TS

ADI Flight Instrument

Installation & User Guide

8300-016 Rev B

TruTrak Flight Systems

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A	07/01/2008	Initial Release	
B	12/07/2009	Updated	12

ADI Operation

The artificial horizon, when needed is without a doubt, the most important instrument in the panel. For this reason, the display must be easy to fly and the instrument very reliable. To achieve this, the ADI combines modern solid state technology with an easy to see uncluttered mechanical display. In the basic instrument flight panel it is intended for installation between an airspeed indicator and an altimeter. It is also well suited as the conventional backup in panels incorporating one of the large glass displays.

The ADI is easy to fly partly because it contains in one instrument, roll, pitch, and direction. Beyond this, it is the content of each of these displays that make this instrument easy to fly.

The direction display is located in the center of the instrument just below the rotating horizon mask. As is often the case with an inexperienced pilot caught in IMC, the instrument may be viewed with tunnel vision. For this reason it is good to have the direction in the center of the tunnel. Of more importance is that this display is track instead of magnetic heading in that the modern way to navigate is to fly track. When track is presented as a gyro display, the numbers move sequentially one degree at a time. Experience is showing that direction control with this digital DG placed immediately below the horizon mask is as easy to fly as the conventional vertical card DG in combination with the conventional horizon placed nearby.

The bank angle display is driven in a manner similar to that used in the pictorial turn and bank. The only difference is that in this instrument the display shows bank angle instead of turn rate. The advantage of this is that the presentation is instantaneous data only. It cannot drift to accumulate error as is possible with the more complex AHRS driven systems. It shows bank angles of up to +/- 45° while the requirement on conventional gyro horizons is +/- 100°. To compensate for this, in the 3 1/8" size only, flashing red arrows point in the direction the stick is to be moved to level the aircraft when the bank exceeds +/- 30°. Note that when flying on instruments the object is to stay level or at least in shallow banks. This instrument is therefore designed to keep the pilot out of trouble.

The pitch display is perhaps the most beneficial feature of the ADI when compared with conventional horizon indicators. For short term or immediate movement of the nose up or down, this instrument responds and is flown like any other gyroscopic pitch indicator. The difference is that after the display has moved in response to an attitude change the deflection is sustained by the resulting vertical speed. As compared to a pitch attitude display, the vertical speed display makes it easier to hold altitude and to maintain stable climbs and descents. Also, the movable airplane symbol does not have to be adjusted to compensate for the angle the fuselage flies when vertical speed is zero. It is recognized that an aircraft when at the limit of its altitude capability can fly at an ever increasing angle of attack when vertical speed indicates zero. For this reason an airspeed warning in the form of the letters "A-S" flashing in the DG display is provided. The answer to this situation is then to observe the airspeed indicator. For stall prevention airspeed is the best information short of an angle of attack indicator. (Better than attitude)

Another plus regarding this display is that when the airplane is going straight or not turning a wing level presentation is shown. With this presentation one can disregard the effect of the rudder being out of trim (ball off center) just as crosswind is not a factor when flying GPS track for direction. This is easier than trying to fly straight with the display showing a wing down as is the case with a conventional horizon display when the rudder is out of trim. To sum it up, all of the features described above, in combination, provide what we believe to be the easiest to fly artificial horizon.

ADI Installation

Power and ground connections can be made using 22 gage wire with a 2 amp circuit breaker between the avionics buss and the ADI.

When the unit is purchased in its basic form, the instrument uses the serial output from a GPS (RS-232) for the DG display. The DG will not display a heading until a ground speed of 5 to 10 knots is achieved.
When the unit contains the built-in GPS receiver, it is only necessary to connect the remote antenna and place the antenna in view of the sky. On the initial start up it could take up to 15 to 30 minutes to find the satellites, after the initial startup the GPS will find the satellites in about 5 min the center bar will flash after start up until the GPS receiver finds the satellites. Then the bar will stop flashing and become steady, at this time the internal GPS is ready for flight.

The internal lighting feature is connected to the instrument panel light bus. The LED will dim to the lowest setting with a low voltage on the dimmer wire. Confirm that the dimmer system drops to 0 volts when off or the display may stay very dim and be hard to see in sunlight. The internal lighting is internally grounded.

Apart from the electrical connections, there are standard 1/8" pipe thread receptacles for both pitot and static lines. Correct tightening is accomplished by starting the adapter by hand until unable to turn, then tightening ½ turn more with a wrench. Unless the aircraft is pressurized, there is no need to connect the static line. The airspeed signal is required for the attitude display to function correctly. Also, it is there to provide the low airspeed warning. This warning is in the form of the flashing letters "A-S" alternating with the DG number on the DG display when the airspeed falls below the best rate of climb speed or whatever speed the owner might choose. Setting of this air speed warning requires a flat blade screwdriver small enough (approx. ⅛ shaft, tool provided) through the 6-32 female thread.   The correct screw driver is provided with the unit.
The lower right instrument screw is removed to gain access to the airspeed adjustment screw. The procedure for setting the airspeed warning is to fly the aircraft at the best rate of climb speed (which is also the best glide speed and attitude sustaining airspeed) or whatever speed suits the owner. While holding this speed, rotate the adjustment so the flashing "A-S" just appears.

Mounting of the ADI is not angle sensitive as long as the tilt is not more than 10 degrees in any direction, so no shimming is needed for panel tilt compensation. The mounting screws are 6-32 thread with a maximum length of 3/8". Brass screws are preferred.

| 3 1/8" ADI | 3.4"H x 3.4"W x 4.6"D | 12-28 volts - Weight - 14 oz |
| 2 ¼" ADI | 2.5"H x 2.5"W x 6.7"D | 12-28 volts - Weight - 13 oz |

ADI Backup Battery & Servicing

Switch label should state, "ADI BACKUP POWER" normally on the switch side that engages the battery
The servicing of the ADI backup battery is simply a matter of inspection of the functionality and confirming charge and discharge rates.
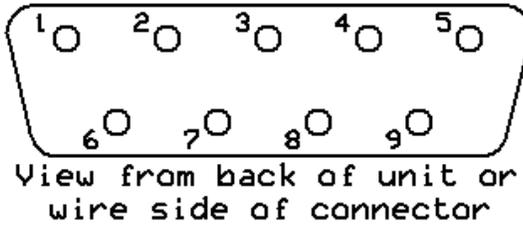   Recommendation of a function test during the pre-takeoff checklist to confirm the LED switch illuminates with activation of the backup battery. The ADI should function normally in this mode. Once it has been verified that the backup battery is properly functioning, return the switch to the normal position.

Once a year a complete function test of the backup battery system is recommended:
        Activate the ADI backup battery and confirm LED is illuminated. Continue in this mode, note the time of activation and confirm minimum one hour function of the ADI.
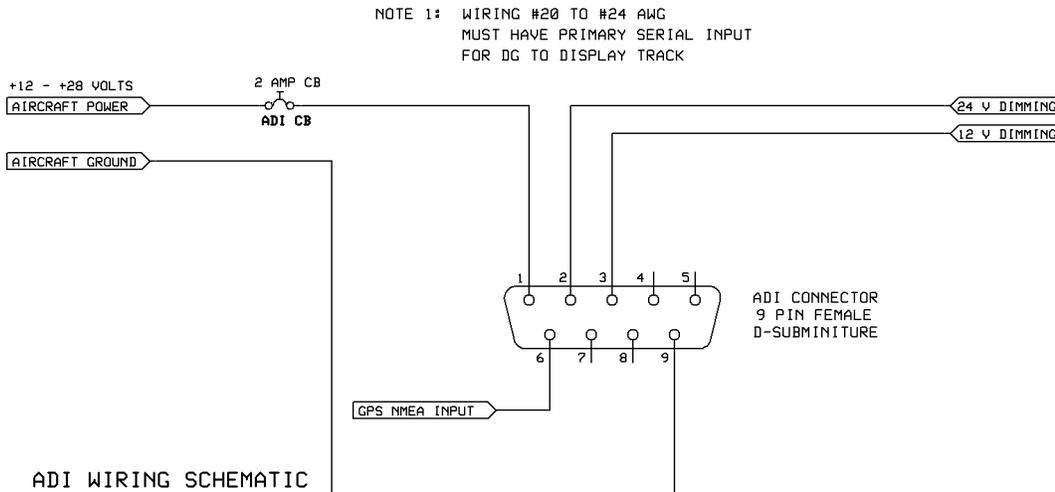If function time is less than one hour then remove backup battery and charge on the bench for a minimum of eight hours and retry function test above.
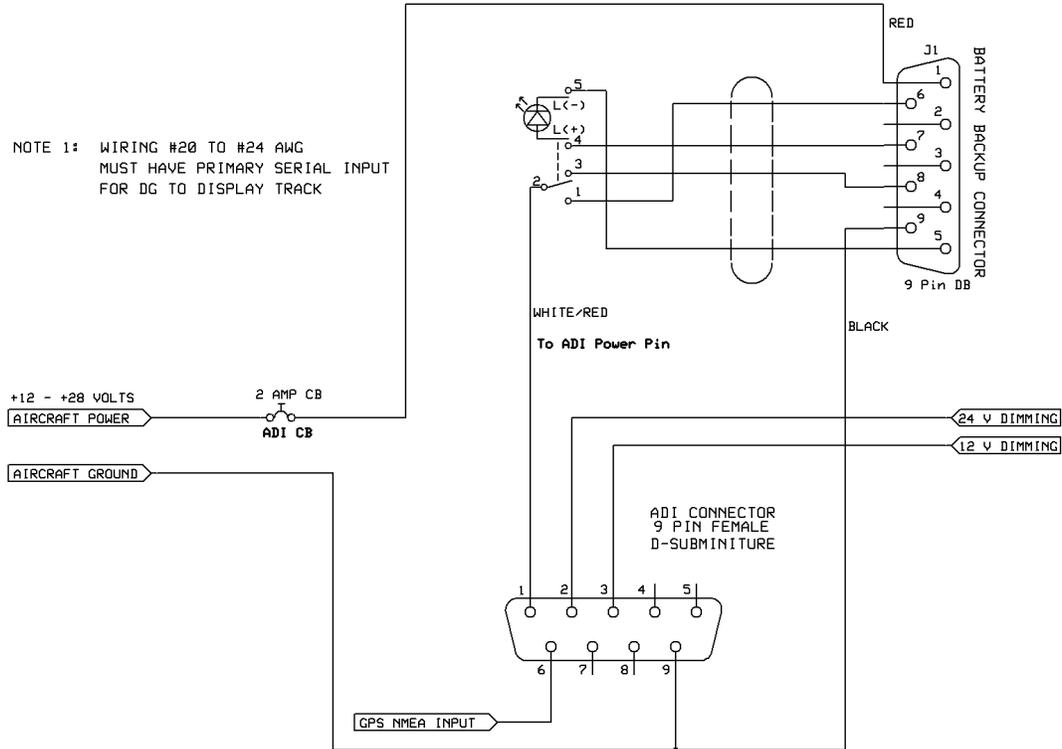
ADI Pin-Out

View from back of unit or
wire side of connector

ADI Connector pin-out			
Pin #	I/O	Connection Pin	Function
1	I	Power +	**AVIONICS** DC Power (9-30 Volts DC)
2	I	24 V Dimmer controller	24V dimmer input
3	I	12 V Dimmer controller	12V dimmer input
4	I	Future AOA module	AOA (Future use)
5	--	No Connection	Do not connect
6	I O	**RS 232 Series Data in** RS 232 Serial Data out with Internal GPS	**RS-232 input or** RS-232 output with internal GPS
7	--	No Connection	Do not connect
8	--	No Connection	Do not connect
9	I	Aircraft Ground	Main DC Ground

ADI Schematic

NOTE 1: WIRING #20 TO #24 AWG
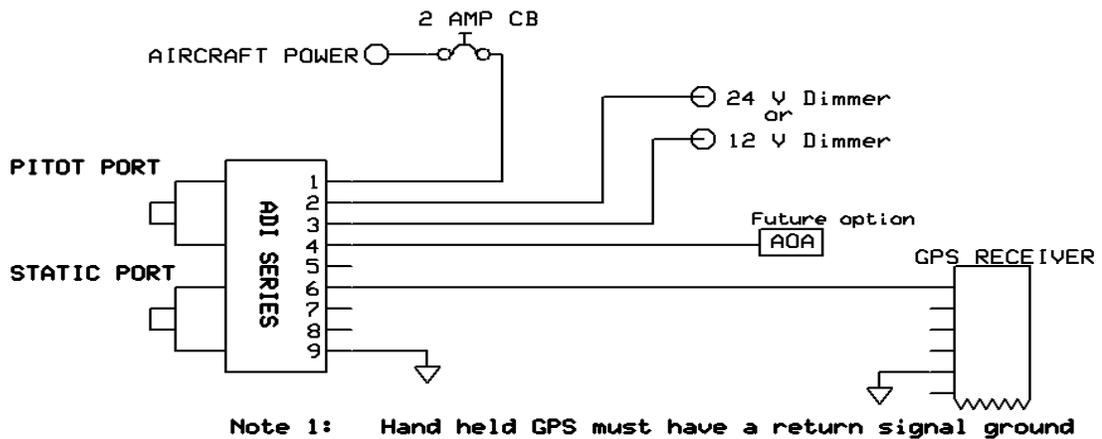MUST HAVE PRIMARY SERIAL INPUT
FOR DG TO DISPLAY TRACK

ADI WIRING SCHEMATIC
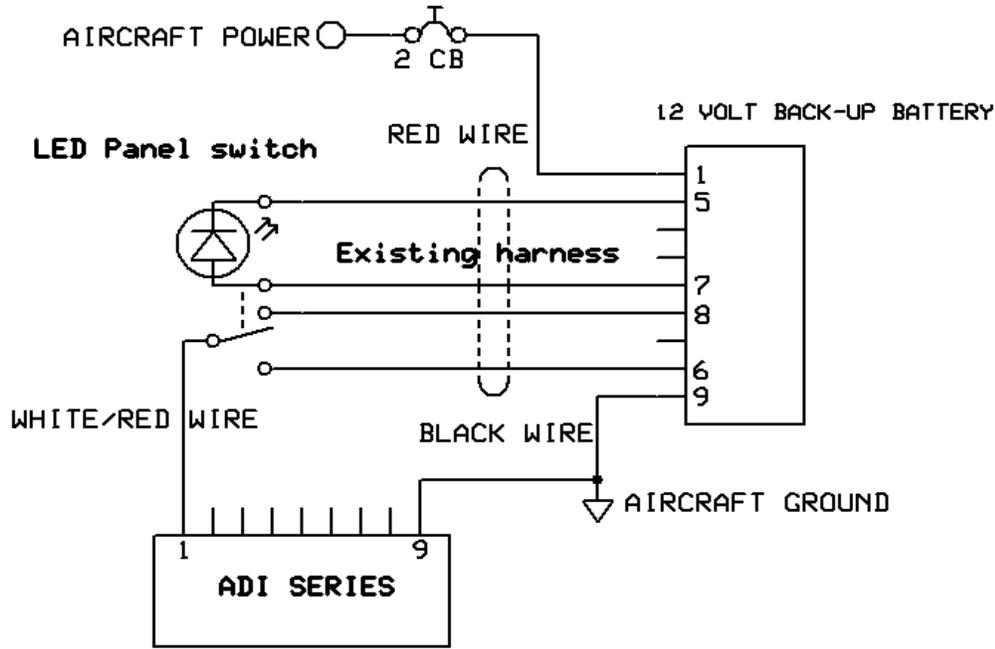
ADI with Battery Backup

NOTE 1: WIRING #20 TO #24 AWG
MUST HAVE PRIMARY SERIAL INPUT
FOR DG TO DISPLAY TRACK

RED

J1

BATTERY BACKUP CONNECTOR

9 Pin DB

L(-)
L(+)

WHITE/RED

To ADI Power Pin

BLACK

+12 - +28 VOLTS
AIRCRAFT POWER

2 AMP CB
ADI CB

AIRCRAFT GROUND

24 V DIMMING

12 V DIMMING

ADI CONNECTOR
9 PIN FEMALE
D-SUBMINITURE

GPS NMEA INPUT

ADI WITH BATTERY BACKUP WIRING SCHEMATIC

ADI Block Diagram

2 AMP CB

AIRCRAFT POWER

24 V Dimmer
or
12 V Dimmer

PITOT PORT

ADI SERIES

1
2
3
4
5
6
7
8
9

Future option
AOA

STATIC PORT

GPS RECEIVER

Note 1:   Hand held GPS must have a return signal ground

ADI Backup Battery Block Connection

AIRCRAFT POWER ◯——o̅⌐o——— 2 CB

LED Panel switch

RED WIRE

12 VOLT BACK-UP BATTERY

Existing harness

1
5

7
8

6
9

WHITE/RED WIRE

BLACK WIRE

AIRCRAFT GROUND

1   9

ADI SERIES

ADI Backup Battery PIN OUT

△ +12v
AIRCRAFT POWER
RED

Power Switch
M2112

J1

5
L(-)
L(+)
4
3
2
1

1
6
2
7
3
8
4
9
5

BATTERY BACKUP CONNECTOR

BLACK

9 Pin DB

▽ **GROUND**

WHITE/RED

To ADI Power Pin
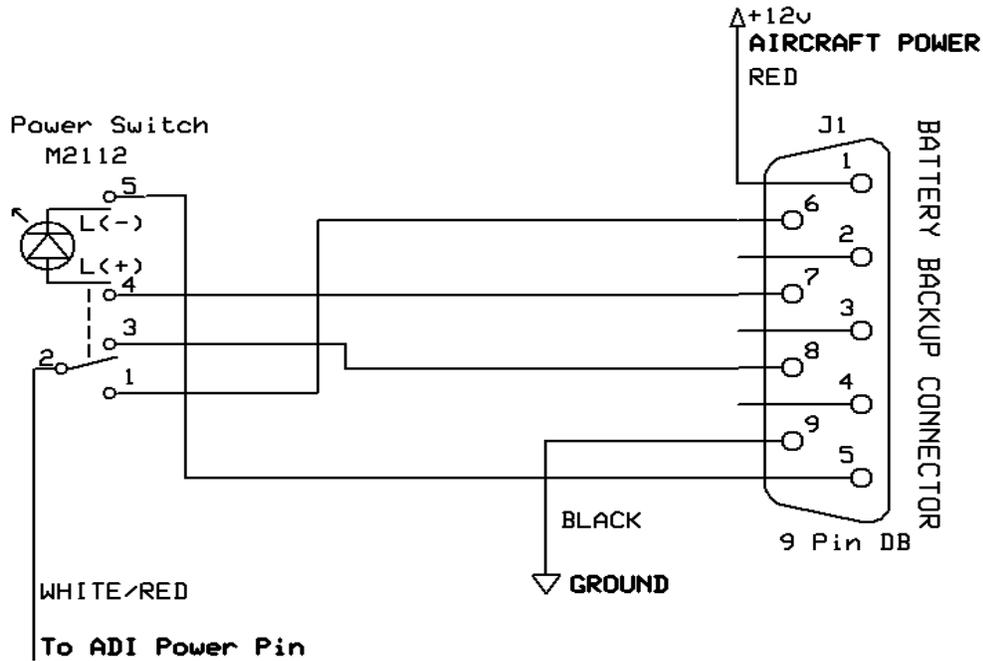
GPS Setup Guide

Many new handheld GPS's have adequate output required to fly a TruTrak autopilot. Although most support data output not all handhelds will provide consistent and reliable information required to fly all TruTrak autopilots. Therefore, some handhelds will not fly the airplane well. Performance may decline by putting the processor in high-load situations.

We require a data output rate of once per second for best performance. Some handhelds output data at longer intervals than once per second. These handhelds will cause the autopilot not to perform well in turns and it may cause overshooting and hunting. If the baud rate is selectable the optimum setting is 4800. Most handhelds will require a data cable that plugs into the handheld and provides a medium for data output. This is an accessory and is available from your GPS manufacturer. The setup procedures are in your GPS manual. If your GPS is not listed here consult your GPS manual for NMEA output setup. The autopilot must have a direct connection with the handheld GPS to provide the autopilot with RS-232. To allow the handheld GPS to be removed easily you should add a connector in your panel. We recommend that you use a 9 pin D subminature connector in your panel that will mate to the harness from the GPS. This will also allow you to wire power and ground and use the aircraft electrical system to power your handheld GPS.

Magellan GPS 315 A

The Magellan GPS 315 A requires a Power/Data Cable (Magellan Product Number 730276) to provide data output.
The Magellan GPS 315 A must be configured to provide the correct output to the autopilot.
> Press the **MENU** key then select "Setup. Press **ENTER**. Select "NMEA" and press **ENTER**. Select "V2.1 GSA" then press **ENTER**. Next we must set the baud rate. Press **MENU** then select "SETUP" and press **ENTER**. Next Select "BAUD RATE" and press enter. Select 4800 for the baud rate. Press **ENTER**.

Note that this is the baud rate that will be entered into the autopilot in the setup mode.

Garmin GPS III

The Garmin III requires a Power/data cable (Garmin Part Number 010-10082-00) to provide data output.
The Garmin III must be configured to provide the correct output to the autopilot.
> Press the **MENU** key twice. Select 'Setup'. Press **ENTER**. Select the 'Interface' tab. Press **ENTER**. Select the NMEA format.

Note: The default baud rate is 4800. This is the baud rate that will be entered into the autopilot in the setup mode.

GPS 92

The Garmin 92 requires a Power/data cable (Garmin Part Number 010-10082-00) to provide data output. The Garmin 92 must be configured to provide the correct output to the autopilot.
> Press the **PAGE** key until the 'Main Menu' appears. Select 'Setup Menu' and press **ENTER**. Next select 'Interface.' Press **ENTER**. Select NONE/NMEA.

Note: The default baud rate is 4800. This is the baud rate that will be entered into the autopilot in the setup mode.

Garmin GPS 195

The GPS 195 provides data output every two seconds and may be slow in recognizing turns and will overshoot the desired track. This may cause the autopilot to wander and not perform well in turns.
The Garmin 195 requires a Power/data cable (Garmin Part Number 010-10135-00) to provide data output. The Garmin 195 must be configured to provide the correct output to the autopilot.
> Press the **MENU** key twice. Select 'Set-Up Menu'. Press **ENTER**. Select 'Input/Output'. Press **ENTER**. The input/output format is 'No In/NMEA Out.' Note that the baud rate is automatically set at 4800 bps.

Note: This is the baud rate that will need to be entered in the setup mode of the autopilot.
Now the Garmin 195 is correctly set up to provide the RS-232 serial output required by your TruTrak autopilot.

Garmin GPS 196

The Garmin 196 requires a Power/data cable (Garmin Part Number 010-10082-00) to provide data output.
The Garmin 196 must be configured to provide the correct output to the autopilot.
  Press the **MENU** key twice. Use the arrow keypad to select the 'SETUP' tab.
  Within the Setup Menu select the 'INTERFACE' tab. Using the arrow keypad highlight the 'Serial Data Format' field.
  Use the arrow keypad to select 'NMEA In/NMEA Out' and press **ENTER**.
  Set the baud rate to 4800.
Note: This is the baud rate that will need to be entered in the setup mode of the autopilot.
  Press **MENU** to enter the Advanced NMEA page. Select 'Advanced NMEA Setup' and press **ENTER**.
  Using the arrow keypad and the **ENTER** key to turn OFF 'GPS Status (GSA, GSV)', 'Waypoint/Route (WPL, RTE)', and 'GARMIN Proprietary'.
Now the Garmin 196 is correctly set up to provide the RS-232 serial output required by your TruTrak autopilot.

Garmin 295

The Garmin 295 requires a power/data cable (Garmin Part Number 010-10082-00) to provide data output. The Garmin 295 must be configured to provide the correct output to the autopilot.
  Press the **MENU** key twice. Use the rocker keypad to select the 'INTERFACE' tab.
  Press the down portion of the rocker keypad to select the 'FORMAT' field.
  Press **ENTER** and a popup window will show the available settings.
  Use the rocker keypad to select 'NMEA OUT' then press **ENTER**. Select 4800 for the baud rate.
Note: This is the baud rate that will need to be entered in the setup mode of the autopilot.
Now the Garmin 295 is correctly set up to provide the RS-232 serial output required by your TruTrak autopilot.

Garmin 296

The Garmin 296 must be configured to provide the correct output to the autopilot.
  Press the **MENU** key twice. Use the rocker keypad to select the SETUP in the vertical tabs. Use the rocker keypad to select the 'COM 1' tab.
  Press the down portion of the rocker keypad to select the 'FORMAT' field.
  Press **ENTER** and a popup window will show the available settings.
  Use the rocker keypad to select 'NMEA IN / NMEA OUT' then press **ENTER**. Select 4800 for the baud rate. Note: This is the baud rate that will need to be entered in the setup mode of the autopilot.
  Press **MENU** to enter the Advanced NMEA page. Select 'Advanced NMEA Setup' and press **ENTER**.
  Using the arrow keypad and the **ENTER** key to select "FAST OUTPUT" or turn OFF 'GPS Status (GSA, GSV)', 'Waypoint/Route (WPL, RTE)', and 'GARMIN Proprietary'.
Now the Garmin 296 is correctly set up to provide the RS-232 serial output required by your TruTrak autopilot.

Garmin 396

The Garmin 396 must be configured to provide the correct output to the autopilot.
  Press the **MENU** key twice. Use the rocker keypad to select the SETUP in the vertical tabs. Use the rocker keypad to select the 'Interface' tab.
  Press the down portion of the rocker keypad to select the 'Serial Data Format' field.
  Press **ENTER** and a popup window will show the available settings.
  Use the rocker keypad to select 'NMEA IN / NMEA OUT' then press **ENTER**. Select 4800 for the baud rate. Note: This is the baud rate that will need to be entered in the setup mode of the autopilot.
  Press **MENU** to enter the Advanced NMEA page. Select 'Advanced NMEA Setup' and press **ENTER**.
  Using the arrow keypad and the **ENTER** key to select "FAST OUTPUT" or turn OFF 'GPS Status (GSA, GSV)', 'Waypoint/Route (WPL, RTE)', and 'GARMIN Proprietary'.
Now the Garmin 396 is correctly set up to provide the RS-232 serial output required by your TruTrak autopilot.

Garmin 496

The Garmin 496 must be configured to provide the correct output to the autopilot.
> Press the **MENU** key twice. Use the rocker keypad to select the SETUP in the vertical tabs. Use the rocker keypad to select the 'Interface' tab.
> Press the down portion of the rocker keypad to select the 'Serial Data Format' field.
> Press **ENTER** and a popup window will show the available settings.
> Use the rocker keypad to select 'NMEA IN / NMEA OUT' then press **ENTER**. Select 4800 for the baud rate. Note: This is the baud rate that will need to be entered in the setup mode of the autopilot.
> Press **MENU** to enter the Advanced NMEA page. Select 'Advanced NMEA Setup' and press **ENTER**.
> Using the arrow keypad and the **ENTER** key to select "FAST OUTPUT" or turn OFF 'GPS Status (GSA, GSV)', 'Waypoint/Route (WPL, RTE)', and 'GARMIN Proprietary'.

Now the Garmin 496 is correctly set up to provide the RS-232 serial output required by your TruTrak autopilot.

Lowrance Airmap 100

The Lowrance Airmap 100 requires a NMEA/DGPS adapter cable to provide data output. The Lowrance Airmap 100 must be configured to provide the correct output to the autopilot.
> Press the **MENU** key then select "NMEA/DGPS CONFIG" from the "System Setup" menu. Highlight the "NMEA OUT" menu then press the right arrow key.
> Note: The default baud rate is 4800. This is the baud rate that will entered into the autopilot in the setup mode.

Now the Lowrance Airmap 100 is correctly set up to provide the RS-232 serial output required by your TruTrak autopilot.

Lowrance Airmap 1000/2000

The Lowrance Airmap 1000/2000 requires a NMEA/DGPS adapter cable to provide data output. The Lowrance Airmap 1000/2000 must be configured to provide the correct output to the autopilot. AirMap has one NMEA 0183 version 2.0 compatible communication port,
> Press **MENU|MENU|↓** to **SYSTEM SETUP|ENT**. Press ↓ to **COMMUNICATIONS PORT|ENT**. Select 9600 Baud. This is the baud rate that will entered into the autopilot in the setup mode. Select "NMEA OUT"

Now the Lowrance Airmap 1000/2000 is correctly set up to provide the RS-232 serial output required by your TruTrak autopilot.

AvMap EKP IV

The AvMap EKP IV requires a NMEA/DGPS adapter cable to provide data output. The AvMap EKP IV must be configured to provide the correct output to the autopilot.
> MENU' 1 sec. + "COMMUNICATIONS" + 'ENTER' + "NMEA OUTPUT" + 'ENTER'.
> The Output NMEA0183 messages are RMC, RMB that need to be selected.

Note: The default baud rate is 4800. This is the baud rate that will entered into the autopilot in the setup mode. The yellow wire is the Data out TX wire.

Now the AvMap EKP IV is correctly set up to provide the RS-232 serial output required by your TruTrak autopilot.

Garmin 35-HVS

Connect Red to Power and Black to Ground then White to Serial input.
The default baud rate is 4800. This is the baud rate that will entered into the autopilot in the setup mode.

There is no necessary setup procedure for the Garmin-35 unit. It may require up to 45 minutes to achieve a position fix the first time it is powered on; afterwards it will take less time to obtain a position fix as it contains its own battery and position memory. To use this unit, configure the DigiFlight II's baud rate to 4800 baud in the setup screen. **This unit does not provide GPS-NAV information, course guidance, or flight planning.** Its sole function is to provide the autopilot with a source of ground track and ground speed information to slave the autopilot's internal DG function.

Garmin 155XL/250XL/300XL

Garmin 155XL/250XL/300XL connections to TruTrak autopilot			
J1 on Garmin unit	Signal Name (Garmin)	Signal Name (TruTrak)	ADI
24	GPS RS 232 OUT 2	Primary Serial Input	6

Press and hold the MSG key and rotate the outer knob until the I/O setup page is displayed. Press CRSR twice and rotate inner knob to select "plotting". Rotate the outer knob to advance to the baud rate field. Use the inner knob and set to 9600. Press the CRSR to finish and save

Note that for the Garmin units, the autopilot will need to be set for 9600 baud.

Garmin 430 and 530

Garmin 430 and 530 connections to TruTrak autopilot			
P4001 [P5001] on Garmin 430 [530]	Signal Name (Garmin)	Signal Name (TruTrak)	P101 on TruTrak ADI/DII
56	GPS RS 232 OUT 1	Primary Serial Input	6/17
46	GPS ARINC 429 OUT A	ARINC-A	14
47	GPS ARINC 429 OUT B	ARINC-B	15

Power 430/530 up and turn it on while holding down the ENT key. Release the ENT key when the display activates. After the data base pages, the first page displayed is the MAIN ARINC 429 CONFIG page. While in Configuration mode, pages can be selected by ensuring the cursor is off and rotating the small right knob. To change data on the displayed Configuration Page, press the small right knob (CRSR) to turn on the cursor. Turn the large right knob to change between data fields. Turn the large or small right knob to change a field that the cursor is on. Once you have made the desired selection, press the ENT key to accept the entry.

With the MAIN ARINC 429 CONFIG page displayed, on the row labeled OUT, select SPEED ➔ Low
and DATA ➔ARINC 429.

Advance to the MAIN RS232 CONFIG page.

On the row labeled CHNL1, select OUTPUT ➔ Aviation.

Note that for the Garmin units, the autopilot will need to be set for 9600 baud.

KMD 150

Power the KMD 150 up and turn it full bright. Press the MENU button then the SETUP button then the INST & DIAGS button then the DATA IN/OUT. Change the DATA OUT PUT to NEMA 0183 the manual states the Baud rate is 9600. The output pin is pin 11 and connects to the Primary Serial input on the auto pilot controller.
You will need to match 9600 Baud rate in the auto pilot.

KMD 150 connections to TruTrak autopilot			
37 Pin Connector on KMD 150	Signal Name	Signal Name (TruTrak)	P101 on TruTrak ADI/ DII /Sorcerer
11	(AV NAV)	Primary Serial Input	6/17/25

UPSAT GX-50/60/65

UPSAT GX-50/60/65 connections to TruTrak autopilot			
37-Pin Connector on UPSAT GX-50/60/65	Signal Name (UPSAT)	Signal Name (TruTrak)	P101 on TruTrak DII
	Use pin 5 – TxD1 – if GX has no GPSS		

Garmin AT GNS480 connections to TruTrak autopilot			
P1 on GNS480	Signal Name (Garmin AT)	Signal Name (TruTrak)	P101 on TruTrak DII/Sorcerer
22	RS232 TxD2	Primary Serial Input	17/25
P5 on GNS480	Signal Name (Garmin AT)	Signal Name (TruTrak)	P101 on TruTrak DII/Sorcerer
4	429 OUT 1A	ARINC-A	14/26
24	429 OUT 1B	ARINC-B	15/27
	Use pin 22 – TxD2 – if GX has GPSS		

Power the GX-50/60/65 up and turn it on while holding down the leftmost and rightmost "smart keys." Rotate the LARGE knob to the Serial Interface Configuration "CH RX TX" page. Press SEL (the selection fields will start flashing), rotate the LARGE knob to select the port, rotate the SMALL knob to select the desired configurations, and then press ENT when complete.

If both the GX unit AND the DigiFlight unit have GPSS capability,
    select "GPSS" for CH 2, TX column, and wire pin 17 on the DigiFlight IIVSG to pin 22 of the GX unit

Otherwise
    select "MOVING MAP" For CH 1, TX column and wire pin 17 on the DigiFlight II / IIVS to pin 5 of the GX unit

To restore the GX-50/60/65 to normal operation, switch its power off, and then back on.

Note that for the GX-50/60/65 units, the autopilot will need to be set for 9600 baud.

Garmin AT GNS480

Power 480 up and select the **1, 4, MENU/ ENTER** keys immediately after the GNS 480 initialization is complete. After restart, the first page displayed is the SETUP page. Select the SERIAL PORTS with the button next to it. Press the small knob to enter the edit mode and move to the TX column for the channel that you have connected the serial wire to (channel 2). Select MAPCOM and 9600. Press the small inner knob again to save. Then press the BACK to go back to the Setup page.

Select the ARINC PORTS SETUP**.** With the MAIN ARINC 429 CONFIG page displayed, on the row labeled Channel 1 OUT, select and DATA ➔ARINC 429, SPEED ➔ Low.

Serial output baud rate should be set to 9600 on the GNS480. Set the TruTrak baud rate to 9600.

Trouble Shooting Guide

PROBLEM	POSSIBLE CAUSE	CORRECTION
ADI will not function	No aircraft voltage to pin 1 or No aircraft ground on pin 9	Correct wiring problem Confirm battery voltage
DG does not display	No RS 232 on pin 6 (GPS input) No ground return from GPS	Connect pin 6 to GPS source & configure output to NMEA Install ground from GPS unit
On power up ADI rolls off to side	Insufficient voltage or current to ADI	Confirm aircraft voltage(Min +11v) Correct bad wires (low current)
Air Speed warning nonfunctional	No Pitot connection	Connect Pitot line to Pitot port
Internal GPS nonfunctional	GPS did not find satellites Unable to find satellites Wrong wire at pin 6 (GPS output)	Wait for center bar to stop flashing Relocate antenna to better position Correct wiring at pin 6 (GPS output)
Display always flashes with GPS on	Incorrect wiring on pin 2 or 3	Correct wiring to dimmer

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 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.

TS TRUTRAK FLIGHT SYSTEMS

<u>RETURN MERCHANDISE POLICY AND PROCEDURE</u>

- 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# _____

TRUTRAK FLIGHT SYSTEMS

1500 S. Old Missouri Road

Springdale, AR 72764

Ph: 479-751-0250 Fax: 479-751-3397

Toll free: 866-TRUTRAK

866-(878-8725)

www.trutrakap.com