TERRA
BY TRIMBLE

OPERATION/INSTALLATION MANUAL

Trimble
2105 Donley
Austin, Texas 78758
(512) 432-0400

PRINTED IN U.S.A.

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AT 3000

ALTITUDE ENCODER

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SECTION I

1. INTRODUCTION

1.1 SCOPE

This manual provides installation and operating instructions for the Terra by Trimble AT 3000 Altitude Encoder manufactured by Trimble, Austin, Texas.

1.2 DESCRIPTION

The AT 3000 Altitude Encoder interfaces with most ATC transponders and is connected to the aircraft pneumatic static system. The encoder converts altitude (pressure) to digital data for transmission by the aircraft's transponder. The transponder, when interrogated by the ground station will reply with aircraft altitude in the digital code set forth in the International Standard Code for SSR Pressure Altitude Transmission.

The altitude encoder is 7.25 inches long x 2.6 inches wide x 1.62 inches high. The weight is 0.5 pounds.

Interconnection to the ATC transponder is made with a 15 pin "D" type connector.

1.3 SPECIFICATIONS

ALTITUDE RANGE:	-1000 FT. TO 30,000 FT.
SUPPLY VOLTAGE:	13.75 VDC OR 27.5 VDC
CURRENT:	180 MA @ 13.75 VDC
	150 MA @ 27.5 VDC
WARM-UP TIME:	10 MINUTES
TEMPERATURE:	-20 DEG. C TO +70 DEG. C
WEIGHT:	0.5 LBS.

TSO C88
DO-160A ENV. CAT. CIA/JKLMNOP/xxxxxxABBBA

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SECTION II

2. INSTALLATION, CALIBRATION AND TEST

2.1 GENERAL

This section contains all necessary installation instructions and check-out procedures for the Terra by Trimble AT3000 Altitude Encoder. For the installer with little or no experience of installing avionics, Section 2.3 provides important information. Trimble recommends reading this section before continuing with the installation.

2.2 PREPARATION FOR USE

Every precaution has been taken to protect the AT3000 during shipment. Upon receipt of the equipment, remove the unit form the shipping container and visually inspect for damage.

If the unit is damaged, a claim must be filed with the carrier. The carrier assumes title of the unit when accepted for shipment. Do NOT return the unit to Trimble or its representatives.

It is suggested that the package be retained for inspection by the carrier in the case of damage or for future use should it be necessary to ship the unit for service or to transfer if to another location.

2.3 GENERAL INSTALLATION INSTRUCTIONS FOR AVIONICS

The following paragraphs contain pertinent hints, advice, and guidance intended for use by installers of avionics equipment. These have been drafted to address common problems encountered during the installation process. Specific questions may be addressed to Trimble for technical assistance by calling 1-800-487-4662 and requesting Technical Assistance.

2.3.1 COAXIAL CABLES AND CONNECTORS

Improper installation of cables and connectors create many of the problems encountered during avionics installations. Problems to avoid include twisted, chafed, or pinched cables, sharp bends in cables, open or shorted conductors or improper grounding. After installing connectors, pull firmly to ensure good mechanical bonding (particularly if you use crimp-on connectors) and use your ohmmeter to insure good electrical connection with no shorting.

2.3.2 WIRING AND HARNESSING

Construct the installation wiring harness carefully from the avionics manufacturer's wiring diagram. Be extremely careful to note recommended wire sizes, the need for shielded wiring (if any), and decide upon any optional wiring to be included. Measure carefully and plan the harness layout to avoid interference of the cable harness with existing avionics, instruments or controls.

Remove the connector plates from the rear of the trays. Connect all wires to the proper pin of each connector, checking as you go to insure that no loose strands cause shorting to adjacent pins or to ground surfaces. We recommend tubing be placed over each soldered pin connection to prevent wire strands from touching adjacent connections. Be particularly careful with the shield braids of shielded wires. Do not expose any more of the conductor than is absolutely necessary and keep the braid connection as short as possible. Remember that on shielded wires only one ground point is recommended. Follow manufacturer's recommendation about where the ground point should be located. **After completing all connections, check wiring with an ohmmeter again to ascertain that all connections are as desired and that no undesired shorting to ground or other pins has occurred**. Visually double check to see that braids on shields are not creating shorting, that no insulator melting has occurred during soldering and pull firmly on all connections to insure good mechanical bond.

Install the harness and connectors/connector plates in the aircraft with very loose dress only.

Solder all connections to power and ground and install panel components/controls and safety devices (eg. fuses or breakers). It is desirable at this point to insert all equipment in trays and perform preliminary check-out. Following a satisfactory check-out, and with all equipment in the properly installed location, complete the final dressing and routing of the harness and secure in place.

Note:

It is extremely important that units should be installed in trays while final dress and bundling of the harness is accomplished to assure proper alignment of connectors between tray and unit. Failure to do this may cause problems when unit is initially inserted into tray due to misalignment of connectors!

The final step is to perform a complete check of all avionics operations and insure that free movement of all cockpit controls is available.

2.3.3 NOISE AND INTERFERENCE

The typical airframe is a small and imperfect platform for providing all of the antenna ground planes and power sources and inter-wiring required for avionics operations, particularly for a low noise and interference free expectation. This subject is far too broad and complex to address in detail in a few paragraphs. However, an approach to categorizing and defining the problem can be outlined.

Noise and/or interference is usually heard in the audio systems, although it may also be detected as an interference to indicator operation. Unless a strong suspicion of the exact source is suspected, it is best to begin a process of elimination, in the following order:

1. Power Source: Check for low voltage when the avionics loads applied. A high resistance battery cell in the A/C can cause numerous problems. View the avionics power line at the avionics master and at the affected unit for noise on the power line. If present, try to categorize the frequency (eg. alternator whine, which may be caused by one or more bad alternator diodes, or if interference is present only when a communication unit is transmitting, etc.). If the noise is present or worse at the affected unit than at the avionics master, investigate the harness for noise coupling between wires. If necessary, disconnect the affected unit power from the aircraft power source and connect to an external power supply or battery.
2. Power Ground: View the power ground line at the avionics master and the affected unit. If noise is discerned at the master source, ground strapping may be corroded or partially broken. If only at unit, a larger wire size or wire re-routing may be required.
3. Interference: Both noise and interference may be either conducted or radiated, and in some cases electro- magnetically coupled between units. If it is determined that the noise or interference is eliminated whenever another avionics unit is not transmitting,first investigate the radiated alternative.Insure complete and proper bonding of antennas to the aircraft surface, and check the coaxial cable and all shield connections and connectors. Review the manufacturer’s recom- mendations for antenna separations. Be aware that antenna radiation directly to conductors at the rear of mounting trays or units may occur if shields are stripped too far back from the connector or are improperly grounded. Disconnecting the interfering antenna and substituting an external dummy load may assist diagnosis. Conducted interference usually occurs through paths which are shared by the avionics equipment such as power lines, ground points, audio equipment, or induced interference between adjacent wires or harnesses. Review the manufacturer’s recommendations for shielded wiring and ground points, and for separation of specific wires. Measure ground points for a small but perceptible resistance to true

2.3.3 NOISE AND INTERFERENCE (Continued)

ground and view power lines with an oscilloscope, turning each unit on and off to detect changes. Recheck common or adjacent connections to jacks, plugs, or shared equipment such as power converters, breakers, or audio panels.

4. Compromise: In some cases noise or interference may be subdued but not eliminated. With the inefficient and imperfect platform provided by the aircraft for antennas and power source, etc, complete elimination of the problem may be very expensive or impossible (eg. if there is simply not enough space to provide ground plane or antenna separation as recommended). Or, the aircraft strobe noise is audible but not objectionable, etc. These problems should be discussed early and thoroughly with the customer.

2.3.4 SUMMARY

The paragraphs above are not intended to be highly technical, completely thorough, or extensive, but serve as a reminder for certain precautionary or follow-up procedures for general avionics installations. Trimble is prepared to assist at any point with additional information, hints, or literature. Simply call 1-800-487-4662 and ask for technical assistance.

2.4 MECHANICAL INSTALLATION

The AT 3000 Altitude Encoder may be mounted in any attitude. The mounting position should allow a short pressure line from the encoder to the same static line as the flight altimeter.

The installation must provide provisions for access to the two adjustment screws during calibration. See Figure 2-1.

2.5 ELECTRICAL INSTALLATION

The encoder is designed to operate on a 14V or 28V DC aircraft bus. No voltage selection in the encoder is necessary.

The interface cable wiring is shown in Figure 2-2.

2.6 CALIBRATION

A pitot-static system test set is required to perform the following calibration procedures.

The AT 3000 is calibrated at the factory to a pressure datum traceable to the National Bureau of Standards. When the encoder is installed in the aircraft it must be calibrated to the primary flight altimeter per Advisory Circular 43-6A so as to comply with FAR 91.36(b) and FAR 91.172.

Calibrate according to the following procedure:

1. Connect the pitot-static test set as shown in Figure 2-1.

2. Apply power to the altitude encoder and the ATC transponder and allow the encoder oven to stabilize (approx. 10 min.).

3. Set primary flight altimeter to 29.92 inches of mercury.

Apply pressure from the pitot-static test set to obtain an altimeter reading of 29,900 ft., then slowly decrease pressure and read the flight altimeter at the encoder transition point. Adjust the 30,000 ft. adjustment, if necessary, until the transition point at decreasing pressure is 29,950 $\pm$20 ft. as read on the primary flight altimeter. Apply increasing pressure to obtain a flight altimeter reading of +100 feet, then slowly increase pressure and read the flight altimeter at the encoder transition point. Adjust the zero altitude adjustment, if necessary, until the transition point at increasing pressure is +50 $\pm$10 ft. as read on the primary flight altimeter.

Check the transition point altimeter reading at 30,000 feet for both increasing and decreasing pressure.

The transition point for decreasing pressure should be 29,950 $\pm$50 feet.

The transition point for increasing pressure should be 30,050 $\pm$50 feet.

Readjust the 30,000 foot adjustment if necessary.

Check the transition point altimeter reading at zero altitude for both increasing and decreasing pressure.

The transition point for increasing pressure should be +50 $\pm$50 feet.

The transition point for decreasing pressure should be -50 $\pm$50 feet.

Readjust the zero altitude adjustment if necessary.

Repeat the above steps until interaction is eliminated.

2.7 DATA CORRESPONDENCE TEST

REF: FAR 91.36, APPENDIX E, FAR 43 and ADVISORY CIRCULAR 43-6A.

Set the primary flight altimeter to 29.92 in. of mercury.

Select the test points in Figure 1 from sea level to the maximum operating altitude of the aircraft or 30,000 feet.

Test each of these transition points for increasing altitude and for decreasing altitude. Maximum error shall be ±125 feet as read on the primary flight altimeter. No more than three (3) points shall have an error greater than 87 feet.

NOTE: The Primary Flight Altimeter needs to have correct readings. The Reference Altimeter should be a calibrated standard, usually in the static test box or the Primary Flight Altimeter if tested against a calibrated instrument.

Compliance with AC-43.13 should be ensured as applicable.

2.8 PLACARDING

The altimeter used for flight reference shall be placarded with the following information:

"Replacement or re-calibration of the altimeter used for flight reference requires re-calibration of Model AT 3000 Altitude Encoder."

Altitude encoded to _____feet.

2.9 TEST POINTS

RANGE INCREMENTS (FEET)	ALTITUDE INFORMATION PULSE POSITION PULSE POSITION (0 to 1 in a pulse position denotes absence or presence of a pulse, respectively)									Correspondence Tolerance
	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4	
1050 to -950	0	0	0	0	0	0	0	1	0	
-50 to +50	0	0	0	0	1	1	0	1	0	
450 to 550	0	0	0	0	1	0	0	1	0	
950 to 1050	0	0	0	1	1	0	0	1	0	
1050 to 1150	0	0	0	1	1	0	1	1	0	
1250 to 1350	0	0	0	1	1	1	1	0	0	
1450 to 1550	0	0	0	1	1	1	0	1	0	
1750 to 1850	0	0	0	1	0	1	0	0	1	
1950 to 2050	0	0	0	1	0	1	0	1	0	
2550 to 2650	0	0	0	1	0	0	0	1	1	
2650 to 2750	0	0	0	1	0	0	0	0	1	
2950 to 3050	0	0	1	1	0	0	0	1	0	
3950 to 4050	0	0	1	1	1	1	0	1	0	
5950 to 6050	0	0	1	0	0	1	0	1	0	
6750 to 6850	0	1	1	0	0	0	0	0	1	
7950 to 8050	0	1	1	0	1	1	0	1	0	
9960 to 10050	0	1	1	1	0	1	0	1	0	
11950 to 12050	0	1	0	1	1	1	0	1	0	
13950 to 14050	0	1	0	0	0	1	0	1	0	
14750 to 14850	1	1	0	0	0	0	0	0	1	
15950 to 16050	1	1	0	0	1	1	0	1	0	
17950 to 18050	1	1	0	1	0	1	0	1	0	
19950 to 20050	1	1	1	1	1	1	0	1	0	
21950 to 22050	1	1	1	0	0	1	0	1	0	
24950 to 25050	1	0	1	1	1	0	0	1	0	
29950 to 30050	1	0	0	0	0	1	0	1	0	

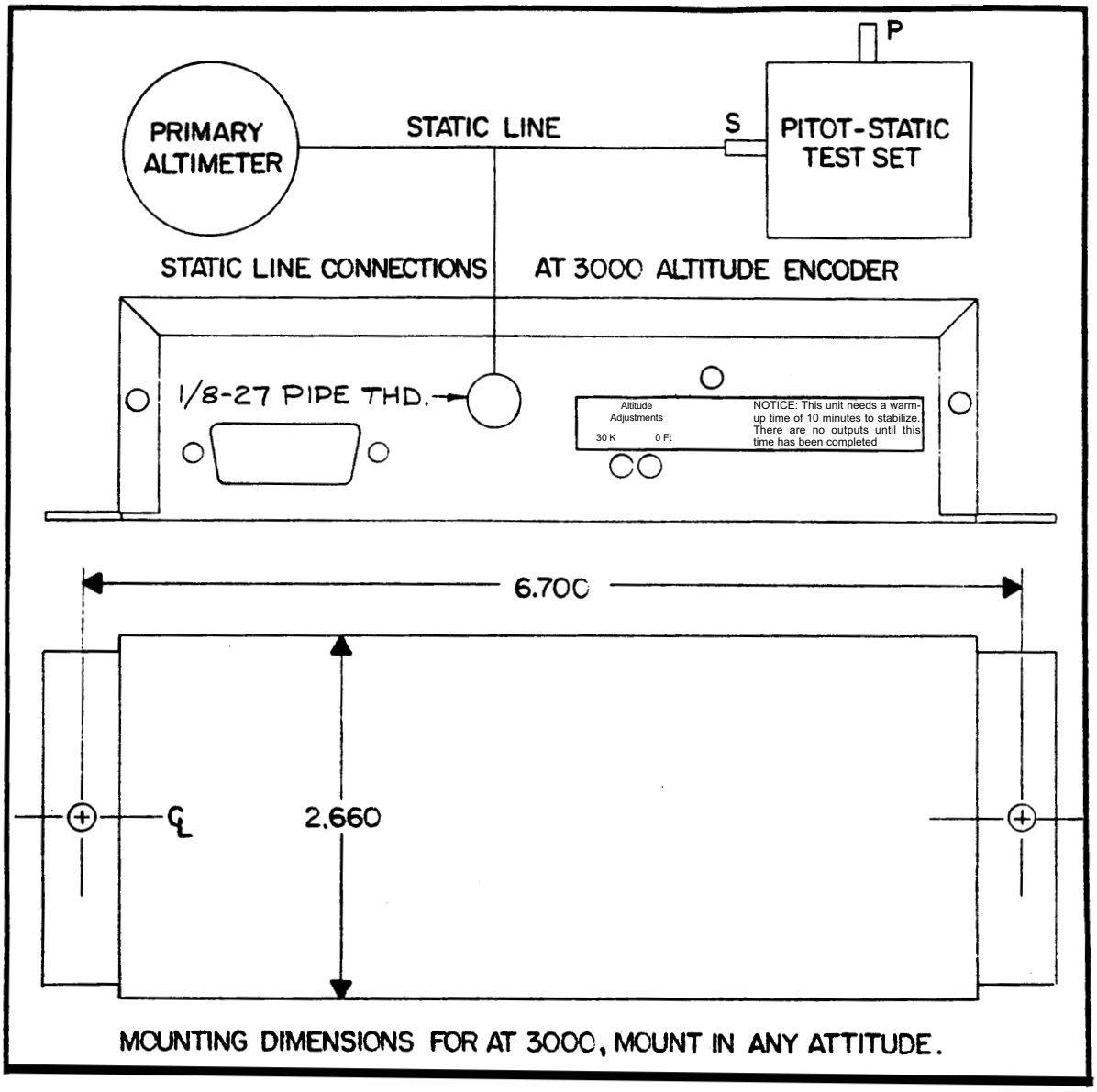
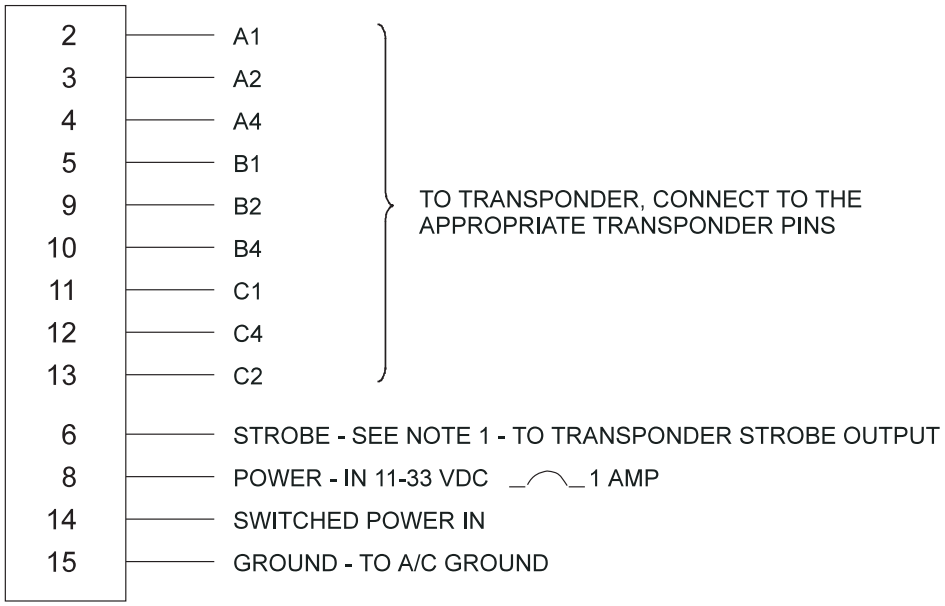


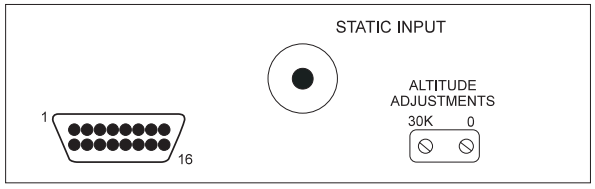
Figure 2-1
Outline Dimensions

AT3000 REAR CONNECTOR



NOTES:

1. If transponder does not provide a strobe output, Pin 6 must be grounded to Pin 15 to enable output codes from the AT3000. As an option, if an instrument panel "Altitude Disable" control is desired, connect a switch between Pins 6 & 15 and connect a 5.1K ohm, 1/2W resistor from Pin 6 to +14/28V Aircraft Power. The AT3000 will be disabled when switch is open.
2. When installing an AT3000 MOD 5 or above, Pin 8 MAY be wired as shown to reduce the warm up period. HOWEVER, PIN 14 MUST BE POWERED. See Section 3. A for details.



VIEW OF AT3000

Figure 2-2
Installation Wiring Diagram

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SECTION III

3. OPERATION (UNITS MOD STATUS 4 AND BELOW)

The AT 3000 Altitude Encoder is supplied power automatically as the ATC transponder is turned on, or if the transponder does not provide switched power, by a separate circuit breaker.

Apply power to the ATC Transponder and the AT 3000 Altitude Encoder

After the required warm-up time (10 minutes for the AT 3000), the AT 3000 will enable its data.

Altitude information can now be transmitted during ground interrogation when the ATC transponder is placed in altitude mode.

Turn off transmission of altitude information by switching the altitude mode off at the ATC transponder. Do not switch the altitude encoder power off.

SECTION III (A)

3A. OPERATION (UNITS MOD STATUS 5 AND ABOVE)

The AT-3000 Altitude Encoder MOD 5 and above is supplied power in two ports. Aircraft power on pin 8 (via the transponder circuit breaker or am independent 1 amp circuit breaker) activates the AT-3000 heater and power supply. Switched power on pin 14 activates the encoder, heater and power supply sections.

NOTE: Switched power on pin 14 only will allow the unit to operate fully but will require warm-up each time the power is removed from the AT-3000. After power has been applied to the AT-3000 heater up to 10 minutes is required to stabilize temperature and activate encoder output. Applying aircraft power to pin 8 through a 1 amp circuit breaker or fuse will allow the unit to start warming before power is applied to the other avionics. Thus, the period of time between the avionics being powered and data is supplied is reduced.

Apply power to the ATC Transponder and the AT-3000 Altitude Encoder. After warm-up stabilization, altitude information will be available to the transponder and transmitted when the transponder is placed in altitude mode.

Turn off transmission of altitude information by switching the altitude mode off at the ATC transponder. Do not switch the altitude encoder power off.

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THREE YEAR UNLIMITED WARRANTY *TRIMBLE*

What does your warranty cover?

Any defect in materials or workmanship of Terra by Trimble equipment.
This warranty applies only to equipment sold after January 1, 1993.

How does your warranty become effective?

Your warranty does not become effective unless you mail your completed Warranty Registration card to us within 15 days after installation of your Terra by Trimble equipment.

For how long?

Three years from date of original installation of the equipment, but not more than four years from date of purchase.
If you receive repair or replacement of equipment under this warranty, the warranty remains in effect on the repaired or replaced equipment for the remainder of the original three-year term.

What will we do to correct problems?

Repair any equipment found to be defective in materials or workmanship.
If we choose, we may replace the equipment rather than repairing it.
We will be responsible for the cost of labor and materials for repair or replacement of any equipment found to be defective in materials or workmanship.

How do you make a warranty claim?

Contact your nearest Authorized Terra by Trimble dealer for repair or replacement of any equipment defective in materials or workmanship.
If directed by your Authorized Terra by Trimble dealer, or if you are unable to contact a Terra by Trimble dealer, send the equipment to our factory:
Properly pack your equipment, we recommend using the original container and packing materials.
Include in the package a copy of the sales receipt or other evidence of date of original purchase and installation. If the equipment was a gift, provide a statement specifying the date received and installed. Also note your name, address, daytime telephone number, and a description of the defect.
Ship the equipment UPS or equivalent. You must prepay the shipping charges. Ship to:

Trimble
2105 Donley Dr.
Austin, TX 78758
(512) 432-0400 Phone (512) 836-9413 FAX

We will pay surface shipping charges to return the equipment to you.

What does your warranty not cover

Terra by Trimble equipment purchased "As New" from other than an Authorized Terra by Trimble Dealer or Distributor.
Malfunctions or failures resulting from the way the equipment was installed or from installation not in accordance with factory instructions.
Certificated Aircraft: Installation by other than an FAA Repair Station (USA), approved installation facility (non-USA) and/or without

- — Appropriate air-worthiness approval(s) as required by governing aviation authority;
- — Form 337;
- — Logbook entry.

Experimental Category Aircraft: Installation without

- — Appropriate air-worthiness approval(s) as required by governing aviation authority;
- — Form, 8130-(x).
- — Logbook entry.

Fuses and batteries.
Use of equipment for purposes other than those for which is was designed.
Accidental or deliberate damage, alterations of any kind, inadequate storage or maintenance.
Warranty repair by anyone other than Trimble or Terra by Trimble Authorized Dealer with factory approval.

For conditions not covered by this warranty, you will receive an estimate of costs before the repair is initiated. Repairs will be billed to you at the normal repair rates of the facility that performs the repairs.

Are there any other limitations or exclusions?

Any implied warranties are in effect only as long as this warranty is in effect.
This warranty does not cover incidental or consequential damage such as damage to other equipment or to your aircraft that results from defects covered by this warranty.
Some states do not allow limitations on how long an implied warranty lasts, or allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

How does state law relate to this warranty?

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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