ASPEN AVIONICS

AT300 Hazard Awareness Display

Operating Procedures
And
Installation Manual

Aspen Avionics Document Number: A-01-104-00

Document Revisions

Revision	Description of Change	ECO
A	Initial Release	1021
B	Incorporation of TSO unit functionality and expanded description of system operation. Addition of installation limitations and operational notes, cautions and warnings associated with certified installations.	1051

Prepared By:	*JDB*		*Original signatures on file. See ECO for release date and dispositions.*	**Release Authorization**		
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Usage Authorization / Master Control Number:				Release Initials:	JDB	
				Release Signature:	*Jeff Bethel*	

Aspen Avionics – Limited Warranty

This product is warranted to be free from defects in material and workmanship for a period of 24 months from date of installation or purchase from an Aspen Authorized Dealer, whichever is later. Within this period Aspen will, at its sole option, repair or replace any product, product component, or software that fails in normal use. Such repairs shall be made at no cost to the customer for parts and labor only. This warranty does not apply to any ASPEN Products or Product Components which have been (1) repaired or modified by persons unauthorized by ASPEN so that, in ASPEN'S sole judgment, the performance or reliability is adversely affected thereby; or (2), subjected to misuse, abuse, neglect, accident, or weather related damage.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES. ASPEN MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. ASPEN SHALL NOT BE LIABLE FOR LOSS OR DAMAGES OF ANY KIND, INCLUDING WITHOUT LIMITATION, LOST OR ANTICIPATED PROFITS, DELAY, INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES ARISING OUT OF THE USE, MISUSE, OR INABILITY TO USE ANY ASPEN PRODUCTS SOLD HEREUNDER, OR FROM ANY DEFECTS IN THE PRODUCT. Some states do not allow the exclusion of incidental or consequential damages, so the preceding limitations may not apply to you.

ASPEN retains the exclusive right at its sole option to repair or replace the unit, or offer a full refund for the original purchase price of the unit. SUCH REMEDY SHALL BE THE SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

If you require warranty service you may contact your local Aspen Authorized Dealer or you may contact Aspen Avionics directly. An original or copy of the sales receipt from the original Aspen Authorized dealer will be required to obtain any warranty service.

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1 Introduction

1.1 Applicability

This operating procedures and installation manual describes the operation, installation planning, installation, and post-installation checkout for the Aspen Avionics AT300 Hazard Awareness Display.

This installation manual is applicable to part numbers:

- A-05-101-00 AT300 (Non-Certified)
- A-05-102-00 AT300 (FAA TSO)

1.2 AT300 Product Overview

The AT300 is a panel mounted instrument that is intended to replace the industry standard Vertical Speed Indicator (VSI) located in most general aviation aircraft. The AT300 incorporates a high-resolution, sunlight readable, color active-matrix liquid crystal display (TFT LCD). As the AT300 provides additional functionality beyond that of the VSI, additional electrical interfaces are required. In addition to an RS232 serial input from a panel mount GPS system, the AT300 requires a single power input from the aircraft power system, and an associated ground connection

Figure 1 - AT300 Product Image

The AT300 provides replacement VSI functionality by displaying both a vertical tape and numerical presentation of the current vertical speed. VSI is internally computed by

the AT300 by monitoring the aircraft static pressure, similar to a standard VSI instrument. This functionality requires interface to the aircraft pitot static line.

In addition to providing terrain situational awareness, the AT300 also provides a supplemental moving map display of GPS navigation information. The AT300 presents aircraft position, track and altitude relative to surrounding terrain, by means of color coding nearby terrain based on the vertical separation between the terrain and the aircraft.

To support this functionality, aircraft barometric altitude data is obtained by measuring ambient pressure via the aircraft static connection, and baro corrections are required to be manually entered through the systems user interface (UI). In addition, the AT300 provides a supplemental display of GPS navigation data, including presentation of the current waypoint and identifier, and the current navigation leg in the moving map display area.

In addition, a supplemental display of the current GPS waypoint identifier, distance to go, desired track, ground speed, and estimated time enroute are presented on the unit, enabled by the AT300's RS-232 serial line connection to the GPS navigation system.

1.3 Non-TSO Functions

The following non-TSO functions are included in the AT300, and were evaluated by the FAA Certification Offices as part of the AT300 TSO Authorization:

- Plan view advisory terrain moving map
- Plan view supplemental GPS active and next course line with waypoint icons
- Supplemental GPS text nav data (Waypoint ID, Distance, DTK, GS ETE)
- Advisory Height above terrain digital value
- Advisory rising terrain symbol
- Monitor Mode
- Demo Mode

2 Specifications

2.1 Physical Specifications

Part Number:	A-05-101-00, A-05-102-00
Width:	3.33 in. (Measured at bezel)
Height:	3.33 in. (Measured at bezel)
Can Depth:	3.4 in. (Front bezel to rear can)
Overall Depth:	4.25 in. (Knob to rear connectors)
Weight:	1.1 lbs
Display:	2.5" Diagonal TFT Active Matrix LCD (240 x 480)
Face:	Anti-Reflective Coated Glass (400nm – 700nm)
Backlight:	High Intensity White LED
Rotary Knob:	Optical encoder with momentary push
Dimming:	Automatic – Front bezel mounted sensor

2.2 Operational Specifications

Operating Temp:	-20°C to +55°C
Storage Temp:	-55°C to +85°C
Maximum Unpressurized Operating Altitude:	35,000 feet
Maximum Operating Altitude (Ambient):	45,000 feet
Maximum VSI Rate (Digital Display):	±9,900 FPM
Cooling:	Not Required
Humidity Max:	95% at 50C
Input Voltage:	+12 to +32 Volts DC
Current:	1.0 Amps (Max)
Design Eye Viewing Envelope:	30° Left/Right & 30° Down to 45° Up Between 10 and 45 inches

2.3 I/O Specifications

GPS Input:	RS-232 “Avionics Format” Serial Output (9600 Baud, NP, 8 Data Bits, 1 Stop Bit) used in IIMorrow, ArNav, Bendix King, Free Flight, Garmin, Garmin AT, Honeywell, Trimble, and UPS AT panel mount GPS navigation systems.
Static Pressure:	1/8” NPT Threaded fitting (Female on Unit)
Weather Input:	RS-232 (Currently not Implemented)

2.4 Certification (P/N A-05-102-00 Only)

TSO:	TSO-C8d (Vertical Velocity Instruments) - Type B, TSO C113 Airborne Multipurpose Electronic Displays
Software:	RTCA DO-178B Level D
Environmental:	RTCA DO-160E
Categories:	See Environmental Qualification Sheet

3 General System Operation

3.1 Startup

The unit performs a power-on self test immediately following application of power. During these tests the unit verifies and displays the status of various internal hardware systems, and also displays the version identification of the operating software and internal databases. Operational limitations are presented, which must be accepted via a knob press.

After the self-test, the unit will switch to the default map mode and will display the "NO GPS" message until valid GPS navigation data is supplied by the navigator.

3.2 User Interface

The following data fields are presented:

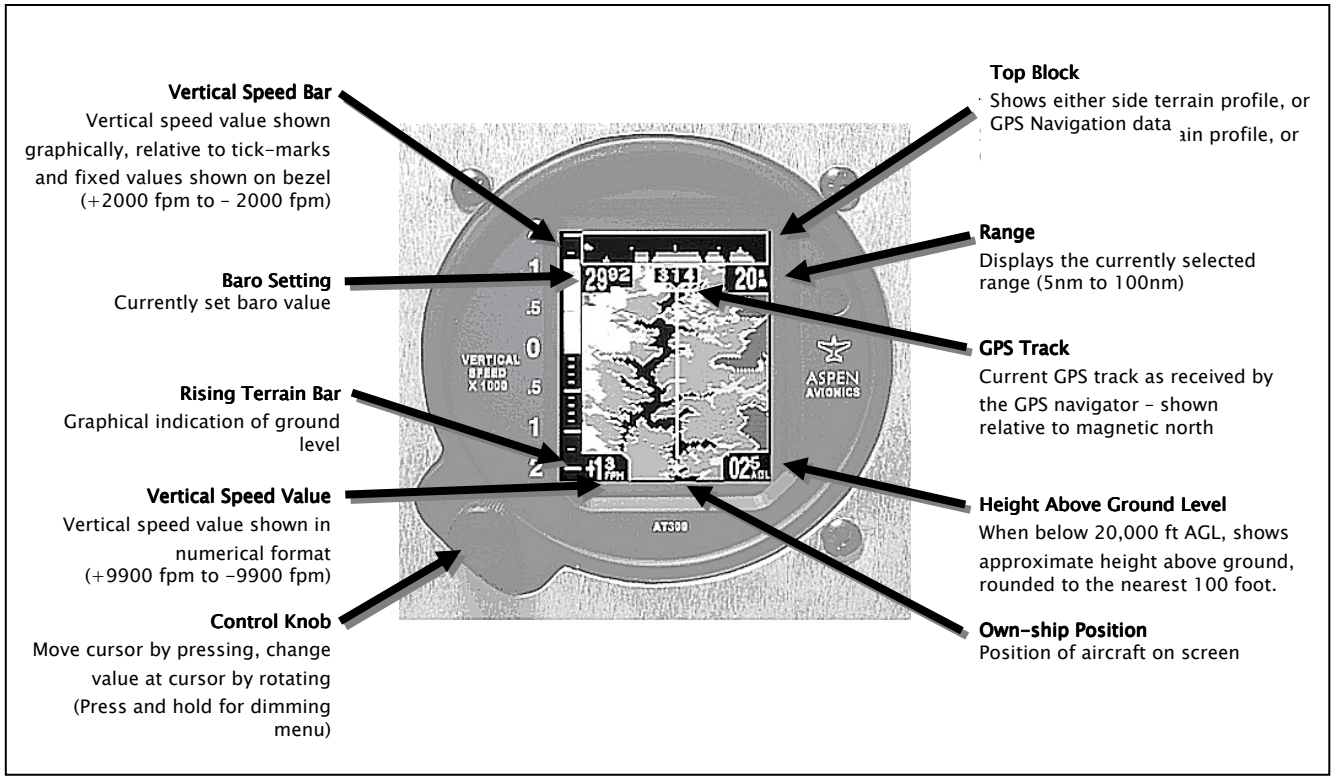


Figure 2 – Screen Layout

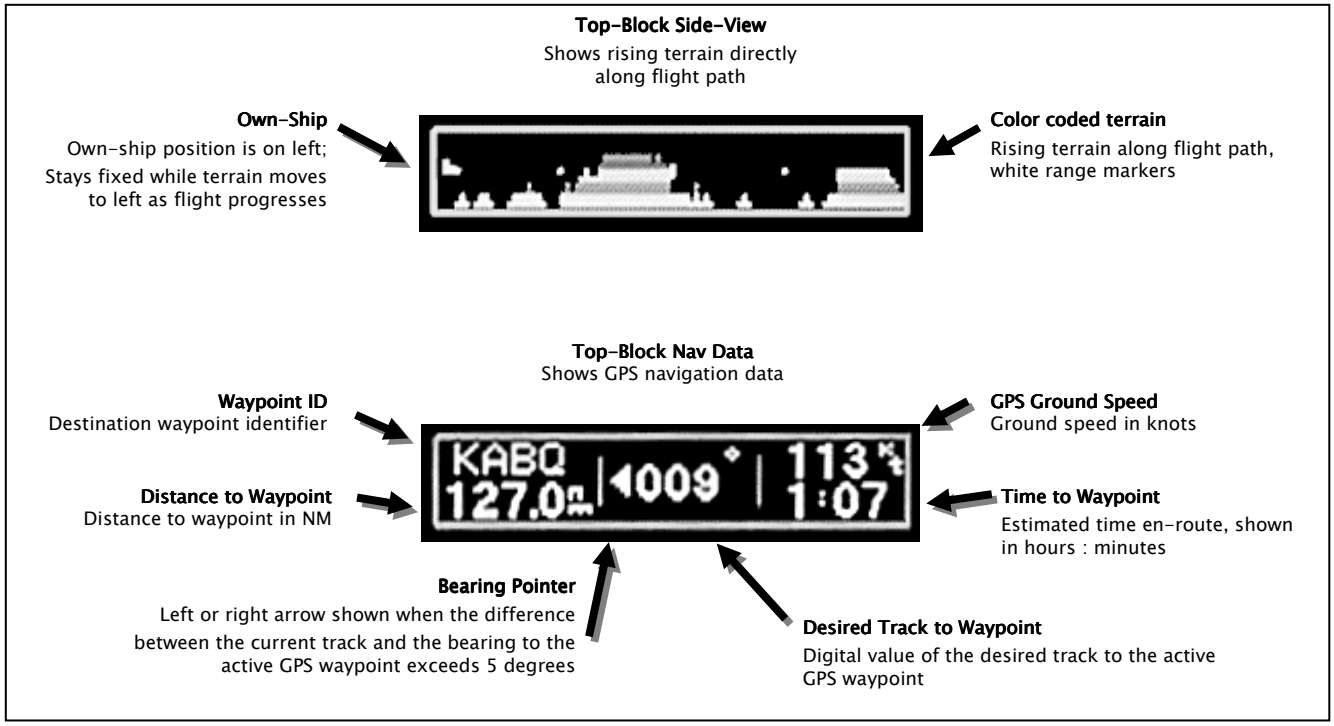


Figure 3 – Top Block Data Presentation

3.3 Cursor Control

Cursor control is accomplished by moving the cursor between three selectable fields on the screen and modifying the selected value. The current cursor position is indicated by the selected field being highlighted in GREEN.

The cursor is advanced by momentarily pressing and releasing the control knob, which will sequence the cursor clockwise between editable fields on the screen (currently 3 fields are editable).

Once the cursor is in a given field, the value of that field is changed by rotating the knob left and right.

3.3.1 Editing the Baro Setting

The AT300 uses internally computed barometric altitude to render terrain and obstacles in the appropriate colors. To ensure correct terrain presentation, the baro setting must to be set to the correct and current baro value. This is accomplished by moving the cursor to the baro setting field (default on power-up), and rotating the knob left and right to adjust the value.

WARNING

> ***Failure to set the correct baro setting on the AT300 will result in incorrect presentation of terrain and obstacle information. Baro setting should be set and updated to the correct value at all times.***

3.3.2 Selecting the Nav Data / Side Profile Terrain Display

The top block can be toggled between showing GPS navigation data or terrain side profile. This is accomplished by moving the cursor to the top block field (the field will be outlined in green when selected), and rotating the knob left for the terrain profile, and right for the navigation data.

3.3.3 Editing the Range Selection

The range can be set to various ranges between 5nm and 100nm. This is accomplished by moving the cursor to the range field and rotating the knob left for smaller values, and right for larger values.

3.3.4 Manually Adjusting Display Backlight Intensity

Display backlight intensity is initialized in the "auto-dimming mode" at each power cycle. In this mode the display brightness is automatically adjusted based on the ambient light detected by the photocell located to the right of the main LCD display.

Pressing and holding the control knob in for several seconds activates a manual dimming menu, which allows the automatic setting to be over ridden and the brightness to be manually adjusted. Once the manual dimming menu is presented, rotate the control knob clockwise to increase and counter clockwise to decrease the brightness. A scale is provided to indicate the selected backlight level.

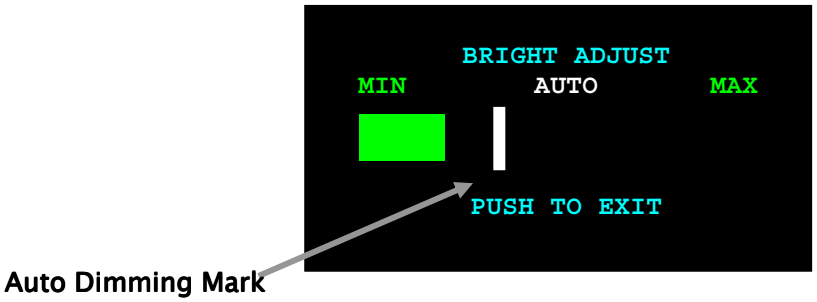


Figure 4 - Manual Dimming Menu

To set the unit back into the auto dimming mode, turn the knob until the manual brightness corresponds to the auto-set level, indicated by a white vertical line within the backlight intensity setting scale area. Auto dimming mode is selected when the end of the brightness scale is set to the vertical white line and the "AUTO" legend color changes from white to green.

The brightness menu will remain in view until the pilot exits the menu by momentarily pushing the control knob.

3.4 Terrain Presentation

Terrain is color coded relative to the aircraft position, track and altitude. Two distinct color coding methods are utilized – one for normal en-route operations, and a second for ground/landing/departure operations.

CAUTION

Evasive maneuvers based solely on this terrain map display are not authorized. Moving Map Approved for Strategic Planning Purposes Only.

3.4.1 Enroute Mode ("Normal Operation")

The Enroute Mode is active when not operating in the close proximity of an airport. In these conditions, terrain profiles from 2500 feet below to 3000 feet above the aircraft are shown, giving excellent awareness of surrounding terrain before it becomes a threat.

The following colors are used to render the AT300 terrain map based upon the approximate proximity of terrain to the current aircraft baro corrected altitude.

Greater than 2500 below:	Black (No Terrain Shown)
2500 to 1500 feet below:	Light Green
1500 to 500 feet below:	Dark Green
500 feet below to same as aircraft altitude:	Yellow
Aircraft altitude to 1500 feet above:	Red
1500 to 3000 feet above:	Magenta
Greater than 3000 feet above:	White
Terrain boundary area with no terrain coverage	Cyan

3.4.2 Ground/Landing/Departure Mode

Ground, Landing and Departure modes are active when operating in close proximity to the airport area. Using internal logic that incorporates knowledge of the aircraft position, track, and altitude, the AT300 will determine the current aircraft flight phase. When on the ground, or during the landing or departure phases of flight, the AT300 will only render terrain that is more than 100' above the aircraft's current baro-corrected altitude. Any terrain that is less than 100' above the current baro-corrected altitude, including all terrain below the aircraft, is not rendered. The Ground, Landing and Departure mode is automatically entered without any pilot action.

This sophisticated phase-of-flight logic ensures that rising terrain in the airport vicinity that is of interest during departure climb-out or go-around is always displayed, while simultaneously ensuring that expected terrain in the immediate airport vicinity is not presented in red during routine close-to-ground flight operations.

While in the Ground, Landing or Departure mode, the following colors are used to render the AT300 terrain map based upon the approximate proximity of terrain to the current aircraft baro corrected altitude.

Less than 100 above:	**Black (No Terrain Shown)**
100 to 1500 feet above:	**Red**
1500 to 3000 feet above:	**Magenta**
Greater than 3000 feet above:	**White**
Terrain boundary area with no terrain coverage	**Cyan**

3.5 Cold Temperature Operations

The AT300 uses baro-corrected altitude to render the color-coded terrain map. As is detailed in the Aeronautical Information Manual and the Instrument Flying Handbook, baro-corrected altitude is subject to known errors when the temperature at the altimeter setting station varies significantly from standard temperatures.

The magnitude of this altimeter error is a function of both the temperature at the ground station providing the altimeter setting, and the height difference between the aircraft and the altimeter setting station's elevation. Colder outside air temperatures and large differences in height between the aircraft and the ground station will produce larger errors. During operations when the temperature at the altimeter setting station is lower than ICAO standard temperature, the aircraft true altitude will be lower than the aircraft's indicated altitude.

The AT300 relies upon the same barometric corrections and principles of altimetry as a standard mechanical altimeter, and is therefore subject to these same errors. During flight operations where the temperature is below ICAO standard conditions, the AT300 will show terrain clearances that are greater than actual. The further the temperature is from ICAO standard temperature, and the greater the separation between the aircraft altitude and the elevation of the reporting station, the larger the errors. Extreme caution should be exercised whenever flight operations are conducted in cold temperatures to ensure that adequate terrain clearance exists.

The AT300 is not acceptable for use as the sole means of determining the aircraft's terrain separation.

WARNING

During flight operations when the outside temperature is below ICAO standard conditions, the AT300 will show terrain clearance that is greater than the actual terrain clearance.

Extreme caution must be taken during any cold temperature flight operations to ensure that the aircraft is operated with adequate separation from terrain.

The pilot is solely responsible to ensure that adequate terrain clearance is maintained and can not rely on the AT300 for this purpose.

3.6 Vertical Speed Display

The AT300 presents vertical speed indications to the pilot using both a digital VSI rate indicator and an analog VSI tape indicator. The vertical speed indications are active for all vertical rates between -9900 fpm to +9900 fpm. For vertical rates in excess of 10,000 fpm, the digital value is dashed and the analog tape will show full scale deflection.

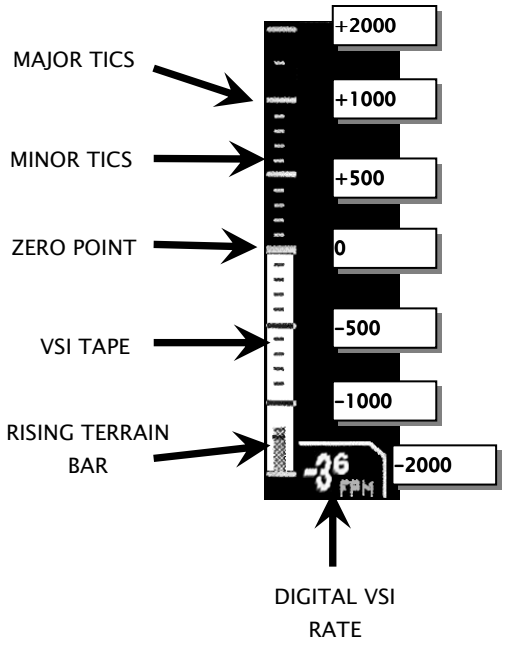


Figure 5 – Vertical Speed Display

The vertical speed tape on the VSI gives analog indications of vertical rates between +/- 2000 fpm. Above these values, the tape saturates at a full scale 2000 fpm value, and the digital value should be referenced to determine the aircraft vertical rate.

The scale tick marks on the vertical speed tape are only depicted whenever the vertical speed is greater than 50 fpm, and then only in the direction of motion of the aircraft. Below 50 fpm, only the zero fpm major tick mark is shown. This implementation provides a clear and unambiguous indication of magnitude and direction vertical rate, even for very shallow climbs or descents.

A digital VSI value is also provide by the AT300, presented in a dedicated display field located near the bottom and immediately adjacent to the VSI tape. This indicator shows the aircraft vertical rate to the nearest 100 fpm, using two digits. One digit is used to represents hundreds of feet per minute, and a second digit is used to represent thousands of feet per minute. The hundreds digits is a single superscript digit, while the thousands digit is a single full size digit. Thus, 500 fpm would be shown as a superscript digit "^{5}" while 9900 fpm would be shown as "9^{9}".

Also presented in the digital VSI field is a digital +/- direction indication. This +/- indicator comes "alive" whenever the aircraft vertical rate exceeds 30 fpm.

3.7 Rising Terrain Bar

The rising terrain bar is a tan colored indicator that rises into the vertical speed tape bar as shown in the following diagram:

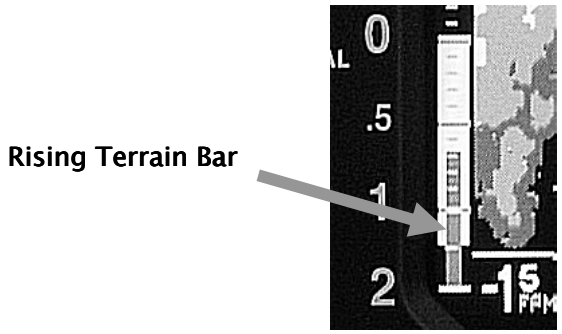


Figure 6 – Rising Terrain Bar

As the aircraft gets closer to the ground the rising terrain bar will come into view. The bar first comes into view when the aircraft height above ground reaches 2000 feet AGL. The bar continues to rise toward zero as the aircraft gets closer to the ground. When the aircraft is on the ground, the bar completely fills the lower half of the VSI scale area. (The VSI "1" mark corresponds to 1000 feet and the ".5" mark corresponds to 500 feet AGL). During a departure, the ground bar will "shrink" as the height above ground increases. This indicator corresponds to the terrain cell height directly below the aircraft and is not forward looking in nature.

3.8 Height Above Ground Digital Indication

Whenever the aircraft's calculated altitude is below 20,000 ft AGL, the AT300 presents the pilot will a digital indication of the aircraft height above ground. This digital AGL value is presented in a dedicated text field in the lower right hand corner of the AT300 display area. This indicator shows the aircraft height above ground to the nearest 100 fpm, using two digits. One digit is used to represents hundreds of feet AGL and the second and third digits are used to represent thousands of feet AGL. The hundreds digits is a single superscript digit, while the thousands digits are full size digit. Thus 500 feet AGL would be shown as a superscript digit "00^{5}" while 19900 feet AGL would be shown as "19^{9}".

Figure 7 – Height Above Ground

3.9 GPS Course Line

Whenever the connected aviation GPS has an active navigation leg, the AT300 will display the current and next (if available) waypoint information in the map area. The active navigation leg is shown as a magenta line, with waypoint symbols at each end. The waypoint identifier for the active waypoint is shown to the right of the waypoint icon. The next navigation leg information (when available) is shown by a white line

with a waypoint icon at each end. The waypoint identifier of the next waypoint is also shown.

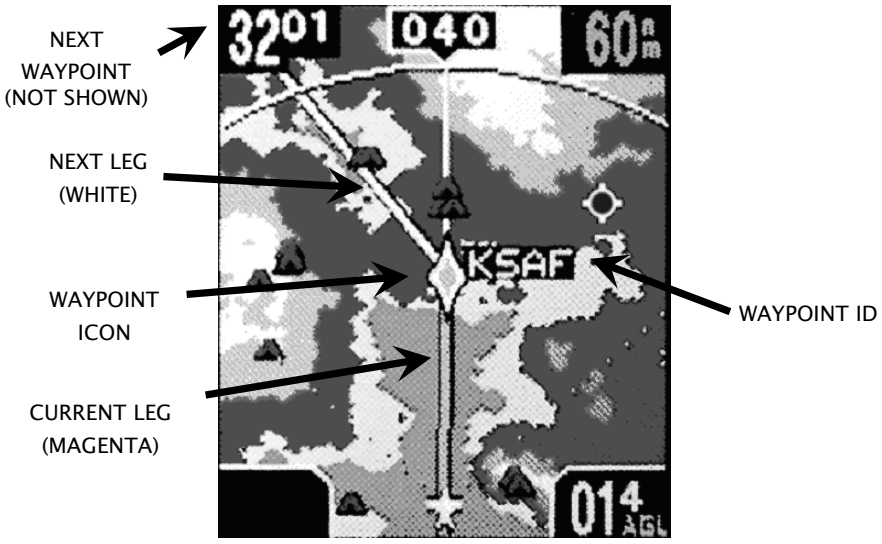


Figure 8 - GPS Course Line

Note: This feature is not supported in ArNav GPS systems

3.10 Airport Locations

Airport locations are indicated with a round white and blue airport icon symbols shown below. Airports icons automatically de-clutter from the screen on range settings of 60nm and above. The airport icon runway symbols do not reflect the runway orientation at the depicted airport.

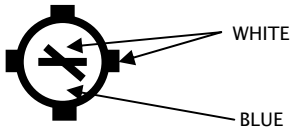


Figure 9 - Airport Icon

3.11 Obstructions

The AT300 obstruction data base includes all man made towers in the coverage area with an elevation of 250' above ground level or higher. The obstructions are depicted using a color coded triangle icon depicted below.

Figure 10 - Obstruction Icon

Obstructions color coding is as follows:

Greater than 2500 below:	Black (No Terrain Shown)
2500 to 1500 feet below:	Light Green
1500 to 500 feet below:	Dark Green
500 feet below to same as aircraft altitude:	Yellow
Above aircraft altitude	Red

3.12 System Status Messages

The following system status messages may be annunciated by the AT300 in a text block in the middle of the moving map display area

Message/Indication	Meaning
"NO GPS"	GPS data is unavailable or flagged invalid by the GPS receiver
"NO COVERAGE"	Current position falls outside the terrain coverage area of the terrain database
"LOW VOLTS"	Aircraft bus voltage is too low for reliable operation. Remainder of screen will be blanked during this mode.
"LANDING"	The AT300 has determined that the aircraft is most likely in the landing phase of flight based upon distance to the nearest airport, direction of flight, altitude, and altitude rate.
"ON GROUND"	The AT300 has determined that the unit is most likely on the ground, based upon current groundspeed.
"DEPARTURE"	The AT300 has determined that the aircraft is most likely in the post take-off departure phase of flight or in the missed approach phase of flight, based upon distance from the nearest airport, direction of flight, altitude, and altitude rate.

3.13 Database Updating

Terrain, airports and obstructions are updated by removing the database label and associated data card located on the side of the unit. Procedures supplied with updated databases should be referenced for detailed instructions on this procedure. Aspen releases updated database images approximately every six months.

Databases are identified with cycles from 00 to 99. There are three databases, terrain, airports and obstructions. The nomenclature utilized on the data card label, located on the side of the unit is XX.YY.ZZ.

Contact the factory for additional information on the current database cycle available.

4 Installation

4.1 Equipment Description

The AT300 is a panel mounted electronic display instrument designed to replace the industry standard Vertical Speed Indicator (VSI) located in most general aviation aircraft. The AT300 incorporates a high-resolution, sunlight readable, color active-matrix liquid crystal display (TFT LCD) with an anti-reflective coating protective glass face.

NOTE

The AT300 protective glass face is coated with a special anti-reflective coating that is sensitive to cleaners, waxes, skin oils, etc. Special care is required when cleaning this glass surface.

DO NOT USE ABRASIVE OR HARSH CHEMICAL CLEANERS, SUCH AS THOSE CONTAINING AMMONIA, TO CLEAN THE AT300 GLASS FACE.

It is recommended that the AT300 glass face be cleaned using a clean, lint free cloth with eyeglass lens cleaner suitable for use on anti-reflective coatings.

In addition to presenting vertical speed information, the AT300 provides a real time moving map depicting terrain information, color coded based on its relative altitude to the current aircraft altitude. Navigation information from the connected GPS system can also be presented in the AT300 moving map area. In addition to an RS232 serial input from a panel mount GPS system, the AT300 requires a single power input from the aircraft power system, and an associated ground connection

4.2 Installation Preparation

As with all avionics products, proper planning and preparation is critical to experiencing a smooth and trouble free installation. It is important to review all of the information within this manual, including the product overview provided in section 1.2, to be sure that all of the pre-installation requirements have been fulfilled.

NOTE

While the AT300 has been designed for easy installation, it is important to read this document in its entirety before an installation is started.

4.3 TSO Installation Statement

The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. The article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.

4.4 Equipment Installation Limitations

When installed in accordance with this installation manual and the limitations that follow, the installation of the AT300 is unlikely to have an appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of the aircraft, and should therefore be eligible for installation as a minor alteration.

1. The AT300 is eligible for installation as the primary Vertical Speed Indicator (VSI) in all 14 CFR Part 23 Class I, II and III airplanes (as defined in Figure 2 of AC 23.1309-1C) operated under 14 CFR part 91 or part 135, subject to the additional restrictions listed below (Typically class I is single reciprocating engine aircraft less than 6000lbs gross, class II is multi reciprocating or single turbine engine aircraft less than 6000lbs gross, and class III is single or multi reciprocating or turbine engine aircraft greater than 6000lbs gross).

2. For class I, II, and III aircraft operated under 14 CFR part 135 operating rules, the AT300 is eligible as the primary VSI only when an alternate static source or a second FAA approved VSI of conventional design is installed. The traditional emergency procedure (in non-pressurized aircraft) of breaking the face of the VSI in the event of a static line blockage is not applicable to the AT300. In the event that neither an alternate static source nor a second VSI of conventional design is installed, a permanent placarded must be provided in the vicinity of the AT300 that prohibits its use for 14 CFR part 135 operations.

3. Additionally, for class III aircraft operated under 14 CFR part 135 operating rules AND while carrying passengers under IFR, the AT300 is only eligible as the primary VSI provided a second FAA approved VSI of conventional design is installed. The AT300 does not currently meet design assurance

levels for software to allow it to be installed as the sole source of vertical speed information in a Class III airplane conducting IFR operations with passengers. In the event that a second VSI of conventional design is not installed, a permanent placarded must be provided in the vicinity of the AT300 that prohibits its use during 14 CFR part 135 operations while carrying passengers under IFR.

4. The AT300 equipment is not eligible to replace a specific make/model VSI or Instantaneous VSI that is listed as required equipment in the Type Certificate or Supplemental Type Certificate of a specific make/model aircraft, such as may be the case when a VSI forms an integral part of an air data computer system. For so-equipped aircraft, the AT300 is eligible only as a secondary display of vertical speed information.

5. The AT300 equipment is not eligible as a replacement for a VSI that forms an integral part of a TCAS II system. For so-equipped TCAS II aircraft, the AT300 is eligible only as a secondary display of vertical speed information.

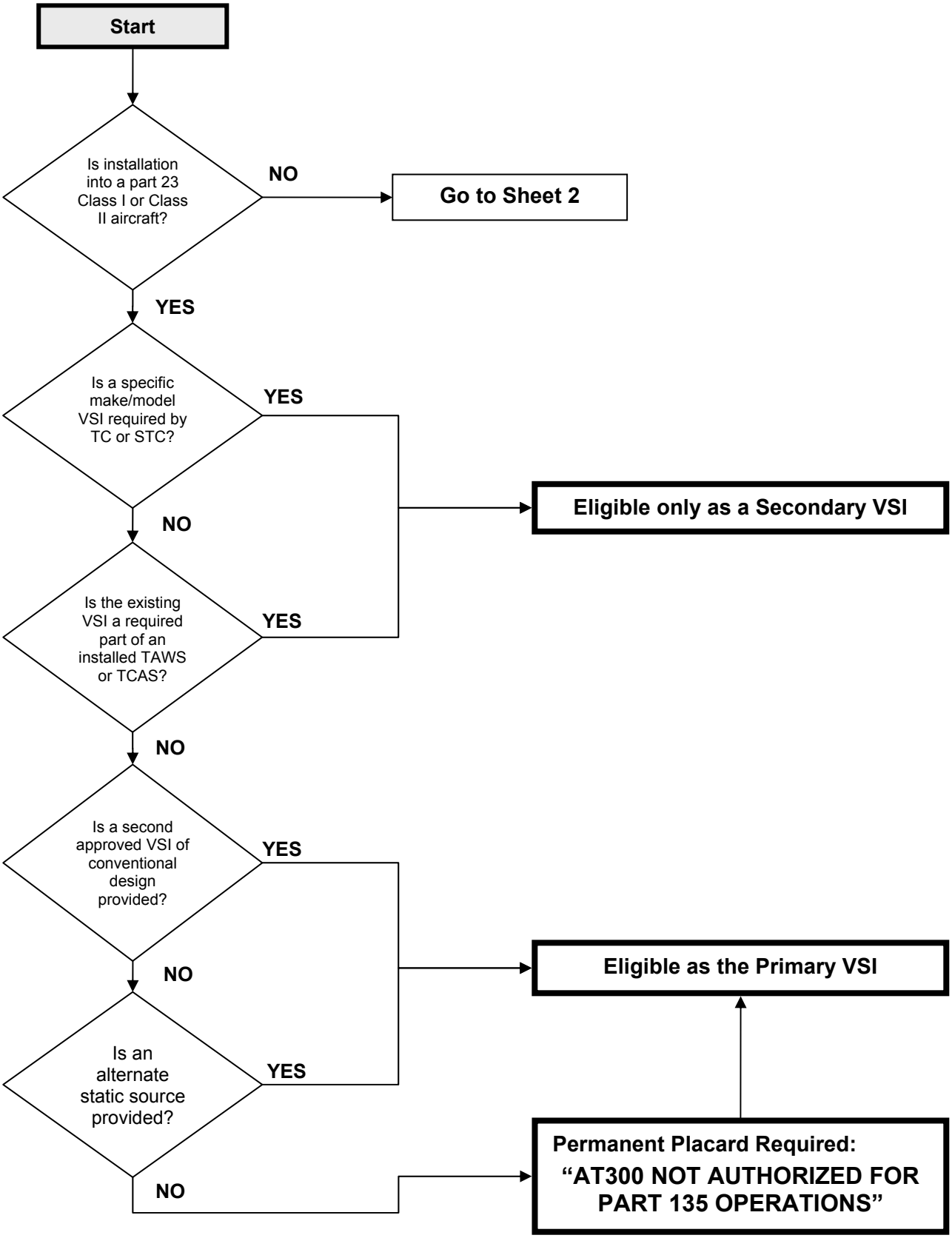
6. The AT300 equipment is not eligible as a replacement for a VSI that forms an integral part of a TAWS system. For so-equipped TAWS aircraft, the AT300 is eligible only as a secondary display of vertical speed information.

7. The AT300 is not eligible as a TSO C151B TAWS device, and therefore can not be installed to satisfy the regulatory requirement for TSO C151B TAWS under 14 CFR Parts 91.223, 121.354, 121.360, 135.153, 135.154, or other similar regulations.

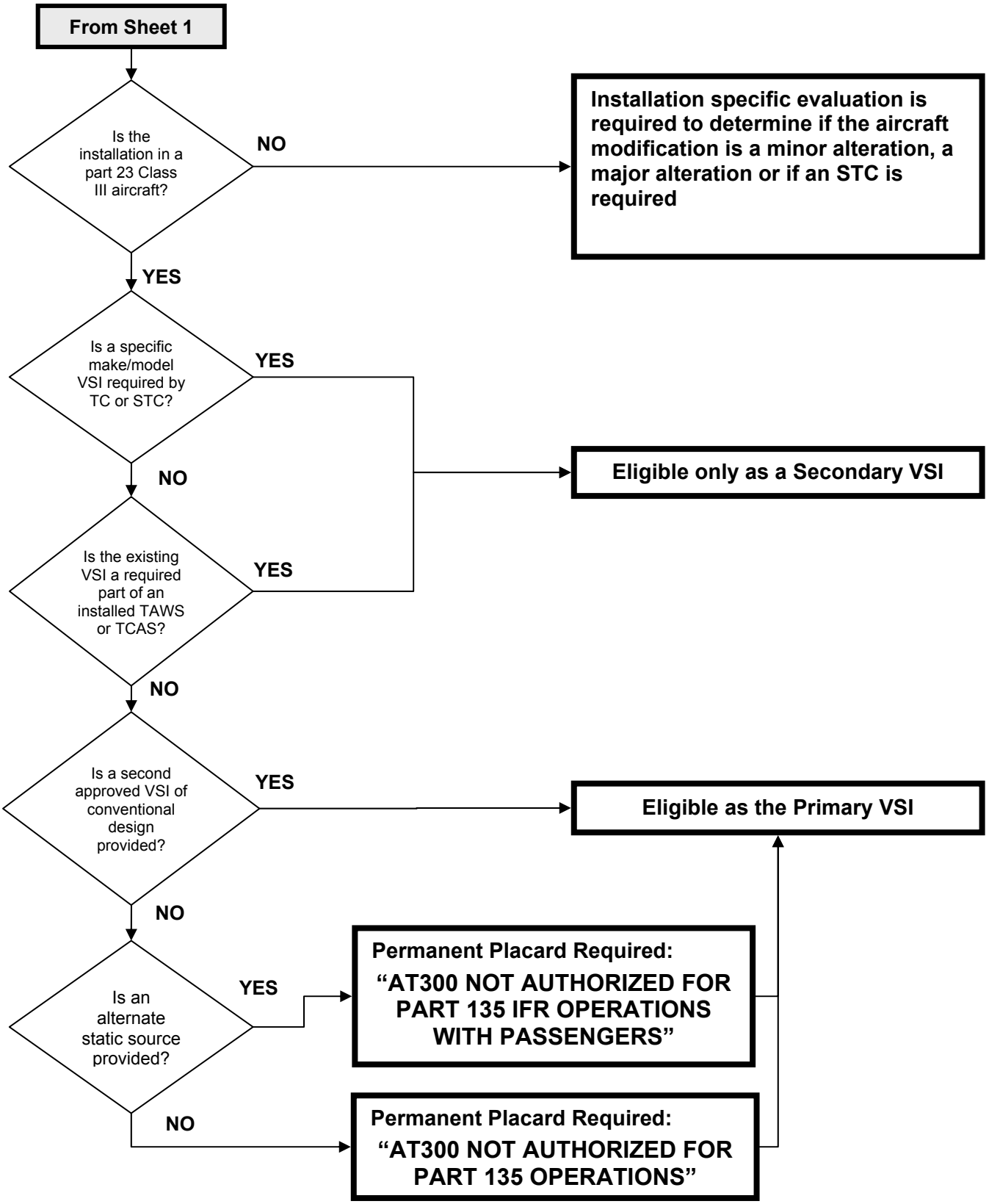
8. Any deviation from these limitations, or installation in any class of aircraft other than those identified above, will require an installation specific evaluation to determine if the aircraft modification is a minor alteration, a major alteration, or if an STC is required

The installation decision flow charts that follow are provided as an aid to the installer for ascertaining the eligibility of the AT300 for use in 14 CFR part 23 classes I, II and III aircraft operated under 14 CFR part 91 or part 135 operating rules.

AT300 Installation Limitations - Sheet 1



AT300 Installation Limitations - Sheet 2



4.5 Installation Steps (Summary)

The AT300 installation comprises the following basic installation steps:

- ☑ **Perform Installation Planning**
- ☑ **Perform the Mechanical and Electrical Installation**
- ☑ **Perform the Systems Checkout (Using Data Monitor Mode)**
- ☑ **Complete Any Other Tasks Required To Return The Aircraft To Service, Such As A Pitot-Static Leak Check**
- ☑ **Complete the Product, Dealer and Customer Information Sections of the Warranty Registration Card provided in Section 9, and provide a copy to the customer, retain one copy, and forward on copy to Aspen Avionics**

4.6 Interfaces

The AT300 interfaces to the aircraft pitot-static connection and the panel mounted navigator as shown (power connections not shown). The AT300 requires no post installation configuration or unit set up to correctly interface to the attached GPS system as the AT300 automatically detects and communicates with all compatible GPS equipment.

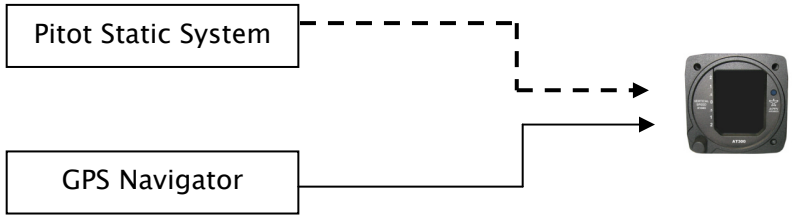


Figure 11 - System Interfaces

4.7 Mounting Location

The AT300 is optically optimized to be located within the pilots primary field of view, in the lower right position of the standard "T" configuration:

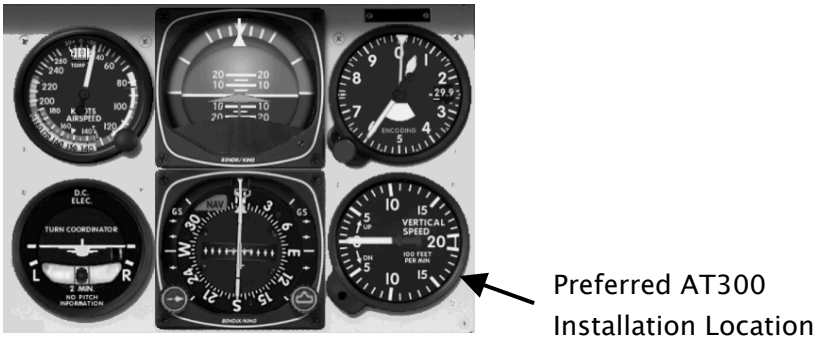


Figure 12 - Installation Location

4.8 Optimal Viewing Angle

Alternate locations can be selected, but viewing quality may suffer and should be carefully evaluated prior to installation. In general, the instrument should be located biased to the right of the pilots center position. The instrument should be located within a design-eye viewing envelope of 10 to 45 inches, and within 30 degrees left or right and 30 degrees down and 45 degrees up, as viewed by the pilot.

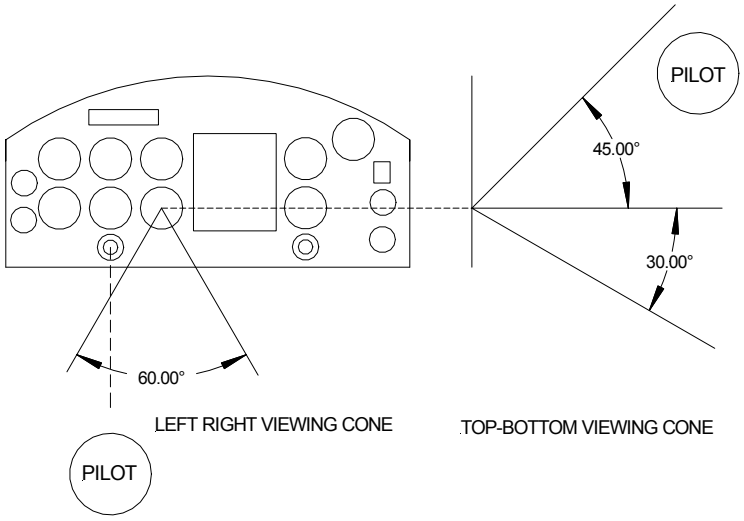


Figure 13 - Left/Right, Top/Bottom Viewing Cone

4.9 Mounting Method

Three (3) #6 screws are provided in the AT300 installation kit and should be used to mount the AT300. The screws must be at least ¾" (thread length), and no more than 1½" long. Standard instrument "Black Coated" brass screws are preferred.

4.10 Pneumatic Connections

The rear 1/8" NPT pneumatic connection may require adaptors to interface to the aircraft pitot static system. It is recommended that a single or double layer of Teflon tape be applied to NPT type pneumatic fittings to protect against possible leaks.

NOTE

The interface to the pitot static line is typically the same pressure source required by the aircraft altimeter – leaks created during this installation may effect altitude readings.

It is recommended that a pitot-static leak test be performed after installation for VFR installations. It is required that a pitot-static leak test be performed after installation for IFR installations.

4.11 Electrical Connections

4.11.1 Load Analysis

Ensure that an electrical load analysis is performed to verify that the additional load introduced by the AT300 is within the design parameters of the aircrafts electrical system.

4.11.2 Installation Connector Kit

The AT300 is supplied with an installation kit that includes the connector and pins, connector housing, and sliding locking mechanism.

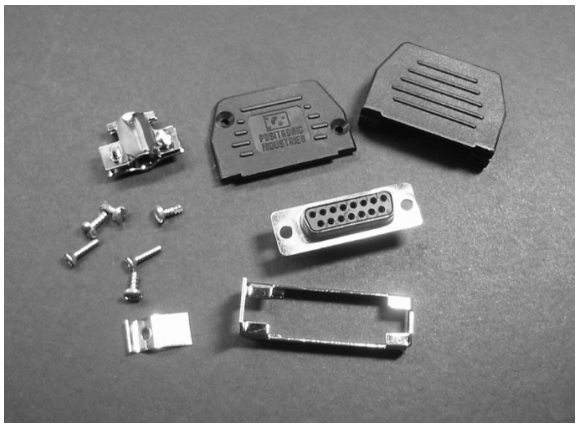
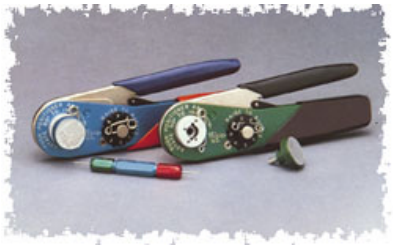


Figure 14 – Installation Connector Kit

The connector included uses crimp pins, which requires use of a crimping and associated pin-removal tool as follows:



MIL/SPEC: M22520/2-01 or
POSITRONICS: 9507 or DANIELS: AFM8 or equivalent.
(Ensure correct turret head is used)

Figure 15 - Crimping Tools

If a crimped connection is not desired, the connector can be replaced with a standard solder cup type connector. The housing and locking mechanisms must be retained however, to provide a locking mechanism to keep the connector attached to the rear of the unit.

For installations where the required crimping and pin removal tools are not easily accessible, it is recommended to use the solder cup connector method.

4.11.3 Connector Housing

Regardless of the connector type (solder or crimp), the supplied connector housing must be used. The following diagram shows the installation of the housing, which incorporates a spring-loaded locking mechanism that securely fastens the connector to the rear of the unit.

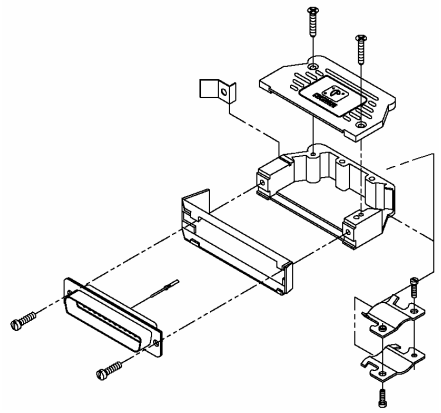


Figure 16 - Connector Housing Assembly

4.11.4 Unit Pin-out

All electrical connections are made on a single 15-Pin Male "D-Sub" connector. The unit uses solid machined type pins for maximum robustness. The connector used on the aircraft is a corresponding 15-Pin Female "D-Sub" connector with either crimp or solder cup terminals.

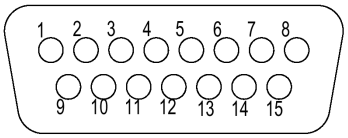


Figure 17 – Connector Pin Numbers

The above figure shows the connector pin numbering of the AT300 unit, **as viewed from the rear of the unit.**

NOTE

Each connector has the individual pins numbered, and these numbers should be used during the wiring, versus solely attempting to determine the correct pin by counting from the "left" or "right" side of the connector.

The AT300 pin-out is defined in the following table:

Pin Number	Name	Input / Output	Function
1	POWER	INPUT	Main DC power input for the unit (positive).
2	NC	N/A	Not Connected
3	SER OUT 1	OUTPUT	Reserved for future use.
4	SER OUT 2	OUTPUT	Reserved for future use.
5	GPS INPUT	INPUT	Serial input from GPS navigator unit.
6	SER IN 2	INPUT	Reserved for future use.
7	ALERT OUT	OUTPUT	Reserved for future use.
8	NC	N/A	Not Connected
9	GND	INPUT	Main DC ground power input for the unit (negative).
10	NC	N/A	Not Connected
11	NC	N/A	Not Connected
12	NC	N/A	Not Connected
13	NC	N/A	Not Connected
14	ANT_PWR	OUTPUT	Reserved for future use.
15	ANT_GND	OUTPUT	Reserved for future use.

Figure 18 – AT300 Main Connector Pin-out

The following diagram highlights the typically pins used:

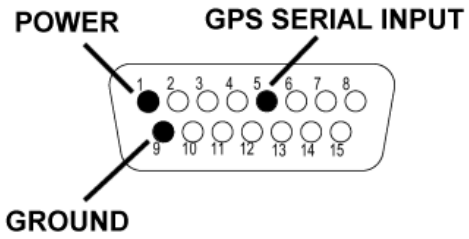


Figure 19 – Commonly Used Pins

4.11.5 Wiring Diagram

The following diagram shows the wiring diagram for a typical installation:

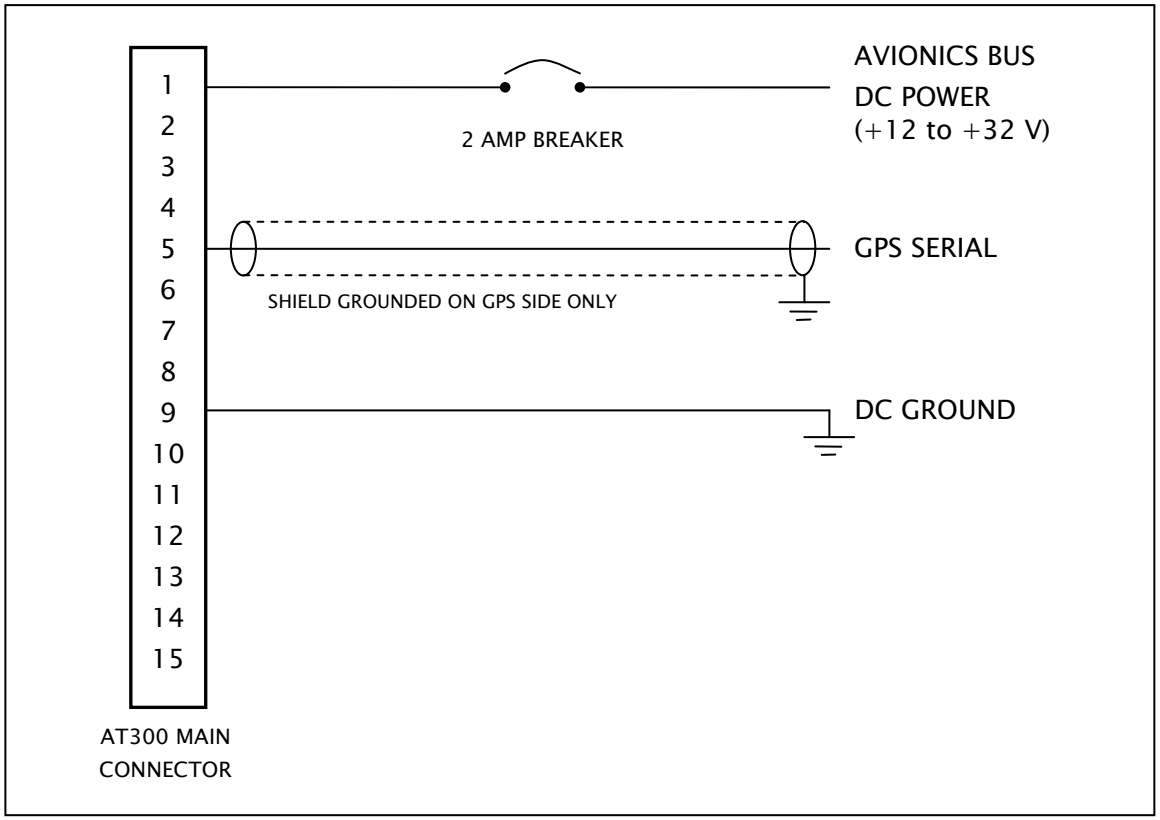


Figure 20 – Wiring Diagram

4.11.6 Power and Ground Connection

A single power line must be supplied to the AT300 from the aircraft avionics power bus. The AT300 does not incorporate a separate power switch, and is powered-on in conjunction with the other non-switched avionics systems.

In selecting the source for power, the current rating of the unit should be observed. It is recommended that a dedicated circuit breaker of at least 2 Amps be supplied for the unit and labeled in a manner consistent with other flight deck nomenclature.

A dedicated ground wire is required from the rear connector to aircraft ground (typically structural ground).

CAUTION

> ***It is not acceptable to ground the unit only through the mechanical interface from the case to the instrument panel. A dedicated ground wire must be provided.***

4.11.7 GPS Interface Connection

Serial (RS-232) data is provided from the panel mounted GPS navigator to the AT300. This is a single wire interface that uses aircraft ground as a reference.

A single conductor, shielded wire is used for this interface. There is no requirement to ground the shield on the AT300 side.

NOTES

> 1. ***Some GPS unit allow for configuration of the serial output. The AT300 uses the basic "Aviation Format" serial data, with or without altitude information.***
> 2. ***Note that some GPS equipment will not output valid navigation data until a destination waypoint is selected, either by activating a flight plan, or by performing a direct-to command.***

The following table defines some common GPS unit interface connections:

Unit	Connector	Serial Output Pin
Garmin GNC 400 series	P4001	56
Garmin GNC 500 series	P5001	56
Garmin GNC 150, 155, 155XL, 165, 250, 250XL, 300, 300XL	P1	24
IIMorrow (Garmin) GX50, 60	P1	5
IIMorrow (Garmin) GX 55	P1	6
IIMorrow 360	P1	8
Trimble 2000, 2000A	P1	5
Bendix King KLN 90, 90B	P901	13
Bendix King KLN 89, 89B	P891	2
ARNAV FMS5000	P1	3

Figure 21 – Common GPS Serial Interface Connections

NOTE

Always refer to the installation manual for the installed GPS make/model to confirm that the correct serial output pin and port configuration has been selected. In the event of a conflict between the information presented here and the information in the GPS manufacturer's Installation Manual, the GPS manufacturer's Installation Manual shall have precedence.

5 Post Installation Checkout

5.1 Data Monitor Function

The AT300 requires no post installation configuration or unit set up to correctly interface to the attached GPS system as the AT300 automatically detects and communicates with all compatible GPS equipment.

After installation, start the system in the Data Monitor Mode as described below to ensure that it is communicating with the GPS system. This function shows activity on the RS-232 line, in addition to other internal diagnostic data.

To start the Data Monitor Mode:

1. Apply power to the unit while holding the unit knob in the depressed position.
2. Release the knob prior to completion of the startup sequence.
3. Upon completion of the start up self tests, the AT300 will enter the Data Monitor Mode and will display the page shown below.

NOTE

> ***If the unit knob is held until the completion of the start up sequence, the unit will enter DEMO mode. Once in DEMO mode, the unit will subsequently power up in DEMO each time power is cycled. To exit DEMO mode, follow the instruction provided in section 5.3***

To exit data monitor mode:

1. While the unit is in Monitor Mode, cycle power and allow it to re-start normally.

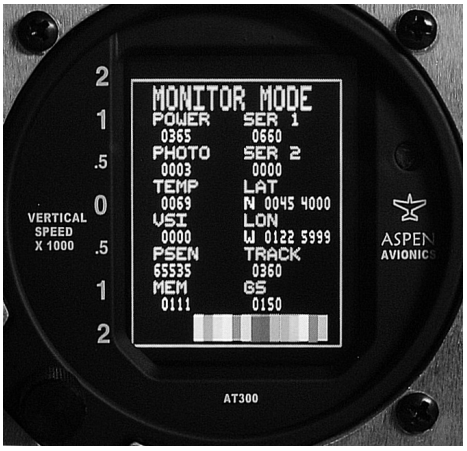


Figure 22 - Data Monitor Screen

With the GPS system powered and the aircraft receiving GPS signals (via either a GPS repeater if located in a hanger, or with the antenna in clear view of the sky), the SER 1 field should show incrementing numbers. This represents data being received by the unit from the panel mounted navigation system, indicating that the wiring is correct.

NOTE

Other fields will also display data, depending on the state of the GPS navigator. Some systems do not output latitude, longitude, or track information until a "Direct To" command has been entered, flight plan has been activated, or the aircraft is in motion.

5.2 Interface Verification

Verify that the following values are being correctly received from the GPS:

- ✓ Verify that the Serial Interface (SER 1) count is incrementing at approximately once per second. The value of the increment will vary as this represents the number of characters received from the GPS unit once per second.
- ✓ Verify that the GPS Latitude and Longitude are being correctly received from the GPS unit. Note that the AT300 displays these values in decimal format.
- ✓ Verify that the track is being received from the GPS unit. Note that this is different than aircraft heading and may not be valid until aircraft movement has been initiated.
- ✓ Verify that the ground speed is received from the GPS unit. Note that this will be zero until aircraft movement has been initiated.

5.3 Demo Mode Function

Each AT300 includes a built in demonstration mode where the unit displays a short flight profile sequence for demonstration purposes. During Demo mode operation "DEMO MODE" is continually displayed in yellow immediately below the current track field.

To start the Demo Mode:

1. Apply power to the unit while continuously holding the unit knob in the depressed position until the end of the start up self test sequence.
2. After completion of the start up sequence, the unit will enter Demo Mode and annunciate "DEMO" in yellow immediately below the current track.
3. Once DEMO MODE is annunciated, release the knob.

NOTE

Once in Demo Mode, the unit will enter into Demo Mode on each subsequent power cycle. To cancel Demo Mode, the unit must sequenced through Monitor Mode as described below

To exit Demo Mode:

1. While operating in Demo Mode, cycle power to the unit while holding down the control knob.
2. Release the control knob during the startup self test sequence while the start up screen is displayed.
3. The unit will subsequently enter Monitor Mode at the end of the start up self test sequence.
4. Exit Monitor Mode by cycling power to the unit, and the unit will thereafter start normally.

5.4 Trouble Shooting Guide:

Symptom	Verify
Unit does not power on	Ensure power is wired to correct pin on the AT300 and all electrical connections are sound.
	Verify aircraft supply is greater than 12 Volts.
	Verify the AT300 is on dedicated breaker (may effect supplied voltage to unit).
Unit powers on, but continues to show "NO GPS"	Verify the panel mount navigator is powered up and has a valid GPS position.
	Verify the navigator has a valid active flight plan (some navigators do not output basic position until a leg is active).
	Verify the serial connection is correct between the navigator and the AT300.

6 Continued Airworthiness

6.1 Database Updating

The terrain, obstacle and airports database is subject to periodic updates by the various government agencies that publish this data. Aspen Avionics will release updates to the unit databases approximately every six months. The AT300 database is updated by removing the database label and associated data card located on the side of the unit. Procedures to complete this activity will be supplied with the database update kit. These instructions should be referenced for the detailed database update instructions. Contact the factory for additional information.

6.2 Periodic Maintenance and Calibration

No periodic maintenance or calibration is required.

7 Environmental Qualification Form

NOMENCLATURE:	AT300 Hazard Awareness Display
PART NUMBER:	A-05-102-00
TSO NUMBER:	TSO-C8d (Vertical Velocity Instruments), TSO-C113 Airborne Multipurpose Electronic Displays
MANUFACTURER:	Aspen Avionics
ADDRESS:	8360 Corona Loop NE Albuquerque, NM 87113

DO-160E SECTION	PARA	CATEGORY	DESCRIPTION OF TESTS CONDUCTED
DO-160E Temperature/ Altitude	4.0	C1	Equipment tested to category C1
DO-160E Loss of Cooling	4.5.4	X	Not tested – no auxiliary cooling required
DO-160E Temperature Variation	5.0	C	Equipment tested to category C
DO-160E Humidity	6.0	A	Equipment tested to category A
DO-160E Shocks / Crash	7.0	A	Equipment tested to category A
DO-160E Vibration	8.0	S	Equipment tested to category S, curve M
DO-160E Explosion	9.0	X	Not tested
DO-160E Waterproof	10.0	X	Not tested
DO-160E Fluids Susceptibility	11.0	X	Not tested
DO-160E Sand / Dust	12.0	X	Not tested
DO-160E Fungus	13.0	X	Not tested
DO-160E Salt Fog	14.0	X	Not tested
DO-160E Magnetic Effect	15.0	Z	Equipment tested to category Z
DO-160E Power Input	16.0	B	Equipment tested to category B
DO-160E Power Input Harmonics	16.0	X	Not tested
DO-160E Voltage Spike	17.0	B	Equipment tested to category B
DO-160E Conducted Audio	18.0	B	Equipment tested to category B
DO-160E Induced Signal	19.0	AC	Equipment tested to category AC
DO-160E RF Susceptibility	20.0	S	Equipment tested to category S
DO-160E RF Emissions	21.0	B	Equipment tested to category B
DO-160E Lightning Induced	22.0	X	Not tested
DO-160E Lightning Direct	23.0	X	Not tested
DO-160E Icing	24.0	X	Not tested
DO-160E ESD	25.0	A	Equipment tested to category A
DO-160E Fire	26.0	X	Not tested

8 Serial Interface Specification

The following serial interface specification applies to the format of the RS-232 data transmitted from the GPS navigator to the AT300 GPS input port. Data is accepted in packets coded in the industry standard "avionics" format at a baud rate of 9600, 8 data bits, 1 stop bit, no parity. Packets are accepted at approximately 1 Hz.

Serial packets are prefixed by an ASCII <STX> character (0x02 hex), and completed with an ASCII <ETX> character (0x03 hex). Multiple messages consisting of an ID and a Value are contained between the <STX> and <ETX>. Each message is terminated with an ASCII carriage return (<CR> = 0x0d hex).

A single packet therefore is organized as follows:

<STX><ID><VALUE><CR><ID><VALUE><CR><ID><VALUE><CR> … <ID><VALUE><CR><ETX>

Values used by the AT300 are as follows: (All other data is ignored)

ID	VALUE	VALUE FORMAT	DESCRIPTION
A	Latitude	sddmmhh	s = sign (N for north, S for south) dd = degrees mm = minutes hh = hundredths of minutes
B	Longitude	sdddmmhh	s = sign (E for east, W for west) ddd = degrees mm = minutes hh = hundredths of minutes
C	Magnetic Track	ddd	ddd = track in degrees
D	Ground Speed	ddd	ddd = speed in knots
E	Distance to Waypoint	ddddd	ddddd = distance in nm X 10
E	Distance to Waypoint	dddddd	(Alternate format for ARNAV) dddddd = distance in nm X 100
I	Desired Track	dddd	dddd = track in degrees x 10
K	Active Waypoint Identifier	ddd[dd]	ddd = ASCII waypoint ID [dd] is optional for up to 5 characters
L	Bearing to Active Waypoint	dddd	dddd = bearing in degrees x 10
Q	Magnetic Variation	sddd	s = sign (E for east, W for west) ddd = degrees x 10
T	Warnings	---A-----	A indicates GPS NAV flagged Otherwise, all dashed
w	Waypoint Info	See below	

Figure 23 - Serial Navigation Message Format

'w' messages are waypoint route information and correspond to the flight plan programmed in the GPS navigator. A unique 'w' message is allocated for each waypoint in the current flight plan. The following table describes the bit coding within the message value field.

Byte	VALUE	VALUE FORMAT	DESCRIPTION
1	ID from above table	w	ASCII Character Indicates beginning of a single waypoint item
2-3	Waypoint Number	dd	ASCII Characters dd = waypoint number represented with two ASCII characters
4	Sequence Number	xiannnnn	Packed unsigned binary x = not used i = 1 if last waypoint in route a = 1 if active waypoint in route nnnnn = waypoint number
5-9	Waypoint Identifier	ddddd	ASCII Characters Identifier as 5 ASCII characters
10	Waypoint Latitude	sddddddd	Packed unsigned binary s = sign (0 for north, 1 for south) ddddddd = degrees
11	Waypoint Latitude	xxdddddd	Packed unsigned binary x = not used dddddd = minutes
12	Waypoint Latitude	xddddddd	Packed unsigned binary x = not used ddddddd = hundredths of minutes
13	Waypoint Longitude	sxxxxxxx	Packed unsigned binary s = sign (0 for east, 1 for west)
14	Waypoint Longitude	dddddddd	Packed unsigned binary dddddddd = degrees
15	Waypoint Longitude	xxdddddd	Packed unsigned binary x = not used dddddd = minutes
16	Waypoint Longitude	xddddddd	Packed unsigned binary x = not used ddddddd = hundredths of minutes
17	Magnetic Variation	dddddddd	Packed unsigned binary dddddddd = LS Byte
18	Magnetic Variation	dddddddd	Packed unsigned binary dddddddd = MS Byte
19	Waypoint Terminator	<CR>	ASCII Character Packet terminator

Figure 24 - Serial Waypoint Interface Specification

9 Warranty Registration Card

Aspen Avionics Warranty Registration Card

Product Information

Aspen Part Number: _____
Serial Number: _____
Software Version: _____

Dealer Information

Dealer _____
Phone Number _____
Address _____
_____

Customer Information

Customer Name _____
Street _____
City _____
State _____
Zip _____
Phone Number _____

Installation Information

Installation Date _____
Aircraft Make/Model _____
Aircraft N Number _____
Installer Last Name: _____
Repairman Number _____
Repairman Signature

Note to Dealer: Please complete the Above Warranty Registration Card, provide the original to the customer, retain one copy for your records, and mail one copy to Aspen Avionics at the address below. Failure to complete this warranty registration card and return it to Aspen Avionics may result in delays in obtaining warranty service.

Aspen Avionics
8360 Corona Loop NE
Albuquerque, NM 87113
Attention: Warranty Department