ACES Model 1000 ProBalancer User Manual

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List of Effective Pages

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Warranty

The ACES Model 1000 ProBalancer is warranted to be free of defects in material and workmanship for a period of 60 months (5 years) following the purchase date. Warranty does not cover the ProBalancer unless it is properly used, stored, and maintained in accordance with the provisions of this manual. Accessories are warranted for a period of 12 months (1 year). Individual accessories not manufactured or assembled by TEC may be covered by the original manufacturer for longer periods.

The required annual calibration must be complied with to validate the terms of this warranty. Warranty replacement and/or repair will not be honored on any unit which is overdue an annual calibration at the time of the warranty claim. If your calibration is overdue and no warranty claim is being made, you need only have your overdue calibration completed to revalidate your warranty.

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

Warranty shall not apply to any product that, in the judgement of TEC, has been subjected to misuse or

neglect, or has been repaired or altered outside the TEC factory in any way, which may have impaired its safety, operation, or efficiency, or to any product that has been subjected to accidental damage.

Warranty does not cover any cost incurred by Purchaser as the result of the purchase of TEC products. Nor does Warranty cover costs incurred by Purchaser for labor charges for replacement of parts, adjustments, or repairs or any other work performed by the Purchaser or his agents on, or connected with, TEC-supplied products.

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Notes, Cautions and Warnings

Throughout this manual you will encounter notes, cautions and warnings. They will be in **BOLD** capital print centered above 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.

Conventions

You should be aware of the following conventions:

1. This manual refers to the ACES Model 1000 ProBalancer as "The ProBalancer."

Calibration and Certification

Your ACES equipment is calibrated and certified effective the date of shipment. TEC requires the unit to be calibrated by TEC or a TEC authorized repair facility on an annual basis to insure accuracy and currency of installed electronic components. In addition, the vibration sensors, pressure and temperature transducers (if applicable) also require calibration on an annual basis or when dropped, damaged or suspect of improper operation. The unit will be identified as calibrated by a sticker stating the date of calibration and next due date of calibration. A certificate of calibration will be provided to you to verify compliance to inspectors. For information about calibration services, contact the TEC Aviation group at the number listed in front of this manual.

NOTE

The annual calibration is required to comply with the terms of the 5-year guarantee. See "Warranty" in this section.

Table of Contents

Introduction

This manual was designed to provide the owner with an overview of the ProBalancer Kit and operation of the ProBalancer. It contains a brief description of the ProBalancer and each of the accessories provided with the kit. The **SETUP** section was designed as a step-by-step guide in the preparation of a normal propeller balancing job. If followed it should alleviate all the common pitfalls encountered by the new or first-time user. The video supplied with the kit will provide visual support to the setup procedure. Technical support is available Monday through Friday, 8:00 AM until 5:00 PM Eastern time by calling (423) 966-5856, extension 319. Before you call for support, consult the TROUBLESHOOTING GUIDE. The quality of the ProBalancer prevents malfunctions to a great degree but occasionally problems can arise. The troubleshooting guide will assist you in solving some of the most frequently occurring discrepancies. An order form which can be Faxed or Mailed is provided for your convenience when replacement or spare parts are required. The parts listing contains accessories, their part numbers and cost per unit. Refer to this parts list when ordering ACES ProBalancer accessories.

The ACES ProBalancer and Accessories

The Balancer

The ACES ProBalancer is a self-contained, computerized, dynamic propeller balancing system. It was designed and built for rapid, accurate dynamic balancing of aircraft propeller and engine assemblies as indexed units.

Instrument Case

The ProBalancer instrument case is expanded ABS plastic. It is crush and water resistant when the lid is closed and locked. Clean the case with mild soap and water and wipe with Armorall or similar product to restore luster.

CAUTION

The ProBalancer is not weather resistant when the case is unlatched or open. To prevent damage to the unit, do not expose it to the elements or conditions where moisture or other foreign material might enter the unlatched or opened case.

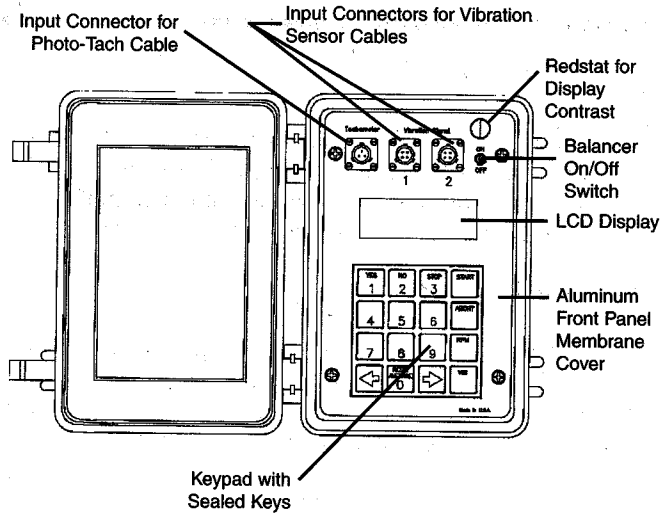


Figure 1.

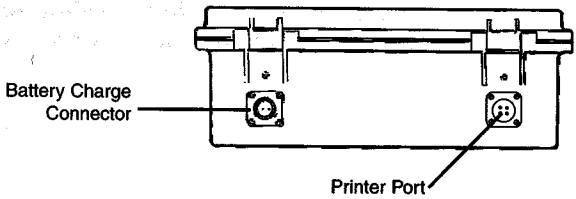


Figure 2.

Removable Lid Hinge Pins

The lid of the ProBalancer case is attached with removable, safety pin type hinge pins. By removing the pins, the lid can be removed to prevent its interference with movement in the confined space of a cockpit.

Leg Strap Assembly

The ProBalancer kit also contains a two piece leg strap assembly for securing the ProBalancer, with lid removed, to your leg. This allows you to use the ProBalancer "hands free" in the cockpit.

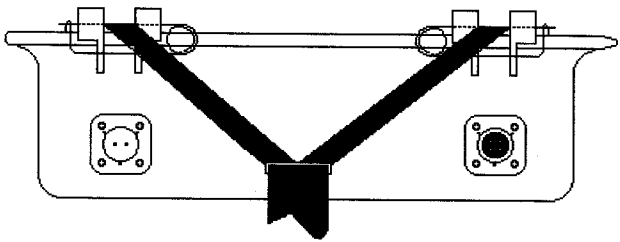


Figure 3.

As illustrated in Figure 3 above, the "V" portion of the assembly is attached to the left side of the ProBalancer case with the hinge pins after the lid has been removed. Place the ProBalancer on your leg where it sits comfortably. The strap from the buckle portion is then routed under the leg and through the carrying handle on the right side of the ProBalancer case. Adjust the strap to fit and attach with the hook and pile (velcro) end.

CAUTION

The leg strap assembly cannot be attached to the ProBalancer case while the lid is installed nor can the lid be installed while the leg strap assembly is attached to the case. Configurations other than the above described attachment method may damage the hinges of the case.

Face Panel

The face panel is a membrane type switch panel with a lexan clear display cover. The mounting hardware is stainless steel.

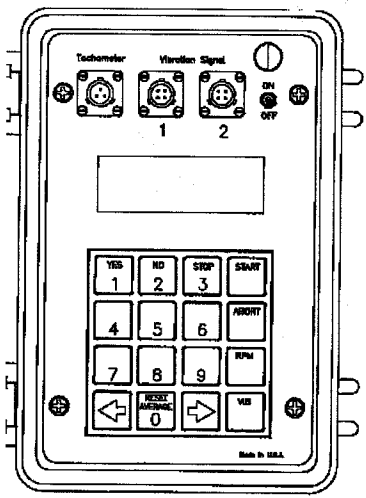


Figure 4.

Connectors

All external connectors are high quality, durable MIL-SPEC 3100 series connectors.

CAUTION

When connecting cables to the unit or sensors, take care not to bend connector pins. Bent pins may damage equipment or supply faulty information to the ProBalancer.

Battery

The 12 Volt, 2.3 amp hour DC lead acid battery supplied with the ProBalancer will fully recharge in one to two hours. A fully charged battery will operate the unit for a minimum of ten hours continuous use. Turning the unit off between uses may double operation time.

Balancer Keys

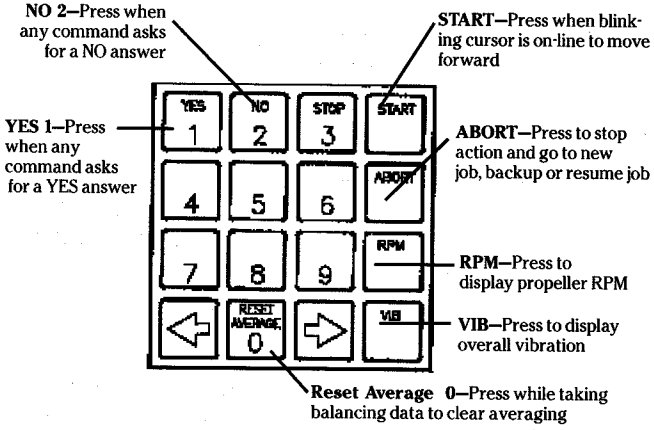


Figure 5.

The Accessories

Vibration Sensor

The ACES Model 991 V vibration sensor (Figure 6.) provided with the ProBalancer is a rugged component encased in stainless steel. It has a 1/4-28 integral stud for mounting, a safety wire hole for securing and a MS connector for cable attachment. Only one vibration sensor is included with the kit. An additional sensor may be purchased as an option for dual sensor operation. (See parts list on page 52).

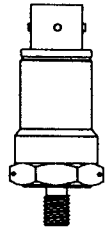


Figure 6.

CAUTION

Although the vibration sensor is a rugged design, it can be damaged when dropped on hard surfaces. Take care not to drop the sensor when handling.

Vibration Sensor Cable

The cable which connects the vibration sensor to the ProBalancer is a small diameter, conductor shielded, four cable type with MS connectors (Figure 7.). The two connector housings are different sizes. The large end, marked "Vibration Signal" connects to the balancer face panel port marked "Vibration Signal". The Version 1.3 ProBalancer is designed to operate with one or two vibration sensors. If only one vibration sensor is being used, connect the cable to the port marked "1". The small end of the cable marked "Sensor" connects to the Model 991 V vibration sensor mounted on the engine. Only one

vibration sensor cable is included with the kit. An additional cable may be purchased as an option for dual sensor operation. (See parts list on page 52).

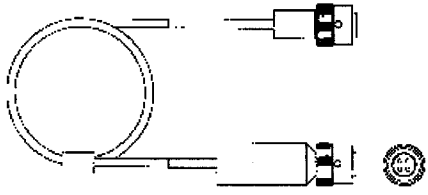


Figure 7.

Case Bolt Adapters

A set of eight case bolt adapters (Figure 8.) with nut sizes 1/4 to 7/16 NF and NC threads is included in the kit. The stud portion is 1/4-28 thread. The adapters allow attachment of the right angle mount to piston engine cases without removing a case bolt or nut. They are made of electropolished stainless steel. A nylon locking nut is provided for securing the right angle mount (Figure 9.) on the selected adapter. Only one set of case bolt adapters is included with the kit. An additional set may be purchased as an option for dual sensor operation. (See parts list on page 52).

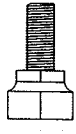


Figure 8.

Right Angle Mount

The right angle mounts (Figure 9.) are made of anodized aluminum and designed to be mounted directly on the engine or the case bolt adapter. They have a 1/4-28 tapped hole for the vibration sensor and either a 1/4 or 5/16 through hole for attachment to the engine. Only one 1/4 Right Angle Mount is included with the kit. Additional mounts for two sensor operation may be purchased as an option. (See parts list on page 52).

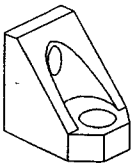


Figure 9.

Photo-Tach

The Photo-Tach (Figure 10.) provides the speed signal to the balancer. It is mounted on the engine or cowling 12 to 18 inches behind the propeller and aimed at a strip of reflective tape which you place on the back of one propeller blade. The gain control knob and alignment indicator are on the back of the unit. The Photo-tach is cast in durable plastic and has a replaceable lens and lens cover. (See parts list on page 52).

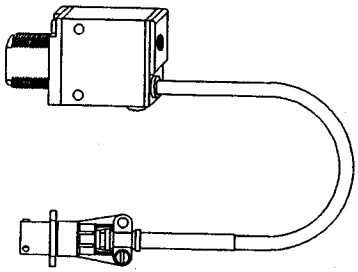


Figure 10.

Photo-Tach Cable

The photo-tach cable (Figure 11.) is of the same construction as the vibration sensor cable but only uses three of the four internal wires. The cable is marked "Tachometer" on the end which connects to the ProBalancer and "Photo-Tach" on the end which connects to the photo-tach.

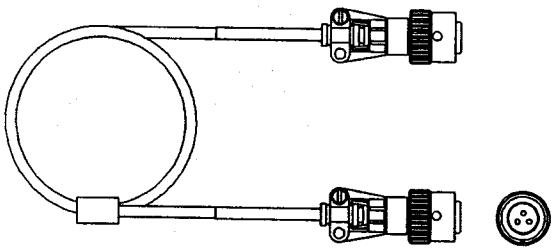


Figure 11.

Photo-Tach Mounts

A three piece Photo-Tach Mount assembly (Figure 12.) is supplied with the kit which allows the photo-tach to be attached in a correct angle and position in most cases. The three inch by three inch portion of the mount is placed on the cowling and can be securely and rapidly attached by six inch strips of duct tape.

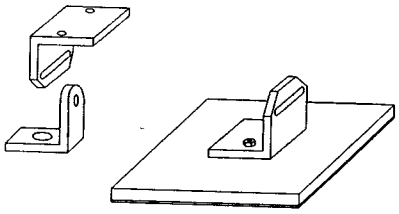


Figure 12.

Battery Charger

The float type Battery Charger (Figure 13.) provided with the unit is designed so that it can be left plugged in without damaging the battery. The MS connector end of the charging cord connects to the charger port on the left side of the ProBalancer case. The charger plugs into any 120 V AC, 60 Hz outlet. The charger has a red LED indicator in its lower left corner. A steady red light indicates the battery is charging and a flashing red light indicates the battery is fully charged.

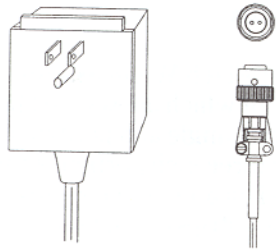


Figure 13.

CAUTION

Do not leave the charger connected to the ProBalancer if the charging head is not connected to an electrical outlet. To do so may drain the unit's battery through reverse current flow.

Spinner Protractor

The ACES Spinner Protractor (Figure 14) aids in determining the placement angle for the balance weights. To correctly use the protractor, rotate the propeller until the reflective tape is directly in front of the Phototach. With the propeller in this position, stand in front of the propeller (facing aft). With the **pointed end of the protractor pointing in the direction of rotation**, align any **"360"** degree reference point of the protractor with the position of the **991V vibration sensor**. With the propeller positioned as directed, the vibration sensor, not the reflective tape, is the "360" degree reference point from which all measurements are started. The black lines of the protractor are at intervals of 15 degrees. Circles, located every 30 degrees, contain four angle numbers. To

read the angle of any location, simply read the one which is right side up.

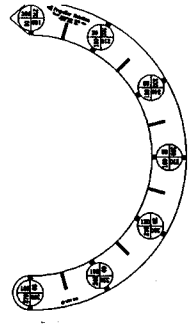


Figure 14.

Digital Gram Scale

The Digital Gram Scale (Figure 15.) is used to measure the balance weights used in the balancing procedure. A 100 gram test weight is supplied to verify accuracy. The scale is powered by a nine volt battery and is stored in a vinyl cover.

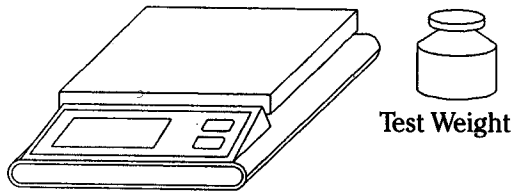


Figure 15

To achieve the best results with your scale:

1. Place the scale on a firm level surface. Press ON and wait until the display shows zero (0) before putting any weight on the platform. Place the test weight gently on the platform. It should read one hundred (100) grams plus or minus 0.1 grams.

2. Place in an area of little or no wind as wind will cause the weight indications to fluctuate and make accurate reading difficult.

3. The temperature range for optimal operation of the scale is from 64 to 77 degrees Fahrenheit. It is best to keep the scale within this temperature range when not in use as well.

4. Place the balance weights gently on the platform. The weight limit is one hundred fifty (150) grams. If you place more than 150 grams on the platform the scale will display an "E" for error. If this occurs, remove the weight, turn off the scale and turn it back on. Reduce the total weight and try again.

Using the ACES ProBalancer

SETUP

NOTE

If it is not possible to attach all the hardware as recommended, the balancer will still balance the propeller but the first recommended weight and angle will not be as accurate as when the sensors are mounted in the ideal position. All subsequent runs will be accurate.

1. Prior to attaching any part of the ProBalancer Kit to the aircraft, conduct an inspection of the kit contents. Turn the power switch of the ProBalancer on and check the battery condition. Charge the battery if necessary. Check all cables for cuts, nicks, scrapes or evidence of burns and heat damage. Check cable and ProBalancer connectors for visible damage. Check the vibration sensor(s) for obvious physical damage. Check the Photo-Tach lens for cleanliness and condition. Check the Photo-Tach connector for damage. Repair or replace damaged components as necessary to ensure proper and timely operation.

2. Place the Right Angle Mount at the twelve o'clock position, if possible, on the top, forward most area of the engine. The case bolts of most engines make an excellent choice for a mounting location. Use case bolt adapters when necessary. Slide the unthreaded hole of the Right Angle Mount over the chosen bolt or adapter and secure with a self locking nut. Attach the Vibration Sensor, as upright as possible, by screwing it into the threaded hole of the Right Angle Mount. A slight tilt in position for clearance of other components should not affect it's performance. Snug down the sensor to prevent movement but take care not to strip the threads of the Right Angle Mount. If two Vibration Sensors are to be used, the second sensor should be installed at the rear of the engine as close as possible to the same for and aft plane as the front sensor.

3. If necessary, assemble the Photo-Tach Mounts (Figure 12.) to best suit your particular needs. Assemble the Photo-Tach and mounts into a single assembly. Attach the Photo-Tach with tape to the cowling (12 o'clock position is desirable but not required) no closer than 12 inches, but not farther away than 18 inches, behind the aft surface of a selected propeller blade. Make sure the lens of the Photo-Tach is pointed toward the propeller blade. Secure the Mount base to the cowling using six inch strips of duct tape. Recheck the Photo-Tach lens and clean if necessary.

4. Locate the four wire cable and identify the end marked "SENSOR". Connect this end of the cable to the Model 991 V vibration sensor. Route the cable away from hot areas, moving parts and electrical equipment to the cockpit. Secure the cable every six to eight inches along it's route with ties or strips of duct tape.

WARNING

Do not pinch or cut the cables by closing them in doors, windows or panels. This may cause shorting of the cables and cause damage or failure of the ProBalancer.

WARNING

Position the balancer power (ON/OFF) switch to OFF during connection of cables and sensors.

Connect the vibration end to the ProBalancer connection marked "Vibration Signal 1". When using two Vibration Sensors, the aft sensor cable will be attached to the "2" connector.

NOTE

If only one vibration sensor is to be used, it must be connected to the "Vibration Signal 1" connector.

5. Locate the three wire cable and identify the end marked "Phototach". Connect this end to the Photo-Tach connector. Route the cable away from hot areas, moving parts and electrical equipment to the cockpit. Secure the cable every six to eight inches along it's route with ties or strips of duct tape.

WARNING

Do not pinch or cut the cables by closing them in doors, windows or panels. This may cause shorting of the cables and cause damage or failure of the ProBalancer.

WARNING

Position the balancer power (ON/OFF) switch to OFF during connection of cables and sensors.

Connect the cockpit end to the cable marked "Tachometer" to the ProBalancer connection marked "Tachometer". Coil up the excess length of cable and secure it with the velcro ties attached to the cable.

6. Turn the ProBalancer power switch to the "ON" position and leave it there. Cut a three inch strip of the reflective tape supplied with your ProBalancer Kit.

NOTE

Use only the reflective tape supplied by ACES Systems. Other reflective tapes or targets may not perform as well and will cause delays or inaccurate signals to the ProBalancer.

Do not remove the protective backing of the tape at this time. Align the selected propeller blade with the Photo-Tach lens. Clean the area where you intend to attach the reflective tape with a quality degreaser. Hand position the tape on the aft side of the selected propeller blade. Center the tape between the leading and trailing edges of the blade while aligning the long edge of the tape parallel to the propeller edges. Adjust the tape so it is directly in line with the lens of the Photo-Tach. When alignment is correct, the small alignment indicator light on the back of the Photo-Tach will illuminate. (An inspection mirror will help if this is being done by one person.) When satisfied that the tape position is good, remove the reflective tape backing and attach it to the propeller in that position.

NOTE

Take care not to lose alignment with the Photo-Tach when attaching the tape. Squeeze any bubbles in the tape toward the edges to prevent separation after engine start.

Rotate the propeller through the Photo-Tach's path and check to see that the alignment indicator on the back of the Photo-Tach flashes when the reflective tape passes through it's path.

WARNING

Do not move the propeller until you ensure the magnetos are functioning properly and that they are in the "OFF" (grounded) position.

This completes the SETUP portion of the balance job. You are now ready to dynamically balance the propeller.

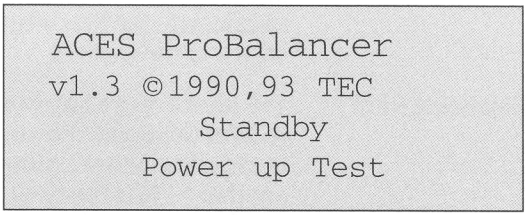
ACES ProBalancer Screens:

Section One: Balancing with One Vibration Sensor

NOTE

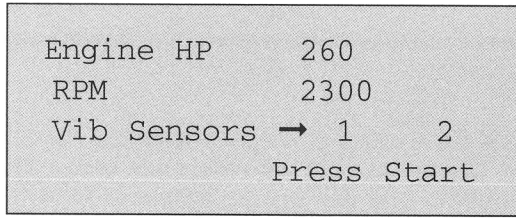
Any data number displayed in the screens in this manual is for reference only. The numbers you see on the balancer in actual use will be different.

This screen will appear when the balancer is turned on.



v1.3	Version number of balancer code.
© 1990, 93 TEC	TEC Copyright 1990 through 1993.
Power up Test	Balancer is checking battery and memory. When the test is complete the balancer will report either BATTERY OK or BATTERY RECHARGE. Then the balancer will proceed to the programs.

This screen appears if all old balancer data has been cleared from the balancer's memory and you are starting a new balance job.



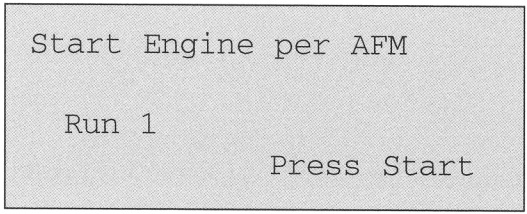
Engine HP	The engine data plate horsepower is entered here. The balancer must know this number to calculate the first weight to attach to the spinner.
Balancing RPM	You must enter a balancing RPM at this point. We recommend a low cruise setting unless another RPM is required by another approved procedure.
Vib Sensors 1 2	You can use one or two vibration sensors with this balancer and you must select at this point. See Section Two for 2 vib sensor screens.

NOTE

If you select two vibration sensors, but only use one sensor, the balance calculation may be incorrect.

Press START — After all selections have been made on this screen, a blinking cursor appears after the word "start." Any time this occurs, press START.

This screen will appear each time you begin a new balance run.

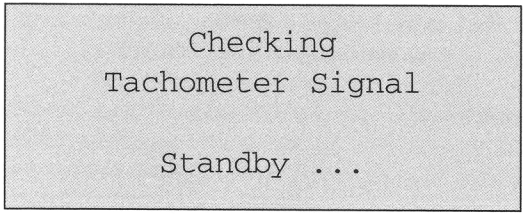


Start Engine per AFM — Refer to the aircraft flight manual for correct operation of the aircraft engine.

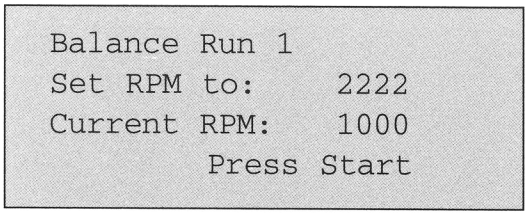
Run 1 — This is the run number you are about to take. The balancer will start with Run 1 and increment up for each run completed. You are allowed a total of nine runs for each job.

Press START — Press START to begin taking data.

This screen will appear each time the balancer is checking the RPM sensor.



This screen will appear if the balancer receives pulses from the RPM sensor.

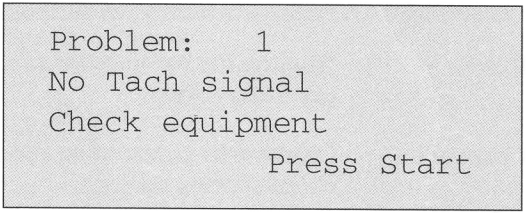


Set RPM to:	The number displayed is the number you entered at the beginning of the balance job.
Current RPM:	Displays current engine RPM.
Press START	Press START to begin taking data.

NOTE

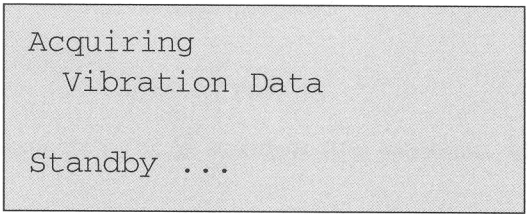
All numbers displayed on the screens in this manual are for reference only. The numbers you see on the balancer in actual use will be different.

This screen will appear if the balancer does not detect the RPM sensor.

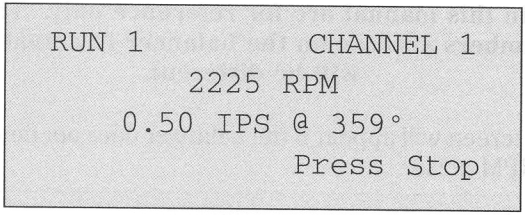


This means the balancer is not receiving pulses from the RPM sensor. (Refer to the Trouble-Shooting Guide on page 45.)

This screen will appear if the balancer is receiving tach signals from the RPM sensor and the START key is pressed.



This screen will appear while the balancer is reading the RPM, vibration signal (IPS) and phase angles.

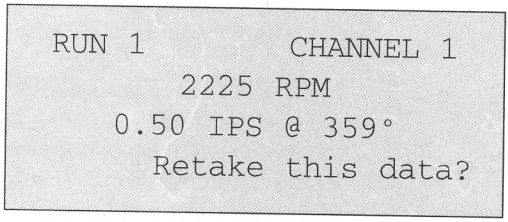


Run 1	Displays the run number you are currently taking.
Channel 1	Displays the current vibration channel being taken.
2225 RPM	Displays the current RPM—this will be changing slightly.
0.50 IPS	Displays the current vibration level—this will be changing slightly.
@ 359°	Displays the current phase angle.
Press STOP	This freezes the display number and brings up the next screen.

NOTE

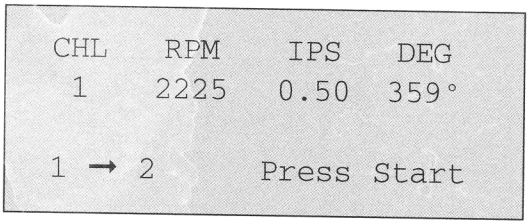
The numbers will stabilize in 15 to 45 seconds.

This screen will appear after pressing the STOP key.



If the data looks substantially different than what you saw while taking data, press the YES key to retake the data. If you are satisfied with the data, press the NO key.

If you press the NO key, this screen will appear:



CHL 1 2	Displays the channel the reading was taken from.
RPM 2225	Displays the RPM that the reading was taken at.
IPS 0.50	Displays the amount of unbalance in in/sec of vibration.

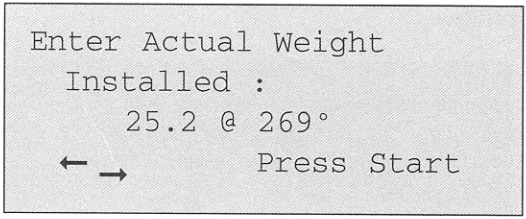
DEG 359°	Displays the phase angle—this is used for estimating the location of the balance weight on the spinner.
1→ 2	LEFT and RIGHT arrow keys change the display to show data taken on each run. In this case it shows the next run is 2. If you had taken run 2, the display will show 1←2→3.
Press START	Moves to the next screen.

This screen appears after you take your first balance run.

```
First Weight
Install:
    25.2 @ 269°
            Press Start
```

First Weight	This is the first test weight installed.
Install: 25.2 @ 269°	This is the weight in GRAMS and the ANGLE opposite propeller rotation in degrees.
Press START	Moves to the next screen.

After you press the START key, this screen will appear.



Enter Actual Weight — You enter the actual weight and exact angle at which the weight was installed.

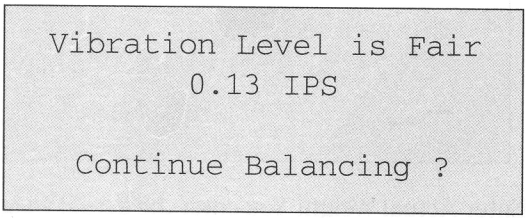
Note

The weight and angle numbers displayed in this screen are the same as the suggested solution. You must enter the actual weight and angle installed on the propeller or the balancer will calculate incorrect solutions.

← → — LEFT and RIGHT arrow keys allow backspacing to correct a number input.

Press START — Moves to the next screen.

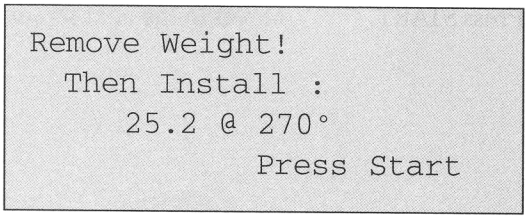
This screen will appear if the vibration level is below 0.15 IPS but above 0.07 IPS. If you press YES, the balancing job will continue.



Note

The vibration level may increase following the addition of the first (test) weight. This is normal because the test weight is not being used to accomplish a vibration reduction but rather to induce a change to the known condition and calculate an influence coefficient. The second weight addition should show a positive reduction in vibration.

This screen appears any time the balancer calculates a solution weight and angle.

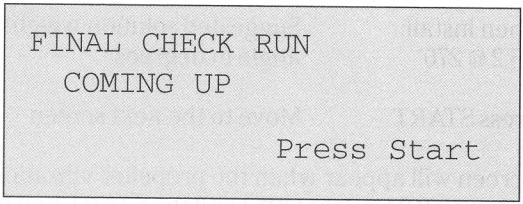


Remove Weight!	Remove the weight or weights you installed on the previous run.
Then Install: 25.2 @ 270°	Suggested solution weight and angle in degrees.
Press START	Move to the next screen

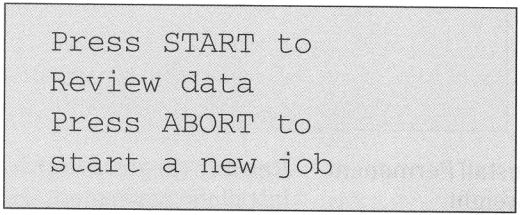
This screen will appear when the propeller vibration level is below 0.07 in/sec (IPS) and the START key from the previous screen has been pressed.

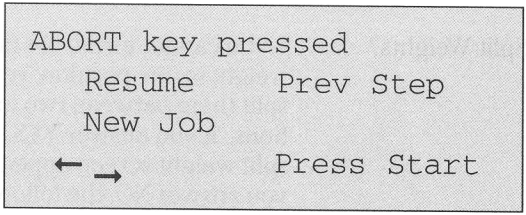
Install Permanent Weight	Remove the test weights and install the permanent weight on the spinner or propeller.
Split Weights?	If you cannot install the final weight in one position, you can split them between two locations. If you answer YES, the split weight screen appears. If you answer NO, the following screen appears.

This is the final run screen to verify that the permanent weights are correctly placed. Press START to move to the next screen.



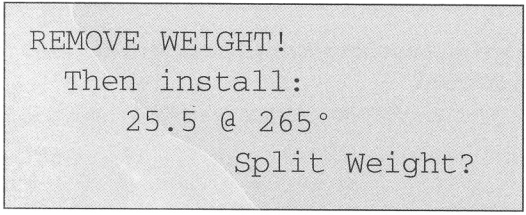
This screen will appear at the end of the balance job. Pressing the START key will return you to a review screen. Pressing the ABORT key will take you to the following screen.





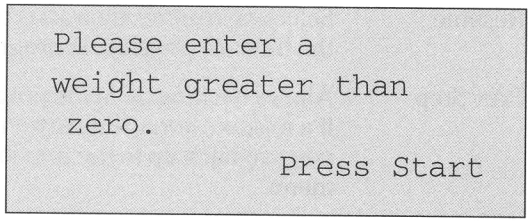
Resume	Selecting resume allows a return to the balance program in progress.
Prev Step	Allows backing up in the program. If a mistake is made in any entry, you can back up to the previous menu.

This screen will appear each time the balancer calculates a balance solution.



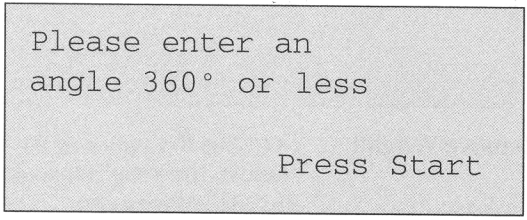
Remove Weight!	Reminds the operator to remove the weight installed on the last balance run.
Then Install: 25.5 @ 265°	Calculates the total weight and location in degrees required to balance the propeller.
Split Weight?	By answering this question YES, the split weight screen will appear. If NO is selected, the single weight screen will appear.

This screen appears when a zero is entered instead of a number. A weight greater than zero must be entered in the balancer.



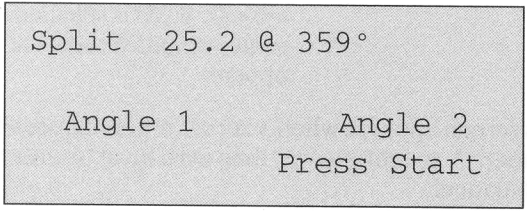
Pressing the START key returns you to the weight entry screen.

This screen appears when an angle greater than 360° has been entered.



The balancer only understands angles up to 360° and will not allow entry of a larger number.

When the question "Split Weight?" on a balancer is answered by pressing YES, then this screen appears.



Split 25.2 @ 359°	This is the solution weight in grams and the weight location in degrees to balance the propeller, brought forward from the solution screen.
Angle 1	Enter an angle on one side of the desired angle.
Angle 2	Enter an angle on the other side of the desired angle.

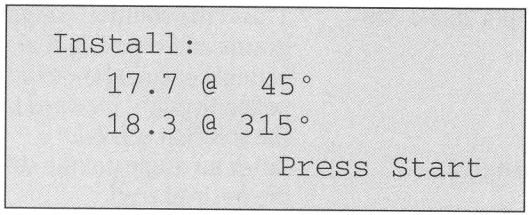
Note

The maximum distance between Angle 1 and Angle 2 will be 120°.

If you enter an incorrect angle, this screen appears. Always make sure the entries straddle the single weight angle.

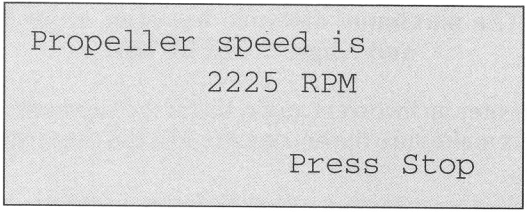
```
You have entered an
incorrect angle

                Press Start
```

This screen appears after you have correctly entered the angles on each side of the single weight angle.



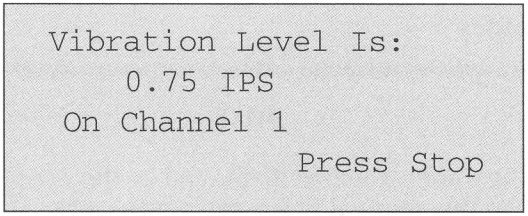
This screen calculates the amount of weight in grams to install at the angle you entered in the Split screen.

This screen will appear if the RPM key is pressed.



2225 RPM	Displays the current propeller RPM.
Press STOP	Returns the balancer to the previous screen.

If you press the VIB key, this screen appears.



Vibration Level is: 0.75 IPS	Displays the overall vibration in Inches Per Second Velocity (IPS). This is the sum of all the vibration in the engine not at the propeller rotating speed.
On Channel 1	Shows that Channel 1 is selected. If you have a vibration sensor connected to Channel 2, pressing the 2 key will change to Channel 2 and display vibration on that channel.
Press STOP	Pressing stop will return to the previous screen.

ACES ProBalancer Screens:

Section Two: Balancing with Two Vibration Sensors

NOTE

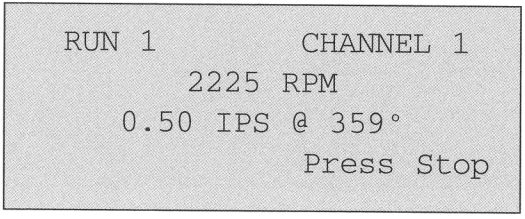
Any data number displayed in the screens in this manual is for reference only. The numbers you see on the balancer in actual use will be different.

Most screens in Section One are displayed again when you use two vibration sensors. These will be different.

This screen will appear if the balancer is receiving tach signals from the RPM sensor and the START key is pressed.

```
Acquiring
 Vibration Data

Standby ...
```

This screen will appear while the balancer is reading the RPM, vibration signal (IPS) and phase angles.

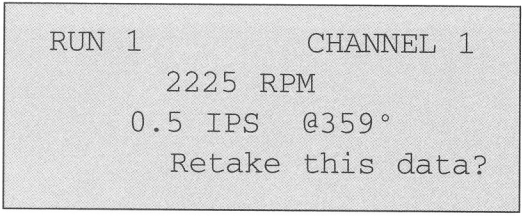


Run 1	Displays the run number you are currently taking.
Channel 1	Displays the current vibration channel being taken.
2225 RPM	Displays the current RPM—this will be changing slightly.
0.50 IPS	Displays the current vibration level—this will be changing slightly.
@ 359°	Displays the current phase angle.
Press STOP	This freezes the display number and brings up the next screen.

NOTE

The numbers will stabilize in 15 to 45 seconds.

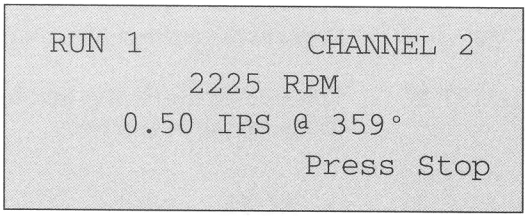
This screen will appear after pressing the STOP key:



If the data looks different than what you saw while taking data, press the YES key to retake the data. If you are satisfied with the data, press the NO key.

If the NO key is pressed, the balancer automatically switches to Channel 2 and collects information from Channel 2.

This screen will appear when the balancer switches to Channel 2. It is reading the RPM, vibration signal (IPS) and phase angles.



Run 1 — Displays the run number you are currently taking.

Channel 2	Displays the current vibration channel being taken.
2225 RPM	Displays the current RPM—this will be changing slightly.
0.50 IPS	Displays the current vibration level—this will be changing slightly.
@ 359°	Displays the current phase angle.
Press STOP	This freezes the display number and brings up the next screen.

NOTE

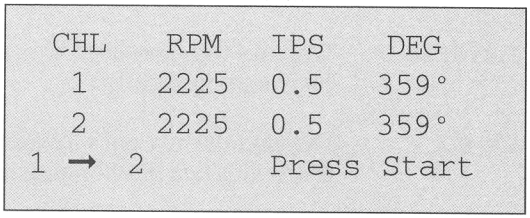
The numbers will stabilize in 15 to 45 seconds.

This screen will appear after pressing the STOP key.

```
RUN 1              CHANNEL 2
          2225 RPM
       0.5 IPS   @ 359°
          Retake this data?
```

If the data looks different than what you saw while taking data, press the YES key to retake the data. If you are satisfied with the data, press the NO key.

If you press the NO key, this screen will appear:



CHL 1 2	Displays the channel the reading was taken from.
RPM 2225	Displays the RPM that the reading was taken at.
IPS 0.5	Displays the amount of unbalance in in/sec of vibration.
DEG 359°	Displays the phase angle—this is used for estimating the location of the balance weight on the spinner.
1→2	LEFT and RIGHT arrow keys change the display to show data taken on each run. In this case it shows the next run is 2. If you had taken run 2, the display will show 1←2→3.
Press START	Moves to the next screen.

Printing with the ProBalancer

Version 1.3 of the ProBalancer firmware allows you to print out a report of the balance job. This report shows all information about each run performed including the vibration level and angle, RPM, calculated weights, and actual installed weights.

The ProBalancer can print to any serial printer configured to 9600 baud, 8 data bits, 1 stop bit, and no parity. If you own a parallel printer, an optional serial-to-parallel converter is available from TEC. See the ProBalancer Accessory Parts List on page 52.

To print a balance report, connect the printer to the ProBalancer using the printer cable, P/N 10-320-0091 and turn on the printer. Turn on the ProBalancer, press the ABORT key, select "Print" from the menu using the right arrow key, and press START. If you have customized information stored in the ProBalancer, that information will print at the top of the page, followed by the balancing information for each run.

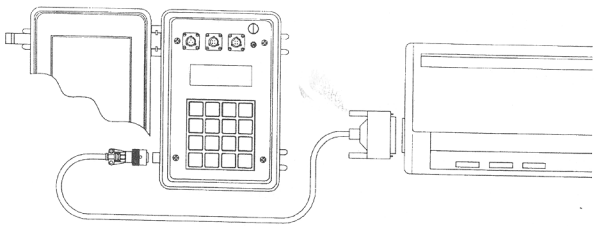


Figure 16.

Trouble-Shooting Guide

If you are unable to solve a problem using this guide, please call ACES ProBalancer Customer support at:

423/966-5856

The balancer can display one of two problem messages. These quality checks are built into the program to help you get good information and complete your job with a minimum of delay.

Display reads: "PROBLEM: 1 No Tach Signal Check Equipment"

Possible Cause: Balancer is not supplying power to the Photo-Tach.

Inspection: Make sure the ProBalancer power switch is in the "ON" position. Look into the lens of the Photo-Tach. If the red light is not on, check the Photo-Tach cable for damage or evidence of shorting. Check to ensure the connectors are secure to both the Photo-Tach and the Tachometer input on the ProBalancer.

Possible Cause: Photo-Tach lens is dirty or obstructed.

Inspection: Check the Photo-Tach lens for damage. A cracked or severely scratched lens may interfere with normal operation. If the lens is dirty, clean it with plastic cleaner and a soft cloth. Check to ensure that no obstruc-

tions or aircraft parts are between the Photo-Tach and the reflective tape.

Possible Cause: Reflective tape is obstructed, misaligned or at an incorrect distance.

Inspection: If the reflective tape is old or dirty, replace it. In some cases, light conditions will interfere with the tape's reflective properties. Try two pieces of tape side by side to create a greater reflective surface. Recheck the alignment of the reflective tape with the Photo-Tach and adjust as necessary. (See the section titled "SETUP".) Check the distance between the reflective tape and the Photo-Tach lens. The distance should not be closer than twelve (12) inches, or farther away than eighteen (18) inches. If necessary, readjust the Photo-Tach to within this range.

Possible Cause: The width of the tape is not wide enough to trigger the Phototach for the placement of the tape vs the speed of the propeller.

Inspection: Refer to the chart following this paragraph. To use the chart, first measure the distance from the center of the propeller shaft to the location of tape placement on the target propeller blade. This is the radius. Next, enter the chart in the RPM column and proceed down until you reach your balancing RPM. Move to the right until you intersect a box containing a number GREATER than the radius you measured from the propeller shaft to the tape location. From that box, move to

the top of the column and read the necessary tape width for the location, either 1, 2, 3, or 4 inches wide. The tape provided with the ProBalancer is 1 inch wide. If three inches are required, place three strips side-by-side to form a three-inch wide target.

Max OK Radius at 300 µs at tape width (in.)				
RPM	1	2	3	4
1000	31.8	63.7	95.5	127.3
1200	26.5	53.1	79.6	106.1
1400	22.7	45.5	68.2	90.9
1600	19.9	39.8	59.7	79.6
1800	17.7	35.4	53.1	70.7
2000	15.9	31.8	47.7	63.7
2200	14.5	28.9	43.4	57.9
2400	13.3	26.5	39.8	53.1
2600	12.2	24.5	36.7	49.0
2800	11.4	22.7	34.1	45.5
3000	10.6	21.2	31.8	42.4
3200	9.9	19.9	29.8	39.8
3400	9.4	18.7	28.1	37.4
3600	8.8	17.7	26.5	35.4
3800	8.4	16.8	25.1	33.5
4000	8.0	15.9	23.9	31.8

Translated to approximate formulas (all distances are in inches):

Maximum Radius to Reflective Surface = Reflector Width x 32000/RPM

or

Minimum Reflector Width = Radius to Reflector * RPM/32000

or

Maximum RPM = Reflector Width x 32000/ Radius to Reflector

Display reads: "PROBLEM: 3 No Improvement Check Propeller"

This problem will appear if, after the third run, there is no improvement in the vibration IPS reading. It indicates that there is a problem in reducing the vibration. If this appears, check the following:

Possible Cause: Loose or worn propeller components.

Inspection: Check the mechanical condition of the propeller. Problems with worn or loose components will cause vibration that is not correctable by balancing. Failure to correct or replace the faulty component will prevent a successful balance job.

Possible Cause: Counting Angles the wrong way.

Inspection: Verify the propeller rotation direction and use the spinner protractor to measure angles. Look at Figures 17 and 18 to determine if you are counting the angle correctly. Remember to place the reflective tape in front of the Phototach first, then count the angle opposite the direction of rotation starting at the vibration sensor.

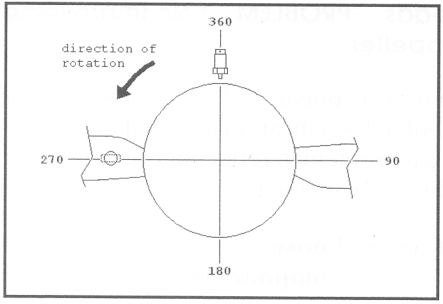


Figure 17.

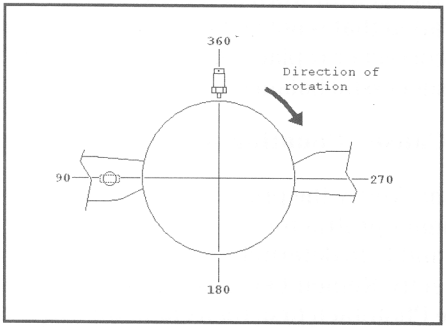


Figure 18.

Possible Cause: You are entering wrong weights into balancer.

Inspection: Use the gram scale to verify the weights you install on the propeller and enter the correct weight into the balancer.

Possible Cause: You are weighing the weights incorrectly.

Inspection: Check the accuracy of the scale with the test weight. Make sure you allow the scale to zero out before weighing any weights.

Possible Cause: The vibration pickup is loose.

Inspection: Verify that all equipment is installed properly.

There are two other problems that may occur in picking up the photo-tach signal:

If RPM is low (about 1/2 of actual): The tape width is insufficient for the photo-tach. To get a good response, increase the width of the reflective tape by adding another piece next to the existing piece.

If RPM is high (double or more): The photo-tach is picking up another reflective surface and giving extra RPM counts. This can occur during very bright sunny days caused by reflections. If this occurs reposition the aircraft in relation to the sun. Another cause can be that the photo-tach is mounted too close to the reflective tape. Try mounting the photo-tach 12"-18" behind the propeller.

If IPS reading is fluctuating during data acquisition:

High noise or vibration is probably present and creating interference. Allow the ProBalancer about 45 seconds to acquire a stable reading. Pressing the "Reset Average" key will allow the ProBalancer to start a new averaging cycle if necessary.

Specifications

ACCURACY

Vibration Amplitude:	+/-5% 300-6000 RPM
Phase:	+/-5% 300-6000 RPM
Tachometer:	+/-.1% 300-6000 RPM +/-.3% 6000-10000 RPM

VIBRATION LIMITS

Minimum Vibration:	0.01 IPS Display limited
Maximum Vibration:	8.00 IPS

POWER SUPPLY

Camcorder type battery:	VDO-PAK Model RB 85 or equivalent
Operation time:	10 to 20 hours
Voltage:	12 V DC
Charging Time:	2 hours

PHYSICAL SPECIFICATIONS

Height:	8 1/2 inches
Width:	6 1/2 inches
Depth:	3 1/4 inches (Lid closed)
Weight:	3.5 lbs.

ProBalancer Accessory Parts List

The following list of Part Numbers should be used when ordering ProBalancer Accessories. Prices are subject to change without notice. Call TEC Aviation Division at 423/966-5856 for current price quotes. Photocopy the TEC Order Form at the back of this manual. Fill in the required information and FAX it to TEC at 423/675-1241, or mail it to us at the following address:

TEC Aviation Division
10737 Lexington Drive
Knoxville, TN 37932-3294

Your order will be processed and sent to you as quickly as possible. Thank you for using ACES equipment.

NOMENCLATURE	PART NUMBER
1" wide reflective tape, 10 ft. roll	85-710-0006
ACES Guide to Propeller Balancing	10-300-0048
ACES Lasetach Assembly	10-100-0424
ACES Photo-Tach Assembly	10-100-1772
Battery Charger, 110 V (Domestic use)	10-320-0017
Battery Charger, 220 V (International use)	10-100-0414
Box, Segmented, accessory storage	22-100-0041
Carrying Case, small, accessory	10-100-0403
Case Bolt Adapter Set, eight piece	10-400-0192
Foam Insert for Carrying	75-900-0724
Interface Cable, ATR-42 and Embraer	10-100-0428
Interface Cable, Beechcraft	10-320-0039
Interface Cable, Dash 8	10-320-0049
Lead Acid Battery, 12 V	29-100-0001
Photo-Tach Cable, 25 ft.	10-320-0198
Photo-Tach Cable, 50 ft.	10-320-0191

NOMENCLATURE	PART NUMBER
Photo-Tach Mount, 2 piece universal	22-430-0058/59
Photo-Tach Mount, 3" x 3" base plate	10-100-0196
Right Angle Mount, Universal Vibe Sensor (2)	22-430-0056/57
Scale, Gram, Pocket Pro 150 Digital	75-900-0505
Spinner Protractor	82-100-0032
Velocity Sensor Cable, 25 ft.	10-320-0197
Velocity Sensor Cable, 50 ft.	10-320-0190
Velocity Sensor, Model 991 V	69-100-0064
Printer Cable	10-320-0091
ACES Propeller Placards (Stickers)	82-100-0117
ProBalancer Training Video	75-900-0191
ProBalancer User Manual	75-900-0147
Diconix Printer	75-210-0045
Hinge Pins (2 ea.)	30-600-0011
Powered Serial-Parallel Converter	75-210-0056