



Installation & User Guide

For



Altrak Altitude Hold & Altrak VS Altitude Hold

TRUTRAK FLIGHT SYSTEMS

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INSTALLATION MANUAL

For

Altrak VS & Altrak Altitude Hold

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Mechanical Considerations



The installation information in this section is extremely important and must be clearly understood by the installer. Improper servo installation or failure to observe and diagnose installation problems prior to flight can result in extremely serious consequences, including loss of ability to control the aircraft. If there are any questions on the part of the installer it is mandatory to resolve these questions prior to flight of the aircraft.

Most modern experimental aircraft use push-pull tubes to drive the primary controls. These tubes generally have a total travel of 3" or less; therefore, it is best to connect the autopilot servo to the primary control by the same method. This connection consists of an arm on the servo connected by a push-pull rod to the primary control. Rod-end bearings are required on each end of the push-pull rod.



The servo arm **must not** rotate even **near** to the point called OVER CENTER, the point at which the primary aircraft control would **lock up**. Some aircrafts mechanical primary control installations will not allow this to occur and do not need the servo stops.

This is a condition that would result from the servo being back driven when the pilot operates the controls, or from the servo itself driving the controls to a stop. To protect against this mechanical stops are supplied with the servos. These stops are drilled so that they can be mounted at different angles as required (18° intervals).

In addition to the proper use of the stop it is important to know the amount of travel on the primary control that the servo can handle. With the push rod connected to the outer most hole (1 1/2") the travel on the primary can not exceed 2 1/2", the intermediate hole 2 1/16", and the inner hole 1 5/8".

It is important to note that the servo travel should be very nearly the same in both directions. In most cases this means that the servo arm needs to be perpendicular to the push rod but there are exceptions such as the RV-4 and RV-8 installations.

There will be installations in which space does not permit the use of the stop. When this is done the aircraft's primary control stops must be positive and care must be taken to be sure that the servo drives the push rod the same distance in both directions, and that the travel limits of the servo arm are not exceeded.

There are installations in which the travel of the push-pull tube exceeds the allowable 2 1/2". For such installations, the drive can be applied to a bell crank at a radius point that moves the desired 2 1/2" of maximum allowed travel in the outer most hole of the arm.

When there is no way to have a drive point of less than 2 1/2" or when the primary control is cable-driven it is necessary to use the capstan-cable servo drive. When this is done the servo should be mounted so that the 1/16" diameter cable which wraps around the capstan when extended parallel to the primary cable is approximately 3/16" from the primary cable. If the primary control travel does not exceed 5" the cable-locking pin will be 180° away from the point at which the cable leaves the capstan. When the primary control is at the neutral point this means the total cable wrap around the capstan is 360°. If the primary control travel is greater than 5" the cable wrap is 720° and the pin is adjacent to the output point when the primary control is at the neutral point. The cable clamps when properly installed will not slip and thus get loose, but it is desirable to nico press or swedge a fitting onto the cable so as to provide added assurance that the cable will not become slack. If the bridle cable is not sufficiently tight there will be lost motion in the autopilot drive. This will result in hunting (oscillation).

RFI/EMI considerations

The autopilot programmer is shielded and does not generate any appreciable level of electromagnetic interference. More over, the servo lines (except for power and ground) are low-current and cannot contribute to RF interference. The servo power and ground lines do have switching currents through them, but so long as there are no parallel runs of servo power and ground lines with such things as poorly-shielded antenna lines or strobe light power lines, there is no need to shield the servo harnesses.

The autopilot itself has been internally protected from RF interference and has been tested under fairly extreme conditions, such as close proximity to transmitting antennas. However, it is always good practice to insure that such antennas are properly shielded and not routed directly over or under sensitive panel-mounted electronic equipment. Most problems in this area are the result of improper RF shielding on transmitting antennas, microphone cables, and the like. The most sensitive input to the autopilot is the Control Wheel Switch input. This line should not be routed in parallel with transmitting antennas or other sources of known RF interference. If necessary, it can be shielded with the shield connection to pin 15 of the autopilot connector.

Altrak Programmer Mounting / Setup / Ground Test Must be performed before first flight

After the servo is installed check to see which direction the servo turns to move the elevator up. If the servo turns counter-clockwise (when looking at the servo arm or capstan) to drive the elevator up then no jumper is necessary on the programmer. If the servo turns clockwise for elevator up then the pitch servo reverse jumper must be installed. See Pin 4 on the wiring table for instructions on how to wire the pitch servo reverse jumper.

The programmer has a static port located next to the connector. The static port can be connected to the static system. For pressurized aircraft it is necessary that the static system be connected to the Altrak static port. For most other aircraft the static connection is optional.

Before mounting the Altrak it should be tested for proper operation. After the servo installation and wiring are complete and the Altrak programmer is plugged in, the test can be performed. When the Altrak is powered-up **it is necessary that the Altrak be stationary**. The attitude of the programmer is not important during the power-up phase. With the Altrak programmer secured turn on the master switch and avionics master so the Altrak has power. During the power-up phase of operation (the first ten seconds that the Altrak has power) the ALT button will flash. Next engage the Altrak by pressing the ALT button. With the THIS SIDE RIGHT sticker facing you rotate the programmer module clockwise to simulate a nose down attitude. The servo should cause the elevator to move up to correct for the simulated nose down attitude. Rotating the programmer counter-clockwise should drive the elevator down.

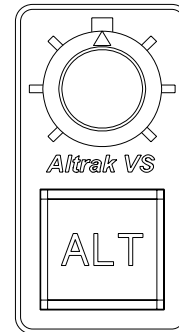
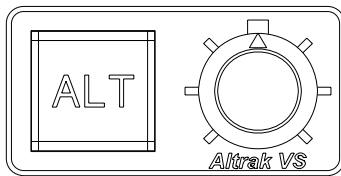
Mounting the programmer module of the Altrak can be done in any location; the only requirement that must be met is that the side of the unit label "This side right" must face the right side of the aircraft. This is also the side that has six (6) screws on the surface. The rotational position is not important as long as the right side is facing right. The side with the sticker also must be parallel with the direction of flight. The mounting holes on the programmer are 1-1/2 inches apart, and are tapped for a 6-32 thread, use any screw length up to 1" in length. The engage/disengage pushbutton which also serves as the enunciator can be mounted anywhere in the panel.

The activity setting (activity is the amount of servo movement for a given amount of programmer movement) in all **RV type aircraft** will be at medium activity setting. If more or less activity is required, it is necessary to use a jumper as per the wiring diagram to change the activity setting.

MOVE TAIL UP AT LEAST A FOOT AND ELEVATOR MUST MOVE UP AT SAME TIME. MOVE TAIL DOWN AT LEAST A FOOT AND ELEVATOR MUST MOVE DOWN AT SAME TIME.

Altrak VS control panel installation

The Altrak VS comes with a reversible control panel, which can be mounted either horizontally or vertically. The engage/disengage button requires a 5/8" diameter hole; the same size hole can be used for the mounting of the VS control knob. A template for the two holes is included with this manual. When putting the knob on the VS control potentiometer, the pointer must be pointing at the larger white mark on the control panel. This is shown below for both the horizontal and vertical mounting orientations.



Power Up



When powering up the autopilot ensure that the aircraft is still for 10 seconds.

The power up of the autopilot takes approximately ten seconds. During the power up cycle it is very important that the aircraft be as still as possible for the initialization of the internal gyro. While the autopilot is in the power up phase, the enunciator will flash rapidly for approximately ten seconds. Once the power up phase is completed, the enunciator will remain unlit.

Basic Altrak Operation

Once the aircraft is at the desired altitude, and trimmed for level flight, the altitude hold can be engaged. Pushing the **ALT** button will engage the Altitude hold. If in severe turbulence or when the aircraft is out of trim and the servo may run out of torque, in this case the current altitude and the selected altitude may be different. When the difference between the current altitude and the initial selected altitude is more than approximately 50 feet the light in the switch will flash, rapid flashing of the light for below altitude and slow flash of the light for above altitude. If an out of trim condition is suspected, disengage the altitude hold, re-trim the aircraft, and re-engage the altitude hold. If turbulence is the cause for the altitude departure the Altrak will fly back to the desired altitude automatically.

Changing the desired altitude can be done by simply disengaging the altitude hold, flying to the desired altitude and re-engaging by pushing the **ALT** button. If on a long flight setting the barometer to the local setting will result in a difference in indicated altitude and the altitude selected by the Altrak. To correct the altitude error, disengage the altitude hold, fly to the new desired altitude and re-engage the altitude hold.

If the optional trim sensing pitch servo has been purchased, the Altrak will enunciate the need to trim the aircraft, with a rapid flash of the light in the switch for the need to trim up, and a slow flash of the light in the enunciator for the need to trim down. If the Altrak is coupled with a Digitrak / Pictorial Pilot, the Altrak can only be engaged if the Digitrak / Pictorial Pilot are engaged. When the control wheel switch is pushed, the Digitrak / Pictorial Pilot will enter control wheel steering mode as normal, but the Altrak will remain engaged and holding altitude while the pilot manually flies the aircraft to the desired track. Upon release of the control wheel switch the Digitrak / Pictorial Pilot will re-engage and synchronize to the track being flown at the time, and the Altrak will remain engaged throughout the maneuver. It should be noted that the Altrak will lose some altitude while the aircraft is turning. The altitude loss could be as much as 50 to 100 feet depending upon the bank angle. The Altrak will recover the lost altitude on it's own after the turn is completed, or if the aircraft is in a sustained turn.



Because Altrak does not receive bank angle information, it will lose some altitude in turns. If the bank angle is less than 30 degrees the altitude loss will be less than 50 feet, for this reason it is recommended that the bank angle be kept below 30 degrees.

Altrak VS Operation

Note: Zero vertical speed (Altitude hold) must be selected or Altrak VS will NOT engage.

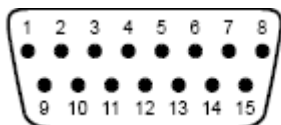
To engage the Altrak VS, ensure that zero vertical speed is selected on the VS control knob (The VS control knob should be at the center detent.) Push the ALT button to engage the Altrak VS. When Altrak VS is engaged it will be in altitude hold mode. If the aircraft is out of trim the light in the Altrak engage/disengage button will enunciate the need for trim, with a rapid flashing of the light for trim up, and a slow flashing of the light for trim down.

If Altrak is coupled with the Digitrak / Pictorial Pilot, the Altrak can only be engaged if the Digitrak / Pictorial Pilot are engaged. When the control wheel switch is pushed, the Digitrak / Pictorial Pilot will enter control wheel steering mode as normal, but the Altrak will remain engaged while the pilot manually flies the aircraft to the desired track. Upon release of the control wheel switch the Digitrak / Pictorial Pilot will re-engage and synchronize to the track being flown at the time, Altrak will remain engaged throughout the maneuver. It should be noted that if Altrak is in altitude hold during this maneuver, it will lose some altitude while the aircraft is turning. The altitude loss could be as much as 50 to 100 feet depending upon the bank angle. The Altrak will recover the lost altitude on its own after the turn is complete.

Changing the desired altitude can be done by simply rotating the VS control knob to the right to command a vertical speed climb, or to the left to command a vertical speed descent. The maximum possible vertical speed in either direction is approximately 800 feet per minute. As when in the altitude hold mode, the Altrak VS will always enunciate the need for trim, with a rapid flashing for trim up, and a slow flashing for trim down.

Electrical Pin-Out

The table below provides a brief explanation of each pin function on the main 15-pin connector P101.



Rear 15-Pin Connector P101
viewed from rear of unit

P101 Pin	Function	Notes	
1	Autopilot Master (+12 to +14 V DC). The autopilot itself draws less than 0.3 ampere. Most of the current required by the system is used by the servo (up to 1Amp depending on torque setting).	See note 3 on wiring diagram	
2	Control Wheel Switch . Connect as shown in wiring diagram to a SPST momentary switch located remotely to the autopilot for convenient disengage function.	See note 3 on wiring diagram	
3	On / Off Switch . Connects to the illuminated push button module		
4	Pitch Reverse Jumper , present or absent, as follows:	See note 2 on wiring diagram	
	Pin 4 open (no connection)		Servo CCW (counter-clockwise) → UP
	Pin 4 Jumpered to pin 15		Servo CW (clockwise) → UP
5	Pitch Servo Trim Sensor . A signal from the pitch servo to the autopilot which indicates an out-of-trim condition and its direction. (For use with trim sensing servo upgrade)		
6	Engage Lamp / LED Connects to LED which connects to 470 ohm resistor.	See Module Rear View on wiring diagram	
7	Pitch Servo Torque Control . A signal from the autopilot to the pitch servo which sets the amount of torque to be delivered by the servo.		
8	VS control input from button assembly on panel.	VS Option only	
9	AP On . Connect to pin 7 on Digitrak / Pictorial Pilot/Pictorial Pilot (This function is only to be used if Altrak is coupled to Digitrak / Pictorial Pilot/Pictorial Pilot.)	See note 3 on wiring diagram	
10	Activity Select . Connect to ground for low activity, leave open for medium activity, and connect to 12v for high activity	See note 4 on wiring diagram	
11 12 13 14	Pitch Servo control lines . These lines cause the stepping motor in the pitch servo to run in the appropriate direction at the desired velocity. They are small-signal lines and do not have any substantial current-carrying capability or require any special shielding. Connect to pitch servo as shown on wiring diagram.	Do NOT attempt to reverse servo direction by swapping wires	
15	Ground Connection . Provide #20 AWG to common grounding point.		

BASIC ALTRAK WIRING DIAGRAM

INSTALLATION NOTES:

- USE #20 AWG FOR POWER AND GROUND WIRES TO SERVO (PINS 1 AND 9 ON 9-PIN CONNECTOR J2) AND WIRE TO AUTOPILOT MASTER AND SINGLE-POINT GROUND. ALL OTHER WIRING #20 TO #24 AWG.
- REVERSAL OF SERVO DIRECTION CAN BE ACCOMPLISHED AS NECESSARY BY INSTALLING OR REMOVING A JUMPER BETWEEN PINS 4 AND 15 OF THE 15-PIN CONNECTOR (CUSTOMER'S J1 MATING ALTRAK P1).
- WIRES MARKED (*) TO BE USED IN CONJUNCTION WITH DIGITRAK /PICTORIAL PILOT UNIT ONLY. ALLOWS ALTRAK ENGAGE ONLY WITH ROLL CONTROL ENGAGED.
- SELECTION OF SERVO ACTIVITY CAN BE ACCOMPLISHED AS NECESSARY BY CONNECTING PIN 10 :
 (Low Activity) --- Connect to GROUND
 (Medium Activity) --- LEAVE OPEN
 (High Activity) --- Connect to +12V
- MAIN DIAGRAM SHOWS DEFAULT WIRING WITH NO PROVISION FOR DIMMING. IF DIMMING IS DESIRED SEE INSET

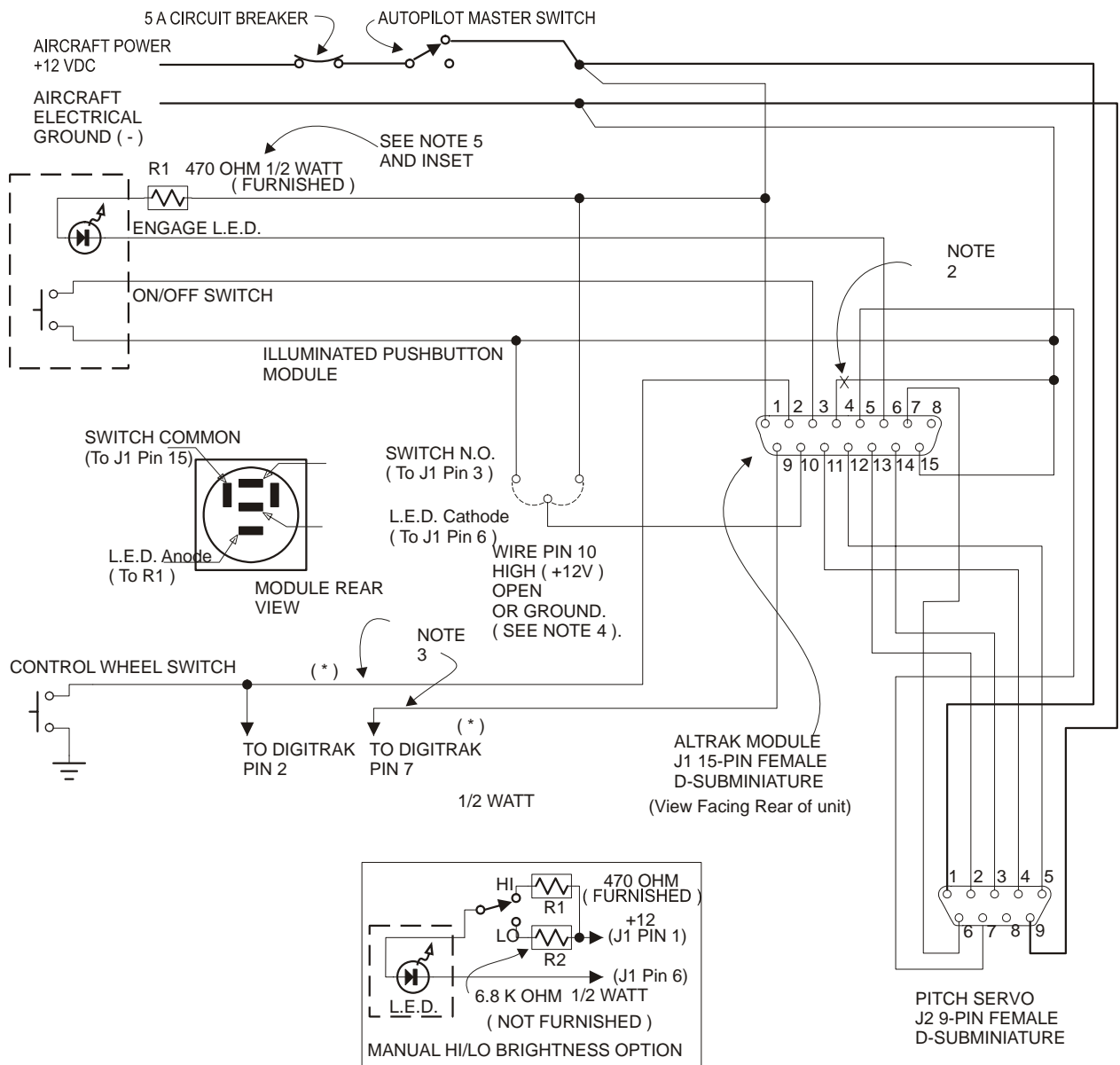


FIGURE 2 - ALTRAK EXTERNAL WIRING DIAGRAM

ALTRAK VS WIRING DIAGRAM

INSTALLATION NOTES

- USE #20 AWG FOR POWER AND GROUND WIRES TO SERVO (PINS 1 AND 9 ON 9-PIN CONNECTOR J2) AND WIRE TO AUTOPILOT MASTER AND SINGLE-POINT GROUND. ALL OTHER WIRING #20 TO #24 AWG.
- REVERSAL OF SERVO DIRECTION CAN BE ACCOMPLISHED AS NECESSARY BY INSTALLING OR REMOVING A JUMPER BETWEEN PINS 4 AND 15 OF THE 15-PIN CONNECTOR (CUSTOMER'S J1 MATING ALTRAK P1).
- WIRES MARKED (*) TO BE USED IN CONJUNCTION WITH DIGITRAK /PICTORIAL PILOT UNIT ONLY. ALLOWS ALTRAK ENGAGE ONLY WITH ROLL CONTROL ENGAGED.
- SELECTION OF SERVO ACTIVITY CAN BE ACCOMPLISHED AS NECESSARY BY CONNECTING PIN 10 :
 (Low Activity) --- Connect to GROUND
 (Medium Activity) --- LEAVE OPEN
 (High Activity) --- Connect to + 12V
- MAIN DIAGRAM SHOWS DEFAULT WIRING WITH NO PROVISION FOR DIMMING. IF DIMMING IS DESIRED SEE INSET

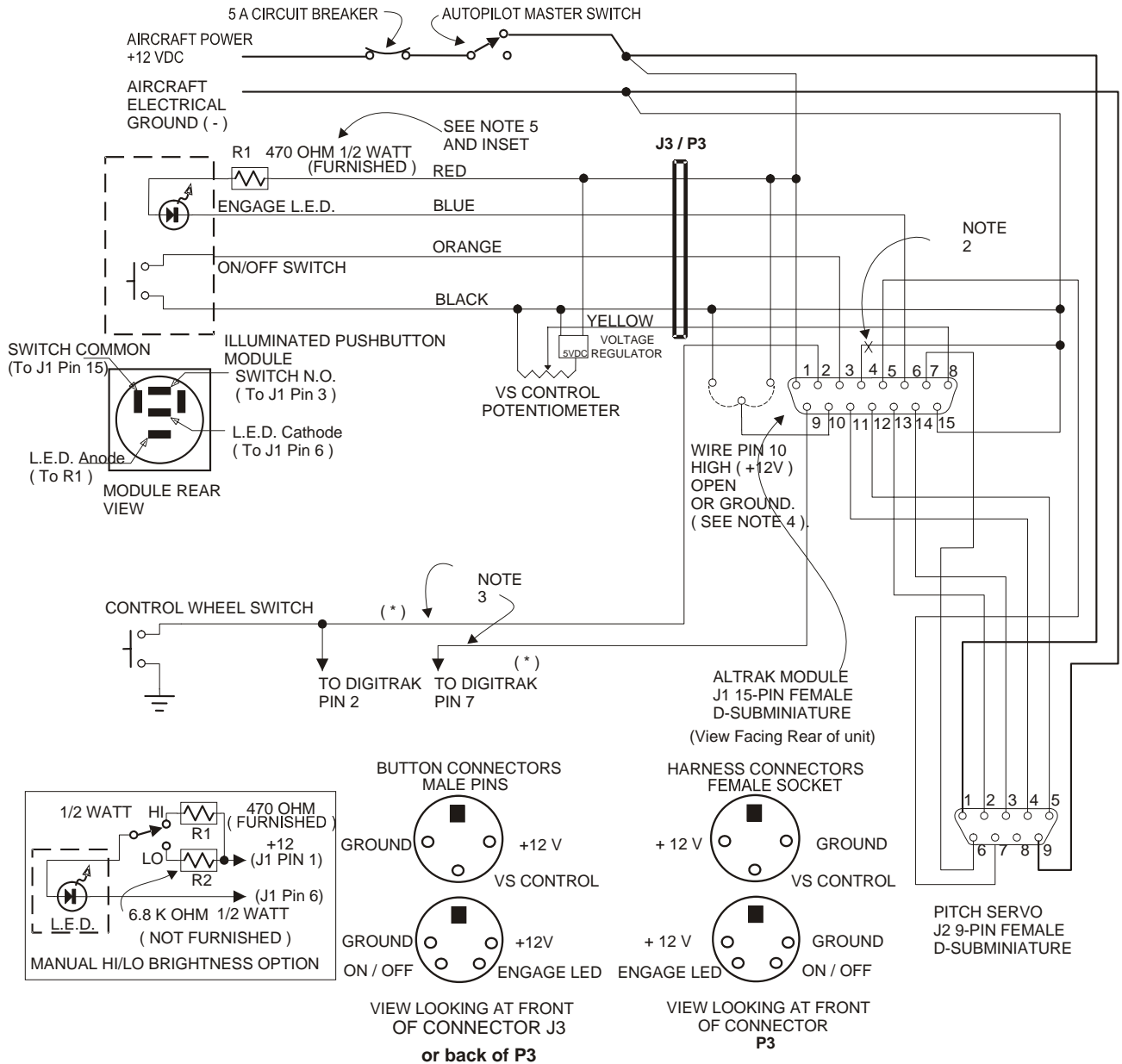
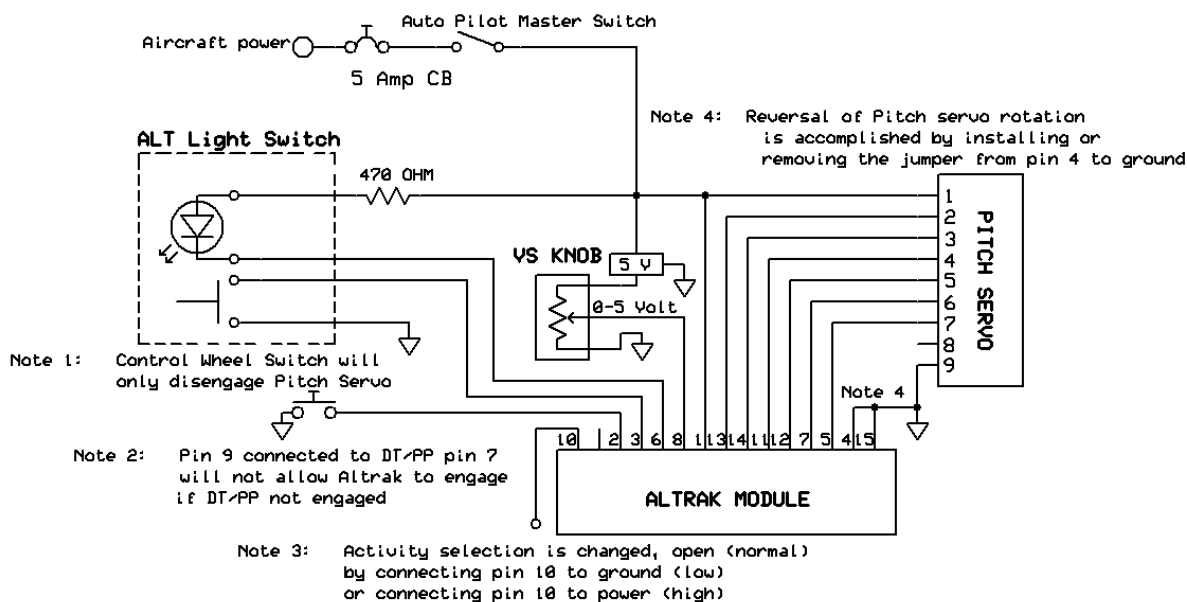


FIGURE 2 - ALTRAK/VS EXTERNAL WIRING DIAGRAM

ALTRAK VS BLOCK DIAGRAM



VS KNOB section only used in Altrak VS option.

Trouble Shooting

Problem	Cause	Corrective Action
ALT LED will not blink when power applied	No aircraft voltage and/or ground to system	Correct power, ground wiring
ALT LED blinks but will not light up when pressed	Engage signal not received at module or DT/PP not engaged if connected pin 9	Check for low (ground) at pin 3 when ALT switch depressed
ALT VS will not engage (ALT LED light up)	Engage signal not received at module or VS knob not centered (2.5 v)	See above and/or check for 2.5 v at pin 8 at module
Aircraft pitches up or down rapidly	Pitch servo is reversed	Install or remove jumper to ground pin 4
Aircraft hunts up and down	Activity not correct	See note 3 (slow hunt increase activity)



RETURN MERCHANDISE POLICY AND PROCEDURE

- Under no circumstances should products be returned to TruTrak without first obtaining a Return of Merchandise Authorization number (RMA #) from TruTrak. An RMA # may be obtained by contacting us at 866-878-8725.
- Products that do not have an RMA # will not be processed.
- Please include some form of documentation stating the reason for the return and describing any symptoms, failure modes, suspected causes of damage, diagnostics performed, data collected, etc.
- Product(s) should be packaged in their original shipping containers. In lieu of this, they should be very carefully packaged in containers suitable to protect them during transit. Note that damage caused during shipping will not be repaired under warranty.
- The outside of the box must be clearly marked with the RMA # issued by TruTrak and the RMA # must also be noted on the return documents.
- Products will be returned to the customer at no charge via FedEx Ground or UPS Ground. If customer requests expedited shipping (2nd Day or Overnight) they will be charged the shipping cost and must supply a credit card number.
- Send ALL return shipments to:

Trutrak Flight Systems, Inc.
 1500 South Old Missouri Road
 Springdale, AR 72764
 USA
 Attention: Returns Dept.
 RMA# _____

TruTrak Warranties		
<u>Product Description</u>	<u>Warranty Begins</u>	<u>Length Of Warranty</u>
Autopilot Programmer	Date Of Purchase	Limited Lifetime
Autopilot Servo	Date Of Purchase	Limited Lifetime
ADI	Date Of Purchase	Limited Lifetime
Pictorial Turn & Bank	Date Of Purchase	1 Year

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