Installation & User Guide

For



ADI Flight Instrument

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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 and easy to see uncluttered mechanical display. In the basic instrument flight panel it is intended for installation between and 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 near by.

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, 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. 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 first start up it could take up to 15 minutes to find itself. The DG will not display a heading until a ground speed of 5 to 10 knts.

The internal lighting feature is connected to the instrument panel light bus. The internal lighting is internally grounded.

Apart from the electrical connections, there are receptacles for both pitot and static lines. Unless the aircraft is pressurized, there is no need to connect the static line. The airspeed signal is not required for the attitude display to function. Instead, 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 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.

ADI Backup Battery Servicing

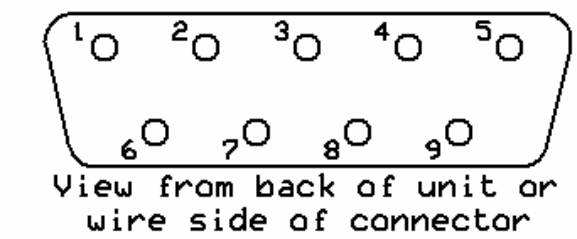
The servicing of the ADI backup battery is simply a matter of inspection of the functionality and confirming charge and discharge rates.

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.

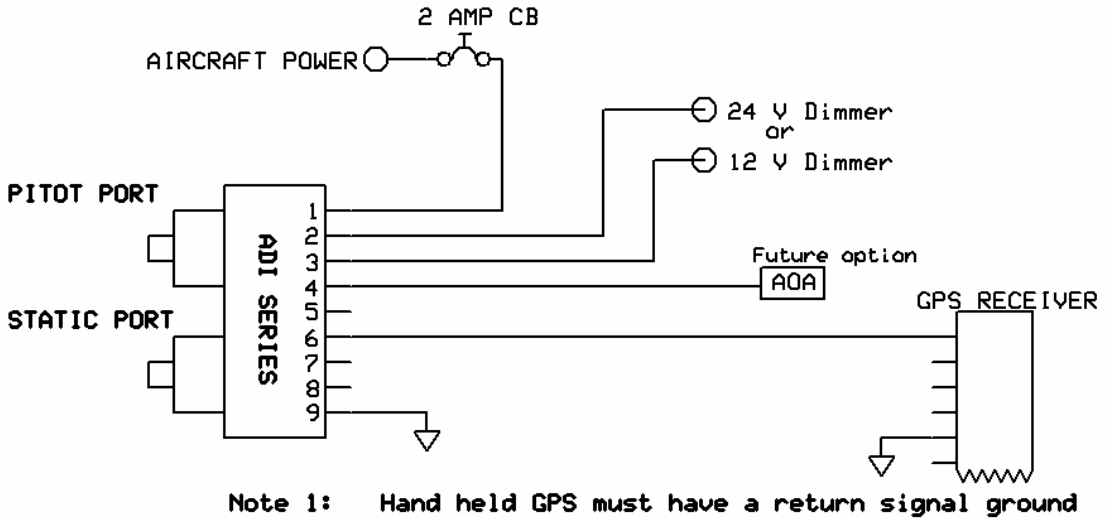
Activate the ADI backup battery and confirm LED is illuminated. Continue in this mode, note the time of activation and confirm minimum one hour function of the ADI.
If function time is less than one hour then remove backup battery and charge on the bench for a minimum of eight hours and retry function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

ADI Pin-Out

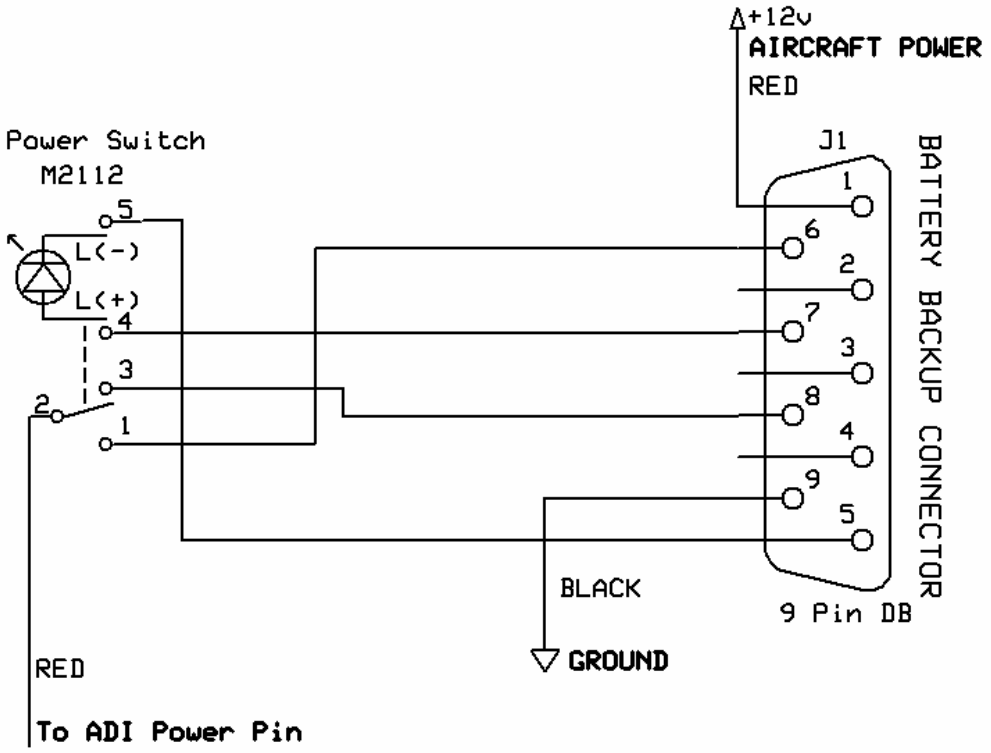


ADI Connector pin-out			
Pin #	I/O	Connection Pin	Function
1	I	Power +	Main DC Power (9-30 Volts DC)
2	I	24 V Dimmer controller	24V dimmer input
3	I	12 V Dimmer controller	12V dimmer input
4	I	Future AOA module	AOA (Future use)
5	--	No Connection	Do not connect
6	I O	**RS 232 Series Data in** RS 232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

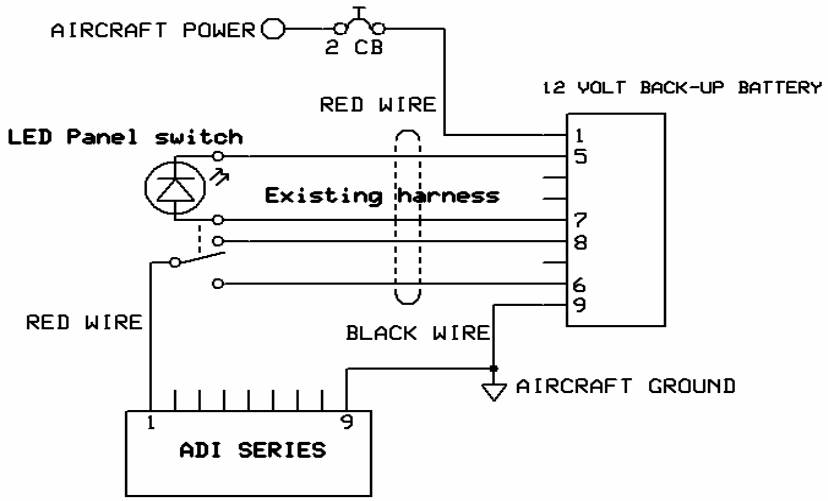
ADI Block Diagram



ADI Backup Battery Connection



ADI Battery Backup Block Diagram



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 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 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 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 Blue 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)	P101 on TruTrak Sorcerer
24	GPS RS 232 OUT 1	Primary Serial Input	17
16	GPS ARINC 429 OUT A	ARINC-A	14
15	GPS ARINC 429 OUT B	ARINC-B	15

Remove the data cards turn the unit on. Press "enter" in response to "Select operating mode Normal?" Press "enter" in response to "No Jeppesen database rte / prx limited to user wpts ok?" After the satellite status page is displayed for 5 seconds the unit may be turned off.

With power OFF press and hold the ENT key and turn the power on (release the ENT key when the display activates). You should be in the TEST MODE. Rotate the outer knob to advance to I/O Channel 1. Press the CRSR key then rotate the outer knob to Select Output rotate inner knob to select "Aviation". Press the CRSR key then rotate the outer knob to Select ARINC 429 CHANNEL. Press the CRSR key then rotate the inner knob to advance to OUTPUT and select "w/o GAMA labels"

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 Sorcerer
56	GPS RS 232 OUT 1	Primary Serial Input	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.

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 Sorcerer
5 or 22	Use pin 5 – TxD1 – if GX has no GPSS	Primary Serial Input	17
	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

Garmin AT GNS480 connections to TruTrak autopilot			
P1 on GNS480	Signal Name (Garmin AT)	Signal Name (TruTrak)	P101 on TruTrak Sorcerer
22	RS232 TxD2	Primary Serial Input	17
P5 on GNS480	Signal Name (Garmin AT)	Signal Name (TruTrak)	P101 on TruTrak Sorcerer
4	429 OUT 1A	ARINC-A	14
24	429 OUT 1B	ARINC-B	15

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.

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