

**ACES
LASETACH® II
MODEL 299**

USER MANUAL



S Y S T E M S

**TEC AVIATION
DIVISION**

**LASETACH® II
TEC 299 LASER TACHOMETER
USER MANUAL**

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Warranty

The TEC Model 299 LASETACH II instrument is warranted to be free of defects in material and workmanship for a period of 5 years after shipment. Warranty does not cover the LASETACH II unless it is properly used, stored and maintained in accordance with the provisions of this manual.

Warranty is limited to supplying Purchaser with replacement or repair of any unit, which, in TEC opinion, is defective. All repaired or replacement parts will be warranted for the unexpired period of the basic/original warranty. All work will be on a return-to-the-factory basis. Shipping costs to the factory will be borne by the Purchaser.

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Accessory items included with the instruments (cables, battery and charger, scale, phototach, and vibration sensor) are in warranty for one year from date of shipment.

Warranty will remain valid for a period of 5 years from the date of shipment.

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Calibration and Certification

Your ACES equipment is calibrated and certified effective the date of shipment. TEC requires no routine calibration of the Model 299 unit or its accessories. For information about the calibration services, contact the TEC Aviation group at the number listed in front of this manual.

Notes, Cautions and Warnings

Throughout this manual you will encounter notes, cautions and warnings. They will be in **BOLD** capital print centered about a short paragraph. The information in the paragraph is defined as follows for each of the three categories:

NOTE

Information considered essential to emphasize for clarity or to ensure the related procedure is correctly accomplished.

CAUTION

Information which, if not heeded, may result in the damage or faulty operation of equipment.

WARNING

Information which, if not heeded, may result in damage or destruction of equipment and/or injury to personnel.

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Introduction

The ACES Model 299 LASETACH II® is an improved non-contact optical sensor designed exclusively for use in aviation related tachometer functions. Like most optical sensors, it is used with reflective tape or reflective liquid.

NOTE

As with all optical devices, such as binoculars and cameras, you should handle the LASETACH II carefully, to ensure that you don't damage the optics.

The LASETACH II uses a visible (red) light semiconductor laser diode to illuminate the trigger target. When a reflective target on a turbine fan or propeller passes through the laser beam, the target reflects the laser back to the 299 receiver which will then provide an output pulse to the analyzer connected to the Lasetach.

The LASETACH II is self-contained in a rugged cast aluminum housing and is powered externally via a cable to the analyzer or other 12VDC power source. The output pulse is available through the same cable. The housing includes two mounting holes and a 1/4-20 threaded mounting adapter for mounting on a tripod, magnetic base or other device.

The Model 299 LASETACH II is designed for retro-reflective tape applications, with maximum range and noise rejection. It has a maximum effective range of 30 feet. The Lasetach automatically sets the gain for variations in distance to the reflective target.

This manual documents the following aspects of the TEC Model 299 LASETACH II:

- Safety considerations
- Getting started
- Using the LASETACH II
- Troubleshooting the LASETACH II

SAFETY CONSIDERATIONS:

WARNING

The LASETACH II is a Class IIIa laser product and can cause damage to the eyes. Do not look directly into the aperture when the laser is on. Also, avoid aiming the beam at a mirror or mirror-like surface. The LASETACH II does not include any user-serviceable parts, so do not attempt to open or disassemble the LASETACH II.

This device is a Class IIIa laser product and complies with 21 CFR 1040.10 as set forth by the Center for Devices and Radiological Health (CDRH). Read all labels attached to the unit for additional warnings and locations of laser emissions.

CAUTION

The Lasetach is sealed to make it water-resistant. It is not waterproof. Do not submerge the unit or allow it to be exposed to extend periods of precipitation such as rain or snow.

Getting started

When you first receive your LASETACH II, you will need to:

Determine and set up the trigger
Connect the LASETACH II to your equipment
Learn the controls and features

This section explains each of these in detail.

Determining and Setting Up the Trigger

The first thing you need to do is determine what you are going to use to trigger the LASETACH II. What you choose will depend on what you are trying to tach.

The easiest trigger mark to use is retro-reflective tape. A 10 foot roll of reflective tape is included with the Lasetach purchase.

NOTE

This 3M-brand 7610 reflective tape is made specifically for use with tachometers. You can purchase it from ACES or another 3M vendor. Reflective tape is rated by its reflective ability in candlepower. 3M brand 7610 has a reflective quality of 200 candlepower. Use only the tape supplied by ACES or one of equal or greater reflective quality from a distributor. Using other reflective targets will hamper proper operation.

Another option is reflective liquid which is of a much lower contrast and therefore more difficult to read. TEC recommends the reflective liquid be used only when an adherence difficulty (such as in very high speed applications) dictate its use.

When determining your trigger mark, you should keep in mind the two factors that affect the "readability" of each trigger mark--reflectivity and contrast. If your mark is less reflective and there is less contrast between it and the object you are taching, you will have to operate closer to the object.

Connecting the LASETACH II to your Equipment:

The LASETACH II is manufactured with an MS connector already installed on the cable. This is for use with existing ACES equipment. If you choose to wire the LASETACH II to another system using a mating connector or to hardwire the LASETACH II to another system, you will need to wire your LASETACH II Power wiring as follows:

<u>Connector Pin</u>	<u>Wire Color</u>	<u>Function</u>
A	Black (shield)	Ground (common)
B	White/red stripe	+12V (power)
C	White	Pulse Output (signal or + 5V)
--	White/black stripe	Not Used
--	White/green stripe	Not Used

Learning the LASETACH II Controls and Features

The picture below shows the physical location of the LASETACH II controls and features. The following pages describe them in detail.

The LASETACH II has only one control, the Laser power switch. The switch is a two position, ON / OFF, micro toggle switch.

In addition, it has the following features you will want to be familiar with:

- Laser Power Switch
- Aperture cap
- Mounting adapter
- Gate LED

The following pages explain each of these in detail.



LASETACH II Controls

Laser Power Switch

This switch controls the power to the laser beam:

The **OFF** position, shuts off the laser beam

The **ON** position, turns the laser beam on.

(The red BEAM ON Indicator LED will be illuminated)

Aperture Cap

For safety, an aperture cap to cover the laser beam aperture is attached to the LASETACH II with a lanyard. This is shown in the photo above. It is the object at the upper right side of the unit. When you are not using the LASETACH II, be sure to replace

the aperture cap. It simply snaps on. This cap will block the laser beam as well as protect the lens and filter of the unit.

Mounting Adapter

The 1/4-20 mounting adapter enables you to attach the LASETACH II to a commonly available mount, such as a tripod or magnetic base.

To use it, attach it onto the bottom of the LASETACH II (opposite the controls) by inserting the 2 screws (provided) through the holes beneath the "Avoid Exposure" label. The screws will extend through the LASETACH II housing. Thread the 2 screws into the two threaded holes in the adapter.

Gate LED

The GATE LED is located in the control area of the LASETACH II underneath the cover disk. The green LED will illuminate when the retroreflective target is passed through the laser beam to indicate proper laser alignment and acquisition of the retro reflective target. During initial acquisition, there may be a 7 to 10 second delay before a stable RPM is indicated. This is normal and is due to the lasetach making self-adjustments.

Using the LASETACH II

The LASETACH II should be used with with retro-reflective tape or reflective liquid. Using any target other than reflective tape or liquid makes it difficult to specify performance or exact solutions to potential problems, since there are so many different situations that may be encountered.

The following paragraphs explain some important points to remember when using reflective tape or liquid.

Using the LASETACH II with Retro-reflective Tape

To use the LASETACH II with retro-reflective tape, follow these steps:

NOTE

The retro-reflective tape we recommend (3M brand, 7610) is made specifically for this type application. It is NOT the reflective tape used on bikes, clothing etc. to make them visible in the dark. The tape is available from ACES Systems.

1. Attach the retro-reflective tape to the object you are taching. **On high-speed turbine engines**, the best location is on the spinner. If the spinner is heated or does not rotate, the tape may be placed on the fan blade as close to the root of the blade as possible. Be sure to clean the area, including the backside, thoroughly with a quality degreaser. Cut a length of tape 1.5 to 2 inches long and round the

corners with scissors. Apply the tape with approximately 1/4-inch of the long edge extended over the leading edge of the fan blade and as close to the root of the blade as possible. (An angle of up to an optimum 30 degrees to the LASETACH II beam is acceptable.) Paint all edges of the tape with a thin smooth coat of clear fingernail polish to reduce high-speed friction and wind drag. This will help the tape to remain in place. Check the tape and retouch the edges with the clear polish or replace as necessary between engine runs. Make sure there are no air bubbles trapped under the tape as these will act as an airfoil at high speeds, creating a low pressure area which will pull the tape loose during the engine run.

On propellers, clean the target area thoroughly with a quality degreaser. Cut a length of tape 1.5 to 2 inches long and round the corners with scissors. Place the tape in the center of the selected prop blade with the long edge parallel to the leading edge of the blade. If the application is a turboprop or other high-speed propeller, it may be advisable to paint the edges of the tape with a smooth coat of clear fingernail polish. Consider the final angle to the laser beam when using the LASETACH II with variable pitch propellers. (An angle of up to an optimum 30 degrees to the LASETACH II beam is acceptable.)

NOTE

Be sure when applying "paint" that you leave a solid painted area, and not a gapped or striped

one that might be interpreted by the LASETACH II as two or more separate marks. This could result in multiple taching and higher than actual speed indications.

Although normally you won't have to worry about it, the width of the trigger mark you use can be important, especially at very high speeds. That's because the LASETACH II must have in excess of 40-microsecond exposure time to the target in order to sense a pulse.

NOTE

At faster speeds, the width of the trigger mark you use is important, because the signal amplitude may begin to decrease at high transitional velocities. The LASETACH II must have in excess of 40 micro-seconds exposure time to the target in order to sense a pulse .For an estimate of the trigger mark (tape) width you should use this formula: $W = D \cdot \text{RPM} / 500,000$, where D = the diameter of the object on which you will place the tape in the same units of measurement as W. For example, if you are taching a point on a fan blade with a diameter (at the attachment point) of 5 inches and a speed of 30,000 RPM, then $W = 5 \cdot 30,000 / 500,000 = .3$ inches. The tape, in this case, must be at least .3" wide where it crosses the laser beam.

2. Assemble the Lasetach mounting block, if necessary, and attach the Lasetach assembly to the mount. ACES sells a camera mount for the lasetach, which connects to the mounting block and offers excellent position control. The camera mount can be attached to the fuselage or leading edge of the wing with screws or tape such as duct tape or speed tape.
3. Connect the LASETACH II to a power source (e.g., your ACES Analyzer or other equipment).
4. Mount the LASETACH II at a convenient distance from the engine or prop. (Up to the maximum operating range of 30 feet).
5. You can obtain the best signal and longest operating range when the tape is at about 30-35 degrees from the perpendicular to the laser beam.
6. Ensure your Analyzer is providing power to the LASETACH II. Move the laser power switch to the ON position. The red LED indicator will illuminate, showing that the laser is on.

WARNING

The LASETACH II is a Class IIIa laser product. Do not look directly into the aperture when the laser is on. Also, avoid aiming the beam at a mirror or mirror-like surface. The LASETACH II Does not include any user-serviceable parts. DO NOT attempt to open or disassemble the LASETACH II.

7. Remove the aperture cover.
8. Use the visible laser beam to aim the LASETACH II at the reflective target. When satisfied with the alignment, secure the LASETACH II in position.

NOTE

You may place the LASETACH II at an angle of up to the optimum 30 degrees to the surface of the reflective tape.

9. When use of the LASETACH II is complete, be sure to replace the aperture cover.

Troubleshooting the LASETACH II

This section explains problems or symptoms that may interfere with accurate tachng and how to correct them. They are:

- Fluctuating RPM reading
- Saturating the receiver
- Cloudy Window
- Wet or dirty lens
- Fogging in the engine intake
- Precipitation (Rain, snow, fog)

If you try the suggestions listed here and still are having problems, call TEC: at the number listed on

the inside cover and ask for LASETACH II Product Support.

Fluctuating RPM Reading

If your RPM reading is fluctuating between markedly different values, the laser beam is sensing multiple or irregular triggers.

If you are using the LASETACH II at close range, you may be triggering off objects such as abrasions, scratches, or other imperfections. The LASETACH II is "seeing" too much.

To solve the problem, you need to adjust the position of the LASETACH II so that it "sees" only the trigger mark you are interested in. You can:

- Place the LASETACH II farther from the fan or prop. This will reduce the amount of false triggers the Lasetach detects.
- Try changing the target location of the beam slightly, so that the laser beam hits fewer imperfections as the fan or prop rotates.

Saturating the Receiver

Due to the intensity of the laser beam, it is possible under unusual circumstances to saturate the receiver of the LASETACH II. This will occur only at very close ranges, and only if the object is very reflective and

the LASETACH II is exactly perpendicular (90°) to the object.

To resolve this problem:

- Increase the distance between the LASETACH II and the target and/or position the LASETACH II at an angle other than 90° from the fan or prop.

NOTE

It's good practice to work at a small angle from the reflective tape to prevent this problem from ever occurring. The tape has an effective operating limit of +/- 45° from the perpendicular to the beam.

Cloudy Window

If you bring the LASETACH II in from the cold, or from cold to hot humid conditions, the laser window will probably cloud up temporarily. Allow a few minutes for the window to uncloud as it acclimates to the warmer indoor temperature.

Wet or Dirty Lens

If the laser lens becomes wet or fogged over you can wipe it dry. We suggest you use lens tissue (such as that used to clean eyeglasses or a camera lens), so that you don't scratch the window. You might also try a cotton swab.

If the lens has visible dirt, you will want to treat it like you would treat binoculars or a camera lens. Blow on the window to remove particles that might scratch it. Then use a cotton swab or lens tissue to clean it. (You may wish to moisten the tissue or swab with a small amount of lens cleaning solution or isopropyl alcohol.) Scratches on the lens will disperse the laser beam and reduce performance.

After extended use, the laser may actually etch the lens, which will also disperse the laser beam. The lens can be replaced to correct etching and scratches.

Fogging in the Engine Intake

During certain atmospheric conditions, the low pressure area created just forward of the fan may cause fogging in the intake. This fog will effectively block the laser beam from reaching its reflective target and defeating the tach altogether. This may also occur if the engine is picking up water from the ramp at higher power settings. In cases such as these, you should wait for the conditions to change or move the aircraft to a new geographic location to complete the balance job.

Precipitation (Rain, Snow or Fog)

Rain, snow or fog has the same effect as fogging in the intake. While the conditions may be intermittent

dependent on the intensity of the precipitation, operating the laser in these conditions is not advised. The unit is sealed and is water resistant, but not water proof. For this reason, do not leave the unit exposed to precipitation.