rotate OBS to cause CDI to move SLOWLY back toward center.

(1) Watch ailerons and as soon as movement is noticed, STOP rotation of OBS and observe CDI has not yet fallen into the color bar.

(2) After step (1), place CDI just at the OUTER EDGE OF THE COLOR BAR by rotating OBS.

(3) Adjust ailerons to neutral by CAGING D. G. with CAGE KNOB located on LOWER LEFT HAND CORNER OF D. G.

(4) Observe C/S is at a position of 10 degrees less than before.

C20. If above (C19) cannot be seen, remove Radio Coupler and adjust RADIO GAIN on BENCH using Radio Coupler Test Box #753 873 and Radio Coupler Service Manual, Part #753 691, page 8.

IN-FLIGHT ADJUSTMENTS

BANK ANGLES:

It requires smooth air for correct adjustments. ACCURATELY SET THE D. G. TO THE CORRECT MAGNEITC HEADING PRIOR TO TAKE OFF.

D1. Trim up aircraft for hands-off level flight with the BALL OF TURN AND BANK CENTERED.

D2. Unplug CD-33 at the rear of the D. G.

D3. Fully engage the roll knob. (If pitch has been adjusted, it can be engaged to keep the aircraft level, if not, it need not be adjusted at this time.)

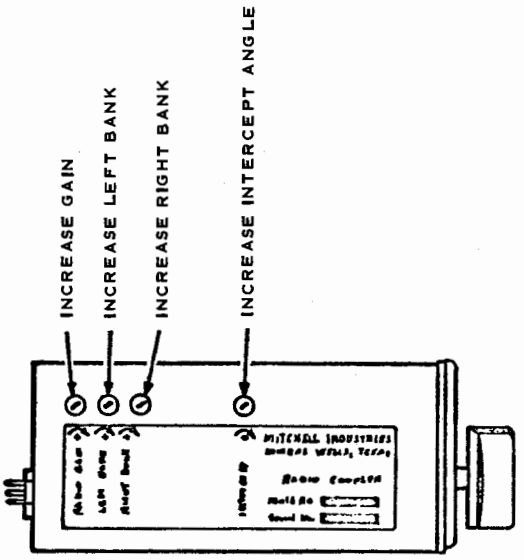
D4. Adjust the leveling condenser of the amplifier for absolute level flight. Allow at least two minutes during which time the D. G. should be observed to determine the aircraft is not turning to either side. Plug CD-33 back into the D. G.

D5. Set coupler mode selector to HEADING position.

D6. Turn on radio, which the coupler is connected to, and tune in an Omni station.

D7. Set the C/S 90^{o} to the left of the heading being flown and observe the degrees of bank on the horizon.

D8. If necessary, adjust LEFT BANK adjustment on the coupler for $16^{o} \pm 2^{o}$ (do not adjust the radio gain control, this is a bench adjustment.) If this adjustment is not accomplished quickly, make certain aircraft is not coming up on called for heading as bank angle decreases 15^{o} before selected heading. Turning adjustment clockwise increases bank.



D9. Set C/S 90° to the right of present heading and observe degree of bank on horizon.

D10. If necessary, adjust RIGHT BANK adjustment on coupler for 16° ± 2°. Right and left banks should be within 2° of each other.

INTERCEPT ANGLES:

E1. Coupler mode selector set to OMNI position.

E2. Center the CDI with a TO heading (location should be approximately 30 miles from the VOR.)

E3. Turn OBS just enough to give a full scale needle deflection to the right side. (TO flag if heading is to the station.)

E4. Set C/S to read same heading as the OBS.

E5. The C/S, after 90 seconds, should be located under the 45° left hand index within ± 3°. If necessary, adjust the INTERCEPT angle adjustment on the coupler. (Clockwise - increased intercept angle.)

E6. Turn OBS to cause the CDI to deflect fully to the left side. (TO flag if heading is to the station.)

E7. Set C/S to same heading as OBS.

E8. The C/S, after 90 seconds, should be located under the 45° right hand index within ± 3°.

NOTE

There's only a single adjustment for both left and right intercept angles.

RADIO GAIN:

This adjustment is factory set for the standard ARINC output of 150 MV for full scale CDI deflection. It requires no adjustment when coupled to the Narco VOA-4 or VOA-5. If adjustment is necessary, see Coupler Service Manual It will require the Coupler Test Kit for this adjustment.

The gain adjustment can be checked, in the air, in the following manner:

F1. About 30 miles out from the VOR, tune in the station.

F2. Set the coupler mode selector to the OMNI mode.

F3. Head toward the VOR and center the CDI with a TO flag.

F4. Turn OBS just enough to cause CDI to deflect full scale to the right side.

F5. Set the C/S of the Directional Gyro to the same heading as read on the OBS. (Make certain D. G. is set to correct magnetic heading.)

F6. Allow approximately 90 seconds after the C/S has reached the 45° intercept point, then adjust the OBS so that the CDI starts back toward center. Turn OBS slowly, reducing the intercept angle. A heading change should start prior to the CDI entering the color bar and hold approximately a 10° less intercept angle with CDI just at the outer edge of the color bar, than was noted for the full scale needle deflection.

If it is deemed necessary to change the radio gain adjustment, this should be accomplished on the bench.

LOCALIZER-NORMAL: (Front course in-bound)

G1. Tune in a localizer frequency.

G2. Coupler mode selector set to LOC-NORM for in-bound.

G3. Set C/S to published in-bound heading.

Localizer check should be made beyond the outer marker within the normal approach distance. Aircraft should be flown at approach speed.

LOCALIZER-REVERSE:

To check LOC-REV, either fly the back course in-bound or fly out-bound on the front course.

For out-bound on the front course:

H1. Radio tuned to localizer frequency.

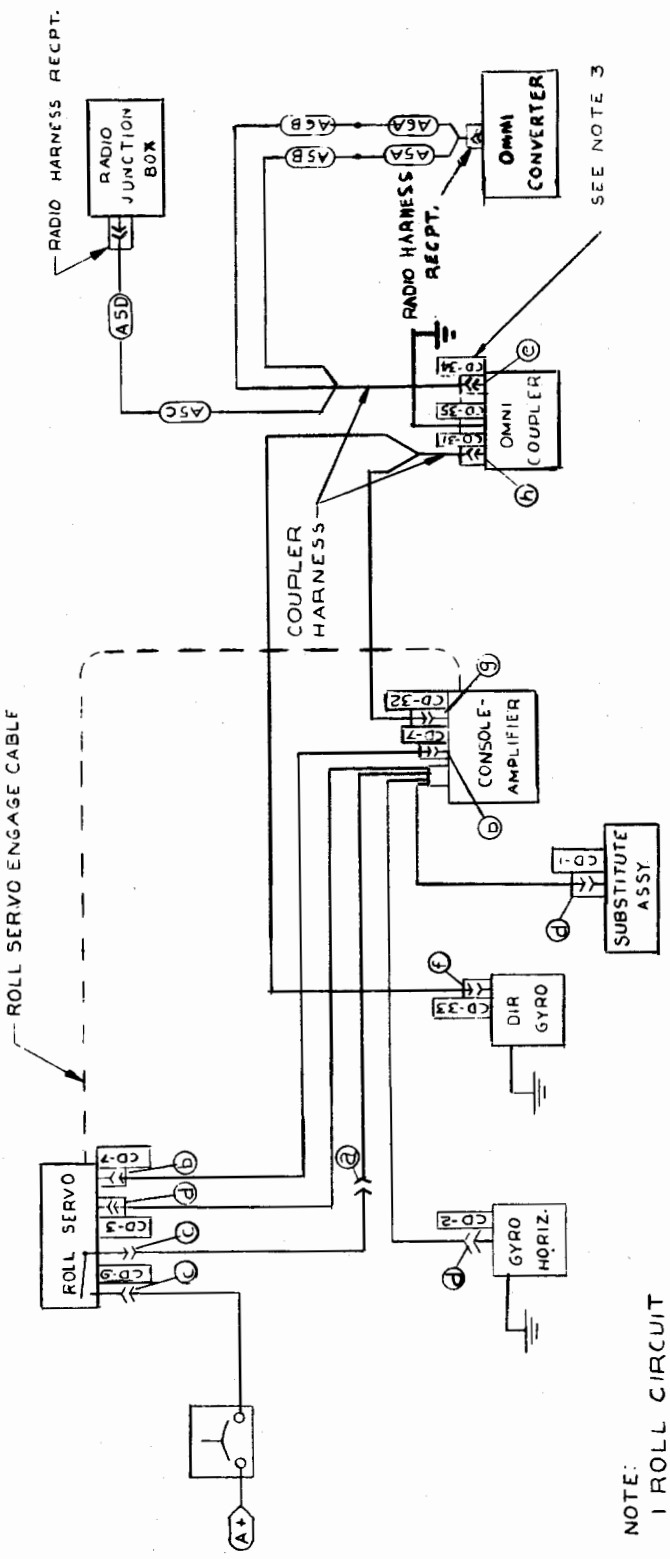
H2. Coupler mode selector to LOC-REV.

H3. C/S set to published out-bound heading.

Check should be made from the outer marker out bound, within the normal distance for the procedure turn. Use approach airspeed.

When mode selector is in REV position, the aircraft will correct away from CDI.

For complete instructions covering the operation of the Piper Omni/Localizer Coupler see Operator's Manual, #753 687.



NOTE:
1 ROLL CIRCUIT
CD-1, CD-2 & CD-3 (RADIO FREQ.)
CD-7 & CD-9 (12 V-D.C.)
2. RADIO COUPLER CURCUIT
CD-31, CD-32, CD-33 & CD-34 (AUDIO FREQ)
CD-35 (LIGHT GND.)

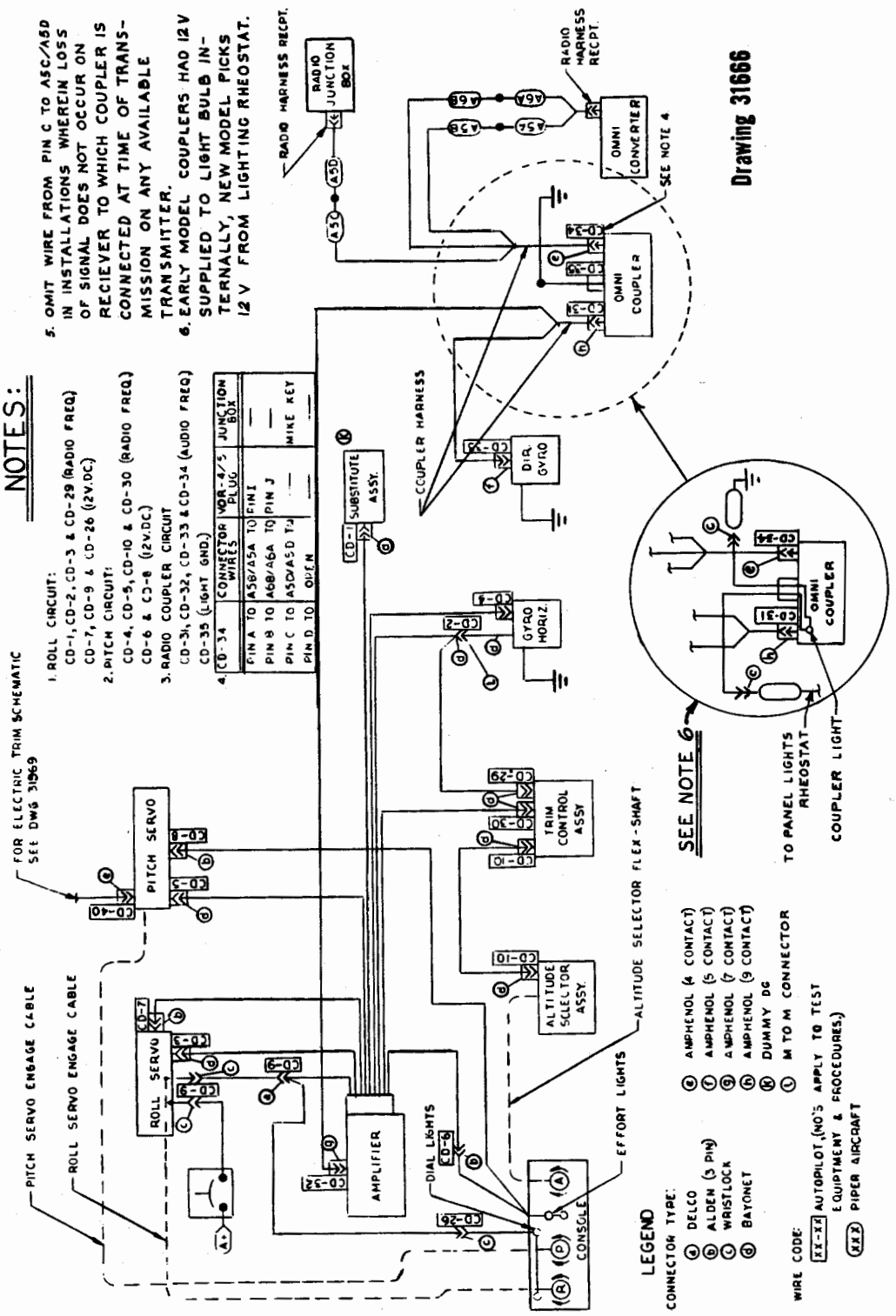
3.

CD-34	CONNECTOR WIRES	VOR-40RS PLUG	JUNCTION BOX
PIN A TO	A5B/A5A TO	PIN I	—
PIN B TO	A6B/A6A TO.	PIN J	—
PIN C TO	A5C/A5D TO	—	MIKE KEY
PIN D TO	OPEN	—	—

Omit wire from pin C to A5C/A5D in installations wherein loss of the Omni/Localizer signal does not occur on receiver to which coupler is connected at time of transmission on any available transmitter.

LEGEND
CONNECTOR TYPE;
(a) DELCO
(b) ALDEN (3 PIN)
(c) WRISTLOCK
(d) BAYONET
(e) AMPHENOL (4 CONTACT)
(f) AMPHENOL (5 CONTACT)
(g) AMPHENOL (7 CONTACT)
(h) AMPHENOL (9 CONTACT)
WIRE CODE:
XX-XX AUTOPILOT (NO'S. APPLY TO TEST EQUIPMENT AND PROCEDURES)
(XXX) PIPER AIRCRAFT

DRAWING 31669


NOTES:
1. ROLL CIRCUIT:
CD-1, CD-2, CD-3 & CD-29 (RADIO FREQ.)
CD-7, CD-9 & CD-26 (12V.DC.)
2. PITCH CIRCUIT:
CD-4, CD-5, CD-10 & CD-30 (RADIO FREQ.)
CD-6 & CD-8 (12V.DC.)
3. RADIO COUPLER CIRCUIT
CD-31, CD-32, CD-33 & CD-34 (AUDIO FREQ.)
CD-35 (LIGHT GND.)
4.
CD-34 | CONNECTOR WIRES | VOR-4/5 PLUG | JUNCTION BOX
PIN A TO | A5B/A5A TO | FINI | —
PIN B TO | A6B/A6A TO | PIN J | —
PIN C TO | A5D/A5D TO | — | MIKE KEY
PIN D TO | OPEN | — | —
5. OMIT WIRE FROM PIN C TO A5C/A5D IN INSTALLATIONS WHEREIN LOSS OF SIGNAL DOES NOT OCCUR ON RECIEVER TO WHICH COUPLER IS CONNECTED AT TIME OF TRANSMISSION ON ANY AVAILABLE TRANSMITTER.
6. EARLY MODEL COUPLERS HAD 12V SUPPLIED TO LIGHT BULB INTERNALLY, NEW MODEL PICKS 12 V FROM LIGHTING RHEOSTAT.
Drawing 31666
FOR ELECTRIC TRIM SCHEMATIC SEE DWG 31969
PITCH SERVO ENGAGE CABLE
ROLL SERVO ENGAGE CABLE
PITCH SERVO
ROLL SERVO
AMPLIFIER
DIAL LIGHTS
EFFORT LIGHTS
CONSOLE
ALTITUDE SELECTOR FLEX-SHAFT
ALTITUDE SCLECTOR ASSY.
TRIM CONTROL ASSY
GYRO HORIZ.
DIR. GYRO
SUBSTITUTE ASSY.
COUPLER HARNESS
RADIO JUNCTION BOX
RADIO HARNESS RECPT.
OMNI CONVERTER
OMNI COUPLER
SEE NOTE 4
SEE NOTE 6
TO PANEL LIGHTS RHEOSTAT
COUPLER LIGHT
LEGEND
CONNECTOR TYPE:
(A) DELCO
(B) ALDEN (3 PIN)
(C) WRISTLOCK
(D) BAYONET
(E) AMPHENOL (4 CONTACT)
(F) AMPHENOL (5 CONTACT)
(G) AMPHENOL (7 CONTACT)
(H) AMPHENOL (9 CONTACT)
(K) DUMMY DC
(L) M TO M CONNECTOR
WIRE CODE:
XX-XX AUTOPILOT (NO'S APPLY TO TEST EQUIPTMENT & PROCEDURES.)
(XX) PIPER AIRCRAFT

PART II

OMNI-LOCALIZER COUPLER

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

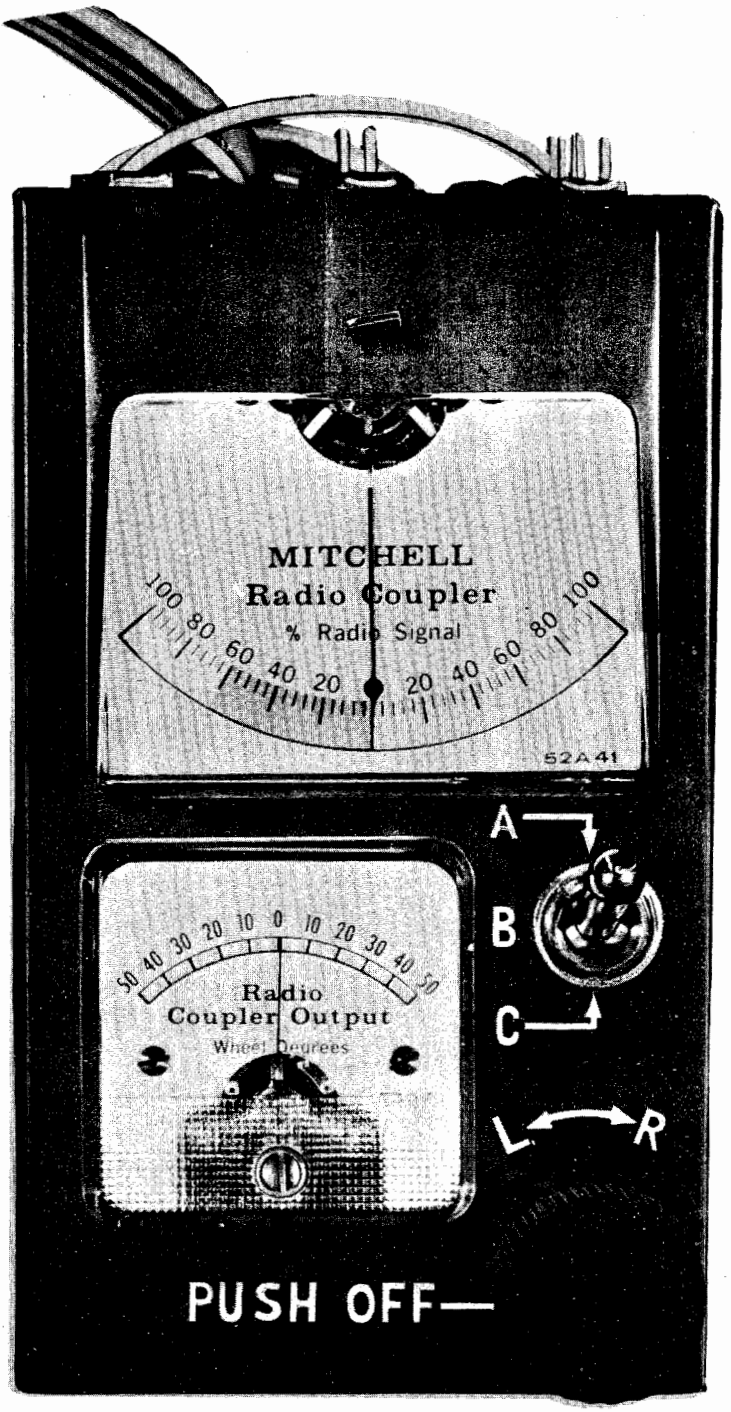


Figure 1. Coupler Test Kit (756 873)

SECTION I

DESCRIPTION

The Piper Omni-Localizer Coupler is a completely automatic analog computer. It is offered as an option with the AutoControl II or AltiMatic II.

The capture, intercept and tracking sequence is accomplished automatically. Crosswind correction up to 15° is another automatic feature of this fine coupler. Intercept angle of approximately 45° for full scale omni needle deflection, is factory set. At no time can the coupler become "confused" and cause the aircraft to go into orbit.

The coupler will operate with most all omni converters. The Radio Gain control is pre-set at the factory for operation with omni converters having a standard ARINC output of 150 millivolts.

SECTION II

SPECIFICATIONS

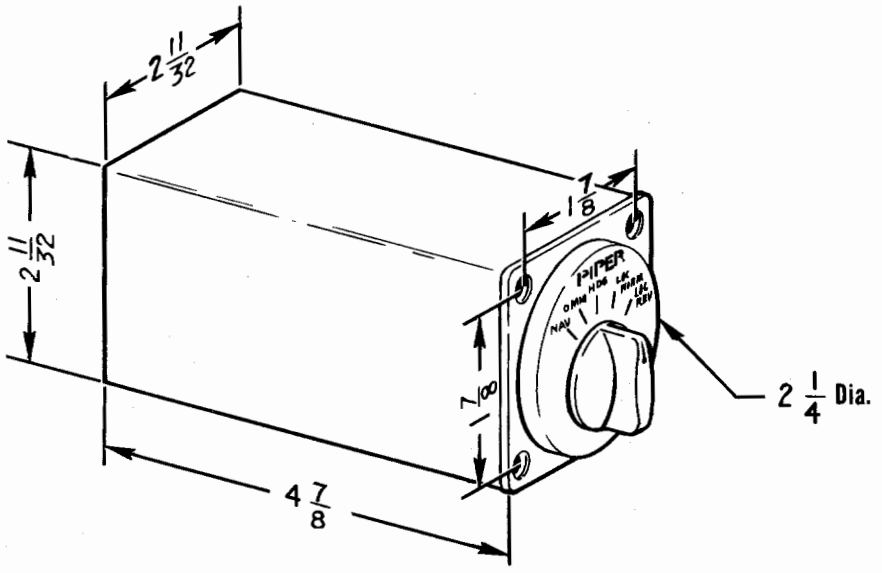


Figure 2. Piper Omni Localizer Coupler

SECTION III

MAINTENANCE

66D94 COUPLER TEST BOX & 30B152 CABLE ASSEMBLY
(PIPER KIT NO. 756 873)

USE:

To detect inoperative coupler or other roll component that is affecting coupler operation.

1. By substituting the Directional Gyro in the circuit. (zero output only)
2. By substituting radio input to the coupler.
3. By reading output from the coupler. (input to the AutoPilot amplifier)
4. By reading radio input to the coupler.

USE:

To adjust the coupler gain to work with radio outputs other than ARINC.

1. By measuring radio input to the coupler.

In some of the troubleshooting and all of the adjusting procedures herein, the radio gain toggle switch will need to be set to one of the three positions marked A, B or C to match the millivolt output of the various VOR converters as outlined below.

NOTE

Production couplers are set to ARINC outputs. (position B)

POSITION A:

Less than 150 and more than 100 millivolt output from converter. Reads per cent of full scale for models listed.

Examples: Narco CS-3
Narco CS-5

POSITION B:

150 millivolt ARINC output. Reads per cent of full scale for models listed.

Examples: Narco VOA-4
Narco VOA-5
King KI-201 & 211

POSITION C:

All VOR converters with millivolt outputs that are less than those listed under A and B. This is the actual millivolt output as depicted on the scale reading 0 to 100.

Examples: Collins 344D1 & D2
Dare DN-480 System
(See pg. 20)

NOTE

Field repairs to couplers are not authorized and will void warranty and/or full exchange value.

TEST EQUIPMENT REQUIRED

66D94 Coupler Test Box
30B152 Coupler Cable Assembly } 756 873
Volt Ohm Meter
12 Volt Power Source

NOTE

The validity of these tests is dependent on their being conducted in the sequence outlined in this manual.

The 66D94 Test Box incorporates a 9 volt dry cell battery (Burgess 2U6, Ray-O-Vac 1604, or equivalent) to furnish a substitute radio signal. Test for a weak battery may be made as follows.

1. Plug a 31671-00 coupler into the CD-34 test box lead.
2. Place radio gain toggle switch in "B" position and coupler in omni position.
3. Pull Out L-R knob and rotate full left and right. Radio signal meter indication should be in excess of 100% in both directions. If reading is less than 100% replace battery.

NOTE

CD reference numbers can be located on Drawing 31669 & 31666, pages 18 and 19 of this manual.

SYMPTOM 1

ROLL AND/OR COUPLER INOPERATIVE

Precheck: Make sure all autopilot harness cables and separate interconnecting cables are secure.

It will be necessary to isolate the problem to either the autopilot roll section or the coupler components of the roll circuit.

Step 1-A: Remove the CD-32 cable from the amplifier. (AutoControl II only, Heading lock button to "Pushed Out" position. Directional Gyro out of the system.)

TEST NO. 1-1

Turn the autopilot on and test the roll section for action by rotating the Roll Trim Knob. If there is no response, the trouble is in the roll circuit of the autopilot and not in the coupler section.

Refer to the appropriate autopilot manual for further troubleshooting procedures.

If there is roll response, the trouble is in the coupler section. Proceed with step 1-B.

Step 1-B Place the CD-32 cable that was removed from the amplifier into the CD-32 receptacle in the coupler test box. Place coupler in HDG. mode. (AutoControl II only, Directional Gyro Heading Button pushed IN, Directional Gyro in the system.)

Step 2-B Supply the coupler test box with 12 volts (observe polarity).

TEST NO. 1-2

Rotate the Course Selector of the Directional Gyro left and right of the lubber line and observe the output on the radio coupler output meter (wheel degrees) on the lower part of the test box.

If needle shows output the autopilot amplifier receptacle wiring is defective.

If there is no output the autopilot amplifier is O.K., proceed with Test No. 1-3.

TEST NO. 1-3

Check for shorted coupler section components. Using a Volt Ohm Meter set to 100K.

Test pins A and B at CD-33 on the Directional Gyro for short to ground. If shorted replace Directional Gyro.

Test pins A and B at CD-33 on the cable assembly for short to shielding. If shorted repair or replace cable assembly.

Test pins A and B at CD-32 on the autopilot amplifier for short to ground. If shorted replace amplifier.

Test pins A and B at CD-31 on the coupler for short to ground. If shorted replace coupler.

If none of these components are shorted, proceed with step 1-C.

Step 1-C: Connect ground wire from test box 66D94 to common aircraft ground.

Step 1-D: Connect 12V+ to power source. (On 24V aircraft, use separate 12V power source.)

Step 1-E: Remove the CD-34 connector from the coupler and replace it with CD-34 lead cable from the test box.

Step 1-F: Position the coupler switch to OMNI mode.

Step 1-G: Place the toggle switch on the test box to "B" position.

TEST NO. 1-4

Check for radio output from the coupler by pulling out the L-R knob on the test box and rotating it to the left and right, noting the output on the radio coupler output meter (lower dial) of the test box.

If an output is noted it may be assumed that there is a mis-wiring or other defect in the leads from the VOR omni converter.

If there is no output radio leads are O.K., proceed with Step 1-H.

Step 1-H: Remove CD-33 from the Directional Gyro and place it into CD-33 on the test box.

TEST NO. 1-5

Rotate the knob on the test box to the left and right and note the output on the radio coupler output meter.

If there is an output it indicates that the Directional Gyro is defective.

If there is no output the coupler is the only remaining component and it may be assumed to be defective.

SYMPTOM 2

AIRCRAFT FAILS TO RETURN TO OR MAINTAIN LEVEL FLIGHT WHEN MIKE IS KEYED WITH COUPLER IN RADIO MODES (ALL MODES EXCEPT HDG.)

Step 2-A: Plug test box CD-34 lead into coupler, (AutoControl II only, Heading Lock Button to IN position) coupler in omni position, and Directional Gyro heading and course selector matched.

TEST NO. 2-1

Engage autopilot and with horizon level, control wheel should go to level flight position. Pull out L-R knob of test box and turn full left or right. Control wheel will deflect left or right. With wheel deflected, ground mike key clip of CD-34 test box lead to airframe ground.

NOTE

If wheel does not return to level flight position, coupler is defective. Replace coupler.

NOTE

If wheel returns to level flight, the wires (A5C - A5D) to Pin "C" of receptacle CD-34 (to mike key) are defective. See drawings 31666 and 31669, Pages 18 and 19 of this manual.

SYMPTOM 3

COUPLER IS INOPERATIVE IN ALL RADIO MODES, BUT OPERATES IN HDG. MODE

Step 3-A: Plug test box CD-34 lead into coupler, (AutoControl II only, Heading Lock Button to IN position) coupler in omni mode, and Directional Gyro heading and course selector matched.

TEST NO. 3-1

Engage autopilot and with horizon level, control wheel should go to level flight position.

CAUTION

Do not ground mike key clip of CD-34 test box lead.

Pull out L-R knob of test box and rotate full left or right. Control wheel should deflect left or right.

If control wheel does not deflect, coupler is defective. Replace coupler.

If control wheel does deflect, wire from Pin "C" of CD-34 receptacle to aircraft mike is shorted or improperly installed. (A5C - A5D)

SECTION IV

ADJUSTMENT PROCEDURES

COUPLER ADJUSTMENT WITH 66D94 TEST BOX

There are four (4) adjustments to the Piper Coupler as follows:

1. Radio Gain
2. Intercept Angles
3. Left Bank Limitation
4. Right Bank Limitation

NOTE

All of the above adjustments are completed at the factory. Field adjustment should not be required unless:

1. A roll component is replaced. (See Table No. I for adjustment affected.
2. Coupler uses VOR converter other than ARINC. (Gain adjustment.)

TABLE NO. I

Component Changed	Adjust Amplifier Leveling Condition	Adjust Coupler Bank Angles	Adjust Coupler Intercept Angles
Directional Gyro	No	No	Yes
Horizon	Yes	Yes	No
Amplifier	Yes	Yes	No
Coaxial Harness	Yes	Yes	No
Roll Servo	Yes	No	No
Coupler	No	Yes	Yes

After replacing a roll component, these adjustments may be accomplished in flight without the coupler test box as outlined in Piper Coupler Set-Up Procedures EL-46.

Adjustment No. 1 (Radio Gain) can be accomplished with the 66D94 Test Box and 30B152 Cable, as follows:

If position A or B is to be used (see pages 2 and 3) scale should be set to 20% position of the full 100% scale.

Step A: Connect Test Box cable CD-34 to CD-34 plug on coupler.
Step B: Connect CD-31 end of test cable to CD-31 plug on coupler.
Step C: Connect CD-33 and CD-32 test cable on to test box.
Step D: Connect 12V+ and ground leads from test box to 12V power source.
Step E: Place test box toggle switch in A, B, or C position for Radio output as outlined on pages 2 and 3.
Step F: Place coupler in Omni mode.
Step G: Turn test box switch to 20% position either side of scale when using A or B or to 20% of maximum output from VOR converter as per instructions below on position C. Allow 3 minutes for coupler time delay to stabilize and note wheel degrees reading on Radio Coupler output scale. Repeat test on opposite side of scale and again note wheel degrees reading.
Step H: Total these readings and divide by 2 for average. Adjust Radio Gain pot (see coupler drawing, Page 11) to average 10 wheel degrees. Allowing 3 minutes for time delay each time, repeat test to confirm adjustment.

If position "C" (see page 3) is required, it will be necessary to determine the millivolt output of the VOR converter as follows:

Connect lead from VOR to CD-34 on Test Box. Feed Omni signal to VOR receiver. With test box switch pushed in (off), deflect omni needle with OBS and note maximum scale reading. For radio gain adjustments using "C" position, 20% of this maximum reading should be used in the following instructions.

Repeat Steps A thru H.

NOTE

With DARE DN-480 systems the DARE Radio Adapter APC-1, Piper No. 753 929, must be used. This adapter boosts the output of DNCI-1 to almost that of the VOA-4

or 5. Use "B" position for making all adjustments with the 66D94 test box.

Pin Information for the APC-1

A = A+	C = Right + In	E = Right + Out	
B = GND	D = Left + In	F = Left + Out	H = Spare

C goes to Pin J of DNCI-1
D goes to Pin K of DNCI-1
E goes to Pin A of CD-34
F goes to Pin B of CD-34

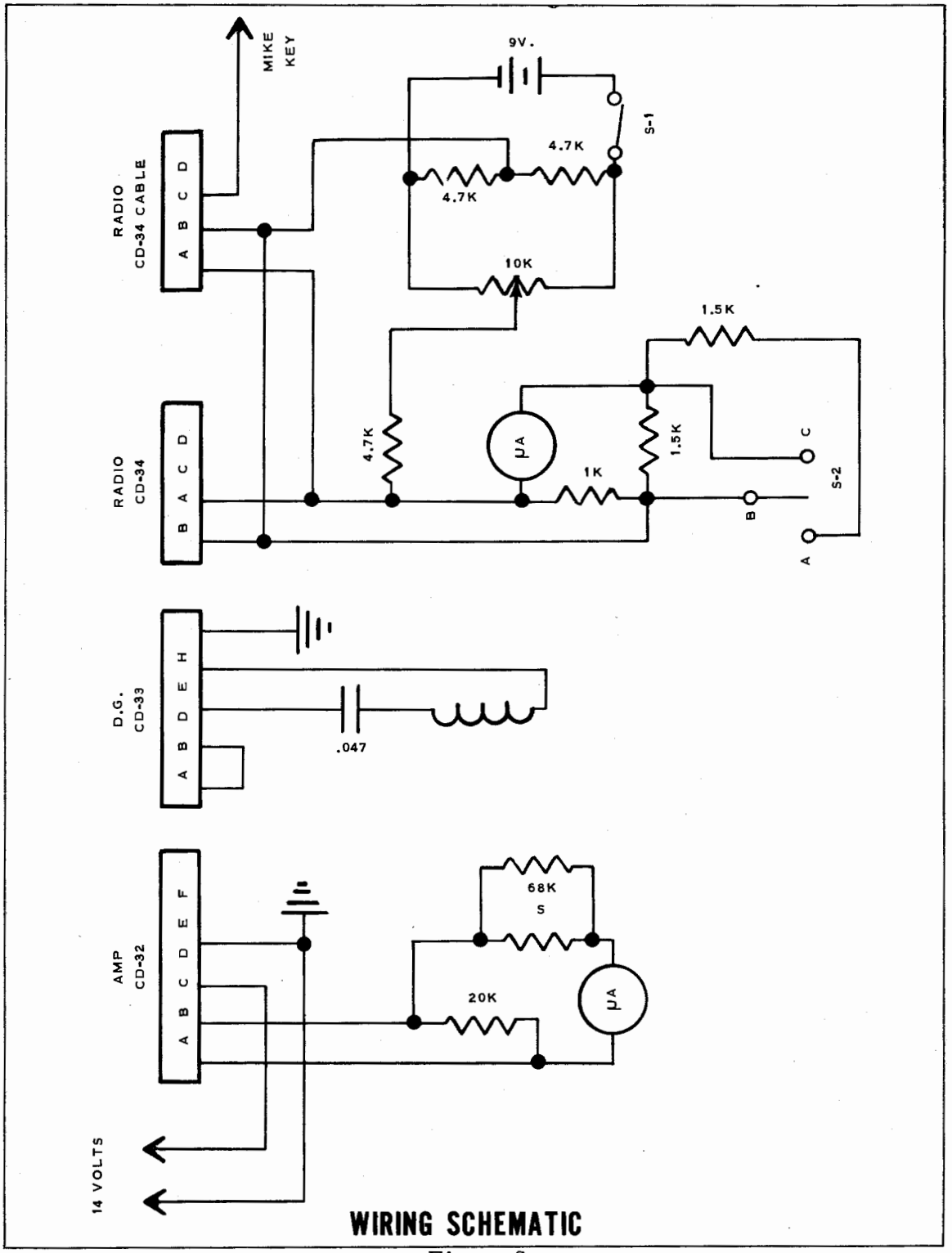

MIKE KEY
9V.
S-1
4.7K
4.7K
10K
RADIO CD-34 CABLE
A B C D
1.5K
RADIO CD-34
B A C D
4.7K
μA
1.5K
1K
C
B
A
S-2
D.G. CD-33
A B D E H
.047
AMP CD-32
A B C D E F
68K
S
20K
μA
14 VOLTS
WIRING SCHEMATIC

Figure 3.

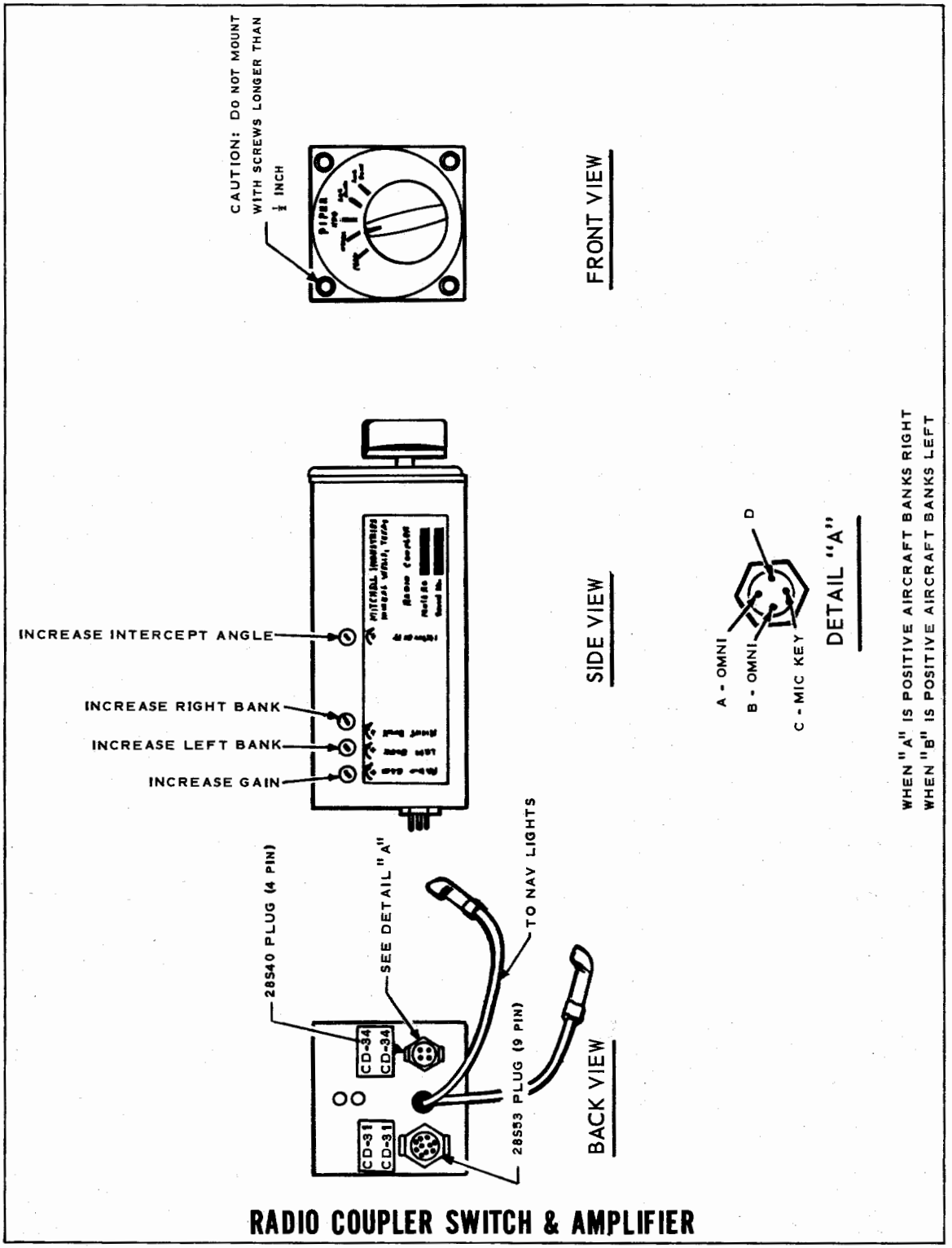
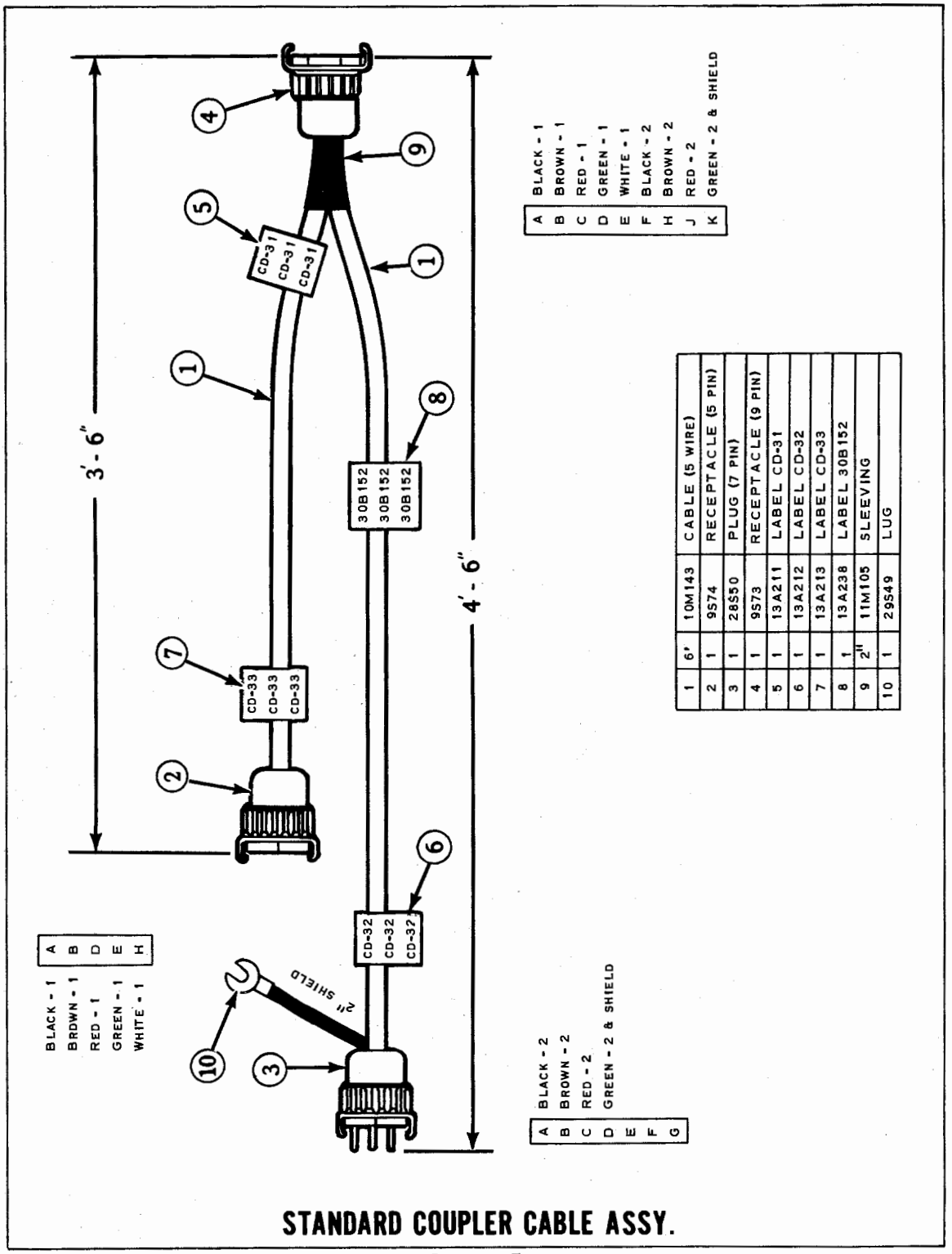

CAUTION: DO NOT MOUNT WITH SCREWS LONGER THAN ¼ INCH
FRONT VIEW
INCREASE INTERCEPT ANGLE
INCREASE RIGHT BANK
INCREASE LEFT BANK
INCREASE GAIN
SIDE VIEW
A - OMNI
B - OMNI
C - MIC KEY
D
DETAIL "A"
WHEN "A" IS POSITIVE AIRCRAFT BANKS RIGHT
WHEN "B" IS POSITIVE AIRCRAFT BANKS LEFT
28540 PLUG (4 PIN)
SEE DETAIL "A"
TO NAV LIGHTS
CD-34
CD-34
CD-31
CD-31
28553 PLUG (9 PIN)
BACK VIEW
RADIO COUPLER SWITCH & AMPLIFIER

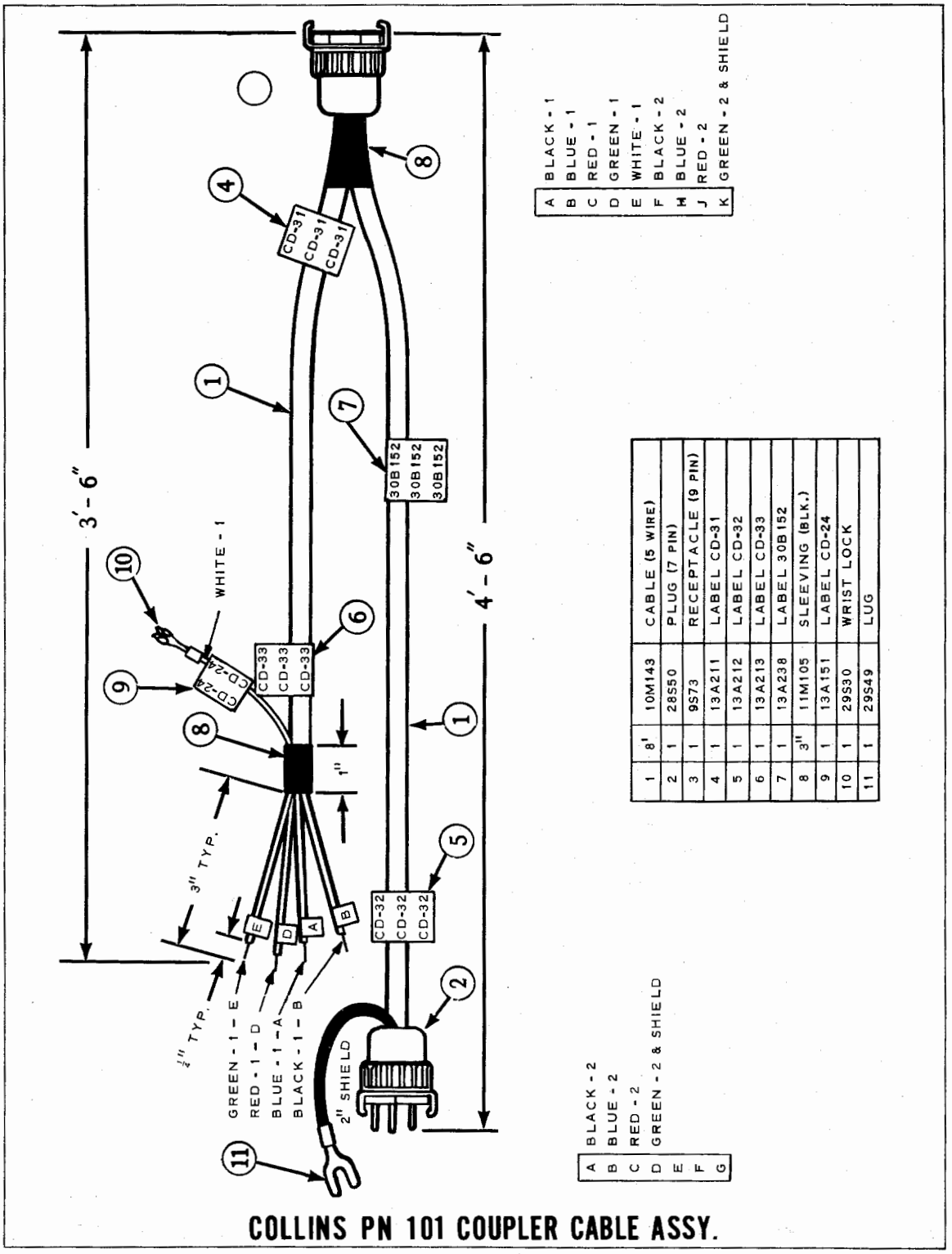
Figure 4.



1	6'	10M143	CABLE (5 WIRE)
2	1	9S74	RECEPTACLE (5 PIN)
3	1	28S50	PLUG (7 PIN)
4	1	9S73	RECEPTACLE (9 PIN)
5	1	13A211	LABEL CD-31
6	1	13A212	LABEL CD-32
7	1	13A213	LABEL CD-33
8	1	13A238	LABEL 30B152
9	2"	11M105	SLEEVING
10	1	29549	LUG

STANDARD COUPLER CABLE ASSY.

Figure 5.



1	8'	10M143	CABLE (5 WIRE)
2	1	28550	PLUG (7 PIN)
3	1	9S73	RECEPTACLE (9 PIN)
4	1	13A211	LABEL CD-31
5	1	13A212	LABEL CD-32
6	1	13A213	LABEL CD-33
7	1	13A238	LABEL 30B152
8	3"	11M105	SLEEVING (BLK.)
9	1	13A151	LABEL CD-24
10	1	29S30	WRIST LOCK
11	1	29S49	LUG

COLLINS PN 101 COUPLER CABLE ASSY.

Figure 6.

SECTION V

DARE APC-1 RADIO ADAPTER FOR PIPER RADIO COUPLER USE
(PIPER PART NO. 753 929)

APPLICATION:

The Dare APC-1 Radio Adapter serves two purposes in coupling Dare and Narco radios to the AltiMatic H-14.

1. Isolation.

2. Increase the output of the DNCI-1 to approximately 150 millivolts.

It is also required when coupling the Dare to the AltiMatic II. In this installation, it serves only to increase the output of the DNCI-1, isolation is not a requirement

DARE RADIO PACKAGE WITH ALTIMATIC H-14:

A. Isolation between the Dare and the H-14 computer. (Floating ground.)

B. To bring up the output of the DNCI-1 Omni Converter/Indicator for AutoPilot use. (Approximately 150 millivolts.)

NARCO PACKAGE WITH ALTIMATIC H-14:

A. Isolation between the Narco and the H-14 computer. (Floating ground.)

DARE RADIO PACKAGE WITH ALTIMATIC II:

A. To bring up the output of the DNCI-1 Omni Converter/Indicator for

Pilot use. (Approximately 150 millivolts.)

APC-1 RADIO ADAPTER SPECIFICATIONS

Size:	1-3/8 high X 2-1/8 wide X 4 long
Weight:	0.4 pound
Durrent Drain:	92 ma @ 14 vdc
Mounting:	Can be secured any convenient place behind the instrument panel.
Adjustments:	Sensitivity and Balance potentiometers accessible for external adjustment.

The APC-1 radio adapter is complete self-contained and requires no power source other than the aircraft 14 vdc.

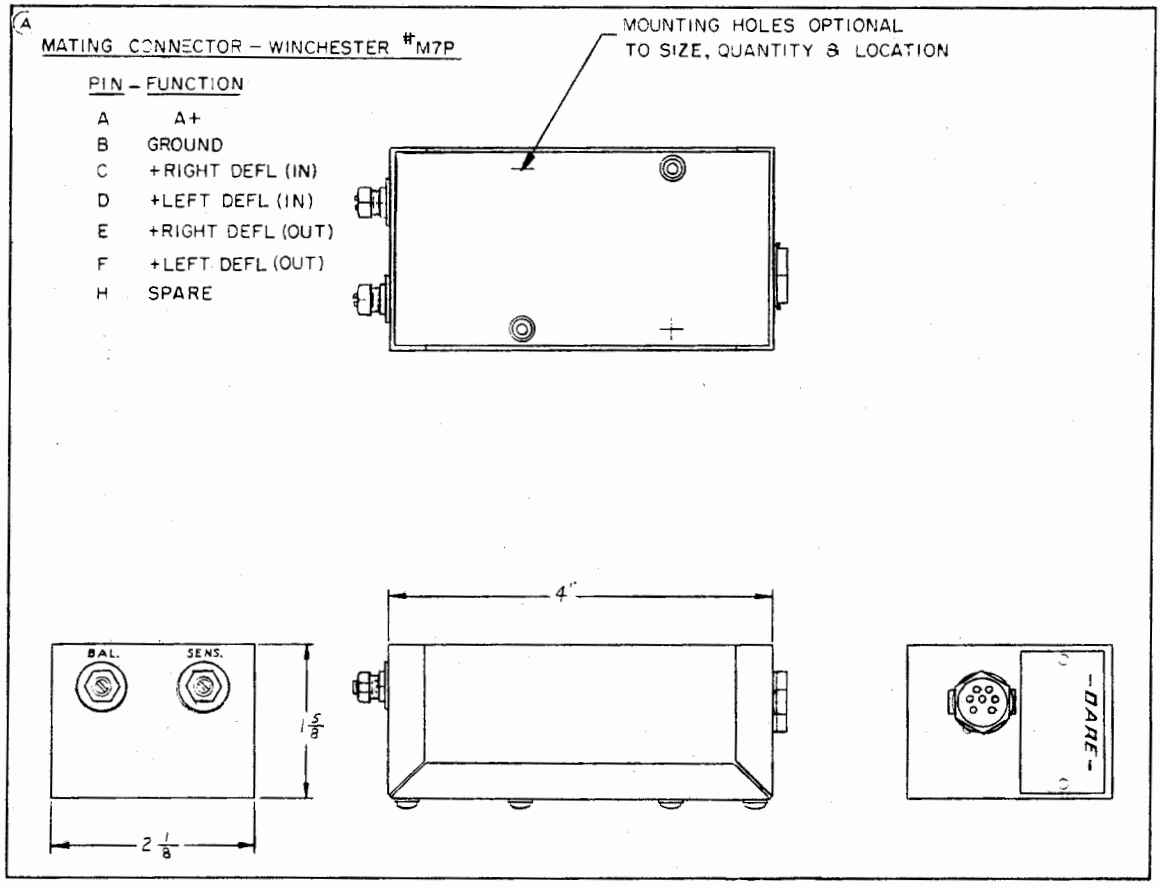
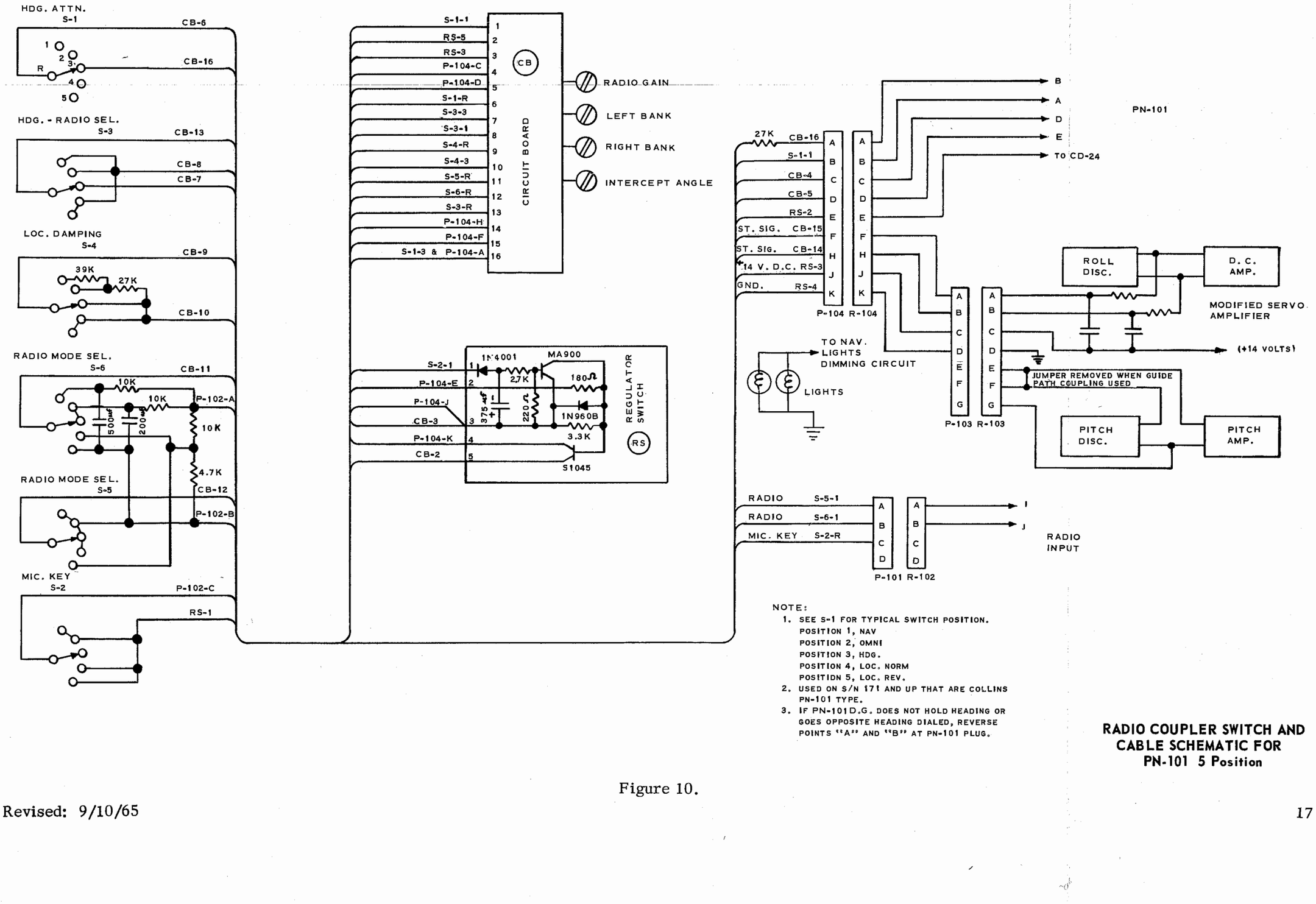


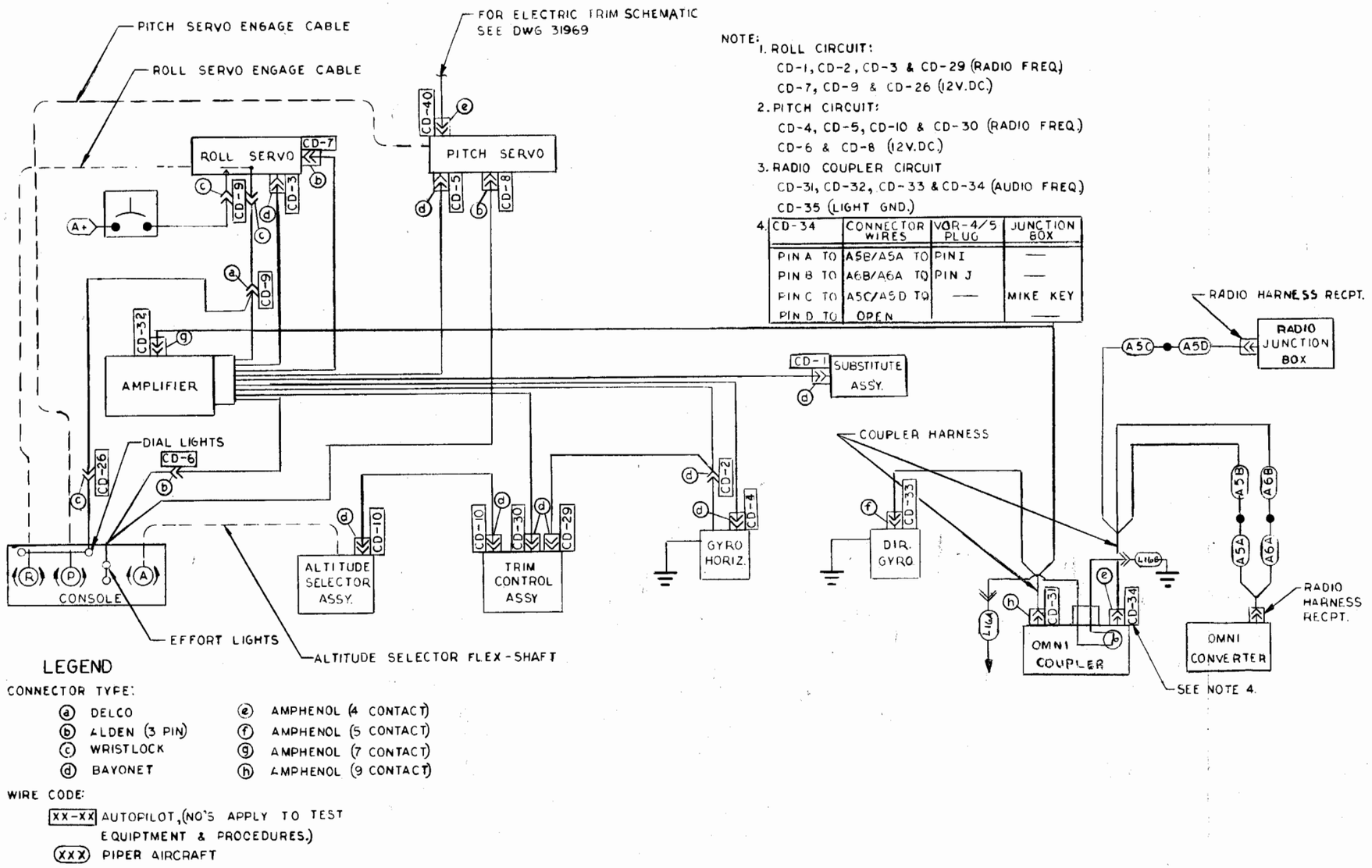
Figure 13. Dare APC-1 Radio Adapter



NOTE:
1. SEE S-1 FOR TYPICAL SWITCH POSITION.
   POSITION 1, NAV
   POSITION 2, OMNI
   POSITION 3, HDG.
   POSITION 4, LOC. NORM
   POSITION 5, LOC. REV.
2. USED ON S/N 171 AND UP THAT ARE COLLINS PN-101 TYPE.
3. IF PN-101 D.G. DOES NOT HOLD HEADING OR GOES OPPOSITE HEADING DIALED, REVERSE POINTS "A" AND "B" AT PN-101 PLUG.

RADIO COUPLER SWITCH AND CABLE SCHEMATIC FOR PN-101 5 Position

Figure 10.



NOTE:
1. ROLL CIRCUIT:
   CD-1, CD-2, CD-3 & CD-29 (RADIO FREQ.)
   CD-7, CD-9 & CD-26 (12V.DC.)
2. PITCH CIRCUIT:
   CD-4, CD-5, CD-10 & CD-30 (RADIO FREQ.)
   CD-6 & CD-8 (12V.DC.)
3. RADIO COUPLER CIRCUIT
   CD-31, CD-32, CD-33 & CD-34 (AUDIO FREQ.)
   CD-35 (LIGHT GND.)
4.

CD-34	CONNECTOR WIRES	VOR-4/5 PLUG	JUNCTION BOX
PIN A TO	A5B/A5A TO	PIN I	—
PIN B TO	A6B/A6A TO	PIN J	—
PIN C TO	A5C/A5D TO	—	MIKE KEY
PIN D TO	OPEN		—

LEGEND

CONNECTOR TYPE:

(a) DELCO	(e) AMPHENOL (4 CONTACT)
(b) ALDEN (3 PIN)	(f) AMPHENOL (5 CONTACT)
(c) WRISTLOCK	(g) AMPHENOL (7 CONTACT)
(d) BAYONET	(h) AMPHENOL (9 CONTACT)

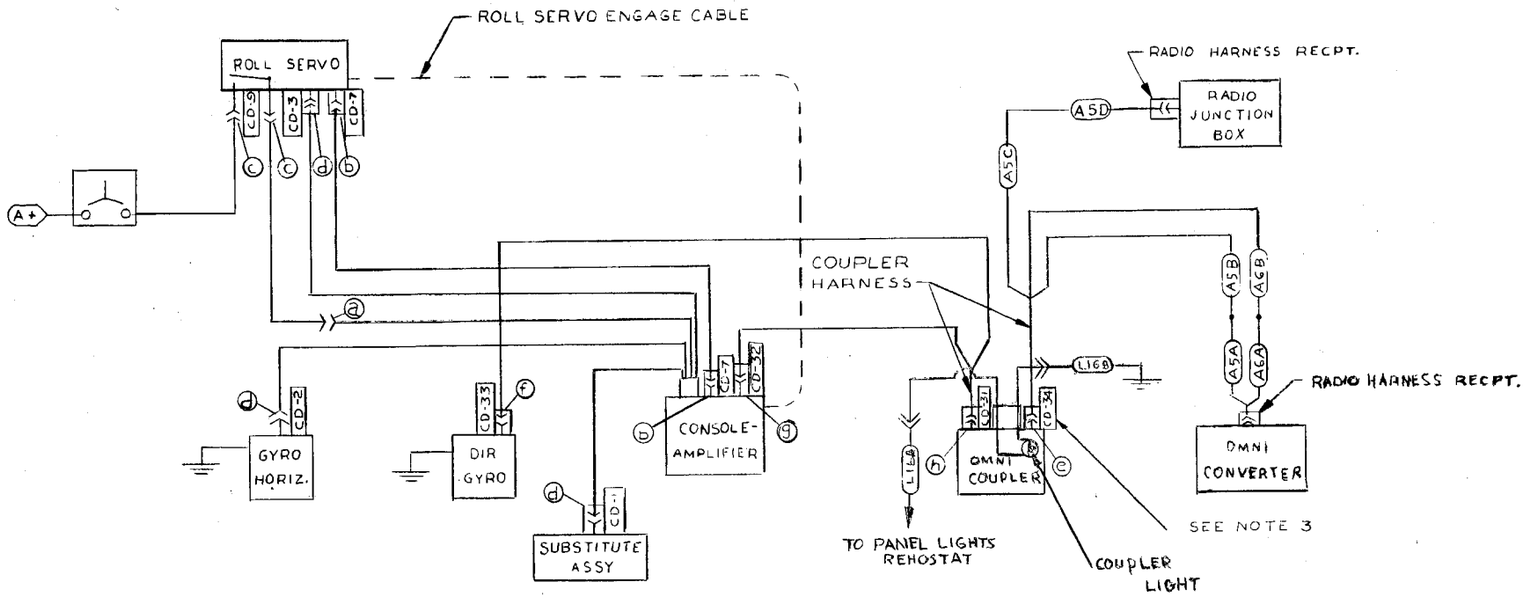
WIRE CODE:

[XX-XX] AUTOPILOT, (NO'S APPLY TO TEST EQUIPTMENT & PROCEDURES.)

(XXX) PIPER AIRCRAFT

Figure 11.

DRAWING 31666
WIRING DIAGRAM
ALTIMATIC II



LEGEND

CONNECTOR TYPE:

- ⓐ DELCO
- ⓑ ALDEN (3 PIN)
- ⓒ WRISTLOCK
- ⓓ BAYONET
- ⓔ AMPHENOL (4 CONTACT)
- ⓕ AMPHENOL (5 CONTACT)
- ⓖ AMPHENOL (7 CONTACT)
- ⓗ AMPHENOL (9 CONTACT)

WIRE CODE:

- [xx-xx] AUTOPILOT (NO'S APPLY TO TEST EQUIPMENT AND PROCEDURES)
- (xxx) PIPER AIRCRAFT

NOTE:

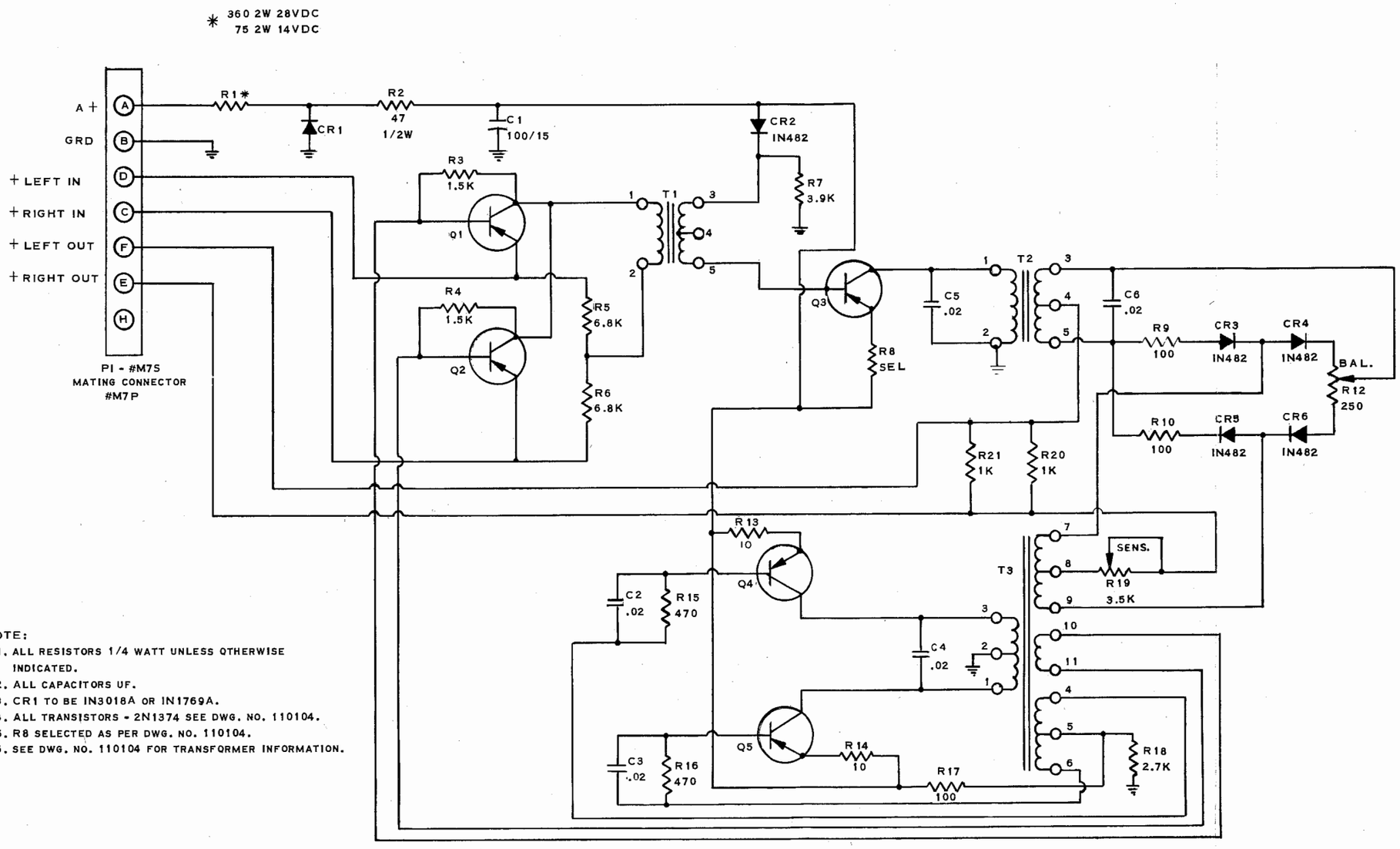
1. ROLL CURCUIT
   CD-1 CD-2 & CD-3 (RADIO FREQ.)
   CD-7 & CD-9 (12 V-D.C.)
2. RADIO COUPLER CURCUIT
   CD-31, CD-32, CD-33 & CD-34 (AUDIO FREQ.)
   CD-35 (LIGHT GND.)

3.

CD-34	CONNECTOR WIRES	VOR-40R5 PLUG	JUNCTION BOX
PIN A TO	A5B/A5A TO	PIN I	—
PIN B TO	A6B/A6A TO	PIN J	—
PIN C TO	A5C/A5D TO	—	MIKE KEY
PIN D TO	OPEN	—	—

Figure 12.

DRAWING 31669
WIRING DIAGRAM
AUTOCONTROL II

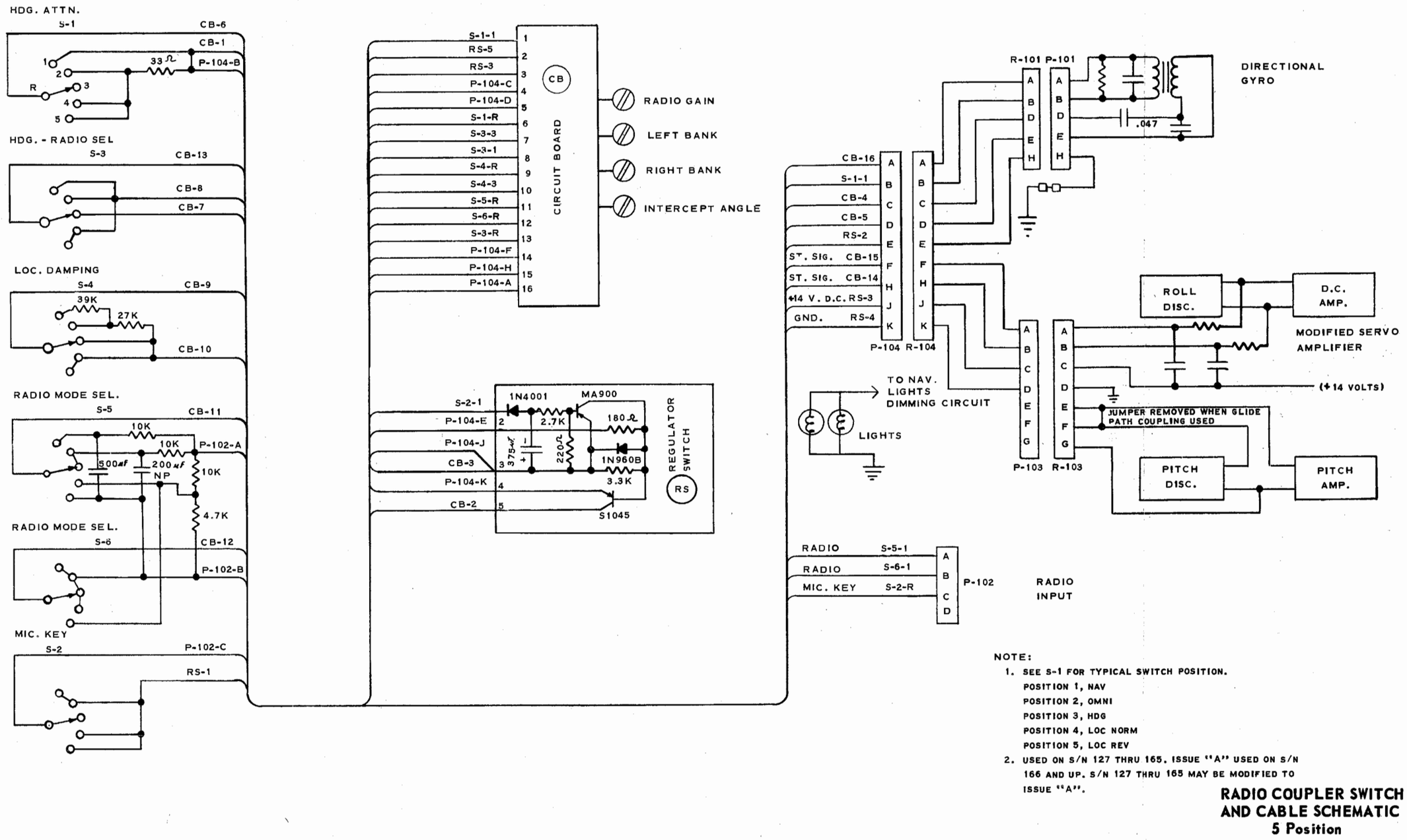


NOTE:

1. ALL RESISTORS 1/4 WATT UNLESS OTHERWISE INDICATED.
2. ALL CAPACITORS UF.
3. CR1 TO BE IN3018A OR IN1769A.
4. ALL TRANSISTORS - 2N1374 SEE DWG. NO. 110104.
5. R8 SELECTED AS PER DWG. NO. 110104.
6. SEE DWG. NO. 110104 FOR TRANSFORMER INFORMATION.

Figure 14

WIRING DIAGRAM
DARE APC-1 RADIO ADAPTER
753 929

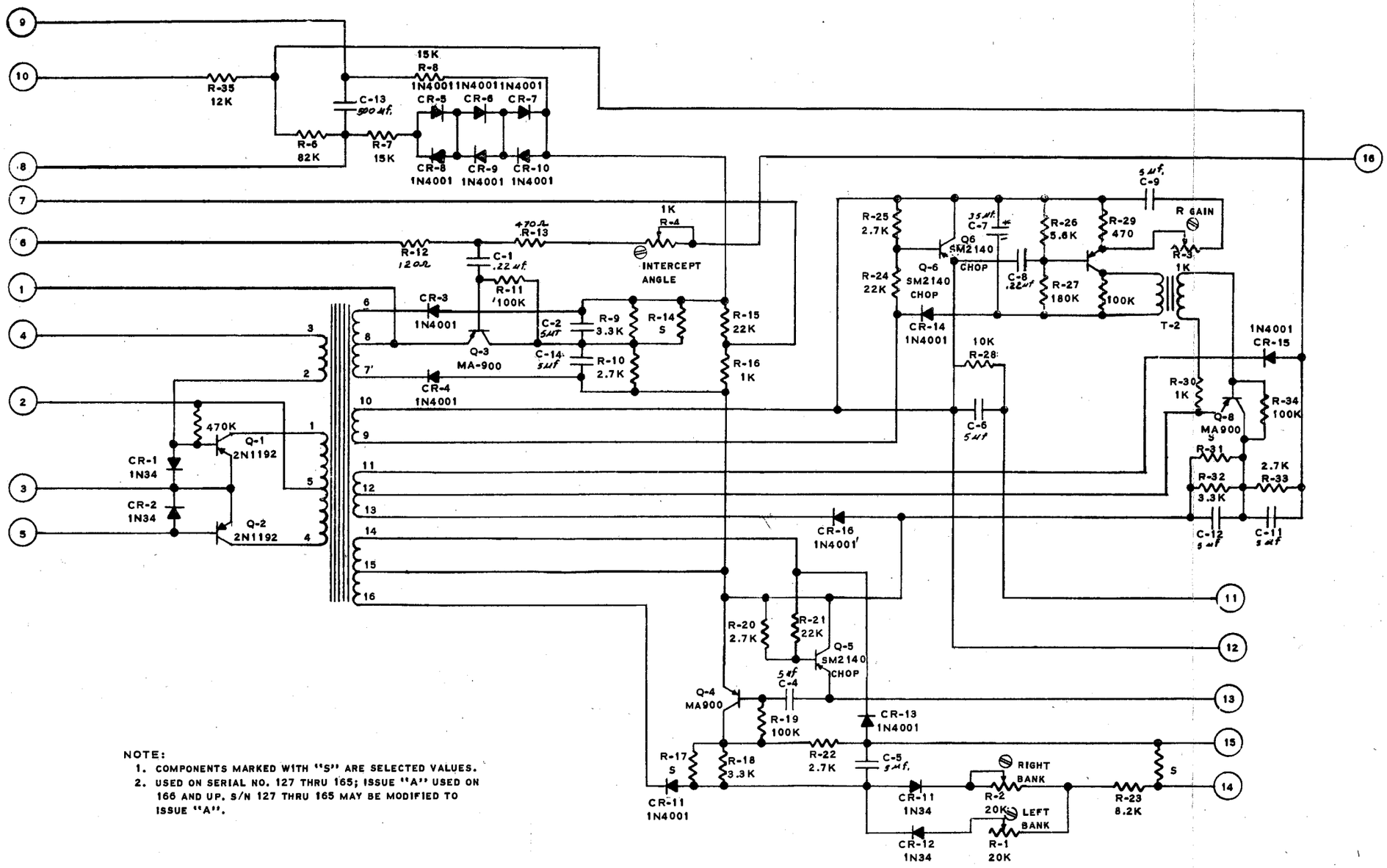


NOTE:

1. SEE S-1 FOR TYPICAL SWITCH POSITION.
   POSITION 1, NAV
   POSITION 2, OMNI
   POSITION 3, HDG
   POSITION 4, LOC NORM
   POSITION 5, LOC REV
2. USED ON S/N 127 THRU 165. ISSUE "A" USED ON S/N 166 AND UP. S/N 127 THRU 165 MAY BE MODIFIED TO ISSUE "A".

RADIO COUPLER SWITCH AND CABLE SCHEMATIC
5 Position

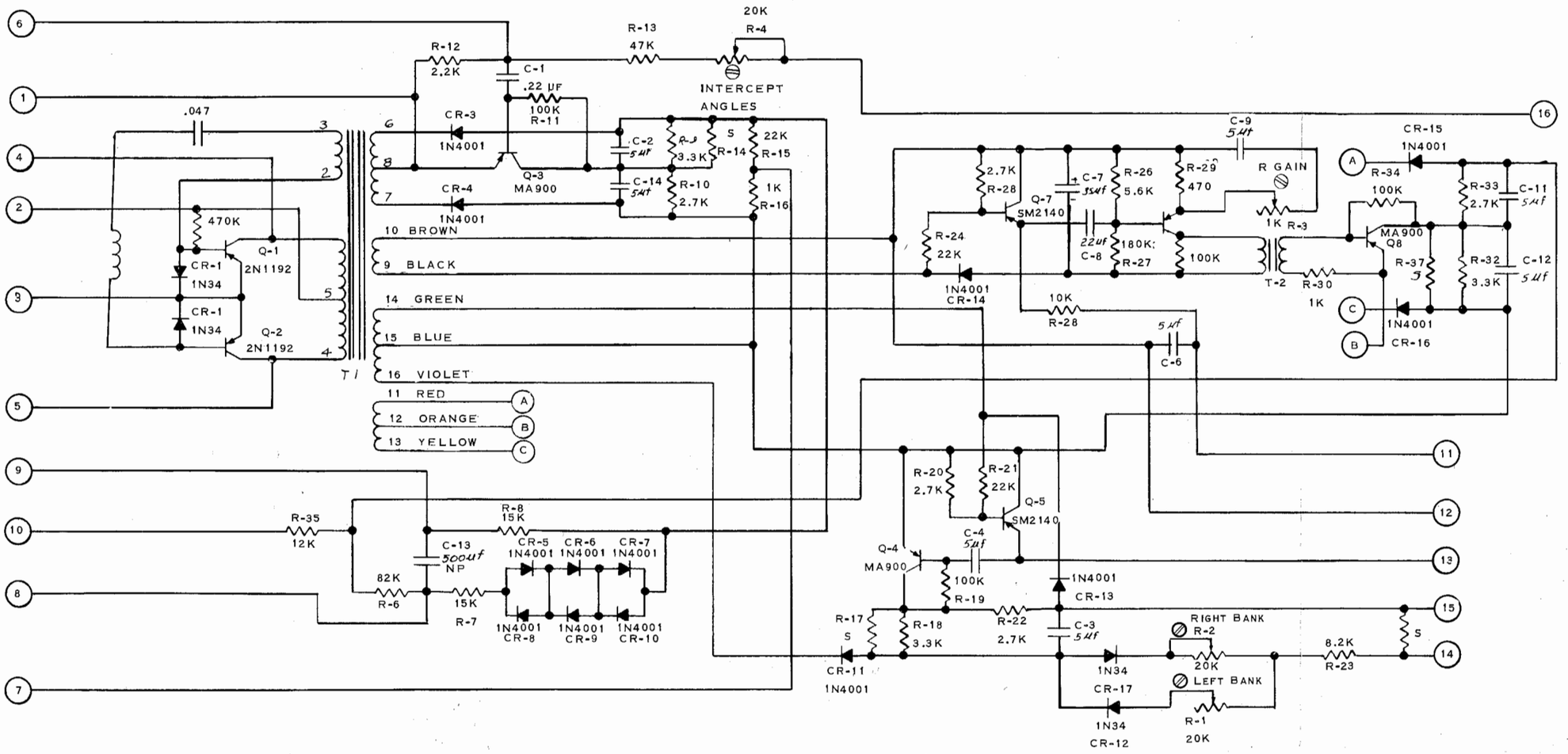
Figure 7.



NOTE:
1. COMPONENTS MARKED WITH "S" ARE SELECTED VALUES.
2. USED ON SERIAL NO. 127 THRU 165; ISSUE "A" USED ON 166 AND UP. S/N 127 THRU 165 MAY BE MODIFIED TO ISSUE "A".

RADIO COUPLER CIRCUIT BOARD SCHEMATIC
5 Position

Figure 8.



NOTE:

1. COMPONENTS MARKED WITH "S" ARE SELECTED VALUES.
2. CHANGE "A" WILL BE ON ALL RADIO COUPLERS AFTER S/N 170 THAT ARE PN-101 TYPES.

CIRCUIT BOARD SCHEMATIC FOR PN 101 CONVERSION 4 & 5 Position

Figure 9.