



EFIS

Installation & Operation Manual

8300-056 Rev B



TRUTRAK FLIGHT SYSTEMS

1500 S. Old Missouri Road

Springdale, AR 72764

Ph. 479-751-0250 Fax 479-751-3397

www.trutrakflightsystems.com

OPERATION OF THE BASIC FLIGHT INSTRUMENT

As with our autopilot products, extensive attention has been given to providing the simplest operation. No sequential pressing of buttons is required to reach basic control functions and no additional button pressing is required to set values. Starting with a clean sheet of paper the layout of controls (two knobs and five soft keys) is sufficient to handle all EFIS and built in autopilot control functions.

On the basic flight instrument the right hand knob is primarily dedicated to setting the barometer and the left hand knob is primarily dedicated to setting the direction bug. Pressing the ALT soft key sets the altitude bug to the 100 foot mark nearest the present altitude. This setting is entered into the active state by pressing the right hand knob. If the intent is to select an altitude the ALT button is pressed and the right hand knob is rotated to select the desired altitude. (with the knob out steps are 500 feet and with the knob depressed steps are 100 feet.) When the altitude has been set press the knob to ENTER the value. It will be noted that when any value is to be set a screen showing the selection to be made will appear above the appropriate knob.

When the aircraft is within 30 miles of the destination fix the CRS labels the soft key at the far left. To select an arrival course different from the enroute course on the HSI press CRS and then rotate the left hand knob. When the course is set press the knob to ENTER. A computer generated arrival procedure in which steering from the enroute course to the selected runway is described in the special functions section.

Just above the left knob is the label [DIM] in small print. To set the dimmer press and hold the knob in for approximately one second, then rotate to set the desired light intensity. When this is done press the knob to exit the set mode.

When there is NO GPS FIX the directional gyro operates in the free gyro mode, and the label above the far left soft key is SET DG. When this button is pressed the left knob is used to set the DG to the magnetic compass. As is the case with any free gyro this procedure is to be repeated periodically as required.

THE DISPLAY

Consider first the pitch display. Motion of the pitch display short term is gyroscopic as it must be to fly in IMC. Long term it is VSI. This is a special case of a presentation used in the military called VELOCITY VECTOR. This display has two advantages. The first is that it provides an instantaneous vertical speed presentation. The second is that when the reference airplane is on the horizon the aircraft is neither climbing nor descending. This eliminates the need for adjusting the position of the pitch reference airplane to compensate for the angle the fuselage is flying. The resulting benefit of this concept is that it makes holding altitude easier (not only in straight flight but also in turns). It is a fact that next to AOA, airspeed provides the best warning of approaching a stall. For this reason the airspeed pointer flashes red when a pre-set minimum airspeed safely above a stall is reached. There are critics of this concept who believe that attitude is an indicator of approaching a stall. NOT SO, attitude alone is not at all such an indicator.

The HSI is placed below the horizon as in the larger more expensive displays. It is in the form of an ellipse for two reasons. First, an ellipse when compared with a circle of the same height provides a broader scale at the top where it is read. Second, it looks as a circle would when laid out on the ground ahead of the aircraft. When a DIRECT TO or FLIGHT PLAN is set into the GPS this display becomes an HSI. The boldness of this high quality display in combination with its location enhances the flyability of the overall instrument. Finally, the HSI contains features that make functions available that are not found in other low cost systems. These are described in other sections.



The analog presentations of airspeed and altitude are based on the belief that in some cases round is better. It will be noted that after having tried other presentations the automobile industry is back to round instruments. Nothing in the modern world of vertical tapes compares with the dynamic effect of a white needle moving around a black altimeter dial. As a target altitude is approached it is natural for the pilot to slow the needle velocity so as to arrive at the altitude without overshoot. The difference is that in this system the dials rotate about fixed pointers, but the relative motion retains the same effect as the moving pointer. In addition, the rotating altimeter dial further enhances the motion factor. To satisfy personal preference the display can be switched back and forth between round and rectangular, even in flight. Of those who have tried both the choices have been almost unanimous in favor of the round.

Within the bank angle scale indicators are inserted which show the angle for a standard rate turn. These indicators move outward on the bank angle scale as airspeed increases. Placed above the bank angle scale is an inclinometer that looks just like a conventional ball in a curved tube.

Still another convenient feature is the optional presentation of important engine data in the pilot's direct field of vision displayed across the top of the instrument.

Mechanical Installation Considerations

PROGRAMMER INSTALLATION

Mounting Considerations

The EFIS Series unit is designed to mount in the aircraft instrument panel within view and reach of the pilot. The primary unit location should minimize pilot head movement when transitioning between looking outside of the cockpit and viewing/operating the EFIS Series unit. Maximum recommended viewing angle should be no more than 20 deg. The maximum mounting angle the EFIS can accommodate is 12 degrees longitudinal axis and 0 degrees lateral axis. The location should be such that the EFIS Series unit is not blocked by the glare shield on top, or by the throttles, control yoke, etc. on the bottom. Use aircraft installation standards for mounting and support of the EFIS programmer.

Wiring Considerations

Use AWG #24 or larger wire for all connections unless otherwise specified. The standard solder pin contacts supplied in the connector kit are compatible with up to AWG #18 wire. In cases where some installations have more than one component sharing a common circuit breaker, sizing and wire gauge is based on, length of wiring and current draw on units. In these cases, a larger gauge wire such as AWG #20 may be needed for power connections. Do not attach any wires to the outside of the EFIS or route high current wires within six (6) inch of the programmer. Ensure that routing of the wiring is not exposed to sources of heat, RF or EMI interference. Check that there is ample space for the cabling and mating connectors. Avoid sharp bends in cabling and routing near aircraft control cables. Do not route the COM antenna coax near any EFIS components.

RFI/EMI considerations

The EFIS programmer is shielded and does not generate any appreciable level of electromagnetic interference. The EFIS 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.

Pitot and Static Connections

The TruTrak EFIS require connections to the Pitot and static lines. The preferred method of this connection would be tee fittings near the aircraft's airspeed indicator. The importance of a good static port and line cannot be overstated. In some cases, problems can be caused by having a large number of devices connected to a single, insufficient, static port. In other cases, the static line itself is adequate but there are one or more devices connected to the same line, one of which has a large static reservoir. A simple remedy for this problem if it occurs is a tee-fitting near the static port, and a dedicated line to the EFIS only or a dedicated static port close to the autopilot. Obviously, an insufficiently-large orifice coupled with large static reservoirs can aggravate the problems associated with lag.



PITOT

STATIC

Operating Controls

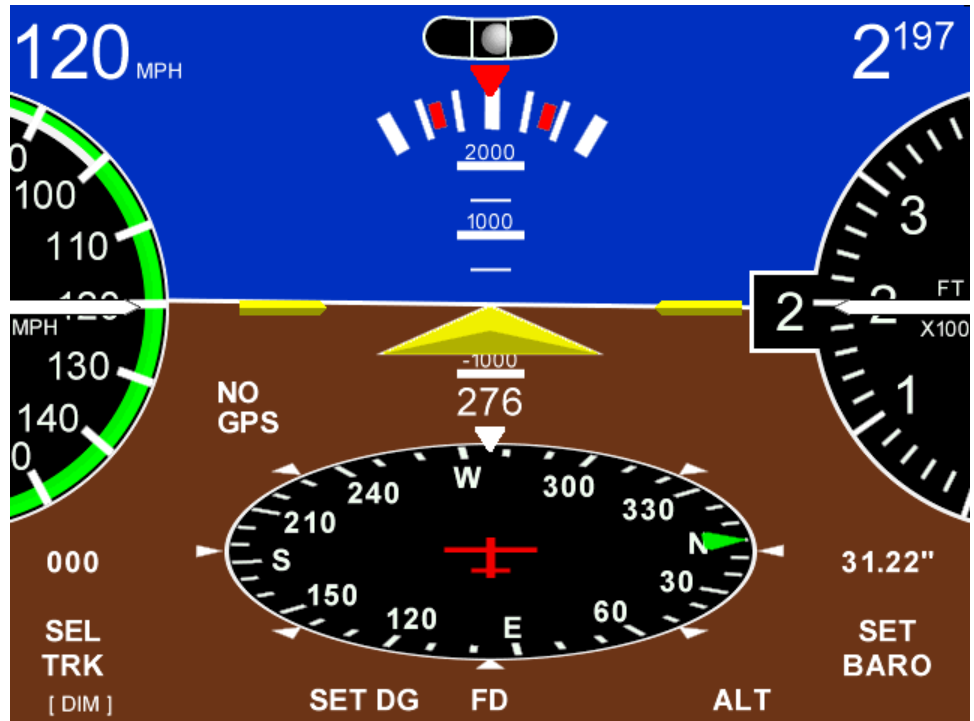
As with our autopilot products, extensive attention has been given to providing the simplest operation. No sequential pressing of buttons is required to reach basic control functions and no additional button pressing is required to set values.

BARO & TRK SELECTION

In the TruTrak EFIS display, both barometer **BARO** and direction **TRK**, the green triangle bug, are directly set by rotation of dedicated knobs.

DIMMING

Dimming of the display is accomplished by press and release of the left knob [DIM] and then rotating the knob Counter Clock wise to reduce the display illumination. External dimmer input will only control the button illumination.



DIRECTION GYRO

Normally this adjustment will not be necessary as the HSI will be slaved to a GPS NMEA source. If there is a loss of the GPS source then the internal gyro backup will maintain the DG. Depressing the soft key beneath **SET DG** provides a screen for correction any drift in the DG that may occur. Natural progression will be reduced with repeated DG SET.

ALTITUDE BUG

Depressing the soft key beneath **ALT** provides a screen for selecting the altitude bug. The bug will move to the closes 100 ft mark of the current altitude. Then rotating the right hand knob **SELECT ALT** will allow the altitude to be selected. Each step of the rotary encoder moves the bug 500ft. while depressing the knob provides 100ft. steps. The altitude bug will never move out of view but will remain ether at the top of the altimeter to indicate selected altitude is above current altitude or the bottom to indicate selected altitude is below current altitude. The selected altitude can always be seen above the **ALT** on the display.



GPS INFORMATION

The HSI requires GPS NMEA information to function correctly. If the primary serial connection and communication protocols have been setup correctly, the EFIS screen will display **NO GPS FIX** until the GPS unit has acquired satellites. Then the display will show GPS/HSI information as shown. If not then the Display will show **NO GPS** and only the DG will be operational. When a flight plan has been entered into the GPS the HSI will display a Course to the first way point. The deviation bar will offset to show the aircraft present position compared to the desired track. The yellow diamond bug shows bearing to waypoint. Setting the HSI CRS pointer is accomplished by pressing the soft key beneath **CRS** to enter the set up screen. Rotation of the left knob selects the course.



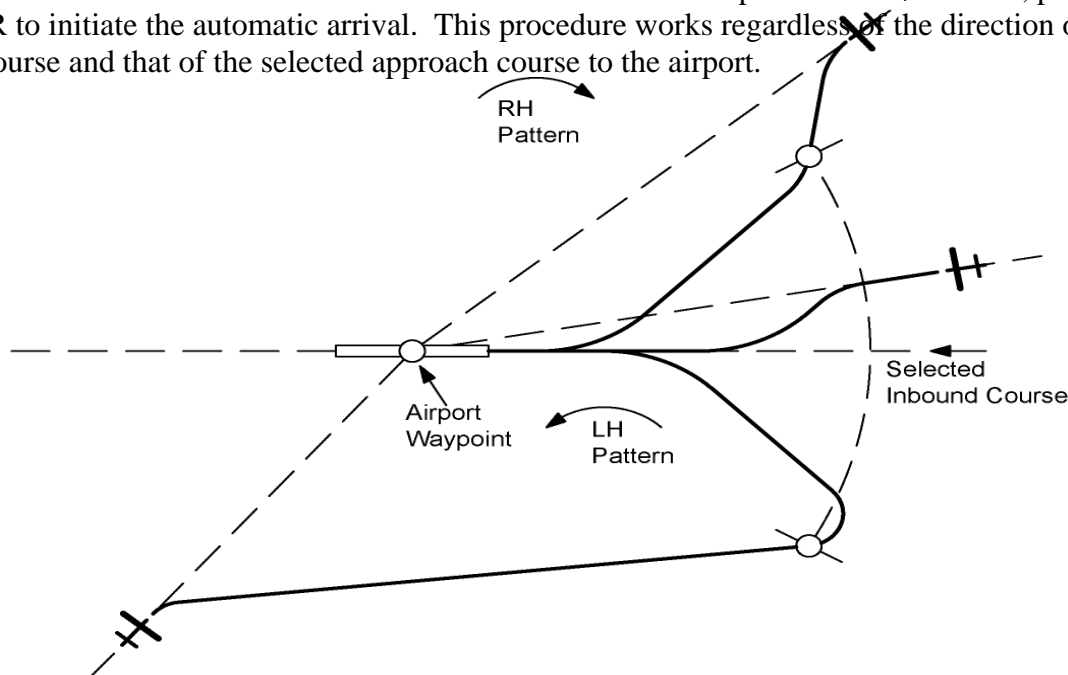
SL 30 INFORMATION

If the serial wires are connected from a SL 30 NAV/COM. The EFIS will have VOR or ILS above the CRS label. Press and HOLD the button to display this information on the HSI.

AUTOMATIC ARRIVAL TRANSITION

In an aircraft tracking a course inbound to a destination airport, the letters CRS will appear above the far left soft key when the distance becomes less than 30 miles. When CRS is showing the autopilot can be programmed to fly a transition from the enroute arrival course to a selected arrival course set into the HSI. This is not intended to be used in an IFR approach but instead as a convenience for the low time pilot in arriving at an un-familiar airport or for the over loaded pilot in marginal VFR weather.

To initiate the automatic arrival mode, press CRS, select the desired **inbound runway course**, and press APPR. The autopilot will now fly the entire arrival path to the desired runway. An additional feature of the automatic arrival mode can be used to position the aircraft according to the desired right or left hand pattern. After setting the inbound course press ENTER instead of APPR to remain in track mode. Once the desired aircraft position is established, press CRS then APPR to initiate the automatic arrival. This procedure works regardless of the direction of the inbound course and that of the selected approach course to the airport.



PRESS CRS – SELECT COURSE – PRESS APPR

SETUP SCREENS

To enter the setup screen the right knob must be pressed and held until the **SETUP** shows then press and release the soft key below **SETUP** before releasing the right knob. This is the location that the **STYLE, ATT & ZERO, INFO, UNITS, BALL, ALERTS, SPEEDS, & SERIAL** Baud rate are set at.



Press and release the right knob to return to the main screen.

STYLE

Select either **ROUND** gauge or **RECT** tape style airspeed and altimeter gauges.

Press and release the right knob to return to the **SETUP** screen if no selection pressed.



ATT & ZERO

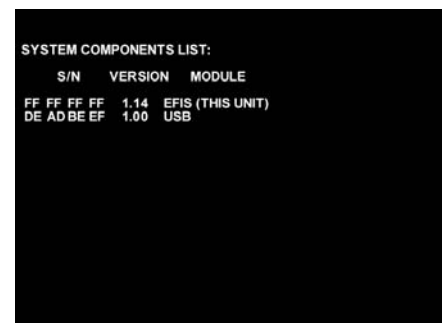
Click ATT on or off to show aircraft attitude indication on the EFIS horizon. The attitude can be zeroed for different aircraft by clicking the ZERO soft key button.



INFO

This button will display the information about all the components that are connected to the EFIS communication buss, Serial numbers, Software version, and Model type.

The **LEFT KNOB** must be clicked to return to the main page.



UNITS

Under this button the **UNIT** of Measure for the **BARO** (IN HG, MBAR) or **DIST** (NM, MI, KM) readouts can be set.



BALL

After the EFIS is installation in the aircraft, center the ball by rotating the right knob.
Press and release the right knob to return to the **SETUP** screen.



ALERTS

LOW AS

Setting the airspeed to 0 will disable the warning.

When an airspeed is selected by the right knob, the arrow on the airspeed gauge will flash red at your selected airspeed. The flight director bar, if engaged, will flash red and drop to indicate an airspeed increase is needed.



Press and release the right knob to return to the **SETUP** screen if no selection pressed.

SPEEDS

- VSO Bottom of the white arc. The stall speed or the minimum steady flight speed in the landing configuration.
- VS Bottom of the green arc. The stall speed or the minimum steady flight speed clean configuration.
- VFE Top of the white arc. Maximum flap extended speed.
- VNO Top of the green arc. Maximum structural cruise speed.
- VNE Red line, Top of yellow arc. Never exceed speed.

Press and release the right knob to return to the **SETUP** screen if no selection pressed.



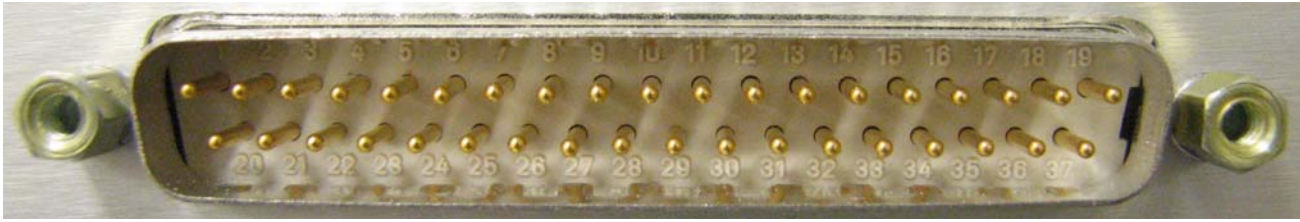
SERIAL

Select either 4800 or 9600 Baud for correct GPS communications. Press and release the right knob twice to return to the **MAIN** screen.



Electrical Pin-out

The table below provides a brief explanation of each pin function on the main 37-pin connector P101.



P101 EFIS Rear Connector (Viewed from rear of EFIS) or **wire side of connector.**

P101 Pin	Function	Notes
1	Dedicated ground connection for Pitch Reverse Jumper.	EFIS autopilot only
2	Pitch Reverse Jumper	Direction of servo arm / capstan rotation EFIS autopilot only
3	SL-30 RS-232 OUTPUT.	
4	BUTTON DIMMER connection	
5	NO CONNECTION	
6	NO CONNECTION	
7	ALERT	Not used at this time
8	NO CONNECTION	
9		Not used at this time
10	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.	EFIS autopilot only
11	Pitch Servo Trim Sensor. A signal from the pitch servo to the autopilot which indicates an out-of-trim condition and its direction.	EFIS autopilot only
12	AIRCRAFT POWER (+12 to +28 V DC). The EFIS itself draws less than 3 ampere.	
13	Audio signal Out. This pin may be wired to an unswitched input of an audio panel. The autopilot uses various voice or tones to denote specific events (loss of GPSS, capture Glideslope, etc). Volume is adjustable within a setup screen of the autopilot.	
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.	EFIS autopilot only
15		
16		
17		
18	AOA	Not used at this time
19	GROUND CONNECTION. Provide #20 AWG to common grounding point.	

Autopilot Rear Connections to P101 (Continued)

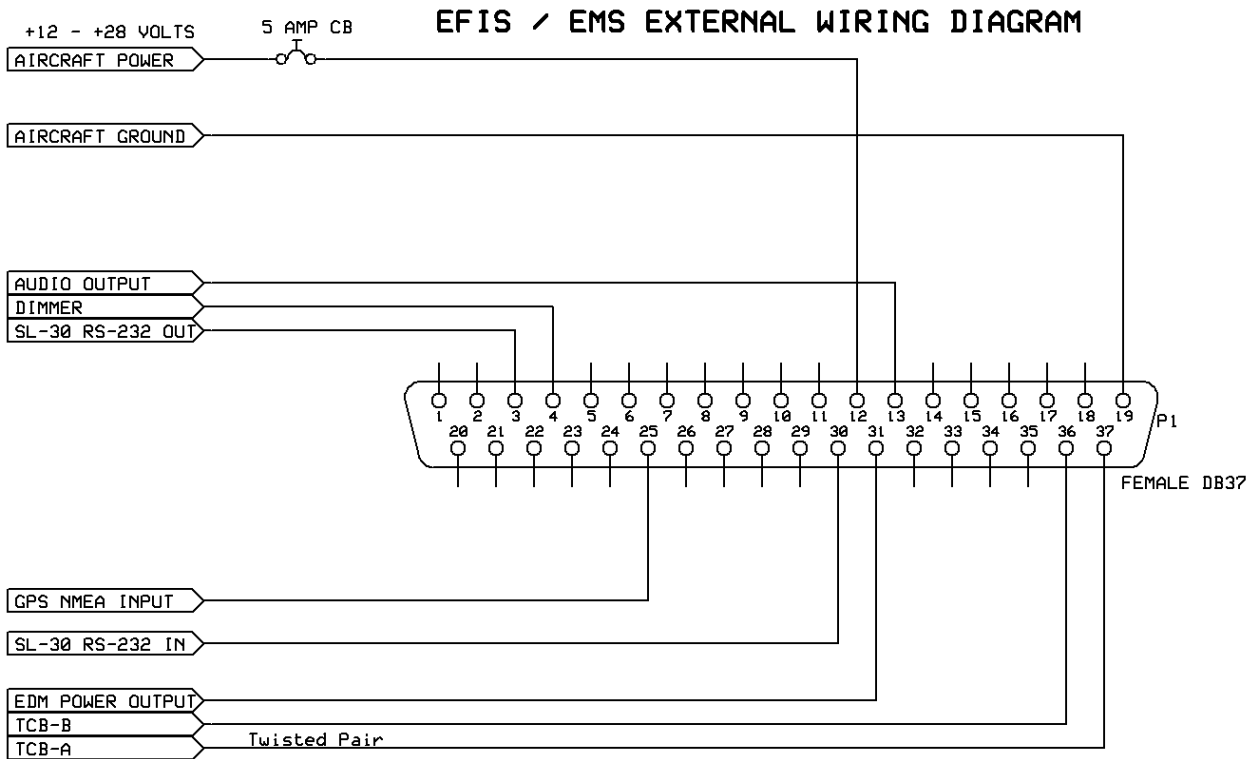
P101 Pin	Function	Notes														
20	Control Wheel Switch. Connect as shown in wiring diagram to a SPST momentary switch located remotely to the autopilot for convenient engage/disengage function.	EFIS autopilot only														
21	FLAP SW.	Not used at this time														
22	ALT RS-232 Output	Not used at this time														
23	SPARE SWT	Not used at this time														
24	No Connection															
25	PRIMARY SERIAL INPUT. Baud rate selectable 1200, 2400, 4800 or 9600 baud. Automatically decodes NMEA-0183, Garmin Aviation Format, or Apollo/UPSAT Moving-Map or GPSS format. Provides directional reference to the autopilot.															
26	ARINC-A Digital differential signals from Garmin, Sierra, or other panel-mount receiver which provide directional steering commands (GPSS) to autopilot	EFIS autopilot only														
27			ARINC-B													
28	Roll Servo Torque Control. A signal from the autopilot to the roll (aileron) servo which sets the amount of torque to be delivered by the servo.	EFIS autopilot only														
29		Not used at this time														
30	SL 30 RS232 IN															
31	AP Power	No Connection														
32	Roll (aileron) Servo control lines. These lines cause the stepping motor in the roll 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 roll servo as shown on wiring diagram.	EFIS autopilot only Reverse servo direction if necessary by swapping wires on pin 32 and 33. See note 3 on wiring diagram.														
33																
34																
35			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3">Wiring to roll servo J201</td> <td rowspan="4" style="text-align: center; vertical-align: middle;"> Direction of servo arm / capstan rotation (as viewed from face of the servo body) for RIGHT aileron </td> </tr> <tr> <td style="text-align: center;">J101</td> <td style="text-align: center;">Pin 32</td> <td style="text-align: center;">Pin 33</td> </tr> <tr> <td style="text-align: center;">Standard</td> <td style="text-align: center;">J201-4</td> <td style="text-align: center;">J201-5</td> </tr> <tr> <td style="text-align: center;">Reversed</td> <td style="text-align: center;">J201-5</td> <td style="text-align: center;">J201-4</td> </tr> </table>	Wiring to roll servo J201			Direction of servo arm / capstan rotation (as viewed from face of the servo body) for RIGHT aileron	J101	Pin 32	Pin 33	Standard	J201-4	J201-5	Reversed	J201-5	J201-4
Wiring to roll servo J201			Direction of servo arm / capstan rotation (as viewed from face of the servo body) for RIGHT aileron													
J101	Pin 32	Pin 33														
Standard	J201-4	J201-5														
Reversed	J201-5	J201-4														
	Servo CCW (counter-clockwise) → RIGHT															
	Servo CW (clockwise) → RIGHT															
36	TCB-B	Not used at this time														
37	TCB-A	Not used at this time														

EFIS P1 pins	King KMD 150	Garmin III	Garmin 92	Garmin 195	Garmin 196	Garmin 295	Garmin 296	Garmin 396	Garmin 496	AvMap EKP IV
RS 232	25	11	Data out	Data out	Blue wire	Blue wire	Blue wire	Blue wire	Blue wire	Data out
ARINC A	26	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
ARINC B	27	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C

EFIS P1 pins	Garmin 155XL	Garmin 200XL	Garmin 300XL	Garmin GX 50-65	Garmin GNS 480	Garmin 430 P4001	Garmin 530 P5001
RS 232	25	19	19	5 / 22	P1 - 22	56	56
ARINC A	26	16	16	N/C	P5 - 4	46	46
ARINC B	27	15	15	N/C	P5 - 24	47	47

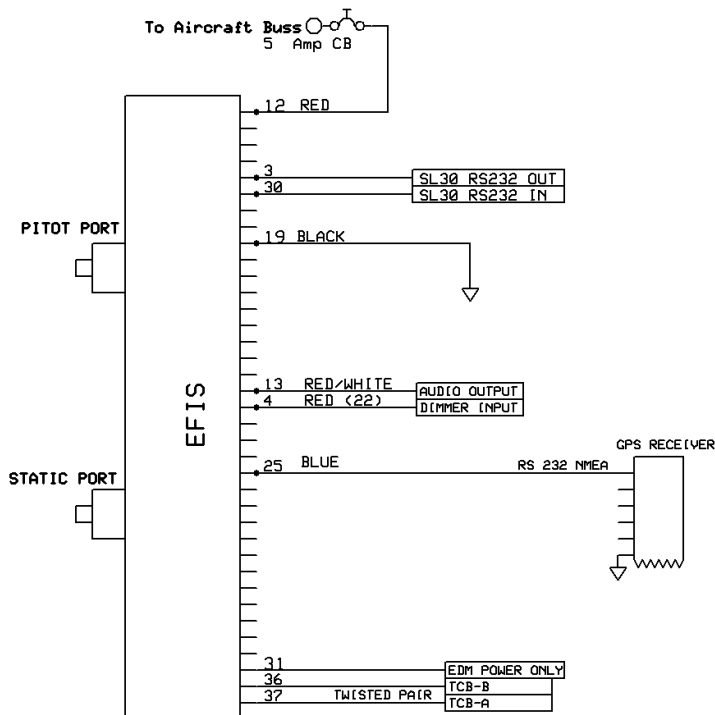
EFIS or EFIS AP SERIES	CURRENT DRAW LOW BRIGHT	CURRENT DRAW HIGH BRIGHT	WEIGHT	DIMENSIONS Behind panel
ALL	1.07 Amps @ 12v 0.65 Amps @ 24v	2.02 Amps @ 12 v 1.15 Amps @ 24v	2.33 lbs High bright 1.95 lbs Low bright	6.375W x 5.75H x 3.625D

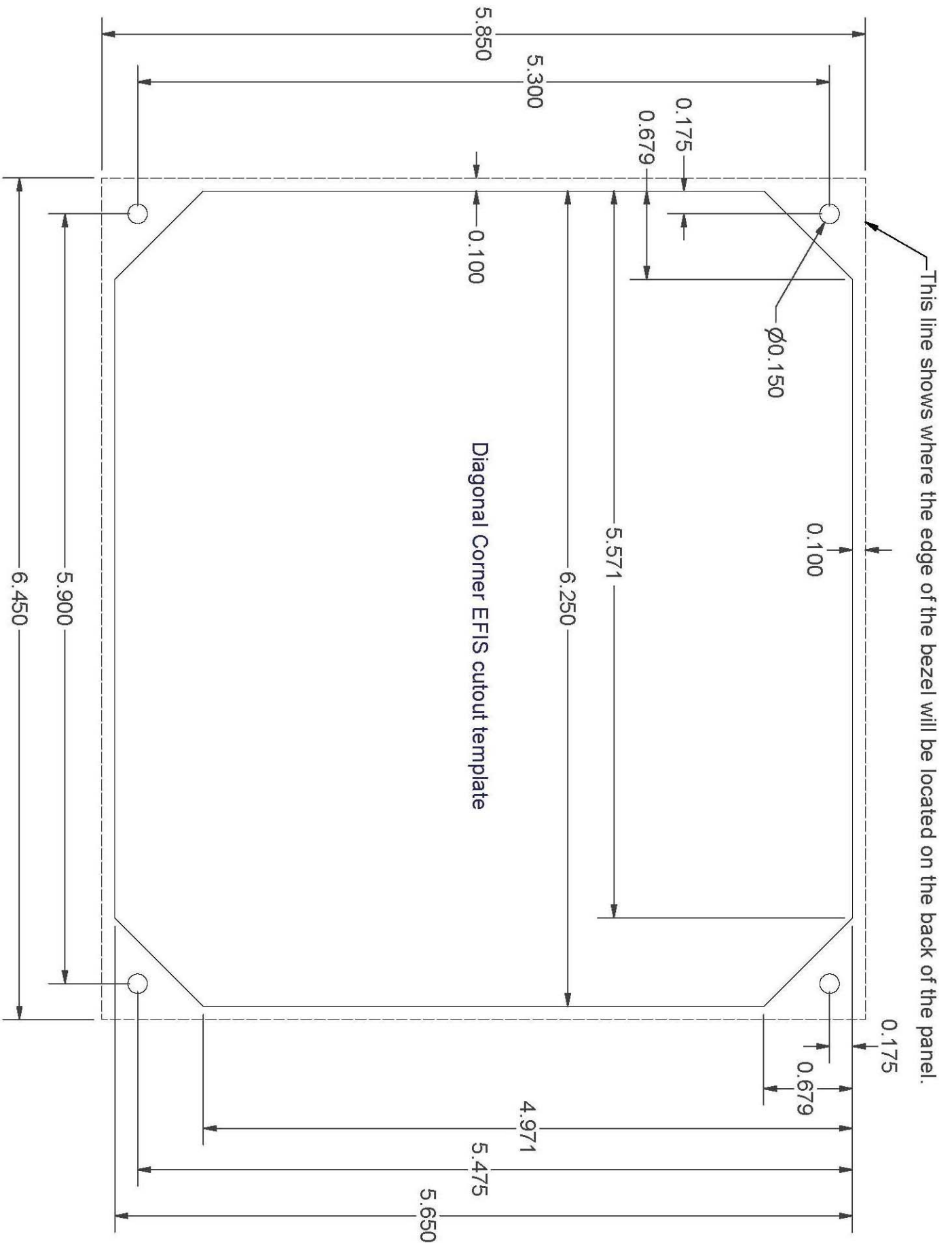
EFIS Basic Wiring Diagram

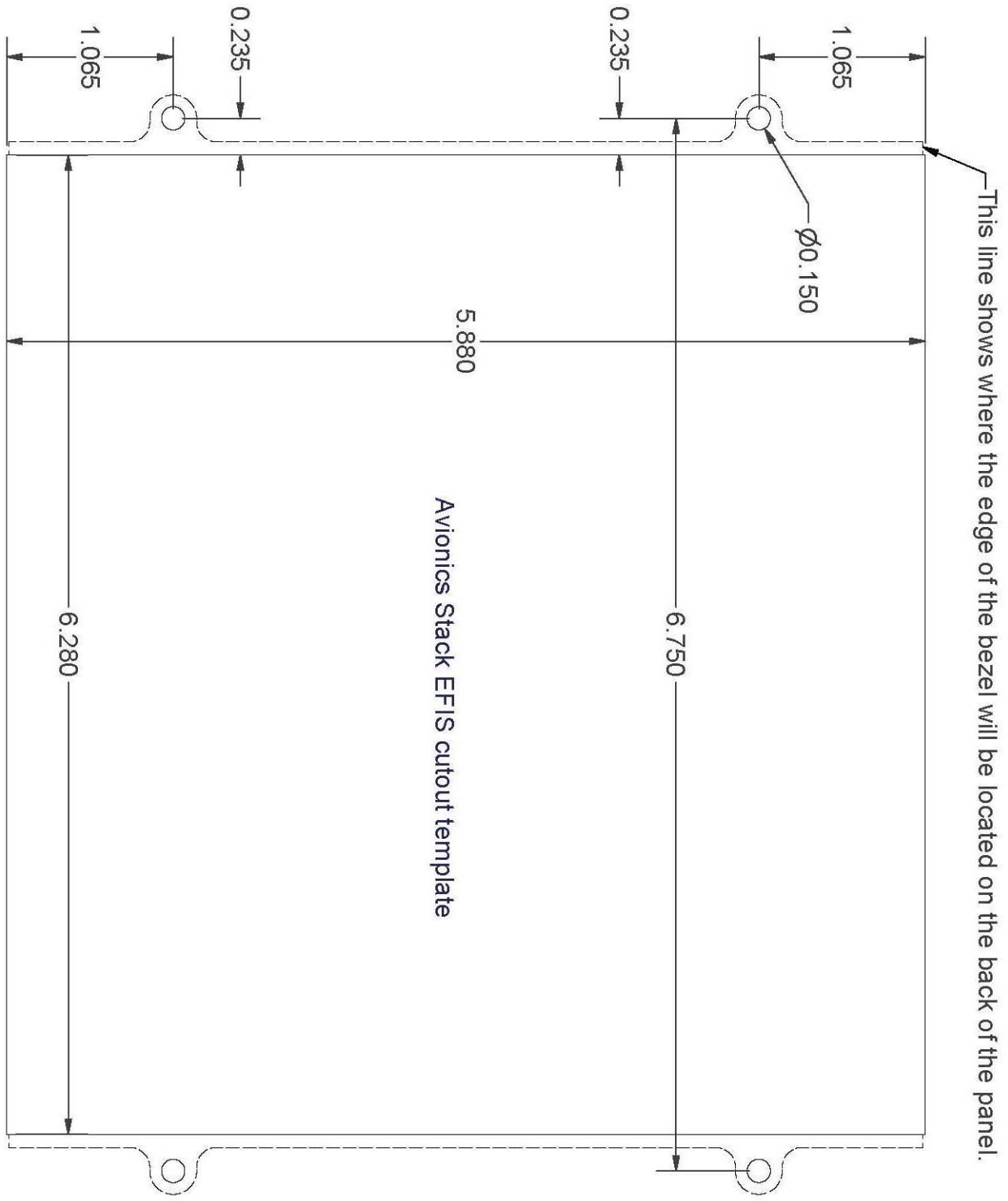


The connector (P1) view is as if you are looking at the connector on the unit. This is the same view of the wire connector on the wire side for pin placement.

NOTE: Some pins are not used at this time, see pin out page 11 & 12.







EFIS Pilot's Guide

- | | | |
|---------------|---|--|
| Button labels | – | White - mode is OFF , Green - mode is ON |
| Click | – | Momentarily push and release any knob or button |
| Press | – | Push and hold any knob or button for 2 seconds and release |
| Enter | – | Click knob labeled [Enter] |

Basic Operation

- | | | |
|----------------------|---|--|
| Barometer adjust | – | Rotate right knob |
| Track bug adjust | – | Rotate left knob |
| Altimeter bug adjust | – | Click ALT button, bug will synchronize to nearest 100 feet
Rotate right knob to select new altitude (Depress knob for 100 ft resolution)
Click [Enter] |
| Altimeter bug cancel | – | Click ALT button |
| Dimmer function | – | Click left knob to enter setup mode Rotate left knob to set desired brightness
Click [Enter] |
| Nav mode | – | Click NAV button |
| Nav mode cancel | – | Click NAV button or rotate left knob (Track bug adjust) |

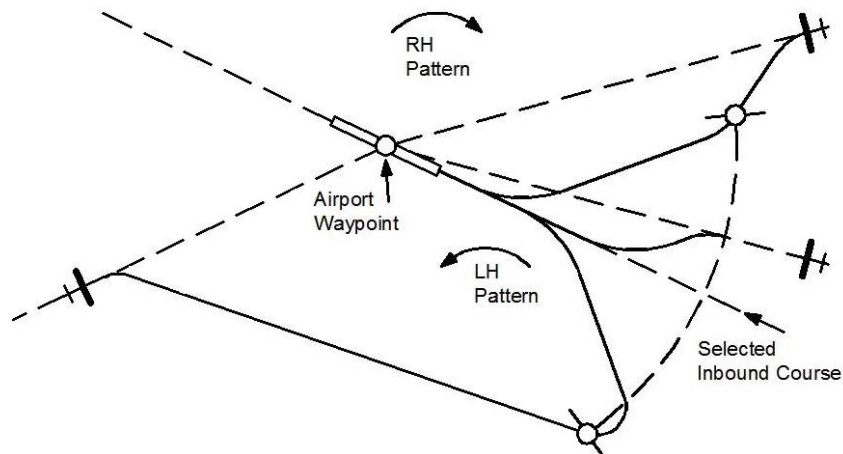
Flight Director Operation

- | | | |
|--------------------------|---|---|
| Flight Director on / off | – | Press FD button – on,
Press FD button – off |
| Track select | – | Rotate left knob |
| Nav mode | – | Click NAV button |
| Nav mode cancel | – | Click NAV button or rotate left knob (Track select) |
| Altitude select | – | Click ALT button, bug will synchronize to nearest 100 feet
Rotate right knob to select new altitude (Depress knob for 100 ft resolution)
Click [Enter] (VS is fixed at +/- 500 FPM) |
| Barometer adjust | – | Rotate right knob |
| Dimmer function | – | Click left knob to enter setup mode, Rotate left knob to set desired brightness
Click [Enter] |

Arrival Transition

(Note: Operation is the same regardless of FD being on or off)

- | | | |
|--------------------|---|--|
| Arrival Transition | – | Click CRS
Rotate left knob to set HSI course pointer to selected runway direction
Click APPR |
|--------------------|---|--|



TruTrak Flight Systems No Penalty Upgrade Policy

As the product line continues to grow, it becomes increasingly difficult to maintain a simple upgrade policy. We do want to reward our repeat customers by allowing a lower cost upgrade from one system to another; however we are not able to offer this across the board on all products. If you are considering an upgrade, please call and we will give you a quote on what this would cost. Many products that we sell today are upgradeable for only the difference in system price. Because we continually strive to have the most up to date products possible, we occasionally have to discontinue products. We will continue to offer discounted upgrades even for our discontinued products.



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 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. For your protection, items should be insured for the full value. 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.

INTERNATIONAL SHIPMENTS:

TruTrak sends all International shipments with an insurance value on all products. TruTrak pays for shipping only. The customer is responsible for any and all additional fees, duties, taxes associated with the shipment.

When sending products to TruTrak for repair or otherwise please be advised that the customer is responsible for all charges and fees associated with shipment. For your protection, items should be insured for the full value.

TruTrak states on all product returns "WARRANTY REPAIR AT NO CHARGE TO CUSTOMER. A COMMERCIAL INVOICE VALUE OF \$___ GIVEN FOR INSURANCE PURPOSES ONLY"

Please keep in mind that your government or another entity in your country may impose a charge for custom and/or brokerage fees, duties and taxes on items received from the US. These charges do not originate from our company nor do we benefit from them in any way. You are responsible for payment of all custom and brokerage fees, duties and taxes that may be imposed when these goods are imported into your country.

Send ALL return shipments to:

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

Warranty On TruTrak Flight Systems Products

We here at TruTrak Flight Systems know how important it is to feel as though the customer is purchasing a product that the manufacturer is going to stand behind. For this reason we want offer more than the basic one year warranty that is standard to this industry. The warranty on all TruTrak products will be three years from the date of purchase. Abuse and misuse of a product are not covered under this warranty. Modification to a product may void the warranty, as well as carry a penalty when upgrading to another product. This three year warranty will be for all products except the Pictorial Turn & Bank, which will continue to have a warranty of one year from the date of purchase.

TruTrak Flight Systems, Inc.
1500 S. Old Missouri Rd.
Springdale AR 72764

(479) 751-0250
FAX (479) 751-3397

www.trutrakap.com